Ulcer Index

An Alternative Approach to the Measurement of Investment Risk & Risk-Adjusted Performance

What is Ulcer Index?

Ulcer Index (UI) is a method for measuring investment risk that addresses the real concerns of investors, unlike the widely used standard deviation of return (SD). Using UI instead of SD can lead to very different conclusions about investment risk and risk-adjusted return, especially when evaluating strategies that seek to avoid major declines in portfolio value (market timing, dynamic asset allocation, hedge funds, etc.).

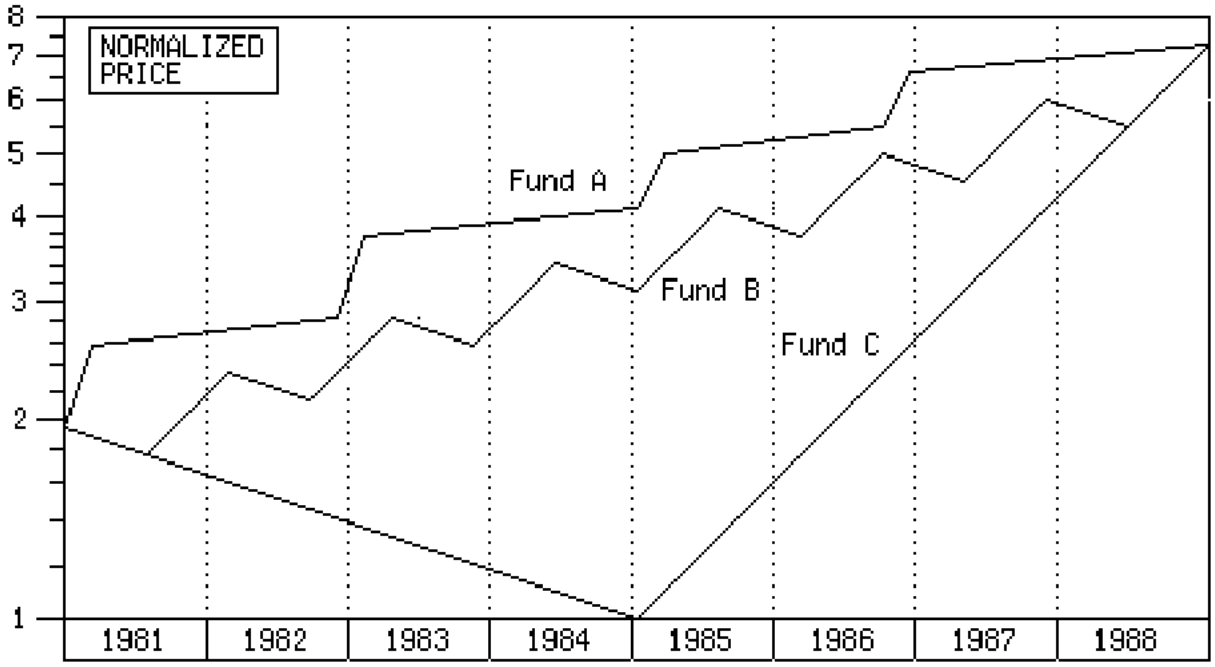
The Ulcer Index was originally developed by the author of this page in 1987. Since then, it has been widely recognized by the investment community. The Index was first described in *The Investor's Guide to Fidelity Funds: Winning Strategies for Mutual Fund Investors*, by Peter Martin & Byron McCann. Originally published by John Wiley & Sons in 1989, this out-of-print book is available as a free download in PDF format.

There have been instances of the term "Ulcer Index" being used for risk measures that do not strictly follow the details described here. This document explains the correct use of the concept.

What's Wrong with Standard Deviation of Return?

Standard deviation is a statistical measure of the variability or unpredictability of an investment's return. It suffers from a number of serious drawbacks:

- Both upward and downward changes in value add to the calculated SD. Real investors associate risk only with the downside. Rising prices create profits, not risk.
- The calculated value of SD is not affected by the sequences in which gains and losses occur. Thus, SD does not recognize the strings of losses that result in significant drawdowns in value. The three hypothetical investments in the chart below have the same annualized return and the same SD, but no rational investor would consider them as having the same risk.



- When SD is used to measure the risk of a market timing strategy, it will tell you roughly how often you were out of the market, but *nothing* about whether you were out at the right times. SD doesn't tell you if your strategy reduced risk by avoiding market downturns.

