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Options as equity overlays: Do they improve risk-adjusted returns in high-volatility regimes?

Evidence on protective puts versus covered calls

School of Accounting and Finance
Bachelor’s thesis
Finance

Vaasa 2025

UNIVERSITY OF VAASA
School of Accounting and Finance
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Title of the Thesis: Options as equity overlays: Do they improve risk-adjusted returns in high-volatility regimes? : Evidence on protective puts versus covered calls
Degree: Bachelor of Science in Economic and Business Administration
Programme: Finance
Supervisor: Nebojsa Dimic
Year of graduation: 2025 **Sivumäärä:** 45

ABSTRACT:
This thesis examines whether equity option overlays can improve risk-adjusted returns in high-volatility regimes and whether protective put strategies provide greater portfolio stability than covered calls during market downturns. The study is purely theoretical and empirical in the sense of a literature review: it synthesizes prior research on option pricing, volatility risk premia and behavioural distortions, and evaluates protective puts and covered calls across different market regimes. The analytical framework is regime-based and acknowledges the non-normal return distributions created by options. Performance is assessed using traditional and downside-sensitive measures, including the Sharpe and Sortino ratios, maximum drawdown, beta-adjusted measures and the Stutzer index. The evidence shows that covered calls often deliver equity-like returns with lower volatility in calm or moderately rising markets, mainly by monetizing the volatility risk premium. In these regimes, risk-adjusted performance typically improves. Protective puts, by contrast, reliably truncate extreme losses but usually reduce risk-adjusted returns, because insurance premia accumulate and implied volatility is persistently overpriced. Protective puts only add clear value in sharp crises, where their convexity meaningfully limits drawdowns and downside deviation, while covered calls offer little true crash protection. Overall, the findings lead to a rejection of the broad claim that option overlays improve risk-adjusted returns in high volatility. However, they support the view that protective puts provide superior portfolio stability in genuine downturns. Option overlays are therefore best understood as regime-dependent tools that must be aligned with market conditions and investor risk preferences rather than applied mechanically.

KEYWORDS: Option overlays, Protective puts, Covered Calls, Risk-adjusted returns, Volatility regimes, Volatility risk premium

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1 Introduction

Periods of heightened market volatility regularly force investors to reconsider how much risk they are truly willing to bear. Financial markets can deliver long stretches of calm and gradual appreciation, only to shift abruptly into disorder, leaving portfolios exposed to deep losses. This has led both institutional and private investors to consider equity option overlays as a way to shape the balance between risk and return. The two examined strategies, protective puts and covered calls, are at the heart of this, yet their actual ability to improve portfolio performance remains widely debated (Israelov & Nielsen, 2014; Aggarwal & Gupta, 2013).

A central question is whether the option strategies genuinely help when markets become unstable, or do they mostly shift risks around while adding costs?

The literature certainly does not offer an easy answer to this. Covered call indices have often matched or even exceeded the risk-adjusted performance of broad equity benchmarks, mainly by monetizing the volatility risk premium (Hill et al., 2006; Kapadia & Szado, 2011; Israelov & Nielsen, 2014). Protective puts, by contrast, provide strong downside protection but frequently suffer from the persistent cost of buying insurance. Bookstaber & Clarke (1984), Figlewski et al. (1993) and Israelov (2019) find that these costs tend to outweigh the benefits outside of short, sharp crisis periods. Yet Abid et al. (2007) and Aggarwal & Gupta (2013) examine that well-chosen protective puts improved both stability and risk-adjusted returns.

The conflicting nature of these findings makes the topic relevant, because investors treat option overlays as tools for improving portfolio efficiency, not just reducing risk. In highly volatile regimes, where uncertainty is greatest and the non-linear features of options become most influential, the question becomes even more pressing. Traditional risk measures such as variance often fail to capture the skewness, fat tails and drawdown behaviour that dominate optioned return distributions (Stutzer, 2000).

1.1 Purpose of the Study

The purpose of this study is to examine whether option overlay strategies overall, and especially protective puts and covered calls, can improve risk-adjusted performance of equity portfolios when markets enter high-volatility regimes. Covered calls may benefit from elevated implied volatility due to higher premiums that cushion short-term fluctuations. Protective puts may, under certain regimes, convert sudden drawdowns into manageable losses through their convex payoffs (Hill et al., 2006; Aggarwal & Gupta, 2013). It remains unclear whether option overlays help or hinder portfolio efficiency when volatility is elevated. Hence,

H_1 = Option overlay strategies improve risk-adjusted returns during periods of high-volatility.

The hypothesis is intentionally broad, as it merely tests whether any consistent performance benefit emerges when markets are turbulent and option premiums become more economically significant.

The second hypothesis is based on the contrast between protective puts and covered calls under volatile downturn conditions. This is essentially the time when risk management is most urgent and when protective puts offer explicit downside truncation. When markets fall rapidly, convexity becomes valuable and losses can be capped at the strike price. A covered call does not offer this luxury, as it only provides partial relief through option premiums, leaving the full downside of the equity exposure largely intact.

Do covered calls have anything meaningful to offer beyond small, short-lived relief? Or is the structural convexity of protective put the decisive feature that determines whether an overlay strategy actually stabilizes the portfolio?

Downturns with high volatility create exactly the kind of environment where these differences matter the most. In these periods, investors discover whether the premiums they paid for protection was worth it, or whether the acquired income from written calls leaves them with more downside risk than expected. These considerations motivate the second hypothesis:

H_2 = Protective put strategies provide greater portfolio stability during market downturns than covered call strategies.

1.2 Structure of the Study

This study progresses from foundational concepts toward increasingly focused analysis. It begins by establishing the theoretical elements needed to understand how options shape return distributions. These concepts provide the groundwork for interpreting how protective puts and covered calls behave when market conditions shift.

Once this foundation is in place, the thesis turns to the question of performance. Here, the emphasis moves from simple variance to a broader set of risk measures that capture downside behaviour, drawdowns and higher-moment effects. This allows the analysis to reflect the way option strategies actually influence portfolio outcomes, especially in volatile markets.

The final part of the thesis brings these strands together by examining the empirical evidence on protective puts and covered calls. By looking at how these strategies perform across different volatility regimes, this thesis evaluates whether they succeed in improving risk-adjusted returns when markets become unstable.

2 Theoretical background

Options are a central tool for shaping the risk and return characteristics of modern portfolios (Black & Scholes, 1973; Merton, 1974). Their flexibility and versatility provide investors with an opportunity to limit losses or benefit from market movements. However, due to their rather complex nature, it is useful to first discuss the principles before examining options in greater depth. This chapter breaks down options in order to grasp how they affect portfolio outcomes.

2.1 Basic concepts of options

Options are considered to be key instruments of financial markets, especially if used to hedge and adjust return asymmetry. According to Hull (2022, p. 33-39) derivative users can be divided into speculators, arbitrageurs and hedgers. Speculators look forward to profit from price movements, where they take positions with options based on expectations of an asset's price rising or falling, hence their returns rely heavily on market volatility and price shifts. Arbitrageurs seek to profit from price discrepancies without taking on risk, in other words; they are looking for mispricings. Hedgers use options to protect themselves from adverse price movements, with the aim of locking in the value of investments at a certain level, effectively acting as an insurance against potential losses.

