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Online Survey Data on Economic Effects of Lockdowns and Post-Stratification Data Adjustment: Evidence from Bulgaria

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Abstract

This contribution aims to discuss an original survey methodology, conceived in lockdown conditions, when face to face interviewing was prohibited and economic and sociological research faced obstacles in obtaining empirical data. An original pseudo-longitudinal Covid-CAWI is conducted in two fully harmonized waves. The basic methodological principles are elucidated along with limitations and advantages within the context of anti-epidemic measures and lockdowns in Bulgaria. The article elaborates the steps of data cleaning, conducted as an essential pre-processing step to high level of data quality. Special focus is devoted to posterior data optimization, using post-stratification adjustments. A comparison between weighted and unweighted data on economic effects is analysed. The paper contributes to the scientific debate on methodology insofar as online surveys become the one and only research opportunity for quantitative research in a crisis situation. The presented analysis of subsequent optimization procedures in Internet studies aims to open a discussion, especially in the context of socioeconomic research in a crisis situation where there are physical distance constraints. The data from the Covid-CAWI survey will be available for open access, so all interested in research may analyse the effects of the pandemic on social and economic life and debate on survey methodology.

Keywords: Lockdown, Computer Assisted Web Interview - CAWI, Post-stratification, Online Survey Methodology

JEL: C18, C61, C83

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and Sociology at the Bulgarian Academy of Sciences (IPS-BAS). Ekaterina Tosheva designed, tested and analysed various posterior optimisation measures for CAWI survey data.

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Introduction

This paper aims to analyse original Bulgarian survey experience in a critical situation, where a face to face approach was impossible due to anti-epidemic measures. Survey design and data collection as well as data cleaning and optimisation procedures (weighting) were carefully planned to cover the two waves (Covid-CAWI1 and Covid-CAWI2) of the pandemic with their respective emergency measures. Various posterior optimisation measures for CAWI survey data are designed, tested and analysed in addition. The research efforts toward data optimization try to minimise the coverage bias.

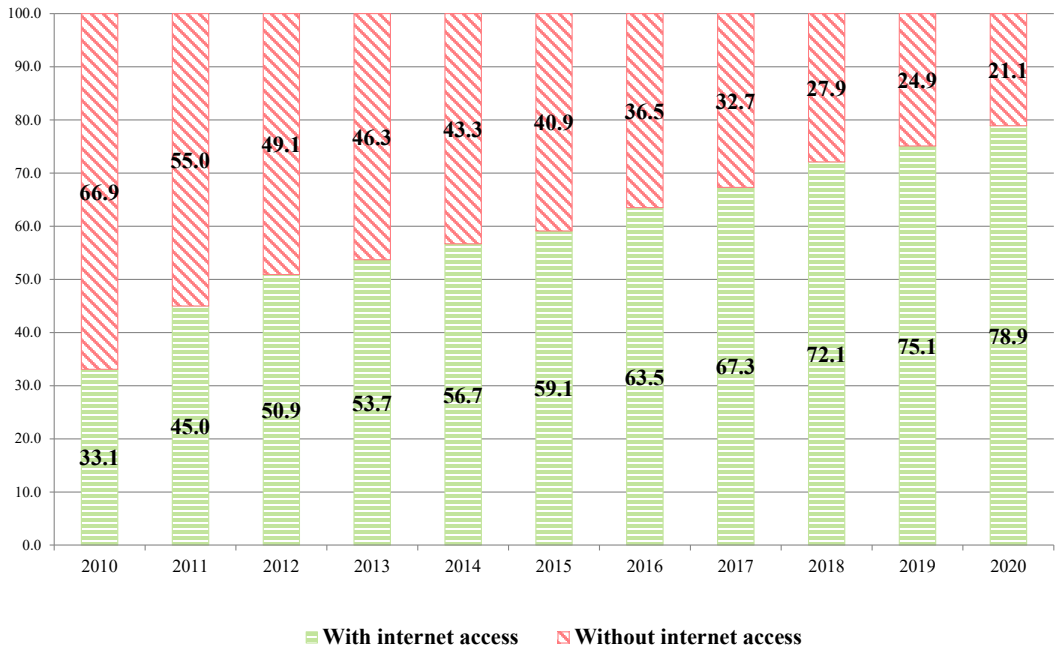
This contribution presents for the first time a comprehensive survey methodology that has been planned and implemented during a two-wave crisis situation. The methodology is described according to CHERRIES (Eysenbach, 2004). Despite the survey methodology limitations, this approach has been the only way to obtain data on how people are coping with the pandemic crisis in terms of work, income, family obligations, implementation of anti-poverty measures, mental health, etc. Moreover, solutions to overcome the inadequacies of online surveys are proposed and discussed.

Epidemics accompany human civilisation but the Covid-19 crisis is specific for research and policy management due to the huge variations between countries (Zinn, 2021). The Covid-19 crisis plays the role of a catalyst, a magnifying glass for existing contradictions, social conflicts and economic misbalances (Markova, 2021). The main challenges that accompany the socio-economic response to the pandemic are cultural, institutional and structural, such as conflict zones and inequalities, stigma, problems with solidarity and trust in institutions, etc. The pandemic mobilises science, but at the same time it shows a rift between societal values and institutions, it takes the mask off the failure of politicians, incapable of *'mobilizing a collective response to the crisis*' (Krastev, 2020). The global pandemic of Covid-19 has challenged personal and community lives in unprecedented ways.

We perceive the pandemic as a case study of critical and multilevel crisis in line with the processes of digital transformation, which are proving key to minimising some of its negative effects. The physical distance limitation imposed changes on personal life, economic and social activity. The study of individual reactions to different economic or anti-epidemic measures and restrictions is of great importance for crisis management and science. The pandemic challenged researchers by making it impossible to collect empirical data in a traditional way - face to face. Scientists, respondents and interviewers remained confined to their homes, and physical contact was generally prohibited during lockdown. The online survey-based research has been the only option because of fast and easy data collection (Singh et al., 2021). During the Covid-19 pandemic a large number of people transferred their social contacts to the Internet and virtual social networks, but significant parts of the population remained off the grid. However, previous research, as well as the Covid-19 crisis itself, indicates that

social media tools may '*serve as an integral and significant component of crisis*' (Simon et al., 2015). The only available "terrain" for research in this crisis was the Internet, but it did not provide a fully hospitable and fertile environment for research for many reasons that sociology needs to compensate (coverage bias, scale validity, etc.). The pandemic and the respective restrictive measures require a number of organisational and logistical difficulties to be resolved with respect to the availability of technological resources, training and engaging digitally competent interviewers, the provision of informed consent, appropriate incentives for respondents, the need to organise databases of telephone numbers and e-mails. Research agencies in Bulgaria suddenly found themselves unable to cover the needs of dynamic fieldwork due to a lack of sufficient computer devices, trained interviewers and technological infrastructure (Markova, 2021).

On the other hand, a major issue when conducting an online survey is the difficulty of obtaining a sample that is representative of the population of interest (Andrade, 2020; de Man et al., 2021). One of the major deficiencies of online surveys is that those who do not use the Internet are unable to be part of the sample and this inevitably introduces coverage biases (Lavrakas et al., 2022). However, in recent years this gap in coverage has narrowed in many countries with the growth in Internet and mobile device usage (Bahia and Suardi, 2019). In Bulgaria, Internet coverage has also more than doubled over the last ten years (Figure 1.).



