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Covered Call Strategies: One Fact and Eight Myths

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A covered call is a long position in a security and a short position in a call option on that security. Equity index covered calls are an attractive strategy to many investors because they have realized returns not much lower than those of the equity market but with much lower volatility. However, a number of myths about the strategy—from why it works to why an investor should or should not invest—have surfaced, and many of them are erroneously considered "common knowledge." The authors review the underlying risk and returns of covered call strategies and dispel eight common myths about them.

A covered call is a combination of a long position in a security and a short position in a call option on the same security. The combined position caps the investor's upside on the underlying security at the option's strike price in exchange for an option premium. **Figure 1** shows the covered call payoff diagram, including the option premium, at expiration when the call option is written at a $100 strike with a $25 option premium.

The covered call strategy has generated attention because of its attractive historical risk-adjusted returns. For example, the CBOE S&P 500 BuyWrite Index (BXM)—the industry-standard covered call benchmark—is commonly described as providing average returns comparable to those of the S&P 500 Index with approximately two-thirds the volatility, supported by statistics like those in **Table 1**.[1]

Although the BXM has historically demonstrated total returns similar to those of the S&P 500, it has done so with a lower beta than that of the S&P 500. However, it is important to understand that the BXM is more exposed to negative S&P 500 returns than to positive S&P 500 returns. This asymmetric relationship with the S&P 500 is consistent with the BXM's payoff characteristics and results from the fact that a covered call strategy sells optionality. What this means in simple terms is that although drawdowns are somewhat mitigated by the revenue associated with call writing, the upside is capped by those same call options, as shown in Figure 1.

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For obvious reasons, strategies that may offer equity-like expected returns but with lower volatility and market exposure (beta) generate strong investor interest. As a case in point, covered call strategies have been gaining popularity: Growth in assets under management in covered call strategies has been over 25% per year over the past 10 years (through June 2014), with over $45 billion currently invested.[2]

Recently, a strategy with similar performance objectives has piqued the interest of investors: low-volatility investing. However, the sources of returns for low-volatility investing, unlike those of covered call strategies, have not been subject to so many confusing and distracting myths.

Low-volatility investing is based on the low-risk anomaly, which runs contrary to textbook finance theory: Low-risk stocks, as defined by their volatility, idiosyncratic volatility, or beta, do not have lower average returns than their high-risk counterparts.[3] This characteristic may be used to construct a portfolio with average returns comparable to those of an underlying equity index but with lower volatility. The resulting portfolio provides investors with two sources of return: the equity risk premium and the low-volatility anomaly.[4]

Although the low-volatility anomaly portfolio is generally understood to allocate to two sources of return—the equity risk premium and low-volatility excess returns—the covered call strategy is rarely described according to its two sources of return: the equity risk premium and the volatility risk premium.[5] Rather than transparently identify the covered call's compensated risk exposures, it is more common to improperly describe the strategy as a method of producing income or obtaining downside protection.

In this article, we identify and debunk eight such myths about covered calls. To begin, we suggest that investors and portfolio managers who are interested in using a covered call strategy must first understand an important fact, which is summarized, along with the eight myths, in **Exhibit 1**.

