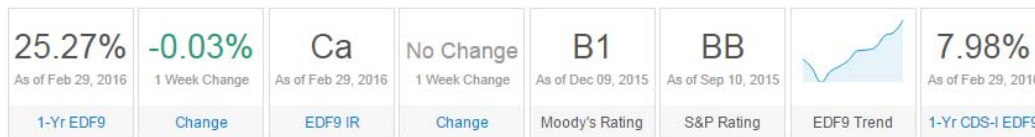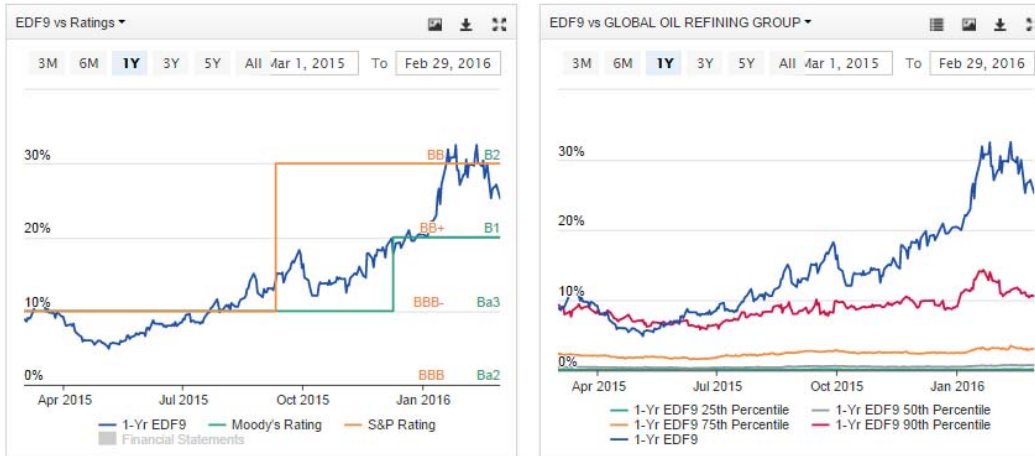# Moody's
ANALYTICS

CreditEdge[TM] – At a Glance

What Is CreditEdge?

CreditEdge is a suite of industry leading credit metrics that incorporate signals from equity and credit markets. It includes Public Firm EDF[TM] (Expected Default Frequency) measures, which have been the premier tool for measuring the probability of default for publicly-listed firms since they were introduced in 1990.[1] More than 300 of the largest banks, asset managers, corporations, insurance firms and government institutions around the globe rely on CreditEdge. EDF measures provide greater accuracy, consistency, and efficiency in evaluating public firms than internal bank models or other commercially available solutions.

Figure 1   CreditEdge Overview for Petroleo Brasileiro SA Petrobas

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[1] In this document, we use the terms "Public Firm EDF" and "EDF" interchangeably. The EDF measures discussed here and the model from which they are derived differ from RiskCalc EDF measures, Moody's Analytics' default probabilities for private firms, and the RiskCalc EDF Model.

CreditEdge data is available via a web-based platform, an Excel Add-in, a data feed and a flexible Application Programming Interface (API). The dataset includes:[2]

» **EDF Measures**: Forward-looking, point-in-time default probabilities, available on a daily basis, for over 35,000 corporate and financial entities globally with publicly traded equity. Like fundamental credit analysis, the EDF model quantifies business and financial risk, but unlike fundamental credit analysis, it calculates the value of firms' assets and the volatility of the assets in part from equity prices and price volatility.

» **CDS-Implied EDF (CDS-I-EDF) Measures and Fair-Value CDS Spreads (FVS-CDS)**: Default probabilities derived from credit default swap (CDS) spreads. Through this model, CreditEdge is able to extend coverage to entities without traded equity, including sovereigns, private firms, and/or subsidiaries of public firms, as well as select state-owned and supranational entities, and US municipalities. Fair Value CDS spreads are modeled CDS spreads derived from CDS-implied EDF measures that can be directly compared with observed CDS spreads.

» **Through-the-Cycle EDF (TTC EDF) Measures**: One-year probabilities of default that primarily reflect a firm's long-run credit risk. TTC EDF measures are derived from Public Firm EDF measures through a filtering technique that separates the underlying components of EDF measures that correspond to the frequency of the credit cycle. The model filters out transient, short-run changes in credit risk that are likely to be reversed with the passage of time.

» **Stressed EDF Measures**: One-year default probability forecasts for public companies conditional on hypothetical economic scenarios. They are used primarily by financial institutions to stress test their C&I loan, corporate bond, and CLO portfolios and by portfolio managers to improve their understanding of risk using scenario analysis. The Stressed EDF methodology relies on estimates of structural relationships between key macroeconomic risk factors and public firm EDF measures observed over a long history.

