

# Leveraging Artificial Intelligence & Big Data to Maximize Your Early Warning Practices

**Paolo Persurich**  
Director, Senior Product Strategist

November 4, 2019



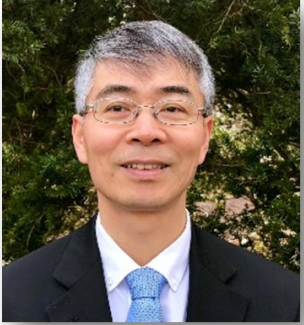
## Paolo Persurich

Director of Product Management | Moody's Analytics



## Irina Korablev

Sr. Director of Product Management | Moody's Analytics



Jack Chen  
Head of Credit Risk Analytics  
AIG



Karina Magnollay  
Credit Portfolio Manager  
PNC



Boniface Pasaribu  
Senior Credit Manager  
Cisco Capital

# Agenda

1. AI & ML techniques
2. Panel: AI & ML applications - a multi-industry perspective
3. Use of AI/ML in credit analysis - the Credit Sentiment Score (CSS)

1

AI & ML techniques

# Which of the following best describes ML?

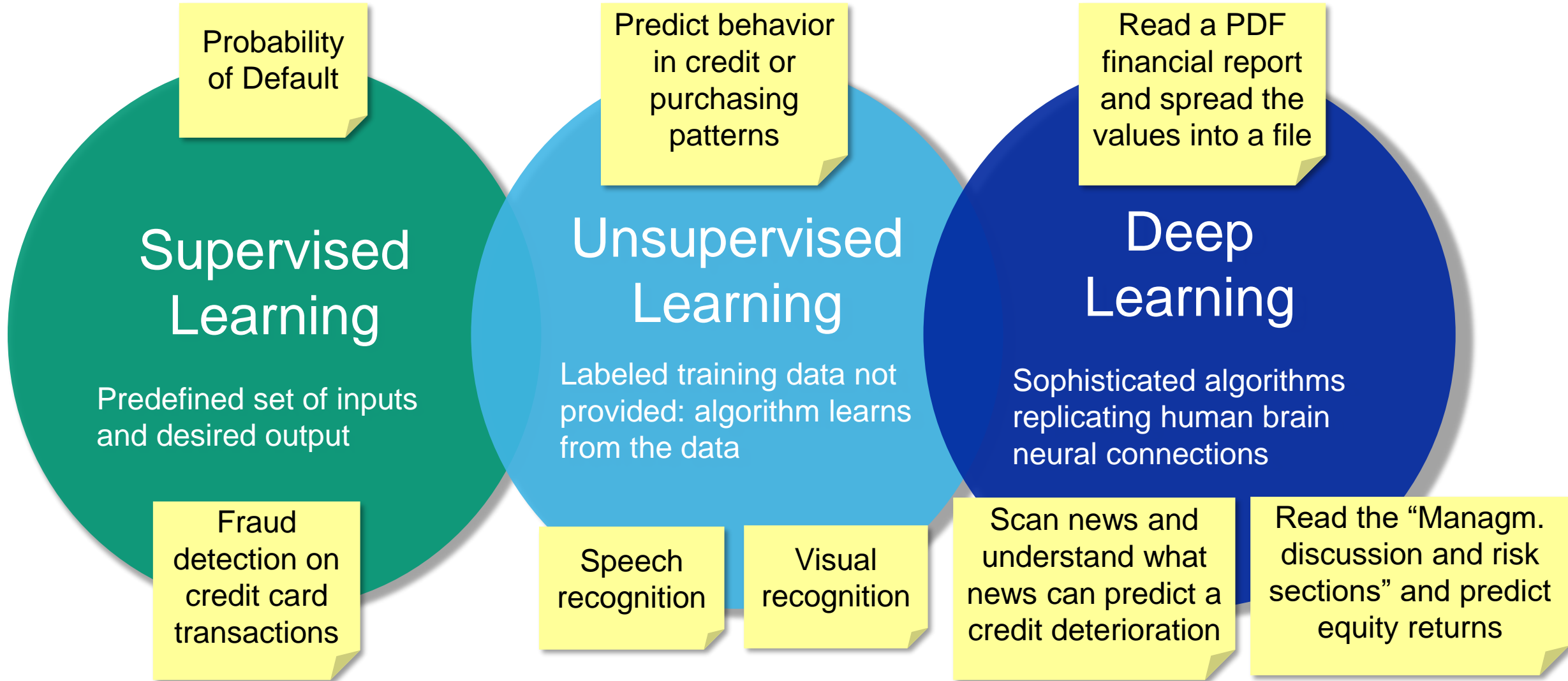


A. is a type of computer algorithm.

B. is a set of computer-driven approaches aimed at generating structure or predictions from data without human intervention by finding a pattern and then applying the pattern.