Source: NSI 2019, 2020

Figure 1. Share of households in Bulgaria with Internet Access (2010-2020)

In Bulgaria, Internet surveys do not provide representative data due to coverage bias. Online users differ by age, sex and regions. According to the 'Information and communication technologies usage in households and by individuals in 2020' (NSI, 2020), 78.9% of Bulgarian households had Internet access at home, which was 3.8 percentage points higher than the previous year (in cities 83.8%, in villages - 63.4%). The highest relative share of households with Internet access is in the Southwestern region (85.9%), and the lowest is in the Northwestern region - 66.2%. Households with children used the global network more actively as 96.1% of them had Internet access, compared to 75.5% of households without children. In 2020, 69.2% of individuals aged between 16 and 74 years used the Internet every day or at least once a week at home, at work or any other place and 56.7% took advantage of the resources of the global network several times per day. The most active Internet users were those with tertiary education (93.8%), as well as young people aged between 16 and 24 - 91.5%. Individuals used the network mostly for communication, with 58.5% of them conducting phone or video calls (using applications, e.g. Viber, WhatsApp, Skype, FaceTime, Messenger, Snapchat), and 54.7% participating in social networks (Facebook, Twitter, Instagram, Snapchat, etc.).

The restrictive anti-epidemic measures in Bulgaria began with the introduction of a State of Emergency from 13 March until 14 May 2020, which was subsequently transformed into an Epidemic Emergency from 14 May 2020 to 31 March 2022. However, under conditions of physical distance, data collection fieldwork was suspended in March 2020. After June 2020, with the easing of restrictive measures, fieldwork resumed, but with difficulty and limited scope, until it was suspended again when the so-called second wave of the pandemic was announced (27.11.2020)[1]. An increased reluctance of respondents and interviewers to participate in face to face surveys was constantly reported by various survey agencies and even by the National Statistical Institute (NSI) with regard to conducting the Census[2].

The future of survey research is the subject of in-depth scientific discussion (Brick, 2011; Couper, 2011; Schaefer, 2011; Miller 2017). Different research methods are being explored for the provision of empirical data in a rapid, effective and theoretically justified manner. The opportunities to use non-random sampling are investigated in detail (albeit with the disclaimer that they cannot replace random ones) as an acceptable alternative due to coverage bias and non-response, as well as the significant planning, control and implementation costs of representative surveys (Groves, 1989; Savage et al., 2007). The Covid-19 crisis forced the global research community to organise, analyse and present fast and easily collectable data, and both the Internet and social media were the only accessible fieldwork environment (Yamada et al, 2021). Already at the beginning of the Covid-19 State of Emergency the challenge of gathering survey data provoked the creation of an innovative methodology to study public opinion through social networks. The unprecedented pandemic crisis, the dire

[1] Order No. RD-01-677 of 25.11.2020 on the introduction of anti-epidemic measures on the territory of the Republic of Bulgaria (amended and supplemented), https://coronavirus.bg/bg/620

[2] Dnevnik, https://www.dnevnik.bg/bulgaria/2021/10/04/4261054_nov_problem_pred_prebroiavaneto_-_prebroiteli_se/

need for fresh and relevant empirical data, the closure of businesses, public spaces and sociological curiosity lay behind the creation of two waves of Covid CAWI survey. Survey data will be published in a user friendly open format, so all those interested in research could work with it to analyse the effects of the pandemic[3].

Facebook is the most frequently used social network in Bulgaria. In 2016 Facebook users in Bulgaria were 2 150 million (Statista, 2016), increasing to 3 876 000 in February 2020. The State of Emergency and lockdowns encouraged many people to register on social networks. In April 2020 the number of Bulgarian users of Facebook reached 3 935 million, which is in fact 57.1% of the total population (NapoleonCat, 2020a). The majority are women (51.4%). Persons aged 25-34 are the largest user group (960 000). The highest gap between men and women is observed in people aged 55 to 64, where women lead by 90 000, which is understandable given the demographic processes in Bulgaria. In December 2020, Bulgaria's Facebook users increase by 365 000, reaching 4 300 million, or 62.4% of the country's total population (NapoleonCat, 2020b).

Data and Methods

Theoretical considerations behind the design and implementation of the original Covid-CAWI follow the most recent scientific consensus/debate. The basic principles for data validity in online surveys are as follows (Moser and Kalton, 1971): questions must be correctly and fully understood, recalled or identified and reported by respondents. Total Survey Error encompasses both non-observation error and observation error (Biemer et al., 2017; Tourangeau, 2018) caused by sample quality and limited coverage and measurement bias due to data collection methods. Independently from the survey mode in use, the recruitment of respondents is key to minimising non-observation error within sampling and non-response bias. Self-selection is a particular concern for methodology in online surveys (Spencer et al., 2022), as well as the absence of an interviewer to facilitate the question-answer process. Another challenge in online surveys is that the observation bias cannot be separated from the choice of survey mode (de Leeuw, 2018).

In designing the Covid-CAWI survey we tried to overcome several potential sources of bias, as follows:

- To help respondents clearly understand the questions asked by presenting them in written format in an online survey form. The questions were accompanied by written instructions, scale information and user friendly completion.
- To standardize the answer options in order to avoid confusing respondents with a large number of responses, and to reasonably limit the open answers.
- To limit the time and effort the respondents need to complete the questionnaire through paradata, available in programming. Respondents tend to provide the simplest possible responses in order to avoid cognitive burden (Krosnick and Alwin, 1987) and the absence of an interviewer is not a burden to recall bias into thinking about responses (Gooch, 2015).
- To construct the questionnaire in such a way as to control socially desirable

[3] The data will be published (2023) with open access at Bulgarian Portal for Open Science, available at: https://bpos.bg/

answers (de Leeuw, 2018). The absence of an interviewer is an advantage and an online format encourages respondents to give more sincere answers.

- To provide detailed information about the academic purpose of the survey, its authors and their affiliation in order to grant anonymity and data confidentiality (Callegaro, Manfreda and Vehovar, 2015) although trust in the organisation/person conducting the survey is very important (Dodou and de Winter, 2014). In our case the Institute of Philosophy and Sociology at the Bulgarian Academy of Sciences enjoys a high degree of confidence in society.
- To design a balanced distribution matrix to appeal to a wide audience of Internet users in order to achieve better sampling coverage. Nevertheless, low educated and male respondents remain a challenge for online research not only in Bulgaria.

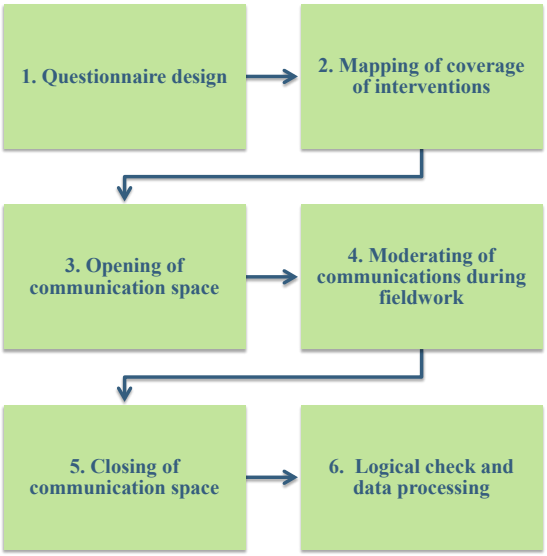
The Covid-CAWI survey could be defined as a pseudo-longitudinal, repeated cross-sectional survey, using self-administered computer assisted web interview (CAWI), distributed online through social networks and a forum, with a non-stochastic sample of respondents. The first wave of Covid-CAWI was conducted during the State of Emergency between April 16, 2020 and May 1, 2020 among 1,173 individuals aged 18 years and older, programmed and completed via Google forms. The second Covid-CAWI was conducted under the emergency measures due to the second wave of COVID-19 between December 15, 2020 and December 21, 2020 among 1,796 persons over 18 years of age via SurveyMonkey platform. In both waves the sampling procedure is without replacement – controlled by designing the CAWI instrument, and then verified via a data cleaning process. No incentives have been offered during the fieldwork. As appreciation to participants who have left a feedback email, the first results of each wave have been sent. All respondents were informed about the length of time of the survey, data protection, data use for research purposes only, reading and answering instructions, as well as contacts of the principal investigators. The research project[4] within which the studies are being conducted has been approved by the scientific council of the Institute of Philosophy and Sociology at the Bulgarian Academy of Sciences.