» **Fair Value Bond Spreads (FVS) and Alpha Factors**: Fair Value Spreads are modeled bond spreads derived from EDF measures. FVS metrics provide an alternative assessment of bond valuation that is directly comparable with option-adjusted spreads. For entities with publicly traded equity and no traded debt, FVS measures fill a gap in market-based valuation tools. Bond-level Alpha Factors (bond OAS/FVS) provide a relative value framework for bond investors.

What Differentiates CreditEdge?

In addition to the broad coverage and forward-looking metrics included in CreditEdge, there are a number of reasons why financial institutions, corporations, asset managers, insurance firms, and regulators globally choose it as their primary solution for assessing the credit risk of public firms:

» Unbiased, consistent, and transparent methodologies for assessing rated and unrated public exposures

» Comprehensive documentation, regular model validation, and modeling enhancements based on extensive research

» Full support from Moody's Analytics' global team of researchers, data specialists, and product specialists

» Access to Moody's Analytics' best practices, expertise, and market leading insights

» No user inputs are required

Additionally, CreditEdge offers many built-in features and functions to enhance and simplify credit risk analysis, including:

» An EDF-Implied mapping function that translates EDF measures to internal or external rating scales

» Benchmarking of individual entities against peers, industry groups, and regions

» Adjustments for unique industry differences, market conditions, and regional considerations

» Both point-in-time and through-the-cycle risk measures for underwriting, monitoring, and early warning and use in economic capital calculations

» A term structure of EDF measures and Fair Value Spreads ranging from one to ten years

» "What-If" scenario analysis that allows users to modify firm-level model inputs and view the impact the firm's EDF measure

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[2] For more information about Public Firm EDF measures and the other CreditEdge metrics, please see the "At a Glance" documents for Public Firm EDF Measures, CDS-Implied EDF Measures, Fair Value CDS Spreads, Through-the-Cycle EDF Measures, Stressed EDF Measures, and Fair Value Bond Spreads.

The Power of the Public Firm Default Database

Comprehensive data is the foundation of a superior modeling framework. Regulators and internal oversight teams, however, require evidence that the data, methods, and results from risk rating systems can be validated. To prove that a model meets their stringent criteria, institutions must validate and calibrate it via statistical tests using data that is:

» Comprehensive and of high quality

» Sufficiently large and of sufficient breadth (time, size, industry)

» Reflective of a portfolio similar to the institution's own exposures

» Regulatory-compliant with respect to the definition of default

The CreditEdge EDF model is the leading industry benchmark for quantitative default risk assessment. It is calibrated on a global database containing over 11,700 defaults since 1973. Such a large calibration dataset enables the EDF model to perform reliably under all manner of market conditions and for a wide range of entities. We evaluate the performance of EDF measures on a regular basis along three dimensions:

» **Rank order power:** Like ratings, EDF measures provide a way to rank firms according to their default risk. High accuracy ratios demonstrate that EDF measures are better able to discriminate between high-risk and low-risk firms than agency ratings and equity returns.

» **Level accuracy:** Average EDF measures are consistent with observed default rates.

» **Early warning effectiveness:** The EDF measures of defaulters often signal credit distress well in advance of other credit measures. The early warning power of EDF measures can be evident as early as 24 months before a default occurs and rises rapidly as default nears.

Figure 2   Historical Default Database, 1973-2014
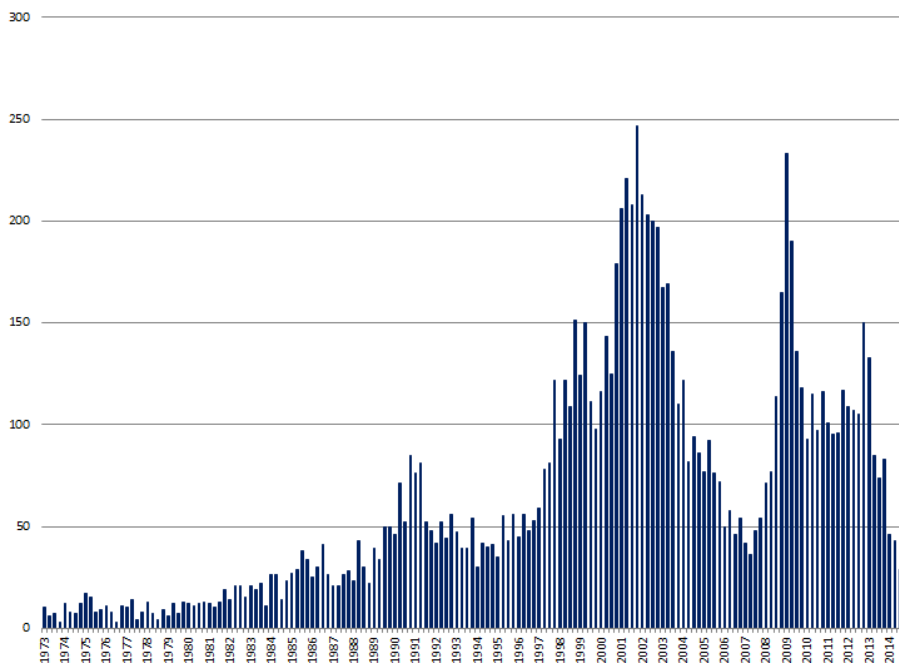
How Does the CreditEdge EDF Model Work?

