

The change to adaptive survey design: Some preliminary work and a plan for the work ahead¹

Anton Örn Karlsson

Statistics Iceland

1. Background

The Icelandic Labour Force Survey (ISLFS) is an ongoing panel survey conducted by Statistics Iceland. The survey is the main source of timely information about the labour force in Iceland - including the unemployment rate, working hours and education. The results are used by the Icelandic ministries and the Central Bank of Iceland for long term policy formulation and to monitor the developments and changes in the Icelandic economy. Additionally, the results are used by various private firms and the Icelandic media. As such, it is important for Statistics Iceland to ensure the quality of the survey and that its results are a faithful reflection of the Icelandic labour force. Currently, the main quality area on which Statistics Iceland is focusing on is the nonresponse situation of the ISLFS. From the end of 2011 and until the second quarter of 2017 there has been a steady decline in the response rate of the survey, from a high point of 86% to a low point of 68% - an 18 percentage point drop. In this paper, the main aim is to assess if this drop in response rate in the ISLFS signals a decrease in the quality of the survey, i.e. does it signify an increase in nonresponse bias and, if so, how could Statistics Iceland react to this?

2. The Icelandic Labour Force Survey

The ISLFS is a quarterly panel survey with a 3-2-2 rotation scheme, i.e. sample units participate in three consecutive quarters, then they are not contacted for two quarters and finally they are contacted again for participation for two additional quarters. The sample is selected from the most recent version of the Icelandic national registry with a simple random sampling scheme. Only individuals between the ages of 15 - 75, living in Iceland are selected for the survey.

Data is exclusively collected via telephone by interviewers working for Statistics Iceland in its call center. Telephone numbers for the sample are found by searching for the personal identification numbers of the sample members within a database containing all registered phone numbers in Iceland which is hosted by a private company. Clerical staff within Statistics Iceland perform manual tracing for all other sample members for whom telephone numbers were not found in the database.

Introductory letters are sent to all sample units before the start of data collection and reminders are sent to every unit that Statistics Iceland has not been able to contact after two weeks. Each sample member can be contacted through a three week long window, with the first week being straight after the reference week of the sample unit in question. The reference week is a fixed time period for which many of the questions in the survey (e.g. regarding employment and unemployment, working hours, educational or training activities, job search etc.) are linked to. It is therefore important to try and secure the interview as early as possible in the three week window, so that recall error is minimized (Eisenhower, Mathiowetz & Morganstein, 1991). The average interview in the ISLFS takes roughly 5 - 7 minutes, with interviews in latter waves being shorter than interviews in the first wave, mostly due to the use of dependent interviewing and because the respondents have more experience in answering the questions of the survey.

¹ Paper presented at the International Workshop on Household Survey Nonresponse in Utrecht, August 2017

3. Current situation

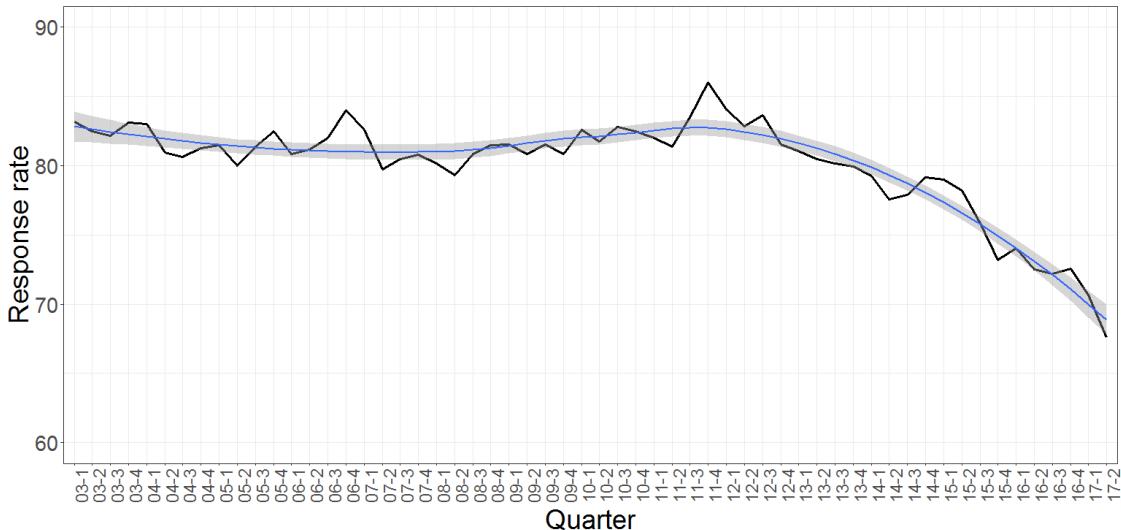


Figure 1. Response rate, 2003-2017.

