MOODY'S ANALYTICS

Introducing The Deterioration Probability Metric

A New Metric for Downgrade Risk

Credit Risk Analytics Group

May 2018

Agenda

1. Introducing the Deterioration Probability
2. Deterioration Probability Model Drivers and Output
3. Deterioration Probability in Practice: Teva Pharmaceutical
4. Demo: Accessing the Deterioration Probability through CreditEdge
5. Q&A

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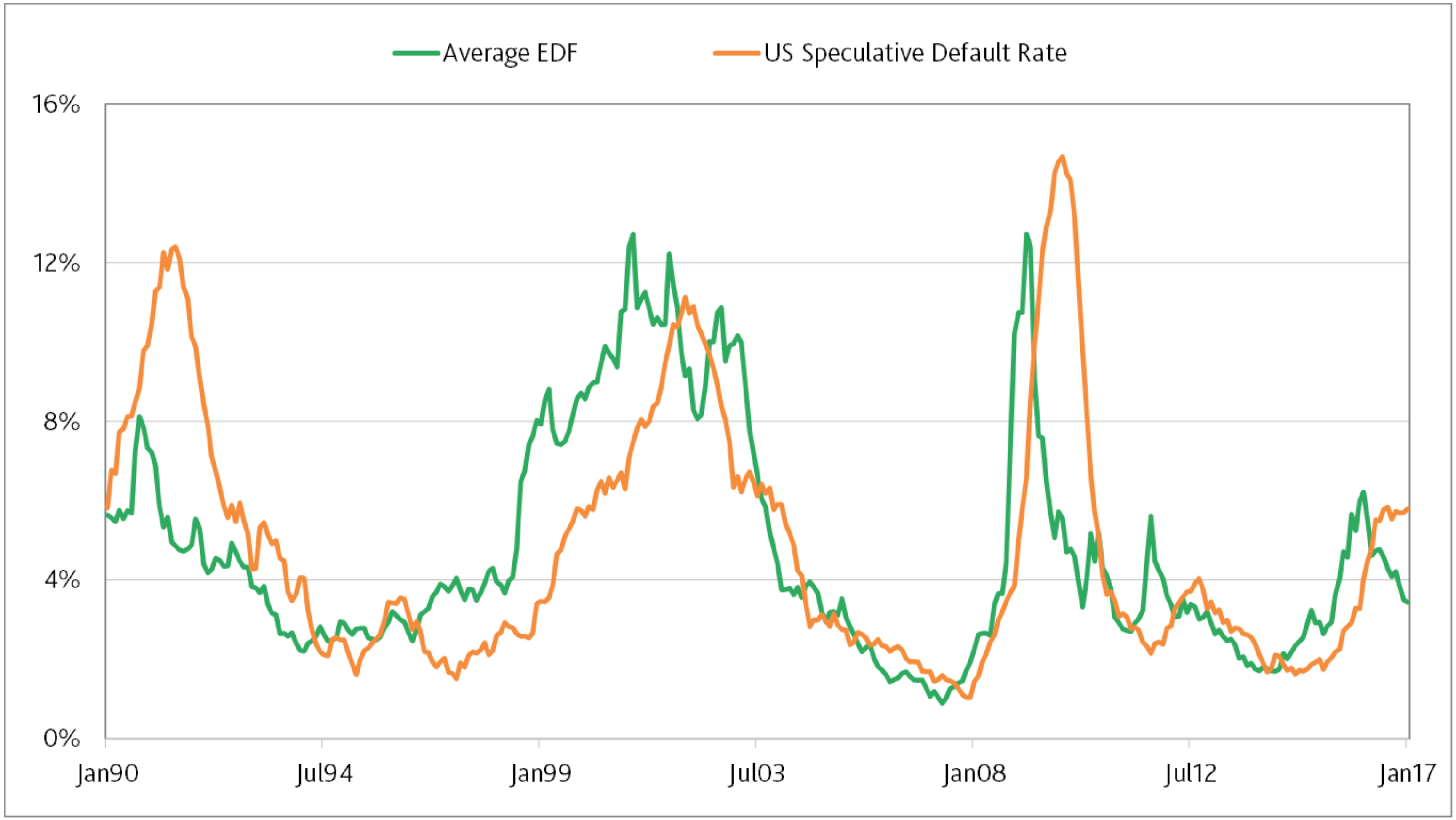