The public firm EDF model (also referred to as the EDF model) belongs to a class of credit risk models called structural models. Their basic assumption is that there is a causal, economically motivated reason why firms default. In the EDF model, default is assumed to occur when the value of a firm's assets falls below the value of its liabilities at some future date – in other words, when

it is insolvent. The two main factors determining a firm's default risk in the EDF model are its financial risk and its business risk. The model therefore takes essentially the same approach to credit risk as fundamental credit analysis. Like traditional accounting-based credit analysis, the EDF model relies on financial statements for companies' liability structures. However, what distinguishes the EDF model is its incorporation of equity market information to estimate a firm's asset value and volatility. Equity markets can be thought of as forward-looking valuation engines that attempt to estimate the future cash flows and risks of companies in real time. The incorporation of market information into the EDF model yields PDs that provide both timely warning of changes in credit risk and an up-to-date view of a firm's value.

EDF metrics range from 0.01%-35% for financials and 0.01%-50% for corporates. They are cardinal measures of credit risk – that is, they provide absolute default probability estimates rather than simply a rank ordering of risk. Thus, a 1% one-year EDF has the same meaning at different stages of the economic cycle. More specifically, one out of a hundred such entities (with the same one-year EDF) can be expected to default within the next 12 months. In contrast, the realized default rate associated with a given level on a relative rank-order scale – for example, a Baa2 rating from Moody's Investors Service – will exhibit significant variation over time. While the one-year EDF is the most widely used metric, CreditEdge also contains term structures of EDF credit measures ranging from two years to ten years.

What Are the CreditEdge EDF Model Outputs and How Can I Use These Metrics?

EDF Measures and EDF Drivers

The public firm EDF model has three main drivers: market value of assets, default point (a measure of the notional liabilities due in the event the firm experiences distress), and asset volatility. Leverage, or the ratio of the default point to the market value of assets, represents financial risk, while asset volatility reflects business risk. All else equal, a rise in a firm's default point or asset volatility or a decline in its market value of assets increases its EDF. The CreditEdge dataset includes these drivers to assist users in understanding the level and trend of each firm's EDF in isolation and in comparison with other firms.

As an example, the figure below shows the EDF and drivers for Eastman Kodak Co. In late 2008, a perfect storm of falling market value of assets, rising asset volatility, and declining default point drove its EDF measure from below 1% to a new norm ranging from roughly 5% to 10%. The EDF measure began another and ultimately more dramatic ascent in early 2011, as its market value of assets slid closer and closer to its default point. By the time the company filed for bankruptcy on January 19, 2012, its EDF had reached 50%.

Figure 3   EDF Measure and EDF Drivers for Eastman Kodak Co Leading Up to Default
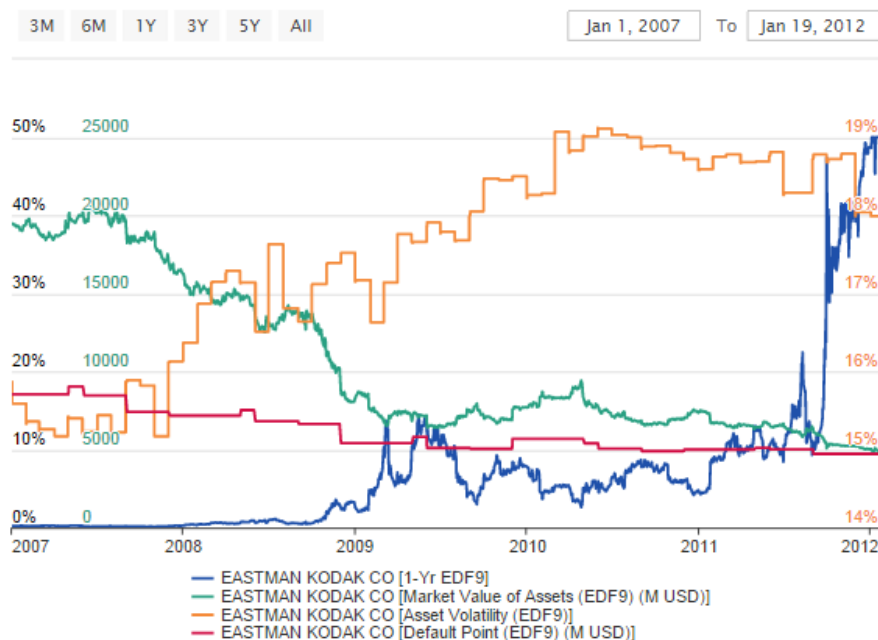
EDF-Implied Ratings

CreditEdge users sometimes prefer rating scales as measures of credit risk, rather than probabilities of default. To a large degree this reflects the widespread use of such scales, but the practice is also common because many regulators require a mapping of internal ratings to ratings grades with sufficient risk differentiation. Therefore, we map EDF metrics to the Moody's and S&P rating scales as well as users' own internal rating scales. These implied ratings and their mapping tables are available to CreditEdge customers.