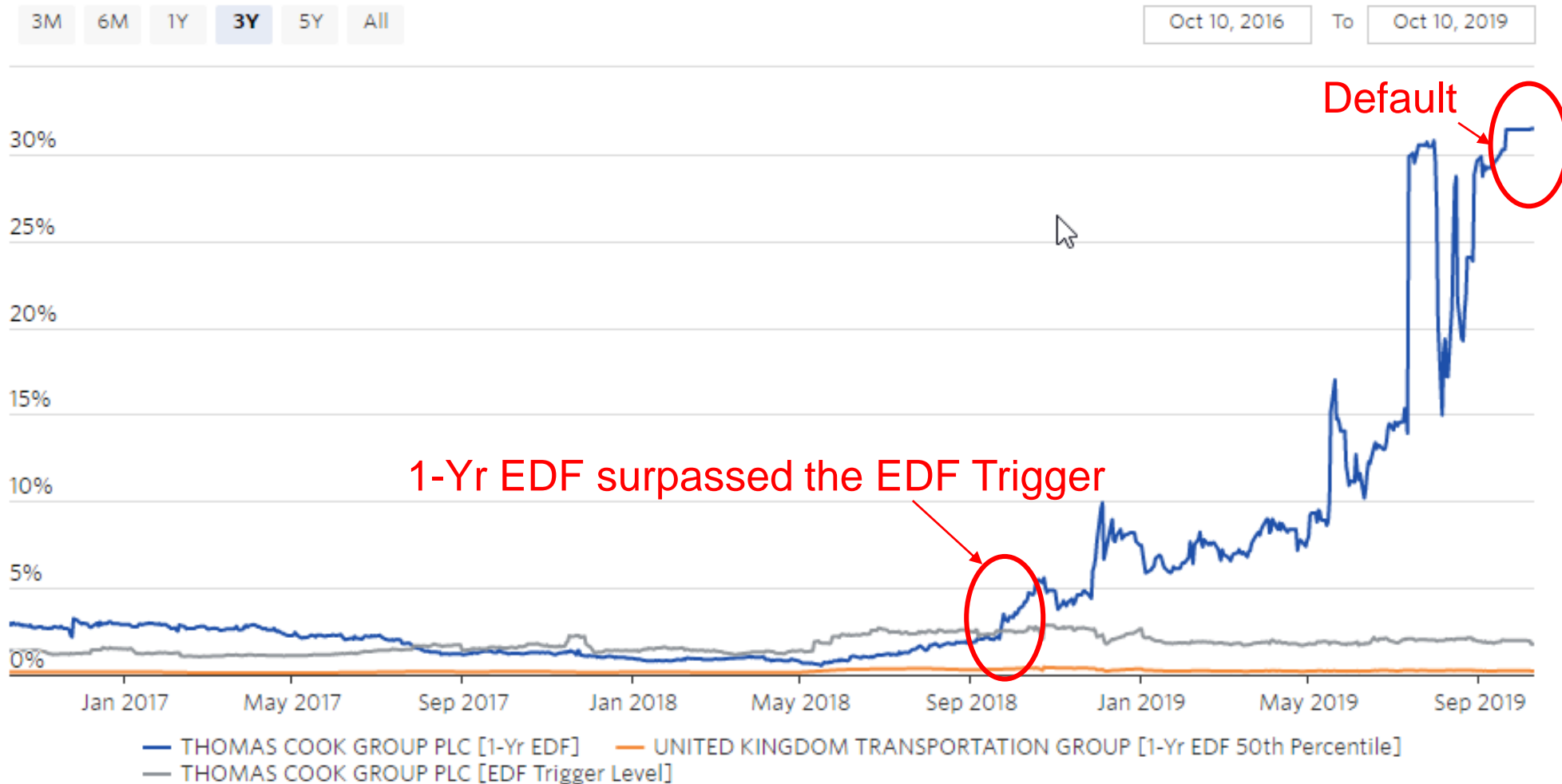
C. is a set of computer-driven approaches adapted to extracting information from linear, labeled data sets.

# Three main types of Machine Learning



# CreditEdge EDF metric

Predicted Thomas Cook default one year prior





2

Panel: AI & ML applications -  
a multi-industry perspective

How does AI/ML currently help you monitor portfolio risk?

How has AI/ML impacted risk monitoring in your industry so far?



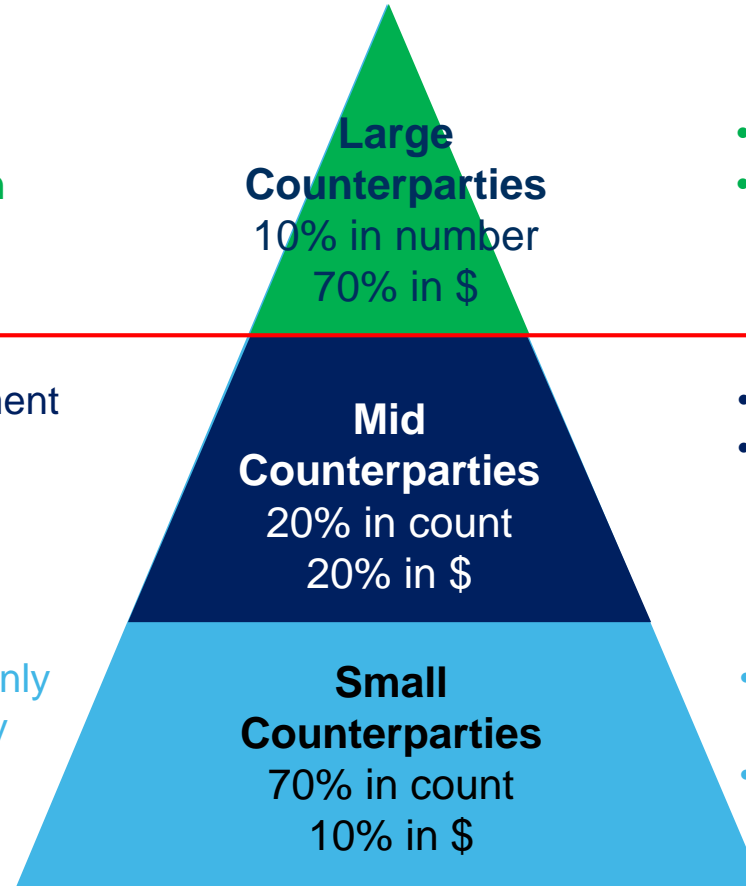
## Challenges for global mid-size financing