Figure 1. Covered Call Payoff Diagram

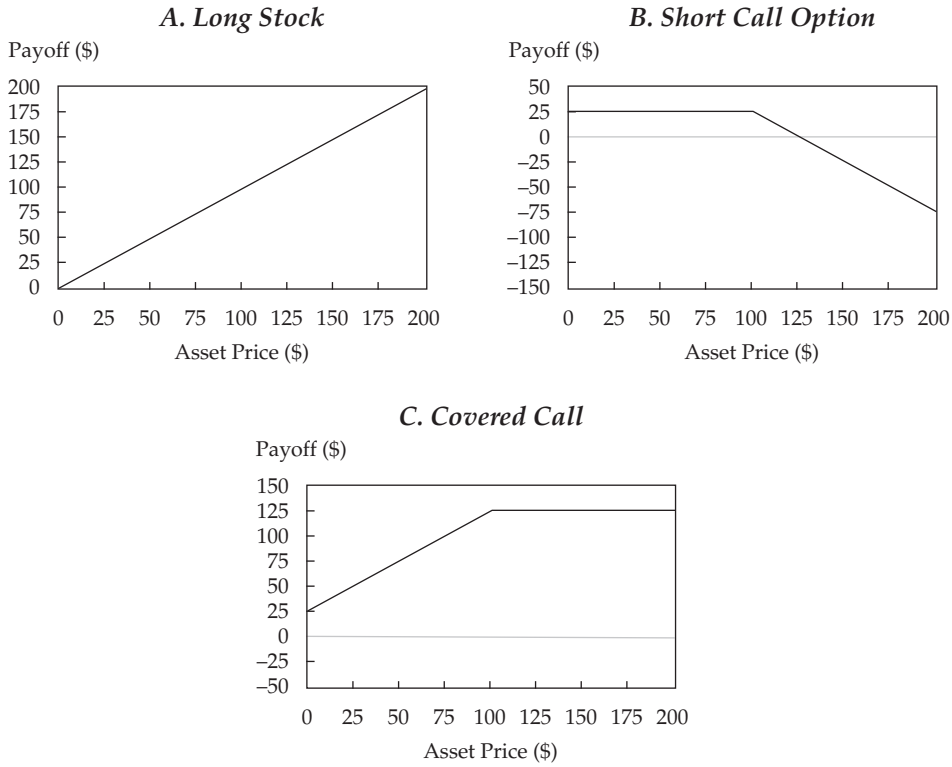


Table 1. Summary Statistics, 1 July 1986–31 December 2013

	S&P 500	BXM
Annualized excess return	5.4%	4.4%
Annualized volatility	18.5%	13.4%
Sharpe ratio	0.29	0.33
Worst drawdown	–61.7%	–43.0%
Beta to S&P 500	1.00	0.67
Upside beta	1.00	0.63
Downside beta	1.00	0.78

Note: Returns are excess of cash (US three-month LIBOR).
Sources: Standard & Poor's and CBOE.

Exhibit 1. One Fact and Eight Myths

Fact

Covered calls provide long equity and short volatility exposure.

Myths

1. Risk exposure can be expressed in a payoff diagram.
2. Covered calls provide downside protection.
3. Covered calls generate income.
4. Covered calls on high-volatility stocks and/or shorter-dated options provide higher yield.
5. Time decay of written options works in your favor.
6. Covered calls are appropriate if you have a neutral or moderately bullish view.
7. Covered calls pay you for doing what you were going to do anyway.
8. Covered calls allow you to buy a stock at a discounted price.

Fact: Covered Calls Provide Long Equity and Short Volatility Exposure

To understand this fact, consider that a short call option has negative exposure to its underlying security's return and negative exposure to its underlying security's volatility. Therefore, writing a call option to cover an existing position reduces the portfolio's exposure to the underlying security while adding short volatility exposure to that security.

$$\text{At-the-money covered call} = \underbrace{\text{Long equity exposure}}_{(\text{½ long position})} + \underbrace{\text{Short volatility exposure}}_{(\text{½ short straddle})}.$$

This equation disentangles the two distinct exposures provided by a covered call strategy: long equity and short volatility. **Figure 2** reconstructs the covered call payoff diagram using this long equity and short volatility decomposition.

Because options tend to be richly priced (versus the *ex ante* expected volatility of the underlying equity index) and transfer risk from option buyers to option sellers, they are considered to embed a risk premium. This risk premium is earned when selling options, which is commonly described as "selling volatility" because (as depicted in Figure 2) the short straddle position is profitable when volatility is low and unprofitable when volatility is high relative to implied volatility. For this reason, this risk premium is commonly referred to as the *volatility risk premium*.