Figure 4   Sample EDF-Implied Rating Table

Implied Rating Table   Internal Rating Table

The following table displays the correlation between EDF9 Implied Ratings and Median EDF9 credit measures. These values are updated on a monthly basis.

Source: Moody's | EDF9 Median Calculation: Spot Median | EDF9 Implied Rating: 1 Year | IR Mapping Date: February, 2016

EDF9 Implied Rating	Entity Type	Equivalent Median EDF9 Credit Measure	Bound Range	
			Greater Than or Equal To	Less Than
Aaa	Corporates	0.0100%	0.0100%	0.0126%
Aaa	Financials	0.0446%	0.0100%	0.0562%
Aa1	Corporates	0.0159%	0.0126%	0.0178%
Aa1	Financials	0.0707%	0.0562%	0.0794%
Aa2	Corporates	0.0200%	0.0178%	0.0214%
Aa2	Financials	0.0891%	0.0794%	0.1001%

EDF-Implied Ratings provide the following benefits:

» They have a consistent meaning across industries and geographies

» Over the long run, the distribution of EDF-Implied Ratings is consistent with distribution of ratings assigned by Moody's Investors Service

» They offer the ability to assign implied ratings to unrated firms

CreditEdge has implied ratings for over 35,000 firms, including those without ratings. As described in more detail in "At a Glance – Public Firm EDF Measures", we utilize separate mapping tables for corporate and financial firms.

EDF Term Structure

A term structure of default probabilities is necessary for pricing, hedging, and risk management of long-term obligations. The EDF model produces EDF measures with horizons of one to ten years. General observations about the EDF term structure are:

» EDF measures are more stable as the term structure extends

» Low-risk firms have upward sloping term structures; high-risk firms have downward sloping term structures

» Firms in riskier industries have steeper term structures

» Term structures are typically steeper during economic expansions and flatter during recessions

Figure 5   Sample EDF Term Structure
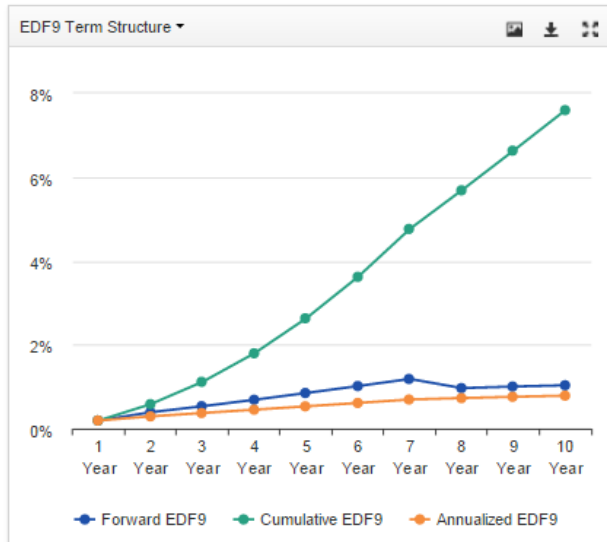
Year	Cumulative EDF9	Annualized EDF9	Forward EDF9	Moody's IR	S&P IR
1-Yr	0.19%	0.19%	0.19%	Ba2	BB+
2-Yr	0.58%	0.29%	0.39%	Ba2	BB+
3-Yr	1.12%	0.37%	0.53%	Ba2	BB+
4-Yr	1.80%	0.45%	0.69%	Ba1	BB+
5-Yr	2.63%	0.53%	0.85%	Ba1	BB+
6-Yr	3.62%	0.61%	1.02%	Ba1	BB+
7-Yr	4.76%	0.69%	1.19%	Ba1	BB+
8-Yr	5.68%	0.73%	0.97%	Ba1	BB+
9-Yr	6.63%	0.76%	1.00%	Ba1	BB+
10-Yr	7.60%	0.79%	1.03%	Ba1	BB+

EDF Date: As of Feb 29, 2016. Implied Rating based on Annualized EDF9

Additional Features Available Through the CreditEdge Website and Excel Add-In

The CreditEdge website has a number of tools to aid the analytical process. Many of these features can be customized to users' specifications. Other delivery options offer additional flexibility. The Excel add-in and a library of spreadsheet templates provide an alternative method to monitor and analyze data, while the data file service and API offer a more direct channel to CreditEdge data for those wishing to integrate it into their internal processes.

