Journées de méthodologie statistique de l'Insee
JMS
2018

Measurement error in self- and proxy reports of educational qualifications: A validation using administrative data

Fiona Müller (*), Caroline Roberts (**)

(*) Office fédéral de la statistique, Suisse
(**) Université de Lausanne, Suisse

caroline.roberts@unil.ch

_____

Résumé

Les mesures du niveau de formation achevé joue un rôle important dans la recherche par sondage. Elles sont essentielles pour décrire des populations, et ainsi, pour l'évaluation et l'ajustement de la représentativité des échantillons d'enquête, et elles servent comme variables explicatives importantes pour des phénomènes divers. La pratique courante est de demander aux répondants des enquêtes de déclarer leur niveau de formation, leurs qualifications, ou le nombre d'années en formation, et souvent, de faire la même chose pour les membres de leur famille ou de leur ménage. Cette pratique repose sur l'hypothèse que les auto-rapports et les déclarations par procuration du niveau de formation sont sans erreur, mais des opportunités pour tester cette hypothèse sont rares. Dans ce papier nous étudions l'étendue de l'erreur de mesure dans des rapports du niveau de formation du Relevé Structurel de l'Office fédéral de la statistique Suisse, qui fait partie du recensement de la population, avec des données administratives des enregistrements des inscriptions actuelles dans des institutions de formation et des diplômés récents. Avec ces données uniques, nous analysons l'étendue et la nature du biais lié aux déclarations erronées, ainsi que les mécanismes qui pourraient expliquer les erreurs observées. Nous trouvons qu'entre 11% et 16% des réponses se diffèrent des enregistrements officiels, et nous discutons des éventuelles explications pour les différences observées.

Abstract

Measures of people's educational qualifications play an important role in survey research. They are not only key to describing populations, and hence evaluating and adjusting the representativeness of survey samples, they also serve as important explanatory variables for diverse phenomena. As such, it is standard practice to ask survey respondents to report their level of education, their qualifications, or the number of years they have spent in education, and frequently, to also do so for other family and household members. This practice rests of the assumption that self- and proxy reports of education are largely error-free, yet opportunities to verify this assumption are rare. In this paper, we investigate the extent of measurement error in

reports of educational qualifications in the Structural Survey of the Swiss Federal Statistical Office, which is a key component of the Population Census, using linked administrative data from records of current registrations in educational institutions and recent qualifications. Using this unique dataset, we analyse the extent and nature of bias introduced by misreporting, as well as possible mechanisms accounting for any observed errors, under the assumption that the register data provide 'true values' against which the self- and proxy reports can be validated. Comparing the two data sources at the aggregate level, we find broadly similar estimates of distributions across educational qualifications. However, we find between 11% and 16% of the survey reports differ from official records due to respondents misreporting their own or others' educational qualifications. The results suggest that over-reporting is more prevalent than underreporting and that the rate of misreporting is higher for respondents with lower educational levels, who have studied abroad, or who speak none of the Swiss national languages. There is little evidence of specification error, or problems associated with particular response categories, thus we tentatively attribute the observed errors to forward telescoping and social desirability bias. However, we discuss the conclusions in light of the challenges involved in validating survey responses using administrative data.

Key words: measurement error, administrative data, response validation, self-reports, proxy reports, educational qualifications

1   Introduction

In recent years, there has been a growing interest in the potential benefits of supplementing survey data with administrative data (Wallgren and Wallgren, 2014), which at the same time, has brought to light some of the many challenges involved in combining data sources (e.g. Oberski et al., 2017; Künn, 2015; Sakshaug and Kreuter, 2012). In official statistics, administrative data provide a more extensive, comprehensive, and potentially more accurate source of information on which to base population estimates; a way to reduce reliance on sample surveys of declining quality, as well as the burden placed on survey participants (National Academies of Sciences, Engineering, and Medicine, 2017). Among survey methodologists, one interest in supplementing survey data with administrative records lies in the possibility of validating the answers respondents give in surveys in the context of record check studies (Groves, 2004) designed to assess data quality. The availability of external criteria against which survey responses (and missing data) can be verified offers the possibility to identify and quantify different types of survey error in estimates (Biemer and Lyberg, 2003), to investigate their causes, and if needed, a basis on which estimates may be corrected or calibrated, or replaced entirely by the alternative, more accurate data source. Two types of survey error considered to be especially damaging are measurement error (due to effects of data collection modes or respondents misreporting their answers), and error due to non-validity (the failure of survey questions to capture the concept of interest). In this study, we use administrative data to investigate the effect of these error sources in survey estimates of educational qualifications.

Numerous studies provide evidence as to the sensitivity of respondents' answers to the way in which the questionnaire is designed and administered, as well as to the cognitive demands particular types of question (e.g. questions requiring recall of past events, behavioural frequency questions, and measures of attitudes and opinions) place on respondents as they formulate their answer, all of which can increase the 'distance' between final survey estimate and the 'true' population value (see Tourangeau, Rips, and Rasinski (2000) for an overview).

Research on survey error has paid relatively little attention, however, to potential misreports of socio-demographic characteristics, as it is typically assumed that respondents are motivated and able to report such 'facts' accurately. Yet, frequently, surveys require not only that respondents provide extensive information about their current and past status in the terms dictated by questions and response options selected by researchers, but often that they additionally provide information about other family or household members. Given the importance of socio-demographic data and the widespread use of survey questions to gather such information, it makes sense to ask to what extent people provide accurate self and proxy reports. This is especially true of questions about educational qualifications, the data from which are widely used to describe populations, for the purposes of adjusting survey response samples, and as an explanatory variable in analyses of numerous substantive phenomena.

In this context, the principal aim of the research reported in this paper was to address the following research questions:

1. Do people misreport their own and other people's educational qualifications?
2. If so, what is the extent and nature of bias in estimates of highest educational qualification introduced by misreporting?
3. What are the possible mechanisms that may account for misreporting?

We addressed these questions through a comparison of responses to the Swiss Federal Statistical Office's Structural Survey and official records of higher educational qualifications awarded, under the assumption that these validation data are error free – an assumption that may be problematic for a number of reasons, which we discuss below. A secondary aim of the research, therefore, was to assess the challenges involved in using administrative data for this purpose. Before describing our analytic approach, we first review relevant literature relating to 1) the use of administrative data for the purposes of validating survey data; and 2) research on response quality in reports of educational qualifications.

1.1 Using administrative data in record check studies

It is often unclear to what extent survey data contain measurement error, as the true value of the population parameter is rarely known. Nevertheless, a number of different techniques for the investigation of measurement error exist, including for example, re-interview studies, multiple indicator studies, or cognitive studies (Salvucci et al., 1997). Groves (2004; p.348-349) has classified methods of assessing measurement error that can be embedded within surveys into four categories: 1) replications of identical measures over trials; 2) replications of indicators of the same concept within trials; 3) randomisation of measurement procedures to different persons, and 4) the collection of correlates of measurement error. An alternative, more direct approach is to validate survey results in so-called 'record check studies' by comparing them to those based on external data, such as administrative records like population registers or a high-quality census (Biemer and Lyberg, 2003). Answers from individual survey respondents can either be compared to external records for those individuals, or population estimates (e.g. means and proportions) based on survey data can be compared to estimates based on the external data source (see e.g. Bingley and Martinello, 2014; Kreuter et al., 2011; Olson, 2006; Poulain et al., 1992). The assessment of bias is based on the assumption that the external estimate is highly accurate, i.e. that it is the gold standard against which the survey can be evaluated.