The short straddle component is short volatility, but it also includes additional risk owing to its options' dynamic equity exposure. A short option's equity index exposure is negatively related to its equity index value in order to provide its intended payoff profile. Israelov and Nielsen (2014) showed that although both short volatility exposure and dynamic equity exposure contribute to the short straddle's risk, only the volatility risk premium emanating from shorting volatility contributes to expected returns. Delta-hedging the short straddle position substantially increases its Sharpe ratio because similar average returns are obtained at significantly lower risk.

Table 2 reports the hypothetical performance of a covered call in accordance with the long equity and short straddle decomposition. The covered call writes one-month at-the-money call options on option expiration dates and holds them until they expire. This strategy is similar to that of the BXM except that the BXM prices its sold call options using a volume-weighted average of intraday prices whereas our strategy writes new call positions using reported closing midpoint prices. The short straddle component is not delta-hedged.

Figure 2. Covered Call Payoff Diagram Using Long Equity and Short Volatility Decomposition

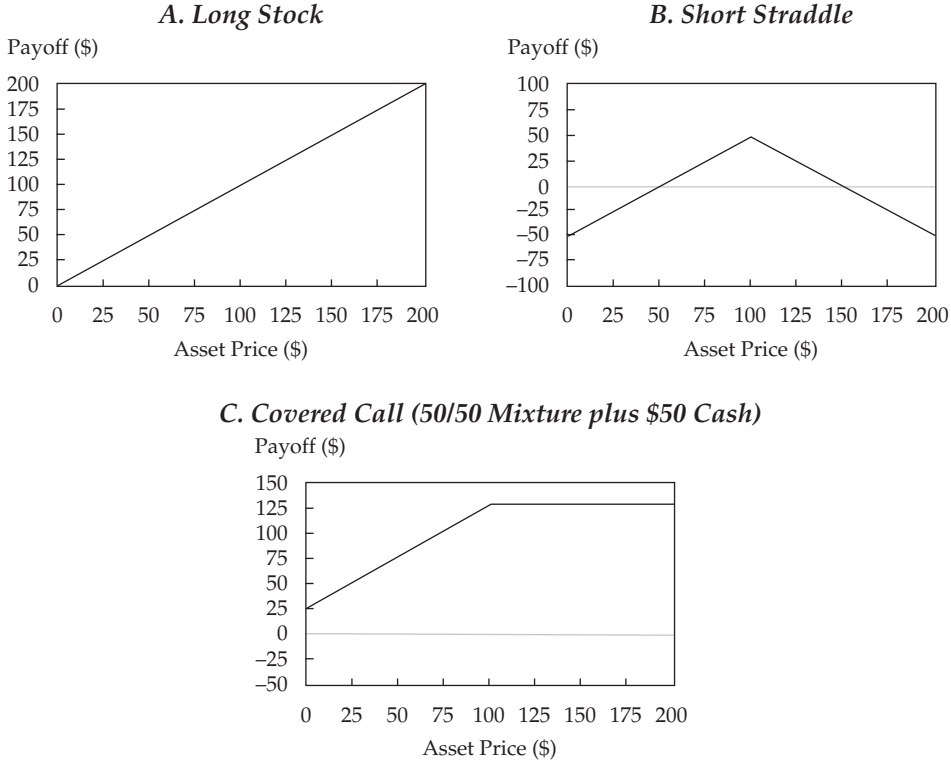


Table 2. Hypothetical Summary Statistics, 1 April 1996–31 December 2013

	Covered Call	Long Equity	Short Straddle
Annualized excess return	5.0%	3.3%	1.8%
Annualized volatility	14.1%	9.9%	6.7%
Sharpe ratio	0.36	0.33	0.27
Skew	–0.3	0.0	–0.5
Kurtosis	20.1	8.0	21.9
Beta to S&P 500	0.64	0.50	0.14
Risk contribution		64%	36%

Notes: Long equity versus short straddle correlation = 0.42. The long equity and the short straddle represent futures and option positions, respectively, written on the S&P 500. The risk contribution is the covariance of the component with the covered call divided by the variance of the covered call.

