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Summary report on the revision of the longitudinal weightings of SILC-2018

Methodological considerations

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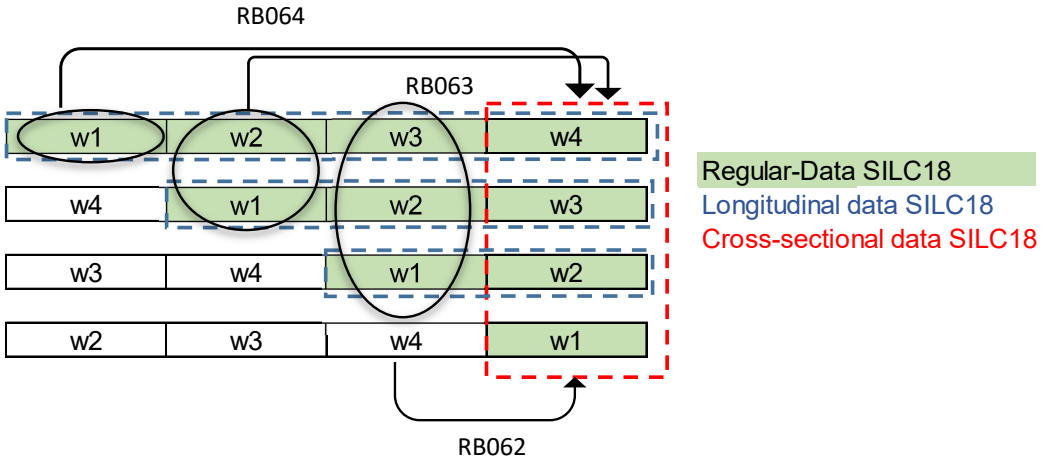
1 Introduction

Since 2014, the sample for the Survey on Income and Living Conditions (SILC) has been drawn from a new sample frame - the FSO's new population survey sample frame (SRPH). This change led to a revision of the cross-sectional weighting on the SILC14 data[1]. The calculation method for the longitudinal weightings[2] that enable analyses of the transitions over two, three or four years was not affected by this revision. The SILC is a rotating panel over four years, which means that each year, a quarter of the sample is renewed and the remainder are interviewed for four years (cf. G1.1). Data have only been composed of four panels in the SRPH sample frame from SILC17 onwards, i.e. the panels 2014 to 2017. Although the revision of the longitudinal weights is therefore possible from SILC17, it has only been implemented from SILC18. However, the revision will be applied retroactively to the SICL17 longitudinal data during 2022.

Diagram of SILC rotating panel and longitudinal weightings (RB062/63/64) G1.1



The longitudinal weighting model has been revised by integrating new data from administration registers as well as other methodological improvements. These changes imply a break in series between the longitudinal results SILC17 (or earlier) and SILC18 (or later), as was the case between the cross-sectional results SILC13 and SILC14.

This document aims to summarise the methodological improvements in the longitudinal weightings as of SILC18 and to detail the main changes that ensue at the results level. Detailed documentation will be available in the SILC18 quality report[3].

[1] Further information at http://www.bfs.admin.ch/asset/en/be-e-20.03-SILC-05

[2] Further information at www.bfs.admin.ch/asset/en/be-e-20.03.02.05.01

[3] www.bfs.admin.ch/asset/be-e-20-quality_report-2018 (will be published in spring 2022)

2 Changes and improvements made

This revision of the longitudinal weightings has an effect on the one hand on the adjustment for total non-response[4] (TNR) and on the final calibration on the other.

Prior to SILC14, persons living in a household who had replied to the grid questionnaire[5] in wave 1[6] were followed for four years, even if the household was incomplete (it is complete when the household answered the grid and household questionnaires and at least one person answered the individual questionnaire). From SILC14, this rule changed and individuals had to be in a complete household in wave 1 to be followed. This change aligned the rules for being followed with those of Eurostat and enabled an increase in the number of auxiliary variables for correction of TNR in waves 2, 3 and 4 - both longitudinal and cross-sectional. These variables come from data surveyed in wave 1, available only for complete households, such as the risk of poverty, cost of housing, and interest in politics, etc.
Before SILC18, adjustment for TNR in the longitudinal weighting was modelled using segmentation: this is an asymmetrical tree diagram of explanatory factors for TNR, in rising order of importance. This modelling was carried out at individual level, which resulted in different weights between individual members of the same household. This did not correspond to the actual process of non-response, which is carried out first of all at household level. The most common longitudinal attrition is observed in refusal of the grid questionnaire (household level). With the revision, correction for TNR is done at household level but on the basis of an individual data set using a calibration algorithm integrated at household level[7]. This was not possible with segmentation. This method enables an equal weight to be obtained for all persons in the same household. This makes it possible to be closer to the actual response process.