The implementation of both waves of Covid-CAWI strictly follows the standardised methodological process to ensure the high quality of data collection in six stages (Figure 2.). The development of the survey instrument is based on a theoretical model of the impact of anti-epidemic measures on life, economic activity and health. A particular focus is the closure of educational institutions and distance (online) learning. A programming platform was chosen[5], including filtering construct and logical routing of the population under study. Both waves include a pilot study. The populations of interest were then mapped and an analysis was conducted of potential audiences among which to distribute the questionnaires. A challenging task was to design a balanced distribution matrix to appeal to a wide audience of Internet users in order to achieve better sampling coverage by gender,

[4] The Covid-CAWI survey is initiated, designed and conducted as part of a collective research project by Gabriela Yordanova and Ekaterina Markova.

[5] Covid-CAWI wave 1 was programmed and implemented using Google Forms, while wave 2 used SurveyMonkey. This detail is important because Google Forms provides limited options for survey design and control of the reply process.

age, education, place of residence. The greatest effort was devoted to the third stage of the survey: opening up the communication space. At this stage, contact was made with Facebook groups and administrators, opinion leaders. Focused moderation of comments, questions and obtaining permission to post the survey invitation was required.



Source: authors' contribution

Figure 2. Methodological process of data collection of CAWI online

Social media communication requires significant time and attention in providing feedback to the audience and to survey respondents. A selection matrix consisted of 26 Facebook groups which we were granted access and permission to post an announcement and link to the study with a total number of potential respondents in excess of 580,000. In parallel with the activity in Facebook groups, the survey was disseminated through institutional websites, personal profiles and a forum, which added over 1 million potential respondents (Table 1). Targeted actions to open communication space (stage 3) show that in the beginning, when announcing the first wave of the survey, non-cooperation was met in 14 groups. Subsequently, due to the publicity of the survey, non-cooperation decreased - 8 groups refused in the second wave of the survey. A total of 7 groups show a persistent lack of interest and cooperation in both waves (1 parent group, 2 professional groups, 3 hobby groups and 1 health service group).

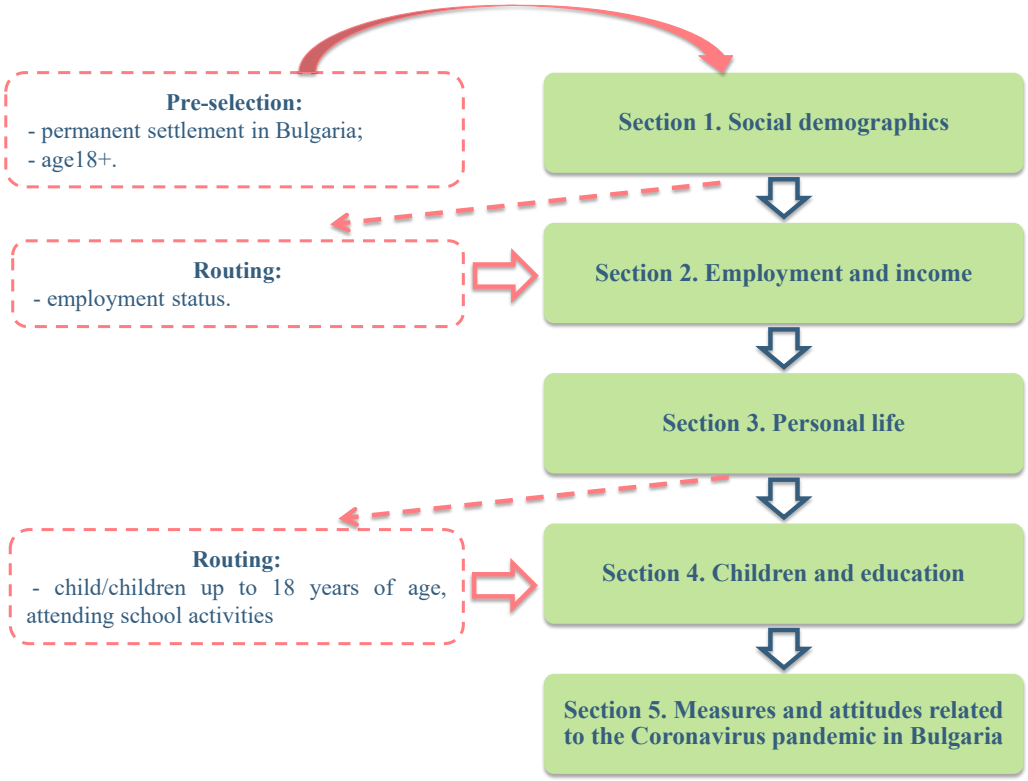
Table 1. Distribution matrix for Covid-CAWI (1 u 2)

Group type	Number of users
Parent groups	281 933
Information groups	28 880
City groups	90 307
Professional groups	121 813
Hobby groups	44 652
Health service group	4 278
Institutional group	6 783
Forum	1 000 000
Total	1 578 646

Source*:* authors' contribution

The data set includes socio-demographic variables, one section about parents and online and distant learning during the pandemic, and one section about individual perceptions of the state of emergency, government measures, labour organisation change and economic challenges.

The survey instrument was harmonized across the two waves (Figure 3.) taking into account the change in contextual framework. The study population was pre-selected from the beginning: only among those living in Bulgaria, aged over 18 years. Subsequently the thematic blocks further recruited relevant respondents – for example, those without children in school cannot respond to the section about distance learning. The survey is pseudo-longitudinal because it aims to measure changes in attitudes and behaviour in the following periods: 1) before the introduction of the state of emergency, 2) during the state of emergency due to the first wave, 3) before the second wave - May-November 2020, 4) after the introduction of the measures due to the second wave - after 27.11.2020.



Source: authors' contribution

Figure 3. Questionnaire structure CAWI 1 u CAWI 2

Data processing

Data has become important in helping governments and healthcare organizations create effective responses to mitigate the spread of the Covid-19 virus. Using data as a basis for decision making leads to better and more grounded policies and response implementation (Chua, 2021). Data cleaning is

considered to be an essential pre-processing step to ensure that subsequent data analysis is correct (Neutatz et al., 2022). The general samples of interest are further limited due to the need for data cleaning in order to increase the data quality of the Covid-CAWI data. A total of 3.7% of observations within wave 1 and 13.6% of those in wave 2 have been removed due to unwanted (irrelevant) or duplicate data (Table 2).