- The calculated value of SD depends on the time period used. For typical investments, the SD of annual return is roughly 7.2 times the SD of weekly return (7.2 is the square root of 52 weeks per year). Since the time period is often unstated, this creates an opportunity for misunderstandings.

As a result of these weaknesses, SD does not reward an investment strategy for avoiding market downturns. Using Ulcer Index as a risk measure avoids all of these problems.

What About Other Risk Measures?

Other established risk measures have weaknesses too. For example:

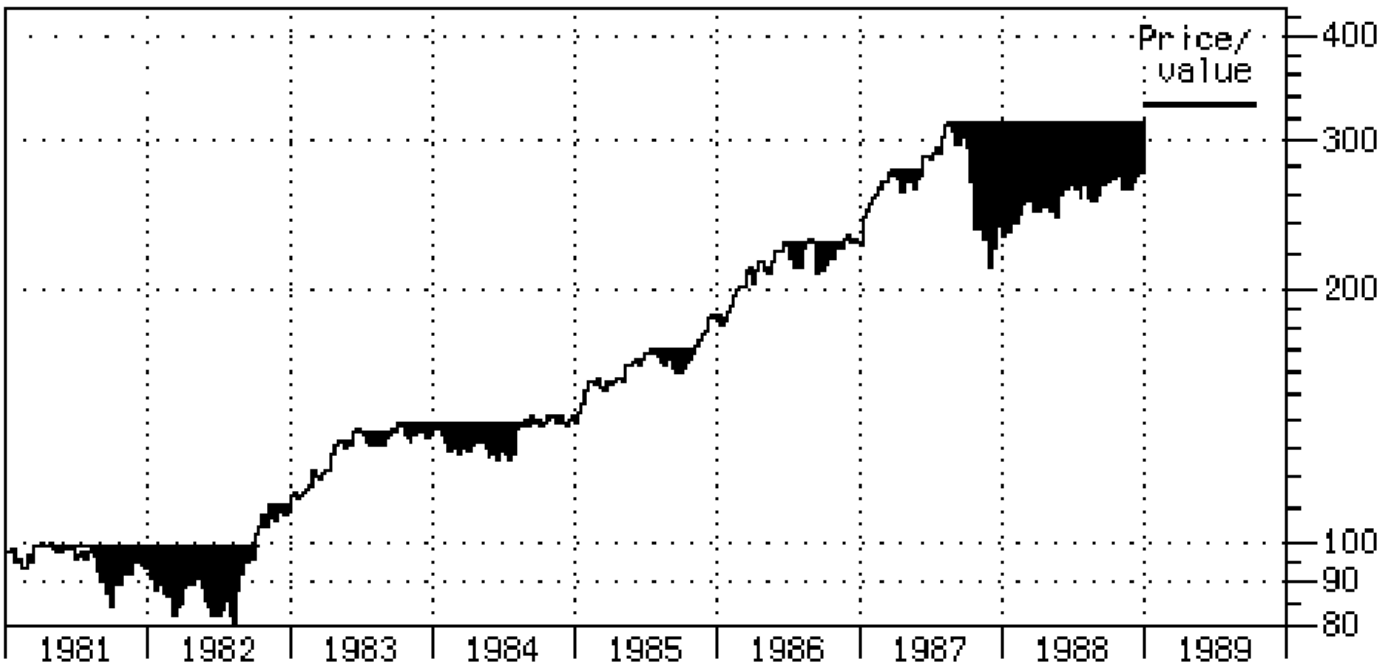
- Some are based on the single worst event over a time period, which by definition has no statistical significance (e.g. Worst Trade and Maximum Drawdown).
- Some are based on absolute rather than percentage price changes, which distorts results over long time periods (e.g. Average Maximum Retracement).
- Some cannot be used to compare investment alternatives (e.g. Percentage Losing Trades cannot be used to compare a market timing strategy with a buy-and-hold approach, because the latter has no trades).
- Some share some or all of the problems of standard deviation (e.g. Beta).

What Does Ulcer Index Measure?