2.1.1 Option types

Options are financial instruments which can be traded either on stock exchange or in over-the-counter (OTC) markets. They are categorized into two main types, call options and put options, wherein they offer investors a possibility to hedge against risks or take positions on future price movements and volatility (Hull, 2021)

A call option gives its holder a right to buy an underlying asset, such as a stock, at a specified price, known as the strike price, within a certain time period. This time period that the option can be exercised is referred to as the expiration date, or maturity. Call options are particularly appealing when the price of an underlying asset is expected to soar, hence providing its holder with a possibility to profit from price increases without having to purchase the asset outright. The cost of this right is the premium paid for the option. If the price does not rise as wanted, the option can simply not be exercised. (Hull, 2021)

Strike Price ($)	*December 2024*		*March 2025*		*June 2025*	
($)	*Bid*	*Ask*	*Bid*	*Ask*	*Bid*	*Ask*
200	28,05	28,65	33,05	33,45	37,40	37,75
210	18,75	19,00	25,00	25,25	29,90	30,15
220	10,25	10,85	17,90	18,10	23,00	23,45
230	4,20	4,40	12,10	12,25	17,50	17,70
240	1,20	1,26	7,60	7,80	12,75	12,95
250	0,30	0,33	4,50	4,65	9,00	9,20

Figure 1. Prices of call options on Apple, November 8, 2024; Stock price: bid $226,93, ask $226,96 (Source: Nasdaq)

Suppose that an investor gives a broker an assignment to purchase one December 2024 call option on Apple with a strike price of $240. The broker will relay the information forward and trade is executed. The ask price for the December 2024 option is $1.26. Since an option contract in the United States usually covers 100 shares, the investor wishing to buy must pay a total of $\$1.26 \times 100 = \$126$ to acquire the right to buy 100 Apple shares for $240 per share. If Apple's stock price does not rise above $240 or higher until the maturity (December 13.), the option will not be exercised and the investor loses the premium of $126. In other situation, where the stock price of Apple rises for example to $250, the investor should exercise the option to purchase Apple stocks for a price of $240 per share. When exercised, the investor will sell the shares and net up a profit of $\$100 \times \$10 = \$1000$. After deducting the premium, the profit would be $\$1000 - \$126 = \$874$. It should be noted, that these examples ignore a) commisssions to the trader and b) the effect of discounting, where the $1000 should be discounted.

In contrast to call options, a put option allows its holder to sell the underlying asset at a predetermined strike price within a specific time frame. This works particularly well against price drops, as put option provides its holder with a possibility to sell with a higher price, if the market value falls below the strike price. Investors use put options to hedge their portfolios, particularly in times when it can be expected for markets to decline. Likewise with call options, the cost of put option is the amount of premium paid and it does not have to be exercised.

Strike Price ($)	*December 2024*		*March 2025*		*June 2025*	
($)	*Bid*	*Ask*	*Bid*	*Ask*	*Bid*	*Ask*
200	0,29	0,32	2,60	2,67	4,95	5,10
210	0,74	0,81	4,35	4,50	7,15	7,40
220	2,11	2,28	7,15	7,25	10,35	10,50
230	6,10	6,25	11,25	11,45	14,50	14,70
240	12,90	13,55	16,90	17,15	19,65	20,00
250	22,70	23,15	24,10	24,95	25,95	26,70

Figure 2. Prices of put options on Apple, November 8, 2024; Stock price: bid $226,93, ask $226,96 (Source: Nasdaq)

Prices of put options on Apple, November 8, 2024; Stock price: bid $226,93, ask $226,96 (Source: Nasdaq)

As previously mentioned, according to Hull (2021) options give its holder a right to buy or sell the underlying asset. Hull (2021) describes this to be the key feature distinguishing options from futures and forwards, wherein it is mandatory for the holder to sell or buy the underlying asset. Furthermore, the key point is that calls and puts introduce non-linear payoffs, wherein calls increase upside participation relative to the premium paid, while puts truncate losses at the strike.

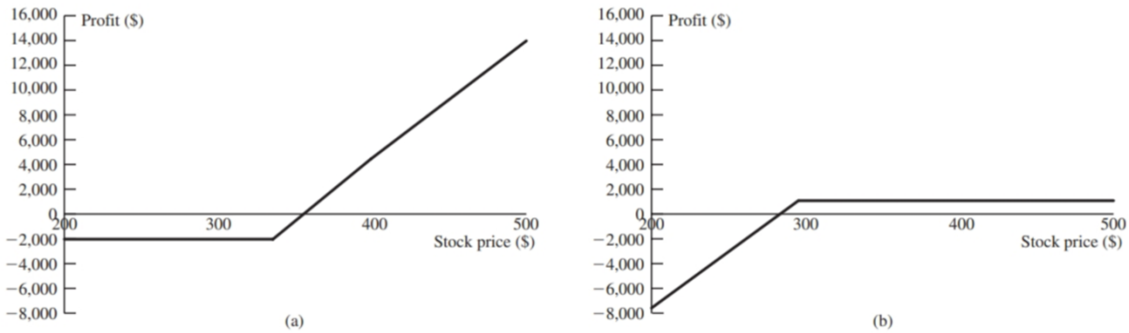

Figure 3. Payoffs from long and short positions on options. (Hull 2022, p. 33)

In addition to previously described features of options, according to Hull (2021) options can be divided into American and European options. European options can only be exercised on the expiration date, whereas American options can be exercised at any time within the maturity. This disparity affects the flexibility and strategic value of these options. For example, Hull (2021, p. 395) finds that American options offer more possibilities, which can make them more expensive relative to their European counterparts, since they can be exercised at any given moment. It should be noted, that most of options traded in the exchange are American.

2.1.2 Option pricing fundamentals

Option pricing is one of the most central and most complex aspects of the derivatives market. According to Hull (2021, p. 247), option prices are affected by six factors:

1. Current stock price, S_0
2. The strike price, K
3. The time to expiration, T
4. The volatility of the stock price, σ
5. The risk-free interest rate, r
6. Dividends expected to be paid for the underlying stock, D

One of the primary determinants in option pricing is the price of an underlying asset relative to the strike price. The prices of call options correlate positively with the price of an underlying asset, as the option holder has the right to buy the assets at a lower price. In other words, call options become more valuable when the price of an underlying asset rises and becomes less valuable as the strike price increases. Conversely, as the price of an underlying asset deteriorates, the price of a put option increases as the option holder has the right to sell the asset at a higher price than the market value.

Volatility or the scale of price fluctuations of the underlying asset, is also a significant factor in option pricing. Higher volatility means that there is a higher probability for the option to become profitable, and thus the premium is higher. It is worth noting, that the values of call and put options correlate positively with volatility (Hull, 2022, p. 250). Volatility is especially important because it largely determines the cost of protective puts and the income from written calls.

The risk-free interest rate also plays an important role in option pricing. Hull (2022, p. 250-251) notes that when interest rates rise, the present value of future cash flows declines, which tends to increase (reduce) the value of call (put) options.

Dividends also influence option prices, as stock prices drop predictably on the ex-dividend date (Dinh & Nguyen, 2016, p. 211). Call options lose value, while put options benefit from the decline.

