An Innovative Look at Corporate Credit Risk

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Stephen Malinak, PhD, Global Head of Analytics

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AGENDA

• CORPORATE CREDIT RISK BASICS

• CORPORATE CREDIT RISK MODEL
  – STRUCTURAL MODEL (MERTON APPROACH)
  – RATIO ANALYSIS
  – TEXT MINING
  – COMBINATION
Credit Risk models can be used in several different contexts by traders, investors, and risk managers working with many asset classes.

- **Fixed Income**
  - Measuring the riskiness of fixed income assets relative to their prices and yields.

- **Equity Selection**
  - Screening for “quality” stocks with low default risk.

- **Cross-Asset Arbitrage**
  - Comparing StarMine default probabilities with CDS spreads

- **Risk Management**
  - Monitoring counterparty risk
Company credit risk basics

- Two fundamental quantities of interest
  - Probability of Default (PD)
  - Loss Given Default (LGD)

Expected Loss = PD * LGD * Exposure

- Traditionally, two fundamental types of data used to model PD
  - Market prices (Structural/Merton model; e.g. KMV)
  - Accounting data (reported financials; e.g. Altman-Z)
  - Analyst estimates
  - Text (News, conf call transcripts, filings, analyst research)

StarMine adds two more
Default prediction model performance metric

Accuracy Ratio (AR) Definition

Area = A

Area = B

AR = B/(A+B)

- Theoretically Perfect Model, AR = 100%
- Typical Model, AR ~ 50%
- Non-predictive Random Model, AR = 0%
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StarMine Structural Credit Risk (SCR) model uses a Structural (Merton) framework.

• Based on the Black-Scholes Merton option pricing framework, introduced in 1973-4
  – Merton and Scholes got the 1997 Nobel Prize in Economics for this work (Black had died in 1995)

• Models a company’s equity as a call option on its assets.

• Probability of default (PD) equates to the probability that the option expires worthless.

• StarMine SCR uses a 1-year forecast horizon.
Structural Default models typically have three types of inputs.

<table>
<thead>
<tr>
<th>Input</th>
<th>Effect on default probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leverage (assets/debt)</td>
<td>Higher leverage increases default %</td>
</tr>
<tr>
<td>Volatility of assets</td>
<td>Higher asset volatility increases default %</td>
</tr>
<tr>
<td>Drift rate of assets</td>
<td>Higher growth rate decreases default %</td>
</tr>
</tbody>
</table>

An example asset path:

- A possible asset value path (random walk with drift)
- Distribution of asset value at horizon
- Default Point
- Probability of default
The Merton model asserts that corporate equity is a call option on the company’s assets.

- A vanilla Black-Scholes formulation implies a “distance-to-default” risk measure:

$$DD_{Merton} = \frac{\ln\left( \frac{A}{D} \right) + T\left( r - \frac{1}{2} \sigma_A^2 \right)}{\sigma_A \sqrt{T}}$$

- $A$, the market value of the company’s assets, and $\sigma_A$, the volatility of assets, are not directly observable and must be estimated.

- One common way to do this is solve a system of two equations & two unknowns, using the relationship between $\sigma_A$ and $\sigma_E$, the volatility of equity.
Research questions we asked in creating the structural model

• What mathematical framework should we use?
  – Barrier option, numerical solving method, stochastic or fixed default barrier, approximations to use

• How should we define the default point (what function of liabilities)?

• How should we define equity volatility – EWMA, GARCH, etc.?

• How should we estimate the drift component? Can we do better than just using $R_f$ for all companies?
We tested many Merton model flavors. More complexity did not translate to more performance.

Performance of various Structural Model Formulations

- Just Equity volatility
- Plain Vanilla Merton model
- closed form Merton (simplifying approximations)
- Naive Merton (Bharath and Shumway, 2004)
- Barrier Option Formulation
- Barrier Option Formulation + stochastic default point
- Vanilla Merton + price change in drift

Volatility, Leverage, and Drift definitions matter.

Performance of various Structural Model Formulations

Cumulative percent of defaults identified

Percentile rank of model output

- Just Equity volatility
- Plain Vanilla Merton model
- closed form Merton (simplifying approximations)
- Naive Merton (Bharath and Shumway, 2004)
- Barrier Option Formulation
- Barrier Option Formulation + stochastic default point
- Vanilla Merton + price change in drift
- closed form Merton + price change in drift
- closed form Merton + price change in drift + optimized volatility + leverage

StarMine’s Structural model outperforms both a standard Altman-Z model and a baseline naïve Merton implementation.
StarMine SCR’s default prediction performance handily beats the Altman Z-score, as well as a basic Merton model that uses numerical solving.

