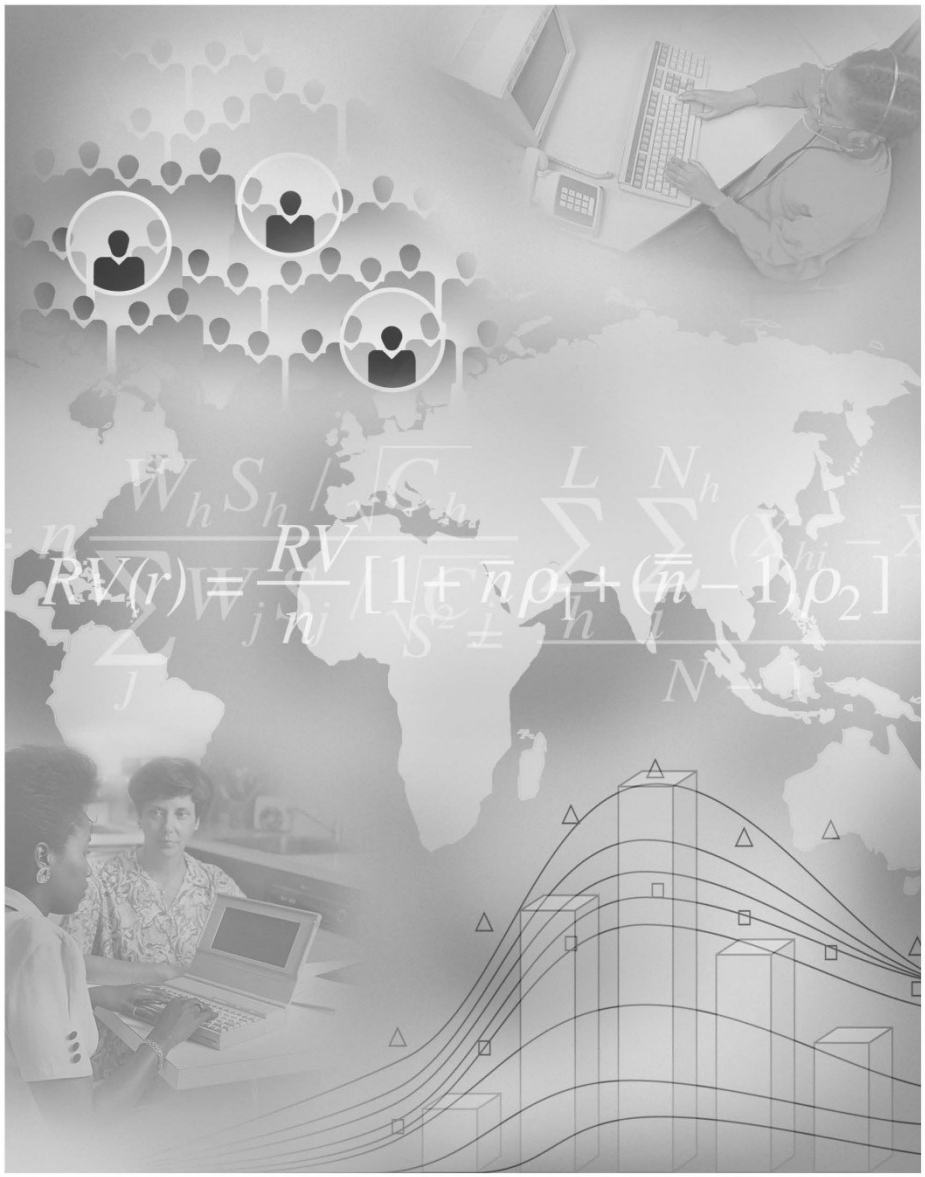
the Survey Statistician

The Newsletter of the International Association of Survey Statisticians

No. 79 **January 2019**



INTERNATIONAL ASSOCIATION OF SURVEY STATISTICIANS

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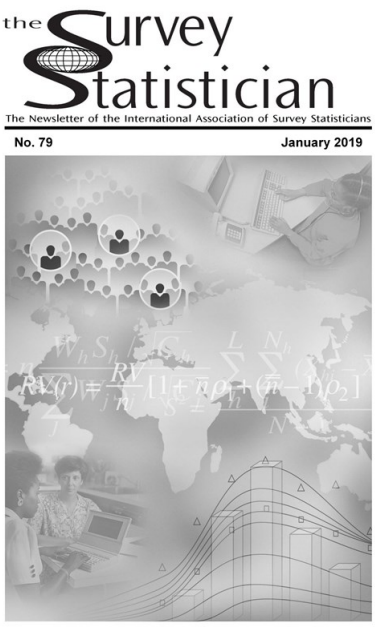

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In this Issue:

Letter from the Editors

The current issue of *The Survey Statistician* (TSS) will reach you after complete start of the New Year 2019. We wish the readers success in your work and life in this New Year.

The current issue of TSS summarizes the main projects in survey statistics implemented in 2018 and presents also 2018 year evaluation of the achievements attained earlier. Knowledge of all statistical community is enriched by these brilliant gains.

The issue starts with the **Letter from the President** where he highlights the 2018 accomplishments of the IASS stressing the impact it has had through the sponsoring of conferences. Related to such events that can take place in developing countries, he then encourages people to get involved in technical assistance. He concludes with the announcement of who will deliver the President's invited lecture at the World Statistics Congress in Kuala Lumpur this coming August.

Report from the Scientific Secretary Risto Lehtonen presents the current situation on the ongoing organizational work for the 62th World Statistical Congress (WSC) in Kuala Lumpur, Malaysia, on August 18-23, 2019. This is one of the largest meetings of the world statistical community, concentrating on the presentation of knowledge in many fields, and you still are able to submit your proposal for the contributed presentation before February 31, 2019, if you have not done it yet. WSC gives the participants a possibility for acquaintance, communication, fruitful discussions, exchange of knowledge. The meeting is usually glamorized with the cultural centrepieces of the hosting country.

The rest of the Report from the Scientific Secretary presents the conferences supported by IASS in 2018 and future events supported by IASS in 2019. Please submit your contributions and take part at these events! Competition for the Cochran-Hansen prize of IASS stimulates young statisticians to demonstrate their results and prepare themselves for the future career of the statisticians. Scientific Secretary invites to submit a paper before February 15, 2019.

News and Announcements section includes formal information about the 62th WSC and contact information needed for participation at the event.

It is a big pleasure to present information about the Second Congress of Polish Statisticians held in Warsaw. Five statisticians were granted with the Jerzy Spława-Neyman medal, and the section paper presents congratulations to the laureates.

The year 2018 saw the first *BigSurv* conference (*BigSurv 2018*). Thanks to Antje Kirchner, one of the organizers, TSS presents a brief summary of the event which was a success. This conference brought together experts from multiple disciplines with an agenda focused on how to combine different approaches on topics such as collection, processing and analysis of data. Experts where from the survey, social sciences, information technology and other backgrounds. Many of the presentations will be featured in an up-coming book and there are already some plans to hold a second event in 2020.

In the **Ask the Experts** section, Frauke Kreuter considers alternative data sources and how to use them. This is a very topical issue as nonresponse rates and survey costs are going up in a world of ever-increasing data demands coupled with the fact that immense amounts of data are now becoming available to statisticians.

Small area estimation is one of the most popular topics in survey statistics of the 21st century. **New and Emerging Methods** section presents a paper by Risto Lehtonen and Ari Veijanen where they

present an overview of the calibration methodology in small area estimation and present their own simulation results for methods comparison.

The Book & Software Review section includes reviews of two books. The first one is prepared by Sahar Z. Zangeneh for a book *Statistical Analysis with Missing Data* by Roderick J. A. Little and Donald B. Rubin. It is pleasant to memorize that the authors received the Karl Pearson Prize at the 61st WSC by ISI in Morocco. Despite firstly published in 1987, the methods described in the book attained many attacks of criticism, they still are important and useful nowadays.

Review of the new book *Survey Weights: A Step-by-step Guide to Calculation* by Richard Valliant and Jill A. Dever published in 2017 is written by Andrés Gutiérrez. This book is devoted to the basics of survey sampling enriched with complex methods for non-response adjustment, traditional calibration and various variance estimation methods including bootstrap. The exceptional feature of the book is that practical examples are presented using Stata software code.

The **Country Reports** section (edited by Peter Wright) has always been a central feature of *The Survey Statistician*. This issue includes reports on the activities in survey statistics in seven countries and we thank all country representatives for their contribution.

Due to the rotation in the editorial board we have a new designer for *The Survey Statistician* newsletter, and we will transfer responsibility for editing the *Ask the Experts* section. We kindly thank Lori Young of Statistics Canada for her creative work when making the design for the newsletter during last several years and Kennon Copeland of the University of Chicago for being editor of the contents of the *Ask the Experts* section. We wish them success in their other duties.

We thank Mārtiņš Liberts from the Central Statistical Bureau of Latvia for preparing the tables of contents in the *In Other Journals* section. We also thank Mārtiņš for preparation of the design for *The Survey Statistician* as it is now.

As always, we want to address everyone working hard to put *The Survey Statistician* together and in particular Margaret A. de Ruiter-Molloy of the Statistics Netherlands, Janusz Wywiał of the University of Economics in Katowice, Nicholas Husek at the Australian Bureau of Statistics and Olivier Dupriez from the World Bank for their invaluable assistance.

Please let Risto Lehtonen (risto.lehtonen@helsinki.fi) know if you want to contribute to the *New and Emerging Methods* section in the future. If you have any questions which you would like to be answered by an expert, please send them to Eric Rancourt of the Statistics Canada (eric.rancourt@canada.ca). If you are interested in writing a book or software review or suggesting a source to be reviewed, please get in touch with Danutė Krapavickaitė of the Vilnius Gediminas Technical University, Lithuania (danute.krapavickaite@vgtu.lt). The country reports should be sent to Peter Wright of Statistics Canada (peter.wright2@canada.ca).

If you have any information about the conferences, events or just the ideas you would like to share with other statisticians – please contact with any member of the editorial board of the newsletter.

The Survey Statistician is available for downloading from the IASS website at http://isi-iass.org/home/services/the-survey-statistician/.

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Letter from the President

The year 2018 seems to have flown by. I have not managed to achieve all the things I would have liked to as President, but the IASS enters 2019 as a healthy organisation. We are able to support a number of workshops and conferences each year and for me it has been a pleasure to be able to liaise with the organisers of these. In 2018 the IASS supported events in China, France, Latvia and UK. We have already agreed to support events in Spain, Italy, Sweden and Nigeria in 2019. I am particularly pleased about the workshop in Nigeria, which will have already taken place by the time you read this newsletter. It is not part of a regular series of workshops, but is instead a training event made possible solely by the existence of the IASS funding. I hope that we will be able to encourage and support more capacity-building events of this kind in developing countries in the future. And I hope that we will be able to include a colourful report of the Nigerian workshop in the next issue of the Survey Statistician.

If you haven't made a New Year's resolution this year, you could do worse than offering your expert services to a worthy cause. Survey statisticians are in great demand from non-profit organisations of various kinds and even just a little advice can be invaluable in setting a project off in the right direction. Both the Royal Statistical Society in the UK and the American Statistical Association run schemes to put volunteering statisticians in touch with needy non-profit organisations. Make a difference in 2019 and earn yourself a whole lot of gratitude! Details of how the schemes work and how you can contribute can be found at the respective websites:

- Statisticians for Society (RSS): (http://www.rss.org.uk/RSS/Get_involved/Statisticians_for_Society.aspx)
- Statistics Without Borders (ASA): (https://community.amstat.org/statisticswithoutborders)

A privilege of being President is that I get to choose who should present the President's invited lecture at the World Statistics Congress. I am delighted to announce that Gero Carletto from the World Bank will present the lecture at the congress in Kuala Lumpur in August. Gero has a wealth of experience in cross-national surveys, notably as manager of the Living Standards Measurement Survey and the Integrated Surveys on Agriculture. At the Center for Development Data (C4D2) in Rome, he is leading a programme to foster methodological innovation and strengthen capacity in household surveys in low- and middle-income countries. His lecture, "A Thing of the Past? Household Surveys in the New Global Data Ecosystem" will make the point that the countries that need good surveys the most are the ones that can least afford them. Gero will focus on a number of methodological and technological innovations to improve the accuracy, timeliness and cost-effectiveness of survey instruments, with a focus on low- and middle-income countries with scarce resources and weak capacity, and will make recommendations for future methodological research to address some of the current trends and to enhance the value of household survey data in the evolving global data ecosystem. Don't miss it!

Peter Lynn, President

Report from the Scientific Secretary

ISI WSC 2019. Starting with the 62th World Statistics Congress of the ISI and its Associations, there are a number of announcements concerning the scientific programme. The Scientific Programme Committee (SPC), chaired by Yves-Laurent Grize, has completed the selection of proposals submitted for Invited Paper Sessions (IPS). The Local Programme Committee, chaired by Datin Rozita Talha, has done the same thing for the Special Topic Session (STS) proposals. Both lists have been released at the ISI WSC 2019 webpage. Thanks to the work of Cynthia Clark as the IASS representative for the SPC and the activity of the other IASS Executive Committee members and IASS members, the scientific programme will contain a fair number of sessions on survey statistics and related areas.

The SPC has made decisions on the Special Invited Paper Sessions (SIPS) proposed by the ISI Associations. I am glad to announce that IASS is organizing two Special Invited Paper Sessions proposed by the IASS Executive Committee. Peter Lynn informs that Gero Carletto of World Bank has agreed to act as invited speaker for IPS167 (IASS President's Invited Session). For IPS182 (IASS Journal and Cochran-Hansen Prize Invited Session), I want to inform that an invited talk will be delivered by Frauke Kreuter (University of Mannheim, University of Maryland, Institute for Employment Research, Germany). The other invited speaker will be the winner of the Cochran-Hansen Prize 2019 competition. Pedro Silva of IBGE, Brazil, has agreed to serve as discussant for the session.

Contributed paper sessions will constitute a major share of the scientific programme of the ISI WSC 2019. It is foreseen that a good number of interesting presentations will be given by IASS members, as in the previous WSC:s.

Denise Silva, the IASS representative in the Short Course Committee, informs that a short course "Imputation methods for the treatment of item nonresponse in surveys" proposed by David Haziza has been approved in the Short Course programme.

The ISI WSC 2019 will take place in 18-23 August 2019 in Kuala Lumpur, Malaysia. Registration has been opened. More information is available at (http://www.isi2019.org/).

The Cochran-Hansen Prize of the IASS is awarded every two years and is given for the best paper on survey research methods submitted by a young statistician for a developing country or transition country. The prize winner of the 2019 competition will be invited to present his or her paper at the ISI WSC 2019. There is still time for paper submission, it is open until 15 February 2019. Anders Holmberg serves as the Chair of the Award Committee. The complete announcement is published at (http://isi-iass.org/home/cochran-hansen-prize).

Report on conferences and workshops supported by IASS in 2018. As in the previous years IASS has provided modest financial support for a number of conferences and workshops in survey statistics. The following events have been supported in 2018.

> The SAE 2018 Conference on Small Area Estimation, A Celebration of Professor Danny Pfeffermann's 75th Birthday, was held in 16-18 June 2018 in Shanghai, China. The keynote speakers were James O. Berger, Malay Ghosh and J.N.K. Rao. The second Award for Outstanding Contribution to Small Area Estimation was given to Danny Pfeffermann. Summaries of the keynote lectures, as well as an interview of Danny Pfeffermann by Lyu Ni and Kai Tan and the dinner speech of Danny Pfeffermann, were published in *Statistical Theory and Related Fields*, Volume 2, Issue 2, 2018. The conference was hosted by the East China Normal University (ECNU).

MoLS2 – Second International Conference on the Methodology of Longitudinal Surveys was organized in 25–27 July 2018 in Essex, UK. Four pre-conference workshops were arranged. The conference highlighted broadly the methodology of longitudinal surveys and the advances made in the last 12 years. A Wiley book entitled Advances in Longitudinal Survey Methodology, edited by Peter Lynn, will be published containing monograph papers presented at the conference. The event was hosted by the Institute for Social and Economic Research (ISER) at the University of Essex. Interested readers can find the scientific programme and links to abstracts of presentations at the conference website: (https://www.understandingsociety.ac.uk/mols2).

The Baltic-Nordic-Ukrainian Network on Survey Statistics, together with partner organizations, arranged its annual Workshop on Survey Statistics Theory and Methodology in 21–24 August 2018 in Jelgava, Latvia. The main theme of the workshop was "Population census based on administrative data". Keynote speakers were Li-Chun Zhang and Anders Holmberg. In addition, talks of seven additional invited speakers and 28 contributed papers were presented. The winner of the first Best Student Paper Award was Diana Sokurova (University of Tartu, Estonia) with a paper "The local pivotal method and its application on StatVillage data". Congratulations! The workshop was hosted by the Latvia University of Life Sciences and Technologies, Faculty of Economics and Social Development. Workshop programme and abstracts plus slides of the presentations can be accessed at the workshop website: (http://home.lu.lv/~pm90015/workshop2018/).