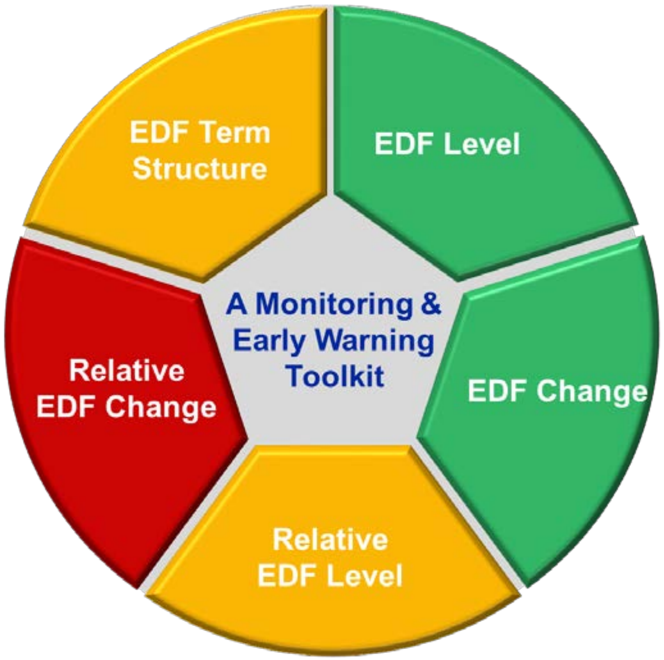
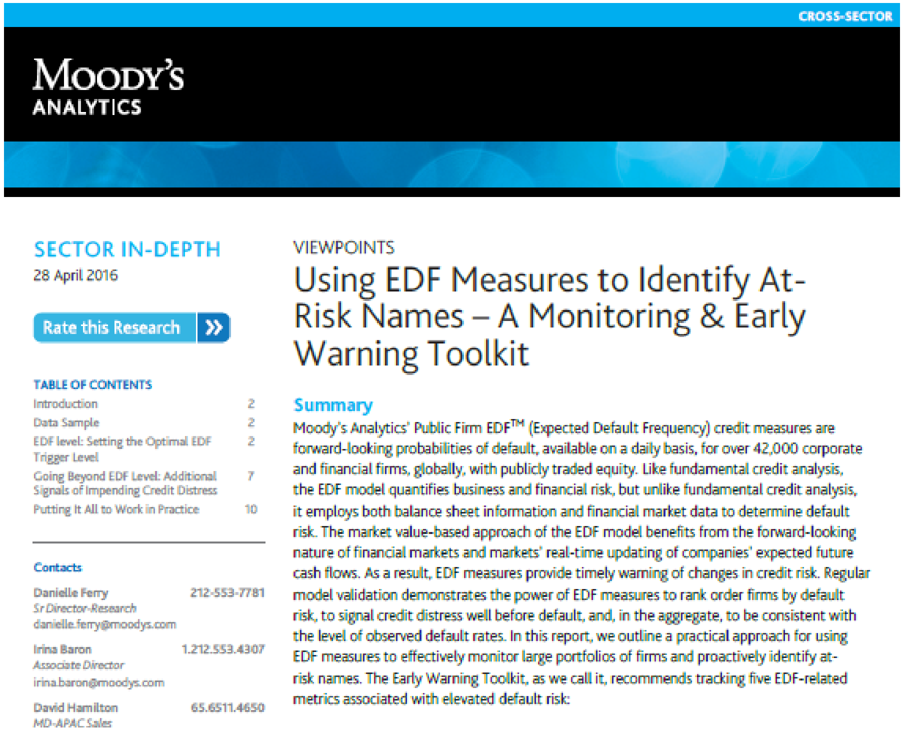
Introducing the Deterioration Probability

The EDF model predicts default with accuracy and high degree of early warning



The Early Warning Toolkit helps uncover additional insight into elevated default risk

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VIEWPOINTS

Using EDF Measures to Identify At-Risk Names – A Monitoring & Early Warning Toolkit