Record check studies can be designed in three different ways (Groves, 2004). In a *reverse record check study*, the records serve as a sampling frame. Questions about information contained in

the registers are asked in the survey in order to later compare the two sources. In a *forward record check study*, the survey responses already obtained are compared to relevant record systems that contain information on respondents. In a *full design record check study*, the forward and backward methods are combined. All three approaches depend on the availability of the administrative records - information derived from administrative systems typically used in the public sector, such as in taxation, education, healthcare or similar sectors, collected, for example, for registration or transaction purposes (Elias, 2014). Examples include vital records, voter lists, national censuses, education records and so on. As such, they are not explicitly designed or collected for research purposes; they are characteristically large and unwieldy to analyse, which is why they have been classified as a form of big data (Connelly et al., 2016), and there may be issues surrounding access due to data protection laws. The possibility to use administrative data in record check studies additionally depends on being able to link them to survey data, which in turn, depends (among other things) on the availability of a unique identifier that can be matched across data sources, and on the legal framework governing data linkage, which may require survey respondents to give their consent (Schnell, 2013).

The challenges around gaining access to relevant administrative data, around data linkage, and around the facility of analysing them means that opportunities to carry out record check studies are quite rare. When administrative data are available for such research, their utility rests on the assumption that the data are error free, or at least more accurate than self-reports. This is not an unreasonable assumption, especially given the improvements in record keeping afforded by the computerisation of administrative systems. However, given the multiple challenges involved in gaining access to such data, it is important to be aware of potential sources of error in administrative records (Oberski et al., 2017). As with survey data, there may be biases relating to missing data, due, for example, to consent bias, or matching errors, and the quality of individual record capture is, of course, subject to processing error (Sakshaug and Antoni, 2017; Groen 2012, Lyberg, Kasprzyk 2004, p. 245, Connelly et al. 2016, pp. 8–9). Unfortunately, not much is known about the quality of administrative data from different sources or how it should be evaluated, and hence, it is not clear the extent to which the 'gold standard' assumption holds in record check research. It is important, therefore, to bear this potential limitation in mind when interpreting the results of such studies. Nevertheless, given the scarce opportunities to benefit from linked survey and administrative data, there is considerable value in conducting such research, not only with a view to validating the quality of survey estimates, but also as a way to bring to light the potential limitations of the external data source.

1.2 Response quality in reports of highest level of education

Survey measures of educational qualifications are particularly strong candidates for validation using a record check design. Questions about respondents' level of education are included in most surveys, and besides their descriptive value in producing population statistics they are frequently used as control and explanatory variables in survey analysis across a wide variety of research domains (Black et al., 2003). Furthermore, education is a key variable used in weight construction for the purposes of nonresponse adjustment, post-stratification and calibration. As well as having to report their own level of education, respondents are frequently asked to report on other people's educational qualifications. For example, parental educational attainment is commonly used as a measure of social background, and in surveys where household level data are sought respondents may be required to proxy report education levels for other members of their household to whom they are not related. It is vital, therefore, that education levels are measured accurately (Kreuter et al., 2010). In this section we review existing research that has

investigated the quality of survey reports of educational qualifications. First, we consider the possible mechanisms that might give rise to misreports in measures of education.

It is often assumed that highly institutionalised, non-disputable respondent characteristics – so-called 'socio-demographic' variables – are reported without error. However, it is well known that respondents' answers to survey questions are generally prone to errors of different kinds (Tourangeau, Rips and Rasinski, 2000), and thus, there is little reason to assume that socio-demographic questions should be different. Reporting errors depend on task characteristics (notably, the type of information sought (factual vs. nonfactual), question wording and format, and the mode of administration), respondent characteristics (such as variables relating to the motivation and ability to provide accurate answers, as well as respondent status on the measure of interest), and possible interactions between the two. Factual questions in particular, often require respondents to recall past events, or to estimate quantities; cognitive processes known to be at risk of error, depending on task difficulty. Task difficulty may vary as a function of both question formulation (e.g. the length of the recall period specified in the question or the complexity of the estimation required) and respondent status (e.g. length of time since the occurrence of the event to be recalled). In turn, response quality depends on how much effort respondents expend in executing the task (*ibid.*), which is known to vary with respondent motivation and ability, for which level of education is frequently used as a proxy (e.g. Narayan and Krosnick, 1996). Factual questions also vary in terms of how sensitive the information requested is considered by respondents to be and whether there are socially normative responses that could provoke deliberate misreporting (Fowler, 1995).

In the case of measures of education, if a long period of time has passed since the award of the last qualification, answers may be affected by recall errors. Misclassification errors (selecting the wrong response option) may arise for groups with particular categories of educational qualification that are not clearly accounted for in the response options (e.g. increased migration means that national minorities reporting their qualifications may be confronted with unfamiliar educational categories (as well as language barriers) resulting in inaccurate reports). Respondents may equally be tempted to over-report their educational level due to social desirability pressures, particularly if they were/are close to completing a particular qualification. Proxy reports of other people's education may be subject to similar errors or be simply based on best guesses where respondents do not have the information to begin with.

Existing research into the accuracy of reports of educational qualifications finds that they are indeed subject to errors of these kinds (e.g. Jakubson, 1986; Chaney, 1994; Kane et al., 1999), but conclusions about the extent of the problem, the groups most affected, and the exact nature of the underlying mechanisms are mixed. Inconsistencies between studies may in part be due to the variety of methods that have been used to investigate the problem, and the absence of validation data from which to draw more robust conclusions. For example, Ashenfelter and Krueger (1994) studied measurement error in schooling levels by surveying twins about their own and their sibling's education and comparing their answers, finding between 8% and 12% of the variance in schooling levels could be attributed to reporting errors. Black and colleagues (2003) conducted re-interviews to validate self-reports of higher education in the 1990 Decennial Census in the United States (Black et al., 2003). When comparing the survey responses to the reports in the resurvey, they found substantial and non-random error; respondents indicated their level of education consistently higher than it actually was (ibid., p.545), a result they attributed to misclassification errors among specific respondent subgroups (especially minority groups). Warburton and Warburton (2004) compared data from the

Statistics Canada's Survey of Labour and Income Dynamics to administrative data on social assistance recipients and found that the high school graduation rate was accurately estimated by the survey data, but that grade 12 completion rates were significantly different in the two data sources, especially for social assistance recipients. Meanwhile, Salvucci and colleagues (1997) found evidence of misreporting that they attributed to specification errors in the response categories, due to changing nomenclature in US educational qualifications over time. More recently, Bingley and Martinello (2014) found evidence for more measurement errors in educational qualifications among respondents with lower levels of education, which they attributed to possible social desirability bias.

Thus, although measurement error in self-reports of educational qualifications may not be as prevalent as it might be in more sensitive or attitudinal questions, there is nevertheless an accumulation of evidence to suggest we should be wary of the assumption that these and other socio-demographic measures are error-free. The opportunity to investigate the extent of measurement error in greater detail through a record check study, is therefore, extremely valuable, not only for revealing the extent of data quality issues, but also the mechanisms that may underlie them. This was the motivation behind the present study. Before presenting the results, in the next section we describe the linked data used in this study and our analytical approach.

