

## Is the Kish Household Sampling Method Better than the Birthday Method?

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# *Is the Kish Household Sampling Method Better than the Birthday Method?*<sup>1</sup>

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## **Abstract**

Practically all studies on household survey sampling have given some space to the different dwelling selection processes. Since most surveys are administered to ONE person within each household, reselection is necessary within those households where there are two or more people. This study compares two within-household selection methods: the last-birthday method and the Kish method. The hypothesis is that the last-birthday method represents the population better than Kish method. It complements the “classic” representation of sex and age distribution with the representation of educational attainment, labor force participation rates, employment and unemployment by sex.

The data from the European Social Survey (8<sup>th</sup> wave) shown point toward accepting this hypothesis. In spite of the last-birthday method producing a greater selection of women, the differences in educational level and labor force participation are smaller than with the Kish method.

Keywords: within-household selection, demographic representativeness, face to face survey.

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## 1. Introduction

Practically all studies on household survey sampling have given some space to the different dwelling selection processes. Since most surveys are administered to ONE person within each household, reselection is necessary within those households where there are two or more people. This process is ignored by the vast majority of sampling studies, which increases the *total error* (Smyth et al. 2019). As Kish said more than half a century ago, “the sample of dwellings must be translated into a sample of persons, or of adults, or other elements; and the procedure must meet the demands of validity, efficiency and practicality” (Kish, 1965).

Numerous methods have been developed to do this. According to Gaziano (2005), these have been grouped into probability methods, quasi-probability methods and nonprobability methods. Probability methods consider that all members of the household have the same probability of being included in the sample, removing interviewer bias in the selection of respondents. These require a list of people to calculate the probability of each individual being selected. Their advantages include that they produce consistent and unbiased estimates (among others, Yan, 2009). The main disadvantages of probability methods, however, are their high intrusiveness and the workload involved in listing household members. No less important is the increase in interview time, and the greater likelihood of refusal when so much household information is requested.

The random selection methods proposed by Kish in 1949 were the “age-order method” and the “age-only method”, which were attributed to Denk, Hall (2000); and “full enumeration methods”, Piazza (unknown year) Denk, Hall (2000).

Quasi-probability methods were developed to avoid the problems inherent in probability methods. The main problem is the high refusal rate when a lot of information is demanded when accessing the household (Smyth et al. 2019). The term quasi-probability is used to describe them because they do not have a known probability of selection, as some members of the household can self-select or avoid being selected. These methods reduce intrusiveness by avoiding “listing” household members, as well as decreasing the time needed for selection. However, many experts (among others, Lavrakas, 2008; Lavrakas, 1996; Lavrakas, Stasny, Harpuder, 2000; Yan, 2009) caution that, while not having to make lists increases cooperation and reduces cost, representativeness is sacrificed. These methods include birthday selection methods (Salmon, Nichols, 1983), probably the most commonly used (Yan, Tourangeau, McAloon, 2015), and others developed more recently, such as the “Minimally

Intrusive Method” or “Rizzo Method” (Rizzo, Brick, Park, 2004) and a within-household sampling scheme based on household size (Le et al. 2013).

Nonprobability methods were created to facilitate the selection process by reducing its cost. They seek to approximate population age and gender distributions (Yan, 2009), but sacrifice randomness. The method devised by Trolldahl, Carter (1964) and its several variants belong in this classification: Paisley, Parker, 1965; Bryan, 1975; Groves, Kahn, 1979; Czaja, Blair, Sebestick, 1982; Hagan, Collier, 1983. Too youngest male/oldest female method (Keeter, Kevin, 1997) and quota method (Moser, 1952).

This study compares two within-household selection methods, one of which is a quasi-probability method and another one a probability method. These are: the last-birthday method, used by the European Social Survey (hereinafter ESS) in Portugal, and the Kish method, applied by the ESS in France. The hypothesis is that the last-birthday method represents the population better than Kish method.

This research presents three innovations in comparison to the rest of the research on the subject. Firstly, a face-to-face survey was used, whereas most of the research carried out used RDD telephone surveys and self-administered surveys (among others, Stange et al. 2016; Olson, Smyth, 2014; Olson, Strange, Smyth, 2014). Secondly, it was administered to national samples, while most of the previous experiments have been applied to states, cities, or counties: among others, Illinois, in the experiment by O’Rourke, Blair (1983); Chicago, in Lavrakas, Bauman (1993); two counties in Kentucky, in Salmon and Nichols (1983); etc. Thirdly, it complements the “classic” representation of sex and age distribution with the representation of educational attainment, labor force participation rates, employment and unemployment by sex. Finally, it was administered in Europe, whereas most of the research has been carried out in the United States.

The study is organized into four parts. The first section of the article provides the theoretical background of the two within-household selection methods used here. The second section presents the data source used, the eighth wave of the European Social Survey, and describes its specific design characteristics and the sampling selection in the two countries considered. The results section considers the representation by age and sex, educational attainment and labor rates, and is followed by the conclusions.

