

The Audit Integrity Bankruptcy Risk Model

An Enhanced Approach to Predicting Bankruptcies and Identifying Companies in Severe Financial Distress

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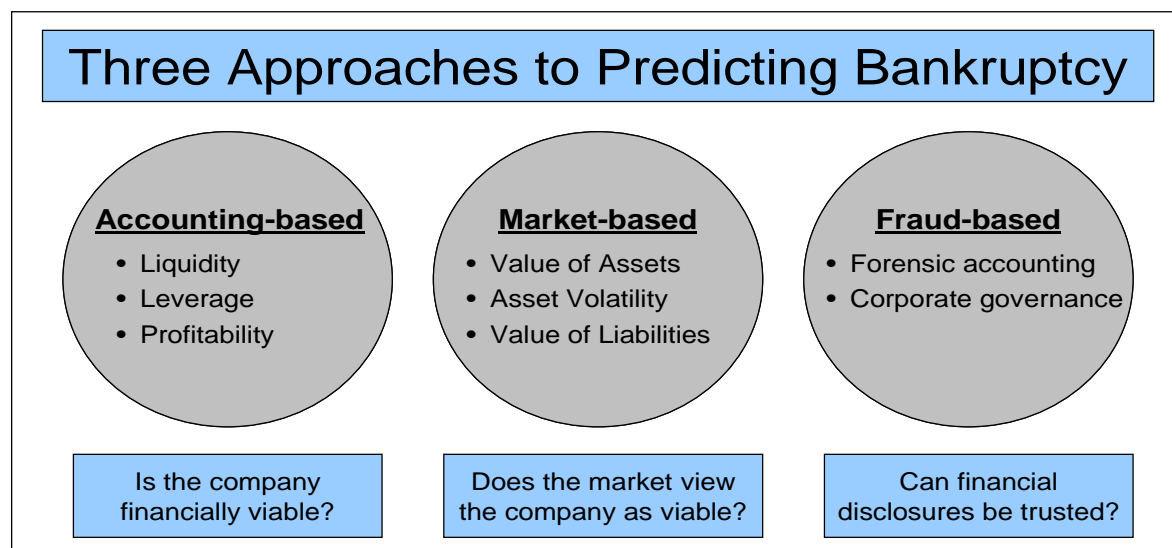
I. Executive Summary

The recent economic downturn has brought bankruptcy risk to the forefront of investor and corporate stakeholder concerns. The need exists for more effective approaches to identifying the companies most likely to go bankrupt or suffer severe financial distress. With an increase in the number of bankruptcies and the changing nature of company failures – driven by risks related to financial instruments and the speed in which companies decline – Audit Integrity has conducted extensive research around building a better approach to predicting bankruptcies.

There are a number of broadly accepted bankruptcy models, both academic and practical, which are based on accounting factors that have been found to be predictive of bankruptcy. Measures of liquidity, leverage and profitability have formed the basis for these accounting-based bankruptcy models, the best known of which are the Altman Z-Score and the Ohlson O-Score. Accounting-based models are viewed as largely static, updated after annual or quarterly financial data is made available.

An alternative to static accounting-based models is a market-based approach. Market-based models have been found in academic research to provide a measure of bankruptcy risk as effective, or more effective, than accounting-based models. Market-based risk models are based on the option-pricing theories of Black-Scholes and Merton.

A third measure of bankruptcy risk is through evaluating the potential for fraudulent reporting of financial statements. The Audit Integrity Accounting and Governance Risk (AGR[®]) rating has been used widely to measure fraud-related risk, through statistical evaluation of accounting and governance risk factors.



Each of these three approaches – accounting-based, market-based, fraud-based – is moderately effective on a stand-alone basis in predicting bankruptcies. Since the models are not highly correlated, each model has the potential to add incremental value to the other models. Audit Integrity combined the three approaches to determine whether the accuracy ratio of an aggregate model would surpass that of any single approach.

The combination of the three models is the Audit Integrity Bankruptcy Risk Model (AI-B), which was found to be significantly more effective than any of the three alternative models taken on a stand-alone basis.

Against the most widely used bankruptcy model, the Altman Z-Score, the Audit Integrity Bankruptcy Risk Model results have been more than 20 percentage points higher in predicting bankruptcy, based on accuracy ratios, a common validation technique.

