Are Short Equity Puts Economically Equivalent To Buy Limit Orders?

Introduction

A friend of mine and I recently debated strategies for accumulating stocks in our accounts which we wanted to hold long term for our retirement. We started out discussing the various types of stock market orders types one can employ (market, limit, buy-stop, buy-stop limit, etc.), and eventually the conversation expanded to include the use of exchange traded options. By the end of the discussion, my friend and I had both concluded that use of short puts was the best strategy for purchasing shares at "good" prices since by virtue of receiving the option premium, the investor gets paid while waiting to get filled (exercised). While we were both fairly confident we were correct, I agreed to perform some research to see whether the "short put", or its stock market order analog, the "buy limit order", was the better strategy, or alternatively if the "short put" and "buy limit order" turned out to be equivalent strategies. Let's begin by discussing what a "limit order" is.

Limit Orders

Different from a "market" order, in which all shares are either purchased or sold immediately at the prevailing market price, a "limit" order buys or sells shares at a predetermined, or "limit", price. Investors use limit orders to control the execution price they are willing to pay or receive for their shares. In addition to the price constraint, a limit order also imposes a time constraint. For example, a limit order can live for a single day (order lives until 4pm ET) or potentially indefinitely (good until cancelled, or GTC).

However, some major drawbacks of the limit order are:

- It does not guarantee order execution even when limit price is reached.
- Due to how order types are prioritized, even when limit price is reached an execution might still not occur[1].

First, if the market does not trade at or below the limit price for a buy limit order then no fill will take place. However, if the number of shares offered for sale are fewer than the total specified on the buy limit order, an investor will purchase fewer shares than desired (or sell fewer than desired if a sell limit order was used). The issue of receiving fewer shares can be addressed by use of special order modifiers such as specifying an "all-or-none" designation (AON), but doing so means the order will either be entirely filled or not at all.

Second, market orders take priority over limit orders. What this means is that a stock can technically trade at an order's limit price or better without the order being eligible for execution. Only when there are no competing market orders of higher priority will limit orders be eligible for execution. This situation can be especially frustrating when a market is deemed "fast", which the exchange can declare when there is a combination of high volatility and heavy trading or order imbalances. At the end of the day, the limit order only guarantees the price paid (or received). It does not guarantee order execution. So in the case of the "buy limit order", the investor will only be guaranteed the price paid, not the number of shares purchased. Next we discuss what a "short put" is.

[1] Further details regarding Reg NMS rules can be found on www.sec.gov.

Short Put

A "short put", sometimes called a naked put, is a strategy whereby the option writer (the option seller) does not have a position in the option's underlying asset. This strategy is often used by investors who want to accumulate a position in the underlying stock, but only if the price is low enough. If the investor fails to get "put" the shares, then he keeps the option premium from selling the put free and clear and without further obligation. Before moving on, some important details about option exercise style and exercise optimality need to be highlighted.

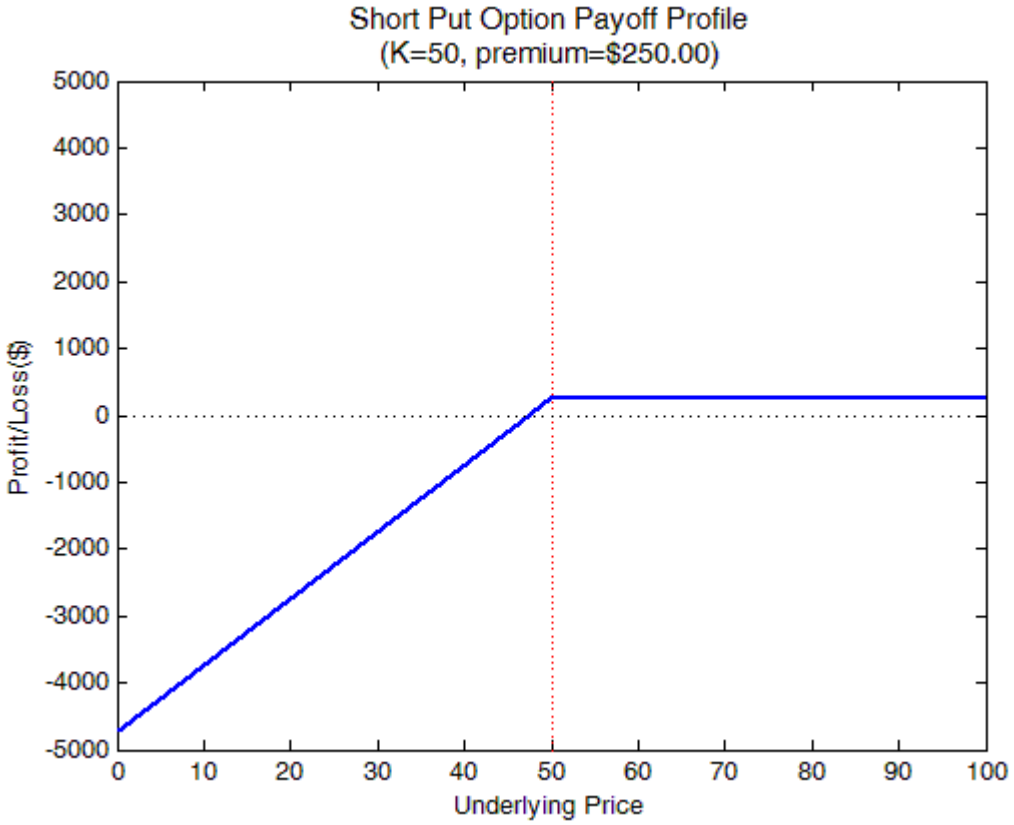
Because options on stocks and ETFs are American exercise style, the long put holder can exercise the option anytime until expiration date. However, even when an option is in-the-money, it still may not make economic sense to exercise. Specifically, a long put holder could simply sell his in-the-money put for a profit and continue to hold the stock if he owns it. Alternatively, the long put holder may decide that funding a stock purchase, paying the commissions and bid/ask spread, and ultimately putting the stock to the short put holder is not economically worth it.

