KOEN DERKS

STATISTICAL AUDITING WITH JASP

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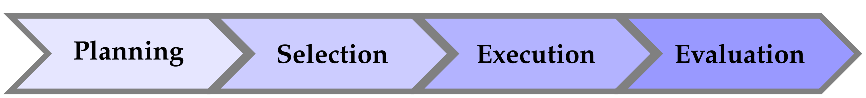
Introduction

Statistical theory lies at the core of many auditing guidelines and procedures. Consequently, an auditor needs easy-to-use software that implements the required statistical analyses as well as sufficient knowledge to interpret the results of these analyses. JASP is an open-source, free-of-charge, cross-platform statistical software program that facilitates auditing through JASP for Audit (JfA), a downloadable add-on module that is built to support the statistical aspects of an audit.

A Fresh Way to Do Statistics

Figure 1: JASP is a free cross-platform statistical software program with a state-of-the-art graphical user interface. JASP can be downloaded at www.jasp-stats.org.

With JfA you, as the auditor, are able to plan, perform and interpret a substantive testing procedure using the correct statistical methods and without making any programming errors. The module is designed with the auditor in mind. This means that the interface is user-friendly and directly relates to audit processes and International Standards on Auditing. In order to create the most efficient experience for auditors, JfA separates the procedure into four stages: *planning, selection, execution* and *evaluation*. In JfA's main feature, the audit workflow, you are guided through these four stages in terms of statistical choices and interpretation of results.



Next to the standard frequentist methods that currently dominate audit practice, JfA incorporates Bayesian counterparts of these methods that can improve the quality and efficiency of your audit. These Bayesian methods allow you to utilize the advantages of knowledge updating by accurately incorporating prior information.

In short, JfA performs all the required statistical heavy lifting and enables you to plan, evaluate and interpret your statistical analysis in terms of auditing standards and using state-of-the-art classical and Bayesian techniques. This manual has been adjusted from its original source for instructional purposes. For the original paper on JASP for Audit, see www.notyetavailable.com.

Figure 2: JASP for Audit (JfA) is a freely downloadable add-on module for JASP. It can be downloaded at www.notyetavailable.com.

Statistical Auditing Using the Audit Risk Model

Considering the size of audit populations, it would be enormously expensive to make an audit assertion with absolute certainty. Since the auditor cannot evaluate the total population of financial statements, but wants to make a population statement with a certain amount of confidence, statistical inference is a prerequisite. Recognizing this, the auditor defines a probability that he or she will provide an incorrect opinion on the population of financial statements, the **audit risk**. To correctly quantify the audit risk in terms of probability, the International Standards on Auditing consider the Audit Risk Model, which provides a mathematical association between the specified audit risk and the assessed risks of material misstatement.

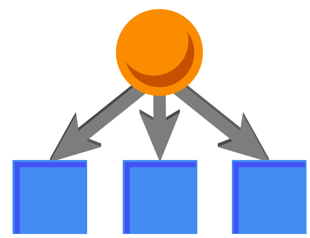


Figure 3: The Audit Risk Model partitions audit risk into inherent risk, control risk, and detection risk.

According to the Audit Risk Model, the audit risk as a whole can be divided into three constituents; inherent risk, control risk, and detection risk. **Inherent risk** is the risk posed by an error in a financial statement due to a factor other than a failure of internal controls. **Control risk** is defined as the probability that a material misstatement is not prevented or detected by the internal control systems of the company (e.g., computer managed databases). Both these risks and are commonly assessed by the auditor on a 3-point scale consisting of the categories low, medium, and high. JfA numerically translates these categories to probabilities of respectively 50%, 60% and 100% according to the Dutch IODAD standard [1]. **Detection risk** is the probability that an auditor will fail to find material misstatements that exist in an organization's financial statements. For a given level of audit risk, the tolerable level of detection risk bears an inverse relationship to the other two assessed risks. Intuitively, a greater risk of material misstatement should require a lower tolerable detection risk and, accordingly, requires more persuasive audit evidence [2].

