

NEPS Technical Report for Weighting: Weighting the Sample of Kindergarten Children and Grade 1 Students of the National Educational Panel Study (Waves 1 to 4)

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Abstract

The National Educational Panel Study (NEPS) surveys a cohort sample of Kindergarten children (Starting Cohort 2, SC2) and follows them over their transition to elementary school and beyond. The data are released via corresponding Scientific Use Files (SUF). The actual SUF version is available under [DOI:10.5157/NEPS:SC2:4.0.0](https://doi.org/10.5157/NEPS:SC2:4.0.0). This paper gives details on the applied indirect sampling procedure, the derivation of design weights, their successive adjustments, and the derivation of panel weights. Sampling of Kindergartens was based on an indirect approach as a sampling frame for direct sampling was accessible neither for Kindergarten children nor for Kindergarten institutions. Starting with a sample of elementary schools, we received a list of Kindergartens that were supplying these elementary schools with first-grade students in school year 2009/2010. Kindergartens were then sampled from the listings provided by the elementary schools. In 2011, within the sampled Kindergartens all children together with their parents were asked for participation in the panel study. After correcting for institutional and individual unit nonresponse, each panel cohort member is assigned an adjusted design weight. Relying on these, cross-sectional and longitudinal weights are computed for the first two panel waves (with Wave 1 in 2011 and Wave 2 in 2012). In 2013, the cohort of Kindergarten children transitioned to elementary school. Children who transitioned to previously sampled schools were followed up within their institutional context together with their classmates who augment the cohort sample. Besides that, there are previously sampled schools no children transitioned to. Students within these schools also augment the cohort sample. Children who transitioned to other schools were tracked individually. By design, these children do not take part in the tests until Wave 6, when most of the children will be in Grade 4. Here, the entire sample will be surveyed and tested again. For all of groups of children attending in the survey, (nonresponse) adjusted design weights are provided. Furthermore, weights are given for subgroups of the panel cohorts that are of special interest in our analysis. This concerns particularly the group of children continually taking part in the successive waves of the survey (currently, Wave 1 to 4) and the group of children and parents participating jointly. Nonresponse models are estimated using probit regressions. The (observed) factors found to influence the participation probability are place of residence, native language, and special educational needs.

1. Introduction

This paper documents the sampling procedures and the derivation of sampling weights for the sample of Kindergarten children cohort (Starting Cohort 2, SC2) of the National Educational Panel Study (NEPS), see [DOI:10.5157/NEPS:SC2:4.0.0](https://doi.org/10.5157/NEPS:SC2:4.0.0) for the actual scientific use file (SUF).¹ The SC2 sample comprises Kindergarten children in the Waves 1 and 2, and Grade 1 students in Wave 3. The latter are again surveyed in Wave 4. Wave 1 was conducted in 2011, Wave 2 in 2012, Wave 3 in 2013, and Wave 4 in 2014. Table 1 documents the accordant study numbers, the sample sizes, and the number of participants, temporary as well as final dropouts. Access to the accordant population was gained via the institutions, that is, via the Kindergartens or the elementary schools. A detailed description of the related processing is given in Section 2. In the following, Kindergartens and elementary schools that agreed to participate in the NEPS are called NEPS Kindergartens or NEPS schools. Each Kindergarten and elementary school sampled by the NEPS was assigned a design weight to map its inclusion probability. Refusals and non-response on the level of institutions was compensated for by either replacing an institution or (if this was not possible) by weighting adjustments. To account for temporary dropouts on the level of individuals, nonresponse analyses are carried out. Replacement rules and nonresponse adjustments of weights are described in Section 3. Along the distinct panel waves, for all participating children cross-sectional and longitudinal weights are provided. Cross-sectional weights are assigned to children relying on their participation in the different panel waves. Longitudinal weights are provided for those children who have continually participated in the successive panel waves. As the information on children is enriched by interviewing one of their parents, additional weights are provided for the group of participating Kindergarten children for whom an interview with one parent was conducted. The remainder of this paper is structured as follows: Section 2 details the population definition, the sampling process and the grouping of the panel cohort induced by the transition to elementary school. Section 3 describes the sample-specific response propensity analyses applied to SC2. At this point, we also explore in detail the derivation of weights accounting for the joint participation of children and parents (up to Wave 3). Section 4 gives insights into the trimming procedure that was applied to the weights to increase the statistical efficiency of weighted analysis. Section 5 gives a summary of the provided sampling weights and design information. Finally, Section 6 concludes with some comments regarding the usage of sampling weights in data analysis.