2   Methods

2.1 Data

To estimate measurement error in self and proxy reports of educational qualifications, we compare survey data to administrative data based on educational registers. The survey responses originate from the Structural Survey conducted by the Swiss Federal Statistical Office (SFSO). It is one of the four components of the Population Census, which was introduced in this form in 2010. A sample of around 200 000 members of the permanent resident population aged 15 or over, living in private households is surveyed annually (Federal Statistical Office (FSO) 2016a, pp. 3–4). Respondents answer questions about themselves and their households concerning religion, mobility, status of occupation, education and so on by filling out a paper questionnaire or using an online version on the Internet, providing information about the socio-economic and socio-cultural structure of the population in Switzerland at the end of each year (Federal Statistical Office (FSO) 2010)[1]. Respondents of the Structural Survey are asked to choose all educational qualifications they have completed out of a list of thirteen options (see figure A1 in Appendix), and on the basis of their answers, the SFSO derives a variable indicating respondents' highest educational qualification[2]. Similarly, survey participants report the highest educational qualification of every household member aged 15 and older out of a shorter list of six categories (see figure A2 in Appendix).

The administrative data originate from a number of different education registers, which have been linked and harmonised by the SFSO since 2012 as part of their project LABB (longitudinal analyses in the area of education), which is aimed at systematizing the measurement of

---

[1] Further details about the Structural Survey and the entire Population Census can be found online: https://www.bfs.admin.ch/bfs/en/home/basics/census.html. The entire questionnaire of the structural survey 2017 can be downloaded here:
https://www.bfs.admin.ch/bfs/en/home/statistics/population/surveys/se.assetdetail.3742907.html.
[2] Further details about the Swiss education system are available in Müller, 2017.

educational transitions and trajectories (Federal Statistical Office (FSO) n.d.). The registers (listed below) are updated yearly with the same reference day as the structural survey, the 31 of December (Laganà and Babel 2015, p. 4):

- *SDL*: The statistics on pupils and students include everyone in Switzerland who is following a programme for a certain training objective at any level, either in a public or private institution, part- or full-time, for at least six months (Federal Statistical Office (FSO) 2015, p. 22). The data are collected by schools serving as a basis for administrative purposes (e.g. school planning) and are sent to the SFSO after first controls and plausibility checks conducted at the cantonal level, which also ensures the correct, complete and timely collection of the data by the educational establishments (Federal Statistical Office (FSO) 2017b, pp. 5–7). The SFSO then checks, combines and harmonizes the data received from the different cantons (Federal Statistical Office (FSO) 2017b, p. 6).
- *SBA*: These statistics include certificates of upper secondary education and of higher vocational education (tertiary level B) (Laganà and Babel 2015, p. 32). The data are collected in the same way as for the SDL, by the educational establishments (Federal Statistical Office (FSO) 2017a, p. 4).
- *SBG*: The statistics of vocational basic education include apprenticeship contracts and information about basic federal certificates of vocational education and training (2 years) and federal diplomas of vocational education and training (3 or 4 years) (Laganà, Babel 2015a, p. 32). The statistics are based on the registers of the cantonal offices for vocational education, which send their administrative data to the SFSO (Federal Statistical Office (FSO) 2016b, pp. 4–5).
- *SHIS*: The Swiss university information system's student and graduate database includes information on every student enrolled at a Swiss university, federal institute of technology, university of applied science or university of teacher education, including additional socio-demographic characteristics (Federal Statistical Office (FSO) 2015, p. 22). It was launched in the 1970s "to meet a growing need for coordination and planning by the Confederation and the cantons in the university sector" (Federal Statistical Office (FSO) 2015, p. 22).

As with responses from the Structural Survey, the data combined for LABB also offer information on which to base estimates of educational qualifications in the Swiss population. However, in the case of the administrative data, the information is limited to a very specific sub-group of the population – those who completed or followed an educational programme at the upper secondary or tertiary level from 2012 on. Both data sources contain the social security number (AHVN13) of the population members and have been linked by this unique personal identifier to allow comparisons of educational qualifications at the individual level.

The analyses of measurement error are based on the assumption that the survey responses can be compared to the administrative data, which represent the true population values for educational qualifications of the covered population, though as mentioned, this assumption may be flawed. Nevertheless, the data used here are compiled by the SFSO, which is committed to high quality standards, implementing different control mechanisms for its products and processes as well as regular evaluations. For example, the Population and Households statistics (STATPOP), which are also included in the LABB, have been evaluated with a quality survey showing that the registers are of a high standard in general and the statistics produced from

them are very reliable (Fritschi, 2015). The first two LABB publications also found evidence for the high quality of the data used (Laganà and Babel, 2015, p. 5).

2.2 Sample

Although current educational programmes are also available in the datasets compiled for LABB, in the present paper we focus on completed educational qualifications in order to validate those reported by respondents to the Structural Survey. The sample we analyse includes all respondents to the 2012, 2013 and 2014 Structural Survey with a personal entry in one of the education registers referring to a completed educational programme in the same year, or respondents living in the same household as someone with an entry in the registers for whom they were required to provide proxy reports. In addition, for respondents to the 2014 Structural Survey, not only the registered completed education of that respective year was available, but also the highest educational qualification registered from 2012 onwards.

The final dataset analysed, includes data on educational qualifications from the LABB administrative data for a total of 58,347 individuals, matched to either self- or proxy reports of educational qualifications provided by respondents to the Structural Survey. Of these, 18 054 were respondents to the Structural Survey providing self-reports of their own educational qualifications registered in the LABB, and 40,293 were proxy reports by respondents to the Structural Survey of educational qualifications for other household members that were registered in the LABB (see Table 1 for descriptive statistics of the sample).

Table 1: Descriptive statistics of the sample

Year	Type of report				Sex				Age	
	Self-report		Proxy report		Male		Female		Range	Mean
2012	4086	30%	9583	70%	6815	50%	6854	50%	16-68	21.9
2013	4230	31%	9338	69%	6654	49%	6914	51%	17-69	22.2
2014	9738	31%	21372	69%	14934	48%	16176	52%	17-80	23.0
Total	18054	31%	40293	69%	28403	49%	29944	51%	16-80	22.6

N=58347

2.3 Analytical Approach

To respond to our first two research questions, we estimate measurement error in self and proxy reports of educational qualifications by comparing them to the LABB register entries. This comparison is possible on two different levels: at the aggregate and at the individual level. At the aggregate level, we assessed differences between the distributions of individuals across the different educational qualification categories in each of the two data sources. At the individual level, each reported educational qualification was compared one-to-one to the register entry in order to identify and analyse misreports. In these individual level comparisons, any discrepancy between the two data sources was generally defined as measurement error. Additionally, more specific error types were distinguished, in order to investigate the reasons for discrepancies and their distributions across subgroups of the sample in more detail. Specifically, depending on the direction of misreporting, we differentiate between under- and over-reports of level of education. For example, reporting a Master's degree in the Structural Survey as the respondent or household member's highest educational qualification when a Bachelor's degree is registered in the LABB data is defined as overreporting; reporting a vocational baccalaureate in the Structural Survey when a Bachelor's degree is registered in the LABB data defined as underreporting. Note that over-reports, as we define them here, should be interpreted with

some caution, as it is possible (though unusual) for individuals to have previously completed (prior to the start of the period covered by the LABB registers) an educational qualification classified at a higher level than the qualification recorded in the LABB (for example, in the case of vocational qualifications undertaken after having completed a higher degree). We estimated the extent of this trajectory with the available data and found the rate was low (2%). Thus, for the purposes of this study, we define all over-reports as measurement error, though we in fact observe some false-positives.

