Dynamic Strangle as a Lossless Hedge

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Purchasing a call and a put contract on the same underlying generally produces a "well-shaped" profit-and-loss curve with a loss at the center and profit emerging on either side beyond two breakeven points. For fixed premiums, one could in principle reposition the strikes to invert these breakeven points, raising the well and eliminating loss. This brief note examines how realistic, variable premiums affect such an approach, showing that a truly lossless configuration generally requires the two contracts to be acquired at different times under very different market conditions. For sufficiently large differences in the underlying prices at the times of purchase, this mechanism can provide a lossless hedge for a position that has developed into deep in-the-money status.

I. OVERVIEW

This short note explores the risk associated with a novel position resembling the familiar strangle. The aim is to find conditions for arbitrage or lossless positions. To fix notation we begin with a reminder of the profit/loss curves for a long put, a long call, and their combination in a strangle.

A **long put** with strike price K_P and premium P has profit/loss φ_P as a function of underlying asset price S

$$\varphi_P(S) = \max(K_P - S,\, 0) - P \;, \tag{1}$$

sketched in Fig. 1.

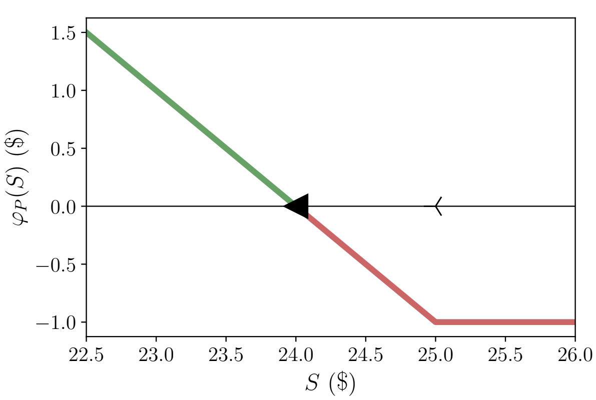

FIG. 1. Profit and loss curve for a long put with representative values of $K_P = \$25$ and $P = \$1$. The breakeven point $S_- = K_P - P$, is shown as a left-pointing triangle, and the strike price K_P is marked with the $\langle$ symbol.

If $S > K_P$, at the time of exercising, the option finishes worthless, and the net loss is the premium P. If instead $S < K_P$, the profit increases linearly as S decreases, bounded by $\varphi_P(0) = S_-$, where S_- is also the breakeven point for the put

$$S_- = K_P - P \;. \tag{2}$$

A **long call** with strike price K_C and premium C has profit/loss

$$\varphi_C(S) = \max(S - K_C,\, 0) - C \;, \tag{3}$$

sketched in Fig. 2.

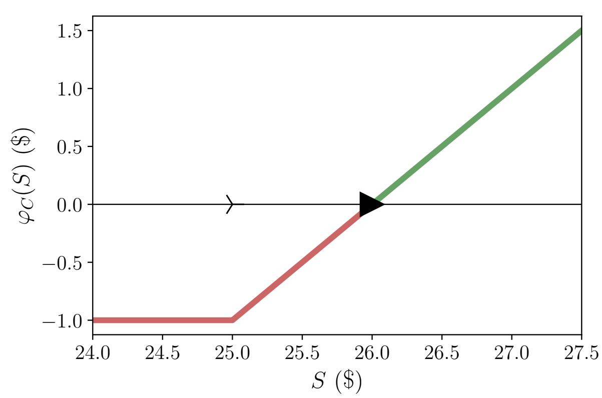

FIG. 2. Profit and loss curve for a long call with representative values of $K_C = \$25$ and $C = \$1$. The breakeven point $S_+ = K_C + C$, is shown as a right-pointing triangle, and the strike price K_C is marked with the $\rangle$ symbol.

If $S < K_C$ at the time of exercising, the call is worthless and the net loss is the premium C. If instead $S > K_C$, the net profit increases linearly with S, without bound. The breakeven point for the call occurs at underlying price

$$S_+ = K_C + C \;. \tag{4}$$

A **strangle** combines a long put and a long call giving a total profit/loss $\varphi(S) = \varphi_P(S) + \varphi_C(S)$,

$$\varphi(S) = \max(K_P - S,\, 0) + \max(S - K_C,\, 0) - \Pi \;, \tag{5}$$

with total premium $\Pi = P + C$. A generic strangle with $K_P < K_C$, is sketched in Fig. 3. This produces a profit when S moves significantly outside the strike region (K_P, K_C), but has a loss in the middle. The two breakeven points for this strangle are

$$S_- = K_P - \Pi \;, \quad S_+ = K_C + \Pi \;. \tag{6}$$

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If $K_P < K_C$, then $S_- < S_+$. When $K_P > K_C$ however, it is possible to have inverted breakeven points $S_- > S_+$.