2.1.3 Moneyness and time value

In addition to the previous fundamental elements of options, moneyness and time value are essential in valuating options and the strategy behind their usage. Moneyness refers to an option's current value relative to its strike price and defines its profitability at a certain point of time (Hull, 2022). Simply, option can be in three different states: in-the-money (ITM), at-the-money (ATM) or out-of-the-money (OTM). When dealing with calls, an option is ITM when its underlying stock is valued above its strike price, whereas a put option is ITM when the underlying stock price is below the strike price. Moreover, an option is ATM if the price of an underlying object exactly meets the strike price. Generally, it can be said that exercising an OTM option is not financially viable; call option is OTM when the market price is under the strike price and a put option is OTM when the market price is higher than the strike price (Hull, 2022).

Time value represents the residual value of an option based on the time remaining until its expiration and the market's volatility. The total value of an option consists of intrinsic value, which is the monetary benefit of an ITM option, and time value which is the additional value of an option before expiration. As the expiration date gets closer, the more the value of an option resembles its intrinsic value, as the possibilities of market movements diminish (Aggarwal & Gupta, 2013). High volatility increases the time value of options, because the price changes enhance the possibility for an option to end up ITM before expiration. On the other hand, long maturity increases time value, since it offers the holder more time to utilize market movements.

2.2 Option overlay strategies

2.2.1 Protective put

As previously said, protective put is a fundamental risk management tool for investors to hedge their positions from significant market fluctuations. Protective put is formed by combining long position on a stock with a long put option. The strategy works as an insurance that protects the investor from significant losses, simultaneously maintaining the potential to benefit from upward movements.

Should an investor own 100 shares with a market price of $50 per stock. In order to hedge the possible decline in value, the investor buys a long put option with a strike price of $45 with a premium of $2 per stock. If the stock price drops below $45, the investor can exercise the option and sell their shares for $45 which caps the losses. However, if the price goes beyond $50, the investor benefits from the price increase without the put option restricting their gains. In the case of share staying between $45-$50, the investor only bears the premium, which represents the cost of maintaining the protection.

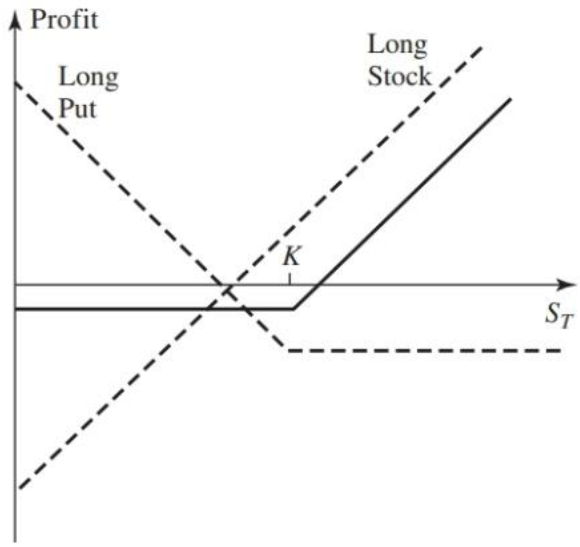

Figure 4. Protective put payoff diagram (Hull, 2022, p. 271)

The payoff of the protective put is portrayed below, wherein dashed lines represent long stock position and a long put option to produce a combined profit curve. The figure shows that losses are capped below the strike price of the put option, while gains remain unlimited as the stock price increases.

The strength of the protective put strategy is clear, as it can offer robust protection against market downturns. By establishing a clear boundary for losses, protective put mitigates the risk of significant declines in portfolio value, which is particularly critical in volatile markets (Aggarwal & Gupta, 2013). In addition, its flexibility allows investors to benefit fully from upward price movements, distinguishing itself from other hedging methods that often limit their profit potential. For example, when comparing these two strategies Aggarwal and Gupta (2013) found that protective put outperformed covered call both in effectiveness and risk-adjusted return with an appropriate option selection.
Although effective, protective puts are not free. Over time, the cumulative premium payments lower average returns, especially in stable market conditions where the value

of the protection is limited. In addition, the size of premium depends on the volatility of the market and the strike price of an option, which can shift the strategy to be expensive during volatile markets. This implies that the impact on risk-adjusted measures is ambiguous and depends heavily on regime (Aggarwal & Gupta, 2013; Israelov, 2019).

2.2.2 Covered call

A covered call is a combination of holding a long position with a stock and simultaneously writing a call option on the same stock. This approach presents the investor with a way of gathering added value through option premium, especially in stable or slightly bullish markets. Although Israelov and Nielsen (2014) note that this characterization oversimplifies the underlying exposure, it remains a useful starting point for understanding the mechanics of the strategy. The main point of the strategy is to enhance portfolio returns by utilizing the stability of the underlying stock.

