LSEG StarMine

An update on the performance of LSEG StarMine Credit Risk models

By StarMine research team

Abstract

We present an update on the performance of StarMine's suite of credit risk models for three different time periods, between January 1998 and December 2010, between January 2011 and June 2020, and between January 1998 and June 2020. We verify that the performance of the suite remains essentially unchanged throughout the years. The suite continues to significantly outperform the Altman Z-Score in predicting the probability of default or bankruptcy within one year for over 47,000 public companies globally. StarMine's suite of credit risk models is a valuable tool for financial professionals in the assessment of credit and counterparty risk; for fixed income security selection and valuation; and for equity selection and risk management.

LSEG DATA & ANALYTICS

Contents

1.   Introduction

The goal of this paper is to present an update on the performance of StarMine's suite of credit risk models since 2011, providing nine and a half years of out-of-sample performance. We also take this opportunity to standardise performance reporting across all LSEG StarMine credit risk models and use the most accurate data available. As of this writing, we have bankruptcies and defaults data to report performance of predictions made till June 2020. The suite includes the following four credit risk models:

– StarMine Structural Credit Risk model (SCR) evaluates the equity market's view of credit risk via StarMine's proprietary extension of the structural default prediction framework that models a company's equity as a call option on its assets (Erickson et al., 2012).

– StarMine SmartRatios Credit Risk model (SRCR) provides a view of a firm's financial health by analysing a wide array of accounting ratios that are predictive of credit risk and incorporates both reported information and forward-looking estimates via the StarMine SmartEstimates® in its ratio analysis (Li et al., 2012).

– StarMine Text Mining Credit Risk model (TMCR) systematically assesses the language in Reuters news, LSEG StreetEvents® conference call transcripts, corporate filings (10-K, 10-Q and 8-K) and permissioned broker research reports to predict which firms are likely to come under financial distress, and which are likely to thrive (Roser et al., 2013).

– StarMine Combined Credit Risk model (CCR) intelligently combines the power of StarMine SCR, StarMine SRCR and StarMine TMCR to generate a single, final estimate of public company credit risk (Yan et al., 2014).

More information, including detailed white papers and historical testing files, is available for all four credit risk models. Performance of StarMine SCR, StarMine SRCR and StarMine CCR was originally reported between January 1998 and December 2010. Performance of StarMine TMCR was originally reported between January 2003 and December 2010.

2.   Coverage universe

The coverage universe of StarMine's suite of credit risk models is all public companies globally, including those in the financial sector. StarMine SCR, StarMine SRCR and StarMine TMCR incorporate information from multiple independent and complementary data sources, and their respective coverage universes are restricted by the availability of the underlying data. StarMine CCR covers the broadest public company universe among all our credit risk models – the union of the coverage of StarMine SCR, StarMine SRCR and StarMine TMCR, as only one is required to generate a final StarMine CCR score.

Figure 1 plots the coverage of the four credit risk models from 1998 to 2020 (coverage of StarMine TMCR initiated in 2002). In December 2020, StarMine CCR covered over 47,000 public companies, followed by StarMine SRCR with coverage of over 41,000 public companies, StarMine SCR with coverage of over 39,000 public companies, and StarMine TMCR with coverage of over 33,000 public companies.

Figure 1. Coverage universe of the four StarMine credit risk models from 1998 to 2020. StarMine CCR covers the broadest public company universe among them, with over 47,000 in December 2020.
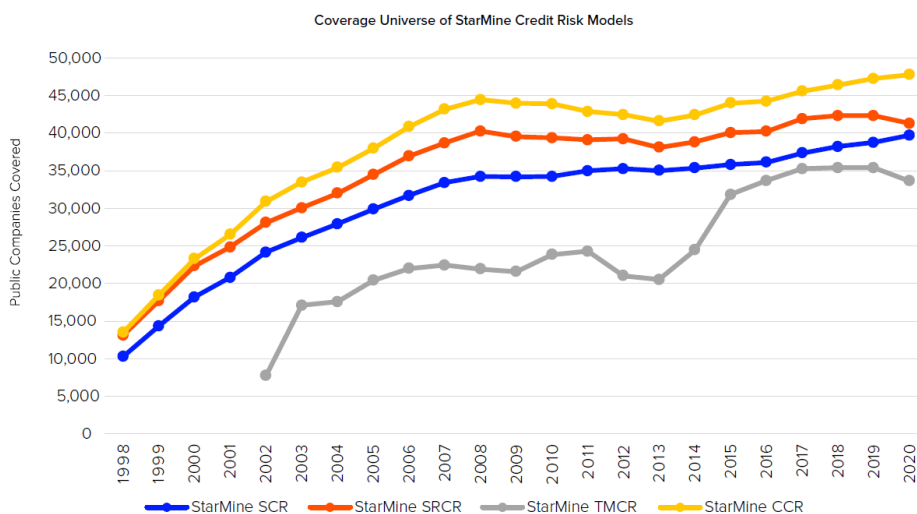
3.   Performance measures and benchmark

Starting from this update, we are adopting the Area Under the Receiver Operating Characteristic Curve (AUC) as our primary performance metric for all StarMine credit risk models, replacing the Accuracy Ratio (AR) with the current de facto standard. AUC ranges in value from 0 to 1. A model that generates random scores will have AUC = 0.5, whereas the perfect model will have AUC = 1 and the worst model will have AUC = 0. Same as before, we create Cumulative Accuracy Profiles (CAP) and from those we calculate our performance metric. The calculation is discussed in more detail in the StarMine SCR white paper. The relationship between AUC and AR is as follows:

$$AR = 2 \times AUC - 1$$

In addition to the AUC metric, another way to measure a default prediction model's performance is to look at the fraction of default events captured within a specified 'danger zone.' In our case, we use the bottom quintile (20%) as the 'danger zone.'