Table 2. Data cleaning workflow and preparation of the databases for further weighing procedure and analysis

	CAWI-1 ***(start point at N=1218, end point n=1173)***	**CAWI-2** ***(start point at N=2079, end point n=1796)***
Step 1: **Removed unwanted (irrelevant) observations**	*Consent form* – "confirmed" (n=1218); 0 observations removed. *Country of residence* –Bulgaria only (n=1192); 26 observations removed because living abroad. *Gender* – (n=1192); 0 observations removed.	*Consent form* – "confirmed" (n=2065); 14 observations are removed. *Country of residence* –Bulgaria only (n=2025); 40 observations removed. *Gender*[6] – only respondents answered the question remained (n=1801); 224 observations are removed.
Step 2: **Removed duplicate observations (sampling without replacement)**	*By email address* – only one valid email address remained (n=1173); 19 observations removed.	*By IP address* – only one valid IP address per case remained (n=1796); 5 observations removed.
Step 3: **Fixed structural errors**	All structural errors (i.e. strange naming conventions, typos, or incorrect capitalization, etc.) which caused mislabelled categories or classes were fixed.	
Step 4: **Handle missing data**	Missing data, as well as N/A; Refuse to answer; Don't know answers are kept as they were. Item nonresponse is not intervened because both questionnaires have routing questions. Our recommendation is that each section should be analysed separately.	
Step 5: **Logical check**	Multiple criteria *(employment status-pensioners-year of birth; having child/ren – how many - number of children within the household; marital status - help received with household responsibilities and raising children; etc.)* have been used.	
Step 6: **Handle open-ended questions**	Open-ended questions are back coded where possible; some are additionally coded into the same variables.	
Step 7: **Data validation and quality analysis**	Double checks have been made that the previous steps are complete and no duplication or errors remain.	
N	**1173**	**1796**

Source: authors' contribution

Posterior data optimization: weighting

Due to concerns that respondents to online surveys differ from the general population and the probability of unequal selection, weighting procedures have to be applied (Greenacre, 2016). Post-stratification or weighting class adjustments are an estimation technique that attempts to make the sample representative

[6] Missing data on gender has been removed from the database because of weighing procedure.

after the data has been collected. It is the simplest and most commonly used methodology. The post-stratification used here to adjust for the sampling and coverage problems in Web surveys is known variously as ratio adjustment, post-stratification, or cell weighting (Greenacre, 2016). Moreover, there is evidence that online survey respondents are a highly selective subgroup of the general population (Yeager et al., 2011). This is because people who recruit themselves have specific profiles in terms of demographics, personality, values, and habits (Cornese and Bosnjak, 2018). The Covid-CAWI survey is based on nonprobability samples. Adjustments were needed in order to correct the selection and coverage bias.

As stated by Schonlau and Couper (2017) adjustments rely on so called auxiliary variables, related to both outcome variables and the propensity to respond (and thus to be part of the sample) and at the same time these auxiliary variables should be observed in the nonprobability sample. The general population distributions of auxiliary variables must be clear. In that case post-stratification can be used to reweight observations in the nonprobability sample to match the known population distribution of those variables. Cells or weighting classes are formed by crossing all the categories of auxiliary variables. Any continuous auxiliary variables are first turned into categorical variables (Schonlau and Couper, 2017). Calibrated cross-sectional weights are computed at the individual level for inference to the target general population.

Data from both nonprobability samples in the Covid-CAWI survey is weighted through a post-stratified procedure. Initially the following socio-demographic categories were used as auxiliary variables – gender, age group, level of education and place of residence. Multivariate distribution by the auxiliary variables gender (male, female), age group (18-29; 30-39; 40-49; 50-59; 60+), level of education (primary or lower, secondary, tertiary) and place of residence (capital city, big city, small town, village) was used for weighting. The data estimated for the population were received from NSI's Labour Force Survey for 2019. Although the two Covid-CAWI waves were conducted in 2020 and 2021, the structure of the population by auxiliary variable is stable and there is no reason to expect significant changes in one or two years.

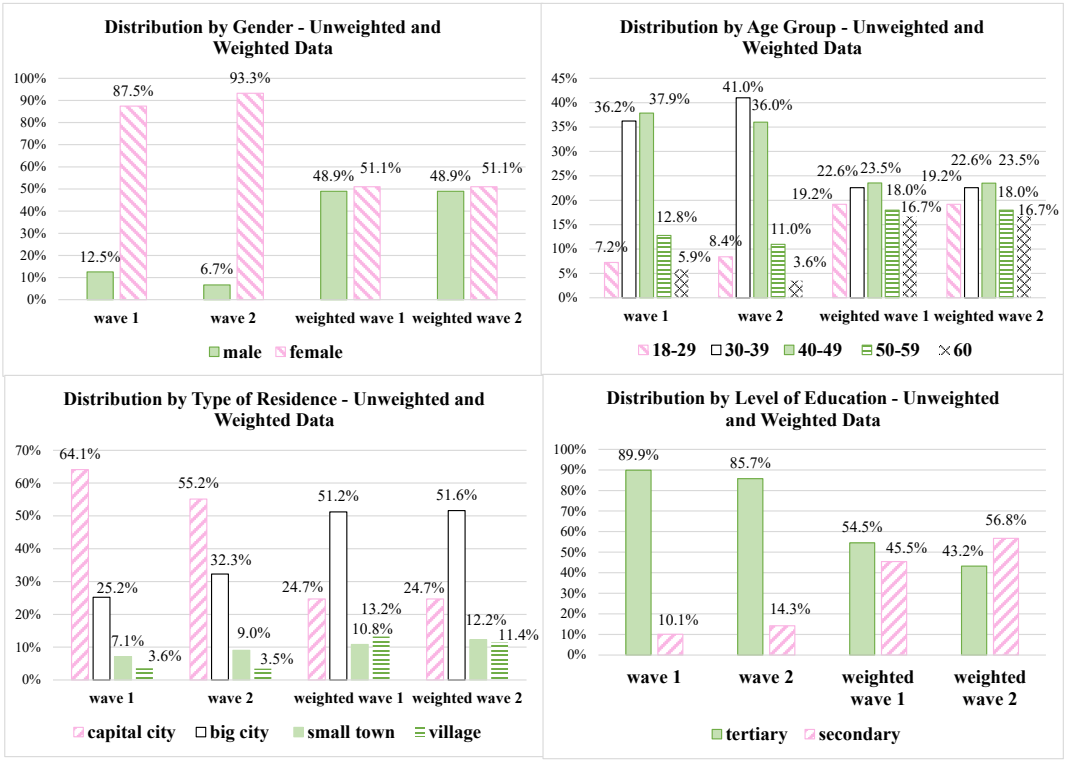
The procedures implemented in the process of preparation of the weighting matrix are as follows:

- Neither wave of Covid-CAWI includes respondents with only primary or lower education and this subpopulation is excluded from the multivariate distribution. Such respondents very rarely recruit themselves in online surveys.
- The respondents from "small town" or "village" in the first wave are only 125 from the total sample size 1173 and in the second wave – 225 from 1796. Residents of the capital city were overrepresented in both waves – 64% in the first and 55% in the second wave compared with the official data for the whole population. According to the Labour Force Survey (NSI, 2019), 19% of the total population and 18% of the population 18+ resides in the capital. For this reason the categories of 'place of residence' were aggregated in two – 'capital city' and 'other'.
- Respondents with secondary and tertiary education from the male subgroup are aggregated into one group because of insufficient observations in age groups 30-39; 50-59 and 60+ in the first wave and 50-59 the second wave.

- The population data for every weighting class is corrected by the share of population with regular Internet usage (every day or at least once a week)[7]. The limitation of the Internet usage data is that it covers the population in the age group 16-74. For the weighting procedure purposes it was assumed that there is no significant difference in the share of individuals with regular usage of Internet for the age ranges 18-29 and 16-29 as well as for 60+ and 60-74 (there were only 6 respondents aged 74+ in the first wave and 2 in the second).