As shown in Table 2, the covered call strategy is a "low-beta" strategy. Writing the call option reduces the portfolio's beta from 1.00 to 0.64. The covered call's annual volatility attributed to its direct exposure to the S&P 500 is approximately 10%. Its short volatility exposure has almost 7% annual volatility, bringing the covered call's total volatility back up to 14%, which is less than the sum of the volatility parts because of the 0.42 correlation between the long equity and short straddle returns. Almost two-thirds of the strategy's total risk is allocated to the equity risk premium; the remaining one-third is allocated to the short straddle position.

The long equity component realizes returns in excess of the cash rate because of its systematic risk—the equity risk premium. The short straddle's positive performance is a result of options' tendency to be richly priced—the volatility risk premium. The covered call is simply a portfolio that combines these two risk premiums, and the strategy's expected returns and risk are best viewed through this lens. More importantly, portfolio construction should be guided by directly targeting exposure to these two sources of return.

However, this is not the typical approach taken when constructing covered call portfolios. Instead, portfolio managers often select the strike of the written call option according to such criteria as the yield target (where the option premium is incorrectly classified as yield) or potential upside capture (i.e., selling options 5% out of the money so that a certain amount of upside may be captured). The exposure to the actual sources of risk and return—long equity and short volatility—is a byproduct of these two criteria. We believe that the direct approach of allocating the risk budget by explicitly targeting exposure to the two risk premiums is more efficient.

A Stylized Example

To more clearly describe the sources of risk and return for covered call writing, we provide a stylized example. Consider an index with a current price of $100 and a covered call written on that index with one month to maturity. For simplicity, the risk-free rate and the dividend yield are assumed to be zero. We further assume that the index's annualized excess return is 6%, the option-implied volatility is 18%, and the realized volatility is 16%.

We begin with an at-the-money covered call strategy in which the call option is written at a strike equal to the current index level ($100 in this example). This covered call has 0.49 exposure (delta) to the index and earns a 2.94% annualized return from this exposure to the equity risk premium. The option sells for $2.07, which is $0.23 higher than it would have sold for if it were priced at the expected realized volatility. In this case, approximately 11% (or $0.23/$2.07) of the collected option premium is compensation for exposure to short volatility. Annualizing the compensation earned monthly, the covered call earns 2.76% per year in volatility risk premium. The covered call's total annualized excess return is, therefore, 5.70% (the combined equity and volatility risk premiums). This return may be attractive considering that the at-the-money covered call has approximately 0.5 exposure to the underlying equity index.

If the option were instead priced such that its implied volatility is 16%—the same as realized volatility in our example—then even though the annual collected option premium is 22.1% of net asset value, there would be zero compensation for shorting volatility (because there would be no volatility risk premium). In this case, the covered call would simply earn the expected market excess return scaled by its exposure to its underlying equity (2.94% per year in our example), which is no different from what would have been earned by simply reducing the index position size by 51%. Given that the delta is 49%, this result comes as no surprise.

Selling the call option reduces exposure to the underlying equity index. The reason for selling the option, however, should be to obtain short

volatility exposure in order to earn the volatility risk premium. The portfolio's equity exposure may be reduced more simply and cheaply by selling the underlying equity index. Systematically selling options makes sense only if the investor is confident that the volatility risk premium exists.

Figure 3 shows the results of repeating the exercise for strikes between $85 and $115 and plots the return contributions owing to the covered call's exposure to long equity and short volatility. This type of risk decomposition is not the norm for portfolio managers who implement covered call strategies. Instead, they tend to focus primarily on the properties of the total strategy return rather than on its components. In our stylized example, such managers would likely select a covered call written slightly out of the money. For instance, the $104-strike covered call has 6.65% annualized return, with 2.05% coming from the volatility risk premium and 4.60% coming from the equity risk premium.

We believe a better approach disaggregates expected returns to a covered call strategy by first determining the desired allocation to the two risk premiums according to a set of portfolio objectives and then selecting the option strike, option leverage, and equity leverage required to achieve that allocation. For instance, the at-the-money option may be preferred because it provides the highest exposure to the volatility risk premium per unit of leverage.

