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session 1: Experiences with the use of registers in the censuses

Comparing approaches of different (partly) register-based countries

Note by Statistics Netherlands¹

Summary

Since the last Census based on a complete enumeration was held in 1971, the willingness of the population in the Netherlands to participate has decreased tremendously. Statistics Netherlands found an alternative in a Virtual Census, by using available registers and surveys as alternative data sources. Advantages of a Virtual Census are that it is cheaper and more socially acceptable. The combined use of registers and surveys for composing the Census however also leads to several methodological challenges. One of them is deciding on the method used to compensate for missing information. Another is the decision on the method used to combine register and survey data.

In this contribution we explore the options chosen by ten (partly) register-based countries. Next to the Netherlands six fully register-based countries (Norway, Denmark, Sweden, Finland, Austria, and Slovenia) and three partly register-based countries (Switzerland, Germany, and Poland) were asked a number of questions. We are thankful that all countries approached were willing to help us in this research project. This research is beneficial to Statistics Netherlands for making final decisions in the approach of the Census of 2011. Hopefully, it is also a useful study for other countries that are working or planning to work with registers in their censuses.

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I. Introduction

1. All European Union (EU) countries conduct a Census in 2011. How this Census is conducted is up to the countries. In the Netherlands virtual censuses are held ever since the last traditional Census in 1971. This means that census forms no longer exist and that the relevant information is provided by data in already existing registers and surveys (Schulte Nordholt, 2004). This approach was used for the Virtual Censuses of 1981, 1991, and 2001. The Censuses of 1981 and 1991 were of a limited character. The data compiled on 1981 and 1991 were much less detailed than the set of tables of the 2001 Census. In 2001 Statistics Netherlands published census information on the municipal level. For the 2011 Census even more registers and surveys will be combined. The Population Register forms the backbone for the integration activities that will eventually result in coherent and detailed demographic and socio-economic statistical information on persons and households.

2. A generic problem in using administrative registers for statistical purposes is that the data in these sources are collected and maintained by other organizations for non-statistical purposes. The process is beyond the control of Statistics Netherlands. This not only makes Statistics Netherlands highly dependent, it may also affect the quality of the output of Statistics Netherlands (Schulte Nordholt, Ossen, and Daas, 2012).

3. Countries that use registers to provide data for the Population and Housing Census of 2011 usually cannot obtain all required census information from the available registers. Registers are usually not set up for statistical purposes, and therefore register data may differ in content and definitions required for the Population and Housing Census of 2011. Several approaches may be used to obtain the missing information (e.g. new fieldwork or already existing sample surveys) or it may even be decided to not provide these data to Eurostat. Statistics Netherlands has conducted a research project in order to compare the ways fully register-based and partly register-based countries deal with this missing data problem for the Population and Housing Census of 2011. Statistics Netherlands uses available sample surveys to obtain missing information, and therefore it was investigated whether other countries also make use of sample survey information for the Population and Housing Census of 2011. One of the goals of this research project was to compare the different estimation methods used to combine register and survey data. Several estimation methods can be used to raise the survey data to the population totals (e.g. imputation or weighting), but not all estimation methods will automatically produce a set of numerically consistent census tables (i.e. when tables with common margins are estimated from different sources the estimated margins differ). Since production of a set of numerically consistent census tables is required in the EU regulation (European Commission, 2008), Statistics Netherlands will use the estimation method of repeated weighting (Houbiers et al., 2003) for the Population and Housing Census of 2011. This method guarantees production of a set of numerically consistent tables. More information about the Dutch methodology used for estimating Census tables based on incomplete information can be found in Schulte Nordholt (2012).

4. Six fully register-based countries (Norway, Denmark, Sweden, Finland, Austria, and Slovenia) and three partly register-based countries (Switzerland, Germany, and Poland) were asked for participation in the research project. Together with the Netherlands, ten countries participated in this research project. All countries were asked about their specific situation on missing census information and the approach that will be used to obtain the missing information. In addition, countries were asked whether sample surveys will be used for the Population and Housing Census of 2011 and, if applicable, which method will be used to combine the register and survey data.