Results. Weighted and unweighted data comparison

The significant difference in distribution by auxiliary variable of weighted and unweighted data is an indicator that the more vulnerable groups with regard to socio-economic challenges during the Covid-19 crisis are underrepresented in the sample. These are respondents with lower education, living in small towns or villages. Male respondents are also underrepresented in the sample and, as noted above, this is in line with the challenges faced by online surveys in general. The univariate distributions by gender, age, education level and place of residence are presented in Figure 4.



Source: authors' estimations

Figure 4. Distributions by auxiliary variables for Covid-CAWI wave 1 and 2

[7] The data on Internet usage is retrieved by a special request to NSI, because it is not publicly available at the necessary level of disaggregation.

In order to illustrate the difference between both approaches – unweighted and weighted data – we present below the results from descriptive analysis of the variables for changes in income after the State of Emergency (for wave 1) and anti-epidemic restrictions (for wave 2), as well as the ability to cover bank credits, household bills and tax payments on time (Table 3 and Figure 5). The share of respondents with sharply worsened incomes in both waves for the total sample in weighted data is higher compared to unweighted. The largest difference between weighted and unweighted data is observed for the response "sharply worsened" income in the age group 40-49 as well as for small town residents in Wave 1 and Wave 2. There is a slight increase in the proportion of 'improved' income situation in the age group 30-39 and among residents of large cities.

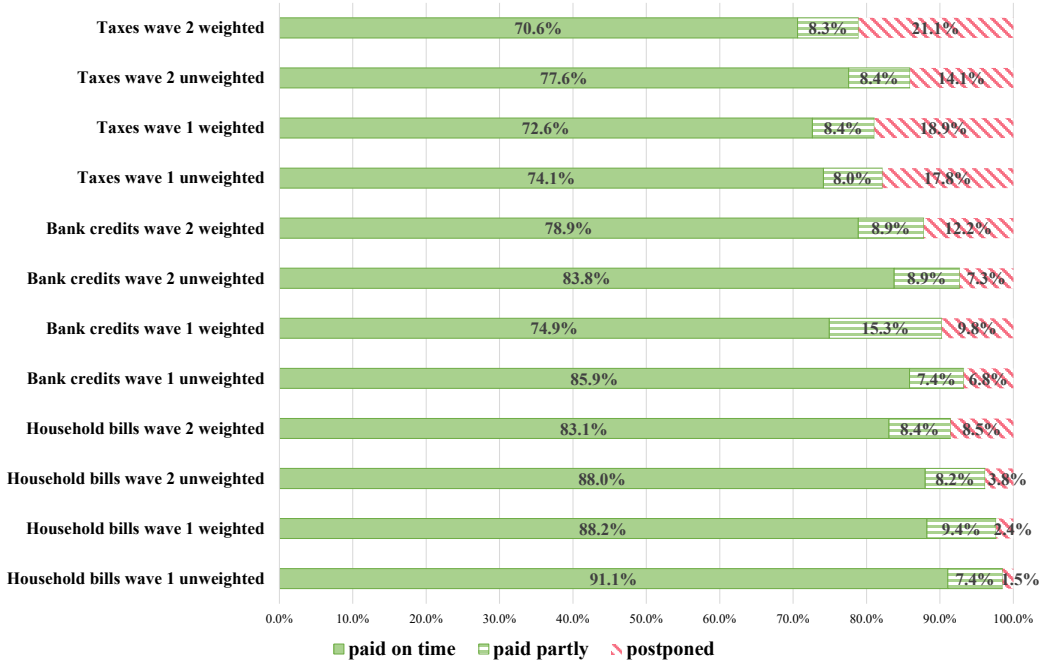
Table 3. Effect on Incomes after the State of Emergency (for wave 1) and Anti-Epidemic Restrictions (for wave 2)

Covid-CAWI	Wave 1					Wave 2*				
Answer options	Sharply worsened	Worsened	Neither worsened nor improved	Improved	Improved sharply'	Sharply worsened	Worsened	Neither worsened nor improved	Improved	Improved sharply'
TOTAL										
unweighted	14.7%	25.9%	56.8%	2.3%	0.3%	13.2%	23.1%	58.2%	5.1%	0.5%
weighted	18.7%	24.7%	54.1%	2.4%	0.1%	22.2%	23.4%	48.4%	5.9%	0.1%
MALE										
unweighted	11.1%	23.6%	62.5%	2.8%	0.0%	11.4%	23.8%	53.3%	11.4%	0.0%
weighted	14.8%	23.1%	59.4%	2.7%	0.0%	26.9%	19.6%	45.8%	7.7%	0.0%
FEMALE										
unweighted	15.2%	26.2%	56.0%	2.2%	0.4%	13.3%	23.0%	58.6%	4.6%	0.5%
weighted	22.6%	26.0%	49.1%	2.2%	0.2%	17.3%	27.4%	51.0%	4.0%	0.3%
18-29										
unweighted	19.3%	21.7%	51.8%	7.2%	0.0%	24.0%	15.2%	52.0%	8.0%	0.8%
weighted	18.9%	16.5%	60.4%	4.2%	0.0%	33.9%	15.1%	47.6%	3.3%	0.0%
30-39										
unweighted	14.6%	27.0%	55.5%	2.2%	0.7%	15.8%	22.2%	55.8%	5.6%	0.6%
weighted	18.2%	18.2%	57.2%	6.1%	0.4%	16.2%	19.0%	46.7%	17.8%	0.3%
40-49										
unweighted	14.5%	25.0%	58.0%	2.3%	0.2%	10.3%	26.3%	59.5%	3.7%	0.2%
weighted	25.6%	25.6%	47.6%	1.1%	0.0%	43.8%	19.7%	34.9%	1.7%	0.0%
50-59										

Covid-CAWI	Wave 1					Wave 2*				
Answer options	Sharply worsened	Worsened	Neither worsened nor improved	Improved	Improved sharply'	Sharply worsened	Worsened	Neither worsened nor improved	Improved	Improved sharply'
unweighted	15.6%	27.2%	56.5%	0.7%	0.0%	7.4%	20.4%	67.3%	4.9%	0.0%
weighted	24.0%	36.0%	40.0%	0.0%	0.0%	8.9%	17.1%	70.0%	3.9%	0.0%
60+										
unweighted	9.0%	26.9%	64.2%	0.0%	0.0%	3.8%	26.4%	60.4%	7.5%	1.9%
weighted	4.6%	28.9%	66.5%	0.0%	0.0%	1.8%	47.1%	48.6%	2.2%	0.4%
CAPITAL CITY										
unweighted	12.6%	26.9%	58.0%	2.2%	0.4%	12.3%	19.8%	61.0%	6.4%	0.5%
weighted	15.7%	21.1%	60.7%	2.1%	0.4%	12.0%	26.9%	53.5%	7.2%	0.5%
BIG CITY										
unweighted	20.6%	22.3%	54.6%	2.1%	0.3%	13.2%	26.7%	55.9%	3.5%	0.6%
weighted	16.9%	25.6%	53.9%	3.6%	0.0%	24.5%	19.3%	48.7%	7.3%	0.1%
SMALL TOWN										
unweighted	13.4%	24.4%	58.5%	3.7%	0.0%	16.2%	30.0%	52.3%	1.5%	0.0%
weighted	40.0%	20.8%	38.3%	0.8%	0.0%	30.9%	16.0%	52.6%	0.6%	0.0%
VILLAGE										
unweighted	14.3%	35.7%	47.6%	2.4%	0.0%	18.9%	24.5%	49.1%	7.5%	0.0%
weighted	14.8%	30.3%	54.8%	0.0%	0.0%	25.7%	41.9%	31.1%	1.2%	0.0%
SECONDARY EDUCATION										
unweighted	29.6%	24.3%	43.5%	1.7%	0.9%	27.7%	31.3%	37.4%	3.6%	0.0%
weighted	25.7%	22.8%	49.9%	1.4%	0.2%	34.3%	26.8%	32.8%	6.0%	0.0%
TERTIARY EDUCATION										
unweighted	13.1%	26.1%	58.3%	2.3%	0.3%	11.0%	21.8%	61.3%	5.3%	0.5%
weighted	12.9%	26.2%	57.6%	3.3%	0.0%	7.5%	19.3%	67.2%	5.7%	0.3%
** In wave2 the answer "Not applicable to me" is treated as missing.*										

