Long-Side Mean-Reversion and the US Stock Market

Mean reversion is not a universal phenomenon. Some markets have a tendency towards mean-reversion, others don't. This has led a number of analysts and traders to look upon mean-reversion with some degree of suspicion. If mean-reversion has a solid statistical foundation, surely it should be applicable to all markets, all the time.

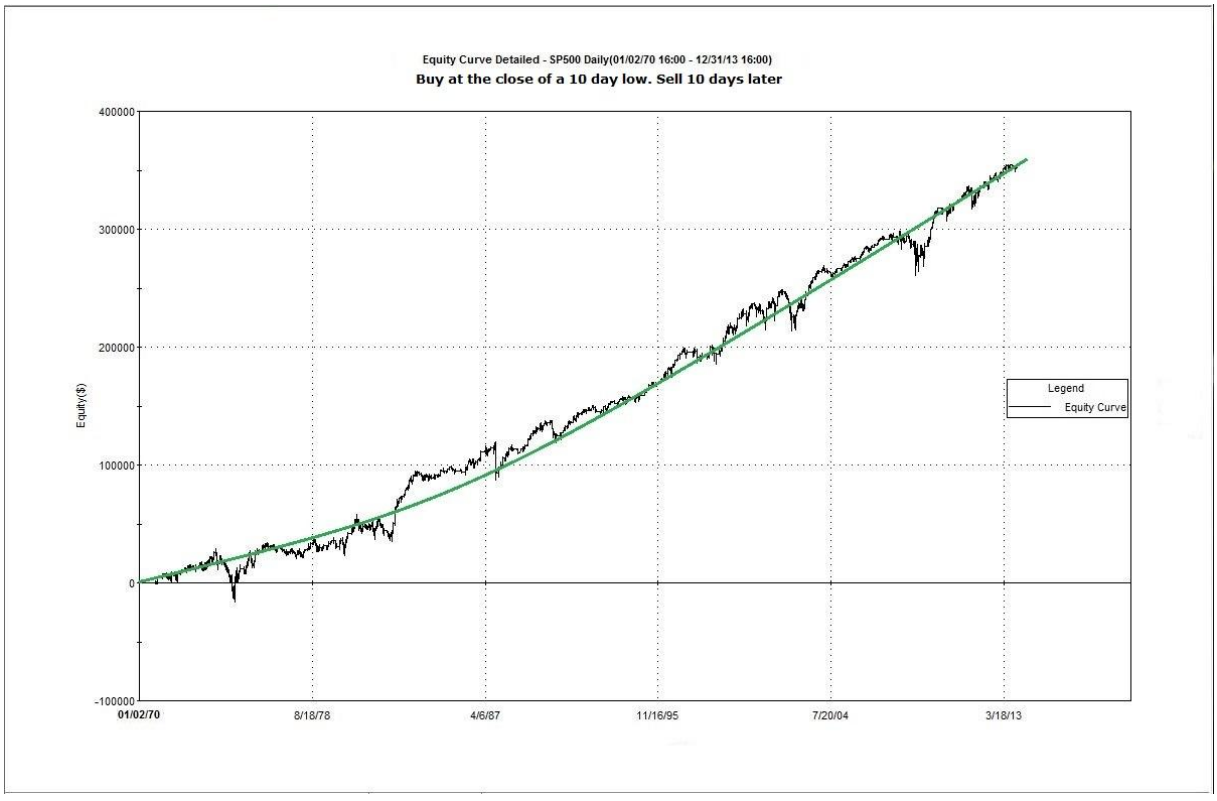
The reality is that some markets respond well to mean-reversion strategies, others don't. There are several possible explanations for this, including the factors that drive the instrument's price (macro vs. micro-economics, news, etc), the number of market participants, the ability to take short positions, the volumes involved and the average volatility of the instrument in question.

It is generally believed that commodity time series respond better to continuation-type systems (trend-following, breakout, etc) than to mean-reversion systems. The same applies to currency pairs, which are generally understood to exhibit both long and short-term trending tendencies. The US stock market index daily time-series, on the other hand, has consistently demonstrated a strong propensity towards mean-reversion. In this paper we will try to determine whether this has always been the case. The focus here will be on *long-side* mean-reversion, that is, on a security's price's tendency to move upwards after an intermediate-term decline.

