Stop Losses: Help or Hindrance?

By Dr. Bruce Vanstone

Background Bruce Vanstone is Assistant Professor at Bond University in Australia. He completed his PhD in Computational Finance in 2006 and is a regular presenter and publisher of academic work on stockmarket trading systems. He teaches stockmarket trading courses, and consults to Porter Capital Management on the design of mechanical, rules-based trading systems. More information on Bruce's research and methods can be found at http://trading.it.bond.edu.au.

Bruce has a controversial view on the effectiveness of stop losses.

Introduction

Many traders and investors place Stop Loss orders as part of their day-to-day investment activity. Virtually all trading books recommend the use of stops, with many making statements like "Trading without stops is like driving without a seatbelt". The argument for the use of stop-loss rules seems inherently sound, yet there appears to be no real evidence that stops are providing the safety benefits that many traders expect.

With regard to medium to longer term equity trading systems (which appears to cover the majority of investors and traders), it may well be that stops are causing more harm than good!

As traders, we are used to having an initial stop loss on a trade, and congratulating ourselves when the stop saves us money as the trade goes south very quickly. Although a stop-loss rule may save us from damage on specific trades, it seems doubtful whether this beneficial effect actually holds when we measure it at a portfolio level. There are a number of specific reasons why this may be the case, which I will touch on later in this series.

As traders, we shouldn't really focus on the return of each individual trade; rather we should focus on the overall return of our portfolio. A large amount of my empirical testing appears to show a mismatch between stop performance at an individual trade level, and stop performance at a portfolio level.

In this series of articles, I would like to demonstrate the mismatch that stops appear to introduce, and show you a way to be able to test this for yourself. This article is part 1 of a 3-part series. In this article, I will introduce an example system, and demonstrate how to benchmark the system with and without a variety of stops, and statistically analyse the results.

You can then use this same process to benchmark the effect stops are having on your own individual trading system, to determine if you are actually benefiting from using stops.

Measuring the impact of Stops

To measure the impact of stops on a trading system, it is necessary to consider the effect that stops have on both individual trades, and on specific portfolios constructed from those trades.

To assess the effect that stops have on individual trades, we can benchmark and measure changes in:

- Trade daily mean return ($) – average return per day
- Average number of days trades are open

To benchmark the raw trades signalled by the entry and exit rules, we initially assume unlimited equity, and a nominal investment of $10,000 per trade.

To assess the effect that stops have on specific portfolios, we can benchmark and measure changes in:

- APR% (Annual Percentage Return) – a portfolio's return
- Max DD% (Maximum % Drawdown) – which shows the worst case drawdown (peak to valley) that the portfolio equity curve has suffered.
- Sharpe Ratio - which shows the amount of risk taken per unit of return. Ignoring the risk-free rate adjustment, the Sharpe Ratio is a measure of how volatile portfolio returns have been. (As an example, two different traders may both have achieved a return of 20% over time. The Sharpe Ratio will be highest for the trader who has achieved this result with the least volatility.)

When benchmarking a portfolio, it is important to take account of the amount of equity used. In this case, a relatively simple 'percentage of equity' model is used. We allocate 2% of available equity to each trade, from an initial starting capital of $1,000,000.

By monitoring the variables above, we can benchmark the metrics that are obtained from a set of trading rules. We can then add stops to the trading rules and repeat this process. This will allow us to empirically measure the effects that the stops have on those key metrics. We can then statistically determine whether the portfolio outcome has been improved by the addition of the stop rules.

Case Study

The majority of traders would be best described as medium to longer-term equity investors. In essence, this means that they trade ordinary shares, and aim to hold each share from several months to several years. Typically, this group of investors name

themselves 'trend traders', and their aim is to identify and ride a trend for as long as possible. Often one or more simple (or exponential) moving averages provide entry and exit setups. Typically, this group also only trades the long side.

For this reason, I have chosen a 60-day ema crossover system as the example case study system . A 60-day ema crossover system buys when the price crosses above a 60-day ema, and sells when the price crosses below a 60-day ema.

An example trade is shown below in Figure 1. The pink line represents the value of the EMA(60).