10ème Colloque francophone sur les sondages took place in 24–26 October 2018 in Lyon, France. In addition to the opening and closing talks, the scientific programme contained a total of 13 invited presentations and several contributed paper sessions. A special plenary session for the presentation of the 2018 Waksberg Award laureate Jean-Claude Deville was arranged. Links to papers of invited speakers and abstracts of contributed papers are given at the conference website (http://sondages2018.sfds.asso.fr/).

The IASS community congratulates warmly Danny Pfeffermann, the Second SAE Award laureate, and Jean-Claude Deville, the Waksberg Award 2018 laureate.

IASS Support to Conferences in 2019. The IASS Executive Committee has published a Call for Requests for Support for Workshops and Conferences for events to take place in 2019. The Executive Committee has decided to support financially the following four events meeting the criteria of the call.

ITACOSM 2019, the 6th ITAlian COnference on Survey Methodology, will take place in 5-7 June 2019 at the Department of Statistics, Computer Science, Applications, of the University of Florence. ITACOSM is a bi-annual international conference promoted by the Survey Sampling Group (S2G) of the Italian Statistical Society (SIS) whose aim is promoting methodological and applied research in survey sampling, in human as well as natural sciences. The conference will include plenary (invited) sessions, specialized (invited) sessions on specific topics, contributed sessions, and poster sessions. More information are available at the SIS website: (http://meetings3.sis-statistica.org/index.php/ITACOSM2019/ITACOSM2019).

BaNoCoSS-2019, The 5th Baltic-Nordic Conference on Survey Statistics, will be held in 16-20 June 2019 in Örebro, Sweden. BaNoCoSS-2019 is a scientific conference presenting developments on theory, methodology and applications of survey statistics in a broad sense. Keynote addresses are on Spatial survey sampling and analysis, and GIS, to be given by Roberto Benedetti and Federica Piersimoni. Deadline for submission of titles and abstracts of contributed papers and posters is 8 April 2019. BaNoCoSS-2019 is organized by the Baltic-Nordic-Ukrainian (BNU) Network on Survey Statistics in collaboration with Örebro University and Statistics Sweden. For more information please follow the website at (https://www.oru.se/hh/banocoss2019).

EESW19, the sixth biennial European Establishment Statistics Workshop, will be held in Bilbao, the Basque Country, Spain, on 24-27 September 2019. EESW9 will be hosted by EUSTAT, the statistical office of the Basque Country. The first day is devoted to short courses, followed by the traditional two-and-a-half day workshop. Under a broad heading of Using modern technology for improving establishment statistics, EESW19 welcomes contributions on all topics related to statistics about and for businesses and other organizational entities. Further information can be found at the conference website: (https://statswiki.unece.org/display/ENBES/EESW19).

In addition, IASS has decided to support financially a regional Survey Process Design Workshop that will be organized as a one-day event in February 2019 at the Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

The Survey Statistician publishes regularly methodological papers on developments in survey statistics. The New and Emerging Methods section is open for such papers. Please contact me if you want to endorse TSS by writing an article to the New and Emerging Methods section.

I complete my report by wishing Happy New Year 2019 for all readers of The Survey Statistician.

Risto Lehtonen (risto.lehtonen@helsinki.fi)

News and Announcements

The Second Congress of Polish Statistics

Along with the Polish Statistical Association, Statistics Poland organised the Second Congress of Polish Statistics, held in Warsaw, 10–12 July 2018, which marked the 100th anniversary of founding Statistics Poland (https://kongres.stat.gov.pl/en/).

The Congress lasted three days. The framework program of the event contained a series of thematic sessions, including a jubilee panel on the history of Polish statistics, as well as sessions devoted to Polish statistics on the international arena, methodology of statistical surveys, mathematical statistics, regional statistics, population statistics, social and economic statistics, statistical data issues and, also sports and tourism statistics.

In a Congress, which emphasised the contribution of Poles to the global treasury of statistical knowledge, representatives of foreign institutions and scientific units participated. The Congress constitutes a unique opportunity for the representatives of official statistics, research centres and other partners involved in the study of social, economic and environmental processes to meet and exchange their knowledge, views and experiences.

Welcome and Opening/Plenary Session presentations:

1. Dominik Rozkrut. 100 years of Statistics Poland: from historical perspective to forward look.
2. Czesław Domański. The role of the scientific community in the process of shaping public statistics.
3. Stanisława Bartosiewicz. Three out of three on the beginning of population statistics of the Second Polish Republic.
4. Graham Kalton. The Past, Present, and Future of Social Surveys.

To celebrate the 100th anniversary of the Polish Statistical Association in 2012 was established the Jerzy Spława-Neyman Medal in order to appreciate the most outstanding statisticians, teachers of statistics and all people of science that by their work significantly contributed to the development of statistics or its education.

Laureates of Jerzy Spława-Neyman Medal 2018 awarded at the second Congress of Polish Statistics 2018 are:

- **Czesław Domański**, University of Łódź.
- **Marie Hušková**, Charles University in Prague.
- **Jan Kordos**, Warsaw School of Economics.
- **Mirosław Krzyśko**, University of Adam Mickiewicz in Poznań.
- **Carl-Eric Särndal**, Statistics Sweden.

Congratulations to the laureates!

Big Data Meets Survey Science (BigSurv18) conference

The European Survey Research Association (ESRA) held the first conference on Big Data Meets Survey Science (BigSurv18). The conference, held 25-27 October 2018, at the *Universitat Pompeu Fabra's* Research and Expertise Centre for Survey Methodology (RECSM) in Barcelona, Spain, was a truly interdisciplinary and international event. More than 400 researchers and practitioners from more than 45 countries who are working at the intersection of the social sciences and computer and data science gathered to "*Explore New Statistical Frontiers at the Intersection of Big Data and Survey Science*".

BigSurv18 began with 143 delegates taking one of four stimulating short-courses and another 24 delegates participating in the "Green City Hackathon," co-organized with the city of Barcelona. A tone of collaborative problem-solving across disciplines was set as the main conference kicked off with two inspiring keynote addresses and a plenary session.

The keynotes included "Automating Metadata Documentation" by Dr. Julia Lane (professor, New York University [NYU] Wagner Graduate School of Public Service; provostial fellow, NYU Center for Urban Science and Progress) and "Data Science for Public Good" by Dr. Tom Smith (managing director, Data Science Campus of the Office for National Statistics, UK). Both were moderated by Dr. Craig Hill (senior vice president; Survey, Computing, and Statistical Sciences; RTI International; USA).

Dr. Frauke Kreuter (professor, Institute for Employment Research, University of Mannheim, University of Maryland) organized an engaging plenary session, "Big Data, Surveys, and the Privacy-Ethics Challenge," which featured renowned experts on the topic.

Once the main scientific program began, delegates were spoiled for choice with 51 individual sessions (including 2 poster sessions) scheduled across 2 full days. The conference emphasized the combination of approaches from different disciplines for the collection, processing, and analysis of data. Sessions focused on how researchers can combine perspectives from both areas: (1) that which touches upon expertly designed small data carefully measuring human behaviors, attitudes, and opinions and (2) that which centers on organic, electronic data capturing massive quantities of observations about our everyday lives in real-time.

Topics of discussion ranged from generating summary statistics that describe entire populations to leveraging fine-grained data that inform the context of each observation; from the sampling of individuals within populations to considering the implications of "N=all"; and from applying the Total Survey Error paradigm to adopting a total statistical uncertainty framework that will be needed to encompass the new quality issues associated with Big Data. More information on the conference and the program can be found here (https://www.bigsurv18.org/program2018).

Feedback from the delegates has been positive—with many describing the conference as "awesome" with "rigor, breadth, and depth!" Organizers are now engaged in planning a continuation of this conference—BigSurv20.

Much of BigSurv18's success will be reflected in the forthcoming special issue of *Social Science Computer Review* and an edited volume, published by John Wiley & Sons, that features selected presentations from the event. Details on these two publications—which should be released in 2019 and 2020, respectively—will follow soon.

Antje Kirchner (Research Triangle Institute, USA)

62nd ISI World Statistics Congress 2019 (ISI WSC 2019)

The 62nd ISI World Statistics Congress is organized by the International Statistical Institute (ISI) in Kuala Lumpur, Malaysia, August 18–23, 2019. Homepage: (http://www.isi2019.org/).

The list of Invited Paper Sessions (IPS) is announced.

The list of Special Topic Sessions (STS) is also confirmed and already announced in December 2018.

Individuals are most welcomed to submit a **contributed paper** for presentation at the ISI WSC 2019. For the submission to be considered by the Local Programme Committee (LPC), it should include a title, an abstract and a short paper of not more than 6 pages. The paper must not have been published in any other conference proceedings or publication before the 62nd ISI WSC. The copyright for the abstracts and papers in the proceedings resides jointly with the authors and the ISI. Authors are free to publish expanded versions of the material elsewhere.

The contributed paper submitted is preferable to cover a wide range of topics nominating one of the following themes: Applied Statistics, Big Data, Finance, Machine Learning and Data Discovery, Official Statistics, Probability Theory, Social Statistics, Statistical Inference, Statistical Modelling, Statistics Education, Simulation and Computation, Other areas of Statistics. Besides new or improved statistical methods, cross-discipline and applied paper submissions are especially welcome.

The **submission** of abstracts and **papers for Contributed Paper Sessions** (CPS) is open until **31 January 2019**. See detailed submission guidelines at the ISI WSC website: (http://www.isi2019.org/scientific-programme/).

Paper Submission for the Cochran-Hansen Prize 2019 Competition

The Cochran-Hansen Prize of the IASS is awarded every two years and is given for the best paper on survey research methods submitted by a young statistician for a developing country or transition country. The prize winner will be invited to present his or her paper at the 2019 World Statistics Congress in Kuala Lumpur, Malaysia.

Submission of papers to the Cochran-Hansen Prize 2019 competition of the IASS is **open until 15 February 2019**. Papers must be sent to Dr Anders Holmberg, the Chair of the IASS 2019 Cochran-Hansen Prize Committee, email (anders.holmberg@ssb.no). The complete announcement is published at (http://isi-iass.org/home/cochran-hansen-prize).

Measuring the 2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development is a global agenda, “to end poverty and hunger everywhere; to combat inequalities within and among countries; to build peaceful, just and inclusive societies; to protect human rights and promote gender equality and the empowerment of women and girls; and to ensure the lasting protection of the planet and its natural resources. We resolve also to create conditions for sustainable, inclusive and sustained economic growth, shared prosperity and decent work for all, taking into account different levels of national development and capacities” (United Nations General Assembly resolution A/Res/70/1).

The 2030 Agenda is a balance of the three pillars of sustainability – economic, social and environmental – and there are 17 Goals and 169 targets associated with the 2030 Agenda.

In 2015, the United Nations Statistics Commission (UNSC) was tasked by the General Assembly to develop and implement the Global Indicator Framework to measure the Sustainable Development

Goals (SDGs). To do this, the UNSC created the Inter-Agency Expert Group on Sustainable Development Goal Indicators (IAEG-SDG) which is made up of 27 countries from all the regions of the UN. Since 2015, the IAEG-SDG has been working with multilateral organisations, industry and civil society to develop the Global Indicator Framework. In July of 2016, the Global Indicator Framework was endorsed by the General Assembly as the starting point for measuring the SDGs.

Since July 2016, the IAEG-SDG continues to ensure the statistical robustness of indicators being developed. To facilitate the implementation, indicators have been classified into three tiers.

- Tier I – Indicator is conceptually clear, has an internationally established methodology and standards are available, and data are regularly produced by countries for at least 50 per cent of countries and of the population in every region where the indicator is relevant.
- Tier II – Indicator is conceptually clear, has an internationally established methodology and standards are available, but data are not regularly produced by countries.
- Tier III – No internationally established methodology or standards are yet available for the indicator, but methodology/standards are being (or will be) developed or tested.

As of November 2018, there were 100 Tier I indicators, 82 Tier II indicators and 44 Tier III indicators. In addition to these, there are 6 indicators that have multiple tiers (different components of the indicator are classified into different tiers).

Over the course of the 2015 – 2030 period, there will be 2 occasions to revise the Global Indicator Framework. The first is in 2020 and the second will be in 2025.

In addition to the development of the global indicator framework, the IAEG-SDG has also created three working groups to address specific areas relevant to SDG indicator implementation. These are Statistical Data and Metadata Exchange (SDMX), Geo-spatial information, and Interlinkages on SDG statistics.

Membership to the IAEG-SDG is based upon regional representation and rotation every 2 years, however some countries may remain in the group longer than that to ensure continuity.

Cara William (Statistics Canada, Canada)

Ask the Experts

What are alternative data sources, and how to use them?

Frauke Kreuter

Joint Program in Survey Methodology, University of Maryland
University of Mannheim & IAB, Germany

National Statistical Institutes (NSIs) around the globe find themselves in a significantly different environment for obtaining information and providing statistical data for policy makers. For decades data could be collected via face-to-face or phone surveys, however, we now increasingly see calls to use alternative data sources to combat the rising costs of surveys as well as rising nonresponse rates. Moreover, leveraging existing alternative data sources can not only reduce the cost of surveys, but can also reduce the time it takes provide the desired information [1].

What are those alternative data sources everyone is talking about? The easiest way to think of them is to think of data that are not collected through surveys or experiments but created through different processes. In the U.S. administrative data are considered one form of **alternative data** source, collected by government entities for program administration, regulatory, or law enforcement purpose. This classification of administrative data sources as alternative data might seem strange to those from countries in which the statistical system was founded on the use of administrative data, such as Denmark, Finland, Iceland, Norway, and Sweden; or come from countries that base their data collection on registers. However, in the U.S. (and other countries), access to administrative data, for other than their primary purposes, has been limited so far -- a situation that is only now changing, in part in response to the recommendations of the 2016 U.S. Commission on Evidence-Based Policymaking and related efforts [2][3] and also given the always-expanding data needs of users.

Structurally very similar to administrative data are so-called **transaction data**, resulting from transactions between businesses and their customers or government entities. Like administrative data, they are the by-product of other activities and their collection is designed to meet the purpose of said activity. This shared feature is also one of the key challenges when using alternative data sources. Salganik labels this difference as custom made vs. ready-made: experiments and surveys are carefully tailored to a customer's need, whereas administrative and transaction data come with a set of variables needed for the primary purpose and a measurement that may or may not meet the constructs of interest to a researcher or an NSI [4][5]. Often even harder to process with even less clearly defined measurement properties are **data from voluntary (and often deliberate) posts** on social media platforms or other online outlets. This mismatch between the measurements desired, and the measurements provided in alternative data sources, means there is a good amount of post processing needed when dealing with administrative data – not unlike the effort that goes into designing a survey or an experiment.

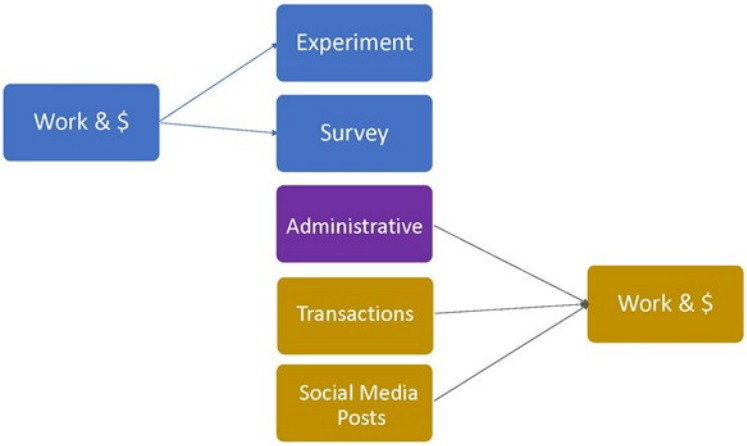

Figure 1. *Stylized depiction of effort and resources needed for traditional and alternative data sources before and after data collection.*

What is needed to make use of alternative data? The recommendations of the U.S. National Academies of Science Panel on "Improving Federal Statistics for Policy and Social Science Research Using Multiple Data Sources and State-of-the-Art Estimation Methods" include six elements needed to make use alternative data [6]. First, to address the problem of insufficient information in most of the alternative data sources, records from several data sources will need to be linked (see Mulrow's Ask the Expert post in the May 2017 IASS Newsletter). Second, data collection and processing pipelines currently used by federal statistical agencies will need to change to allow for enough transparency of the methods used to process and combine the data, and to clearly communicate those methods to users. Third, because privacy threats increase with linked datasets strategies need to be developed and implement to safeguard privacy while increasing accessibility to linked data sets for statistical purposes. Fourth, new quality frameworks need to be developed and should include additional dimensions that better capture user needs, such as timeliness, relevance, accuracy, accessibility, coherence, integrity, privacy, transparency, and interpretability. More dimensions also mean more attention needs to be paid to the tradeoffs between different quality aspects of data. Fifth, most likely a new entity will be needed to facilitate secure access to data and to allow for the combination of multiple data sources. Sixth, new skills are needed for employees working in Statistical Agencies and researchers working with alternative data sources. Besides knowledge of the already mentioned record linkage techniques, knowledge of statistical methods for combining data from multiple sources is needed as well as skills in database management, privacy-preserving and privacy-enhancing technologies, and a fundamental understanding of the quality of the alternative data sources. Data users need an understanding of the data generating processes and the consequences of quality compromises for analyses to be done later on.