We also compute the Altman Z-Score (Altman, 1968) as a benchmark for our credit risk models. Created in 1968, the Altman Z-Score remains a popular measure of default risk. Altman used discriminant analysis to predict bankruptcy using a sample of 66 manufacturing firms, 33 of which went bankrupt during the 1946 to 1965 period and 33 of which survived. Altman tested 22 financial ratios representing liquidity, profitability, leverage, solvency and activity, and selected the five ratios that best predicted bankruptcy. The result is a linear blend of five factors representing ROA, asset turnover, leverage, liquidity and cumulative profitability. It is defined here:

$$Z = \frac{3.3 \times EBIT}{Total\ Assets} + \frac{0.999 \times Net\ Revenue}{Total\ Assets} + \frac{0.6 \times Market\ Cap}{Total\ Liabilities} + \frac{1.2 \times Working\ Capital}{Total\ Assets} + \frac{1.4 \times Retained\ Earnings}{Total\ Assets}$$

Altman suggested a 'rule of thumb' for the Altman Z-Score: scores above 3 indicate high stability and financial health, scores below 1.8 indicate distress and anything in between warrants further investigation. The Altman Z-Score is not intended to be used for companies in the financial sector.

4.   Performance of StarMine Structural Credit Risk model (SCR)

StarMine SCR is our proprietary extension of the 'structural' default prediction framework introduced by Robert Merton (1974). The Merton distance-to-default model builds on the Black-Scholes option pricing framework and models a company's equity as a call option on its assets. In this framework, the probability of default (PD) equates to the probability that the option expires worthless. The Merton model can be used to infer the probability that a corporation will go bankrupt, or default on its debts, within a given time horizon. StarMine SCR uses a one-year forecast horizon.

Table 1 summarises the overall performance of StarMine SCR versus the Altman Z-Score in three different time periods. Performance of StarMine SCR remained essentially unchanged throughout the years both in terms of AUC as well as the fraction of default events captured in the bottom quintile. StarMine SCR consistently outperformed the Altman Z-Score by a wide margin in all three time periods.

Table 1. Performance summary of StarMine SCR versus the Altman Z-Score over all public companies scored by both models globally in three different time periods. The base period between January 1998 and December 2010 was covered in the StarMine SCR white paper.

AUC

	StarMine SCR	Altman Z-Score	Difference
January 1998 – December 2010	0.89	0.78	0.11
January 2011 – June 2020	0.91	0.82	0.09
January 1998 – June 2020	0.90	0.80	0.10

Fraction of default events captured in the bottom quintile

	StarMine SCR	Altman Z-Score	Difference
January 1998 – December 2010	82.7%	62.3%	20.4%
January 2011 – June 2020	86.8%	70.7%	16.1%
January 1998 – June 2020	84.9%	66.8%	18.1%

Table 2 breaks down AUC of StarMine SCR versus the Altman Z-Score by region and sector in the three time periods. StarMine SCR consistently performed better in Japan, North America and Developed Europe. Consumer Non-Cyclicals, Consumer Cyclicals and Healthcare were consistently among the top performing sectors of StarMine SCR.

Table 2. AUC of StarMine SCR versus the Altman Z-Score over all public companies scored by both models globally in three different time periods, broken down by region and sector. The base period between January 1998 and December 2010 was covered in the StarMine SCR white paper.

January 1998 – December 2010

	StarMine SCR	Altman Z-Score	Difference
All Regions and Sectors	0.89	0.78	0.11
By Region			
North America	0.88	0.77	0.11
Developed Europe	0.89	0.77	0.12
Developed Asia	0.83	0.74	0.09
Japan	0.88	0.73	0.15
Emerging Markets	0.80	0.80	0.00
By Sector			
Energy	0.86	0.79	0.07
Basic Materials	0.88	0.77	0.11
Industrials	0.88	0.78	0.10
Consumer Cyclicals	0.90	0.76	0.14
Consumer Non-Cyclicals	0.92	0.83	0.09
Financials	0.88	0.66	0.22
Healthcare	0.90	0.80	0.10
Technology	0.88	0.81	0.07
Telecommunications Services	0.88	0.80	0.08
Utilities	0.97	0.89	0.08

January 2011 – June 2020

	StarMine SCR	Altman Z-Score	Difference
All Regions and Sectors	0.91	0.82	0.09
By Region			
North America	0.92	0.78	0.14
Developed Europe	0.90	0.81	0.09
Developed Asia	0.82	0.79	0.03
Japan	0.98	0.79	0.19
Emerging Markets	0.85	0.78	0.07
By Sector			
Energy	0.88	0.80	0.08
Basic Materials	0.88	0.83	0.05
Industrials	0.91	0.84	0.07
Consumer Cyclicals	0.93	0.76	0.17

	StarMine SCR	Altman Z-Score	Difference
Consumer Non-Cyclicals	0.94	0.76	0.18
Financials	0.87	0.75	0.12
Healthcare	0.93	0.86	0.07
Technology	0.87	0.83	0.04
Telecommunications Services	0.90	0.73	0.17
Utilities	0.88	0.85	0.03

January 1998 – June 2020

	StarMine SCR	Altman Z-Score	Difference
All Regions and Sectors	0.90	0.80	0.10
By Region			
North America	0.90	0.77	0.13
Developed Europe	0.90	0.79	0.11
Developed Asia	0.82	0.78	0.04
Japan	0.92	0.77	0.15
Emerging Markets	0.83	0.78	0.05
By Sector			
Energy	0.88	0.80	0.08
Basic Materials	0.88	0.81	0.07
Industrials	0.89	0.81	0.08
Consumer Cyclicals	0.92	0.76	0.16
Consumer Non-Cyclicals	0.93	0.80	0.13
Financials	0.88	0.70	0.18
Healthcare	0.92	0.83	0.09
Technology	0.87	0.82	0.05
Telecommunications Services	0.88	0.77	0.11
Utilities	0.92	0.87	0.05

Figure 2 breaks down AUC of StarMine SCR versus the Altman Z-Score by region, year and sector between January 1998 and June 2020. StarMine SCR outperformed the Altman Z-Score in all regions, all years and all sectors.