The graph in figure 1 shows the development of the response rate in the ISLFS from the beginning of the current form of data collection (which was in the first quarter of 2003) until the end of the second quarter of 2017 with a smoothed conditional mean line drawn as well. The response rate of the survey began its downward trend in 2011 or 2012 and has been on a downward trend ever since then.

The reduction in the response rate of the ISLFS does not necessarily mean that the quality of the survey has been jeopardized because of nonresponse bias (Peytcheva & Groves, 2008). In order to examine the possible bias of the ISLFS the representativeness of the final group of respondents was examined using the R-indicator (Schouten, Cobben & Bethlehem, 2009) as well as the difference between respondents and nonrespondents for known auxiliary variables, highly linked to the main topics of the ISLFS.

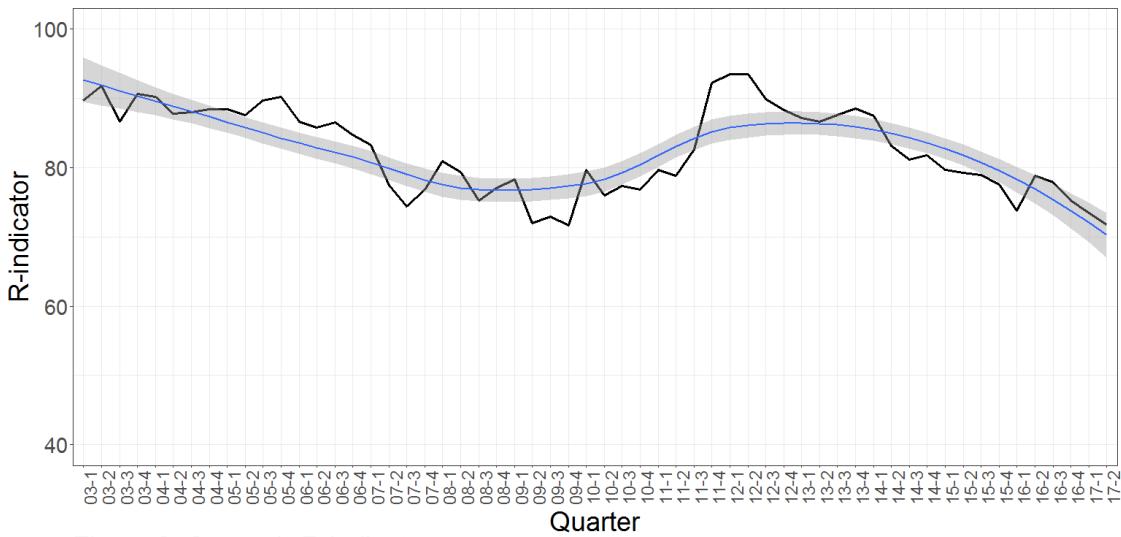


Figure 2. Quarterly R-indicator

3.1 Representativity

Figure 2 shows the R-indicator for the ISLFS from 2003-2017. The indicator was based on a response propensity model with three independent variables: Gender, age and citizenship, recoded as a binary variable indicating if the sampled individual had an Icelandic citizenship or not. The line in figure 2 seems to show a similar trend, although not quite as steep, as the development of the response rate in the ISLFS, i.e. the representativity in the respondents group has been decreasing over the past quarters and has never been as

low as it is now. To get more information on how, exactly this is linked to the different groups in the sample, the partial R-indicator (Schouten, Bethlehem, Beullens, Kleven et al., 2012) was examined.