We will look here at the S&P500 index (^GSPC) from 1970-2013 and apply the following strategy:

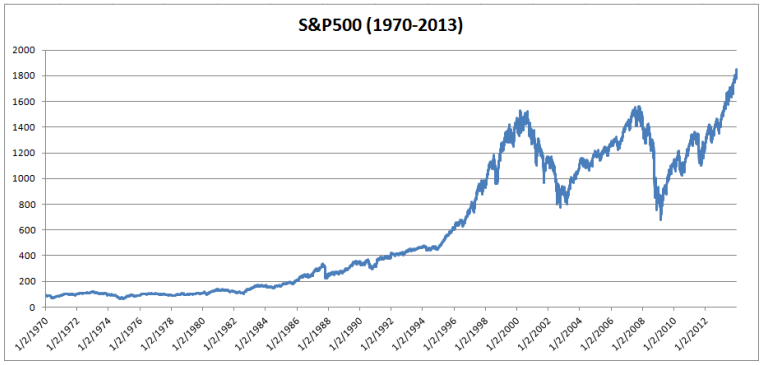
- Buy on the close if the index closes at a 10 day low;
- Sell on the close 10 days later;
- $100,000 per trade, no allowance for commissions or slippage;

Below is the resulting equity curve:



The 60.52% win rate and 1.71 profit factor indicate that, over the past 5 decades, when the index hit a 10 day low, a trader with a long position was generally better off holding his position and exiting 10 days later. But the most remarkable aspect here is the equity curve's regular upward slope. Of course much of this tendency must be assigned to directional bias. The S&P500 went up

in value almost 20 fold over the period, so we would expect the equity curve to show a positive slope. However, the upward slope is still stubbornly present throughout the past two decades that saw wild volatility and extreme draw-downs, as shown in the S&P500 (1970-2013) chart.

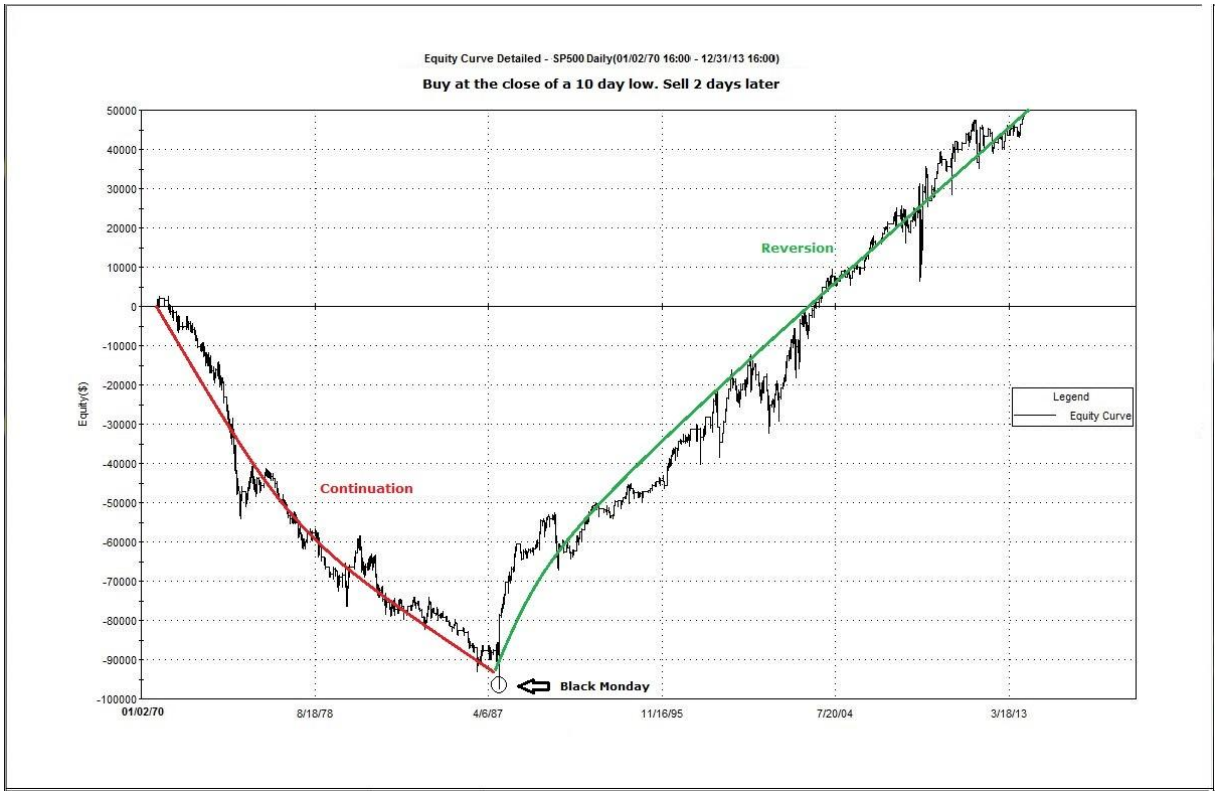


What we must deduce is that, irrespective of market condition, a trader is statistically better off waiting for mean-reversion to resolve a negative price excursion back upwards rather than selling at an intermediate-term low.

