Idiosyncratic Risk; a Function of the Time Interval

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In perhaps one of the most rigorous academic research projects ever undertaken to test the validity and effectiveness of a wide universe of financial metrics, Carton and Hofer, 2006 make the following concluding remark, "Very few non-public companies monitor the change in their Altman's Z-score. However, the findings of this research indicate that this is the single most powerful measure for monitoring shareholder returns for both annual and three year time frames. Since this is a survival measure that is also important to creditors, management should pay particular attention to this financial performance metric". Indeed, it only makes sense that this important measure once again outperforms every metric that it is compared against for the Z-score touches nearly every critical dimension of financial performance. While leveraging the benefits of this important metric makes perfect sense, it is the notion of capturing its change that is most meaningful. This article examines the challenges associated with capturing change and puts forth one solution to help make the process of measuring change useful from a practical perspective.

Measuring Change – Frame by Frame

While it is difficult to argue against the merit of measuring change versus measuring one fixed-point in time, it can be challenging to capture meaningful *change-data* since the time that elapses between periods is constrained by the financial reporting period, in some case a full quarter or a full year. While capturing the rate of change indeed makes sense, capturing the change to Altman's Z-score and other important metrics is only as good as the width of the time interval for which the score is measured.

By way of example, imagine watching a movie that was created using one minute time intervals between each frame. Depending upon the events that occurred over the course of each minute, the end result may or may not make sense to the audience. In fact, each new frame may introduce a complete surprise to the audience and especially if the object changes direction. In the end, such a condition is unpleasant to watch due to the absence of any reliable means to interpret or rationalize the object's next movement. With financial reporting intervals of three months or more, we live in an environment of constant surprise similar to that of a movie filmed frame by frame, minute by minute. Just like the movie, such a condition is unpleasant to watch.

A Tighter Interval

The only way to provide a true representation of space, time and risk in the financial reporting environment is to shrink the interval of time between the frames. This requires that we increase the frequency of financial reporting from one that is quarterly to one that is reported on a monthly basis. Compressing the reporting interval allows for greater insight into the underlying condition of the firm. Breaking time down into smaller increments opens the door to measure movement and changes to important financial measures and loan covenants. Perhaps most important, compressing the time interval enables the analyst to measure idiosyncratic volatility previously obscured by intervals too wide to provide a meaningful perspective of volatility. In terms well known to lenders, economists and financial analysts, volatility is analogous to risk.

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The Tighter Interval continued
Economists have long realized the benefits of breaking time and motion into increasingly small increments in order to observe and capture changes that provide meaningful insight into behavior. Quantifying risk often entails capturing volatility expressed as the standard deviation from which probabilities can be assigned provided the data follow a normal or Gaussian distribution. Financial analysts, with the luxury of access to market return data can capture daily volatility useful for calculating option values and other measures including those that measure risk. Creditors of non-publicly traded private companies however are bounded and constrained by quarterly or annual financial statements since their time intervals make risk analysis as a function of volatility irrelevant or impotent at best.

Obviously, the lack of observable market volatility is difficult to overcome when measuring private companies however that does not prevent analysts from measuring idiosyncratic or firm-specific risk as a function of the volatility of underlying drivers that support viability. Measuring the volatility, direction and trend of Altman's Z-score for example provides critical insight into the future financial performance of the firm.

Compared to the more traditional rear view mirror approach to financial analysis, capturing data in reasonably small time-increments provides for the opportunity to measure volatility of the underlying economic drivers of the firm and represents a major step forward. Measuring the simple standard deviation of trailing period data provides insight into 'normal' behavior specific to the individual company. Once established, a z-distribution (not to be confused with the Z-score) that expresses the behavior as a function of the number of standard deviations to the right or left of the mean provides an intuitive picture of performance relative to the norm in a language that is both understandable and universally recognized. While the z-distribution may not be useful to trend for statistical reasons inherent in time-series data environments, it is ideal to detect *erratic* movement providing advance warning to impending risk.

Standard Deviation - Volatility
The standard deviation is simply the square root of the variance, where variance is the sum of squared deviations divided by the number of observations. The squaring exercise is necessary since adding the deviations from the mean will always return zero. Hence, the standard deviation provides an excellent representation of where the data lie with respect to the mean.