### Structure

- Financial data available
- Price reflects latest information
- Abundance of news

- Financials only by request, payment performance data available
- Industry/Sovereign news
- Refinancing risk

- Financial data only by request, only payment performance data if any
- Industry/Sovereign news
- Refinancing risk



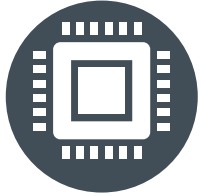
### Challenges

- Lowest need for additional monitoring
- Traditional CM/PM monitoring is good

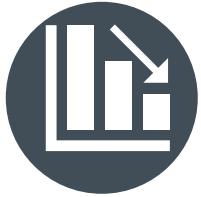
- High need of monitoring
- Too many to be covered manually by CM/PM

- Highest risk / highest need of monitoring
- Too many to be covered manually by CM/PM

Highest need for AI/ML in monitoring



Not currently using AI/ML for commercial portfolio monitoring



Third party data (i.e. early warning signals) and internal metrics to pinpoint customer level and industry level concerns



Using trigger levels and establish thresholds of risk tolerance for industry portfolio monitoring



Screening news, third party research, internal scorecard commentary to extract key industry themes

How could AI/ML help you enhance your early warning monitoring?

How will AI/ML change credit monitoring for your industry?



# Cisco Systems

## Evolution of Early Warnings = Data + Model



	1 <sup>st</sup> Generation	2 <sup>nd</sup> Generation	3 <sup>rd</sup> Generation	4 <sup>th</sup> Generation	Future
Description	Basic detection system that relied on EDF/PD, DQ and Other 3 <sup>rd</sup> party data. Mostly for public companies	Adding Financial DQ, Sovereign Rating, Peer Comparison based on portfolio	Adding counterparty payment behaviors	Unified statistical model	Incorporating richer (non-financial) data set + ML/AI
Data	<ul style="list-style-type: none"> <li>» Public Companies: Moody's EDF, Risk Frontier metrics (EL/UL/RC)</li> <li>» DQ 60+</li> <li>» DnB RAM Scores</li> </ul>	<ul style="list-style-type: none"> <li>» Financial DQ vs Disputes</li> </ul>	<ul style="list-style-type: none"> <li>» History of counterparty behaviors</li> </ul>	<ul style="list-style-type: none"> <li>» Panel data format</li> </ul>	<ul style="list-style-type: none"> <li>» Non-Financial data (News + Corporate Events)</li> </ul>
Model	<ul style="list-style-type: none"> <li>» Comparative to historical</li> </ul>	<ul style="list-style-type: none"> <li>» Comparative to historical &amp; industry statistics</li> </ul>	<ul style="list-style-type: none"> <li>» Outliers based on distribution of each counterparty historical pay performance</li> </ul>	<ul style="list-style-type: none"> <li>» Regression/cluster of historical data to predict company most likely to fail</li> </ul>	<ul style="list-style-type: none"> <li>» ML/AI</li> </ul>
Triggers	<ul style="list-style-type: none"> <li>» Alerts when threshold triggered</li> </ul>	<ul style="list-style-type: none"> <li>» Alerts when threshold triggered</li> </ul>	<ul style="list-style-type: none"> <li>» Alerts when threshold triggered</li> </ul>	<ul style="list-style-type: none"> <li>» Ranked by probability of failure and risk drivers</li> </ul>	<ul style="list-style-type: none"> <li>» Real-time triggers</li> </ul>



Human component will remain key to portfolio management



Use AI/ML to consume credit, market, and macroeconomic data to pinpoint areas of concern