This list has without a doubt a U.S. centric bias and is most relevant to countries without existing digital infrastructure designed for sharing data across functions. An interesting counter example exist in Estonia [7]. However even in the best designed system, it will be important to understand how the data are generated and what they can reasonably be used for (or not). It will also be important to not only master the new skills, but to preserve some of the survey methodology knowledge to augment the alternative data sources with data collection specifically designed to measure those elements not captured in the alternative data sources. This was also the spirit of the first BigSurv Conference in Barcelona last year, bringing together (big) data scientist and survey methodologists, as well as in job postings of all big four U.S. tech companies (Amazon, Google, Facebook, and Apple) – looking for survey methodologists.

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New and Emerging Methods

Calibration methods for small domain estimation

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Abstract. Small area estimation was discussed in this section of The Survey Statistician in the July 2010 issue by Danny Pfeffermann in his article "Small Area Estimation: Basic Concepts, Models and Ongoing Research". A more comprehensive review article was published a couple years later (Pfeffermann 2013). The Wiley book "Small Area Estimation, Second Edition" of 2015 by J.N.K. Rao and Isabel Molina presents an update to Rao's monograph of 2003 on small area estimation. These important sources cover model-based and design-based approaches on small area estimation (SAE) and show in particular the progress in model-based methods, and the progress is ongoing. In this article we introduce methods that incorporate assisting models in a design-based estimation procedure for population characteristics (totals, means etc.) for subgroups or domains, including small domains (with small sample size). We use logistic mixed models in model-assisted calibration estimation of poverty rates for administrative regions (domains of interest). Statistical properties (design bias and accuracy) of the method is compared with the classical model-free calibration method of Deville and Särndal (1992) and further, with a model-based SAE method that relies on the same logistic mixed model as the model-assisted counterpart. Our design-based simulation experiments employ real data obtained from registers of Statistics Finland. The paper is partly based on Lehtonen and Veijanen (2018).

Some keywords. Model-free calibration, model-assisted calibration, mixed models, empirical best predictor, design-based simulation experiments

1. Introduction

Calibration techniques offer flexible tools for the estimation for finite populations by effectively introducing auxiliary data in the estimation procedure. Calibration estimation was formalized in the seminal paper of Jean-Claude Deville and Carl-Erik Särndal (Deville and Särndal 1992). The methodology is widely used in official statistics and elsewhere for design-based estimation of totals, means and other characteristics for populations and sub-populations (domains) whose sample sizes are large enough for reliable estimation. In typical situations, the important sub-divisions of the population are pre-specified and set in the sampling design by stratification. By using suitable allocation techniques, sample sizes in the strata or *planned domains* are determined large enough for reliable results, and estimation is performed by so-called *direct calibration*. In this approach, estimation is carried out independently in each stratum. In small area or small domain estimation, the domain structures of interest are not usually known in advance but emerge afterwards. Sample sizes in such *unplanned domains* are random variates and can be small (even zero). For small domains, the classical calibration can become unreliable because of the possible instability of the

estimates (e.g. Hidiroglou and Estevao 2016), and coefficients of variation for statistics of interest appear too large to be released. This property restricts the use of direct calibration in small domain estimation. Estevao and Särndal (1999, 2004) and Lehtonen and Veijanen (2009) discuss model-free calibration in the estimation for domains.

Classical calibration estimation is called "model-free" (Särndal 2007) because an explicit model statement is not necessarily needed. From the modelling point of view, model-free calibration is best justified for continuous study variables, under an implicit linear fixed-effects model. Wu and Sitter (2001) presented a model calibration (model-assisted calibration) method that involves explicit model specification. Wu (2003) showed that the model calibration estimator of Wu and Sitter (2001) for the finite population mean is optimal among a class of calibration estimators. Model-assisted calibration allows flexible modelling with e.g. generalized linear models (GLM) and generalized linear mixed models (GLMM) for different study variable types, including binary, polytomous, ordinal and count variables. Recent developments in model-assisted calibration using for example nonparametric and semiparametric methods and adaptive lasso techniques are presented in Montanari and Ranalli (2005), Breidt and Opsomer (2009), Rueda et al. (2010), Wang and Wang (2011), McConville et al. (2017) and Chen et al. (2018). Chandra and Chambers (2011) presented a model-based view to the method of Wu and Sitter. Overviews on calibration estimation include Fuller (2002), Särndal (2007), Kott (2009), Kim and Park (2010) and Park and Kim (2014).

Model-assisted calibration for small domain estimation is discussed for example in Fabrizi et al. (2014), Lehtonen and Veijanen (2012, 2016) and Morales et al. (2018). The model-assisted calibration method introduced in Lehtonen and Veijanen (2012) involves two phases. In the *modelling phase*, a carefully chosen model is fitted for the entire sample data set. Predicted values are calculated for population elements by using estimated model parameters and known values of auxiliary variables. Predictions are used in the calibration phase when constructing the calibration equation and a calibrated domain estimator. Calibrated weights are determined to produce the population sums of predictions at a selected hierarchical level of population. Calibration can be defined at the population level, at the domain level, or at an intermediate level, for example at a higher regional level that contains the domain of interest. Lehtonen and Veijanen (2012) introduced two subclasses of (essentially indirect) model-assisted domain estimators. In a semi-direct approach, predictions for a given domain only are incorporated in the calibration phase, whereas in a semi-indirect approach, predictions outside the domain (e.g. from neighbouring areas) also contribute. As design-based methods, model-free calibration and model-assisted calibration involve nearly design unbiased estimation for domain totals and other finite population parameters. For a nearly design unbiased estimator, the design bias is, under mild conditions, an asymptotically insignificant contribution to the estimator's mean squared error (MSE) (Särndal, 2007, p. 99).

In small area estimation, mixed models are often imposed to account for spatial heterogeneity in population. Logistic mixed models are chosen for binary or polytomous study variables. Examples in model-based SAE are Jiang and Lahiri (2006), Datta (2009), Molina et al. (2014), Hobza and Morales (2016) and Hobza et al. (2018). In model-assisted small domain estimation, unit-level logistic mixed models, as well as fixed-effects models, have been incorporated in generalized regression (GREG) and model-assisted calibration estimators. Examples are Lehtonen, Särndal and Veijanen (2003, 2005), Lehtonen and Veijanen (2012, 2016, 2018) and Morales et al. (2018). We present in Section 3 an empirical comparison of bias and accuracy of a model-assisted small domain estimator and a model-based SAE method that use logistic mixed models.

The paper is organized as follows. The design-based and model-based methods considered here are introduced in Section 2. In Section 3, the statistical properties (bias, accuracy) of the methods

are examined by using design-based simulation experiments with real data obtained from statistical registers of Statistics Finland. Discussion is in Section 4.

2. Methods

2.1. Notation and preliminaries

Consider a finite population $U = \{1,2,...,k,...,N\}$ of size *N*, where *k* refers to the label of population element. A sample $s \subset U$ of *n* elements is drawn from *U* with sampling design $p(\cdot)$. Design weights are $a_k = 1/\pi_k$, where π_k is inclusion probability for $k \in U$. Sub-populations of *U* or *domains of interest* are denoted U_d, $d = 1,...,D$, where *D* is the number of domains. In small domain estimation, the number of domains can be large. The size of domain U_d is N_d and the size of the corresponding subset $s_d = U_d \cap s$ of sample *s* is n_d. We discuss unplanned type domains; the realized domain sample sizes n_d are not controlled by the sampling design but are random. Therefore, n_d can be small, even zero, in some domains. We do not address the case of zero sample elements in a domain. Auxiliary information on variables related to the phenomenon of study plays a crucial role. We assume an access to *unit-level auxiliary information*; let $\mathbf{x}_k = (x_{1k},...,x_{Jk})'$ denote a vector value known for population element $k \in U$. We usually insert in the vector a value $x_{0k} = 1$ for all *k*. The study variable values y_k are obtained for sample elements $k \in s$. The sample and auxiliary data sets are merged at the unit level by using unique identifiers that are available for both data sources. Today, this option is met in many advanced statistical data infrastructures. Under the set-up above, we assume a complete data set without missingness.

2.2. Models

In our empirical example we deal with a binary study variable. A logistic model formulation is a natural choice. In small domain estimation, a mixed model is often preferred over a fixed-effects model, in particular if the number of domains is large. A *logistic mixed model* for domain estimation incorporates domain-specific random intercepts $u_d \sim N(0,\sigma_u^2)$ for domain U_d and is given by

$$E_m(y_k \mid u_d) = P\{y_k = 1 \mid u_d;\boldsymbol{\beta}\} = \frac{\exp(\mathbf{x}_k'\boldsymbol{\beta} + u_d)}{1+\exp(\mathbf{x}_k'\boldsymbol{\beta} + u_d)}, \quad k \in U_d,\ d = 1,...,D, \tag{1}$$

where $\mathbf{x}_k = (x_{0k}, x_{1k},...,x_{Jk})'$ with $x_{0k} = 1$ for all *k*, $\boldsymbol{\beta} = (\beta_0, \beta_1,...,\beta_J)'$ is a vector of fixed effects common for all domains and *m* refers to the expectation under the model. The parameters $\boldsymbol{\beta}$ and σ_u^2 are first estimated by maximum likelihood methods (e.g. R package lme4 or SAS procedure GLIMMIX) and estimates $\hat{u}_d$ are calculated. Predictions $\hat{y}_k = P\{y_k = 1 \mid \hat{u}_d;\hat{\boldsymbol{\beta}}\}$ are then computed for $k \in U_d$, $d = 1,...,D$.

2.3. Estimators

Domain totals of a binary variable *y* are given by

$$t_d = \sum_{k \in U_d} y_k,\ d = 1,...,D, \tag{2}$$

where $y_k = 1$ refers to the occurrence of the event of interest (such as a person is in poverty) and $y_k = 0$ otherwise. Proportion parameter (e.g. at-risk-of poverty rate) in domain *d* is defined as

$$r_d = \frac{t_d}{N_d}. \tag{3}$$

Calibration estimators for domain totals (2) are of the form

$$\hat{t}_d = \sum_{k \in s_d} w_{dk} y_k,\ d = 1,...,D, \tag{4}$$

where w_{dk} denotes a method-specific *calibrated weight* for unit *k* in domain *d.* We denote $\hat{t}_{dMFC}$ the model-free calibration estimator and $\hat{t}_{dMC}$ the model-assisted counterpart. A Horvitz-Thompson (HT) type calibration estimator of proportion (3) in domain *d* is:

$$\hat{r}_{dHT} = \frac{\hat{t}_d}{N_d},\ d = 1,\ldots,D\,, \tag{5}$$

where domain sizes N_d are assumed known. A Hájek type estimator

$$\hat{r}_{dHA} = \hat{t}_d \,/\, \sum\nolimits_{k\in s_d} w_{dk}$$

provides an alternative to estimator (5).

In a comparison of model-assisted calibration with a model-based method we consider an *empirical best (*EB*) predictor* type estimator of domain totals (2), given by

$$\hat{t}_{dEB} = \sum\nolimits_{k\in U_d} \hat{y}_k,\ \ d = 1,\ldots,D\,, \tag{6}$$

see e.g. Hobza and Morales (2016). A HT type EB predictor of proportion (3) is defined as

$$\hat{r}_{dEB\_HT} = \frac{\hat{t}_{dEB}}{N_d},\ d = 1,\ldots,D\,. \tag{7}$$

Estimators $\hat{t}_{dMC}$ and $\hat{t}_{dEB}$ that use model (1) are of indirect type, as data on y-variable from other domains also contribute in the estimation for a given domain.

2.4. Calibration estimators of domain totals

Calibration in domain estimation. A calibration weighting system is introduced by deriving calibration equations for a given calibration vector and solving the equations under a chi-square type distance function. In domain estimation, *calibration equations* are given by

$$\sum_{i\in s_d} w_{di}\mathbf{z}_i = \sum_{i\in U_d} \mathbf{z}_i\ ,\ d = 1,\ldots,D\,, \tag{8}$$

where w_{di} is calibration weight for element *i* in domain *d* and $\mathbf{z}_i$ denotes a generic *calibration vector*. Using Lagrange multipliers λ we minimize:

$$\sum_{k\in s_d} \frac{(w_{dk} - a_k)^2}{a_k} - \boldsymbol{\lambda}'_d \left(\sum_{i\in s_d} w_{di}\mathbf{z}_i - \sum_{i\in U_d} \mathbf{z}_i \right) \tag{9}$$

subject to calibration equations (8). The equation is minimized by weights

$$w_{dk} = a_k \left(1 + \boldsymbol{\lambda}'_d \mathbf{z}_k\right), \tag{10}$$

where

$$\boldsymbol{\lambda}'_d = \left(\sum_{i\in U_d} \mathbf{z}_i - \sum_{i\in s_d} a_i \mathbf{z}_i \right)' \left(\sum_{i\in s_d} a_i \mathbf{z}_i \mathbf{z}'_i \right)^{-1},\ d = 1,\ldots,D\,. \tag{11}$$

We assume $\sum_{i\in s_d} a_i \mathbf{z}_i \mathbf{z}'_i$ be invertible. In domain estimation, the weights (10) are applied over a domain.

Model-free calibration (MFC). In classical model-free calibration of Deville and Särndal (1992), a calibration equation is imposed:

$$\sum\nolimits_{k\in s} w_k x_k = \sum\nolimits_{k\in U} x_k\ ,$$

that is, the weighted sample sums of auxiliary x-variable values reproduce the known population sums (coherence or benchmarking property). In domain estimation with MFC, calibration vector $\mathbf{z}_i$ for (8) contains the original auxiliary x-variables; it is of the form

$$\mathbf{z}_i = \mathbf{x}_i = (x_{0i}, x_{1i}, ..., x_{Ji})', \; i \in U_d, \; d = 1,...,D, \tag{12}$$

where $x_{0i} = 1$ for $i \in U_d$. Calibration equations (8) are given by

$$\sum_{i \in s_d} w_{di}\mathbf{z}_i = \sum_{i \in s_d} w_{di}\mathbf{x}_i = \sum_{i \in U_d} \mathbf{x}_i = \left(\sum_{i \in U_d} x_{0i}, \sum_{i \in U_d} x_{1i}, ..., \sum_{i \in U_d} x_{Ji} \right)', \; d = 1,...,D. \tag{13}$$

We minimize (9) subject to (13) and obtain a MFC estimator of domain total t_d of the form

$$\hat{t}_{dMFC} = \sum_{k \in s_d} w_{dk} y_k, \; d = 1,...,D, \tag{14}$$

where weights w_{dk} are computed by (10) and (11) with z-vector given by (12).

Calibrated weights in (14) for classical calibration are obtained without reference to any specific y-variable. Thus, the same weight system can be used for a desired set of study variables (multi-purposiveness). The phrase "model free" is justified, because there is no explicit model statement. Estimator (14) is of direct type, because data on y-variable from a domain of interest only are used. The right-hand part of (13) indicates that unit-level auxiliary data are not needed; it is enough to have access to the known domain totals of x-variables.

Model-assisted calibration (MC). Model-assisted calibration for domain estimation allows explicit modelling as a part of the calibration procedure. In the modeling phase for a binary variable, the logistic mixed model (1) is fitted for the entire sample data set and predictions $\hat{y}_k$ are calculated for $k \in U_d$, $d = 1,...,D$. In the calibration phase, the predictions are incorporated in the calibration z-vector, and calibration weights are determined by inserting the z-vector into formulas (8) to (11).

Calibration vector $\mathbf{z}_i$ for (8) is:

$$\mathbf{z}_i = (x_{0i}, \hat{y}_i)', \; i \in U_d, \tag{15}$$

where $x_{0i} = 1$ for $i \in U_d$. Variable x_0 is included to force the sample sum of calibrated weights to reproduce the known domain sizes N_d. Predictions in (15) are computed as:

$$\hat{y}_k = \frac{\exp(\mathbf{x}_k'\hat{\boldsymbol{\beta}} + \hat{u}_d)}{1 + \exp(\mathbf{x}_k'\hat{\boldsymbol{\beta}} + \hat{u}_d)}, \quad k \in U_d, \; d = 1,...,D, \tag{16}$$

where $\mathbf{x}_k = (x_{0k}, x_{1k}, ..., x_{Jk})'$, $k \in U_d$, $\hat{\boldsymbol{\beta}}$ is the vector of estimated fixed effects and $\hat{u}_d$ are estimates for the domain-specific random intercepts. By equation (16), MC requires an access to unit-level auxiliary data for computing the predictions. Calibration equations (8) are given by

$$\sum_{i \in s_d} w_{di}\mathbf{z}_i = \sum_{i \in U_d} \mathbf{z}_i = \left(\sum_{i \in U_d} x_{0i}, \sum_{i \in U_d} \hat{y}_i \right), \; d = 1,...,D. \tag{17}$$

We minimize (9) subject to (17) and obtain a model-assisted calibration estimator of t_d:

$$\hat{t}_{dMC} = \sum_{k \in s_d} w_{dk} y_k, \; d = 1,...,D, \tag{18}$$

where weights w_{dk} are computed by (10) and (11) with z-vector given by (15).