Peer Analysis for Additional Transparency & Insight

All entities in CreditEdge are classified by industry, country, and region, and the peer analysis module allows users to compare the current and historical credit metrics of an obligor, portfolio, or industry group against a peer group. Users can leverage CreditEdge's predefined peer groups or create their own. Moody's Analytics' research shows that peer analysis can be used to identify troubled companies well before default and to streamline portfolio monitoring. In the example shown below, the EDF measure for American Apparel signaled distress as early as June of 2015, four months before the company filed for bankruptcy. Until June, its EDF measure had been trending on par with the 75th percentile of EDF measures for the "US Apparel and Other Textile Products" group. The company's EDF measure subsequently began an ascent that rapidly brought it above the 90th percentile of its peer group.

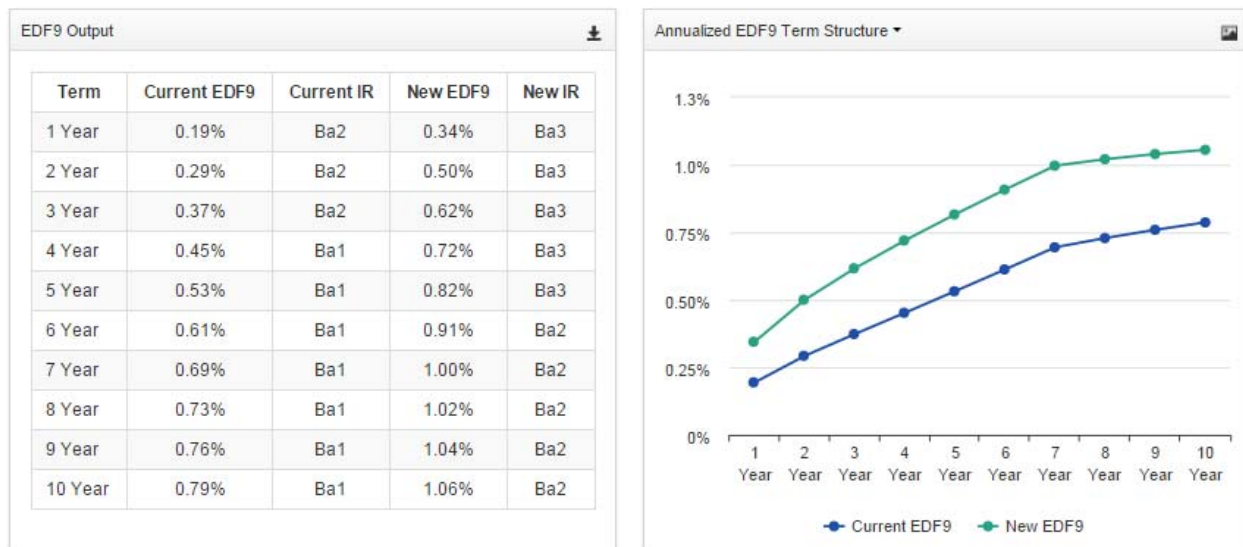**Figure 6   Peer Analysis for American Apparel Inc**
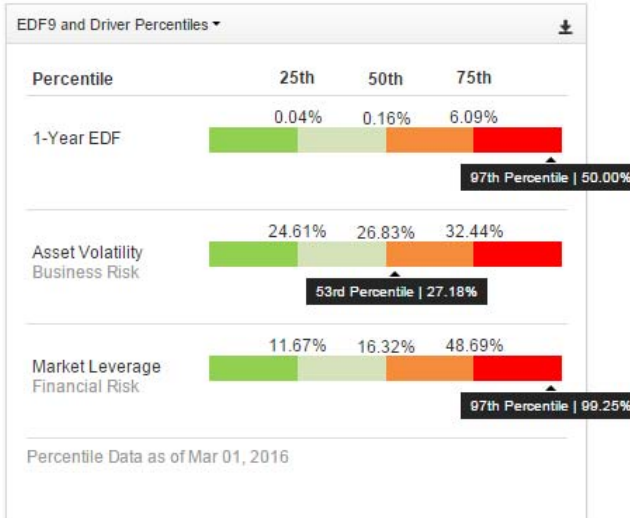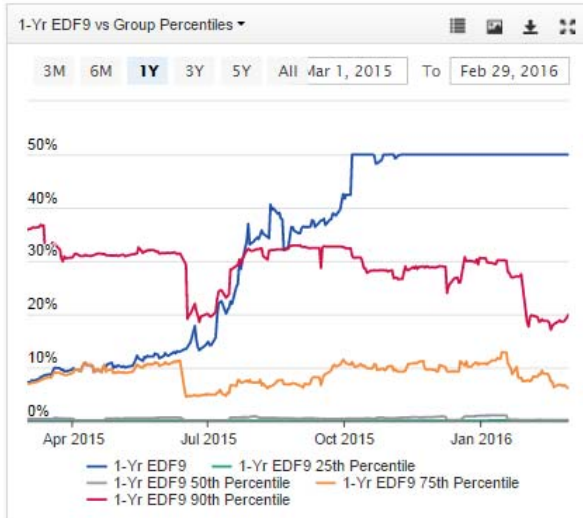
The website's Chart Builder and Report Builder functionality provide additional flexibility to customize your analysis. Outputs include comparisons that show the EDF drivers, EDF group percentiles, and EDF values over time.

