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Finding Alpha via Covered Index Writing

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Covered S&P 500 Index call strategies have, on average, outperformed the S&P 500 Index over the past 15+ years while realizing lower standard deviations of returns. This analysis dissects the strategy underlying the BuyWrite Monthly Index on the S&P 500. The BXM is the most broadly quoted benchmark for index call–selling strategies. Also discussed are alternative structured S&P 500 option–overwriting strategies, which have even more attractive risk–return trade-offs than the BXM because they take advantage of the implicit positive risk premium of equities and potentially adjust the strike price of the call sold on the basis of the volatility environment.

The new S&P 500 BuyWrite Index (BXM) of the Chicago Board Options Exchange (CBOE) has outperformed the S&P 500 Index with only two-thirds of its risk. What's the catch? Well, for one thing, a user of the BXM needs to be willing to accept some underperformance in spectacularly strong equity markets when everyone else is bragging about their hot stock picks. The relatively boring strategy to capture the BXM returns consists of going long S&P 500 exposure while shorting at-the-money (ATM) call options on the S&P 500. It does best relative to the index when equity markets are quiet, posting moderate or falling returns, and is, therefore, worth studying further in the current environment.

Academics and investment consultants have studied the BXM in terms of its return and risk characteristics both alone and in combination with other asset classes.[1] In the period we studied (1 January 1990 to 31 October 2005), the BXM's annualized return of 11.0 percent was about 60 bps above that of the S&P 500, with a standard deviation of less than 10 percent (compared with about 14.5 percent for the S&P 500). Although some of the lower risk in terms of standard deviation came from eliminating upside swings in rising markets, as **Figure 1** and **Figure 2** show, the track record has been impressive in both bull and bear markets.

Some of the best returns of the BXM relative to the S&P 500 have been in low-volatility periods like that of the early 1990s and in the bear market of 2000–2002. In some sustained periods, such as 1995–1998, the BXM underperformed the S&P 500 by more than 5 percentage points each year.

Recently, with investors attracted by the return and risk characteristics, as well as regular cash flows, of the BXM, several funds and structured products have been created to track the index.[2] With the recent introduction of options on the S&P 500 SPDR (S&P Depositary Receipts) exchange-traded funds (SPY), these strategies can also be used for covered call writing on the SPY. The BXM can also serve as a benchmark for more active or alternatively structured options strategies designed to outperform the index.

We analyze the strategy underlying the BXM and some alternative structured index option–overwriting strategies that have even more attractive risk–return trade-offs than the BXM, including fixed-strike overwriting strategies and a flexible strategy that dynamically adjusts the strike based on the volatility environment.

Factors Driving the Performance of a Covered Call Strategy

Before jumping into the specifics of the BXM and alternative overwriting strategies, we remind readers of the factors that drive the performance of these strategies. We have identified the following drivers of overwriting strategy returns:[3]

1. *The fair call premium*: the premium that would go to the call seller who had perfect volatility foresight in a world with no trading costs; that is, the call is priced at the volatility realized over the life of the option, rather than at implied volatility, and there is no bid–ask spread.

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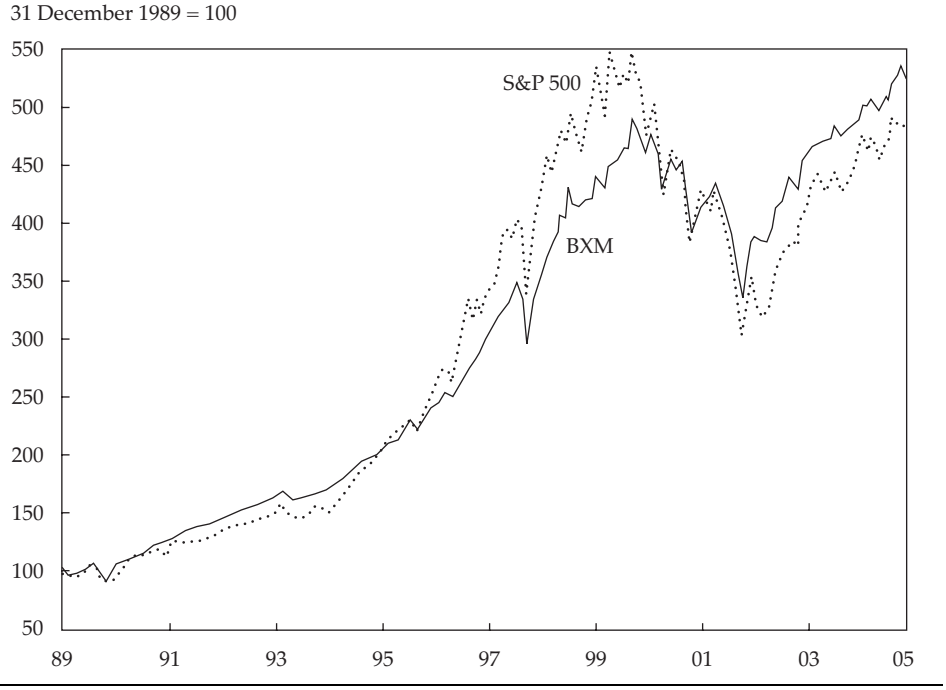
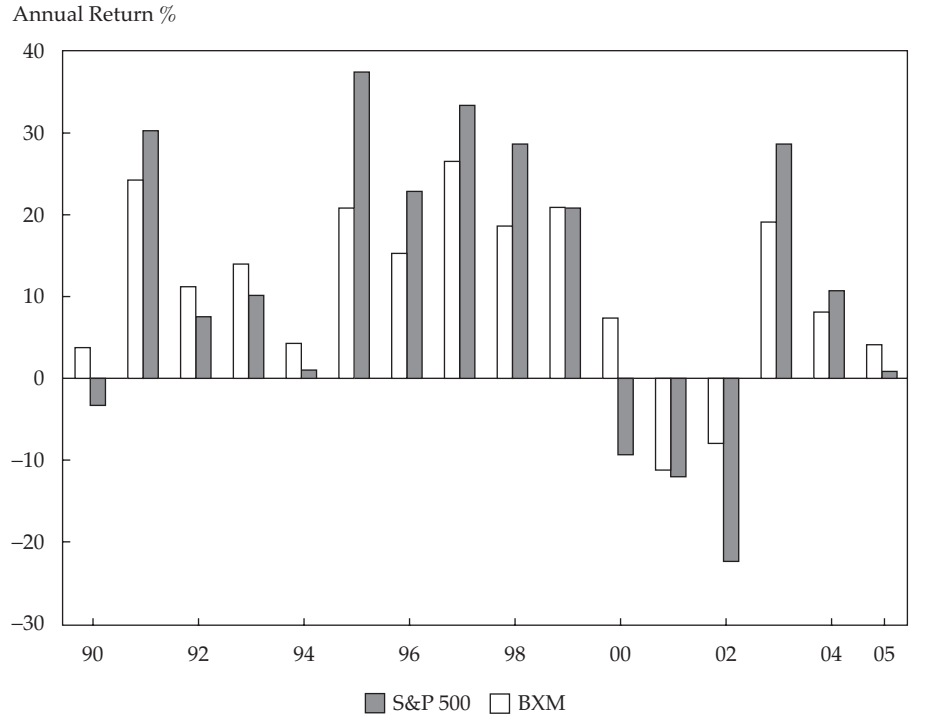
Figure 1. Cumulative Total Return on the BXM and S&P 500, 1 January 1990 to 31 October 2005



Sources: CBOE and Standard & Poor's.

Figure 2. Annual Total Return on the BXM and S&P 500, 1 January 1990 to 31 October 2005



Sources: CBOE and Standard & Poor's.

2. *The volatility premium*: the premium that captures the impact of selling options at implied volatility instead of at the volatility realized over the life of the option.
3. *The exercise cost*: the component of the call premium that reflects the market impact of executing the sale. The bid–offer spread is the basis for this cost unless the transaction size is large enough to move the price.
4. *The trading cost*: the loss in call premium as a result of the bid–ask spread.

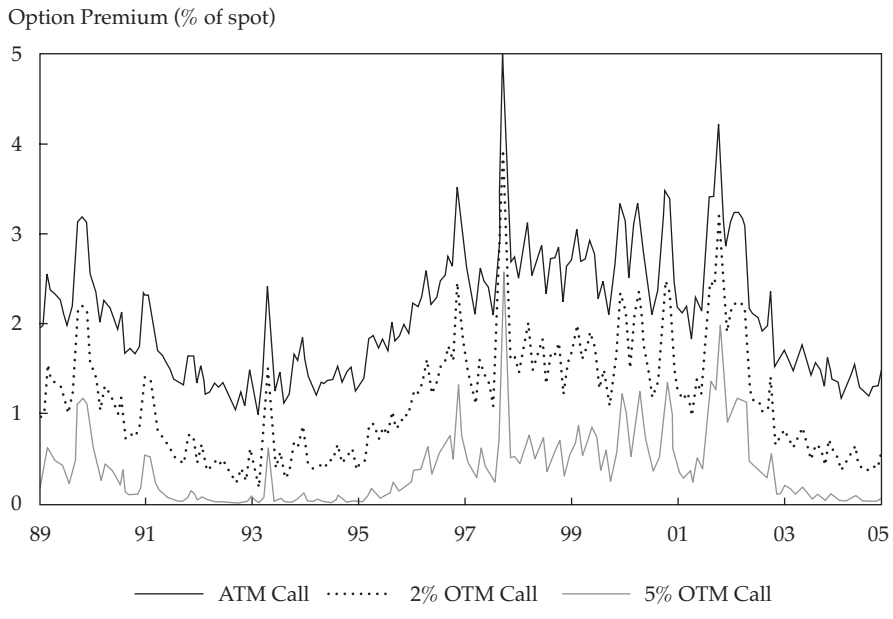
As we demonstrate later, Items 1–3 are the most important contributors to performance. Discussions of covered index–selling strategies are usually restricted, however, to Items 1 and 2: the ability to collect a steady premium that enhances performance and the opportunity to capture a spread of implied volatility over realized volatility, which has been mostly positive at the index level. Because of the general emphasis on these two issues, we provide more details about them before we discuss the significance of the third important point, exercise cost.