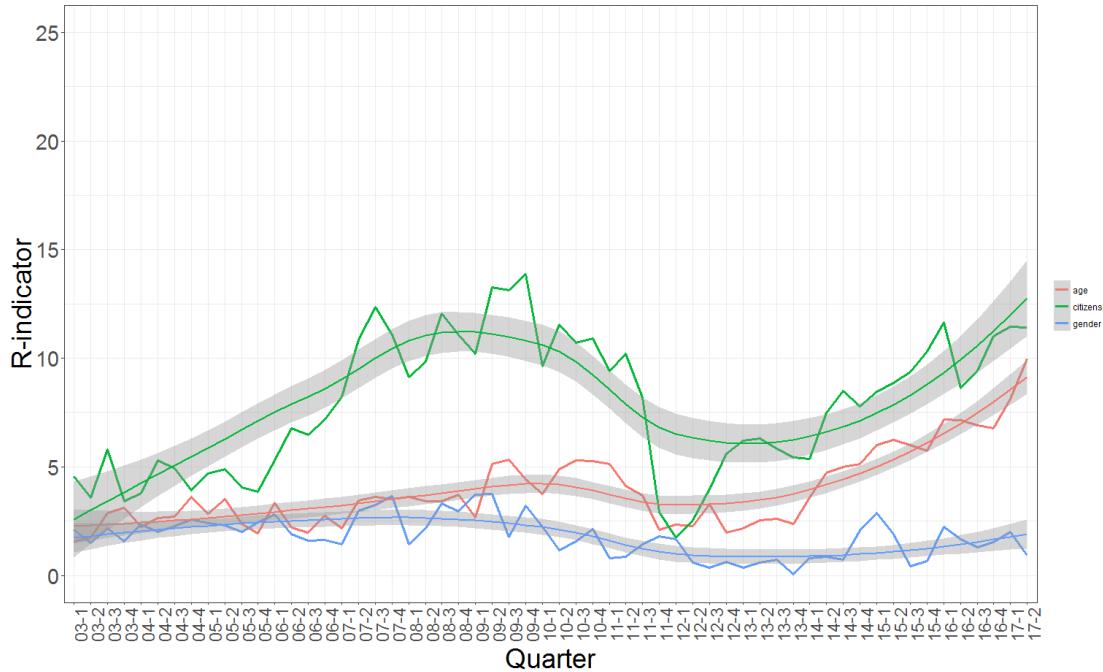


Figure 3. Partial R-indicator

Figure 3 shows a plot of the development of the partial R-indicator for age (red), citizenship (green) and gender (blue). The plot demonstrates that while gender is relatively stable and is relatively well represented in the final group of respondents, both age and citizenship are more irregular and the partial R-indicator for age seems to be growing. Therefore it might be interesting to look at the partial R-indicator for age groups.