Summary

Moody's Analytics' Public Firm EDF™ (Expected Default Frequency) credit measures are forward-looking probabilities of default, available on a daily basis, for over 42,000 corporate and financial firms, globally, with publicly traded equity. Like fundamental credit analysis, the EDF model quantifies business and financial risk, but unlike fundamental credit analysis, it employs both balance sheet information and financial market data to determine default risk. The market value-based approach of the EDF model benefits from the forward-looking nature of financial markets and markets' real-time updating of companies' expected future cash flows. As a result, EDF measures provide timely warning of changes in credit risk. Regular model validation demonstrates the power of EDF measures to rank order firms by default risk, to signal credit distress well before default, and, in the aggregate, to be consistent with the level of observed default rates. In this report, we outline a practical approach for using EDF measures to effectively monitor large portfolios of firms and proactively identify at-risk names. The Early Warning Toolkit, as we call it, recommends tracking five EDF-related metrics associated with elevated default risk:

Deterioration Probability provides early warning on downgrade risk

Deterioration Probability is a metric ranging from 1-70% that estimates probability of downgrade for rated firms in the next 12 months

Quantitative, transparent model

- High accuracy ratios for both corporate & financial firms
- Extensive documentation and model validation

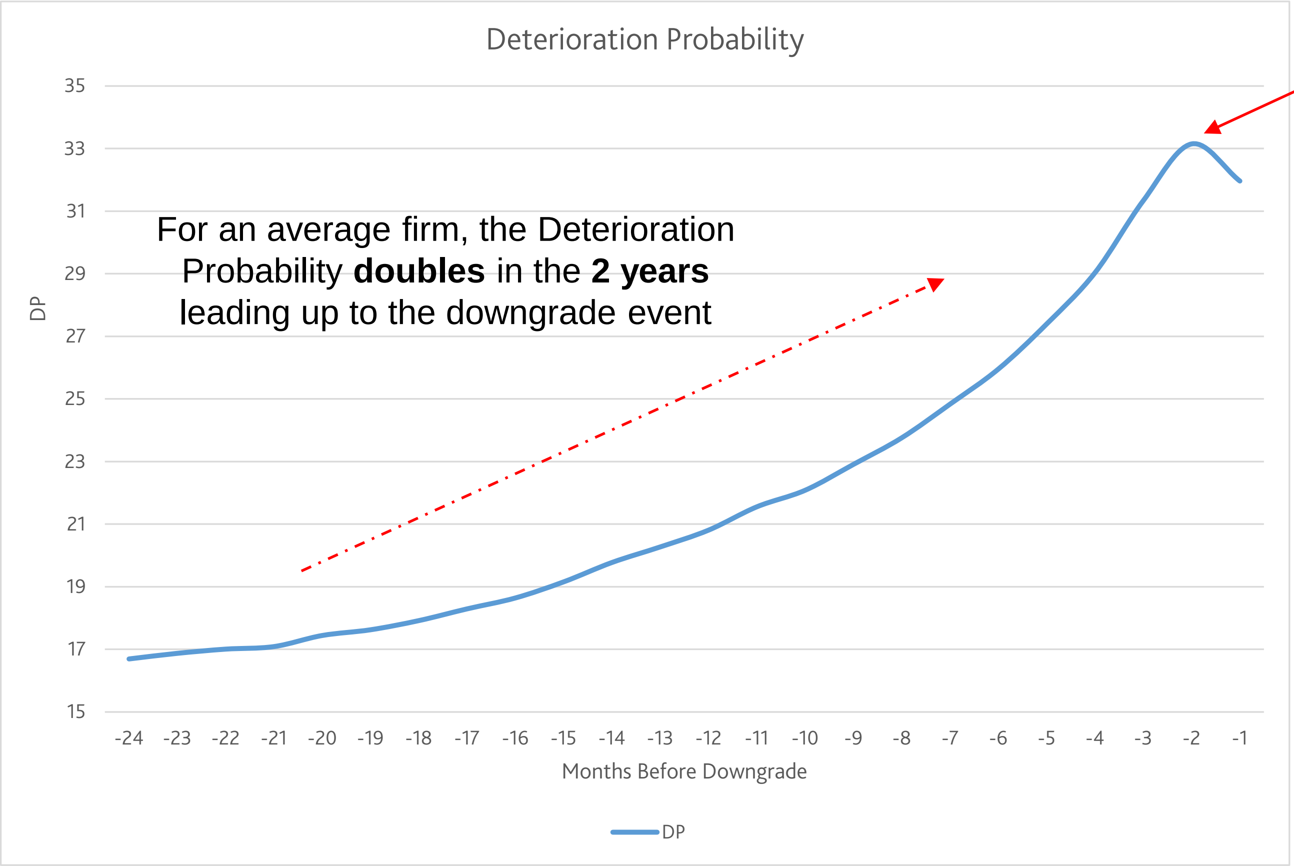
Early warning power

- Deterioration Probability doubles on average during 2 years prior to downgrade event and peaks 2 months before downgrade
- Use Deterioration Probability to monitor downgrade risk & EDF to monitor default risk

Broad coverage

- 44k+ public firms globally
- Updated daily + history available

Deterioration Probability provides a strong solution for early warning of downgrade events



Deterioration Probability **peaks** roughly **2 months before** the downgrade event – giving risk / investment managers time to take action

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Deterioration Probability Model Drivers and Output

Early Warning Toolkit parameters, Implied Rating gaps and Rating Outlook are Deterioration Probability's inputs

The Deterioration Probability = **CreditEdge Early Warning Toolkit** + **Market Implied Ratings** + **Rating Outlooks & History from MIS**

High EDF metrics are associated with high Deterioration Probability

1. **Trigger Exceedance** (EDF trigger level): company's EDF above or below its group trigger
2. **1-year EDF** measure
3. **Slope** (EDF term structure): 5-year EDF minus its 1-year EDF
4. **Industry Median EDF Growth Rate**
5. **Relative EDF**: ratio of a firm's EDF to its industry median EDF

Negative rating gap is associated with increased Deterioration Probability

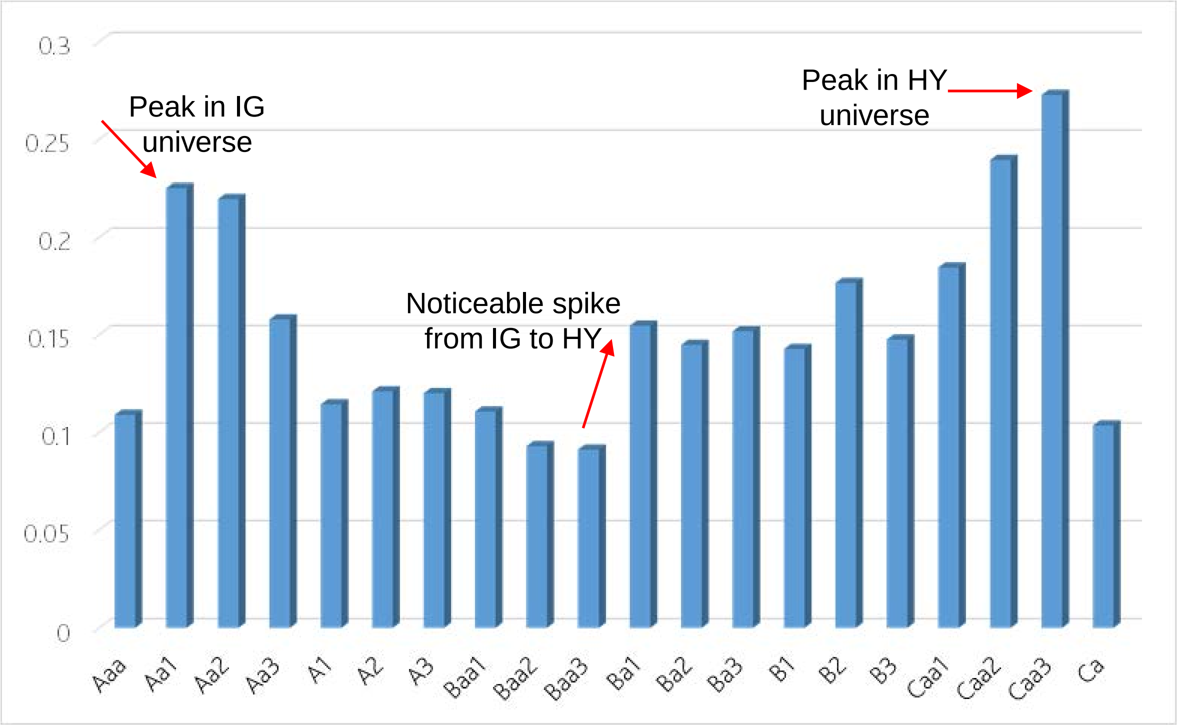
- **Implied Rating gap**: the difference between the firm's Moody's rating and the best available Market Implied Rating

