



## Where is the Tail? Why Short-Selling Makes Sense in Fixed Income

Vol. II, April 2007

**Peter Cordrey**  
Managing Director and  
Product Manager, Pru Alpha Strategy

*Short-selling as an investment strategy has been getting increased investor attention over the past 18 months, particularly in connection with the influx of new “portable alpha” and other long-short strategies. While virtually all investors intuitively understand the basic rationale for short-selling (you sell something you think is going to decline in price), it’s less clear exactly how this objective is translated into an investment strategy in an actual portfolio.*

*Our series of “short” papers examine a range of investment concepts used in long-short strategies in fixed income portfolios. In this second paper of the series, we look at why short-selling makes sense in fixed income portfolios.*

### It’s All About the Tail

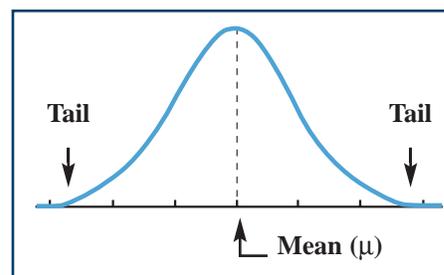
It has been said that bond traders are pessimists by nature and that they always see the glass as “half-empty”. Perhaps they just want to favor the “skew”.

The skew? Think back to a concept we all learned in our college statistics class: the probability distribution. A probability distribution, as you will recall, is simply a range of various outcomes, plotted according to the frequency of those outcomes occurring. The skew of a probability distribution refers to how the sides, or “tails”, of the distribution slope outward in each direction.

### A Symmetric Probability Distribution

The familiar bell shape of a normal probability distribution curve, shown to the right, has no skew, meaning that the tails are of equal shape and length. Note the symmetry of this distribution, implying that the probability of an occurrence on either side of the observed mean ( $\mu$ ) is equal. In fact, mean, median, and mode are all equal. This is known as a “symmetric” probability distribution.

Symmetric Probability Distribution



## Alternative Perspectives

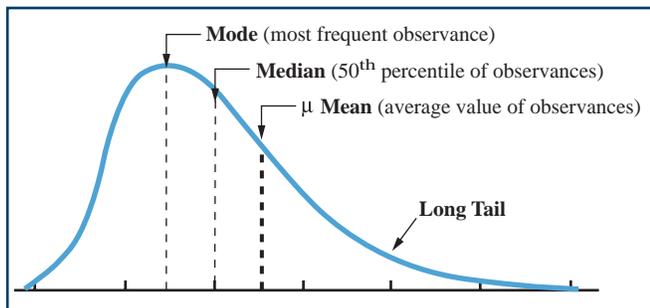
For more information contact:

**Peter Cordrey**  
Prudential Investment Management  
2 Gateway Center, 4th Floor  
Newark, NJ 07102-5096  
973.802.4678  
peter.cordrey@prudential.com

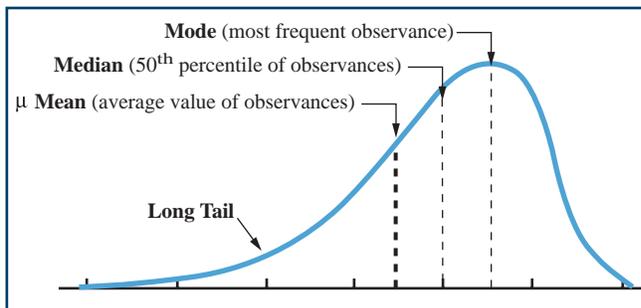
## An Asymmetric Probability Distribution

An “asymmetric” probability distribution, on the other hand, has a tail, or skew, that is longer in one direction, indicating that the distribution of outcomes is biased in that direction. There are two kinds of asymmetric probability distributions:

**Positively Skewed Distribution**



**Negatively Skewed Distribution**



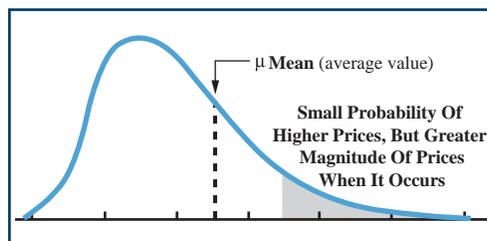
You will note that asymmetric probability distributions have long tails in one direction. Long tails are lower probability events, but of significant magnitude. If the long tail is to the right of the mean, the probability distribution is “positively skewed”. This means the deviation of occurrences above the mean is greater than the deviation below the mean. On the other hand, if the long tail is to the left of the mean, the probability distribution is “negatively skewed”. The deviation of occurrences below the mean is greater than the deviation above the mean.

## The Skew Can Illustrate Upside/Downside Price Potential

The skew of a probability distribution is a key consideration in constructing risk/reward scenarios for securities, and, in turn, for generating alpha. To illustrate this concept, let’s look at the probability distribution of small cap stocks, shown here on the right.

You will note that it is positively skewed. The tail of the distribution is much longer on the right hand side. This makes sense: small cap stocks tend to provide opportunities for outsized gains from price appreciation (think Google), although the probability of such an occurrence is fairly small. However, since theoretically the upside price for a stock is unlimited, the long tail to the right can extend very far.