Use AI/ML to better understand risk correlation and enhance input models

# 3

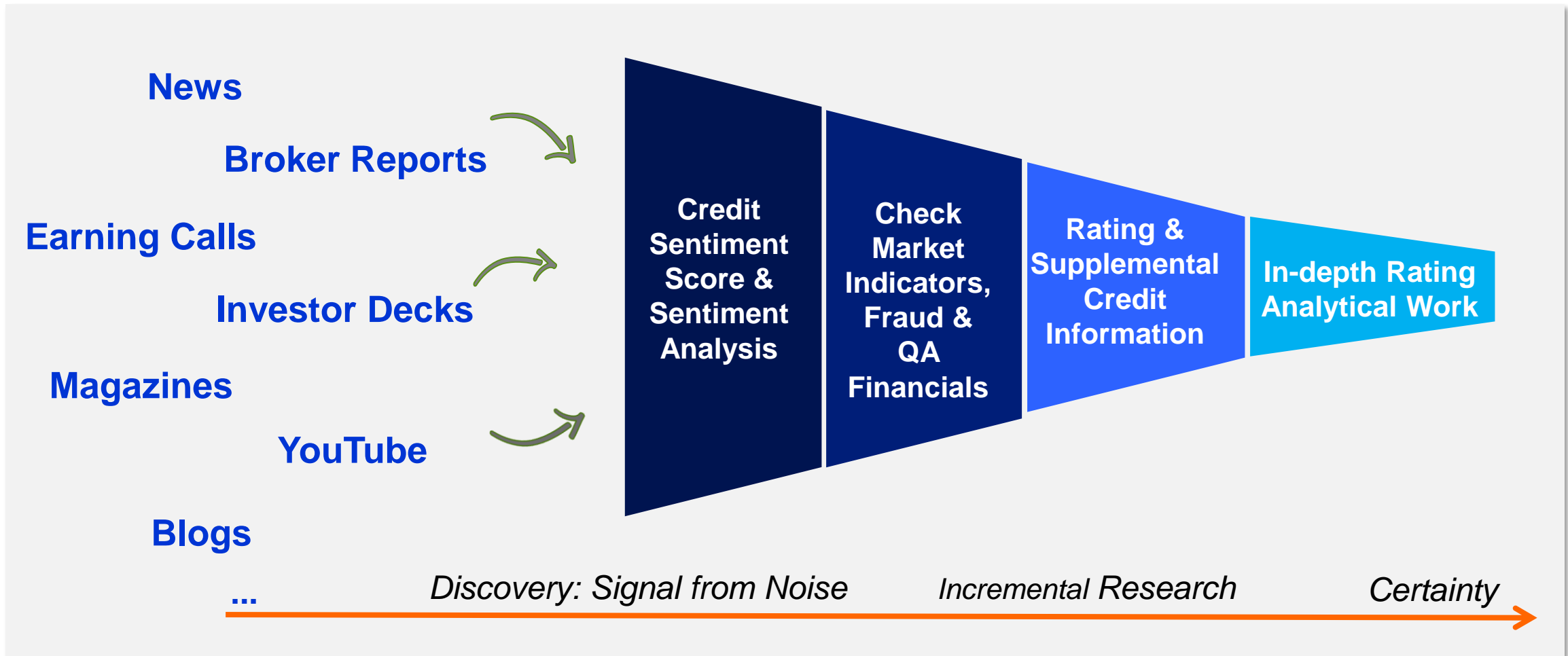
Use of AI/ML in credit analysis  
- the Credit Sentiment Score  
(CSS)



# Signal From Noise



AI and analysis of unstructured data applied to credit analysis



# Introducing Credit Sentiment Score (CSS)

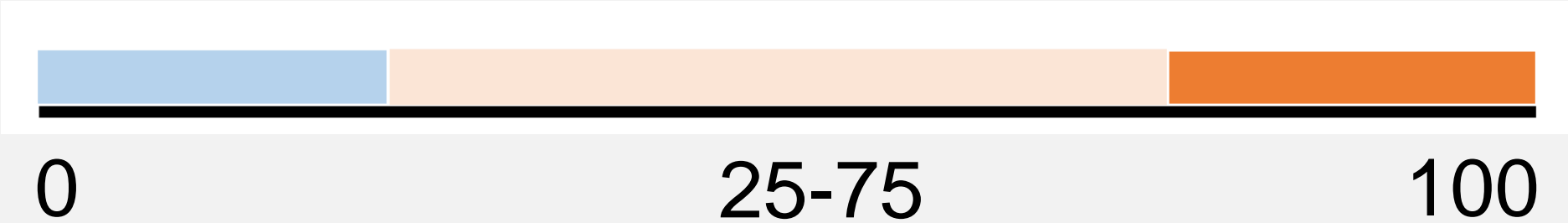
Built using Moody's Analytics unique credit modelling know-how and AI training datasets



