MOODY'S ANALYTICS

SUMMIT 2019

Assessing Financial Statement Quality

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Agenda

1. Why financial statement quality matters
2. How we measure financial statement quality
3. Use case and conclusion

Numbers in this deck for illustration purpose only

1

Why financial statement quality matters

Lending is getting harder

- Alternative lenders are making decisions quickly
- Administrative costs of lending needs to decline
- More real time information is available
- Information will need to be verified quickly and at low cost

2

How to assess financial statement quality

Are this set of financial statements fake

Can we identify low quality financial statements systematically?

Balance Sheet

Inventory	950
Total current assets	950
Intangible assets	40
Total non-current assets	40
Total assets	1,000
Short term debt	1,000
Long term debt	4,000
Total liabilities	5,000
Total equity	**-4,000**

Income Statement

Net sales	10,000
COGS	9,000
Gross profit	1,000
SG&A expense	500
Interest expense	500
Net income	0

Clues:

- Unbalanced accounts
- Missing fields
- Wacky numbers

Decision usefulness of financial statements

Decision-useful statements are high quality and provide a relevant and reliable representation of the firm's financial condition.

Low quality statements are not decision-useful. They may reflect:

- mistakes in entering information
- aggressive accounting
- fraudulent manipulation of numbers

Benefit All Users of Financial Statements

Credit Analysts Loan Officers	Equity Analysts	Regulators	Accountants
Banks	Asset Management	SEC	Accounting and Auditing
Lender	Hedge Fund	IRS	firms
Bond Investors	Equity Research/Advisor	Federal Reserve	Transfer pricing department

A framework pioneered by Moody's

Powered by AI, machine learning, big data, accounting principles

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Provides a score for a set of financial statements
Identifies areas for further review

Differentiated by country, public vs private firms, and industry

Parity | **Completeness** | **Normality**

Parity: Accounting equalities and inequalities

Check 30 accounting rules

Inventory	950
Current assets	950
Intangible assets	40
Non-current assets	40
Total assets	1,000

Current assets	950
+	
Non-current assets	40
≠ Total	1,000

The fake statements violate accounting equality

A low completeness score for the fake statements

Balance Sheet

Inventory	950
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Income Statement

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Interest expense	500
Net income	0

Completeness score

= 71%

The score depends on:

- # of fields populated
- Field importance
- Correlation across fields

Normality analysis

Are financials behaving as expected?

Normality

Peer Comparison Score

- Single factor score + Double factor score
- Unsupervised machine learning method

Likelihood of Misstatement

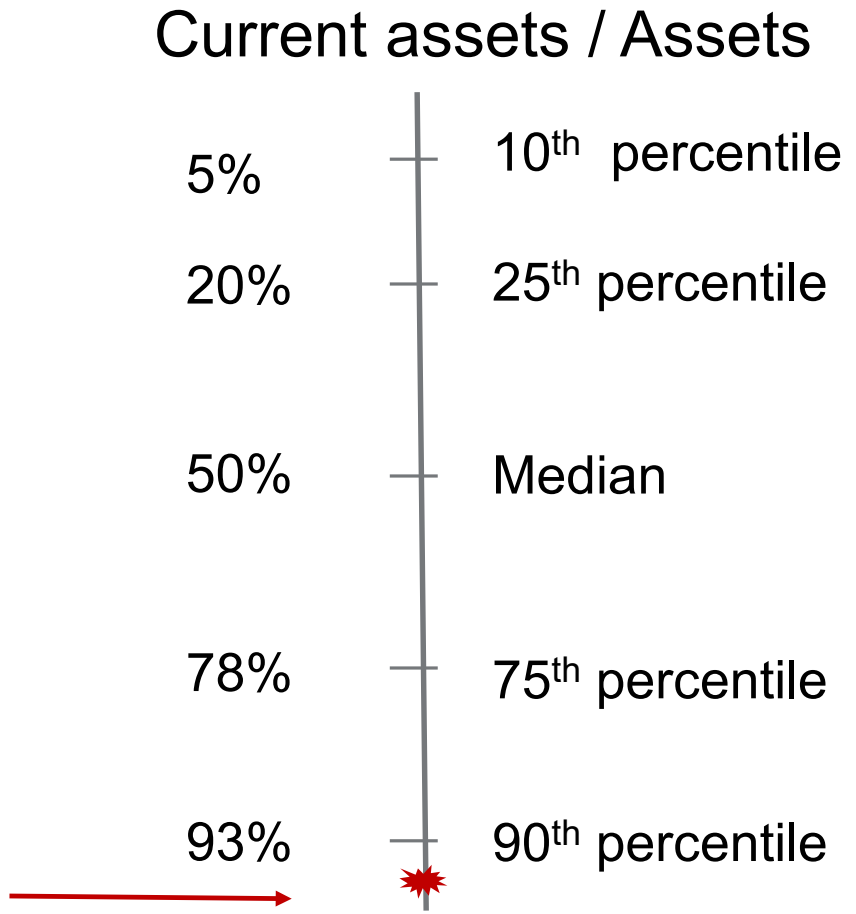
- Predict misstatement events for public and private firms
- Supervised machine learning method