Indicators of future downgrades

- Stable, positive or negative **outlook**
- **Recent downgrade** in last 12 months

Baseline downgrade frequencies differ by initial rating category

Frequencies of Downgrade Events by Rating Class



Downgrade frequencies are **higher on average** for companies in the **high yield (HY)** universe than those with investment grade (IG) ratings

Deterioration Probability can also be derived for unrated public firms

The Deterioration Probability for unrated firms is a metric ranging from 1-70% that estimates probability of how likely a **downgrade event might be** if the firm were rated by Moody's Investors Service

- Estimated based on **patterns of downgrades** observed in data for public rated firms with similar characteristics
- CreditEdge **Early Warning Toolkit** inputs are the available model drivers used to calculate Deterioration Probability for unrated firms
- If a firm becomes rated, Market Implied Ratings data and rating outlook/downgrade variables will also be applied to the firm's Deterioration Probability calculation
- The Deterioration Probability can be used to **rank both rated and unrated** firms by their risk of a downgrade-like credit event

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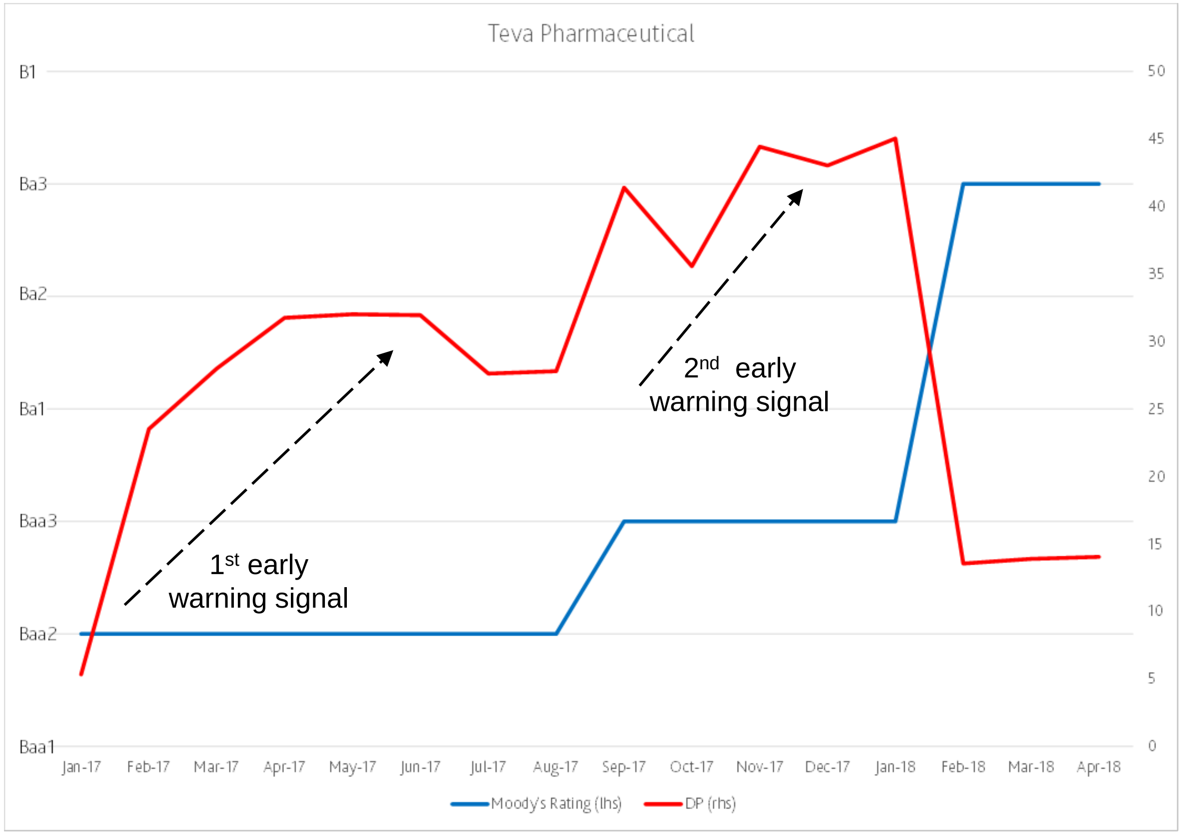
Deterioration Probability in Practice: Teva Pharmaceutical