Consider an example where an investor owns both the stock and a put option on that stock, and the put is trading very near intrinsic value as is often the case when the option is deeply in-the-money. By exercising earlier than expiration date, the holder of the put sells his shares at the exercise price and earns interest on the proceeds earlier than if he were to wait until expiration date. This often occurs after the stock has gone ex-dividend, so that the dividend is retained by the shareholder, but put holder is now left with stock whose price has fallen significantly. So how can we know when the long put holder might exercise his right against the short put holder?

Probably the best way to determine whether the long put should be exercised early is to compare the value of the corresponding call option with the cost of carrying the underlying stock to option expiration. The importance of this relationship is due to the fact that a long stock position plus a long put is equivalent to a long call option with the same strike price and expiration. The two strategies are economically equivalent. Both positions, long stock plus long put, and the long call, profit if the stock goes up but they limit losses if the stock falls. Therefore, if one can effectively exchange the long stock plus long put for its equivalent - the long call - and the cost of doing so is less than the interest earned on the funds received from selling the stock, then early exercise of the put makes sense. This simple arbitrage relationship is due to put/call parity[2], and is the fundamental relationship of option pricing. It is also the reason that mispricing between call and put options on the same underlying with the same strike and expiry is rarely found. Short put holders should actively apply put-call parity for assessing the likelihood of exercise. The payoff profile at expiration of a short put option is depicted in Figure 1.

[2] $c - p = S - Ke^{-rT}$ where c = call price, p=put price, S=stock price, K=strike price, r=risk-free rate, T=time, and 'e' is the exponential function.

Figure 1: Short Put Option Payoff Profile



How Do the Buy Limit Order and Short Put Compare and Contrast?

This section covers the similarities/differences and advantages/disadvantages between buy limit orders and short puts.

The main similarities are:

- investor is guaranteed the price at which he purchases stock.
- the time until order/option expiration can be established upfront.

The main differences are:

- short put provides the option's premium as income to the seller. The limit order does not.
- option exercise guarantees the price paid and the number of shares purchased. The limit order can only guarantee the price paid.
- modification of an existing limit order is possible and essentially costless. This is not the case for a short put.
- short put will experience unrealized gains/losses until exercise or expiration, whichever comes first.

The main advantages of the short put strategy are:

- receipt of the premium (less commissions and bid/ask spread).
- exercise ensures all shares are purchased at the strike (limit) price.

The main disadvantages of the short put strategy are:

- option contract standardization creates inflexibility.
- trading costs.

- potential for realized gains and losses prior to completion of strategy execution.
- lack of continuous strike price and expiration granularity.
- prior to expiration, no guarantee of exercise even when stock price is below strike price (more on this later).

The main advantages of the buy limit order strategy are:

- ability to continuously modify the details of an existing order, including price and expiration, at no cost.

The main disadvantage of the buy limit order strategy are:

- no guarantee of full trade execution even when limit price is reached.

If an investor wants to get long a stock at a predetermined price, which strategy is better: the short put or the buy limit order? From the above, it might appear that the short put holds the clear advantage, as the investor essentially gets paid to wait for the stock to fall to the his desired purchase price. Furthermore, given that the buy limit order only guarantees price paid, and not number of shares purchased, an investor who absolutely requires all shares to be purchased would be better off with the short put.