Call Option Premium Levels. An attractive feature of call-overwriting strategies is that the call sold generates a monthly cash flow much like interest or dividends. However, these cash flows have important differences in regard to how they are collected. First, the option premium reflects the probability that the seller will incur a loss through exercise of the option by the buyer at expiration. Second, tax considerations need to be taken into account. In the United States, for example, the call premium is taxable as a capital gain, which for most U.S.-based investors is taxed at a higher rate than dividends.[4]

Figure 3 shows the level of one-month S&P 500 call premiums historically for ATM options and for options 2 percent and 5 percent out of the money.[5] The premiums for these options averaged, respectively, 2.1 percent, 1.1 percent, and 0.4 percent over the past 15+ years. The variation over time is primarily a result of shifts in volatility reflected in option prices, but premiums also move higher with the level of interest rates relative to S&P 500 dividend yields. Note that these premiums have recently been at the lower end of their range because both volatility and short-term interest rates have been at lower levels (and with improved corporate cash levels and more favorable dividend tax treatment, dividend yields have been shifting higher).

The Volatility Connection. Another reason index-overwriting strategies have such attractive return properties is that they capitalize on investors' and traders' fears of a financial disaster. Options contain a premium for the volatility environment expected to prevail during the life of the option. This premium reflects the risk of having a large move that would cause a loss to the option seller. Ever since the crash in October 1987, the volatility implied in S&P 500 options, especially

Figure 3. One-Month S&P 500 Call Option Premiums for Various Strikes, 1 January 1990 to 31 October 2005



Source: Goldman Sachs.

those with strike prices at or below the index, has contained a premium for "crash" or "downside gap" risk—the risk that all stocks will fall together in jumps so that trading out of positions will be difficult.

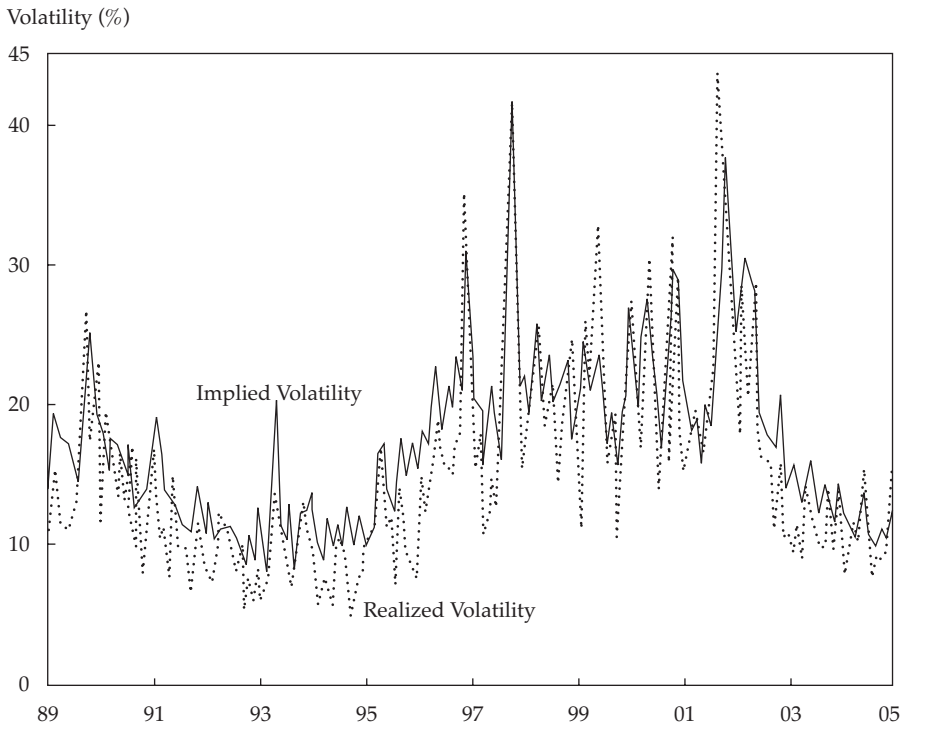
Figure 4 shows the implied volatility of ATM one-month S&P 500 index options back to 1990. Only in the highest-volatility regimes has realized volatility moved higher than the volatility implied in option prices. The average spread between one-month implied and realized volatility has been 2.4 percentage points for 1990 through October 2005. As **Figure 5** shows, however, many times during the bear market conditions of 2000–2002, the actual market risk experienced was higher than that priced into the S&P 500 options.

The existence of differences between the implied volatility of S&P 500 options among strike prices is referred to as the "skew." As shown in Figure 4, implied volatility for ATM options is normally higher than realized volatility for the S&P 500. The spread of implied-to-realized volatility, however, is wider for OTM put options than for OTM call options. For example, over the period January 1990 through October 2005, the implied volatility of the 2 percent S&P 500 OTM put options averaged 3.9 percentage points above realized volatility. In contrast, the implied volatility of the 2 percent S&P 500 OTM call options averaged 1.5 percentage points above that of realized one-month volatility.

The existence of the skew has two, related explanations that imply higher expected volatility in declining markets than in rising markets: (1) Markets have a greater tendency to have gap or jump moves when they fall than when they rise. The cause can be a reaction to unexpected negative macroeconomic or geopolitical events. (2) Stocks are more correlated in falling markets than they are in rising markets, or stated differently, good news comes one stock at a time whereas bad news tends to affect many companies simultaneously. The implication for option-selling strategies is that investors receive higher compensation, in volatility terms, for committing to buy in a declining market than they do for committing to sell in a rising market. Nevertheless, the spread between implied and realized volatility for the S&P 500 has remained positive, even for 2 percent OTM call options.

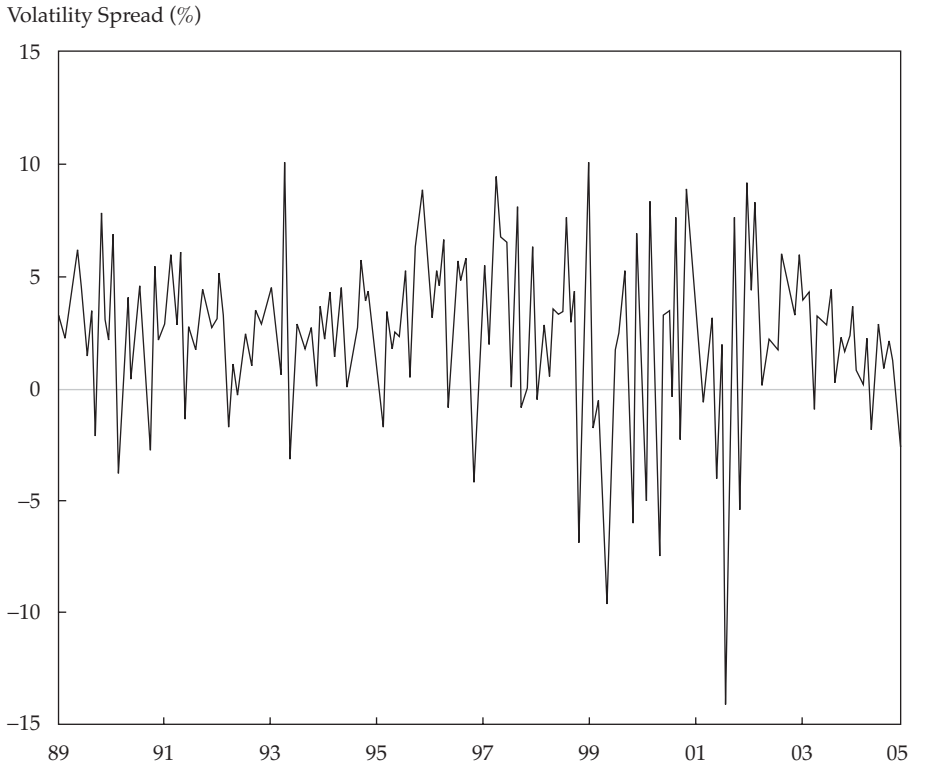
The Forgotten Factor: Exercise Cost. The fair call premium positively contributes to the performance of overwriting strategies, and the index volatility premium usually also adds value, but the return lost from calls that expire in the money (ITM)

Figure 4. S&P 500 ATM One-Month Option: Implied and Realized Volatility, 1 January 1990 to 31 October 2005



Source: Goldman Sachs.