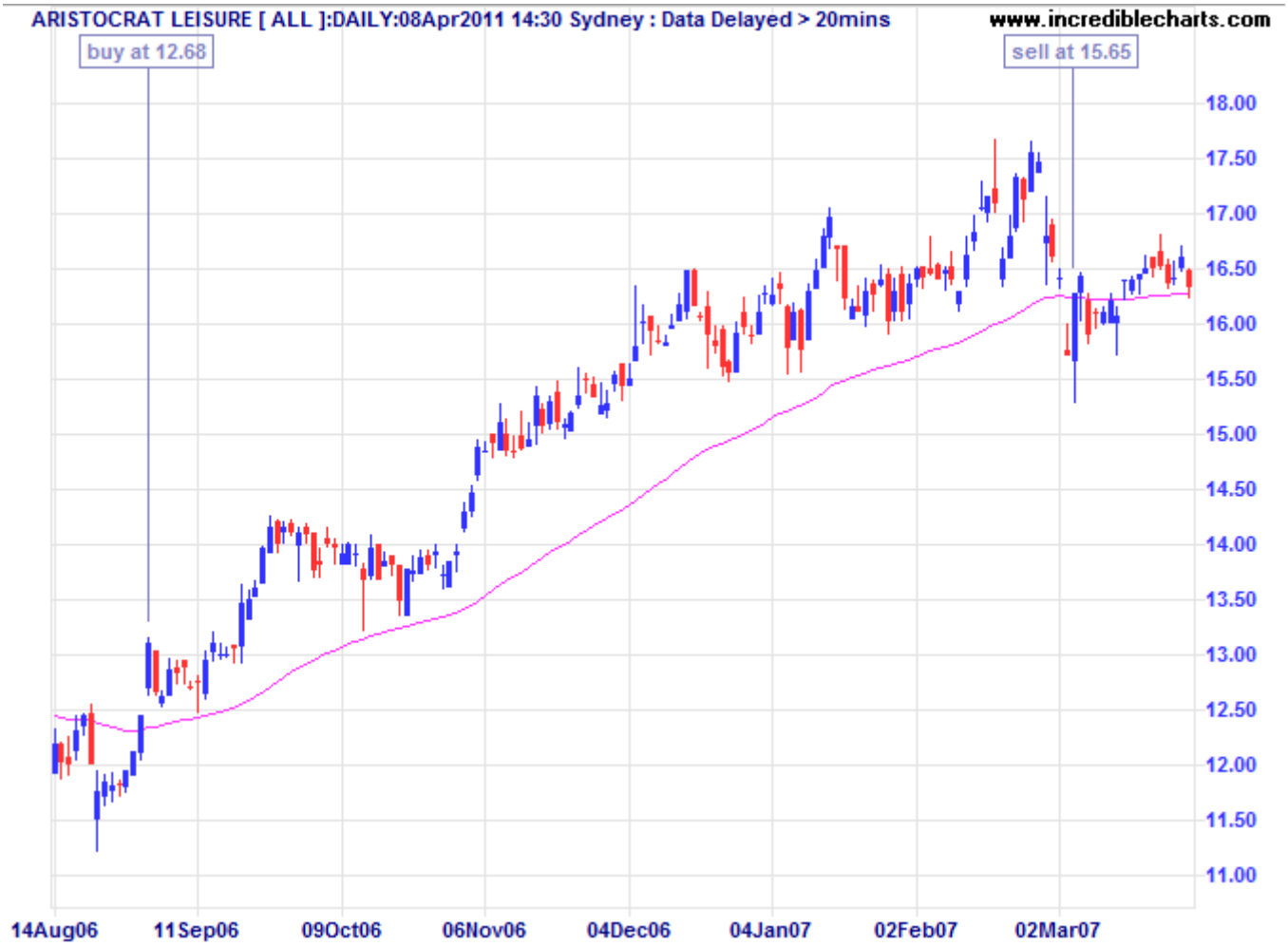


Figure 1: Example of a 60-day EMA crossover trade

The data chosen for the case study is the constituents of the ASX200 (since inception April 2000) until the end of 2009. Where possible, I have adjusted this data for delistings and code changes, and trading results include an allowance for transaction costs. To address survivorship bias, buy signals are only issued on stocks which were constituents of the ASX200 on the day the signal was generated.

Remember the objective is not to determine whether these are desirable rules for trading; it is to allow us to select and emulate the basic characteristics of the kind of stocks that the majority of traders and investors in the ASX200 are focused on.

No stops

Initially, we need to benchmark the buy and sell rules without any stops. This gives us a baseline against which to compare the performance of the stops we will introduce.

Raw Trades

The key characteristics of the raw trades generated by buying/selling $10,000 worth of stock every time the buy/sell conditions occur are:

Daily Mean Return = $ 0.61, Average Number of days trades are open = 21.44

Later, when we introduce a variety of stop combinations to the buy/sell rules, we can measure the effects they have using this baseline.

Portfolio

The key characteristics of the portfolio generated by these trades are:

APR = 2.63 %, MAX DD = -34.63 %, Sharpe Ratio = 0.31

Now we know how much potential return there is in the rules (APR%), how risky those rules are (DD%), and a measure of the overall risk for that specific return (Sharpe ratio). Later, when we introduce a variety of stop combinations to the buy/sell rules, we can measure the effects they have using this baseline.

