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Spoiled for choice - how to configure a short-put strategy?

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- History is ripe with spectacular blow-ups triggered by an inaccurate assessment of the risk and leverage of derivative strategies.
- Nevertheless, some strategies like selling put options enjoy great popularity and are frequently implemented even by private investors.
- We have, therefore, backtested a wide range of short-put strategies on the SP 500 and the STOXX 50 to test the risk/return profile of different parameter combinations.
- We find that investors can likely optimize the risk-adjusted returns by choosing the correct configuration across the maturity and moneyness spectrum.

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Options are highly versatile financial instruments and have been used for various strategies. Among the most popular ones is the systematic selling of put options to harvest the embedded risk premium. Such a strategy promises compelling returns if executed correctly, but the right design and execution are essential.

1 Harvesting insurance premia

Despite their funky reputation, options are ancient financial instruments, with the first known purchase dating back to the fifth century BC. The Greek mathematician Thales of Miletus expected a larger than usual olive harvest and derived the conclusion that this would lead to an increase in demand for olive presses.[2] He, therefore, reportedly set up a call option agreement giving him the right to buy olive presses at a pre-defined price which he then rented out with a handsome profit. While call options give the holder the right to buy an asset at a later point in time at a pre-defined price, the buyer of a put option pays the seller a premium in return for the right to sell him the underlying asset at the agreed price.

The option is thus comparable to an insurance policy, in this case protecting the option holder against a decline in the value of the underlying. If the price of the underlying doesn't change or rise, the insurance becomes worthless at maturity, but if the underlying declines, the insurance holder receives the balance between the pre-defined price (strike) and the price of the asset at maturity. As with any other insurance, the insurance provider takes a risk and naturally expects to be compensated for it. The option price (called the premium) must thus be a function of the likelihood of a specific price decline times its magnitude (the expected loss of the insurance provider). While various options were regularly traded by specialized dealers on the exchanges in Amsterdam, London and Japan as early as the 17th century[6], determining the fair price of these instruments (the adequate insurance premium) remained a challenge until Fischer Black and Myron Scholes introduced the famous mathematical formula known as the Black-Scholes model in a paper in 1973.[1]

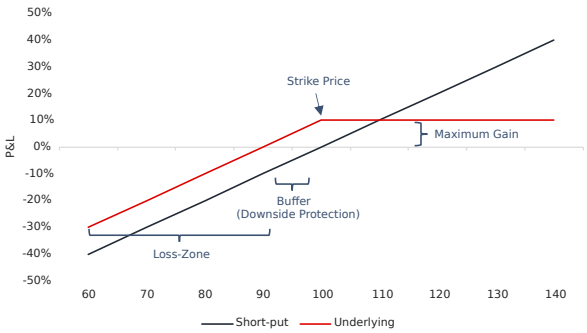

Figure 1: *The functionality of a short-put position on a stock trading at 100 with a strike price of 100.*

A more flexible version covering options that can't be priced using the closed-form approach was developed and formalized by William Sharpe and John Cox, Stephen Ross and Mark Rubinstein in 1978[5]. The Black-Scholes formula ties the fair price of the option

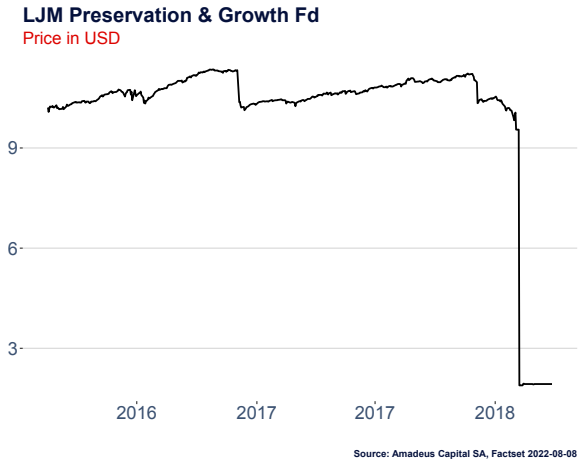

Figure 2: *Volatility strategies can go wrong very badly if tail risks and leverage are not properly understood.*

to the volatility of the underlying asset, the interest rate level and the time to maturity, making its computation fast and easy for everyone with a pocket calculator. As a consequence, over the past decades, increasingly professional and liquid options markets have led to the rise of a new breed of strategies attempting to harvest the risk premium embedded in these financial instruments systematically. Because of the great importance of volatility for the pricing of options, these strategies are often referred to as long or short volatility strategies. While the Black-Scholes formula has made it relatively straightforward to derive an options value and sensitivity to parameter changes, history is nevertheless ripe with examples of spectacular blow-ups of volatility strategies. The low-interest rate environ-