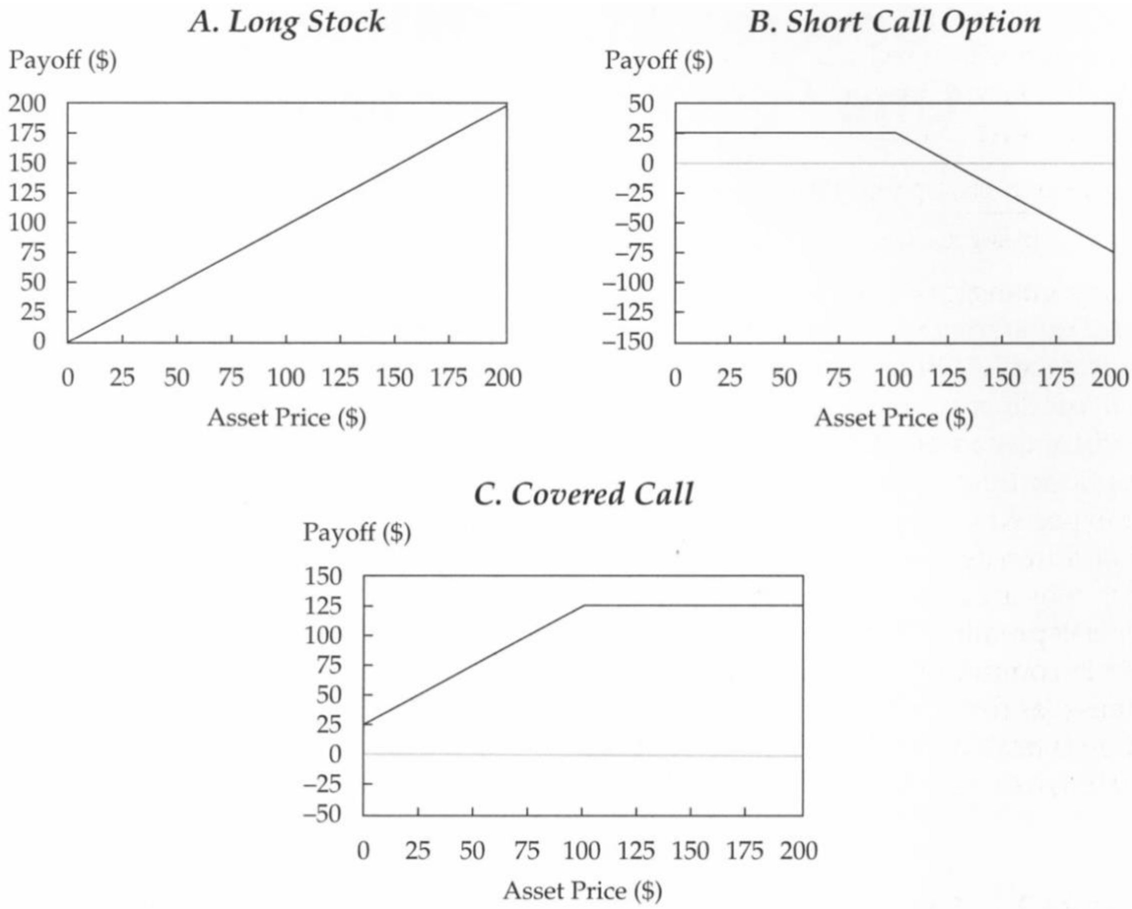

Figure 5. Covered Call Payoff Diagram (Israelov & Nielsen, 2014, p. 23-31)

Suppose an investor holds 100 shares with a market price of $50 per stock. The investor writes a call option for a strike price of $55 and acquires $2 premium per stock. The efficiency of the strategy depends on the market situation. If the stock price stays below $55 the option expires worthless, and the investor gets to keep the premium. If the stock price exceeds $55 the investor is obliged to sell their shares for the strike price which caps the profit. In this case, the investor benefits only from the premium and the difference between the original stock price and the strike price, even if the stock price continues to rise.

A covered call is particularly enticing for investors looking to capture revenue through option premiums, when the stock's price keeps rather stable (Israelov & Nielsen, 2014). The strategy behind covered call is shown in Figure 5, where it clearly shows how the profits are limited in rising markets but provide steady income through premium in stable conditions.

Covered call has significant limitations, as it offers very limited upside potential. Writing the call option obliges the investor to sell at the strike price which prevents benefiting from potential price upswings. In addition, covered call does not offer the same downside protection in bear markets as previously mentioned protective put strategy does (Aggarwal & Gupta, 2013). This is because the investor remains fully exposed to fluctuations in the stock price since the call premium does not cover significant losses in the underlying stocks value. In addition to this, liquidity constraints can be challenging when implementing the strategy, particularly in volatile markets where option premiums may be low, making it less attractive to implement the strategy (Israelov & Nielsen, 2014). Despite these limitations, covered calls remain as a widely used tool especially in stable or moderately bullish markets, and many empirical studies report improved risk-adjusted performance relative to a pure equity position (Kapadia & Szado, 2011; Hill et al., 2006).

3 Analytical framework

The performance of equity option overlays is state-dependent, hence the evidence is stated through different regimes, which distinguishes high-volatility or crisis windows from other states. Covered calls combine long stock position with short volatility. For example, studies on the BXM buy-write benchmark report returns close to the S&P 500, while volatility and the worst drawdown are smaller. The trade-off is clear: upside is capped, and drawdown relief comes mainly from the earned premium (Israelov & Nielsen, 2014). These features motivate a regime aware interpretation.

Protective puts pair long stock with a long put. Here the put sets a floor under losses but it requires a premium. Comparative work by Aggarwal and Gupta (2013) indicates that both strategies can improve risk-adjusted returns and that their return distributions are not normal once options are added.

Because extreme losses occur in the tails of the return distribution, the assessment gives priority to downside sensitive measures, such as the Sortino ratio and Maximum Drawdown. Sharpe ratio and Treynor’s ratio adjusted with Leland’s beta are used as supporting indicators.

3.1 Market regimes

When market situations change, it consequently has an impact on the performance of option-based portfolios. Kapadia and Szado (2011) updated their previous Russell 2000 buy-write study (2007) by extending the sample from 1996 to March 2011 to account for the global financial crisis, and they show why regimes matter.

The regime lens matters because option overlays are state dependent. Evidence on covered calls shows that performance can look strong in benign conditions when the volatility risk premium (the gap between implied and realized volatility) is earned, yet the same structure can lag in fast rebounds or deep selloffs when upside is capped.

Kapadia and Szado (2011) find this trade-off to be explicit and report that outperformance is robust when one-month calls are used and when performance is evaluated with metrics that recognize non-normal distributions. This further reinforces the need to keep the state definition tight, and the horizon aligned with the overlay design.

Regime oriented point of view is further supported by Aggarwal & Gupta (2013) where they documented protective put and covered call performances on the Nifty index through the financial crisis, 2006-2011. The years documented included both bullish and bearish phases, hence they deem the results to be representative of general market conditions.

3.2 Metrics

This thesis evaluates option overlays with several metrics, which consider the non-normal return distributions typical of optioned portfolios. Because empirical studies constantly reject normality (Aggarwal & Gupta, 2013; Kapadia & Szado, 2011), variance alone is not sufficient as a risk proxy. Therefore, the framework combines a total-risk angle with downside-sensitive and beta-adjusted measures. This section will then focus on the ways of evaluating protective put and covered call strategies on a risk-adjusted basis.

A theoretical foundation for evaluating the relationship between risk and expected return is the Capital Asset Pricing Model (CAPM). Within the CAPM, the expected return of a portfolio depends on its systematic risk, measured by beta (β), which captures the portfolio sensitivity to market movements (Sharpe, 1964). A beta of one indicates that a portfolio moves exactly in line with the market, while values above or below one represent higher or lower sensitivity. In the context of option overlays, beta helps describing how much market exposure remains once the protective put or covered call is applied (Bodie et al., 2013).

3.2.1 Sharpe ratio

Sharpe ratio will serve as the baseline for the first hypothesis, as it summarizes excess return per unit of total risk (volatility) and makes it possible to directly compare the optioned portfolio to a long-only benchmark. Hence,

$$Sharpe = \frac{E[R_p - R_f]}{\sigma_p}$$

Where R_p is portfolio return, R_f is the risk-free rate, and σ_p is the standard deviation of portfolio returns (Sharpe, 1966). Ratios are interpreted at a monthly horizon to match one-month option tenors and rolling implementations.

3.2.2 Sortino ratio

Sortino ratio complements the Sharpe by focusing on downside risk. Sortino replaces total volatility with downside deviation relative to a target T:

$$Sortino = \frac{E[R_p - T]}{\sigma_d}$$

Where σ_d is the standard deviation of returns below T. The target T can vary, hence targets are either stated clearly, or they follow a zero or risk-free target for consistency.

3.2.3 Treynor's measure

In order to examine robustness, we approximate non-normal returns while assessing systematic risk with Treynor ratio. Beta is estimated through Leland's adjustment:

$$Treynor = \frac{E[R_p - T]}{\beta_p}$$

where β_p reflects market sensitivity adjusted for higher-moment effect (Leland, 1999). Leland-adjusted Treynor helps interpret whether improved Sharpe results stem from premium income or genuine risk-adjusted gains, but it is not decisive on its own.

