



RESEARCH VALORIZATION THROUGH OPEN-SOURCE SOFTWARE

GENERAL INFORMATION

Title of the Impact Case: Research Valorization through Open-Source Software. Contributor(s) to the Impact Case: Koen Derks, Lotte Mensink, Federica Picogna, Jacques de Swart, Ruud Wetzels. Period when the underpinning research was undertaken: 2018 - present. Period when the Impact occurred: 2018 - present.

EXECUTIVE SUMMARY OF THE IMPACT B

The researchers from the Statistical Auditing Group at Nyenrode Business Universiteit drive innovation by creating opensource tools tailored to audit practitioners. Their work is built on two foundational pillars. The first is the development of cutting-edge statistical methods that transform how auditors analyze and interact with data. The second is the integration of these innovative methods into the open-source software JASP via its Audit module, known as JASP for Audit. Since 2018, the group has published numerous articles in leading Dutch and international journals, focusing on Bayesian statistics. By embedding these previously hard-to-implement methods into JASP for Audit, they have made the practical benefits of these techniques easily accessible to auditors worldwide. This effort led to widespread adoption across the audit profession, with the R package underlying JASP for Audit downloaded approximately 35,000 times (averaging 700 downloads per month). Additionally, the Audit module has been embraced by organizations such as (Dutch) accounting firms and government agencies. The group's work constitutes a paradigm shift, fostering greater transparency and reliability by reducing reliance on expensive proprietary software such as ACL and IDEA, or errorprone spreadsheet tools like Excel. With JASP for Audit, organizations can now conduct the statistical aspects of an audit in a free and open-source environment, paving the way for a more accessible and transparent future in auditing practices.

DISCUSSION OF THE IMPACT

Auditing is a cornerstone of organizational accountability, yet its traditional tools often lag behind the potential of modern techniques. For years, auditors have relied heavily on proprietary software such as IDEA and ACL, as well as spreadsheet tools like Excel, which, despite their ubiquity, have limitations in transparency or reliability. Against this backdrop, researchers from the Statistical Auditing Group at Nyenrode Business Universiteit (www. statistical auditing.com) have spearheaded a transformative initiative to redefine how auditors interact with data. Their work focuses on integrating advanced statistical methods into JASP (www.jasp-stats.org), an open-source software platform. Since 2018, Koen Derks, Jacques de Swart, and Ruud Wetzels have led this initiative by building an Audit module within JASP, aptly named JASP for Audit. In 2023, the team expanded to include Lotte Mensink and Federica Picogna, who are now incorporating their PhD research into the platform. Together, the group has not only made advanced statistical techniques accessible but has also fostered a culture of openness, transparency, and collaboration within the audit profession. This Impact Case delves into the journey of JASP for Audit, highlighting its foundations in research, the innovation it represents, and the lasting impact it has made on the audit profession.

The Statistical Auditing Group began its mission to modernize auditing practices in 2018. The group recognized the need for tools that not only make advanced statistical methods accessible but also address longstanding inefficiencies in the auditing profession. To achieve this, they drew on their expertise in Bayesian statistics, a probabilistic framework that provides nuanced insights into uncertainty and decision-making. Their research is published in leading international and Dutch journals, building a robust theoretical foundation for applying Bayesian methods in audit practice. These research articles focus on the application of Bayesian statistics during an audit, underscoring its potential to improve audit transparency and efficiency (Derks et al., 2021; Derks et al., 2022a; Derks et al., 2022b; Derks et al., 2024; Derks et al., 2024; Derks et al., 2024). While this research is transformative on paper, the true impact emerged when the group decided to make Bayesian methods for auditing universally accessible through open-source software.

In close collaboration with the developers of JASP and the steering group statistical auditing of the Limperg Institute, the group built JASP for Audit from the ground up (Derks et al., 2021; Derks et al., 2023). Based on the R programming language, the module integrates the previously hard-to-implement Bayesian techniques into a userfriendly platform where no coding knowledge is required of the auditor. While these Bayesian analyses enhance audit transparency and efficiency, JASP for Audit also incorporates traditional frequentist methods that auditors are more familiar with. The software has gained significant traction. For instance, the underlying R package 'jfa' (Derks, 2024a), which powers JASP for Audit, has been downloaded approximately 35,000 times, averaging 700 downloads per month (Source #1). This statistic alone underscores the widespread adoption of JASP for Audit and recognition of its value. In this Impact Case we focus on two important features of JASP for Audit that redefined how audit practitioners interact with data.