But how long *does* it take for mean-reversion to kick in? To answer this question we will apply the same strategy but using a much shorter 2 day holding period, as follows:

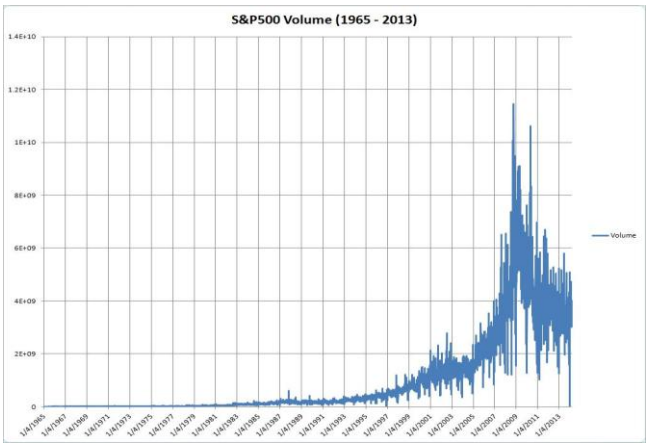
- Buy on the close if the index closes at a 10 day low;
- Sell on the close 2 days later;
- $100,000 per trade, no allowance for commissions or slippage;

The equity curve below shows the results:



We see here is a very different chart. From 1970 to 1987 the S&P500 has shown a strong tendency towards short-term follow-through, or "continuation". More specifically, a 10 day low in the index had a tendency to be followed by further selling, at least in the short term (2 days). From 1987 to date, however, and quite consistently for the past 3 decades, the exact opposite appears to happen: an intermediate-term low in the index is generally followed by a quick bounce, or reversion. And the inflection point of the equity curve occurred on a specific date, Oct 19th 1987, also known as "Black Monday".

There are arguably four main reasons for this fundamental change in the US stock market's short-term profile from trending to mean-reverting. The first lies in the extraordinary rise in the volume



of stock-market transactions over the past 50 years, as reflected in the chart below. Buy-and-hold investing that was the hallmark of most of the 1900s has made way for active investing, short-term trading and hedging. Financial products that were intended as vehicles for investment have become tools for speculation. That is the case for just about every financial instrument available in the electronic marketplace. This added volume has brought about an unprecedented level of liquidity to the marketplace, allowing buyers and sellers to find each other more efficiently, thereby slowing the run-away trains associated with illiquid markets.

The second possible explanation is that until the mid '80s, stop loss orders were usually executed on the day *following* the stop being hit. That is, if a stop-loss level was touched on Monday, the broker would execute the sale at the open on Tuesday morning. These additional sell orders would serve to compound the downward effect, resulting in more stops being hit, and more sell orders being generated on Wednesday morning. The downward spiral would continue until value investors stepped in and confidence was restored. The big change occurred in the mid 1980's with the advent of automated systems that allowed stop losses to be executed *instantly* when hit. The multi-day price-erosion process described above was suddenly compressed, occurring intra-day instead of across several days. That meant that price stability could be reached before the end of the day, allowing value investors to step in the following morning, pushing prices back up towards the mean.

The third likely explanation for the US stock market's short-term mean-reverting tendency is the pervasiveness of short-selling. Short-selling, in its many forms, has been around for a very long time, and was certainly very much alive in the '60s and '70s. But it was only in the 1980s that shorting on electronic platforms became widely available. This rise in the collective power of the shorts has exacerbated the "inverse short-squeeze" effect, which is one of the main ingredients of mean reversion. Essentially, when an instrument's price is falling, short-sellers must buy to cover to take their profits. This buying interest drives prices back up towards the mean. So the greater the short interest, the stronger is the pressure for falling prices to revert back upwards.

Finally, the fourth possible explanation is the advent of strategy-driven automated trading systems and high-frequency traders (HFTs). These have, ironically, brought considerable short-term rationality to the marketplace. Trading systems designed to recognize panic-selling step in to over-sold situations and buy into market over-reactions. This serves to discourage follow-through and favours mean-reversion.

In this paper we have seen that the S&P500 index has exhibited intermediate-term long-side mean-reversion for at least the past half-century. What's more, this tendency has been prevalent in both bullish and bearish periods. We have also seen what appears to be a quickening in the way the market responds to falling prices. Reversion cycles that in the 70's and 80's took several days now occur within a much shorter timeframe.

There certainly seems to be "a before" and "an after" Black Monday. The reality is that we now live in a stock market with a very strong propensity towards short-term mean-reversion, and that traders recognizing this should be able to gain financial reward by using strategies that exploit this edge.