The Anomalous Behavior of the S&P Covered Call Closed End Fund

November 4, 2008

Abstract

This paper examines the anomalous behavior of the S&P Covered Call Closed End (BEP) Fund, which traded in 2007 at substantial premiums to its NAV that reached 23 percent. The large premium is striking in light of the highly transparent and easy to replicate strategy of the fund, which involves rolling over one month, at the money S&P 500 index covered calls. The paper finds that the large premium owed to BEP returns overreacting to positive S&P returns, adjusted for the deltas and gammas of the options that the fund was short. Another possible explanation for the emergence of the large premium is the near doubling of the VIX from very low and stable levels, which may have encouraged unsophisticated investors to buy the BEP fund at increasingly elevated premiums. The paper then examines the anomaly from the perspective of the noise trader literature and finds that the volatility of BEP returns was high relative to the volatility of the underlying fundamentals and that large premiums did not emerge at other covered call closed end funds. The evidence also suggests that short covering may have been a factor behind the surge of the premium as short positions grew substantially during this period, consistent with the noise trader model of Abreu and Brunnermeier (2002) that emphasizes the timing risk associated with arbitrage.

JEL classifications: G11,G14

Keywords: Covered call strategies, Closed end funds, Option strategies

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Equity index covered call strategies recently have enjoyed a resurgence in popularity, in large part because of evidence that these strategies have provided returns in line with those of the underlying index, but with substantially lower risk over the last two decades.[1] During the last few years, several open and closed end mutual funds, as well as structured notes, that focus on covered call strategies have been introduced. A variety of covered call indexes also have been created by the Chicago Board Option Exchange (CBOE), including the BXM, which tracks the returns from rolling over on expiration days one month, at the money S&P 500 index covered calls.[2] The BXM index was recalculated back to 1991 and has become a benchmark for actively managed S&P 500 covered call strategies.

The S&P 500 Covered Call Closed End Fund (subsequently referred to by its ticker symbol--BEP) was introduced in April 2005. The strategy of the fund is to replicate BXM index returns.[3] Because the CBOE provides specific information about the options used to construct the BXM index and because the BXM index level is broadcast to market participants every 15 seconds during trading days, the fund's strategy is both highly transparent and easy to replicate.[4] These characteristics make the behavior of the BEP fund

[1] Hill et al. (2006) find that from January 1990 through November 2005, at the money S&P 500 index covered call strategies outperformed the underlying index by 233 basis points with an annualized standard deviation of 8.5 percent versus an annualized standard deviation of 14.15 percent for the S&P 500 index. Other studies finding similar results include Schneeweis and Spurgin (2001), Whaley (2002), Feldman and Roy (2005) and Callan and Associates (2006).

[2] The CBOE began publishing the BXM index on an intraday basis in September 2006. The CBOE also has created indexes based on the returns of covered call strategies on the Russell 2000 (BXR), the DJIA (BXD), the Nasdaq 100 (BXN) and on covered calls that are 2 percent out of the money on the S&P 500 index (BXY).

[3] The most recent 2007 annual report states that "the investment objective of the S&P 500® Covered Call Fund Inc. (the "Fund") is to seek total returns through a covered call strategy that seeks to approximate the performance, less fees and expenses, of the CBOE S&P 500® BuyWrite IndexSM (the "BXM Index")".

[4] Investors can achieve the same exposure by buying the basket of stocks in the S&P 500 index and selling at the money S&P 500 index calls or by buying an exchange traded fund based on the S&P 500, such as the SPY, and rolling over one month, at the money SPY calls. Alternatively, because covered call positions are

extremely anomalous in the first half of 2007 when after trading at small discounts to net asset value (NAV) for several months, the fund traded on a fairly sustained basis at large premiums that reached as high as 23 percent. Such large premiums typically occur mainly for closed end country funds when market participants become overly enthusiastic about the prospects for a particular country's equity market and investing in that market either directly or through open end mutual funds is difficult.[5] However, the BEP Fund is on the opposite side of the spectrum, again because of the ease of replicating the exposure of the BEP fund.[6]

This paper models NAV returns and actual BEP fund returns in terms of the exposures of the Black-Scholes greeks and then examines whether differences in how NAV and BEP returns responded to these exposures can explain the large premium that emerged in the Spring of 2007. The paper then explores other possible explanations for the large premiums and examines the anomaly from the perspective of the noise trader literature (see De Long, Shleifer, Summers and Waldmann (1990)).

This paper finds that the large premium can be attributed to an overreaction of BEP returns to positive S&P 500 index returns, adjusted for the deltas and gammas of the options that the fund was short. The results also indicate that the run up of the premium occurred as the S&P 500 volatility index (VIX) almost doubled from very low levels that had persisted for several months, which may have kindled interest in covered call strategies and led unsophisticated market participants to pay extremely high premiums for the BEP fund. Consistent with the presence of noise traders, the paper also finds that the volatility of BEP

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equivalent to uncovered short put positions, investors can replicate the strategy of the BEP fund by selling uncovered one month, at the money S&P 500 index puts.

[5] Notable examples are the Germany fund, which traded at a 100 percent premium after the fall of the Berlin Wall and the Turkish Investment Fund (ticker symbol TKF), which traded at a 100 percent premium in April 1994. See Klibanoff et al. (1998) for an examination of the reaction of closed end country funds to headline political news.

[6] It would not necessarily be irrational for the BEP fund to trade at small premiums. The BEP fund charges annual management fees of .9 percent and incurs expense ratios of about 1 percent, which could be lower than the cost that would be incurred by unsophisticated investors who roll over S&P 500 index options every month.

share prices substantially outpaced the volatility of the fundamentals over the entire sample period. In addition, the large build in BEP premiums was a relatively isolated phenomenon, as the average premium of other covered call closed end funds rose, but to only small premiums. Finally, the paper demonstrates a fairly substantial increase in short positions during the period in which the large premium emerged. This increase suggests that some of the surge of the premium could have been caused by those arbitrageurs whose poor timing forced them to buy back short BEP positions under duress.

The paper proceeds as follows. The first section provides a brief discussion about covered call strategies as well as background information on the BEP fund. The second section models NAV and BEP returns and explores whether differences in responses to the exposures captured by the greeks can explain the large premium that emerged in the first half of 2007. The third section explores other explanations for the large premium and examines the phenomenon from the perspective of the noise trader literature, and the final section summarizes the findings of the paper.

1.1 Background on the S&P 500 Covered Call Fund

The BEP Fund began trading in April 2005 and at the end of 2007 had total net assets of $280 million and 17.5 million shares outstanding. The stated strategy of the fund is to replicate the BXM index by buying a basket of stocks identical to the S&P 500 index and rolling over on expiration dates short positions in one month, at the money S&P 500 index calls.[7] Option premiums received by the fund and dividends on the S&P 500 stocks are distributed to share holders as dividends in June and December. These semi-annual dividends have been $1 per share and on an annual basis have amounted to roughly 13 percent of BEP share prices. Option premiums received fundamentally differ from dividend income because the former represents compensation for the risk associated with the S&P 500 index trading in the money at expiration by more than the value of option premiums received.[8] Figure 1 shows BEP share prices and the premium since the inception of the fund in April 2005 through the end of March 2008, with the large downward spikes representing distributions. The figure shows that BEP shares began trading at premiums of roughly 5 percent, consistent with a tendency of closed end funds to be offered at premiums.[9] Within a year, the original premium went to a 10 percent discount, which is not atypical for closed end funds as underwriters withdraw support for IPOs and BEP shares lost 7 percent.[10] During the second year of BEP trading, the 10 percent discount moved to a premium that reached 23 percent. Consistent with the large surge of the premium, BEP shares returned 36-1/2 percent. In the third year of BEP trading through the end of March, the large premium moved to a discount of about 5 percent and BEP shares lost about 16% percent. Overall, the figure shows that the premiums that emerged in the second year of trading were both outsized and sustained for a significant period of time. The figure also underscores the fact that a substantial part of BEP fund returns have been driven by the large fluctuations of the premium. It is also interesting to note that the trading volume of BEP shares (not shown) was heavier in the first half of

[7] S&P 500 index options are European options that are cash settled based on the opening level of the S&P 500 cash index when options expire on the third Friday of each month.