5. In order to compare the approaches used by all participating countries to obtain missing information, the variable “current activity status” is used as an example, since this variable is usually difficult to derive from registers. For each country, the way this variable will be derived for the Population and Housing Census of 2011 is described. It is especially difficult to obtain information on unemployment from registers. Registers used to obtain information on unemployment usually do not cover all unemployed persons. For example, administrations from unemployment benefit agencies and social assistance benefit agencies only cover registered unemployed persons, but there may also be unemployed persons who are not officially registered as being unemployed and who do not receive any social assistance or unemployment benefits. As can be read in the next two sections, Statistics Netherlands has problems deriving this variable and misses information relevant for the Census of 2011 in the available registers. Therefore, examples of different approaches used by other countries to derive this variable can be helpful for Statistics Netherlands as well as for all other participating countries.

6. It should be mentioned that our research yielded information with a variety in content and length per country, since answers provided by the countries differed in their specificity and comprehensiveness. Where some countries provided an extensive description of the amount of missing information, other countries only provided one or more examples of variables with missing information. Moreover, some countries were very clear and honest about the fact that some of the data will not be provided completely in accordance with the definitions as specified in the EU regulations, while other countries did not provide any information about the way data will be provided. The information in this paper is based on the information provided by the countries, sometimes complemented with information from literature. This should be taken into account while comparing the approaches used by the participating countries. A general comparison of the methods used to compensate for missing information and for combining register and survey data can be found in sections 4 and 5. Some conclusions are drawn in section 6. A more detailed description of the approaches of the individual countries that participated will be published in Maris (2012) and can after publication be asked for

II. Methods used in the Dutch Census of 2011 to compensate for missing information

7. The Dutch Population and Housing Census of 2011 will be partly register-based. Data for this census will be obtained from both registers and surveys. Although Statistics Netherlands can make use of a lot of registers (e.g., population register, register on employment, register on income, registers from social assistance benefit agencies, and unemployment benefit agencies), not all required census information can be obtained from these registers.

8. For example, Statistics Netherlands has no register information on “occupation” and therefore this variable must be obtained with the use of survey data. This information will be obtained from existing sample data of the Labour Force Survey (LFS).

9. Moreover, although several administrative sources can be used to obtain information on educational attainment, there is not much information available on educational attainment for persons aged 45 years and older and for persons who have completed private education or education abroad. Therefore, the variable “educational attainment” will be composed by using a combination of register and survey data.

10. Furthermore, it is possible that the variable “current activity status” will also be composed by using a combination of register and sample data. For composition of this variable, sample data will be used to obtain information on homemakers and unemployed

persons. Although information on unemployment can be obtained from administrative registrations from unemployment benefit agencies and social assistance benefit agencies, these administrative registrations do not cover all unemployed persons. There are, for instance, unemployed persons who are not officially registered as being unemployed and who also do not receive any social assistance or unemployment benefits. Moreover, people living in the Netherlands but working abroad may be wrongly classified as being unemployed or homemakers. Furthermore, registers used to obtain information on unemployment usually do not contain information on persons available for work and persons who are looking for work. This information is required to classify the unemployed persons in accordance with the ILO-definition as specified in the EU regulation of 2009 (European Commission, 2009). Thus, information on unemployment is difficult to obtain completely in accordance with the required definition, and therefore the variable “current activity status” is difficult to derive by using register data only. On the other hand, the use of sample survey data to obtain information on unemployment leads to estimation problems for the variable “current activity status” in the census hypercubes. This means that tables containing current activity status are difficult to estimate using repeated weighting. Therefore, Statistics Netherlands is currently investigating the possibility to derive the variable “current activity status” by using register data only. At the moment, it has not yet been decided how this variable will be derived.