2. Sampling

2.1 Population

The target population of the Wave 1 sample focuses on children attending Kindergartens in Germany in the school year of 2010/2011 who are expected to begin schooling in the school year of 2012/2013. These children are approximately at the age of four years, as children in Germany are obliged to start attending elementary school between the age of five to seven years, according to their date of birth. For more detailed descriptions of the target population, see Aßmann et al. (2011) and Berendes et al. (2011).

¹For general information on the NEPS, see Blossfeld, Roßbach, and von Maurice (2011).

Table 1: Participation status (*tx80220*) by wave

Wave	Time	Study number	Total	Participants	Dropouts	
					Temporary	Final
<i>Kindergarten children</i>						
			5,346	3,007	-	2,339
Wave 1	2011	A12	3,007	2,949	47	11
Wave 2	2012	A13	2,996	2,727	269	0
<i>Elementary school students</i>						
			19,205	6,918	-	12,287
Wave 3	2013	A14, A14A	9,337	6,733	2,604	0
Wave 4	2013	A15	9,331	6,337	2,968	32

Note: The number of students in elementary schools participating in the panel (6,918) differs from the corresponding number in the SUF (6,917), because one student withdrew his/her panel consent after Wave 5 and thus is not included in the SUF. The size of the panel cohort in Wave 3 is 9,337. This is 6,917 students with panel consent together with 2,996 Kindergarten children minus 576 Kindergarten children who transitioned from Kindergarten to elementary school.

2.2 The Sample of Kindergarten Children

For sampling Kindergarten children at the time of sampling, no frame information was available neither for Kindergarten children nor for Kindergarten institutions. An alternative way to gain information on Kindergartens are elementary schools. Structurally, Kindergartens and elementary schools are linked by children transferring from Kindergartens to elementary schools. This link can be used to get access to the population of Kindergarten children by using an indirect sampling approach as introduced by Lavallée (2007). Hence, a sample of elementary schools was established to access the Kindergarten population. The elementary schools were drawn using a systemic probability proportional to size sampling. In sum, 212 elementary schools agreed to provide information about their supplier Kindergartens.² From the provided list, Kindergartens were sampled by probability proportional to size sampling without replacement. Hence, the Kindergarten sample was established using a two-stage indirect sampling approach. Within the sampled Kindergartens all children were asked to participate in the survey in the school year 2010/2011. More detailed information is given in Steinhauer, Aßmann, Zinn, Goßmann, and Rässler (2015).

2.3 The Sample of Grade 1 Students and the Field of Individually Retracked

In order to establish a sample of Grade 1 students which is related to the sample of Kindergarten children the following two samples of elementary schools were asked for participation: first, all 212 elementary schools which had already provided information in 2010 about their supplier Kindergartens, and second an additional sample of 200 elementary schools.³ In total, 374 elementary schools agreed to participate in the NEPS. They constitute a gross sample of 19,205 students in Grade 1 in the school year 2012/2013. All students of the gross sample were

²More information on the schools providing access to Kindergartens can be found in the field reports (in German language) for studies A12 and A14. These are available in the documentation section on the [homepage](#).

³The latter additional sample (referring to study A14A) was drawn to reach the intended number of 6,000 Grade 1 students.

asked to participate in the survey and to provide their panel consent. In sum, 6,917 students provided panel consent and are planned to be followed through their time in elementary school and beyond.⁴ A small proportion of these students constitutes Kindergarten children who have already been surveyed in Wave 1 and 2 (in sum, 576 students). The remaining students form the augmentation sample of Wave 3. Of the sample with panel consent, 6,733 participated in the competence test and survey of Wave 3.⁵ Kindergarten children who did not pass to a NEPS school are assigned to the field of individual retracking. By design, they are not interviewed and tested until 2015 (Wave 6), when they are supposed to be in Grade 4. Accordingly, from Wave 3 up to Wave 5 they are defined as temporary dropouts. In total, 6,917 Grade 1 students are to be tested in Wave 3.⁴ In addition to the survey of the students, one of their parents is asked to provide (via a telephone interview) background and circumstantial information. The parent interview is also conducted for the children of the individual retracking field. That way, at least parental information on these students is available before they transition to lower secondary education.