3.2.4 Jensen's alpha

Jensen's alpha (α) measures the abnormal return of a portfolio relative to the return predicted by its systematic risk under the CAPM (Jensen, 1968). In other words, alpha captures the portion of performance that cannot be explained by market exposure alone. A positive alpha indicates that the portfolio has generated excess return for its level of systematic risk, while a negative alpha signals underperformance (Bodie et al., 2013).

Formally, α is defined as:

$$\alpha_p = r_p - [r_f + \beta_p(r_m - r_f)]$$

Where r_p is portfolio return, R_f is the risk-free rate, β_p reflects systematic risk and $(r_m - r_f)$ is market risk premium. In the context of option overlay strategies, alpha reflects whether strategies produce returns beyond what would be expected from its adjusted beta (Aggarwal & Gupta, 2013). A positive alpha may arise when covered calls earn option premiums efficiently or when protective puts preserve value during market declines. Conversely, negative alpha may occur when premium income fails to offset upside in CC, or if the cost of PP outweighs the benefits it provides.

3.2.5 Maximum drawdown

As the name states, Maximum drawdown (MaxDD) provides an intuitive measure of downside risk by calculating the largest observed decline from a portfolio's historical peak to its subsequent trough over a given period (Geboers et al., 2022). Differentiating from volatility-based metrics, which treat positive and negative deviations symmetrically, maximum drawdown distinguishes the magnitude of cumulative losses and hence captures the severity of potential capital erosion.

$$MDD = \frac{P_{Peak} - P_{Trough}}{P_{Peak}}$$

Where P_{Peak} is the highest portfolio value observed before a decline, and P_{Trough} represents the lowest subsequent value before recovery.

Maximum drawdown complements volatility- and beta-based indicators through focusing on tail risk and the persistence of losses.

3.2.6 Stutzer index

Returns generated by option overlayed portfolios deviate from the normal distribution, and this is where the Stutzer index becomes relevant, as it complements the chosen metrics by accounting for skewness and kurtosis of a portfolio (Stutzer, 2000). This characteristic plays especially well with covered call strategies, as their upside potential is capped while downside exposure remains largely intact, resulting in frequent small gains and occasional large losses.

The index can be defined as the optimal value of the following expression:

$$I_p = \max_{\theta}[-\ln(\frac{1}{T}\sum_{i=1}^{T} e^{\theta r_i})]$$

Where r_i represents excess returns across T observations, and θ is an optimization parameter that maximizes I_p. The resulting Stutzer statistic is then transformed into the Stutzer index through:

$$Stutzer\ Index = sign(\bar{r})\sqrt{2I_p}$$

With sign $(\bar{r})$ indicating the sign of the mean excess return, typically relative to the risk-free rate. Additionally, when the return distribution follows normality, the Stutzer index converges to the Sharpe ratio.

3.3 Option pricing factors

3.3.1 Volatility assumptions

In the financial world, the difference between models and the reality is significant. For example, volatility is assumed by the Black-Scholes model to be constant and to follow its assumptions exactly. In fact, it is the opposite, wherein it shifts with the market's mood, clusters during stress and fades in calm periods. This is proven by Israelov (2019), who finds that equity-index volatility is stochastic and time varying, defying the Black-Scholes notion of stability. In simpler terms, stochasticity means that volatility follows a random process rather than remaining constant (Israelov, 2019).

Implied volatility (IV) looks forward, wherein it reflects what the market expects volatility to be in the future. From its name, it actually states that it is implied from the prices, and is not observed directly (Figlewski et al., 1993). Realized volatility (RV) however, is backward looking, as it measures the actual variability that occurred in the asset's returns over a specific past period. In financial markets, implied volatility is often higher than realized volatility, leading to larger premiums for written call options. Furthermore, this leads to excess returns in theoretical models, hence the volatility risk premium raises option prices relative to what actual realized outcomes suggest (Bates, 2008).

3.3.2 Volatility types and volatility smile

Despite the theories, such as the Black-Scholes model, volatility is not constant across different strike prices and maturities, option prices reveal a curved structure where implied volatility varies with both moneyness and time to expiry. This can be portrayed through the volatility smile, where implied volatility is higher for deep out-of-the-money (OTM) and deep in-the-money (ITM) options than for at-the-money options. Simply put, this means that the market requires a higher premium (compensation) for options that protect from the extreme price movements.

This pattern is illustrated in Figure 6, where implied volatility is higher for very low and very high strike prices compared to ATM options in the middle (e.g. Strike = 100) (Feunou et al., 2018).

Figure 6. Volatility smile (Feunou et al., 2018), Simulated with Python.

To describe such patterns more accurately, option pricing can be done with different models, such as the Heston model, which lets volatility follow a random process (Heston, 1993). Furthermore, this helps capturing time series features such as volatility clustering and mean-reversion.

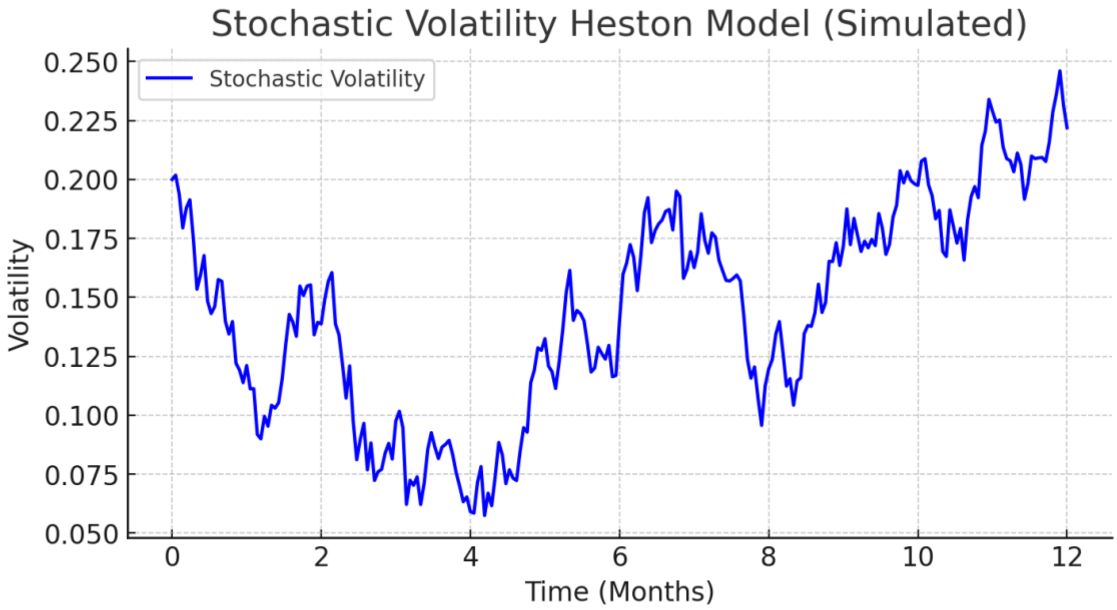

Figure 7. Stochastic volatility simulated with Python (Heston, 1993).