[8] Although some confusion could exist concerning the fundamental difference between income from dividends and income from option premiums, the author was unable to find evidence in the press or in promotional materials reflecting such confusion. Nevertheless, Morningstar and Yahoo.com recently listed the dividend yield on the BEP closed end fund at 13.2 percent.

[9] See Dimson and Minio-Kozerski (1998) for an excellent survey of the closed end fund literature. These authors state that US closed end fund shares are issued at premiums of up to 10 percent, while Weis (1989) finds that US closed end funds within 24 weeks of trade at average discounts of 10 percent.

[10] These comparisons as well as those below assume that dividends are reinvested.

2007 when large premiums emerged. Daily trading volume averaged roughly 122,000 shares in the first half of 2007, compared to about 60,000 shares from April 2005 through the end of 2006 and about 70,000 shares from mid-2007 through March 2008.

As mentioned earlier, the large premium is surprising given that the BEP fund seeks to mirror the strategy of the BXM index, which is highly transparent and easy to replicate. Evidence that the BEP fund actually closely followed the strategy of the BXM index is shown below by a regression of dividend adjusted, daily NAV returns on a constant and on daily BXM returns over the sample period from April 13, 2005 through March 28, 2007. Robust standard errors using the Newey West correction for 6 lags are shown in parentheses.

$$\ln(NAV_t / NAV_{t-1}) = \underset{(.00005)}{-.00003} + \underset{(.0102)}{.9990} * \ln(BXM_t / BXM_{t-1}) + \mu_t \qquad (1)$$

$RBAR^2 = .945$

These results strongly indicate that the BEP fund did not diverge from its stated strategy of replicating the BXM strategy.[11] The next section of the paper provides background on the covered call strategies.

1.2. Background on S&P 500 Index Covered Call Strategies

Covered call strategies are attractive if options are overpriced. If options are fairly valued, covered call sellers receive option premiums equivalent to the present value of expected future gains foregone when the underlying instrument ends in the money by more

[11] The results are very similar for each of the sub-samples that later are examined. One minor difference between the BEP fund and the BXM index is that the former pays dividends twice a year, whereas the latter assumes that dividends are reinvested on a continuous basis.

than the value of the option premiums received. If options are overpriced, covered calls are better than fair bets because option premiums received are worth more than the present value of expected foregone gains when the underlying instrument rises above the strike by more than the value of the option premiums received.[12]

The major immediate impact of selling an equivalent amount of at the money calls against long positions in the S&P 500 index is to cut the deltas in half. The negative gammas of covered call positions cause the deltas--the first derivative of option prices with respect to changes in the underlying instrument--to move unfavorably as the S&P 500 index changes. This owes both to the limited potential gains associated with being forced to sell the index at the strikes of the calls sold if the calls end in the money and to the limited protection in the event of market declines from having sold calls that are moving out of the money.[13] The negative gammas cause the positive deltas of covered call positions to fall toward zero if the S&P increases on a sustained basis during option cycles because further gains are limited and to rise toward one when the S&P decreases on a sustained basis during option cycles as option prices move toward their intrinsic value of zero. As a result, the sensitivity of NAV (and presumably BEP) returns to S&P returns should fluctuate over expiration cycles.

Covered call positions also benefit from implied volatility decreases, which lower the values of options that have been sold and are hurt by implied volatility increases, which raise the values of options that have been sold. Finally, NAV and BEP share returns benefit from time decay as the options sold lose time value as time elapses. To the extent that the above factors explain NAV returns, they tautologically explain either BEP returns or BEP premium changes or some combination of the two.

[12] Leggio and Lien (2002) also demonstrate that covered call index strategies can significantly enhance utility relative to a straight index strategy for loss averse investors even when options are priced fairly.
[13] This statement is made largely for expositional ease as S&P index options are cash settled and thus the underlying portfolio of stocks is not disturbed when options expire in the money.

2. Factors Driving NAV and BEP Returns

This section examines how well NAV returns can be modeled by the exposures to the greeks and then examines how BEP returns respond to the same factors. To the extent that BEP returns have different sensitivities than NAV returns to a particular greek, it may be possible to identify specific market factors responsible for the large premiums during the sample period. This paper calculates the greeks from the Black Scholes model using the adjustment suggested by French (1984) with time expressed in business days when it is multiplied by volatility and time expressed in calendar days when it is multiplied by interest rates. In addition, the S&P 500 index is adjusted for actual dividends and for the 15 minute interval between the settlement of the S&P 500 cash index at 4 pm EST and S&P 500 index options at 4:15 pm EST.[14] The impact from delta (DELTARETS) of a change in the underlying S&P 500 cash index (SPX) on NAV returns is given by

$$\text{DELTARETS} = \frac{[1 - \Delta_{t-1}] \ * \ [\text{SPX}_{t} - \text{SPX}_{t-1}]}{\text{SPX}_{t-1} - \text{C}_{t-1}} \ . \qquad (2)$$

The numerator is the dollar returns from delta, which is equal to one minus the previous day closing delta of the calls sold by the BEP fund multiplied by the change of the S&P index. These dollar returns are scaled by the previous closing values of the covered call position--

[14] The S&P cash index is adjusted by calculating its fair value based on the closing front S&P futures price at 4:15 pm, future dividends and the relevant short term deposit rate.

the previous closing value of the SPX index minus the previous closing value of the call options that the BEP fund is short--to obtain returns owing to the exposure to delta.

The above equation accurately reflects returns on covered call positions for small S&P price changes but overstates positive returns and understates negative returns when absolute S&P price changes are large. The returns from gamma (GAMMARETS) are given in equation 3 and are equal to dollar profits from gamma, scaled by the previous closing values of the covered call position. The numerator is equal to -.5 times the previous day closing gamma of the options that the BEP fund is short multiplied by the squared S&P index price change. The returns from gamma are non-positive as the curvature of the relationship between call option prices and changes of the underlying instrument price works against the option seller.

$$\text{GAMMARETS} = \frac{-.5 * \Gamma_{t-1} * (\text{SPX}_t - \text{SPX}_{t-1})^2}{\text{SPX}_{t-1} - \text{C}_{t-1}} . \tag{3}$$

Equations 2 and 3 are added to obtain what will be referred to as (delta and gamma) adjusted returns (ADJRETS).

$$\text{ADJRETS} = \frac{[(1 - \Delta_{t-1}) * (\text{SPX}_t - \text{SPX}_{t-1})] - .5 * \Gamma_{t-1} * (\text{SPX}_t - \text{SPX}_{t-1})^2}{\text{SPX}_{t-1} - \text{C}_{t-1}} . \tag{4}$$

The returns from vega (VEGARETS) are

$$\text{VEGARETS} = \frac{-\upsilon_{t-1} * (\sigma_t - \sigma_{t-1})}{\text{SPX}_{t-1} - \text{C}_{t-1}} , \tag{5}$$

where the negative of the previous day closing vega of the options sold by the BEP fund is multiplied by the change in implied volatility of those options to obtain the dollar impact on the covered call position, which is scaled by the previous day closing value of the covered call position. The negative sign on vega reflects the fact that implied volatility increases raise the value of options that have been sold and lower the value of covered call positions.