- No alternate formulation (of many) that we tested was as good as StarMine SCR.
- We score both financials and non-financials, and performance is similar.
Structural model can improve long-short equity portfolio risk/return via negative screening.

Combining StarMine Val-Mo with StarMine Structural Credit Risk
Global, non-micro cap stocks, Jan 1998 - July 2011

- L-S Val-Mo top-bottom 10%
- L-S Val-Mo top-bottom 8%
- L-S Val-Mo top-bot 10% AND SCR > 20th pctile

Annualized Sharpe Ratio

<table>
<thead>
<tr>
<th>Year</th>
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<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>Overall</th>
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</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>2.00</td>
<td>1.55</td>
<td>1.25</td>
<td>1.50</td>
<td>1.80</td>
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<td>2.20</td>
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<td>2.00</td>
<td>1.50</td>
<td>1.80</td>
<td>2.50</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Legend:
- Red: L-S Val-Mo top-bottom 10%
- Blue: L-S Val-Mo top-bottom 8%
- Green: L-S Val-Mo top-bot 10% AND SCR > 20th pctile
Historical Example: Lehman Brothers

![Graph showing changes in stock price and ratings from 12/1994 to 12/2008. The graph illustrates the decline in rating from AA to CCC, followed by a sharp decline to bankruptcy in 4/2008. The stock price also shows a marked decline during the same period.]

- **StarMine SCR implied rating**
- **Agency rating**
- **Stock Price**

Bankruptcy →

- **Rating:** AA, A, BBB, BB, B, CCC
- **Stock Price**
Living Company Example: Société Générale

Société Générale

24 Jan 2008
Rogue trader scandal.
Losses of ~ $7 Billion

Stock Price

StarMine Structural Credit Risk Model
Agency Rating
Stock Price
Recent high-profile example: MF Global
Emerging Markets Example: African Bank Investments, Ltd

**Structural Credit Risk**

<table>
<thead>
<tr>
<th>Component</th>
<th>Rank</th>
<th>Component Inputs</th>
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</thead>
<tbody>
<tr>
<td>Structural Leverage</td>
<td>7</td>
<td>Liabilities: 4,824,900</td>
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<tr>
<td></td>
<td></td>
<td>Equity: 1,543,300</td>
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<td></td>
<td></td>
<td>Market Cap: 1,042,460</td>
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<tr>
<td>Asset Volatility</td>
<td>79</td>
<td>Annualized Equity Volatility: 28.25%</td>
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<tr>
<td>Asset Drift</td>
<td>8</td>
<td>T12M Price Change %: -25.82%</td>
</tr>
</tbody>
</table>

**Implied Rating**: BBB-
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Liquidity (e.g., quick ratio, Cash/Debt)

Growth (e.g., ROE expansion, stability of EPS growth)

Industry-specific Information

Country/Region effects

SmartRatios Score & Probability of Default

Profitability (e.g., Return on Capital, Profit Margin)

Leverage (e.g., Net Debt/Equity)

Coverage (e.g., EBITDA/Interest, CashFlow/Debt)

Liquidity (e.g., quick ratio, Cash/Debt)
Ratios based on Estimates are better at predicting defaults than backward-looking ratios.

Value of Forward-looking Ratios
Hit Rate: % of Failures Identified among High Risk (bottom 20%) Firms

- FY0 actuals
- FY1 SmartEstimates

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<tr>
<th>Ratio</th>
<th>FY0</th>
<th>FY1</th>
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<td>Earnings/Tangible Capital</td>
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<tr>
<td>Net Debt/Equity</td>
<td>55%</td>
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<tr>
<td>Free Cash Flow/Debt</td>
<td>40%</td>
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<tr>
<td>EBIT/Interest</td>
<td>55%</td>
<td>65%</td>
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Hit Rate: % of Failures Identified among High Risk (bottom 20%) Firms
## Financial Ratios used in the SmartRatios model.

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<th>Components</th>
<th>Ratios</th>
<th>Banks</th>
<th>Insurance</th>
<th>Retail</th>
<th>Airlines</th>
<th>Utilities</th>
<th>Oil &amp; Gas</th>
<th>All Others</th>
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</tbody>
</table>
Incorporating industry specific metrics adds value.