Another validation approach is to simply look at the results for the lowest scoring companies. Over the past 10 years, companies in the bottom 10% of AI-B scores accounted for 76% of all bankruptcies; companies in the bottom 20% accounted for 91%. That compares to 39% and 64% for the Z-Score, respectively.

Approximately 85% of the U.S. and European industrial companies rated by Audit Integrity will have bankruptcy model results. Companies missing key data will not be rated; financial companies and utilities are also not rated.

II. Background

Bankruptcy risk has taken on greater prominence in the current economic environment. While corporate stakeholders remain focused on stock performance, financial results, regulatory actions and shareholder lawsuits, the basic issue of company survival has moved to the forefront.

The number of business bankruptcy filings during the first six months of the year rose 64 percent over the first-half filings in 2008, according to U.S. Bankruptcy Courts. Chapter 11 reorganization filings were up 113 percent over 2008, while Chapter 7 liquidation filings increased by 57 percent.

Second quarter business filings were the highest total since 1993. Filings increased 11.8 percent from the first quarter, which had already increased 11.1 percent from the fourth quarter. Analysis of past bankruptcy cycles indicates that bankruptcy filings lag an economic rebound by up to a year, which may mean further increases in the quarters ahead.

Notable bankruptcies such as General Motors, Charter Communications and Nortel Networks have raised visibility and public concern around bankruptcy risk.

Investors in these companies face massive equity loss and debt defaults. Insurers are obligated to pay claims in the tens of millions of dollars. Auditors are under increased regulatory pressure to increase the number and accuracy of Going Concern opinions, which has proven to be problematic. Past studies show that slightly more than 50% of bankrupt companies had Going Concern opinions, raising questions on how auditors assess companies in financial distress.

In addition to greater bankruptcy risk in a recessionary economic climate, the nature of bankruptcy risk has changed as well. The impact of the recession combined with the complexity and leverage in many financial statements has challenged basic accounting

AGR and AGR Models

- The Audit Integrity Accounting and Governance Risk (AGR) rating is designed to be predictive of financial statement fraud, using SEC Enforcement Actions (AAERs) as the model training set.
- Numerous research studies have found AGR to be predictive of not only regulatory actions, but also shareholder litigation, financial restatements and equity returns.
- Audit Integrity has developed and released AGR-based Risk Models designed to best predict specific types of risks, incorporating additional risk factors with AGR ratings. These models include:
 - **Litigation Risk Model** – incorporating size, industry, stock performance and other factors to best predict future shareholder litigation
 - **Restatement Risk Model** – including additional risk factors similar to Litigation Risk
 - **Equity Risk Model** – using AGR and AGR-specific metrics to identify a proprietary measure of stock performance risk.

assumptions on the key indicators of bankruptcy risk. Rapid changes in market values and asset valuations have created an environment in which bankruptcy can happen with little advance warning.

Audit Integrity has created risk models to evaluate regulatory, litigation, restatement and equity loss risks. These models are based on the Accounting and Governance Risk rating, a proprietary measure of corporate integrity. Combined with additional factors such as company size, industry and other financial and market data, the Audit Integrity risk models are designed to target specific risks of greatest concern to corporate stakeholders.

Given the need in the market to better evaluate bankruptcy risk, Audit Integrity has developed the Audit Integrity Bankruptcy Risk Model (AI-B). The AI-B provides better results than currently used bankruptcy models, building on approaches that have proven to be effective.