[1] IODAD (2007). *Handboek Auditing Rijksoverheid 2007, vastgesteld door het Interdepartementaal Overlegorgaan Departementale Accountantsdiensten (IODAD) op 28 maart 2006 en 29 mei 2007.*

[2] IFAC (2018). International standard on auditing 200: Overall objectives of the independent auditor and the conduct of an audit in accordance with international standards on auditing

Figure 4: For a given level of audit risk, the tolerable level of detection risk bears an inverse relationship to the other two assessed risks.

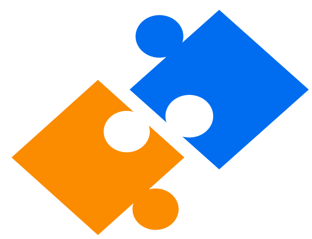
The Audit Risk Model is practically useful, as it provides a statistical framework to increase or decrease the amount of audit evidence required from the auditor. For example, having found that the control risk of an organization is medium (60%) the auditor can increase the detection risk from 5% to 8.33%. When both inherent— and control risk are set to high (100%), the detection risk is not adjusted and equals the audit risk. For a conservative analysis, the auditor can therefore ignore the ARM in its totality.

Using the Audit Risk Model the auditor determines the required detection risk to maintain a specified audit risk, given the assessments of the inherent and control risk. The detection risk must be statistically substantiated by the auditor. Therefore, the auditor must audit a subset of the organization's statements large enough that, when a certain number of expected errors are found, the auditor can conclude with the specified statistical certainty that he or she did not fail to find material misstatements in the total population.

The statistical process underlying this population statement is formalized through the **audit workflow**, an experimental design that allows the auditor to do statistical inference. JfA aims to follow this design as closely as possible.

The Audit Workflow

JfA breaks down the audit process into a four-stage workflow in which you as an auditor can plan the size of your required subset, select the required observations, perform your audit and make a statement about whether or not your population of interest contains material misstatement. The four stages in the audit workflow are *planning*, *selection*, *execution* and *evaluation*.



Stage 1: Planning

Substantive testing starts with the planning stage. Here, you use the available knowledge that is gathered during earlier portions of the audit to determine the appropriate sample size for supporting the assertion that the misstatement in the population is lower than your materiality. This knowledge can consist of information about the organization's field of operations *(inherent risk)* and quality of the organization's internal control mechanisms *(control risk)*, which can be used to adjust the amount of evidence that is needed to approve the financial statements. Furthermore, you often have an expectation of the amount of errors in the population. These expectations can be shaped through the outcomes of last years' audit, or other sources of information. All these factors affect how many observations you need to audit to retain the required statistical confidence in your population statement. JfA automatically performs the required calculations based on your available knowledge.

Stage 2: Selection

You use the calculated sample size from the planning stage as an input for the selection stage where you perform statistical selection. In statistical selection all possible sampling units receive an inclusion probability. Units are then selected from the population with a probability equal to the inclusion probability until the required sample size has been reached. The nature of the sampling units is dependent on the sampling type. The most commonly used sampling method for substantive tests is monetary unit sampling. In monetary unit sampling, probabilities are assigned on the level of individual monetary units. For example, a monetary unit sampling procedure may consider each individual dollar in the population as a sampling unit. In monetary unit sampling, when a monetary unit is selected for the subset, the observation that corresponds to that unique monetary unit is selected. As such, a transaction of $5,000 is five times more likely to be selected than a transaction of $1,000. In record sampling, probabilities are assigned on the observation level, resulting in equal inclusion probabilities for all observations. JfA automatically selects the correct sampling method based on your inputs in the planning stage.

