THE INCREMENTAL INFORMATIVENESS OF MANAGEMENT SENTIMENT IN CONFERENCE CALLS FOR THE PREDICTION OF INTERNAL CONTROL MATERIAL WEAKNESSES (ICMW)

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INTRODUCTION

***** Deep Learning

Use deep neural networks to extract high-level and abstract features from raw data by building multiple layers of representations that are expressed in terms of other, simpler representations (Goodfellow et al. 2016).



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INTRODUCTION

- Deep Learning has been widely applied to computer vision, speech recognition, natural language processing, audio recognition, social network filtering, machine translation and etc. However, the application of deep learning in auditing has just evolved.
- Big Four accounting firms are exploring the value of deep learning for auditing
- Limited research has demonstrated the use of big data as additional audit evidence.

*****Objectives

- Demonstrate the effectiveness and efficiency of deep learning in the context of auditing
- Examine the relationship between sentiment features of management in conference calls and the likelihood of ICMW;
- Investigate whether the sentiment features contain incremental information for the prediction of ICMW

Motivation

- The quality of internal control audit is unsatisfactory due to information asymmetry
- \odot SEC annual review
- \odot PCAOB investigation
- Previous studies show that conference calls contain incremental information beyond mandated disclosures for the situation of the company (Allee and Deangelis, 2015; Sedor, 2002)

PRIOR RESEARCH

Internal control over financial reporting

traditional firm-level fundamentals

- size, age, financial performance, business complexity, growing speed, restructuring experiences (i.e., Doyle, Ge, and McVay, 2007a; Ashbaugh-Skaife, Collins, and Kinney, 2007)
- accruals (Doyle, Ge, and McVay, 2007b)
- audit committee quality, audit independence (Zhang, Zhou, and Zhou, 2007)
- auditor tenure, auditor-client geographic distance (Chen, Gul, Truong, and Veeraraghavan, 2012)
- auditor-provided tax services (De Simone, Ege, and Stomberg, 2014)
- recent auditor and management changes (Rice and Weber, 2012)
- managerial overconfidence (Chen, Lai, Liu, and McVay, 2014; Lee, 2016)

Sentiment features of conference calls

- stock trading volume and return variance (Frankel, Johnson, and Skinner, 1999; Price, Doran, Peterson, and Bliss, 2012; Bushee, Matsumoto, and Miller, 2003).
- future performance ,analyst responses (i.e., Mayew and Venkatachalam, 2012; Druz, Wagner, and Zeckhauser, 2015; Davis, Ge, Matsumoto, and Zhang, 2015).
- financial misstatement (Hobson, Mayew, and Venkatachalam, 2012; Larker and Zakolyukina, 2012; Burgoon et al. 2016)

SOCIAL PSYCHOLOGY RESEARCH

Leakage hypothesis (Ekman and Friesen, 1969), the act of deception will make a single person feel guilty, stressful, and fear of detection.

DePaulo, Rosenthal, Rosenkrantz, and Green (1982) and Kraut (1980) suggest that a person may experience relatively heightened cognitive processing when telling a lie than telling the truth.

MANAGERS' THOUGHT IN CONFERENCE CALLS

- Managers are responsible for the design and operation of internal control
- If there is a ICMW, managers will be blamed
- ICMW is closely related to material misstatement
- It is a critical concern of managers
- Conference calls: Compared to other written financial disclosures such as press releases, conference calls are less formal, more flexible and spontaneous. The management is typically unsure of what exactly the investors and the analysts will ask (Frankel, Johnson, and Skinner, 1999; Larcker and Zakolyukina, 2012).
- It is possible to find information about ICMW by examining the word clue that reveals their sentiment

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HYPOTHESES

- H 1: The sentiment features of conference calls are significantly associated with the likelihood of internal control material weaknesses.
- H2: The explanatory ability of the model that incorporates sentiment features of conference calls along with major financial determinants is superior to that of the model that merely uses the financial determinants.

DATA SeekiNF (https://www.seekedgar.com:8443/seekinf.html)

Initial conference call transcript samples from Seek iNF	6379
Less: Missing fiscal year information	(1595)
Calculate the lowest score of sentiment features for firm-years with multiple conference calls	
Remaining:	<u>2408</u>
Less:	
No internal control information	(20)
Missing Compustat data	(619)
Missing Audit Analytics data	(11)
Final sample	<u>1758</u>

The size of the final conference call (CC) transcripts is 1758 corresponding to fiscal year from 2004 to 2014, among which, 201 firm-years are related to ICMW.

SENTIMENT ANALYSIS TOOL

- Alchemy Language API, a deep learning based text analysis cloud services of <u>IBM Watson</u>
- A collection of text analysis functions that derive semantic information from the content
- Trained with 200 billions of webpages
- Serves 40,000 developers and handles three billion API calls per month

What it does	
You can input: Any publicly accessible URL Plain text or HTML content	And the service will output: Extracted metadata in JSON format

SENTIMENT FEATURES

- The sentiment features acquired from Alchemy Language API include the overall sentiment score (attitude) and the joy score.
- The returned sentiment score measures the sentiment strength of the document, ranged from -1 to 1
- The score of joy values ranges from 0 to 1, which represents the confidence level indicating the probability that the emotion of joy is implied by the sample text.