2.4 Grouping of the Panel Cohort

Due to its composition the panel cohort of SC2 can be categorized into three groups:

- Group 1 The group of students tested in Grade 1 in elementary schools, who were not tested in Kindergarten institutions in Wave 1 and Wave 2. These (target) persons form the augmentation sample of Wave 3.
- Group 2 The group of Kindergarten children who were tested only in Kindergartens in Wave 1 and Wave 2. In Wave 3, they are assigned to the individual retracking field and are temporary dropouts by design until Wave 6.
- Group 3 The group of Kindergarten children, who were tested in Kindergartens in Wave 1 and Wave 2 and transition to elementary schools surveyed by NEPS in Wave 3. These (target) persons belong to the longitudinal sample of Waves 1, 2, and 3.

The groups 2 and 3 form the panel cohort of Kindergarten children in Wave 1 and Wave 2. Starting with Wave 3, the group of Kindergarten children passing to previously sampled elementary schools (Group 3) together with the group of elementary school students surveyed first in Wave 3 (Group 1) form the panel cohort of students in Grade 1 tested within their institutional context. The group of Kindergarten children who were only tested in Kindergartens in Wave 1 and Wave 2 (Group 2) are defined as temporary dropouts by design for Wave 3 up to Wave 5. All three groups will be surveyed and tested again in 2015, in Wave 6, when they are supposed to be students educated in Grade 4, regardless of being in the institutional context of an elementary school or not. Table 2 in Appendix A displays the progress of Kindergarten children and Grade 1 students in SC2.

⁴The according method reports documents 6,918 Grade 1 students in Wave 3. Because one student withdrew panel consent after Wave 5, he or she is not contained in the SUF.

⁵In detail, there were 4,375 students surveyed in study A14 and 2,358 students in study A14A.

3. Nonresponse Adjustments

3.1 Kindergarten Panel Cohort

The initial sample of elementary schools was established in order to access Kindergarten institutions. This sample reported a large and meaningful number of Kindergartens. Thus, here no compensation for refusal or nonparticipation had to take place. However, some of the sampled Kindergartens refused participation in the survey. To address this problem, for each sampled Kindergarten a set of replacement Kindergartens (reported from the same school) was determined. Replacement Kindergartens were defined that in comparison to the original Kindergarten they deliver the same or a very similar Kindergarten with an (almost) identical number of children.⁶ If the original Kindergarten refused participation or failed to give explicit consent within a defined time range, replacement Kindergartens were asked to participate.

To establish a sample of Kindergarten children, all corresponding parents are asked to provide consent for themselves and their children to participate in the survey. Thus, panel consent for Kindergarten children and parents is coupled. All children and corresponding parents that provided panel consent form the panel cohort sample. In sum, the panel cohort consists of 3,007 children and parents (of 5,346 initially sampled Kindergarten children). Of those, 11 consents were withdrawn during Wave 1, resulting in 2,996 cases. To address potential selectivity within the panel cohort sample at the level of children, a probit model regressing the panel-consent status (yes/no) on information available of sampled Kindergarten children was estimated. The set of variables available includes year of birth, gender, language spoken at home, residence, and occupational status of the parents. In addition, a Kindergarten-specific random effect was considered to allow for a potential correlation among children attending the same Kindergarten. The results suggest that children speaking German at home have a higher propensity to participate in the survey. Effects of the opposite direction were found for children with information missing concerning personal characteristics (i.e., gender and year of birth) and information missing concerning the child's environment (i.e., language spoken at home, residence status, and occupational status of parents). However, as the number of cases within these categories is low, effects of selectivity are not considered to be severe in the realized sample, see Steinhauer et al. (2015).

3.2 Calibration

To correct for sampling errors and undercoverage data from Official Statistics has been used for post-stratification. Concretely, raking (Deville, Särndal, & Sautory, 1993) had been applied to adjust the sampling weights to marginal (population) distributions of the number of Kindergarten children by Federal State, Gender, and German being the dominantly spoken language at home. The resulting (calibrated) weight w_{t_cal} is used as the basis for all succeeding wave-specific adjustments.