Normality analysis – Single factor score

Current assets	950
Total assets	1,000

Current assets / Assets = 95%

beyond 90th percentile



- Each field scaled by total assets
- Both level and change
- # of abnormal fields
- By industry
- Based on 2 million financial statements

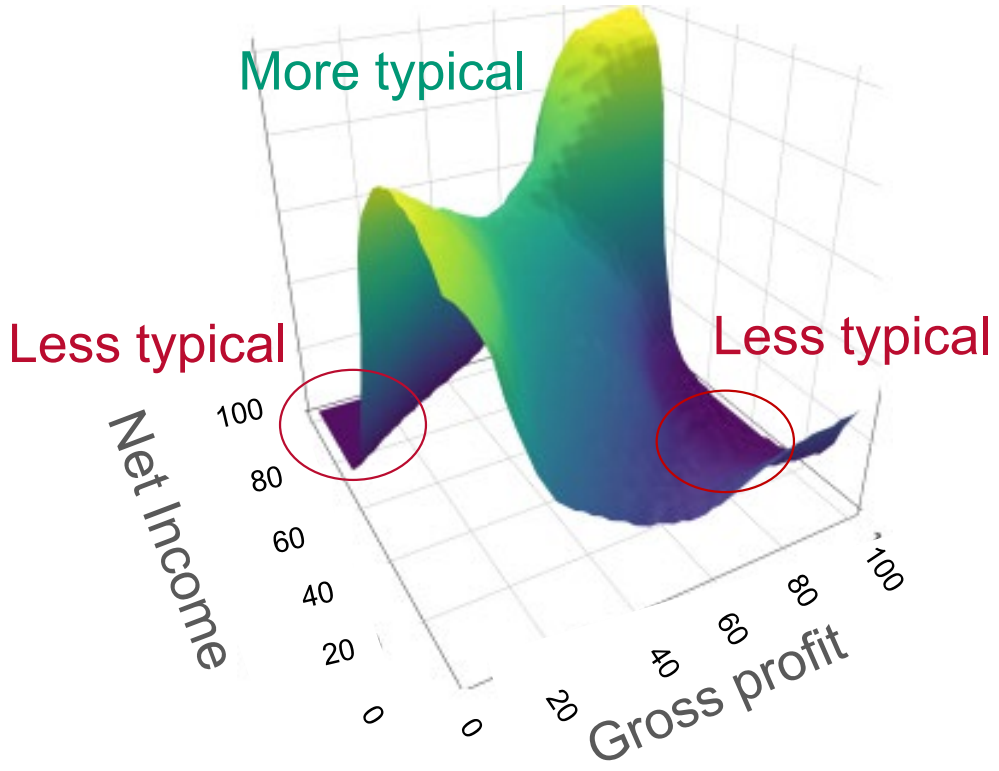
Parity | Completeness | Normality

Normality analysis – Double factor score

Gross profit vs. net income

