Intuitive and Useful
DTS Offers Some Key Advantages for Evaluating Fixed Income Portfolios

KEY ELEMENTS

 Duration times spread (DTS) measures systematic credit-spread risk exposure. DTS estimates the return of any bond, by percentage, if its spread were to change from the current level, all else equal.

 DTS offers several advantages for monitoring risk in credit portfolios over other methods, such as average credit rating, credit rating allocations, average spread duration, average spread, realized risk, and risk estimates by asset managers.

 DTS does not replace other tools used to analyze managers but provides a complementary analysis. It is, however, arguably the single most-important portfolio exposure metric for credit managers.

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Kevin Machiz
Capital Markets Research
Introduction

Institutional investors that want to evaluate their fixed income portfolios or assess managers have a relatively new tool available: duration times spread (DTS or DxS), which measures systematic credit-spread risk exposure, and is comparable to beta for systematic equity market risk exposure, or duration for interest rate exposure.

To provide some context for this discussion, the widening or tightening of credit spreads is watched closely by investors, at both the broad market level and for individual securities, as a measure of risk for fixed income assets, and the appetite for risk in the market.

DTS offers several advantages for monitoring risk in credit portfolios over other methods, such as average credit rating, credit rating allocations, average spread duration, average spread, realized risk, and risk estimates by asset managers. These advantages include a desirable balance of intuitive explanation, simplicity of calculation, and usefulness in the real world. DTS can be used to analyze securitized sectors with credit risk (e.g., collateralized loan obligations), but not those that are guaranteed (e.g., agency mortgage-backed securities).

DTS does not replace other tools used to analyze managers but provides a complementary analysis. It is, however, arguably the single most-important portfolio exposure metric for credit managers.

How DTS Works

DTS was introduced in 2005 in a paper written by Arik Ben Dor, Lev Dynkin, Patrick Houweling, Jay Hyman, Erik van Leeuwen, and Olaf Penninga and published by Lehman Brothers (now Barclays Capital)¹ and has been implemented widely by asset managers and the risk management systems they use. The DTS of a bond can be calculated as the product of option-adjusted spread duration (OASD, quoted in years) and option-adjusted spread (OAS, quoted in percentage terms by convention):

\[
DTS = OASD \times OAS
\]

Intuitively, DTS estimates the return of any bond, by percentage, if its spread were to change from the current level, all else equal. Percentage changes in spreads can be used to estimate returns using familiar bond math:

\[
Return = -OASD \times OAS \times \frac{\Delta OAS}{OAS}
\]

¹ A. Ben Dor, L. Dynkin, P. Houweling, J. Hyman, E. Leeuwen, and O. Penninga. “DTS (Duration Times Spread): A New Measure of Spread Exposure in Credit Portfolios,” Lehman Brothers, June 2005

Building a Bond Vocabulary

| Principal: an amount that a bond issuer is obligated to repay |
| Coupon: fixed payments from a bond |
| Yield: The interest rate earned by a combination of coupon payments as well as any difference between a bond’s market price and its principal. Bond yields have an inverse relationship with bond prices. |
| Duration: the sensitivity of bond prices to shifts in interest rates |
| Spread: The additional yield, or compensation, earned by a bond for taking on additional risk (e.g., credit risk), calculated as the difference between the bond’s yield and the yield on a similar government bond. |
| Excess Return: the difference between the bond’s return and the return on a similar government bond |
| Spread Duration: the sensitivity of bond prices to shifts in spreads |
| Option-Adjusted: indicates that prepayment and extension risks (i.e., the risks of bonds being repaid at unexpected times) have been separately analyzed |
Alternatively:

\[ \text{Return} = -\text{DTS} \times \text{Percentage Change in OAS} \]

<table>
<thead>
<tr>
<th>Bond</th>
<th>OASD (years)</th>
<th>OAS (percent)</th>
<th>DTS</th>
<th>Percentage Change in OAS</th>
<th>Absolute Change in OAS</th>
<th>Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond A</td>
<td>5</td>
<td>10</td>
<td>50%</td>
<td>+10%</td>
<td>+1.0</td>
<td>-5%</td>
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<td>Bond B</td>
<td>2</td>
<td>5</td>
<td>10%</td>
<td>+10%</td>
<td>+0.5</td>
<td>-1%</td>
</tr>
<tr>
<td>Bond C</td>
<td>5</td>
<td>2</td>
<td>10%</td>
<td>+10%</td>
<td>+0.2</td>
<td>-1%</td>
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<tr>
<td>Bond D</td>
<td>5</td>
<td>2</td>
<td>10%</td>
<td>+100%</td>
<td>+2.0</td>
<td>-10%</td>
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So for Bond D, a 100% increase in its OAS (doubling) leads to a -10% change in its return (-10% x 100% = -10%).