First, the open-source nature of JASP ensures that it is accessible to organizations and educational institutions of all sizes, not just those with the budgets for expensive licenses of proprietary tools. As a result, JASP for Audit has already been embraced by a diverse array of stakeholders, including (Dutch) accounting firms (Source #2 and Source #3) and Dutch government agencies. The platform has also influenced regulatory bodies (Source #4), prompting discussions on adopting open-source software as a standard for audit practice. Furthermore, JASP for Audit's open-source nature enables quick integration of the latest scientific developments (Mensink et al., 2024; Picogna et al., 2025) and practitioner recommendations. By integrating these practitioner recommendations into subsequent updates (Source #5), JASP for Audit can evolve in line with the needs of the audit profession. In sum, the development of JASP for Audit resulted in a significant departure from traditional reliance on proprietary software and its challenges.

Second, JASP for Audit has a user-friendly interface that is familiar to auditors and supportive of their professional growth. It automatically selects the appropriate statistical methods and generates an audit report with the correct statistical interpretation of the results. The audit report also explains the statistical choices made in the language of the auditor, so that they can understand the theory behind the calculations. This feature has proven to be tremendously useful in training and educating auditors and accounting students. For instance, JASP for Audit is used in the course Data Science in Auditing of the Practical Education Track Assurance at Nyenrode, where it has been positively received by students (Source #6). With the Audit module, students in this course can not only learn the theoretical principles behind statistical auditing techniques but also gain hands-on experience, enabling them to independently verify the calculations performed by their firm's sampling experts. Finally, due to its clear and interpretable output, JASP for Audit is also featured in an academic textbook on auditing and quality control (Source #7). In summary, the software facilitates audit practitioners in improving their knowledge of statistical theory and its practical application.

The group's consistent output, both in academic journals and through open-source contributions, has fueled sustaining momentum of JASP for Audit over several years. Media coverage and public outreach have further amplified this momentum. Through appearances in webinars (Source #8), conferences (Source #9), social media (Source #10) and posts on the Dutch website accountant.nl (Derks, 2024b; Derks, 2024c; Derks & Mensink, 2024; Van Leeuwen & Derks, 2023) and the JASP website (Derks, 2019; Derks, 2021), the group has engaged with a broad audience. These outlets provided direct channels for sharing insights and gathering feedback from practitioners worldwide. Because of this, the Audit module has cultivated a thriving community of users, whose input helps refine and enhance the tool. This collaborative ecosystem is instrumental in establishing JASP for Audit as a mainstream resource for auditors.

The impact of JASP for Audit is a testament to the transformative power of innovation grounded in research. By bridging the gap between advanced statistical methods and practical application, the Statistical Auditing Group at Nyenrode Business Universiteit is reshaping the auditing profession. Their work not only equips practitioners with better tools but also promotes a culture of openness, transparency, and collaboration. As JASP for Audit continues to evolve, it holds the potential to drive further advancements in the auditing profession and beyond.

REFERENCES GENERATED AS A RESULT OF THE RESEARCH

Academic articles

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Machine learning in de audit: voorspellen van klantverloop. accountant.nl.

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https://jasp-stats.org/2021/11/30/benfords-law-jasp

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Software

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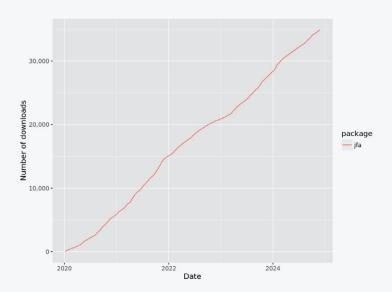
Website

jfa R package website: https://koenderks.github.io/jfa

B SOURCES TO CORROBORATE THE IMPACT

Source #1 Total and monthly downloads of the 'jfa' R package

Total downloads: 35,000



https://ipub.com/dev-corner/apps/r-package-downloads/



Monthly downloads: 695, see https://www.rdocumentation.org/packages/jfa

Source #2 Job listing Senior Manager Audit and Assurance mentioning JASP for Audit

"Als Senior Manager Audit en Assurance ga je met jouw team naar onze klanten toe om controleopdrachten aan te sturen, begeleiden en hen te adviseren over interne beheersing. Daarbij maak je gebruik van geavanceerde IT-tools (zoals PowerBI, JASP en Datasnipper) en de mogelijkheden van data-analyse, ondersteund door ons eigen team Data."

https://werkenbijvisser-visser.nl/vacatures/527/senior-manager-audit

Source #3 JASP for Audit being used in Audit Quality Kick-off at Visser & Visser

"Daarnaast heeft Robert van Beveren de junioren meegenomen in de wondere wereld van de statistiek, en wel toegespitst op het fenomeen steekproef en hoe men hierbij het programma Jeffrey's Amazing Statistics Program, of kortweg JASP, kan gebruiken."

https://www.visser-visser.nl/blogs/audit-quality-kick-off-2021-fraude-corruptie-en-expeditie-robinson

Source #4 JASP for Audit being mentioned in the response to consultation request to the Committee on the **Future of Accountancy**