Initial Percentage Stops

Many traders simply use a fixed percentage to determine their stop level price. As an example, a trader might say, "I will set a stop loss 5% below my entry price". Here, we test every initial stop loss percentage threshold from 1% - 10% in steps of 1, for all the trades generated by the ema crossover rules.

The impact that these initial stops have on both return and risk is presented next.

Raw Trades

Initial Stop Loss setting	Daily Mean Return ($)	Average number of days trades are open
NO STOP LOSS	0.61	21.44
1% stop loss	-0.41	13.73
2% stop loss	0.00	17.54
3% stop loss	0.23	19.69
4% stop loss	0.28	20.30
5% stop loss	0.43	20.67
6% stop loss	0.49	20.81
7% stop loss	0.55	21.02
8% stop loss	0.51	21.19
9% stop loss	0.51	21.23
10% stop loss	0.50	21.25

From the table presented, it is clear that none of the stop methods tested improved the 'NO STOP LOSS' portfolio's daily mean return. This is as expected, given that, by definition, an initial stop loss rule entails selling at a loss. To determine whether this approach has decreased our risk, we next test within a portfolio setting.

Portfolio

Initial Stop Loss setting	APR(%)	MAX DD(%)	Sharpe Ratio
NO STOP LOSS	2.63	-34.63	0.31
1% stop loss	-1.28	-38.30	-0.11
2% stop loss	0.31	-38.76	0.08
3% stop loss	1.19	-38.78	0.18
4% stop loss	1.09	-36.73	0.17
5% stop loss	1.55	-36.13	0.21
6% stop loss	0.89	-34.21	0.15
7% stop loss	1.52	-35.48	0.21
8% stop loss	1.92	-34.74	0.24
9% stop loss	2.40	-36.23	0.28
10% stop loss	2.36	-34.20	0.29

From this table, we can see that none of the stop methods have improved the 'NO STOP LOSS' portfolio's APR. Further, none of the stop loss settings was able to improve the Sharpe Ratio. Some of the higher percentage stops achieve similar Maximum Drawdown%, but none of the stop loss settings was able to improve the Sharpe Ratio. **In essence, all combinations of stop loss tested achieved less return, and were riskier.**

Implications

To statistically compare the portfolio results, we can use the ANOVA procedure, which allows us to simultaneously compare all the trades generated under the 'NO STOP LOSS' condition, with all the sets of trade possibilities from the 10 stop loss combinations. This allows us to determine whether there is any statistical significance in our findings.

The results indicate that no benefit has been obtained from any of the stop combinations. I have purposefully omitted a detailed explanation of using the ANOVA procedure in this article, to allow us to keep focused on the effects of stop losses. Those readers that are interested in pursuing the benchmarking of trading systems using statistical methods can find details of this and many other useful procedures in my book, Designing Stockmarket Trading Systems (with and without soft computing).

Summary

In this article, I have benchmarked the results of a simple EMA crossover strategy. Next, the strategy was tested with a variety of initial percentage based stops to see if adding these stops was able to decrease the risk in the strategy. It was found that all stops tested increased the risk and reduced the return of the original strategy.

In the next article, I will test percentage-based trailing stops and ATR-based trailing stops to see whether these types of stops can decrease the strategy risk.

Introduction

This article is part 2 of a 3 part-series on stops. In this article, I continue testing and benchmarking the original EMA crossover strategy by adding in percentage-based and ATR-based trailing stops.

Trailing Percentage Stops

Many traders and brokers use an initial percentage stop and a trailing percentage stop to manage their positions. As an example, a trader might say, "I will set a stop loss 5% below my entry price, and then trail it 5% below the previous days closing price as the trade progresses". Here, we test this method using percentage thresholds from 1% - 10% in steps of 1, for all the trades generated by the ema crossover rules.

An example is shown in Figure 2. The green dots show the position of the percentage-based trailing stop, and the pink line shows the value of the EMA(60).

