3. Option strategies

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We consider one “underlying” risky security (it can be a stock or exchange rate), and we use \( S \) to denote its price, with \( S_0 = 100 \) being its current price and \( S_T \) being its future price at time \( T \). Ignore bid-ask spread and transaction cost and assume that you can buy or sell any amount of the security at the price \( S_0 = 100 \).

1. For chapter 3, you need to be able to construct a portfolio with calls, puts, forwards, bonds to replicate any payoff I plot at time \( T \). An example is the following figure —It does not mean much, but just complicated enough to allow you do anything. There are multiple solutions to this question (that is, you can use either call or put or a combination). Any solution will do.

\[
\begin{array}{c}
\text{Payoff}
\end{array}
\]

\[
\begin{array}{c}
\text{Price}
\end{array}
\]

The lecture notes show two general procedures that work reasonably well. Let’s use the first one and start from the left side (\( S_T = 0 \)).

(a) Since the payoff is flat at $10 on the left side, we long a bond with $10 payoff.

(b) The first kink is at $80. So we need some $80 strike call. The slope is 1, so we need to long one call option with strike $80.

(c) The next kink is at $100. The new slope is 3, which I compute as \((60-30)/(110-100)\). The change in slope is from 1 to 3 and hence 2. Thus, we need to long two call contracts at $100 strike.

(d) The next kink is at $110, with a new slope of -1 \( (= (50 - 60)/(120 - 110)) \). The slope change is -1-3=-4. Hence, we short four call option contracts at $110.

(e) The next kink is at $120, with a new slope of zero. The change in slope is 0-(-1)=1. Hence, we long one call contract at $120 strike.

That’s it.

If you know what kind of payoff you want, this is the procedure to generate that payoff.

2. Understand the basic uses of straddles, strangles, butterfly spreads, risk reversals, calendar spreads, bull and bear spreads. As a homework, you can do a quick summary on what you can use them to bet on.

There is not much thinking to go through here, but more just to get familiar with all the jargons on the popular combinations/strategies.