Finally, the returns from theta (THETARETS) are given by

$$\text{THETARETS} = \frac{\tau_{t-1}}{\text{SPX}_{t-1} - \text{C}_{t-1}}\ , \tag{6}$$

where the theta of the options sold at the previous day close is scaled by the previous closing day value of the covered call position to obtain a measure of the returns on the covered call position from time decay.

2.1. Factors Driving NAV Returns

The first set of models examines how well dividend adjusted NAV returns can be explained by the greeks. Because the paper later separately examines the reaction of BEP returns to positive and negative (delta and gamma) adjusted S&P returns, the specification allows adjusted S&P returns to have different effects on NAV returns. The specification is

$$NAVRETS_t = \alpha_0 + \alpha_1 * ADJRETS_t^+ + \alpha_2 * ADJRETS_t^- + \alpha_3 * VEGARETS_t + \alpha_4 * THETARETS_t + u_t \quad (7)$$

where daily NAV returns are regressed on a constant and on positive and negative adjusted S&P returns and on vega and theta returns. If NAV returns move in line with the greeks, the coefficients on adjusted S&P returns should be significantly positive and not significantly different from one and the coefficients on vega and theta returns should be significantly negative and not significantly different from minus one. The standard errors are estimated using the Newey-West method for heteroscedasticity and for autocorrelation up to 6 lags owing to a few spikes in the autocorrelation function of the residuals. The equation is estimated for the entire sample period from April 13, 2005 through March 28, 2008, the Pre Anomaly Period from April 13, 2005 through Jan 23, 2007, the Anomaly Period from January 24, 2007 through May 22, 2007 when the premium surged from 5 percent to 23 percent with little retracement and then fell below 10 percent, and the Post Anomaly period from May 23, 2007 through March 28, 2008.

The results in table 1 indicate that most of the variation of daily NAV returns is explained the greeks, with an adjusted R^2 of .93 for the whole sample period and with the vast majority of the greeks entering with highly statistically significant coefficients of the expected sign. Positive and negative adjusted S&P returns enter with highly significant coefficients that are close to one and thus do not reflect any asymmetric or disproportionate impact on NAVs. Vega returns enter with significantly negative coefficients in all but the Post Anomaly Period, while theta returns enter with significantly negative coefficients in each of the sub-periods. However, the response of NAV returns to vega returns is less than expected based on the Black Scholes model, while the response of NAV returns to theta returns is greater than expected.[15]

2.2. Factors Driving BEP Fund Returns

The results indicate that the vast majority of the variation of the NAV returns of the BEP fund is explained by the exposures of the covered call strategy to the greeks. The extent to which the greeks also explain BEP share returns is important because if the greeks have very different effects on BEP and NAV returns, identifying the source of the large BEP premiums may be possible. The next step is to determine how BEP returns respond to the specific exposures that drive NAVs by estimating

$$BEPRETS_t = \beta_0 + \beta_1 {*}PREM_{t-1} + \beta_2 {*}ADJRETS_t^{+} + \beta_3 {*}ADJRETS_t^{-} \qquad (8)$$

$$+ \beta_4 {*}VEGARETS_t + \beta_5 {*} THETARETS_t + \varepsilon_{t,}$$

where daily BEP returns are regressed on a constant, the lagged premium, separate variables for contemporaneous positive and negative adjusted S&P returns, vega returns and theta returns, as defined earlier. The lagged premium is the lagged percentage difference between BEP share prices and NAVs and is included to reflect a possible tendency of premiums and discounts to dissipate because BEP prices fall when the lagged premium is high and BEP prices rise when the lagged premium is low or at a discount. If the premium is mean

[15] These divergences may reflect the effect of cross-derivatives, possible model misspecification, and imprecise adjustment for the 15 minute interval between the settlement of the S&P 500 cash index and index options.

reverting, the coefficient on the lagged premium would be negative.[16] Also, to the extent that BEP returns respond in the expected direction to the factors driving NAV returns, the coefficients on adjusted positive and negative S&P returns again should be significantly positive and not different from one and the coefficients on vega and theta returns should be significantly negative and not different from minus one. The model is estimated for the same period and subperiods as the previous model and standard errors are adjusted for heteroscedasticity using White's method.

The results in table 2 demonstrate that BEP returns respond sluggishly to adjusted positive and negative S&P returns during the Pre Anomaly Period. The coefficient estimates indicate that one percent increases (decreases) in adjusted S&P returns lead to 1/2 percent increases (decreases) in BEP returns that are statistically significant but also significantly less than one. These results are consistent with BEP returns underreacting to both positive and negative S&P returns during the Pre Anomaly Period. The estimates also show that BEP returns do not respond to either vega or theta exposures in the Pre Anomaly Period nor in any of the other subperiods, and the very low adjusted R^2 of .04 for the Pre Anomaly Period shows that very little of the variation of BEP returns is explained by the greeks.

In contrast to the sluggish response of BEP returns to the greeks in the Pre Anomaly Period, the reaction becomes much stronger during the Anomaly Period and the model explains almost half of the variation of daily BEP returns. The coefficient estimate on positive adjusted S&P returns indicates that a 1 percent increase in adjusted S&P returns is associated with a 2.3 percent increase in BEP returns that is both statistically significant and significantly greater than one. By contrast, the reaction of BEP returns to negative adjusted S&P returns is consistent with a statistically significant commensurate BEP return decline.

[16] A variety of specifications were examined such as allowing asymmetric responses to premiums and discounts and allowing BEP returns to respond to premium changes but these specifications did not lead to interesting results and are not reported.

Another difference between the Pre Anomaly Period and the Anomaly Period is the significant mean reversion of the premium observed in the Anomaly Period, but not in the Pre Anomaly Period.

The results for the Post Anomaly Period indicate a statistically significant, one to one relationship between both positive and negative adjusted S&P returns and BEP returns. Overall, the results suggest that the large premium that emerged during the Anomaly Period can be attributed to the overreaction of BEP returns to positive adjusted S&P returns. The sequential pattern across the three subperiods from underreaction to overreaction to proportional reaction with respect to delta and gamma adjusted S&P returns may reflect an ongoing learning process. [17]

2.3. Factors Driving the Premium

The analysis thus far has examined the impact of the greek exposures on both NAV and BEP returns. The next step is to obtain more direct estimates of the impact of these exposures on BEP share premiums across sub-periods. The next model specifies the daily change of the premium as a function of a constant, the lagged premium, the contemporaneous delta and gamma adjusted positive and negative S&P returns, vega returns and theta returns, as defined earlier.

$$\Delta PREM_t = \beta_0 + \beta_1 * PREM_{t-1} + \beta_2 * ADJRETS_t^+ + \beta_3 * ADJRETS_t^- + \beta_4 * VEGARETS_t + \beta_5 * THETARETS_t + \varepsilon_t \quad (9)$$

[17] The terms overreaction and underreaction are used for expositional ease to discuss the proportionalities of reaction and do not necessarily imply irrationality *per se*. For example, an implication of the noise trader model of De Long et al. (1990) is that market events that indicate greater noise trader uncertainty justifies larger closed end fund discounts because rational market participants require compensation for this incremental risk.

If the coefficients on S&P adjusted returns are significantly positive, BEP returns respond more than NAV returns and hence overreact to adjusted S&P returns. In this case, positive (negative) S&P adjusted returns lead to positive (negative) BEP returns that are greater in absolute terms than NAV returns, giving rise greater (smaller) premiums. If the coefficients on S&P adjusted returns are significantly negative, BEP returns underreact or respond less than NAV returns to adjusted S&P returns. In this case, positive (negative) adjusted S&P returns lead to positive (negative) BEP returns that are less than NAV returns, leading to smaller (greater) premiums.

