

Smart Beta and the Pendulum of Mispricing by Vitali Kalesnik, Ph.D.

Stock price movements aren't as smooth and steady as a pendulum's arc, but they both exhibit a process of long-run mean reversion. Highs and lows are temporary; prices tend to return to more average levels. Vitali Kalesnik reviews empirical findings on mean reversion in stock prices, discusses its links with the value and small size premia, and considers why arbitrage doesn't curtail the process. Through rebalancing, he says, Smart Beta can profit from mean reversion.

The Research Affiliates approach to equity investment management is based upon the insight that stock prices are "noisy" and "mean-reverting."

- *Noisy.* Calling prices "noisy" means acknowledging that they contain errors. The market overvalues some stocks and undervalues others. Investors who buy and sell stocks irrationally or erratically are known as "noise traders."
- *Mean-reverting.* "Mean reversion" means that stocks whose prices have been trending upward or downward will, at some point, reverse direction and head back toward their average values.

But there's much more to it than that. After presenting an intuitive explanation of mean reversion and reviewing the empirical evidence for it, I will consider why mispricing isn't quickly arbitrated away and discuss how long-term investors can structure portfolios to benefit from mean reversion.

What is Mean Reversion?

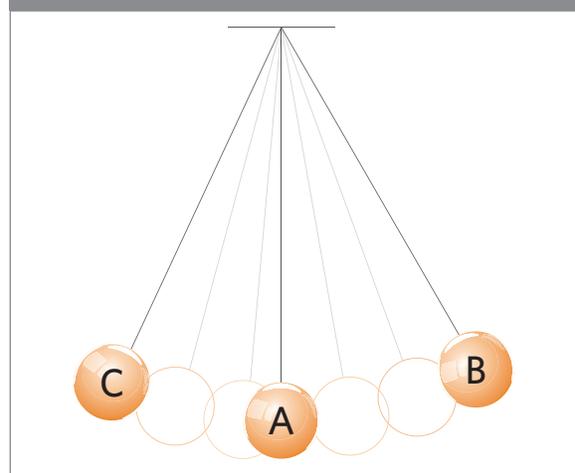
Let us use the analogy of a pendulum—a real one, not a mathematical model—to illustrate the basic concepts of mean reversion. The pendulum consists of a weight, or bob, suspended from a pivot. In **Figure 1**, the bob is moved from point A to point B and released. It will swing back past point A to point C, and it will continue swinging back and forth until it eventually slows down and comes to rest again at the equilibrium point A. While the bob has speed, its momentum is the best indicator of where it will be moving in the immediate future. Because A represents

the bob's average position, it is the place where we are most likely to find the bob in the long run. The shorter and shorter swings of the bob constitute the process of reverting to the mean.

A pendulum is, of course, governed by Newtonian mechanics and has few irregularities. In contrast, the process of mean reversion in financial markets is neither deterministic nor smooth. Nonetheless, the pendulum analogy expresses key characteristics of stock price movements.

In the short run the most recent price movements are predictive of where the price will continue in the immediate future—this is known as momentum in prices. Long run mean reversion implies that high or low prices are temporary; over time, prices tend to return to their more average levels. It also means that if prices were

Figure 1: Pendulum Illustrating Reversion to the Mean



Source: Research Affiliates, LLC.

moving in one direction in the past, they are likely to move in the opposite direction in the future. Moreover, the greater the swing in one direction, the stronger is the reverse movement.

Both Individual Stocks and the Stock Market in General Exhibit Mean Reversion

Empirical studies show that stock returns are not completely random. In a classic study of overreaction in financial markets, Werner De Bondt and Richard Thaler (1985) assigned stocks to “winner” portfolios and “loser” portfolios on the basis of their cumulative excess returns over the previous three years (i.e., the difference between the cumulative 36-month return of the individual stock and that of the market as a whole). They then traced the performance of the winner and loser portfolios for the subsequent three years. Using CRSP prices for the period between January 1926 and December 1982, De Bondt and Thaler employed this procedure to construct winner and loser portfolios for 16 non-overlapping measurement periods. On average, 36 months after portfolio formation, the loser portfolios outperformed the market by 19.6%, while the winner portfolios underperformed the market by about 5.0%. The difference in cumulative average residual was 24.6%. **Figure 2** shows the portfolios’ paths to these striking results.

The shape of the curve on Figure 2 gives us a rich description of the data. In the first month after the portfolio formation there is a very strong mean reversion. This is

known as short term mean reversion. Then for a horizon up to a year the winner stocks actually tend to slightly outperform the loser stocks. Just as there is momentum in a pendulum, there is intermediate term momentum in prices. Beyond the horizon of one year the winner stocks tend to underperform, while the loser stocks tend to outperform. This is known as long-term mean reversion. Even though the De Bondt and Thaler chart stops three years after portfolio formation, long term mean reversion can be detected for as many as 10 years from the starting point.

