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Measuring labour force participation during pandemics and methodological changes

Katarzyna Saczuk, Olga Zajkowska



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Katarzyna Saczuk, Olga Zajkowska

Katarzyna Saczuk – SGH Warsaw School of Economics,
University of Warsaw and Narodowy Bank Polski
Olga Zajkowska – University of Warsaw and Narodowy Bank Polski; olga.zajkowska@nbp.pl

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Abstract

In 2020-2021, several methodological changes were introduced in the Labour Force Survey (LFS), which caused disruptions in data analysis and inference: the Covid-19 pandemic forced a change in the data collection method, and from the beginning of 2021, planned changes related to the harmonisation of social surveys in the EU were introduced (changes in the subject and object coverage of the survey). The aim of this paper is to examine the impact of the methodological changes on the measurement of labour force participation in Poland.

Based on the analysis of quarterly LFS data over the period Q1 2019 - Q4 2021, it is shown that the change in the recruitment and interviewing method to CATI and the change in the rotation scheme had a significant impact on survey selection, attrition, propensity to participate in person and thus also on the sample structure, and that the problems of survey selection are not fully compensated for in the process of generalising the results from the sample to the general population. By treating the change in survey method as a natural experiment, it has been shown that the method of recruitment affects the underlying results of the survey. Over the period Q3 2020 - Q3 2021, the changes introduced to the LFS together increased the estimates of the participation rate by around 0.6 percentage points, the employment rate by around 0.1 percentage points and the unemployment rate by around 0.9 percentage points relative to the pre-pandemic measures. If the effect of the inconsistent classification of some people as working in subsistence agriculture is also taken into account, the overestimation of the participation rate under the new methodology would be around 0.9 percentage points.

JEL: C81, C83, J21.

Keywords: labour force participation, BAEL, surveys, methodological changes, panel attrition, non-response, rotational panels, measurement errors, LFS

Introduction

Nowadays, knowledge-based decision-making is the standard for assessing the current economic situation and formulating assumptions for social policy. A reliable source of data is crucial for short-term forecasts, structural analyses, and research aimed at providing this knowledge. In this context, it is essential that data is comparable over time and that the properties and limitations of the data and indicators used are well understood.

Polish Labour Force Survey (PLFS, pol. Badanie Aktywności Ekonomicznej Ludności, BAEL), is the primary source of data on the economic activity of residents in Poland. It is one of the few sources of micro-data available to researchers and analysts, as opposed to administrative data. At the same time, this survey is the most comprehensive and complete in many areas. It provides population coverage, demographic and social cross-sections, diagnostic indicators of the condition of the Polish labour market, and issues related to labour market research. Like its counterparts in other countries, BAEL enables the current assessment of the degree of labour force utilisation and, at the same time, allows for a broader characterisation of certain population groups distinguished by their status on the labour market, taking into account demographic, socio-economic and occupational characteristics, as well as an assessment of the pace and direction of changes in these variables. The Labour Force Survey (LFS) enables cross-sectional analyses and statistical modelling of labour market processes. Therefore, it can be used to formulate knowledge-based social and economic policy solutions. Unlike administrative data, the LFS is also a source of data for international comparisons.

The BAEL survey has been conducted since 1992. Initially, it was designed to diagnose new phenomena during the period of systemic transformation. However, with Poland's accession to the European Union, the survey data became the basis for developing key indicators used in various international and national strategies (Statistics Poland, 2021). However, there are limited works in Poland that describe the objectives, determinants, and history of the LFS. Exceptions to this are Witkowski (2017) and Zgierska (2017). Additionally, there are few methodological works that discuss the characteristics and quality of the survey results. These include Szarkowski (1994), Szarkowski and Witkowski (1994), Popiński (2006), Zgierska (2017), Pastore and Socha (2006), and Saczuk (2014). Labour market researchers often use the Labour Force Survey (LFS) results without questioning their quality or comparability between

survey waves. This overlooks the implications of the methodological works mentioned above (all three of them).

In 2020-2021, the issue of result quality and comparability during the survey became crucial due to a relatively high number of methodological disturbances in the LFS. The Covid-19 pandemic significantly affected the collection of labour force participation data, with the LFS being conducted as a telephone survey (CATI) from Q2 2020. The Labour Force Survey (LFS) underwent significant changes in 2021, particularly in terms of subject coverage and the method of classifying the different groups of people in the labour market (employed, unemployed and inactive). The survey's subject scope was also modified (Statistics Poland, 2021). It is important to assess how these changes impact the measurement of economic activity.

The ongoing discussion in the literature includes the issues of methodological changes and their consequences for LFS results. This discussion mainly concerns the deteriorating quality of survey data, particularly household data, and their diminishing comparative advantage in relation to developing alternative sources of data, such as administrative data and big data. Surveys are relatively expensive, time-consuming, and susceptible to data processing errors. Furthermore, surveys are susceptible to unit non-responses, item non-responses, reliability issues, measurement errors, and respondent response process-related result biases and other errors (Meyer, Mok, Sullivan, 2015).

The literature widely discusses survey errors. Meyer and Mittag (2021) provide an empirical assessment of different types of errors within the total error survey paradigm. However, Groves and Lyberg (2010) argue that attempting to list all possible sources of measurement error in survey research according to this paradigm is doomed to failure, and such lists will always be incomplete. New sources of errors emerge due to technological and methodological innovations, as well as changes in survey implementation strategies. These changes are often conditioned by the evolving environment, such as the emergence of new technologies and increasing reluctance of respondents to participate in redundant surveys. Measurement errors can vary in magnitude depending on the defined sample, survey purpose, questionnaire translation, and other factors. The wording, number, and sequence of questions, as well as the selection and co-occurrence of specific topics, can also affect measurement and consequently

measurement errors. It is important to consider the cognitive processes of response formulation and respondent fatigue. A separate strand in the literature is the discussion of proxy interviews and their impact on the quality of results (e.g. Mellow, Sider, 1983; Bound, Krueger, 1991; Todorov, 2003; Lee, Lee, 2012).

The objective of this paper is to analyse the effect of methodological changes on the measurement of labour force participation in Poland. It discusses the errors affecting LFS results and how they have changed due to the introduced modifications. The paper also attempts to quantify these changes, providing a foundation for a thorough analysis of labour market processes during and after the pandemic.

Most of the literature available concentrates on errors in measuring household income and financial transfers, the exception being Ahn, Hamilton, 2022. The available estimates frequently fail to consider the cumulative estimation of different sources of error and the fact that respondents' reporting of income in surveys is conditional on their reporting of labour force participation. In this work, we concentrate on core measures of labour force participation. This paper presents a comprehensive survey that captures the multidimensionality of the changes that have occurred in the LFS. It documents the changes in the survey's implementation between 2020 and 2021 and identifies potential sources of measurement error. The effects of these sources are indicated separately and in combination. The paper is one of the few to our knowledge to look at the quality of the LFS following the changes in the 2021 survey.

International context

Public statistics are constantly changing due to the need for greater comparability over time and across different regions. Additionally, the phenomena being measured are constantly evolving and require updates in terms of definitions and data collection methods. Adjustments have been necessary in national labour force surveys of varying magnitudes due to various reasons. These include the transition from a quarterly to a continuous survey in different years, revisions for the 2001 and 2011 censuses (not for all countries), and the implementation and modification of NACE (2008), ISCO (1992 and 2011), or ISCED (1998, 2014, and 2016). Different countries have made different adjustments, and the comparability of the time series has been disturbed to varying degrees.¹ The accession of Central and Eastern European (CEE) countries to the EU marked a significant methodological change, requiring the adaptation of national labour force surveys to align with Eurostat guidelines. In the case of Poland, the LFS transitioned from a quarterly survey conducted in the middle month of the quarter to a continuous quarterly survey conducted evenly over all weeks of the quarter in Q4 1999.² In 2021, all countries were required to comply with the Integrated European Social Statistics Framework Regulation (IESS FR), also known as the Integrated European Social Statistics, and recalculate the back series of the main indicators from Q1 2009 to Q4 2020 based on the new methodology.

Although there has been an effort to harmonise the implementation of the LFS by 2020, there are still differences between countries (cf. Eurostat, 2020). As a result, there are varying degrees of adjustments that were implemented in 2021, and the difficulty of converting the series backwards also varies. Tables 1 and 2 illustrate the main differences in the methodology and implementation of the national LFS surveys.³ Countries vary in their rotation schemes and

¹ The discontinuity of the LFS series across countries and other issues related to harmonisation of national survey methodologies and comparability of results are described in detail in the Eurostat material: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_labour_force_survey_%E2%80%93_data_and_publication#Structure_of_EU-LFS_dissemination; a summary of basic information on national LFS can be found in Eurostat (2020).

² Due to the transition to a continuous formula, the Polish LFS was not conducted in Q2 and Q3 1999.

³ The publication 'Labour Force Survey in the EU, EFTA and candidate countries - Main characteristics of national surveys, 2020, 2022 edition' describes all relevant differences in detail. It was published by the Publications Office of the European Union in 2022.

patterns of weighting observations. The percentages of interviews collected using different methods, such as CAPI, CATI, PAPI, and CAWI, also differ (see Figure 1)⁴.

Table 1. Implementation of the LFS in European countries in 2020.

	Obligatory	Rotation Scheme	Survey Implementation Method					
			CAPI [%]	CATI [%]	PAPI [%]	CAWI [%]	Other [%]	
Austria	yes	5	18.5	81.5	0	0	0	
Belgium	yes	2-(2)-2	7.7	52.9	0	39.4	0	
Bulgaria	no	2-(2)-2	0	0	88.9	0	11.1	
Croatia	no	2-(2)-2	28.1	71.9	0	0	0	
Cyprus	yes	6	90.3	9.7	0	0	0	
Czech Republic	no	5	8	25	40	0	27	
Denmark	no	2-(2)-2	0	49.8	0	50.2	0	
Estonia	no	2-(2)-2	18	82	0	0	0	
Finland	no	3-(1)-2	0.2	99.8	0	0	0	
France	yes	6	19	81	0	0	0	
Germany	yes	2-(2)-2	1.7	22.8	34.2	40.3	0	
Greece	yes	6	2.9	0	97.1	0	0	
Hungary	no	6	33.6	66.4	0	0	0	
Ireland	no	5	50.1	38.7	0	0	11.2	
Island	no	3-(2)-2	0	100	0	0	0	
Italy	yes	2-(2)-2	CATI as dominant method due to COVID-19					
Latvia	no	2-(2)-2	10.6	84	0	5.4	0	
Lithuania	no	2-(2)-2			n/a			
Luxembourg	yes	5	0	30.7	0	69.3	0	
Malta	yes	2-(2)-2	0	92	8	0	0	
Montenegro	no	2-(2)-2	0	0	100	0	0	
Northern Macedonia	no	2-(2)-2	36	64	0	0	0	
Norway	yes	8	0	100	0	0	0	
Poland	no	2-(2)-2	23.1	74.5	2.5	0	0	
Portugal	yes	6	7.3	92.7	0	0	0	
Romania	no	2-(2)-2	66	0	34	0	0	
Serbia	no	2-(2)-2	34.8	65.2	0	0	0	
Slovakia	yes	5	0	66.2	19	0	0	
Slovenia	no	3-(1)-2	15	85	0	0	0	
Spain	yes	6	27.9	71.4	0	0.8	0	
Sweden	no	8	0	100	0	0	0	
Switzerland	no	2-(2)-2	0	100	0	0	0	
The Netherlands	no	5	4	69	0	27	0	
Turkey	yes	2-(2)-2	34	66	0	0	0	

Source: Eurostat (2022a).

⁴ The implementation of the LFS in different countries in 2020 differs significantly from previous years due to adjustments made during 2020 related to the Covid-19 pandemic outbreak. The data is also likely to differ significantly from 2021 onwards. The table displays averaged data for the whole year, which does not allow for a full assessment of the changes introduced to the survey from Q2 2020 onwards. For comparison, the appendix provides a summary of data on the methods used to implement the LFS in European countries in 2020 and 2019.

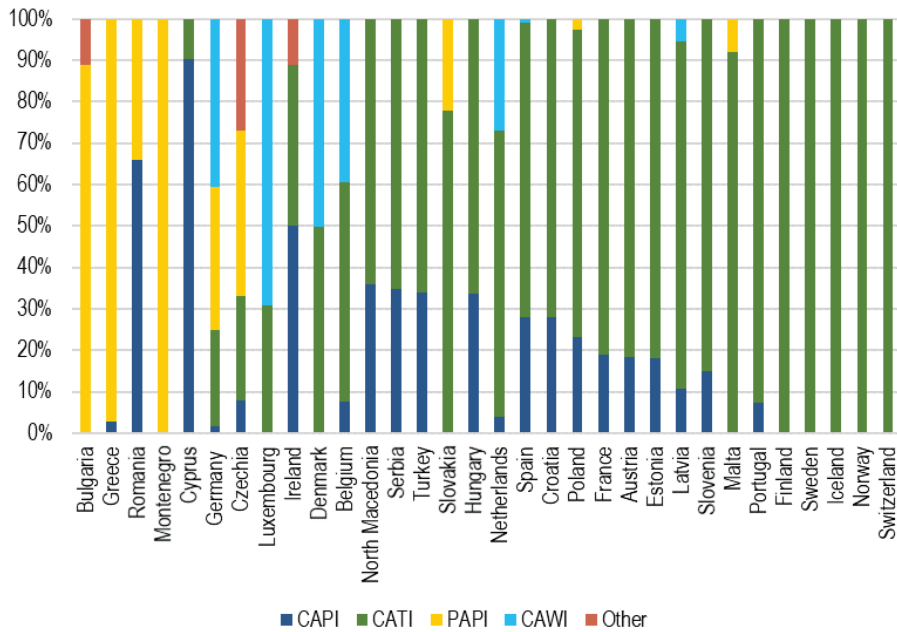
Table 2. Implementation of the LFS in European Countries in 2020.

	Population covered	Percentage of population surveyed	Achieved sample size		Response rate	Percentage of proxy interviews with people aged 15-74	Percentage of refusals in non-responses
			[households]	[individuals]			
	[age]	[%]			[%]	[%]	[%]
Austria	15+	0,60	20 400	33 600	94,60	22,30	33,50
Belgium	15-76	0,14	15 700	28 800	81,40	27,60	17,70
Bulgaria	15+	0,65	13 100	22 300	72,60	27,00	14,50
Croatia	15+	0,51	3 600	6 800	57,00	51,20	56,00
Cyprus	15+	1,40	3 700	7 300	94,00	39,50	35,00
Czech Republic	15+	0,60	23 000	36 800	73,80	42,10	62,50
Denmark	15-74	0,77	-	18 124	54,00	6,90	12,00
Estonia	15-74	0,73	3 300	5 900	71,80	23,40	49,60
Finland	15-74	0,90	-	21 469	59,30	3,90	49,00
France	15+	0,20	44 100	70 000	72,80	27,10	14,00
Germany	15+	0,15	42 300	63 300	53,20	21,00	0,00
Greece	15+	0,79	23 100	35 900	64,50	39,30	28,20
Hungary	15-74	0,92	21 800	37 500	64,70	41,60	23,40
Ireland	15+	0,70	12 598	22 400	49,00	47,10	24,30
Island	16-74	1,95	-	3 200	61,90	0,12	21,80
Italy	16+	0,27	61 800	98 200	79,80	32,90	21,60
Latvia	15-74	0,89	4 300	6 800	58,40	40,20	21,80
Lithuania	15+	1,00	6 100	10 400	77,50	32,00	31,20
Luxembourg	15+	1,60	5 200	6 400	62,90	26,50	5,90
Malta	15+	1,54	2 100	4 300	65,40	44,70	7,80
Montenegro	15+	1,54	2 100	4 500	77,80	43,30	30,20
Northern Macedonia	15-79	0,90	4 000	9 400	83,90	55,30	38,90
Norway	15-74	0,60	13 800	20 500	85,30	11,80	0,00
Poland	15+	0,40	29 600	55 200	66,10	40,10	42,60
Portugal	15+	0,60	12 300	22 900	61,70	50,30	7,50
Romania	15+	0,38	22 400	43 500	84,70	19,60	20,80
Serbia	15+	0,80	11 100	21 700	70,50	48,90	19,20
Slovakia	15+	0,60	8 500	16 700	79,90	52,10	74,50
Slovenia	15+	1,00	5 700	11 500	57,80	54,20	17,30
Spain	16+	0,39	60 800	112 600	84,70	50,00	26,70
Sweden	15-74	0,70	-	26 700	51,00	2,00	32,70
Switzerland	15-89	0,51	-	28 148	78,80	2,10	12,70
The Netherlands	15+	0,50	40 600	78 600	47,50	43,50	70,90
Turkey	15+	0,22	47 900	112 100	94,50	12,10	0,60

Source: Eurostat (2022a).