Given the evidence presented earlier that shows that NAVs fall when implied volatility rises, a positive coefficient on vega returns would indicate that BEP returns respond less than NAV returns to implied volatility changes and hence underreact. In this case, when implied volatility rises (falls), BEP returns fall less (rise less) than NAV returns causing premiums to rise (fall). A negative coefficient on vega returns would indicate that BEP returns overreact or more than NAV returns to implied volatility changes and when implied volatility rises (falls), BEP returns fall more (rise more) than NAV returns causing premiums to fall (rise). Finally, if the coefficient on theta returns is positive (negative), time decay causes BEP share prices to fall by more (less) than NAV prices.

The results in table 3 indicate that the underreaction of BEP returns to NAV returns during the Pre Anomaly Period owes to both positive and negative adjusted S&P returns as the coefficients on both terms are significantly negative. These results indicate that positive adjusted S&P returns lead to smaller positive BEP returns relative to NAV returns and lower premiums, while negative adjusted S&P returns give rise to smaller negative BEP returns relative to NAV returns and greater premiums. These coefficient estimates indicate that during the Pre Anomaly Period, positive and negative adjusted returns lead to declines and increases in premiums that are about half the size of the adjusted S&P returns, respectively. During the Anomaly Period, positive adjusted S&P returns lead to higher premiums with the coefficient estimate indicating that 1 percent positive adjusted S&P returns lead to 1.4 percent premium increases. By contrast, negative adjusted S&P returns have no impact on premiums and in the Post Anomaly Period, neither positive nor negative adjusted returns lead to premium changes. In addition, neither vega returns nor theta returns have significant effects on premiums in any of the sub periods.

Overall, the results demonstrate that BEP share prices responded sluggishly to adjusted S&P returns during the first 1-3/4 years of the life of the S&P Covered Call Fund, and then overreacted to positive adjusted S&P returns during the Anomaly Period when the premium on the S&P Covered Call Fund went from 5 percent to 23 percent. The next section takes a more in-depth look at the Anomaly Period and then provides a noise trader perspective on the anomaly.

3.1 An In-Depth Examination of the Anomaly Period

Although the evidence in the previous section indicates that the premium that emerged during the Anomaly Period can be attributed to an overreaction of BEP shares to delta and gamma adjusted positive S&P returns, it does not explain why the overreaction occurred. Figures 2a-2c provide an in-depth look at the factors that may have contributed to the emergence of the large premium during the Anomaly Period. These factors include the S&P 500 index, the S&P 500 Volatility Index (VIX) and the deltas of the options that the

BEP fund was short.[18] The figures do not show an obvious catalyst for the initial increase of the premium from 5 percent to 10 percent during February 2007, as S&P prices were flat (figure 2a) and the VIX (figure 2b) remained at the same very low levels between 10 and 11 percent that had persisted for several months. The S&P index fell sharply from 1450 to 1400 on February 27, and the VIX spiked to 18 percent and remained elevated for a few weeks. One possibility is that the spike of the VIX and the general rise in implied volatilities encouraged investors to adopt covered call strategies and in particular caused BEP investors to bid up further the price of BEP shares relative to their NAVs.[19]

Over the next few weeks, the premium increased further despite the minimal protection provided by the 1455 strike call that the fund was short, which had moved well out of the money and consequently had a delta close to zero (figure 2c). As the S&P index rebounded in the second half of March from 1400 to 1430, the premium rose from roughly 15 percent to its peak of 23 percent as BEP share prices strongly overreacted to positive delta and gamma adjusted S&P returns, as the delta of the 1395 strike call that the BEP fund now was short rose to about .8, which substantially limited potential further NAV returns. It is worthy of note that both the increase of the premium from 5 percent to 23 percent occurred over a period in which the S&P 500 index was little changed on balance (figure 1) and that the decline of the premium from its high of 23 percent at the end of March to 10 percent at the beginning of May occurred against a backdrop of a strong rally of the S&P 500 index from 1420 to around 1530 and a drop in the VIX to around 13 percent. Thus, the premium

[18] The models examined in the previous section also were estimated with the change of the VIX representing the impact of changes in volatility assumptions. The rationale was to allow for the possibility that the unsophisticated market participants who bid up BEP premiums were looking at general measures of implied volatility rather than considering the impact of a change in the implied volatility assumption of the specific options that the fund was short. Although the change of the VIX did not enter the models significantly, this does not rule out the possibility that the substantial jump of the VIX was the source of the large jump of the premium in the Anomaly Period.

[19] While the BEP fund fell about 4 percent on February 27, it was trading at higher levels than prior to the large decline within seven trading days.

rose and fell more in sympathy with the VIX than with the S&P 500 index. These findings are consistent with the possibility that some of the increase of the premium owed to the sharp increase of the VIX, which augured well for covered call strategies and encouraged unsophisticated investors to bid up the premiums of the BEP fund. The next section examines the large increase of the premium from a noise trader perspective.

3.2 A Noise Trader Perspective on the Anomaly Period

Ross (2004) refers to the often large discounts on closed end funds as the poster child of the behavioral finance literature. In light of the extremely transparent and easy to replicate strategy of the fund, the large run up of the premium of the BEP fund is by definition evidence of noise trader activity. Along these lines, Lee, Shleifer, and Thaler (1991) argue that swings in the sentiment of small investors--the major investors in closed end funds--drive closed end fund discounts, which should cause closed end fund discounts to move together. An interesting issue is whether the large premium that emerged in BEP shares was part of a general increase in premiums that small and unsophisticated investors were willing to pay for covered call closed end funds or was specific to the BEP fund.

Figure 3 shows the BEP fund premium over the period from September 2005 through March 2008, as well as the average premium of eleven other covered call closed end funds.[20] The figure shows that the average behavior of the other funds moved in line with the BEP

[20] These funds include the Enhanced Covered Call Fund (BEO), the Eaton Vance Tax Managed Global Buy-Write Opportunity Fund (ETW), the Eaton Vance Tax Managed Buy Write Fund (ETV), the Eaton Vance Tax Managed Buy Write Income Fund (ETB), the Madison Strategic Sector Premium Fund (MSP), the Nuveen Index Options and Equities Fund (JSN), the NFJ Dividend, Interest and Premium Strategy Fund (NFJ), the Nuveen Equity Premium Fund (JPZ), the Madison Claymore Covered Call Fund (MCN), the First Trust Fiduciary Asset Management Covered Call Fund (FFA) and the Dow 30 Premium and Dividend Income Fund (DPD).

fund from mid to late 2006, as both went from 5 percent discounts to parity with their NAVs. However, as the BEP fund went from parity to a 23 percent premium at the end of March 2007, the average premium of the other covered call closed end funds rose only to about 4 percent. On the day that the BEP fund closed at a premium of 23 percent, four of the other covered call closed end funds had premiums over 5 percent with the highest being 10-1/4 percent, five had premiums less than 5 percent, and two had discounts. Thus, the large increase in the BEP fund premium was largely a fund-specific event that did not reflect an across the board increased willingness to pay large premiums for covered call closed end funds.[21]

In the noise trader model of De Long et al. (1990), noise traders cause transitory market inefficiencies because arbitrage is risky. This risk can be partitioned into fundamental risk and noise trader risk. Fundamental risk stems from the possibility that taking positions in mispriced securities is risky because of the difficulty of constructing perfectly hedged arbitrage positions. Noise trader risk owes to the possibility that noise traders push mispriced securities further away from their fundamental values. Professional money managers are especially concerned about this risk because large transitory losses on arbitrage positions could cause investors to withdraw funds, which could force managers to liquidate positions after mispricings have become more extreme (see Shleifer and Vishny (1997)).