11. In order to obtain all required census information, Statistics Netherlands will make use of sample survey data from the Labour Force Survey (LFS) in addition to register data. The LFS will be used to obtain information on occupation, to complement the information on educational attainment, and possibly to obtain information on unemployed persons and homemakers. Information needed from the LFS for the Dutch Census is already available at Statistics Netherlands and will thus not be collected for the purpose of the Population and Housing Census of 2011.

12. Thus, in order to deal with the problem that not all required information can be obtained from registers, Statistics Netherlands uses already existing sample survey data to obtain the missing information.

III. Methods used in the Dutch Census of 2011 for combining register and survey data

13. The LFS is a sample survey that covers about one percent of the labour force population per year and can be used for the Dutch Population and Housing Census of 2011 to obtain missing information on occupation, education, unemployment, and homemakers. The sample data will be raised to population totals by the method of ‘Repeated Weighting’ (Houbiers et al., 2003). This estimation method, developed by Statistics Netherlands, will be used to produce a set of numerically consistent tables, in order to meet the requirement of consistency as required in the EU regulation (European Commission, 2008). The repeated weighting procedure exists of three steps. First, relevant information will be extracted from the registers and surveys and put into rectangular data blocks. Second, a set of weights will be assigned to each data block. And third, numerically consistent table estimates will be generated from the data blocks. For each table to be estimated, the largest rectangular data block that contains all relevant variables will be used. The order in which the tables are estimated is important. Tables that can be estimated from the largest data block should be estimated first, followed by tables that can be estimated from the second largest data block, etc. The following procedure should be applied:

- If a table has a margin that can be estimated from a larger data block, this margin should be added to the table set and estimated before the table is estimated. The

margin is estimated more accurately and can serve as auxiliary information for the estimation of the table under consideration.

- All tables that can be estimated consistently with the block weights of the most suitable data block should be estimated before tables that cannot be estimated consistently with these block weights.
- If a table cannot be estimated consistently with the block weights of the most suitable data block but a margin of this table can, this margin should be added to the table set and estimated before the table under consideration is estimated.
- Only if a table cannot be estimated consistently with the block weights of the most suitable data block, the table has to be estimated by repeated weighting. The block weights will be adjusted by an additional reweighting scheme that takes into account the whole table set and already estimated margins. The weights are adjusted such that the distance between the block weights and the adjusted weights is minimized, under the restriction that consistency is achieved with all other tables having variables in common with the table under consideration.

IV. Comparison of Census 2011 methods used to compensate for missing information

14. The methods used by six fully register-based countries (Norway, Denmark, Sweden, Finland, Austria, and Slovenia) and three partly register-based countries (Switzerland, Germany, and Poland) to compensate for information that is not available from registers are compared. Moreover, these methods used are compared with the method of Statistics Netherlands. All fully register-based countries can make use of a lot of registers, such that most of the census variables can be obtained by using register data only. However, all fully register-based countries experience problems with obtaining data that is not available from registers. Several approaches will be used for the Population and Housing Census of 2011 to deal with this problem. For example, Statistics Austria and the Statistical Office of the Republic of Slovenia will impute all missing information, whereas Statistics Norway and Statistics Sweden will impute some of the missing information. Moreover, Statistics Norway and Statistics Sweden will not be able to specify some categories of the required variables and will therefore assign some persons to a different category. Furthermore, Statistics Finland will derive all missing variables by using a so-called ‘register estimation method’. In addition, Statistics Denmark, the three partly register-based countries involved (Switzerland, Germany, and Poland) and Statistics Netherlands will use additional sample information to obtain all required census information.