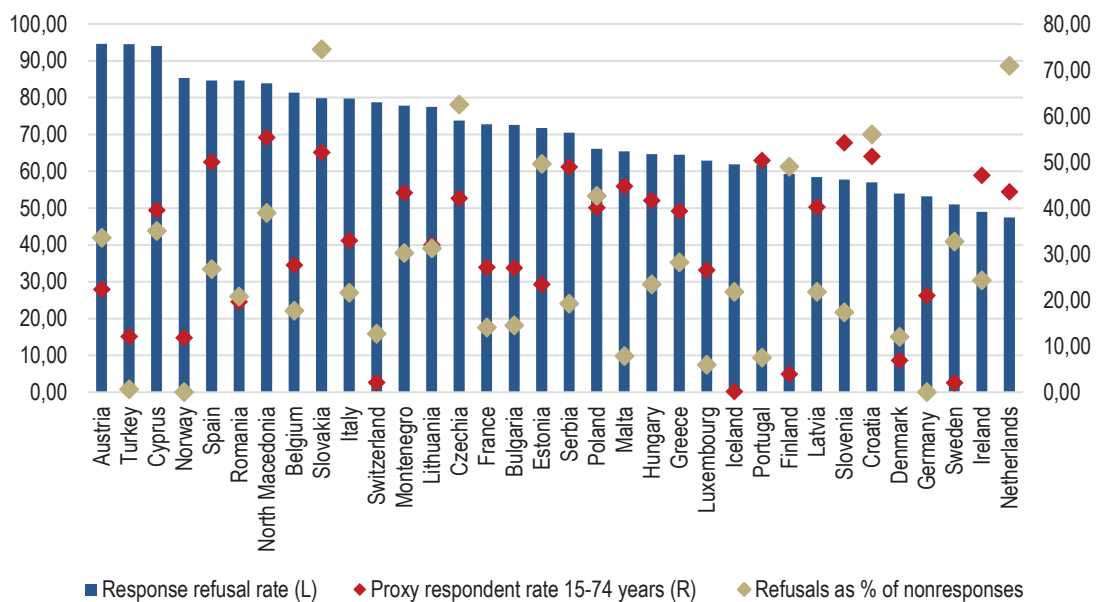
Most countries do not use sampling strata to exclude the 90+ age group. In the so-called 'old EU', a significant number of countries only ask questions about labour force participation and employment to individuals aged 15-74.

Figure 1. Implementation of the European Labour Force Survey in 2020.



Source: Eurostat (2022a).

Figure 2. Response refusal and proxy responses in European countries, 2020.



Source: Eurostat (2022a).

The purpose of regulations (EU) 2019/1700 and (EU) 2019/2240, which came into effect on 1 January 2021, is to establish a standardised framework for collecting high-quality data that can be compared internationally in the field of social statistics. These regulations replace regulation (EU) 1897/2000, which was in effect since Q1 2017.

Among other things, the following have been streamlined:

- The reference population - this has been restricted to those aged 15-89 years,
- The classification of absenteeism from work, in particular people on parental leave (if they receive income or work-related benefits or if their absence is expected to last 3 months or less, they are counted as employed) and seasonal workers (who are classified as employed in the off-season if they continue to perform tasks and duties regularly for their employer in the off-season). Thus, people who are temporarily absent from work during the reference week but who are relatively strongly attached to their place are still considered employed,
- Persons engaged in farming and fishing activities exclusively or mainly for their own use - are no longer classified as employed,
- Jobseekers - are classified only based on active job search methods (passive methods are excluded),
- Measurement of the number of hours effectively worked per quarter,
- Measurement of annual labour income,
- The rotation and sampling scheme and the required precision of the estimates of the most important indicators,
- The weighting procedure and the requirement for an even distribution of the quarterly sample between the weeks of the quarter,
- Principles for adjustment, imputation and use of administrative data and other sources.

The guidelines for implementing the LFS have affected the surveys to varying degrees, depending on the assumptions made by each country.

Additionally, countries implementing the LFS have had to adapt to the epidemic situation. Furthermore, most countries will reweight the series, considering the censuses implemented in 2021, which will further impact the survey results.

Polish LFS – Badanie Aktywności Ekonomicznej Ludności (BAEL)

The Covid-19 pandemic outbreak in Poland occurred during a period of relatively good, albeit deteriorating, labour market conditions. The stable labour demand and historically low levels of unemployment created a positive environment, despite the low labour force participation rate and the shrinking labour resources due to the ageing population. During the pandemic, various sectors of the economy were disrupted due to both sanitary needs and the government's attempt to protect employment. This significantly affected labour market processes and rendered basic labour market indicators, such as the unemployment rate, no longer informative. The freezing of economic activity due to employment protection lockdowns, the rise of remote working, and the introduction of distance learning have limited work opportunities for some parents. Additionally, the increase in unpaid domestic work due to the freezing of some services and changes in people's labour and social activity triggered by the fear of contagion have created a confluence of factors with difficult-to-predict consequences. Adjustment processes have emerged over time, and the already observed population decline has accelerated. The labour market has undergone significant changes, which have resulted in corresponding changes in the LFS core indicators. However, as the onset of the pandemic coincided with some of the changes introduced in the survey and was itself the cause of the introduction of others, it is reasonable to ask what part of the changes recorded in the indicators reflect actual processes and what part is due to changes in the way LFS activity is measured.

In accordance with the announcement and the need to harmonise European social surveys, the LFS in Poland has undergone significant methodological changes due to the implementation of the Regulation of the European Parliament and Council (EU)⁵ in line with Eurostat guidelines.

In the case of Poland, these changes concerned to the greatest extent:

- (i) the exclusion from the employed category of self-employed or assisting family members in individual farming producing exclusively or mainly for their own consumption, as long as they have no other job (approximately 20% of those working in individual farming in 2019),
- (ii) the inclusion in the working category of those on unpaid parental leave of more than 3 months (approximately half of all parental leaves in 2019),

⁵ Regulation (UE) 2019/1700 of the European parliament and of the Council of 10 October 2019 r.

- (iii) limiting the scope of subjects to the population of 15–89-year-olds (until now it has been those aged 15 and over) and questions on unemployment to those aged 15-74.

The changes resulting from the harmonisation of European surveys were implemented immediately after adapting the survey to the sanitary guidelines due to the Covid-19 pandemic. Table 3 summarises the changes made to the survey from the beginning of 2020 and their potential impact on the results. The hypothesis is that the observed results in the labour market cannot be solely interpreted in terms of real economic phenomena related to the Covid-19 epidemic and its impact on the economy.

Table 3. Summary of LFS (BAEL) methodological changes in 2020-2021.

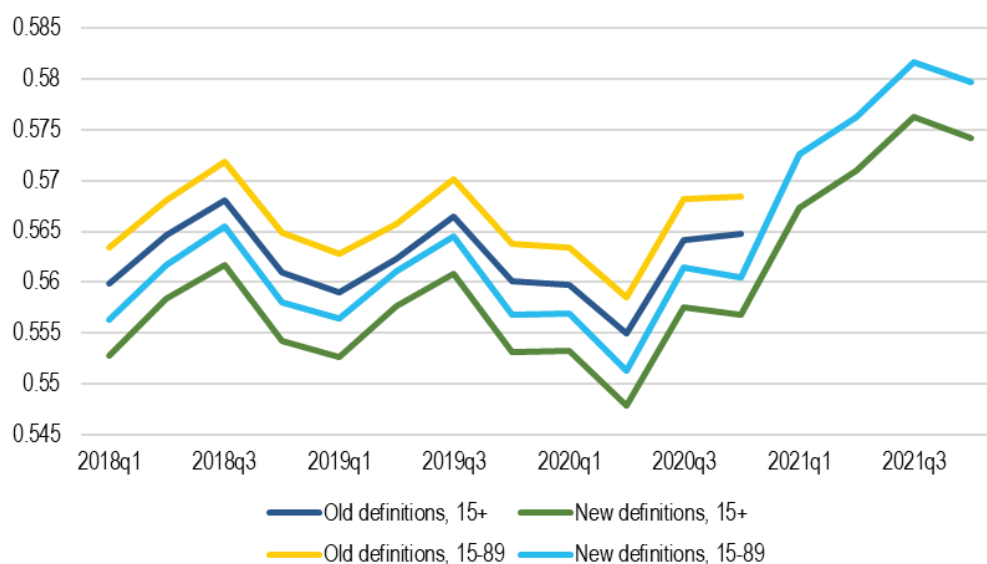
Quarter	Change	Potential implications and problems
1Q2020	Change of data collection method from face-to-face to telephone interviews	Problem of population coverage (difficulty in reaching certain socio-economic groups) Change in the percentage of refusals to participate in the survey or refusals to respond.
2Q2020	Changing the rotation scheme of elementary samples in the survey (keeping some of the samples in the survey longer, delaying the inclusion of one of the samples in the survey)	Disruption of the fixed rotation scheme Impact on calibration weights Potential bias in sample/results
	Adding COVID-19 related questions	Influencing other responses by adding additional context
3Q2020	Changing the method of recruiting households for the survey from face-to-face (CAPI or PAPI) to telephone (CATI)	Problem of population coverage (difficulty in reaching certain socio-economic groups) Change in the rate of refusal to participate in the survey or refusal to respond
	Changing the calibration of the weights (inclusion of education)	Unknown marginal distribution of education in the population
1Q2021	Revision of basic definitions in the survey	Comparability of results over time
	Changing the order of questions, filters and questionnaire design	Comparability of results over time
1Q2021, 2Q2022	Changing the wording of the questions and the cafeteria	Influence on other responses by adding additional context. Comparability of results over time

Source: own summary.

In addition to the non-measurable qualitative effects, the changes introduced have a measurable impact on the underlying survey results. This is confirmed by comparing estimates of the labour force participation rate based on individual data before 2021, taking

into account changes in the definition and population⁶. It shows clearly that changes affect the results to different degrees and in different directions and that the published survey results are the result of all methodological changes and actual labour market processes.

Figure 3. Comparison of activity rates according to old and new populations and definitions.



Source: GUS data, own calculations.

The differences in the estimates, using the labour force participation rate as an example, demonstrate only a portion of the changes that have taken place in the LFS over the past two years. The summary only considers the impact of population and definition changes that were implemented in 2021. The alterations in the definitions and survey population were further complicated by other factors, as discussed in Table 3. The impact of these factors may not have affected activity estimates proportionally between the old and new survey methodologies. This is indicated by the modifications made to the survey implementation parameters, which are summarised in Tables 4 and 5. The first estimates of the survey parameters after all the changes introduced will be available after the publication of the 2021 data.

⁶ A certain methodological difficulty here is the cutting off the sample of people aged 90+ from the group of people aged 65+.

Table 4. Proxy interviews and non-response between 2012 and 2020.

Year	Share of proxy interviews	Households' unit non-responses
2012	40.9	24.2
2013	40.7	28.1
2014	40.0	31.5
2015	37.8	34.9
2016	37.2	37.6
2017	37.6	38.7
2018	36.5	42.2
2019	36.2	45.9
2020*	40.1	33.9

* Figures for 2020 are averaged estimates for Q1 implemented almost entirely face to face, as in previous years, and the remaining three implemented 100% by telephone due to the COVID-19 pandemic.

Source: Eurostat (2022a), Eurostat (2021a), Eurostat (2020), Eurostat (2019), Eurostat (2018).

Table 5. Structure of non-response between 2016 and 2020.

Year	Total	Households' unit non-responses	Non-contacts	Other reasons
2016	37.1	20.5	14.7	1.8
2017	38.7	20.4	17.0	1.3
2018	42.2	21.3	19.5	1.4
2019	45.9	23.8	20.7	1.4
2020*	33.9	14.5	11.3	8.1
2021	35.1	11.7		

* Figures for 2020 are averaged estimates for Q1 implemented almost entirely face to face, as in previous years, and the remaining three implemented 100% by telephone due to the COVID-19 pandemic.

Source: Eurostat (2022a), Eurostat (2021a), Eurostat (2020), Eurostat (2019), Eurostat (2018), GUS (2023).

Since the start of the survey, various measures have been taken during the preparation and implementation of the LFS to minimize measurement error. These methods include announcement lists, cyclical interviewer training, feedback from interviewers, monitoring of implementation through control contacts with respondents, observation of the conduct of interviews, monitoring of implementation through the analysis of selected indicators and remote monitoring of survey implementation. Following the changes made to the survey, not all of its components perform their functions equally as well as before. This could indirectly affect the survey results. The change in the method of calibration of the scales in mid-2020, which incorporated education into the calibration variables, may provide some confirmation

of the problems encountered by the Statistics Poland regarding representativeness and data quality⁷.

Furthermore, due to changes in the way respondents are reached and interviews are conducted, there may have been changes in sampling error, error due to non-response, coverage error, and selection bias. These changes could have serious consequences for the research results and the quality of the data collected.

Changing the survey to telephone slightly increases the population coverage problem in the LFS. According to the 2019 Household Budget Survey (BBGD), only 16.63% of households declared having a landline phone, while 3.33% of households did not declare the use of at least one mobile phone (or smartphone). Additionally, 1.26% of households surveyed by the BBGD have neither a landline nor a mobile phone.

Based on the analysis conducted by Ward and Edwards (2021), this text attempts to estimate the impact of the change in survey method on the LFS survey results. The LFS survey underwent a transition from mainly face-to-face to entirely telephone-based, which is similar to the case described by Ward and Edwards (2021). However, the situation is further complicated by significant changes to the survey methodology that were introduced at the beginning of 2021. The aim of the remainder of this article is to analyse how the survey method impacts respondent characteristics in the context of the Polish LFS.

⁷ It is important to note that education has historically been solely based on outcomes, with edge distributions derived from previous waves of the LFS. The weights used for calibration previously took into account probabilities of being selected for the sample, missing responses by locality, age, gender, place of residence (split urban/rural with provincial strata), and information on household composition.

Non-response

The Economic Activity Survey is conducted using an address-based sample. The survey includes individuals aged 15 and over who are members of households residing in the selected dwellings. Basic information about the household and its composition, as well as temporarily absent persons, is also collected. The survey excludes individuals living in collective households.

By default, households selected for the survey participate in the survey four times (4 quarters) - two consecutive quarters after selection and then the same two quarters in the following year (i.e., after a two-quarter break). The LFS sample in each quarter before the pandemic consisted of 4 representative independent elementary samples (numbered): one participating for the first time, one participating for the second time, one participating for the third time and one participating for the fourth time. The survey was carried out using face-to-face computer-assisted interviewing (CAPI) or a paper-and-pencil questionnaire (PAPI). Telephone interviews (CATI) were also allowed, but only for one-person households interviewed for the second or subsequent time, who agreed to this form of interview and provided a telephone number (Statistics Poland, 2018). The interviews are carried out using a continuous method, i.e., a random sample of about 1/13 is interviewed each week of the quarter, with the reference week being the week before the survey.

After the pandemic was announced in March 2020, the Statistics Poland suspended face-to-face surveys and conducted them only by telephone starting from week 11 of Q1 2020. Despite this change, the level of survey completion at the beginning of the pandemic was not significantly disrupted, as shown in table 6. However, the continuity of the survey in Q1 2020 was affected. During the initial three weeks of the telephone survey, the average share of the sample completed each week and the average number of interviews completed were about 10% lower than in the remaining weeks of Q1 2020. Additionally, the realised sample size of the elementary sample 87, who participated in the survey for the first time, was also lower (see table 7).

During the pandemic, households were contacted using telephone numbers obtained from previous survey rounds, but only for respondents who had given permission for such contact.

For other and newly recruited respondents, contact data prepared for the 2021 National Census was used.

Table 6. Numbers of interviews completed in consecutive weeks of the quarter, Q1 2019 - Q4 2021⁸.

Survey week	2019				2020				2021			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	5148	4980	4923	4983	4759	5019	6371	6430	6077	6312	5197	5183
2	5283	5058	4908	5179	4984	5197	6375	6433	6055	6594	5423	5240
3	5414	5195	4811	4941	5094	5416	6314	6624	6169	6135	5120	5235
4	5377	4811	4676	4900	4886	5175	6281	6133	6086	6220	5248	5308
5	5461	5060	4941	5016	4982	5354	6335	6394	6163	6294	5170	5254
6	5255	5084	4832	4949	4893	5155	6024	6364	6329	6276	4989	5260
7	5594	5151	4849	5038	5126	5282	6389	6556	6285	6326	5177	5277
8	5322	5309	5135	5033	4950	5146	6436	6682	6284	6174	5257	5426
9	5372	4966	4912	5119	4914	5050	6579	6463	6135	6414	5286	5425
10	5355	4934	5087	5078	4561	4867	6243	6137	5862	6014	4921	5332
11	5284	5041	5194	4831	4353	4866	6258	6166	5804	5816	4829	5214
12	5341	5049	5085	4776	4319	4887	6148	6044	5774	5799	4759	5257
13	5320	4975	4933	4690	4434	4887	6227	6203	5809	5956	4804	5052
	69526	65613	64286	64533	62255	66301	81980	82629	78832	80330	66180	68463

Source: own compilation based on LFS unit data (Statistics Poland).

Table 7 displays the actual elementary sample sizes for the following survey rounds from Q1 2019 to Q4 2021. The rows indicate the actual counts of numbered elementary samples that participated in the survey during the respective survey quarters. The columns show the counts of all elementary samples surveyed during the respective quarters. Disturbances to the survey rotation scheme introduced due to the pandemic, such as samples surveyed or omitted not in accordance with the scheme, are highlighted in yellow. The horizontal line between elementary samples 87 and 88 separates samples recruited for the survey by face-to-face interviews (up to and including 87, except for the last three weeks of the survey when recruitment was by telephone) from elementary samples recruited for the survey by telephone only (from 88 onwards).