Value of Sector-Specific Ratios
Hit Rate: % of Failure Identified among High Risk (bottom 10%) Firms
The SmartRatios model outperforms literature models.
The SmartEstimate can predict estimate revisions. Can the SmartRatios rating predict agency rating changes?

YES. When the agency & SmartRatios ratings differ significantly, the agency rating moves toward the SmartRatios rating 4-5x more often than it moves away.
The SmartRatios model can improve equity selection performance.

**StarMine Val-Mo Top Quintile Filtered by SmartRatios Model PD**

- **Annualized Sharpe**
- **Annualized Return**

**StarMine SmartRatios Model PD Cutoff (%)**

*PD cutoffs correspond to 10th, 20th, …90th percentiles.*
Example: Pilgrim’s Pride

Rising feed prices
Increasing debt load
Liquidity degrades

Analysts reduce estimates. Profitability, Coverage, Leverage degrade
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Text mining of company documents can predict financial failure

- Identify linguistic content that provides best discrimination between firms that fail vs. those that do not
- Apply sophisticated machine learning algorithms to these high-dimensional data to provide unique and powerful failure predictions
We model each document source independently and then combine to create an overall probability of default.
Volume of text has grown and presents computational challenges.

<table>
<thead>
<tr>
<th>Source</th>
<th># of docs</th>
<th># Distinct Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statements</td>
<td>380,361</td>
<td>217,737</td>
</tr>
<tr>
<td>Transcripts</td>
<td>114,181</td>
<td>398,705</td>
</tr>
<tr>
<td>News</td>
<td>540,946</td>
<td>105,577</td>
</tr>
<tr>
<td>Total</td>
<td>1,131,398</td>
<td>Union: 549,664</td>
</tr>
</tbody>
</table>

SarbOx
Reuters News: Filtering out small news articles improves accuracy

- Removing these small machine-generated articles improves the accuracy ratio by removing observations we are unable to score correctly.
- A small article may precede a credit event, but it does not contain any useful text so we are unable to make a useful prediction.
- Examples:

For a summary of rating actions and price target changes on U.S. and Canadian listed stocks:
Reuters 3000Xtra users, double-click [RCH/US], Reuters Station users, click .1568
((Bangalore Equities Newsdesk +91 80 4135 5800; within U.S. +1 646 223 8780))

NYSE ORDER IMBALANCE <COF.N> 144000 SHARES ON BUY SIDE

Reuters terminal users - A press release related to this news headline is available. Please click within the brackets to access. [nPNB1F140]
(New York News Desk (646)-223-6000)
Broker Research (only for permissioned brokers): Identifying disclosure pages

We use tell-tale phrases to identify the disclosure pages

<table>
<thead>
<tr>
<th>Disclosure Related Phrases</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>disclaimer</td>
<td>analysts certifications</td>
</tr>
<tr>
<td>disclaimers</td>
<td>rating system</td>
</tr>
<tr>
<td>global disclaimer</td>
<td>distribution of ratings</td>
</tr>
<tr>
<td>disclosure</td>
<td>rating structure</td>
</tr>
<tr>
<td>disclosures</td>
<td>rating definitions</td>
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<td>recommendation structure</td>
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<td>company specific disclosures</td>
<td>distribution of recommendations</td>
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<td>recommendation system</td>
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<td>foreign affiliate disclosures</td>
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<tr>
<td>analyst certification</td>
<td>this information is categorised as marketing material</td>
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<tr>
<td>analyst(s) certification(s)</td>
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<tr>
<td>analyst certifications</td>
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</tr>
</tbody>
</table>

Source: ClearForest
Remove disclosure pages and machine-generated reports

- We remove about 4 pages of disclosures in a long report
- We also remove machine-generated reports
Some 8-K filings are red flags just by their presence

