Electronic analysis of financial narratives: an overview
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The Future of Financial Reporting 2017:
Change, Narratives, Education and Globalisation

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Discretion over narratives

- Companies have a considerable amount of discretion over the quality and quantity of information supplied in their financial narratives.
- Under what circumstances, do companies use their discretion to inform or mislead investors (and other potential users) of the narratives?
- How do investors, and other users respond to such disclosures?

Fantastic Opportunities for New Research

- Whilst Baruch Lev and Feng Gu argue that we have reached "The End of Accounting" the analysis of Financial Narratives is a new beginning;
- But, such work requires broader expertise;
- Genuinely inter-disciplinary: requires knowledge of accounting and finance to be combined with linguistics and psychology;
- Also there is a significant overlap with Investor Relations;

Some European Pioneers

- Walter Aerts
- Vivien Beattie
- Niamh Brennan
- Mark Clatworthy
- Mike Jones
- Doris Merkl-Davies
- Thomas Schleicher
- Richard Taffler

Some North American Pioneers

- Elaine Henry
- Paul Tetlock
- Tim Loughran
- Bill McDonald
- Feng Li
- Stephen Baginski
- James Bettman and Barton Weitz 1983!
- SP Kothari

Document Types

- Almost all of the studies published to date focus on one particular type of document or a particular section of a particular type of document.
- In broad terms the documents fall into two main types: annual reports, outside the US, or 10Ks, within the US.
- or corporate press releases relating to some aspect of financial performance.
- In the UK, the annual report is seen as a substantial and complex document containing a broad set of information about the firm in addition to the financial statements.
- The 10K serves a similar purpose in the US, though its content and structure is much more regulated than in the UK.
- Some studies analyse the whole of the annual report or the 10K (see Loughran and McDonald (2014) for an example), but most of the studies based on such documents focus on specific sections, such as the MD&A section of the 10K (Ball et al (2015)).

AR and 10k: Content Types

- Forward looking content
- Strategic discussion
- Reviews of financial performance
- Risk and Uncertainty statements
- Corporate Governance reports
- Remuneration reports
- The New Audit Report
- Corporate Social Responsibility reports

Trading statements

- Other studies focus on shorter documents such as earnings related press releases and various forms of trading statements and profit warnings (Schleicher and Walker (2014)).
- These shorter documents typically focus on narratives that discuss some aspect of current financial performance, perhaps also including some forward looking information about expected financial performance up to 12 months ahead.

Other Potentially Interesting Document Types

- Prospectuses: IPOs and SEOs,
                  Debt and Equity
- EU Interim Management Statements

Information Intermediation
- Conference call transcripts
- Media articles
- Equity Analyst Update Notes
- Equity Analyst Valuation Reports
- Credit Analysts Reports

Content Selection and Unit of Analysis

- The linguistic analysis of financial narratives typically involves some type of content analysis of the words, sentences, and paragraphs contained in the document.
- This analysis may involve some prior screening to identify sections, paragraphs, or sentences of the document for detailed analysis, followed by detailed analysis of the specific content screened in as being relevant for analysis.
- An important distinction in the screening of content for detailed analysis is that between performance commentary and other forms of content. The majority of studies of financial narratives focus on content relating to the recent financial performance of the company.

Selection of Linguistic Characteristics

- Having decided which type of document, and which type of content within the document to study, the next issue is to decide which specific linguistic characteristics of the relevant content are to be analysed.
- In this regard, two particular linguistic characteristics have proved particularly popular in the literature. These are the analysis of *readability* and *tone*.
- Ease of computer based analysis has led to a focus on the simplest features.

Readability

- Li (2008) finds that the readability of US 10Ks is negatively associated with firm performance.
- Lee (2012) finds that firms with more readable 10Qs exhibit lower levels of post-earnings announcement drift.
- Lawrence (2013) finds that individual investors are more willing to invest in firms with more readable 10K reports.
- Loughran and Macdonald (2014) question the use of the Fog index to measure readability, and show, for their particular research context, that 10k document size seems to be a more appropriate (inverse) measure of effective communication.

