Exit Strategies (Part 1)

Introduction

For most non-discretionary traders, trade entries are always predicated by a strict set of rules. When these rules are met, the trade is deemed "triggered" and the position is opened. Conversely, when the stars are not aligned, the systematic trader simply sits on his hands and does nothing. No trigger, no trade.

Interestingly, while strict with their entry rules, even seasoned traders tend to exhibit considerable more flexibility when it comes to their exit rules, and complacency with sticking to them. The reason is simple: when entering a position the trader's P&L is de-facto neutral, and so is his emotional investment in the trade. But once the trade is in play, both rising unrealized profits or rising unrealized losses will tend to play on the trader's emotions and incite him to "manage" the trade, all too often to the detriment of the system's long-term profit expectancy.

In this study we will use a simple mean-reversion system and look at several exit strategies and analyse their respective merits. The objective here is to illustrate how quantitative analysis can be used to objectively determine the best exit rules for a specific system and, with that knowledge, motivate traders to stick to both their entry *and* their exit rules.

Analysis

The instrument used in this study is the INX (S&P500 Index), from Jan 1st 1991 to Dec 31st 2015. Since the INX is not a tradable financial instrument, actual positions would have been taken either with futures (ES) or with ETFs (SPY or IVV).

System rules:

- Entry: go long on the lowest close in 10 days
- Profit Target & Stop Loss: to be determined

System data:

- Instrument: INX (S&P500 Index), from Jan 1st 1991 to Dec 31st 2015 (25 years)
- Initial capital: US$ 100,000
- Profits not reinvested
- No allowance for commissions or slippage

Fixed Target and Fixed Stop

In this first example we will place a symmetrical bracket order to dictate both the profit target and the stop loss. So the trade will be exited either at an X% profit or at an X% loss.

Table 1

	X %	All: Net Profit	All: Total Trades	All: Winning Trades	All: Losing Trades	All: % Profitable	All: Win/Loss Ratio	All: Avg Trade	All: Max Intraday Drawdown	All: ProfitFactor
1	1	91,560.88	685	385	300	56.20	1.01	133.67	-16,343.81	1.30
2	2	98,221.53	455	250	205	54.95	1.02	215.87	-44,182.31	1.24
3	3	142,714.59	322	184	138	57.14	1.01	443.21	-54,383.01	1.34
4	4	99,586.00	237	131	106	55.27	1.00	420.19	-84,727.69	1.23
5	5	173,956.34	181	108	73	59.67	1.00	961.08	-62,305.30	1.48
6	6	143,236.19	132	78	54	59.09	1.00	1,085.12	-77,371.53	1.44
7	7	167,715.75	108	66	42	61.11	1.00	1,552.92	-80,016.09	1.57
8	8	199,722.41	97	61	36	62.89	1.00	2,058.99	-82,365.52	1.69
9	9	247,121.59	76	52	24	68.42	0.98	3,251.60	-46,274.52	2.13
10	10	208,809.02	59	40	19	67.80	0.99	3,539.14	-68,138.70	2.09

As we can see in Table 1, the system would have been profitable throughout the 1%-10% bracket order range. We notice that, as the size of the bracket increases, so does the system's overall net profit, average trade profit and profit factor. The system's win rate also increases, albeit to a lesser degree.

There are however some serious issues with this system. Firstly, by setting fixed targets for *both* profits and losses the system caps each trade's maximum profit potential, meaning that it doesn't allow profits to run. This results in both small average trade profit numbers and small profit factor numbers. Moreover, achieving an even modest profit factor of at least 1.5 would have required a profit-target and stop-loss figure of 7% or higher. This is a large risk to take for any one trade, and back-to-back losses would have compounded to a huge maximum drawdown of up to 82%, as seen in the red column above. This would have had a catastrophic impact in 2002 and later in 2008, as shown in the equity curve below (using a 7% target/stop).

Time-Based Target and Time-Based Stop

In this second example we will let a specific number of days dictate both the profit target and the stop loss of our mean-reversion system. So the trade will be exited, at a profit or a loss, after exactly X days.

As we can see in Table 2, this simple time-based exit strategy has some interesting benefits. First of all it is extremely easy to implement: the trade is entered into and a conditional sell order is placed to trigger after a set number of days. That's it. Secondly, swing-trade systems tend to have a "sweet-spot": a window of days where the system's edge is at its peak. Before this sweet spot, there are still potential profits left in the trade; after it, the edge that triggered the trade has essentially disappeared and it is probably time to exit the position. This concept is discussed in some detail in the *"Swing Trade Cycle Analysis"* paper published on our website. In this example, the sweet-spot appears to be somewhere between day 7 and day 10. This is the compromise place where net profit, win rate and profit factor numbers are at relative highs, and maximum drawdown numbers are at relative lows.