DTS was introduced as a preferred metric for credit spread risk exposure because of two observations about the historical behavior of credit spreads. First, percentage changes in spreads tended to have more stable volatility than absolute changes in spreads. Second, the volatility of absolute spread changes tended to follow a linear relationship with the level of spreads; that is, the spread volatility for bonds with wider spreads tends to be higher than for bonds with narrower spreads. For every 100 basis points of spread widening, there tends to be about a 10 bps increase in the volatility of spreads. Exhibit 2, an excerpt from the 2005 paper that introduced DTS, demonstrates this linear relationship (the circle notes questionable outliers with very high spread levels and a small sample size).
For this time period and again using familiar bond math, for every unit that DTS increases, there tends to be a 10 bps increase in the volatility of returns attributable to credit spreads.

A DTS ratio for a credit portfolio versus its benchmark can be calculated to provide a systematic credit spread risk exposure that is comparable to an equity portfolio’s beta. The DTS ratio is the DTS of a portfolio divided by the DTS of the benchmark:

\[
DTS\, Ratio_{port} = \frac{DTS_{port}}{DTS_{bench}}
\]

A DTS ratio represents how a portfolio should perform proportional to the benchmark as a result of a systematic change in credit spreads. For example, if a portfolio has a DTS ratio of 1.1 and credit spread widening leads the market benchmark to fall by 5%, the portfolio’s return would be expected to fall by 5.5%, all other things being equal. One important note: This analysis views the impact of systematic credit spread risk in isolation. The impact of security selection or of exposure to other risk factors, such as duration or currency, would not be captured in this analysis.

**Comparing DTS Analysis to Other Methods**

In addition to DTS, there are a handful of alternative methods for evaluating fixed income portfolios or managers, but all have shortcomings compared to DTS. These other methods include:

- Spread duration (e.g., OASD)
- Spreads (e.g., OAS)
- Credit ratings
- Historical risk statistics
- Forward-looking risk statistics

There are several advantages to using DTS over OASD or OAS alone. OAS is an interesting indicator of risk premia associated with defaults and liquidity, but gives no indication of the sensitivity to changes in credit spreads without incorporating spread duration. On the other hand, OASD does not represent a true risk exposure because the volatility of spreads varies across different bonds. Some other complementary data would have to be analyzed to understand the systematic risk of credit spreads.

Another common bond evaluation approach is to rely on credit rating agencies to categorize bonds by default risk. The principal drawbacks of this method are that it relies upon the agencies to produce accurate and timely assessments of default risk, and credit ratings are difficult to compare. For example, the “average” credit quality of a portfolio hides the fact that the relationship between ratings and default risk is not linear.
Historical realized risk statistics are a critical tool for manager evaluations, but they do not indicate how the portfolio may behave after managers make changes to their portfolios. A manager’s past track record of taking little risk will not be comparable if the manager reallocates to bonds with much higher risk. DTS can be used to identify that higher risk since it is based on current, not historical, data.

Fixed income managers often produce forward-looking risk estimates, which can be very informative about a credit manager’s investment process and portfolio. Risk systems used to generate these estimates identify a variety of risk exposures in the portfolio, including DTS, and make many assumptions about issues like volatility and correlation. But the conclusion will be affected by the underlying assumptions made by an asset manager on a myriad of topics for which there is no industry standard. By contrast, DTS analysis is a significant simplification and allows for an “apples-to-apples” comparison between different managers.

DTS significantly reduces the complexity of reporting and improves the accuracy of risk exposure measurement. DTS allows low-duration, high-spread bonds to be compared on an equal footing with high-duration, low-spread bonds with a single metric. DTS does not depend on rating agencies but instead relies on market perceptions of risk as captured by spreads. The more efficient and liquid markets are, the quicker this information about bonds will be incorporated into prices.

**Applying DTS Analysis to Manager Selection**

DTS ratios shown over time can be easily compared across potential candidates in a manager search process. This quickly allows candidates to be differentiated by style or riskiness, and trends over time can inform how the investment process dials credit risk up and down in the portfolio relative to the benchmark in response to the market environment.