Figure 5. S&P 500 ATM One-Month Option: Implied vs. Realized Volatility Spread, 1 January 1990 to 31 October 2005



Note: The average spread was 2.4 percentage points; the median, 2.7 percentage points.
Source: Goldman Sachs.

can easily overwhelm both, especially for calls struck at the money. In spite of the sizable magnitude of this cost (it was, on average, close to 2 percent a month for ATM calls for 1990 through October 2005), discussions of covered call strategies too often ignore this component. The exercise cost is by definition negative, and it is capped at zero.

The success of a covered call strategy, therefore, hinges as much on minimizing this exercise cost as on capturing the fair call value and the implied versus realized volatility premium. If an investor expects a positive risk premium associated with equities, the investor implicitly expects ATM calls to expire in the money. If the investor wants to reduce the expected exercise loss, the investor should consider OTM strikes and make a trade-off between the reduction in expected exercise cost and the reduction in the call premium associated with moving from at the money to out of the money. We present empirical evidence that overwriting strategies can be significantly enhanced without adding much risk by selecting such OTM strategies.

BXM Construction Compared with Alternatives

The BXM introduced in 2002 reflects a strategy of going long the S&P 500 and selling (writing) a one-month ATM call option on the S&P 500 on the third Friday of each month (the option expiration day).[6] The BXM methodology assumes that this European-style call option will be sold at a price equal to the volume-weighted average of the prices of the option from 11:30 a.m. to 12 p.m. EST.[7] The option is held until expiration one month later, when the strategy rolls and new near-term ATM call options are sold against the long S&P 500 holding. The option premium and any dividends on the S&P 500 constituents are assumed to be reinvested in the covered call strategy (i.e., the BXM is a total-return index).[8]

To study alternative index-overwriting option strategies, we carried out strategies that sold a one-month (or three-month where indicated) European-style call on the S&P 500 at the close on the Thursday before monthly (or quarterly) expiration and held the position until the close on the Thursday before the next monthly (or quarterly) expiration. We used

a variety of strike prices: ATM, 2 percent OTM, and 5 percent OTM for the one-month calls and ATM, 5 percent OTM, 7 percent OTM, and 10 percent OTM for the three-month calls.[9] In addition, for the three-month calls, we rolled on a January/April/July/November cycle. We assumed that the bid–ask spread was 1 implied volatility point and that the option premium received was invested at LIBOR during the life of the option.[10] Our sample period was 18 January 1990 to 17 November 2005 (a total of 180 months or 60 quarters).[11]

Of the alternatives we analyzed, the ATM one-month call-overwriting strategy is closest to the BXM approach. Our calculations, however, differed from the BXM return calculation along broadly three dimensions:

1. We rolled at the close of the Thursday before expiration instead of on expiration Friday. With daily data, this Thursday close is nearest to the time when the BXM's underlying option would expire and a new option would be sold. This assumption implies that expiration happens at the close of business and that a new call is sold simultaneously (instead of splitting expiration day returns into three portions, as is the case for the BXM).
2. We priced exact ATM calls instead of calls that, as is the case for the BXM, are slightly out of the money but closest to at the money. In addition, the new BXM strike is influenced by movements in the S&P 500 during the morning of the expiration Friday, which we did not capture when we set the new strike at the Thursday close.
3. We invested the call premium at LIBOR instead of using it as a reduction of the initial capital required.

The impact of this last point was marginal—a few basis points, on average, a month. The precise choice of the strike (a combination of the roll and pricing), however, could be significant. Consequently, our ATM strategy is different from the BXM, not a proxy for the BXM, and the results we describe should be interpreted in this context.

Performance Comparison

We report in this section the historical return and risk profiles of the fixed-strike S&P 500 buy-write strategies over the past 15 years, analyses of index sensitivity and exercise risk, a performance attribution analysis, and a comparison of one-month and three-month strategies.

Historical Return and Risk Profiles. The return characteristics of the BXM and related S&P 500–overwriting strategies are attractive, as **Table 1** shows, over the long history of our study, but **Table 2** indicates that these strategies have had periods when they underperformed the index. Note that the periods of underperformance occurred in

Table 1. Annualized Performance of BXM and Fixed-Strike S&P 500 Call Overwriting, 18 January 1990 to 17 November 2005

	Annualized Return			Annualized Risk Measures			
Strategy	Return	Return vs. S&P 500	Return vs. Initial Delta	Standard Deviation	Tracking Error vs. S&P 500	10th Percentile Monthly Return	90th Percentile Monthly Return
S&P 500	10.92%	—	—	14.15%	—	–2.72%	5.31%
BXM	11.27	0.35%	—	9.10	7.78%	–1.28	2.96
ATM	13.25	2.33	5.50%	8.50	8.30	–1.00	3.00
2% OTM	13.42	2.50	4.50	10.43	6.11	–1.85	3.68
5% OTM	12.22	1.30	2.15	12.63	3.32	–2.59	5.31

Sources: CBOE, Standard & Poor's, and Goldman Sachs.

Table 2. Returns to BXM and Fixed-Strike S&P Call Overwriting: Subperiod Performance

	January 2000 to November 2005		January 1995 to January 2000		January 1990 to January 1995	
Strategy	Return	Return vs. S&P 500	Return	Return vs. S&P 500	Return	Return vs. S&P 500
S&P 500	–1.01%	—	27.71%	—	10.02%	—
BXM	2.88	3.89%	20.65	–7.06%	12.46	2.44%
ATM	5.88	6.89	22.10	–5.61	13.62	3.60
2% OTM	4.36	5.37	25.59	–2.12	12.87	2.85
5% OTM	2.58	3.59	26.75	–0.95	10.34	0.32

Sources: CBOE, Standard & Poor's, and Goldman Sachs.

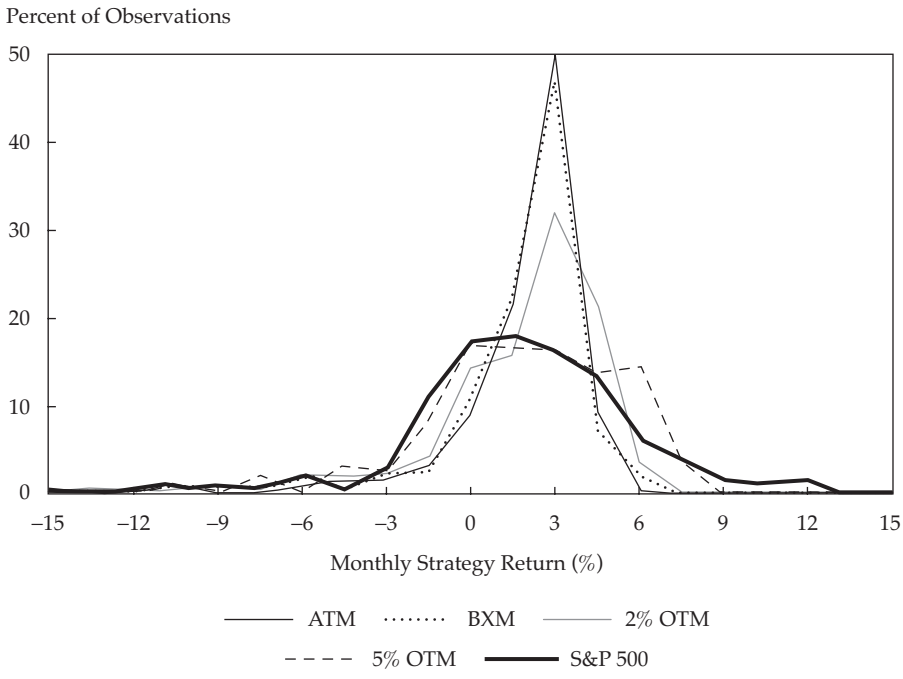
the environment of the 15–20 percent U.S. equity returns of the late 1990s, which few investors expect to be repeated in the next decade.[12] The BXM annualized return of 11.3 percent for the period 18 January 1990 to 17 November 2005 was 35 bps higher than that of the S&P 500, but the annualized standard deviation of the monthly returns was about 5 percentage points lower.[13]

Similarly attractive return and risk characteristics (13.3 percent return, 8.5 percent standard deviation) came from selling the exact ATM option, which can be constructed by weighting option strike prices that bracket the index level when each monthly option is sold or by selling an OTC option. The risk reduction for the BXM and the ATM strategies came largely from lower upside return, however, as can be seen from the 90th percentile returns in Table 1, which are lower than the 90th percentile return of the S&P 500. These statistics are based on the frequency distribution of monthly returns. **Figure 6** highlights the lower portion of returns coming from option-overwriting strategies in periods of strong index returns (right tail of the distributions).