It is justified to call MC estimator (18) indirect, because formulas (15) and (16) show that y-variable values outside domain d contribute in deriving predictions $\hat{y}_k$ for weights w_{dk}. For a further

specification, Lehtonen and Veijanen (2012) called estimator (18) semi-direct, as weight calibration is performed at the domain level.

3. Monte Carlo experiments

Simulation design. The binary poverty indicator shows when a person's equivalized income is smaller than or equal to the poverty threshold, 60% of the median equivalized income M in the population. The indicator for sample person k is defined as $y_k = I\{y_k \leq 0.6\hat{M}\}$, where $y_k = 1$ if a person is in poverty and 0 otherwise. The quantity $0.6\hat{M}$ is the estimated poverty threshold, where $\hat{M}$ is estimated by HT from the estimated distribution function of equivalized income in the population (Lehtonen and Veijanen 2012). The binary poverty indicator y acts as the study variable in the calibration exercise.

For design-based simulation experiments, an adult population of about 600,000 persons was constructed from real income data of Statistics Finland, containing 36 LAU level 1 regions in Western Finland. In addition to the equalized income variable, our population contained three auxiliary variables: two-category gender, three-category age and three-category labor force status. We created indicator variables for classes of each qualitative variable; one indicator for sex and two indicators for age and labor force status. The complete auxiliary x-vector for $k \in U$ thus is $\mathbf{x}_k = (x_{0k}, x_{1k}, x_{2k}, x_{3k}, x_{4k}, x_{5k})'$, where $x_{0k} = 1$. The covariates showed some explanatory power: in logistic models, the complete x-data explained about 15% of the variation of y. As domains of interest we used the D = 36 LAU-1 regions. Overall poverty rate in population was 14.3%. In the regions, lowest rate was 9.9% and highest was 22.4%.

In the simulations, K = 1000 samples of n = 2000 units were drawn with simple random sampling without replacement (SRSWOR) from the unit-level population. Design bias and accuracy of domain poverty estimators $\hat{r}_d$ were measured by absolute relative bias (ARB) and relative root mean squared error (RRMSE):

$$ARB(\hat{r}_d) = |(1/K)\sum_{j=1}^{K}(\hat{r}_{dj} - r_d)|/r_d \text{ and } RRMSE(\hat{r}_d) = \sqrt{(1/K)\sum_{j=1}^{K}(\hat{r}_{dj} - r_d)^2}\,/\,r_d .$$

Poverty rate (3) for domain d was estimated by HT type estimators $\hat{r}_d = \hat{t}_d / N_d$, $d = 1,\ldots,D$, where $\hat{t}_d$ is obtained for MFC by (14), MC by (18) and EB by (6). Our logistic mixed models (1) contained regional random intercepts associated with LAU-1 regions. We computed average ARB and RRMSE over three domain size classes defined by expected domain sample size.

Design-based calibration estimators. Results for model-free calibration MFC and model-assisted calibration MC are in Table 1. ARB figures are not presented because both estimators appeared nearly design unbiased.

Over all domains, indirect model-assisted calibration shows better accuracy than direct model-free calibration. This holds for all domain sample size classes and is best visible in the smallest size class. The difference in accuracy between MFC and MC declines with increasing domain sample size. Accuracy figures are nearly equal in the largest size class. The logistic mixed model in MC clearly tends to improve accuracy over MFC, whose implicit assisting model is a linear fixed-effects model fitted separately in each domain. As a direct estimator, MFC may suffer from instability problems in the smallest domains.

Table 1. *Average relative root mean squared error (RRMSE) (%) of model-free and model-assisted calibration estimators of domain poverty rates in three domain sample size classes in a design-based simulation experiment.*

Estimator	Calibration vector & assisting model	Expected domain sample size			All 36 domains
		Minor <25 units (10 domains)	Medium 25-50 units (16 domains)	Major >50 units (10 domains)	
Direct estimator					
Model-free calibration MFC	Calibration vector $\mathbf{z}_k = (1, x_{1k}, x_{2k}, x_{3k}, x_{4k}, x_{5k})'$	61.1	40.4	20.1	47.3
Indirect estimator					
Model-assisted calibration MC	Calibration vector $\mathbf{z}_k = (1, \hat{y}_k)'$ $\hat{y}_k = \exp(\mathbf{x}_k'\hat{\boldsymbol{\beta}} + \hat{u}_d) / (1 + \exp(\mathbf{x}_k'\hat{\boldsymbol{\beta}} + \hat{u}_d)),\ k \in U_d,$ $d = 1,...,36,\ \mathbf{x}_k = (1, x_{1k}, x_{2k}, x_{3k}, x_{4k}, x_{5k})'$	54.1	37.6	19.8	43.0

Model-assisted and model-based estimators. It is known that design-based and model-based methods differ in their design-based properties. Design-based estimators are constructed nearly design unbiased; model-based estimators do not possess this built-in property. We compared empirically the bias and accuracy properties of model-assisted MC and model-based EBP. Both methods use model (1) and employ the same auxiliary x-data. Simulation results are in Table 2.

A trade-off between design bias and accuracy is seen in the results. MC appears nearly design unbiased as expected, and EB predictor is design biased. Mean ARB figures of EBP are large in the smallest domains, and ARB remains substantial in the other domain classes too. The opposite side of the coin shows the superiority of EBP in accuracy, notably in the smallest domains. The difference in accuracy between MC and EBP declines with increasing domain sample size.

Table 2. *Average absolute relative bias (ARB) (%) and average relative root mean squared error (RRMSE) (%) of design-based model-assisted calibration estimator and model-based EB predictor of poverty rates in three domain sample size classes in a design-based simulation experiment.*

Estimator	Average ARB (%)			Average RRMSE (%)		
	Expected domain sample size			Expected domain sample size		
	Minor <25	Medium 25-50	Major >50	Minor <25	Medium 25-50	Major >50
Design-based estimator						
MC	1.3	1.2	0.56	54.1	37.6	19.8
Model-based estimator						
EBP	16.2	11.1	9.0	21.7	18.4	16.3
Model in MC and EBP: $E_m(y_k \mid u_d) = \exp(\mathbf{x}_k'\boldsymbol{\beta} + u_d) / (1 + \exp(\mathbf{x}_k'\boldsymbol{\beta} + u_d)),\ \mathbf{x}_k = (1, x_{1k}, x_{2k}, x_{3k}, x_{4k}, x_{5k})',\ k \in U_d,\ d = 1,...,36$						

The results verify that the role of model is different in the two methods. EB predictor relies on the model. EBP can be badly design biased if the model is misspecified in a given domain, and the bias can dominate MSE. In MC, model is used as an assisting tool. MC remains nearly design unbiased in every domain even under model misspecification. For both methods, model improvement results in improved accuracy. In a SAE study on the effect of model improvement to accuracy, Lehtonen et al. (2003) showed that when moving from a "weaker" model to a "stronger" model, average relative

improvement in MSE can be much larger for a model-based estimator than for a model-assisted estimator, and the strength of the effect depends on the domain sample size.

Let us illustrate the trade-off between bias and accuracy by Figure 1. It shows the distribution of relative error $RE_i(\hat{r}_d) = (\hat{r}_d(s_i) - r_d)/r_d$, $i = 1,...,1000$, for MC and EBP in a large domain.

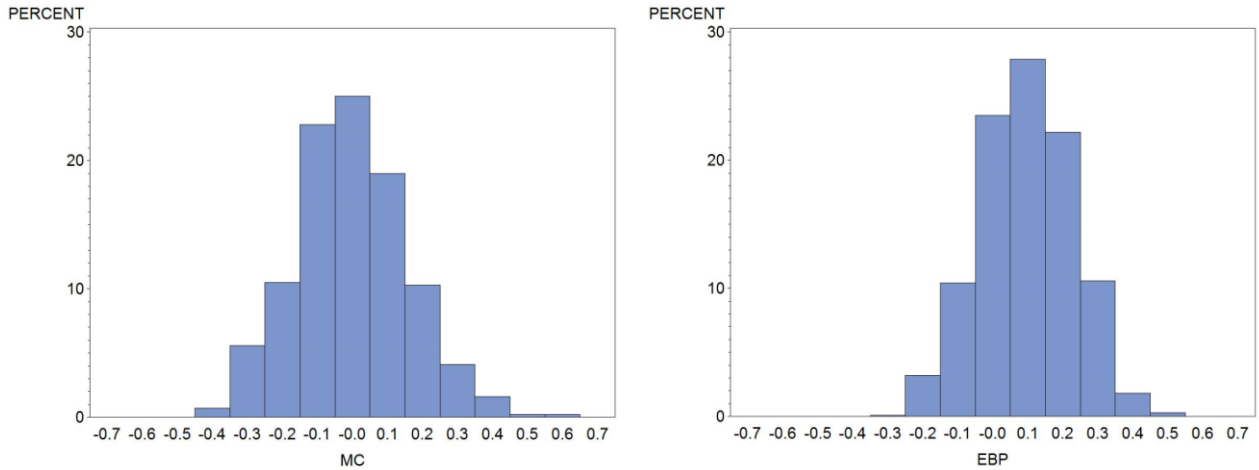

Figure 1. *Distribution (%) of relative error of design-based MC estimator (left-hand panel) and model-based EBP estimator (right-hand panel) of poverty rate in a large domain.*

The expectation of the distribution of relative error for MC is about zero, implying nearly design unbiased estimation. For EBP, the expectation differs from zero, indicating some design bias. Variation of relative error of EBP is smaller than that of MC, suggesting slightly better accuracy for EBP for a large domain. Lehtonen et al. (2005) reported related results for model-assisted GREG estimators and model-based estimators of EBP type that use similar models.

4. Discussion

Classical calibration with direct model-free estimation becomes unreliable when domain or area sample sizes get small. In these situations, model-based small area estimation methods are often used, such as EBLUP and empirical best (EB) prediction methods. We introduced a related model-assisted calibration approach for small domain estimation. An indirect model-assisted calibration (MC) estimator and an indirect EBP type estimator were constructed that use logistic mixed models for a binary study variable. We studied the bias and accuracy properties of the estimators by design-based simulation experiments. Our results verified the near design unbiasedness of model-free and model-assisted calibration estimators. The accuracy superiority of model-assisted calibration over direct model-free calibration was observed in small domains in particular, where direct model-free calibration often fails. A comparison of model-assisted calibration with model-based empirical best predictor manifested a trade-off between bias and accuracy. While the model-assisted estimator remained nearly design unbiased, the accuracy was worse than that of the model-based method. The price that had to be paid by the model-based method for better accuracy was a risk of uncontrolled design bias. The bias was most apparent in small domains.

In small area estimation literature, composite estimators that are constructed as a weighted combination of design-based estimator and model-based estimator have been proposed as a compromise method. Composite estimators are discussed for example in Rao and Molina (2015) and Tzavidis et al. (2018). Lehtonen et al. (2003) reported empirical results on relative behaviour of certain model-assisted, model-based and composite estimators for small domain estimation.

Hidiroglou and Estevao (2016) reported results from design-based simulation experiments on the relative performance of selected design-based and model-based estimators of domain totals under

equal probability sampling. They used at least approximately design unbiased estimators (direct model-free calibration estimators and an indirect modified regression estimator) and certain model-based small area estimators (design-biased synthetic and EBLUP estimators and a pseudo EBLUP that was constructed to account for model mis-specification). The modified regression estimator was the best design-based estimator in accuracy. Design bias of the pseudo EBLUP estimator was smaller than the bias of the other model-based estimators, and the bias decreased when domain sample size grew. In accuracy, the pseudo EBLUP outperformed the other model-based estimators as well as the best design-based estimator. Even if there are certain differences in the set-up, the results are in many respects comparable to the results of this paper.

We used linear calibration with a chi-square type distance function. It is well known that linear calibration can involve large variation of weights and negative weights. Such weights are often considered unfeasible in practical applications. Many techniques have been proposed in the literature to restrict the variation of weights and for weight trimming and smoothing (e.g. Deville and Särndal 1992 p. 378, Chen et al. 2002, Park and Fuller 2005, Beaumont and Bocci 2008, Guggemos and Tillé 2010, Kim 2010, Wu and Lu 2016). Alternative (asymptotically equivalent) distance functions are possible in order to avoid unfeasible weights (Deville and Särndal 1992, Section 2). However, it is not clear how these techniques behave in small domain estimation. More research is needed in this area.

In small domain estimation with linear calibration, weight distributions can differ considerably between model-free and model-assisted methods (Lehtonen and Veijanen 2018). In small domains, the distribution of weights calibrated by the model-free method tends to become instable, and extreme negative and positive weights can appear. The distribution of weights in model-assisted calibration tends to be more stable, even in small domains. Model-assisted calibration weighting can also be considered as a weight smoothing method for small domain estimation.

In model-assisted calibration, the built-in coherence property of model-free calibration to reproduce the known (published) official statistics of the covariate or auxiliary variables is lost. Methods have been proposed to overcome this restriction. Examples are the multiple model calibration method of Montanari and Ranalli (2009) and a hybrid calibration method of Lehtonen and Veijanen (2018) developed for small domain estimation.

The assessment of the precision of domain estimates is an important phase of an estimation procedure. Estimation of design variance for classical calibration and GREG estimation are discussed in Deville and Särndal (1992) and Deville (1999), for domain estimation see Lehtonen, Särndal and Veijanen (2003) and Lehtonen and Veijanen (2009). Torabi and Rao (2008) address MSE estimation of a GREG estimator assisted by a mixed model. Variance estimation in model calibration is discussed for example in Montanari and Ranalli (2005) and Kim and Park (2010).

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Book and Software Review

Roderick J.A. Little and Donald B. Rubin (2002)
Statistical Analysis with Missing Data, 2nd ed.
John Wiley & Sons

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Missing data is an inescapable component of all real datasets, irrespective of scientific area and discipline. The survey research community has long recognized this reality and profound attention has been focused on minimizing the occurrence of missing observations and mitigating biases in statistical estimates. Such pioneering efforts have been operationalized at the design, data collection, and analysis levels, and have motivated a large body of research. Statistical methods for handling known forms of nonresponse are readily available and built into standard software packages, which can be reliably used for estimating standard summary measures. What is less known to most data analysts is the statistical theory underlying each method.

Any method for handling nonresponse relies on assumptions, and blindly using a method could outweigh its potential benefits. While there are numerous high-quality books on the topic of missing data, most of these books either focus on specific application areas, narrow statistical methodology, or require prior familiarity with the topic. Little and Rubin's *Statistical Analysis with Missing Data* is unique in presenting a unified approach to statistical analysis with missing data and providing a self-contained and comprehensive overview of likelihood-based approaches for missing data. Such a comprehensive and unified structure not only provides analysts with the ability to choose appropriate methods for analysis, but also provides researchers with technical knowledge to extend existing-- and develop new -- statistical methodology. With survey response rates declining and surveys evolving in terms of objectives, form and complexity, there is once again a dire need for development of new statistical methods for analyzing incomplete data. Grown out of several decades of research by two prominent statisticians, the classic Wiley book *Statistical Analysis with Missing Data, 2nd Edition*, continues to be the ideal resource for (bio)statisticians as well as statistical analysts dealing with incomplete data.

The content of the book is elegantly organized into three parts. While the book does assume a basic knowledge of probability theory and mathematical statistics, each of the three parts increases in degree of technicality and rigor. Part I caters to a more general audience: the general problem of missing data is introduced in a simple manner and key concepts are presented. Standard methods for handling missing data such as weighting and imputation are also presented in Part I. Part II focuses on likelihood-based approaches to analysis with missing data. Part II is suitable for anyone interested in using or developing methods for analyzing incomplete data. While more dense and technical than Part I, Part II is self-contained and suitable for analysts, methodologists, and practitioners. Various inferential tools are presented, and some of the concepts introduced in Part I are revisited with more rigor. Part III extends the theory presented in Part II in analyzing more complex data structures and is suitable for a more statistical audience. While many of the examples are now dated, the development of the ideas and the manner in which the theory presented in Part II is extended is extremely useful for carrying out new research.

Part I is defined by Chapters 1-5, and can be used as a stand-alone introductory textbook for understanding and analyzing incomplete data. Chapter 1 introduces key concepts, definitions and

notation used throughout the book. Concepts of missing data patterns and mechanisms are introduced in this chapter along with different approaches to handling missing data. Chapter 3 reviews methods of complete case analysis, including weighting methods commonly used in design-based survey inference. Chapter 4 and 5 present imputation methods, first starting with very simple single imputation in Chapter 4, and advancing to multiple imputation in Chapter 5. Measuring imputation uncertainty is also thoroughly discussed in Chapter 5. The assumptions underlying each of the methods presented are stated and their limitations are identified. Given the current computational tools, Chapter 2 is a bit outdated and could be easily skipped all together, without interrupting the flow of the book. The first part of the book also motivates more rigorous likelihood-based theory, which is presented in Part II.