Exhibit 3 shows a sample report comparing DTS ratios for the five years ended June 30, 2016, across four long-duration fixed income managers benchmarked to the Bloomberg Barclays US Long Government/Credit Index. A DTS ratio of 1 indicates neutral credit spread risk exposure versus the benchmark.

Focusing in on Manager D as an example, a DTS ratio persistently above 1 indicates the portfolio was overweight to credit spread exposure during the period shown. The portfolio was close to neutral in mid-2011, but quickly rose to a meaningful overweight by the end of the year amid significant volatility in global markets. That risk exposure was gradually cut to around 1.1 near the end of 2012. That call looks prescient in hindsight as the portfolio became relatively more exposed to spreads as they rose and the exposure was cut as they fell. A similar tactic with much smaller magnitude was taken in 2013 around the taper tantrum. The exposure began slowly increasing again to around 1.25 from mid-2014 to through the end of 2015 as credit markets sold off, in large part due to concerns around commodity credits.
The DTS ratio alone does not account for the risk of industry-level tilts. A 2015 paper by Lev Dynkin and Jay Hyman and published by Barclays Capital discussed how analyzing the contributions to DTS from various industries can inform how the credit spread risk might be impacted by differing industry-level risks.\(^2\) Additionally, this analysis could reveal trends in industry rotation within the portfolio.

Exhibit 4
DTS Contribution by Industry Across Credit Managers

Exhibit 4 shows a sample report comparing relative DTS contribution by industry for the same four managers. For example, if Manager D has a relative DTS contribution of 2% from financial institutions, this would represent an overweight to risk from that industry. If credit spreads on financial institutions were to double from their current levels, the move would be expected to detract 2% from returns of the portfolio relative to the benchmark. In fact, Manager D’s overweight was at or below that level over the time period shown.
The behavior of Manager D’s portfolio was consistent with Callan’s qualitative analysis and understanding of the investment strategy. Manager D follows a value-oriented approach to bottom-up credit selection, seeking out undervalued bonds and mispriced opportunities in the market. If better opportunities are available, then the manager will take more risk, and if few opportunities are available, the manager will decrease risk. Over the time period analyzed above, the behavior of the portfolio was consistent with the manager’s investment philosophy and process, which supported returns relative to the benchmark and delivered a consistent style to clients. As a result of a comprehensive investment due diligence, Callan was able to gain greater comfort with the manager.

Conclusion
Duration times spread measures systematic credit-spread risk exposure in a way that captures the relationship between high-risk bonds and low-risk bonds with a single number. Importantly, the exposure is measured in a way that reflects the historical experience of markets to help clients understand the risks in their credit portfolios. DTS represents the expected loss if spreads change from their current level. The DTS ratio allows for quick comparisons to a benchmark, akin to beta for systematic equity risk. Contribution to DTS by industry reveals exposures to different industries within credit.

Callan, which uses DTS in some of its client reporting, is often asked if there is a single metric that will tell clients which manager to select. Unfortunately, no such metric exists. DTS analysis, especially when complementing other analyses, can instead be used as an indicator of manager style (e.g., high risk vs. low risk, dynamic vs. static, top-down vs. bottom-up, industry-neutral vs. industry-biased, etc.).

DTS is the most important indicator of risk in credit portfolios. It complements previous methods for analyzing credit risk because it is simple to calculate, intuitive, forward-looking, and reduces reliance on rating agencies and asset managers. For these reasons, sophisticated institutional investors and consultants would benefit by including DTS in their analysis and monitoring of credit managers.
About the Author

Kevin Machiz, CFA, FRM, is a vice president and consultant in Callan’s Capital Markets Research group. He is responsible for assisting clients with their strategic investment planning, conducting asset allocation studies, developing optimal investment manager structures, and providing custom research on a variety of investment topics. Kevin is also the head of Callan’s multi-asset class research effort and a shareholder of the firm.

Prior to joining Callan in 2014, Kevin was a senior associate product manager at Franklin Templeton Investments, responsible for coverage of global fixed income strategies.

Kevin earned a BBA from Temple University with majors in finance and international business administration (minor in Spanish). Kevin is a holder of the right to use the Chartered Financial Analyst® designation and is a member of the CFA Society of San Francisco and the CFA Institute. He is a Certified Financial Risk Manager.
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<td>Atlanta</td>
</tr>
<tr>
<td>Suite 800</td>
<td>800.522.9782</td>
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<tr>
<td>San Francisco, CA 94111</td>
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