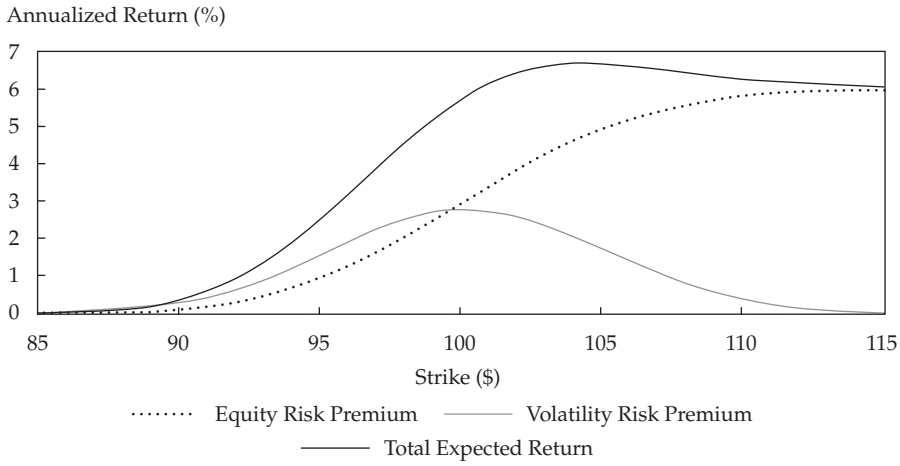
Outside of this stylized example, implied volatilities typically exhibit a "smile" (higher implied volatilities for options with lower strike prices). This smile may suggest that lower-strike options are more profitable to sell, and hence, a simple approach may potentially be improved upon by selling these lower-strike options. Alternatively, a basket of options at different strikes may be sold in order to diversify the idiosyncratic risk embedded in each specific option.

By disentangling the short volatility and long equity exposures, the allocation to long equity and short options may be selected in order to meet risk premium allocation objectives. This optimal allocation will depend on whether the manager chooses to hedge the dynamic equity exposure described by Israelov and Nielsen (2014). Caution is in order because mean–variance optimization may not account for some adverse characteristics—specifically, losses that occur disproportionately in bad times and tails that are fatter than normal and skewed to the downside. For this reason, selecting exposure to long equity and short volatility in order to maximize the Sharpe ratio may not be the most prudent approach because the Sharpe ratio does not take into consideration the strategy's tail characteristics.

We have established that a covered call is best understood in the context of its long equity and short volatility risk exposures. The short volatility risk exposure is complex and depends nonlinearly on option characteristics, such as strike maturity, volatility, interest rate, and dividend yield. Perhaps as a result of this complexity, a number of myths on the covered call strategy have developed, leading many to invest in a good strategy for the wrong reasons. Having laid the foundation for properly assessing a covered call strategy, we can more fully address these myths.

We begin each of the following sections on the eight myths with a one-sentence plain English explanation for why it is a myth and then provide a longer discussion.

Figure 3. Stylized Representation of Underlying Risk Premiums and Total Returns



Myth 1. Risk Exposure Can Be Expressed in a Payoff Diagram

Prices move before expiration, and mark-to-market returns matter.

Myth 1 is true only once—at the option's expiration. The mark-to-market returns on the days prior to expiration can look very different from the payoff diagram, and as such, exposure to the underlying security may also differ significantly from the payoff diagram if the covered call position is liquidated prior to expiration.

In this regard, we can compare an option to a zero-coupon bond. The zero-coupon bond payoff diagram with respect to interest rates is a horizontal line because we know its yield to maturity with certainty. However, we certainly do not consider a zero-coupon bond to be a riskless instrument. Instead, we realize that the bond price varies on the basis of a number of factors, including interest rates, inflation, and credit spreads. Consequently, in order to better understand the bond's return properties prior to its maturity, we find it useful to understand its sensitivity to interest rates (among other factors). Therefore, we calculate its duration and convexity.