This note explores the feasibility of a strangle position whose profit/loss curve is raised in such a way that the loss well is entirely eliminated, $\varphi(S) \geq 0$ for all S.

II. FIXED PREMIUM MODEL

We begin by assuming that the strikes can be adjusted without changing the total premium. We will remove this unrealistic constraint in the next section. However, it enables exploring the full range of positions, including lossless ones, be they possible or not. The sequence shown in Fig. 4 demonstrates the effect of shifting the strikes K_C and/or K_P, in such a way that eventually the breakeven points defy their meaning, become inverted $S_- \geq S_+$, and $\varphi(S) \geq 0$, for all S. The breakeven points lose their meaning when the strikes are critically inverted. As the strike separation continues, the flat region shrinks to a point, when the so-called breakeven points are identical. Further separation of the strikes inverts the breakeven points and widens the flat region

$$\varphi(S_+ < S < S_-) = \varphi_{\min} = K_P - K_C - \Pi \geq 0 \ . \quad (7)$$

III. VARIABLE PREMIUM MODEL

The final two strangles in Fig. 4 would amount to an arbitrage in that they are completely lossless. Unsurprisingly, this is not an achievable position when premiums are allowed to vary realistically. To see this, note that the arbitrage-like scenarios have minimum profit (7). However, if the put and call are both purchased simultaneously, they will have premiums bounded by

$$P \geq \max(0, K_P - S) \geq K_P - S \ , \quad (8a)$$
$$C \geq \max(0, S - K_C) \geq S - K_C \ , \quad (8b)$$

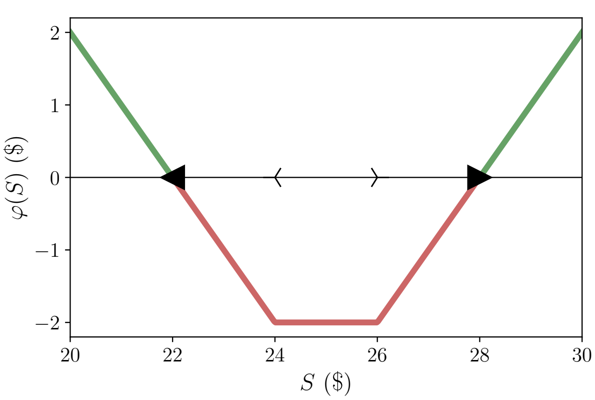

FIG. 3. Profit and loss curve for a generic strangle with representative values $K_P = \$24$, $K_C = \$26$, and $C = P = \$1$. The breakeven points $S_\pm$ are again shown as triangles, and the strikes by the $>$ and $<$ symbols.

so that the total premium is bounded by $\Pi \geq K_P - K_C$, which can be restated as the contradiction

$$\varphi_{\min} \leq 0 \ . \quad (9)$$

So the arbitrage only occurs for mispriced premiums, violating the simple bounds (8). The next section will show however that the lossless positions can in principle be achieved, they will be dynamically constructed, lacking the instantaneous and simultaneous ingredients of a traditional definition of arbitrage.

A. Dynamic Strangle

Now consider the case where the put is purchased when the underlying asset has price S_P, and the call is purchased at some other time when the underlying asset has price S_C. In that case, our simple bounds (8) become

$$P \geq \max(0, K_P - S_P) \geq K_P - S_P \ , \quad (10a)$$
$$C \geq \max(0, S_C - K_C) \geq S_C - K_C \ , \quad (10b)$$

so that the total premium is bounded by

$$\Pi \geq (K_P - S_P) + (S_C - K_C) \ , \quad (11)$$

which can be restated as

$$\varphi_{\min} \leq S_P - S_C \ . \quad (12)$$

So if one purchased a put or a call, and then that position develops a deep in-the-money status, one could purchase a corresponding call or put such that $S_P \gg S_C$. This could cause $\varphi_{\min} \geq 0$, such that the second option contract acted as a lossless hedge insuring at least some profit even if S were to experience a high volatility event such that the deep in-the-money contract completely collapsed. Thus, for a deep in-the-money contract, one may find it possible to dynamically construct a strangle with inverted breakeven points that locks out loss. This dynamic strangle hedge would of course come at a cost, unappealing to someone holding a deep in-the-money option contract. However that cost would only reduce the overall profit, and could not convert it to a loss.