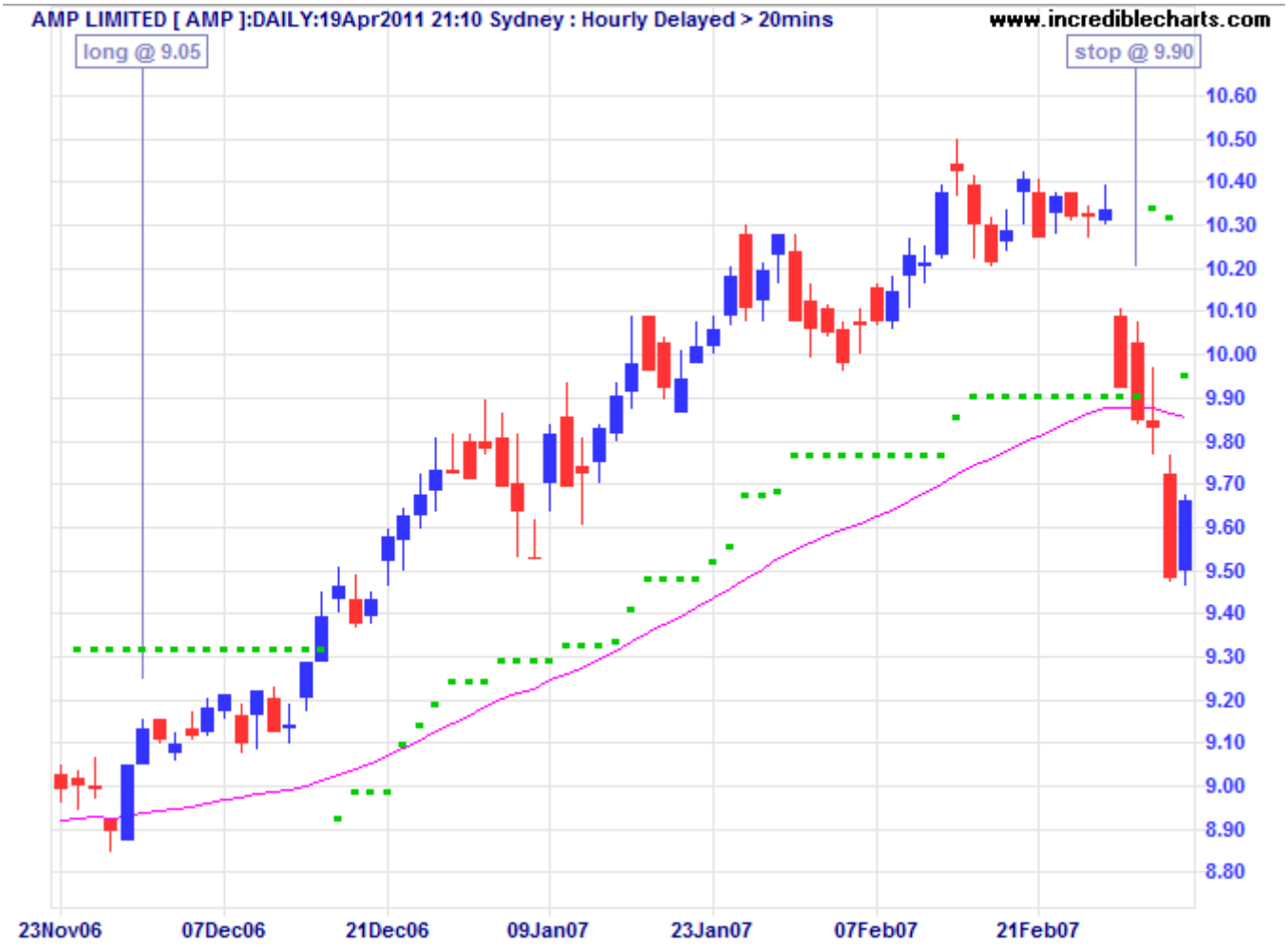


Figure 2: Percentage trailing stop (5%) used for controlling the stop loss price

The impact that these percentage trailing stops have on both return and risk is presented next.

Raw Trades

Initial Stop Loss setting	Daily Mean Return ($)	Average number of days trades are open
NO STOP LOSS	0.61	21.44
1% trailing stop loss	-14.12	3.25
2% trailing stop loss	-8.91	5.64
3% trailing stop loss	-5.62	8.69
4% trailing stop loss	-4.18	10.96
5% trailing stop loss	-3.41	12.67
6% trailing stop loss	-2.67	14.08
7% trailing stop loss	-2.03	16.08
8% trailing stop loss	-1.55	17.53
9% trailing stop loss	-1.24	18.79
10% trailing stop loss	-0.94	19.41

From the table presented, it is clear that none of the stop methods tested improved the 'NO STOP LOSS' portfolio's daily mean return. This is as expected, given that, by definition, an initial stop loss rule entails selling at a loss. To determine whether this approach has decreased our risk, we next test within a portfolio setting.

Portfolio

Initial Stop Loss setting	APR(%)	MAX DD(%)	Sharpe Ratio
NO STOP LOSS	2.63	-34.63	0.31
1% trailing stop loss	-9.28	-61.95	-2.00
2% trailing stop loss	-8.11	-57.14	-1.78
3% trailing stop loss	-6.31	-49.71	-1.22
4% trailing stop loss	-6.12	-49.30	-0.98
5% trailing stop loss	-5.87	-48.81	-0.84
6% trailing stop loss	-4.95	-45.24	-0.62
7% trailing stop loss	-3.39	-37.32	-0.42
8% trailing stop loss	-2.09	-34.92	-0.23
9% trailing stop loss	-1.68	-29.04	-0.21
10% trailing stop loss	-1.37	-36.78	-0.12

From this table, we can see that none of the stop methods have improved the 'NO STOP LOSS' portfolio's APR. Further, none of the stop loss settings was able to improve the Sharpe Ratio. Again, all combinations of stop loss tested achieved less return, and were riskier.