In terms of the dichotomy between noise trader risk and fundamental risk associated with arbitraging the BEP fund premium, fundamental risk is minimal because traders who short the BEP fund can easily and effectively hedge their NAV exposure, which leaves noise

[21] Another possibility is that dividend capture strategies could cause transitory premiums given the large distributions of the BEP fund. This possibility is unlikely because the fund makes distributions in December and June of each year and did not make distributions during the period of the large premium increase. Also, neither trading volume nor intraday volatility appears to be unusually high or to rise around the time of distributions.

trader risk.[22] A hallmark of the presence of noise traders is an elevated level of market volatility relative to the volatility of the fundamentals.[23] This corresponds to an elevated volatility of BEP share prices relative to the volatility of the underlying fundamentals, as reflected by the NAV. Although the NAV is reported only at the close, the intraday volatility of the fundamentals can be determined from the BXM index because the BEP fund follows the strategy of the BXM, which is reported to market participants during the trading day. The Garman-Klass (1980) daily annualized standard deviation of BEP and BXM logarithmic returns is calculated based on the open, high, low and close of BEP share prices and the BXM index as

$$\sigma = \{[(\ln O_t/C_{t-1})^2 + .5 * (\ln H_t/L_t)^2 - .39 * (\ln C_t/O_t)^2]^{.5}\} * \sqrt{252}. \qquad (11)$$

Figure 4 shows the BEP premium and the differences between the 5-day moving averages of the BEP and the BXM return annualized volatility estimates from when the CBOE began broadcasting intraday data for the BXM index in September 2006 through March 2008. The figure shows that BEP return volatility consistently outpaced BXM return volatility over the sample period by an average of about 10 percent, with some fairly pronounced spikes relative to BXM return volatility. However, these spikes are largely absent during the period in which the premium increased to 23 percent and are more prevalent later in the sample period. Thus, while the presence of noise traders is reflected by the consistently positive and sometimes large spread between BEP and BXM return

[22] Traders who short the BEP fund are short S&P 500 covered calls, which is equivalent to buying S&P 500 puts synthetically. This position could be hedged by shorting the S&P 500 index put that has the same strike and expiry month of the call that the BEP fund is short.

[23] For example, Roll (1988) finds that most of the idiosyncratic volatility of individual stocks can not be connected to public news, while Cutler, Poterba and Summers (1989) find that days where stock indexes move the most are not necessarily days when important fundamental news is released.

volatilities, noise traders do not appear to have increased the volatility of BEP shares relative to the volatility of the fundamentals during the period in which the BEP premium increased to 23 percent.

Other noise trader models such as Abreu and Brunnermeier (2002) emphasize that mispricings can persist owing to the need for a critical mass of arbitrageurs to counteract the effect of noise traders, which increases the importance of timing. A related question is whether the BEP premium increase was driven by arbitrageurs whose timing was off and who were forced to cover short BEP share positions as premiums rose substantially and losses mounted. Figure 5 shows the premium of the BEP fund and the level of short interest over the life of the fund. Short interest was about 80,000 shares in the months following the IPO, as the BEP fund initially traded at a premium and short sellers presumably anticipated the typical move toward a discount in the year after a closed end fund IPO. Short interest was at negligible levels over much of 2006, as the BEP fund traded at a discount. It then picked up in the beginning of 2007 and during the period in which the premium increased from 5 percent to 15 percent from the end of January through mid-March, short interest picked up from 100,000 shares to 240,000 shares, with the latter representing about two times average daily trading volume. Thus, a substantial portion of the large run up of the premium was associated with a significant build in short positions. A potential contributing factor for the increase of the premium during this period could be traders who shorted BEP shares and subsequently were forced to cover losing bets by buying back BEP shares. In this case, the large short position increase reflects a sequence of arbitrageurs setting up short positions and being forced to buy back shares because of poor timing. It is also interesting to observe that short positions peaked at 280,00 shares after the premium crested at 23 percent and remained at elevated levels as the premium deflated, consistent with the model of Abreu and Brunnermeier (2002) that emphasizes the timing of arbitrage strategies and the need for a critical mass of arbitrageurs to correct mispricings. In addition, the fairly substantial increase in short positions to sizable levels suggests that the large run up of the premium did not owe to the difficulty of finding BEP shares to short.

4. Conclusions

This paper examines the behavior of the S&P 500 Covered Call Closed End Fund (BEP), which traded for a few months in 2007 at substantial premiums to its NAV that reached as high as 23 percent. These large premiums are anomalous in light of the highly transparent and easy to replicate strategy of the fund, which involves rolling over one month, at the money S&P 500 index covered calls. To isolate the source of the large premiums, this paper estimates and compares the response of BEP and NAV daily returns to the exposures of the Black Scholes greeks and finds that the large run up of the premium can be attributed to BEP returns overreacting to positive S&P 500 returns, adjusted for the deltas and gammas of the options that the fund was short.

The paper then provides evidence consistent with the possibility that the large premium increase was driven by a near doubling of the VIX from very low and stable levels that had persisted for several months, which may have led unsophisticated market participants to bid up the price of BEP shares without regard to their underlying NAVs. This possibility is supported both by the subsequent drop of the premium from its peak as the VIX fell toward its previous low level and by the fact that the level of the S&P 500 index was little changed during the period in which the BEP premium rose sharply and the S&P 500 index rallied strongly as the BEP premium dissipated.

The paper then examines the anomaly from the standpoint of the noise trader literature. The evidence shows that the large increase of the BEP fund premium was an isolated event and not reflective of an overall increased demand for covered call exposure, as the average premiums of eleven other covered call closed end funds rose to modest premiums. The paper then examines whether one of the hallmarks of noise trader activity--excess volatility--is present by examining BEP share price volatility relative to the volatility of the underlying fundamentals, with the latter reflected by the volatility of the BXM (S&P 500 covered call) index that the BEP fund strategy replicates. The evidence demonstrates that noise trader activity is present, as the volatility of BEP returns greatly surpassed the volatility of BXM index returns over the sample period. However, the evidence does not show unusual patterns of excessive noise trader activity during the period in which the anomaly occurred, as large spikes in BEP return volatility relative to BXM index return volatility did not occur until later periods. Finally, the paper examines the pattern of short interest and finds a substantial build in short positions as the premium rose from 5 percent to 15 percent. This evidence indicates that arbitrageurs were able to execute short positions and suggests that a possible contributor to the run up of the premium was the poor timing of arbitrageurs who later were forced to cover short positions as losses mounted. These findings are in line with the theoretical results of Abreu and Brunnermeier (2002) that emphasize the risk associated with the timing of arbitrage, which causes arbitrage opportunities to be longer lived than they otherwise would be.

Overall, while this study econometrically identifies the source of the anomaly--an overreaction to positive delta and gamma adjusted S&P 500 returns--identifying the underlying reasons for the overreaction is far more challenging. The most likely explanations are the large jump of the VIX and short covering under duress by arbitrageurs who rightly saw the large premium as unsustainable over the long run but who underestimated the ability of BEP shares to become even more overpriced in the short run.