Implied volatility tends to react quickly to shifts in perceived risk. For example, during the 2008 financial crisis, implied volatility surged as investors sought protection against collapsing asset prices (Schwert, 2011). Implied volatility is therefore shaped by factors such as market sentiment, hedging activity, and expectations regarding future stability (Whaley 2009). The CBOE Volatility Index (VIX) synthesizes this information by measuring the market's expectation of 30-day forward-looking volatility for S&P 500 options (Whaley, 2009)

Risk aversion and the perpetual demand for downside protection tends to elevate implied volatilities, particularly for out-of-the-money (OTM) put options. As a result, markets often display the previously mentioned volatility smile and volatility risk premium (compensation). These features moreover help explain why option strategies often generate skewed and fat-tailed return distributions, that differ from the normal bell-curved distribution assumed in classical pricing models.

Regarding traders, it should be noted that implied volatility speaks only to the magnitude of expected moves, not their direction. Traders often use it to judge whether options look rich or cheap, relative to their volatility expectations. Higher IV (implied volatility) means higher option premiums, thus benefiting option writers. This, however, indicates elevated market risk. (Hull, 2012; Bollen & Whaley, 2004)

3.3.3 Behavioral limitations

Option prices do not emerge from a vacuum, instead they're driven by fear and greed. In practice that shows up as systematic demand for insurance (puts) and income (covered calls) that pushes implied volatility away from what a frictionless model would predict. Israelov (2019) documents that implied volatility typically sits above subsequently realized volatility, which is in line with investors' interests to pay up for downside protection. The same gap subsidizes call-writing income (Israelov, 2019). This demand appears to be rather cyclical, as it spikes in stress when protection is most desired and fades in calm. This implies, that the cost-benefit of buying insurance or selling calls is partly a story about crowd psychology (Israelov, 2019).

A misframing of strategy payoffs is also common, as Israelov and Nielsen (2014) find in their paper, where covered call returns are often portrayed as "free yield", as the premium harvested is compensation for giving up upside and absorbing left-tail risk. Apparently, that misframing tends to appear exactly when option premium is the most enticing (Israelov & Nielsen, 2014). This can be interpreted, that behavioral preferences can overweight the steady drip of "premium drops" and simultaneously underweigh the rare occasional episodes that dominate long-horizon outcomes.

Behavioral factors also tilt the volatility smile. When a big group of investors desire crash insurance at the same time, lower strikes become relatively very expensive, steepening index-option skews. Furthermore, this directly affects the running costs of protective puts and makes the preservation of long-term returns significantly harder (Israelov & Nielsen, 2014).

4 Protective puts versus covered calls

This chapter evaluates how these two chosen strategies alter portfolio outcomes through concrete examples across different market environments. Although both strategies modify the return distribution, they do it in fundamentally different ways.

The goal of the fourth chapter is to analyze these differences, where section 4.1 focuses on protective puts, particularly in bear and high-volatility regimes, while section 4.2 (and later 4.3) turns to covered calls and the comparative evidence between the two approaches.

4.1 Protective puts in bear/high-volatility regimes

4.1.1 Mechanisms

The idea of protective put is fairly simple, when the price of an equity falls below the strike price of the put option, the hedge kicks in. This mechanism is called downside truncation, and it essentially cuts off the left tail of the return distribution (Figlewski et al., 1993). In practice this means protective puts can soften the impact of sudden drops, where the option's convexity has real value (Israelov, 2019).

The downside is the real cost, where put prices depend heavily on volatility, and in stressed markets they get expensive, sometimes more than what the actual risk would imply (McKeon & Svetina, 2017). Option markets also price in jump risk and extreme downside scenarios, meaning that PP buyers systemically pay for crash insurance even though such events are rare (McKeon & Svetina, 2017). A further characteristic is path dependence, as protective puts provide strong protection only if losses happen within the option's life. Typical slow, grinding bear markets often lead puts to expire with little or no payoff before the main part of the decline materializes, effectively reducing the hedge (Israelov, 2019).

Over time, rolling these positions again and again builds up marginally big costs over time. Across long horizons, only a handful of purchased puts finish in-the-money, meaning that most premiums simply accumulate and weigh down returns (Figlewski et al., 1993; Bookstaber & Clarke, 1984).

4.1.2 Performance drivers in high-volatility markets

High-volatility regime both amplifies the strengths and weaknesses of protective puts. During implied volatility spikes, put prices inflate sharply due to heightened demand for protection. McKeon & Svetina (2017) find that the increase in premiums often exceeds the increase in actual downside risk, leading to hedges that are stabilizing, but extremely costly. When VRP (Volatility risk premium) widens, the put buyer effectively pays more for volatility than is later realized, creating a consistent negative expected return (Israelov, 2019).

The timing of market declines also matters, as PP's work best during fast, sudden drawdowns, where the option payoff materializes before expiration (Israelov, 2019). Israelov (2019) demonstrates this through a year peak-to-trough period, with a hedged S&P 500 portfolio, where it suffered a drawdown exceeding 32% during a prolonged sell-off, compared to roughly 21% for a simple low-equity allocation. This is mainly because the puts often expire before the worst part, meaning the investor must then purchase new hedges at higher IV.

4.1.3 Cross-study evidence

Across the literature, there is a strong consensus that protective puts reliably reduce the magnitude of extreme losses, sharply truncating the left tail of the distribution (Figlewski et al., 1993; Israelov, 2019). However, many studies agree that this benefit comes at the cost of lower average returns and typically worse risk-adjusted performance, driven by volatility dependent premiums, path-dependent misalignment with losses, and long-run compounding of insurance costs (McKeon & Svetina, 2017; Israelov 2019). There is, however, significant divergence, most notably the outlier findings of Abid et al. (2007), who report that ITM protective puts on French equities improved both returns and Sharpe ratios during 1999. This is a straight contradiction with the multi-decade evidence from Israelov (2019) and McKeon & Svetina (2017). Differences arise from sample period (single year vs. multi-decade), volatility regime variation, strike selection (Deep ITM vs. OTM), and assumptions regarding option pricing. Similarly, simulation studies assuming fair pricing or constant volatility (e.g., Figlewski et al., 1993; Bookstaber & Clarke, 1984) find milder performance drag, whereas reality-based studies incorporating volatility risk premium report far more negative outcomes.

4.1.4 Implications for risk-adjusted performance

In high-volatility markets protective puts typically worsen risk-adjusted performance. Although they lower realized volatility and cap catastrophic losses, the reduction in mean returns is typically larger than volatility reduction, consequently leading to lowered Sharpe and Sortino ratios (Israelov, 2019; McKeon & Svetina, 2017). PP portfolios also exhibit thinner right tails due to premiums, generating lower upside participation potential in recoveries.

Regarding drawdowns, protective puts do reduce maximum potential loss when compared with an unhedged equity position (Figlewski et al., 1993). Yet when compared with simple de-risking strategies, such as reducing equity exposure, they usually perform worse over extended downturns because hedged portfolios retain more equity risk and accumulate option expenses (Israelov, 2019).

Thus, the evidence does not support H_1. Protective puts do reduce volatility, but lower risk-adjusted returns across most periods with elevated volatility. This pattern seems to come from expensive premiums, VRP (Volatility risk premium), and the cumulative cost of rolling the hedge (Israelov, 2019; McKeon & Svetina, 2017). Only exception to this is the short, one-year sample from Abid et al. (2007), which appears to reflect unusual conditions rather than generalizable results. Across broader data, protective puts tend to hurt risk-adjusted returns, not improve them.