Source*:* authors' estimations

The share of respondents who reported delaying payments is higher in the weighted data for all type of liabilities in wave 1 and 2 (Figure 5.). This confirms the underrepresentation of more economically vulnerable groups in these surveys and the fact that the online survey respondents are mostly a specific part of the general population.



Source: authors' estimations

Figure 5. Distribution of weighted and unweighted data for the ability to cover on time bank loans, household bills and tax payments

Conclusions

The Covid CAWI survey carried out in the context of the emergency measures provides unique and reliable information on the impact of the pandemic and can serve as a basis for planning and implementing various mixed sampling designs and mixed registration methods, as well as verification of the results obtained. The presented Covid-CAWI as a pseudo-longitudinal study enriches practice in using repeated surveys to investigate fast developing social processes. The efforts toward controlling coverage bias contribute to the current discussion about the increase of online surveys, their limitations and advantages and need to be further analysed and discussed.

This methodological example is both necessary and particularly important for development of national traditions in empirical research because coverage in sample surveys on the Internet remains a serious problem in Bulgaria, not only in times of crisis. In 2020, 21.1% of the population did not use the Internet for various reasons (3.8% less than 2019 according to NSI). As digitalized panels of private research agencies are not publicly available, Internet surveys are mostly conducted using self-selection. The coverage and response rate in a quantitative sample survey depends on the registration method (Mulder et al., 2019), and accordingly, activity in online surveys depends on various social demographic factors and skews the realized sample. Those active in Internet

research are more likely to be women, from younger age cohorts, living in big cities, with higher than secondary education, and with a correspondingly higher income (Smith, 2008; Smyth et al., 2014; Sandor et al., 2020).

Since Covid-19 anti-epidemic measures target vulnerable groups (over 60 years, poor and socially excluded, children, those in social and health institutions, etc.), the prohibitions caused by physical distance make it difficult to research the impact of the pandemic. Vulnerable groups remain definitively hidden, because they do not use the Internet. The pandemic affects the poorest segments of society and conducting an empirical study in ghettoized areas, in segregated ethnic neighbourhoods (Pamporov, 2020) in Bulgaria is not possible in a state of emergency. In fact, the analyses as well as the collection of actual empirical data on the effects of the pandemic exclude the most vulnerable and socially excluded and seem to render them insignificant, unimportant and invisible (Mespoulet, 2020) for public policies and public communication. Within the Covid-CAWI survey, low educated, male, living in villages and small towns are underrepresented. However, research (Peshev et al., 2022) provides evidence that NSI survey data tend to underestimate the income inequality in Bulgaria and the future analysis should explore how combining various sources of survey data could provide more accurate estimates.

Proper survey methodology definition is of a great importance for both quality of data collection and scientific analysis. The presented research experience is in line with the latest theoretical considerations, and the contribution is the application of an adapted methodology during a multivariate and rapidly evolving critical situation. Properly defining the survey type is a key to its cognitive capabilities, the research questions it can answer, and the selection of appropriate methods for analysing empirical information. A very important distinguishing criterion for the type of longitudinal study with the same instrumentation and methodology is whether the observations are of the same sample units at different points in time or whether different sample units are observed at different points in time. Two main types of pseudo-panel sample surveys can be distinguished: repeated cross-sectional and unbalanced panels. An unbalanced panel study exists under the hypothesis that some units are surveyed more than once (in more than one wave), but the mandatory condition that all observations are repeated at each time repetition is not observed (Lebo and Weber, 2015). Repeated sample surveys (Fox, 2020) can be conducted over a well-defined time period, e.g. the European Social Survey (ESS), the World Values Survey (WVS), or at irregular but meaningfully related to the theoretical model and research tasks time intervals (such as Covid-CAWI). In repeated surveys, an independent sample is constructed for each wave and so there is no overlap of samples between time periods (Fox, 2020). Repeated sample surveys can be of high scientific value because of the addition of a dynamic component and the ability to examine time-varying relationships, behaviours, life strategies, etc. A pseudo-longitudinal or repeated cross-sectional design may be an appropriate research strategy in a crisis situation for at least three reasons (Yee and Niemeier, 1996): the possibility to construct multiple samples over time rather than a longitudinal study of the same sample; sample size enough to compensate for any loss of statistical precision; different weighting

procedures can be implemented to correct disparities in sample distributions.

Because our survey was not conducted among the same individuals, it cannot be defined as a true panel. We define it as pseudo-longitudinal (repeated) because it measures change in attitudes and life situations by means of a harmonised instrument at specific points in time - typical of the situation under research. The basic principle of longitudinal cohort studies, namely to observe a variable for a given population cohort where individuals have common characteristics, is respected in this case, since the individuals surveyed in Covid-CAWI live in Bulgaria, they are over 18 years of age, and use the Internet.

We aim to control the coverage bias using nationally representative data about Internet users, provided by the National Statistical Institute, because in Bulgaria Internet penetration levels and digital literacy significantly vary by sex, age and settlement type. When designing the next, third wave of the survey, we will need to make focused, additional efforts to reach (to distribute the survey among) low education and low-income groups. The latter were affected most by the lockdown, especially those working in the service sector (Ministry of Finance, 2020). For this reason analysis of the socio-economic response to the pandemic would be more precise when conducted using weighted data. Moreover, using empirical data in critical situations for knowledge based policy response should rely on careful and precise posterior data adjustments. For example, survey data on the economic effects of the Covid-19 pandemic differ between weighted and unweighted samples. People initially appear to have an increased ability to meet their financial commitments for taxes, bank loans, etc., but when correct posterior adjustment is applied, it turns out that there is an increase in postponed payments. The economic burden caused by the pandemic could be underestimated if policy decisions are based on data that have been collected due to erroneous assumptions or without the data being subsequently processed with properly chosen optimisation adjustments. This scientific challenge needs to be addressed with targeted research in the future.

Discussion

Bulgaria is no exception to the other countries and the online surveys during the COVID-19 crisis have been growing significantly (Markova, 2021). These numerous online surveys, however, are not in line with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). Covid-CAWI survey could be referenced as a good example with its adherence to CHERRIES, as well as with its carefully planned and documented design in line with the highest methodological standards. In addition, the detailed description of the adapted data cleaning procedure, implemented in a comprehensive way, also preventing multiple entries from the same individual could be of use for the survey practitioners in order to improve the online survey quality.