3.3 Kindergarten Children in Waves 1 and 2

From the panel cohort, 2,949 children participated in Wave 1. Nonresponse in Wave 1 occurring at the level of Kindergarten children has been adjusted for by means of response propensity models, see Table 3. The participation in Wave 1 is positively affected by living with both

⁶Such processing has been considered to be feasible because the Kindergartens listed by a single school are similar with respect to regional aspects.

parents. After Wave 1, 215 children left the NEPS Kindergartens, either because they entered elementary schools or they went to another Kindergarten. Of the remaining 2,781 children, 2,727 decided to participate in Wave 2. The only factor (positively) affecting the propensity of participating in Wave 2 is whether having already participated in Wave 1 or not. Table 4 presents the model estimating the joint participation propensities for students and parents. In Wave 1, living with both parents influences the child's participation propensity positively. No factors were found to significantly influence the parents participation decision in Wave 1. The child's as well as the parent's participation in Wave 2 is positively affected by the participation in Wave 1. The parent's participation propensity is further positively affected by having a child living with both parents as well as German being the language spoken at home. From these results, adjusted weights for Wave 1 and Wave 2 are achieved by multiplying the inverse of the predicted response propensities of the distinct models with the nonresponse adjusted design weights of the Kindergarten children. For previous versions of weighting adjustments, see Steinhauer, Zinn, and Aßmann (2016).

3.4 Elementary Schools, Panel Cohort

Ahead of Wave 3, a sample of 412 elementary schools was asked to participate in the NEPS (see Section 2.3). Each of these schools was assigned a set of replacement schools. The sampling of schools was based on implicit stratification according to Federal States, regional classification, and funding. Accordingly, each nonparticipating school was replaced by a school identical to the originally drawn one with regard to the values of the implicit stratification variables. Reasons for replacing schools were participation refusals and obstacles hindering trouble-free test runs (such as the school moves). Although replacement schools were defined, in some cases schools could not be replaced. Reasons for this were the closure of schools, schools without students of Grade 1, and fusions of two schools leading either to another school type or to two separate geographic locations with separate classes. In sum, 38 schools were affected by one of these circumstances. The design weights of the schools participating in NEPS were adjusted to account for this loss. Nonresponse adjustment of the design weights of students of Grade 1 has been conducted in three stages: (i) at the level of schools, (ii) at the level of all sampled students, (iii) at the level of students taking part in Wave 3. The nonresponse adjusted design weight for the school j in federal state h is defined as follows

$$w_{jh} = d_{jh} \cdot \frac{\sum_{j=1}^{m_h} d_{jh}}{\sum_{j=1}^{m_h^R} d_{jh}}, \quad (1)$$

where d_{jh} is the design weight of the school, m_h is the number of sampled schools in the federal state h , and m_h^R is the number of schools participating in the federal state h .

At the student level, the probability to give panel consent is modeled by means of a multilevel probit model with a random intercept at the school level. To explain students' participation willingness the following attributes are available: Federal State, gender, month and year of birth, nationality (German, other than German, missing), when the student started schooling (as expected, earlier, later), special educational needs (yes, no, unknown), and German as native language (yes, no, missing). Factors significantly influencing the probability to provide

panel consent are age group, beginning of schooling and the special educational needs. All of the predictors considered, have a positive effect on the willingness to participate in the panel study, except for a later timing in the beginning of schooling, see Table 5. Subsequently, δ_{ij} denotes the inverse of the predicted probability, for student i in school j , of being willing to participate in the panel. Then, the nonresponse adjusted design weight of students willing to participate in the panel cohort of Wave 3 is determined by

$$\omega_{ijh} = w_{jh} \cdot \delta_{ij}. \quad (2)$$

3.5 Students in Waves 3 and 4

As before, a multilevel probit model was used to estimate the individual participation propensities for students in Grade 1, that is, participants in Wave 3. The results are given in Table 3. Note that the place of residence and the participation status in Wave 1 is only available for Groups 2 and 3, since Group 1 participates in Wave 3 for the first time. Thus, in the Group 1 regression model accordant information could not be used. Apparently, the propensity of students of Group 1 who are willing to participate is significantly influenced by native language and special educational needs. Both factors have, compared to the reference category 'missing and unknown', a positive effect on the participation propensity in Wave 3. For Group 3, the joint participation propensities of students and parents, see Table 4, are positively influenced by the parents' participation in Wave 2. The participation propensity of Group 1 students is positively influenced by the native language (German as well as another language) and having special educational needs or not, compared to having missing information in these variables. In Group 1, parent's participation propensity is negatively influenced by having a child with a native language other than German. Opposed to this, it is positively influenced by having a child whose native language is German and by having a child without special educational needs. The residual correlation in the joint participation decisions is weakly positively correlated. The participation propensity in Wave 4 is analyzed separately for the Groups 1 and 3 using probit regressions. As in Wave 3, no factors significantly influencing the participation could be found for students in Group 3. In contrast, for Group 1 students the previous waves participation status is influencing the Wave 4 participation significantly, see Table 3. On the basis of the estimated (non)response models participation probabilities are predicted and used as adjustment factors to derive cross-sectional and longitudinal survey weights. The accordant processing is as described in Section 3.4.