<table>
<thead>
<tr>
<th>Section</th>
<th>Section Title</th>
<th>Sub Sections</th>
</tr>
</thead>
</table>
| Section 1 | Registrant's Business and Operations | 1. Entry into a Material Definitive Agreement  
2. Termination of a Material Definitive Agreement  
3. **Bankruptcy or Receivership** |
| Section 2 | Financial Information             | 1. Completion of Acquisition or Disposition of Assets  
2. Results of Operations and Financial Condition  
3. Creation of a Direct Financial Obligation or an Obligation under an Off-Balance Sheet Arrangement of a Registrant  
4. **Triggering Events That Accelerate or Increase a Direct Financial Obligation or an Obligation under an Off-Balance Sheet Arrangement**  
5. Costs Associated with Exit or Disposal Activities  
6. Material Impairments |
| Section 3 | Securities and Trading Markets    | 1. **Notice of Delisting or Failure to Satisfy a Continued Listing Rule or Standard; Transfer of Listing**  
2. Unregistered Sales of Equity Securities  
3. Material Modification to Rights of Security Holders |
| Section 4 | Matters Related to Accountants and Financial Statements | 1. Changes in Registrant's Certifying Accountant  
2. Non-Reliance on Previously Issued Financial Statements or a Related Audit Report or Completed Interim Review |
| Section 5 | Corporate Governance and Management | 1. Changes in Control of Registrant  
2. **Departure of Directors or Certain Officers; Election of Directors; Appointment of Certain Officers**  
3. Amendments to Articles of Incorporation or Bylaws; Change in Fiscal Year  
4. Temporary Suspension of Trading Under Registrant’s Employee Benefit Plans  
5. Amendment to Registrant’s Code of Ethics, or Waiver of a Provision of the Code of Ethics  
6. Change in Shell Company Status |
| Section 6 | Asset-Backed Securities           | 1. ABS Informational and Computational Materials  
2. Change of Servicer or Trustee  
3. Change in Credit Enhancement or Other External Support  
4. Failure to Make a Required Distribution  
5. Securities Act Updating Disclosure |
| Section 7 | Regulation FD                     | 1. Regulation FD Disclosure |
| Section 8 | Other Events                      | 1. Other Events (The registrant can use this Item to report events that are not specifically called for by Form 8-K, that the registrant considers to be of importance to security holders.) |
| Section 9 | Financial Statements and Exhibits  | 1. Financial Statements and Exhibits |
Reduce computational complexity by eliminating very rare words ...
... and by eliminating very common words.

Common “stop words” words (a, and, the,…) appear

- in documents frequently → high mean frequency
- in docs equally → low StDev of frequency

Inverse coefficient of variance, \( ICV = \frac{\text{mean}}{\text{StDev}} \)

~1900 very common words eliminated

High ICV

ICV histogram

Result

Left with ~5000 word “dictionary” that spans ~50% of the text volume

Dimensionality reduced by > 100x!
Text Model: Identify key language from multiple text sources to turn raw textual data into credit scores.

Documents:
News, transcripts, filings, analyst research

“good morning…
…potentially violating the covenants…”

Stem words. Remove high & low frequency words. Chop into unique words and phrases.

Bag-of-words and phrases

potential, violat, the, covenant,
potential violat,…

Full numerical representation of documents

<table>
<thead>
<tr>
<th></th>
<th>covenant</th>
<th>good morning</th>
<th>apple</th>
</tr>
</thead>
<tbody>
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<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>doc3</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Select most valuable words and phrases

Score docs, aggregate scores

Machine Learning Algorithm

Make predictions

NLP context overlay
Financial language and context is unique. Standard sentiment classification does not work for default prediction.
Key language is fairly stable over time.

30-60% of Top 30 words in period 1 are also in Top 30 in next period.

70-95% are captured in the next period’s Top 300.
Combining signals from multiple textual sources produces a stronger failure prediction model.
Text mining can raise red flags early on.

Comparison of Agency Rating and TR Model Components for Chesapeake Corp

<table>
<thead>
<tr>
<th>Agency Rating</th>
<th>TR Text Model Equivalent Rating</th>
<th>Stock Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AA</td>
<td></td>
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<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **8/17/2007 – Transcript**
  Analyst: I take it you're still in compliance with all of your covenants there? And have you spoken to any of your creditors about refinancing any of the credit terms?
  CEO: The question on compliance. Yes. We certainly are in compliance ...

- **11/30/2007 - Transcript**
  CEO: There is a reasonable possibility that we will not be able to comply with these covenants ...

- **08/31/2008 – 10-Q**
  Based on current projections we are likely to not be in compliance with the financial covenants under the Credit required…. These matters raise substantial doubt about our ability to continue as a going concern.
Case study: Jackson Hewitt

• Bankruptcy was partially caused by the company’s inability to obtain financing for “Refund Anticipation Loans”

• The StarMine Text Mining Credit Risk Model is unaware of this specialized terminology, yet is still able to accurately model the company’s credit score
March 2009: The company notes potential problems on its conference call

... and this sluggish pace continued ... ... we have seen is a significantly higher level encroachment from online filing ...

... our leverage ratio at the end of the third quarter was 3.1 times versus our maximum allowable ratio under our credit agreement covenant of 3.5 times ...