## 2. Background

### 2.1 *The Kish (probability) method*

The Kish method is, without a doubt, the most widely used and known probability method. In households with two or more members, the interviewer makes a list of the residents, ordered by sex and decreasing age (from the oldest to the youngest). Once this information has been recorded, a table of random numbers is assigned based on the total number of members in order to select the person to be interviewed. In its original format, 12 tables were used with the same number of different combinations.<sup>1</sup>

In four studies conducted between 1946 and 1967, Kish showed that the method achieves adequate representation, except in households with five adults (Kish, 1949). The selected sample was compared with the population register, considering race, age and education attainment, and few differences were found. Numerous studies have subsequently been performed to test the method's suitability. In one of the first, Groves and Kahn (1979) found that 9 percent of households provided incorrect information about the number of adults living in the dwelling. Other research has shown that it tends to over identify older people and to slightly over represent women (among others, Yan 2009, Gaziano, 2005, O'Rourke, Blair, 1983).

The fact that some people consider the information requested to be sensitive, together with the fact that it is demanded at the initial point of interaction with the informant, results in a large number of refusals to cooperate. This is its main drawback, at a time when the phenomenon of nonresponse (among others, Brehm, 1993; Beullens et al. 2018; de Leeuw et al. 2018) casts doubt on the representativeness of survey-based research. In addition to this problem, some time is needed to ask the questions and record their answers. These processes increase the duration of the interview and, therefore, fieldwork costs. Moreover, some studies conducted in European countries (Nemeth, 2001; Ping, 2013) have identified survey administration errors due to the differences from the population structure of the American society of the 1950s. Thus, for example, in Hungary it produced an underrepresentation of men and an overrepresentation of older people, which led Nemeth to propose a modification in the grid used for selection, noting that Kish himself had already recommended it. The same was proposed by Gaziano (2005) when the method was used in European countries. Another drawback is the difficulty in administering it, as several studies have shown (among others,

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<sup>1</sup> For those who are not familiar with how this operates, Figure 1 shows the respondent selection procedure used in the ESS Round 8.

Czaja, Blair, Sebestik, 1982, Oldendick et al. 1988), mainly by inexperienced interviewers. In short, despite the suitability of the Kish method for within-household respondent selection (measured on the basis of equiprobability and the ability to remove interviewer preference in the selection) the number of refusals to cooperate may pose representativeness problems.

## **2.2 (Quasi-probability) birthday methods**

These methods basically consist in interviewing the household member who had the most recent birthday (last birthday or most recent birthday), the person in the household who will have the next birthday (next birthday), or the person whose birthday is closest to the date of interview (closest birthday) (Salmon, Nichols, 1983; Marlar et al. 2018). In these, listing household members is replaced by the question “could I speak to the *last* person (in the household) to have had a birthday/the next person (in the household) who *will have* a birthday?” (Salmon, Nichols, 1983). The simplicity of the birthday selection methods, which use less sensitive questions, explains their greater popularity in recent years (Yan, Tourangeau, McAloon, 2015).

One of the advantages of this method is the *innocent* question asked, insofar as asking about the next birthday is less *intrusive* than asking for sex and age of all family members. Compared with the method proposed in the previous section, this selection process is simpler and quicker, as it does not involve listing household residents. This means reducing the intrusiveness and shortening the duration of the interview.

Regarding the different birthday selection methods, Lind et al. (2000) showed that the “last birthday” reduces the number of incorrect selections. Salmon and Nichols (1983) also recommended it, because interviewers pointed out that respondents have problems understanding the concept of “next birthday”. This opinion was shared by Goyder et al. (2001), as they found that the question about the “next birthday” was difficult to understand for people who were not born in Canada. In fact, the last-birthday method has been more widely used than the next-birthday method, since it achieves higher cooperation rates at a lower cost, and has a lower impact on sociodemographic representation (among others, Gaziano, 2005; Yan, Tourangeau, McAloon, 2015; Lind et al. 2000). However, there is no unanimity on this issue, as other studies have revealed the opposite (among others, Marlar et al. 2018).

Numerous studies (among others, Marlar et al. 2018; Yan, 2009; Yan, Tourangeau, McAloon, 2015; Lavrakas, 2008; Lavrakas, Bauman, 1993; Lavrakas, Stasny, Harpuder, 2000) have found incorrect selections of up to 30 percent which have produced an overidentification of women and young people. The study by Marlar et al. (2018), one of the most recently available,

found that rates ranging between 20 and 25 percent were more common (among others, Lind et al., 2000, Lavrakas, 2008 and Lavrakas, Stasny, Harpuder, 2000).

In contrast, other studies have detected an overrepresentation of older people (Yan, Tourangeau, McAloon, 2015; Stange et al. 2016). Other experts have also identified a greater number of incorrect selections of people with low educational attainment (Lavrakas, Bauman, 1993), and in households where a higher number of people reside (Lind et al. 2000). Olson and Smyth (2014) explained the poor selection of these methods by referring to three phenomena: confusion, concealment and commitment. *Confusion* in terms of who exactly are considered members of the household; *concealment* of certain groups (“Nonwhite adults are about twice as likely as white adults to have an inaccurate selection”, p. 64), and mode preference or *commitment*: “Size of household, education, and presence of children in the household were proxies for *confusion*; gender, age, race, income, concern with identity theft, and fear of crime for *concealment*; and previously reported mode preference (a variable on the sample frame) for *commitment*” (Olson, Smyth, 2014).