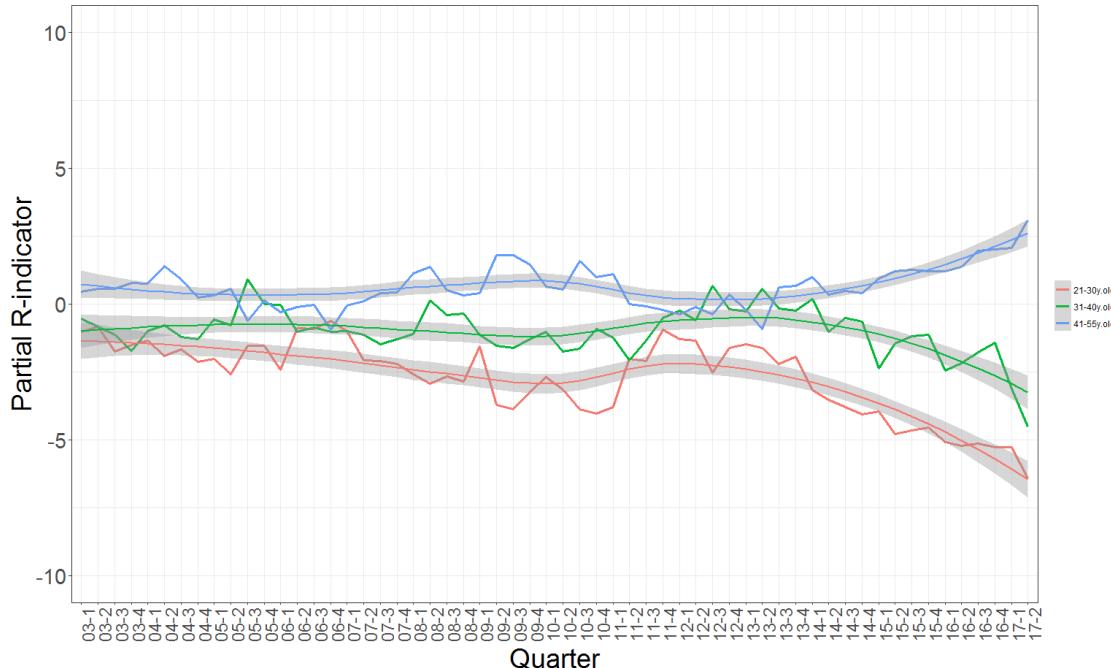


Figure 4. Partial R-indicator for age groups

The partial R-indicator for age groups in figure 4, shows that the representativity of the three age groups shown (21 - 30 year old in red, 31 - 40 year old in green, 41 - 55 year old in blue) has been getting worse in the last years, with the ISLFS over-representing the oldest of the three age groups and the younger age groups (especially the 21 - 30 year old) being underrepresented in the final group of respondents. This pattern of results indicates that there might be something in the current data collection scheme of Statistics Iceland that should be changed in order to increase the response rates of the younger age groups, from 21 - 40. Further analysis indicate that this stems mostly from an increase in the noncontact rate of the younger age groups - while the refusal rate seems roughly similar for all age groups and has not increased over the past quarters. The noncontact rate for 21 - 30 year old and for 31 - 40 year old is at an all-time high at the moment, as can be seen in figure 5. A similar pattern could also be seen for foreign citizens living in Iceland.

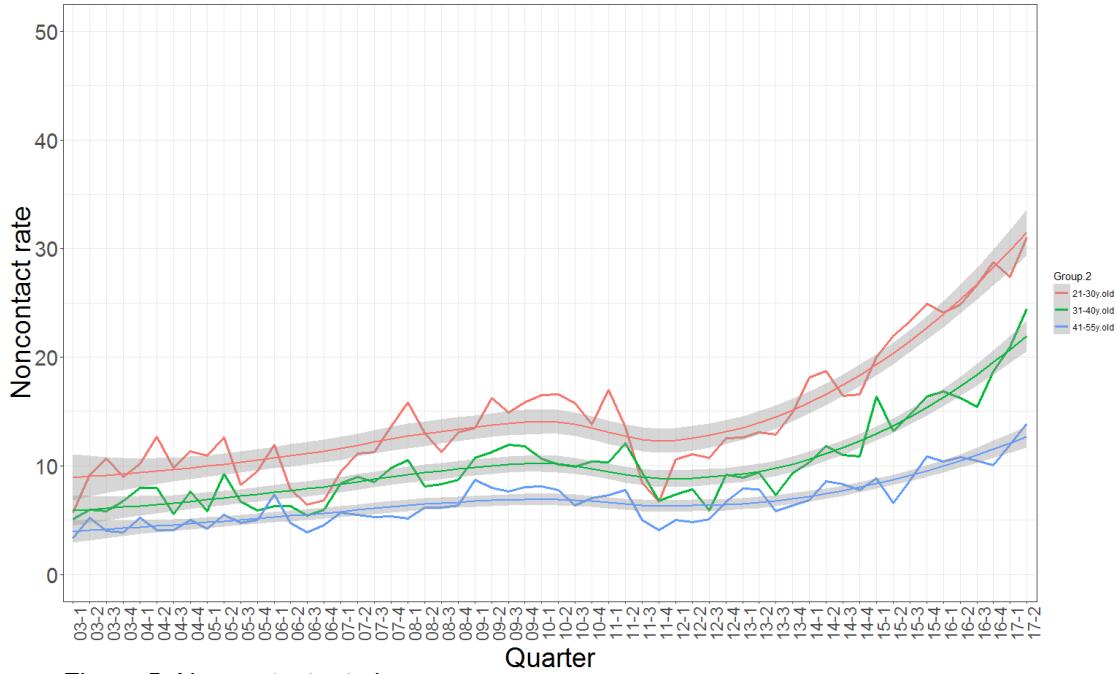


Figure 5. Noncontact rate by age groups

This analysis suggests that the representativity of the ISLFS has been decreasing in the last years, especially with regards to age composition and citizenship. Additionally, the noncontact rate of the youngest groups in the sample has been increasing which can explain the under-representativity of these groups in the survey. However, the question remains how this affects the nonresponse bias of the survey. This was examined by looking at two register variables that are highly related to the main topic of the ISLFS and are available for both respondents and nonrespondents: Receiving unemployment benefits and income.