Implications

To statistically compare the portfolio results, we can use the ANOVA procedure, which allows us to simultaneously compare all the trades generated under the 'NO STOP LOSS' condition, with all the sets of trade possibilities from the 10 stop loss combinations. This allows us to determine whether there is any statistical significance in our findings.

The results indicate that no benefit has been obtained from any of the stop combinations. I have purposefully omitted a detailed explanation of using the ANOVA procedure in this article, to allow us to keep focused on the effects of stop losses. As mentioned earlier, those readers interested in pursuing the benchmarking of trading systems using statistical methods can find all the details in my book, Designing Stockmarket Trading Systems (with and without soft computing).

ATR-based Stops

Many traders simply use a multiple of the ATR (Average True Range) to determine their stop level price. As an example, a trader might say, "I will set a stop loss 2 times the 5-day ATR below my entry price". To demonstrate the versatility of this technique, I have implemented this as both an initial ATR stop, and then allowed it to become a trailing stop as the trade moves into profit. This is typical of the way many retail traders manage their ATR based stops.

An example is shown in Figure 3. The green dots show the position of the ATR-based trailing stop, and the pink line shows the value of the EMA(60).

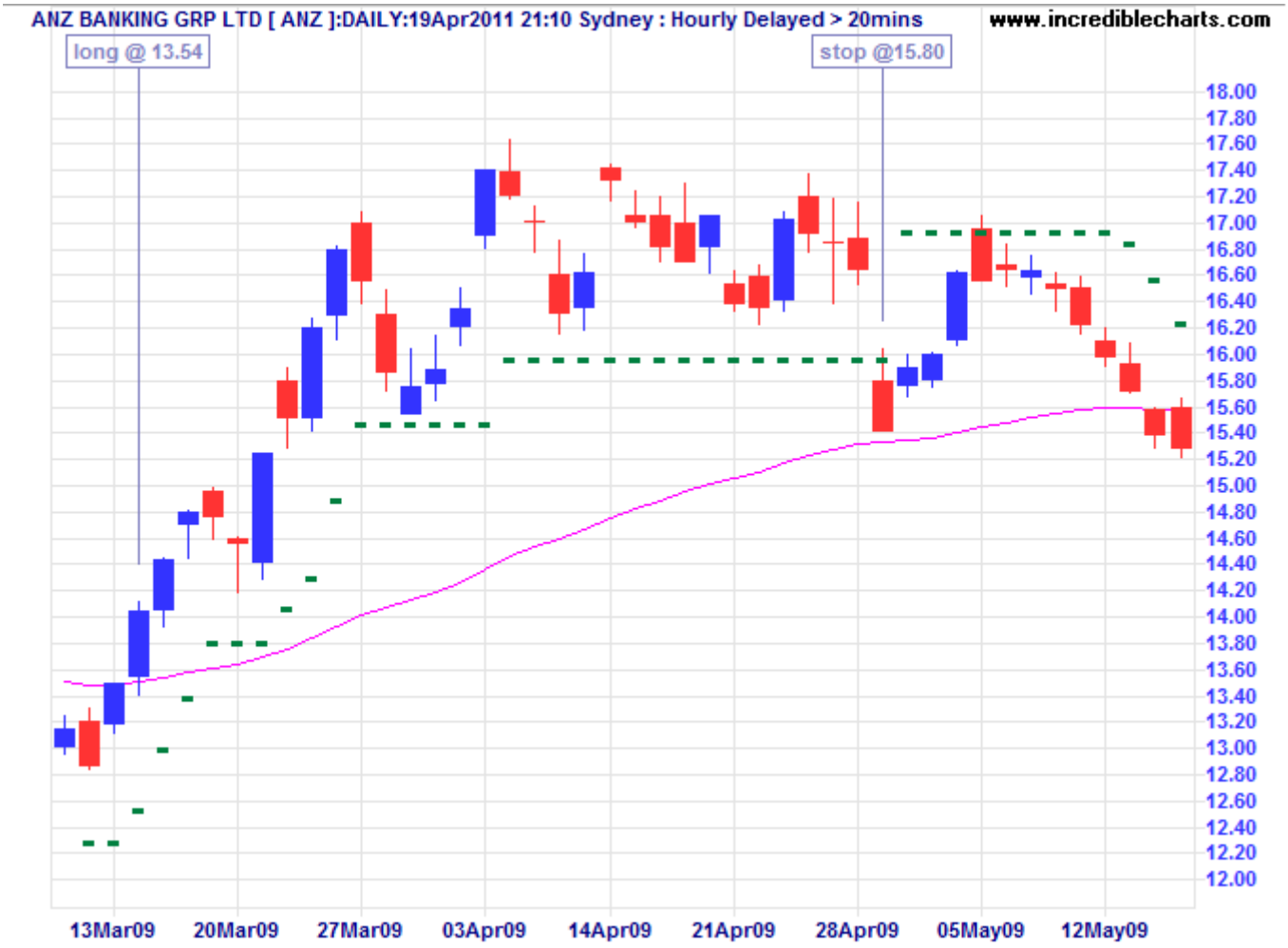


Figure 3: ATR stop (2 x ATR(5)) used for controlling the stop loss price

The impact that these initial stops have on both return and risk is presented next.

Raw Trades

Stop Loss setting	Daily Mean Return ($)	Average number of days trades are open
NO STOP LOSS	0.61	21.44
1 x ATR(5) trailing stop loss	-9.88	5.93
2 x ATR(5) trailing stop loss	-3.97	11.24
3 x ATR(5) trailing stop loss	-1.53	15.52
4 x ATR(5) trailing stop loss	-0.51	18.11
5 x ATR(5) trailing stop loss	0.03	19.70

From the table presented, it is clear that none of the stop methods tested improved the portfolio's return. This is as expected, given that, by definition, an initial stop loss rule

entails selling at a loss. To determine whether this approach has decreased our risk, we next test within a portfolio setting.

Portfolio