It is quite surprising to see just how effective a simple mean-reversion system like this can be when coupled with a time-based exit. There are, however, some major caveats. Specifically, a lot can happen in X days. The system could have caught the beginning of a multi-day market crash and the time-based rule might just exit the trade at the very bottom of the market. And this market bottom, also a 10 day low, would trigger a new trade which could also continue running south, further compounding losses. This issue is seen in the high drawdown numbers of the full 5 to 15 day exit rule range. The use of a 10 day exit rule, for example, would have resulted in a maximum drawdown of 34.5%. Not nearly as severe as in our previous example, but nevertheless enough to put a large dent in a trader's account and possibly an even larger dent in his confidence in the viability of the system.

Table 2

	X Days	All: Net Profit	All: Total Trades	All: Winning Trades	All: Losing Trades	All: % Profitable	All: Win/Loss Ratio	All: Avg Trade	All: Max Intraday Drawdown	All: ProfitFactor
1	1	104,072.69	602	358	244	59.47	0.99	172.88	-21,028.49	1.46
2	2	110,424.06	495	287	208	57.98	1.01	223.08	-23,784.00	1.40
3	3	132,060.00	439	265	174	60.36	0.96	300.82	-31,458.58	1.47
4	4	128,880.03	387	229	158	59.17	0.99	333.02	-35,098.88	1.44
5	5	172,756.31	362	215	147	59.39	1.12	477.23	-31,053.10	1.64
6	6	137,767.03	337	201	136	59.64	1.00	408.80	-35,746.09	1.48
7	7	128,683.53	318	193	125	60.69	0.93	404.67	-45,590.48	1.44
8	8	142,948.47	302	188	114	62.25	0.91	473.34	-38,717.50	1.50
9	9	185,699.91	290	183	107	63.10	0.98	640.34	-37,217.51	1.67
10	10	247,842.94	283	180	103	63.60	1.16	875.77	-34,550.63	2.02
11	11	242,170.75	276	170	106	61.59	1.23	877.43	-43,639.51	1.98
12	12	210,848.25	262	164	98	62.60	1.07	804.76	-67,126.42	1.79
13	13	199,426.88	248	144	104	58.06	1.23	804.14	-67,996.70	1.70
14	14	170,528.97	239	142	97	59.41	1.11	713.51	-58,152.84	1.62
15	15	140,103.00	228	134	94	58.77	1.06	614.49	-58,885.13	1.51

The problem of large drawdowns is particularly noticeable in the equity curve shown below, which uses a 10 day exit rule. The steady upward-sloping chart indicates that the system's edge was strong and persistent throughout the 25 year period under study. The choppy nature of the equity curve, however, would have tested the resolve of most traders.

Floating Target and Fixed Stop

In this third example we will use a floating target coupled with a fixed stop. A "floating" or "dynamic" target is an exit rule that changes as a function of time and price. Floating targets are typical of mean-reversion systems and come in several flavours. In this example the stop loss will be set to range from 1% to 10%.

As we can see in Table 3 the results are fairly good throughout the 1%-10% stop range. The floating target and the absence of a timed exit did a good job at allowing trades to resolve themselves profitably. From a 4% stop and upwards, win rates are above 70%, much higher than in the previous two example systems.

The highest net profit figure would theoretically have been achieved using a 1% stop, but at the expense of a low win rate and an even lower average profit per trade figure. This is a problem as real-world commission costs and slippage risks might well have rendered this system unprofitable. A better stop value would probably have been 5% or 6%, which would have yielded higher average profit per trade, win rate and profit factor.

The major downside of this system is, once again, potential maximum drawdown: almost 30% using a 5% hard stop. As in our first example, fixed stops mean that high unrealized losses often become *realized,* sometimes preventing the trade to otherwise turn profitable, particularly in volatile environments. Stops hit in succession would have resulted in some steep losses, as seen in the choppy nature of the equity curve below.

Table 3

	% STOP	All: Net Profit	All: Total Trades	All: Winning Trades	All: Losing Trades	All: % Profitable	All: Win/Loss Ratio	All: Avg Trade	All: Max Intraday Drawdown	All: ProfitFactor
1	1	181,748.88	657	308	349	46.88	1.72	276.63	-18,978.59	1.51
2	2	176,190.13	507	316	191	62.33	0.90	347.52	-24,169.05	1.50
3	3	173,477.81	445	306	139	68.76	0.69	389.84	-28,113.78	1.52
4	4	171,116.34	408	288	120	70.59	0.66	419.40	-32,250.59	1.58
5	5	174,581.06	393	281	112	71.50	0.65	444.23	-29,340.48	1.62
6	6	177,941.58	380	273	107	71.84	0.66	468.27	-23,970.61	1.69
7	7	151,077.50	372	265	107	71.24	0.64	406.12	-27,486.59	1.58
8	8	143,684.38	369	264	105	71.54	0.61	389.39	-25,033.08	1.53
9	9	153,734.20	364	261	103	71.70	0.65	422.35	-20,574.80	1.64
10	10	168,453.34	359	256	103	71.31	0.73	469.23	-24,814.38	1.82

Equity curve for this system, using a 5% stop-loss exit rule:

Floating Target and Time-Based Stop

In this fourth example we will use the same floating target used in the previous study but this time coupled with a time-based stop. So if the dynamic target is not hit within X days, the trade will automatically be exited.