Where options are concerned, it is helpful to first acknowledge, in a manner similar to that for bonds, the limitations of payoff diagrams. Far more useful than using payoff diagrams is understanding the covered call's exposures to the various underlying factors that cause the option's price to change, such as the price and volatility of the underlying security. As we illustrated earlier, a covered call has long equity and short volatility exposure. Proper risk modeling and risk management require that these two risk exposures be identified and quantified. Although a payoff diagram is a useful visualization tool and is helpful for understanding the intuition behind options, it is of limited use in practical option risk management.

Myth 2. Covered Calls Provide Downside Protection

Writing a call option reduces exposure to the underlying security.

A stock position can lose its full value, but a covered call can lose only the stock value less the call premium. In other words, covered calls provide some, but only very limited, support on the downside. Propagators of the downside protection myth overstate the importance of the realistic impact of the call premium on downside protection.

The root of the problem is that it is inappropriate to compare a covered call's payoff properties with those of the stock because their respective equity exposures are different. As discussed earlier, an at-the-money covered call has roughly 50% exposure to the stock, as does a long call position. It is true that the covered call's downside is less than that of the stock, but its downside risk is significantly higher than that of a position in a stock with comparable equity exposure. Although writing the call option reduces exposure to the stock, the remaining exposure is significantly concentrated in downside risk.

To help clarify these ideas, consider a covered call position on a $100 stock with a $10 at-the-money call premium. The covered call can potentially lose $90, and the long call option can lose $10. Each position has the same 50% exposure to the stock, but the covered call's downside risk is disproportionate to its stock exposure. This is consistent with the covered call's realized upside and downside betas reported in Table 1. The call seller provides insurance to the call buyer. Covered calls do not give downside protection; they provide significant downside exposure with limited upside potential.

Myth 3. Covered Calls Generate Income

Income is revenue minus cost.

It is true that option selling generates positive cash flow, but this incorrectly leads investors to the conclusion that covered calls generate investment income. Consider the following analogy: A zero-coupon bond provides the issuer with an immediate positive cash flow in exchange for a liability. If the present value of the liability matches the sale price, then the issuance is profitless; the costs and revenues perfectly offset one another. It is clear that cash generated from the bond issuance is not income.

Writing a call option is similar to issuing a zero-coupon bond. The call option seller receives an immediate positive cash flow and a future liability. The liability obligates the option seller to sell the underlying stock at a certain price at the discretion of the option buyer, which means the stock is sold below market value if the option is exercised. Just as in the case of bond issuance, the revenue generated from selling the call option is not income (though, like income, the cash flows received from selling options are considered taxable for many investors). In order for there to be investment income or earnings, the option must be sold at a favorable price; the option's implied volatility needs to be higher than the stock's expected volatility.

Myth 4. Covered Calls on High-Volatility Stocks and/or Shorter-Dated Options Provide Higher Yield

Price is not value.

Although it is true that options on high-volatility stocks and short-dated options command higher annualized premiums, insurance on riskier assets

rationally should command a higher premium and selling insurance more often per year should provide higher annual premiums. However, higher premiums do not equate to higher net income or yield. For instance, if options are properly priced (e.g., according to the Black–Scholes pricing model), then selling 12 at-the-money options will generate approximately 3.5 times the cash flow of selling a single annual option, but this does not unequivocally translate into higher net profits, as discussed earlier. Assuming fairly priced options, higher revenue is not necessarily a mechanism for increasing investment income.

Although it is possible for high prices to be related to value, it is not necessarily the case. Myth 4 is related to Myth 3 in that it ignores the cost of the liability taken on by the option seller. The simple carry of the option may be higher (as measured by the option's time decay or proxied by the option premium), but the actual expected return is related to the option's mispricing owing to a mismatch between the option's implied volatility and the stock's realized volatility, as explained earlier.

In other words, expected investment profits are generated by the option's *richness*, not the option's *price*. For example, if you want to short a stock with what you consider to be a high valuation, then the goal is not to find a stock with a high price but, rather, to find one that is overpriced relative to its fundamental value. The same principle applies to options. It is not appropriate to seek an option with a high price or other characteristics associated with high prices. Investors must instead look for options that are expensive relative to their fundamental value.