The Internet surveys do not provide representative data for the adult population in Bulgaria. The problem of Internet coverage in surveys is actively discussed in the scientific community (Sterrett et al., 2017; Couper et al., 2005). However, online surveys have a number of advantages which, in combination with other empirical data collection methods, can optimize the quality of information. Panel surveys in Europe have adapted quickly to the pandemic, reaping various benefits: collecting data in an intensively evolving event rather

than every two years; urgent digitisation and investment in technology; conducting field research at a specific time, quickly and flexibly; cost minimization; timeliness and expansion of the coverage of respondents in a combination of mixed registration methods (CAWI and CATI). With this Covid-CAWI project we intend to start an intensive scientific discussion in Bulgaria.

A similar procedure for weighting to the one used by Covid-CAWI is applied by Eurofound in the "Living, working and COVID-19" survey, which was conducted in three waves.[8] The data in that survey is weighted to reflect the demographic profile of the sample in terms of age, gender, region and education of each EU Member State. High variety among the Member States with regard to the indicator share of households with access to high speed Internet (form 19.8% in Greece to 100% in Malta in 2021) (Eurostat, 2021a) and the indicator share of individuals that have never used the Internet (from 0% in Ireland to 17% in Bulgaria in 2021) (Eurostat, 2021b) confirms the fact that analysis and conclusions about the whole population without taking into account distributions of the auxiliary variables only among Internet users are unreliable. In our approach, the general population that is appropriate for constructing weights in Covid-CAWI survey is that which uses the Internet. Constructing weights based on the entire general population of a country's adult population is not an effective approach, precisely because of differences in Internet use by gender, age and settlement type. According to Frippiat and Marquis (2010), Internet access has a definite impact on the likelihood of an individual being included in a sample and agreeing to respond to a survey. In Bulgaria the share of households with access to high speed Internet is relatively high, but the share of the population aged 16-74 that has never used Internet is the highest among the EU countries. There is a significant difference in Internet usage among individuals in groups formed by age, education level and region. For example, the share of individuals using Internet at least once a week in the age group 16-24 is 93% and is treble the share in the age group 65-74 (31%). The share of individuals with tertiary education is 93% compared to 52% among those with primary or lower education (NSI, 2020). All this motivated the fact that more appropriate weighting procedure would be once based on the cross-distribution by gender, age group, level of education and place of residence only among Internet users.

Some research has argued that stochastic samples are more accurate than non-stochastic samples (Chang and Krosnick, 2009; Yeager et al., 2011, etc.), but others present evidence that non-probability samples can also be accurate on estimates as much or more than stochastic ones (Goel, Rothschild and Wang, 2017). A meta-analysis of the relationship between sample characteristics and representativeness (Cornesse and Bosnjak, 2018) recalls the current debate surrounding the representativeness of stochastic versus non-stochastic surveys. According to the Bulgarian methodological tradition, the statement *'probability surveys are more representative than nonprobability surveys'* (Cornesse and Bosnjak, 2018 p. 10) is unacceptable, but when implementing a stochastic survey, every effort should be made to increase the response rate, including a mixed mode of face-to-face and online. It

[8] The survey is conducted in April 2020, July 2020 and February-March 2021 and it is directed to anyone aged 18 and over with access to the Internet.

might be of interest to explore the concept of "*degrees*" of representativeness further within the Bulgarian practice of online survey research.

During the pandemic, many researchers worldwide collected online data with non-representative samples, but only a small proportion of them implemented posterior statistical correction for response rates (Sharma et al., 2021). Our contribution tries to add value to the ongoing discussion about the way of improving the quality of online surveys. Despite the large sample sizes for Bulgaria of Covid-CAWI, the data is not representative of the adult population and the two waves are implemented on the basis of those who responded. The specificity of samples, however, does not reduce the quality of data, especially since a number of posterior optimization procedures have been used in non-stochastic web surveys.

Conducting online surveys in a crisis situation is a highly beneficial research task, even with the absence of financial and human resources. The analysis of subsequent optimization procedures in Internet studies should continue and be a priority for empirical sociology in Bulgaria, especially in the context of the sociology in (crisis) situation and physical distance constraints. Methodological research in Bulgaria is urgently needed - on the one hand to assess the socio-economic effects of the pandemic on the process of data collection and on the other, to assess the specificities of the Bulgarian experience and the possibilities for adaptation and innovation of good practices from global survey research methodology. Online surveys are a widespread practice around the world and are increasingly entering Bulgaria, but the related methodological problems remain understudied and unexplored.

References

Andrade C. 2020. The Limitations of Online Surveys. *Indian J Psychol Med*.; 42(6): 575–576.

Bahia, K. and Suardi S. 2019. Connected Society: The State of Mobile Internet Connectivity 2019, London: GSMA. Brick, J.M. 2011. The future of survey sampling. *Public Opinion Quarterly*, pp. 872–888.

Biemer, P. P., E. D. de Leeuw, S. Eckman, B. Edwards, F. Kreuter, L. E. Lyberg, N. C. Tucker & B. T. West (eds). 2017. Total Survey Error in Practice, New York: John Wiley & Sons.

Callegaro, M., Manfreda, K. L. and Vehovar, V. 2015. Web Survey Methodology, London: SAGE.

Chua, J. 2021. Automation of Data Cleaning Process by Understanding Nuances in Covid-19 Data. ITTPCOVID19, Vol 1, No 1.

Cornesse, C., & Bosnjak, M. 2018. Is there an association between survey characteristics and representativeness? A meta-analysis. *Survey Research Methods*, 12(1), 1-13. available at: https://doi.org/10.18148/srm/2018.v12i1.7205.

Couper, M. P. 2011. The future of models for data collection, *Public Opinion Quarterly*, Volume 75, Issue 5, Pages 889–908.

Couper, M. P., Kapteyn, A., Schonlau, M., Winter, J. 2007. Noncoverage and nonresponse in an Internet survey, *Social Science Research*, Volume 36, Issue 1, Pages 131-148, https://doi.org/10.1016/j.ssresearch.2005.10.002.

de Leeuw, E. D. 2018. Mixed-mode: past, present and future, *Survey Research Methods*, 12 (2):75–89.

Dodou, D. and de Winter, J. C. F. 2014. Social desirability is the same in offline, online, and paper surveys: A meta-analysis. *Computers in Human Behavior*, 36:487–495.

Eurofound, 2020. Living, working and COVID-19, COVID-19 series, Publications

Office of the European Union, Luxembourg, available at: https://www.eurofound.europa.eu/publications/report/2020/living-working-and-covid-19.

Eurostat, 2021a. High-speed internet coverage, by type of area, available at: https://ec.europa.eu/eurostat/databrowser/view/sdg_17_60/default/table (Accessed 27.07.2022).

Eurostat, 2021b. Internet use by individuals, available at: https://ec.europa.eu/eurostat/databrowser/view/tin00028/default/table?lang=en (Accessed 27.07.2022).

Eysenbach, G. 2004. Improving the Quality of Web Surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES), *J Med Internet Res* 2004;6(3):e34, doi: 10.2196/jmir.6.3.e34.

Greenacre, Z. 2016. The Importance of Selection Bias in Internet Surveys. *Open Journal of Statistics*, 6, 397-404. doi: 10.4236/ojs.2016.63035.

Gooch, A. 2015. Measurements of cognitive skill by survey mode: Marginal differences and scaling similarities, Research and Politics, July–September:1–11.

Groves, R. M. 1989. Survey Errors and Survey Costs, New York: John Wiley & Sons.

Fox, S. 2020. Repeated Cross–Sections. In SAGE Research Methods Foundations, edited by Paul Atkinson, Sara Delamont, Alexandru Cernat, Joseph W. Sakshaug, and Richard A. Williams. London: SAGE Publications Ltd., available at: https://dx.doi.org/10.4135/9781526421036907577.