4.2 Covered calls in stable/bull regimes

4.2.1 Mechanisms

A covered call takes a long equity position and layers a short call on top of it, which ends up reducing the net equity exposure while also adding short-volatility flavour to the payoff structure (Israelov & Nielsen, 2014). The strategy's returns originate from two sources: the portion of the equity risk premium the investor still holds onto, and the volatility risk premium embedded in index options, as implied volatility typically exceeds realized volatility (Kapadia & Szado, 2011). Hill et al. (2006) make this mechanism more unambiguous by decomposing covered call performance into four components: the fair call premium, the volatility premium, the exercise cost and trading costs. The first two contribute positively, while exercise cost (losses when calls finish ITM) acts as the main drag on returns, especially for ATM strategies.

The downside of a CC is essentially the upside potential you willingly give away, since gains above the strike price are truncated (Israelov & Nielsen, 2014). Kapadia & Szado (2011) and Chang (2021) summarize the significance of moneyness well in their studies, where they find that CCs written at-the-money (ATM) generate higher immediate premium and stronger volatility reduction, but cap upside almost immediately. Out-of-the-money (OTM) calls, by contrast allow more equity participation while still capturing a slice of the volatility risk premium.

Interestingly, the payoff can be thought as something like a reduced-delta equity position combined with a short straddle-like profile (Israelov & Nielsen, 2014). Hill et al. (2006) actually quantify the deltas: ATM calls around 0,53, 2% OTM calls near 0,34, and 5% OTM strikes down closer 0,13. These deltas translate directly into lower equity betas, which explains the similarity.

Maturity choice seems to be a significant factor as well, as Hill et al. (2006) show that one-month strategies tend to beat three-month ones because the short maturities let the investors refresh strikes more often and capture the IV-RV spread more effectively.

4.2.2 Return distribution and risk characteristics

The covered call reshapes the underlying return distribution by compressing the right-tail and only subtly decreasing left-tail risk. Because the investor gives up extreme positive returns but remains exposed to negative moves, monthly returns exhibit negative skewness and excess kurtosis relative to S&P 500 (Bookstaber & Clarke, 1984). This is examined well by Kapadia & Szado (2011), where they found that long-term Russell 2000 buy-write displayed far more negative skew (approximately –1,4) and higher kurtosis than the index itself.

Hill et al. (2006) strengthen these findings with percentile analysis. They find that the 90th-percentile monthly returns for ATM and OTM covered calls are materially lower than those of the S&P 500. Furthermore, 10th-percentile losses are less severe than the index's, especially for ATM and 2% OTM calls. Hill et al. (2006) also report that this volatility reduction is mainly happening because the extreme positive outcomes disappear, not because downside risk is eliminated.

Beta and volatility decline as well, often to 60-80% of the index (S&P 500 $\beta = 1$) because short calls reduce net equity exposure (Israelov & Nielsen, 2014). Hill et al. (2006) find the betas to be around 0,51 for ATM, 0,68 for 2% OTM and 0,87 for 5% OTM. Even with these reductions the strategy can still face large drawdowns, hence the option premium only partly covers losses in significant downturns.

4.2.3 Empirical evidence across regimes

On a long horizon, covered calls deliver equity-like returns but with quite a bit less volatility. Over 1986-2013, the S&P 500 BuyWrite Index (BXM) delivered an annualized excess return only slightly below S&P 500, with about two-thirds of the volatility, consequently resulting in a higher Sharpe ratio (Israelov & Nielsen, 2014). Kapadia & Szado (2011) finds similar patterns where they examine a 2% OTM buy-write strategy which returned 8,87% versus the index's 8,11%, with significantly lower volatility. International evidence hints at the same way, as Hill et al. (2006) show that overwriting OTM calls on French stocks in 1999 improved Sharpe and sometimes even delivered first-order stochastic dominance.

Hill et al. (2006) support this with more detailed evidence using multiple moneyness levels regime splits. Their ATM strategy returned 13,25% annually with only 8,5% volatility between 1990-2005, outperforming the S&P 500 by over 2 percentage points while taking only partially the risk. Similar succession proved their 2% OTM strategy and even 5% OTM calls beat the index while keeping risk fairly close to benchmark levels (Hill et al. 2006)

Kapadia & Szado (2011) observe the performance to be rather regime dependent. Covered calls tend to outperform in stable or sideways markets because premium income accumulates while upside truncation does not bite often. Hill et al. (2006) show that the best three-year relative performance windows clustered in 1999-2001 and 2000-2002. It should be noted that these periods were dominated by bear markets. Within these windows, cumulative excess returns over the S&P 500 ranged from roughly 14 to 38 percentage points, depending on the strike.

In moderate bull markets, covered calls can keep up with equities, especially when volatility is low. Kapadia & Szado (2011) finds that during 2003-2007 the Russell 2000 Buy-Write returned nearly the same as the index while maintaining much lower volatility.

Hill et al. (2006) reinforce this with S&P 500, where they find that the strategy lagged in strong individual years during the mid-1990s but held up better in steadier uptrends.

In strong and persistent bull markets, covered calls clearly lag. Israelov and Nielsen (2014) note that repeated monthly rallies force the short call to bind continuously. Hill et al. (2006) find that in the mid-1990s bull market, the BXM underperformed the S&P 500 by up to 15 percentage points in certain years, and up to 41 percentage points over the worst three-year period. Chang (2021) documents similar effects in the post-2009 recovery.

Interestingly, dynamic strike strategies behave broadly like fixed-strike OTM strategies (Hill et al., 2006). Their 20-30% exercise probability approaches generated returns near 12% with lower tracking error, suggesting that adjusting strikes to match implied volatility does not fundamentally change the economic outcome (Hill et al., 2006).

4.2.4 Synthesis of findings

Across studies the general agreement is that covered calls improve risk-adjusted performance by monetizing the volatility risk premium in stable or moderately rising markets (Israelov & Nielsen, 2014; Kapadia & Szado, 2011; Chang, 2021). Hill et al. (2006) reinforce this by illustrating how fair call premium and the volatility premium consistently add to returns, while exercise cost is the main drag.

The main differences across studies mostly come up with different strike prices, maturities and sample periods. Slightly OTM strikes tend to offer the best long-run balance between income and upside retention (Kapadia & Szado, 2011; Hill et al., 2006; Chang, 2021). ATM calls deliver the highest premium but also the highest exercise cost, hence they underperform more in strong uptrends. One-month maturities seem to generally outperform three-month maturities because the shorter horizon captures the implied-realized volatility gap more efficiently (Hill et al., 2006). Market conditions matter significantly, as a strong volatility premium or muted upside helps the strategy, while powerful bull markets expose their opportunity cost more directly. (Israelov & Nielsen, 2014; Hill et al., 2006).

4.3 Protective puts versus covered calls

High-volatility markets offer a natural setting for comparing protective puts (PP) and covered calls (CC), because the two reshape equity returns in quite different and asymmetric ways. Across the reviewed studies, a theme that PPs provide materially stronger downside protection, while CCs deliver high premium income at the expense of upside participation (Aggarwal & Gupta, 2013; Bookstaber & Clarke, 1984).