Table 1 also contains summary return and risk metrics for OTM S&P 500 call–selling strategies. The 2 percent OTM call-selling strategy for one-month options had a somewhat higher return than the ATM strategy. This outcome is not surprising because this OTM strategy sells options that are more likely, given a positive expected return for the S&P 500, to be just slightly out of the money or at the money at expiration. The risk was not much higher than for the ATM option strategy; the greater risk also comes partly in the favorable form of a higher probability of moderate returns, as Figure 6 shows. This strategy maintains the property of higher returns than the S&P 500 (as with the BXM) with only about two-thirds of the risk of the S&P 500. The 5 percent OTM strategy may be the most attractive for investors who wish to use index overwriting as a source of alpha. The annualized risk (Table 1) is only slightly lower than that of the S&P 500, and the monthly return distribution (Figure 6) is more similar to that of the index in both risk and shape.

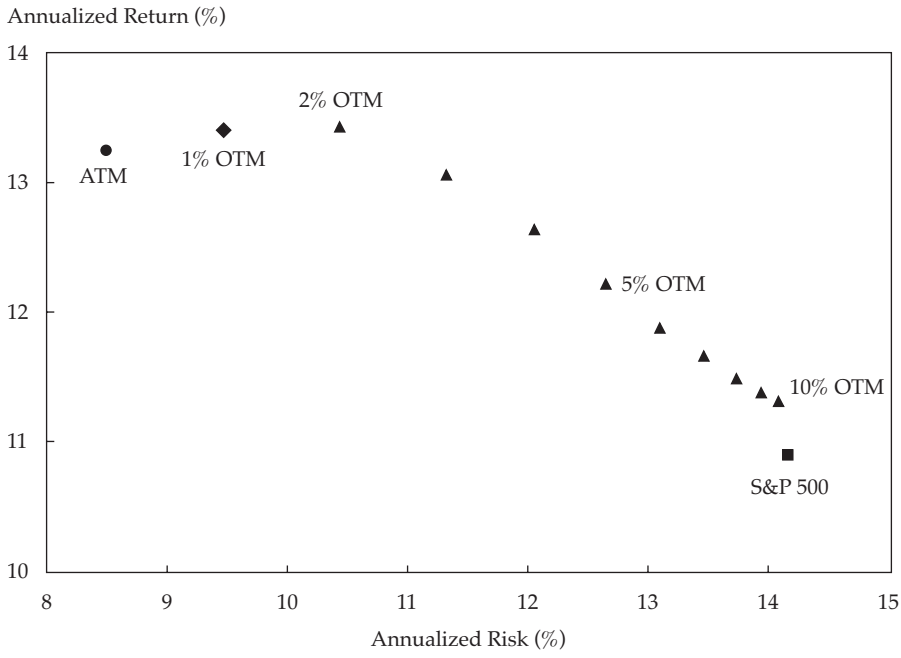
The plot in **Figure 7** shows that the farther out of the money the chosen strike is, the more closely the risk and return profile of the call-selling strategy resembles that of the S&P 500. In regard to total risk–total return trade-offs, the strategies that are slightly out of the money dominated the ATM strategy over the past 15+ years, a time when the S&P 500 was appreciating by about 1 percent, on average, a month. Because farther-OTM call-selling strategies retain more of the upside returns on the

Figure 6. Distribution of Returns from the S&P 500, BXM, and Various Fixed-Strike Strategies, 18 January 1990 to 17 November 2005



Sources: CBOE, Standard & Poor's, and Goldman Sachs.

Figure 7. Risk–Return Trade-Off for Call-Selling Strategies and the S&P 500, 18 January 1990 to 17 November 2005



Sources: CBOE, Standard & Poor's, and Goldman Sachs.

S&P 500, they also have lower levels of tracking error to the S&P 500, as Table 1 shows, than do the BXM or ATM strategies. The 2 percent OTM strategy had a tracking error of 6.1 percent a year, and the 5 percent OTM strategy had a tracking error of about half that amount.

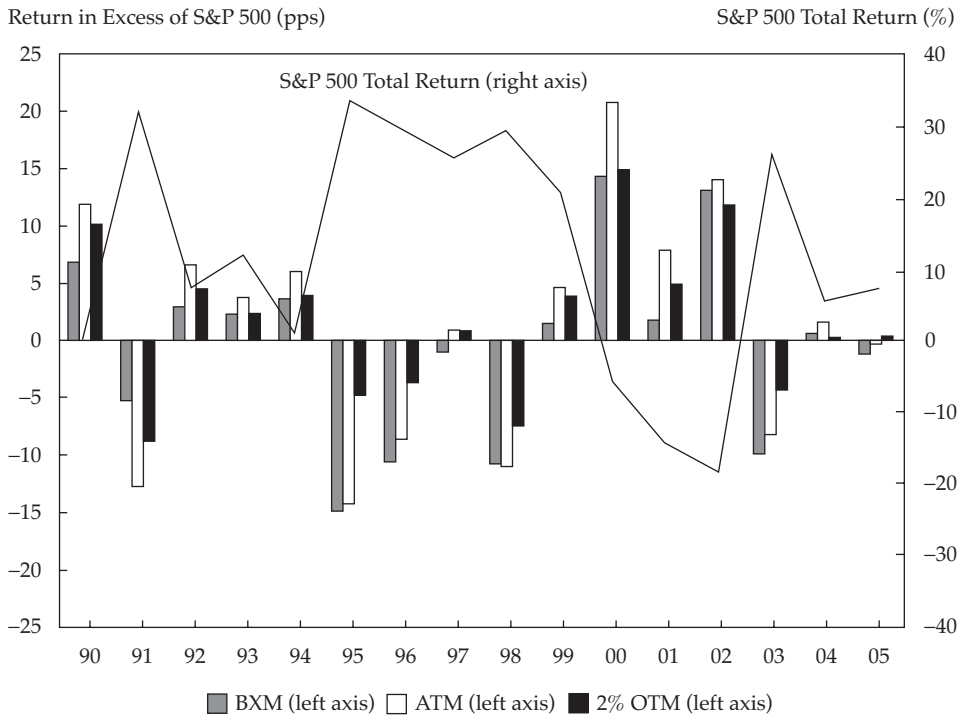
Keep in mind that, although metrics such as total risk, tracking error, downside risk, and the expected loss in upside potential can help an investor assess whether these types of strategies are appropriate, they do not capture all potential risks embedded in overwriting strategies. Unexpected shifts in volatility, price gaps to the upside, the liquidity in options when the strategy is extended to other indices or to single stocks, bid–offer spreads that differ among instruments, and the additional monitoring that is required when options are added to the investment universe are some of the additional factors that need to be taken into account.

Year-by-Year Returns. **Figure 8** shows the return experiences in the period studied for the BXM, the ATM strategy, and the 2 percent OTM one-month call-selling strategy compared with the return of the S&P 500, on a year-by-year basis.[14] The BXM outperformed the index in 9 of the 16 years after 1990. The year 1995 was the worst year for this strategy; in fact, it was a time when index-overwriting strategies, which had in excess of $10 billion in assets under management at the time, experienced a large outflow as the index gapped higher, large cash payments were due to cover losses, and investors terminated or reduced their commitments. Underperformance compared with the S&P 500 was as much as 14.9 percentage points (pps) in 1995. Another tough year for the BXM was 2003. Figure 8 also highlights the contrast between persistent underperformance of the BXM during the bull market of the late 1990s and strong outperformance in 2000–2002, when the S&P 500 posted negative results.

An S&P 500–overwriting strategy centered around selling a slightly OTM call (2 percent) exhibited smaller swings than the BXM in annual returns relative to the S&P 500, especially in the 1995–99 period, because it allowed room for 2 percent moves in the index each month that could be captured by the investor. The outperformance of this strategy during the bear market periods was not as strong as that of the BXM, but it was quite consistent. The more stable and consistent relative-return history under quite varying market conditions is one of the primary reasons for potentially favoring the 2 percent OTM strategy over the BXM.

■ *Index sensitivity and exercise risk*. Table 2 and Figure 8 show that the performance of these call-selling strategies depends on market direction. When one writes calls against the S&P 500, one is

Figure 8. Year-by-Year Performance of the BXM and Fixed-Strike OTM Call-Overwriting Strategies Compared with the S&P 500, 18 January 1990 to 17 November 2005



Sources: CBOE, Standard & Poor's, and Goldman Sachs.

effectively decreasing exposure to the market. The decrease is measured by the delta of the underlying calls. (The delta measures the sensitivity of the option price to small changes in the index.) **Table 3** shows a variety of metrics that help in understanding the differences among the variations on S&P 500 overwriting, including the average delta (from an option-pricing model). The deltas of the alternative overwriting strategies vary quite a bit (finishing at either 0 or 1 at expiration), as do the frequencies of exercise, which in cash-settled options reflects the need to post cash at expiration that represents the ITM amount.[15]

For an ATM strategy, which is similar to the BXM, the investor had a delta and beta close to 0.50 in this period. (The beta equals 1 minus the delta, so it measures the exposure to the market; i.e., the delta of a call is the beta-reduction equivalent.) This value of 0.50 means the market risk was similar to that of holding a portfolio 50 percent invested in the S&P 500 and 50 percent invested in one-month money market securities.