Lind et al (2000) added the number of months a respondent’s birth date was from the interview date to these factors, and found a high number of incorrect selections (around 20 percent) when a respondent’s birth date was five or more months from the interview date.

In short, “if within households, birthdays were randomly assigned to persons or the date of the survey contact were randomly determined and the household informant provided the information correctly, a probability sample would result” (Groves, Lyberg, 1988). However, there is evidence that birthdays varied from one season to another,<sup>2</sup> and that informants self-selected or excluded certain members of the household.

In order to have an accurate understanding of how these two within-household selection methods affect the selection of respondents for face-to-face surveys, this general hypothesis is formulated on the basis of several questions:

*Research question 1:* Does the last-birthday method identify a greater number of women, as detected in numerous studies carried out in American society (among others, Yan, 2009)?

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<sup>2</sup> In northern Europe there is a higher number of births in the spring period, with the fall seeing a commensurate decrease. In the United States the opposite occurs: there are more births in summer-fall period, and the lowest number of births takes place in the spring (Lledo, Pavía, Morillas Jurado, 2017).



*Research question 2:* Is the greater number of women selected using the last-birthday method due to a greater selection of unemployed people that is, of those with a lower labor force participation rate (outside the home)?

*Research question 3:* Does the Kish selection method overrepresent old people and people with a lower level of educational attainment?

### 3. Research design

#### ***3.1 Sample design in international surveys: the case of the European Social Survey***

The object of study of the European Social Survey (hereinafter ESS) is the population aged 15 and over residing in main households in European countries, regardless of their nationality and language (Stoop et al., 2010). The Core Scientific Team (CST) establishes the criteria and lays down the execution guidelines of the whole process, including the rules to be adhered to by the teams from the different countries involved.

The variability of European society should be taken into account when considering sampling frames, as some countries have updated lists of residents, others have updated lists of buildings or addresses, and a third group of countries have none of these, and use area sampling with field enumeration (The ESS Sampling Expert Panel, 2016). Therefore, sample design is based on *flexibility* rather than on similarity. Based on this idea, the central committee sets the requirements to be met by all countries:

- Usage of probability samples, using strict random probability methods at every stage, does not allow the use of quotas, substitution of non-responding households or individuals.  
The use of random route techniques is also not allowed, due to the difficulty in calculating the probability of selection, the alteration of equiprobability (equal selection probabilities), and the easy manipulation by the interviewer (Menold, 2014).
- Best possible coverage of the ESS target population.
- Similar statistical precision between countries. In order to facilitate comparison between countries, an effective minimum sample size of 1,500 interviews is established, considering simple random sampling. The size should be expanded if less accurate sampling is used, such as the cluster sampling usually used in face-to-face surveys.<sup>3</sup>

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<sup>3</sup> In countries with less than 2 million people over 15 years of age, the minimum size is reduced to 800 (Stoop et al., 2010).

The central committee also suggest employing variables related to the survey topics (European Social Survey, 2018).

- A minimum response rate of 70 percent must be achieved by using strategies that increase the cooperation of the most elusive elements of the sample.

In order to fulfill this last requirement, detailed fieldwork is carried out that includes specific training for the interviewers, at least 4 unannounced visits to households (at different times and days, one on weekends), conversion of “soft refusals”, offering a reward to survey respondents, and use of several introduction letters before the interviewer’s (normally two, accompanied by a brief summary of the results of the previous wave). These letters inform the respondents that they have been selected to participate in a survey, detail the survey objectives, and refer participants to a web page and a free number to call if they have any questions. Those who do not wish to cooperate are sent a third letter emphasizing the importance of their participation if adequate representation is to be achieved.

Once the requirements have been met, there is some leeway as to how the selection is carried out.<sup>4</sup> However, the Central Team recommends using the best possible sampling design considering the information available in each country, the experience of the national team, and the cost (The ESS Sampling Expert Panel, 2016). In order to ensure that these recommendations are taken into account, the teams of each country must submit the sampling proposal to the Sampling Expert Panel for evaluation. The Panel will assess the design for consistency with the specified criteria, to see if the most cost-effective sampling plan has been selected, and if the relevant details of the sample are fully documented (European Social Survey, 2018), proposing changes when it deems they are appropriate.<sup>5</sup> One of the documents prepared for the 2019 European Social Survey (round 9) noted the importance of the sampling frame precisely by defining the three used in the ESS: 1) Lists of residents (population registers), 2) lists of buildings or addresses, and 3) area sampling of dwellings.

The use of population registers is the ESS coordinating team’s preferred type of sampling (The ESS Sampling and Weighting Expert Panel, 2018) due to its high level of coverage, the reduced design effect, the fact that specific groups can be detected that are not part of the target population, and the availability of auxiliary individual information (for example sex, age, etc. can be used to define

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<sup>4</sup> Flexibility is also reflected in the fact that sample designs may differ among countries and may even be different in each country: for example, an unclustered (single-stage) in urban areas, and a clustered multi-stage in rural areas (European Social Survey 2018: 4).