Figure 2. AUC of StarMine SCR versus the Altman Z-Score over all public companies scored by both models globally between January 1998 and June 2020, adding nine and a half years of out-of-sample performance compared to the StarMine SCR white paper. Performance is broken down by region, year and sector.
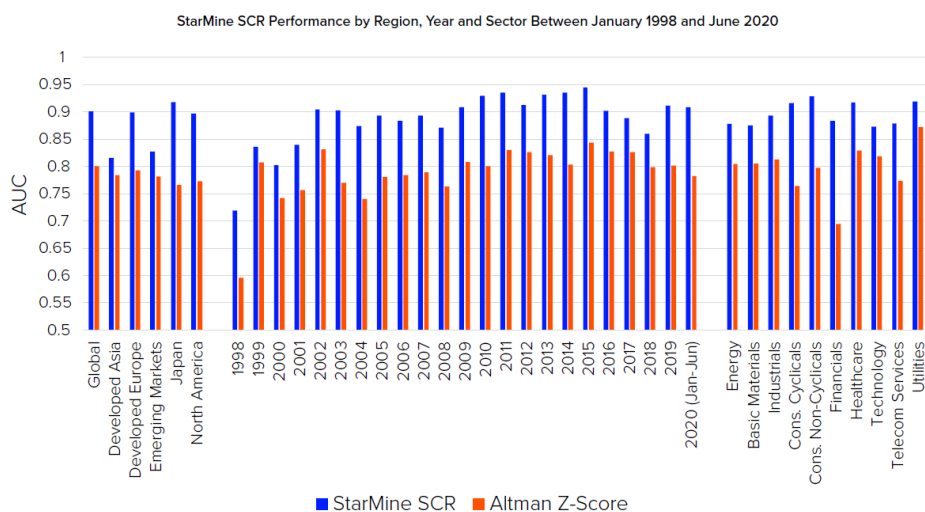
5. Performance of StarMine SmartRatios Credit Risk model (SRCR)

StarMine SRCR analyses a wide array of accounting ratios that are predictive of credit risk. It seamlessly blends information from both reported actuals and forward-looking analyst estimates via StarMine's proprietary SmartEstimates. The accounting ratios, along with industry-specific metrics, are combined in a framework that ensures the most important ratios for a given sector have the greatest influence on the final score.

Table 3 summarises the overall performance of StarMine SRCR versus the Altman Z-Score in three different time periods. Performance of StarMine SRCR remained essentially unchanged throughout the years both in terms of AUC as well as the fraction of default events captured in the bottom quintile. StarMine SRCR consistently outperformed the Altman Z-Score, although the margin narrowed in the period between January 2011 and June 2020 compared to the base period.

Table 3. Performance summary of StarMine SRCR versus Altman Z-Score over all public companies scored by both models globally in three different time periods. The base period between January 1998 and December 2010 was covered in the StarMine SRCR white paper.

AUC

	StarMine SRCR	Altman Z-Score	Difference
January 1998 – December 2010	0.86	0.76	0.10
January 2011 – June 2020	0.86	0.81	0.05
January 1998 – June 2020	0.86	0.78	0.08

Fraction of default events captured in the bottom quintile

	StarMine SRCR	Altman Z-Score	Difference
January 1998 – December 2010	75.8%	57.2%	18.6%
January 2011 – June 2020	75.7%	70.4%	5.3%
January 1998 – June 2020	76.1%	63.6%	12.5%

Table 4 breaks down AUC of StarMine SRCR versus the Altman Z-Score by region and sector in the three time periods. StarMine SRCR consistently performed better in North America and Japan. Consumer Cyclicals was consistently the top performing sector of StarMine SRCR.

Table 4. AUC of StarMine SRCR versus the Altman Z-Score over all public companies scored by both models globally in three different time periods, broken down by region and sector. The base period between January 1998 and December 2010 was covered in the StarMine SRCR white paper.

January 1998 – December 2010

	StarMine SRCR	Altman Z-Score	Difference
All Regions and Sectors	0.86	0.76	0.10
By Region			
North America	0.85	0.74	0.11
Developed Europe	0.80	0.74	0.06
Developed Asia	0.74	0.73	0.01
Japan	0.78	0.73	0.05
Emerging Markets	0.74	0.75	(0.01)
By Sector			
Energy	0.83	0.78	0.05
Basic Materials	0.87	0.78	0.09
Industrials	0.88	0.76	0.12
Consumer Cyclicals	0.88	0.74	0.14
Consumer Non-Cyclicals	0.86	0.76	0.10

	StarMine SRCR	Altman Z-Score	Difference
Financials	0.75	0.60	0.15
Healthcare	0.85	0.79	0.06
Technology	0.85	0.78	0.07
Telecommunications Services	0.86	0.76	0.10
Utilities	0.85	0.88	(0.03)