Initial Stop Loss setting	APR(%)	MAX DD(%)	Sharpe Ratio
NO STOP LOSS	2.63	-34.63	0.31
1 x ATR(5) trailing stop loss	-8.67	-61.82	-1.81
2 x ATR(5) trailing stop loss	-5.49	-49.59	-0.68
3 x ATR(5) trailing stop loss	-2.83	-39.41	-0.27
4 x ATR(5) trailing stop loss	-1.49	-36.67	-0.12
5 x ATR(5) trailing stop loss	0.34	-36.66	0.09

From this table, we can see that none of the stop methods have improved the 'NO STOP LOSS' portfolio's APR. Further, none of the stop loss settings was able to improve the Sharpe Ratio. **Again, all combinations of stop loss tested achieved less return, and were riskier**.

Implications

Again we can use the ANOVA procedure to determine the statistical significance of these results. The results indicate that no benefit has been obtained from any of the stop combinations tested.

Summary

In this article, I have continued testing different types of stops to see if they can improve the original EMA crossover strategy. This time I have tested percentage-based trailing stops, and ATR-based trailing stops. It was found that all stops tested increased the risk and reduced the return of the original strategy.

In the next article, I will demonstrate the Monte-Carlo technique and show how it can provide additional insights into the use of stops.

Introduction

In this article, I will introduce the Monte-Carlo technique and show how we can use it to increase our knowledge of the behavior of the different types of stops tested in this series.

Monte-Carlo Analysis

By definition a portfolio is a subset of the raw trades signalled by the entry and exit rules. The most common reason that a portfolio usually has less trades than the total possible relates to the way the trader/investor manages money, and that is why it is important to test a portfolio with a specific amount of capital. Different amounts of capital (and money management approaches) can give rise to different possible portfolios.

Consider a trader/investor who invests his/her money in multiples of $10,000 according to the above buy/sell rules. What will the trader/investor do if 2 stocks are signalled on the same day, yet the trader/investor only has $10,000 left? Clearly, only 1 trade can be taken, but which one?

It may well be that over time the two trades have very different outcomes. For example, one goes up, and one goes down!

