Backtesting Your Algo Strategies

Dear readers, let us continue the journey of Quant…um leap by delving deeper into the world of Algo trading. Continuing to build momentum from my last article where I gave a sneak peek into what Algo world is all about – this month is going to be far more exciting. We will talk about backtest, one of the most misunderstood topics in the Algo world. Yes, I say misunderstood because, everyone has their own version of backtesting, own version of playing around with the historical data and coming out with fancy and monstrously great backtested results. There are no standards to backtesting an Algo, and this makes this topic all the more complex. How many times have you backtested the Algo strategy that have seen the returns in triple-digits just to get knocked over in the real world with losses? Sounds familiar…read on!

I have often seen so many Algo strategies falling flat on their faces, in the real market – due to proper know how and lack of understanding of back-testing. Backtesting is not only a science – but is also an art, which means the more you practice it, the more seasoned you become in developing great Algo trading models.

Let me once again start with a small anecdote. This was my first year in Merrill Lynch, Tokyo and as a young, energetic fresh graduate, I was asked to develop a trading strategy on Nikkei futures. My guru, Dr. Hiwon Yoon told me to backtest a trading strategy. He had observed that whenever the Nikkei futures open higher as compared to previous day's close by X points and moves higher w.r.t to the opening price by another Y points – it is a great short trade and a short position taken could either be unwounded at a profit target of Z points, a stop loss of K points or towards the market close (intra-day trade). He then asked me to back-test the strategy and optimize the model parameters namely, X, Y, Z and K. Needless to say I spent many sleepless nights as a young energetic quant trader on the desk trying to find the golden goose. Finally I found that every trade of this nature done in the last 10 years could make on an average 15 points, for a certain optimal values of X, Y, Z and K. My

eyes sparkled and my heart pounded to see that I was this close to making a strategy which could make the next million dollars at our desk. My dear readers, 15 points on Nikkei futures, if done on 1000 contracts (~ 100 Million USD notional) can make USD 150,000 daily! I was already annualizing this number and hence my bonus. May be I was too impatient, in hindsight I was too naïve, but at that time all I could see was driving a Porsche next year.

Next morning I presented the strategy to the MD of our trading desk and our senior management team. They liked my findings and more importantly my enthusiasm to get on with the strategy and my detailed backtested results. Our MD agreed to start with 100 contracts (~ 10 Million USD notional) and ramp it up if the strategy performed as expected. Dear friends my experience over the last few years in the markets have been that more often than not, when you build an Algo strategy, it always starts at a loss and deviates significantly from the back-test, but in my case it was just the opposite. We used to run this Nikkei intra-day short strategy everyday on 100 contracts and make an average of USD 15,000 daily. Slowly and steadily the profit of the book had swelled to USD 700,000 in a matter of 3 months. Not a small feat for a first timer on the trading desk and suddenly I was the blue eyed boy of our MD, who could do no wrong. I started getting requests to develop more strategies; experienced traders would seek my advice on quant related ideas. But all this was soon going to change.

When Murphy (If things can go wrong, they will go wrong) strikes a thoroughly back-tested quant trading strategy, it strikes it big. I was no exception, just that I had not realized it, yet. In the summers of 2005, Nikkei very quietly broke through 12,000 levels after several years of resistance. We continued to short Nikkei futures, which was now on 200 contracts, and everyday would lose anywhere between USD 25,000 to USD 50,000 daily. So confident I was about my back-test and the live performance this far that I continued to run the strategy not worried about the daily loss until one fine day, the strategy lost all the USD 700,000

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and was down another USD 300,000 in a matter of 2 months. Yes a straight loss of more than a million dollar in no time. I started questioning myself, and so did the senior management. It was time to shut the strategy down and go back to the drawing board.

I once again met Dr. Yoon, who by that time had left Merrill Lynch, over lunch. I told him about all the ups and downs of the back-tested strategy and wanted his advice. The first question he asked me was what was the data I had taken for back-test? Pat came the reply, last 10 years. He said, Manish, Nikkei has been in a complete bear market from 1994 to 2004. Any strategy on shorting Nikkei futures (intra-day, carry over etc), would make money. Did you see if that strategy made money in a bull market or a range bound market? The answer was "No". There lied the mistake, I had back-tested the strategy on a biased set of data. I didn't know if my strategy could withstand every kind of market or not and hence when the market turned around from a bear to bull rally in summers of 2005, we kept bleeding on the strategy. Had I optimized the strategy to not loose money in bull phases, we probably would still be in the game. But then as they say, every trader is a billionaire in hindsight.

The lesson I learnt my friends is that, when you backtest an Algo strategy take data from all kind of markets conditions. Bull, bear, range bound, news related etc. You never know when your strategy hits the road which direction the market might take and is your strategy equipped to handle this route?

The critical importance of back testing lies in understanding whether a pattern which we think is profitable has actually been profitable across different kinds of markets. Besides that backtesting gives an Algo trader an opportunity to avoid mistakes which the strategy might have made in the past, by applying rules of risk management and stop losses. Thirdly, since we come to know the limitations of the models in terms of expected returns, maximum flattish period when the strategy might not make any money, kinds of market where the strategy are likely to fail etc. It makes us only more informed about the risk associated with the strategy and hence gives us an upper hand in terms of

preparing for the expected rather than facing the unexpected.