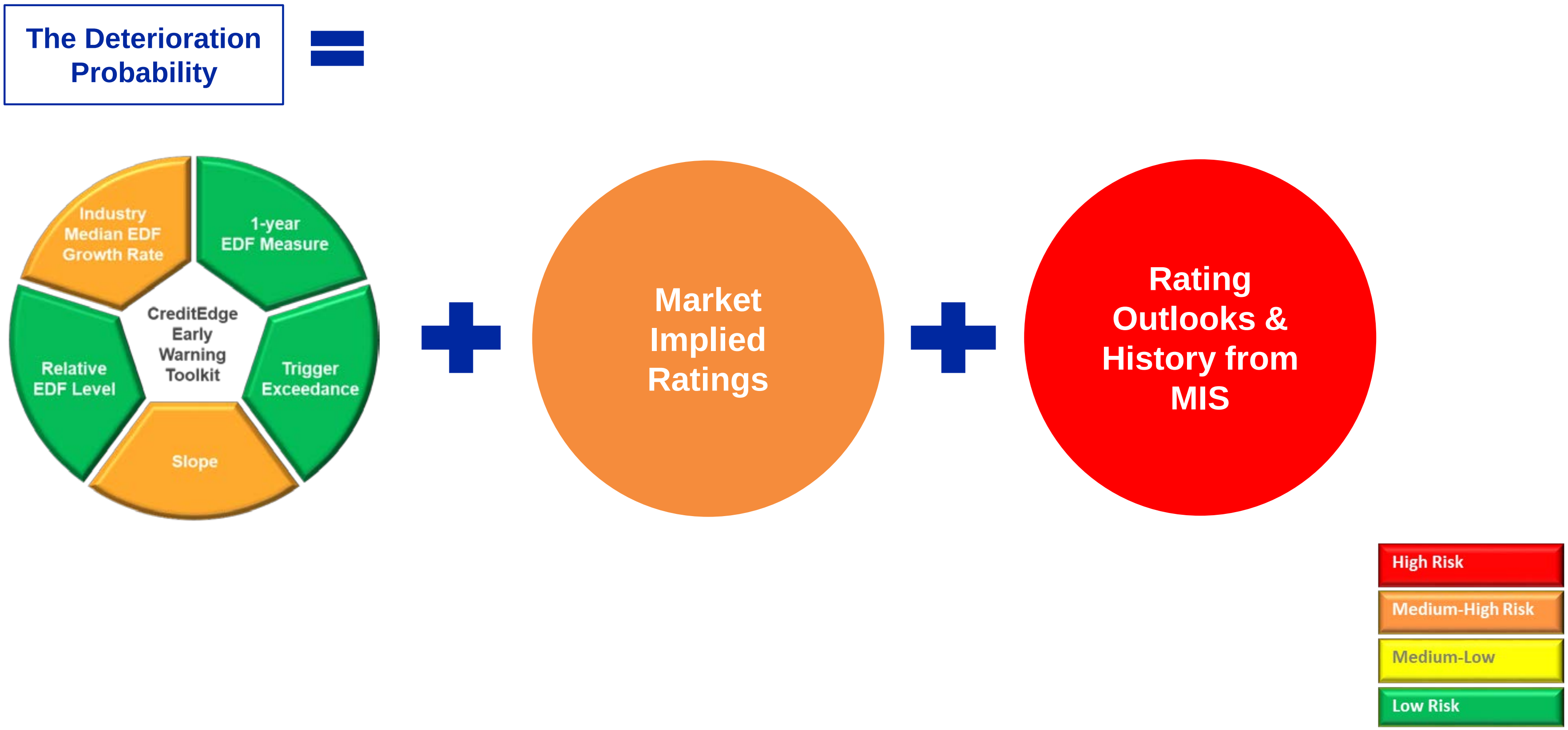
Teva's Deterioration Probability peaks two months before each downgrade occurs