Abnormal statements worth further investigation

It is unusual to have large gross profit but small net income, or vice versa

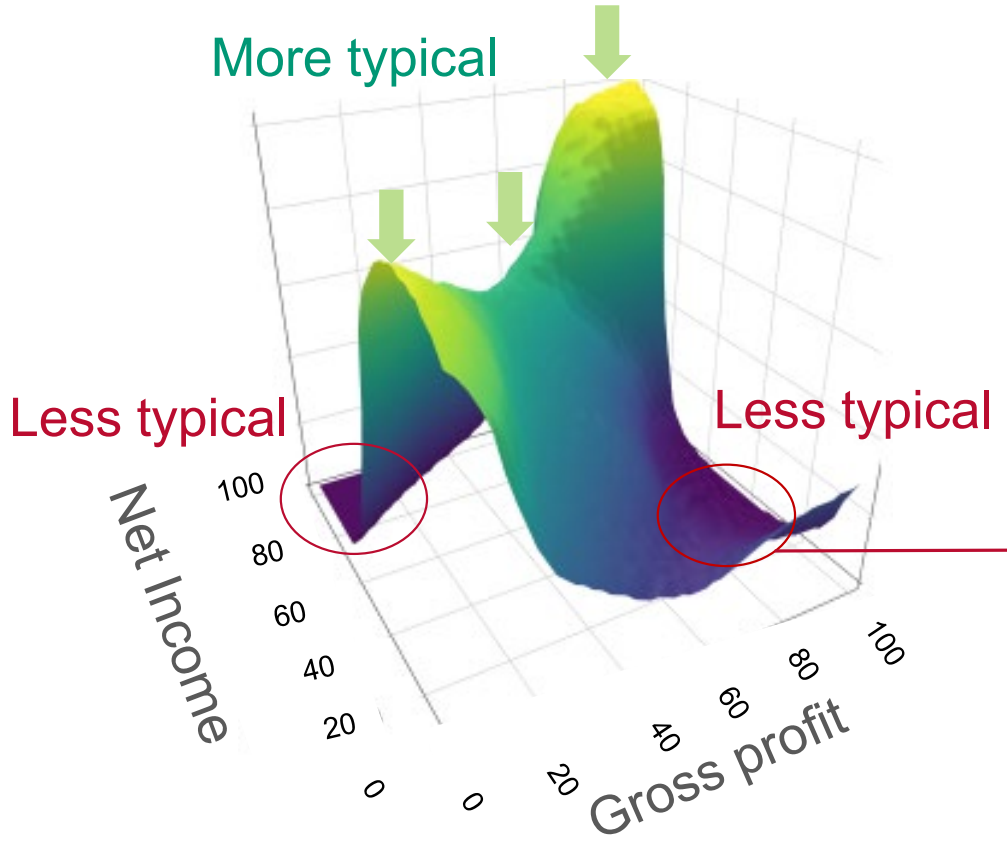


- Each field scaled by total assets
- Z axis: density
- X, Y axis: percentile
- Selected from thousands of pairs
- Both level and change
- By industry
- Based on 2 million financial statements

Normality analysis – Double factor score

Where do our fake statements fall on this graph?