What if an investor changes his mind about the price he wants to pay for the stock, or to withdraw his order all together because he's changed his mind? Due to standardization of option contracts, the static details of a short put, mainly the strike price and expiration, obviously can't be changed when the investor changes his mind. Investors generally understand this, but for purposes of comparison to the buy limit order this is being highlighted. The existing buy limit order can be modified almost continuously and contain whatever combination of limit price and order expiration date the investor desires. Assuming there's been no execution, the buy limit order can even be cancelled altogether, again at no cost (other than a phone call or time spent online).

The short put, however, can only be "modified" by covering the original position and selling a new put having the newly desired static details. However, there is a limit as to how precise the strike price and expiration can be made due to the standardized nature of exchange traded options. Strike prices are chunky, often coming in half-point and one-point increments, while expiration choices can be made only from a relatively small set of fixed dates. Lastly, covering the short put will in most cases involve paying a commission and the bid/ask spread, as well as realizing either a net gain/loss. Again, changes made to an existing buy limit order cost the investor essentially nothing.

As previously mentioned, an advantage to employing a similarly defined short put option strategy relative to the simpler buy limit order strategy was that the investor keeps the short put premium (net of commissions and bid/ask spread) no matter where the stock price winds up at option expiration. If we for a moment only focus on the simultaneous expiration date of the buy limit order and short put, the analysis becomes simplified, although as it turns out, somewhat unrealistic.

Recalling that buy limit orders do not guarantee execution quantity, and noting that a put must be a least one penny in the money at expiration, Table 1 below attempts to inform the choice.

Table 1: Economic Outcome at Expiration of Buy Limit Order and Short Put.

Economic Outcome at Expiration of Buy Limit Order and Short Put				
	Market State	Strategy		
		Buy Limit Order (a)	Short Put (b)	Short Put (b-a)
Market Price	Above Limit or Strike Price	no stock purchased	no stock purchased; premium earned	premium earned
	At Limit or Strike Price*	indeterminate	no stock purchased; premium earned	indeterminate
	Below Limit or Strike Price**	stock purchased at limit price	shares purchased at strike price; premium earned	premium earned
* This situation, while rare, is most uncertain. Given that investor wants to buy stock at a limit price, the stock must be offered at his limit price and in sufficient quantity to fill entire order. Therefore, partial fills, or no fill at all if using AON, are possible. However, the put option will not be automatically exercised as it's at-the-money.				
** Given American exercise style of put options on stocks/ETFs, exercise and limit order execution are assumed to be simultaneous, or nearly so. However, due to put/call parity only deep in-the-money puts would tend to be exercised prior to expiration. Clearly by option expiration, if an option is one tick in-the-money, the exchange will exercise the option and assign the stock.				

As can be seen in Table 1, when (a) assuming the put's strike price is equal to the buy limit order's price, (b) the expiration of the put option and the buy limit order coincide, and (c) option exercise and limit order execution occur at the same time, ceteris paribas, the short put position will in two of the three market states outperform a similarly structured buy limit order. Despite the attempt to simplify the possible outcomes, two areas of concern remain in trying to figure out which strategy is better.

First, the one state that is bothersome is when the market price of the stock closes precisely at the limit price. Because we have no way of knowing in advance whether the limit order would be executed in its entirety, if at all, we cannot say much about the buy limit order's status other than to say it might be filled. What we can state is that the put, being at-the-money, would not be exercised and so no shares would be purchased by the short put holder. In this case the short put holder keeps the option premium without further obligation. However, at the precise moment of expiration with the market price of the stock trading at exactly the limit price, the buy limit order holder may have purchased all shares, some shares, or no shares as all!

Second, there is a complication as relates to point(c). It was previously mentioned that because of put-call parity, unless a put is sufficiently deeply in-the-money it would not make economic sense for the long put holder to exercise prior to expiration. Given put-call parity, the originally assumed advantage of the short a put, mainly the receipt of the option premium, is somewhat less of an advantage given that exercise of put prior to expiration even when the option is in-the-money, could be construed as less advantageous. If exercise is less certain then the short put holder's ability to get long the stock at a price he wants to pay is also less certain, thus making receipt of the put premium less attractive, especially if owning the stock is of prime importance to the investor. The only time when stock assignment wont' be in question is at expiration.

Given the complexities around limit order execution and option exercise, how might we discern which is the better strategy? To try and answer more definitively the original a historical back test was run on both strategies using comparable terms and realistic assumptions.