Myth 5. Time Decay of Written Options Works in Your Favor

If the only thing that happened with the passage of time was the passage of time, it would be a big surprise.

It is absolutely true that an option's time value declines with the passage of time. However, this is only half (actually, less than half) the story. As time passes, prices change and volatility is realized. An option's intrinsic value increases, in expectation, as the underlying security realizes volatility. A short option position is a bet that realized volatility will be lower than implied volatility—that an option's intrinsic value will increase by less than its time value decays.

Ignoring the effect of realized volatility on an option's intrinsic value—or pretending that realized volatility will be zero—leads to the misperception that time decay is a real moneymaker. In truth, an option's time decay works in the seller's favor only if the option is initially priced expensively relative to its fundamental value. If the option is priced cheaply, then time decay works very much against the seller.

Myth 6. Covered Calls Are Appropriate If You Have a Neutral to Moderately Bullish View

A covered call is a bet on more than the direction of the underlying stock.

This myth is an oversimplification. In fact, when selling a call option, investors do more than merely reduce their underlying stock exposure. They are also expressing a view on the volatility of the underlying stock. Whether this is appropriate depends entirely on their view in regard to volatility and the price paid for the option as compensation to the option seller for that volatility and has nothing to do with their view on the direction of the stock.

For instance, if investors who own a stock wish to express a negative view on its volatility (e.g., they believe that the future realized volatility will be lower than the implied volatility) while maintaining their existing view on the stock's direction, they can sell a call option and purchase additional shares of the stock to leave their stock exposure unchanged.

A neutral view on the stock may imply a belief that the security price will not move far from the current price rather than a belief that the expected return is zero. If an investor believes that the price will stay close to the current price, then a short straddle position—not a covered call—is a way to express that view because in this case, no active position should be taken in the security. Overwriting calls on an existing position may be appropriate if you have a neutral view and yet you are constrained from liquidating your position in the security. However, there is a trade-off because the reduced security exposure coincides with a new (risky) exposure to the security's volatility.

Myth 7. Covered Calls Pay You for Doing What You Were Going to Do Anyway

An option is a contractual obligation, not a plan.

This myth is typically posed as the following question: If you have a price target for selling a stock you own, why not get paid to write a call option struck at that price target?

In fact, there is an important distinction between following a plan to (hopefully) sell a stock at a certain price and being contractually obligated to do so. In the case of a long stock position, the owner plans to sell the stock at the prevailing market price when that price is equal to some predetermined price target. However, this does not represent an obligation; it represents only a plan—a plan that can be changed in accordance with the owner's wishes. At the moment of sale, the sale price is neither favorable nor unfavorable; it is the market price at that time.

However, when selling an option struck at the price target, the option seller is contractually obligated to sell the security at an unfavorable price (from the option seller's point of view), but that is why there is an option premium. Prior to option expiration, if the underlying stock price has reached the desired price target, the long stock position may still be sold at that target price (as would have occurred had the call option not been written) but the portfolio will nevertheless have the short call option position. However, the price of that short option will have changed since it was initially sold owing to the passage of time (down), the stock price appreciation (up), and any change in the option's implied volatility (up or down). The investment risk associated with option overwriting clearly is not equivalent to getting paid to write a call option struck at some hoped-for price target.

Myth 8. Covered Calls Allow You to Buy a Stock at a Discounted Price

The price and value of the stock when you trade are what matters.

Although this myth is typically phrased in the context of selling naked puts, we include it in this article on covered calls because selling a naked put and writing a covered call are effectively equivalent investments.

This myth is typically framed as follows: If a stock that you would like to own is currently priced at $100 and you believe it is currently expensive, you can act on that opinion by selling a naked put option at a $95 strike price, at which point you will collect a premium of, say, $1. If the price subsequently declines below the strike price, the option will likely be exercised, thus requiring you to buy the stock for $95. Including the $1 premium, you will effectively buy the stock at a 6% discount. If the option is not exercised, you will keep the premium as income.