I too often see young quant programmers, trying too hard to optimize numbers and parameters to make the strategy profitable in backtesting. Dr. Yoon, always told me, "Manish, you torture the data enough and it will bend to almost anything!". Data torturing is as good as, becoming a hindsight billionaire. Just that it never works in real market. A Good way to find if you have tortured the data or not in backtesting –is what is called data sampling. When you backtest a strategy or optimize any parameters always take about 70% of the data which we usually call as in-sample data and do the backtest. Once you are convinced that the strategy is profitable in this 70% of the data – use the out-of-sample 30% data and see if the returns generated in 70% in-sample is consistent with 30% out-of-sample data or not. If the answer is no, than its time to re-do the strategy and back-test it again.

In the figure below I illustrate all the steps which are usually taken while doing a thorough back-testing of a strategy.

Strategy/Pattern Recognition

Data Gathering/Data Cleaning

Back Testing

Factor Optimization

Monte Carlo Simulation (Parameter Optimization)

Trade/Portfolio Result Analysis

Simulated Trading/ Risk Management

Live Trading and Execution

Fig: Steps involved in an end to end backtested strategy

The 2 key backbones in any Algo trading strategy to be backtested are the factors and parameters. In a trend following strategy, factor could be Simple Moving Average (SMA) crossover, MACD (This might come from host of technical indicators and patterns) etc.

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Parameters could be 5 day SMA crossing over 21 day SMA or a standard 12, 26 – 9 MACD. What is required is correct set factors and optimized parameters which can work in most market circumstances. Once you have found the right set of factors and parameters, for say a trend following system – the next step is to see how they behave when markets are very very range bound. Do they bleed? Do they loose money within acceptable limits? The answers to many of these questions lies in the foundation of risk management and statistical factors, which I shall be covering in my forthcoming articles.

The final outcome of every backtested strategy has to be an equity curve. An equity curve is like a bible, which tells everything about the behavior of the strategy. An equity curve is a daily plot (or hourly, half day in case of high frequency trading strategies) of the returns of the strategy over the back-tested period. Just by looking at an equity curve, an investor can sniff everything about the strategy. An equity curve, tells a complete story about: the average annualized return of the strategy, the maximum peak to trough drawdown which the strategy can suffer, the time it takes for the drawdown to recover, the maximum period for which a strategy can stay flat, before it starts making any money, the volatility in returns which the strategy is likely to witness etc. The figure below shows an equity curve of one of the strategy called samCAP which is run by our company.
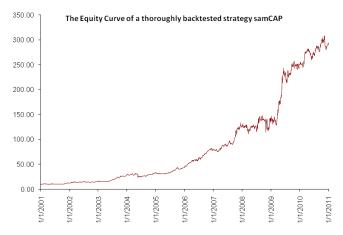

Fig: Equity Curve of cumulative return of Rs. 10 invested in a thoroughly back-tested Algo strategy

When we go to the investors, with a thoroughly backtested strategy like samCAP, we have a complete story to tell them. By just showing the equity curve, we can make them aware of the kind of markets that the strategy will do well and vice versa. They know exactly the risk associated and the range of drawdown they can see – so that there is no panic button to be hit when it actually happens. The foremost duty of us as an Algo trader, then becomes to make sure that the Algo like samCAP performs and yields returns and risks, within the acceptable limits of the backtest. As long as that continues to happen the investors are comfortable, the Algo traders are comfortable and the strategy is there to create long term wealth for its investors.

To conclude, I would like to say that backtest is more like making us aware of the pitfalls, the dos and the dont's of any technical strategy which we want to run for a very long period of time. Once we know the pitfalls, we can prepare to tackle the rainy days in advance, so that there are no nasty surprises which might lead to rapid wealth erosion. Long term sustainability and an ability to withstand any kind of market circumstances, can only come if the strategy has been thoroughly and truthfully backtested, with no bias either towards data or towards factors and parameters. Because, remember when Murphy strikes any Algo trading strategy, it strikes it hard and backtest helps us avoid the havoc which Murphy could have on our strategy.

The Quant…um leap journey will continue in the coming months with more sections, more insights and more leaps… Let the journey be the destination!

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About Samssara Capital Technologies LLP

Samssara Capital Technologies LLP ("Samssara") is an investment solutions firm focused solely on developing automated algorithmic and quantitative trading and investment strategies. It was launched in 2010 by a team of IIM Ahmedabad and IIT Bombay graduates - Rajesh Baheti, Manish Jalan and Kashyap Bhargava. Samssara caters to its clients' needs of providing an alternative asset management vehicle, with the focus on 100% automated and quantitative trading strategies.

Samssara's products vary from pair trading (statistical arbitrage), factor models, Nifty Index beating products to very high frequency trading strategies. The team at Samssara works on mathematical models and statistics that identify repetitive patterns in equity, commodity and currency markets. The addressable market for Samssara is global - as the firm can develop and build models which can function in both developing markets with limited competition and developed markets with strong competition. Samssara's client base includes the leading international and domestic banks, international and domestic stock brokers, family offices, corporate treasuries and HNIs.

Profile of Manish Jalan

Manish Jalan is the Chief Strategist and Director of the Algo trading firm Samssara Capital Technologies LLP. Prior to his new found Indian venture, Manish was a Quantitative Prop Trader in Tokyo, with Merrill Lynch Prop Desk handling USD 100 Mn. portfolio. Manish has worked closely with many Indian brokers and numerous International banks in algorithmic trading, trend following strategies, statistical arbitrage, factor modeling and back testing. Manish is a B.Tech and M.Tech from IIT Bombay in Mechanical Engineering.

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