January 2011 – June 2020

	StarMine SRCR	Altman Z-Score	Difference
All Regions and Sectors	0.86	0.81	0.05
By Region			
North America	0.85	0.77	0.08
Developed Europe	0.82	0.81	0.01
Developed Asia	0.80	0.79	0.01
Japan	0.88	0.79	0.09
Emerging Markets	0.79	0.78	0.01
By Sector			
Energy	0.82	0.80	0.02
Basic Materials	0.82	0.82	0.00
Industrials	0.87	0.85	0.02
Consumer Cyclicals	0.89	0.76	0.13
Consumer Non-Cyclicals	0.81	0.77	0.04
Financials	0.75	0.75	0.00
Healthcare	0.88	0.86	0.02
Technology	0.86	0.82	0.04
Telecommunications Services	0.82	0.73	0.09
Utilities	0.71	0.86	(0.15)

January 1998 – June 2020

	StarMine SRCR	Altman Z-Score	Difference
All Regions and Sectors	0.86	0.78	0.08
By Region			
North America	0.85	0.75	0.10
Developed Europe	0.81	0.78	0.03
Developed Asia	0.79	0.78	0.01
Japan	0.83	0.76	0.07
Emerging Markets	0.78	0.77	0.01
By Sector			
Energy	0.82	0.80	0.02
Basic Materials	0.85	0.80	0.05
Industrials	0.88	0.80	0.08
Consumer Cyclicals	0.89	0.75	0.14
Consumer Non-Cyclicals	0.84	0.77	0.07
Financials	0.77	0.65	0.12
Healthcare	0.87	0.82	0.05
Technology	0.86	0.80	0.06
Telecommunications Services	0.85	0.77	0.08
Utilities	0.77	0.87	(0.10)

Figure 3 breaks down AUC of StarMine SRCR versus the Altman Z-Score by region, year and sector between January 1998 and June 2020. StarMine SRCR outperformed the Altman Z-Score in all regions, all years and all sectors except Utilities.

Figure 3. AUC of StarMine SRCR versus the Altman Z-Score over all public companies scored by both models globally between January 1998 and June 2020, adding nine and a half years of out-of-sample performance compared to the StarMine SRCR white paper. Performance is broken down by region, year and sector.
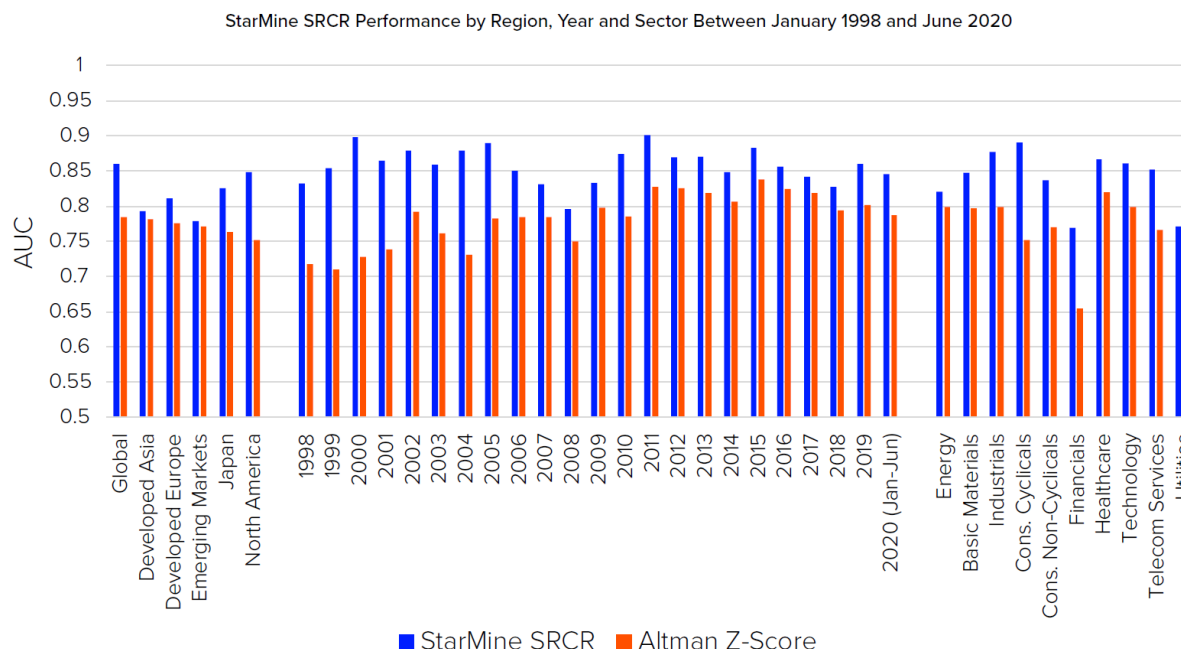
6. Performance of StarMine Text Mining Credit Risk model (TMCR)

StarMine TMCR assesses the default risk of publicly traded companies by systematically evaluating the language in Reuters news, StreetEvents conference call transcripts, corporate filings (10-K, 10-Q and 8-K) and select research documents from participating brokers to predict which firms are likely to come under financial distress, and which are likely to thrive. StarMine TMCR is the first commercial credit risk model to measure corporate financial health by quantitatively analysing text.

The volume of textual data available to StarMine TMCR is a key determinant of its accuracy. StarMine TMCR typically does not include financial filings for companies outside of the United States and StreetEvents coverage is lower outside of North America, both of which decrease the model's performance and limit coverage to at most three components outside of North America.