In Q2 2020, the sampling scheme was disrupted when elementary sample No. 88 was omitted from the survey. Instead, elementary sample No. 86, which was supposed to have a break in the survey, and elementary sample No. 82, which should have already completed its

⁸ An analogous table with the percentages of the sample that were realised in the following weeks of the survey can be found in the annex.

participation in the LFS, were surveyed again. The LFS sample comprised five elementary samples, all conducted through face-to-face interviews.

New elementary samples added to the LFS in accordance with the scheme were recruited to the survey by telephone from the third quarter of 2000 onwards. In Q3, elementary samples No. 88 (which should be surveyed a second time this quarter according to the rotation scheme) and sample No. 89 (according to the scheme) were included. In addition to the new elementary samples, directly recruited elementary samples 82 (for the sixth time) and 83 (for the fifth time), which according to the scheme should have already left the survey, were again surveyed in Q3 2020. The LFS sample consisted of six elementary samples, four of which were directly recruited (two scheduled and two additional) and two were recruited by telephone, up to and including Q1 2021. In the second quarter of 2021, the Labour Force Survey (LFS) sample was composed of six elementary samples, four of which were according to the scheme and two were additional. Starting from the third quarter of 2021, the sample is made up of five elementary samples, four of which are according to the scheme, and one is surplus. As of the fourth quarter of 2021, there are no longer any directly recruited elementary samples (individuals) in the LFS sample.

Table 7. Numbers of completed individual interviews by elementary sample, Q1 2019 - Q4 2021.

Sample no.	2019				2020				2021			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
78	19203											
79	18136	18099										
80	-	17323	17453									
81	-	-	17085	17423								
82	17036	-	-	16957	16956	14207	13358					
83	15151	15859	-	-	16218	14041	13163	13026				
84		14332	15076	-	-	12487	11701	11605	10993			
85			14672	15607	-	-	13923	14229	13290	13071		
86				14546	15444	13481	-	13509	12774	12442		
87					13637	12085	-	-	11315	11103	10852	
88						-	14583	-	-	13528	13423	13283
89							15252	15135	-	-	14165	14159
90								15125	14605	-	-	13997
91									15855	15436	-	-
92										14750	14357	-
93											13383	13226
94												13798
Total	69526	65613	64286	64533	62255	66301	81980	82629	78832	80330	66180	68463

Source: own compilation based on LFS unit data (Statistics Poland).

Table 8 summarises the number of individual interviews completed in Q1 2020, in consecutive weeks of the survey, by elementary sample. It is worth noting that the first case of Covid-19 in Poland was recorded on 4 March 2020 (in week 10 of the quarter), and face-to-face surveying was completely suspended from 13 March. As a result, the continuity of the survey over time was disrupted in Q1 2020. From week 10 onwards, there is a noticeable decrease in the number of completed interviews (see table 8), with a fluctuation of around 5% in the directly recruited elementary samples (82, 83 and 86) compared to the first 9 weeks of the quarter. In subsample 87, which participated in the survey for the first time, there was a decrease of almost 30% in the number of completed individual interviews from week 10 onwards compared to the beginning of the quarter. As a result, the final weeks of Q1 2020 were slightly under-represented.

Table 8. Numbers of completed individual interviews in consecutive weeks of Q1 2020, by elementary sample.

Survey week	Elementary sample no.				Total
	82	83	86	87	
1	1259	1241	1186	1073	4759
2	1335	1240	1242	1167	4984
3	1338	1356	1208	1192	5094
4	1381	1223	1166	1116	4886
5	1434	1250	1093	1205	4982
6	1264	1185	1288	1156	4893
7	1345	1356	1251	1174	5126
8	1229	1328	1219	1174	4950
9	1319	1234	1260	1101	4914
10	1341	1179	1148	893	4561
11	1249	1175	1072	857	4353
12	1208	1188	1191	732	4319
13	1254	1263	1120	797	4434
Total	16956	16218	15444	13637	62255

Source: own compilation based on LFS unit data (Statistics Poland).

The number of individual interviews carried out in Q2 2020, which is already conducted entirely by telephone, falls by around 13% compared with the previous quarter in elementary samples 83, 86 and 87 up to week 10 of the survey (from week 10 onwards the number of interviews carried out is only around 8% lower, largely due to the low base effect). In both Q2 and Q3, the lower number of interviews conducted in all the elementary samples is spread more evenly over the quarter (see Tables 9 and 10). The data shows a systematic decrease in counts for subsequent quarters of survey participation among a given elementary sample,

which is related to the attrition of elementary samples. The initial quarters of the telephone-recruited sample survey are noteworthy. The counts of the first five elementary samples (elementary samples no. 88 - 92) are higher than those of the samples introduced by the face-to-face method in 2019 (cf. Table 7).

Table 9. Numbers of completed individual interviews in consecutive weeks of Q2 2020, by elementary sample.

Survey week	Elementary sample no.					Total
	82	83	84	86	87	
1	1061	1069	937	1015	937	5019
2	1119	1103	873	1086	1016	5197
3	1084	1203	975	1076	1078	5416
4	1163	1021	977	1035	979	5175
5	1195	1129	1008	969	1053	5354
6	1044	1005	964	1127	1015	5155
7	1135	1121	1003	1044	979	5282
8	1003	1116	978	1030	1019	5146
9	1070	1015	884	1103	978	5050
10	1085	1020	934	1007	821	4867
11	1101	1026	1006	940	793	4866
12	1075	1054	1021	1063	674	4887
13	1072	1159	927	986	743	4887
Total	14207	14041	12487	13481	12085	66301

Source: own compilation based on LFS unit data (Statistics Poland).

Table 10. Numbers of completed individual interviews in consecutive weeks of Q3 2020, by elementary sample.

Survey week	Elementary sample no.						Total
	82	83	84	85	88	89	
1	1030	1008	869	1121	1145	1198	6371
2	1052	1035	858	1124	1166	1140	6375
3	1023	1071	937	1101	1000	1182	6314
4	1093	985	919	1037	1161	1086	6281
5	1159	1064	951	1020	1028	1113	6335
6	980	958	887	989	1053	1157	6024
7	1066	1048	961	1117	1033	1164	6389
8	938	1081	935	1105	1053	1324	6436
9	1052	990	865	1157	1258	1257	6579
10	996	942	837	1004	1254	1210	6243
11	1013	960	893	1073	1113	1206	6258
12	967	963	927	1004	1221	1066	6148
13	989	1058	862	1071	1098	1149	6227
Total	13358	13163	11701	13923	14583	15252	81980

Source: own compilation based on LFS unit data (Statistics Poland).

In 2019, the LFS had an average sample size of 66,000 people, with an average of around 16.5 thousand interviews in the elementary sample. In Q1 2020, the sample size was 62,000 people, with an average completion of 15.6 thousand persons in the elementary sample. This decrease in sample size was most likely due to lower completions towards the end of the quarter after the switch to telephone surveys. During Q2 2020, the sample size was 66,000. However, the survey was conducted on 5 elementary samples, with an average of 13.3 thousand interviews in each (cf. Table 7). From Q3 2020 to Q2 2021, the survey was conducted on 6 elementary samples, with an average of approximately 13.5 thousand interviews in each. During Q3 and Q4 of 2021, the survey was conducted on five elementary samples, each consisting of an average of 13.5 thousand interviews. The total sample size was approximately 63.7 thousand people on average.

The completed interviews in elementary samples during successive quarters of the survey appear to be significantly influenced by the survey method. Since the start of the telephone survey in Q2 2020, the number of interviews completed in samples recruited by telephone has been consistently higher than those completed in samples recruited directly. On average, 14.3 thousand interviews were completed in telephone-recruited samples compared to 12.7 thousand in directly recruited samples (cf. Table 7). This may be related to the loss of households from the elementary samples in successive rounds of the survey (panel attrition). A comparison of the number of interviews conducted in each round of the survey for individual elementary samples reveals variations between samples recruited directly and those recruited by telephone (refer to Table 11).

Table 11. Index of completed individual interviews in the elementary samples in consecutive quarters of the elementary samples in the survey (first quarter in the survey = 100).

Elementary sample no.	Quarter in the survey					
	I	II	III	IV	V	VI
78	100	104	105	107		
79	100	103	106	106		
80	100	107	107	108		
81	100	109	109	111		
82	100	107	107	107	89	84
83	100	105	107	93	87	86
84	100	105	87	82	81	77
85	100	106	95	97	91	89
86	100	106	93	93	88	86

87	100	89	83	81	80
88	100	93	92	91	
89	100	99	93	93	
90	100	97	93		
91	100	97			
92	100	97			
93	100	99			
94	100				

The line dividing elementary sample 87 and 88 represents the boundary between samples recruited directly (up to and including 87) and those recruited by telephone (88 and above). The shaded areas indicate the quarters in which a particular elementary sample was surveyed entirely by telephone (i.e. Q2 2020 or later).

Source: own compilation based on LFS unit data (Statistics Poland).

For the elementary samples recruited directly (excluding sample No. 87), it is noteworthy that in subsequent survey rounds conducted directly before the pandemic, the number of individual interviews was higher than in the round in which the elementary sample was included in the survey (on average about 6%). This is likely since some households could not be reached in the quarter in which they were selected for the survey and therefore left that round. In the next round of the survey, the household was only able to be surveyed after contact was made, which may have required a higher-than-average involvement of the interviewer. This effect was also noted by Ward and Edwards (2021) in the CPS survey. It should be noted that prior to the pandemic, face-to-face surveys consistently yielded no fewer (and usually more) completed interviews each consecutive quarter for all elementary samples. In the fourth round of the survey for elementary samples 78-82, the number of interviews completed on average was 8% higher than in the first round. In contrast, the number of interviews for elementary samples recruited and completed by telephone (88 and above) was highest in the quarter in which the elementary sample joined the survey, and then declined steadily. A decrease in the number of completed interviews systematically occurred in the elementary samples recruited immediately after the transition to the telephone survey, except for the fourth round in sample survey 85 and 86.

The transition to telephone interviewing for the directly recruited elementary samples meant a drop in the number of completed interviews by an average of 14% (Table 11.; the grey colour indicates quarters in which the elementary sample was interviewed entirely by telephone, i.e., from Q2 2000 onwards). As the telephone recruited samples only entered the survey, it is

difficult to assess the extent to which the survey method reduced completion in these elementary samples.

An analysis of the percentage of people who can be reached in the first interview, combined with information about non-participants and dropouts, provides yet another set of conclusions. This part of the study uses the time frame of Q4 2018. Q4 2021, including the start of elementary sample No. 82. Table 12 shows the structure of elementary sample numbers 82-93. The analysis pertains to individuals' participation in subsequent rounds of the survey⁹ (unit non-response).

Table 12. Structure of elementary samples no. 82-93 (Q4 2018 - Q4 2021).

Elementary sample No.	Max number of interviews in the analysed time period	% of complete interview cycles in the observed time window (unweighted data)
82	6	54.66
83	6	55.82
84	6	56.08
85	6	53.81
86	6	59.10
87	5	66.02
88	4	71.24
89	4	72.42
90	3	79.44
91	2	90.40
92	2	89.89
93	2	90.20

The line dividing elementary sample 87 and 88 represents the boundary between samples recruited directly (up to and including 87) and those recruited by telephone (88 and above). Source: own compilation based on LFS unit data (Statistics Poland).

The complete interview cycle was taken to be the number of completed interviews with a given respondent that was equal to the number of all the interviews foreseen for the basic sample from which his/her household was drawn. For instance, in sample 82, only 54.66% of individuals participated in all six scheduled interviews, and in sample 87, only 66.02% of individuals participated in all five interviews. However, the average percentage of survey participants is higher. For instance, in samples 82 and 87, the percentages are 84.42% and 85.03% respectively. This indicates that unit non-response does not exclusively affect the same individuals and that survey participation patterns are more diverse than mere panel attrition. These include, but are not limited to, problems in contacting and conducting the first

⁹ Based on the individual interviews.

interview, problems in contacting respondents after a break, one-off random non-participation in a particular week of the survey, and refusals to continue participating in the survey.

The percentage of completed interviews decreases with the order of the visit, i.e. the later the interview in the survey cycle, the higher the percentage of non-responses (Table 13). It is worth noting, however, that there are relatively high rates of unit non-response in the first interview for those who do eventually participate in the survey. The switch to telephone recruitment resulted in a significant decrease in non-response rates for the first interview conducted during the first theoretical household visit.

Table 13. Realisation of the survey according to consecutive visits for elementary samples No. 82-93 (Q4 2018 - Q4 2021).

Elementary sample No.	Quarter in the survey						Total
	1	2	3	4	5	6	
82	90.1%	96.8%	91.1%	88.0%	73.6%	68.9%	84.4%
83	92.3%	96.0%	90.3%	77.9%	72.7%	71.5%	83.1%
84	90.7%	95.4%	78.0%	73.3%	72.0%	68.1%	79.5%
85	90.6%	96.4%	81.0%	80.8%	75.5%	73.4%	82.6%
86	90.2%	95.4%	83.0%	82.3%	77.8%	74.7%	83.8%
87	98.8%	88.2%	81.6%	79.5%	77.4%		85.0%
88	94.5%	88.1%	86.0%	84.0%			88.1%
89	95.2%	94.7%	86.2%	84.9%			90.1%
90	95.8%	93.7%	87.3%				92.2%
91	96.6%	93.8%					95.2%
92	96.1%	93.7%					94.9%
93	95.5%	94.7%					95.1%
Total	89.7%	90.0%	83.5%	80.8%	74.4%	71.3%	

The line dividing elementary sample 87 and 88 represents the boundary between samples recruited directly (up to and including 87) and those recruited by telephone (88 and above). The shaded areas indicate the quarters in which a particular elementary sample was surveyed entirely by telephone (i.e., Q2 2020 or later).

Source: own compilation based on LFS unit data (Statistics Poland).

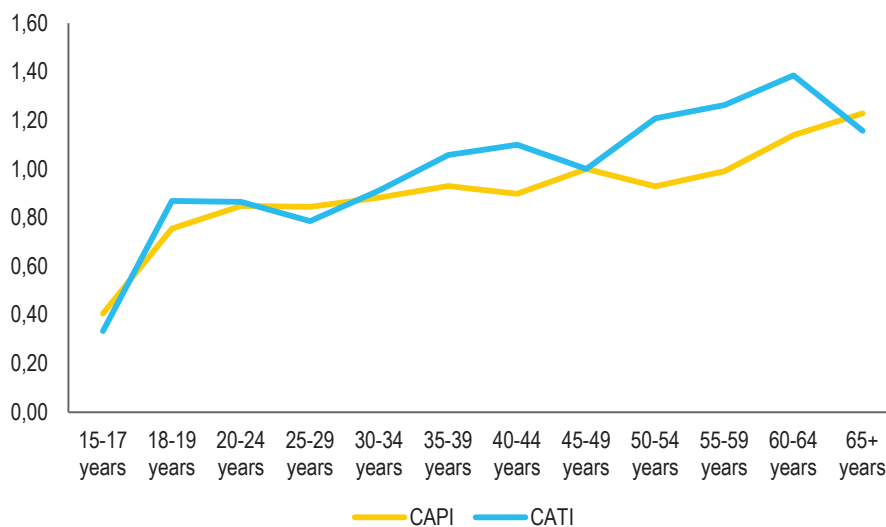
To examine the structure of unit non-response, the dataset was converted into a panel. The 'time' variable represents the number of the interviewer's 'theoretical' visits to the household. The number of missing visits was imputed using the cold-desk method, along with the characteristics from the last available interview. These characteristics include sample number, gender, education (categorized into 3 categories), place of residence (urban/rural), age (categorized into 12 categories), labour market status, completion of the interview directly or by proxy, and completion of the first interview directly or by telephone (CAPI/CATI). The only

exception is the initial visit that is missing, where no substitution is imputed, and the remaining variables are imputed from the subsequent completed visit. All analyses in this section of the survey were conducted on unweighted data since the weights in the LFS for a particular respondent are not constant over time.

To determine who was harder to reach, we estimated the probability of participation in the first interview using the back-imputed data set. We estimated four logit models of the probability of participation in the first interview. The first model includes the variables used in the construction of the weights: age, gender, education, and place of residence (urban/rural). The second model included a variable to indicate the method of completion for the first interview, or the second if the first was not conducted. The third model was estimated using a subsample recruited directly, while the fourth was based on a subsample recruited by telephone. For detailed results, please refer to Tables A.3 and A.4 in the appendix.

CATI recruitment can increase the likelihood of completing the initial interview, particularly among individuals with higher education, those residing in rural areas, and those in peri-retirement or retirement age (cf. Figure 4). Conducting the first interview with underage respondents can be particularly challenging. However, it is important to note that individuals who were not reached during the initial interview may appear in later waves of the survey.

Figure 4. Odds ratios of first interview completion by age group, Q4 2018 - Q4 2021 (Elementary samples no. 82-93).



Source: own calculations based on LFS unit data (Statistics Poland).

To determine who drops out of the survey in subsequent interviews (after initiating contact with the household and completing at least one interview), logit models were estimated for the probability of participation as a function of the method of completion of the first interview, direct or proxy responses, number of visits and the variables used to calibrate the weights (gender, age, education, place of residence) and labour market status at the last interview (selected estimates are shown in Table 14¹⁰).

The missing interviews were then imputed with the variables from the earlier interviews. However, missing observations from unobserved interviews prior to the first contact with the respondent were not imputed. Logit models with a robust variance-covariance matrix and stratification by respondent ID were estimated on the pool data structure. Models 1-3 were estimated on all available elementary samples, similar to the models describing the probability of completing the first interview. Models 4-6 were estimated using data from elementary samples 82-90. Model 7 was estimated using data from samples recruited before the epidemic, where the first interview was conducted face-to-face, and model 8 was estimated using data from samples recruited during the epidemic, where the first interview was conducted over the phone.