Tone A

- Tetlock et al (2008) study the negativity of press stories about S&P 500 firms in the Wall Street Journal and Dow Jones News Service. They find that negativity in news stories helps in predicting accounting earnings and stock returns.
- Henry (2008) examines the link between the market reaction to earnings press releases and the linguistic features of the press release, including tone. Controlling for the earnings surprise itself, she finds a significant positive association between the tone of the press release and the market reaction.
- Davis et al (2012) extend Henry (2008) by working with a much larger sample, and the complete DICTION lists of positive and negative keywords to construct their measure of net tone.
- Feldman et al (2010) examine tone *changes* in the MD&A sections of 10K and 10Q reports. They find that tone changes have incremental information content for the market reaction to such reports.
- Loughran and Macdonald (2011) develop a list of negative words that better reflect tone in a financial context, and show that their new word list is significantly related to 10K announcement period returns.

Tone B

- Li (2010) examines the tone of forward looking statement in the MD&A statement in 10K and 10Q findings.
- He proposes a more sophisticated measure of tone than a simple bag of positive and negative keywords approach, and shows that his measure leads to superior predictive performance.
- Overall he finds that the tone of the forward looking statements helps to predict future earnings.

Tone C

- Henry and Leone (2016) provide a detailed evaluation of alternative tone measures and find that positive and negative word frequency measures are as powerful as the measure suggested by Li (2010). They differ from Li by focusing on general financial narratives rather than forward looking statements.
- Rogers et al (2011) find that US firms issuing unusually optimistic earnings press releases are more likely to attract shareholder litigation.
- Huang et al (2014) examine tone management in US earnings press releases. Their evidence suggests that some firms use tone management to mislead investors.
- Allee and Deangelis (2015) study the extent to which tone is evenly dispersed throughout the managers' prepared remarks in conference calls. They argue that tone dispersion "both reflects and affects the information that managers convey through their narratives".

"New" Theme: Use of Causal Language

- Zhang and Aerts (2015) uses a computer based approach to score the use of causal language in the performance related content and MD&A sections.
- They use a set of performance key words to identify paragraphs in the MD&A that discuss performance, and a set of causal language keywords to measure the amount of causal language in the performance related paragraphs.
- They find that the amount of causal language is positively associated with the failure by the firm to meet key performance thresholds. Firms that have disappointing performance appear to provide more causal explanation.

Latent Dirichlet Allocation: Blei et al 2003

A technique for identifying the main types of themes in a large set of documents.

For example the main themes in all 10k reports.

The technique defines a theme as a particular pattern of words. For example a performance theme might be identified by the type of sentence that discusses financial outcomes.

The technique is analogous to factor analysts of numerical data. The factors are latent (i.e not directly observable) and are inferred from analysis of the data.

"The Evolution of 10-K Textual Disclosure: Evidence from Latent Dirichlet Allocation" Dyer et al (2016).

- Document marked trends in 10-K disclosure over the period 1996-2013, with increases in length, boilerplate, stickiness, and redundancy and decreases in specificity, readability, and the relative amount of hard information.
- Uses Latent Dirichlet Allocation (LDA) to examine specific topics and finds that new FASB and SEC requirements explain most of the increase in length
- 3 of the 150 topics—fair value, internal controls, and risk factor disclosures—account for virtually all of the increase.
- These three disclosures also play a major role in explaining the trends in the remaining textual characteristics.
- SCOPE FOR WORK ON FIRMS WITH UNUSUAL 10ks OR ARs IN WHICH SOME THEMES ARE OVER OR UNDER-REPRESENTED

Document Comparisons

- In addition to the scoring of readability and tone, there has also been work on comparing the content of two documents electronically.
- Brown and Tucker (2011) identify year on year changes in the MD&A using the cosine between the two vector of words appearing in successive MD&A sections. They find that firms experiencing larger economic changes have greater changes in their MD&A content, and that the stock price response to the disclosure of the MD&A is positively associated with the amount of change.
- Davis, and Tama-Sweet (2012) compare the tone of US earnings press releases with the tone of the MD&A. They find that US press releases are significantly more optimistic than their matched MD&As suggesting a deliberate attempt provide more optimistic content at the time of the unregulated event.