Thanks to matching, which uses AHV/AVS numbers, the use of the SRPH survey frame makes it possible to obtain basic demographic information from the SRPH on the type of household as well as information from other registers for the entire population and thus also for individuals in TNR (e.g. compensation funds with certain income components). This information, which allowed the cross-sectional weighting to be improved, were used in the same way as for the revision of the longitudinal weighting.

As for cross-sectional weighting, the final calibration of longitudinal weights was revised by including new data from registers. As all of these variables were known for the entire sample as well as for the Swiss population, the final calibration can be carried out more efficiently than before.

The whole point of weightings is to determine the characteristics of persons/households that do not respond and to increase the weights of persons/households who most resemble them. A similar approach is adopted to reduce the weights of persons/households most like the profiles that are most willing to respond. The last stage, called final calibration, enables the weight of respondents to be adjusted so that the weighted totals of respondents' socio-economic characteristics coincide with the known totals of these characteristics in the reference population. In this way, the large amount of information available in the SRPH or other registers also containing AHV/AVS numbers has made it possible to improve the quality of the weighting by reducing the bias caused by TNR.

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[4] In the longitudinal weightings, only household total non-response (hTNR) is considered, indicated in this note only by TNR.

[5] The SILC survey questionnaire is comprised of three parts. The grid questionnaire, answered by a household person aged at least 18, mainly concerns the household composition as well as socio-demographic data. The second part is the household questionnaire, to which can be added the proxy adults questionnaire (when a person is not eligible for the individual questionnaire) and the proxy children questionnaire (children aged 0-12). The third part is the individual questionnaire for individuals aged 16 and over.

[6] Individuals in a household interviewed in the first of four years.

[7] Calibration integrated at household level is a calibration to which a constraint has been added at household level. This requires the weights of the TNR correction to be the same for all members of the same household.

3 Assessment of the improvements made to longitudinal weights

3.1 Distribution

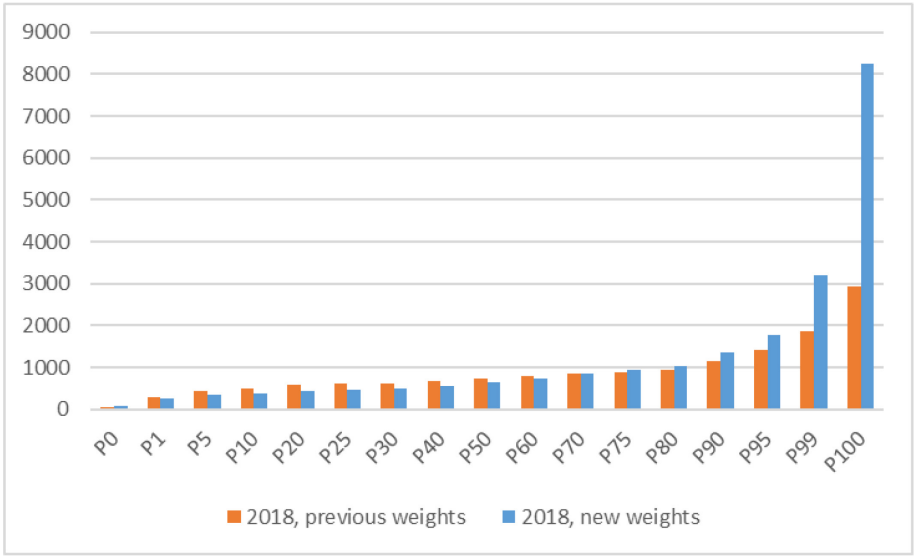
Distribution of longitudinal weights using the previous and new method T3.1

	RB062		RB063		RB064	
	previous weighting	new weighting	previous weighting	new weighting	previous weighting	new weighting
Nobs	10273	10272	6563	6563	3246	3246
mean	794	806	1229	1249	2458	2498
stddev	305	574	437	908	992	1587
max	2922	8242	3719	16220	8775	16273
P95	1429	1762	2110	2787	4522	5428
Q3	892	934	1390	1448	2757	3039
median	728	648	1106	1006	2258	2125
Q1	607	476	946	718	1839	1426
P5	441	346	750	505	1412	960
min	57	95	148	127	515	513
relative increase of standard deviations with the new method	88%		108%		60%	

Source: FSO - Statistics on Income and Living Conditions (SILC), longitudinal data 2015-2018, excluding imputed rent
Note: The difference in the number of observations for the weight RB062 is due to a household considered complete during the previous weighting and which is no longer complete in the new weighting.