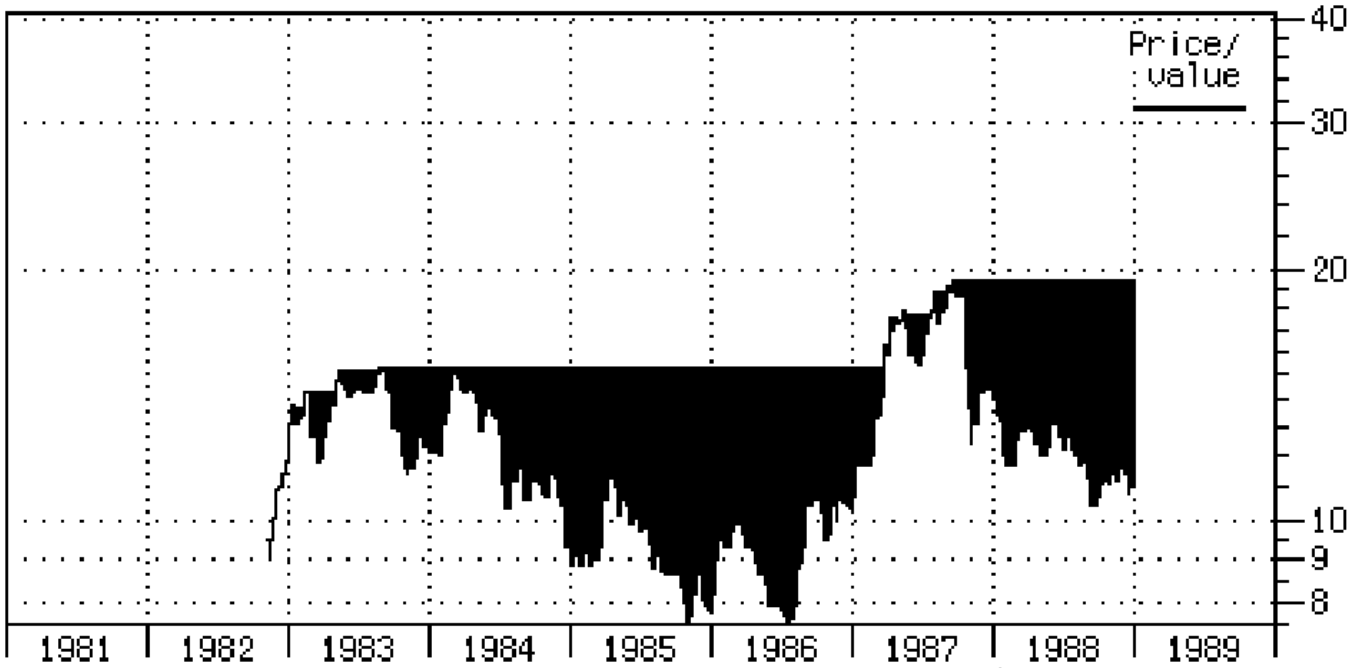
Ulcer Index measures the depth and duration of drawdowns in portfolio value from earlier highs. Technically, it is the square root of the mean of the squared percentage drops in value. The greater a drawdown in value, and the longer it takes to recover to earlier highs, the higher the

UI. The squaring effect penalizes large drawdowns proportionately more than small drawdowns.

In effect, UI measures the "average" drawdowns in value from earlier highs, as represented by the dark regions in the charts below:



Drawdowns in value: S&P 500 index with dividends reinvested



Drawdowns in value: Fidelity Select Precious Metals & Minerals fund

The algorithm for computing UI is simple, and can be seen in the pseudo-code fragment below:

```
SumSq = 0;
MaxValue = 0;
for T = 1 to NumOfPeriods do
    if Value[T] > MaxValue then MaxValue = Value[T]
    else SumSq = SumSq + sqr(100 * ((Value[T] / MaxValue)
    - 1));
UI = sqrt(SumSq / NumOfPeriods);
```

Unlike SD, the calculated value of UI is essentially the same regardless of the time interval per data point. Weekly price data is a good compromise, but daily data can be used as well. As the interval is extended beyond a week, there is an increasing danger of missing significant intra-period retracement-and-recovery events. The use of quarterly or longer intervals is strongly discouraged for this reason.

Measuring Investment Performance

A popular method for measuring investment "performance" is to divide the excess return of an investment by its risk. (Excess return is total return minus risk-free return). This provides a single number that accounts for both return and risk. It reports the additional return achieved (over the risk-free rate), per unit of risk assumed. Traditionally the Sharpe Ratio is used, where risk is again represented by standard deviation of return:

```
Sharpe Ratio = (Total return - Risk-free return) / SD
```

Just as SD is a poor risk measure, so is this formula a poor performance measure. This problem is solved by simply replacing SD with UI. This new performance measure has been dubbed the "Martin Ratio" or "Ulcer Performance Index" (UPI).