In order to respond to our third research question, the defined error types were compared for different groups, in order to investigate possible explanations for different types of measurement error based on our review of the literature. Over-reports and under-reports in self- and proxy reports respectively were analysed separately as the reasons for misreporting might vary for each. First, we compared error rates on a bivariate level using chi-square tests of association to see whether the distribution of types of measurement error was different between two or more groups. Then, we estimated the parameters of logistic regression equations to assess the conditional effects of the different explanatory variables on the probability of over- and under-reporting educational qualifications (see e.g. Pedace and Bates, 2001; Bingley and Martinello 2014).

3   Results

3.1 Aggregate Level Comparisons

The distributions of the different educational programmes in the administrative and survey data are contrasted in table 2 for self-reports and table 3 for proxy reports. These comparisons reveal differences between the two data sources already at the aggregate level.

Regarding the self-reports, the greatest difference between administrative data and reports in the survey can be observed in the case of basic vocational educations: 27.5% of the comparable responses indicate this qualification whereas 32.2% of the register entries do so. At tertiary level, the greatest discrepancy is found for advanced technical and professional training degrees (1.3%); the proportions of the other educational qualifications on this level are not very different (differences between 0.5% and 1.1%) in the two compared data sources.

Regarding the proxy reports it can be observed that according to both data sources, most household members included in the sample completed a higher secondary general education as their highest educational qualification, followed by basic vocational education and training. Considering the register, 78% have a highest educational qualification on upper secondary level in contrast to 22% sample members with a completed education on tertiary level. Similarly, only 26.1% of the proxy reports indicate an education on tertiary level. Once again, the differences between the distributions of the highest educational qualifications are not very large on aggregate level, amounting to no more than 3.9% concerning the share of respondents reporting a higher secondary general education. Nevertheless, the level of education is slightly overestimated by the survey data.

Table 2: Comparison of proportions (register vs. survey) of highest educational qualifications of respondents

Highest educational qualification		Self-reports		
		Register	Survey	Difference (R-S)
None		-	0.0%	0.0%
Compulsory education		-	1.6%	-1.6%
Upper secondary level	2-3 years higher secondary general education	1.7%	3.3%	-1.6%
	Basic vocational education and training	32.2%	27.5%	4.8%
	General baccalaureate	20.2%	18.7%	1.5%
	Vocational baccalaureate	13.4%	14.1%	-0.7%
Tertiary level	Advanced technical and professional training	4.5%	5.8%	-1.3%
	Bachelor's degree	15.7%	15.0%	0.6%
	Master's degree	11.0%	12.2%	-1.1%
	Doctorate	1.5%	2.0%	-0.5%
Total		100.0%	100.0%	

N=18054

Table 3: Comparison of proportions (register vs. survey) of highest educational qualifications of respondents' household members

Highest educational qualification		Prox reports		
		Register	Survey	Difference (R-S)
None		-	0.1%	-0.1%
Compulsory education		-	1.4%	-1.4%
Upper secondary level	Basic vocational education and training	35.8%	34.1%	1.7%
	Higher secondary general education	42.2%	38.3%	3.9%
Tertiary level	Advanced technical and professional training	2.5%	6.1%	-3.6%
	University degrees	19.5%	20.0%	-0.5%
Total		100.0%	100.0%	

N=40293

3.2. Individual Level Comparisons

When comparing the survey responses to the administrative data on the individual level, the number of discrepancies amounts to 11.8% in the case of self-reports and 16.1% in the case of proxy reports (see table 4). Under-reports are in both cases less prevalent than over-reports, i.e. respondents who misreport their own or the educational qualification of their household members more often indicate a higher diploma than the one that has officially been awarded to the person in question.

Next, we consider possible mechanisms that may underlie these misreports by investigating variation in the prevalence of misreporting across different subgroups. First, we examine whether respondents with lower education are more likely to misreport their education and indeed, find fewer misclassifications among respondents with higher educational attainment. For example, it can be observed that error rates for self-reports vary significantly (X^2 = 271.2, d.f. = 7, p<0.01; Cramer's V = 0.123) across the different educational levels and that both over- and under-reports are generally more prevalent among less educated respondents (see figure 1 and table A1 in the Appendix).

Table 4: Error rates of highest educational qualifications in self and proxy reports

	Self reports (N=18,054)		Proxy reports (N=40,293)	
	N	%	N	%
Under-reports	853	4.7	3070	7.6
Over-reports	1279	7.3	3409	10.7
Highest education				
Upper secondary level	1640	13.5	321	16.1
Tertiary level	492	8.4	124	11.3
Country of Birth				
Switzerland	1495	9.8	1166	13.5
Other country	637	23.2	174	17.7
Main language				
German	1015	9.2	705	12.1
French	716	13.1	491	15.8
Italian	258	23.7	115	22.3
Other	140	32.5	25	17.2
Total	2132/2129	11.8	6479/…	16.1

The proportion of over-reports is highest among those in the lowest category of educational qualification, followed by Bachelor's degree graduates. Only 1.2% of respondents in this group selected a lower education compared to 9.5% of respondents, who reported a Master's degree or even a doctorate. One possible explanation for this type of error is that it is a form of forward telescoping (Sudman and Bradburn, 1973), i.e. respondents report having completed a programme for which they are officially still registered as students. Based on the available administrative data on current registrations in education, it was possible to confirm that 400 (50.8%) out of the 788 respondents with a Bachelor's degree who over-reported their highest educational qualification were officially still registered as students for the level of education that they reported as their highest one at the time of the Structural Survey. For the proxy reports, we could confirm that 70.3% of the 2119 over-reports could be explained by this form of forward telescoping, i.e. 43.7% of the overall over-reporting rate among proxy reports.

Second, we consider differences in misreporting relating to country of birth and main language spoken. Both were found to be significantly associated with misreporting (descriptive statistics are shown in table 4). Higher error rates, especially over-reports, were found for respondents born outside of Switzerland and for those whose main language is not one of the Swiss national languages. Differences were also observed between the national languages. For example, in the case of self-reports, the error rate for German-speaking respondents was 9.2%, for French-speaking respondents was 13.1%, while for Italian-speakers it was 23.7% and for those speaking another language it was 32.5%.
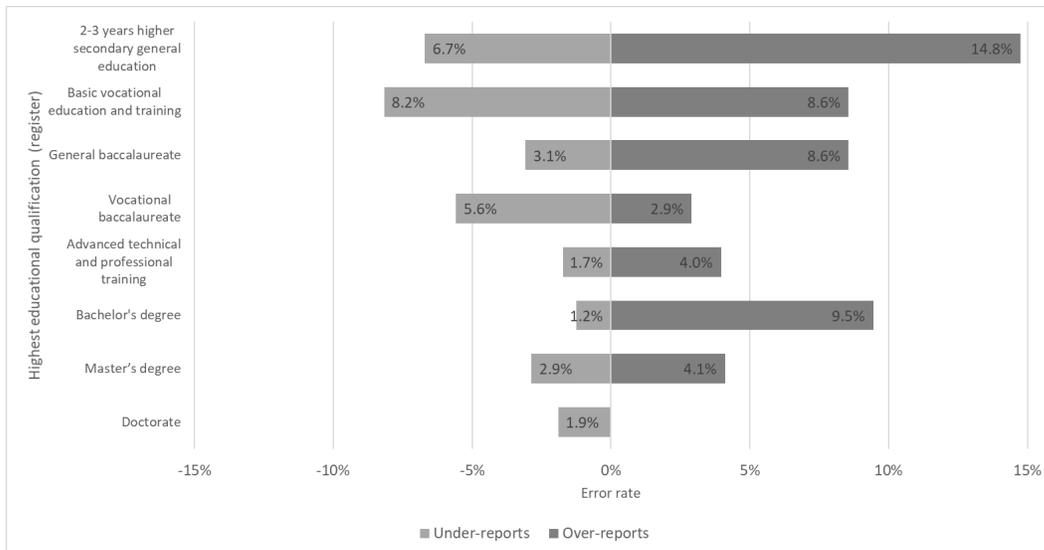
Figure 1: Error rates (under- and over-reports) in self-reports by highest (registered) educational qualification