Empirical Evidence

To get an idea of how much better off an investor might be utilizing short puts in lieu of buy limit orders for accumulating stock, a historical trading comparison (using Matlab and Excel) was made between the two strategies. For practicality and repeatability reasons, the following assumptions have been made:

- securities used for the analysis are SPY and put options on SPY.
- buy limit and short put orders were assumed to be initiated on the open of Monday's trading following third Friday of the month and made to expire at 4pm ET on the third Friday of the following month.
- both strategies set the limit price and strike price for the buy limit and short put orders, respectively, at 97.5, 95, 90 and 80 percent of the Friday closing price level of SPY.
- new buy limit order and short put trades were initiated every month over the same historical period for each percentage of closing price level.
- in order to take put-call parity into account, the following relationship, if true, would trigger an early exercise of the put: If interest expense of holding the shares until expiry was greater than corresponding call price, then exercise put. In other words, if $p + S > c$ then exercise the put.
- in order to be conservative, if SPY hadn't previously traded below the limit price, but wound up closing precisely at the limit price on option/order expiration date, then no execution of the buy limit order was assumed.

The following additional assumptions/clarifications, described in Table 2, were incorporated into the historical analysis:

Table 2: Model Assumptions

Historical Period	Jan. 10, 2005 - Jan. 10, 2011
Option Model	Trinomial
Exercise Style	American
Early Option Exercise Decision[3]	$r \cdot t \cdot K > c$
Option Expiration Exercise Decision	Intrinsic value >= $0.01
Limit Order Execution Decision	Limit Price > Daily Low Price
Number of Shares per Trade or Exercise	100
Number of Option Contracts per Trade	1
Commissions	0.00
Bid/Ask Spread	0.00
Interest Rate	1-month Libor
Dividend Rate	SPY-implied dividend yield

The hypothetical trading results for the buy limit order and short put strategies are presented in Tables 3, 4, and 5 below:

[3] See previous foot note for variable definitions. "·" is the multiplication operator.

Table 3: Hypothetical Trading Results for Short Put Strategy

Buy Limit Order Trading Strategy Risk and Return Metrics (A)				
	97.5% of Close	95% of Close	90% of Close	80% of Close
Total of Trades	27	16	6	1
Profit/Loss ($)	26,246	22,168	15,188	3,398
Return (%)	2.8731	4.6848	11.0955	14.8112
Maximum Drawdown	-110,600	-61,070	-16,750	-2,590
Maximum Best Open Profit	28,541	23,528	15,698	3,483
Required Capital	316,600	181,000	61,000	9,300

Table 4: Hypothetical Trading Results for Limit Order Strategy

Short Put Trading Strategy Risk and Return Metrics (B)				
	97.5% of Close	95% of Close	90% of Close	80% of Close
Total of Trades	17	9	4	1
Profit/Loss ($)	10,066	12,582	8,192	3,398
Return (%)	2.8942	5.9914	6.4789	4.3637
Maximum Drawdown	-82,650	-36,720	-11,770	-2,590
Maximum Best Open Profit	13,560	13,347	8,532	3,483
Required Capital	220,700	116,200	56,400	21,500

Table 5: Risk & Return Metric Differences

Strategy Risk and Return Metric Differences (B - A)				
	97.5% of Close	95% of Close	90% of Close	80% of Close
Total of Trades	-10	-7	-2	0
Profit/Loss ($)	-16,180	-9,586	-6,996	0
Return (%)	0.02	1.31	-4.62	-10.45
Maximum Drawdown	27,950	24,350	4,980	0
Maximum Best Open Profit	-14,981	-10,181	-7,166	0
Required Capital	-95,900	-64,800	-4,600	12,200

Conclusion

We can observe from table 5 the following noteworthy items:

- Short Put Trading Strategy generally had fewer trades (assignments) than the corresponding Buy Limit Order Trading Strategy, owing to put-call parity.
- percentage-wise, the Limit Order Trading Strategy tended to outperform at lower percentages of close, and conversely the Short Put Trading Strategy tended to outperform at higher percentages of close.
- overall, risk and return metrics for both strategies were driven mainly by the number of trades/exercises experienced over the historical period, which in turn were driven by the operational/economic technicalities of how limit order executions (order priority) and option exercises (put-call parity) are determined.

This paper started out by asking, are short equity puts equivalent to buy limit orders. Given that the two strategies are not equivalent, the question was subsequently modified to ask which strategy was better if the investor's goal was to accumulate stock. It would appear that if the investor's objective is strictly to purchase stock at a particular (low) price then the Buy Limit Order Trading Strategy should be chosen. Although the Short Put Strategy generates premium income, because of put-call parity a short put holder may not be assigned the stock until expiration date, if at all. Even the receipt of the option premium may not represent sufficient compensation for the possibility of not being assigned the stock if stock ownership is the investor's ultimate objective.

What the preceding analysis has shown is that, while the buy limit order and short put strategies are similar, they are not economically equivalent.