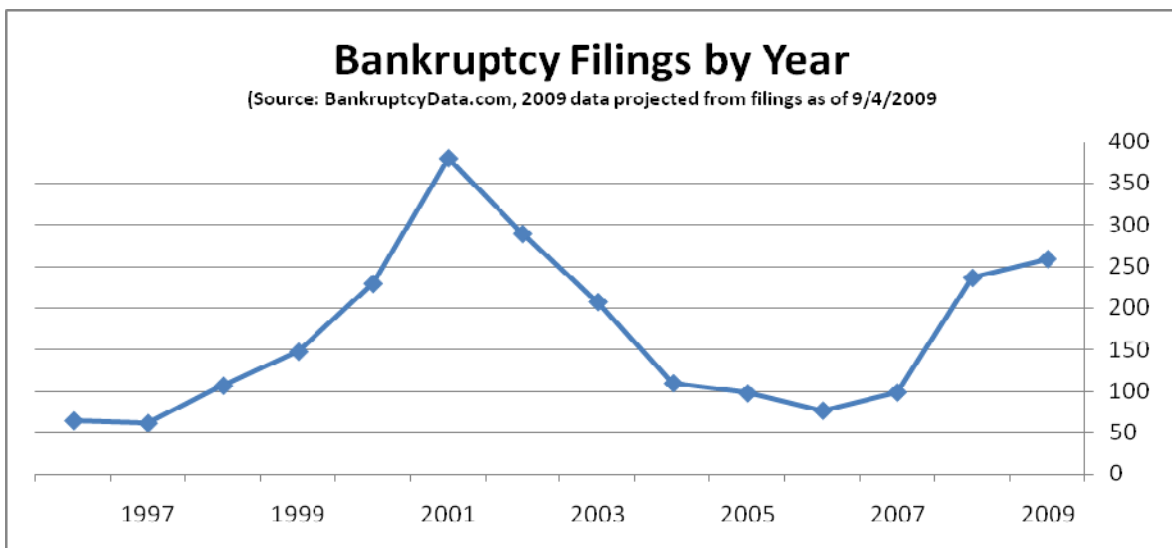
III. Summary of Results

The goal in developing an advanced bankruptcy risk model is to improve the model's predictivity of a company's likelihood of bankruptcy or, by extension, severe financial distress. The impact of financial distress to shareholders, debt holders, employees, creditors and others can be as great as if the company filed for bankruptcy.

Key findings:

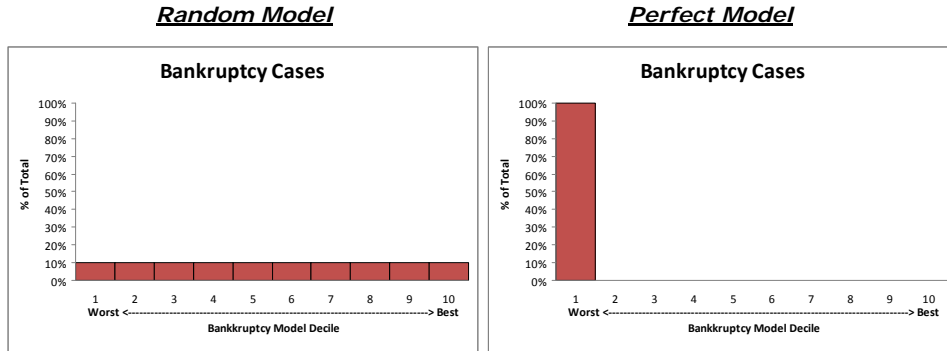
1. The AI-B is an improvement on other bankruptcy model approaches. AI-B ranked 91% of bankruptcy cases in the worst 20% of companies, vs. 74% for Altman Z-Score.
2. The three models – accounting-based, market-based and fraud-based – were found to be incrementally informative, with each adding value to the AI-B. On a stand-alone basis, the market-based Merton "Distance to Default" (DD) model was found to be the most effective.
3. Proprietary enhancements to Ohlson and Merton DD models were found to improve results for each model independently.
4. Recent results for 2008-2009 indicate that the AI-B is effective in a recessionary environment, with results significantly better than traditional accounting-based approaches.

The AI-B identifies companies showing the conditions most likely to result in bankruptcy. Whether an actual bankruptcy filing occurs or not, these are companies with weak financial condition, raising the risks for losses, defaults and other high risk events.



There are multiple methods used to validate statistical models. For the purposes of this paper, validation results will focus on three basic tests:

1. **Histogram of Results by Decile.** In a random model, 10% of companies would fall into each decile of model results, as illustrated in the first chart below. A perfect model would have all bankrupt companies in the “Worst” decile, as noted in the second chart. This paper will use this basic approach to validate AI-B results, in comparison to the most widely used Bankruptcy Model in use, the Altman Z-Score.



2. **Accuracy Ratio.** This standard validation test is designed to measure the predictive power of a model. An Accuracy Ratio of 100% indicates a perfect model, and an Accuracy Ratio of 0% indicates a model with no predictive power. The higher the percentage, the closer the approximation to a perfect model. Accuracy Ratio results are valuable because they are easily comparable. Results will be shown for each component of the AI-B, as well as in comparison to the Z-Score.
3. **Detailed Empirical Results.** The AI-B score will be compared to actual bankruptcy filings, again in comparison to Z-Score results. This empirical evidence is often the simplest and most straight-forward approach to reviewing model effectiveness.