Table 1. The factors driving the S&P 500 Covered Call Fund daily NAV returns from April 13, 2005 through March 28, 2008. Daily NAV returns are regressed on a constant and contemporaneous variables for delta and gamma adjusted positive and negative S&P returns (ADJRETS), vega returns (VEGARETS) and theta returns (THETARETS). The variables are standardized so that the coefficients on the delta and gamma adjusted returns should be one and the coefficients on vega and theta returns should be minus one. The equations are estimated with OLS and with standard errors corrected for heteroscesticity and autocorrelation through six lags with the Newey-West correction. Two and one asterisks denote statistical significance at the one and five percent levels, respectively.

$$NAVRETS_t = \alpha_0 + \alpha_1 * ADJRETS_t^+ + \alpha_2 * ADJRETS_t^- + \alpha_3 * VEGARETS_t + \alpha_4 * THETARETS_t + u_t$$

	Whole Period	Pre Anomaly Period	Anomaly Period	Post Anomaly Period
	4/13/05 - 3/28/08	4/13/05 - 1/23/07	1/24/07 -5/22/07	5/23/07 - 3/28/08
Constant	-.0003**	-.0004 *	-.0009*	-.0002
	(.0001)	(.0002)	(.0004)	(.0002)
$ADJRETS_t^+$	1.0644**	1.0757**	1.0904**	1.0603**
	(.02216)	(.0237)	(.0447)	(.0323)
$ADJRETS_t^-$	1.0346**	1.0243**	.9159**	1.0497**
	(.0187)	(.0484)	(.0353)	(.0259)
$VEGARETS_t$	-.3066*	-.2883*	-.7000**	-.3014
	(.1484)	(.1422)	(.1875)	(.2742)
$THETARETS_t$	-1.9673**	-2.4150**	-3.6389**	-1.8632**
	(.2329)	(.5208)	(.9498)	(.2861)
$RBAR^2$	.9305	.8633	.9591	.9551
NOBS	743	447	82	214

Table 2. The factors driving S&P 500 Covered Call (BEP) share daily returns from April 13, 2005 through March 28, 2008. Daily BEP returns are regressed on a constant, the lagged premium, contemporaneous variables for delta and gamma adjusted positive and negative S&P returns (ADJRETS), vega returns (VEGARETS) and theta returns (THETARETS). The variables are standardized so that the coefficients on the delta and gamma adjusted returns should be one and the vega and theta returns should be minus one. The equations are estimated with OLS and with standard errors corrected for heteroscesticity using White's method. Two and one asterisks denote statistical significance at the one and five percent levels, respectively.

$$BEPRET_t = \beta_0 + \beta_1 * PREM_{t-1} + \beta_2 * ADJRETS_t^{+} + \beta_3 * ADJRETS_t^{-}$$
$$+ \beta_4 * VEGARETS_t + \beta_5 * THETARETS_t + \varepsilon_{t,}$$

	Whole Period	Pre Anomaly Period	Anomaly Period	Post Anomaly Period
	(4/13/05-3/28/08)	(4/13/05-1/23/07)	(1/24/07-5/22/07)	(5/23/07-3/28/08)
Constant	.00071	-.0011	.0045	.00250
	(.0011)	(.0014)	(.0044)	(.0032)
$PREM_{t-1}$	-.0132**	-.0158	-.0503*	-.0358*
	(.0054)	(.0084)	(.0236)	(.01430)
$ADJRETS_t^{+}$	.8693**	.4598**	2.3280**	.9436**
	(.1471)	(.1543)	(.3804)	(.2096)
$ADJRETS_t^{-}$	.9083**	.4833**	.8852**	1.0132**
	(.0937)	(.1509)	(.2271)	(.1465)
$VEGARETS_t$	.0848	.5740	-2.9433	-.0223
	(.6064)	(.6705)	(1.6872)	(.9862)
$THETARETS_t$	.4089	-4.2803	-5.7005	3.3734
	(2.909)	(3.8660)	(9.3278)	(5.336)
$RBAR^2$	.208	.036	.448	.320
Q(6)	7.01	7.84	10.52	8.35
(sign. level)	(.319)	(.250)	(.104)	(.213)
NOBS	743	447	82	214

Table 3. Tests of whether daily S&P 500 Covered Call (BEP) premium changes are driven by the greek exposures from April 2005 through March 2008. Daily premium changes are regressed on a constant and contemporaneous variables for delta- and gamma-adjusted positive and negative S&P returns, vega returns and theta returns. The equations are estimated with OLS and with standard errors corrected for heteroscesticity using White's method. Two and one asterisks denote statistical significance at the one and five percent levels, respectively.

$$\Delta PREM_t = \beta_0 + \beta_1 * PREM_{t-1} + \beta_2 * ADJRETS_t^+ + \beta_3 * ADJRETS_t^-$$

$$+ \beta_4 * VEGARETS_t + \beta_5 * THETARETS_t + \varepsilon_t$$

	Whole Period	Pre Anomaly Period	Anomaly Period	Post Anomaly Period
	(4/13/05-3/28/08)	(4/13/05-1/23/07)	(1/24/07-5/22/07)	(5/23/07-3/28/08)
Constant	.0010	-.0006	.0057	.0028
	(.0011)	(.0014)	(.0051)	(.0032)
$PREM_{t-1}$	-.0135**	-.0168*	-.0545*	-.0360*
	(.0059)	(.0085)	(.0278)	(.0146)
$ADJRETS_t^+$	-.2029	-.6216**	1.423**	-.1412
	(.1469)	(.1568)	(.4488)	(.2039)
$ADJRETS_t^-$	-.1214	-.5247**	-.0396	-.0377
	(.0960)	(.1570)	(.2538)	(.1454)
$VEGARETS_t$	.3658	.9261	-2.488	.2017
	(.6407)	(.6661)	(1.950)	(1.050)
$THETARETS_t$	2.418	-1.778	-2.702	5.292
	(2.844)	(3.809)	(10.751)	(5.291)
$RBAR^2$	.011	.072	.109	.004
Q(6)	6.83	7.65	10.74	9.09
(sign. level)	(.336)	(.265)	(.100)	(.168)
NOBS	743	447	82	214

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Fig 1. The S&P Covered Call Closed End Fund Price (thick line) and the Percent Premium (thin line) from April 2005-March 2008

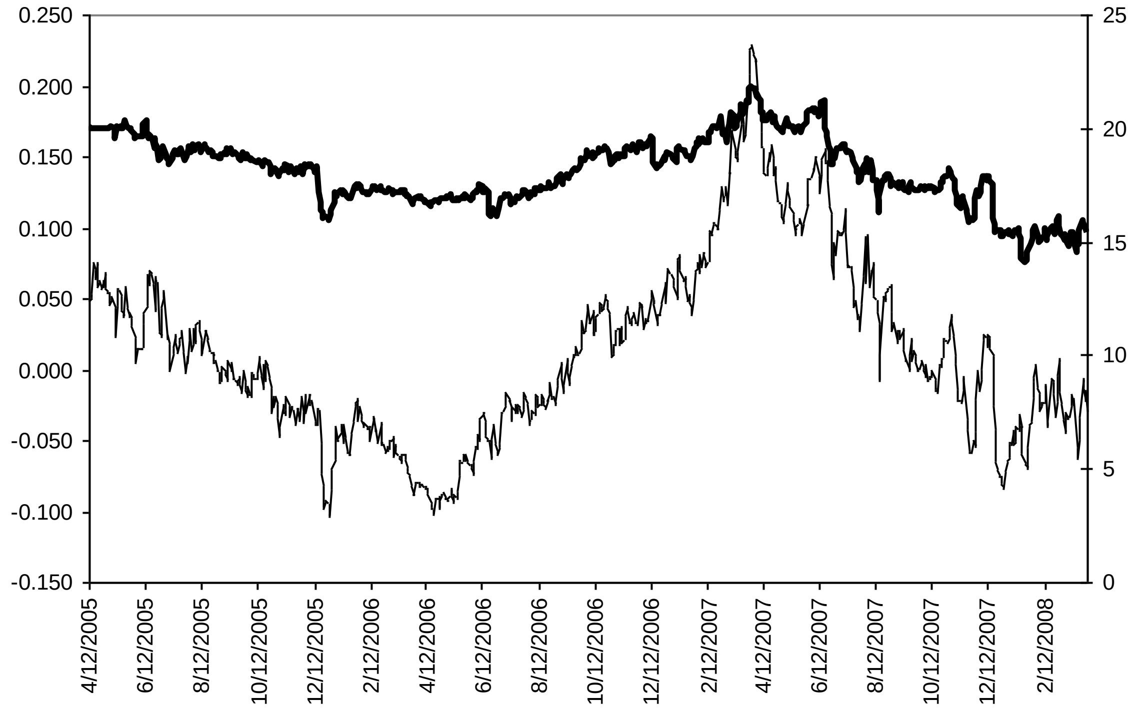


Figure 2a. The BEP Fund Premium (heavy line) and Level of the S&P 500 Index Level During the Anomaly Period