The variability of the longitudinal weights revised is between 1.6 and 2 times greater than that of the previous weights. The addition of new auxiliary variables in the modelling of the response process enabled its improvement by means of a more detailed differentiation of the underlying characteristics, which, of course, leads to greater variability in the final weights (T3.1). We thus hope to reduce the TNR bias, with a risk of increasing the variance of the estimators.

Distribution of longitudinal weight RB062 over two years using the previous and new weighting G3.1



Source: FSO - Statistics on Income and Living Conditions (SILC), longitudinal data 2015-2018, excluding imputed rent

For the three longitudinal weights RB062, RB063 and RB064, the distributions are similar with both the previous and new method. Up to the P80 percentile, the two methods produce weights whose distribution is close (G3.1). Only after P90, i.e. for large weights, does the difference in distribution become more pronounced. This supports the hypothesis that, thanks to the new auxiliary variables, the new weighting takes better account of the lower probabilities of response (either due to better correction for non-response or better calibration).

3.2 Structural effect

The most pronounced structural effect is an increase in the size of the permanent resident population at the main place of residence estimated by SILC of 125 518 persons for 2017, when considering the changeover between 2017 and 2018 (RB062), of 129 641 for that between 2016 and 2018 (RB063) and of 128 332 for the transition between 2015 and 2018 (RB064). With the previous weighting method, the final calibration was made on the permanent resident population at the main place of residence from the Population and household statistics (STATPOP) of 31 December of the year prior to the start of the transition, whereas with the new method, the final calibration was made on the SRPH which also includes non-permanent residents living in a household with at least one permanent resident.

3.3 Attrition and socio-demographic breakdowns

To assess the quality of the longitudinal weighting, we suggest a re-estimation of an indicator in wave 1 by using respondents from wave 4 with the corresponding longitudinal weight and by freezing the variable of interest in wave 1. In the case of a weighting that fully corrects for the attrition correlated to our variables of interest, the result should give a similar value to that given with the cross-sectional weight of wave 1 (before longitudinal attrition).

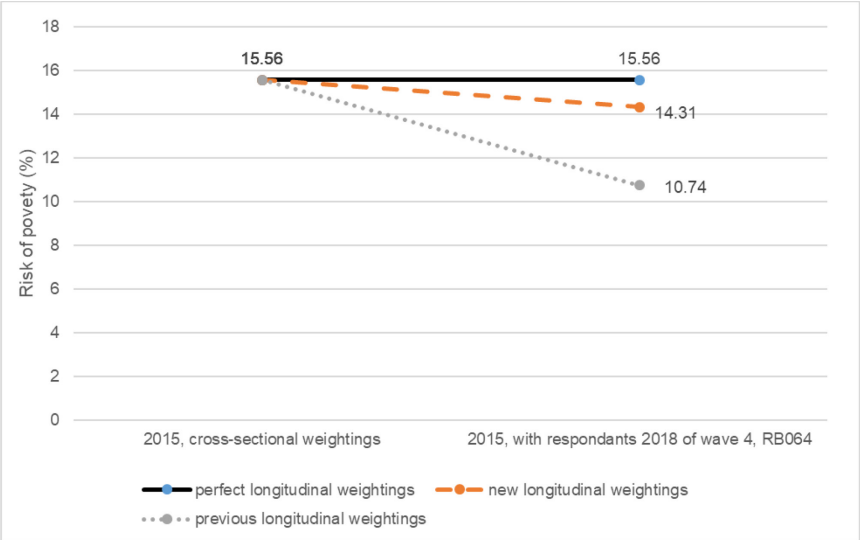
For example, the at-risk-of-poverty rate[8] of 2015 calculated with the cross-sectional weight RB050 is 15.6%. With a perfect longitudinal weighting, this rate should be similar by calculating it based on the individuals in the complete households of wave 4 in 2018 with the “at risk of poverty” characteristic of 2015 fixed and the longitudinal weight RB064. If this is not the case, it shows that the longitudinal weight does not fully correct the bias due to attrition.