Summary of Results – Histograms

- **AI-B** – as noted in the chart below, the AI-B was found to be highly effective in identifying bankrupt companies, with 91% of the companies filing for bankruptcy in the 10-year period 1999-2008 falling into the lowest rated 20% of all companies.
- **Altman Z-Score** – using academic research to construct the model, the Z-Score placed 74% of the bankrupt companies in the bottom two deciles, compared to 91% for the AI-B.

Summary of Results – Detailed Results

A simple empirical approach to testing the AI-B results is to look at recent bankruptcies. For 2008 through May, 2009, 44 companies with total asset values of greater than \$100m are reviewed in Appendix B. This asset value was used to identify companies representing meaningful bankruptcies.

As noted in the Appendix, of the 44 companies reviewed, the AI-B Percentile was significantly more predictive in 24 of the 44 cases. In two cases, the Altman Z-Score was more predictive, and in the remaining 18 cases the results were similar. For the purposes of this analysis, a difference of more than 10 percentile points was used to denote a significant difference.

The scatter charts show the clustering of AI-B scores in the bottom two deciles of companies. All but 3 of the 44 companies had an AI-B percentile score of 80 or greater. Altman-Z percentiles, in comparison, were much more widely distributed, with only 20 of the 44 companies scoring in the bottom two deciles.

IV. Building and Validating the AI-B

Audit Integrity had the intent of applying greater rigor to what is often still a largely subjective process, utilizing a more robust, timely set of bankruptcy cases and enhanced statistical techniques.

Substantial academic literature, in addition to practical business use, has supported two primary methods of estimating bankruptcy risk – one based on accounting factors, the other on market factors.

In addition, the assumption was made that the AGR rating, as a measure of corporate integrity, would identify yet another type of risk associated with bankruptcy – the risk that the company was misrepresenting accounting information or artificially manipulating market data through fraud or high risk behavior.

The final AI-B approach uses three independent models, each using different techniques to capture different aspects of bankruptcy risk:

1. Accounting-based Model. The most common approach to measuring bankruptcy risk is based on accounting factors, with the Altman Z-Score discriminate analysis model and the Ohlson O-Score logit model being the best known. Both models have been widely used in bankruptcy prediction and in our testing both models performed similarly with comparable Accuracy Ratios. The Ohlson model's use of linear regression facilitates the inclusion of other variables, which made it the choice for inclusion in AI-B. The primary weakness of the Ohlson model is a lack of timeliness, as it is a static model that can only be adjusted post-financial reporting period. In general, the four primary drivers of accounting-based models are:
 - a. Size – company size can be a determinant of bankruptcy risk, as larger firms have more alternatives to manage financial distress
 - b. Liquidity – adequate working capital to fund operations, using a ratio such as Working Capital/Total Assets
 - c. Leverage – measuring debt load and the ability to repay debt, using a ratio such as Total Liabilities/Total Assets
 - d. Profitability – reflecting the company's earnings power, using a ratio such as Net Income/Total Assets
2. Market-based Model. The use of current market data has the primary advantage of reflecting all available information about a company in the probability of bankruptcy. Default probability models have become widely used in evaluating credit risk, or the likelihood of a company defaulting on its debt. More recently, these models have been applied to determining bankruptcy probability, with results that match or exceed accounting-based

models. The AI-B used the Merton Distance to Default Model (DD) for its market-based component, gaining the benefit of incorporating data that is continuously updated and forward looking. The key factors in this market-based component are:

- a. Market Value of Assets – since the market value of a firm’s assets is not readily observable, the DD model uses equity market prices to estimate and capture changes in the market value of assets
- b. Asset Value Volatility – derived from volatility in equity prices, and incorporating differences in the company size, industry and geography.
- c. Book Value of Liabilities – captured from company financial statements

As the market value of assets approaches the book value of liabilities, the default (bankruptcy) risk increases. When assets are insufficient to repay liabilities, the company is at risk of default and bankruptcy. The Distance to Default reflects the extent to which the market value of a firm’s assets exceeds its debts, measured in terms of the standard deviation of the asset value.

3. Fraud-based Model – The Audit Integrity Accounting and Governance Risk (AGR) rating is a forensic measure of the transparency and statistical reliability of a corporation’s financial reporting and governance practices. More broadly speaking, it is a measure of corporate integrity. The focus of the AGR model is on identifying the measures most highly associated with fraud, based on statistical analysis of SEC enforcement actions. Testing of over 100 key ratios and metrics identify fraud risks in the following broad categories:

- a. Accounting – evaluating aggressive practices in the areas of revenue recognition, expense recognition and asset/liability valuation
- b. Governance – Measuring metrics related to management motivation (compensation, turnover) and behavior (insider trading, financial disclosures)

Appendix A summarizes the bankruptcies within model deciles, comparing AI-B with Altman Z-Score. Accuracy Ratios were also calculated for each of the three models used in AI-B independently, then combined.

