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Substantial doubt and the entropy of auditors' going concern modifications [☆]

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ABSTRACT

Auditors need to establish a substantial doubt threshold in order to determine the type of audit report to issue, but substantial doubt is not defined in the auditing standards. Auditors are regularly criticized for having high thresholds, which results in too few going concern reports. We apply Shannon entropy from information theory as the criterion to evaluate the informational value of the audit report. Shannon entropy provides a measure of the expected information content associated with the realization of an uncertain event. First, we estimate the client's probability of bankruptcy in our sample. Second, using the distribution of the probability of bankruptcy we calculate the entropy at each point of the probability of bankruptcy. We find that entropy is maximized at the 0.08 probability of bankruptcy.

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1. Introduction

It is in the public interest to have audit opinions that are informative with regard to whether a firm is a going concern or not. The issuance of a going concern modification represents the judgment of the auditor in terms of evaluating and deciding what substantial doubt means, as well as at what threshold the evidence becomes sufficient to warrant the inclusion of a going concern modification (Levitan and Knoblett, 1985). The information content of going concern reports, however, is not independent of the technical judgments made by auditors regarding what constitutes a substantial doubt threshold. Determining when there is “substantial doubt” concerning an entity's ability to continue as a going concern is one of the key steps for an auditor (Davis and Ashton, 2002). Our goal is to identify the optimal threshold (cut-off score) for substantial doubt by applying Shannon entropy to a distribution of bankruptcy probabilities so as to derive a point that maximizes the average information content from the partitioning of clean opinions and going concern modifications.

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The information content of audit reports has frequently been criticized and it remains an important public policy concern. Recently, the [European Commission \(2014\)](#) amended the Directive on Audits (Directive 2014/56/EU) in order to increase the value of audit reports to external users. In the USA, the Public Company Accounting Oversight Board's (PCAOB) Investor Advisory Group suggested that the auditing standard for going concern considerations should be revised, since auditors have perceptibly failed to provide early warning signals in relation to some of the largest US bankruptcies ([PCAOB, 2012a](#)).¹ One of the main concerns highlighted by the Investor Advisory Group was the “high hurdle” for going concern opinions ([PCAOB, 2012a](#)) as interpreted by auditors with regard to the term “substantial doubt” (AU section 341).

We argue that the cut-off value for substantial doubt should be directly linked to the information conveyed by auditors' going concern modifications. By definition, information is the reduction of uncertainty. That is, in order to have information, two components are needed: an uncertainty that matters (e.g., the uncertainty as to whether a company is financially distressed); and something that resolves the uncertainty (e.g., a communication from the auditor regarding a going concern uncertainty). Specifying an appropriate substantial doubt threshold for auditors to decide whether or not to issue going concern modifications, affects how auditors will assign the population of firms into those issued a standard opinion (which is indicative of less financially distressed firms), and those issued a going concern modification (which is indicative of more financially distressed firms).

To identify this appropriate substantial doubt threshold, we utilize Shannon entropy from information theory to estimate the average information content of the audit report at various hypothetical substantial doubt thresholds. Shannon entropy is an important metric in information theory, since it measures the uncertainty associated with an event and, therefore, also the expected information content associated with the realization of that event. It is predicated on the idea that the more *ex ante* uncertainty concerning whether an event will happen or not, the more information is conveyed by the actual realization of that event. As such, Shannon entropy defines information as the reduction in uncertainty on behalf of users of that information. We apply Shannon entropy to the auditors' binary reporting decision on the entity's ability to continue as a going concern, noting that the substantial doubt threshold that auditors use directly affects users' *ex ante* uncertainty regarding whether a going concern modification will be issued or not, as well as the average information content associated with the realization of the type of audit report.

We compile a sample of 31,332 firm-year observations covering the period 2003–2015, and we estimate the *ex ante* probability of bankruptcy for these firms. We use the estimated distribution of the firms' probability of bankruptcy and apply Shannon entropy. We find that the average information content of the auditor's going concern opinion is maximized at a substantial doubt threshold of a 0.08 probability of bankruptcy. That is, if the average information content of audit reports is to be maximized, a warning from the auditor is warranted when there is approximately a one-in-twelve chance or higher that the client might go bankrupt.

We also perform additional analyses of the optimal substantial doubt threshold with respect to minimizing misclassification rates and the expected economic costs of misclassification when the costs between the types of misclassifications are not equal. Under these different criteria, the optimal substantial doubt threshold is different from that identified when trying to maximize the average information content of the audit report. If the substantial doubt threshold is at a 0.5 probability of bankruptcy, then the total number of misclassifications is minimized. In particular, at this hypothetical substantial doubt threshold, we estimate that only 13 percent will be misclassified, which of course means that about 87 percent will be correctly classified. However, if the cost of “incorrectly” issuing a standard opinion to a firm that subsequently goes bankrupt is, in relative terms, ten times higher than the cost of “incorrectly” issuing a going concern modification to a firm that subsequently survives, then we estimate that the optimal substantial doubt threshold minimizes the expected economic costs at a bankruptcy probability of 0.1. This is similar to the optimal substantial doubt threshold estimated for maximizing the average information content of an audit report.

The PCAOB is yet to provide a definition of substantial doubt or quantitative guidance on its application, although it has been explicit that “substantial doubt” as it stands in the existing auditing standards is a qualitative evaluation ([PCAOB, 2014, p. 3](#)). It is, however, our belief that a discussion about the meaning of “substantial doubt” is not just a semantic quibble, but is in fact far more important, since it effectively determines the point on the probability of bankruptcy continuum that partitions firms with standard opinions from those with going concern modifications. It is difficult to assess the appropriate substantial doubt threshold without invoking some sort of criteria to evaluate the audit opinion in a going concern setting. Maximizing the average information conveyed by auditors' going concern modifications could potentially be a criterion for determining an appropriate substantial doubt threshold. While we acknowledge that determining the criteria used to evaluate and determine an optimal substantial doubt threshold is ultimately a public policy decision to be made by standard setters and regulators, our study aims to inform the promulgation of public policy regarding auditors' responsibility for conveying firms' going concern issues by illustrating how the appropriate threshold for “substantial doubt” is not a trivial semantic matter, but instead has implications concerning the information expected to be conveyed by the audit opinion, as well as the expected misclassification rates. In addition, we contribute to the debate in this regard by using a well-accepted, theoretically grounded approach derived from information theory and applying it to a distribution of the

¹ According to [Francis \(2011\)](#) and [DeFond and Zhang \(2014\)](#), auditors frequently fail to warn investors (Type II error or false negative) before a client files for bankruptcy, which supports the concerns of the regulators. However, [Francis \(2011\)](#) also finds evidence that “auditors are conservative and over-qualify” (Type I error or false positive) ([Francis, 2011](#)).

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