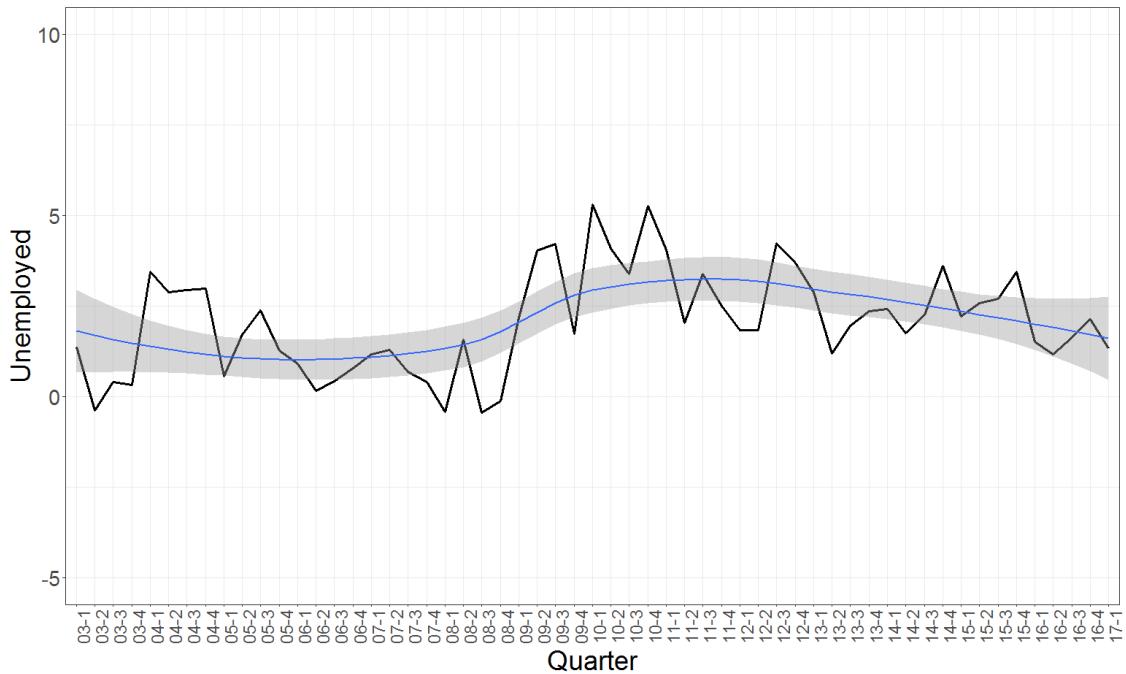


Figure 6. Unemployment benefits - absolute bias

3.2 Bias

Figure 6 shows the absolute bias of the binary variable of having received unemployment benefits at some time during the year of participation in the ISLFS. For the most part there is a small amount of absolute bias in the data, meaning that the respondents of the survey are less likely to have received unemployment benefits compared to the nonrespondents. It is important that this bias is modest (only once over the entire span of the ISLFS is it reach higher than 5%) and, despite the increased nonresponse in the ISLFS, the bias seems to be getting smaller. When examined on the bases of response propensity groups, the group with the lowest response propensity has been (since 2009) has been the most likely to receive unemployment benefits while the medium high and high response propensity groups have both had very low levels of receiving unemployment benefits. This difference between the response propensity groups was highest right after the fall of the Icelandic banking system (when unemployment soared) but it has decreased as the Icelandic economy has gotten back on track. This suggests that during times of crisis (or increased unemployment in the Icelandic labour market), the ISLFS might not be sensitive enough to measure the unemployment rate accurately. That is however a question that will not be addressed here.