To assess the conditional effect of these covariates on the likelihood of over- and under-reporting in self and proxy reports, we estimated the parameter coefficients of logistic regression equations for each type of error, additionally controlling for the sex and age of the respondent (see table 5 (for self reports) and table 6 (for proxy reports)). The bivariate effects already discussed remain significant when controlling for the effects of the other variables. Specifically, there is a significant effect of education on over and under-reporting in self-reports of highest education qualifications. Compared to the base category (2-3 years higher secondary general education) respondents in all higher educational categories were less likely to misreport their highest level of education (with the exception of those with the exception of those in the basic vocational education and training and vocational baccalaureate categories who were no less likely to under-report their highest qualification compared to those in the reference category). The effect size is highest for those registered as master's degree graduates (OR=0.051). There is a significant, positive effect on misreporting of being born abroad (OR=2.075 for over-reporting and 1.766 for under-reporting)) compared to being born in Switzerland. Similarly, having a main language other than German significantly increases the odds of misreporting (for French speakers the odds ratio is 1.400 for over-reporting and 1.645 for under-reporting; for Italian speakers, the odds ration is 3.458) for over-reporting and 2.578 for under-reporting; and for respondents with other main languages, the odds ratio is 3.015 for over-reporting and 2.103 for under-reporting. Respondent's age was also significantly and positively related to over-reporting (OR = 1.101), but there was no effect of respondent's sex.

Turning to the models predicting over- and under-reporting in proxy reports (see table 6), note that our analysis is restricted to respondents reporting on household members for whom a personal register entry was also available, since some respondents' characteristics included as covariates are only available from the administrative data (or they are assumed to be more accurate). The number of observations is therefore relatively low compared to the model on self-reports. Nevertheless, the logistic regression models on proxy reports include other explanatory variables, which are potentially linked to the task difficulty, including household size, and the relationship with the household member for whom the proxy report is provided.

Table 5: Parameter coefficients from logistic regression equations predicting over- and under-reporting in self-reports of highest educational qualification

Predictor	Over-reports		Under-reports	
	B	OR	B	OR
Highest educational qualification				
Basic vocational education and training	-1.012***	0.363***	0.319	1.376
	(0.1827)	(0.0664)	(0.2405)	(0.3309)
General baccalaureate	-0.894***	0.409***	-0.849***	0.428***
	(0.1845)	(0.0755)	(0.2528)	(0.1082)
Vocational baccalaureate	-1.941***	0.144***	-0.085	0.919
	(0.2124)	(0.0305)	(0.2506)	(0.2302)
Advanced technical and professional training	-2.529***	0.080***	-1.281***	0.278***
	(0.2631)	(0.0210)	(0.3632)	(0.1008)
Bachelor's degree	-1.412***	0.244***	-1.762***	0.172***
	(0.1901)	(0.0463)	(0.2927)	(0.0503)
Master's degree	-2.911***	0.054***	-0.980***	0.375***
	(0.2197)	(0.0120)	(0.2783)	(0.1045)
Doctorate			-1.516***	0.220***
			(0.5181)	(0.1138)
Country of birth				
Other country	0.730***	2.075***	0.569***	1.766***
	(0.0751)	(0.1558)	(0.0939)	(0.1657)
Main language				
French	0.337***	1.400***	0.498***	1.645***
	(0.0707)	(0.0990)	(0.0800)	(0.1316)
Italian	1.241***	3.458***	0.947***	2.578***
	(0.1006)	(0.3478)	(0.1239)	(0.3194)
Other language	1.104***	3.015***	0.744***	2.103***
	(0.1470)	(0.4431)	(0.1984)	(0.4174)
Sex				
Female	-0.013	0.987	0.069	1.071
	(0.0624)	(0.0615)	(0.0719)	(0.0770)
Age in years	0.096***	1.101***	0.001	1.001
	(0.0042)	(0.0046)	(0.0066)	(0.0066)
Constant	-3.990***	0.0185***	-3.119***	0.044***
	(0.2016)	(0.0037)	(0.2755)	(0.0122)
N	17468		18021	
Log Likelihood	1199.120		445.250	
df	12		13	
Pseudo-R^2 (McFadden)	0.131		0.065	

Reference categories: 'Highest educational qualification': 2-3 years higher secondary general education,
'Country of birth': Switzerland, 'Main language: German, 'Sex': Male
*$p<0.1$ ** $p<0.05$ *** $p<0.01$; standard errors in parantheses*

Table 6: Parameter coefficients from logistic regression equations predicting over- and under-reporting in proxy reports of highest educational qualification

Predictor	Over-reports		Under-reports	
	B	OR	B	OR
Highest educational qualification of respondent				
Tertiary level	0.082	1.086	-0.442**	0.643**
	(0.1815)	(0.1971)	(0.1863)	(0.1198)
Household size				
3 people	0.607*	1.835*	0.223	1.250
	(0.3642)	(0.6682)	(0.3775)	(0.4717)
4 people	0.623*	1.864*	0.292	1.339
	(0.3680)	(0.6861)	(0.3751)	(0.5023)
5 people	0.664*	1.942*	0.520	1.682
	(0.379)	(0.7365)	(0.3840)	(0.6458)
6 or more people	0.669*	1.952*	0.742*	2.101*
	(0.4032)	(0.7868)	(0.4025)	(0.8456)
Reporting for				
parent	-0.013	0.987	0.077	1.081
	(0.8690)	(0.8576)	(1.0930)	(1.1810)
child	-1.141***	0.319***	0.236	1.267
	(0.3338)	(0.1066)	(0.3696)	(0.4682)
otherwise related	-0.483	0.617	0.323	1.382
	(0.4801)	(0.2960)	(0.5538)	(0.7653)
not related	-0.246	0.782	0.541	1.718
	(0.3677)	(0.2874)	(0.3811)	(0.6548)
Country of birth				
Other country	0.521**	1.684**	0.003	1.003
	(0.2151)	(0.3622)	(0.2288)	(0.2294)
Main language				
French	0.872***	2.392***	0.044	1.045
	(0.1650)	(0.3947)	(0.1515)	(0.1583)
Italian	0.808***	2.244***	0.477*	1.611*
	(0.3071)	(0.6891)	(0.2705)	(0.4358)
Other language	1.501***	4.487***	-0.906	0.404
	(0.4111)	(1.8446)	(0.7475)	(0.3021)
Sex				
Female	-0.147	0.863	-0.300**	0.741**
	(0.1531)	(0.1322)	(0.1408)	(0.1044)
Age in years	0.009	1.009	0.001	1.000
	(0.0156)	(0.0157)	(0.0187)	(0.0187)
Constant	-2.519***	0.081***	-2.917***	0.054***
	(0.4734)	(0.0381)	(0.5556)	(0.0301)
N	2014		3007	
Log Likelihood	-615.956		-780.885	
df	15		15	
Pseudo-R^2 (McFadden)	0.067		0.020	