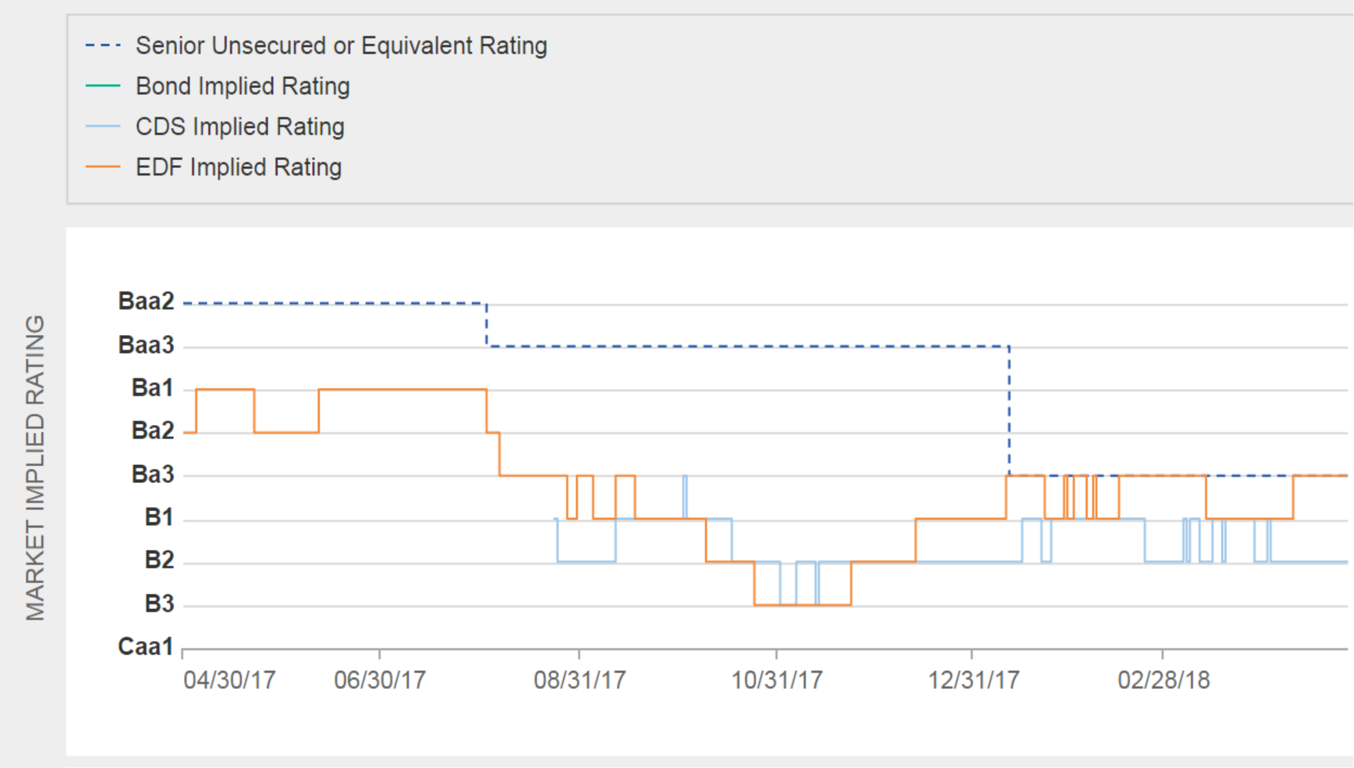
Based in Israel, **Teva Pharmaceutical** is a global pharmaceutical company engaged in the development, production and marketing of drugs, generic drugs, over-the-counter drugs, active ingredients for the pharmaceutical industry (APIs) and therapeutic products.