Cosine Similarity: Salton (1975).

Let W be the number of all words used in Text A or Text B.

Order the W words alphabetically in both texts. So w=1,…,W.

Let Aw (Bw) the count of word w in Text A(B)

VecA (VecB) is defined as the W vector with Aw (Bw) in position w

Cos(VecA, VecB) is the cosine off the angle between the two vectors.

Cos=1 indicates identical word counts;
Cos=0 indicates zero similarity

Example:
A: It will provide a good platform to develop a significant business.
B: It has provided a good platform to develop a significant business.

word	it	will	has	provide	provided	a	good	platform	to	develop	significant	business
A	1	1	0	1	0	2	1	1	1	1	1	1
B	1	0	1	0	1	2	1	1	1	1	1	1

Cos(A,B) = 0.80 (where 1 : identical, 0 : no similarity)

WER: Word Error Rate.
Popovic 2007

- An algorithm that measures the number of insertion, deletion and or substitutions needed to transform one text to another

- 0= no text reuse

- 1=identical text

TESAS Scott Piao

- lexical, semantic & n-gram based measure
- No text reuse = 0
- Identical text = 1

The limits to computer based analysis

- Linguistic characteristics such as tone, readability, and cosine similarity, are popular with researchers, at least in part, because they lend themselves to scoring by computer based methods.
- However, there are other linguistic characteristics that are more difficult to measure using computer based methods.
- Moreover, it can be argued that the other characteristic reflect more sophisticated aspects of the use of narratives to influence the impressions of their readers.
- In relation to the analysis of performance commentaries, the analysis of impression management is of special interest, and this has proved to be more difficult to measure using computer based techniques. Merkl-Davies and Brennan (2011) provide an overview of the impressions management literature.
- Almost all of the work to date on the use of impression management, including the works cited by Merkl-Davies and Brennan (2011) was conducted by reading the documents and scoring the contents using an agreed template.
- This approach has the advantage of more sophisticated (human) analysis of the sentence structure and meaning, but it has the disadvantages of being labour intensive, and involving some degree of inter-coder subjectivity.

Recent papers using manual coding

- Sun (2010) manually coded the MD&A sections of 568 US firms with disproportionate inventory increases, and found that these disclosure have predictive ability for future firm performance, because they help to distinguish between inventory build ups due to rising or falling demand. The disclosures require sophistication in the selection and scoring of key content that would be difficult to program for a computer.

- Aerts and Tarca (2010) present a sophisticated linguistic analysis of the financial performance causal attributions in a sample of 172 10K and Annual Reports for four countries for one year. Their approach requires manual coding of the documents, They find subtle linguistic differences between countries which they attribute to institutional differences across the four countries.

- Kimbrough and Wang (2014) manually code impression management (self-serving attributions) for a (main) sample of 123 US earnings press releases. They find clear evidence of impression management, and that such impression management appears to affect investor behaviour. However investors do not accept attributions at face value, but use industry and other firm information to assess their plausibility.