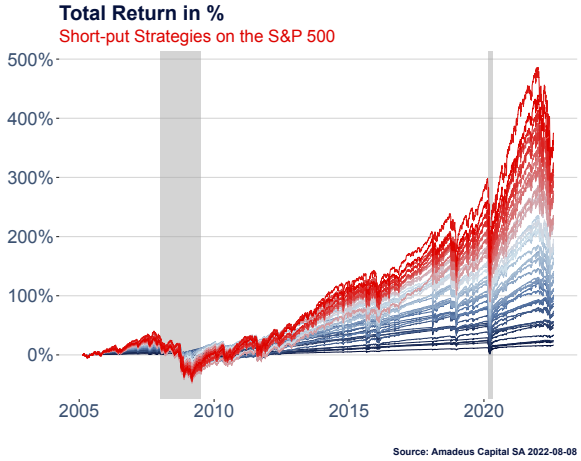

Figure 3: *Return of short-put strategies on the S&P 500 using options with different strikes and maturities.*

ment and the absence of major bear markets following the Great Financial Crisis, in particular, attracted inflows into liquid alternatives products attempting to harvest risk premia by short-selling options, often using the VIX. This includes, for instance, the crash of Pro Shares' Short VIX ETF and the LJM Preservation and Growth fund in early 2018[4] but also the failure and subsequent closure of a whole range of products

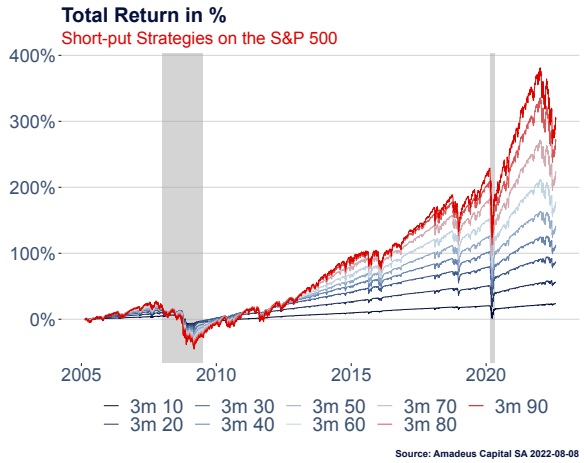

Figure 4: *Investors can easily adjust the risk profile of their short-put strategy by selecting options with an appropriate delta. However, this tells only part of the story as risk-adjusted performance has varied across the moneyness spectrum. Historically, we find that a combination of short and long positions often yielded superior results than a strategy that only sells puts.*

issued by leading asset managers in March 2020. Beyond that, history teaches us that blow-ups in such strategies tend to be particularly painful as embedded leverage frequently results in the wipe-out of almost the whole capital, making any recovery impossible[3]. This is even more grave as the strategies were often advertised as a defensive alternative to outright equity exposure, emphasizing capital preservation and downside protection.

Knowing the danger of derivatives, we generally advise against unformalized do-it-yourself approaches and recommend investors to ensure that they really understand which risks they or the product they are buying are exposed to.

2 Implementation choices matter

In this article, we focus on the systematic selling of put options, which is one of the most popular strategies in the space and is also frequently used by private individuals. To facilitate a better understanding of the longer-term behaviour of systematic volatility strategies, we have backtested a vast range of configurations of systematic short-put strategies on the S&P 500. Most importantly, we provide a comprehensive overview of the risk, return and risk/return profile of different combinations of strikes and maturities and share some observations.