Key Findings:

1. The AI-B is an improvement on other bankruptcy model approaches. AI-B ranked 91% of bankruptcy cases in the worst 10% of companies, vs. 74% for Z-Score.
2. The three models – accounting-based, market-based and fraud-based – were found to be incrementally informative, with each adding value to the AI-B. Due to the non-correlation of these models, the combination of all three

approaches significantly improved of the predictive power of the model relative to each model on a stand-alone basis.

3. Each Model was found to be predictive of bankruptcy. The market-based DD model was found to be the most effective on a stand-alone basis.
4. Audit Integrity's proprietary enhancements to Ohlson and Merton DD models were found to improve results for each model independently.
5. Recent results for 2008-2009 indicate that the AI-B is effective in a recessionary environment.

Methodology and Test Parameters

- Universe of companies covered: 2,700 public companies in the United States. AI-B has been applied to industrial firms only. Modifications for financial institutions, banks and utilities are being considered for future release.
- The AI-B was built using industrial firms with \$100 million in assets, to correspond to the universe of companies contained in the bankruptcy database.
- The corporate bankruptcy database used in building and validating AI-B covered the time period 1997 to 2009, comprising 569 bankruptcy cases.
- The AI-B is updated monthly. For validation purposes, in comparison to the Altman Z-Score, both models were updated monthly, based on the most recent financial filings.
- AI-B was built on bankruptcy cases in the 1998-2004 time period (In Sample) and validated on the 2005-2009 (May) time period (Out of Sample). This ensures that the test results are not over-fitted and that the model's predictive power can reasonably be expected to be replicated in the future.
- In determining whether a bankruptcy model predicted the actual bankruptcy, a time period for filing of 3 – 15 months after the Model calculation date was used.

V. Using the AI-B

The AI-B displays company bankruptcy risk in two ways:

1. **AI-B Percentile** – a percentile score of 1-100%, with the riskiest companies having the lowest scores. A percentile score of 12th means that the company falls in the bottom 12% of all companies covered by Audit Integrity.
2. **AI-B Probability** – based on historical bankruptcy counts, a specific 1-year likelihood of bankruptcy is provided – the probability that the company will file for bankruptcy in the next 12 months. Given the low incidence of bankruptcy, these percentages will be low. Audit Integrity does not attempt to forecast macro bankruptcy statistics.

A one-year forward-looking prediction of bankruptcy is consistent with market practices, which require auditors and insurers to assess risks over the next year.

The AI-B report is available on a stand-alone basis or incorporated into the much more extensive RiskProfile and RiskBook reports.

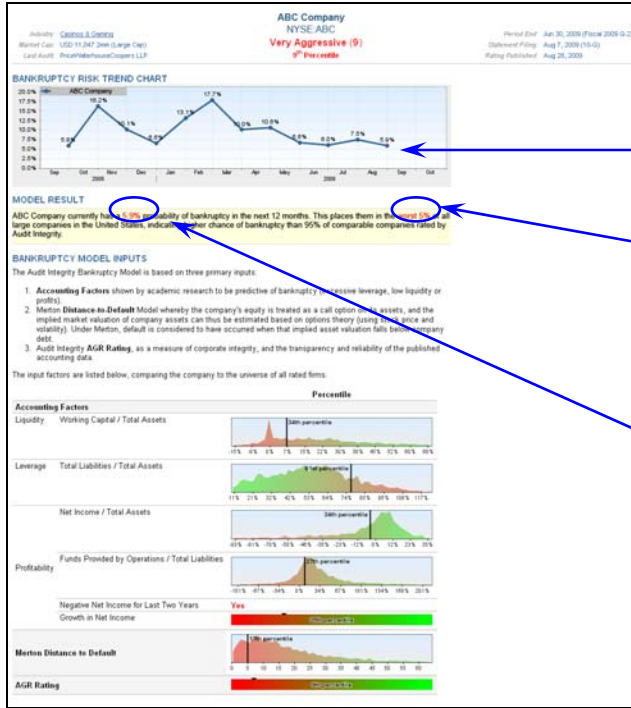
The Additional Bankruptcy Risk Factors page in the RiskBook includes user-entered factors such as loan/debt defaults, ability to obtain financing, loss of key supplier, etc.