Table 5 summarises the overall performance of StarMine TMCR (for observations with coverage on three or more StarMine TMCR components) versus the Altman Z-Score in three different time periods. Performance of StarMine TMCR remained essentially unchanged throughout the years both in terms of AUC as well as the fraction of default events captured in the bottom quintile. StarMine TMCR consistently outperformed the Altman Z-Score, although the margin narrowed in the period between January 2011 and June 2020 compared to the base period.

Table 5. Performance summary of StarMine TMCR (for observations with coverage on three or more StarMine TMCR components) versus Altman Z-Score over all public companies scored by both models globally in three different time periods. The base period between January 2003 and December 2010 was covered in the StarMine TMCR white paper.

AUC

	StarMine TMCR	Altman Z-Score	Difference
January 2003 – December 2010	0.91	0.82	0.09
January 2011 – June 2020	0.90	0.85	0.05
January 2003 – June 2020	0.90	0.84	0.06

Fraction of default events captured in the bottom quintile

	StarMine TMCR	Altman Z-Score	Difference
January 2003 – December 2010	86.4%	70.5%	15.9%
January 2011 – June 2020	85.1%	77.2%	7.9%
January 2003 – June 2020	85.3%	75.0%	10.3%

Table 6 breaks down AUC of StarMine TMCR (for observations with coverage on three or more StarMine TMCR components) versus the Altman Z-Score by region and sector in the three time periods. StarMine TMCR consistently performed better in North America. Consumer Non-Cyclicals and Consumer Cyclicals were consistently among the top performing sectors of StarMine TMCR.

Table 6. AUC of StarMine TMCR (for observations with coverage on three or more StarMine TMCR components) versus the Altman Z-Score over all public companies scored by both models globally in three different time periods, broken down by region and sector. The base period between January 2003 and December 2010 was covered in the StarMine TMCR white paper.

January 2003 – December 2010

	StarMine TMCR	Altman Z-Score	Difference
All Regions and Sectors	0.91	0.82	0.09
By Region			
North America	0.91	0.82	0.09
Ex-North America	0.85	0.77	0.08
Sector			
Energy	0.89	0.85	0.04
Basic Materials	0.92	0.85	0.07
Industrials	0.94	0.91	0.03
Consumer Cyclicals	0.90	0.82	0.08
Consumer Non-Cyclicals	0.93	0.85	0.08
Financials	0.92	0.71	0.21
Healthcare	0.92	0.83	0.09
Technology	0.89	0.81	0.08
Telecommunications Services	0.92	0.92	0.00
Utilities	0.93	0.92	0.01

January 2011 – June 2020

	StarMine TMCR	Altman Z-Score	Difference
All Regions and Sectors	0.90	0.85	0.05
By Region			
North America	0.90	0.84	0.06
Ex-North America	0.83	0.86	(0.03)
Sector			
Energy	0.85	0.87	(0.02)
Basic Materials	0.92	0.89	0.03
Industrials	0.87	0.87	0.00
Consumer Cyclicals	0.90	0.79	0.11
Consumer Non-Cyclicals	0.93	0.80	0.13
Financials	0.83	0.82	0.01
Healthcare	0.89	0.86	0.03
Technology	0.91	0.88	0.03
Telecommunications Services	0.93	0.90	0.03
Utilities	0.89	0.84	0.05

January 2003 – June 2020

	StarMine TMCR	Altman Z-Score	Difference
All Regions and Sectors	0.90	0.84	0.06
By Region			
North America	0.90	0.84	0.06
Ex-North America	0.83	0.85	(0.02)
Sector			
Energy	0.86	0.87	(0.01)
Basic Materials	0.92	0.87	0.05
Industrials	0.89	0.89	0.00
Consumer Cyclicals	0.90	0.80	0.10
Consumer Non-Cyclicals	0.93	0.81	0.12
Financials	0.83	0.81	0.02
Healthcare	0.90	0.85	0.05
Technology	0.90	0.84	0.06
Telecommunications Services	0.91	0.89	0.02
Utilities	0.91	0.89	0.02

Figure 4 breaks down AUC of StarMine TMCR (for observations with coverage on three or more StarMine TMCR components) versus the Altman Z-Score by region, year and sector between January 2003 and June 2020. StarMine TMCR outperformed the Altman Z-Score in North America, all years except 2011 and all sectors except Energy.

Figure 4. AUC of StarMine TMCR (for observations with coverage on three or more StarMine TMCR components) versus the Altman Z-Score over all public companies scored by both models globally between January 2003 and June 2020, adding nine and a half years of out-of-sample performance compared to the StarMine TMCR white paper. Performance is broken down by region, year and sector.