The basic payout profile of a put option, as shown earlier in this article, is a very popular and straightforward illustration, but it only visualizes the return at expiry and doesn't take mark-to-market gains or losses throughout the options lifetime into consideration. Furthermore, it is a one-period model and therefore of

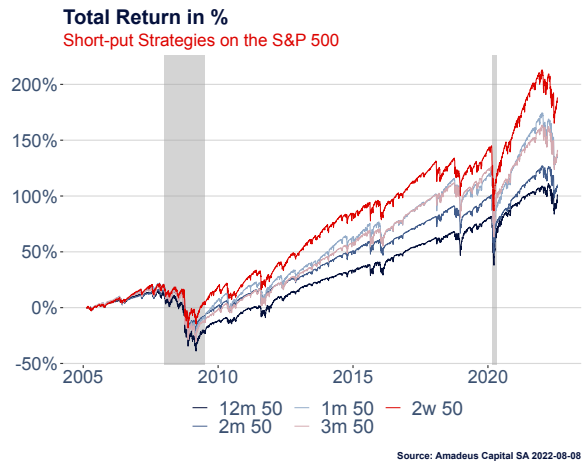

Figure 5: *Ceteris paribus, short put strategies using options close to expiry outperformed strategies selling longer-dated options with the same delta on a risk-adjusted basis. After the Great Financial Crisis, the performance differential has been relatively small though.*

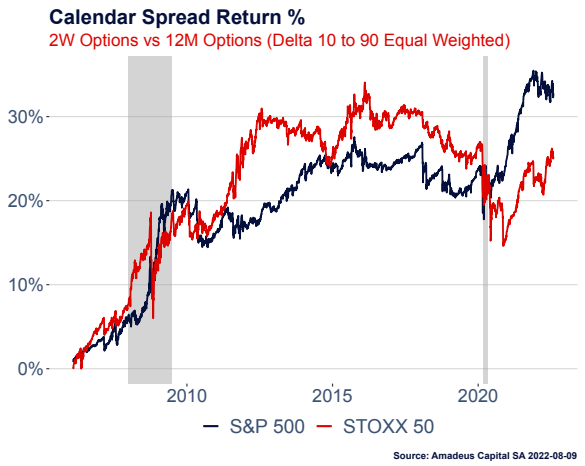

Figure 6: *Selling put options close to maturity while buying longer-dated options with a similar delta has generated positive returns in the U.S. and in Europe alike. In the absence of a clear risk-based explanation, this phenomenon may point to mispricing, which investors could exploit, even though transaction costs have to be borne in mind here. Our tests also indicate that regional diversification works in this context. The calendar spread strategy presented above yielded relatively similar results in the U.S. and Europe but at different times.*

limited use for the assessment of strategies that rely on the continuous rolling of options. Obviously, the strike price of the chosen options is the most important determinant of the strategy's risk and return.

Options with a strike price close to or above the price of the underlying (at or in the money) will have a high sensitivity (delta) to price changes in the underlying asset, while options that are far out of the money (strike price below asset price) have a high likelihood of expiring worthless and, therefore, be only affected by considerable price changes. Figure 3 illustrates the historical performance of strategies rolling 3-month options with different deltas. While the relationship between strike price (represented by the delta) and risk/return profile is relatively straightforward, the effect of shortening or extending the time to maturity of the options used is less intuitive.

As Figure 5 and Figure 6 illustrate, short-put strategies using shorter-dated options have historically generated a higher return than strategies utilizing options with a longer lifetime. We have also tested the same strategy on the European Euro Stoxx 50 with similar results. Not surprisingly, selling options close to expiry while buying puts with the same delta but a longer remaining lifetime (calendar spread) paid off during the Great Financial Crisis when markets tumbled relatively slowly but over an extended period of time. This calendar spread strategy subsequently continued to generate small incremental returns until 2018 before giving them back in 2019 and 2020. It then performed exceptionally well during the strong bull market in 2021 and held up relatively well this year.

The higher long-term return of short-put strategies using short-dated options is interesting because there is no straightforward risk-based explanation for this phenomenon. Not surprisingly, the volatility of short-put strategies increases with the delta (at initiation) of the options utilized. However, we find conflicting evidence for the effect of time to maturity. Looking at the complete backtest period from 2005 to 2022 and using metrics including Volatility, Value at Risk, Conditional Value at Risk and Maximum Drawdown, we find little difference in the riskiness of short-selling shorter-dated options vs longer-dated puts.

> The return distribution of short-put strategies is not symmetric but negatively skewed, meaning that frequent positive returns alternate with steep losses. This diminishes the explanatory power of risk measures such as standard deviation. This problem can be mitigated by using ratios such as Value at Risk, Conditional Value at Risk (Expected Shortfall) and Maximum Drawdown. Not surprisingly, the volatility of short-put strategies increases with the delta (at initiation) of the options used. However, there is no straightforward relationship between risk and the options' time to maturity.

