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> ***"Long run refers to the number of bets that are placed…A year of placing trades in the stock market will not be a long run."***
> ***— Ed Thorp***

The Thorp quote touches on an important theme: time. How long should one expect to wait before an investment pays off?

For the past few months, downside put options in the S&P 500 have been offered at unusually cheap prices. While we cannot predict the future, and frankly do not think a crash or bear-market is likely, we have accumulated a significant amount of downside puts (hedged with stock and at-the-money options) at relative prices we believe are at generational lows.

How long might it take for these puts, or any options position (long or short), to payoff?

Consider the following probability problem: you have an urn with 1 red ball and 9 black balls. You can pay a small bet to select a ball from the urn at random. If you pick the red ball, you win $10,000. If you pick a black ball, you win nothing. You return the chosen ball after each turn.

For a 10% chance at a $10,000 payout, the expected payoff and thus the break-even or "fair-value" price for this bet is $1,000. If someone offered you a chance to play for $300, most would play since the cost is less than the expected payoff. If you kept playing once a month, month after month, eventually the payouts would offset the costs. In the long term, $300 is a great buy.

Assume you bet $300 each month on the above wager. Despite what appears to be an incredible deal, you are likely to lose in the short term. In fact, you have a 90% chance of losing each month. Month after month, you keep playing (at a great price) and yet each time you are likely to lose.

The math is correct: you are getting something with an expected value of $1,000 for $300. Yet every month seems to generate losses. How long do we have to wait before we reach a 95% degree of confidence that we will win?

The probability of *not* winning at all by month n is $(0.90)^n$. For example, the chance of not winning for the first 3 months in a row is:

$$(0.90)^3 = 73\%$$

You *still* have a high probability of losing even after three months of play! In order to be 95% confident of winning at least once, you must solve the following for n:

$$1 - (0.90)^n \geq 95\%$$

It turns out you may have to play for 29 months (over two years) before being close to "certain" of winning once! Of course, you may win sooner, but to be "certain," you must be willing to wait more than two years.

An investor who buys low probability payouts at great odds, has to play repeatedly and potentially wait a long time to receive a payoff. Not knowing the expected waiting time may result in quitting early. One might even claim the market is "irrational" when in fact it is completely "rational" and behaving as expected.

Conversely, by giving the odds and selling low probability bets (e.g. collecting the $300 bet and risking the player selects the red ball), one is likely to make money most of the time irrespective of the price the odds were sold. ***In our example, providing the odds tends to show profits and taking the odds tends to show losses in the short term, despite the ultimate "fair-value" payout in the long term.***

Options, while far more complex, have similarities to this urn example. Many times, the "delta" of an option provides a reasonable (though not exact) approximation of the probability of a payoff. An out-of-the-money put with a delta of 10% can be viewed as a bet with a 10% chance of paying out. While many investors will have different views of the fair price of an option, the delta is generally a useful proxy for estimating the odds.

For example, with 95% confidence, how many expirations should an investor be willing to wait before a three-month option with a 10% delta finishes in the money? As in the urn example, we see it can take 29 three-month periods to pay off. An investor may have to buy these options every three months 29 times to be almost "certain." That is over 7 years!

On the other hand, selling these options at the wrong price (i.e. too cheap relative to "fair") is likely to show profits for long stretches of time. Selling low delta options (at any price) tends to show positive P/L over time—*until the fair payoff inevitably hits*. The opposite is true for buying them. This does **not** mean, however, that selling options is ultimately good or bad, or that buying options is ultimately good or bad. Over time the true P/L of each strategy, if the odds are priced correctly, will materialize.

Short-dated downside put options in the S&P 500 are currently being priced far lower than their expected values. Even if you know the odds of paying off with certainty, you may have to wait a long time to receive the payoff with certainty. The important point is that any options strategy—priced correctly or incorrectly with respect to the true odds—has differing expected waiting times of P/L.

If an investor does not know the expected waiting time for a payoff, he or she is unlikely to have any staying power and may exit at an inopportune time. With listed options, these waiting times can last multiple years! The "rational" time to a payoff may appear "irrational" when in fact it is not.

As with any trade, there is risk. Just because something is cheap (or expensive) does not mean it cannot get cheaper (or more expensive). This is the age-old issue in the trading business. Timing and position sizing are everything. Having a clear and disciplined process to deal with both of these in advance is critical in order to calibrate risk, return and expected waiting time.

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