The following subsections examine how these contrasting characteristics play out when markets become unstable, firstly focusing on performance in high-volatility conditions, then on how each strategy fares in true crisis scenarios.

4.3.1 Performance in high-volatility markets

Most empirical work finds that in markets that are volatile, but not crashing, CCs usually come out on top, when judged by traditional performance metrics. They happen to generate higher mean returns and Sharpe ratios because the premium income reduces portfolio fluctuations and cushions small drops (Foltice, 2022; Misra & Dalmia, 2007). For example, Foltice (2022) looks at a long, 1993-2020 US sample, and finds that every CC strategy beat both buy-hold and protective put overlays on Sharpe ratio grounds.

PPs generally do not look as appealing on these conventional measures in high-volatility markets unless an actual crisis shows up. The premium costs from the bought puts accumulate and if volatility risk premiums are wide, the puts become rather expensive compared to the risk that actually materializes (Foltice, 2022; Misra & Dalmia, 2007). With that said, several authors warn that Sharpe ratios can be misleading here, because reducing volatility by cutting off the upside (as CCs do) is not the same as reducing true downside risk (Bookstaber & Clarke, 1984; Abid et al., 2007). Once higher-moment effects (skewness and kurtosis) are brought in, the comparison switches. Abid et al. (2007), for example, report that deep ITM protective puts on French stocks performed better than covered calls on Sharpe and partly on stochastic dominance grounds during a volatile year.

Hence, in general high-volatility markets, CCs are prone to look better by conventional metrics, while PPs may outperform once tail sensitivity is considered instead of just variance.

4.3.2 Empirical evidence from crisis and stress scenarios

The findings in this section are quite clear. Protective puts outperform covered calls in stabilizing portfolios and limiting losses. In their 2008 crisis tests on the Nifty index, Aggarwal and Gupta (2013) show that PP overlays delivered much higher hedging effectiveness and far better risk-adjusted performance than any covered call alternative. Their 2% ITM PP reduced total variance and produced relatively higher Sharpe, whereas no covered call variant reduced volatility relative to being unhedged. Interestingly, the CC overlays actually increased risk in that environment hence it cut off upside potential but could not meaningfully soften the downside (Aggarwal & Gupta, 2013).

Castellano and Giacometti (2001) express similar results using VaR-constrained simulations around the 1992 ERM crisis. PPs nearly eliminated catastrophic losses with only a modest return trade-off, while CCs were never selected in optimal allocations once heavy tail-risk was included. Abid et al. (2007) provide more proof of the defensive effects of PPs by showing that deep ITM PP cuts systematic risk to roughly 0,25 compared to 0,37 for OTM CCs. Similar results appear in the study of Nifty conducted by Misra and Dalmia (2007) with PP beta of 0,48 versus CCs 0,63.

The one case where CCs can beat PPs even in volatile or difficult markets is when decline is mild rather than catastrophic. The premium income often is able to cover the small losses, whereas the put's premium might go unrewarded Misra & Dalmia, 2007; Foltice, 2022). Foltice (2022) examines how PPs can experience a surprisingly high share of small losing months simply because the premium drags, while deep ITM covered calls had only a handful of negative months. Israelov (2019) reinforces the pattern, where he finds that PPs often struggle in drawn-out or uneven downturns because losses rarely align with the monthly option-expiry cycle. Puts often expire before the real damage hits, leaving the portfolio exposed while still paying the full premium. When the fact that implied volatility Is often overpriced is taken into account, it will lead to a situation where PPs show higher beta, weaker Sharpe, and in some cases, even deeper peak-to-trough drawdowns than a simpler low equity allocation (Israelov, 2019).

5 Conclusions

This thesis examined whether equity option overlays can improve risk-adjusted returns in high-volatility regimes, and whether protective puts provide greater stability in market downturns than covered calls. Because option payoffs are non-linear and strongly regime-dependent, the analysis focused on how the two overlays behave under different volatility conditions rather than assuming homogenous performance.

Covered calls combine long equity with a short call position, earning premium income by selling upside. Protective puts pair long equity with a long put, paying premiums for downside insurance. These structures create fundamentally different trade-offs that become visible only when market conditions shift.

Across calm or moderately rising markets, the evidence seems to be consistent: covered calls tend to deliver similar or slightly lower raw returns than the underlying equity but with meaningfully lower volatility and shallower drawdowns. The volatility risk premium (implied volatility exceeding realized volatility) allows the call writer to earn income that cushions small market fluctuations. In these regimes, upside caps are rarely binding, and Sharpe ratios generally improve. Covered calls function less as a hedge and more as a way to smooth the return path.

Protective puts behave very differently. In markets without deep declines, most purchased puts expire worthless, and the cumulative cost of rolling the hedge month after month becomes costly, and the gain in stability is small compared with the drag on returns. Because investors systematically overpay for crash insurance, especially for out-of-the-money strikes, protective put strategies typically show lower Sharpe and Sortino ratios after accounting for their reduced beta. In benign regimes, the strategy reliably increases stability but at a cost that risk-adjusted measures penalize heavily.

The picture changes sharply during genuine crisis periods. When losses accelerate and volatility spikes, protective puts do exactly what they are designed to do: they impose a hard floor under the portfolio by truncating the left tail. Across the downturns captured in the literature, protective puts consistently produced smaller drawdowns, lower downside deviation, and materially better capital preservation than both buy-and-hold and covered calls. The convexity of the put becomes valuable precisely when the market falls fastest. Covered calls, in contrast, offer almost no help in these severe downturns. Premium income is too small relative to losses, and the capped upside limits participation in volatile rebounds, leaving the strategy exposed to most of the drawdown.

Furthermore, not all volatile periods are crises. In turbulent but range-bound markets (for example high VIX but not collapse) covered calls often outperform protective puts. Strong premiums offset moderate losses, while protective puts frequently expire unused because losses fail to reach the strike in time. In these conditions, rolling puts becomes expensive and path-dependent, while covered calls often deliver higher Sharpe ratios and more stable month-to-month performance.

These results provide clear answers to the hypotheses:
H_1 = The use of options in portfolio hedging improves risk-adjusted returns during periods of high volatility.

Covered calls can improve risk-adjusted returns in certain high-volatility environments, but this benefit disappears in genuine bear markets. Protective puts typically worsen risk-adjusted returns because of the premium drag, only brief, unusual episodes (single-year samples) show protective puts improving risk-adjusted returns, and these do not generalize. Overall, the evidence leads to a rejection of H_1 as a broad statement.

H_2 = Protective put strategies provide greater portfolio stability during market downturns than covered call strategies.

In every meaningful downturn examined, protective puts exhibited superior drawdown protection, lower downside deviation and more controlled tail-risk. The convexity of protective put becomes valuable precisely when losses accelerate and covered calls cannot replicate this.

To summarize the thesis, option overlays reshape portfolio outcomes in predictable, regime dependent ways. Covered calls seem to be most effective as a yield-enhancing, volatility reducing overlay in non-crisis high-volatility markets, while protective puts act as a true crash insurance when markets fall rapidly. Furthermore, neither strategy prevails as universally superior. Effective use requires aligning each overlay with the current volatility environment and the investor’s risk preference.

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