- In a current working paper Guillamon-Saorin et al (2014) study the market reaction to the earnings announcements of EU firms combined with a high level of impression management. They manually code the non-GAAP earnings numbers and impression management of the firms in their sample. They find clear evidence of impression management, but their results also suggest that the market is not fooled by this.
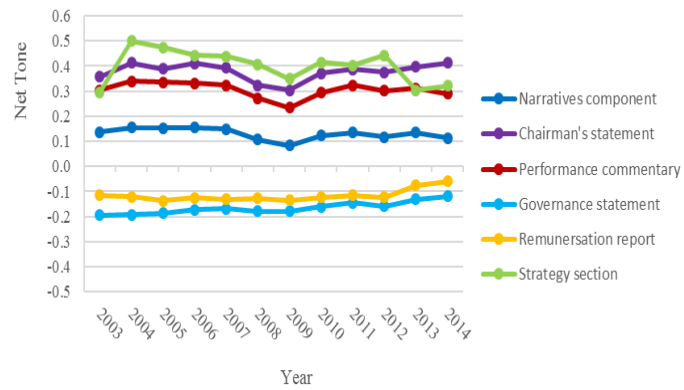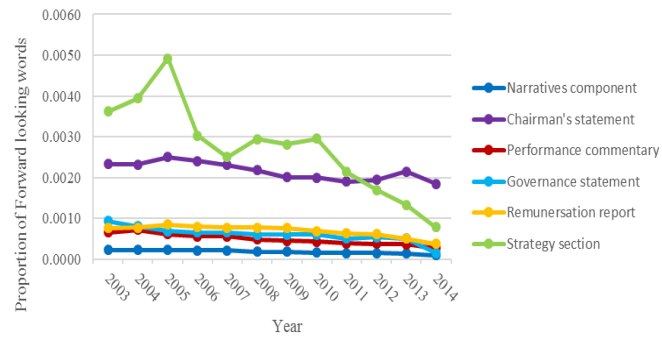
CFIE Project: 10,000 Annual Reports
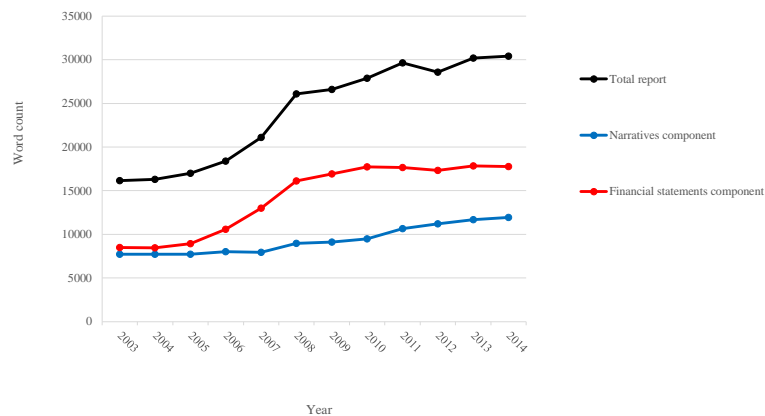
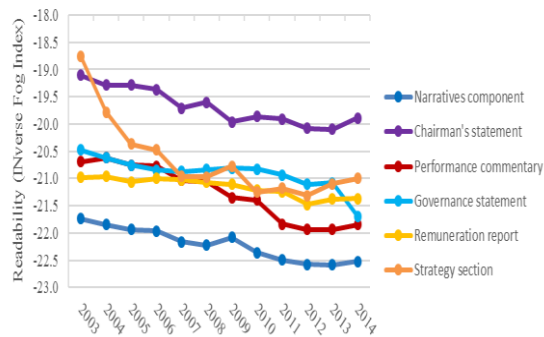# CFIE: Word counts by section
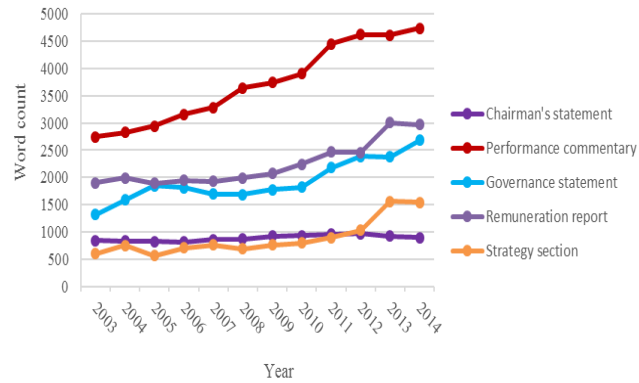
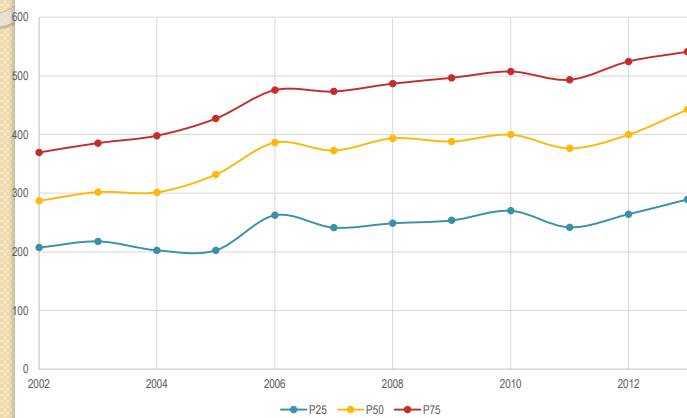