For an OTM call investor, the market exposure increased to 66 percent for the 2 percent OTM and to 87 percent for the 5 percent OTM. The OTM calls expired in the money in 37 percent of the months for the 2 percent OTM strategy (12 percent of the months for the 5 percent OTM strategy). These numbers are significantly lower than the exercise frequency of the ATM strategy, which comes closest to the BXM. Note that the delta gives a reasonable estimate of exercise frequency (the percentage of periods the options expired in the money).

Table 3. Delta, Exercise Frequency, and Market Risk of Covered Index Strategies, 18 January 1990 to 17 November 2005

Strategy	Initial Option		Empirical	Months
	Delta	Beta[a]	Beta[b]	Exercised
S&P 500	—	1.00	1.00	—
BXM	—	—	0.56	—
Sell ATM call	0.53	0.47	0.51	61%
Sell 2% OTM call	0.34	0.66	0.68	37
Sell 5% OTM call	0.13	0.87	0.87	12

[a]The initial beta is 1 minus the initial delta.
[b]The empirical beta is estimated from the monthly total returns on the S&P 500 and the monthly strategy returns.

Sources: CBOE, Standard & Poor's, and Goldman Sachs.

The delta measure can also be used to risk-adjust the return metrics for the index-overwriting strategies. We used the initial delta (δ) at the time

of the option sale as a basis for constructing a risk-equivalent S&P 500 return consisting of being long $1 - \delta$ of the S&P 500 and investing the delta portion at LIBOR during the life of the option. When compared with this delta-adjusted S&P 500 return series, the ATM strategy outperformed by 5.5 percentage points, the 2 percent OTM outperformed by 4.5 percentage points, and the 5 percent OTM outperformed by 2.2 percentage points over the 1990–2005 period (see Table 2). These are solid risk-adjusted alphas. To convert this covered index strategy into an "alpha-only strategy," one could sell the call option and buy a delta-equivalent amount of S&P 500 futures, either based on the initial delta or replicating the shifting delta over the course of the month.

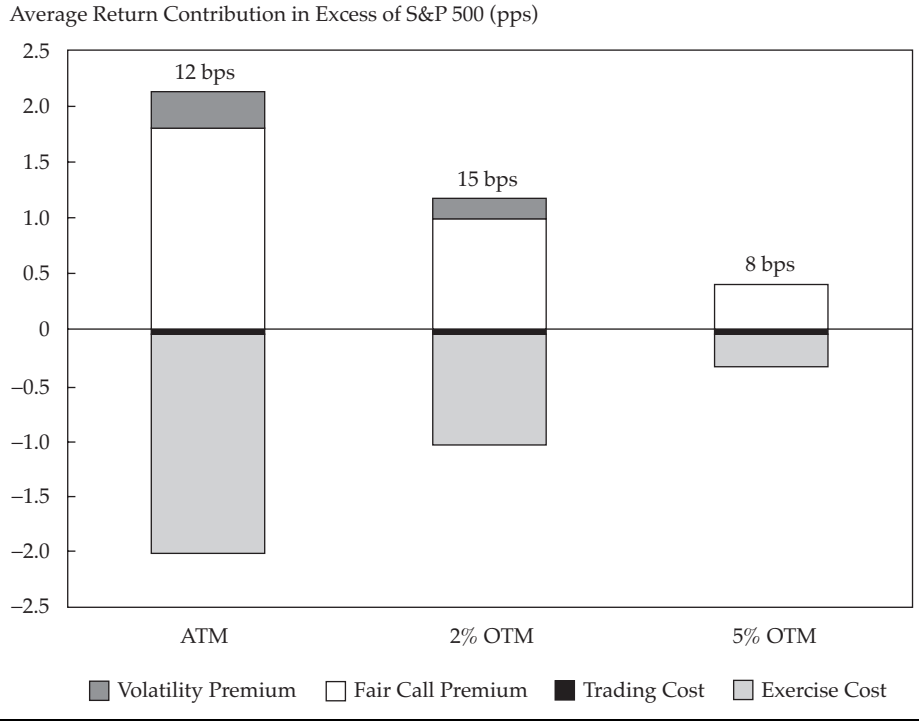
Performance attribution analysis. The return decomposition for the ATM, 2 percent OTM, and 5 percent OTM call-selling strategies are given in **Figure 9**. The bars identify how much of the performance of these strategies in excess of the S&P 500 return (the basis points given on the tops of the bars) was a result of the fair call premium, the volatility premium, the exercise cost, and the trading cost.[16]

Consistent with prior studies, we found the following:

- The bulk of the positive performance can be attributed to the fair call premium.
- The cost of exercise ate away the largest proportion of the excess returns.
- The volatility premium decreased as the strike moved farther out of the money.
- Under the assumption that options were sold at one-half a volatility point from midmarket implied volatility levels (the basis for generating the option premiums used in this analysis), trading costs subtracted 3–6 bps a month, on average.

One-month vs. three-month strategies. In **Table 4**, we show the summary return and risk statistics for S&P 500 three-month option-selling strategies and compare them with those of the BXM and S&P 500. In this case, to reflect the higher return expectations over quarterly rather than monthly horizons, we used higher strike prices for OTM options. These OTM strategies all have similar annualized returns over the most recent 15+ years of about 10.5 percent, not as high as the strategies based on selling the same-strike S&P 500 option on a monthly basis. For three-month calls, the 7 percent OTM strategy has the best risk and return profile—with risk almost 3 percentage points below that of the index but a slightly higher return.[17]

Figure 9. Attribution Analysis of One-Month Covered Call Strategies, 18 January 1990 to 17 November 2005



Sources: Standard & Poor's and Goldman Sachs.

Table 4. Three-Month Covered Call Strategies vs. S&P 500, 18 January 1990 to 17 November 2005

	Annualized Return		Annualized Risk Measures			
Strategy	Return	Return vs. S&P 500	Standard Deviation	Tracking Error vs. S&P 500	10th Percentile Quarterly Return	90th Percentile Quarterly Return
S&P 500	10.59%	—	15.60%	—	–6.45%	10.44%
BXM	11.20	0.61%	10.30	8.47%	–2.61	7.72
ATM	10.34	–0.25	8.73	9.89	–2.20	5.96
5% OTM	10.48	–0.11	11.71	6.67	–4.71	8.30
7% OTM	10.81	0.22	12.82	5.60	–5.28	9.18
10% OTM	10.65	0.06	14.04	4.16	–5.65	11.05

Sources: CBOE, Standard & Poor's, and Goldman Sachs.

In all cases, the three-month call-selling strategies underperformed the strategies selling one-month S&P 500 options. We attribute this result to the missed opportunity with a three-month strategy to reset the strike price monthly in rapidly rising markets, participate in time decay more frequently in highly volatile bear market periods, and capitalize on a favorable implied-to-realized volatility spread with a higher frequency during the year. In a more active overwriting strategy, we would suggest that investors shift to writing longer-term options when implied volatility is at the high end of its normal range and when S&P 500 expected returns are moderate or negative.

Dynamic S&P 500 Overwriting

An S&P 500–overwriting strategy that is a higher risk/higher return variation on the BXM should appeal to large-capitalization equity investors. Although fixed-strike strategies move in that direction, other, more dynamic ways can also be used to achieve a higher risk and higher return profile. We propose a strategy that uses OTM S&P 500 options with a higher strike price in more volatile market conditions and a lower strike price in quieter markets. The strike price of the option is based on a target probability of exercise, which can be derived from an option's implied volatility by using an option-pricing formula.

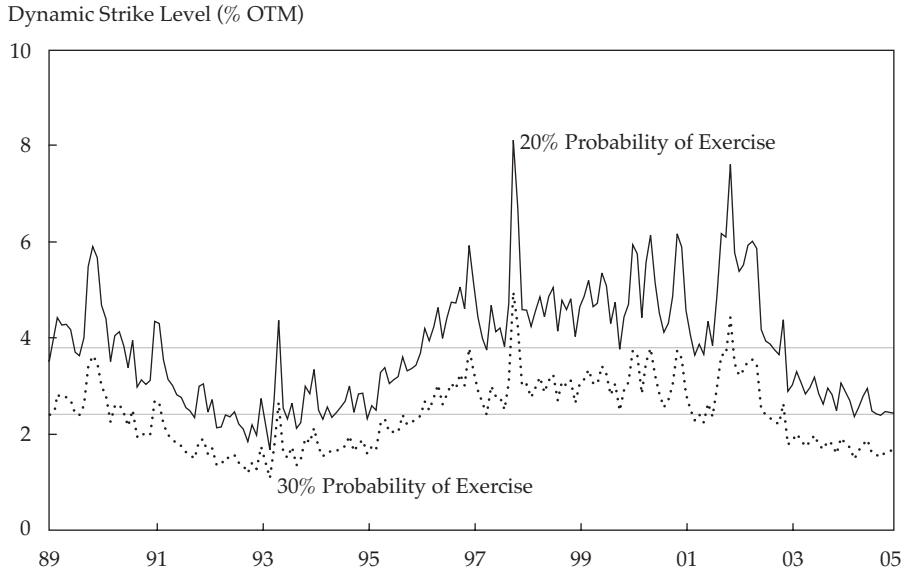
Because this section no longer refers to strategies, like the BXM, that roll on expiration Fridays, we revert to using easier-to-interpret calendar months instead of expiration months in our results.