Gross profit vs. net income



Total assets	**1,000**
Gross profit	1,000
Net income	0

Gross profit / Assets = 100% @ 75th percentile

Net Income / Assets = 0% @ 20th percentile

Normality analysis

Are financials behaving as expected

Normality

Peer Comparison Score

- Single factor score + Double factor score
- Unsupervised machine learning method

Likelihood of Misstatement

- Predict misstatement events for public and private firms
- Supervised machine learning method

Parity | Completeness | Normality

Likelihood of misstatement

- Financial misstatement: a misstatement or omission of material information
  - Publicly traded firms: restatements (*6000 events*), SEC Accounting and Auditing Enhancement Releases (AAERs, *200 events*)
  - Private firms: Significant gap between unaudited and audited statements (*7000 events*)
- Machine learning models: capture features to predict misstatements
  - Accuracy ratio for US private firms is 45%
- The likelihood of misstatement for the fake statements places it at 69th percentile

Overall results on the fake statements

A well-validated score

Parity

Completeness

Normality:
Peer Comparison Score
Likelihood of Mis-statement

Financial Statement Quality Score

Validation

Low quality statements are:

- more likely to be misstatements
- less useful in default prediction
- less useful in predicting next year's earnings
- more likely to be from small firms and be unaudited statements

Parity | Completeness | Normality

Validity of the score

Flag the 10% of the sample with the worst financial statement quality score

Accuracy Ratio Test

Low quality sample	48%
High quality sample	54%

Low quality statements have lower accuracy in default prediction

Earnings Persistency Test

Low quality sample	$ROA_t = 0.03 + 0.46*ROA_{t-1}$
High quality sample	$ROA_t = 0.04 + 0.61*ROA_{t-1}$

Low quality statements have lower earnings persistence

Results based on 2 million financial statements from US private firms

Develop the tool for US and China markets

With the plan to expand to other markets

Phase 1:
Minimum Viable Product

We are here
Developing 4 Models

Phase 2:
Beta Test

Phase 3:
Ready for Market

US public firms
US private firms
China public firms
China private firms

3 Use Cases and Conclusion

Benefit all users of financial statements

- Commercial banks / lenders
  - Part of loan review process or internal rating system, or assessment of acquired loans
- Bond investors / stock investors
  - Portfolio selection and early warning
- Regulators
  - Facilitate examination process
- Accounting and auditing firms
  - Screening and robustness check
- M&A

Conclusion

- We can assess financial statement quality using financial numbers
- The tool produces a well-validated score and suspicious fields for further investigation
- Benefits all users of financial statements
  - Not a replacement of the detailed analysis by accountants, auditors or analysts
- Research-in-progress to produce four models
  - US private firm model will go into beta testing first
  - Plan to expand to other markets