Stage 3: Execution

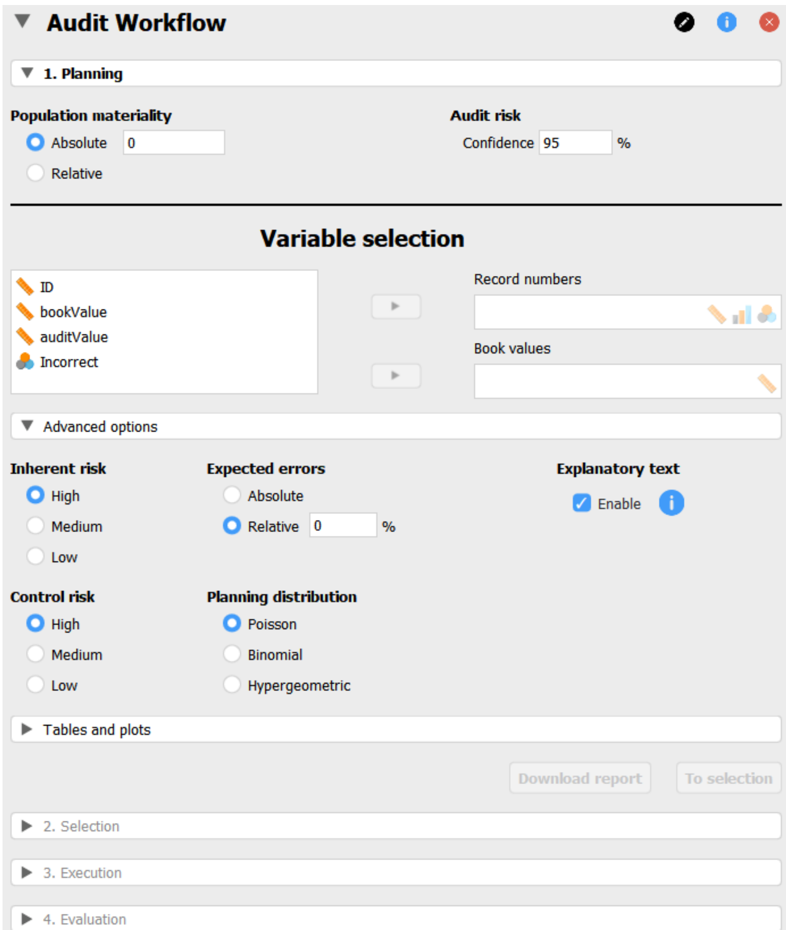
In this stage you will assess the fairness of the selected observations by looking at their degree of correctness. You can choose to do this in one of two ways. The most straightforward method considers the observations to be correct or incorrect. This method does not consider the fact that observations can be partially over- or understated, and therefore results in a more conservative estimate of the total error. A more common method considers the true market value (audit value) of the observations. In this method, information about the size of the error proportional to the size of the transaction is retained. Annotating the selection with the latter technique has preference over the former, as estimation of the total error with audit values is more accurate and less conservative. If you wish to make a statement on the amount of misstatement, it is common practice to annotate the subset with their audit values. If you do not have access to book values, the preferred annotation method is the correct/incorrect method. You exit this stage with an annotated subset of the population. The choice of evaluation mechanism, sampling type, and sampling method, are leading in your choice of a statistical evaluation mechanism for inferring misstatement in the population. JfA automatically selects the correct evaluation method based on your choices.

Stage 4: Evaluation

The evaluation stage is the final stage of the audit workflow. Here you use the annotated subset from the execution stage to make a statistical inference about the total misstatement in your population. To this aim you use statistical techniques to calculate a projected maximum error and approve the population when this maximum error is below your limit of materiality.

The Audit Workflow in JASP

The audit workflow can be found in JASP by clicking the JfA module icon and selecting **Audit workflow**. JfA's audit workflow aims to stay true to the audit workflow as discussed previously as much as possible. The graphical user interface is interactive and reflects both JASP's and JfA's philosophies, as most statistical components are hidden from the auditor under "Advanced options" and information is disclosed progressively by moving through the workflow.