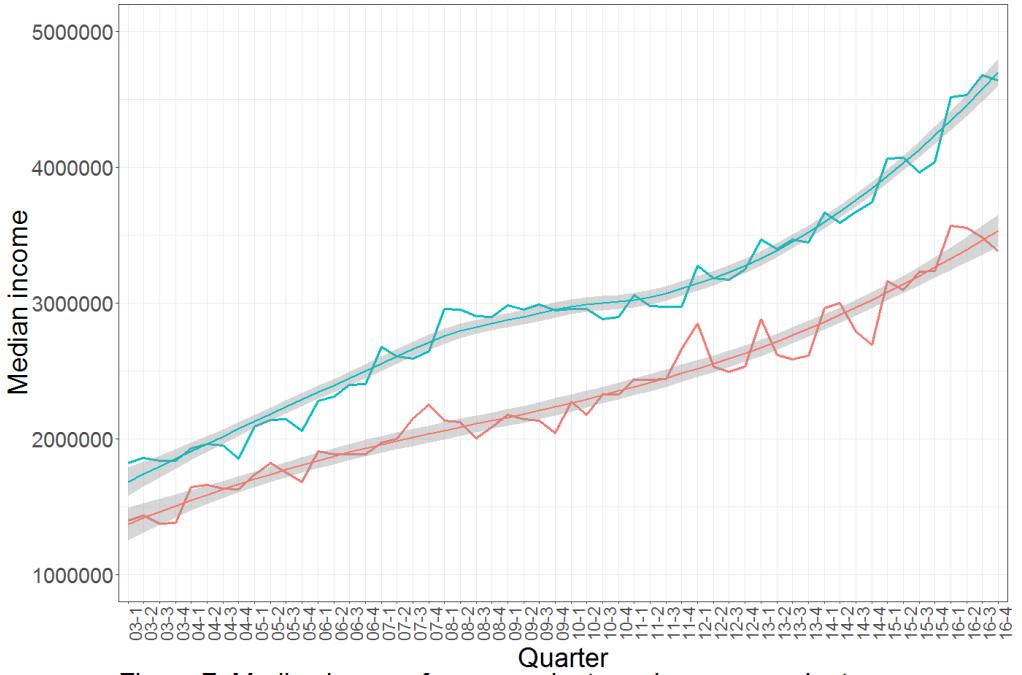


Figure 7. Median income for respondents and nonrespondents.

Another variable that was examined to assess bias was median yearly income (in ISK) of respondents and nonrespondents. As figure 7 shows, the median income of respondents is consistently higher than the income of nonrespondents over the entire survey period. The last few quarters of the chart indicate that this difference might be increasing, perhaps as a function of the increased nonresponse rate of the survey. At least it seems that the survey might overestimate the income in the population and that this overestimation might be increasing.

The difference between respondents and nonrespondents in unemployment benefits and median income suggest that there is indeed a possibility of nonresponse bias in the ISLFS. However, due to the availability of auxiliary data in Iceland, this could be addressed in the estimation stage of the survey, perhaps with the use of weights. The current weights used in the survey do not seem to correct for this difference between respondents and nonrespondents, as can be seen in figure 8. Figure 8 shows the percentage of nonrespondents (red line), unweighted respondents (green line) and weighted respondents (blue line) receiving unemployment benefits. What is clear from the graph is that the weighted data is almost synonymous with the unweighted data, indicating that the current survey weights do contribute at all in reducing the difference between respondents and nonrespondents with regards to having received unemployment benefits.