Reference categories: 'Highest educational qualification of respondent': upper secondary level,
'Household size': 2 people, 'Reporting for': partner, 'Country of birth': Switzerland, 'Main language: German, 'Sex': Male
*$p<0.1$ ** $p<0.05$ *** $p<0.01$; standard errors in parantheses*

The results show that there is a negligible effect of household size on the likelihood of misreporting. Respondents living in larger households were at a slightly higher risk of over-reporting the highest educational qualification of their household members compared to respondents in 2-person households, but the coefficients for the larger household size

categories only approached significance for over-reporting (p<0.1). By contrast, the relationship between the respondent and the household member for whom she or he is reporting educational attainment does seem to influence the accuracy of the report, at least in the case of over-reporting errors. Respondents reporting the highest educational qualification on behalf of their children were significantly less likely to over-report the level of education achieved compared with those reporting on behalf of their partner, whereas the odds of misreporting were not significantly different when reporting on behalf of a parent, another relative or a non-relative. Once again, the results indicate that being born outside of Switzerland and having a main language other than German significantly increases the likelihood of over-reporting the highest education of household members (and Italian-speakers were also significantly more likely to under-report). Female respondents were also significantly less likely to under-report the highest education of their household members. Note, however, that overall the model was a rather weak fit the data, suggesting other unobserved variables play a role in determining the likelihood and extent of measurement error in measures of educational qualifications.

4   Discussion

The aim of the present study was to examine measurement error in self- and proxy-reports of highest educational qualifications in the Swiss context, using a record check approach. Specifically, we used linked data provided by the Swiss Federal Statistical Office, combining the results of the Structural Survey (one component of the Swiss population census) and administrative data based on records of current registrations and qualifications awarded in different types of educational programme in Switzerland. Our analysis addressed three exploratory research questions about 1) whether people misreport their own and other people's educational qualifications, 2) the extent and nature of bias in estimates introduced by misreporting, and 3) possible mechanisms that may account for misreporting.

Consistent with other research looking at how accurately people report their education level (e.g. Ashenfelter and Krueger, 1994; Black et al., 2003; Chaney, 1994; Bingley and Martinello, 2014; Warburton and Warburton 2004; Salvucci et al., 1997; Kane et al., 1999), our study finds evidence of measurement error in self- and proxy reports of educational qualifications. At the aggregate level, discrepancies between estimates produced by the two data sources were relatively small. The maximum absolute bias for self-reports was 3.9% and that for proxy reports was 4.5% (in both cases, the survey under-estimates the true proportion of the population in the relevant categories), and the distributions of educational qualifications were quite similar according to both data sources, i.e. the survey data provide reasonably accurate point estimates. At the individual level, we found larger discrepancies between the survey and administrative data (ranging from 11.3% to 16.1% reports), and there were systematic, statistically significant differences between subgroups in the level of reporting accuracy, which give insight into the possible reasons for misreporting (discussed in further detail below). Overall, however, the picture is positive: although some people misreport their educational qualifications, the vast majority of respondents answer the survey questions accurately, even on behalf of other members of their household.

To what extent should we be concerned, however, about the discrepancies we did observe? Overall, for a number of reasons, we make the assumption that the estimates of misreporting derived from this study are rather conservative. For one, not all educational categories are

included in the administrative data sources we analysed, which meant that we not only decided not to define certain discrepancies between the data sources as error, but also that some differences were impossible to detect. For example, the level of detail concerning advanced technical and professional education was different in the two data sources and no distinction between the different degrees was possible in the register data. This meant that the two response categories of the survey question had to be combined in order to make comparisons. Nevertheless, although errors in this category could not be detected, it is assumed that respondents misclassified their education also at this level, especially as the descriptions in the response categories are quite similar, which could easily lead to confusion. Therefore, we expect measurement error may well be more prevalent than estimated here. On the other hand, as mentioned previously, the number of over-reports of the highest educational qualifications may be slightly overestimated as only recently completed education qualifications were available in the registers and these may not necessarily be the highest educational qualification the respondent or household members have ever been awarded.

Linkage of administrative data with survey data at the SFSO is possible thanks to the availability since 2012 of a unique social security number (AHVN13) for legal residents in Switzerland. This means that the data available for this study covered a relatively limited population – namely, that of very recent recipients of educational qualifications (i.e. qualifications awarded since 2012). This has implications for the generalizability of the conclusions drawn about the extent of measurement error in reports of education level, as well as about its underlying causes. For example, given the recency of the events reported, it seems unlikely that recall errors or difficulties with new nomenclature of educational qualifications explain the over- and under-reporting errors we observed. This is particularly relevant to our conclusions about the accuracy of proxy reports, which may be particularly vulnerable to measurement error in the case of household members who completed qualifications a long time ago. It would be especially interesting and valuable to be able to investigate error in proxy reports on parents, for example, which as mentioned, are widely used for the purposes of assessing the social background of respondents. Additionally, the sample was restricted to respondents currently undertaking or completing educational qualifications at the upper secondary or tertiary level. Less educated respondents, with no post-compulsory educational qualifications, were not included in the linked data file, which is another reason why we assume we under-estimate measurement error compared to what we might expect to find if administrative data were available to validate responses from the full sample of respondents to the Structural Survey. Although we found evidence for more misreporting among respondents with lower levels of education, consistent with the findings of previous research (e.g. Kane et al., 1999), we would expect to see an even stronger effect in a more heterogeneous sample.

Over-reports of highest educational qualification were observed more often than under-reports, in both the self- and proxy-reports – a finding consistent with that of other research (e.g. Black et al., 2003; Bingley and Martinello, 2014). We were able to use the administrative data available to verify the current status of around half the individuals referred to in the erroneous self- and proxy reports. This indicated that the over-reports frequently came from respondents who at the time of the survey were studying for a particular educational qualification on the same level that they indicated themselves as having already completed. In other words, the individuals referred to would sooner or later receive the qualification they reported as having already achieved. Given this, we might conclude that the bias we observed is not necessarily a major cause for concern. However, we were not able to verify the actual current status of all the

individuals referred to in misreports, and it is of interest to survey methodology to understand the reasons for over-reporting in case questionnaires can be easily adapted to reduce the risk of errors in future survey implementations. We described this type of error as a form of 'forward telescoping' (Sudman and Bradburn, 1973), because it involves inappropriately reporting an event as having taken place in an earlier reference period than it did actually (or will actually do). However, the underlying reason for the reporting error may not be recall difficulty, or difficulty placing an event in time. For example, for the less educated respondents who over-reported, it may simply be that the opportunities to misclassify a qualification are greater; ticking a wrong response category mostly results in an over-report. Other more likely explanations are that respondents either simply misunderstand that the survey question is asking about *completed* (awarded) qualifications or do not report their status for the correct reference day, or that they deliberately misreport their highest education (or that of household members) as a way to portray themselves (or others) in a better light. They may be especially motivated to do so when they (or the household members) have for all intents and purposes completed the educational programme leading to the qualification they report (especially if diplomas are awarded a long time after the final exam or coursework submission). Unfortunately, it was not possible to test these different hypotheses with the data available or to disentangle these possible mechanisms. Nevertheless, as a preventative measure, it may still be advisable to modify the question wording to clarify the response task and the need for accuracy.