Part II is defined by Chapters 6-10 and covers likelihood-based approaches to statistical analysis with missing data. Part II covers likelihood-based methods which ignore the missing data mechanism and suffice in many practical applications. This part is geared towards a mathematical audience, balancing computation and rigor, and in my opinion, forms the main thrust of the book. Chapter 6 reviews key concepts in the theory of maximum likelihood (ML): it starts first with likelihood-based inference for complete data, emphasizing asymptotic and Bayesian methods for inference, and then extends these concepts for incomplete data. Chapter 6 ends with a brief introduction to likelihood theory for coarsened data, which is very technical. Similar to Chapter 1, Chapter 6 introduces concepts used throughout Part II, many of which are revisited in subsequent chapters of the book. Focusing on continuous multivariate normal data, Chapter 7 introduces methods based on factorizing the joint likelihood. This chapter starts with maximum likelihood estimation for bivariate normal data where one variable is subject to nonresponse, and gradually increases in dimension and complexity, ending with multivariate data with special non-monotone patterns of missingness. Inferential tools for parameter estimates are also introduced as well as computation using the Sweep operator.

The Expectation Maximization (EM) algorithm and its extensions are introduced in Chapters 8 and 9. Chapter 8 first outlines the need for iterative methods of maximizing the likelihood function. Several methods, including the EM algorithm are introduced along with their convergence properties. The remainder of Chapter 8 introduces extensions of the EM algorithm and compares and contrasts their features. Chapter 9 surveys large sample inferences based on maximum likelihood, when ML estimates are obtained using EM-type algorithms. Asymptotic methods are reviewed along with resampling and Bayesian methods of inference. Chapter 10 is devoted to Bayesian simulation methods. This chapter starts with iterative methods such as data augmentation and the Gibbs sampler, and revisits multiple imputation (MI) within the framework of Bayesian inference. Convergence properties and large-sample features of resulting estimators are presented. Construction of approximate test statistics are also briefly surveyed. This chapter ends with alternative methods for creating multiple imputations, which are useful in situations where the joint distribution of the variables is unknown or complex, and assessing convergence is difficult and time-consuming. In contrast to Chapters 4 and 5 which present MI in a very intuitive manner using real data examples, Chapter 10 is dense and mathematical.

Part III is defined by Chapters 11-15. This part focuses broadly on likelihood-based approaches for analyzing incomplete data, when the standard assumptions outlined in Parts I and II do not hold. The missing data mechanism continues to be assumed ignorable until the end of Chapter 14. The assumption of ignorability is only relaxed in Chapter 15, where nonignorable missing data are introduced and briefly surveyed. Chapters 11 and 12 present maximum likelihood estimation assuming the data is multivariate normal. Chapter 11 studies models assuming different dependence structures. Examples include linear regression, mixed effects and time-series models. Robust methods for estimation and inference are presented in Chapter 12. Chapter 13 relaxes the assumption of multivariate normality and studies ML estimation for partially classified contingency tables: estimators obtained from both unconstrained models and constrained log-linear are presented along with corresponding methods for inference. Consistent with the rest of the book, methods of inference based on large sample theory and Bayesian methods are presented. Building

upon the previous two chapters, Chapter 14 presents methods for datasets exhibiting both continuous and categorical data. The final chapter of Part III and last chapter of the book is chapter 15, which introduces nonignorable missing-data models and briefly reviews the literature on this topic. This chapter is perfect for a savvy investigator familiarizing themselves with challenges with data that are missing not at random, as well as a researcher wanting to contribute to this area.

Almost two decades since its release, Little and Rubin's *Statistical Analysis with Missing Data*, remains a timeless resource for anyone analysing or wanting to do research for incomplete data. In particular, its emphasis on underlying patterns and mechanisms, and simultaneous presentation of various inferential tools, facilitate choosing appropriate methods for analysis, and enable accurate comparison of approaches. Its reference list provides the curious reader a great resource on the classical literature and allows him/her to navigate through the recent research. In the era of big data, more and messier data will increasingly become available. Such increased volume and variety of missing data necessitates analysts to understand and correctly choose appropriate methods, and for researchers to develop new methods when existing methods fail.

Richard Valliant and Jill A. Dever (2017)
Survey Weights: A Step-by-step Guide to Calculation, 1st ed.
Stata Press

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This book takes to the reader to a comprehensive journey in the initial steps of the analysis of a complex survey. The definition of sampling weights is one of the most crucial tasks for the methodologist to implement. Proper adjustments in the survey weights will yield to unbiased and precise inferences about the parameters of interest in the survey. However, following a naïve approach to the adjustment of sampling weights, or even worse, doing nothing to face the deficiencies of sampling frames and the nonresponse reality, will yield to inadequate information, and consequently poor decision making that will affect directly to the society that relies on the reliability and consistency of survey data.

The book starts with a general overview of the weighting process, defining the proper statistical context in which this kind of inference is carried out. Mainly, I found Figure 1.1 very clarifying about the process of representing a whole population from a selected sample from a defective sampling frame. In the first chapter, the authors also define the basic concepts for the reader to get used to the terminology that they will be using in the remaining chapters. Also, they present a quick and non-comprehensive introduction to some of the most commonly used sampling designs and introduce the critical topic of disposition codes that will define every single adjustment of sampling weights over the rest of the book.

Chapter two presents the first step when computing survey weights. They result from the definition of the sampling design. Therefore, the authors show some basic examples related to simple random sampling, stratified simple random sampling with varying stratum sizes, probability proportional to size sampling and multistage sampling. All these examples come with some Stata code that will select a sample according to the sampling method discussed and will generate the corresponding sampling weights. Finally, eligibility adjustment is briefly discussed as it is the most straightforward adjustment presented in the book.

Chapter three discusses the topic of nonresponse adjustments. The authors present the types of nonresponse and their patterns associated with. Then simple class adjustments are performed as a way to reduce weights variability. Therefore, the authors discuss some techniques for the estimation

of propensity scores, and they present the corresponding Stata code needed to implement such an adjustment. One attractive feature of this chapter is that the authors present classical methods based on logistic regressions as well as more complicated models such as regression trees, random forest, boosting, and so forth.

The next chapter presents a further explanation on a topic that deserves much attention: calibration. The authors discuss some of the traditional approaches to calibration, such as poststratification, raking, and general calibration. The way as they present the methodological applications are motivating: however, the basic user will find it a little tricky to follow them, because authors use some Stata complements, written by some other researchers, and attention may deviate from the central topic to a computational issue. Despite this workaround, the reader will find useful the rest of the chapter, where the authors present some practical problems such as negative calibration weights, reduction of weight variability and calibration to sample estimates.

One of the most important topics in practice is introduced in chapter five. The authors discourse the subject of variance estimation for a variety of sampling estimators. They first introduce the theoretical approach through the use of sampling formulas, and then they give the general result of the ultimate cluster technique, where a single-stage stratified with-replacement sampling design is considered. This technique is presented for both linear and nonlinear estimators, and comprehensive examples are given along with their Stata codes. Consequently, they show a discussion about the methods based on replicates: Jackknife, balanced repeated replication (BRR) - where Hadamard matrices and the Fay adjustment are explained, and the finite population version of the Bootstrap. Some advice and guidance are presented in the chapter, and I am sure that the reader will find this chapter so valuable as the authors explain procedures step-by-step.

It is my impression that chapter six would find a better place at the final of the book (as an appendix). Although the information contained in that chapter is essential, especially for those survey methodologists working with nonprobability surveys, the reading is not fluent, because before and after that very chapter the authors are discussing weighting from a design-based perspective, and chapter six (in the middle of the book) is about model-based inference. The authors present some predictors for a population total, based on regression models; later, they define the corresponding weights as a function of the estimated regression coefficients.

Chapter seven returns to the design-based context discussing two-phase sampling, and a variety of problems that methodologist face in complex situations. Also, the authors present a complete discussion about the use of survey weights when estimating analytical quantities, such as regression coefficients, and they discuss whether to use weights or not. Finally, after a comprehensive presentation of the adjustments done to the original sampling weights by the survey methodologists, the book concludes with an essay about survey quality. I found myself astonished before this excellent excerpt where authors show their expertise and seniority. The reading is clear as they summarize the practice of a good weighting process and give the reader many hints to examine the quality and pertinence of every single step in the adjustment of the weights.

It is noticeable how Stata users are growing all over the segment of official statistics, and they would benefit from this book. However, as a native R user, I found it very valuable as, for myself, it was effortless to translate all the Stata code into R code or SAS code. Across all the computational platforms that can be used, when it comes to dealing with complex survey data there appear to be a common language. First, defining the strata, then describing the primary sampling units, then the corresponding weights, and so on. Because of this similarity, the book will be very much appreciated for everyone who earns a basic knowledge of statistical programming, independent from the platform.

Country Reports

ARGENTINA

Reporting: **Veronica Beritich**

National Study on the Profile of Persons with Disabilities

The Principles and Recommendations for Population and Housing Censuses, Revision 2, of the United Nations (UN, 2010), based on the Washington Group proposal, dedicate a section to the inclusion of the measurement of disability in Population Censuses and in complementary or specific surveys. The concept "disability status" aims to "characterize the population with and without disability". People with disabilities are those who "have a greater risk than the general population of experiencing restrictions in their development."

The need to quantify, to know and to establish the needs of the population with disabilities in the territory at a national and regional level constitutes a sustained and intensified historical demand in Argentina. This allows government to estimate the demand of resources that are required for their assistance. Additionally, counting with this essential information for formulating public policies will favor greater integration of disables not only in the field of health, but also in education, employment and urban planning.

The National Institute of Statistics and Censuses (INDEC) presents the preliminary results of the National Study on the Profile of Persons with Disabilities, in agreement with the National Agency for Disability (ANDIS), within the framework of the National Disability Plan (decree n ° 868/2017). During April and May 2018, INDEC interviewed around 41,000 private homes in urban areas of 5,000 and more inhabitants throughout the national territory. It used the direct interview methodology with digital devices, or tablets. This operation has national and regional representation, involving six statistical regions: Great Buenos Aires, Northwest, Northeast, Cuyo, Pampean, and Patagonia.

The preliminary results of the study on July 19 present the prevalence of difficulties and main sociodemographic characteristics of the population of 6 years and over living in private homes in the urban area, in localities of 5,000 and more inhabitants of the country.

According to the “International Classification of Functioning, Disability and Health (CIF)” from the World Health Organization (WHO, 2001), “disability” refers to any limitation in the activity and restriction in the participation, originated in the interaction between a person with a health condition and the contextual factors (physical, human, attitudinal and sociopolitical environment), in order to develop in their daily life within their physical and social environment, according to their sex and age.

This study aims to quantify the population of 6 years and over with difficulties to see, hear, walk or climb stairs, grab and lift objects with their arms or hands, take care of themselves (for example, to bathe, dress or eat alone), talk or communicate, understand what is said, learn things, remember or concentrate, control their behavior, and play with other children of their age (only for the population aged from 6 to 12 years old). It also includes people using a hearing aid, and people having a valid disability certificate, even if they do not have a difficulty.

The specific objective is to describe the profile of the population with difficulties according to: relationship or kinship with the rest of the household members, sex, age, place of birth, health coverage, social security, educational characteristics, conjugal situation, work characteristics, possession and use of disability certificate, age, origin of the difficulty, and housing conditions.

The operative definition is "People with difficulty" involving those people with at least one answer "yes, a lot of difficulty" or "cannot do it" in the questions about difficulties.

The prevalence of persons with difficulty of 6 years and over is 10.2%. In absolute terms, it corresponds to an estimate of 3,571,983 people living in localities of 5,000 or more inhabitants. Cuyo region has the highest proportion of people with impairment (11.0%) and Patagonia region has the lowest proportion (9%).

In general, prevalence is greater for women (10.8%) than for men (9.5%). Among people aged 80 years and over, there is a difference of 11% between both sexes. Besides, about 50% of women aged 80 and over have some difficulty. The prevalence of 5% among the youngest persons, from 6 to 39 years old is lower than in the adults group, from 40 to 64 years old (12%). Prevalence for people aged 65 and over exceeds 25% and, in people aged 80 and over, it is 46.6%.

Among males with difficulty, 32.5% correspond to a population aged 65 and over. Meanwhile, in the case of women with difficulty, prevalence in that age group reaches 41.9%. Among the population with only one difficulty, the most frequent kind is motor difficulty (42.7%), followed by visual (23.3%), auditory (18.6%), and mental-cognitive difficulties (12.7%). Speech and communication (1.5%) as well as self-care (1.2%) are the least prevalent.

In the age group 6 to 14 years, those who have only mental-cognitive difficulty predominate with a 48.3% prevalence. Among those 65 and over, having motor impairment only stands out (53.2%). Meanwhile, in the group of 15 to 64 years, having motor difficulty only (39.9%) or having visual difficulty only (30%) are dominant.

A valid disability certificate mainly allows to obtain a free transport pass, comprehensive medication, medical coverage, and to obtain rehabilitation benefits like transportation, educational benefits, etc. Approximately 60% of people with difficulty do not have a certificate of disability but, among those who have a valid certificate, only 9.5% do not use it.

General information on this survey can be found at (https://www.indec.gov.ar/).

For further information, please contact ces@indec.mecon.gov.ar.

CANADA

Reporting: **Laurie Reedman**

A pilot project using Municipal Wastewater to Measure Cannabis Consumption: Experimental Estimates

Over the last year Statistics Canada has been updating the national statistical system to capture the social and economic changes related to the legalization of cannabis. A key set of information pertains to the consumption of cannabis in Canada. Given that cannabis was previously illegal accurate measures of consumption were difficult to obtain as the stigma associated with use, or reluctance to disclose purchases from non-regulated suppliers are two factors that could contribute to under-reporting.

In an effort to address the issue of under-reporting Statistics Canada is exploring the use of a new technique called Wastewater-based Epidemiology (WBE). WBE has been used in Europe since 2007 to report on the relative consumption of different types of drugs in large cities. When a person consumes cannabis (THC), his or her body processes the cannabis into a metabolite THC-COOH that is later eliminated from the body into the wastewater system. WBE involves sampling municipal wastewater flows, and conducting chemical analysis of the samples using specialized equipment and techniques to measure concentrations of compounds in the wastewater, and in this case, THC-COOH. The advantages of WBE include low cost, no burden on residents or businesses, quick

turnaround time from sampling to reporting, the ability to report for fairly small areas such as a single large city, and importantly, the potential to more accurately determine the total mass of cannabis consumed.

Statistics Canada has implemented a pilot-test of wastewater-based epidemiology. The pilot project covers parts of five large urban centres across the country, and close to 8.4 million people. Each site is sampled continuously during the second week of the month. Sampling started in March 2018, and will continue through the spring of 2019. All processes and analytical performance are compliant with the Sewage Analysis Core Group Europe (SCORE), a worldwide academic consortium specializing in wastewater-based epidemiology.

Consumption of cannabis is calculated as the product of drug metabolite concentration, flow rate through the wastewater treatment plant, excretion rate and drug potency, divided by the population served by the wastewater treatment plant. A scaling factor can also be applied to achieve daily, weekly or annual estimates. In the case of cannabis, there are many different products available, with different potency levels and different modes of consumption. The rate at which the metabolite is eliminated from the body depends on all these factors. For this reason, a composite excretion rate should be calculated to account for the relative popularity of the different products. However, to date we do not have all the parameters needed to calculate a composite excretion rate, therefore an approximation cited in WBE literature is used.

Estimates from the first few months of data collection are coherent with what researchers have found through Statistics Canada surveys, that is, the annual total consumption of cannabis in Canada is in the range of 500 to 1500 metric tonnes, and regular cannabis users are consuming on average just under 1 gram per day. The wide uncertainty is a reflection of our lack of confidence in the true distribution of excretion rates and potency of cannabis products, and variability in the monthly data.

FIJI

Reporting: **M. G. M. Khan**

Fiji National Housing and Population Census 2017

The Fiji Bureau of Statistics (FBoS) had its 7th round of Housing and Population Census from 17th September- 8th October 2017. A de-facto method of counting was used where each persons were enumerated wherever they were during census night which was 17th September. Computer Assisted Personal Interview (CAPI) was used for the first time in the history of Census taking in Fiji via the Survey Solutions an application provided by the World Bank. The first Census release went into publication two months after the Census. Info graphics have been used extensively in the 2nd release. The 2017 Census results are available online at (https://www.statsfiji.gov.fj/index.php/census-2017/census-2017-release-1).

Contact persons: Ms Maria Musudroka (mariam@statsfiji.gov.fj),
Mr Mosese Qaloewai (mqaloewai@statsfiji.gov.fj).