¹⁰ The entire table is included in Table A.4 in the appendix.

Table 14. Selected logit model estimates, Q4 2018. - Q4 2021 (Elementary samples no. 82-93).

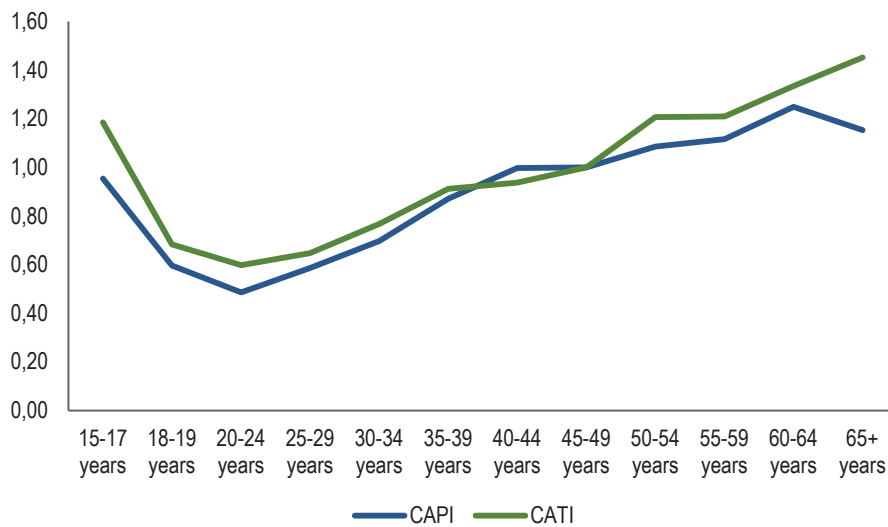
	(1) response probability (participation)	(2) response probability (participation)	(4) response probability (participation)	(5) response probability (participation)	(7) response probability (participation)	(8) response probability (participation)
proxy interview	1.196*** (12.67)	1.245*** (13.82)	1.202*** (12.75)	1.246*** (13.84)	1.281*** (15.21)	0.886*** (-4.53)
CATI	1.047** (3.07)	1.204*** (9.58)	1.051** (3.00)	1.219*** (9.33)		
proxy interview*CATI		0.733*** (-10.73)		0.718*** (-10.42)		
visit 3	0.361*** (-89.02)	0.361*** (-88.97)	0.359*** (-82.90)	0.359*** (-82.91)	0.286*** (-77.55)	0.468*** (-42.89)
visit 4	0.276*** (-110.13)	0.277*** (-110.09)	0.275*** (-102.71)	0.275*** (-102.71)	0.215*** (-94.06)	0.392*** (-47.40)
visit 5	0.187*** (-137.92)	0.187*** (-137.91)	0.186*** (-130.30)	0.186*** (-130.32)	0.151*** (-113.80)	
visit 6	0.157*** (-142.81)	0.157*** (-142.75)	0.156*** (-135.63)	0.156*** (-135.60)	0.127*** (-119.00)	
female	1.062*** (4.40)	1.092*** (6.51)	1.063*** (4.38)	1.094*** (6.49)	1.077*** (4.70)	1.035 (1.37)
unemployed	0.504*** (-17.86)	0.492*** (-18.57)	0.513*** (-16.82)	0.500*** (-17.54)	0.537*** (-13.84)	0.403*** (-13.50)
inactive	0.894*** (-5.85)	0.862*** (-7.90)	0.897*** (-5.57)	0.863*** (-7.66)	0.905*** (-4.61)	0.863*** (-3.81)
N	510839	510839	476266	476266	378659	132180
pseudo R ²	0.076	0.075	0.070	0.069	0.073	0.042

Source: own compilation based on LFS unit data (Statistics Poland).

Based on the estimated models, women, individuals residing in rural areas, and those with lower levels of education were more likely to participate again. Additionally, the probability of re-participating in the survey increases with age, as shown in Figure 5. Therefore, the issue of individuals dropping out of the panel is not randomly associated with the variables used to calibrate the weights. Furthermore, the likelihood of participating in the survey again is increased by proxy responses. However, this effect is already accounted for in samples where the initial interviews were conducted directly. In elementary samples where the first interview was conducted by telephone, proxy respondents are less likely to participate in the survey again. Additionally, the declared labour market status in the last completed interview was found to be significant. The unemployed were the least likely to participate again. The economically inactive have slightly higher chances of participation than the unemployed, but

still lower than those of the employed. Furthermore, the likelihood of participating in an interview decreases with each successive visit. Therefore, retaining elementary samples in the survey has increased the rate of non-response and the number of individuals or households dropping out of the survey. In summary, it is important to note that this drop-out is not a random process. This has an impact on the measurement of labour force participation and the reported aggregates of labour market status.

Figure 5. Odds ratios of remaining in panel by age, Q4 2018 - Q4 2021 (Elementary samples no. 82-93).



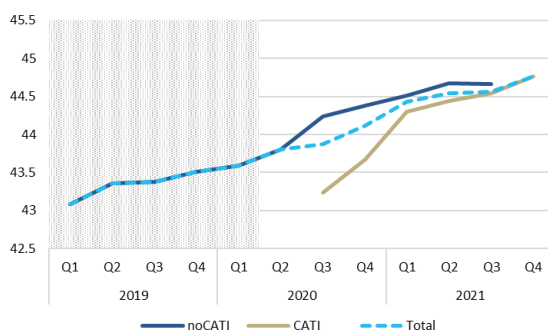
Source: own compilation based on LFS unit data (Statistics Poland).

Survey method vs. demographic characteristics of the elementary samples

The structure of the sample, in terms of relevant socio-demographic characteristics, was significantly influenced by recruitment and survey method, in addition to the number of completed interviews. Following the methodology used in Ward and Edwards (2021), we can investigate the relationship between respondent characteristics and survey method. This can be achieved by utilizing the fact that, for some quarters, the sample includes subsamples recruited by face-to-face and telephone methods. Figures 6 to 11 display statistical characteristics of the LFS sample in successive quarters from 2019 to 2020. The grey colour indicates the period in which the interviews were carried out using the face-to-face method. Each graph shows the characteristics of the entire sample represented by the light blue dashed line. Furthermore, the characteristics of the elementary samples that were recruited traditionally in person (dark blue line) and the elementary samples that were recruited by telephone (gold line) are shown separately.

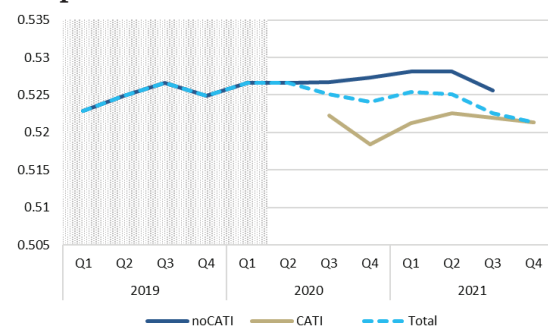
Since the beginning of the pandemic, the average age of survey participants has increased by almost a year (according to the raw data; see Figure 6). The telephone-recruited samples consistently show a lower average age. Additionally, the shift to telephone surveying has resulted in a decrease in the proportion of female participants (see Figure 7). The proportion of women in the sample is approximately 0.6 percentage points lower in the telephone-recruited samples.

Figure 6. Average age in the sample.



Source: own compilation based on LFS unit data (Statistics Poland).

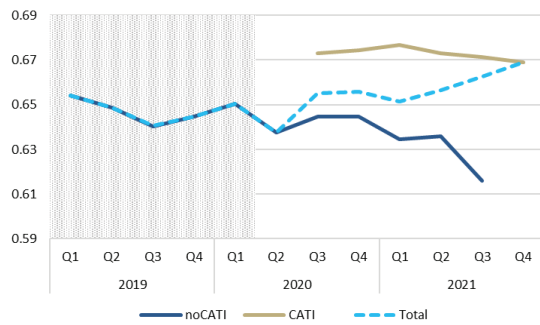
Figure 7. Percentage of women in the sample.



Source: own compilation based on LFS unit data (Statistics Poland).

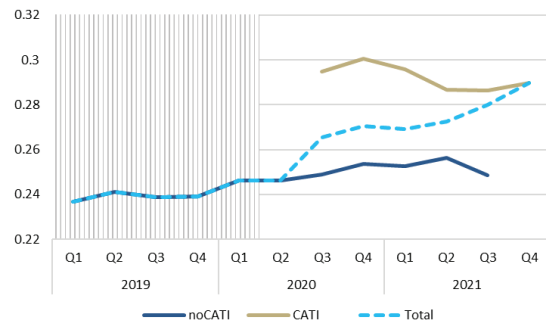
The proportion of urban residents remained stable in the overall sample immediately after the switch to the telephone survey. However, analysis of the elementary samples shows that it is systematically higher in the samples recruited by telephone (by an average of 3.9 percentage points; Figure 8).

Figure 8. Percentage of urban residents.



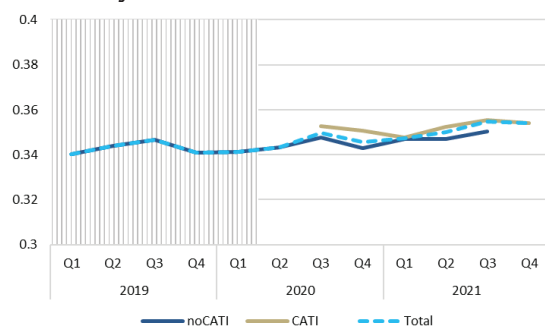
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 9. Percentage of people with tertiary education.



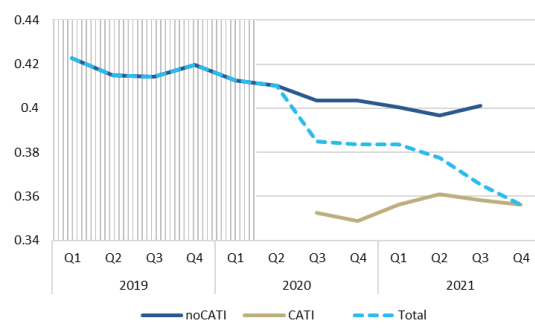
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 10. Percentage of people with secondary education.



Source: own compilation based on LFS unit data (Statistics Poland).

Figure 11. Percentage of people with vocational education and lower.



Source: own compilation based on LFS unit data (Statistics Poland).

The educational structure of the sample underwent significant changes, as shown in Figures 9-11. The proportion of individuals with tertiary education increased rapidly when telephone-recruited elementary samples were included, with an average 4 percentage point increase compared to directly recruited samples. The percentage of individuals in the sample with a vocational education or less has decreased over the same period and is consistently lower in the samples recruited by telephone (by an average of 4.6 percentage points; see Figure 11). In contrast, there has been relatively little change in the percentage of individuals with a secondary education, and this percentage varies little for samples recruited by different methods.

Statistical tests comparing the sample structure by basic socio-demographic characteristics provide similar conclusions. Table 15 shows that the structure of the unweighted samples in the survey significantly differs depending on the method of conducting the first interview (CATI vs. CAPI). This finding is independent of the length of the pre-pandemic period analysed. Telephone-recruited participants tend to be older, better educated, more likely to be male, and reside in urban areas. Additionally, there are more farmers, but fewer individuals reporting farm use, as well as there being more proxy interviews.

Table 15. Unweighted descriptive statistics in samples recruited traditionally (in person) and by telephone.

Test	Variable	2017-2021		2019-2021	
		Test statistic	p-value	Test statistic	p-value
Test t	age (years)	-20.9717	0.000	-8.634	0.000
	number of persons in the household	23.0395	0.000	12.845	0.000
	number of adults in the household	21.9750	0.000	9.220	0.000
Test of proportions	gender	3.3177	0.001	4.058	0.000
	urban/rural	-27.7376	0.000	-25.250	0.000
	individual farmer	-4.0018	0.000	-4.321	0.000
	farm	27.7489	0.000	17.088	0.000
	proxy interview	-17.0772	0.000	-8.436	0.000
Mann-Whitney U test	education (categories)	60.693	0.000	49.210	0.000
	age (ranges)	-24.377	0.000	-10.627	0.000

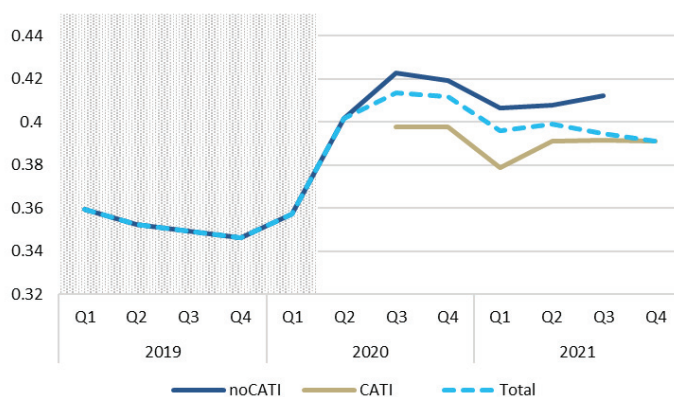
Source: own calculations based on LFS unit data (Statistics Poland).

The characteristics of the elementary samples recruited by different methods and their differences are consistent with the findings of Ward and Edwards (2021). Their analysis shows that the propensity to be surveyed directly is strongly associated with important socio-demographic characteristics. On average, respondents surveyed directly have lower education, lower income, and are more likely to belong to ethnic minorities. The article documents trends in non-response and associated changes in the demographic composition of the sample. It suggests that the suspension of direct surveying may be responsible for these changes.

In addition to the changes in the sample parameters, the percentage of proxy interviews has also changed, which, as will be shown later in the paper, can also affect the survey results. During the transition to the telephone survey between Q1 and Q2 of 2020, the percentage of proxy interviews increased by 4.4 percentage points, reaching a peak of 42.3% in Q3 of 2020 (see Figure 12). In the following quarters, it remained around 41.1%. The data shows that it was

systematically lower in samples recruited by telephone (by 2.2 percentage points on average), but still higher than in samples recruited directly in the pre-pandemic face-to-face survey.

Figure 12. Percentage of proxy interviews.



Source: own compilation based on LFS unit data (Statistics Poland).

Proxy interviewing, in addition to the survey method, depends on the time a person or household takes part in the survey. Table 16 presents test statistics like those in Table 15. These results indicate that individuals who had their answers provided by other household members are a statistically distinct group from those who responded alone, across all socio-demographic characteristics considered.

Table 16. Comparison of unweighted descriptive statistics of interviews conducted by respondents in person or by proxy.

Test	Variable	2019-2021	
		Test statistic	p-value
Test t	age (years)	7.500	0.000
	number of persons in the household	-2.8e+02	0.000
	number of adults in the household	-3.2e+02	0.000
Test of proportions	female	185.82	0.000
	urban/rural	86.19	0.000
	individual farmer	-2.43	0.015
	farm	-83.01	0.000
	CATI	-15.65	0.000
Mann-Whitney U test	education (categories)	-120.029	0.000
	age (ranges)	195.138	0.000

Source: own compilation based on LFS unit data (Statistics Poland).

Table 17 presents the logit model estimates that describe the probabilities of proxy responses. Telephone interviews favour proxy responses in the oldest and youngest age groups, while the opposite effect is observed in the middle groups. The probability of proxy responses significantly increases with subsequent interviews in the survey. The alteration of the fixed sample rotation scheme of the LFS from Q3 2020 to the end of 2021 appears to have impacted the sample structure of the survey and may have influenced the results. It is worth noting that self-reported responses are less common among women, urban residents, and those with higher education.

Table 17. Logit model estimates for proxy response probabilities, Q3 2020 - Q3 2021.

	15-24 years (1)	25-44 years (2)	45-59/64 (3)	60/65+ (4)	Total (5)
Proxy interviews					
CATI	1.920*** (22.21)	0.962** (-2.76)	0.948*** (-3.72)	1.514*** (31.99)	1.096*** (12.06)
Female	0.754*** (-14.30)	0.399*** (-86.96)	0.431*** (-76.24)	0.499*** (-67.92)	0.459*** (-137.80)
City	0.730*** (-15.64)	0.693*** (-33.39)	0.883*** (-11.21)	0.649*** (-40.00)	0.709*** (-57.72)
Years of education	0.851*** (-39.70)	0.959*** (-28.94)	0.973*** (-22.26)	0.963*** (-31.35)	0.954*** (-67.75)
2 visit	1.263*** (7.91)	1.166*** (9.42)	1.184*** (10.15)	1.205*** (11.79)	1.174*** (18.15)
3 visit	1.573*** (15.12)	1.218*** (12.06)	1.236*** (12.66)	1.338*** (18.30)	1.260*** (25.99)
4 visit	1.637*** (16.27)	1.255*** (13.87)	1.296*** (15.40)	1.385*** (20.39)	1.303*** (29.70)
5 visit	2.399*** (17.58)	1.346*** (12.51)	1.335*** (11.86)	1.706*** (24.41)	1.423*** (27.40)
6 visit	2.440*** (16.32)	1.395*** (12.86)	1.308*** (10.23)	1.708*** (22.89)	1.429*** (25.72)
N	88065	248114	240054	298946	875179

Odds ratios; t-statistics in brackets; statistical significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: own compilation based on LFS data (Statistics Poland).

