MV Research Insights: The Anatomy of Pullbacks

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Summary Overview

- In risk asset markets the occurrence of a significant pullback is nearly inevitable: sooner or later, the market will give up a sizable chunk of the gains it earns during periods of growth. There is much debate in the investment community about how to manage pullback risk: when to go defensive, and when to stay firm.
- In our view the most important determinant for managing pullback risk is <u>context</u>. Pullbacks have different characteristics during extended growth markets than they do when the market undergoes a periodic reversal. "The Anatomy of Pullbacks" focuses on the key pullback characteristics that manifest differently in growth and reversal market contexts.
- The most telling context, in our view, is the macro market trend. There have been only five macro contexts since 1929: two macro growth environments, and three macro reversals, or gap markets (see Chart 3 on page 5 below). The S&P 500 and other major U.S. indexes broke out of the latest technical reversal in 2013: we are currently either in the early stages of a new macro growth trend, or a false dawn that will at some point revert to the macro reversal. Historical patterns suggest the growth trend, but of course there can be no certainty.
- For core U.S. equities, we define a *cyclical pullback* event as one with a magnitude of 5% or more from the previous peak closing price to the trough close, followed by a recovery of at least 5%. Since 1950 there have been 176 such pullback events on the S&P 500 (i.e., 176 5%-plus pullbacks followed by 176 5%-plus recoveries). These occur within extended *secular bull and bear markets* (using the accepted technical definition of a 20% peak-to-trough reversal to indicate the bear), which in turn are part of the larger *macro growth or reversal context*.
- We measure the impact of pullbacks by their magnitude (how deep), duration (how long), and frequency (how often). Another important measure for understanding the larger context of a pullback is momentum; i.e. where daily closing prices are relative to longer term moving averages of the closing prices.
- Risk in asset markets is asymmetric: downside risk tends to be more concentrated and pronounced than upside risk. Elevations in baseline risk (e.g. as observed from an asset's standard deviation of short term returns or a market proxy like the CBOE VIX index) can provide warning signals about the potential for near-term pullbacks.
- In-depth analysis of pullbacks in prior growth and reversal environments gives us insight about when going defensive can make a real impact on preserving capital, and when it is likely to achieve nothing more than miscalculated timing and lost upside opportunity. Predictive analytical models that evaluate price, risk and momentum signals can help portfolio managers make informed, contextually appropriate decisions.



What Goes Up...

Markets rise, and markets fall. What to do when they fall – when a pullback occurs – is a matter of debate among the investment community. Many believe in doing nothing; they point to the history of long term outperformance by equities over fixed income investments as reason enough to always stay the course. Others note that past performance is not a reliable predictor of future returns. The fact that U.S. equities have been a great investment for the last fifty years does not guarantee the same for the next fifty, let alone for any one individual's investment time horizon or risk appetite.

The view we put forward in this paper is that *context matters* when considering how to manage pullback risk. No two pullbacks are identical; more importantly, they exhibit very different characteristics in the larger context of cyclical, secular and macro growth or reversal trends. We start with a working definition of pullbacks, then look more closely at their characteristics in different market contexts.

Defining Pullback Events

To establish a definition of pullbacks let us consider the recent time period shown in Chart 1 below.



Chart 1: S&P 500, 1/1/12 – 3/5/14

Each arrow indicates either (a) the end of a peak-to-trough cyclical pullback of 5% or more, or (b) the end of a trough-to-peak rally of 5% or greater, based on the daily closing price. We use 5% as a

Source: FactSet, MVF Research



benchmark because it is a significant price movement, and because there is an abundant amount of data. Since 1950 there have been 176 instances when the S&P 500 pulled back by 5% or more from its most recent peak, to be followed by another 176 trough-to-peak recoveries of 5% or more. This compares to just 10 times in the same period when the index experienced a full-blown bear market, defined as a peak-to-trough reversal of 20% or more. Our analysis in this paper focuses on the cyclical pullback events (i.e. the 5%-plus pullback and the subsequent 5%-plus recovery).