<sup>5</sup> The European Social Survey (2018) document details the seven steps in the sample design evaluation process, as well as the bodies involved in each one.

strata). Currently, half of the countries participating in the ESS use population registers. The specific characteristics of the second and third sampling frames will not be discussed here, as they fall outside the objectives of this paper, and they are explained in the ESS document referred to above). It is sufficient to mention that both require a second selection within the household. The ESS document indicates that there are two common and acceptable types of procedures for randomly selecting one person at a sample address: Kish grid methods, and birthday methods.

Four countries use the Kish method (France, the Netherlands, the Russian Federation and the United Kingdom) and three countries use the Birthday method (Ireland, Israel and Portugal).<sup>6</sup>

### ***3.2 Data source: Round 8 (2016) of the European Social Survey (ESS)***

In order to compare the two within-household selection methods, France and Portugal were selected as case studies, due to the similar sample selection method used. The information on the whole process, collected in the technical report (European Social Survey, 2017), shows the small differences between countries in terms of the sampling frame, as they consist of a list of addresses in France and Portugal. This situation (which only affects the final selection of the respondent) allowed a similar sample selection to be carried out in the two countries in Round 8 (2016) of the ESS, except for the choice of the final respondent.

Once the municipalities had been stratified according to size and region (NUTS), a three-stage selection was used in France and Portugal. In both countries, municipalities (or parts of them when they are large) are considered to be first-stage units, and were selected with a probability that was proportional to the population size. In the second stage, a number of households were chosen within the selected areas. In the third stage, the specific individuals to be interviewed within the household were selected from the areas chosen in the second stage. This was done in Portugal by the use of the last birthday method (Figure 1), and in France using the Kish Grid (Figure 2). The respondent selection form used for each one is shown in Figure 1 and 2.

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<sup>6</sup> Lithuania (p.111) and the Czech Republic use both methods in a four-stage sampling. They both use the Kish method for household selection, and the Birthday method for within-household selection. Whereas the last birthday is used in Lithuania, the next birthday is used in the Czech Republic.

FIGURE 1. Within-household sample with last birthday selection.

B3. Which one of you *last* celebrated his/her birthday?

Record full name of selected person at the first page of the contact form

ASK FOR THE SELECTED RESPONDENT AND INTRODUCE THE SURVEY

Source: European Social Survey, 2017b, pp. 16.

FIGURE 2. Within-household sample with kish selection.

**Kish Grid**

B2. Ask including yourself, how many people aged 15 or over live in this house/flat /part of the accommodation?

Enter the exact number

IF One person only → This is the RESPONDENT, go to B4  
IF 2-12 persons → Go to B3

**SELECTION LABEL:**

PERSON / HH Row: (No. in household)  
2 3 4 5 6 7 8 9 10 11 12

SELECT ROW: (Selected person no.)  
2 1 3 2 4 7 6 5 8 4 1

**B3\_a.** Make a list of all the persons older than 15, living in the household. List them in descending order of age.

First name or initial	Person number	First name or initial	Person number
	<input type="checkbox"/> 1		<input type="checkbox"/> 7
	<input type="checkbox"/> 2		<input type="checkbox"/> 8
	<input type="checkbox"/> 3		<input type="checkbox"/> 9
	<input type="checkbox"/> 4		<input type="checkbox"/> 10
	<input type="checkbox"/> 5		<input type="checkbox"/> 11
	<input type="checkbox"/> 6		<input type="checkbox"/> 12

Look at the selection label on page 1:

- PERSON/HH ROW: Find number of corresponding total number of individuals
- SELECT ROW: Number beneath the total number of persons is selected person number. Tick on grid above!

**Example in a household with three people**

**B3\_a.** Make a list of all the persons older than 15, living in the household. List them in descending order of age.

Step 1: write the names

First name or initial	Person number	First name or initial	Person number
Stephanie (40 years old)	<input type="checkbox"/> 1		<input type="checkbox"/> 7
Melanie (39 years old)	<input type="checkbox"/> 2		<input type="checkbox"/> 8
Kerry (16 years old)	<input type="checkbox"/> 3		<input type="checkbox"/> 9
	<input type="checkbox"/> 4		<input type="checkbox"/> 10
	<input type="checkbox"/> 5		<input type="checkbox"/> 11
	<input type="checkbox"/> 6		<input type="checkbox"/> 12

Look at the selection label below this sentences:

- PERSON/HH ROW: Find number of corresponding total number of individuals
- SELECT ROW: Number beneath the total number of persons is selected person number. Tick on grid above!

Step 2: first row, three people

**SELECTION LABEL:**

PERSON / HH Row: (No. in household)  
2 3 4 5 6 7 8 9 10 11 12

SELECT ROW: (Selected person no.)  
2 1 3 2 4 7 6 5 8 4 1

Step 3: join the first row number (step 2) with the number below: 3 & 1

Step 4: choose the person 1 in the "box name" (step 1) and write here her name

Record full name of selected person at the first page of the contact form

*Stephanie*

ASK FOR THE SELECTED RESPONDENT AND INTRODUCE THE SURVEY

Source: European Social Survey, 2017b, pp. 7.