Table 4 shows the results of this system. As we can see, all key performance figures (net profit, win rate and profit factor) increase in a fairly linear manner as the number of days increase. These results also help us pin-point the new system's sweet-spot, which in this case happens to be day 7. This is where all performance values reach their peak and beyond which holding the position - on average - becomes a 50/50 proposition. These findings are very

much in line with swing-trading theory which sees the bulk of mean-reversion edges expressing themselves within 1 to 3 weeks, rarely beyond.

Table 4

	X Days	All: Net Profit	All: Total Trades	All: Winning Trades	All: Losing Trades	All: % Profitable	All: Win/Loss Ratio	All: Avg Trade	All: Max Intraday Drawdown	All: ProfitFactor
1	1	104,072.69	602	358	244	59.47	0.99	172.88	-21,028.49	1.46
2	2	117,789.44	501	300	201	59.88	0.96	235.11	-23,784.00	1.43
3	3	147,752.91	452	296	156	65.49	0.81	326.89	-26,046.75	1.54
4	4	129,468.19	408	274	134	67.16	0.71	317.32	-25,843.95	1.46
5	5	139,068.66	388	270	118	69.59	0.68	358.42	-24,951.59	1.55
6	6	134,269.06	370	261	109	70.54	0.66	362.89	-23,348.70	1.59
7	7	175,816.25	365	264	101	72.33	0.74	481.69	-23,348.70	1.92
8	8	163,346.38	359	258	101	71.87	0.72	455.00	-23,348.70	1.84
9	9	173,286.55	357	256	101	71.71	0.77	485.40	-23,348.70	1.96
10	10	170,063.84	356	256	100	71.91	0.75	477.71	-23,348.70	1.92
11	11	175,635.64	355	256	99	72.11	0.77	494.75	-23,348.70	1.98
12	12	170,710.20	354	255	99	72.03	0.76	482.23	-23,348.70	1.95
13	13	171,002.61	353	254	99	71.95	0.77	484.43	-23,348.70	1.96
14	14	173,603.61	353	254	99	71.95	0.78	491.79	-23,348.70	1.99
15	15	173,603.61	353	254	99	71.95	0.78	491.79	-23,348.70	1.99

Below is the equity curve for this system, using a 7 day exit rule. We notice a strong, persistent upside sloping chart with only some chop during the bear years of 2001-2003. The system would have incurred its maximum drawdown of 23.3% during the market collapse of 2008, but would have quickly recovered.

Floating Target and Stop

In this fifth and final study we will use the same floating target as above to dictate both our target and our stop. So essentially the system has no stop, and simply allows time and price-action to exit the trade.

Table 5

All: Net Profit	All: Total Trades	All: Winning Trades	All: Losing Trades	All: % Profitable	All: Win/Loss Ratio	All: Avg Trade	All: Max Intraday Drawdown	All: ProfitFactor
173,603.61	353	254	99	71.95	0.78	491.79	-23,348.70	1.99

As we can see, the results are identical to those shown in the last row of Table 4. The system allows the mean-reversion cycle to take its course to completion, well beyond its sweet-spot. Results are overall rather good, but the system would have underperformed somewhat during strongly bearish and volatile times, particularly during 2000-2003.

Below is the equity curve:

Summary

While our exact findings are specific to the test system analyzed in this paper, they are undoubtedly relevant to the majority of long-side swing-trading systems:

- Bracket exits are often favoured by short-term investors because they appear to provide a balanced risk/reward proposition. But fixed profit targets and stop losses are problematic because they do not successfully manage downside risk. Moreover, since they intrinsically limit the profit potential of the trade, they negatively impact the overall long-term profit expectancy of the system.
- Simple time-based exit strategies can be surprisingly effective and are very easy to put in place. They key here is to understand the system's natural "cycle" and to select a timed exit that captures the bulk of the system's profit potential. All swing-trading systems have their respective "sweet-spots", so it is essential to identify the one for each system. Note however that time-based exit strategies sometimes have the unfortunate tendency to exit positions at market bottoms, so a number of back-to-back losing positions could result in large cumulative losses.
- Using floating targets is probably the best way to capture the maximum profit potential of a swing-trading system. Using hard stops, however, is likely to reduce the effectiveness of floating targets due to the likelihood of consecutive losing trades and the resulting risk of high drawdown.
- The use of floating targets *and* stops is an elegant and simple way of achieving strong and consistent system performance, while limiting downside risk. Adding a time-based exit has the additional benefit of exploiting the system's "natural" cycle. Using quantitative analysis can help determine the system's sweet-spot, and hence the culmination of its trading edge.