15. Since most of the fully register-based countries use register data only, wrongly classified persons and categories that cannot be specified are unavoidable. This implies that some of the data will be sent to Eurostat not completely in accordance with the definitions as specified in the EU regulations. For example, most of the fully register-based countries will not be able to provide information on unemployed persons in the way it is required according to the EU regulations, since information on persons available for work and persons who are looking for work is usually not available in registers. Moreover, administrative registrations from unemployment benefit agencies and social assistance benefit agencies only cover registered unemployed persons, but there may also be unemployed persons who are not officially registered as being unemployed and who also do not receive any social assistance or unemployment benefits. Furthermore, most of the fully register-based countries have no information on persons who have completed education abroad, such that the variables “educational attainment” and “current activity status” are difficult to obtain completely in accordance with the definitions required.

16. Thus, although several methods will be used to deal with the missing data problem, most of the fully register-based countries will not be able to send all required census variables to Eurostat completely in accordance with their definitions as specified in the EU regulations. Where the fully register-based countries can obtain most of the census variables from registers and will provide some of the data not completely in accordance with the definitions, the three partly register-based countries included in this research project will conduct sample surveys for their Censuses of 2011 to obtain additional information since they can only obtain some of the variables from registers. For Statistics Netherlands, most of the variables can be obtained from registers, but there is no register information on occupation available. Moreover, there is not much register information on educational attainment for some of the residents (e.g. persons older than 45 years). Therefore, information on occupation and educational attainment must be obtained from sample surveys. In this way, the method used by Statistics Netherlands is comparable to the approaches used by the three partly register-based countries involved. However, Statistics Netherlands uses existing sample survey data on occupation and educational attainment, whereas the three partly register-based countries conduct sample surveys for their Censuses of 2011 to obtain this information. On the other hand, Statistics Netherlands has a lot of register information and it is possible that Statistics Netherlands will derive the variable “current activity status” from register data only. In this way, the method used by Statistics Netherlands is comparable to the approaches used by fully register-based countries. Moreover, the costs of the Dutch Population and Housing Census of 2011 are comparable to the costs of a fully register-based census (United Nations, 2010). Thus, the method used by Statistics Netherlands corresponds to a combination of a fully register-based approach and a partly register-based approach.

V. Comparison of Census 2011 methods used to combine register and survey data

17. In this section it is described whether the participating countries make use of survey data to obtain information that is not available from registers and which methods are used to combine the register and survey data. As mentioned above, all three partly register-based countries in this research project (Switzerland, Germany, and Poland), Statistics Denmark and Statistics Netherlands make use of survey data to obtain information missing in registers. Although Statistics Denmark is a fully register-based country, existing sample survey information will be used to obtain information on educational attainment for immigrants. Moreover, Statistics Netherlands will use the Labour Force Survey to obtain information on occupation and educational attainment and possibly also to obtain information on unemployment and homemakers. Where Statistics Denmark and Statistics Netherlands make use of available sample survey data, the three partly register-based countries involved have conducted surveys for the Population and Housing Census of 2011. For example, the Federal Statistical Office of Germany has conducted several surveys to obtain information on, for instance, education, employment, and housing, whereas the Federal Statistical Office of Switzerland has conducted several surveys to obtain information on, for instance, households, families, housing, employment, and education. Furthermore, the fully register-based countries Norway, Sweden, and Austria will conduct sample surveys in order to assess the quality of the variables derived, but these sample survey data will not be used to complement the data obtained for their Population and Housing Censuses of 2011.

18. All three partly register-based countries in this research project will use traditional weighting methods to raise the survey data to the population totals. For both the Swiss and the Polish Population and Housing Census of 2011, the survey data will be weighted and calibrated with the use of register data. Survey data used for the German Population and

Housing Census of 2011 will be calibrated with the use of the GREG-estimator, after which the number of German residents estimated from the survey data will be used to correct the number of German residents obtained from registers. Moreover, Statistics Netherlands will use the method of repeated weighting to raise the survey data to the population totals. By using this method, a set of numerically consistent tables will be obtained, whereas by using traditional weighting inconsistencies among census tables may occur (i.e. when tables with common margins are estimated from different sources, the estimated margins may differ). Furthermore, Statistics Denmark will impute the non-response in the survey on the basis of register data, after which the survey data will be integrated with the register data.