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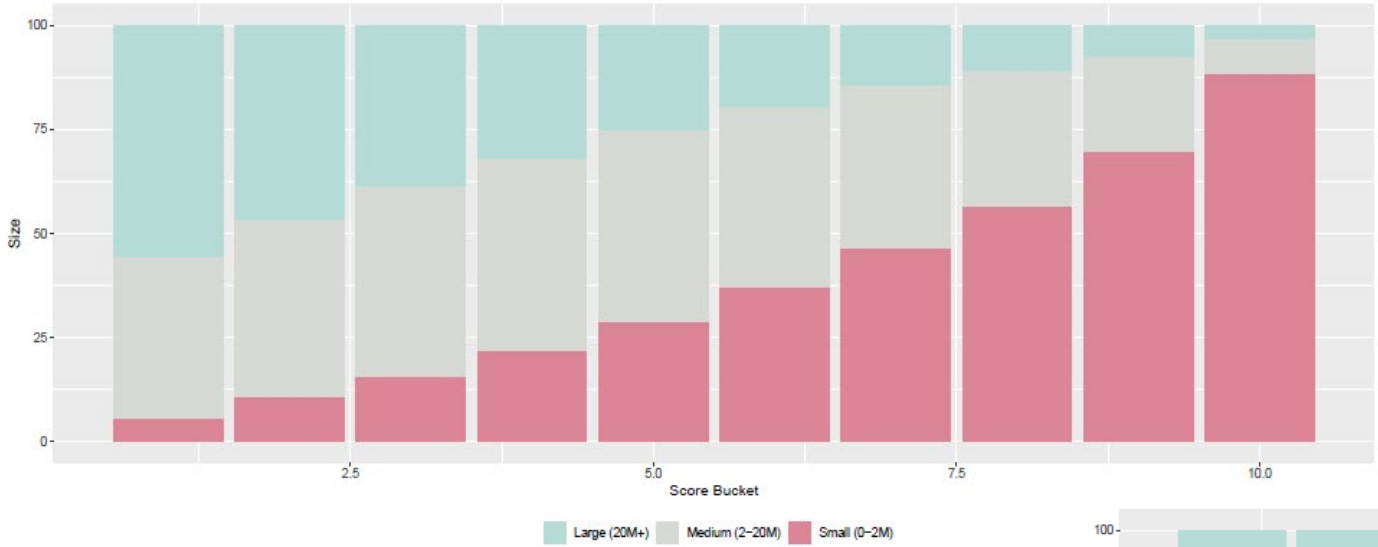
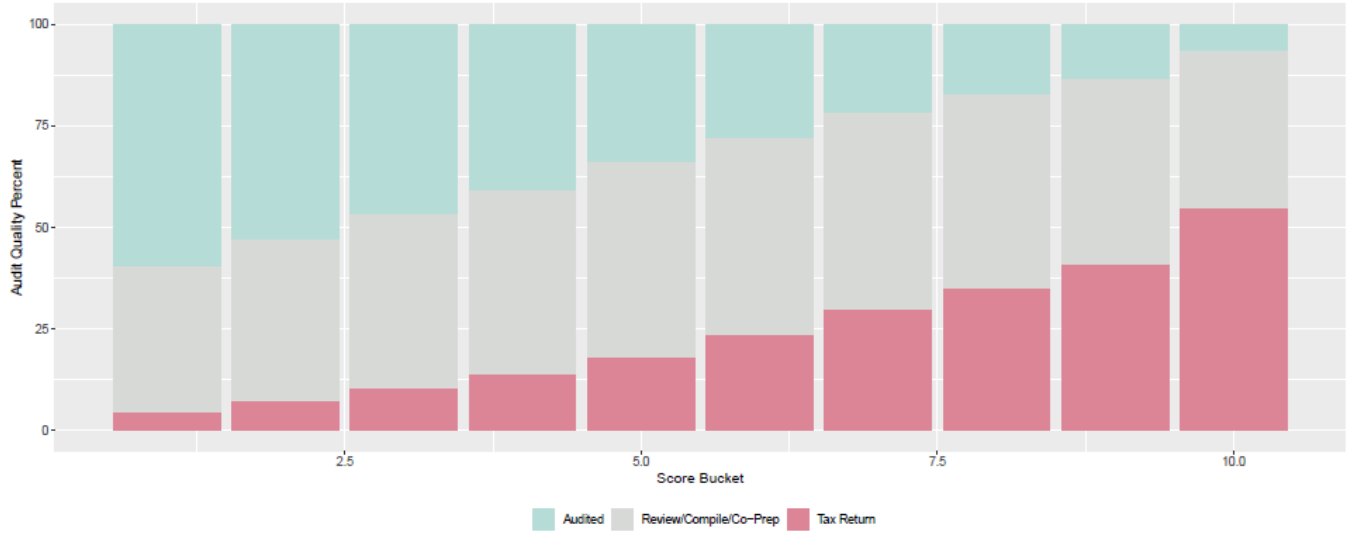
Use large datasets

Model	# Statements	# of Firms	# of defaults	Year	# of Mis-Statements
US Private Firms	3 million	704k	19k	1990 - 2016	7,000
US Public Firms	124k	14k	2k	1998 - 2018	6,873
China Private Firms	2 million	732k	4k	1999-2015	
China Public Firms	74k	9k	287	2000-2018	2,556

Validity of the score (2)

Group the sample by financial statement quality score: 1 = best; 10= worst





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