FRAUD PREDICTION MODELS

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Fraud Prediction Models

- **Fraud prediction models examine companies that have been caught committing fraud to model how they differ from companies not caught**
  - **Uses statistical techniques to chose a small set of ratios that provide the best explanatory power**
- **Advantages**
  - **Specifically tailored to characteristics of fraud firms**
  - **Model parameters are fixed and don't have to be re-estimated for each company**
- **Disadvantages**
  - **Models based on companies that were caught with large frauds; i.e., more extreme forms of earnings management**
  - **Large number of false positives**
- **Beneish M-score has performed the best over last 20 years**
  - **Developed in 1999; has flagged 12 of 17 "high-profile" frauds since then**

Beneish M-Score

- M-Score is based on eight ratios
  - Higher M-Score means higher likelihood of manipulation
  - Uses comparisons between current year and prior year
- Days sales receivable index (DSRI)
  - Days Receivable / Prior Days Receivables
    - Days Receivable = (Receivables / Sales) *365
  - An increase could suggest revenue manipulation
- Gross margin index (GMI)
  - Prior Gross margin / Gross margin
    - Gross Margin = (Sales – Cost of Goods Sold) / Sales
  - Flags deteriorating earnings prospects as an incentive to manage earnings

Beneish M-Score

- **Asset quality index (AQI)**
  - **Asset Quality / Prior Asset Quality**
    - Asset quality = (Total Assets – (Current assets + PP&E)) / Total assets
  - **Measures "soft" assets for which the realization of benefits is uncertain; could suggest excessive capitalization of costs**
- **Sales growth index (SGI)**
  - **Sales / Prior Sales**
  - **Growth companies often face pressure to meet earnings targets and have high capital needs**
- **Depreciation index (DEPI)**
  - **Prior Depreciation Rate / Depreciation Rate**
    - Depreciation Rate = Depreciation / (Depreciation + PP&E)
  - **Ratio greater than 1 indicates the depreciation rate slowed; could reflect income-increasing depreciation policy changes**

Beneish M-Score

- **SG&A index (SGAI)**
  - **SG&A Ratio / Prior SG&A Ratio**
    - SG&A Ratio = SG&A expense / Sales
  - **Decreasing SG&A efficiency predisposes companies to manipulate earnings**
- **Total accruals to total assets (TATA)**
  - **Accruals / Total Assets**
    - Accruals = Income before extraordinary items – Cash from Operations
  - **Proxy for non-cash earnings**
- **Leverage index (LVGI)**
  - **Leverage / Prior Leverage**
    - Leverage = (Long term debt + current liabilities) / Total assets
  - **Captures incentives to avoid violating debt covenants**

Beneish M-Score

- **M-Score = Intercept + Σ (Weights x Variables)**
  - **Same weights for all companies**

	Weight
Intercept	-4.840
DSRI	0.920
GMI	0.528
AQI	0.404
SGI	0.892
DEPI	0.115
SGAI	-0.172
TATA	4.679
LVGI	-0.327
M-Score	

Beneish M-Score

- **M-Score = Intercept + Σ (Weights x Variables)**
  - **Same weights for all companies**

	Weight	Variable
Intercept	-4.840	
DSRI	0.920	2.994
GMI	0.528	0.882
AQI	0.404	1.415
SGI	0.892	1.155
DEPI	0.115	1.110
SGAI	-0.172	0.905
TATA	4.679	-0.040
LVGI	-0.327	0.669
M-Score		

- Example: Calculate variables for Company X in 2015

- When SGAI, AQI, or DEPI are not defined, set to one

Beneish M-Score

- **M-Score = Intercept + Σ (Weights x Variables)**
  - **Same weights for all companies**

	Weight	Variable	Weight x Variable
Intercept	-4.840		-4.840
DSRI	0.920	2.994	2.754
GMI	0.528	0.882	0.466
AQI	0.404	1.415	0.572
SGI	0.892	1.155	1.030
DEPI	0.115	1.110	0.128
SGAI	-0.172	0.905	-0.156
TATA	4.679	-0.040	-0.178
LVGI	-0.327	0.669	-0.219
M-Score			-0.442

- **M-Score greater than -1.78 flags a potential manipulator**

~~Dogron~~ Enron Case

- ~~Dogron is~~ Enron was one of the world's major electricity, natural gas, commodities, communications, and pulp and paper companies ~~for dogs~~
- In October 2001, Enron was found to have committed “fraud” in the reporting of its financial statements
  - Used Special Purpose Entities, Mark-to-Market Accounting and other “tricks” to manipulate its financial statements
  - Declared bankruptcy within one month of news of fraud
  - Its auditor, Arthur Andersen, was forced to close after an obstruction of justice charge
- How does the M-Score work for Enron?


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