Figure 2 note:

<sup>1</sup> Here the interviewer writes the first name of household occupants in descending order of age. For example, Stephanie (row 1), Melanie (row 2) and Kerry (row 3).

In the “selection label” box the interviewer reads the first row (number of persons), and marks the number of occupants in the household (3 in this example).

Join the number in the first row with the number below (1 in this example). After that, look for the names of the people in this household and choose the name of the person number 1

The fieldwork in France began on November 10, 2016 and ended on March 1, 2017. Up to 5 visits to households were made. Portugal started a month before (October 10, 2016) and ended on June 15, 2017, and a maximum of 4 visits were made. The highest response rate was obtained in France (52.47 percent<sup>7</sup>), higher than Portugal (45.49 percent), with sample sizes of 2,070 and 1,270 respectively. Taking into account that the objects of comparison were *stable* characteristics of individuals (age and educational level), it was considered that the difference in the dates of collection did not affect the results. In the most changing aspects, such as labor force participation, employment and unemployment rates, the figures considered were those from the information collection period.<sup>8</sup> The information contained in the section “Breakdown of response and nonresponse” of the technical report (European Social Survey, 2017) shows similar samples.

### ***3.3 Analysis plan: Comparison between distributions***

Out of the three strategies proposed by Smyth et al (2019) for assessing the quality of the selection, the first was used, namely to “compare the characteristics of the completed sample to benchmark measures for the target population”. As the aim is always to use the strategy that provides the most accurate information (the gold benchmark), the population register data for each country (on January 1, 2017) was utilized to compare the distribution of ages and sexes.

The population register data did not contain up-to-date information about education level or employment rates. Therefore, variables from the *Labor Force Survey*, one of the largest surveys conducted in the two countries, were used. It

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<sup>7</sup> RR6 or Completion Rate =  $I + P / I + R + NC + O$  = valid interviews / interviews + refusal + non-contact + others (AAPOR, 2016: 48).

Non-contact: No contact after 4 visits, contact but not interview for broken appointment, respondent unavailable, other reasons and address not traceable.

Others: Death, language barrier, respondent ill or incapacitated (unable to cooperate during the fieldwork period) and respondent emigrated (left the country for more than 6 months).

<sup>8</sup> This will be explained in more detail in Section 3.3.

is a large sample and its design features provided a good approximation to the different universes. The fact that it presented the information disaggregated by sexes meant that a comparison could be made between the education level, labor force participation rate, unemployment rate and employment rate for both sexes. The employment rate was considered to be the most important one, since it presents the relationship between the “productive” and the “dependent” population.

The *Labor Force Survey* is designed as a continuous quarterly survey with interviews spread uniformly over all weeks of a quarter. The sampling designs uses a form of multistaged stratified random sample design, especially those that do not have central population registers available. Both countries use a three-stage sampling design, usually selecting municipalities, administrative districts or census enumeration areas in the first stage, and dwelling units as *Ultimate sampling units*. All persons, and therefore, all households residing within the dwelling/at a given address are interviewed (Eurostat, 2020).

In order to gain a precise understanding of how accurate each of the different surveys was, the joint distribution of each variable of interest and sex was compared; that is, the number of men between 15 and 19 years old (for example) with respect to the total, NOT with respect to the number of men. Both variables were considered together to identify any possible deviations that would remain hidden in certain groups if marginals were used, since the compensation between subgroups could *conceal* this deviation. For example, in the second part of Table 1, last birthday method, the marginal distribution (“total” column) of the group between 35 and 39 years old presents an underrepresentation (0.40 points) when compared with the population register data, which could be indicative of a good fit. However, when disaggregating by sex, there was an underrepresentation of 1.28 points for men and an overrepresentation of 0.88 points for women. When aggregated, this involved a mismatch of 2.15 points. The men in this age group were therefore identified as being “responsible” for the deviation detected.

The contrast of the significant difference between proportions was used to identify when the size difference between the universe and the sample was significant.

## **4. Results**

### ***4.1 Distribution by age and sex***

Table 1 shows the distribution of ages achieved by each survey compared with the population register data from January 1, 2017. Regarding its composition, the second column (Score) presents the percentage of men in each

age group with respect to the total of the sample, and the third (difference) is the result of subtracting the distribution of the universe (the population register) from that value. As this is a subtraction of the sample estimates minus the universe, if the scores obtained are positive, they indicate overrepresentation (in the sample) if they are negative, they indicate underrepresentation (in the sample).

Data on a cell-by-cell basis was complemented by the sum of differences (SD) and the sum of absolute differences (SAD). The latter avoids the compensation that occurs in the *sum of differences*, thus indicating the total magnitude of deviations for each distribution. Finally, the tables also show a significant difference in proportions, with asterisks marking where the differences are significant.

At this stage the information contained in the tables can be analyzed. The selection by means of the Kish method shows a difference of almost 21 points compared with the total, a slightly higher difference than that achieved using the last birthday method.

After discussing the overall fit, the strata that were properly and poorly represented by each method will be analyzed. The Kish method applied in France produced a slight overrepresentation of women, of around 1.8 percentage points (SD).