Weak credit risk signal

Moderate to strong credit risk signal

Very strong credit risk signal



# Credit Sentiment Score: example

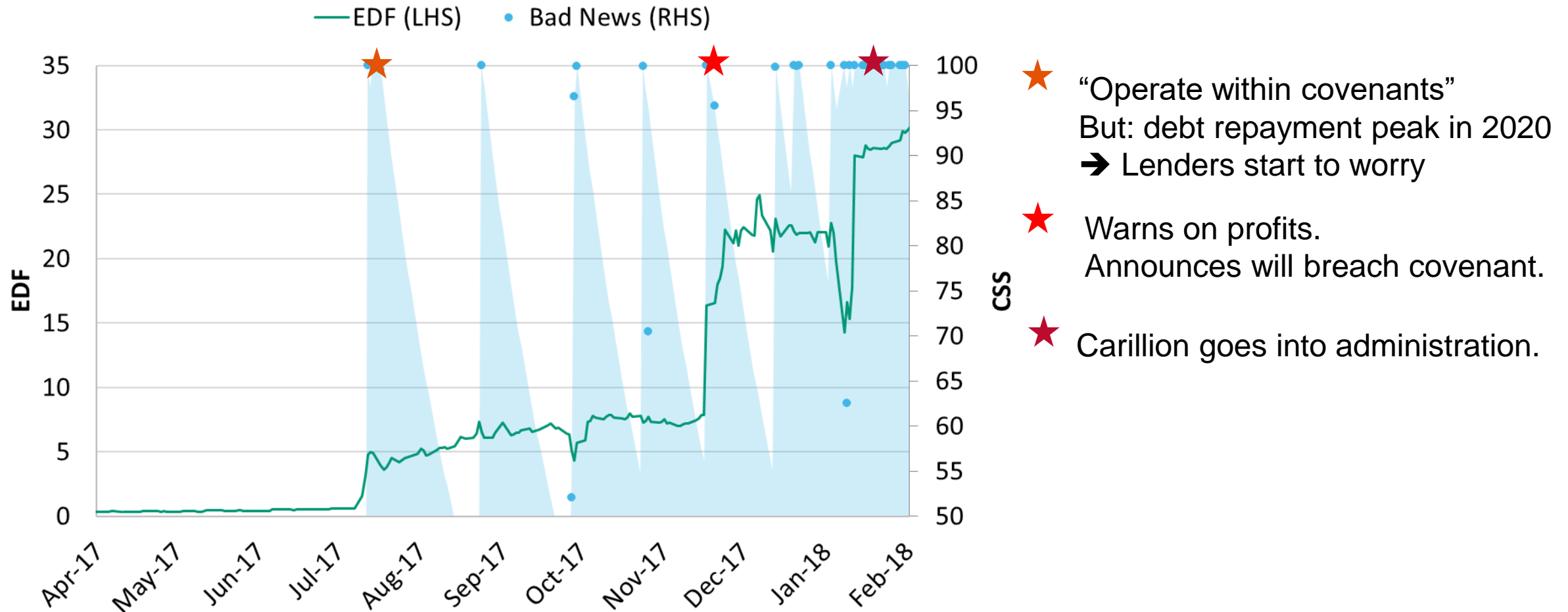


Headlines	CSS
Forever 21 Inc. recently filed for bankruptcy protection under Chapter 11 of the US Bankruptcy Code.	100
Forever 21, struggling with global expansion, explores a debt restructuring.	50
Forever 21 invests in DailyLook.	0

# Carillion Case Study



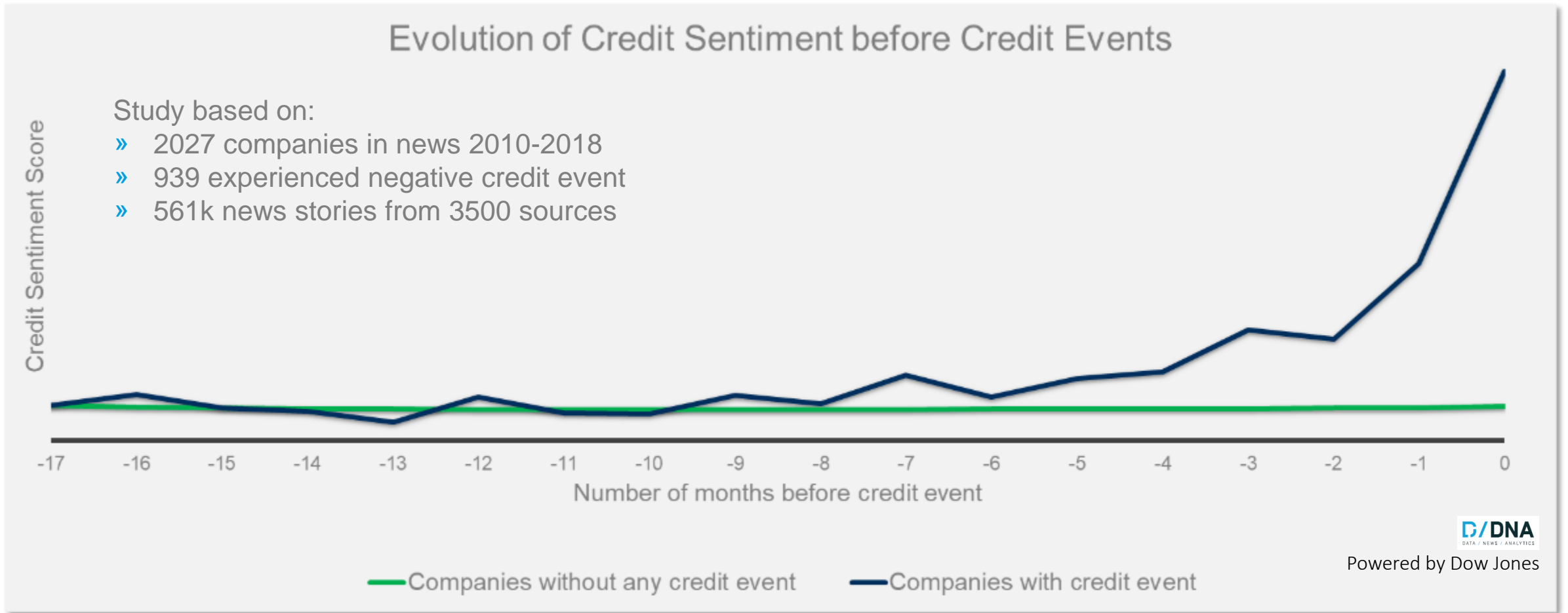
Credit Sentiment Scores capture and explain deterioration