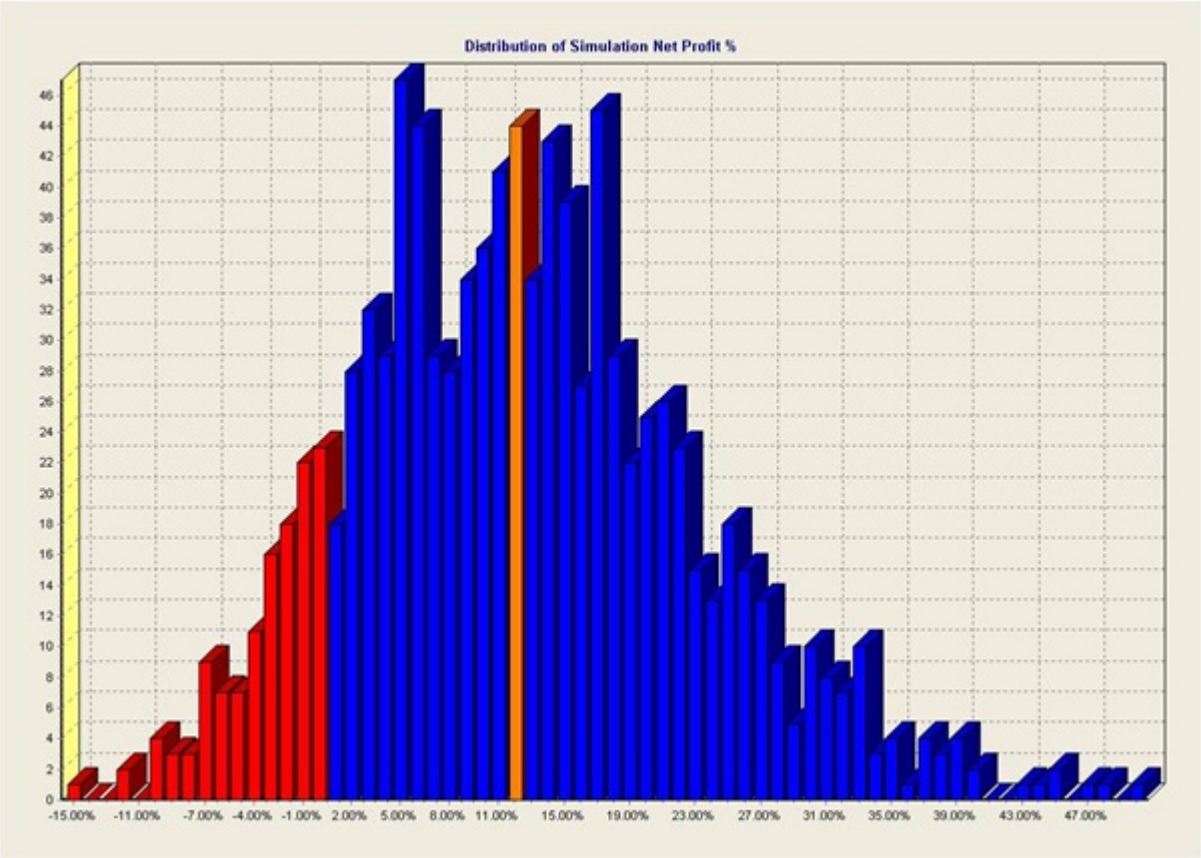
When running a portfolio, the issue of having more trading opportunities than money can occur reasonably frequently, particularly in a trend-trading approach. Again, in the above example, what will the trader/investor do on the next day, when yet another trade is signalled, and there is no money left to take it. Of course, it must be skipped from the portfolio.

To fully understand the implications of taking and skipping certain trades, quantitative analysts may resort to Monte-Carlo modeling, which allows us to build a probability outcome of all the possible portfolios which could have been built dependent on the decisions the trader/investor took.

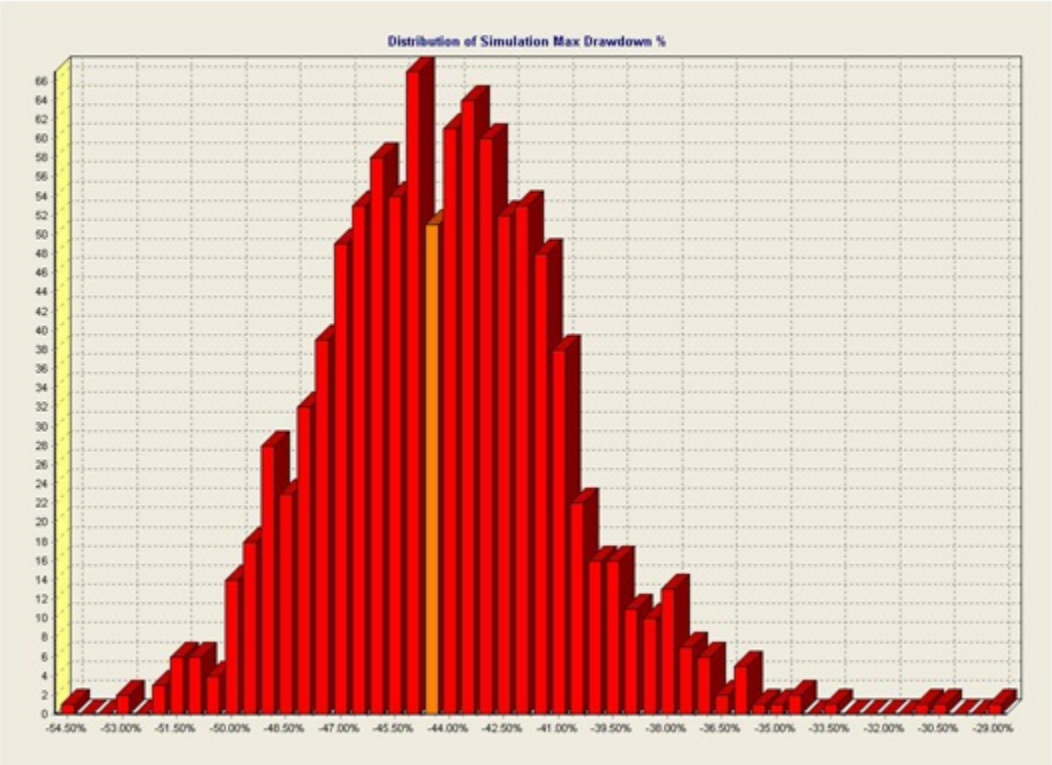
As an example, in an earlier paragraph we wondered how to model the portfolio outcome when there were two possible trading candidates but only enough money to take 1 trade. The solution using computational mathematical methods is that from this point forward, there are now two theoretical portfolios one with each possible stock in it. Following on from this logic, you can see that over a period of time, there could actually be a great number of possible portfolios, all dependent on the decisions taken by the individual trader/investor. All of these portfolios would be real possible outcomes, totally dependent on the choices made by the trader/investor on a day to day basis!