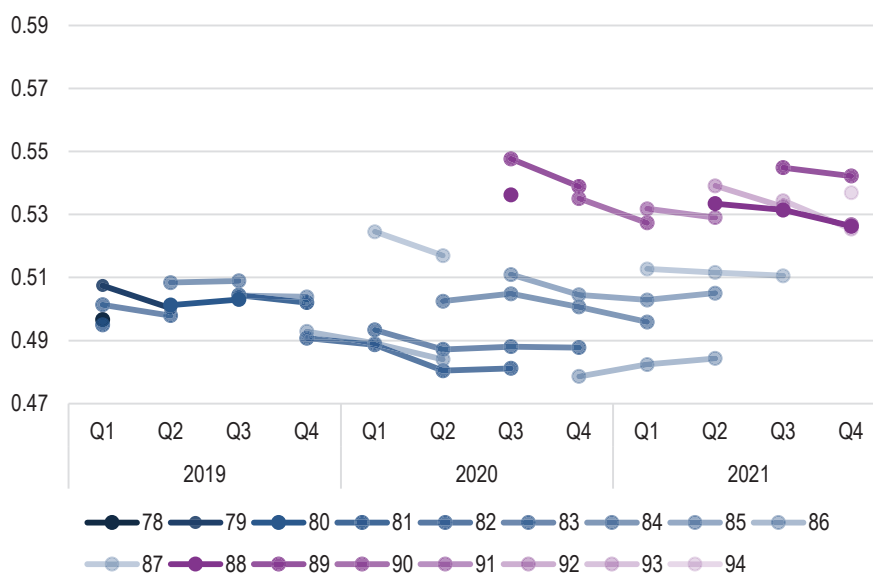
Survey method vs. labour market indicators

The change in the recruitment method is responsible for the differences in the basic characteristics of the elementary samples discussed in the previous section. As these characteristics are strongly correlated with labour force participation, it is possible that the survey results were also affected by the change in recruitment method. The analysis suggests that participation in the survey was positively correlated with labour force participation and employment after the suspension of direct surveying and recruitment. This finding is similar to that of Wards and Edwards (2021).

Sample structure - rotation of elementary samples

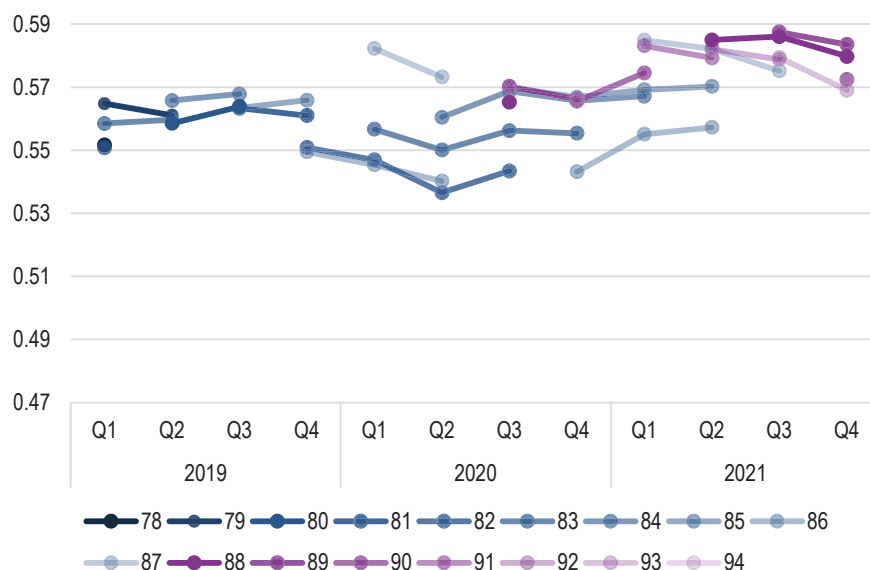
Figure 13 displays the estimated labour force participation rates for each subsample separately in the following quarters. The blue colour represents elementary samples recruited directly, while the purple colour represents elementary samples recruited by telephone. In both cases, the lighter the shade, the higher the sample number. This comparison of estimates indicates that, on average, more active individuals are recruited for new trials. The sample's lower labour force participation in subsequent visits is systematically observed, which appears to have a greater impact on the survey results than seasonal variation specific to labour force participation. Therefore, it can be concluded that the LFS data exhibits bias in the indicators due to sample rotation.

Figure 13. Labour force participation rate by elementary sample in Q1 2019 - Q4 2021 (raw data).



Source: own compilation based on LFS unit data (Statistics Poland).

Figure 14. Labour force participation rate by elementary sample in Q1 2019 - Q4 2021 (weighted data).



Source: own compilation based on LFS unit data (Statistics Poland).

Figure 14 displays the weighted estimates in the same colours¹¹. A comparison of the estimates shows that the economically inactive are over-represented in the sample and that the difference in participation between the directly recruited and the telephone samples is not fully compensated for by the weights. While the over-representation of the economically inactive is a consistent feature of the survey, the persistence of significant differences in the estimates of the basic indicators after weighting casts doubt on both the continuity of the survey and the comparability of the results over time.

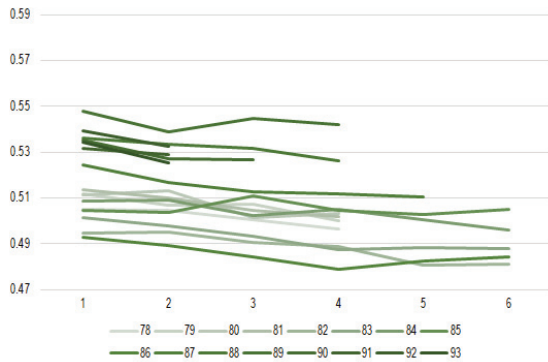
Analysis of the primary labour market indicators in the elementary samples¹² indicates that the likelihood of individuals/households remaining in the sample is dependent on their labour market status. Figures 15 to 20 present the labour force participation rate, employment rate,

¹¹ Estimates of labour force participation rates in elementary samples show the percentage of active individuals in a given elementary sample after taking into account the Statistics Poland weights. The weights indicate the relative importance of individual records in the elementary sample. However, it is important to note that none of the elementary samples, on their own after weighting, possess the characteristics of the general population. Therefore, any estimates derived from these samples cannot be generalised to the entire population. Only an estimate for all elementary samples combined can serve as the basis for such generalisations.

¹² Below are the results of a basic analysis using the weights assigned by the Statistics Poland. It is important to note that these weights are calibrated for all elementary samples carried out in a given quarter combined. Therefore, generalising the results for individual elementary samples may result in a larger error than the sheer size of these samples would suggest.

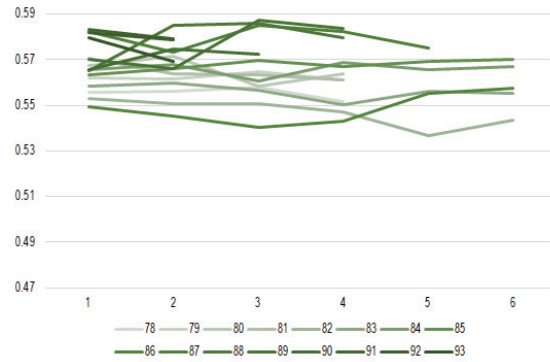
and unemployment rate from Q1 2019 to Q4 2021, according to the visit number. The darker the colour of the line, the higher the elementary sample number.

Figure 15. Labour force participation rate by consecutive visits in unweighted elementary samples 1Q 2019 - 4Q 2021.



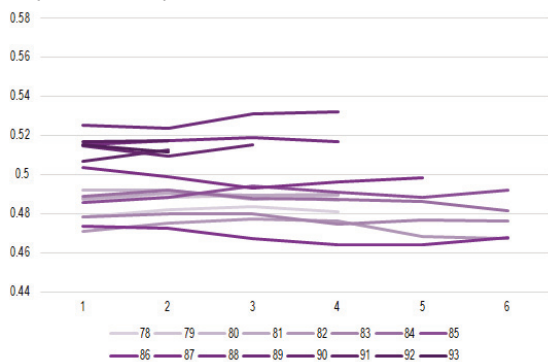
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 16. Labour force participation rate by consecutive visits in weighted elementary samples 1Q 2019 - 4Q 2021.



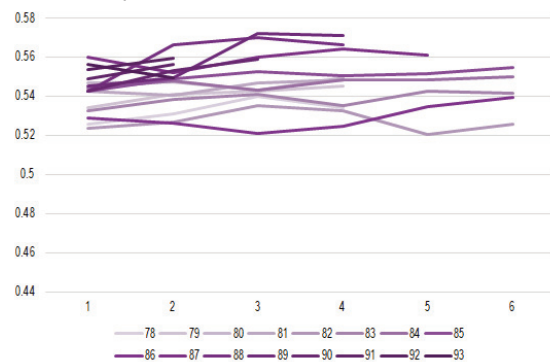
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 17. Employment rate by consecutive visits in unweighted elementary samples 1Q 2019 - 4Q 2021.



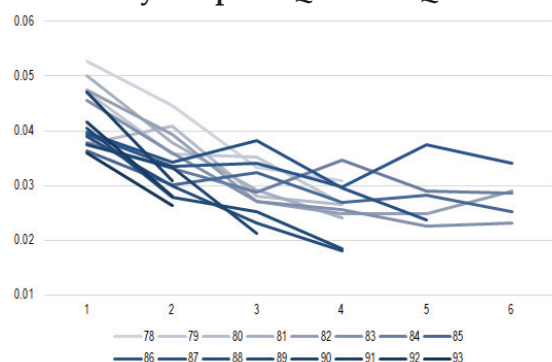
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 18. Employment rate by consecutive visits in weighted elementary samples 1Q 2019 - 4Q 2021.



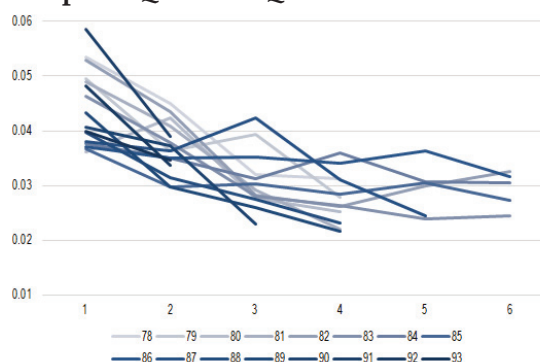
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 19. Unemployment rate by consecutive visits in unweighted elementary samples 1Q 2019 - 4Q 2021.



Source: own compilation based on LFS unit data (Statistics Poland).

Figure 20. Unemployment rate by consecutive visits in weighted elementary samples 1Q 2019 - 4Q 2021.



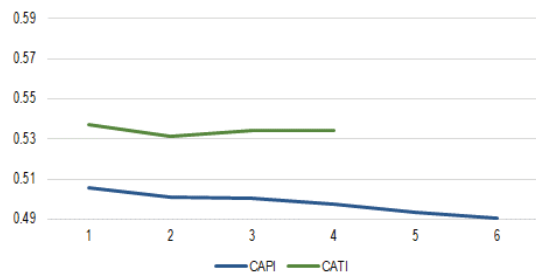
Source: own compilation based on LFS unit data (Statistics Poland).

The shape and position of the line suggest that, in successive visits, the activity rate in the sample decreases, regardless of the sample number (as already seen in Figures 13 and 14). Successive elementary samples are increasingly active, which is probably related to the increase in activity over the study period. Charts 19 and 20 show a systematic decrease in the unemployment rate at successive visits. However, it is important to note that this decrease is due to the observed decrease in the unemployment rate during the period under study. The employment rate does not exhibit the same pattern. A statistical analysis of this will be discussed later in the paper.

Panel attrition, i.e. respondents dropping out of successive waves of the survey, largely affects the unemployed.

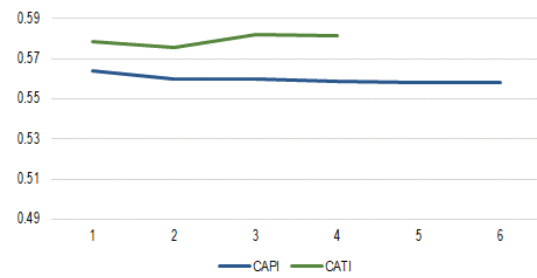
To facilitate the assessment of differences between the direct and telephone-recruited samples, Figures 21-26 summarise the labour force participation rate, the employment rate and the unemployment rate from Q1 2019 to Q4 2021 separately for the direct and telephone-recruited samples (using the original Statistics Poland weights). In analysing the indicators, it is worth bearing in mind that the period covered by the analysis was characterised by a nominal (i.e. in line with published LFS data) increase in labour force participation and a decrease in the unemployment rate.

Figure 21. Labour force participation rate by consecutive visits in unweighted samples by mode of recruitment Q1 2019 - Q4 2021.



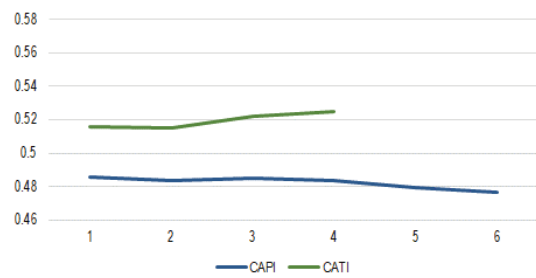
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 22. Labour force participation rate by consecutive visits in weighted samples by mode of recruitment Q1 2019 - Q4 2021.



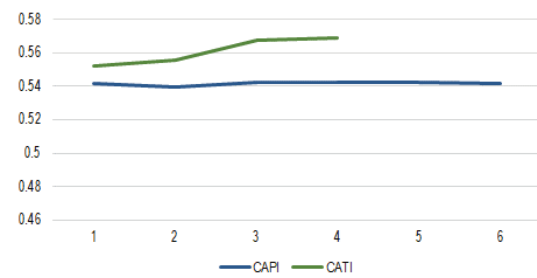
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 23. Employment rate by consecutive visits in unweighted samples by mode of recruitment Q1 2019 - Q4 2021.



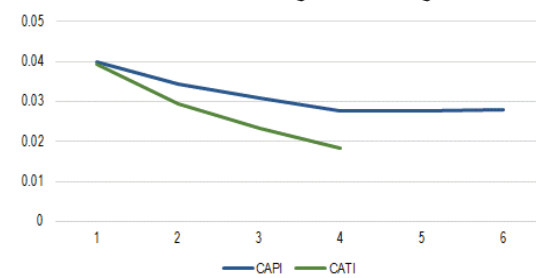
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 24. Employment rate by consecutive visits in weighted samples by mode of recruitment Q1 2019 - Q4 2021.



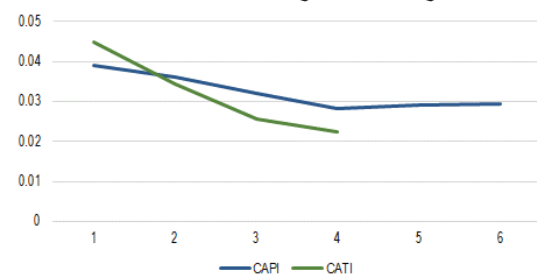
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 25. Unemployment rate by consecutive visits in unweighted samples by mode of recruitment Q1 2019 - Q4 2021.



Source: own compilation based on LFS unit data (Statistics Poland).

Figure 26. Unemployment rate by consecutive visits in weighted samples by mode of recruitment Q1 2019 - Q4 2021.



Source: own compilation based on LFS unit data (Statistics Poland).

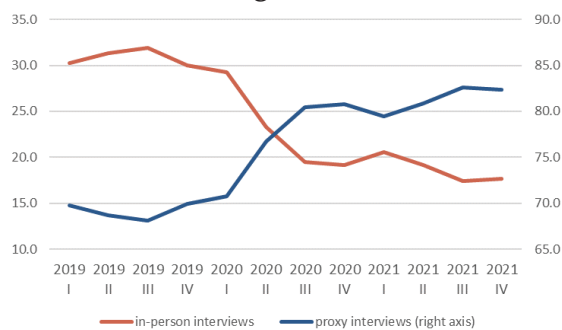
In summary, the results of the survey can be significantly affected by the process of households dropping out of the sample in successive rounds, in addition to selection into the sample due to the method of recruitment and conduct of the survey.

Proxy interviews

Another factor that can significantly affect the results is the implementation of proxy interviews and changes in the scale of this phenomenon following the switch to telephone surveying. According to Meyer, Moka, and Sullivan (2015), the increasing scale of proxy interviews, along with the rise in refusal to participate and response, is the most significant problem in contemporary survey research. The impact of this factor can be illustrated by analysing the proportion of proxy interviews and the participation rate among 15–24-year-olds. In this age group, the proportion of proxy interviews is particularly high, with more than two-thirds of participants having a proxy interview. On average, the proportion of proxy interviews in the whole sample is about one-third¹³.