What a Dynamic Strike Looks Like. The strike prices associated with a 20 percent and a 30 percent target probability of exercise are shown in **Figure 10**. In the early 1990s, when volatility was low, the strike price associated with the 20 percent probability was 2–3 percent out of the money—as it is today. In the 1997–2002 period, however, when volatility was much higher, the strike price of the option sold was typically in the 4–6 percent range if the target was 20 percent probability of exercise. Notice how the implied strike price tends to be higher when returns are reversing a great deal. The one exception that appeared to hurt the strategy was in 2003, when the sharp shift down in volatility caused the target strike to compress prior to the strong market gains in the second part of that year.

Characteristics of Dynamic-Strike Strategies. The delta, beta, exercise frequency, and risk metrics for the dynamic overwriting strategies with various target exercise probabilities are in **Table 5**. The 30 percent target probability is comparable to the 2 percent OTM overwriting strategy (see Table 3) in terms of average delta (0.32 versus 0.34) and beta (0.68 versus 0.66). The 36 percent experienced exercise frequency is almost identical to that of the 2 percent OTM strategy, which was 37 percent. Also, the strategy with the 20 percent target probability has risk characteristics similar to those for selling a fixed 4 percent OTM one-month call option.[18] As for the fixed-strike strategies, the initial delta for the dynamic-strike strategies serves as a reasonable proxy for the percentage of months the options expire in the money.

Historical Return and Risk. The historical performance of the dynamic-strike strategies that vary the strike price by targeting a probability of exercise is given in **Table 6**. In both cases, the dynamic-strike strategies performed in line with the fixed-strike strategies with comparable risk.[19] The strategy with the 20 percent target probability, for example, marginally outperformed the strategy with the 4 percent OTM fixed strike with marginally higher risk. **Figure 11** shows in Panel A the performance of the 2 percent OTM strategy versus the strategy based on 30 percent probability of exercise

Figure 10. Dynamic Strategies: Strike of Option Sold, 1 January 1990 to 31 October 2005



Note: The shaded lines denote the average strikes—3.8 percent for the 20 percent probability of exercise and 2.4 percent for the 30 percent probability of exercise.

Sources: Standard & Poor's and Goldman Sachs.

Table 5. Characteristics of Dynamic Strategies, 1 January 1990 to 31 October 2005

Prob. of Exercise	Average Strike	Initial Option		Empirical Beta	Months Exercised	Annual Standard Deviation	Annual Tracking Error vs. S&P 500
		Delta	Beta				
10%	5.60%	0.10	0.90	0.95	8%	13.80%	1.83%
20%	3.81	0.21	0.79	0.87	25	12.76	3.33
30%	2.44	0.32	0.68	0.75	36	11.26	5.01
40%	1.17	0.42	0.58	0.62	50	9.77	6.74

Sources: Standard & Poor's and Goldman Sachs.

and in Panel B, the performance of the 4 percent OTM strategy versus the strategy based on 20 percent probability of exercise. The scatterplots of monthly returns are provided in **Figure 12**.

The strategy with the 20 percent target probability would be attractive for investors seeking an alpha strategy with almost full equity market risk. It has delivered an average annualized return more than 2 percentage points higher than the S&P 500 return for the past 15+ years, as shown in the calendar-year performance chart given in Panel B of Figure 11 and in the scatterplot in Panel B of Figure 12. For investors who want an index-overwriting strategy with somewhat less total and beta risk, the 30 percent target probability might be a better fit—with a beta of 0.7, a standard deviation of 11.3 percent (about 3 percentage points less than the S&P 500 Index), and a tracking error to the index of 5 percent (Table 6). Annualized returns of 12.1 percent still show a healthy premium to S&P 500 performance, with returns better than the index in 69 percent of the months during the period January 1990 through October 2005.

Panel A in Figure 11 shows that the strategy with the 30 percent probability of exercise by calendar year outperformed the S&P 500 in 11 of 16 years.

The periods when the dynamic-strike overwriting strategies are superior to the fixed-strike strategies in terms of return tend to be those with stronger S&P 500 returns. The average strike of 2.4 percent of the dynamic-strike strategies provides a bit more room for upside than does the fixed-strike 2 percent OTM strategy, but the key is how much the strike varies with market risk levels.

Table 6. Return and Risk of Dynamic-Strike Strategies, 1 January 1990 to 31 October 2005

		Annual Return		Annual Risk Measures			
Strategy	Average Strike	Return	Return vs. S&P 500	Standard Deviation	Tracking Error vs. S&P 500	10th Percentile Monthly Return	90th Percentile Monthly Return
S&P 500	—	10.40%	—	14.37%	—	–4.36%	5.98%
2% OTM	—	12.45	2.05%	10.51	5.88%	–3.27	3.74
30% Prob. exercise	2.44%	12.13	1.73	11.26	5.01	–3.52	4.30
4% OTM	—	12.35	1.94	12.38	3.69	–3.80	4.93
20% Prob. exercise	3.81	12.40	2.00	12.76	3.33	–4.01	5.28

Sources: Standard & Poor's and Goldman Sachs.

Implications for Investment Strategies

Index overwriting can be implemented as a stand-alone strategy or as part of a balanced or asset allocation strategy. The idea of selling upside equity returns is consistent with the bias of many asset class strategies to shift out of strongly performing asset classes into alternative investment opportunities. It also fits well into global macro or global alpha strategies. Equity index–overwriting can also be considered a lower-risk equity enhancement strategy that has regularity in its cash flows from the option premiums. This feature makes it a potential alternative to equivalent-risk fixed-income or yield/value-oriented active equity strategies. Returns from the BXM or other S&P 500–overwriting strategies diversify momentum-based strategy returns as well as returns derived from currency or global tactical asset allocation.

The BXM provides an easily accessible benchmark for S&P 500 overwriting, structured products, or an index for replication for investors wanting the risk profile of selling ATM options. For investors seeking to retain some upside consistent with a risk premium for equities or to increase returns, the BXM can serve as a risk benchmark for evaluating a more aggressive overwriting strategy or variations embedded in structured products. These OTM index option–selling strategies are likely to have returns that are correlated with the BXM but also have a greater sensitivity to the underlying index.

In most countries with developed index option markets, index options trade at a premium to realized index volatility. Against the backdrop of an outlook for moderate to weak equity market returns and slowly rising interest rates, the historical track record of overwriting strategies in similar environments is quite compelling. In periods of cyclically low interest rates, strategies with a steady cash flow are favored. Competitive, liquid markets in short-term index options exist, and investors are comfortable with using derivatives now that risk systems have improved. Finally, the quest for diversified sources of alpha also argues for choosing index overwriting as part of an absolute-return or market-neutral allocation, in which other strategies may have alphas more correlated with styles, rising volatility, momentum, or other equity market factors.

Conclusion

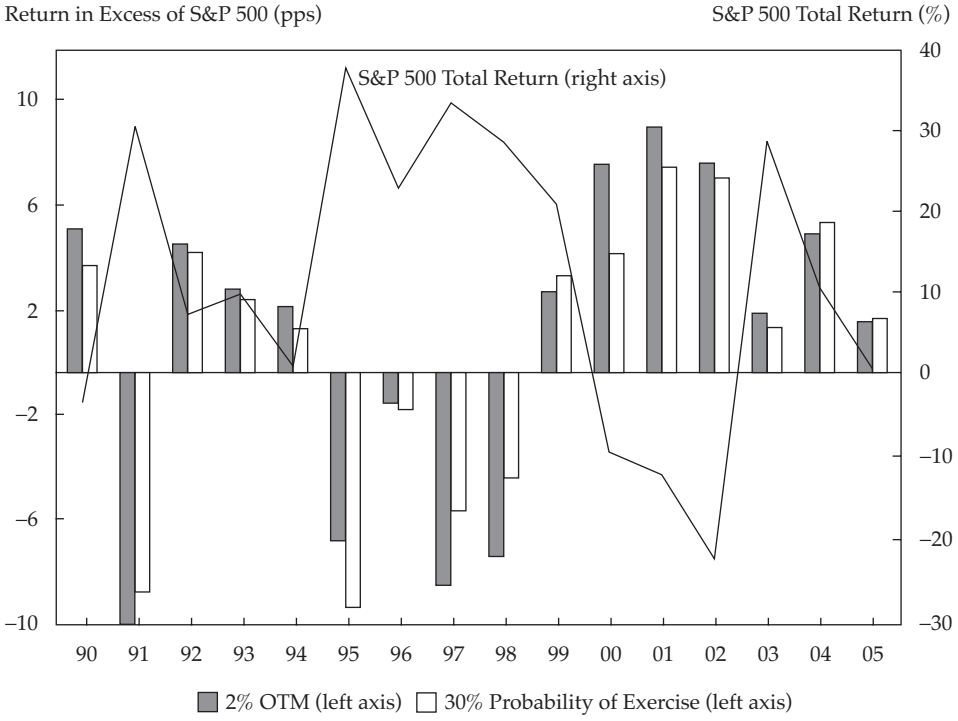
This analysis closely examined the historical return and risk characteristics of a variety of short-term S&P 500–overwriting strategies with both fixed and dynamic strikes. These strategies have very favorable performance characteristics at a range of risk levels. Because of the presence of an equity risk premium and the goal of higher returns for equity-based strategies, we would recommend strategies at least 2 percent out of the money or with a 30 percent or less probability of exercise. The lower exercise frequency also reduces tracking error and operational issues compared with an ATM strategy, as represented by the BXM. All of the strategies adapt to changing volatility regimes because they sell one-month options that change in price as volatility changes. Investors who hold S&P 500 exposure as part of their investment policy and who are looking for low-risk enhancement strategies may wish to take a close look at the opportunities offered by the liquid short-term index option markets.