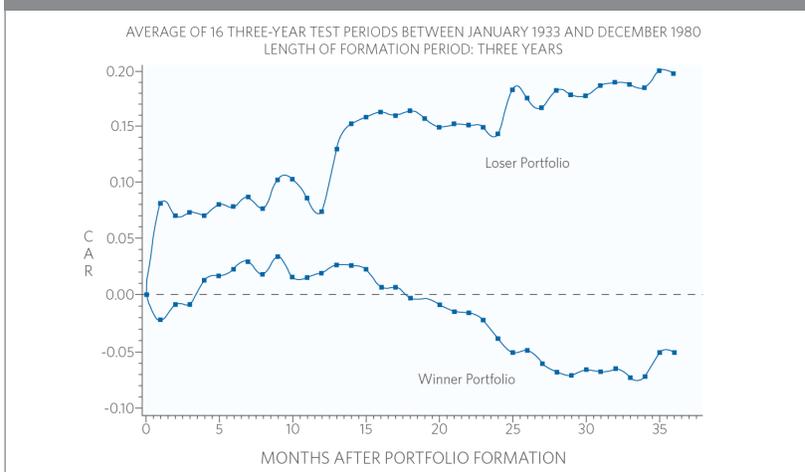
One potential explanation for the superior performance of extreme loser stocks is that they are riskier. However, De Bondt and Thaler report that the average market betas of the securities in the winner portfolios (1.369) are significantly larger than the betas of the loser portfolios (1.026). “Thus,” the authors write, “the loser portfolios not only outperform the winner portfolios; if the CAPM is correct, they are also significantly less risky.” The traditional risk-based model does not explain the difference in return between “winner” and “loser” portfolios.

De Bondt and Thaler suggested an alternative, non-risk based explanation. Market participants might have overreacted to several years of subpar performance by the loser stocks, and underpriced them. Market participants also overreacted to several years of extraordinary performance on the part of the winner stocks, and overpriced them. Eventually the market discovers this

mispricing, and the undervalued “losers” surprise their holders with superior performance. The overvalued “winners,” of course, produce disappointing results as their prices are corrected.

In addition, numerous articles demonstrate that not only individual stocks but the stock market in general is subject to mean reversion. Among others Fama and French (1988) and Poterba and Summer (1988) present evidence that stocks mean-revert on the horizon up to five

Figure 2: Cumulative Performance of Winner and Loser Portfolios



Source: Research Affiliates, LLC, based on De Bondt and Thaler (1985).

years. Furthermore, high valuation multiples such as aggregate book-to-market or earnings-to-price ratios, which signal low current prices, have been found to forecast high subsequent stock market returns. (See Campbell and Shiller [1988], among others).

Mean Reversion is Related to the Value and Small Size Effects

The mean reversion effect stands in an interesting relationship with the value and small size premia. All three reflect the fact that low-price stocks tend to outperform high-price stocks. Value stocks have relatively low price-to-fundamentals ratios. For example, as of July 31, the price-to-earnings multiple of the Russell 1000® Value Index (15.02) was 26% lower than that of the Russell 1000 Growth Index (20.3). And small stocks have lower market capitalizations. (Market capitalization is also a measure that reflects a company's stock price.) At the end of July 2013, the median market capitalization of the Russell 1000 was U.S. \$6.762 billion, while the median market capitalization of stocks held in the Russell 3000® Index was U.S. \$0.642 billion.¹ Some companies are in the Russell 1000 because they are large companies; some companies are in Russell 1000 because they are high price companies. In the case of mean reversion, the "losers," the stocks which recently went down in price, are the outperforming stocks. A study by Arnott, Hsu, Liu, and Markowitz (2011) shows that a mispricing component in prices which the market eventually corrects can fully account for the mean reversion, value, and size effects observed in the data.²

Mispricing is similar to a pendulum's weight moving away from the resting position. The farther the distance, the stronger the gravitational pull. The degree to which stocks are mispriced can vary over time, and when there is more mispricing there are greater opportunities for generating profits. Asness, Friedman, Krail, and Liew (2000) demonstrated that an estimate of the degree of aggregate mispricing can be used to forecast the value premium. The measures

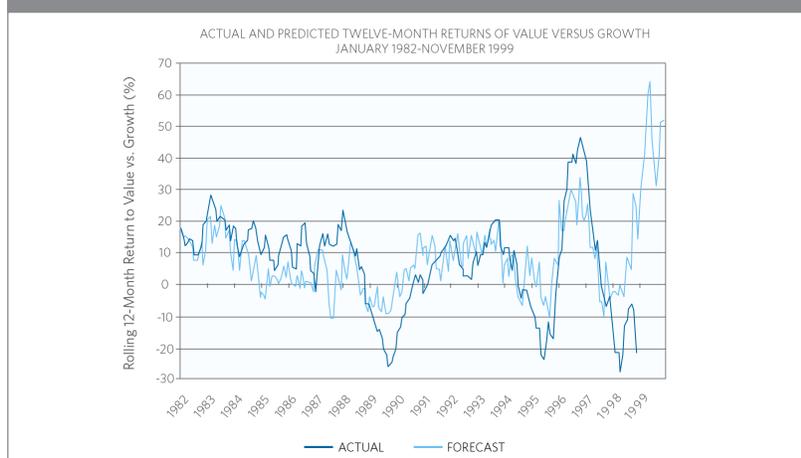
they chose were the spread in valuation multiples between a value portfolio and a growth portfolio (the value spread) and the spread in expected earnings growth between a growth portfolio and a value portfolio (the earnings growth spread). The authors found that both measures are significant determinants of the difference in expected returns between value and growth strategies.