To illustrate, consider measuring the volatility of Altman's Z-score using the well known standard deviation equation in Figure 1.

Figure 1

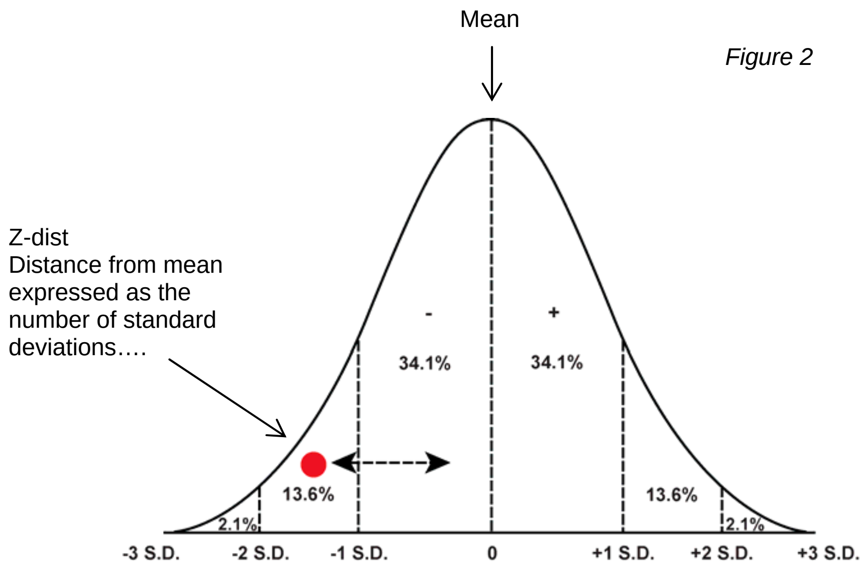
$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n}}$$

The standard deviation, sometimes referred to as the Greek symbol, 'Sigma', is essentially the square root of the variance which can be thought of as the EXPECTED value. Both the variance and the standard deviation are probability-weighted measures that express the dispersion of observations about the expected value. The standard deviation is easy to interpret since it is expressed in the same unit of measure as the observation. This is in contrast to the expected value where the units are squared for reasons previously mentioned.

Volatility in the Context of the Normal Distribution

In a normal distribution (Figure 2), approximately 68.2% of the observations will fall between +1 and -1 standard deviations from the mean. Approximately 95 % will fall between +2 and -2 full standard deviations from the mean, etc. Depending upon the volatility it may be reasonable to assume that most observations will fall within a plus or minus window of one standard deviation, some will fall within two standard deviations and occasionally some will fall within three standard deviations or more. Depending upon the direction, (minus for example), and the metric, a standard deviation of minus 2.75 may be cause for alarm.

Figure 2



The Z-distribution

The Z distribution can be used to express the distance from the expected value in units of the standard deviation. Figure 2 for example illustrates a Z-distribution of approximately -1.4. In other words, the observation is approximately 1.4 standard deviations to the left of the mean. The Z distribution can be found using the equation in Figure 3.

Figure 3

$$Z = \frac{x - \mu}{\sigma}$$

Taking this one step further, we can find the probability of the observation falling to the left of the mean using the equation in Figure 4.

Figure 4

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{z^2}{2}}$$

Obvious but worth mentioning is that the equation in Figure 4 requires the data to exhibit characteristics of a normal Gaussian distribution.

Practical Use – Risk Management
The Z distribution is a useful measure that provides some indication of where the specific observation appears compared to what would be considered 'normal or expected behavior' of the measure. In this case, normal or *expected-value* is considered the mean of the trailing 'x' number of periods. For this reason the Z distribution should be interpreted in the context of the trend consisting of the trailing periods if a trend indeed exists. It could be argued, and rightly so, that if a firm is in a state of steady decline or is steadily improving, (in this case the data is skewed to the right or left of the mean), that the Z distribution provides a perspective in the context of its current state where the current state is defined as the *'expected-value*'.

Forward Looking Alert Mechanism
While this may be important, the Z distribution may contribute the most value as an alerting mechanism. For example, recent studies of Altman's Z-score have shown that companies in distress are often preceded by an erratic fluctuation of the score followed by a deteriorating trend long before default. Using the Z distribution to measure the movement of Altman's Z-score may provide months of advance warning that impending distress looms on the horizon. More recent studies have shown that the Z distribution will pick up distress signals months before any sign of loan covenant deterioration for example.