We thank Barbara Dunn and Dmitry Novikov for their editorial and research assistance.

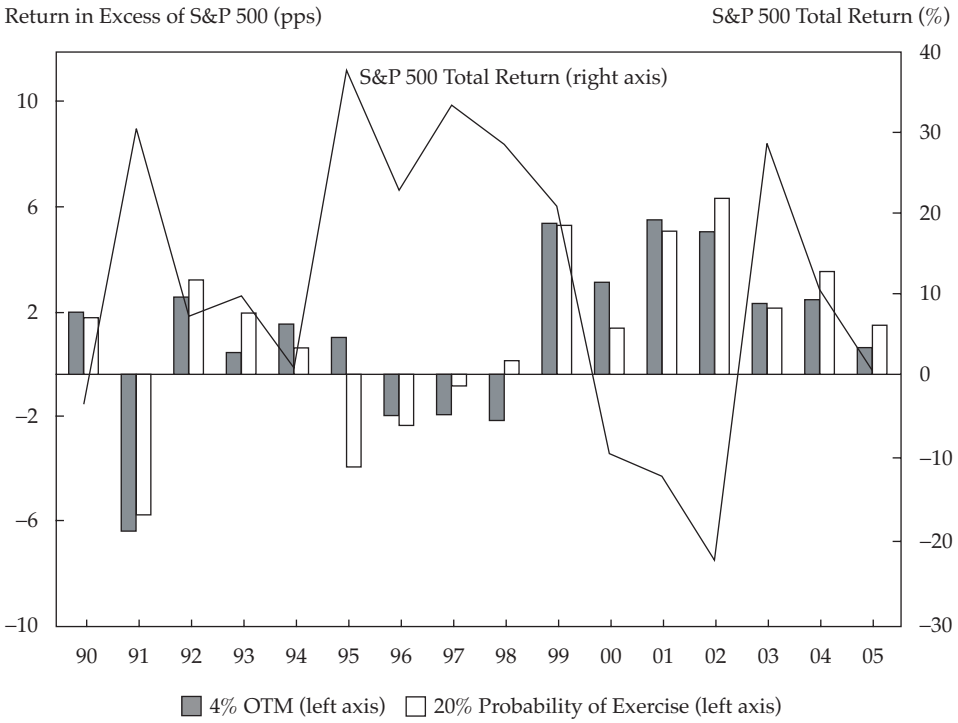
This article qualifies for 1 PD credit.

Figure 11. Calendar-Year Performance of Fixed-Strike OTM and Dynamic-Strike Call-Overwriting Strategies Compared with the S&P 500, 1 January 1990 to 31 October 2005

A. 2 percent OTM vs. 30 percent probability of exercise



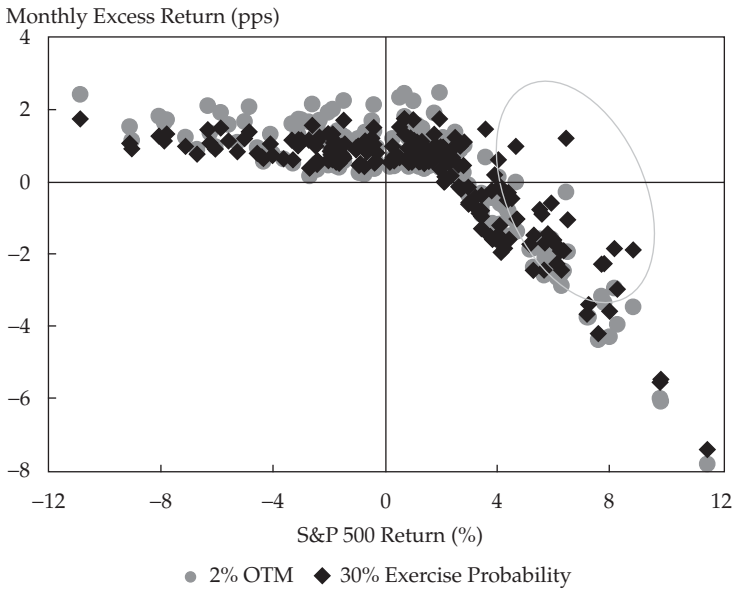
B. 4 percent OTM vs. 20 percent probability of exercise



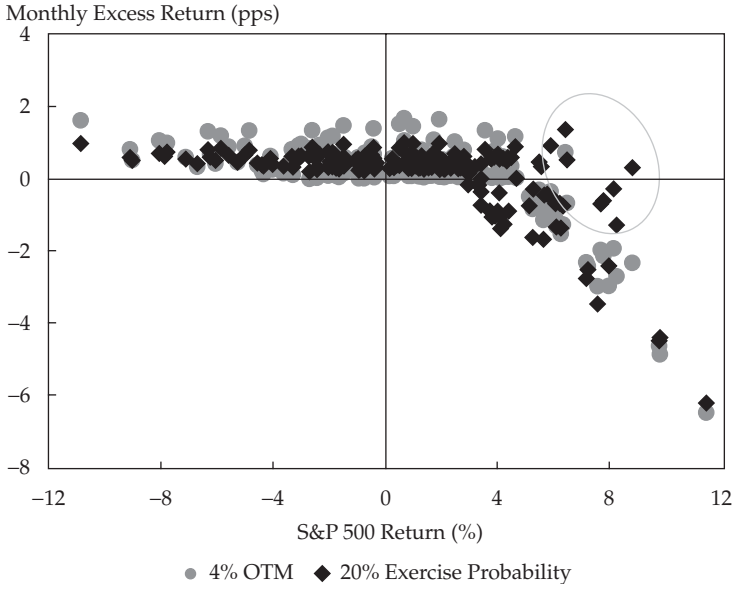
Sources: Standard & Poor's and Goldman Sachs.

Figure 12. Monthly Performance of Fixed-Strike OTM and Dynamic-Strike Call-Overwriting Strategies Compared with the S&P 500, 1 January 1990 to 31 October 2005

A. 2 percent OTM vs. 30 percent probability of exercise



B. 4 percent OTM vs. 20 percent probability of exercise



Note: The ovals indicate excess returns of the strategy in stronger equity markets.

Sources: Standard & Poor's and Goldman Sachs.

Appendix A. Calculation of the BXM

The BXM is calculated as follows:

$$BXM_t = BXM_{t-1}\left(1 + R_{t-1,t}\right),$$

where $R_{t-1,t}$ is the total return of the covered call index portfolio from the close of day $t-1$ to the close of day t.

The daily return calculation depends on whether the trading day coincides with expiration or not. On nonexpiration days, return is calculated as

$$R_{t-1,t} = \frac{S_t + D_t - C_t}{S_{t-1} - C_{t-1}} - 1,$$

where

S_t = the S&P 500 value at the close of day t

D_t = cash dividends on stocks that went ex dividend on day t, expressed in S&P 500 index points

C_t = the average of the last bid and ask prices of the S&P call option reported before 4:00 p.m. EST on day t

On expiration days, when the options in the strategy are rolled, the return consists of three portions:

$$R_{t-1,t} = \left(1 + R_{t-1,Settlement}\right)\left(1 + R_{Settlement,Initiation}\right) \times \left(1 + R_{Initiation,\,t}\right) - 1,$$

where

$R_{t-1,Settlement}$ = return from the close on day $t-1$ to the time the Special Opening Quotation (SOQ) is determined to settle the expiring option (usually before 11:00 a.m. EST)

$R_{Settlement,Initiation}$ = return from the SOQ to the time the new option is deemed sold

$R_{Initiation,t}$ = return from option initiation to the close on day t

These three components are defined as follows:

$$R_{t-1,Settlement} = \frac{S_{SOQ} + D_t - C_{Settlement}}{S_{t-1} - C_{t-1}} - 1,$$

$$R_{Settlement,\,Initiation} = \frac{S_{VWAP}}{S_{SOQ}} - 1,$$

and

$$R_{Initiation,\,t} = \frac{S_t - C_t}{S_{VWAP} - C_{VWAP}} - 1,$$

where

$C_{Settlement}$ = settlement price of the expiring call

C_{VWAP} = volume-weighted average of the prices (VWAP) of the new one-month ATM option from 11:30 a.m. to 12:00 p.m. EST

S_{VWAP} = VWAP level of the S&P 500 with the same time and weights as used in the calculation of C_{VWAP}

Appendix B. Calculation of Covered Call Strategy Returns

In our analysis, the index call–overwriting strategy returns were calculated as follows:

$$R_{t-1,t} = \frac{S_t + D_t - S_{t-1}}{S_{t-1}} + \frac{C_{t-1}\,e^{L_{t-1}\tau}}{S_{t-1}} - \frac{C_t}{S_{t-1}},$$

where

S_t = the S&P 500 value at the close of day t

D_t = cash dividends on stocks that went ex dividend on day t, expressed in S&P 500 index points

C_{t-1} = call premium (bid price) received on the Thursday before expiration (time $t-1$)

C_t = call premium (ask price) paid on the Thursday before the next expiration (time t) to buy back the option

τ = investment horizon (one month or three months)

L_{t-1} = continuously compounded annualized LIBOR at time $t-1$ for investment horizon τ

For the one-month strategy, $t-1$ to t covers one month, from the Thursday before expiration to the Thursday before the next expiration; for the three-month strategy, it covers from the Thursday before the expiration to three months later.