Figure 3 plots the forecasted and realized differences between value and growth returns as reported in Asness et al. (2000). The pale blue line shows the forecast implied by the relative cheapness of stocks with low valuations. It operates on something like the pendulum principle: the higher it goes, the higher will be the value strategy's subsequent outperformance (the dark blue line). Interestingly, the paper appeared at the height of the tech bubble, and the last point on the chart was forecasting a very high value premium. This prediction came true when the tech bubble burst in 2001.

Why Doesn't Arbitrage Eliminate the Profit Potential?

According to textbook finance, if noise traders introduce mispricing, then arbitrageurs can be expected to enter profitable trades that will soon drive prices close to fundamental values. However, in a 1997 study called "Limits to Arbitrage," Shleifer and Vishny (1997) explain why asset managers may be unable to exploit mispricing. There is a quote attributed to John Maynard Keynes: "Markets can remain irrational a lot longer than you and I can remain solvent." Shleifer and Vishny formalized this idea in their paper.

Figure 3: Predicted and Actual Value-Growth Return Differences



Source: Research Affiliates, LLC, based on Asness, Friedman, Krail and Liew (2000).

In financial theory, arbitrageurs require no capital and bear no risk. Shleifer and Vishny assume, much more realistically, that arbitrageurs operate with investors' capital. "The fundamental feature of such arbitrage," they write, "is that brains and resources are separated by an agency relationship."³

Reduced to the essentials, engaging in arbitrage means buying cheap (i.e., undervalued) assets and selling similar assets that are expensive (overvalued). However, the market may continue to misprice the cheap asset that the arbitrageur holds. Indeed, the gap between the asset's market price and its fundamental value may proceed to widen. In this case, the expected value of the trade is rising but, in the interim, the arbitrageur is sustaining losses. The investors, who may or may not understand what the arbitrageur is doing, will surely see that he or she is losing their money. They may then engage in what Shleifer and Vishny call "performance-based arbitrage," withdrawing their capital from the losing manager and placing it with someone who appears to be more competent.

Current institutional arrangements in the asset management industry make it possible for mispricing to persist for prolonged periods. The long-term mean reversion that we observe is the consequence of this tenacious mispricing. Shleifer and Vishny help us understand the paradox, if not relish the irony: as the opportunities to profit from mispricing increase, traditional asset managers become more constrained and less capable of taking advantage of them.

The outcome described by Asness and his co-authors constitutes an empirical validation of this paradoxical conclusion. The dot-com bubble is a prime example of persistent and increasing mispricing. As tech stocks continued to outperform the market for years on end, it became harder and harder for managers to adopt a contrarian stance and trade against them. The fear of losing clients (and the assets under management on which investment advisory fees are based) prevents managers from taking advantage of mispricing. Although long-term portfolio returns are bound to suffer, the managers' behavior is quite rational.⁴

Why Does—or *Should*—Mean Reversion Matter to Long-Term Investors?

We saw above that, due to the process of mean reversion, winner stocks become losers, and losers, winners. Contrarian investment strategies create opportunities for investors who have the courage to sustain interim losses and the discipline to rebalance even—or especially—when mispricing increases.

It is exceedingly difficult for investors and managers alike to hold fast when the market continues to move against them. One potential solution is to strip contrarian investing of its emotional component by committing long-term assets to a transparent algorithmic rebalancing strategy. Smart Beta strategies—a recent innovation in financial management—are transparent, non-price weighted solutions. Transparency and dispassionate rebalancing rules help significantly mitigate the agency problems facing regular managers.

Chow, Hsu, Kalesnik, and Little (2011) and Arnott, Hsu, Kalesnik, and Tindall (2013) showed that Smart Beta strategies consistently trade against price movements. This contra-trading allows them to capture the opportunities presented by mispricing. The authors demonstrate that long term mean reversion in the form of value and size premia explains the majority of the Smart Beta value added.

The intent of Smart Beta investing is to profit from mean reversion; accordingly, the best strategies would be the ones which have high capacity and do not trade too frequently. (Recall that rebalancing too often raises turnover costs and risks trading against momentum.) If stock prices are noisy and mean-reverting, as we firmly maintain, then fundamentals-weighted indexing—a rules-based Smart Beta strategy which sells winners and buys losers—seems very sensible. Tying weights to accounting measures of company size creates capacity; choosing to rebalance annually, rather than more often, controls turnover; and "buy low/sell high" is truly a sound investment principle.

Endnotes

1. Russell Investments is the source of the P/E and median market cap figures cited here.
2. See also Arnott and Hsu (2008).
3. Shleifer and Vishny (1997), 36.
4. The managers' failure to buy losers and sell winners may be described as rational because the fear of losing clients before portfolio gains materialize is, itself, entirely reasonable. For recent evidence that mutual fund investors withdraw funds from underperforming managers, see Cashman, Deli, Nardari, and Villupuram (2012).

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