With the new longitudinal weighting, the bias not fully corrected by the weight is greatly diminished. The at-risk-of-poverty rate of 2015 (15.6%) was recalculated at 10.7% with the previous longitudinal weighting on wave 4 and at 14.3% with the new weighting.

Graph 3.2 shows that the new weighting is not perfect but that it is considerably better at correcting for the lower probability of response in wave 4 of people at risk of poverty in wave 1 compared with those who were not at risk of poverty.

[8]The at-risk-of-poverty rate is calculated here without imputed rent.

At-risk-of-poverty rate of 2015 in wave 1, estimated by cross-sectional weighting, by the previous and by the new longitudinal weighting G3.2



Source: FSO - Statistics on Income and Living Conditions (SILC), longitudinal data 2015-2018 and cross-sectional data 2015, excluding imputed rent

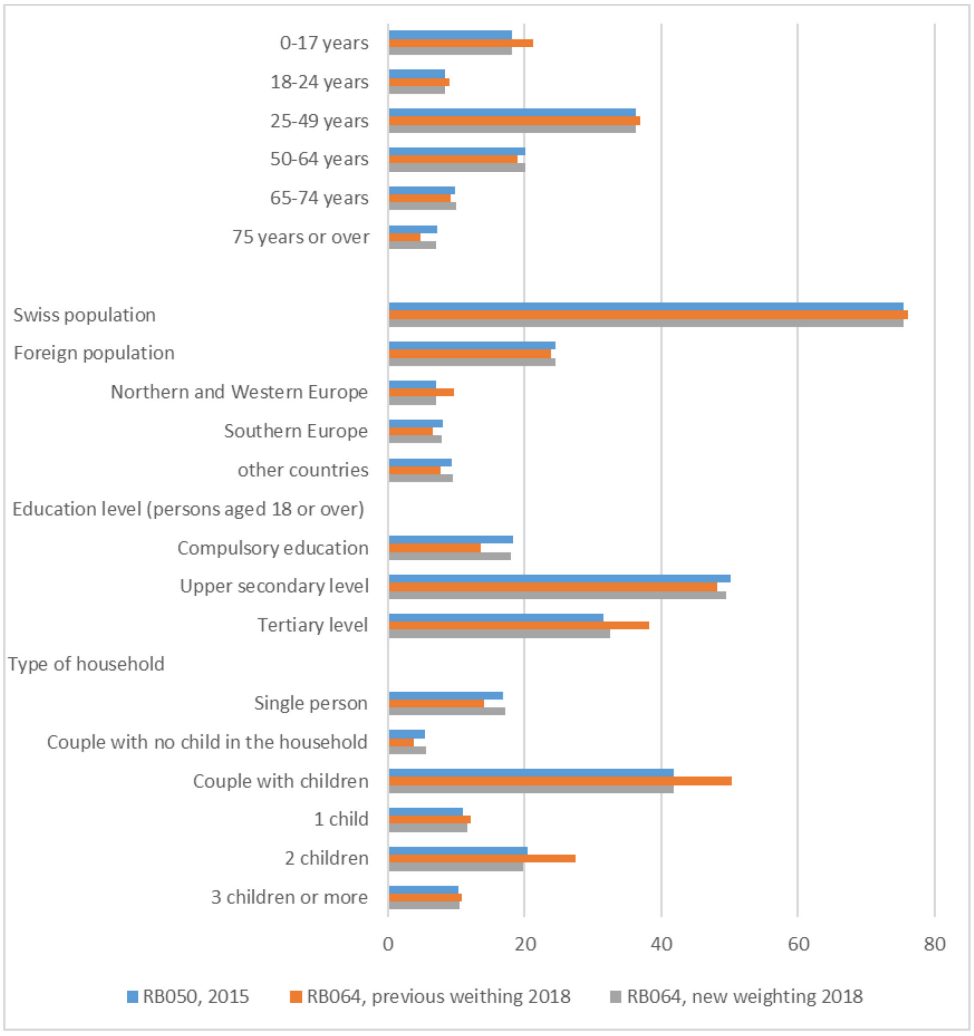
In the same way as for the at-risk-of-poverty rate, attrition is analysed on certain socio-demographic variables survey with SILC15. The percentage is calculated on the population responding to SILC15 by using the cross-sectional weight RB050 of 2015. This percentage is also calculated on the same socio-demographic variables of SILC15 but only for respondents to SILC18, using the previous and the new weight RB064.