IV. SUMMARY

This note analyzes the feasibility of a lossless strangle. We show that such a position is not realistic unless the traditional static strangle is configured dynamically, with each leg being acquired under different market conditions. A deep in-the-money option contract can be dynamically reconfigured into a lossless position resembling a strangle with inverted breakeven points. Although this hedge reduces the upside potential, it cannot force the overall strategy into a net loss—hence "lossless." The main ingredient for this position is purchasing the two contracts at sufficiently different market conditions, rather than relying on static mispricing.

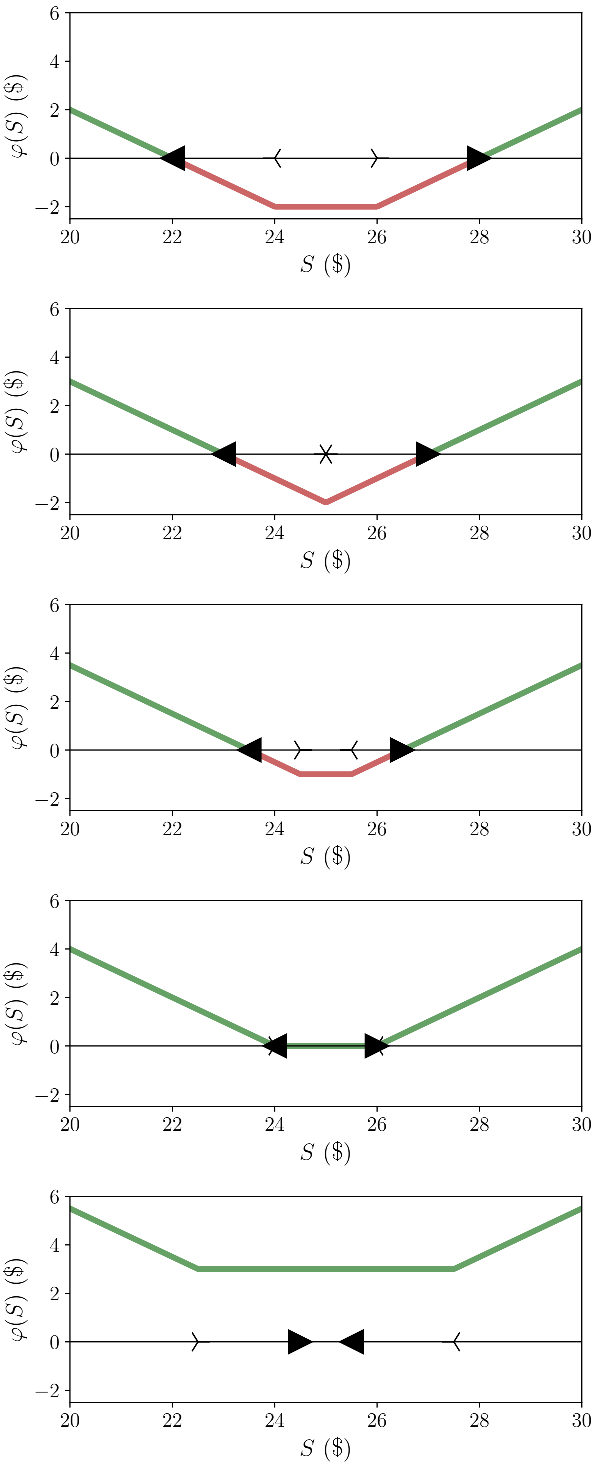

FIG. 4. A sequence of profit and loss curves as strikes K_C and/or K_P are repositioned while the combined premium $\Pi = C + P$ is unrealistically held fixed at a representative \$2. The strike positions include: a generic strangle with $K_P < K_C$ (top, $K_P = \$24$, $K_C = \$26$), a straddle with $K_P = K_C$ ($K_P = \$25$, $K_C = \$25$), an inverted strangle with $0 < (K_P - K_C) < \Pi$ ($K_P = \$25.5$, $K_C = \$24.5$), a critically inverted lossless strangle where the breakeven points essentially lose their meaning and $0 < (K_P - K_C) = \Pi$ ($K_P = \$26$, $K_C = \$24$), and a generic inverted lossless strangle where both the strikes and the so-called breakeven points are inverted with $\Pi < (K_P - K_C)$ (bottom, $K_P = \$27.5$, $K_C = \$22.5$). The breakeven points $S_\pm$ are again shown as triangles, and the strikes by the $\succ$ and $\prec$ symbols.