In fact, the maximum drawdown was higher for longer-dated options, but this was driven by the Great Financial Crisis when markets tumbled slowly but consistently over an extended period, illustrating the path dependency of such strategies. To test for robustness, we separately analyzed the realized risk since 2010, thus excluding the Great Financial Crisis. This results in slightly higher risk estimates for shorter-dated options, indicating that the higher average return may be attributable to perceived higher risk. Furthermore, we

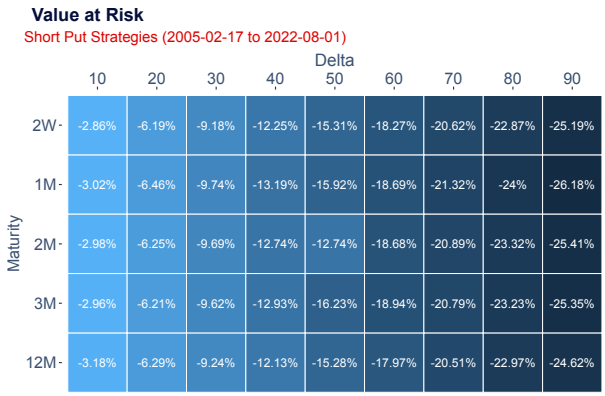

Figure 7

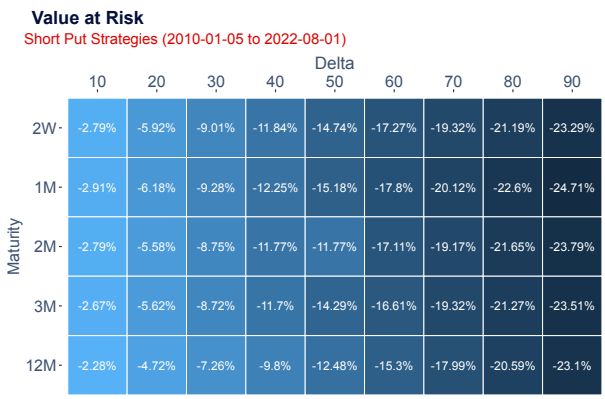

Figure 8

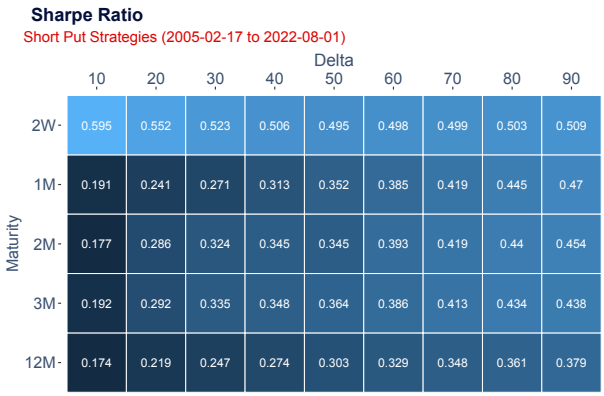

Figure 9

Figure 10

are looking at performance before transaction cost here and utilizing shorter-dated options naturally results in higher turnover. Depending on an investor's trading setup, this may eat up a sizable chunk of the excess return.

3 Conclusion - knowledge enables optimization

The risk and return of systematic short-put strategies vary widely depending on the options chosen. Most importantly, investors have to select the time to maturity and the moneyness/delta of the options. While there is a straightforward relationship between the strategy's riskiness and the Delta, we find conflicting evidence concerning the maturity profile. Strategies selling shorter-dated options tend to do better when markets are trending relatively strongly and over an extended period, like during the Great Financial Crisis or the 2021 Bull-Market.

Due to their superior performance during the Great Financial Crisis, the short-selling of options close to maturity historically also resulted in a lower maximum drawdown. Based on our research, we believe that investors can effectively fine-tune their short-put strategies and potentially reap higher risk-adjusted returns by combining long and short positions across the spectrum. For instance, selling 3-month puts with a delta of 80 and buying puts with a delta of 20 resulted in average volatility of 10.6% and a maximum drawdown of 42.6% while generating a return of 5.3%.

The strategy thus generated a similar return as selling delta 50 puts and experienced approximately the same maximum drawdown but almost 4% lower average volatility, resulting in a significantly improved strategy's Sharpe ratio.

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