To assess the impact of stops completely, we need to consider not just one simulated portfolio outcome (as we did earlier), but a large number of the possible theoretical outcomes. We can approach this using the Monte-Carlo methodology, and determine the probability of various return and drawdown outcomes.

The following figures show the probability distributions for the Raw Return (aka Net Profit) and the Maximum Drawdown metrics for 1000 of the possible 'NO STOP LOSS' portfolios. These provide the benchmark for this final piece of analysis. Under each figure, I have also included the smallest, average and largest values obtained from the 1000 simulations.



Smallest =-17.32%, Average = 11.66%, Largest = 43.82%



Smallest = -30.00%, Average = -44.44%, Largest = -53.21%

Outcomes

The following table shows the average values for both the Net Profit % (not the APR%), and the Maximum Drawdown % for 1000 possible portfolios for each of the 25 stop combinations tested.

Stop Loss Setting	Average Net Profit %	Average Maximum Drawdown %
NO STOP LOSS	11.66	-44.44
1% stop loss	-44.05	-73.54
2% stop loss	-0.71	-54.76
3% stop loss	5.05	-48.67
4% stop loss	5.70	-47.49
5% stop loss	6.12	-47.72
6% stop loss	9.90	-46.50
7% stop loss	11.62	-45.44
8% stop loss	10.51	-45.13
9% stop loss	10.22	-44.29
10% stop loss	10.20	-43.98
1% trailing stop loss	-72.93	-80.62
2% trailing stop loss	-73.00	-81.56
3% trailing stop loss	-57.23	-74.09
4% trailing stop loss	-47.48	-69.07
5% trailing stop loss	-34.77	-64.59
6% trailing stop loss	-29.09	-61.55
7% trailing stop loss	-23.01	-58.46
8% trailing stop loss	-17.25	-55.84
9% trailing stop loss	-8.79	-50.83
10% trailing stop loss	-7.38	-51.40
1 x ATR(5) trailing stop loss	-75.58	-84.31
2 x ATR(5) trailing stop loss	-42.27	-72.14
3 x ATR(5) trailing stop loss	-3.70	-58.44
4 x ATR(5) trailing stop loss	1.54	-52.54
5 x ATR(5) trailing stop loss	4.62	-48.35

Implications

From inspection of this table, we can see that there was no set of 1000 possible portfolios more profitable than the 'NO STOP LOSS' combinations. We can also see the ATR based stop methods have performed quite poorly compared to nearly all of the simple percentage based stop methods. In summary, no combination of stops was able to improve on the basic strategy without stops.

Conclusion

Some traders appear to use stops to provide a level of comfort about the risk they take with their trading. If you feel you absolutely cannot live without stops, even after performing similar tests to these on your own system, you must, of course, continue using them. Perhaps you could even consider simply making them wider.

However, many traders and investors appear to view the stop loss order as a panacea. These empirical results show that the stop loss order may actually be contributing to the

poor performance of some traders, and may even be the cause of their lower than expected returns.

One of the reasons that this behavior may be occurring is that many stops are being hit at the same time. This is more likely due to changes in the overall market rather than having any specific relationship to changes in some particular company share price.

I have seen similar results in the past when testing stop orders against long-only, equity based, trend-following types of systems.

If your trading style is best described by phrases like "long-only", "equity based", and "trend-following", and you use stop-loss orders, then you may wish to consider testing your trading rules to see if the stops are actually helping or hindering your performance. You can follow the procedure outlined in this series of articles, and in my book, Designing Stockmarket Trading Systems (with and without soft computing), to help you do this.