... our leverage ratio will step down from 3.5 to 3.15 times for the period ending April 30, 2009. And it is this 3.15 times leverage ratio from which we believe we will need additional relief ...
This action is reflected positively in the Research, News, and Filings signals.
… 2010 was a very challenging year …

… just a question with regards to the new credit agreement. you mentioned a couple of amended covenants, but is there anything in there that would terminate or breach a covenant …

[We saw an] increased the likelihood of a default under certain financial covenants in our then existing credit agreement, we entered into an amendment to this facility, which, among other things, modified the financial covenants and provided us access to sufficient funding for the 2011 tax season.
March 2011: Bankruptcy is an option

News

… Jackson Hewitt sees pre-packaged bankruptcy as an option …

... Jackson Hewitt tax service Inc <jtx.n> said it is working along with its lenders towards "a mutually satisfactory plan" for restructuring the company's balance sheet and future funding, which may include a pre-packaged bankruptcy.
AGENDA

• CORPORATE CREDIT RISK BASICS

• CORPORATE CREDIT RISK MODEL
  – STRUCTURAL MODEL (MERTON APPROACH)
  – RATIO ANALYSIS
  – TEXT MINING
  – COMBINATION
StarMine approach to PD models

- **StarMine Structural Model**: Assesses equity market’s view of credit risk
- **StarMine SmartRatios Model**: Accounting ratio analysis using SmartEstimates
- **StarMine Text Mining Model**: Mines language in key company documents

**StarMine Combined Model**: Integrates information from all three perspectives
Different credit risk models have different strengths. Ratios see problems from farthest out, and the structural model reacts fastest.
Combining multiple sources of information adds value.
The Combo model is formulated to take utilize each component model effectively.

- Combines the outputs from the Structural, Smart Ratios, and Text Mining models into one final best estimate of credit risk.

- Weighting between Text Mining and other models is conditioned on volume of text – weight on Text Mining increases with volume of text.

- Incorporates momentum in credit risk, which is more pronounced on the downside.

- Handles missing data intelligently – only one input model is required for a final score, but uses any available.
Combo model performance: Significant improvement from any single model

Universe is all securities with all 3 input model scores
The Combo model improves upon the individual component models consistently.
The Combo model also works well in Emerging Markets, making the best use of all available data.
Emerging Markets Example: Moroccan construction company

<table>
<thead>
<tr>
<th>STR MC</th>
<th>Ste de Travaux de Realisation d'Ouvrages (Construction &amp; Engineering)</th>
<th>SEDOL: B65MCJ</th>
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</thead>
<tbody>
<tr>
<td>Val-Mo</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>ARM</td>
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<td>N/A</td>
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<tr>
<td>Price Mo</td>
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<td>28</td>
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<tr>
<td>RV</td>
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<td>IV</td>
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<td>SI</td>
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<td>N/A</td>
<td>N/A</td>
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<tr>
<td>TMCR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summary | Valuation | Models | Analysis | Peers | Estimates | Recommendations | Top Analysts | Research | Statements | PrintPack™ |

Combined Credit Risk

**Percentile**: 2
100=Lowest Risk

**Input Models**
- Structural
- SmartRatios
- Text Mining

**Ranking**
- Worst
- Best

**Key**:
- Ranks 91-100
- Ranks 71-90
- Ranks 51-70
- Ranks 11-30
- Ranks 1-10

**Implied Rating**: B+

<table>
<thead>
<tr>
<th>Input Model Rank</th>
<th>Component Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural</td>
<td></td>
</tr>
<tr>
<td>SmartRatios</td>
<td></td>
</tr>
<tr>
<td>Text Mining</td>
<td></td>
</tr>
</tbody>
</table>

**Credit Model Region Rank History**

Graph showing price movements from July to April.
Credit signals can add alpha for equity selection.
What did we learn about modeling credit risk?

- Incorporating information from multiple perspectives improves upon any single source of data or type of analysis
- You can often be more responsive by incorporating market intelligence embedded in stock prices
- There is great value in using more forward-looking, timely information in ratios analysis
- Incorporating textual analytics from several sources can flag problems before they show up in the numbers. And, text is underused from a quant perspective
- Used to filter out risky stocks, credit risk factors can add value to equity portfolios
Alpha Now provides a regular stream of live examples of our models and analytics at work.

www.alpha-now.com

STARMINE SCORE FOR EARNINGS SURPRISES IN ASIA HITS BULL’S-EYE WITH 90% ACCURACY

August 1st, 2013 by Sridharan Raman

Many Asian companies are currently reporting earnings for the end-of-March fiscal year. The research team at Thomson Reuters StarMine has been scrutinizing the earnings forecasts that were made using StarMine SmartEstimates (SE) and Predicted Surprises (PS) models. We had identified five companies like to beat consensus estimates and five likely to miss. We can now report StarMine’s accuracy score — 90%.

