Morningstar Calculated Fixed-Income Portfolio Measures
Introduction to Morningstar fixed-income calculations.

Traditionally, Morningstar has provided a number of fixed-income analytic measures related to mutual funds, exchange-traded funds, and other managed investments. Some of the measures are calculated by Morningstar from holding characteristics, such as portfolio breakdown measures, while others, such as duration, yield, and credit quality, are provided directly from asset managers or their intermediaries.

Morningstar collects information from asset managers through two mechanisms, the Portfolio Holding Template, which gathers holding-level identifiers, descriptive data, and valuations, and through the Fixed-Income Survey, which includes specific portfolio-level analytic measures related to interest-rate risk and credit quality. Morningstar has provided guidance on preferred methodology for the analytic calculations provided by asset managers through the Fixed-Income Survey in an effort to promote comparability; however, there has not been a mechanism to verify or validate that the values being submitted adhere to the methodology guidance.

To enhance the consistency, objectivity, and transparency of the fixed-income analytics that Morningstar provides to investors, a corresponding set of internally generated fixed-income calculations will now be produced for the same data points traditionally produced from the Fixed-Income Survey. Morningstar will calculate these analytic measures using a set of consistent methodologies and repeatable processes for fixed-income portfolio holdings globally. Each calculation will be based on the specific characteristics and attributes inherent to each holding. The resulting calculations will then be combined to produce portfolio-level analytics. Relevant attributes and characteristics include determinants of interest and principal, rules governing embedded options, exposure attributes, credit attributes, and information related to the organizations that issue and are otherwise meaningfully associated with the holding.

Each analytic measure Morningstar produces will be based on industry or other commonly accepted standards. In the case of calculation of proprietary metrics that Morningstar has created, the underlying methodologies will be transparently documented.

Fixed-Income Analytics Overview
The primary characteristic of fixed-income investing is that investor return is predicated on a rate of interest paid on a principal amount, resulting in a series of cash payments being received by the investor. In this regard, fixed-income securities are also logically thought of as debt, whereby the investor becomes a lender who is repaid principal and interest by a borrower, usually the issuer of the securities. To be useful to an investor, fixed-income analytics must inform how to measure the returns
generated by the repayments of interest and principal, as well as potential risks to the payments being made.

Over time, a robust, commonly agreed upon framework for measuring the primary risks and returns of fixed-income investments has been developed. Morningstar will produce analytics that address the following fixed-income measures:

► **Expected Returns**
As lenders, fixed-income investors are concerned with the rate of return that they can expect their investment to generate. The primary source of return for a fixed-income investment is through the interest paid by the borrower, most commonly the issuer of the holding. The primary measure of expected interest return is called *yield*. The yield of a holding is the rate of discount by which the present value of all future cash flows equal the price of a bond and represents a rate of return measure. Morningstar will calculate *yield to maturity*, a measure of the return expected if the fixed-income investment pays principal at the stated date of maturity.

► **Interest-Rate Risk**
Most securities have a fixed rate of interest payable, so the adverse change of rising interest rates is a primary risk for fixed-income investors. Measuring the sensitivity to rising interest rates is most commonly accomplished through the calculation of *duration*. There are multiple types of duration that are commonly used by fixed-income investors. Morningstar will produce both *modified duration* and *effective duration* measures that indicate the percentage change in value of a fixed-income investment for a given change in overall interest rates.

► **Length of Term**
The length of time that interest will be collected and until return of principal are critical factors in exposure to risk and an input to many analytic measures, especially expected returns and interest-rate risk. Morningstar will produce a specific measure of term called *effective maturity*, which represents the time until the return of principal can be objectively expected to occur.

► **Credit Risk/Quality**
Measuring the probability that interest and principal payments will be made on a timely basis is critical to determining the appropriate return to an investor. Credit ratings are the most pervasive way to measure credit risk. Morningstar will produce a measure of the distribution of credit ratings across a portfolio's holdings called *credit-rating breakdown*.

Taken together, these data points provide a good foundation for fixed-income investors to understand the risks and returns of a managed investment portfolio.

**Data Inputs for Calculated Fixed-Income Analytics**
Because of their complexity and the very large number of individual fixed-income instruments outstanding, the ability to calculate meaningful analytic measures is dependent on obtaining sufficient
input data. The importance of the quality of input data and the breadth of needed coverage cannot be overemphasized. The fixed-income market consists of millions of individual securities, each of which has numerous data elements that serve as specific calculation inputs.

For the managed investment portfolios for which Morningstar will calculate fixed-income analytics, the number of individual holdings calculated each period numbers in the millions. To meet this challenge, Morningstar collects a significant amount of data directly for use in fixed-income calculations and uses a variety of third-party data sources that provide different types of information needed to support precise analytic calculations.

**Third-Party Data**

Fixed-income analysis is complex, requiring many data elements for any individual holding to be properly analyzed. Morningstar uses a number of third-party sources of fixed-income data to provide the myriad inputs used in calculation of fixed-income analytics, as well as to ensure that the need for global coverage is addressed.

- **Fixed-Income Terms and Conditions Data**
  Terms and conditions data represent the specific rules, contractual obligations, and covenants put in place at the time a holding is issued. Knowledge of these data elements is needed for the calculation of interest and principal payments, such as their timing, periodicity, day counts, and optionality. They also determine aspects of credit quality such as specifying the order of priority of claim to payments between different classes of obligations and whether there is more than one entity responsible for repayment.

- **Credit Ratings Data**
  Credit ratings are forward-looking measures of the credit risk of fixed-income securities and the entities related to them. Credit ratings are issued by companies known as credit-rating agencies, which are generally subject to regulatory oversight and generally employ a letter-based schema that represents an order of relative credit risk. Holding and entity level credit ratings are used as inputs to generate credit-rating measures and other proprietary credit analytics.

- **Organization and Entity Data**
  Payments of fixed-income obligations are ultimately dependent on an organization or other legal entity. Data related to issuers and other salient organizations can have an impact on credit risk and other exposures.

**Morningstar Portfolio Holdings Data**

Morningstar managed investment portfolio analytics are created from the portfolio holdings received from asset managers and their agents. Morningstar has been collecting holdings data provided by asset managers for over 30 years, with over 150,000 funds globally submitting this information on a regular basis. Holdings are generally collected on a monthly or quarterly basis, although some are collected daily.
Among the data elements received by Morningstar are identifiers for the fund and each holding, effective date of the portfolio, currency of the fund and the holding, descriptive data such as coupon and maturity, holding value, accounting position (for example, long or short), and par value (notional value of derivatives).

**Holding-Based Analytics**
All of these measures will be produced at an individual holding level. The holding-level calculations can be combined to provide higher-level aggregations, especially portfolio-level measures. For each analytic measure, aggregation is dependent on specific methodology for which the goal is to optimally represent risk or return factor exposures.

**Conclusion**
By calculating fixed-income analytics from holding-level data, Morningstar intends to offer enhanced consistency, transparency, and comparability for investors of managed investments. Using robust holding-level data as inputs to commonly accepted measures of fixed-income risk and return will provide a uniform global analysis platform that will help investors make better-informed choices to help enable more successful outcomes.