StarMine TMCR Performance by Region, Year and Sector Between January 2003 and June 2020
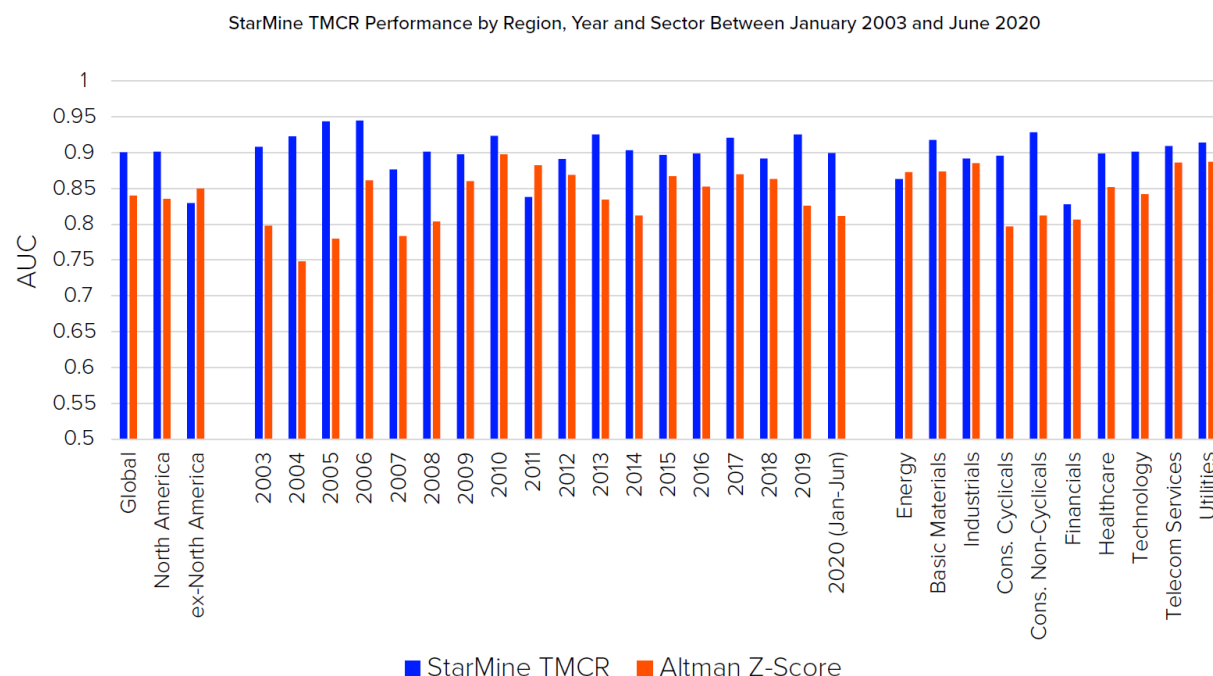
7. Performance of StarMine Combined Credit Risk model (CCR)

StarMine CCR has the largest scored public company universe among all StarMine credit risk models. It intelligently combines the power of StarMine's three credit risk models – the StarMine Text Mining Credit Risk model (TMCR), the StarMine SmartRatios Credit Risk model (SRCR) and the StarMine Structural Credit Risk model (SCR) – to generate our single, final estimate of public company credit risk.

Table 7 summarises the overall performance of StarMine CCR versus the Altman Z-Score in three different time periods. Performance of StarMine CCR remained essentially unchanged throughout the years both in terms of AUC as well as the fraction of default events captured in the bottom quintile. StarMine CCR consistently outperformed the Altman Z-Score by a wide margin in all three time periods.

Table 7. Performance summary of StarMine CCR versus Altman Z-Score over all public companies scored by both models globally in three different time periods. The base period between January 1998 and December 2010 was covered in the StarMine CCR white paper.

AUC

	StarMine CCR	Altman Z-Score	Difference
January 1998 – December 2010	0.91	0.76	0.15
January 2011 – June 2020	0.91	0.81	0.10
January 1998 – June 2020	0.91	0.78	0.13

Fraction of default events captured in the bottom quintile

	StarMine CCR	Altman Z-Score	Difference
January 1998 – December 2010	85.7%	57.5%	28.2%
January 2011 – June 2020	85.9%	70.3%	15.6%
January 1998 – June 2020	86.4%	63.7%	22.7%

Table 8 breaks down AUC of StarMine CCR versus the Altman Z-Score by region and sector in the three time periods. StarMine CCR consistently performed better in Japan, North America and Developed Europe. Consumer Cyclicals, Consumer Non-Cyclicals, Industrials and Healthcare were consistently among the top performing sectors of StarMine CCR.

Table 8. AUC of StarMine CCR versus the Altman Z-Score over all public companies scored by both models globally in three different time periods, broken down by region and sector. The base period between January 1998 and December 2010 was covered in the StarMine CCR white paper.

January 1998 – December 2010

	StarMine CCR	Altman Z-Score	Difference
All Regions and Sectors	0.91	0.76	0.15
By Region			
North America	0.89	0.74	0.15
Developed Europe	0.88	0.76	0.12
Developed Asia	0.82	0.73	0.09
Japan	0.89	0.72	0.17
Emerging Markets	0.81	0.76	0.05
By Sector			
Energy	0.89	0.78	0.11
Basic Materials	0.90	0.78	0.12
Industrials	0.91	0.76	0.15
Consumer Cyclicals	0.92	0.74	0.18
Consumer Non-Cyclicals	0.92	0.76	0.16
Financials	0.87	0.63	0.24

	StarMine CCR	Altman Z-Score	Difference
Healthcare	0.90	0.79	0.11
Technology	0.89	0.78	0.11
Telecommunications Services	0.89	0.76	0.13
Utilities	0.95	0.88	0.07

January 2011 – June 2020

	StarMine CCR	Altman Z-Score	Difference
All Regions and Sectors	0.91	0.81	0.10
By Region			
North America	0.91	0.77	0.14
Developed Europe	0.90	0.82	0.08
Developed Asia	0.84	0.79	0.05
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Basic Materials	0.86	0.82	0.04
Industrials	0.91	0.84	0.07
Consumer Cyclicals	0.93	0.76	0.17
Consumer Non-Cyclicals	0.92	0.77	0.15
Financials	0.85	0.75	0.10
Healthcare	0.93	0.86	0.07
Technology	0.88	0.81	0.07
Telecommunications Services	0.89	0.73	0.16
Utilities	0.83	0.86	(0.03)

January 1998 – June 2020

	StarMine CCR	Altman Z-Score	Difference
All Regions and Sectors	0.91	0.78	0.13
By Region			
North America	0.90	0.75	0.15
Developed Europe	0.89	0.79	0.10
Developed Asia	0.83	0.78	0.05
Japan	0.92	0.76	0.16
Emerging Markets	0.84	0.77	0.07
By Sector			
Energy	0.88	0.80	0.08
Basic Materials	0.88	0.80	0.08
Industrials	0.91	0.80	0.11
Consumer Cyclicals	0.93	0.75	0.18
Consumer Non-Cyclicals	0.92	0.77	0.15
Financials	0.87	0.67	0.20
Healthcare	0.91	0.82	0.09
Technology	0.89	0.79	0.10
Telecommunications Services	0.89	0.77	0.12
Utilities	0.88	0.87	0.01

Figure 5 breaks down AUC of StarMine CCR versus the Altman Z-Score by region, year and sector between January 1998 and June 2020. StarMine CCR outperformed the Altman Z-Score in all regions, all years and all sectors.