For the dynamic-strike strategies for which we assumed that the rolling of the strategy coincided with expiration (both at the close on month-end), the strategy returns can also be written as

$$R_{t-1,t} = \frac{S_t + D_t - S_{t-1}}{S_{t-1}} + \frac{C_{t-1}\,e^{L_{t-1}\tau}}{S_{t-1}} - \max\left(0,\ \frac{S_t - S_{t-1}}{S_{t-1}} - \lambda\right),$$

where λ represents the "out-of-the-moneyness" of the call (0 percent, 2 percent, or 5 percent for one-month calls and 0 percent, 5 percent, 7 percent, or 10 percent for three-month calls).

Appendix C. Best and Worst Three-Year Relative Performance

Data for the best and worst three-year periods for selling S&P 500 calls with different strike prices are in **Table C1** for both one-month and three-month options. On the positive side, note that the best periods for overwriting were during bear markets—with outperformance of 14–38 percentage points for the one-month call-selling strategy or BXM (Panel A) and 10–24 percentage points for the three-month strategy (Panel B). Defining a year as starting on January expiration and running until the following year's January expiration, the 1999–2001 period delivered the best relative performance for selling 2 percent OTM one-month options; the 2000–02 period provided the best for 5 percent and 7 percent OTM three-month options.

As for the worst periods for engaging in overwriting compared with holding the S&P 500, note that during the 1995–97 period, S&P 500 overwriting with one-month ATM options was quite costly. Cumulative underperformance was 41 percentage points for the BXM and 35 percentage points for the ATM option. By selling the 2 percent OTM option instead in this time period, the drag was reduced by more than 50 percent to less than "only" 20 percentage points underperformance. Similar results are visible for the worst 12-quarter periods (Panel B). Selling three-month S&P 500 OTM calls produced the worst relative underperformance—negative 29–46 percentage points—which occurred in the 1996–98 period.

These extreme relative returns highlight one of the reasons this strategy may be more appealing over the very long run (10 years): It produces multiple-year returns below the index when equity markets are in a sustained bullish phase. Few investors, however, expect the market experience of the second half of the 1990s to be repeated soon, which is a primary reason overwriting has much appeal today.

Table C1. Extreme Cumulative Returns Relative to the S&P 500, 18 January 1990 to 17 September 2005

	Three Years (January to January)			36-Month Period		
Strategy	Period	Excess Return vs. S&P 500	S&P 500 Return	Period	Excess Return vs. S&P 500	S&P 500 Return
A. One-month S&P 500 call–selling strategies						
Best relative performance						
BXM	00–02	24.0%	–34.1%	Mar 00–Mar 03	26.5%	–37.3%
ATM call selling	99–01	37.7	–2.5	Aug 98–Aug 01	41.2	12.4
2% OTM call selling	00–02	26.4	–34.1	Aug 98–Aug 01	30.4	12.4
5% OTM call selling	01–03	14.1	–11.9	Oct 01–Oct 04	16.0	8.6
Worst relative performance						
BXM	95–97	–41.1	117.3	Jul 94–Jul 97	–54.9	120.7
ATM call selling	95–97	–34.7	117.3	Jul 94–Jul 97	–51.8	120.7
2% OTM call selling	96–98	–16.1	110.5	Jul 94–Jul 97	–27.2	120.7
5% OTM call selling	96–98	–8.3	110.5	Nov 95–Nov 98	–9.8	104.1
B. Three-month S&P 500 call–selling strategies						
	Three Years (January to January)			12-Quarter Period		
Strategy	Period	Excess Return vs. S&P 500	S&P 500 Return	Period	Excess Return vs. S&P 500	S&P 500 Return
Best relative performance						
BXM	00–02	24.0%	–34.1%	Apr 00–Apr 03	25.4%	–35.6%
5% OTM call selling	00–02	21.8	–34.1	Jan 00–Jan 03	21.8	–34.1
7% OTM call selling	00–02	16.1	–34.1	Jan 00–Jan 03	16.1	–34.1
10% OTM call selling	99–01	10.4	–2.5	Jan 99–Jan 02	10.4	–2.5
Worst relative performance						
BXM	95–97	–41.1	117.3	Jul 94–Jul 97	–54.9	120.7
5% OTM call selling	96–98	–45.9	110.5	Apr 95–Apr 98	–51.0	133.4
7% OTM call selling	96–98	–38.8	110.5	Apr 95–Apr 98	–40.9	133.4
10% OTM call selling	96–98	–29.3	110.5	Jan 96–Jan 99	–29.3	110.5

Sources: CBOE, Standard & Poor's, and Goldman Sachs.

Notes

1. See, for example, Feldman and Roy (2004) and Whaley (2002). The primary source of information and historical data on the BXM and related topics is the CBOE. See www.cboe.com/bxm.
2. For example, Rampart Investment Management, Connors Investors Services, Morgan Stanley, and Merrill Lynch use the BXM as a basis for option-writing products targeted at institutional and/or retail clients. Gateway Investment Advisers' Gateway Fund, a mutual fund that has existed since the late 1980s, sells index calls against its S&P 500 stock holdings and buys protective puts. Since mid-2004, more than 20 closed-end funds have been launched that incorporate option selling in a variety of option strategies, including stock as well as index options on U.S. and non-U.S. stocks and indices.
3. See Balasubramanian and Tierens (2004); Hill and Gregory (2002); Hill, Gregory and Balasubramanian (2003); Hill, Balasubramanian, Gregory, and Tierens (2005); Hill and Novikov (2006); Mussavian and Kassam (2002); Rattray, Gregory, and Balasubramanian (2003); Tierens and Balasubramanian (2005a, 2005b).
4. These gains could be offset by losses on the exercise of the option, but with ATM or OTM (out-of-the-money) options, only a portion of the options are exercised through time. S&P 500 options are Section 1256 contracts and are, therefore, marked to market at year-end. Of the realized gains, 60 percent are taxed at the long-term capital rate and 40 percent are taxed at the short-term capital rate. (Please note that we are not providing tax, legal, or accounting advice. Readers should consult professional tax, legal, and accounting advisers for specific information.)
5. To be precise, the call premiums in Figure 3 are the sum of what we labeled the fair call premium and the volatility premium at the start of this section.
6. More precisely, the strike price of the call option is the strike price above the prevailing S&P 500 level that is closest to at the money.
7. For details on the methodology and historical data, see www.cboe.com/bxm.
8. The BXM was set at a value of 100 on 1 June 1988. Appendix A provides details on the calculation of the BXM.
9. An index similar to the BXM but selling the listed option with a strike closest to (and at least) 2 percent OTM was introduced by the CBOE early in 2006, with a return history dating back to 1988. The return and risk profile of this index (ticker BXY) is similar to that of the 2 percent OTM one-month overwriting strategy examined in this article and can be a useful benchmark for S&P 500 buy-write strategies with short-term OTM call options.
10. The 1 point implied volatility is a conservative estimate that should be wide enough to also absorb commission costs.
11. Appendix B contains details about how we calculated the returns on these strategies.
12. To fully understand the benefits and risks of this strategy, we also looked at the best and worst relative returns over a three-year window on both a calendar and a 12-quarter moving basis; Appendix C provides the results.
13. Because this section defines a month as an expiration month rather than a calendar month, the annualized risk and return numbers differ from the ones quoted in reference to Figure 1.
14. A "year" was defined here as the period starting at the close of the January expiration Friday and ending at the close of the January expiration Friday of the following year. These annual periods are not identical, therefore, to calendar years.
15. If this strategy were executed via S&P 500 exchange-traded funds and ETF options, the SPY ETF could be delivered into the option exercise.
16. We included the reinvestment of the call premium at LIBOR in the fair call premium because it was small (a few basis points a month).
17. Note that these measures are based on quarterly rather than monthly returns, resulting in BXM and S&P 500 risk measurements that are different from those in Table 1.
18. These comparisons between dynamic and fixed strikes held up whether we used calendar month-end or expiration month-end.
19. To make the results of the fixed- and dynamic-strike strategies comparable in Table 6 and the figures, we recalculated the fixed-strike strategy results under the assumption of calendar-month-end periods instead of expiration-month-end periods. The numbers in Table 6 are, therefore, slightly different from the numbers presented Table 1.

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