In practice, as mentioned earlier, survey response errors typically result from the interaction between task and respondent characteristics. Besides the actual educational level of the respondent, we found systematic differences in misreporting as a function of country of birth and main language spoken, consistent with the findings of other research (e.g. Black et al., 2003). In the case of respondents born outside of Switzerland, such errors may be due to a lack familiarity with the Swiss educational system, or difficulties matching qualifications gained elsewhere to the available categories. This explanation seems unlikely to hold, however, for respondents who have undertaken their training in Switzerland. In the case of respondents whose main language is not German, it is not immediately clear why we observed the differences we observed. We do not know, for example, which language the respondents completed the questionnaire in, so we cannot assess the extent to which this may have been a barrier (typically, respondents are asked to complete the questionnaire in the dominant language of the region they inhabit, but even for Swiss residents this is no guarantee that it will be their preferred language). The effect of language remained significant even when controlling for country of birth, so it seems unlikely that lack of familiarity with the educational system was confounded with comprehension problems due to language barriers. Given that error rates varied significantly between the Swiss national languages, as well as between national and foreign languages, it may be that the translation of certain categories is not entirely clear given the educational context in particular regions (there is some variation at the cantonal level in educational systems), or it may simply be indicative of different cultures around reporting such attributes in surveys. Further research is needed to investigate the causes of these differences, the extent to which they may affect other survey estimates, as well as possible solutions.

One of the reasons for increased interest in combining administrative data with survey data is to provide a means to reduce the burden on survey respondents by asking fewer questions. In this study, measurement error was not found to be much more prevalent in proxy reports of educational qualifications than in self-reports. However, the burden for the respondents in

larger households is increased, as they need to answer not only questions about themselves but also about their household members. Given that increased burden may be another reason for reduced response quality, there is a strong argument for reducing questionnaire length and for relying on administrative data where possible for producing certain population estimates. The possibility to replace survey data with administrative data, as well as to conduct record check studies of the type reported here, depends on the assumption that the registers provide a more accurate data source. We had strong grounds for adopting this assumption, and it was fundamental to our research design, as well as to the conclusions we have drawn about survey quality. Nevertheless, we are aware that it is a problematic assumption, which unfortunately, we were not able to verify here. In any case, we encountered several challenges in using the available administrative data in a record check study of this kind. As mentioned, coverage was a considerable limitation, as we were restricted to a very limited sample, which would similarly restricts the possibility for the SFSO of relying only on these registers for data on educational qualifications. We also had to restrict our comparisons between specific categories of education because the administrative data did not always provide the same level of detail as was possible with the survey data. Finally, some of the discrepancies we defined as errors may have been due to lags in updating records, which may have been out of sync with the survey reports. Thus, just as with survey data, it is essential that the quality of administrative data be evaluated in order to guarantee the quality of the estimates produced from them.

## 5	References

Ashenfelter, Orley; Krueger, Alan (1994): Estimates of the economic return to schooling from a new sample of twins. In *The American Economic Review* 84 (5), pp. 1157–1173.

Biemer, Paul P.; Lyberg, Lars E. (2003): Introduction to survey quality. Hoboken, NJ: Wiley-Interscience (Wiley series in survey methodology).

Bingley, Paul; Martinello, Allessandro (2014): Measurement error in the Survey of Health, Ageing and Retirement in Europe: A validation study with administrative data for education level, income and employment. Edited by SHARE-ERIC. Munich (Working Paper Series, 16).

Black, Dan; Sanders, Seth; Taylor, Lowell (2003): Measurement of higher education in the census and current population survey. In *Journal of the American Statistical Association* 98 (463), pp. 545–554.

Chaney, Bradford (1994): The accuracy of teachers' self-reports on their post secondary education: Teacher transcript study, schools and staffing survey. U.S. Department of Education, National Center for Education Statistics. Washington D.C. (Working Paper 94-04).

Connelly, Roxanne; Playford, Christopher J.; Gayle, Vernon; Dibben, Chris (2016): The role of administrative data in the big data revolution in social science research. In *Social science research* 59, pp. 1–12.

Elias, Peter (2014): Administrative data. In Adrian. Duşa, Dietrich. Nelle, Günter. Stock, Gert G. Wagner (Eds.): Facing the future: European research infrastructures for the humanities and social sciences. Berlin: SCIVERO, p. 47.

Federal Statistical Office (FSO) (n.d.): Längsschnittanalysen im Bildungsbereich.

Federal Statistical Office (FSO): Verpflichtung zur Qualität. Edited by Federal Statistical Office (FSO). Available online at https://www.bfs.admin.ch/bfs/de/home/bfs/verpflichtung-qualitaet.html, checked on 6/24/2017.

Federal Statistical Office (FSO) (2010): Structural survey. Factsheet - Surveys, sources. Neuchâtel.

Federal Statistical Office (FSO) (2011): The new census. Edited by Federal Statistical Office (FSO). Neuchâtel.

Federal Statistical Office (FSO) (2015): People in education. 2015 edition. Edited by Federal Statistical Office (FSO).

Federal Statistical Office (FSO) (2016a): Data collection programme of the Federal Census. Edited by Federal Statistical Office (FSO). Neuchâtel.

Federal Statistical Office (FSO) (2016b): Factsheet - Surveys, Sources. Population and household statistics (STATPOP). Edited by Federal Statistical Office (FSO).

Federal Statistical Office (FSO) (2016c): Statistik der beruflichen Grundbildung. Technisches Handbuch. Edited by Federal Statistical Office (FSO). Neuchâtel.

Federal Statistical Office (FSO) (2017a): Bildungsabschlüsse der institutionalisierten Ausbildungen. Handbuch der Erhebung für das Referenzjahr 2017. Edited by Federal Statistical Office (FSO). Neuchâtel.

Federal Statistical Office (FSO) (2017b): Statistik der Lernenden SDL (Schüler/innen und Studierende). Technisches Handbuch der Erhebung 2017/18. Edited by Federal Statistical Office (FSO). Neuchâtel.

Fowler, F.J. (1995). *Improving Survey Questions: Design and Evaluation.* Thousand Oaks, CA: Sage Publications.

Fritschi, Rachel (2015): FSO News. New census system - Quality survey. Edited by Federal Statistical Office (FSO). Neuchâtel.

Groen, Jeffrey A. (2012): Sources of error in survey and administrative data: The importance of reporting procedures. In *Journal of Official Statistics* 28 (2), pp. 173–198.

Groves, Robert M. (2004): Survey errors and survey costs. New York: Wiley (Wiley series in survey methodology).

Jakubson, George (1986): Measurement error in binary explanatory variables in panel data models: Why do cross section and panel estimates of the union wage effect differ? Working Paper No. 209. Princeton University, Industrial Relations Section.

Kane, Thomas J.; Rouse, Cecilia Elena; Staiger, Douglas (1999): Estimating returns to schooling when schooling is misreported. Edited by National Bureau of Economic Research. Cambridge, MA (NBER Working Paper Series, 7235).

Kreuter, F.; Olson, K.; Wagner, J.; Yan, T.; Ezzati-Rice, T. M.; Casas-Cordero, C. et al. (2010): Using proxy measures and other correlates of survey outcomes to adjust for non-response. Examples from multiple surveys. In *J Royal Statistical Soc A* 173 (2), pp. 389–407.

Kreuter, Frauke; Müller, Gerrit; Trappmann, Mark (2011): Nonresponse and measurement error in employment research. Making use of administrative data. In *Public Opinion Quarterly* 74 (5), pp. 880–906.