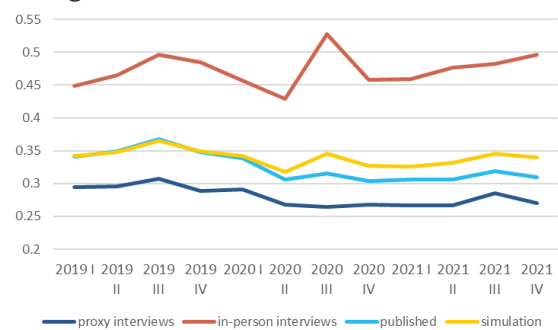
In Figure 27, the shares of interviews completed in person and by proxy in the 15-24 age group are presented. The proportion of in-person interviews decreased by almost half when switching to telephone surveying, while the proportion of proxy interviews increased accordingly.

Figure 27. Percentage of face-to-face and proxy interviews in the 15-24 age group; Q1 2019 - Q4 2021 (weighted data).



Source: own compilation based on LFS unit data (Statistics Poland).

Figure 28. Labour force participation rate for the 15-24 age group; Q1 2019 - Q4 2021 (weighted data).



Source: own compilation based on LFS unit data (Statistics Poland).

Figure 28 displays the labour force participation rate for the 15-24 age group. The blue line indicates the averaged labour force participation rate as published, which has decreased by almost 4 percentage points since the outbreak of the pandemic. Additionally, the graph shows

¹³ Since Q2 2020. - with a 100% telephone survey - the share of proxy interviews in the total sample has increased by more than 4 percentage points on average.

separate labour force participation rates for personal and proxy interviewees¹⁴ to highlight the impact of proxy interviewing. For the presented period, the labour force participation rate for in-person interviewees is nearly 20 percentage points higher than the corresponding rate for proxy interviewees. To evaluate the impact of the change in the proxy interview structure, we estimated the simulated labour force participation rate that would have been recorded if the share of proxy interviews had not changed. We assumed a constant share at the 2019 average (yellow line in Figure 28). The data shows that the labour force participation of the 15–24-year-old group remained virtually unchanged after the pandemic outbreak. The decrease in activity noted in the data for this group is solely due to the change in the share of surrogate interviews in the sample. Therefore, this can be considered a statistical artefact.

It is important to note that changes in individual elements of the survey methodology do not affect all socio-economic groups proportionally. Table 18 compares estimates of logit models that measure the probability of labour force participation, employment, and unemployment for four broad age groups. The age groups were selected to ensure homogeneity among individuals for labour market incentives. Proxy responses show a negative correlation with labour force participation, with the strongest effect observed in the youngest age group. A positive and significant correlation between proxy responses and the probability of activity is only observed in the pre-retirement group (45-59/64 years). Telephone recruitment is positively correlated with activity in all age groups except the youngest, where the effect is statistically insignificant. In the pre-retirement and retirement groups, the propensity to be active increases with subsequent interviews in their households. The effects on the probability of employment are similar in sign and magnitude to those for labour force participation.

¹⁴ Weighted data: coefficients were estimated for the relevant parts of the sample.

Table 18. Logit model estimates for labour force participation rates, Q3 2020 - Q3 2021.

	Labour force participation rate					Employment rate					Unemployment rate				
	15-24 years	25-44 years	45-59/64	60/65+	Total	15-24 years	25-44 years	45-59/64	60/65+	Total	15-24 years	25-44 years	45-59/64	60/65+	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
CATI	1.101 (0.96)	1.286** (3.18)	1.446*** (6.45)	1.265*** (3.37)	1.236*** (8.12)	1.163 (1.46)	1.307*** (3.74)	1.488*** (7.14)	1.280*** (3.52)	1.260*** (8.86)	0.712 (-1.51)	0.749 (-1.90)	0.564** (-3.26)	0.0557* (-2.57)	0.699*** (-3.46)
Female	0.509*** (-18.35)	0.191*** (-49.43)	0.888*** (-5.55)	0.926** (-2.80)	0.421*** (-86.56)	0.515*** (-17.20)	0.248*** (-47.66)	0.901*** (-5.00)	0.926** (-2.80)	0.432*** (-84.28)	1.230* (2.35)	1.434*** (6.66)	0.958 (-0.67)	1.044 (0.14)	1.227*** (5.48)
City	0.676*** (-10.80)	1.545*** (15.08)	1.156*** (6.78)	1.080* (2.42)	0.843*** (-16.56)	0.670*** (-10.56)	1.392*** (12.52)	1.103*** (4.68)	1.071* (2.14)	0.842*** (-16.69)	1.217* (2.27)	1.103 (1.68)	1.452*** (5.34)	3.886** (2.86)	1.095* (2.31)
Years of education	1.247*** (21.71)	1.118*** (46.44)	1.060*** (36.20)	1.130*** (27.51)	1.110*** (100.03)	1.227*** (19.77)	1.111*** (46.44)	1.062*** (38.11)	1.131*** (27.46)	1.110*** (98.32)	1.001 (0.08)	0.940*** (-14.18)	0.941*** (-12.91)	0.958* (-1.96)	0.956*** (-15.99)
Proxy interview	0.464*** (-17.02)	0.836*** (-6.23)	1.062** (2.71)	0.848*** (-5.60)	0.822*** (-19.61)	0.445*** (-17.62)	0.831*** (-7.05)	1.074*** (3.32)	0.854*** (-5.36)	0.803*** (-21.83)	1.763*** (5.63)	1.251*** (4.13)	0.863* (-2.19)	0.372* (-2.38)	1.514*** (11.14)
2 visit	1.001 (0.02)	1.084 (1.70)	1.146*** (4.14)	1.066 (1.59)	1.082*** (5.09)	1.067 (1.08)	1.166*** (3.61)	1.180*** (5.21)	1.077 (1.83)	1.113*** (6.93)	0.728* (-2.32)	0.711*** (-4.21)	0.720*** (-3.63)	0.413* (-2.20)	0.712*** (-6.16)
3 visit	1.025 (0.31)	1.229** (3.08)	1.349*** (6.48)	1.158** (2.67)	1.187*** (8.04)	1.099 (1.12)	1.361*** (5.10)	1.453*** (8.30)	1.177** (2.97)	1.243*** (10.21)	0.681* (-2.10)	0.561*** (-4.56)	0.408*** (-6.35)	0.0411** (-3.11)	0.539*** (-7.26)
4 visit	0.968 (-0.28)	0.996 (-0.04)	1.215** (2.89)	1.104 (1.19)	1.064* (2.01)	1.046 (0.37)	1.161 (1.78)	1.333*** (4.40)	1.128 (1.45)	1.126*** (3.87)	0.669 (-1.54)	0.530*** (-3.59)	0.360*** (-4.93)	0.0234** (-3.12)	0.504*** (-5.71)
5 visit	0.908 (-0.83)	1.159 (1.60)	1.405*** (5.12)	1.178* (2.01)	1.185*** (5.56)	1.046 (0.37)	1.347*** (3.58)	1.537*** (6.65)	1.206* (2.29)	1.264*** (7.67)	0.488** (-2.70)	0.465*** (-4.40)	0.338*** (-5.32)	0.0186*** (-3.30)	0.425*** (-7.19)
6 visit	0.901 (-0.90)	1.121 (1.25)	1.307*** (4.03)	1.155 (1.77)	1.147*** (4.50)	1.019 (0.15)	1.307** (3.24)	1.447*** (5.71)	1.179* (2.01)	1.223*** (6.63)	0.555* (-2.24)	0.474*** (-4.25)	0.308*** (-5.80)	0.0281** (-2.97)	0.433*** (-7.03)
N	27595	81931	82901	105533	297960	27595	81931	82901	105533	297960	7150	72173	64706	9748	153777

Odds ratios; t-statistics in brackets; statistical significance: * p<0.05, ** p<0.01, *** p<0.001

Source: own compilation based on LFS data.

A simulation to compensate for changes in the sample structure due to education and proxy interviews leads to similar conclusions. To evaluate the effect of these factors on the survey results, the weights in the micro-data were adjusted to ensure that the proportions of proxy interviews and those with a given level of education (in the five groups) were the same as before the pandemic (the average proportions in 2019 were used). This procedure is similar to that used in Ward and Edwards' (2021) work. However, instead of selecting respondents from the realized sample, compensation for the underrepresented categories of people was made at the weight level. To ensure methodological correctness, the simulation used definitionally standardized data in line with Statistics Poland (2022).

Table 19. Labour force participation rate published and counterfactual (with fixed sample structure by education and share of proxy interviews), Q2 2020 – Q4 2021.

	2020 II	2020 III	2020 IV	2021 I	2021 II	2021 III	2021 IV
Labour force participation rate (published)							
15-24 years	30,6	31,6	30,4	30,6	30,7	31,9	31,0
25-44 years	85,0	86,0	85,8	87,5	88,1	88,0	88,3
45-59/64 years	73,7	75,5	76,3	78,1	78,5	80,0	79,7
60/65+ years	8,0	8,4	8,5	8,3	8,7	9,0	9,0
Total	54,8	55,8	55,7	56,7	57,1	57,6	57,4
Counterfactual labour force participation rate (fixed sample structure by education and share of proxy interviews)							
15-24 years	31,7	33,2	31,4	32,5	32,6	32,9	32,1
25-44 years	84,8	85,9	85,6	87,3	87,8	87,7	88,2
45-59/64 years	73,4	75,0	75,8	77,5	78,1	79,6	79,3
60/65+ years	7,8	8,2	8,3	8,1	8,5	8,9	8,8
Total	54,7	55,7	55,5	56,6	57,1	57,5	57,4
Difference (percentage points)							
15-24 years	-1,2	-1,7	-1,0	-1,9	-2,0	-1,0	-1,1
25-44 years	0,2	0,1	0,2	0,2	0,3	0,3	0,1
45-59/64 years	0,4	0,5	0,6	0,7	0,4	0,4	0,4
60/65+ years	0,2	0,2	0,2	0,2	0,2	0,2	0,1
Total	0,1	0,0	0,2	0,1	0,0	0,1	0,1

Source: own compilation based on LFS data (Statistics Poland).

Table 19 presents the counterfactual labour force participation rates alongside the published rates, highlighting the differences between them. The summary indicates

that changes in the sample structure, resulting from the share of proxy interviews and education, have varying impacts on different age groups. The activity rates in the youngest age group (15-24 years) were underestimated by about 1.0-2.0 percentage points, while the activity rates in the pre-retirement age groups (45-59/64 years) were overestimated by about 0.4-0.7 percentage points. When the results were averaged for the whole sample, the effects largely cancelled each other out. For the entire population aged 15-89, changes in the sample structure due to education and proxy interviews result in an overestimation of the labour force participation rate by 0.1-0.2 percentage points.

Similar effects were observed in the same groups, although slightly smaller in magnitude, for the employment rate. For the unemployment rate, the effects were approximately half as large and had opposite signs. Tables for the employment rate and unemployment rate can be found in the annex.

Recruitment method

Analyses of the size and structure of the elementary samples indicate that the changes made to the LFS in 2020 and 2021, during a period of atypical labour market regulations due to the pandemic, have made it challenging to analyse both the actual labour market processes and the impact of methodological changes on the survey results. In under two years, the survey has undergone significant changes. It has transitioned from a face-to-face survey of individuals aged 15 and over, which was based on a fixed sample rotation scheme and a questionnaire that had been in use for over 25 years, to a telephone survey of individuals aged 15-89. The new survey has a disrupted sample rotation scheme and a completely new questionnaire that had not been fully tested¹⁵.

¹⁵ Information about the pilots of selected questions in the new questionnaire has been made public. However, no documentation or results of the pilots have been published as of the beginning of 2022. The Statistics Poland has not announced any plans to publish such documentation. Based on the information available on the Statistics Poland website, it does not appear that a full pilot of the new tool has been carried out, ideally in parallel with the

This framing enables an assessment of changes in certain elements of the survey methodology. As demonstrated earlier, survey elementary samples recruited through different methods exhibit substantial differences due to important characteristics of the individuals in the sample that are correlated with labour force participation. To evaluate the impact of changes in methodology, basic indicators were estimated for elementary samples by method of recruitment separately.

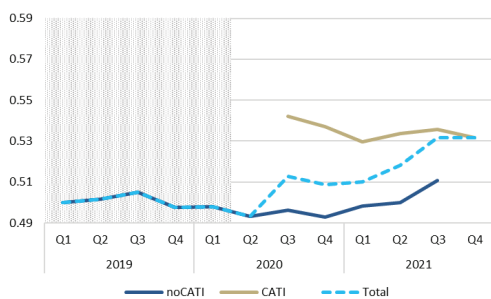
The Labour Force Survey (LFS) draws elementary samples at random and executes them independently. Each household and its members are assigned weights based on their probability of being sampled. However, when generalising the results, the weights are calibrated collectively for all elementary samples participating in the survey during a given quarter. The Statistics Poland assigns weights to individuals to enable generalisation of survey results to the entire population. The weights also ensure a consistent structure by age (12 groups), gender, and place of residence (urban/rural split) that aligns with demographic data. To ensure accurate estimation of effects for the entire sample, it is necessary to use the weights provided. It would be incorrect, however, to use weights given by the Statistics Poland to estimate effects for only a portion of the sample, such as elementary samples recruited directly or by telephone. Selecting a portion of the sample does not guarantee representativeness based on the selected characteristics.

To ensure accurate assessment of isolated effects in quarters where the sample consisted of elementary samples recruited by different methods (from Q3 2021 to Q3 2022), a weighting process was simulated. This allowed for correct generalisation of estimates based on elementary samples of only one type to the entire population. For this purpose, the sample was divided into two parts. One part consisted only of elementary samples recruited directly, while the other consisted of elementary samples recruited only by telephone. The weights were calibrated separately for each

old one. These results could serve as a basis for evaluating the impact of the changes introduced on the fundamental labour market indicators estimated from the survey.

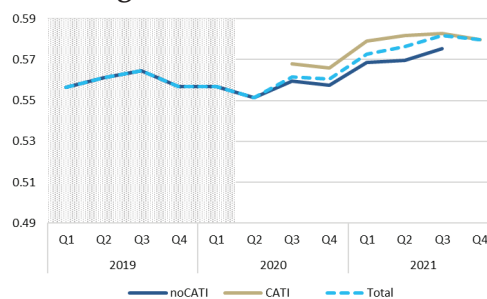
part using the methodology developed by Saczuk (2014). The calibration was done in such a way that the structure by age, sex, and place of residence after weighting was identical to that of the total population in the whole sample with Statistics Poland weights. Figures 29 to 34 summarise the estimates of the labour force participation rate, employment rate, and unemployment rate for 2019-2020. The grey colour in the graphs indicates the period in which the survey was conducted. Each graph shows the characteristics of the entire sample combined (with Statistics Poland weights) by a light blue dashed line. The characteristics of the sample traditionally recruited directly for the survey (simulated weights; dark blue line) and the sample recruited by telephone (simulated weights; gold line) are also shown separately in each graph. The graphs display only the mean estimates of the relevant sample parameters (elementary samples) in the raw and weighted data. When analysing parameter changes in successive survey rounds, it is important to consider the larger estimation errors for elementary samples compared to the total sample. The presented estimates are for the population aged 15-89 years old¹⁶.

Figure 29. Labour force participation rate (raw data).



Source: own compilation based on LFS unit data (Statistics Poland).

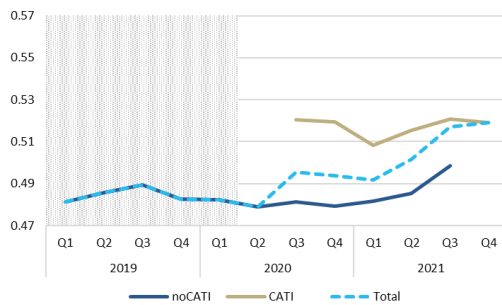
Figure 30. Labour force participation rate (weighted data).



Source: own compilation based on LFS unit data (Statistics Poland).

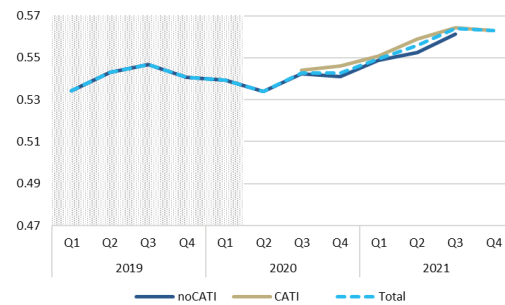
¹⁶ In line with the LFS methodology from Q1 2021.

Figure 31. Employment rate (raw data).



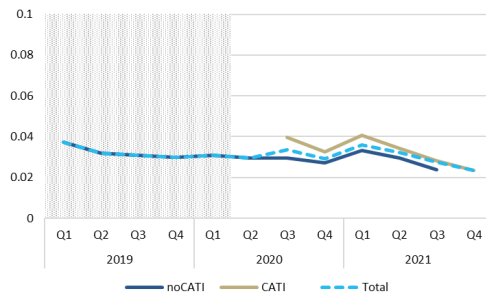
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 32. Employment rate (weighted data).



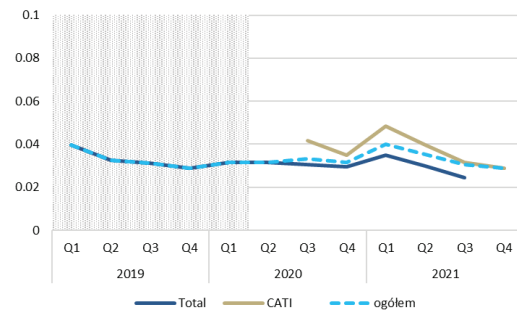
Source: own compilation based on LFS unit data (Statistics Poland).

Figure 33. Unemployment rate (raw data).