Seasonal Adjustment of Time Series Data

FBoS has been releasing Bi-Annual Seasonally Adjusted Tourist Arrival since December 2016. Since May 2018, Seasonally Adjusted Visitor Arrivals have been released on a monthly basis. This is a development work and the Australian Bureau of Statistics (ABS) has provided technical support. The software currently used for Seasonal Adjustment is SEASABS (Seasonal Adjustment Software for ABS) provided freely by ABS. Seasonally Adjusted Fiji Visitor Arrivals releases are available online at (https://www.statsfiji.gov.fj/index.php/latest-releases/tourism-and-migration/visitor-arrivals).

Contact persons: Ms Shaista Bi (shaistab@statsfiji.gov.fj), Mr Rupeni Tawake (rtawake@statsfiji.gov.fj).

2014 GDP Rebase

With the increase in demand for a recent base year, the Fiji Bureau of Statistics is currently working on a GDP rebase for the year 2014. A Supply and Use table for 2014 will also be compiled. The 2014 industry reports for the entire economy is used in the GDP rebasing exercise. Apart from the industry reports, the indicators and deflators used for GDP estimation like the Industrial Production Index, Consumer Price Index, Import & Export Price Index and Building Material Price Index will all be rebased to the year 2014.

These are important development works to update Fiji's GDP by expenditure and income approach which are currently available up to 2011. These statistics are published on our website (https://www.statsfiji.gov.fj/) as well as on our quarterly publication titled Key Statistics.

Contact persons: Ms Amelia Tungi (ameliat@statsfiji.gov.fj), Ms Artika Devi (artikad@statsfiji.gov.fj).

Household Income and Expenditure Survey (HIES) 2019-2020

FBoS is currently preparing for the 2019-2020 HIES. The HIES is a year-long nationwide survey which gathers information on household income and expenditure from a representative sample of households. The major uses of HIES data are as follows:

1. The reweighting of the Consumer Price Index (CPI).
2. Benchmark estimates are derived when such surveys are carried out while indicators are used to provide non-survey year estimates.
3. The collection of Household Sector information which is an important input to the compilation of GDP.
4. Reveal the extent and nature of poverty in Fiji.
5. Informal sector studies.

A new module will be included in the 2018-2019 HIES and is titled 'Multidimensional Poverty'. CAPI will also be used for the first time in this survey. The contact persons are Ms Maria Musudroka (mariam@statsfiji.gov.fj) and Mr Mosese Qaloewai (mqaloewai@statsfiji.gov.fj).

LATVIA

Reporting: **Mārtiņš Liberts**

Workshop of the Baltic–Nordic–Ukrainian Network on Survey Statistics 2018

The Workshop of the Baltic–Nordic–Ukrainian Network on Survey Statistics 2018 was organised in Jelgava (Latvia) on August 21–24. It was the twenty-second annual event organised by the Baltic–Nordic–Ukrainian (BNU) Network on Survey Statistics (https://wiki.helsinki.fi/display/BNU). The aim of the workshop was to maintain the cooperation between survey statisticians in Baltic and Nordic countries, Ukraine and Belarus. The objectives were to present recent achievements and results, learn from teachers and colleagues, discuss the future, share opinions and experience and strengthen contacts between survey statisticians. The main topic of the workshop in 2018 was "Population census based on administrative data". Other survey statistics related topics were presented as lectures or contributed papers.

There were 61 participants from 12 countries – Austria, Belarus, Estonia, Finland, Latvia, Lithuania, Norway, Poland, Russia, Sweden, Ukraine, and the United Kingdom. The audience of the workshop was diverse – consisting of undergraduate students, research students, university teachers and practising statisticians.

The keynote speakers were Prof. Li-Chun Zhang (University of Southampton, UK & Statistics Norway) and Dr. Anders Holmberg (Statistics Norway). Keynote speakers gave a series of six

lectures entitled "*The past, present and future of population censuses: Methodology and quality aspects when data sources are being reused and combined to transform a census system*". There were seven lectures given by invited speakers – Maciej Beręsewicz (Poznań University of Economics and Business, Poland & Statistical Office in Poznań, Poland), Natallia Bokun (Belarus State Economic University), Juris Breidaks (Central Statistical Bureau of Latvia), Danutė Krapavickaitė (Vilnius Gediminas Technical University, Lithuania), Manuela Lenk (Statistics Austria), Prof. Li-Chun Zhang (University of Southampton, UK & Statistics Norway), and Carl-Erik Särndal (Statistics Sweden). There were 28 presentations of contributed papers all discussed by invited discussants.

The best student paper award was announced for the first time at the BNU events. Six papers presented at the workshop were competing for the award. The winner of the first BNU Best Student Paper Award is Diana Sokurova (University of Tartu, Estonia) with a paper titled "*The Local Pivotal Method and its Application on StatVillage Data*". Congratulations!

The sponsors of the workshop were the International Statistical Institute (World Bank Trust Fund for Statistical Capacity Building), the International Association of Survey Statisticians, the Nordplus Higher Education program (Nordic Council of Ministers), and the Central Statistical Bureau of Latvia.

The next annual event organised by the BNU network will be the Fifth Baltic–Nordic Conference on Survey Statistics (BaNoCoSS) organised in 16–20 June 2019 in Örebro, Sweden.

The BNU workshop 2018 website: (http://home.lu.lv/~pm90015/workshop2018).

For further information, please contact martins.liberts@csb.gov.lv.

MALAYSIA

Reporting: **YBhg. Dato' Sri Mohd Uzir Mahidin**

Key features of the My Local Stats initiative

My Local Stats is disseminated via application and publication. In line with the Department of Statistics Malaysia, 2015-2020 Transformation Plan, Strategy 3: Strengthening the Statistical Delivery System, an interactive system mobile application known as My Local Stats was developed by the Department of Statistics, Malaysia (DOSM).

My Local Stats is developed in two versions: web and the smartphone (mobile apps). It allows users to access statistics up to the district level through the DOSM website and their respective smartphone apps. My Local Stats 1.0 (Phase 1) provides the latest statistics of the number of establishments by major district, derived from the Economic Census. Birth and death statistics as well as population estimates by regions for 2015 and 2017 are also available.

The first publication of My Local Stats was introduced in 2017. This publication contains Social and Economic statistics up to the district level. Social statistics comprise Basic Information; Population; Housing; Labour Force; Household Income & Expenditure; Education; Health; Welfare Services; Public Safety; Communication and Recreation; Internet and Social Media; and Basic Amenities. Meanwhile, the economic statistics comprise Gross Domestic Product (GDP); Consumer Price Index (CPI); Export & Import; Agriculture; Mining and Quarrying; Manufacturing; Construction and Services.

This publication was launched by the Deputy Prime Minister Malaysia, Dato' Seri Dr Wan Azizah Dr Wan Ismail on 26th July 2018 at the Multimedia University, Cyberjaya.

NEW ZEALAND

Reporting: **Susmita Das**

Stats NZ exploring different ways to collect household survey information

Stats NZ is determining how it can integrate its existing household surveys into a yet-to-be-developed large-scale attribute survey.

Stats NZ is in a strong position to integrate survey content because of its ongoing work standardising production and collection systems. The census attribute survey being developed as part of the proposed new census model will also aid this project. Other than the post-censal surveys, the three main surveys carried out by Stats NZ are the Household Labour Force Survey (HLFS), the General Social Survey, and the Household Economic Survey.

The survey content could be integrated in various ways:

- dropping existing surveys and developing a new one
- merging existing surveys to have fewer surveys
- combining some stages of existing surveys, for example making data collection a single process.

Initially we identified a set of criteria to decide which options should be considered. Five options were then assessed: full integration, no integration, and three intermediate options. Each option was then rated based on user and producer acceptability, the extent of sampling method changes, sample sizes and sampling cycle, reduced costs, flexibility gains, and loss of information.

The strongest option was integrating all household surveys, except the HLFS, into the new census attribute survey. The fallback option was to keep all the surveys separate but make use of higher pooling opportunities for some of the content. We are currently identifying what steps are needed to obtain the preferred option.

Administrative data census model

Stats NZ is also investigating an administrative data census model that would combine linked administrative data and survey sources. A large-scale attribute survey sampling 5 percent of the population annually would collect a range of social and economic variables down to small areas and small population groups that cannot otherwise be obtained from linked administrative data sources.

For more information, please contact susmita.das@stats.govt.nz.

POLAND

Reporting: **Tomasz Żądło**

Second Congress of Polish Statistics

The Second Congress of Polish Statistics took place in Warsaw from 10th to 12th July 2018, on the 100th anniversary of the founding of Statistics Poland. It was organized by Statistics Poland and the Polish Statistical Association. Almost 500 participants took part in 32 sessions including four sessions on "Survey Sampling and Small Area Estimation" and three sessions on "Population statistics".

The detailed program is available here (https://kongres.stat.gov.pl/images/pdf/harmonogram_II_kongresu_statystyki_polskiej_en.pdf).

The book of abstracts and all presentations can be found at

- https://kongres.stat.gov.pl/images/pdf/abstrakty.pdf
- https://kongres.stat.gov.pl/en/sesje-naukowe/prezentacje/10-lipca
- https://kongres.stat.gov.pl/en/sesje-naukowe/prezentacje/11-lipca
- https://kongres.stat.gov.pl/en/sesje-naukowe/prezentacje/12-lipca

During the Second Congress of Polish Statistics 2018 the following persons were awarded the Jerzy Spława-Neyman Medal by the Chapter of the Polish Statistical Society: Prof. Czesław Domański (University of Łódź), Prof. Marie Hušková (Charles University in Prague), Prof. Jan Kordos (Warsaw School of Economics), Prof. Mirosław Krzyśko (Adam Mickiewicz University in Poznań) and Prof. Carl-Eric Särndal (Statistics Sweden).

Upcoming Conferences and Workshops

62nd ISI World Statistics Congress 2019 (ISI WSC 2019)

- **Organized by**: International Statistical Institute (ISI) 62nd ISI World Statistics Congress
- **When**: August 18-23, 2019
- **Where**: Kuala Lumpur, Malaysia
- **Homepage**: http://www.isi2019.org/

This is a global gathering of statistical practitioners, professionals and experts from industries, academia and official authorities to exchange knowledge and establish networks for future engagements and collaborations.

The 62nd ISI WSC 2019 will bring together about 2,500 delegates, comprises statistical researchers, academia, industry practitioners, analysts and policymakers, from all over the world to share insights on development in statistical science and to advance application of statistics for discovery, innovation and decision making. About 1,300 papers in various statistical disciplines and applications will be presented and discussed over a period of five days. In addition to the Scientific Program, satellite seminars, meetings and short courses will be organized as the pre- and post-congress events. Organizers believe that such a gathering of great minds will definitely surface great things!

The Congress venue, Kuala Lumpur Convention Centre, is strategically located in the Kuala Lumpur City Centre (KLCC), overlooking the iconic PETRONAS Twin Towers and the 50-acre KLCC Park. The Centre is the city's most technologically–advanced, purpose-built facility for international, regional and local conventions,

Paper Submission for ISI WSC 2019 Contributed Paper Sessions (CPS)

IASS encourages members to submit abstracts and papers for Contributed Paper Sessions (CPS). The submission will be closed on 31 January 2019. Detailed submission guidelines can be found at (http://www.isi2019.org/submissions-guidelines/).

Paper Submission for the Cochran-Hansen Prize 2019 Competition

Submission of papers to the Cochran-Hansen Prize 2019 competition of the IASS will stay open until 15 February 2019. The prize is given for the best paper on survey research methods submitted by a young statistician from a developing or transition country. The complete announcement can be found at (http://isi-iass.org/home/cochran-hansen-prize/).

IASS Support to Conferences in 2019

The Executive Committee of the IASS has decided to support financially the following conferences and workshops that will be organized in 2019.

ITACOSM 2019 – the 6th ITAlian COnference on Survey Methodology

- **Organized by**: Survey Sampling Group (S2G) of the Italian Statistical Society (SIS) and supported by the International Association of Survey Statisticians (IASS)
- **When**: June 5-7, 2019
- **Where**: Florence, Italy
- **Homepage**: http://meetings3.sis-statistica.org/index.php/ITACOSM2019/ITACOSM2019

ITACOSM is a bi-annual international conference promoted by the Survey Sampling Group (S2G) of the Italian Statistical Society (SIS) whose aim is promoting the scientific discussion on the developments of theory and application of survey sampling methodologies in the fields of economics, social and demographic sciences, of official statistics and in the studies on biological and environmental phenomena.

Fundamental changes in the nature of data, their availability, the way in which they are collected, integrated, and disseminated are a big challenge for all those working with designed data from surveys as well as organic data. ITACOSM 2019 tries to give a response to the increasing demand from researchers and practitioners for the appropriate methods and right tools to face these changes.

ITACOSM 2019 will include plenary (invited) sessions on very relevant themes, specialized (invited) sessions on specific topics, contributed sessions, and poster sessions.

Keynote speakers for ITACOSM 2019 are:

- Prof. Paul Biemer (RTI International)
- Prof. Elisabetta Carfagna (University of Bologna), as past-S2G coordinator
- Prof. David Haziza (University of Montréal)
- Prof. Li-Chun Zhang (University of Southampton, Statistics Norway, University of Oslo)

The 5th Baltic-Nordic Conference on Survey Statistics – BaNoCoSS-2019

- **Organized by**: the Baltic-Nordic-Ukrainian (BNU) Network on Survey Statistics and Örebro University, in cooperation with Statistics Sweden, and supported by the International Association of Survey Statisticians (IASS)
- **When**: June 16-20, 2019
- **Where**: Örebro, Sweden
- **Homepage**: https://www.oru.se/hh/banocoss2019

April 8, 2019 is a deadline for submission of titles and abstracts of contributed papers and posters.

BaNoCoSS-2019 is a scientific conference presenting developments on theory, methodology and applications of survey statistics in a broad sense.

The conference provides a platform for discussion and exchange of ideas for a variety of people. These include, for example, statisticians, researchers and other experts of universities, national statistical institutes, and research institutes and other governmental bodies, and private enterprises, dealing with survey research methodology, empirical research and statistics production. University students in statistics and related disciplines provide an important interest group of the conference.

The conference will include key note sessions, specialized (invited) sessions on specific topics, contributed sessions, and poster sessions. Keynote speakers are Roberto Benedetti, professor, University of Chieti-Pescara, and Federica Piersimoni, Dr, senior researcher, Italian National Statistical Institute with presentations on the theme *Spatial survey sampling and analysis and GIS*. Additional speakers are invited for presentations on other areas of survey statistics. Two of them are Esa Läärä, professor, University of Oulu, with presentation *Uses of sampling methodology in epidemiologic research*, and Vera Toepoel, Dr, assistant professor, University of Utrecht, with *Mobile surveys and sensor data*.

Examples of topics of contributed papers and posters: Model-based and non-parametric methods; Non-response and non-sampling errors in surveys; Sampling design and estimation methods; Combining data from registers, surveys and associated methods; Use of big data, web and internet surveys; Survey methodology; Teaching of survey statistics.

EESW19, the sixth biennial European Establishment Statistics Workshop

- **Hosted by**: EUSTAT, the statistical office of the Basque Country, Spain, and supported by EFTA and International Association of Survey Statisticians (IASS).
- **When**: 24-27 September 2019
- **Where**: Bilbao, the Basque Country, Spain
- **Homepage**: https://statswiki.unece.org/display/ENBES/EESW19
- **Registration deadline**: March 31, 2019

Continuing in the traditions of its preceding five events, EESW19 is devoted to furthering the understanding of topics in designing, collecting, analysing and using statistics about and for businesses and other organizational entities. EESW19 is aiming to continue to be a prime European venue for official statistics methodologists, academic researchers and private sector professionals in the fields of business, economic and other areas of establishment statistics to exchange experiences, share new methods and findings, learn from each other, and create opportunities for deeper collaboration.

The first day is devoted to short courses, followed by the traditional two-and-a-half-day workshop. Methodologists, academic researchers and private sector professionals are invited to submit the papers on all topics related to statistics about and for businesses and other organisational entities: sample design, data collection, response process, editing and imputation, estimation, modelling, quality assessment, data presentation and dissemination, metadata and process data for establishment statistics, cross-national statistics, and similar.

Especially are welcome contributions on some of the emerging topics:

- Development and implementation of electronic communication,
- Making best use of administrative and alternative data sources,
- Speeding up production.