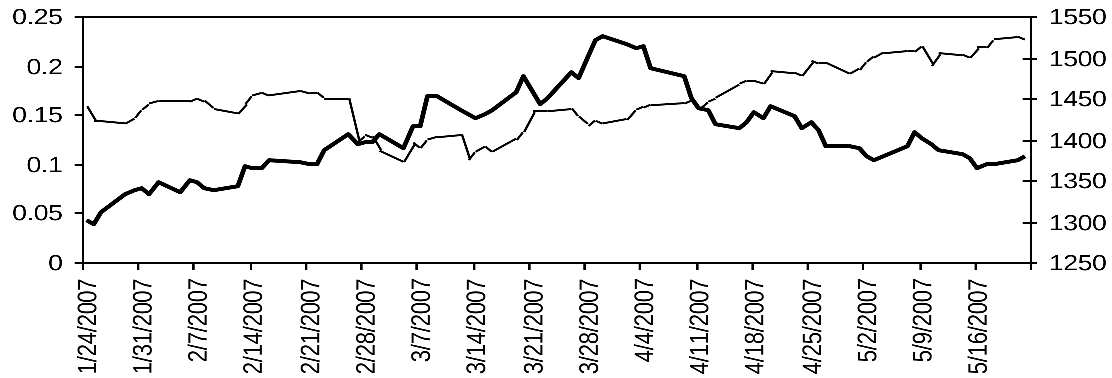


Figure 2b. The BEP Fund Premium (heavy line) and VIX During the Anomaly Period

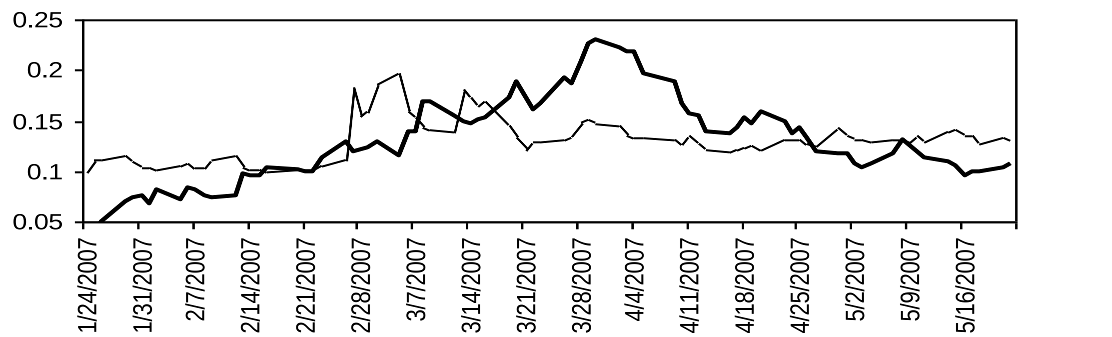
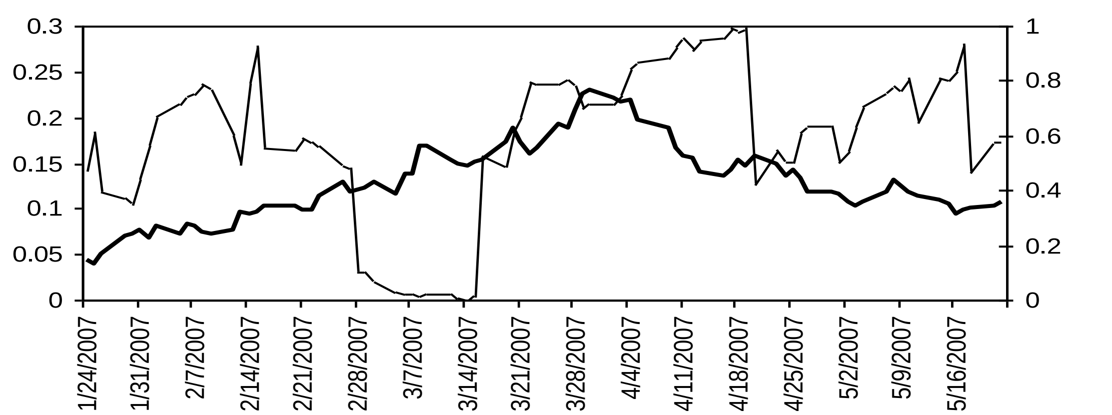


Figure 2c. The BEP Fund Premium (heavy line and left axis) and Delta of the Option that the BEP Fund is Short During the Anomaly Period