The AI-B report, as illustrated below, provides The Bankruptcy ranking, in the form of a percentile, as well as an estimate of the probability of bankruptcy.

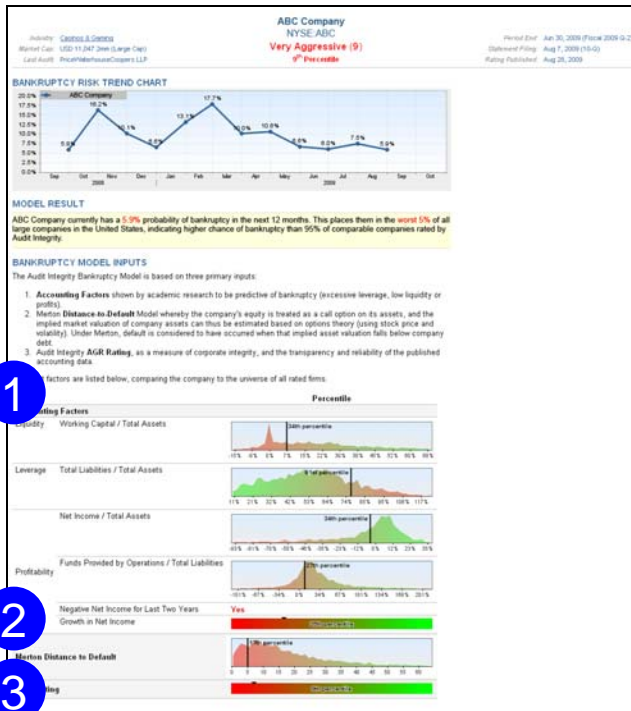
Key highlights of the AI-B report are noted below.

False Positives/False Negatives

- Audit Integrity builds risk models around events which are, by their nature, low incidence events. SEC enforcement actions, litigation, restatements and bankruptcies occur as few as 30 times per year, on average, and at most 250 times per year – out of 10,000 or more publicly traded U.S. companies.
- These are low incidence/high cost events, however, with costs to corporate stakeholders in the tens or even hundreds of millions of dollars for regulatory settlements, insurance claims, litigation, cost of capital and other exposures. Equity and debt losses, as well as reputational risk, can threaten company survival.
- The cost of a “False Positive” – a company forecast by a model at the highest level of risk that does NOT experience the forecasted event – are controllable and can be measured in staff time to analyze risks as well as fees for risk services.
- The cost of a “False Negative” – a company thought to be at low risk that suffers a high risk event – can be, as noted above, immense.
- False Positives can be limited by setting the cut-off point for the “riskiest” companies at a low number – 10%, 5%, even 1%. The trade-off is more False Negatives.
- For the purposes of presenting this research, Audit Integrity sets the cut-off point for the “riskiest” companies at either 10% or 20%, consistent with accepted bankruptcy model research.



- AI-B Report**
- **Bankruptcy Trend Chart** – a 2-year chart of monthly Bankruptcy probabilities.
 - **Bankruptcy Percentile** – a percentile score of 1-100%, with the riskiest companies having the lowest score. A percentile score of 12th means that the company falls in the bottom 12% of all companies covered by Audit Integrity.
 - **Bankruptcy Probability** – a specific 1-year likelihood of bankruptcy – the probability that the company will file for bankruptcy in the next 12 months



- 1 **Accounting Factors** – based on the risk factors used in calculating the Ohlson O-Score, each individual factor is displayed on a 1-100% scale, with lower numbers indicating the greatest risk. Nine accounting factors are used in the AI-B, in the broad categories of Size, Liquidity, Leverage and Profitability.
- 2 **Distance-to-Default Factors** – these five market-based factors are based on the Merton DD model. As with the other factors, they have been normalized to a 1-100% scale.
- 3 **AGR Rating** – a percentile score of 1-100%, with the riskiest companies having the lowest score. AGR has been found to be predictive of regulatory actions, litigation, restatements and equity loss.