"Het combineren van deductief met inductief onderzoek is veelbelovend, maar het is alleen mogelijk bij gebruik van software die beide faciliteert. Met de opkomst van generieke open-source programmeertalen zoals R of Python is begint dit steeds meer vorm te krijgen, maar dan vooral voor de technisch goed onderlegde accountant. Voor accountants die minder statistisch onderlegt zijn is er op maat gemaakte open-source software voor accountants zoals JASP via de audit module JASP voor Audit." https://www.internetconsultatie.nl/commissietoekomstaccountancysector/reactie/112179/bestand

Source #5 List of resolved issues for JASP for Audit

- https://github.com/jasp-stats/jasp-issues/issues/815
- https://github.com/jasp-stats/jasp-issues/issues/934
- https://github.com/jasp-stats/jasp-issues/issues/1588

Source #6 JASP for Audit is used in teaching Data Science in Auditing at Nyenrode

JASP is used in teaching Data Science in Auditing in the Practical Education Track Assurance at Nyenrode Business Universiteit. The following quote illustrates a student's positive perspective on using JASP for Audit during an audit. https://www.nyenrode.nl/opleidingen/p/data-science-in-auditing

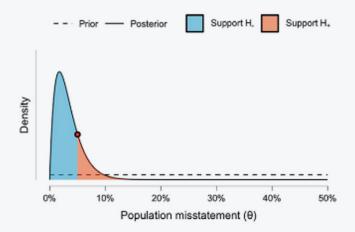
"JASP, de vernieuwende opensource analytics tool, biedt mogelijkheden om steekproeven in auditpraktijken te vereenvoudigen en uit te breiden."



Source #7 JASP for Audit being used in an academic textbook

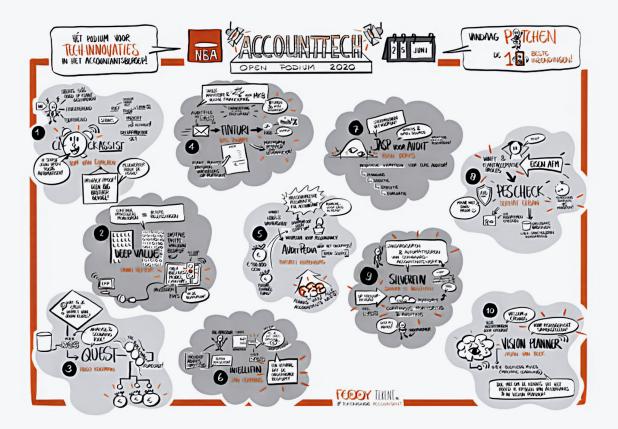
Figure extracted from JASP for Audit.

Figure 3. Beta distribution of population misstatement



Strang, K. D. (2022).

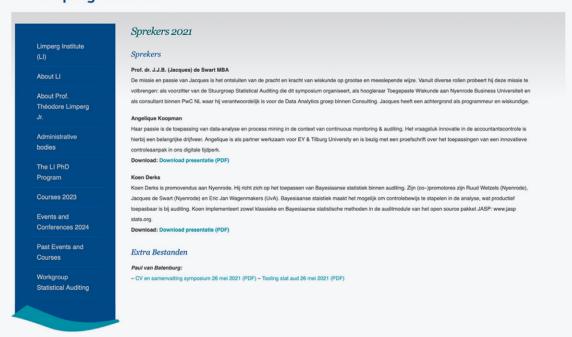
Petroleum industry contingency planning using auditing theories and inferential statistics. In Global Risk and Contingency Management Research in Times of Crisis (pp. 15-28). IGI Global.



Source #8 JASP for Audit was present at the NBA Open Podium 2020 on Tech Innovations

https://www.youtube.com/watch?v=5vBQzzzidKw&t=4548s

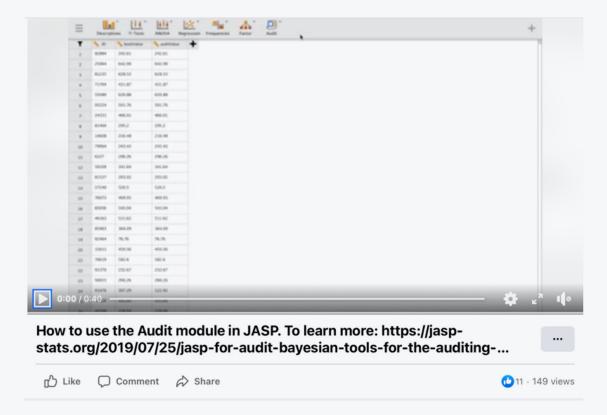
Limperg Instituut



Source #9 Presentation on the Limperg Statistical Auditing Conference 2021 about JASP for Audit

https://www.limperginstituut.nl/events-and-conferences-2021/sprekers-2021/

Source #10 Facebook post about JASP for Audit with 11 likes and 149 views



https://www.facebook.com/JASPS tats/videos/how-to-use-the-audit-module-in-jasp-to-learn-more-httpsjasp-statsorg20190725jasp/240609604201316/