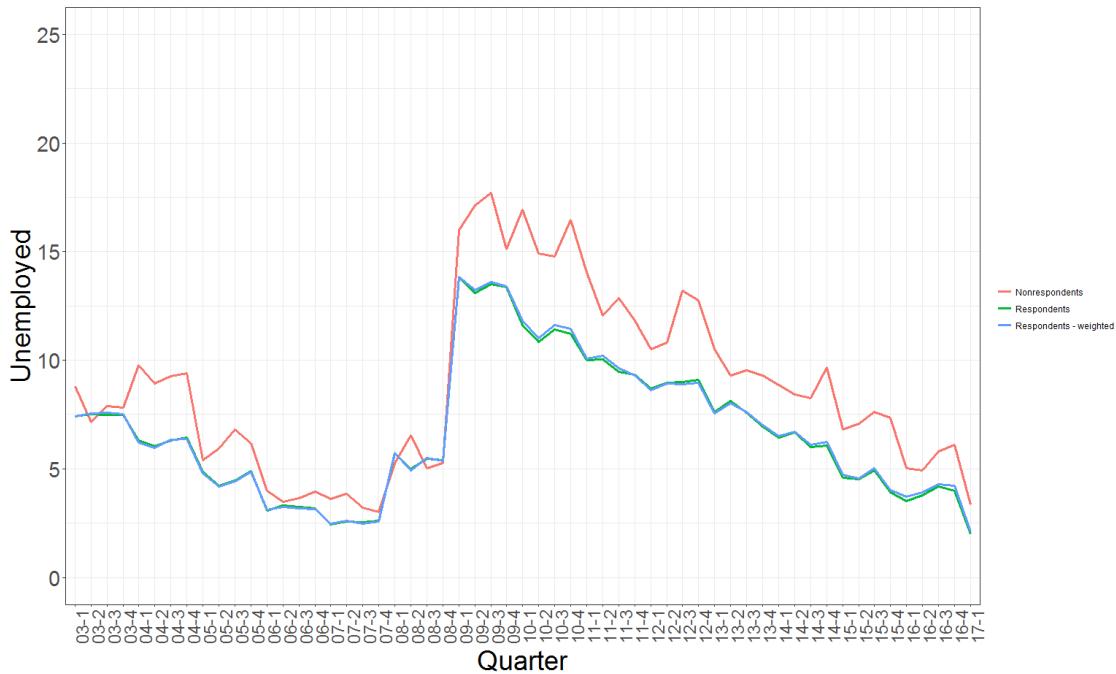


Figure 8. Unemployment for nonrespondents and respondents, weighted and unweighted

4. Future plans

The analysis suggests that there is a possibility of nonresponse bias in the ISLFS and that this bias can get more detrimental in the future. Furthermore, it seems that the current weights of the survey do not affect this possibility of bias. At the very least it seems to make sense for Statistics Iceland to make changes to its data collection efforts as well as how the results of the survey are weighted in order to reduce the possibility for bias to appear in the results. A further discussion of the proposed changes in weights will not be provided in this paper.

4.1. Changes in data collection

Statistics Iceland has for some time now considered to change its survey collection design in order to more efficiently conduct the fieldwork for the survey and reduce the possible nonresponse bias in the results of the survey. One possibility would be to categorize the fieldwork based on the predicted response propensities of the sample units. However, targeting sample units with high response propensity scores would not necessarily reduce the possibility of bias. For instance, the percentage of respondents and nonrespondents receiving unemployment benefits (taken from tax records) differed for the year 2016 where 5.5% of the nonrespondents had received unemployment benefits for at least one month compared to 3.9% of the respondents. If everyone in the group with the highest response propensities (.8 and higher) would have participated in the survey (due to increased effort in the fieldwork) the difference would actually increase as a higher percentage of the nonrespondents (5.8%) would have received employment benefits. A similar pattern was seen for the change in median income for respondents and nonrespondents. However, this would have increased the response rate by approximately 5 percentage points. So while this increased effort would have brought in more respondents than before, the possibility of bias in the estimates of the survey would actually have increased.

According to the partial R-indicator, age and citizenship were both variables that had an effect on the representativity of the ISLFS. It has been a long standing problem with the ISLFS to gain more responses from foreign citizens in Iceland, a problem that is only exacerbated because of the small size of this group in the population (less than 10% of the Icelandic population has a foreign citizenship). Both age and citizenship are linked to important labour market indicators and labour market indicators (like unemployment) are often broken down by these variables. Therefore, Statistics Iceland will focus on two groups when making changes to the data collection scheme of the ISLFS: Foreign citizens and sample units between the ages of 21 and 40. For both of these groups, noncontact is the most important reason for nonresponse which means that

Statistics Iceland will focus on reducing noncontact for these groups. It becomes apparent at a later stage that some of these noncontacts are actually hidden refusals changes will be made to the strategy applied.