What-If Calculations for Scenario Analysis

What-If is a calculator that allows users to consider how the EDF or FVS-CDS of an entity would change given alternative inputs. For the EDF model, changes can be applied to the EDF drivers and market data as well as select income statement and balance sheet items. For the FVS-CDS model, overrides can be applied to select inputs, including the one-year EDF, loss given default (LGD), and the market Sharpe ratio. The calculator output compares the firm's current and new EDF measures and EDF-implied ratings or FVS-CDS across the term structure. Overrides can be shared with other users.
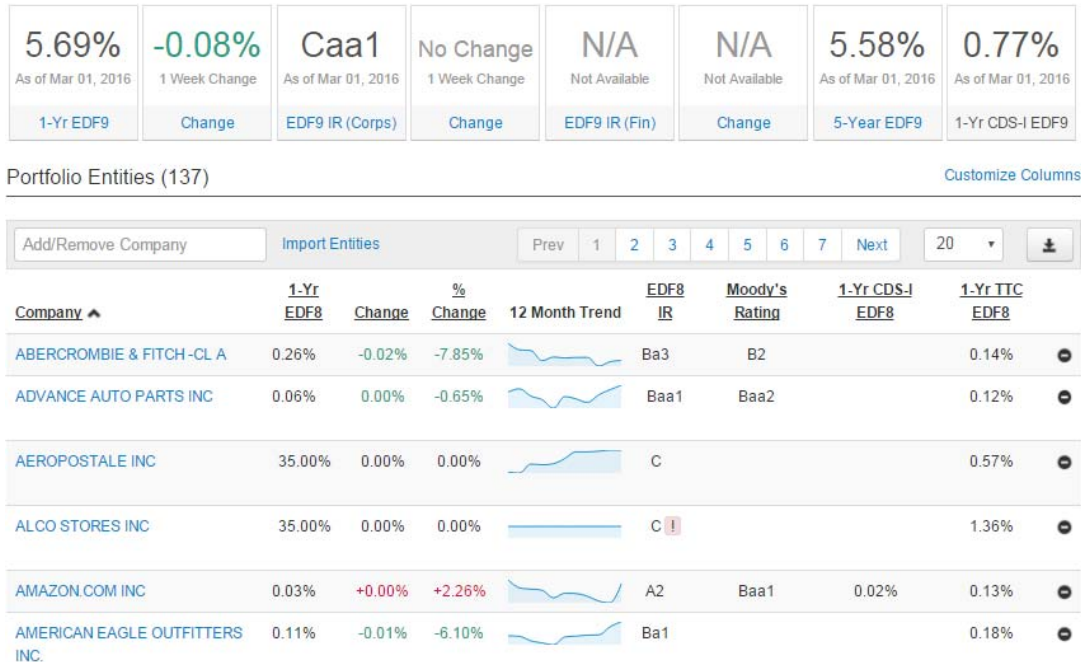
Figure 7   EDF Calculator

Term	Current EDF9	Current IR	New EDF9	New IR
1 Year	0.19%	Ba2	0.34%	Ba3
2 Year	0.29%	Ba2	0.50%	Ba3
3 Year	0.37%	Ba2	0.62%	Ba3
4 Year	0.45%	Ba1	0.72%	Ba3
5 Year	0.53%	Ba1	0.82%	Ba3
6 Year	0.61%	Ba1	0.91%	Ba2
7 Year	0.69%	Ba1	1.00%	Ba2
8 Year	0.73%	Ba1	1.02%	Ba2
9 Year	0.76%	Ba1	1.04%	Ba2
10 Year	0.79%	Ba1	1.06%	Ba2

Portfolio & Alerts Functionality

Users can easily monitor a group of entities or bonds by grouping them into portfolios. The portfolio landing page of the CreditEdge website shows both aggregated portfolio statistics and overviews of the credit risk profiles for each constituent entity. This view facilitates comparisons of credit risk across the entities in a portfolio and allows users to easily identify improving or deteriorating trends.