# Does it work?



Yes: Scores start to diverge about eight months prior to a credit event

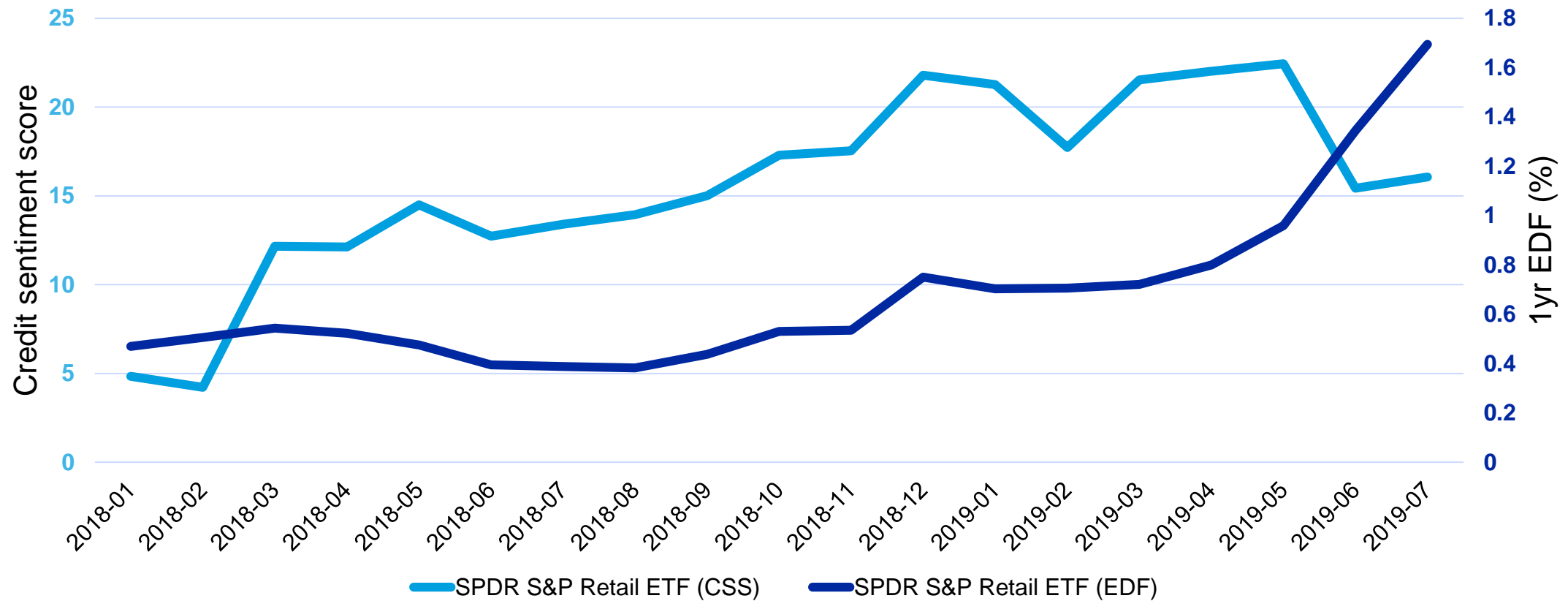


# Leveraging CSS and Public EDFs

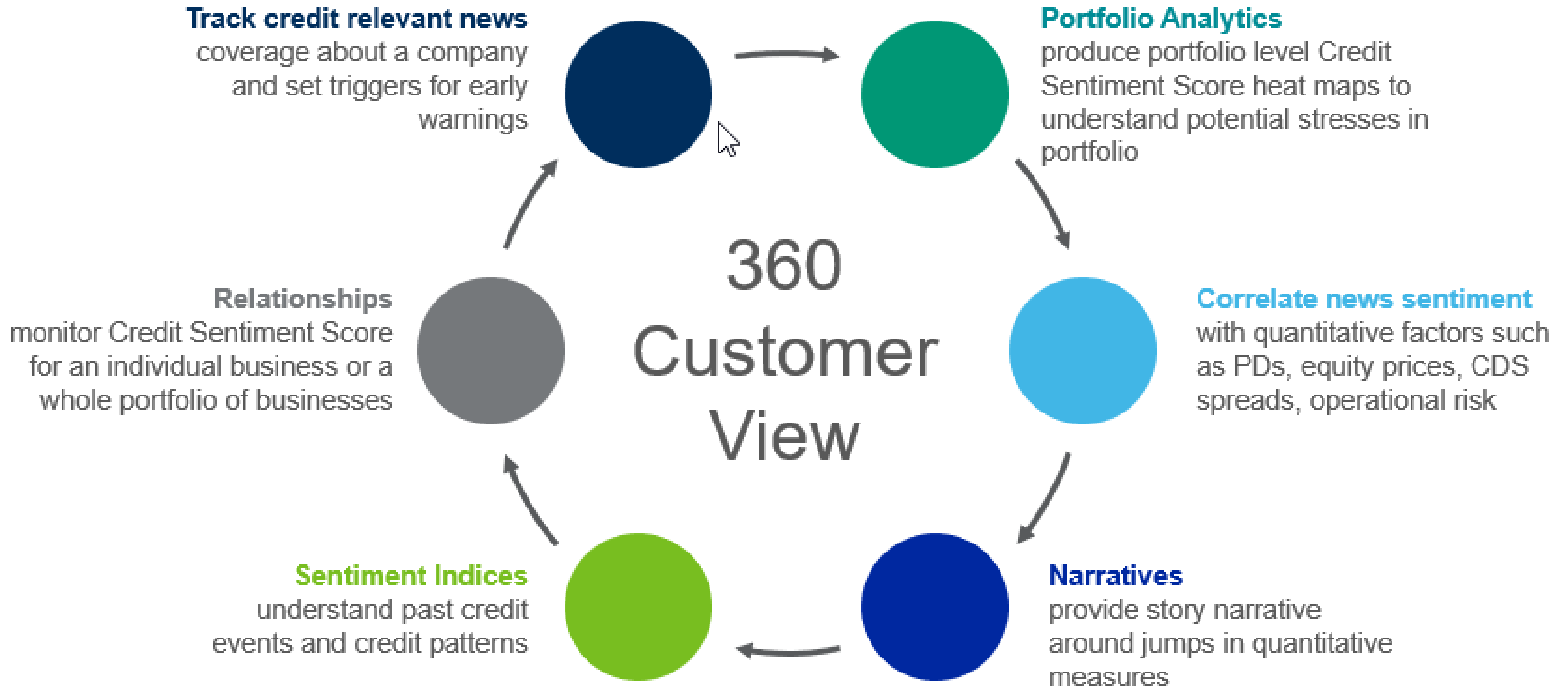
Levels show elevated risk for Retail Sector