Net Tone By Section

Forward Looking Content

Readability

Annual Report Disclosures and the Cost of Equity Capital:

Non-linear Evidence for the UK

Vasiliki Athanasakou (LSE)

Florian Eugster (SSE)

Thomas Schleicher (AMBS)

Martin Walker (AMBS)

Disclosure Index changes over time

Main Regression Results

	(1)	(2)	(3)
Discindex	-0.397***	-0.384***	-0.154***
	(-10.04)	(-9.48)	(-3.86)
Discindex_squared	0.296***	0.292***	0.115***
	(9.40)	(8.88)	(3.85)
Beta	-0.015***	-0.004	0.002
	(-3.49)	(-1.02)	(0.53)
Leverage	0.095***	0.086***	0.074***
	(8.64)	(7.11)	(4.97)
MTBV	-0.007***	-0.008***	-0.005***
	(-11.61)	(-11.63)	(-7.37)
LogTA	-0.034***	-0.038***	-0.045***
	(-17.14)	(-17.35)	(-9.50)
AbsAwca	0.008	0.007	0.004
	(0.62)	(0.59)	(0.40)
LogAge	0.004	0.002	0.016
	(1.45)	(0.58)	(1.60)
Constant	0.675***	0.691***	0.691***
	(31.60)	(24.30)	(13.48)
Observations	5,152	5,152	5,152
Adj R-squared	0.457	0.502	0.468
Fixed Effect	No	Industry	Firm
Optimum-Level of Disclosure	0.67	0.66	0.67

Non-Linear Relation Between UK Disclosure Index and Cost of Equity Capital
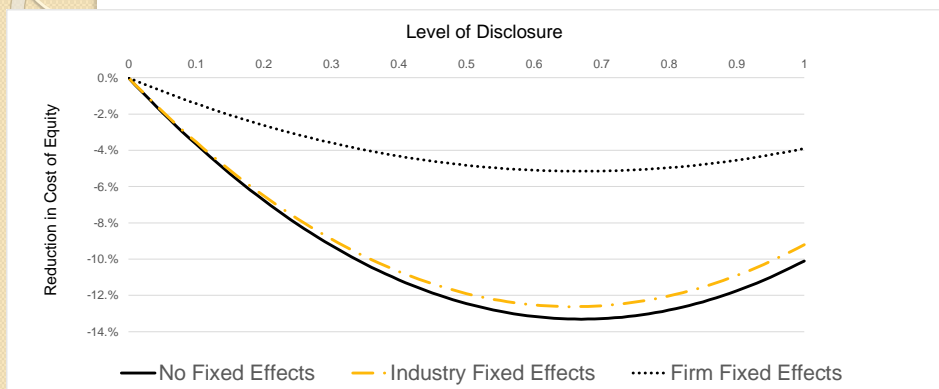
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