Analyzing the Context

Let us look more closely at the four pullback events shown in Chart 1 (i.e., four pullbacks and four rallies). Three measures are particularly important for analyzing the content of pullback events: magnitude, duration and frequency. We want to know how much the market gains or falls (magnitude), how long the events last (duration), and how often they happen over a defined period (frequency).

In Chart 1 the average trough-to-peak gain was 19.5%, and the average uptrend duration was 157 days. By contrast, the pullbacks tended to be briefer and of a lesser magnitude. The average peak-to-trough price decline here was -7.3%, with average duration of 44 days. Basically the market was up much more often than it was down, and gains widely outpaced losses.

What about frequency? There were 176 pullbacks from the beginning of January 1950 to the beginning

Three measures are particularly important for analyzing the context of pullback events: magnitude, duration and frequency. of March 2014, so on average one occurred every 4.3 months. For the period covered by Chart 1 there were four pullbacks over 26 months, or one every 6.5 months (i.e. less often than average). All of these data points suggest that the market context for the two year period to early March 2014 was relatively benign, as indeed it was.

Context and Moving Averages

Another way to analyze the broader market context is to examine the relationship between daily price movements and rolling averages of these prices over defined time intervals. Chart 1 shows the moving averages for 50, 100 and 200 days, as indicated by the blue, crimson and gold lines respectively. There's nothing mysterious about a moving average – each point on the line is just the average of the last however-many days' closing prices. But in practice, moving averages often act as key support or resistance levels for directional market trends.

We will take a closer look at moving averages later in this paper. For now, we can see that in Chart 1 the S&P 500 is above all three moving averages for a large majority of the time. In fact it only breaks the plane of the 200-day moving average twice throughout this period – yet another piece of data to suggest an overall growth context.

Context and Measures of Risk

Pullbacks are manifestations of market risk. For purposes of this discussion we define market risk as the magnitude of deviations (both up and down) of a time series of asset prices around a central tendency. Chart 2 below presents one important characteristic of market risk: the asymmetry between its upside



and downside variants. In this chart we overlay the S&P 500 with the CBOE VIX index, a barometer of market volatility. The time period is the same as for Chart 1.





The striking visual characteristic of this chart is the handful of sharp, brief spikes in the VIX (higher VIX prices connote a heightened risk environment). The spikes lend an element of drama to the chart, but in fact it reflects a period of unusually low market risk for equities. Consider this: in 2013 the VIX closed above 20 only four times, and its average daily close for the entire period shown in Chart 2 was 14.4. Since its inception in 1990, though, the VIX's <u>average</u> daily closing price is 20.2, and it has on occasion closed over 80. When risk did flare up in 2012-13, it was usually in response to an economic or political event – the Fed's "taper talk", fears of a fiscal cliff or debt default for example – and it beat a hasty retreat when a consensus view quickly formed that worst case scenarios would not emerge.

We now take a closer look at the characteristics of pullbacks in different macro market contexts.

The Macro Context

Macro Growth and Reversal (Gap) Markets

By macro context we mean a multi-year period of directional growth or reversal, within which there are shorter periods of secular and cyclical growth and reversal. We consider an asset to be in a macro growth cycle for as long as it can successively establish new nominal high closing prices. When it falls

Source: FactSet, MVF Research



below and is unable to regain the previous high water mark we say that the asset is in a macro reversal trend (at MVF we also use the term "gap market" for a macro reversal trend, as we will explain below).

Since 1929 there have been only five macro trends in U.S. equity markets. Each macro trend has its own "narrative": environmental, political and other circumstances that in hindsight provide some explanatory insights for asset performance trends during that period. Chart 3 below shows the five macro contexts, using the S&P 500 price performance from 1929 to the present and calling out some key narrative themes associated with each.





Source: FactSet, MVF Research

This chart provides a visual backdrop for a more detailed look at pullbacks in the context of the larger macro environment. As we will see, there are important differences to be taken into account when managing risk for equity portfolios. And this is very timely, because as of March 2014 we are technically out of the 2000-13 macro reversal trend...the question is whether we will stay out or fall back.