### SPDR S&P Retail ETF: Credit Sentiment Scores vs EDF



# Leveraging Credit Sentiment Scores






MOODY'S  
ANALYTICS

Paolo Persurich  
Moody's Analytics  
7 WTC, 250 Greenwich Street  
New York, NY  
[Paolo.persurich@moodys.com](mailto:Paolo.persurich@moodys.com)



## Matching Risk with Early Warnings

	Description	Signals	Models	Alerts
 <div style="background-color: #ADD8E6; padding: 5px; text-align: center; margin: 5px 0;">Country</div> <div style="text-align: center;">↓</div>	<p>aka Sovereign Risk, reflecting government credit risk, <b>annually updated, extreme shifts are rare</b>. Any up/down reflect underlying changes in fiscal or monetary position of that country</p>	<p><b>Sovereign ratings by S&amp;P, Moody's, Fitch etc.</b> Global institutions reviews like IMF, World Bank etc. Macroeconomics variables</p>	<p><b>Sovereign analysis</b></p>	<p><b>Country Trigger</b></p>
 <div style="background-color: #ADD8E6; padding: 5px; text-align: center; margin: 5px 0;">Industry</div> <div style="text-align: center;">↓</div>	<p>Reflecting average risk of companies within particular industry, often driven by business cycle. <b>Updated quarterly or annually.</b></p>	<p><b>Industry-level EDF Change</b> Moody's or S&amp;P Industrial Averages Industrial statistics</p>	<p><b>Peer or Industry analysis</b></p>	<p><b>Industry Trigger</b></p>
 <div style="background-color: #ADD8E6; padding: 5px; text-align: center; margin: 5px 0;">Counterparty</div>	<p>Risk of particular counterparty. Mostly driven by business performance, liquidity, and capital structure of that counterparty. Can be a public or private entity. <b>Updated regularly, as events unfold</b></p>	<p><b>PD/EDF Change DQ (Admin &amp; Financial)</b> DnB Adverse News or Credit Events Portfolio Risk Metrics</p>	<p><b>Statistical modeling (e.g. Regression) or AI/ML models</b></p>	<p><b>Red flags/ Yellow Flags</b> <b>Ranking of counterparties based on risk of default and risk drivers</b></p>

© 2019 Moody's Corporation, Moody's Investors Service, Inc., Moody's Analytics, Inc. and/or their licensors and affiliates (collectively, "MOODY'S"). All rights reserved.

CREDIT RATINGS ISSUED BY MOODY'S INVESTORS SERVICE, INC. AND ITS RATINGS AFFILIATES ("MIS") ARE MOODY'S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES, AND MOODY'S PUBLICATIONS MAY INCLUDE MOODY'S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES. MOODY'S DEFINES CREDIT RISK AS THE RISK THAT AN ENTITY MAY NOT MEET ITS CONTRACTUAL, FINANCIAL OBLIGATIONS AS THEY COME DUE AND ANY ESTIMATED FINANCIAL LOSS IN THE EVENT OF DEFAULT. CREDIT RATINGS DO NOT ADDRESS ANY OTHER RISK, INCLUDING BUT NOT LIMITED TO: LIQUIDITY RISK, MARKET VALUE RISK, OR PRICE VOLATILITY. CREDIT RATINGS AND MOODY'S OPINIONS INCLUDED IN MOODY'S PUBLICATIONS ARE NOT STATEMENTS OF CURRENT OR HISTORICAL FACT. MOODY'S PUBLICATIONS MAY ALSO INCLUDE QUANTITATIVE MODEL-BASED ESTIMATES OF CREDIT RISK AND RELATED OPINIONS OR COMMENTARY PUBLISHED BY MOODY'S ANALYTICS, INC. CREDIT RATINGS AND MOODY'S PUBLICATIONS DO NOT CONSTITUTE OR PROVIDE INVESTMENT OR FINANCIAL ADVICE, AND CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT AND DO NOT PROVIDE RECOMMENDATIONS TO PURCHASE, SELL, OR HOLD PARTICULAR SECURITIES. NEITHER CREDIT RATINGS NOR MOODY'S PUBLICATIONS COMMENT ON THE SUITABILITY OF AN INVESTMENT FOR ANY PARTICULAR INVESTOR. MOODY'S ISSUES ITS CREDIT RATINGS AND PUBLISHES MOODY'S PUBLICATIONS WITH THE EXPECTATION AND UNDERSTANDING THAT EACH INVESTOR WILL, WITH DUE CARE, MAKE ITS OWN STUDY AND EVALUATION OF EACH SECURITY THAT IS UNDER CONSIDERATION FOR PURCHASE, HOLDING, OR SALE.

MOODY'S CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT INTENDED FOR USE BY RETAIL INVESTORS AND IT WOULD BE RECKLESS AND INAPPROPRIATE FOR RETAIL INVESTORS TO USE MOODY'S CREDIT RATINGS OR MOODY'S PUBLICATIONS WHEN MAKING AN INVESTMENT DECISION. IF IN DOUBT YOU SHOULD CONTACT YOUR FINANCIAL OR OTHER PROFESSIONAL ADVISER.