The strategy to reduce non-contact will be implemented in the spirit of the philosophy of plan-do-check-act where the planning stage will consist of a change in the data collection scheme, designed to increase the contact rate of the two groups in question. The 'do' stage indicates the implementation of the planned changes. After implementation, the effects of the changes are evaluated by comparing contact rates (either by performing a split ballot test or by using a longitudinal measure for testing the effects) and assessing the nonresponse bias. The goal would be increase the contact rate of these groups and a reduce bias. The final stage (act) is where it is possible to adjustments the final implementation of the changes in the data collection scheme for the ISLFS - or, to drop the changes if they prove to be impractical or have neither increase contacts rates nor reduce bias. Currently, Statistics Iceland plans to test the following changes to the ISLFS data collection scheme:

- Targeted introductory letters to younger sample units and foreign citizens in the sample (Lynn, 2016)
- Call prioritization of younger sample units and foreign citizens, based on differing metrics, e.g. response propensities, expectent value of a case (Tourangeau, Brick, Lohr & Li, 2017)
- Providing incentives to interviewers for contacting and interviewing cases with a high prioritization (Peytchev, Riley, Rosen, Murphy & Lindblad, 2010)
- Test different calling patterns for younger sample units and foreign citizens (Luiten & Schouten, 2013)
- Use information gained from previous contacts in securing contact in a later wave of data collection
- Call caps for high propensity cases (Beaumont, Bocci & Haziza, 2014)
- Provide a web survey alternative for younger non-respondents

5. Questions for discussion

1. Which type of indicator should Statistics Iceland use when changing its data collection scheme towards a more adaptive or targeted design? It seems that simply using the response propensities will not be helpful - what other indicators are available and can be recommended?
2. Can some form of targeted survey design be used to increase the likelihood of contact with younger sample units? Should Statistics perhaps rather focus on contact (e.g. by calculating contact propensities) rather than on response rates, per se?
3. Apart from the two measures that will be monitored (contact rates and bias of unemployment benefits/income), are there other measures that Statistics Iceland should rather be monitoring?
4. Is there a danger that the current plans of Statistics Iceland would increase the effects of other error sources on the results of the ISLFS? Are there any particular aspects (or indicators) that should be specially monitored, for example with regards to measurement error?
5. How should Statistics Iceland go about with re-calculating weights for the ISLFS? Should they be re-calculated backwards in time? Any ideas about methods? Calibration? Any ideas about good variables to use or for metrics to use when deciding upon which variables should be used when designing the new weights?

6. References

- Beaumont, J. F., Bocci, C., & Haziza, D. (2014). An adaptive data collection procedure for call prioritization. *Journal of Official Statistics, 30*, 607-621.
- Eisenhower, D., Mathiowetz, N. A., & Morganstein, D. (1991). Recall error: Sources and bias reduction techniques. In P.P. Biemer, R.M. Groves, L.E. Lyberg, N.A. Mathiowetz & S. Sudman, *Measurement errors in surveys*, (pp. 125-144), New York: Wiley.
- Groves, R. M., & Peytcheva, E. (2008). The impact of nonresponse rates on nonresponse bias: a meta-analysis. *Public opinion quarterly, 72*, 167-189.
- Luiten, A. & Shouten, B. (2013). Tailored fieldwork design to increase representative household survey response: an experiment in the Survey of Consumer Satisfaction. *Journal of the Royal Statistical Society, 176*, 169-189.
- Lynn, P. (2016). Targeted appeals for participation in letters to panel survey members. *Public Opinion Quarterly, 80*, 771-782.

- Lynn, P. (2017). From standardization to targeted survey procedures for tackling non-response and attrition. *Survey Research Methods*, 11, 93-103.
- Peytchev, A., Riley, S., Rosen, J., Murphy, J., & Lindblad, M. (2010). Reduction of nonresponse bias through case prioritization. *Survey Research Methods*, 4, 21-29.
- Schouten, B., Bethlehem, J., Beullens, K., Kleven, O., Loosveldt, G., Luiten, A., Ruter, K., Shlomo, N. & Skinner, C. (2012). Evaluating, Comparing, Monitoring, and Improving Representativeness of Survey Response Through R-Indicators and Partial R-Indicators. *International Statistical Review*, 80, 382-399.
- Schouten, B., Cobben, F., & Bethlehem, J. (2009). Indicators for the representativeness of survey response. *Survey Methodology*, 35, 101-113.
- Tourangeau, R., Brick, J.M., Lohr, S. & Li, J. (2017). Adaptive and response survey designs: a review and assessment. *Journal of the Royal Statistical Society*, 180, 203-223.