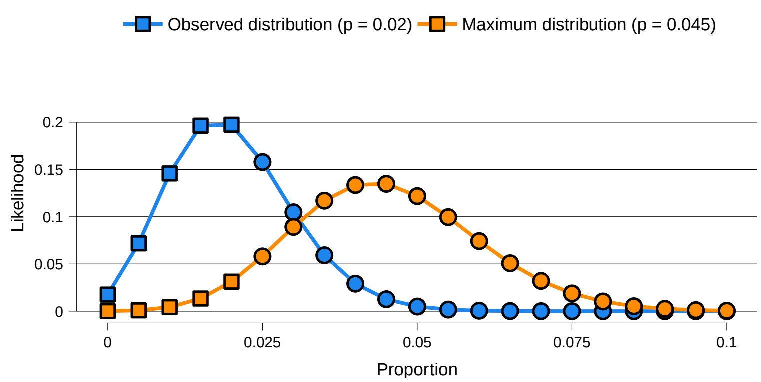


In these interactive layouts, the auditor can select the corresponding data and options to plan their audit. Upon completion of a stage, the auditor can request a report of the output by clicking the "Download report" button. Every stage can produce output in the form of tables and figures that clarify the statistical results. The *selection*, *execution*, and *evaluation* stages have a similar layout as the planning stage to keep the auditor focused on their matter of expertise.

Frequentist Auditing

The frequentist approach to auditing models the misstatement in an audit population using a probability distribution with a fixed parameter, the materiality. The presumption is that this parameter is true and that all observed data is sampled from the corresponding distribution. Consequently, your estimate of the maximum misstatement is solely based on the likelihood of that distribution.

To clearly explain the frequentist approach to auditing, consider the case where you have to audit a population of documents and judge them as either correct or incorrect. You have observed 200 documents and found that 4 of them contained an error. The likelihood of the data is the sum of the likelihood of the blue squares. A frequentist approach to inferring the maximum error would construct an exact confidence bound by finding the lowest proportion that corresponds to a binomial distribution where the sum of the likelihood of the observed errors is lower than the confidence level.

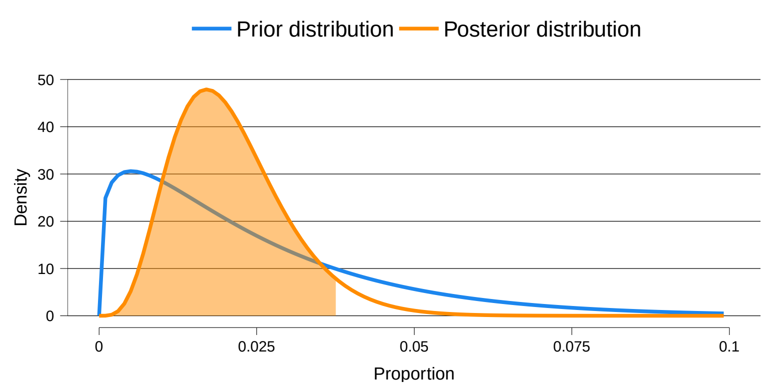


Since inferences with confidence bounds are solely based on the assumed distribution of the sample statistic, frequentist statistics does not consider the maximum misstatement to be a random quantity. Hence, a frequentist population statement is one of long-term frequency, not of probability.

Bayesian Auditing

The Bayesian approach models the prior uncertainty about the misstatement in an audit population by a probability distribution over possible its possible values. Using the available information in the data, this prior distribution is transformed by into a posterior distribution by means of Bayes theorem. Consequently, your estimate of the maximum error is based on the prior distribution and the likelihood of the data.

To clearly explain the Bayesian approach to auditing, consider the case where you have to audit a population of documents and judge them as either correct or incorrect. Prior to your investigation, you have specified a prior probability distribution quantifying your prior knowledge about the misstatement in the population. You have observed 200 documents and found that 4 of them contained an error. Your prior distribution is updated by the likelihood of the data to a posterior distribution. A Bayesian approach to inferring the maximum error would construct an exact credible bound by finding the proportion that corresponds to the area under the posterior distribution quantifying the confidence level.



Since inferences with credible bounds are based on the posterior probability distribution on the misstatement, Bayesian statistics considers the maximum misstatement to be a random quantity. Hence, a Bayesian population statement is one of probability.

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