The detailed analysis by age group and sex revealed an underestimation of people under 49, a difference that increased as age decreased: in the 40-44 year old age group, the underrepresentation was 0.92 percentage points, which increased to 3.23 among the youngest. The imbalance was greater for women than for men, which contributed to a greater presence of the women than of men.

Men under 54 were underrepresented. This changed for those aged 55 and above, with the over 64-year-old age group being overrepresented by almost two percentage points (exactly 1.91). In the case of women, overrepresentation began earlier (50-year-old group), and was more pronounced, reaching 3.44 in the older group. These groups best explained the poor fit for women (SAD 12.01).

The total difference was essentially caused by the four most extreme age groups, people under 24 and people over 60. These explained 70 percent of the total variation.

The last birthday method applied in Portugal presented slightly lower differences, almost 19 points. Except for the remarkably greater overrepresentation of women, higher than 5 percent, the situation was similar to the Kish method: the under-representation of the under-54 was higher for men than for women, as was overrepresentation of the over 55-year-old group. In this case, it was higher for women than for men. It was noteworthy that men

were underrepresented up to the age of 59, and were overrepresented above that age. The main difference with respect to Kish's estimation, in addition to the smaller number of women, was that lower magnitudes were obtained.

TABLE 1. Sample vs universe in sex and age. Vertical percentages and differences between magnitudes (sample estimates minus universe).

	Kish method (France)						
	Men		Women		Total		
	Score	Difference	Score	Difference	Score	Difference	SAD
15-19 years old	2.50	-1.36	1.80	-1.87	4.30	-3.23	3.23
20-24 yrs old	2.40	-1.08	1.90	-1.50	4.30	-2.58	2.58
25-29 yrs old	2.90	-0.64	2.90	-0.74	5.80	-1.37	1.37
30-34 yrs old	3.00	-0.64	3.30	-0.53	6.30	-1.17	1.17
35-39 yrs old	3.10	-0.66	4.80	0.90	7.90	0.24	1.56
40-44 yrs old	3.40	-0.52	3.60	-0.40	7.00	-0.92	0.92
45-49 yrs old	3.90	-0.18	4.10	-0.08	8.00	-0.26	0.26
50-54 yrs old	3.80	-0.25	4.80	0.59	8.60	0.34	0.84
55-59 yrs old	3.90	0.10	4.10	0.06	8.00	0.16	0.16
60-64 yrs old	5.10	1.54	5.80	1.90	10.90	*3.45	3.45
Over 64 yrs old	12.00	1.91	16.90	3.44	28.90	**5.35	5.35
Total	46.00		54.00				
SD		-1.77		1.77		0.00	
SAD		8.86		12.01		19.06	<b>20.88</b>
	Last birthday method (Portugal)						
	Men		Women		Total		
	Score	Difference	Score	Difference	Score	Difference	SAD
15-19 years old	1.90	-1.27	1.60	-1.43	3.50	-2.71	2.71
20-24 yrs old	2.20	-0.83	2.70	-0.26	4.90	-1.09	1.09
25-29 yrs old	2.00	-1.06	2.80	-0.26	4.80	-1.32	1.32
30-34 yrs old	3.10	-0.13	4.00	0.62	7.10	0.49	0.75
35-39 yrs old	2.50	-1.28	5.00	0.88	7.50	-0.40	2.15
40-44 yrs old	3.50	-0.85	5.00	0.23	8.50	-0.63	1.08
45-49 yrs old	3.80	-0.32	4.60	0.08	8.40	-0.24	0.40
50-54 yrs old	2.70	-1.31	4.60	0.13	7.30	-1.18	1.44
55-59 yrs old	3.40	-0.44	5.30	0.99	8.70	0.55	1.44
60-64 yrs old	4.20	0.72	5.70	1.71	9.90	<b>2.43</b>	2.43
Over 64 yrs old	12.40	1.81	17.10	2.38	29.50	<b>*4.19</b>	4.19
Total	41.70		58.40				
SD		-4.97		<b>5.07</b>		0.10	
SAD		10.02		8.96		15.21	<b>18.98</b>

\* < 0.05; \*\* < 0.01

Note: Subtracting the sample scores from the universe implies that positive values should be interpreted as overrepresentation in the sample. The negative figures show strata underrepresented in the sample.

Source: European Social Survey, 2017. BENCHMARK: INSEE (2017a) in France; Statistics Portugal (2017a).



The greatest differences took place, again, in the two extremes of age distribution, but in this case the difference in the over 60-year-old group ( $2.43 + 4.19 = 6.62$ ), was much higher than in the youngest (2.71). Older people were overrepresented, and younger people were underrepresented. These three groups represented 49.11 percent of the total imbalance; a figure that increased to 69 percent when considering the three most extreme groups, those under 29 (underestimated) and those over 55 (overestimated).

There was also a large imbalance in the number of people between 50 and 59 years old, mainly due to the low number of males. The greater number of women was not enough to compensate for the underrepresentation of this group.