In order to move out of the 2000-13 macro reversal, the S&P 500 needed to regain both the 1565 record high set in 2007 and the previous high of 1527 set in 2000 (the 2007 high marked the apex of a secular bull market which failed to sustain that level as it slipped into what would become the

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great market crash of 2008-09). In March 2013 it surpassed both levels and has remained above them ever since, setting consecutive record highs.



Macro Context and False Dawns

Of course, we don't know with certainty that it will continue to do so. When a growth trend reverts back below the high point reached in the last growth market we call it a false dawn. There have been several such false dawns, including 2007, 1981 and 1973. Sometimes the false dawns are fleeting; in 2007 just a couple months separated the October record high from the beginning of the 2008-09 bear market. But the 1981 false dawn appeared about two years after the market had, in autumn 1979, gained back its November 1968 high point.

Analyzing the behavior of pullbacks is one way to make informed assumptions about which macro environment we are likely to be in. As we saw in Charts 1 & 2 above, the pullback history has been fairly gentle since the April 22, 2013 surpassing of the prior 2007 high. The evidence suggests a macro growth context, but does not definitively confirm it.

The Macro Growth Context

Let's start with the macro growth context and consider some overall metrics. In the 1953-68 market the S&P 500 had a cumulative price appreciation of 377% from beginning to end. Over that 15 year period there were 27 pullbacks of 5% or more. The average pullback was -9.2%, and the maximum peak-to-trough drawdown was -26.4%. The average pullback lasted just about 50 days, with an average subsequent recovery of 150 days. On three occasions the pullbacks extended into longer term secular bear markets, which subsequently were able to rebound back to and surpass the previous high point.

For the 1982-2000 growth trend (about 18.5 years), the cumulative price appreciation was 1,392%. There were 43 pullbacks with an average level of -8.3% and maximum drawdown of -33.5% (most of which came in a single day, Black Monday 1987). The average pullback lasted 38 days, and the average duration for the subsequent recovery was 111 days. On only two occasions over this 18-year period did the cyclical pullbacks extend into secular bears, and the second of them (during the 1990 recession) just barely grazed the 20% bear threshold before resuming the growth trend.

A Growth Market Snapshot

The time period from 1992-97 provides a useful snapshot of what pullbacks can look like in a growth environment. This period encompasses the recovery from the 1990-91 recession, a couple brief pullbacks in 1992 (British currency crisis) and 1994 (surprise Fed interest rate hike), the first wave of the Internet boom following the 1995 Netscape IPO, and a pullback with higher volatility when the Asian currency crisis broke out it 1997.

Chart 4 below shows the S&P 500 and CBOE VIX for this period.





Here again we see the characteristic spikes of the VIX flare up occasionally from a mostly subdued baseline risk level. The pullbacks that accompanied those flare-ups have the growth market characteristics of being brief, mostly shallow, and resulting either from exogenous factors (e.g. overseas currency crises) or from unrealized economic fears (e.g. the 1996 recession that wasn't).

One interesting observation in Chart 4 is that, even as baseline risk levels increased in the second half of 1996 and through all of 1997, the growth trend accelerated. This underscores the fact that, in asset markets, not all risk is bad. 1997 was a year full of "global macro" event risk, most notably a protracted currency crisis centered in emerging Asian economies. The steady increase in baseline risk (the VIX touched a high of 30 off the 11-15 lows seen in early 1996) reflects market fears of those crises blowing up into something much worse; the steep growth trajectory of the S&P 500 reflects the growing consensus that the worst outcome would not play out.

Long Ups, Short Downs

Chart 5 below uses a bubble chart format to compare the magnitude, duration and frequency of the pullbacks and ensuing recoveries over the '92-'97 period. Here's how to read the bubble chart: the Y-axis represents the magnitude of each peak-to-trough or trough-to-peak return. The X-axis shows where the closing price was, at the peak or trough point, relative to its 200 day moving average (remember that the 200 day average tends to act as a key support or resistance level). The bubble size represents the event duration.