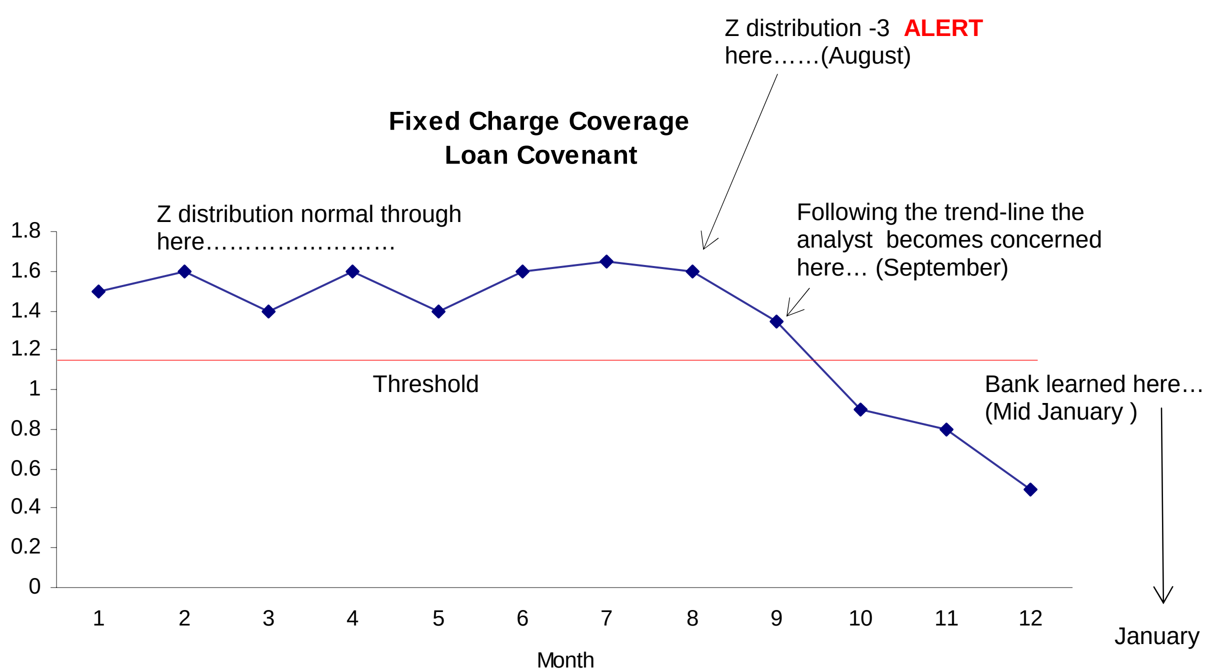


Figure 5 illustrates a twelve month fixed charge coverage loan covenant analysis for a mid sized privately held company. As part of the loan agreement, the example company provided the lender with quarterly financial statements at the close of the first month after the end of the quarter. For example, a quarterly financial statement for the period ending December 31st was due to the lender on January 30th.

In the example case presented in Figure 5, the Z-distribution signaled distress one month before a monthly trend analysis indicated cause for concern and a full five months before the lender realized that the company was in distress. More interesting still is that while the loan covenant performance fluctuated from January through September, the Z distribution of the Z-score fluctuated normally between +.608 and -1.04. However in August the Z distribution exhibited a dramatic shift of -3.06 standard deviations from the mean signaling immediate cause for concern.

Conclusion

Three important points are discussed in the preceding pages. First, lenders and risk managers can mitigate considerable risk by compressing the time interval of the financial data used in the analysis. This approach provides the analyst with valuable trend data that increases the lead-time to respond with the appropriate strategy. Second, compressing the time interval opens the door to measuring movement, change and volatility, transforming the perspective of risk from one that represents a fixed point in time to one that is forward looking. Finally, embracing statistical measures such as the Z distribution and other important measures may provide early warning signals to risk managers that may otherwise go unnoticed using traditional financial metrics that are geared to provide a historical perspective of financial risk.

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