ALL INFORMATION CONTAINED HEREIN IS PROTECTED BY LAW, INCLUDING BUT NOT LIMITED TO, COPYRIGHT LAW, AND NONE OF SUCH INFORMATION MAY BE COPIED OR OTHERWISE REPRODUCED, REPACKAGED, FURTHER TRANSMITTED, TRANSFERRED, DISSEMINATED, REDISTRIBUTED OR RESOLD, OR STORED FOR SUBSEQUENT USE FOR ANY SUCH PURPOSE, IN WHOLE OR IN PART, IN ANY FORM OR MANNER OR BY ANY MEANS WHATSOEVER, BY ANY PERSON WITHOUT MOODY'S PRIOR WRITTEN CONSENT.

CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT INTENDED FOR USE BY ANY PERSON AS A BENCHMARK AS THAT TERM IS DEFINED FOR REGULATORY PURPOSES AND MUST NOT BE USED IN ANY WAY THAT COULD RESULT IN THEM BEING CONSIDERED A BENCHMARK.

All information contained herein is obtained by MOODY'S from sources believed by it to be accurate and reliable. Because of the possibility of human or mechanical error as well as other factors, however, all information contained herein is provided "AS IS" without warranty of any kind. MOODY'S adopts all necessary measures so that the information it uses in assigning a credit rating is of sufficient quality and from sources MOODY'S considers to be reliable including, when appropriate, independent third-party sources. However, MOODY'S is not an auditor and cannot in every instance independently verify or validate information received in the rating process or in preparing the Moody's publications.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability to any person or entity for any indirect, special, consequential, or incidental losses or damages whatsoever arising from or in connection with the information contained herein or the use of or inability to use any such information, even if MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers is advised in advance of the possibility of such losses or damages, including but not limited to: (a) any loss of present or prospective profits or (b) any loss or damage arising where the relevant financial instrument is not the subject of a particular credit rating assigned by MOODY'S.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability for any direct or compensatory losses or damages caused to any person or entity, including but not limited to by any negligence (but excluding fraud, willful misconduct or any other type of liability that, for the avoidance of doubt, by law cannot be excluded) on the part of, or any contingency within or beyond the control of, MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers, arising from or in connection with the information contained herein or the use of or inability to use any such information.

NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, TIMELINESS, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY SUCH RATING OR OTHER OPINION OR INFORMATION IS GIVEN OR MADE BY MOODY'S IN ANY FORM OR MANNER WHATSOEVER.

Moody's Investors Service, Inc., a wholly-owned credit rating agency subsidiary of Moody's Corporation ("MCO"), hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by Moody's Investors Service, Inc. have, prior to assignment of any rating, agreed to pay to Moody's Investors Service, Inc. for appraisal and rating services rendered by it fees ranging from \$1,500 to approximately \$2,500,000. MCO and MIS also maintain policies and procedures to address the independence of MIS's ratings and rating processes. Information regarding certain affiliations that may exist between directors of MCO and rated entities, and between entities who hold ratings from MIS and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually at [www.moody's.com](http://www.moody's.com) under the heading "Investor Relations — Corporate Governance — Director and Shareholder Affiliation Policy."

Additional terms for Australia only: Any publication into Australia of this document is pursuant to the Australian Financial Services License of MOODY'S affiliate, Moody's Investors Service Pty Limited ABN 61 003 399 657 AFSL 336969 and/or Moody's Analytics Australia Pty Ltd ABN 94 105 136 972 AFSL 383569 (as applicable). This document is intended to be provided only to "wholesale clients" within the meaning of section 761G of the Corporations Act 2001. By continuing to access this document from within Australia, you represent to MOODY'S that you are, or are accessing the document as a representative of, a "wholesale client" and that neither you nor the entity you represent will directly or indirectly disseminate this document or its contents to "retail clients" within the meaning of section 761G of the Corporations Act 2001. MOODY'S credit rating is an opinion as to the creditworthiness of a debt obligation of the issuer, not on the equity securities of the issuer or any form of security that is available to retail investors. It would be reckless and inappropriate for retail investors to use MOODY'S credit ratings or publications when making an investment decision. If in doubt you should contact your financial or other professional adviser.

Additional terms for Japan only: Moody's Japan K.K. ("MJKK") is a wholly-owned credit rating agency subsidiary of Moody's Group Japan G.K., which is wholly-owned by Moody's Overseas Holdings Inc., a wholly-owned subsidiary of MCO. Moody's SF Japan K.K. ("MSFJ") is a wholly-owned credit rating agency subsidiary of MJKK. MSFJ is not a Nationally Recognized Statistical Rating Organization ("NRSRO"). Therefore, credit ratings assigned by MSFJ are Non-NRSRO Credit Ratings. Non-NRSRO Credit Ratings are assigned by an entity that is not a NRSRO and, consequently, the rated obligation will not qualify for certain types of treatment under U.S. laws. MJKK and MSFJ are credit rating agencies registered with the Japan Financial Services Agency and their registration numbers are FSA Commissioner (Ratings) No. 2 and 3 respectively.

MJKK or MSFJ (as applicable) hereby disclose that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by MJKK or MSFJ (as applicable) have, prior to assignment of any rating, agreed to pay to MJKK or MSFJ (as applicable) for appraisal and rating services rendered by it fees ranging from JPY200,000 to approximately JPY350,000,000.

MJKK and MSFJ also maintain policies and procedures to address Japanese regulatory requirements.