This type of outcome for selling naked put options leads some investors to conclude that the equivalent covered call strategy makes sense and is valuable. This description, however, is really a sleight of hand and reflects how several other option strategies are often incorrectly presented. Why is it a sleight of hand? Because this story gives the impression that a naked put allows the seller to obtain a favorable purchase price, better than the market price at the time the put was written—seemingly, a win for the seller. In fact, it is precisely the opposite. A naked put option obligates the option seller to buy the stock at the stated price at a time when that price is *unfavorable* to the option seller. This is why the buyer pays an option premium in the first place.

In the example just described, if the option is exercised, then when you buy the stock for $95, you will not care what the stock price was when you sold the option. What matters is the stock price on the date the option was exercised. If the stock price drops all the way down to $80, the $95 purchase price will no longer seem like a discount. Your profit and loss statement will show a mark-to-market loss of $14 ($95 – $80 – $1). The initial stock price is irrelevant, and the $1 premium hardly helps.

Furthermore, if the stock price declines, as in our example, and the put option is exercised, you will more likely be buying when the fundamental value is lower than it was on the date you sold the put option. In other words, stating a stock's future fair price today is quite simply a naive approach to investing; prices move, but so do fundamental values. An option obligates the seller to transact at a specific price in the future, regardless of how the stock's fundamental value changes.

Interestingly, this myth also contains a contradiction. A naked put option (or equivalently, a covered call) provides positive exposure to the very stock that the investor chose not to purchase because he believed it was overpriced. The example illustrates this positive exposure: Shorting a $1 naked put option that is $5 out of the money results in a loss of $14 if the stock price declines $20 by the option's expiration date.

Conclusion

Call overwriting is a method of simultaneously expressing a view on a security and a view on its volatility, and the BXM is one of many ways to get a bundled allocation to the equity and volatility risk premiums. A more informed approach requires investors to obtain their equity exposure by buying or selling the index and obtain their desired volatility exposure by buying or selling straddles.

We suggest that investors ignore the misleading storytelling about obtaining downside buffers and generating income. A covered call strategy generates income only to the extent that any other strategy generates income—by buying or selling mispriced securities or securities with an embedded risk premium. Avoid the temptation to focus too much on payoff diagrams. If you believe that the index will rise and that implied volatilities are rich, a covered call is a step in the right direction toward expressing those views. If you have no view on implied volatility, there is no reason to sell options.

Selling volatility is correctly considered a risky strategy. In this article, we have attempted to demonstrate that many of the myths surrounding covered call strategies are just that: myths. In our view, the myths collectively conceal the simple fact that option overwriting is a version of selling volatility. It may be a good standalone strategy when implied volatilities are high relative to expectations and, in particular, a

good strategy when combined with earning the equity risk premium.

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This article qualifies for 0.5 CE credit.

Notes

1. See Whaley (2002); Feldman and Roy (2005); Hill, Balasubramanian, Gregory, and Tierens (2006).
2. Morningstar Direct and eVestment fund databases.
3. Many papers have been written on this topic, including Black, Jensen, and Scholes (1972); Ang, Hodrick, Xing, and Zhang (2006, 2009); Asness, Frazzini, and Pedersen (2012, 2013, 2014); and Frazzini and Pedersen (2012, 2014).
4. Li, Sullivan, and Garcia-Feijóo (forthcoming 2015) presented evidence that low-volatility anomaly returns are not the result of systematic risk factor exposures. Asness et al. (2012) demonstrated that leverage aversion may lead to higher risk-adjusted returns for less risky assets.
5. Bakshi and Kapadia (2003) analyzed delta-hedged index option returns and found evidence in favor of a volatility risk premium. Hill et al. (2006) showed that covered call returns are higher because of the spread between implied and realized volatility. Bollen and Whaley (2004) showed that net buying pressure, particularly for index put options, has an impact on the shape of the implied volatility surface. Gârleanu, Pedersen, and Poteshman (2009) showed that the volatility risk premium can be explained by demand pressure for options that cannot be perfectly hedged.

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