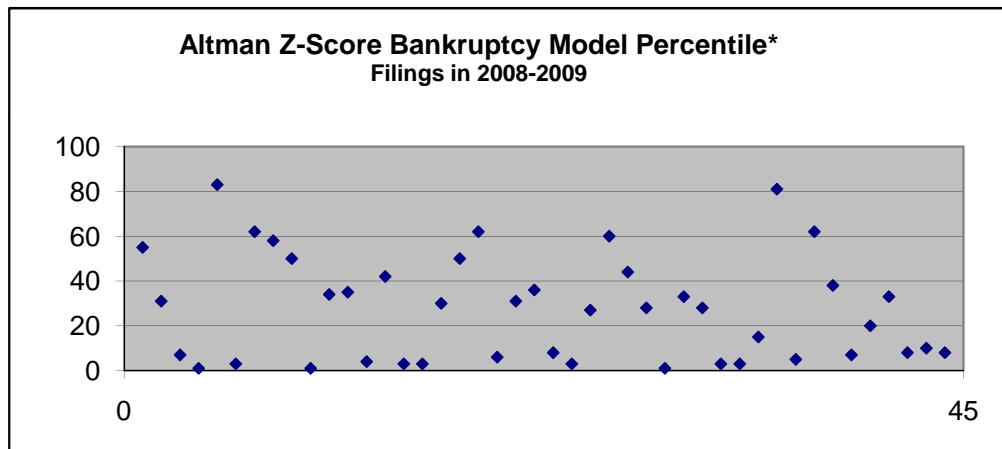
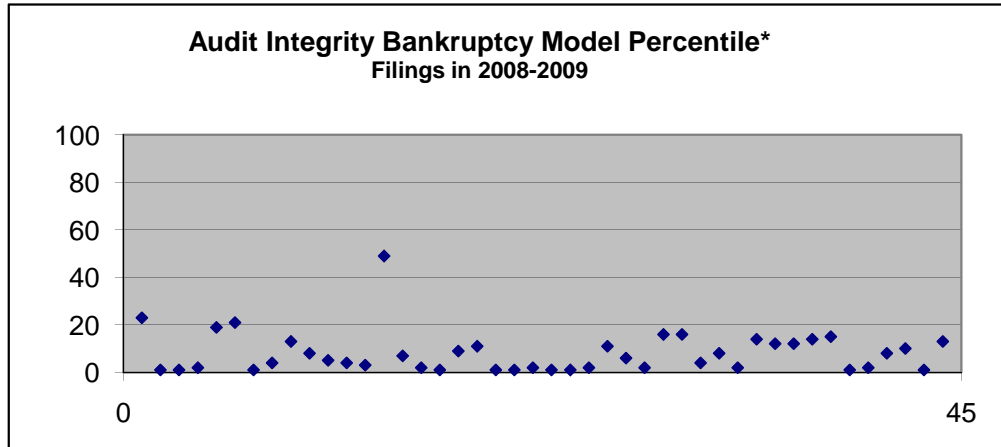
Comparison of AI-BRM and Altman Z-Score
Companies Filing for Bankruptcy in 2008-2009, Minimum Asset Value of \$100m