Figure 5. AUC of StarMine CCR versus the Altman Z-Score over all public companies scored by both models globally between January 1998 and June 2020, adding nine and a half years of out-of-sample performance compared to the StarMine CCR white paper. Performance is broken down by region, year and sector.

StarMine CCR Performance by Region, Year and Sector Between January 1998 and June 2020
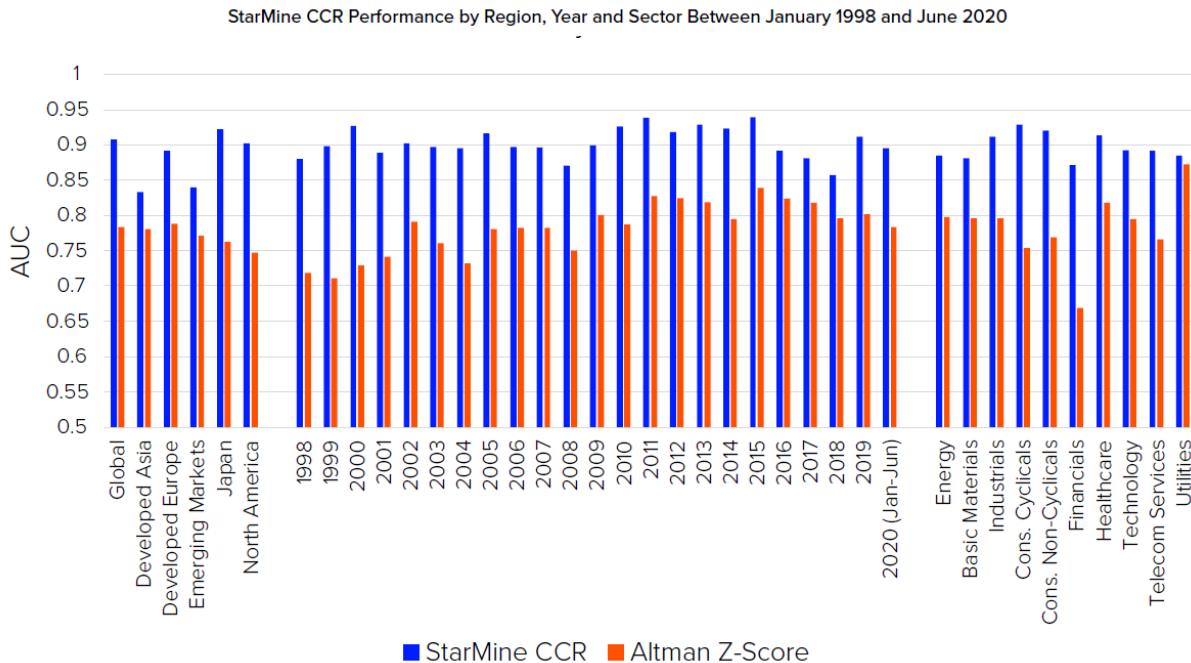
8. A case study on StarMine ratings versus agency ratings

Many investors are accustomed to the letter rating scales commonly employed by the rating agencies. By examining the historical distribution of agency ratings on a common universe of companies, we map StarMine default probabilities to letter ratings such that the distribution of StarMine ratings is consistent with the distribution of agency ratings. This ensures that a difference in rating between StarMine and a rating agency is due to differences in assessment of credit risk, rather than simply differences in distributions of ratings.

Once we map StarMine default probabilities to letter ratings, a natural question arises: "What happens when the agency rating and the StarMine rating differ significantly? Who follows whom?" Table 9 summarises results from a case study using StarMine CCR. It shows that most of the time agency ratings remain unchanged. But more importantly, if the agency rating does move, it will move towards the StarMine CCR rating at least 81% of the time. We use a difference of at least six notches to define a 'significant difference.' This corresponds to about 15% of the data. This finding is consistent across different time horizons up to at least 12 months. In other words, when the two disagree significantly, the agency ratings are about five to six times as likely to move towards the StarMine CCR rating as they are to move away from it. This implies that StarMine CCR can be used as a leading indicator of the future moves of agency ratings, much like the difference between the consensus estimates and the StarMine SmartEstimates can be used to predict earnings surprises (Stauth and Bonne, 2009).

Table 9. When the agency rating differs significantly from the StarMine CCR rating, the agency rating moves towards the StarMine CCR rating at least 81% of the time that it moves. The sample set represents all global companies with both StarMine CCR and agency rating data available over the period from January 1998 to December 2020.

| Change in agency rating	Move towards StarMine CCR rating	Move away from StarMine CCR rating	% of movers that move towards StarMine CCR rating	No change	Move towards StarMine CCR rating more often than move away
in the next one month	3.04%	0.49%	86.09%	96.47%	6.19x
in the next three months	8.40%	1.46%	85.18%	90.14%	5.75x
in the next six months	15.01%	2.87%	83.97%	82.13%	5.24x
in the next 12 months	24.81%	5.58%	81.64%	69.61%	4.45x

9.   A case study on 2020 performance

Our credit risk models are calibrated to predict defaults over the next 12 months. Since we are writing this paper in mid-2021, we've presented performance through mid-2020. However, this doesn't fully capture the impact of the Covid-19 pandemic. During this turbulent time, unprecedented lockdowns led to uncertainty about the survival of various businesses. In this section, to show performance for all of 2020, we look ahead six months instead of 12.