Figure 8   Sample Portfolio Landing Page on the CreditEdge Website

5.69%	-0.08%	Caa1	No Change	N/A	N/A	5.58%	0.77%
As of Mar 01, 2016	1 Week Change	As of Mar 01, 2016	1 Week Change	Not Available	Not Available	As of Mar 01, 2016	As of Mar 01, 2016
1-Yr EDF9	Change	EDF9 IR (Corps)	Change	EDF9 IR (Fin)	Change	5-Year EDF9	1-Yr CDS-I EDF9

Portfolio Entities (137)   Customize Columns

Add/Remove Company	Import Entities		Prev 1 2 3 4 5 6 7 Next	20 ▾	±

Company ▲	1-Yr EDF8	Change	% Change	12 Month Trend	EDF8 IR	Moody's Rating	1-Yr CDS-I EDF8	1-Yr TTC EDF8	
ABERCROMBIE & FITCH -CL A	0.26%	-0.02%	-7.85%		Ba3	B2		0.14%	⊖
ADVANCE AUTO PARTS INC	0.06%	0.00%	-0.65%		Baa1	Baa2		0.12%	⊖
AEROPOSTALE INC	35.00%	0.00%	0.00%		C			0.57%	⊖
ALCO STORES INC	35.00%	0.00%	0.00%		C !			1.36%	⊖
AMAZON.COM INC	0.03%	+0.00%	+2.26%		A2	Baa1	0.02%	0.13%	⊖
AMERICAN EAGLE OUTFITTERS INC.	0.11%	-0.01%	-6.10%		Ba1			0.18%	⊖

The alerts function provides an easy way to monitor credit risk changes at the entity and portfolio level. Notifications appear as flags on the portfolio landing page and/or can be delivered by email.

Figure 9   Sample Benchmark Alert for Volkswagen AG

Create Benchmark Alert   Create Basic

Entity:
[C VOLKSWAGEN AG ✖]   Select an entity to compare against a benchmark.

Data:
[1-Yr EDF9 ▾]   Select the EDF or CDS-I EDF to compare to a benchmark.

Operator:
[Greater than or equal to ▾]   Select the operator to use for comparison.

Benchmark:
[G GERMANY AUTOMOTIV... ✖]   Select the benchmark group or portfolio.

Benchmark Data:
[1-Yr EDF9 75th Percentile ▾]   Select the EDF aggregate of the benchmark group.

[Create Alert]

Bond & Obligor Screener

The Screener tool allows users to identify entities or bonds that fit defined criteria. These criteria can include country/region, industry, credit risk measures, and financials. After filtering, the Screener displays information for each entity across four dimensions including EDF levels, EDF drivers and other credit risk measures. Customers typically use the Screener to construct custom portfolios. In the example shown below, the US Telephone group has been filtered to include only those names rated Baa1 or lower. The chart displays for those companies market leverage against asset volatility, where the bubble size corresponds to net sales and the color of the bubbles represents a sliding scale of one-year EDF measures (blue = low, red = high).

Figure 10 Entity Screener
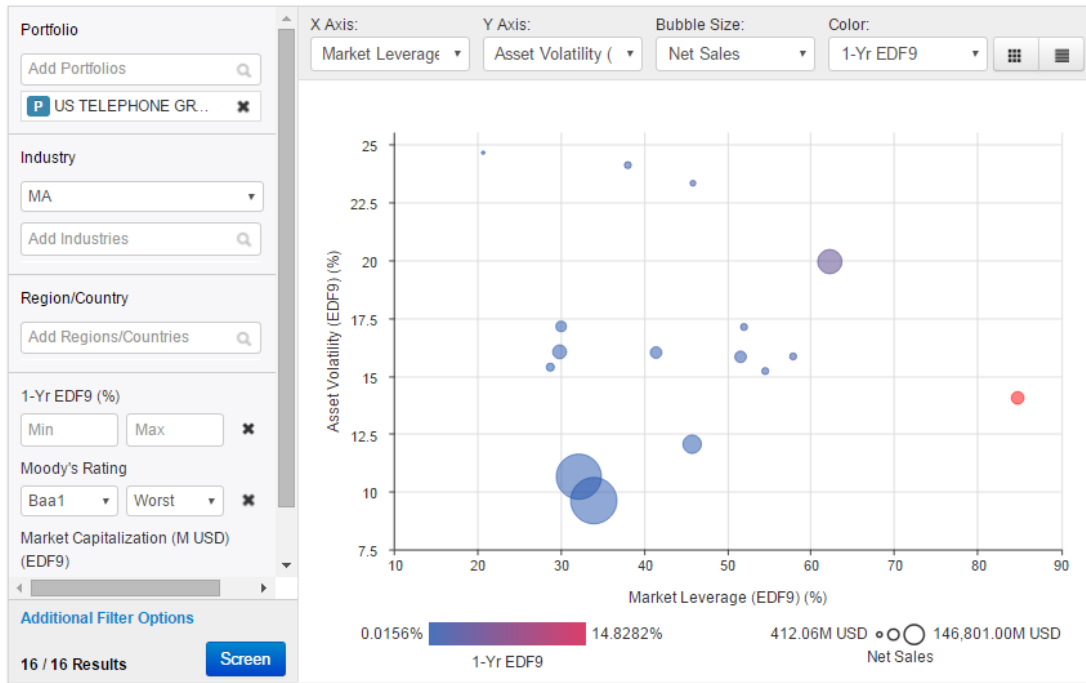
Other Ways to Obtain CreditEdge Data

Excel Add-In for Automated Analysis

The Excel add-in provides access to CreditEdge data directly through Excel. Users can create customized spreadsheets with more than 200 CreditEdge data points or leverage pre-defined templates for portfolio risk monitoring, early warning, and bond analysis. The spreadsheets can be set to update daily on an automated basis.