#### ***4.2 Differences in educational level***

The information concerning the educational level for each country was recategorized in order to seek similarities with the results of the Labor Force Survey. The educational level comparison showed a great difference in the selection that used the Kish method, higher than 30 percentage points, which dropped to 10 points when using the birthday method.

In the Kish method, the greatest differences were caused by the strong underrepresentation in groups with lower educational levels, with similar scores being found both for men and women (around 8 percent each). The opposite occurred for people with primary education; they were highly represented, much more for women than for men. Respondents with high school educational levels were overrepresented, although scores were lower. Women with secondary education appeared to be more overrepresented, while there were more male graduates than female graduates.

The imbalances in the groups with lower educational levels were responsible for 90 percent of the difference between sample and universe, and were higher for women than for men (51.7 and 38.8 percent, respectively).

The use of the last birthday method generated incorrect selection of some 20 points, similar to the Kish method, but to a lesser extent (difference 10 points). The group with no formal education was underrepresented by almost 5 percent, this underrepresentation being more pronounced for women than for men. In the group with primary education there was a slight marginal overrepresentation, very unbalanced by sex due to the underrepresentation of men (and therefore, overrepresentation of women). This trend was exacerbated for people with secondary education, as men were notably underrepresented and women were overrepresented. Although the differences were compensated for (marginal value of -0.66), this group had the poorest fit, since SAD was 6.8 points. In fact, this educational level explained 33.8 percent of the total

variation. The groups with the highest educational level were overrepresented by 4.18 percentage points, women more than men.

TABLE 2. *Sample vs benchmark<sup>9</sup> in sex and studies finished. Vertical percentages and differences between magnitudes (sample minus universe).*

Kish method ( <i>France, first term 2017</i> )							
	Men		Women		Total		
	Score	Difference	Score	Difference	Score	Difference	SAD
None	5.00	*-7.78	9.30	**7.99	14.30	**15.77	15.77
Primary level	18.30	**4.48	19.10	**8.36	37.40	**12.84	12.84
Secondary	8.80	0.90	10.10	1.17	18.90	2.07	2.07
Higher education	13.90	0.70	15.60	0.25	29.50	0.95	0.95
Total	46.00		54.10				
SD		-1.69		1.79		0.10	
SAD		13.86		17.78		31.64	<b>31.64</b>
Last birthday method ( <i>Portugal</i> )							
	Men		Women		Total		
	Score	Difference	Score	Difference	Score	Difference	SAD
None	0.70	-1.51	2.20	-3.25	2.90	-4.79	4.76
Primary level	8.90	-1.50	14.50	2.84	23.40	1.26	4.34
Secondary	23.20	-3.72	28.20	3.06	51.40	-0.66	6.78
Higher education	8.80	1.66	13.60	2.52	22.40	*4.18	4.18
Total	32.10		42.70				
SD		-5.07		5.17		0.00	
SAD		8.39		11.68		10.88	<b>20.06</b>

\* < 0.05; \*\* < 0.01

Source: European Social Survey, 2017. BENCHMARK: INSEE (2017b) in France; Statistics Portugal (2017b).

### 4.3 The comparison of employment variables

The imbalances identified in the previous sections increased in the comparison with labor variables, with the Kish method providing the poorest results. As these are rates, the calculation of the sum of differences located in the lower part of the table was not applicable.

The selection that used the Kish method had a deficit of 20 percent in relation to the people who were part of the employed population, with hardly

<sup>9</sup> It should be recalled that in France fieldwork was carried out between October 11, 2016 and November, 3, 2017 (ESS Round 8, 2016/2017). As fieldwork for three of the four months used was carried out in 2017, the data were compared with the data from the first quarter of the year 2017.

In Portugal most of the data were collected that same year (fieldwork took place from October 20, 2016 to June 15, 2017), but given the late completion, the data used as a benchmark are those from the second quarter of 2017.

any differences by sex. The same happened when the number of employees was considered in relation to the total, employment rate. The imbalance in the unemployment rate was lower, and was overrepresented more for women.

The differences were lower in the selection using the last birthday method, the most notable being the underestimation of the employment rate by 0.8 percentage points, which was higher for men than for women. The imbalance in the unemployment rate was double that found in the selection using the Kish method and was higher among women. The employment rate showed an underestimation that was higher among men than among women.

TABLE 3. *Sample vs benchmark<sup>10</sup> in sex and rates of activity and unemployment. Vertical percentages and differences between magnitudes (sample minus universe).*

Kish method (France)							
	Men		Women		Total		
Rates of...	Score	Difference	Score	Difference	Score	Difference	SAD
Activity	55.40	** -20.10	47.70	** -20.00	51.30	** -20.25	40.10
Unemployment	11.10	1.25	12.50	2.70	11.80	2.00	3.95
Employ	49.50	** -18.70	42.00	** -19.30	45.50	** -19.20	38.00
Last birthday method (Portugal)							
	Men		Women		Total		
Rates of...	Score	Difference	Score	Difference	Score	Difference	SAD
Activity	57.10	-2.40	51.60	1.20	53.90	-0.80	3.60
Unemployment	10.70	1.30	16.50	6.55	13.90	4.20	7.85
Employment	51.80	* -6.50	44.30	-4.20	47.50	** -5.55	10.70

\* < 0.05; \*\* < 0.01

Source: European Social Survey, 2017. BENCHMARK: INSEE (2017b) in France; Statistics Portugal (2017c).