Survey Process Design Workshop

- **Organized by**: The Federal University of Agriculture and supported by EFTA and International Association of Survey Statisticians (IASS).
- **When**: February 2019, a one-day event.
- **Where**: Abeokuta, Ogun State, Nigeria.
- **Homepage of the university**: https://unaab.edu.ng/

In Other Journals

Journal of Survey Statistics and Methodology

Volume 6, Issue 3, September 2018

https://academic.oup.com/jssam/issue/6/3

Survey Statistics

An Unbalanced Ranked-Set Sampling Method to Get More Than One Sample from Each Set
B Panahbehagh; R Bruggemann; A Parvardeh; M Salehi; M R Sabzalian

Estimating Survey Questionnaire Profiles for Measurement Error Risk
Barry Schouten; Frank Bais; Vera Toepoel

Survey Methodology

Nonresponse and Measurement Error Variance among Interviewers in Standardized and Conversational Interviewing
Brady T West; Frederick G Conrad; Frauke Kreuter; Felicitas Mittereder

Overview of Three Field Methods for Improving Coverage of Address-Based Samples for In-Person Interviews
Rachel Harter; Ned English

Mitigating Satisficing in Cognitively Demanding Grid Questions: Evidence from Two Web-Based Experiments
Joss Roßmann; Tobias Gummer; Henning Silber

New Insights on the Cognitive Processing of Agree/Disagree and Item-Specific Questions
Jan Karem Höhne; Timo Lenzner

Motivated Misreporting in Web Panels
Ruben L Bach; Stephanie Eckman

Volume 6, Issue 4, December 2018

https://academic.oup.com/jssam/issue/6/4

Survey Statistics

A Bayesian Analysis of Design Parameters in Survey Data Collection
Barry Schouten; Nino Mushkudiani; Natalie Shlomo; Gabi Durrant; Peter Lundquist; James Wagner

Survey Methodology

How Do Question Evaluation Methods Compare in Predicting Problems Observed in Typical Survey Conditions?
Aaron Maitland; Stanley Presser

Improving Traditional Nonresponse Bias Adjustments: Combining Statistical Properties with Social Theory
Andy Peytchev; Stanley Presser; Mengmeng Zhang

Are Interviewer Effects on Interview Speed Related to Interviewer Effects on Straight-Lining Tendency in the European Social Survey? An Interviewer-Related Analysis
Caroline Vandenplas; Geert Loosveldt; Koen Beullens; Katrijn Denies

A Method for Accounting for Classification Error in a Stratified Cellphone Sample
Marcus E Berzofsky; Caroline B Scruggs; Howard Speizer; Kimberly C Peterson; Bo Lu; Timothy Sahr

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Survey Methodology

Statistics Canada Statistique Canada Canada

Volume 44, Number 2, December 2018

https://www150.statcan.gc.ca/n1/pub/12-001-x/12-001-x2018002-eng.htm

Measuring uncertainty associated with model-based small area estimators
J.N.K. Rao, Susana Rubin-Bleuer and Victor M. Estevao

Small area estimation for unemployment using latent Markov models
Gaia Bertarelli, M. Giovanna Ranalli, Francesco Bartolucci, Michele D'Alò and Fabrizio Solari

Sample-based estimation of mean electricity consumption curves for small domains
Anne De Moliner and Camelia Goga

Coordination of spatially balanced samples
Anton Grafström and Alina Matei

Using balanced sampling in creel surveys
Ibrahima Ousmane Ida, Louis-Paul Rivest, and Gaétan Daigle

Optimizing a mixed allocation
Antoine Rebecq and Thomas Merly-Alpa

Variance estimation under monotone non-response for a panel survey
Hélène Juillard and Guillaume Chauvet

How to decompose the non-response variance: A total survey error approach
Keven Bosa, Serge Godbout, Fraser Mills and Frédéric Picard

Comparison of the conditional bias and Kokic and Bell methods for Poisson and stratified sampling
Thomas Deroyon and Cyril Favre-Martinoz

Criteria for choosing between calibration weighting and survey weighting
Mohammed El Haj Tirari and Boutaina Hdioud

Journal of Official Statistics

Volume 34: Issue 3 (September 2018)

https://content.sciendo.com/view/journals/jos/34/3/jos.34.issue-3.xml

Responsive and Adaptive Design for Survey Optimization
Asaph Young Chun, Steven G. Heeringa and Barry Schouten

A Distance Metric for Modeling the Quality of Administrative Records for Use in the 2020 U.S. Census
Andrew Keller, Vincent T. Mule, Darcy Steeg Morris and Scott Konicki

Transitioning a Survey to Self-Administration using Adaptive, Responsive, and Tailored (ART) Design Principles and Data Visualization
Joe Murphy, Paul Biemer and Chip Berry

A Study of Interviewer Compliance in 2013 and 2014 Census Test Adaptive Designs
Gina Walejko and James Wagner

Estimation of True Quantiles from Quantitative Data Obfuscated with Additive Noise
Debolina Ghatak and Bimal Roy

Accounting for Spatial Variation of Land Prices in Hedonic Imputation House Price Indices: a Semi-Parametric Approach
Yunlong Gong and Jan de Haan

Accounting for Complex Sampling in Survey Estimation: A Review of Current Software Tools
Brady T. West, Joseph W. Sakshaug and Guy Alain S. Aurelien

Generalized Method of Moments Estimators for Multiple Treatment Effects Using Observational Data from Complex Surveys
Bin Liu, Cindy Long Yu, Michael Joseph Price and Yan Jiang

Volume 34: Issue 4 (December 2018)

https://content.sciendo.com/view/journals/jos/34/4/jos.34.issue-4.xml

Preface
Martin Karlberg, Silvia Biffignandi, Piet J.H. Daas, Loredana Di Consiglio, Anders Holmberg, Risto Lehtonen, Ralf T. Münnich, Boro Nikic, Marianne Paasi, Natalie Shlomo, Roxane Silberman and Ineke Stoop

Data Organisation and Process Design Based on Functional Modularity for a Standard Production Process
David Salgado, M. Elisa Esteban, Maria Novás, Soledad Saldaña and Luis Sanguiao

Efficiency and Agility for a Modern Solution of Deterministic Multiple Source Prioritization and Validation Tasks
Annalisa Cesaro and Leonardo Tininini

Detecting Reporting Errors in Data from Decentralised Autonomous Administrations with an Application to Hospital Data
Arnout van Delden, Jan van der Laan and Annemarie Prins

Population Size Estimation and Linkage Errors: the Multiple Lists Case
Loredana Di Consiglio and Tiziana Tuoto

Statistical Matching as a Supplement to Record Linkage: A Valuable Method to Tackle Nonconsent Bias?
Jonathan Gessendorfer, Jonas Beste, Jörg Drechsler and Joseph W. Sakshaug

Assessing the Quality of Home Detection from Mobile Phone Data for Official Statistics
Maarten Vanhoof, Fernando Reis, Thomas Ploetz and Zbigniew Smoreda

Megatrend and Intervention Impact Analyzer for Jobs: A Visualization Method for Labor Market Intelligence
Rain Opik, Toomas Kirt and Innar Liiv

Augmenting Statistical Data Dissemination by Short Quantified Sentences of Natural Language
Miroslav Hudec, Erika Bednárová and Andreas Holzinger

Survey Practice

Volume 11, Issue 2, 2018

https://www.surveypractice.org/issue/591

Probability-Based Samples on Twitter: Methodology and Application
Marcus E. Berzofsky, Tasseli McKay, Y. Patrick Hsieh, Amanda Smith

Smart(phone) Approaches to Mobile App Data Collection
Yasamin Miller, Cyrus DiCiccio, Juan Lavista, Cheryl Gore-Felton, Carlos Acle, Jeff Hancock, Amanda Richardson, Lorene Nelson, Oxana Palesh, Ingrid Oakley-Girvan

Within-Household Selection and Dual-Frame Telephone Surveys: A Comparative Experiment of Eleven Different Selection Methods
Jennifer Marlar, Manas Chattopadhyay, Jeff Jones, Stephanie Marken, Frauke Kreuter

Comparing Response Rates, Costs, and Tobacco-Related Outcomes Across Phone, Mail, and Online Surveys
Elizabeth M. Brown, Lindsay T. Olson, Matthew C. Farrelly, James M. Nonnemaker, Haven Battles, Joel Hampton

Taking Another Look at Counterarguments: When do Survey Respondents Switch their Answers?
Thomas R. Marshall

Ask the Expert: Polling the 2018 Elections
Scott Keeter

Protecting Human Subjects in the Digital Age: Issues and Best Practices of Data Protection
Thomas Jamieson, Güez Salinas

Interview with an Expert Series – Usability Testing in Survey Research
Nicholas Parker

Developing a New Measure of Transportation Insecurity: An Exploratory Factor Analysis
Alix Gould-Werth, Jamie Griffin, Alexandra K. Murphy

Predictors of Multitasking and its Impact on Data Quality: Lessons from a Statewide Dual-frame Telephone Survey
Eva Aizpurua, Ki H. Park, Erin O. Heiden, Jill Wittrock, Mary E. Losch

Exploring Reminder Calls Intended to Increase Interviewer Compliance with Data Collection Protocols
Amanda Nagle, Gina Walejko

The Use of Response Propensity Modeling (RPM) for Allocating Differential Survey Recruitment Strategies: Purpose, Rationale, and Implementation
Paul J Lavrakas, Michael Jackson, Cameron McPhee

Survey Research Methods **SRM**

Journal of the European Survey Research Association

Home About Login Register Search Current Archives Editorial Board

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Vol 12, No 2 (2018)

https://ojs.ub.uni-konstanz.de/srm/issue/view/138

Mixed-Mode: Past, Present, and Future
Edith D. DeLeeuw

Item Sum Double-List Technique: An Enhanced Design for Asking Quantitative Sensitive Questions
Ivar Krumpal, Ben Jann, Martin Korndörfer, Stefan Schmukle

Sequence Matters in Online Probing: the Impact of the Order of Probes on Response Quality, Motivation of Respondents, and Answer Content
Katharina Meitinger, Michael Braun, Dorothée Behr

From Strangers to Acquaintances? Interviewer Continuity and Socially Desirable Responses in Panel Surveys
Simon Kühne

How to Abbreviate Questionnaires and Avoid the Sins?
Paweł Kleka, Emilia Soroko

Respondent Mental Health, Mental Disorders and Survey Interview Outcomes
Francisco Perales Perez, Bernard Baffour

Vol 12, No 3 (2018)

https://ojs.ub.uni-konstanz.de/srm/issue/view/139

Two Simple Methods to Improve Official Statistics for Small Subpopulations
Nikolas Mittag

A Closer Look at Attitude Scales with Positive and Negative Items. Response Latency Perspectives on Measurement Quality
Jochen Mayerl, Christoph Giehl

Continuity Trumps? The Impact of Interviewer Change on Item Nonresponse
Kristin Hajek, Nina Schumann

Memory Gaps in the American Time Use Survey. Are Respondents Forgetful or is There More to it?
Antje Kirchner, Robert F Belli, Ana Lucía Córdova-Cazar, Caitlin E Deal

Randomization in Surveys with the Halton Sequence
Kien T. Le, Martha McRoy, Abdoulaye Diop

Is satisficing responsible for response order effects in rating scale questions?
Florian Keusch, Ting Yang

Statistical Journal of the IAOS

Volume 34, issue 3 (2018)

https://content.iospress.com/journals/statistical-journal-of-the-iaos/34/3

Interview with Irena Križman
Condon, Katherine M.

Development and application of international guidelines for statistical business registers: Discussant's remarks
Colledge, Michael

Development and application of the SBR guidelines of the Conference of European Statisticians
Rainer, Norbert

Development and application of the african development bank statistical business register guidelines
Madhow, Vikash; Muwele, Besa; Mungralee, Sariff

Experiences in application of the European Statistical System Business Registers Recommendations Manual
Liotti, Amerigo

Reconciliation of inconsistent data sources by correction for measurement error: The feasibility of parameter re-use
Pankowska, Paulina; Bakker, Bart; Oberski, Daniel L.; Pavlopoulos, Dimitris

The quality assurance of official statistics in Japan: Framework and practice
Takahashi, Masao

The National Statistical System in Nigeria: Developments and issues
Ekpenyong, Emmanuel John; Enang, Ekaette Inyang

Statistical monitoring for politics in the European Union and the OECD, supporting economic growth and social progress: A comparison between Europe 2020 and the OECD Better Life Initiative
Schnorr-Bäcker, Susanne

The Aggregate Association Index applied to stratified 2 × 2 tables: Application to the 1893 election data in New Zealand
Tran, Duy; Beh, Eric J.; Hudson, Irene L.

Small area estimation strategy for the 2011 Census in England and Wales
Baffour, Bernard; Silva, Denise; Veiga, Alinne; Sexton, Christine; Brown, James J.

Improving seasonal adjustment by accounting for sample error correlation using state space models
Mayer, Andreas

Synthetic time series technique for predicting network-wide road traffic
Cirillo, Cinzia; Han, Ying; Kaushik, Kartik; Lahiri, Parthasarathi

An updated analysis of the predictive ability of Mexico's Manufacturing Business Opinion Survey
Guerrero, Víctor M.; Sainz, Esperanza

Civil registration and national identity system all under one roof: Uganda's fastest path to the revitalization of CRVS for Africa
Habaasa, Gilbert; Natamba, Jonan

Early versus late respondents in web surveys: Evidence from a national health survey
Klingwort, Jonas; Buelens, Bart; Schnell, Rainer

Volume 34, issue 4 (2018)

https://content.iospress.com/journals/statistical-journal-of-the-iaos/34/4

Interview Olav Ljones
Condon, Katherine M.

The usability of administrative data for register-based censuses
Schulte Nordholt, Eric

Telematics data for official statistics: An experience with big data
Husek, Nicholas

Hard to count: How survey and administrative records modeling can enhance census nonresponse followup
Chow, Melissa C.; Janicki, Hubert P.; Kutzbach, Mark J.; Warren, Lawrence F.; Yi, Moises

What can administrative tax information tell us about income measurement in household surveys? Evidence from the Consumer Expenditure Surveys
Brummet, Quentin; Flanagan-Doyle, Denise; Mitchell, Joshua; Voorheis, John; Erhard, Laura; McBride, Brett

Evaluating race and Hispanic origin responses of Medicaid participants using census data
Fernandez, Leticia E.; Rastogi, Sonya; Ennis, Sharon R.; Noon, James M.

Using administrative records to increase quality and reduce burden in the Survey of Graduate Students and Postdoctorates in Science and Engineering
Gordon, Jonathan; Eckman, Stephanie; Einaudi, Peter; Sanders, Herschel; Yamaner, Mike

Accurate reporting of U.S. opioid deaths: Level, type, temporal and geographical comparability
Kadane, Joseph B.; Williams, Karl E.

Evaluating the utility of a commercial data source for estimating property tax amounts
Seeskin, Zachary H.

Predicting postsecondary trajectories in Virginia high schools using publicly available data
Pires, Bianica; Crandell, Ian; Arnsbarger, Madison; Lancaster, Vicki; Schroeder, Aaron; Shipp, Stephanie; Kang, Wendy; Robinson, Paula; Keller, Sallie

Realisation of 'administrative data first' in quarterly business statistics
Liken, Craig; Page, Mathew; Stewart, John

Big Data ethics and selection-bias: An official statistician's perspective
Tam, Siu-Ming; Kim, Jae-Kwang

When adjusting for the bias due to linkage errors: A sensitivity analysis
Di Consiglio, Loredana; Tuoto, Tiziana

Matching techniques and administrative data records linkage
Zeidan, Haitham

Community-based canvassing to improve the U.S. Census Bureau's Master Address File: California's experience in LUCA 2018
Kissam, Ed; Quezada, Cindy; Intili, Jo Ann

International Statistical Review

Volume 86, Issue 2, August 2018

https://onlinelibrary.wiley.com/toc/17515823/2018/86/2

Optimal Adaptive Designs with Inverse Ordinary Differential Equations
Eugene Demidenko

Missing Data: A Unified Taxonomy Guided by Conditional Independence
Marco Doretti, Sara Geneletti and Elena Stanghellini

The Use of Prior Information in Very Robust Regression for Fraud Detection
Marco Riani, Aldo Corbellini and Anthony C. Atkinson

Estimating Precision and Recall for Deterministic and Probabilistic Record Linkage
James Chipperfield, Noel Hansen and Peter Rossiter

Methods and Tools for Bayesian Variable Selection and Model Averaging in Normal Linear Regression
Anabel Forte, Gonzalo Garcia-Donato and Mark Steel

Towards a Routine External Evaluation Protocol for Small Area Estimation
Alan H. Dorfman

A History of the GLIM Statistical Package
Murray Aitkin

Measuring Identification Risk in Microdata Release and Its Control by Post-randomisation
Tapan K. Nayak, Cheng Zhang and Jiashen You

Comparing Inference Methods for Non-probability Samples
Bart Buelens, Joep Burger and Jan A. van den Brakel

Modeling Temporally Evolving and Spatially Globally Dependent Data
Emilio Porcu, Alfredo Alegria and Reinhard Furrer

Volume 86, Issue 3, December 2018

https://onlinelibrary.wiley.com/toc/17515823/2018/86/3

Statistical Medical Fraud Assessment: Exposition to an Emerging Field
Tahir Ekin, Francesca Ieva, Fabrizio Ruggeri and Refik Soyer

A Tutorial on the Practical Use and Implication of Complete Sufficient Statistics
Lisa Hermans, Geert Molenberghs, Marc Aerts, Michael G. Kenward and Geert Verbeke

