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THE STATE UNIVERSITY OF NEW JERSEY

A Predictive Ordered Logistic Regression Model for Quality Review of Control Risk Assessments

Hussein Issa
Alexander Kogan

Rutgers University

Background

- Management and external auditors are required to report on the adequacy of internal controls *(SOX 404)*
- Internal audit quality is important to external auditors as well as management *(Gramling & Vandervelde, 2006)*
- External auditors are encouraged to take the work of internal auditors into consideration (AS No. 5)
- The quality of internal audit affects external auditors in 3 phases *(SAS No. 65) (AU Section 322)*:
  - Risk assessment
  - Understanding, documenting, and testing internal controls
  - Substantive testing
- Control Risk Assessments (CRA): a popular tool that helps the auditors to get a better understanding of business processes

Information Overload

- Big data causes a shift towards audit-by-exception
- Prior Continuous Auditing (CA) and Continuous Control Monitoring (CCM) research focused on detecting exceptions efficiently
- Analysis usually yields large amounts of exceptions, overloading auditors with information due to sub-optimal business processes or overly conservative CA/CCM system *(Alles et al 2006, 2008 ; Debreceny et al. 2003)*
- Human users perform complex aggregation and processing tasks poorly*(Iselin, 1988; Kleinmunitz, 1990)*

Objectives & Research Questions

- **Objectives**
  - Formulate a predictive model for preliminary control risk assessment
  - Identify exceptions (quality review)
  - Propose a methodology to prioritize these exceptions (*Exceptional* Exceptions)

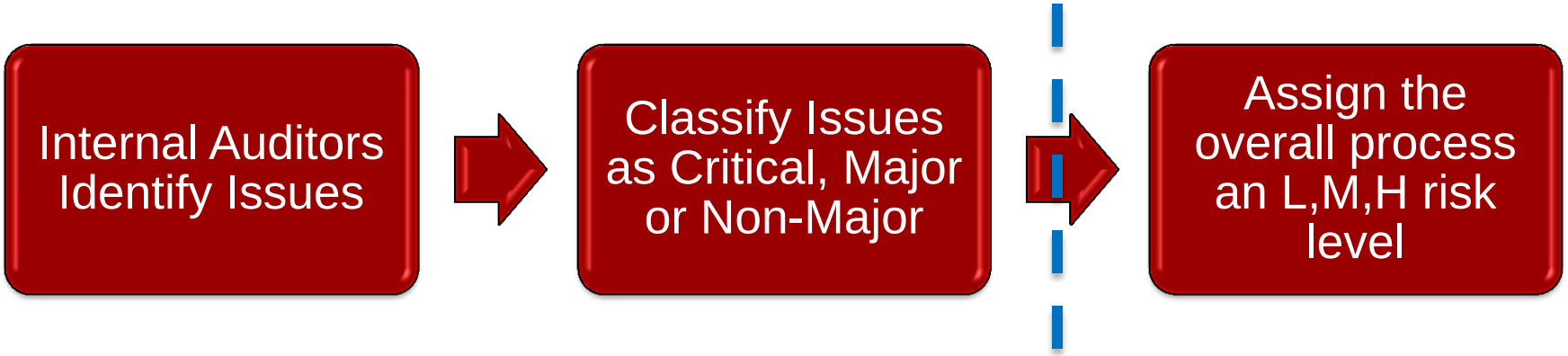
- **Research Questions**

1. How can we verify and review the quality of internal auditors' judgment in control risk assessments?

2. How can we prioritize the exceptions that deviate from the norms?

Data

- Source: Multinational consumer products company
- Issues identified by location and business process (e.g. Distribution, Payroll, Purchasing, A/P)



- Data breakdown:

	FY 08/09	FY 09/10	FY 10/11	All (08-11)
AS	344	305	275	924

Ordered Logistic Regression

- Variables: ordinal and labeled (audit risk levels)

- **Ordered Logistic Regression:**

$$\boldsymbol{logit = ln\left(\frac{prob(event)}{1 - prob(event)}\right) = \beta^T x_i + \varepsilon_i = \beta_0 + \beta_1 CC + \beta_2 MC + \beta_3 NMC}$$

- **Predicted probability:**

$$\boldsymbol{PredProb = \widehat{P}(C_i|x) = {1}/{(1 + e^{-(\beta^T x_i + \varepsilon_i)})}}$$

  - $\boldsymbol{\beta^T}$ is a vector of Intercepts
  - $\boldsymbol{x_i}$ is the vector of coefficients
  - The class with the highest calculated probability is the predicted class

Outliers Identification and Ranking

Record	CC	MC	NMC	Calc_H	Calc_M	Calc_L	Assign. Class	Pred. Class	Ratio	Diff.
123456	0	2	3	0.60719	0.39195	0.00086	M	H	**0.64551**	**0.21524**

Outliers' disagreement measure:

$$Ratio = \frac{Calc.prob\_Assigned\ Class}{Calc.prob\_Predicted\ Class}$$

$$Difference = Calc.prob\_Predicted\ Class - Calc.prob\_Assigned\ Class$$

$$Ratio = \frac{0.39195}{0.60719} = 0.64551$$

$$Difference = 0.60719 - 0.39195 = 0.21524$$

The lower (bigger) the ratio (difference), the more suspicious the record is

Main Findings

- Accuracy of the fitted model is 93%, indicating that only 7% of the records deviated from the model
- Predictive power of the model is 76.36%
- Top 20 outliers using both ranking metrics were the same, and were sent to the company for further investigation
- Interesting finding: 3 records with no issues, but High risk.
- Check for robustness and consistency: sliding window technique
  - Coefficients differed slightly, but top 20 outliers were the same

Conclusion

- **Contribution:**
  - Proposed a methodology for external auditors to review the quality of auditors' judgment of CRAs
  - Proposed a methodology to prioritize outliers, thus increasing audit efficiency by helping auditors focus their efforts on more suspicious records
  - Developed a methodology for consistency check, which can provide non-experts with expert-like knowledge

- **Future Research:**
  - Develop more sophisticated ranking techniques and compare their performance

Thank You!