Source: own compilation based on LFS unit data (Statistics Poland).

Figure 34. Unemployment rate (weighted data).



Source: own compilation based on LFS unit data (Statistics Poland).

Labour force participation rates, estimated using simulated weights, confirm the observations made in Figures 13 and 14. The weights increase the labour force participation rate in the entire sample by an average of 5.6 percentage points. The difference between the samples recruited directly and by telephone decreases to 0.9 percentage points from 3.6 percentage points in the raw data, after considering the simulated weights that allow for generalisation of the estimates for the presented elementary samples. The employment indicator is raised by an average of 5.3 percentage points when the weights are included. When the simulated weights are included, the difference in indicator estimates decreases to 0.4 percentage (from 3.2 percentage points in the raw data). Survey weighting has a relatively small effect on estimates of the unemployment rate, raising it by an average of 0.2 percentage points.

When considering simulated weights, the difference between the unemployment rates estimated for the face-to-face and telephone-recruited elementary samples increases from 0.6 percentage points in the raw data to 0.9 percentage points.

To analyse the isolated impact of changes in methodology on survey results, the sample was divided into two groups: one group had face-to-face interviews for their first interviews, while the other group had telephone interviews. We then counted labour force participation rates (LFPR) based on old definitions for the entire 15+ population, old definitions for the 15-89 population, and new definitions for the 15-89 population.

Table 20 summarises the estimates of the labour force participation rate, employment rate, and unemployment rate for different sets of assumptions used to estimate the impact of individual changes in survey methodology. The column presenting total results (1) shows estimates prepared using Statistics Poland weights, while in the columns presenting estimates based only on elementary samples recruited directly ((2), (5), and (7)) or by telephone (3) we used simulated weights. It is important to note that estimates based on samples recruited by only one method have larger standard errors because the parts of elementary samples are always smaller than the total sample size in a quarter¹⁷.

The estimates of all indicators in the compilations are consistently higher for the elementary samples recruited by telephone. As the estimates were calculated for the new LFS population (15-89 years old) and considering the new definitions (adjustment for definition changes up to and including Q4 2021 and the new questionnaire from Q1 2022), the disparity between the estimates for elementary samples recruited by telephone and directly (column (4)) can be regarded as a pure recruitment effect. On average, recruitment changes increase the labour force

¹⁷ Due to the lack of significant realisation variables, it is not possible to determine the standard errors of the estimates according to the Statistics Poland methodology.

participation rate and the unemployment rate by 0.94 percentage points and the employment rate by 0.37 percentage points.

Table 20. Counterfactual estimates of selected LFS indicators during a pandemic.

	Published data	Recruitment effect			Population change effect		Definition change effect		Total effect
	(1)	(2)	(3)	(4) (3)-(2) difference (percentage points)	(5)	(6) (2)-(5) difference (percentage points)	(7)	(8) (5)-(7) difference (percentage points)	(9) (4)+(6)+(8) (3)-(7)
	total	CAP1*	CAT1**		CAP1*		CAP1*		
	15-89 years	15-89 years	15-89 years		15+ years		15+ years		
	new definitions	new definitions	new definitions		new definitions		old definitions		
Labour force participation rate									
III 2020 r.	56.15	55.94	56.78	0.84	55.54	0.40	56.11	-0.57	0.67
IV 2020 r.	56.05	55.75	56.59	0.84	55.38	0.37	56.07	-0.69	0.52
I 2021 r.	57.26	56.87	57.89	1.02	56.35	0.52			
II 2021 r.	57.62	56.96	58.19	1.23	56.43	0.53			
III 2021 r.	58.16	57.53	58.29	0.76	56.99	0.54			
<i>Average difference</i>				0.94		0.47		-0.63	0.59
Employment rate									
III 2020 r.	54.28	54.23	54.42	0.19	53.84	0.39	54.42	-0.57	0.00
IV 2020 r.	54.29	54.11	54.61	0.51	53.75	0.36	54.44	-0.69	0.17
I 2021 r.	54.96	54.89	55.09	0.20	54.38	0.51			
II 2021 r.	55.59	55.26	55.88	0.62	54.74	0.52			
III 2021 r.	56.39	56.12	56.45	0.32	55.59	0.53			
<i>Average difference</i>				0.37		0.46		-0.63	0.09
Unemployment rate									
III 2020 r.	3.33	3.05	4.16	1.11	3.05	0.00	3.02	0.03	1.14
IV 2020 r.	3.15	2.94	3.49	0.55	2.94	0.00	2.91	0.04	0.59
I 2021 r.	4.01	3.49	4.85	1.36	3.49	0.00			
II 2021 r.	3.52	2.99	3.97	0.98	2.99	0.00			
III 2021 r.	3.05	2.45	3.16	0.71	2.45	0.00			
<i>Average difference</i>				0.94		0.00		0.03	0.86

* elementary samples recruited directly

** elementary samples recruited by telephone

Source: own compilation based on LFS unit data (Statistics Poland).

To estimate the effect of population change, the indicators were calculated using the same elementary samples and definitions for the population of individuals aged 15 and over (i.e., the population surveyed up to and including Q4 2020). Comparisons were made for the same elementary samples to determine the pure effect of change.

Table 20 shows that these are almost identical whether the total sample, elementary samples recruited by telephone or directly recruited are considered. For the directly recruited sample, excluding individuals aged 90 years and older from the population (column 6) increases the labour force participation rate by an average of 0.47 percentage points and the employment rate by 0.46 percentage points. This exclusion does not affect the unemployment rate, which is consistent with the fact that there were no unemployed or working individuals over the age of 89 in previous quarters' surveys.

Questionnaire effect (selected aspects)

As with other factors, modifying the questionnaire can have various effects on the main labour market indicators measured in the LFS. The order and wording of the questions can both have an impact. For instance, some individuals may be classified as working in individual farming, which is not entirely consistent with the guidelines.

The impact of the changes made to the questionnaire can only be estimated for the third and fourth quarters of 2021. To achieve this, we compare the estimates for the same basic samples using the new and old definitions in the LFS (the change practically only affects the employed) - the difference for the directly recruited samples is shown in column (8). In these elementary samples, the change in definitions decreases the participation rate and the employment rate by 0.63 percentage points on average and increases the unemployment rate by 0.03 percentage points.

The Q3 and Q4 2021 changes had an average impact of 0.59 percentage points on the labour force participation rate, 0.09 percentage points on the employment rate, and 0.86 percentage points on the unemployment rate. It is important to note that recruitment had the largest impact on activity and unemployment, while the questionnaire (and changes in definitions) had the largest impact on employment.

The implementation method enables the isolation of the recruitment effect, population change effect, and definition change effect. However, due to the absence of a variable on the pre-pandemic survey method (face-to-face vs. telephone), it is not possible to estimate the effect of survey method. Additionally, the effect of disruption to the rotation pattern cannot be quantified. The absence of a complete piloting of the new survey tools before their introduction in Q1 2021 prevents an estimation of the impact of the questionnaire change.

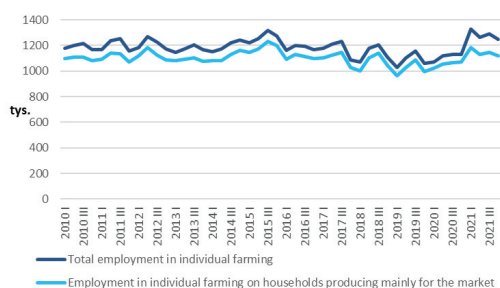
An important change in the LFS due to the change in the definition of employment from the first quarter of 2021 is the way in which those working in individual farming are treated. Prior to 2021, individuals working in farming were considered as working, regardless of the production purpose of the household. According to the new Eurostat guidelines, only individuals working in agriculture in households with the primary purpose of producing for the market are considered individual farmers since the beginning of 2021.

The analysis of survey instruments used in the LFS from the beginning of 2021 and individual data reveals that respondents are asked about the purpose of farm production twice - once in the household questionnaire and once in the individual questionnaire. However, there is not complete consistency between the answers in the two questionnaires. To classify a person as employed, unemployed or inactive, a response from the individual questionnaire is used. Furthermore, the core questions on work in the individual questionnaire have changed. The current format may prompt reporting of work by people who would have been considered not to be working in the previous questionnaire (used until the end of 2020)¹⁸. This could explain the rise in the number of individuals working in individual farming and

¹⁸ The questionnaire used until 2020 had one question about performing work, which was replaced by two questions in 2021. The second question provides additional clarification that unpaid assistance in the family business, including work on the family farm, is also considered work. This information was not included in the previous version of the questionnaire, in the question on work done during the survey week or in any other question.

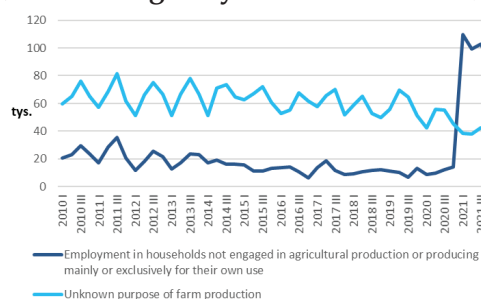
contribute to the increase in labour force participation since the start of the survey with the new questionnaire.

Figure 35. Number of employed in individual farming 2010-2021 (methodologically unified data).



Source: own compilation based on LFS unit data (Statistics Poland).

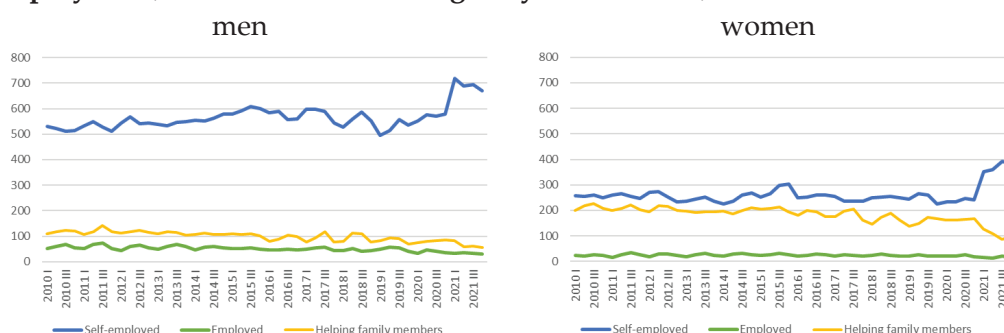
Figure 36. Number of persons working in private agriculture by household production purpose 2010-2021 (methodologically standardised data).



Source: own compilation based on LFS unit data (Statistics Poland).

Confirmation of this hypothesis can be provided by analysing individuals working in individual farming, based on the purpose of farm production declared in the household questionnaire. Figure 35 shows the number of people employed in individual farming, both in general and in households producing mainly for the market. According to the new methodology, these numbers should be the same. However, in practice, the historical methodologically unified data includes people for whom the purpose of farm production is not known and possibly people with another job who are also considered to be employed in individual farming. Figure 36 summarises the number of people working in individual farming from farms not engaged in agricultural production or producing only or mainly for their own needs and for which the purpose of the farm production is not known (missing data in this respect). The increase in the number of individuals engaged in agriculture from households not involved in production or producing mainly for their own needs, as reported in the household questionnaire, may suggest a change in household classification or a questionnaire mechanism that counts individuals who would have been classified as economically inactive under the previous questionnaire as working in individual farming.

Figure 37. Employment in individual farming by gender and form of employment, 2010-2021 (methodologically unified data; in thousands).



Source: own compilation based on LFS unit data (Statistics Poland).

Source: own compilation based on LFS unit data (Statistics Poland).

Figure 37 displays the number of individuals employed in individual farming categorized by gender and form of employment. The data indicates that changes are more pronounced among women and, regardless of gender, among the self-employed. However, as other data sources, such as the number of insured individuals in KRUS, do not confirm radical changes in the number of people working in agriculture, it can be assumed that these are statistical artefacts related to the change in the LFS questionnaire. It is important to note that these factors not only affect the number of individuals working in agriculture, but also impact the total number of employed individuals and, consequently, the labour force participation rate.

To determine the extent of overestimation of the number of individual farmers and its impact on the labour force participation rate, individuals employed in individual farming in households that do not produce or produce only or mainly for their own needs and for whom this was the only activity, were reclassified as inactive. Table 21 summarises the officially published and the resulting reclassification of the number of persons employed in individual farming as well as the corresponding labour force participation rates.

Table 21. Labour force participation rate 15-89 years, Q1–Q4 2020 r.

	2021 I	2021 II	2021 III	2021 IV	Annual average
	Number of employed in individual farming (thousands)				
Published	1330	1265	1289	1248	1283
Counterfactual	1224	1170	1192	1161	1187
Difference	106	95	96	87	96
	Labour force participation rate (%)				
Published	57.26	57.62	58.16	57.97	57.75
Counterfactual	56.91	57.31	57.84	57.67	57.43
Difference	0.35	0.32	0.32	0.29	0.32

Source: own compilation based on LFS unit data (Statistics Poland).

Table 21 provides estimates that can be considered a lower bound on the overestimates resulting from the new survey instruments (mainly questionnaires) for individual farming. The estimates do not include individuals who work in individual farming but for whom the purpose of farm production is unknown, as stated in the household questionnaire. It is probable that some of these individuals are economically inactive.

The classification of people from households that do not produce exclusively for the market, for whom this is the only job, as working in individual farming, which is not consistent (with the household questionnaire), is responsible for overestimating the number of people working in individual farming in 2021 by an average of 96 000. As a result, the total number of employed people is also overstated, leading to an average overstatement of the labour force participation rate by 0.32 percentage points.

Conclusions

Since mid-2020, the recorded levels of labour force participation in the LFS have been substantially different from those before the pandemic. It is likely that the pandemic and its associated labour market changes and restrictions on economic activity have significantly impacted labour force participation and forced adjustments in the labour market, including changes in the behaviour of the employed. However, it is important to note that several methodological adjustments have been made to the LFS related to both the outbreak of the pandemic and the harmonisation of social surveys in the EU. The purpose of this paper is to assess the extent to which the change in the main labour market indicators is due to actual socio-economic processes and to what extent it is due to a change in the way they are measured.

Measuring basic labour market indicators based on a survey (LFS) is neither a new nor atypical phenomenon of Poland. Some of the phenomena described in the text have a long-term character and are well-recognised in the literature. These difficulties were further compounded by changes in the survey's implementation due to the pandemic and Eurostat's harmonisation efforts for the LFS in all Member States. The disturbances in the comparability of the 2020-2021 series are not unique to Poland, nor are they likely to be exclusive to LFS surveys.

Analysis of the quarterly LFS data from Q1 2019 to Q4 2021 shows that the shift to telephone recruitment and survey mode, as well as changes in the rotation scheme, have had a significant impact on the selection process, sample attrition rates and the propensity to participate in person. These factors therefore affected the overall sample structure. The impact of changes in sample structure, caused by the increased proportion of proxy interviews and socio-economic characteristics of individuals interviewed, mainly education, on the different age groups analysed varies in magnitude and direction. When the results for the whole sample are averaged, the effects largely cancel each other out. For the entire population aged 15-89, changes in the sample structure due to education and proxy interviews result in an overestimation of the labour force participation rate by 0.1-0.2 percentage points.

The analysis of basic labour market indicators in the elementary samples indicates that individuals and their households' propensity to remain in the sample is not independent of their labour market status. The presented analyses suggest that the survey's weighting process does not fully compensate for selection problems. The survey's imposed definitional and subject changes further distort the understanding of actual labour market processes.

Based on the results of Ward and Edwards' (2021) study, we treated the change in survey method (from face-to-face to telephone) as a natural experiment to compare the labour force participation of those who joined the survey before and after the Covid-19 pandemic outbreak. Our findings indicate that the mode of recruitment to the survey affects the estimates of the labour force participation rate, employment rate, and unemployment rate. In particular, we demonstrated that both the probability of survey participation and proxy responses are affected by the socio-economic characteristics used to calibrate the weights and the characteristics that are determinants of activity. Using a simulation of the weighting process, we estimated that the changes introduced to the LFS between Q3 2020 and Q3 2021 collectively increased the estimates of the labour force participation rate by approximately 0.6 percentage points, the employment rate by approximately 0.1 percentage points, and the unemployment rate by approximately 0.9 percentage points compared to pre-pandemic measurements. Of the estimated effects of recruitment, population change, and questionnaire change, the recruitment effect has the largest impact on activity and unemployment, while the questionnaire effect (and changes in definitions) has the largest impact on employment. If we also consider the impact of the inconsistent classification of some individuals as working in subsistence agriculture, which is not in line with the household questionnaire, the overestimation of the labour force participation rate under the new methodology would be approximately 0.9 percentage points.

It is unclear from the presented analyses which method of measuring activity - before or during the pandemic - is more reliable. The implemented changes have increased

the likelihood of surveying active individuals, who on average have higher weights in the survey than inactive individuals. However, based on the presented results, it can only be concluded that the data before and after the changes are not fully comparable, despite the recalculation of historical data by the Statistics Poland.

The study did not address issues of classification error in the labour market status of the individuals, panel attrition, and the potential non-randomness of this process. Additionally, it did not consider the impact of adding COVID-related questions on the distribution of the remaining responses or the effect of adding calibration variables that are outcome variables from earlier waves of the survey. This is because of the inadequate identification strategy, insufficient information on the survey implementation, and the volume of work.