Frippiat, D. and Marquis, N. 2010. Web Surveys in the Social Sciences: An Overview, translated by Elizabeth Wiles-Portier, Population, 65, 309-338, available at: https://doi.org/10.3917/popu.1002.0309.

Krastev, I. 2020. Is It Tomorrow Yet?: Paradoxes of the Pandemic. New York: Penguin Books.

Lavrakas, P. J., Pennay, D., Neiger, D., & Phillips, B. 2022. Comparing Probability-Based Surveys and Nonprobability Online Panel Surveys in Australia: A Total Survey Error Perspective. *Survey Research Methods*, 16(2), 241-266. https://doi.org/10.18148/srm/2022.v16i2.7907.

Lebo, M. J., and Weber, C. 2015. An Effective Approach to the Repeated Cross–Sectional Design." *American Journal of Political Science* 59, no. 1: 242–58. Available at: http://www.jstor.org/stable/24363607.

Markova, E. 2021. Locked down society. Problems of sociological research in (post) crisis situations. Bulgarian Academy of Sciences Publishing House "Prof. Marin Drinov". 226. ISBN 978-619-245-162-2, ISBN 978-619-245-166-0 (in Bulgarian),e-book: https://press.bas.bg/bg/eBooks-105/show-106(37).

Mespoulet, M. 2020. The Invisibles to Statistics. Sociological problems, Issue 52:38–54 (in Bulgarian).

Miller, P.V. 2017. Is there a future for Surveys? *Public Opinion Quarterly*, Volume 81, Issue S1, 205–212.

Ministry of Finance, Republic of Bulgaria, 2020. Annual Report on Bulgarian Economy, available at: https://www.minfin.bg/bg/873.

Moser, C. A. and Kalton, G. 1971. Survey Methods in Social Investigation, 2nd ed., London: Heinemann Educational Books. Mulder, J., de Bruijne, M. 2019. Willingness of Online Respondents to Participate in Alternative Modes of Data Collection. Survey Practice 12 (1). https://doi.org/10.29115/SP–2019–0001. 2019.

NapoleonCat, 2020a. Facebook users in Bulgaria (April 2020), https://napoleoncat.com/stats/facebook-users-in-bulgaria/2020/04.

NapoleonCat, 2020b. Facebook users in Bulgaria (December 2020) https://

napoleoncat.com/stats/facebook-users-in-bulgaria/2020/12.

Neutatz, F., Chen, B., Alkhatib, Y. et al. 2022. Data Cleaning and AutoML: Would an Optimizer Choose to Clean?. Datenbank Spektrum. https://doi.org/10.1007/s13222-022-00413-2.

NSI, 2019. Information and communication technologies usage in households and by individuals in 2019. Available at: https://www.nsi.bg/sites/default/files/files/pressreleases/ICT_hh2019_en_LDOBNRL.pdf (Accessed 14.06.2022).

NSI, 2020. Information and communication technologies usage in households and by individuals in 2020. Available at: https://www.nsi.bg/sites/default/files/files/pressreleases/ICT_hh2020_en_PSRP7D5.pdf (Accessed 14.06.2022).

NSI, 2021. Individuals regularly using the internet in 2021, available at: https://nsi.bg/en/content/2814/individuals-regularly-using-internet (Accessed 27.07.2022).

Osborne, J. W. 2012. Best Practices in Data Cleaning: A Complete Guide to Everything You Need to Do Before and After Collecting Your Data. Thousand Oaks, CA: Sage Publications.

Pamporov, A. 2020. Unnecessary Ghettos. *Sociological Problems* 52: 55-67 (in Bulgarian).

Peshev, P. et al. 2022. Is Income Inequality in Bulgaria Underestimated in Survey Data? *Economic Thought Journal*, 67(3), 301-326.

Sándor, E.and Ahrendt, D. 2020. Living, working and COVID–19 – Methodological Annex to Round 2. Eurofound.Schaeffer, N. C., Dykema, J. 2011. Questions for Surveys: Current Trends and Future Directions, *Public Opinion Quarterly*, Volume 75, Issue 5: 909–961.

Schonlau, M.and Couper, M.P. 2017. Options for Conducting Web Surveys, *Statistical Science*, 32(2): 279-292.

Sharma R., Tikka S.K., Bhute A.R., Bastia B.K. 2021. Adherence of online surveys on mental health during the early part of the COVID-19 outbreak to standard reporting guidelines: A systematic review. *Asian J Psychiatr.*; 65:102799. doi: 10.1016/j.ajp.2021.102799.

Savage, M., and Burrows, R. 2007. The Coming Crisis of Empirical Sociology, *Sociology*, 41: 885–899.

Simon, T., Goldberg, A., Adini, B. 2015. Socializing in emergencies—A review of the use of social media in emergency situations. *International Journal of Information Management* 35, 609-619, https://doi.org/10.1016/j.ijinfomgt.2015.07.001.

Singh S, Sagar R. 2021. A critical look at online survey or questionnaire-based research studies during COVID-19. *Asian J Psychiatr.*; 65:102850, doi: 10.1016/j.ajp.2021.102850.

Smith, W.G. 2008. Does gender influence online survey participation?: A record–linkage analysis of university faculty online survey response behaviour. ERIC Document Reproduction Service No. ED 501717.

Smyth J., Kristen Olson, D., Millar, M. 2014. Identifying Predictors of Survey Mode Preference. *Social Science Research* 48 (11): 135–44.

Spencer, N.H., Syrdal, D. S., Coates, M. and Huws, U. 2022. Assessing bias in online surveys using alternative survey modes, Work organisation, labour & globalisation Volume 16, Number 1, 2022, available at: https://uhra.herts.ac.uk/bitstream/handle/2299/25526/WOLG_16_1_Assessing_bias_in_online_surveys.pdf?sequence=1&isAllowed=y.

Statista, 2016. Forecast of Facebook user numbers in Bulgaria from 2015 to 2022 (in million users), www.statista.com/statistics/568753/forecast-of-facebook-user-numbersin-bulgaria/.

Sterrett, D., Malato, D., Benz, J., Tompson, T., English, N. 2017. Assessing Changes in Coverage Bias of Web Surveys in the United States, *Public Opinion Quarterly*, Volume 81, Issue S1, Pages 338–356, https://doi.org/10.1093/poq/nfx002.

Tourangeau, R. 2018. Data collection mode in D. L. Vannette and J. A. Krosnick (eds) The Palgrave Handbook of Survey Research, Cham: Palgrave Macmillan.

Yamada, Y., Ćepulić, D., Coll-Martín, T., Debove, S., Gautreau, G., Han, H., … Lieberoth, A. 2020. COVIDiSTRESS Global Survey dataset on psychological and behavioural consequences of the COVID-19 outbreak. https://doi.org/10.31234/osf.io/v7cep.

Yeager, D. S., Krosnick, J. A., Chang, L., Javitz, H. S., Levendusky, M. S., Simpser, A., анд Wang, R. 2011. Comparing the accuracy of RDD telephone surveys and internet surveys conducted with probability and non-probability samples. *Public Opinion Quarterly*, 75(4), 709-747.

Yee, J. L., Niemeier, D. 1996. Advantages and Disadvantages: Longitudinal vs. Repeated Cross–Section Surveys, Discussion paper, Project Battelle 94–16, FHWA, HPM–40.

Zinn, J. O. 2021. Introduction: Towards a Sociology of Pandemics. Current Sociology, https://doi.org/10.1177/00113921211020771.