Company Name	Bankruptcy Filing Date	AI-B Percentile*	Altman Z-Score Percentile*	AI-B Percentile - Altman Percentile
Syntax-Brilliant Corp.	8-Jul-08	23	55	-32
WCI Communities, Inc.	4-Aug-08	1	31	-30
Luminent Mortgage Capital, Inc.	5-Sep-08	1	7	-6
Worldspace, Inc.	17-Oct-08	2	1	1
VeraSun Energy Corporation	31-Oct-08	19	83	-64
MPC Corp.	6-Nov-08	21	3	18
Circuit City Stores, Inc.	10-Nov-08	1	62	-61
Lenox Group Inc.	23-Nov-08	4	58	-54
Pilgrim's Pride Corporation	1-Dec-08	13	50	-37
Bally Total Fitness Holdings Corporation	3-Dec-08	8	1	7
Tribune Company	8-Dec-08	5	34	-29
Chesapeake Corporation	29-Dec-08	4	35	-31
Constar International, Inc.	30-Dec-08	3	4	-1
Lyondell Chemical Company	6-Jan-09	49	42	7
Apex Silver Mines Limited	12-Jan-09	7	3	4
Tarragon Corporation	12-Jan-09	2	3	-1
Tronox Incorporated	12-Jan-09	1	30	-29
Gottschalks Inc.	14-Jan-09	9	50	-41
Hartmarx Corporation	23-Jan-09	11	62	-51
Smurfit-Stone Container Corporation	26-Jan-09	1	6	-5
Spectrum Brands, Inc.	3-Feb-09	1	31	-30
Young Broadcasting Inc.	13-Feb-09	2	36	-34
Trump Entertainment Resorts, Inc.	17-Feb-09	1	8	-7
BearingPoint, Inc.	18-Feb-09	1	3	-2
Spanion Inc.	1-Mar-09	2	27	-25
Monaco Coach Corporation	5-Mar-09	11	60	-49
Fleetwood Enterprises, Inc.	10-Mar-09	6	44	-38
Milacron Inc.	10-Mar-09	2	28	-26
Primus Telecommunications	16-Mar-09	16	1	15
Chemtura Corporation	18-Mar-09	16	33	-17
Fairchild Corporation	18-Mar-09	4	28	-24
Transmeridian Exploration Incorporated	20-Mar-09	8	3	5
Charter Communications, Inc.	27-Mar-09	2	3	-1
Meruelo Maddux Properties, Inc.	27-Mar-09	14	15	-1
Idearc Inc.	31-Mar-09	12	81	-69
Sun-Times Media Group, Inc.	31-Mar-09	12	5	7
Aventine Renewable Energy Holdings, Inc.	7-Apr-09	14	62	-48
Noble International, Ltd.	15-Apr-09	15	38	-23
AbitibiBowater Inc.	16-Apr-09	1	7	-6
General Growth Properties, Inc	16-Apr-09	2	20	-18
Dayton Superior Corporation	19-Apr-09	8	33	-25
Asyst Technologies, Inc.	20-Apr-09	10	8	2
Source Interlink Companies, Inc.	27-Apr-09	1	10	-9
Energy Partners, Ltd.	1-May-09	13	8	5

* The percentiles range from 1-100. The lowest percentiles signify the greatest risk of bankruptcy.

AI-BRM Superior
Altman Z Superior

Based on difference of > 10



* The percentiles range from 1-100. The lowest percentiles signify the greatest risk of bankruptcy.

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Audit Integrity Bankruptcy Risk Model

Appendix C

Companies With the Greatest Risk of Bankruptcy Over the Next 12 Months

U.S. Companies with Market Capitalization > \$1billion

Company Name	Ticker	AGR Percentile	Market Cap (\$mm)	Industry	AI-B Bankruptcy Probability	AI-B Bankruptcy Percentile *
Rite Aid Corporation	RAD	23	1,362.840	Retail (Drugs)	10.54%	2
Sirius XM Radio Inc.	SIRI	6	2,621.780	Broadcasting & Cable TV	9.04%	2
AMR Corporation	AMR	25	1,528.210	Airline	8.74%	3
Federal-Mogul Corporation	FDML	6	1,250.510	Auto & Truck Parts	8.64%	3
Textron Inc.	TXT	7	3,703.240	Conglomerates	7.09%	4
The Goodyear Tire & Rubber Company	GT	13	3,978.860	Tires	6.85%	4
Continental Airlines, Inc.	CAL	16	1,832.040	Airline	6.59%	4
CBS Corporation	CBS	29	6,417.180	Broadcasting & Cable TV	6.22%	5
Las Vegas Sands Corp.	LVS	9	9,416.200	Casinos & Gaming	5.91%	5
Liberty Media Corporation (Capital)	LCAPA	16	1,715.570	Broadcasting & Cable TV	5.55%	5
Advanced Micro Devices, Inc.	AMD	22	2,910.810	Semiconductors	4.81%	6
Macy's, Inc.	M	21	6,527.150	Retail (Department & Discount)	4.65%	6
Mylan Inc.	MYL	1	4,479.200	Biotechnology & Drugs	4.46%	7
Apartment Investment and Management Co.	AIV	21	1,424.410	Real Estate Operations	4.04%	7
Hertz Global Holdings, Inc.	HTZ	17	4,060.820	Rental & Leasing	3.99%	8
Redwood Trust, Inc.	RWT	24	1,244.760	Real Estate Operations	3.96%	8
Oshkosh Corporation	OSK	6	3,003.650	Auto & Truck Manufacturers	3.84%	8
Amkor Technology, Inc.	AMKR	10	1,014.090	Semiconductors	3.47%	8
Interpublic Group of Companies, Inc.	IPG	20	2,997.440	Advertising	3.35%	9
Sprint Nextel Corporation	S	13	10,525.610	Communications Services	3.27%	9

* The percentiles range from 1-100. The lowest percentiles signify the greatest risk of bankruptcy.