Source: FactSet, MVF Research

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Chart 5: S&P 500 Pullback and Recovery Events, 1992-97

Source: Standard & Poor's, FactSet, MVF Research

The relatively large size of the recovery bubbles (green) compared to the pullback bubbles (red) reinforces the fact that, in a macro growth context, the market can continue rising for a very long time without pulling back by 5% or more. The longest such rally of this stretch of time ran for 533 days, from December 1994 to May 1996, with a 52.3% trough-to-peak gain. The pullback that followed, by contrast, lasted only 61 days and took just 7.6% off the gains of the previous rally.

Managing Risk in a Macro Growth Environment

Looking at the relative size of the bubbles in Chart 5 above, it would seem that during a growth market environment the important thing to do is to stay fully invested during those long rallies, and not worry

During a growth market environment it is generally more advantageous to stay invested during the long rallies – not to worry as much about turning defensive when a pullback occurs. as much about turning defensive when a pullback occurs. The 7.6% pullback that followed the 1994-96 rally was succeeded in turn by another 209 days of barely interrupted upward momentum, which added another 30.3% to the earlier 52% trough-to-peak gain. Trying to engineer a defensive move out of equities during the pullback would have required exquisite timing, very little room for error,



and very little actual benefit.

Chart 6 below shows in more detail just how difficult this defensive maneuvering would have been. This is a close-up of daily activity in the S&P 500 before, during and after the 61-day, -7.6% pullback from May to July 1996. The green series denotes the daily close (horizontal tick) and intraday high and low for the S&P 500. The two solid blue lines are Bollinger bands, which depict 2x the standard deviation of the trailing 20 days' closing price average (which in turn is represented by the dotted blue line).



Chart 6: S&P 500 Price & Volatility Trends, 5/1/96 – 10/1/96

Source: FactSet, MVF Research

Although the 533-day rally hit a peak close on May 22, price levels didn't exhibit any really unusual activity until July; there was nothing much in the way of a market signal alert. Then, on July 5, the index dropped by more than 2%, just breaking through the lower Bollinger band. In market signal terms that would count as an alert. But signal algorithms crunch data about past patterns, and historically a one-day fall of 2% is actually somewhat more likely to be followed by a rebound or a flat corridor than by a sequential drawdown. An aggressive intraday strategy might act on this, but near-intermediate term models most likely would not.

The S&P 500 then gave up another 4.7% to its bottom on July 24. On that day the index hit an intraday low of 605 before rallying 3.5% to close at 628 – a fairly strong buy signal. Again, though, your reward for acting on the 7/5 sell signal and then on the 7/24 buy signal (assuming that you could have ignored other false positives during and after that time) was the 4.7% difference between those two closing prices. In the context of the 83.3% cumulative price gain from December 1994 to February 1997, when



the S&P 500 reached its next peak from the 7/24/96 trough, 4.7% seems like a pretty meager reward for the risk of making the wrong call and missing part of the next rally.

The problem, of course, is that only in hindsight do we know how the market performed during that 1994-97 run. In the thick of the July 1996 pullback there was no crystal ball to say that things wouldn't go further south than they did. Sometimes markets pull back by 5-10% and then keep going down. That's when risk management takes center stage. Since there are no public service announcements to the effect of "beware the certain downturn that lies ahead", our risk management systems need to be switched on even when, as in the 1994-97 environment, they may not be particularly needed. They need to be on the alert for when macro growth changes to macro reversal.

The Macro Reversal Context

We use the term "gap market" synonymously with macro reversal contexts. Chart 7 below illustrates why this seems an apt phrase. As you will recall from Chart 3 above, the long term trend for U.S. equities has been steady growth, but with interim periods of no growth. These interim periods – the reversal trends – are essentially *time gaps* in an otherwise growth trajectory. Hence, the term gap market.



Source: FactSet, MVF Research

This chart shows that the most recent gap market lasted 13 years, from the height of the technology boom in early 2000 through two recessions, a financial meltdown and subsequent Fed-engineered asset price recovery. Of course, there is no guarantee that the gap market is over for once and all; it could plausibly fall There are no public service announcements warning of the downturn ahead; risk management systems should be switched on even when they may not be needed.

back below the March 2013 levels where it surpassed previous all-time highs. For now, however, we can



study the 2000-13 period to observe the distinct characteristics of pullbacks in a gap environment, and the role of risk management in such environments.

