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ORIGINAL ARTICLE

Information economics approach to the performance evaluation of error-prone internal auditors

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ABSTRACT

Suppose that an internal auditor inspects financial records of a company or government agency, such as social security payments. Human errors are inevitable in any inspection process, and such an auditing procedure is error-prone as well. This implies that the internal auditor may classify correct payments as incorrect (type I error) or may fail to detect some incorrect payments (type II error). In this article, we consider various methods of estimating (i) the internal auditor's two types of errors and (ii) the total number of incorrect records. If we treat each internal auditor as an information structure with imperfect information, we can calculate the value of information via an information economics approach. We use the same approach to measure and compare the performances of multiple internal auditors with different type I and II errors. In a simulation study, we first show that our proposed estimation method performs very well and then demonstrate how to evaluate the performance of several internal auditors from 0 to 100% on the same scale. Our estimation and evaluation method can be applied to any practical situations in which testing devices, inspection methods, or screening procedures are error-prone.

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1. Introduction

Various inspection, screening, and auditing procedures have been widely used as one of the most important and effective tools in assuring product and service quality. For example, complex products such as computer chips are subject to a rigorous testing process to identify any defective items (Greenberg & Stokes, 1995). A team of software engineers tests a package of computer programs for any bugs, errors, or issues (Rallis & Lansdowne, 2001). Airline passengers are required to undergo a screening procedure for weapons and explosives (Zhang, Luh, & Wang, 2011). Accounting documents such as income tax returns are routinely reviewed for any math errors or intentional frauds (Simnett, Carson, & Vanstraelen, 2016).

Human errors are inevitable in any inspection, screening, or auditing processes. This implies that non-defective items may be rejected (type I error) and some defective items may be accepted incorrectly (type II error). To ensure the outgoing quality of products and services at a certain level, we should be able to estimate the two types of inspection errors as well as the average defective rate of incoming items. One method of obtaining more information on the misclassification errors is to inspect the same group of sampled units (i) repeatedly with the same testing device or (ii) independently with a different testing device.

In the "repetitive" inspection plan, the number of defective items detected during each round of the inspection process is used to estimate the inspection errors of a testing device. Various models have been proposed for the repetitive inspection plan by Bonett and Woodward (1994), Greenberg and Stokes (1995), Rallis and Lansdowne (2001), Maleyeff, Kaminsky, and Farris (2003), Quinino and Ho (2004), Ding and Gong (2008), Duffuaa and Khan (2002, 2008), Chun (2008, 2009, 2016), and Gong (2012). In the article, we focus on the "two-stage" inspection plan in which we use a different testing device at each stage and use the inspection results to estimate the unknown parameters.

As a motivating example of the two-stage audit process, consider the payment of social security checks (Raats & Moors, 2003). Suppose that an internal auditor took a random sample of $N = 500$ payments and reviewed them for accounting errors. Among the 500 payments, the internal auditor reported that $x = 16$ payments failed the audit. Of course, the internal auditor's classification of the 500 payments as "pass" or "fail" is not perfect due to the lack of proper training, complexity of financial regulations, and so on.

To evaluate the efficiency of the internal auditor, a supervisor took a random sample of $n = 53$ payments from the same 500 payments and re-examined the payments independently. From the sample

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