Figure 11 Sample Spreadsheet Utilizing the CreditEdge Excel Add-In

Data File Service and API

The CreditEdge Data File Service (a File Transfer Protocol, or FTP solution) and API enable customers to automate the integration of CreditEdge data into internal systems. The Data File Service can be accessed through Moody's Analytics' FTP site, where end-of-

day CreditEdge files are posted on a daily basis. Intraday updates are available for select data items. The CreditEdge API service allows users to access data and run What-If scenarios.

How Are Customers Using CreditEdge?

Underwriting

Lenders use CreditEdge to provide systematic evaluations of obligors at the time of origination. EDF measures and EDF-Implied Ratings are also often employed in pre-qualification assessments. Additionally, the metrics are employed in internal scorecards to improve the quantitative analysis of borrowers. Finally, the metrics are used for credit approval and credit limit setting based on internal thresholds and risk appetites.

Pricing, Reserves & Limit Setting

EDF measures enhance risk-based pricing of loans and vendor contracts. As a key input to expected loss calculations, EDF measures are a key input to many banks' processes for setting reserves, and they inform the process by which banks set credit limits for different segments of their portfolios.

Counterparty Assessment

CreditEdge helps users assess the credit risk of their suppliers and service providers based on default probabilities and implied ratings. The platform provides continuous monitoring of counterparties, so that users can quickly identify potential changes in vendor creditworthiness. This allows them to get ahead of possible credit deterioration, and thus manage their business continuity risk.

Early Warning & Portfolio Monitoring

CreditEdge has a number of features that allow users to monitor changes in obligor credit quality. As forward-looking probability of default metrics, EDF measures have helped risk managers allocate resources more effectively.

The web platform's portfolio feature provides users with an aggregate view of key trends, and provides insights into a portfolio's risk profile. Customers quickly identify outliers and decide whether to take steps such as reducing credit limits or toughening the terms of their agreements with counterparties.

Pre-Screen Investments & Perform Relative Value Analysis

Asset managers, particularly investors in corporate bonds and credit default swaps, use CreditEdge in a number of ways. The platform's data is used to increase the efficiency of portfolio surveillance; to find undervalued assets; and as inputs into a variety of quantitative security and portfolio construction and valuation models. Our research shows that portfolios of bonds with high Alpha Factors (i.e., that have OAS well in excess of their FVS) consistently outperform the broad markets over time.

Inputs to Internal Risk Rating Systems

Internal rating systems are the foundation of many business decisions within financial institutions. They typically combine quantitative and qualitative factors at both the market/industry-level and firm-level. Since EDF measures are based on large amounts of data and rigorous statistical methods, they are often used as quantitative inputs to internal risk rating systems.

Benchmarking & Calibrating Internal Risk Rating Systems

EDF measures reflect the experience learned from the large number of defaults in our database, as well as other credit-related inputs. They are therefore well-suited for benchmarking and calibrating internal risk systems. Many institutions do not possess enough internal data for this purpose, so using external sources such as CreditEdge improves model accuracy.

Input to Bank Regulatory Capital Calculations

Probabilities of default associated with internal ratings play a central role in the calculation of capital requirements in the Basel framework. Many banks use EDF or TTC EDF measures as part of their internal ratings, either for regulatory capital calculations or for benchmarking and calibrating their internal models to fulfill regulatory requirements.

Stress Testing

CreditEdge offers the unique ability to provide both granular and portfolio-level conditional default probabilities that are used to calculate post-stress expected loss estimates. The Stressed EDF model is backed up by a robust methodology and strong validation results. It has served as a primary and challenger model for stress testing C&I loan portfolios and as an input to CDONet, Moody's Analytics' tool for stress testing CLOs.

Input to Required Economic Capital Calculation

CreditEdge provides the probability of default input needed in portfolio models to calculate expected loss (EL), unexpected loss (UL), and thus subsequently to set economic capital (EC). Many institutions leverage CreditEdge EDF measures in this capacity.

Loss Provisioning

CreditEdge is used to estimate the likelihood of borrowers defaulting on their loans, information vital to determine appropriate levels of loan loss provisions. Borrowers can use firms' EDF term structures to establish loss provisions for long-dated exposures.

For More Information

To learn more about CreditEdge and other Moody's Analytics solutions, please contact our experts at
creditedge_support@moodys.com