As we saw from the close-up focus on the 1994-97 period, pullbacks in a macro growth context tend to be relatively benign, with investors' time better spent on selective buying opportunities at somewhat more attractive valuations than on overly defensive risk management. The calculus in a gap market is decidedly different. In Chart 8, below, we see the same bubble chart we provided above for the 1992-97 period, this time for the three years from January 2000 – December 2002.



Chart 8: S&P 500 Pullback and Recovery Events, 2000-02

Source: Standard & Poor's, FactSet, MVF Research

These cyclical pullbacks took place in the context of a secular bear market which gave up -49.2% from peak to trough. Several things immediately jump out when comparing this chart to the 1992-97 example on page 8. First of all the red bubbles (drawdowns) extend farther down the y-axis, meaning *deeper* pullbacks. There were eight pullbacks with a magnitude of -10% or more during this period, four of which exceeded -15%. The average drawdown was-11.7%, compared to -7.5% for the 1992-97 growth period. They also extend farther along the left side of the x-axis, indicating that for much of this time the S&P 500 was below its 200-day moving average.



Volatile pullback and recovery events happen <u>more often</u> in macro reversal (gap market) environments. The pullbacks also account for a larger percentage of the total time measured and tend to be substantially deeper than pullbacks in a macro growth environment. Second, there is closer parity between the size (i.e. duration) of the red bubbles and green bubbles than for the 1992-97 period. Interestingly, the average duration for each pullback event is actually higher for the 1992-97 period (48 days) than for the 2000-02 period (35 days). But the real question here is not individual event duration as much as period duration.

During these three calendar years 33 peak-to-trough or trough-to-peak events occurred. By contrast, the six

year period from the beginning of 1992 to the end of 1997 witnessed only 16 such events. In a macro reversal environment these volatile pullback and recovery events happen *more often*, and the pullback events account for a *larger percentage of the total time*. For the 2000-02 period the S&P 500 was in pullback mode for a full 54.7% of the total number of calendar days in the period. It was much lower – 17.8% - over the six years from Jan '92 – Dec '97.

Managing Risk in a Macro Gap Environment

In the 1992-97 growth market example we studied, the benefits of aggressive defensive action seemed minimal relative to the gains earned by simply staying in the market. A reversal context changes the calculus, as Chart 9 below illustrates.





Source: FactSet, MVF Research



Chart 9 provides useful insight into the gradual evolution of a protracted downtrend. Bear in mind that the S&P 500 reached an all-time high in late March 2000 (seen here as the uppermost high-low-close bar). Just three weeks later the index plunged, recording a -11.2% pullback from March 24 to April 14. That event put the index below its 200-day moving average; however, by the next week prices had rebounded and settled above both the 200-day and 100-day moving average support levels.

Interpreting Moving Averages

There is nothing mystical about these moving averages; they act as support and resistance levels largely because lots of model-driven trading platforms set buy and sell triggers off them. Chart 9 shows how the relationship between the daily price close and the moving averages changes as a pullback moves into a macro reversal environment. From March to August 2000 there were four 5%-plus pullback events; each time, however, the market rebounded after briefly falling below the 100- or200-day moving average. The heightened volatility (indicated by the wide intraday high-low range) was a warning signal, but – even with that 11% March-April pullback – not a clear sign that a prolonged reversal was at hand.

That indication came in September 2000, when the S&P 500 fell below the 200-day moving average support level and failed to break back above either the 100- or the 200-day moving average, while trending through a succession of lower lows as autumn proceeded. From an intermediate peak on September 1, the S&P 500 experienced three double digit pullbacks through March 2001, each followed by a more modest single digit trough-to-peak recovery. All told, the index lost -26.8% from the March 24, 2000 high to the March 22, 2001 low. That is what constitutes meaningful damage to invested capital – and in this case there would be two more down years before the market reached the bottom of this secular bear phase of the macro gap context.

Putting It Together: Predictive Analytics and All-Market Risk Management

In this paper we have seen that asset market pullbacks have distinct characteristics in macro growth and macro gap (prolonged downturn) environments. These differences call out for different applications of risk management: less defensiveness during growth markets, with opportunistic buying, and more aggressive hedging of long positions during gap environments.