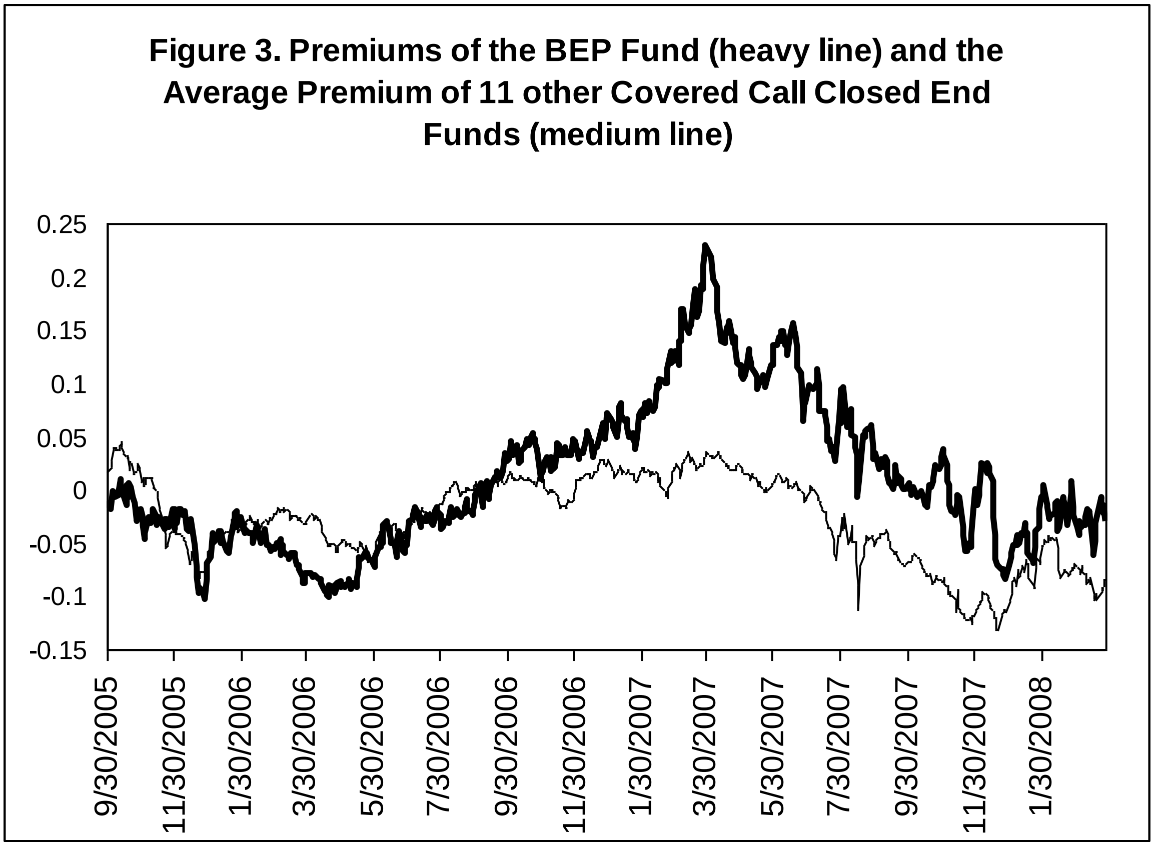
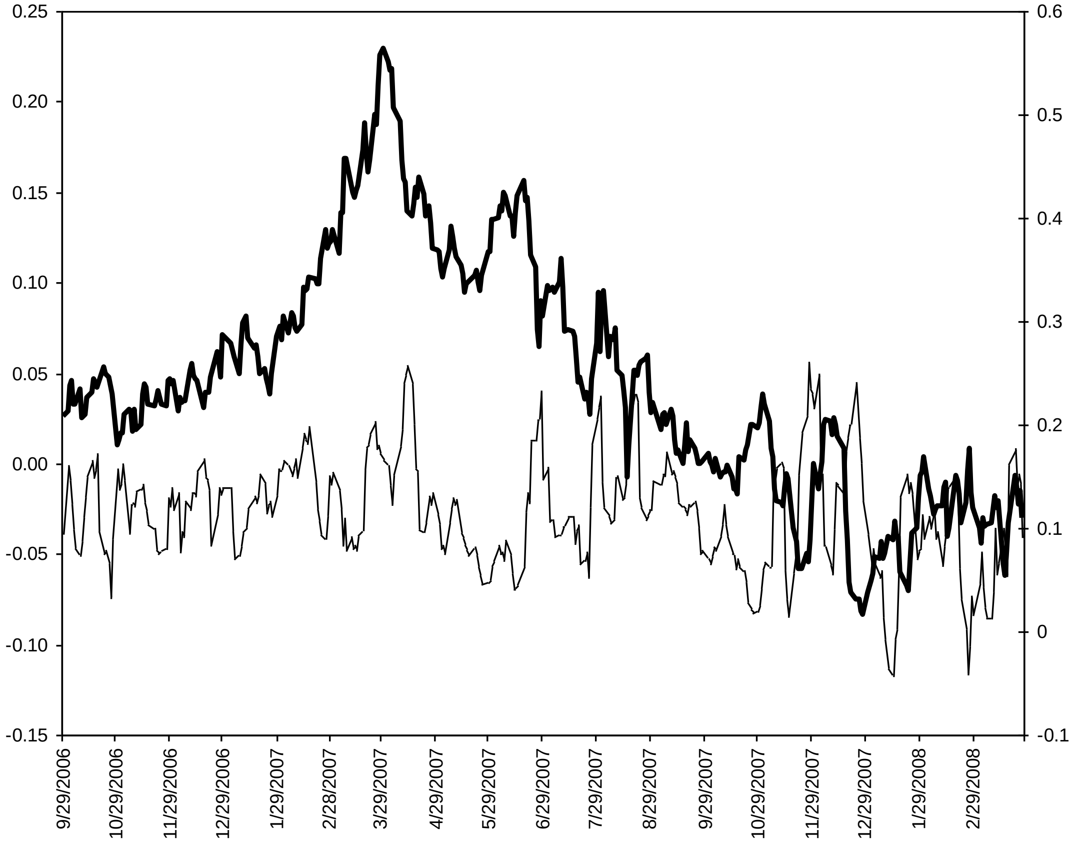


Figure 3. Premiums of the BEP Fund (heavy line) and the Average Premium of 11 other Covered Call Closed End Funds (medium line)
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
9/30/2005
11/30/2005
1/30/2006
3/30/2006
5/30/2006
7/30/2006
9/30/2006
11/30/2006
1/30/2007
3/30/2007
5/30/2007
7/30/2007
9/30/2007
11/30/2007
1/30/2008

Figure 4. The BEP Premium (heavy line and left scale) and the Spread between the 5-Day Moving Averages of the BEP Share and BXM Index Annualized Return Volatilities using the Garman-Klass Method (thin line and left scale) from September 2006-March 2008



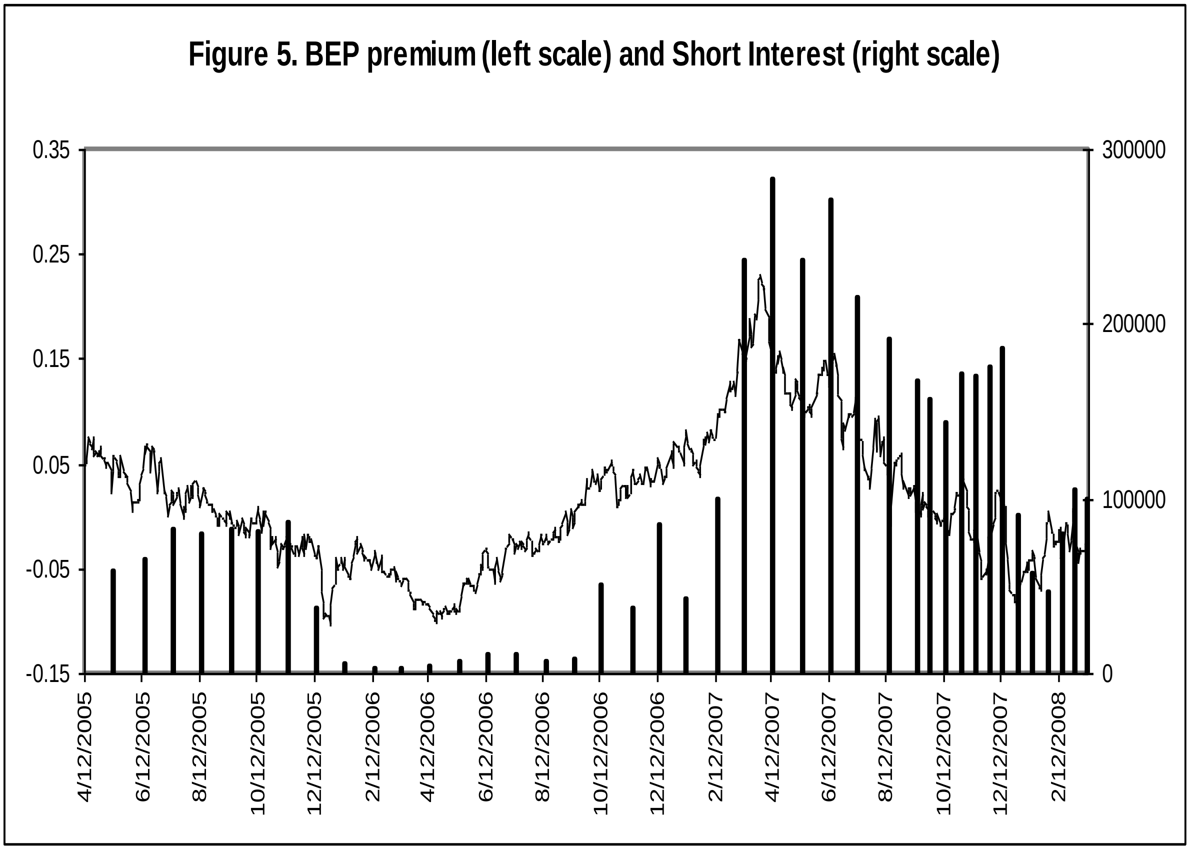


Figure 5. BEP premium (left scale) and Short Interest (right scale)
0.35
0.25
0.15
0.05
-0.05
-0.15
300000
200000
100000
0
4/12/2005
6/12/2005
8/12/2005
10/12/2005
12/12/2005
2/12/2006
4/12/2006
6/12/2006
8/12/2006
10/12/2006
12/12/2006
2/12/2007
4/12/2007
6/12/2007
8/12/2007
10/12/2007
12/12/2007
2/12/2008