The previous longitudinal weighting under-corrected for the attrition of 50-64 year-olds and of 75 year-olds and over (including deaths occurring between SILC15 and SILC18), particularly in favour of 0-17 year-olds. This is no longer the case with the new weighting (G3.3).

Regarding people's education, the new weighting corrects better for the under-representation of lower education levels. The level of education is only used in the algorithm of correction for TNR. The level of education is not available for final calibration but certain variables taken from the registers are strongly correlated with it.

Overall, in all the socio-demographic variables used in our standard tables, an improvement has been observed with the new weighting.

Weighted percentage of individuals in the population, with the cross-sectional weight RB050 of 2015 and the longitudinal weights RB064 previous and new method.
By socio-demographic breakdown of SILC15 G3.3

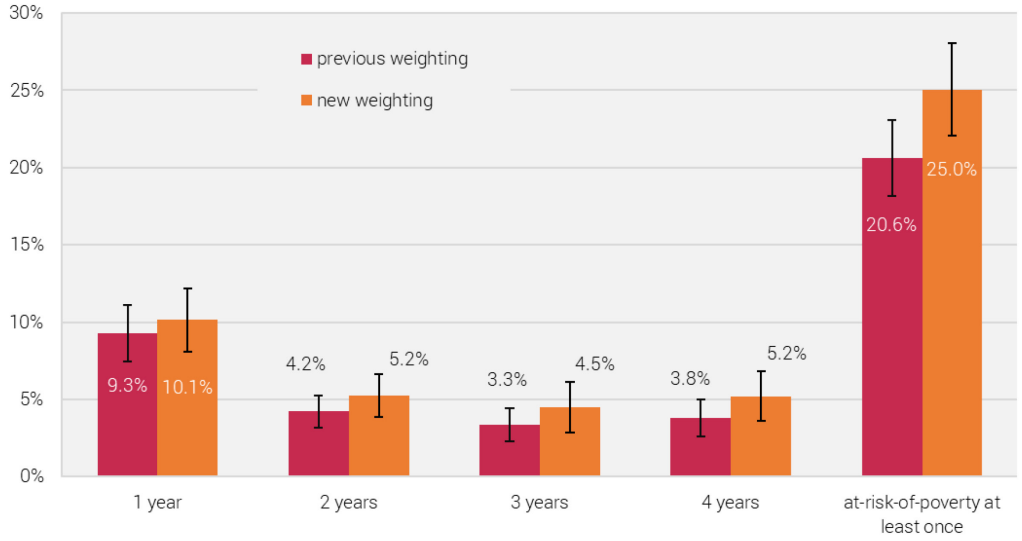


Source: FSO - Statistics on Income and Living Conditions (SILC), longitudinal data 2015-2018 and cross-sectional data 2015, excluding imputed rent

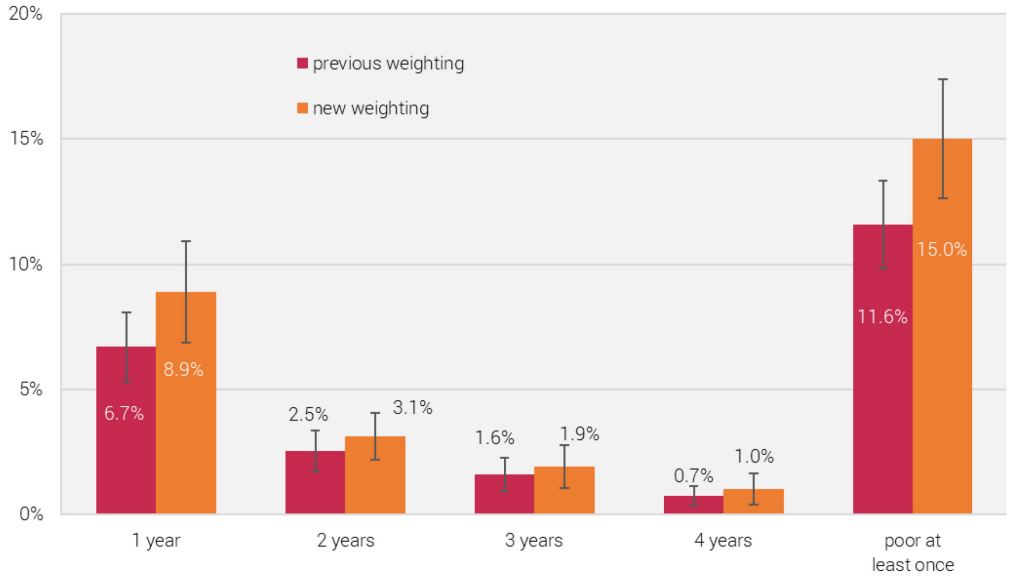
4 Consequences for the published indicators