The one company that was not counted as a success — GAIL (India) Ltd. — actually reported earnings on target with the estimates. We had predicted it would beat estimates, so we didn’t give ourselves credit for that one. We were correct in all nine other calls and that makes the year on par with our historical success rate.

<table>
<thead>
<tr>
<th>TICKER</th>
<th>COMPANY NAME</th>
<th>MEAN</th>
<th>SMARTESTIMATE</th>
<th>ACTUAL</th>
<th>RESULT</th>
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</thead>
<tbody>
<tr>
<td>PDBL.PK</td>
<td>Pardeshia S. Ltd.</td>
<td>CN¥24.47</td>
<td>CN¥25.55</td>
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<td>7261.T</td>
<td>Mazda Motor Corp.</td>
<td>¥36.22B</td>
<td>¥39.6B</td>
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<tr>
<td>3673.TW</td>
<td>TPK Holdings</td>
<td>NT¥42.18</td>
<td>NT¥43.99</td>
<td>NT¥42.24</td>
<td>✔</td>
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<tr>
<td>0400.T</td>
<td>TV Azadi Corp.</td>
<td>¥11.49</td>
<td>¥12.49</td>
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<tr>
<td>GAIL.NS</td>
<td>GAIL (India) Ltd.</td>
<td>Rs. 34.48</td>
<td>Rs. 35.95</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TICKER</th>
<th>COMPANY NAME</th>
<th>MEAN</th>
<th>SMARTESTIMATE</th>
<th>ACTUAL</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5868.HK</td>
<td>Sinotruk (HongKong) Ltd.</td>
<td>CN¥0.13</td>
<td>CN¥0.10</td>
<td>CN¥0.04</td>
<td>✔</td>
</tr>
<tr>
<td>6057.T</td>
<td>Advantest Corp.</td>
<td>$3.50</td>
<td>$2.48</td>
<td>$0.18</td>
<td>✔</td>
</tr>
</tbody>
</table>
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• APPENDIX
  – CDS
  – LOSS GIVEN DEFAULT
CDS Model: Analyze the CDS market’s view of credit risk.

- Reduced form modeling approach which uses all daily pricing data to derive a PD curve
- Create CDS market-implied values, compare with StarMine forecasts.
  - Input: StarMine PD + StarMine LGD
  - Output: StarMine fair value CDS
  - Input: observed CDS price + StarMine LGD (or ISDA LGD)
  - Output: CDS market-implied PD
- Produce term structure of PD
  - Group similar companies, fit hazard rate function to their CDS, apply same shape to like companies w/o CDS
Apply term structure of PD from CDS to estimate PD at any horizon.

- **Given 1-year PD from Credit Risk model.**
- **CDS-implied PD term structure for the company’s peer group.**
- **Borrow term structure shape from CDS peer fitting.**
- **Resulting 5 year PD.**
Example: Goldman Sachs
Comparison of StarMine CDS-implied PD and Structural model PD

Comparing CDS view with other pieces.
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• APPENDIX
  – CDS
  – LOSS GIVEN DEFAULT
Loss Given Default (LGD) basics.

• **Definition:**
  
  LGD = 1 – recovery rate
  
  = 1 – post-default price/redemption price, where the post-default price refers to the price quoted one month after the default event, and redemption price normally equals $100.

• **Usage:**
  
  Expected loss = Exposure at Default (EAD) * Probability of Default (PD) * LGD

  Basel II Capital Requirement (LGD errors are more expensive than PD errors):

  \[
  K = LGD \times \left( \Phi \left( \sqrt{\frac{1}{1-\rho}} \Phi^{-1}(PD) + \sqrt{\frac{\rho}{1-\rho}} \Phi^{-1}(0.999) \right) - PD \right)
  \]
Seniority is important in determining LGD, but not the only thing …

Average Recovery Rate by Bond Seniority

- Sr. Secured
- Sr. Unsecured
- Sr. Subordinated
- Subordinated

Thomson Reuters 1995-2007
Company, industry, and macro data are also important.

- **Macro-level**: Treasury yields and spreads, VIX
- **Industry-level**: Industry Aggregate PD
- **Company-level**: SmartRatios Components
- **Bond-level**: seniority & capital structure

**StarMine Loss Given Default**