LOGISTIC REGRESSION

The Baseline Model

ICW

 $= \beta_0 + \beta_1 Market value + \beta_2 Aggregate loss + \beta_3 Distress + \beta_4 Segments + \beta_5 Foreign$

+ β_6 *Inventroy* + β_7 *Restructure* + β_8 *Acquisition* + β_9 *Resign* + β_{10} *Big4* + β_{11} *Litigation*

+ \sum IndustryFE + ε

The Sentiment Model

ICW

 $= \beta_0 + \alpha_1 Sentiment + \alpha_2 Joy + \beta_1 Marketvalue$

+ $\beta_2 Aggregateloss + \beta_3 Distress + \beta_4 Segments + \beta_5 Foreign$

+ β_6 *Inventroy* + β_7 *Restructure* + β_8 *Acquisition* + β_9 *Resign*

 $+ \beta_{10}Big4 + \beta_{11}Litigation + \sum IndustryFE + \varepsilon$

		Predicted	Estimate coefficients of group A		Estimate coefficients of group B		
6		sign	Baseline model A	Sentiment model A	Baseline model B	Sentiment model B	
	Intercept		-14.5503	-14.5190	-13.9141	-13.7929	
	Marketvalue	-	-0.2557***	-0.2486***	-0.3587***	-0.3343***	
DECILIT	Aggregateloss	+	-0.2914	-0.2919	-0.4308	-0.4719	
KEJULI	Distress	+	$-3.64E^{-5}$	-0.0009	-0.0058	-0.0046	
	Segments	+	0.2755**	0.2762**	0149	-0.0904	
	Foreign	+	0.3584	0.3820	Variable dropped	Variable dropped	
	Inventroy	+	-0.1793	-0.1753	-1.4041	-1.0135	
	Growth	+			-0.8943**	-0.8975**	
• Logistic re	Restructure	+	-0.0581	-0.0656	-0.0708	-0.0550	
	Acquisition	+	0.1934	0.2109	0.7645***	0.7591***	
	Resign	+	2.3138***	2.3031***	3.0643 ***	3.1091***	
	Big4	-	-0.1997	-0.2042	0.2613	0.3247	
	Litigation	+	0.1045	0.1255	0.0438	0.0297	
	Sentiment	Ś		0.1079		1.0278	
	Јоу	-		-1.2631**		-2.5623**	
	Industry indicator variables		Included	Included	Included	Included	
	Number of total observations		1758	1758	749	749	
	Likelihood ratio, χ^2		94.35	101.81	78.94	86.03	
	~		(0.0001)	(0.0001)	(0.0001)	(0.0001)	
	(p-value)						
	Pseudo R ²		0.0755	0.0815	0.1577	0.1719	
	Likelihood-ratio		7.45**		7.09**		
	test: Likelihood						
	ratio (p-value)		(0.0241)		(0.0289)		

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ADDITIONAL ANALYSIS

- Internal control material weaknesses have also been disclosed under the SOX Section 302, which requires the officers to certify their responsibility of establishing and maintaining internal controls as well as evaluate the effectiveness of internal control and issue an unaudited report to present their conclusions on it.
- SOX 302 requires all public companies (including smaller companies) to disclose ICMW,
- the SEC, due to the high cost of complying with SOX 404, **permanently exempted smaller companies** (that are neither accelerated nor large accelerated filers) from SOX 404 (b) internal control audit requirement (SEC, 2010).
- Therefore, the material weaknesses identified under SOX 302 are more than those disclosed under SOX 404.

		Predicted	Estimate coefficients		Estimate coefficients		
0			sign	Baseline model A	Sentiment model A	Baseline model B	Sentiment model B
\backslash		Intercept		-14.0341	-13.9394	-13.7431	-13.5001
$\backslash \bigcirc$		Marketvalue	-	-0.2492***	-0.2450***	-0.2908***	-0.2687***
	<u>Results of Addition</u>	Aggregateloss	+	-0.2686	-0.2885	-0.2327	-0.3006
$\backslash \cup$		Distress	+	-0.0109**	0099**	-0.0110	-0.0096
6		Segments	+	0.1343	0.1375	-0.1142	-0.1813
		Foreign	+	0.4143	0.4427	0.2134	0.1244
	Additional analysis: Depender	Inventroy	+	-0.9553	-0.9251	-1.2692	-0.7712
	Additional analysis. Dependen	Growth	+			-0.7367**	-0.7723***
		Restructure	+	0.0757	0.0796	-0.1364	-0.1149
		Acquisition	+	0.0349	0.0544	0.3759*	0.3828*
		Resign	+	2.3841***	2.3706 ***	2.7495***	2.7798***
		Big4	-	-0.0716	-0.0824	0.2100	0.2620
		Litigation	+	-0.1372	-0.1041	-0.6513	-0.6064
		Sentiment	Ś		0.6961		1.6621
		Joy	-		-1.2005***		-2.6027***
0		Industry indicator variables		Included	Included	Included	Included
\int_{Ω}		Number of total observations		1979	1979	807	807
		Likelihood ratio, γ ²		128.93	138.42	92.89	104.88
/ 9		(p-yalue)		(0.0000)	(0.0000)	(0.0000)	(0.0000)
		Pseudo R ²		0.0711	0.0764	0.1304	0.1472
		Likelihood-ratio		9.49***		11.99***	
		test: Likelihood					
		ratio (p-value)		(0.0087)		(0.0025)	

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CONCLUSION

With the incorporation of the sentiment features, especially the score of joy, the explanatory ability of the model improves significantly, compared to the baseline model that merely utilizes the major ICW determinants suggested by prior literature.

Deep Learning is a promising technology that can effectively and efficiently help auditors make decisions.