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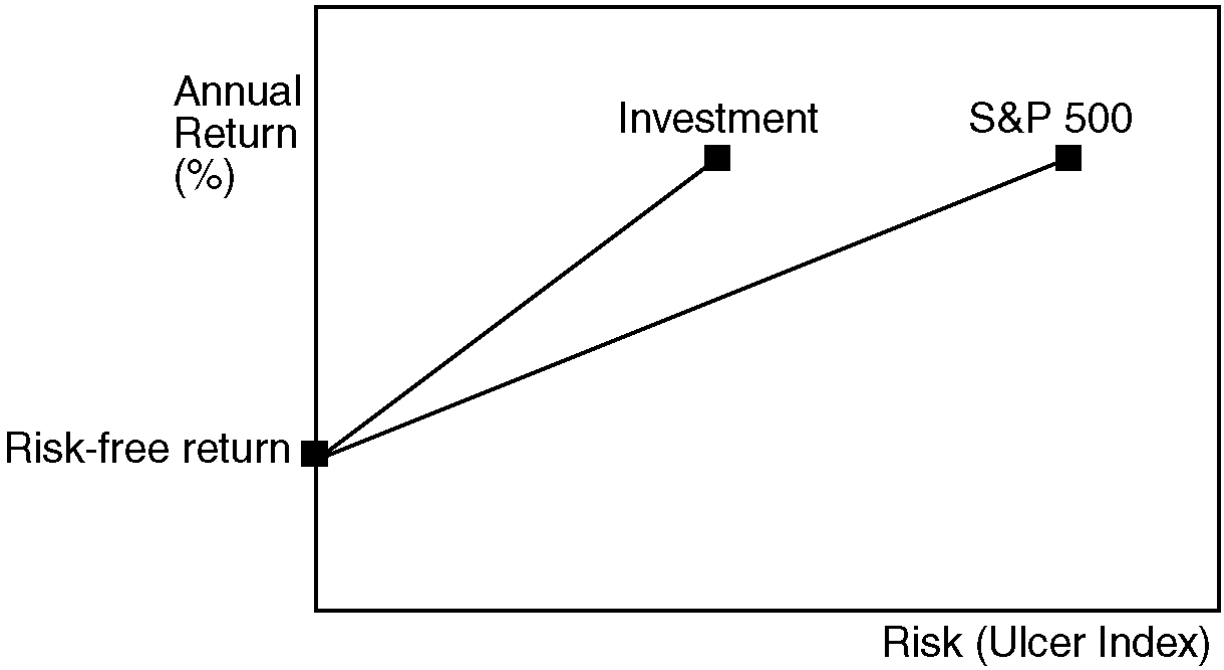
Martin Ratio = (Total return - Risk-free return) / UI
```

In either case, compounded annual returns should be used for consistency. These figures should include reinvestment of dividends and other distributions; and should be net of all recurring fees, transaction costs and trading slippage.

When plotting investments on a risk vs return chart, UI can be used instead of SD for the horizontal (risk) axis.



If a line is drawn between the points representing the risk-free return and a risky investment, the slope of the line is equal to the Martin Ratio. As always, if an investment lies above the line joining the risk-free return with the S&P 500, the investment is "beating the market" on a risk-adjusted basis.

Market Timing Example

The table below shows the results achieved with both UI and SD. We compared two strategies over the period 1940-1997: buy-and-hold the S&P 500 index, and timing the index with a popular indicator. Results include reinvestment of dividends in both cases.

	Buy-and-Hold	Timing System	% Change
Annualized Total Return (%/yr)	12.59	14.79	17.5
Ulcer Index (%)	8.85	5.14	-41.9
UI Performance (Martin Ratio)	0.92	2.01	118.9
Standard Deviation (%/yr)	16.10	13.18	-18.1
SD Performance (Sharpe Ratio)	0.51	0.78	52.9

For the timing system, annualized total return is increased by a modest 2.2 percentage points. SD reports risk 18% lower and performance (Sharpe Ratio) 53% higher. UI reports risk 42% lower and performance (Martin Ratio) 119% higher. Thus, UI places a much higher value on the market timing system.

Other experimental work has shown that many popular market timing systems have little value when SD is used to measure risk, but significant value when UI is used instead. This arises largely because SD fails to recognize the success of timing systems in avoiding major market downturns.

Caveat Emptor

With any method for computing risk and performance, it is important to use data covering as long a time period as possible. In particular, the time period should include both bull and bear markets for the investments of interest. Needless to say, when comparing multiple investments, the same time period *must* be used in each case.