The problem is that we often don't know with certainty which environment we are in. Within any extended growth environment there will be reversals, and with those reversals uncertainty about future directional trends. Buying on the dip was a good idea for most of the 1990s, but anyone who extended that approach into the first three months of 2000 paid a hefty price.

Predictive Analytics

In this paper we have examined some of the market signals that provide clues about near- to midterm trends. These kinds of signals can be brought together in models that use predictive analytics calibrated to react defensively to high-probability threats to invested capital, while resisting the temptation to run away every time the market experiences a cyclical pullback.

The point of predictive analytics is not to bet on a directional trend ahead of time. The objective is to let current market signals give you probabilistic guidance as to where you may be in the course of a



directional trend, given historical patterns. Past performance does not tell you what is going to happen, or whether the U.S. stock market's trajectory for the next 75 years – from 2014 to 2089 – will in any way resemble the steady growth trajectory for the 75 years from 1939 – 2014. But predictive signals give you objective data from the market in place of cognitive decision-making under the emotional influence of fear and greed.

Volatility is a key predictive signal. The CBOE VIX index provides a useful indicator of market sentiment, most notably in the form of those periodic spikes when unexpected X-factors bring about a sudden (if often brief) pullback. It can also be useful to measure VIX movements relative to other volatility indicators, like the standard deviation around short-term asset returns. Chart 10 below shows such a comparisons:



Chart 10: S&P 500 Standard Deviation & CBOE VIX, 1/1

Source: FactSet, MVF Research

While both of these risk measures tend to correlate fairly highly – they both reflect market volatility after all – they don't always correspond to each other. For example, one can see that, in February - March 2014, (the rightmost part of each chart) the VIX spikes up briefly and then falls back again, while the 30-day standard deviation of the S&P 500 remains elevated. That could mean that risk levels are still elevated even if market sentiment (the "fear gauge") has returned to a calmer state.

Price trends relative to long term moving averages present another opportunity for letting the market inform us as to what is going on, rather than trying to guess what the effect of some new economic data point or geopolitical X-factor will be on near-term S&P 500 price trends. Recall (from Chart 9 above) that the evolution of the 2000-02 environment showed the index repeatedly bouncing off its 100- and 200-day moving average support levels after the first significant pullback in March-April, only to finally break through and stay below these levels by the time fall arrived, and for a long time henceforth.

As noted elsewhere in this paper, there is nothing magical about these moving averages. It is arguably a case of "perception becomes reality": because so many trading models trigger buying and selling activity



off the moving averages, they become important. As Chart 11 below shows, the S&P 500 has spent a prolonged period of time below its 200-day moving average on only a small number of occasions.



Chart 11: S&P 500, January 1980 – March 2014

Source: FactSet, MVF Research

Again, this does not mean that every time the index falls below the 200-day moving average it is time to flee the market into cash or bonds. There are plenty of false positives, when the moving average acts as a support level (or, as we saw in the 2000-02 example earlier in this paper, an upside resistance level). It means that, taken with other price, volatility and

The use of predictive analytics is to <u>let the data inform us</u>, rather than making emotional decisions based on cognitive guesswork.

momentum signals, it can provide a composite set of probabilities around market direction and thus a more disciplined, data-driven decision point as to what action is advisable.

Conclusions

There is no way to predict with certainty what the market will do in the case of any individual pullback, or which ones will extend into secular bear markets or macro reversal contexts. Even the most complex, rigorous quantitative models are only as good as the historical data patterns they analyze and reveal. Those patterns may play out completely differently the next time around. The use of predictive analytics is to let the data inform us, rather than having us make decisions based on mere guesswork.



MVF Research Team

Masood Vojdani, President Katrina Lamb, CFA, Head of Investment Strategy & Research Courtney Martin, Investment & Research Analyst

Blake Chasen, Research Intern, contributed to this paper

MV Financial 4520 East West Highway, Suite 300 Bethesda, MD 20814 (301) 656-6545 <u>info@mvfinancial.com</u> www.mvfinancial.com

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