A Brief Review of Approaches to Non-ignorable Non-response
Anna Sikov

Ranking Forecasts by Stochastic Error Distance, Information and Reliability Measures
Omid M. Ardakani, Nader Ebrahimi and Ehsan S. Soofi

A Method for Testing Additivity in Unreplicated Two-Way Layouts Based on Combining Multiple Interaction Tests
Zahra Shenavari and Mahmood Kharrati-Kopaei

Vine Copulas for Imputation of Monotone Non-response
Caren Hasler, Radu V. Craiu and Louis-Paul Rivest

On Properties of the MixedTS Distribution and Its Multivariate Extension
Asmerilda Hitaj, Friedrich Hubalek, Lorenzo Mercuri and Edit Rroji

Estimation and Testing in M-quantile Regression with Applications to Small Area Estimation
Annamaria Bianchi, Enrico Fabrizi, Nicola Salvati and Nikos Tzavidis

Geostatistical Methods for Disease Mapping and Visualisation Using Data from Spatio-temporally Referenced Prevalence Surveys
Emanuele Giorgi, Peter J. Diggle, Robert W. Snow and Abdisalan M. Noor

TRANSACTIONS ON
DATA PRIVACY
Foundations and Technologies
http://www.tdp.cat

Volume 11, Issue 2, August 2018

http://www.tdp.cat/issues16/vol11n02.php

PATCONFDB: Design and Evaluation of Access Pattern Confidentiality-Preserving Indexes
Alexander Degitz, Hannes Hartenstein

Biometric Systems Private by Design: Reasoning about privacy properties of biometric system architectures
Julien Bringer, Hervé Chabanne, Daniel Le Métayer, Roch Lescuyer

PRUDEnce: a System for Assessing Privacy Risk vs Utility in Data Sharing Ecosystems
Francesca Pratesi, Anna Monreale, Roberto Trasarti, Fosca Giannotti, Dino Pedreschi, Tadashi Yanagihara

Anonymising social graphs in the presence of active attackers
Sjouke Mauw, Yunior Ramírez-Cruz, Rolando Trujillo-Rasua

Volume 11, Issue 3, December 2018

http://www.tdp.cat/issues16/vol11n03.php

Big Data Privacy Context: Literature Effects On Secure Informational Assets
Celina Rebello, Elaine Tavares

Personalized Anonymization for Set-Valued Data by Partial Suppression
Takuma Nakagawa, Hiromi Arai, Hiroshi Nakagawa

EPIC: a Methodology for Evaluating Privacy Violation Risk in Cybersecurity Systems
Sergio Mascetti, Nadia Metoui, Andrea Lanzi, Claudio Bettini

Differentially Private Verification of Regression Predictions from Synthetic Data
Haoyang Yu, Jerome P. Reiter

ROYAL STATISTICAL SOCIETY
DATA | EVIDENCE | DECISIONS
Journal of the Royal Statistical Society
Statistics in Society
Series A

Volume 181, Issue 4, October 2018

https://rss.onlinelibrary.wiley.com/toc/1467985x/2018/181/4

Editorial

Editorial: Statistical flaws in the teaching excellence and student outcomes framework in UK higher education
Guy Nason

Book reviews

Metric Power
Thomas King

Hurricane Climatology: a Modern Statistical Guide using R
Isaac Dialsingh

The Mata Book: a Book for Serious Programmers and Those Who Want To Be
Baptiste Leurent

Graphics for Statistics and Data Analysis with R, 2nd edn
R. Allan Reese

Teaching Statistics
Neil Sheldon

Statistical Regression and Classification: from Linear Models to Machine Learning
Kuldeep Kumar

Handbook of Applied Modelling: Non-Gaussian and Correlated Data
Mark Pilling

Volume 182, Issue 1, January 2019

https://rss.onlinelibrary.wiley.com/toc/1467985x/2019/182/1

Original Articles

The contributions of paradata and features of respondents, interviewers and survey agencies to panel co-operation in the Survey of Health, Ageing and Retirement in Europe
Johanna Bristle, Martina Celidoni, Chiara Dal Bianco, Guglielmo Weber

The long-run effect of childhood poverty and the mediating role of education
Luna Bellani, Michela Bia

Forecasting gross domestic product growth with large unbalanced data sets: the mixed frequency three-pass regression filter
Christian Hepenstrick, Massimiliano Marcellino

A latent variable modelling approach for the pooled analysis of individual participant data on the association between depression and chlamydia infection in adolescence and young adulthood in the UK
Artemis Koukounari, Andrew J. Copas, Andrew Pickles

Evaluating the use of realtime data in forecasting output levels and recessionary events in the USA
Chrystalleni Aristidou, Kevin Lee, Kalvinder Shields

A Bayesian time varying approach to risk neutral density estimation
Roberto Casarin, German Molina, Enrique ter Horst

Ask your doctor whether this product is right for you: a Bayesian joint model for patient drug requests and physician prescriptions
Bhuvanesh Pareek, Qiang Liu, Pulak Ghosh

Bayesian semiparametric modelling of contraceptive behaviour in India via sequential logistic regressions
Tommaso Rigon, Daniele Durante, Nicola Torelli

Visualizing rate of change: an application to age-specific fertility rates
Han Lin Shang

Participating in a panel survey changes respondents' labour market behaviour
Ruben L. Bach, Stephanie Eckman

Model-based county level crop estimates incorporating auxiliary sources of information
Andreea L. Erciulescu, Nathan B. Cruze, Balgobin Nandram

Misspecification of multimodal random-effect distributions in logistic mixed models for panel survey data
Louise Marquart, Michele Haynes

A Bayesian approach to modelling subnational spatial dynamics of worldwide non-state terrorism, 2010–2016
André Python, Janine B. Illian, Charlotte M. Jones-Todd, Marta Blangiardo

Early illicit drug use and the age of onset of homelessness
Duncan McVicar, Julie Moschion, Jan C. van Ours

Obituaries

Ian Maclean MBE, MA, 1930–2018
Douglas Graham Altman, 1948–2018

Journal of the American Statistical Association

Volume 113, Issue 522 (2018)

https://www.tandfonline.com/toc/uasa20/113/522?nav=tocList

Presidential Address

Statistics: Essential Now More Than Ever
Barry D. Nussbaum

Applications and Case Studies

A Permutation Test for the Regression Kink Design
Peter Ganong & Simon Jäger

Estimating the Number of Sources in Magnetoencephalography Using Spiked Population Eigenvalues
Zhigang Yao, Ye Zhang, Zhidong Bai & William F. Eddy

Scalable Bayesian Modeling, Monitoring, and Analysis of Dynamic Network Flow Data
Xi Chen, Kaoru Irie, David Banks, Robert Haslinger, Jewell Thomas & Mike West

Statistical Methods for Standard Membrane-Feeding Assays to Measure Transmission Blocking or Reducing Activity in Malaria
Bruce J. Swihart, Michael P. Fay & Kazutoyo Miura

A Tailored Multivariate Mixture Model for Detecting Proteins of Concordant Change Among Virulent Strains of *Clostridium Perfringens*
Kun Chen, Neha Mishra, Joan Smyth, Haim Bar, Elizabeth Schifano, Lynn Kuo & Ming-Hui Chen

On Estimation of the Hazard Function From Population-Based Case–Control Studies
Li Hsu, Malka Gorfine & David Zucker

A Unified Framework for Fitting Bayesian Semiparametric Models to Arbitrarily Censored Survival Data, Including Spatially Referenced Data
Haiming Zhou & Timothy Hanson

Semiparametric Estimation of Longitudinal Medical Cost Trajectory
Liang Li, Chih-Hsien Wu, Jing Ning, Xuelin Huang, Ya-Chen Tina Shih & Yu Shen

Nested Hierarchical Functional Data Modeling and Inference for the Analysis of Functional Plant Phenotypes
Yuhang Xu, Yehua Li & Dan Nettleton

Disentangling Bias and Variance in Election Polls
Houshmand Shirani-Mehr, David Rothschild, Sharad Goel & Andrew Gelman

Theory and Methods

Model Selection for High-Dimensional Quadratic Regression via Regularization
Ning Hao, Yang Feng & Hao Helen Zhang

Bayesian Regression Trees for High-Dimensional Prediction and Variable Selection
Antonio R. Linero

Unsupervised Self-Normalized Change-Point Testing for Time Series
Ting Zhang & Liliya Lavitas

Multivariate Functional Principal Component Analysis for Data Observed on Different (Dimensional) Domains
Clara Happ & Sonja Greven

Boosting in the Presence of Outliers: Adaptive Classification With Nonconvex Loss Functions
Alexander Hanbo Li & Jelena Bradic

Bayesian Nonparametric Calibration and Combination of Predictive Distributions
Federico Bassetti, Roberto Casarin & Francesco Ravazzolo

Design-Based Maps for Finite Populations of Spatial Units
L. Fattorini, M. Marcheselli & L. Pratelli

Group-Linear Empirical Bayes Estimates for a Heteroscedastic Normal Mean
Asaf Weinstein, Zhuang Ma, Lawrence D. Brown & Cun-Hui Zhang

Equivalence of Regression Curves
Holger Dette, Kathrin Möllenhoff, Stanislav Volgushev & Frank Bretz

On Reject and Refine Options in Multicategory Classification
Chong Zhang, Wenbo Wang & Xingye Qiao

Dimensionality Reduction and Variable Selection in Multivariate Varying-Coefficient Models With a Large Number of Covariates
Kejun He, Heng Lian, Shujie Ma & Jianhua Z. Huang

Hidden Population Size Estimation From Respondent-Driven Sampling: A Network Approach
Forrest W. Crawford, Jiacheng Wu & Robert Heimer

On the Effect of Bias Estimation on Coverage Accuracy in Nonparametric Inference
Sebastian Calonico, Matias D. Cattaneo & Max H. Farrell

Parametric-Rate Inference for One-Sided Differentiable Parameters
Alexander R. Luedtke & Mark J. van der Laan

Distribution-Free Detection of Structured Anomalies: Permutation and Rank-Based Scans
Ery Arias-Castro, Rui M. Castro, Ervin Tánczos & Meng Wang

Efficient Functional ANOVA Through Wavelet-Domain Markov Groves
Li Ma & Jacopo Soriano

Invariant Inference and Efficient Computation in the Static Factor Model
Joshua Chan, Roberto Leon-Gonzalez & Rodney W. Strachan

Optimal Subsampling for Large Sample Logistic Regression
HaiYing Wang, Rong Zhu & Ping Ma

Residuals and Diagnostics for Ordinal Regression Models: A Surrogate Approach
Dungang Liu & Heping Zhang

The Bouncy Particle Sampler: A Nonreversible Rejection-Free Markov Chain Monte Carlo Method
Alexandre Bouchard-Côté, Sebastian J. Vollmer & Arnaud Doucet

Using Standard Tools From Finite Population Sampling to Improve Causal Inference for Complex Experiments
Rahul Mukerjee, Tirthankar Dasgupta & Donald B. Rubin

Nonparametric Maximum Likelihood Estimators of Time-Dependent Accuracy Measures for Survival Outcome Under Two-Stage Sampling Designs
Dandan Liu, Tianxi Cai, Anna Lok & Yingye Zheng

Efficient Estimation for Semiparametric Structural Equation Models With Censored Data
Kin Yau Wong, Donglin Zeng & D. Y. Lin

Testing for Inequality Constraints in Singular Models by Trimming or Winsorizing the Variance Matrix
Ori Davidov, Casey M. Jelsema & Shyamal Peddada

Semiparametric Ultra-High Dimensional Model Averaging of Nonlinear Dynamic Time Series
Jia Chen, Degui Li, Oliver Linton & Zudi Lu

Reviews

Partial Identification of the Average Treatment Effect Using Instrumental Variables: Review of Methods for Binary Instruments, Treatments, and Outcomes
Sonja A. Swanson, Miguel A. Hernán, Matthew Miller, James M. Robins & Thomas S. Richardson

Volume 113, Issue 523 (2018)

https://www.tandfonline.com/toc/uasa20/113/523?nav=tocList

Applications and Case Studies

Bayesian Neural Networks for Selection of Drug Sensitive Genes
Faming Liang, Qizhai Li & Lei Zhou

Controlling the FDR in Imperfect Matches to an Incomplete Database
Uri Keich & William Stafford Noble

Optimal Probability Weights for Inference With Constrained Precision
Michele Santacatterina & Matteo Bottai

Latent Variable Poisson Models for Assessing the Regularity of Circadian Patterns over Time
Sungduk Kim & Paul S. Albert

Modeling Motor Learning Using Heteroscedastic Functional Principal Components Analysis
Daniel Backenroth, Jeff Goldsmith, Michelle D. Harran, Juan C. Cortes, John W. Krakauer & Tomoko Kitago

A Bayesian Phase I/II Trial Design for Immunotherapy
Suyu Liu, Beibei Guo & Ying Yuan

Maximum Rank Reproducibility: A Nonparametric Approach to Assessing Reproducibility in Replicate Experiments
Daisy Philtron, Yafei Lyu, Qunhua Li & Debashis Ghosh

Front-Door Versus Back-Door Adjustment With Unmeasured Confounding: Bias Formulas for Front-Door and Hybrid Adjustments With Application to a Job Training Program
Adam N. Glynn & Konstantin Kashin

On the Long-Run Volatility of Stocks
Carlos M. Carvalho, Hedibert F. Lopes & Robert E. McCulloch

Cross-Screening in Observational Studies That Test Many Hypotheses
Qingyuan Zhao, Dylan S. Small & Paul R. Rosenbaum

Theory and Methods

On Recursive Bayesian Predictive Distributions
P. Richard Hahn, Ryan Martin & Stephen G. Walker

Distribution-Free Predictive Inference for Regression
Jing Lei, Max G'Sell, Alessandro Rinaldo, Ryan J. Tibshirani & Larry Wasserman

Assessing Time-Varying Causal Effect Moderation in Mobile Health
Audrey Boruvka, Daniel Almirall, Katie Witkiewitz & Susan A. Murphy

Quantitative Evaluation of the Trade-Off of Strengthened Instruments and Sample Size in Observational Studies
Ashkan Ertefaie, Dylan S. Small & Paul R. Rosenbaum

Quasi-Likelihood Estimation of a Censored Autoregressive Model With Exogenous Variables
Chao Wang & Kung-Sik Chan

A Weighted Edge-Count Two-Sample Test for Multivariate and Object Data
Hao Chen, Xu Chen & Yi Su

False Discovery Rate Smoothing
Wesley Tansey, Oluwasanmi Koyejo, Russell A. Poldrack & James G. Scott

Weighted False Discovery Rate Control in Large-Scale Multiple Testing
Pallavi Basu, T. Tony Cai, Kiranmoy Das & Wenguang Sun

Oracle Estimation of a Change Point in High-Dimensional Quantile Regression
Sokbae Lee, Yuan Liao, Myung Hwan Seo & Youngki Shin

Optimal Control and Additive Perturbations Help in Estimating Ill-Posed and Uncertain Dynamical Systems
Quentin Clairon & Nicolas J.-B. Brunel

On the Use of Reproducing Kernel Hilbert Spaces in Functional Classification
José R. Berrendero, Antonio Cuevas & José L. Torrecilla

Functional Feature Construction for Individualized Treatment Regimes
Eric B. Laber & Ana-Maria Staicu

Estimation and Inference of Heterogeneous Treatment Effects using Random Forests
Stefan Wager & Susan Athey

Quantile-Optimal Treatment Regimes
Lan Wang, Yu Zhou, Rui Song & Ben Sherwood

A Bayesian Machine Learning Approach for Optimizing Dynamic Treatment Regimes
Thomas A. Murray, Ying Yuan & Peter F. Thall

Robust High-Dimensional Volatility Matrix Estimation for High-Frequency Factor Model
Jianqing Fan & Donggyu Kim

Identifying Latent Structures in Restricted Latent Class Models
Gongjun Xu & Zhuoran Shang

Modeling Persistent Trends in Distributions
Jonas Mueller, Tommi Jaakkola & David Gifford

Edge Exchangeable Models for Interaction Networks
Harry Crane & Walter Dempsey

Confidence Regions for Spatial Excursion Sets From Repeated Random Field Observations, With an Application to Climate
Max Sommerfeld, Stephan Sain & Armin Schwartzman

A Randomized Sequential Procedure to Determine the Number of Factors
Lorenzo Trapani

Inference in Linear Regression Models with Many Covariates and Heteroscedasticity
Matias D. Cattaneo, Michael Jansson & Whitney K. Newey

On the Null Distribution of Bayes Factors in Linear Regression
Quan Zhou & Yongtao Guan

Review

Bayesian Inference in the Presence of Intractable Normalizing Functions
Jaewoo Park & Murali Haran

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- Istituto nazionale di statistica (Istat), Italy
- Statistics Korea, Republic of Korea
- Direcção dos Serviços de Estatística e Censos (DSEC), Macao, SAR China
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- Statistics New Zealand, New Zealand
- Statistics Norway, Norway
- Instituto Nacional de Estatística (INE), Portugal
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- Numérika (Asesoría estadística y estudios cuantitativos), Mexico
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