Künn, Steffen (2015). The challenges of linking survey and administrative data. IZA World of Labor: 214. doi: 10.15185/izawol.214

Laganà, Francesco; Babel, Jacques (2015): Längsschnittanalysen im Bildungsbereich. Übergänge und Verläufe auf der Sekundarstufe II. Ausgabe 2015. Neuchâtel: Federal Statistical Office (FSO) (Statistik der Schweiz. 15, Bildung und Wissenschaft).

Lyberg, Lars E.; Kasprzyk, Daniel (2004): Data collection methods and measurement error: an overview. In Paul P. Biemer, Robert M. Groves, Lars E. Lyberg, Nancy A. Mathiowetz, Seymour Sudman (Eds.): Measurement errors in surveys. Hoboken: Wiley-Interscience (Wiley series in probability and statistics), pp. 237–257.

Müller, Fiona (2017). *Measurement error in self- and proxy reports of educational qualifications. A validation using administrative data.* Unpublished Masters dissertation, University of Neuchâtel. Available on request.

National Academies of Sciences, Engineering, and Medicine. (2017). *Innovations in Federal Statistics: Combining Data Sources While Protecting Privacy*. Washington, DC: The National Academies Press. doi: 10.17226/24652.

Narayan, Sowmya; and Krosnick, Jon. A. (1996). *Education moderates some response effects in attitude measurement.* Public Opinion Quarterly, 60(1): 58-88.

Oberski, Daniel L.; Kirchner, Antje; Eckman, Stephanie; and Kreuter, Frauke (2017). *Evaluating the quality of survey and administrative data with Generalized Mulittrait-Multimethod Models*. Journal of the American Statistical Association, 520: 1477-1489.

Olson, K. (2006): Survey participation, nonresponse bias, measurement error bias, and total bias. In *Public Opinion Quarterly* 70 (5), pp. 737–758.

Pedace, Roberto; Bates, Nancy (2001): Using administrative records to assess earnings reporting error in the survey of income and program participation. In *Journal of Economic and Social Measurement* 26 (3), pp. 173–192.

Poulain, Michel; Riandey, Benoit; Firdion, Jean-Marie (1992): Data from a life history survey and from the Belgian population register: A comparison. In *Population: An English Selection* 4, pp. 77–96.

Sakshaug, Joseph W.; and Kreuter, Frauke (2012). Assessing the magnitude of non-consent biases in linked survey and administrative data. Survey Research Methods, 6(2):

Sakshaug, Joseph W.; and Antoni, Manfred (2017). Errors in linking survey and administrative data. In P.P. Biemer, E.D. de Leeuw, S. Eckman, B. Edwards, F. Kreuter, L.E. Lyberg, C. Tucker, and B.T. West (Eds.). *Total Survey Error in Practice: Improving Quality in the Era of Big Data.* Hoboken, NJ.: John Wiley and Sons, Inc.

Salvucci, Sameena; Walter, Elizabeth; Conley, Valerie; Fink, Steven; Saba, Mehrdad (1997): Measurement error studies at the National Center for Education Statistics. U.S. Department of Education. National Center for Education Statistics. Washington D.C. (NCES 97-464).

Sudman, Seymour; and Bradburn, Norman (1973). *Effects of time and memory factors on response in surveys.* Journal of the American Statistical Association, 68, 805-815.

Schnell, Rainer (2013): Linking surveys and administrative data. Edited by German Record Linkage Center. Nuremberg (Working Paper Series).

Tourangeau, Roger; Rips, Lance J.; Rasinski, Kenneth A. (2000): The psychology of survey response. Cambridge: Cambridge Univ. Press.

Wallgren, Anders; and Wallgren, Britt (2014). *Register-based statistics: Statistical methods for administrative data.* Wiley Series in Survey Methodology. Hoboken, NJ: John Wiley and Sons.

Warburton, Rebecca N.; Warburton, William P. (2004): Canada needs better data for evidence-based policy: Inconsistencies between administrative and survey data on welfare dependence and education. In *Canadian Public Policy / Analyse de Politiques* 30 (3), pp. 241–255.

6   Appendix

8. Indicate all education/training you have completed in column a)… (tick all qualifications obtained) 9. … and in column b) enter the education or training in which you are currently engaged. (only one answer)	a) Education/training completed	b) Current education/ training
1 none	1 ☐	1 ☐
2 up to 7 years of compulsory education	2 ☐	2 ☐
3 compulsory education (lower secondary school, middle education, special needs school)	3 ☐	3 ☐
4 1-year preliminary course, 1-year general education school, 1-year vocational course, language school (at least 1 year) with certificate of completion, social work year, bridging courses or similar	4 ☐	4 ☐
5 2-3 years higher secondary general education not giving access to universities or similar	5 ☐	5 ☐
6 basic vocational education and training (2-4 year apprenticeship or full-time vocational school, commercial diploma, technical college, national vocational qualifications NVQ 1-3 or similar)	6 ☐	6 ☐
7 high school-leaving certificate giving access to universities (general baccalaureate) or similar	7 ☐	7 ☐
8 vocational baccalaureate	8 ☐	8 ☐
9 advanced technical and professional training (vocational associate's degree, national vocational qualifications NVQ 4), higher technical or commercial college or similar	9 ☐	9 ☐
10 advanced technical and professional training (i.e national vocational qualifications NVQ 5)	10 ☐	10 ☐
11 bachelor's degree (university, ETH/EPF, university of applied sciences, university of teacher education)	11 ☐	11 ☐
12 master's degree, licentiate, diploma, state examination, post-graduate degree (university, ETH/EPF, university of applied sciences, university of teacher education)	12 ☐	12 ☐
13 doctorate (Ph.D, Research), post-doctoral qualification (habilitation)	13 ☐	13 ☐

Figure A1: Question concerning educational qualifications of respondents (Structural Survey 2015)

28. What is the highest educational level completed by the person? (only one answer)	Only to be completed for persons aged 15 and older.	
1 none or up to 7 years of compulsory education	1 ☐	1 ☐
2 compulsory education (lower secondary school, middle education, special needs school), preliminary course or other bridging courses	2 ☐	2 ☐
3 basic vocational education and training (2-4 year apprenticeship or full-time vocational school, commercial diploma, technical college, national vocational qualifications NVQ 1-3 or similar)	3 ☐	3 ☐
4 higher secondary general education (high school-leaving certificate giving access to universities, general or vocational baccalaureate, higher secondary general education not giving access to universities or similar)	4 ☐	4 ☐
5 advanced technical and professional training (vocational associate's degree, national vocational qualifications (NVQ 4 or higher)), higher technical, commercial college or similar	5 ☐	5 ☐
6 university, ETH/EPF, university of teacher education, university of applied sciences, doctorate (Ph.D., Research)	6 ☐	6 ☐

Figure A2: Question concerning educational qualifications of household members (Structural Survey 2015)

Table A1: Crosstabulation of misreports of highest educational qualifications of respondents and their highest educational qualification

Error		Highest educational qualification								
		1	2	3	4	5	6	7	8	Total
No	Count	237	4855	3223	2210	762	2524	1853	258	15922
	Percent	79.5	83.5	88.6	91.5	94.3	89.3	93.0	98.1	88.2
Yes	Count	61	958	416	205	46	302	139	5	2132
	Percent	20.5	16.5	11.4	8.5	5.7	10.7	7.0	1.9	11.8
Total	Count	298	5813	3639	2415	808	2826	1992	263	18054
	Percent	100	100	100	100	100	100	100	100	100

$Chi^2 = 271.195$ (df=7), p<0.01, Cramer's V=0.123