- In August 2017, the Deterioration Probability peaks at roughly 35%, before it is downgraded to a Baa3 in the same month.
- Before downgrade, the EDF Implied Rating was Ba1, with an Implied Rating gap of -2.
- The Deterioration Probability reaches 43% in the two months before it is downgraded three notches to Ba3 in January 2018.
- At this time, Teva had a negative outlook, EDF Implied Rating of B1, Implied Rating gap of -4, and an EDF of 0.26%.

Teva’s downgrade risk is driven by its negative Implied Rating gap, negative outlook and downgrade over the last year

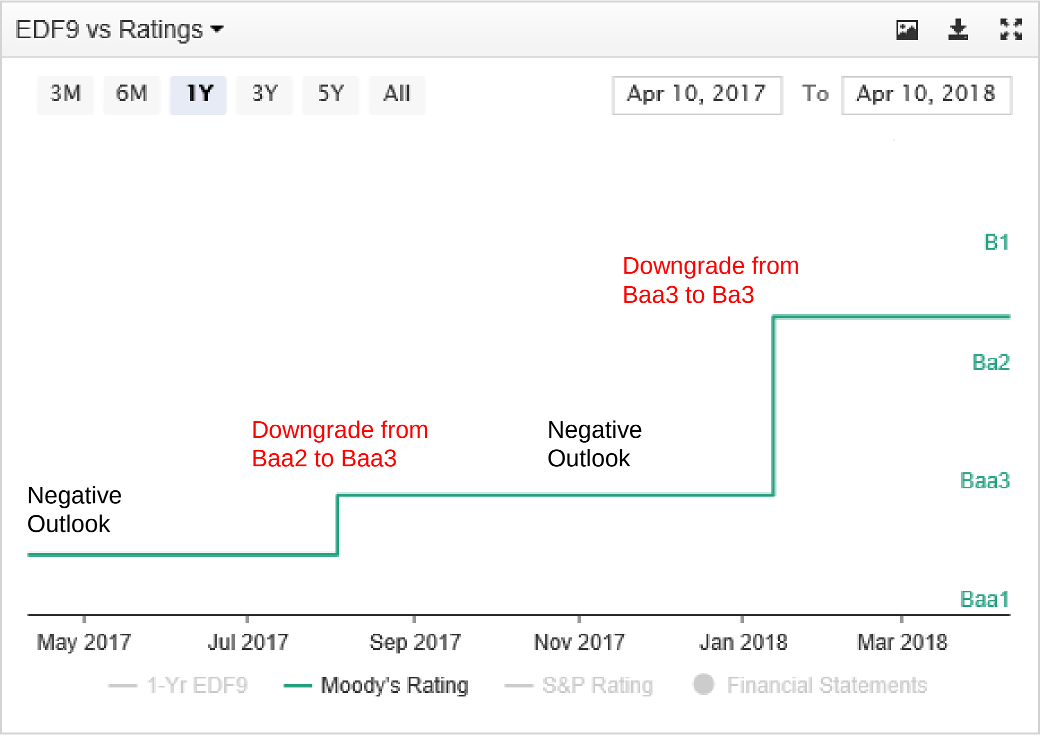


Teva's negative Implied Rating gaps preceded each downgrade, with a larger gap before its January 2018 downgrade



- At the time of Teva's August 2017 downgrade, its EDF Implied Rating was Ba1, giving it an Implied Rating gap of -2.
- By its January 2018 downgrade, its EDF Implied Rating of B1 gave it an Implied Rating gap of -4.

Teva’s negative outlook and August 2017 downgrade also indicated potential future downgrade risk



- At the time of Teva’s August 2017 downgrade, MIS analyst cited “slower deleveraging” than expected, plus high leverage and profit concentration in its leading multiple sclerosis drug, Copaxone.
- MIS analysts equate Teva’s three-notch downgrade by January 2018 in part to its high leverage and numerous impending maturities.

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Demo: Accessing the Deterioration Probability through CreditEdge

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Q&A

Available collateral material

- **Full methodology paper**: available on CreditEdge Help Page
- **At-a-Glance paper**: available on CreditEdge Help Page, www.moodysanalytics.com (CreditEdge page), LinkedIn page
- **Historical file**: available via ftp upon request, containing the entire CreditEdge universe and Deterioration Probability (Daily from 2017, Monthly from 2004)

Please reach out with questions

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