## 5. Conclusion and discussion

The use of the last-birthday within-household sampling method achieved a better estimate of the variables considered than the Kish method. Educational level provided the worst fit. The information discussed leads to answer the first research question in the affirmative, since the last birthday method found a greater number of women. Although the Kish method produced a higher selection of people over 60, the difference between sexes identified by using the birthday method was much lower, selecting 10 percent more women. However, what truly characterized the last birthday method was the largest selection of women over 29 years old, a difference that reached 1 percent in the 55-59 year-old group and reached 2.4 percent in the older group.

<sup>10</sup> See note 11.

The second question, which considered that the over selection of women occurred because they tended to work more at home (housewives), was answered negatively. Women showed high levels of education and high labor force participation rate, both higher than men. However, they had a low employment rate and their unemployment rate was three times higher than men's. It was high unemployment that explained this greater selection of women.

The underestimation of the employment and labor force participation rates for men can be explained by considering that the employed spend less time in the home, which involves greater difficulty in being contacted. This situation could explain the smaller number of middle-aged men located by the Kish and the birthday methods.

The third question asked whether the kish method overrepresented old people and people with lower education levels, specifically those who had not completed their formal education or had a primary education level. The Kish method selected the smallest number of people under 34 years old, with a difference that increased as age decreased. This trend continued in the selection of the last birthday, but was less pronounced. The deficit of the Kish method was 7.18 percent for those under 30 years old, a percentage that was reduced to 5 percent when using the last birthday method. With regard to education, the Kish method was the one that most underrepresented people who had not completed their formal education (difference of 15.78), while it overestimated those who had a primary education level by almost 13 points. In order to answer research question 3, it should be considered that the birthday method had a better fit for the lower educational levels, while it underestimated the group without formal education (less than 5 points), and slightly overestimated those who had completed primary education (1.26 percent). In short, the Kish method was the one that most underrepresented young people and produced the worst fit for groups with low education levels.

The above conclusions have shown sufficient evidence that the Kish method is not the most appropriate when population registers are unavailable, something that happens in many countries (among others, Smyth et al., 2019; Brenchon, 2015). This means that the fourth question has to be answered in the negative. Although this method achieved a slightly higher cooperation rate than the rest, the underestimation of the number of young people (and overestimation of older women), the great differences in educational level, and the high underestimation in the labor force participation rate and employment rate (20 percent), means that the last birthday method is the most recommendable when population registers are not available. Although the ESS recommends the Kish method more than the last birthday method, the results

seem to confirm that the latter obtains samples that are more similar to the universe.

## **6. Limitations and further research**

The limitations of this study are related to the fact that the two southern European countries analyzed are geographically very close. Despite this, they are different countries, with their own culture and their individual cooperation rates. Fearing that these results were merely temporal, unique to the ESS Round 8, an analysis using previous waves showed very similar results. In contrast, when the analysis was repeated for two different countries, the United Kingdom and Ireland, similar differences to those detected and described above were found.

I recommend that other researchers who are interested in this area replicate the analysis for the northern and central European countries, although the fact that most of these countries use Lists of Residents would make it difficult to verify whether the best results of the last birthday method obtained here can be extended to the rest of Europe. It would be more interesting to make a comparison within the same country, using both the same geographical areas and the same interviewers. For example, the Kish method could be used for even-numbered questionnaires and the last-birthday for odd-numbered questionnaires. Operating in this way would avoid both zoning and interviewer bias effects.

It would be advisable for other researchers interested in the topic to replicate the analysis in northern and central European countries, in order to see if the best results of the last birthday method obtained here can be extended to the rest of Europe.

In any case, within-household selection may become less important considering that the new ESS projects are using an online probabilistic panel to conduct their survey, in line with what other similar institutions do (see, for example, Pew Research Center, 2020). The information reported about this project in the European Social Survey (2020) included that contact has been made by post, or by SMS in the pilot study carried out in three European countries. This is possible because the study used the people who previously participated in the face-to-face survey of the 6th round, but what would the procedure be with people not previously contacted?

Based on the procedure used by other organizations, there would be three major requirements. First, detailed information would be needed, including full address and telephone number for sending the SMS (it should be recalled that only half of the countries have population registers). Second the data must be

up to date. In France, 11% of the contacts were made with households that were not part of the object of study, and 14% were made with households where no one answered (after 4 attempts); in Portugal these figures were 9 and 19% respectively. And third, the cooperation logic in face-to-face and in online surveys is totally different, both in terms of cooperation rate and mode effects. There are also other factors to be considered, which will not be discussed in detail here, including the need for the questionnaire to be shorter (among others, Revilla & Ochoa, 2017), the workload it involves for respondents (among others, Cape & Phillips, 2015), the level of survey saturation (among others, Tourangeau, Couper and Conrad, 2013), and the lower participation of older groups with a lower educational level.

Finally, a limitation found by all of the studies on within-household sampling is that the differences in the distributions are produced by the method, and not by the lack of response.

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