Figure 6 shows the percentage of defaults, within six months of the date on the x-axis, that are in the bottom quintile of StarMine CCR. For example, for February 2020, this is above 90%. If you used StarMine CCR at the end of February (the beginning of the 2020 stock market crash) and avoided the bottom 20% of companies, you would have steered clear of over 90% of defaults in the following six months (March 2020 to August 2020). If you had used the Altman Z-Score instead, you would have avoided less than 70% of defaults.

Figure 6. Fraction of defaults captured (in the following six months) in the bottom quintile of StarMine CCR, versus the Altman Z-Score between January 2019 and December 2020.

Fraction of F6M Defaults Captured in the Bottom Quintile Between January 2019 and December 2020
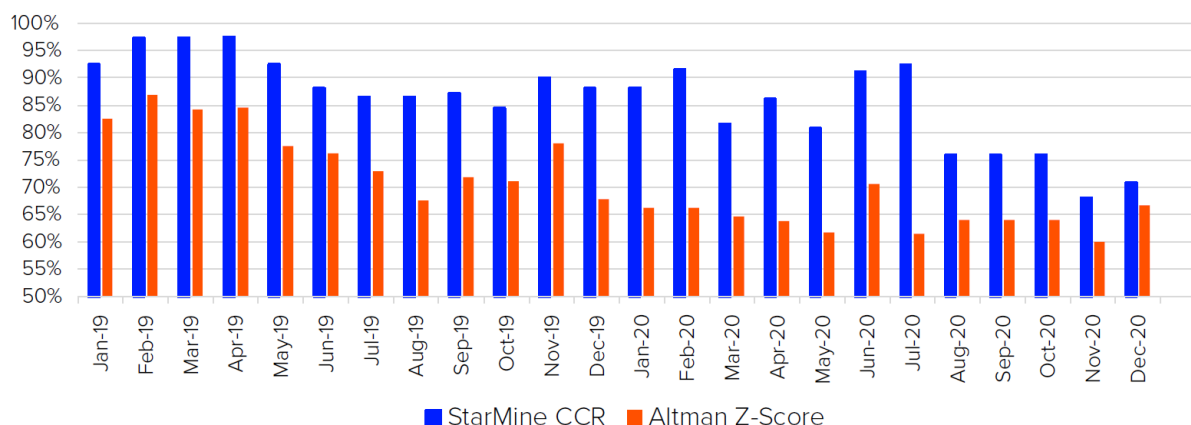
Next, Figure 7 shows the monthly AUC of StarMine CCR in 2019 and 2020, for defaults in the following six months. As above, StarMine CCR outperforms the Altman Z-Score.

Figure 7. Monthly F6M AUC of StarMine CCR versus the Altman Z-Score between January 2019 and December 2020.

Monthly F6M AUC Between January 2019 and December 2020
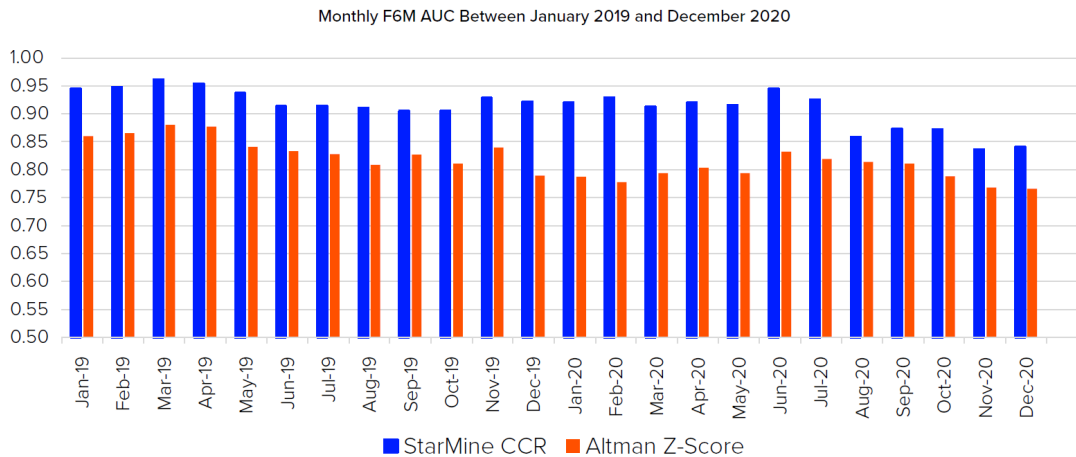
10. Conclusion

We verify that the performance of StarMine's suite of credit risk models remains essentially unchanged in the years since each model was released. The suite continues to significantly outperform the Altman Z-Score in predicting the probability of default or bankruptcy within one year for over 47,000 public companies globally. StarMine CCR is still the best performer, achieved AUC of 0.91 and captured 86.4% of default events in the bottom quintile between January 1998 and June 2020, compared to 0.78 and 63.7% respectively for the Altman Z-Score. StarMine's suite of credit risk models is a valuable tool for financial professionals in the assessment of credit and counterparty risk, for fixed-income security selection and valuation, and for equity selection and risk management.

11. References

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