**Probability Distribution of Prices of Small Cap Stocks**



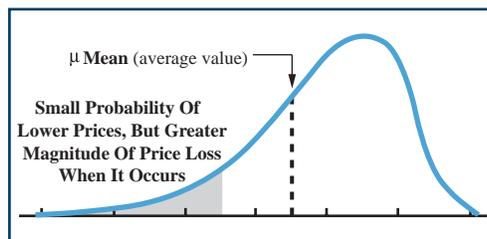
Of course, plenty of small cap issuers run into trouble every year, with their stock prices plummeting. However, the lowest a stock’s price can ever go to is zero. The downside potential of a stock, therefore, is limited. As such, the magnitude of a small cap stock’s potential price decline is noticeably shorter on the downside, relative to its theoretically unlimited upside. What does this mean for alpha generators? It means that there can be significant reward for investors skilled in researching equities. **The long buyer of stocks may have better opportunities for outsized price gains.**

## How is a Bond’s Price Probability Distribution Skewed?

Bonds, like equities, also have asymmetric price probability distributions. However, as you can see to the right, the probability distribution for investment grade corporate bonds is negatively skewed: the long tail is to the left.

That long left tail illustrates the magnitude of *downside* price potential. The tail on the right, indicating upside price potential, is noticeably shorter. This distribution of observable prices suggests that for investment grade corporate bonds, the magnitude of potential price loss is greater than the magnitude of potential price gain.

**Probability Distribution of Prices of Investment Grade Corporate Bonds**



Why do we observe this kind of negative skew in investment grade bonds? The short tail on the right side reflects the fact that investment grade bonds, theoretically, have a maximum price. That price is the sum of their coupon flows and their principal. For example, a five-year, 8% coupon bond priced at par pays \$40 in coupons ( $5 \times 8.00\%$ ) over its lifetime. It will then mature at \$100. So, its maximum price should be \$140. To pay even one nickel more for that bond would imply a negative rate of interest. The short tail on the right side also reflects the fact that, by definition, high quality investment grade bonds have little potential for further credit upgrades, typically the catalyst that drives potential price gains. Not surprisingly, then, the majority of investment grade bonds trade near par levels over their lifetimes.

But what explains the long tail of the probability distribution on the left hand side? We all know investment grade bonds can decline in credit quality after issuance, for varying reasons. Declining credit quality usually translates into a declining bond price, sometimes quite rapidly. While not as common, investment grade bonds can also default, with the price of the bonds dropping to a considerably lower recovery value. When that happens, it is a long way down in price from par. Hence, the long tail on the left, capturing this potential, albeit unlikely, outcome.

### Implications of a Negative Skew

The negative skew of the probability distribution of investment grade bonds suggests that, all else being equal, a bond's "downside price potential" is greater than its "upside price potential". Put another way, a bond priced at par is more likely to decline from par value down to zero (-100% change in price) than it is likely to rise in price by the same amount (+100% change in price to \$200.)

That means that instead of providing opportunities for outsized gains like small cap stocks, investment grade bonds present better opportunities to take advantage of price *declines*. The probability of a big price decline is small, but the potential magnitude of any price decline that does occur can be significant. Unlike short-sellers of equities, who are facing a positive skew, the negatively-skewed probability distribution of bond prices implies that **short-sellers of bonds may have the better opportunity for outsized price gains**. A disciplined risk management framework incorporates this upside/downside trade-off when sizing positions in a portfolio.

### Implications for Fixed Income Managers

The traditional view of bonds – that of a stable, low risk beta source – does not come close to capitalizing on their full potential. As we have seen, the ability to sell short is particularly valuable in fixed income portfolios given the negatively-skewed probability distribution of corporate bond prices. Because investment grade corporate bonds exhibit a negative skew, the ability to sell bonds short in a portfolio, and thereby fully capitalize when a bond declines in price, can significantly increase the potential alpha and information ratio a portfolio can generate. The asymmetry in the probability distribution can influence the risk-taking decisions of a portfolio manager. Skilled managers can make the appropriate trades to take advantage of the upside/downside potential.

Asset managers with excellent credit research expertise and well-developed short-selling skills should be able to generate additional alpha through short-selling bonds. In these few cases, bond investors can revel in their pessimistic nature, rewarded in their view of a glass half-empty.

### High Yield Bonds Are Different

High yield bonds differ from investment grade bonds, particularly when the high yield bond is purchased at a distressed price. For example, the average price of outstanding high yield bonds was 75 cents on the dollar as recently as 2002.\*

Bonds purchased at such low prices have distinctly different risk profiles than investment grade bonds purchased near par. Indeed, the probability distributions of prices of distressed high yield bonds often look like those of stocks: a short tail on the left hand side (because the initial purchase price was at a steep discount) and a longer tail on the right hand side (significant upside price potential from the low purchase price.)

\*Source: Merrill Lynch

*Coming Next: Establishing Short Positions Using Credit Default Swaps*

*© Copyright 2007, Prudential Investment Management, Inc. Prudential Financial and the Rock logo are registered service marks of The Prudential Insurance Company of America and its affiliates. Prudential Investment Management (PIM) is the primary asset management business of Prudential Financial, Inc. Prudential Investment Management - Fixed Income is PIM's largest public fixed income asset management unit, and operates through Prudential Investment Management, Inc., a registered investment adviser and a Prudential Financial company. The comments, opinions and estimates contained herein are based on or derived from publicly available information from sources that Prudential Investment Management believes to be reliable. We do not guarantee their accuracy. This commentary, which is for informational purposes only, sets forth our views as of this date. The underlying assumptions and these views are subject to change. There is no guarantee that the views expressed will be realized. The securities shown are for illustrative purposes and not recommendations or representative of Prudential Investment Management holdings.*