4.1 Poverty dynamic

Persons affected by poverty over a four-year period
By number of years, in % of the population G4.1

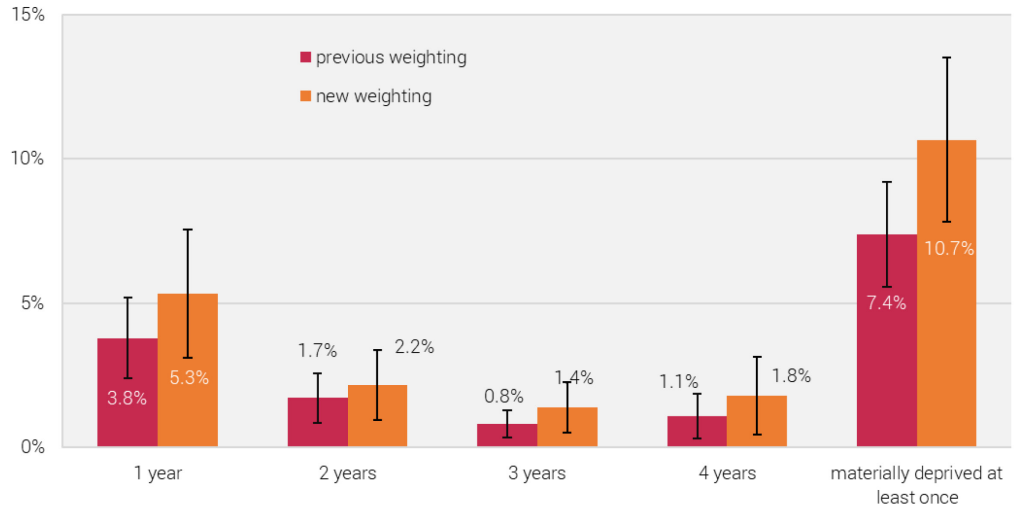


Persons at risk of poverty at 60% of the median over a four-year period
By number of years, in % of the population G4.2



Source: FSO - Statistics on Income and Living Conditions (SILC), longitudinal data 2015-2018, excluding imputed rent.
Interpretation example: With the previous weighting, 2.5% of the population were affected by poverty according to the absolute concept during two of the four years considered and 0.7% were affected during four years.

Persons materially deprived over a four-year period
By number of years, in % of the population G4.3



Source: FSO - Statistics on Income and Living Conditions (SILC), longitudinal data 2015-2018, excluding imputed rent

For the three indicators[9] , there is an undeniable increase in rates with the new weighting, but this is never significant.

4.2 Persistant poverty

The at risk of persistent poverty rate[10] with SILC18 rose by 2.2 percentage points, rising from 6.6% with the previous weighting to 8.8% with the new one. The most pronounced increase (3.5 percentage points) concerns persons aged 18-24, whose rate rose from 3.8% with the previous weighting to 7.3% with the new one, followed by the under 18s (from 15.0% to 18.0%). An undeniable increase was also observed among people aged over 65, whose rate rose from 7.4% to 10.9%.

5 Conclusion

The change in the rule for following households made it possible to use variables from data surveyed in wave 1 available only for complete households in the adjustment for household total non-response. The new weighting thus models better the probabilities of response. The SRPH survey frame, by offering a much more complete coverage of the reference population and access to a greater amount of data on the population, has led to an improved final calibration. The result is a fundamental revision of the methods of longitudinal weighting and consequently a marked improvement in the quality of longitudinal estimates produced from SILC 2018. The dispersion of the revised weights is wider, resulting in an upward trend in confidence intervals.

Analysis of the impact of the revision on the main indicators shows that it is essential to indicate a break in the series between the longitudinal results before and after the revision.

[9] The definitions of these three indicators are available at Risk of poverty | Federal Statistical Office (admin.ch) and results at Dynamics of poverty | Federal Statistical Office (admin.ch)

[10] Percentage of people with an income lower than the risk of poverty threshold (60% of the median) for the current year and at least two of the three previous years.