19. The results of this research project can be used to compare different census methods for the Population and Housing Census of 2011 and to learn from experiences of other countries. There is a variety of missing information among the countries and several approaches will be used to obtain the missing information. Since all countries deal with different situations of missing information (e.g. only a small amount of missing information, problems with consistency, quality problems) several methods will be used for these different situations. This research project can be helpful to compare the methods used by other countries in a specific situation and to investigate the possibility of using a similar method for this situation. For example, when countries deal with a small amount of missing data for some of the variables, it may be considered to impute all missing information. This is most frequently done when dealing with a small amount of missing information. Moreover, many countries experience difficulties with obtaining information on educational attainment for immigrants. These countries may consider using the method of Statistics Denmark to use existing sample survey information for the variable “educational attainment”. In addition, most of the countries will not be able to derive the variable “current activity status” completely in accordance with the definition as specified in the EU regulation (European Commission, 2009) and therefore other countries may also consider to derive this variable not completely in accordance with the required EU definition. This finding is especially important for Statistics Netherlands, since Statistics Netherlands has not yet decided how this variable will be derived for the Dutch Population and Housing Census of 2011. Furthermore, it may also be investigated whether the variable “current activity status” can be derived by using an approach similar to the ‘register estimation method’ used by Statistics Finland or whether this method can be used for deriving variables that cannot be obtained directly from any register.

20. In addition, countries that have problems with consistency may investigate the possibility to use the method of repeated weighting. For example, the partly register-based countries may use the method of repeated weighting in order to obtain a set of numerically consistent census tables. However, it should be taken into account that by using repeated weighting several estimation problems may occur. For example, sampling zeros cause estimation problems such that it is sometimes not possible to estimate the required census tables completely.

21. Although countries that do not make use of sample survey data for the Population and Housing Census of 2011 will probably not have problems with consistency, the method of repeated weighting may still be useful when dealing with quality problems. For example, it may be considered to use existing sample survey data for variables that are not of good quality and to apply the method of repeated weighting to combine the register and survey data. In addition, fully register-based countries that conduct quality assessment surveys may consider using the survey information obtained from this quality survey and to use the method of repeated weighting.

VI. Conclusions

22. The virtual census has proved to be a successful concept in the Netherlands. It has many advantages compared to traditional censuses. The costs are now considerably lower. Still, census data on the Netherlands can be compared to results of earlier Dutch censuses and to the results of other countries that take part in the same Census Round. So far the Netherlands has conducted three virtual censuses. However, the Dutch data that have been compiled for 1981 and 1991 were of a much more limited character than the set of tables of the 2001 Census. Moreover, they were largely based on a register count of the population in combination with the then existing surveys on the labour force and housing conditions. Also for the Virtual Census of 2011 it is important that the final results are comparable both over time and with other countries. Therefore, the quality of the Dutch registers used is of vital importance for the 2011 Census.

23. It is possible to conduct a register-based census in more and more countries. Although, in most countries not all census variables can be derived from register information. For those variables additional surveys remain a necessity. To be able to use registers for statistical purposes, it should be possible to determine the quality of these registers. In the coming period it will be decided how the different Dutch Census variables will be derived.

24. Big advantage of the method used for the construction of the Virtual Census (Schulte Nordholt, 2004) is the use of micro-integration. In this way data are checked and incorrect data are adapted. The number of measurement errors thus decreases. By the introduction of the technique of repeated weighting the remaining inconsistencies are solved. Given the detailed information requests of the 2011 Census, the available sources for the Dutch Census, and the current research comparing approaches of different (partly) register-based countries, it is sure that we will have a lot of interesting experiences with our register-based 2011 Census in the coming years that will draw the attention of many other countries.

25. Thus, although all countries deal with different situations of missing information and different amounts of available register information, this research project can be helpful to learn from approaches used by other countries in a specific situation, not only for the Population and Housing Census of 2011 but also for future censuses.

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