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Appendix

Table A.1. Methods for implementing the LFS in European countries in 2019 and 2020.

	Implementation method for the 2020 survey					Implementation method for the 2019 survey				
	CAPI	CATI	PAPI	CAWI	Inne	CAPI	CATI	PAPI	CAWI	Inne
	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
Austria	18,5	81,5	0,0	0,0	0,0	38,0	62,0	0,0	0,0	0,0
Belgium	7,7	52,9	0,0	39,4	0,0	29,0	33,0	0,0	38,0	0,0
Bulgaria	0,0	0,0	88,9	0,0	11,1	0,0	0,0	100,0	0,0	0,0
Croatia	28,1	71,9	0,0	0,0	0,0	63,0	37,0	0,0	0,0	0,0
Cyprus	90,3	9,7	0,0	0,0	0,0	16,0	84,0	0,0	0,0	0,0
Czech Republic	8,0	25,0	40,0	0,0	27,0	17,0	19,0	51,0	n/a	13,0
Denmark	0,0	49,8	0,0	50,2	0,0	0,0	54,0	0,0	46,0	0,0
Estonia	18,0	82,0	0,0	0,0	0,0	30,0	70,0	0,0	0,0	0,0
Finland	0,2	99,8	0,0	0,0	0,0	1,0	99,0	0,0	0,0	0,0
France	19,0	81,0	0,0	0,0	0,0	44,0	56,0	0,0	0,0	0,0
Germany	1,7	22,8	34,2	40,3	0,0	10,0	58,0	32	0,0	0,0
Greece	2,9	0,0	97,1	0,0	0,0	3,0	0,0	97,0	0,0	0,0
Hungary	33,6	66,4	0,0	0,0	0,0	63,0	37,0	0,0	0,0	0,0
Ireland	50,1	38,7	0,0	0,0	11,2	61,0	39,0	0,0	0,0	0,0
Island	0,0	100	0,0	0,0	0,0	0,0	100	0,0	0,0	0,0
Italy	CATI dominant method due to COVID-19					47,0	53,0	0,0	0,0	0,0
Latvia	10,6	84,0	0,0	5,4	0,0	62,0	34,0	0,0	4,0	0,0
Lithuania			n/a					n/a		
Luksembourg	0,0	30,7	0,0	69,3	0,0	0,0	27,0	0,0	73,0	0,0
Malta	0,0	92,0	8,0	0,0	0,0	0,0	75,0	25,0	0,0	0,0
Montenegro	0,0	0,0	100	0,0	0,0	0,0	0,0	100	0,0	0,0
Netherlands	4,0	69,0	0,0	27,0	0,0	6,0	71,0	0,0	23,0	0,0
Northern Macedonia	36,0	64,0	0,0	0,0	0,0	54,0	46,0	0,0	0,0	0,0
Norway	0,0	100	0,0	0,0	0,0	0,0	100,0	0,0	0,0	0,0
Poland	23,1	74,5	2,5	0,0	0,0	87,0	1,0	12,0	0,0	0,0
Portugal	7,3	92,7	0,0	0,0	0,0	31,0	69,0	0,0	0,0	0,0
Romania	66,0	0,0	34,0	0,0	0,0	53,0	0,0	47,0	0,0	0,0
Serbia	34,8	65,2	0,0	0,0	0,0	37,0	63,0	0,0	0,0	0,0
Slovakia	0,0	66,2	19,0	0,0	0,0	23,0	41,0	36,0	0,0	0,0
Slovenia	15,0	85,0	0,0	0,0	0,0	40,0	60,0	0,0	0,0	0,0
Spain	27,9	71,4	0,0	0,8	0,0	26,0	74,0	0,0	0,0	0,0
Sweden	0,0	100	0,0	0,0	0,0	0,0	100,0	0,0	0,0	0,0
Switzerland	0,0	100	0,0	0,0	0,0	0,0	100,0	0,0	0,0	0,0
Turkey	34,0	66,0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0

Source: Eurostat (2022), Eurostat (2021).

Table A.2. Sample interest realised in the following weeks of the quarter, Q1 2019 - Q4 2021.

Survey week	2019				2020				2021			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	7.40	7.59	7.66	7.72	7.64	7.57	7.77	7.78	7.71	7.86	7.85	7.57
2	7.60	7.71	7.63	8.03	8.01	7.84	7.78	7.79	7.68	8.21	8.19	7.65
3	7.79	7.92	7.48	7.66	8.18	8.17	7.70	8.02	7.83	7.64	7.74	7.65
4	7.73	7.33	7.27	7.59	7.85	7.81	7.66	7.42	7.72	7.74	7.93	7.75
5	7.85	7.71	7.69	7.77	8.00	8.08	7.73	7.74	7.82	7.84	7.81	7.67
6	7.56	7.75	7.52	7.67	7.86	7.78	7.35	7.70	8.03	7.81	7.54	7.68
7	8.05	7.85	7.54	7.81	8.23	7.97	7.79	7.93	7.97	7.88	7.82	7.71
8	7.65	8.09	7.99	7.80	7.95	7.76	7.85	8.09	7.97	7.69	7.94	7.93
9	7.73	7.57	7.64	7.93	7.89	7.62	8.03	7.82	7.78	7.98	7.99	7.92
10	7.70	7.52	7.91	7.87	7.33	7.34	7.62	7.43	7.44	7.49	7.44	7.79
11	7.60	7.68	8.08	7.49	6.99	7.34	7.63	7.46	7.36	7.24	7.30	7.62
12	7.68	7.70	7.91	7.40	6.94	7.37	7.50	7.31	7.32	7.22	7.19	7.68
13	7.65	7.58	7.67	7.27	7.12	7.37	7.60	7.51	7.37	7.41	7.26	7.38
	100	100	100	100	100	100	100	100	100	100	100	100

Source: own compilation based on LFS unit data (Statistics Poland).

Table A.3. Response probability estimation, logistic regressions Models 1 and 2- full sample, model 3- face-to-face recruitment, model 4- telephone recruitment, reference categories: primary education and age group 45-49.

	(1) response probability (participation)	(2) response probability (participation)	(3) response probability (participation)	(4) response probability (participation)
CATI		1.977*** (29.32)		
female	0.990 (-0.48)	1.003 (0.16)	1.016 (0.59)	0.980 (-0.55)
secondary education	0.984 (-0.55)	1.011 (0.37)	1.062 (1.69)	0.933 (-1.36)
higher education	1.027 (0.83)	1.093** (2.80)	1.255*** (5.81)	0.841** (-3.18)
city	0.675*** (-15.43)	0.668*** (-15.71)	0.582*** (-16.66)	0.870*** (-3.35)
15-17 years	0.382*** (-15.85)	0.375*** (-16.03)	0.423*** (-10.81)	0.333*** (-11.59)
18-19 years	0.808** (-2.59)	0.822* (-2.38)	0.839 (-1.70)	0.821 (-1.44)
20-24 years	0.752*** (-4.67)	0.804*** (-3.56)	0.813** (-2.77)	0.827 (-1.76)
25-29 years	0.764*** (-4.60)	0.837** (-3.04)	0.855* (-2.19)	0.851 (-1.52)
30-34 years	0.927 (-1.34)	0.980 (-0.35)	0.975 (-0.36)	1.031 (0.31)
35-39 years	0.989 (-0.20)	1.021 (0.37)	1.021 (0.30)	1.026 (0.28)
40-44 years	0.952 (-0.88)	0.964 (-0.66)	0.923 (-1.16)	1.046 (0.49)
50-54 years	1.036 (0.61)	1.041 (0.69)	1.011 (0.15)	1.102 (1.01)
55-59 years	1.093 (1.56)	1.116 (1.92)	1.060 (0.82)	1.257* (2.34)
60-64 years	1.204*** (3.37)	1.237*** (3.85)	1.212** (2.80)	1.312** (2.91)
65+ years	1.201*** (3.95)	1.223*** (4.32)	1.295*** (4.39)	1.107 (1.34)
N	144911	144911	74453	70458
pseudo R ²	0.012	0.026	0.017	0.014
AIC	66856.6	65942.9	41073.4	24713.5

Source: own compilation based on LFS unit data (Statistics Poland).

Table A.4. Response probability estimation, logistic regressions, visit>1, unweighted data.

	Full sample			Without subsample 91+			CAPI	CATI
	(1) response probabili ty	(2) response probabili ty	(3) response probabili ty	(4) response probabili ty	(5) response probabili ty	(6) response probabili ty	(7) response probabilit y	(8) response probabili ty
proxy responde nt	1.196*** (12.67)	1.245*** (13.82)	1.246*** (13.87)	1.202*** (12.75)	1.246*** (13.84)	1.247*** (13.89)	1.281*** (15.21)	0.886*** (-4.53)
CATI	1.047** (3.07)	1.204*** (9.58)	1.203*** (9.57)	1.051** (3.00)	1.219*** (9.33)	1.219*** (9.31)		
proxy *CATI		0.733*** (-10.73)	0.733*** (-10.74)		0.718*** (-10.42)	0.718*** (-10.42)		
visit 3	0.361*** (-89.02)	0.361*** (-88.97)	0.362*** (-88.90)	0.359*** (-82.90)	0.359*** (-82.91)	0.360*** (-82.88)	0.286*** (-77.55)	0.468*** (-42.89)
visit 4	0.276*** (-110.13)	0.277*** (-110.09)	0.277*** (-109.97)	0.275*** (-102.71)	0.275*** (-102.71)	0.276*** (-102.63)	0.215*** (-94.06)	0.392*** (-47.40)
visit 5	0.187*** (-137.92)	0.187*** (-137.91)	0.187*** (-137.84)	0.186*** (-130.30)	0.186*** (-130.32)	0.186*** (-130.27)	0.151*** (-113.80)	
visit 6	0.157*** (-142.81)	0.157*** (-142.75)	0.157*** (-142.74)	0.156*** (-135.63)	0.156*** (-135.60)	0.156*** (-135.60)	0.127*** (-119.00)	
female	1.062*** (4.40)	1.092*** (6.51)	1.102*** (7.19)	1.063*** (4.38)	1.094*** (6.49)	1.103*** (7.12)	1.077*** (4.70)	1.035 (1.37)
city	0.735*** (-20.72)	0.771*** (-18.13)	0.768*** (-18.37)	0.735*** (-20.30)	0.772*** (-17.65)	0.769*** (-17.88)	0.723*** (-19.09)	0.794*** (-8.18)
15-17 years	1.032 (0.67)	0.943 (-1.26)	1.012 (0.25)	1.029 (0.59)	0.937 (-1.36)	1.003 (0.06)	1.007 (0.13)	1.117 (1.25)
18-19 years	0.609*** (-10.47)	0.583*** (-11.49)	0.612*** (-10.47)	0.604*** (-10.36)	0.578*** (-11.39)	0.605*** (-10.44)	0.596*** (-9.44)	0.661*** (-4.75)
20-24 years	0.425*** (-24.37)	0.451*** (-22.87)	0.452*** (-22.82)	0.418*** (-24.21)	0.445*** (-22.70)	0.445*** (-22.67)	0.404*** (-22.26)	0.541*** (-9.32)
25-29 years	0.507*** (-19.78)	0.531*** (-18.51)	0.526*** (-18.82)	0.503*** (-19.53)	0.527*** (-18.25)	0.522*** (-18.54)	0.496*** (-17.67)	0.552*** (-9.19)
30-34 years	0.675*** (-11.74)	0.706*** (-10.43)	0.703*** (-10.56)	0.667*** (-11.76)	0.700*** (-10.43)	0.697*** (-10.56)	0.664*** (-10.50)	0.716*** (-5.53)
35-39 years	0.856*** (-4.67)	0.890*** (-3.53)	0.887*** (-3.64)	0.852*** (-4.70)	0.886*** (-3.55)	0.883*** (-3.65)	0.851*** (-4.16)	0.877* (-2.25)

40-44								
years	0.960	0.981	0.980	0.957	0.980	0.978	0.973	0.912
	(-1.23)	(-0.56)	(-0.60)	(-1.28)	(-0.60)	(-0.64)	(-0.70)	(-1.57)
50-54								
years	1.102**	1.089*	1.093*	1.094*	1.081*	1.084*	1.102*	1.092
	(2.75)	(2.42)	(2.52)	(2.47)	(2.14)	(2.23)	(2.35)	(1.40)
55-59								
years	1.159***	1.148***	1.163***	1.159***	1.148***	1.162***	1.157***	1.159*
	(4.24)	(3.97)	(4.34)	(4.12)	(3.85)	(4.20)	(3.60)	(2.35)
60-64								
years	1.341***	1.335***	1.394***	1.330***	1.324***	1.381***	1.337***	1.342***
	(8.44)	(8.30)	(9.58)	(8.00)	(7.86)	(9.06)	(7.23)	(4.55)
65+ years								
	1.256***	1.252***	1.340***	1.242***	1.237***	1.321***	1.223***	1.419***
	(7.25)	(7.12)	(9.42)	(6.70)	(6.57)	(8.72)	(5.53)	(5.94)
Secondary education	0.992			0.991			0.968	1.082*
	(-0.47)			(-0.50)			(-1.54)	(2.47)
Higher education	0.801***			0.795***			0.759***	1.027
	(-11.71)			(-11.85)			(-12.61)	(0.74)
unemployed	0.504***	0.492***		0.513***	0.500***		0.537***	0.403***
	(-17.86)	(-18.57)		(-16.82)	(-17.54)		(-13.84)	(-13.50)
inactive	0.894***	0.862***		0.897***	0.863***		0.905***	0.863***
	(-5.85)	(-7.90)		(-5.57)	(-7.66)		(-4.61)	(-3.81)
employed			1.242***			1.238***		
			(12.04)			(11.56)		
N	510839	510839	510839	476266	476266	476266	378659	132180
pseudo R ²	0.076	0.075	0.074	0.070	0.069	0.068	0.073	0.042
AIC	423001.7	423341.0	423785.4	408005.4	408372.4	408777.5	338226.5	83913.9

*Exponentiated coefficients; t statistics in parentheses; * p<0.05, ** p<0.01, *** p<0.001.*

Reference categories: group 45-49 years old, not working (where the variable working occurs), employed (for unemployed and inactive).

Source: own compilation based on LFS unit data (Statistics Poland).

Table A.5. Employment rates – published and counterfactual (assuming stable sample with respect to education structure and proxy interviews proportion) II q 2020 r. – IV q 2021 r.

	2020 II	2020 III	2020 IV	2021 I	2021 II	2021 III	2021 IV
Employment rate (published)							
15-24 years	27.6	27.6	26.5	26.3	26.6	28.3	28.2
25-44 years	82.3	83.3	83.4	84.1	85.2	85.5	85.8
45-59/64 years	72.0	73.8	74.7	75.9	76.4	78.2	78.0
60/65+ years	8.0	8.3	8.4	8.2	8.7	9.0	8.9
Total	53.0	53.9	53.9	54.5	55.1	55.9	55.8
Counterfactual employment rate							
15-24 years	28.8	28.9	27.6	28.2	28.5	29.5	29.1
25-44 years	82.0	83.2	83.2	83.8	84.9	85.1	85.6
45-59/64 years	71.6	73.3	74.0	75.2	76.0	77.7	77.6
60/65+ years	7.8	8.1	8.1	8.0	8.5	8.9	8.8
Total	53.0	53.8	53.7	54.3	55.0	55.7	55.7
Difference (percentage points)							
15-24 years	-1.2	-1.3	-1.1	-1.9	-1.9	-1.2	-0.9
25-44 years	0.2	0.2	0.2	0.3	0.3	0.4	0.2
45-59/64 years	0.4	0.6	0.6	0.7	0.5	0.5	0.4
60/65+ years	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total	0.1	0.1	0.2	0.1	0.1	0.2	0.1

Source: own compilation based on LFS unit data (Statistics Poland).

Table A.6. Unemployment rates – published and counterfactual (assuming stable sample with respect to education structure and proxy interviews proportion), II q 2020 r. – IV q 2021 r.

	2020 II	2020 III	2020 IV	2021 I	2021 II	2021 III	2021 IV
	Unemployment rate (published)						
15-24 years	9.6	12.6	12.9	14.0	13.3	11.4	9.0
25-44 years	3.2	3.2	2.8	3.9	3.3	2.9	2.9
45-59/64 years	2.3	2.2	2.2	2.8	2.6	2.2	2.2
60/65+ years	0.2	0.8	1.4	1.1	0.5	0.1	0.5
Total	3.2	3.3	3.2	4.0	3.5	3.0	2.9
	Counterfactual unemployment rate						
15-24 years	9.1	13.0	12.2	13.2	12.8	10.3	9.3
25-44 years	3.2	3.2	2.8	4.0	3.3	3.0	2.9
45-59/64 years	2.3	2.3	2.3	3.0	2.7	2.3	2.2
60/65+ years	0.2	0.9	1.6	1.2	0.5	0.1	0.6
Total	3.2	3.5	3.2	4.1	3.6	3.1	3.0
	Difference (percentage points)						
15-24 years	0.5	-0.4	0.8	0.9	0.5	1.2	-0.3
25-44 years	0.0	-0.1	0.0	-0.1	0.0	-0.1	0.0
45-59/64 years	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
60/65+ years	0.0	-0.1	-0.1	-0.1	0.0	0.0	-0.1
Total	0.0	-0.1	0.0	-0.1	-0.1	0.0	-0.1

Source: own compilation based on LFS unit data (Statistics Poland).

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