4. Weight Trimming

To possibly increase the statistical efficiency of weighted analysis, the adjusted weights were trimmed. The general goal of weight trimming is to reduce sampling variance and, at the same time, to compensate for potential increase in bias. Trimming was performed using the so-called "Weight Distribution" approach (Potter, 1990). Here, design weights are assumed to follow an inverse beta distribution with a cumulative distribution function F_w . Parameters of the sampling weight distribution are estimated using the sampling weights, and a trimming level τ is computed whose occurrence probability is 1%, that is, $1 - F_w(\tau) = 0.01$. Sampling weights in excess of τ are trimmed to this level and the excess is distributed among the untrimmed weights. The parameters for the sampling weight distribution are then again estimated using

the trimmed adjusted weights, and a revised trimming level $\tilde{\tau}$ is computed. The trimmed adjusted weights are compared to the revised level $\tilde{\tau}$. If any weights are in excess of $\tilde{\tau}$, they are trimmed to this level, and the excess is distributed among the untrimmed weights. This procedure is iteratively repeated until no weights are in excess of a newly revised trimming level. To ease statistical analysis, the trimmed sampling weights are standardized with mean 1.

5. Summary of Weights

The NEPS provides various kinds of weights for Kindergarten children and elementary school students as part of SC2 together with design information. Table 6 lists the design information and the different weights provided by SUF release version [DOI:10.5157/NEPS:SC2:4.0.0](https://doi.org/10.5157/NEPS:SC2:4.0.0). In SC2, weights are provided in two distinct weighting files. One contains the information for Kindergarten children (Groups 2 and 3) and the other covers elementary school students (Groups 1 and 3). Besides individual/target (ID_t) and institutional (ID_i) identifiers, design information for the cohort is provided. This information covers the identifier of the groups defined in Section 2.4 and the number of the study in which the target persons were surveyed first for the entire cohort. Besides that, information on the implicit stratification variables at the school level are included for students in Grade 1.

Furthermore, nonresponse adjusted design weights on the institutional (w_i) and the individual (w_t) level are given for the entire cohort.⁷ Naturally, each of the 576 children being part of Group 3 (i.e., those children who passed from Kindergartens surveyed by NEPS to elementary schools surveyed by NEPS) are assigned survey weights and design information in both weighting files.

The weighting file for Kindergarten children further contains the cross-sectional weights for Wave 1 (w_{t1}) and Wave 2 (w_{t2}) as well as the longitudinal weights for a continuous participation in all successive waves (w_{t12} and w_{t123}). The cross-sectional as well as the longitudinal weights are also available for those Kindergarten children for whom an additional interview with one parent is available (w_{tp1} , w_{tp2} , w_{tp12} , and w_{tp123}).

The weighting file for elementary school students contains design information on the school level which is available from the sampling frame and covers the implicit stratification variables. These include Federal State ($stratum_imp2$), regional classification ($stratum_imp3$) and funding ($stratum_imp4$).⁷ The file also contains the cross-sectional weights for students participating in Wave 3 (w_{t3}) and Wave 4 (w_{t4}) as well as a longitudinal weight (w_{t34}) for this group as well as for students for whom an additional interview with one parent is available (w_{tp3}). All kinds of weights are provided in a trimmed and standardized form, that is, weights are standardized in such a way that their mean is 1.

6. Comments Regarding the Usage of Weights

No general recommendations are at hand concerning the usage of design and nonresponse adjusted weights. Whether and how weights should be used depends on the analysis considered. While the use of weights is recommended in descriptive analysis, there are no general results available on how to use nonresponse adjusted design weights in statistical inference, see Rohwer (2011) for a general discussion. The use of weights may possibly help to highlight

⁷The institutional weight as well as the implicit stratification variables belong to the institution and thus are equal for all cases within the institution.

important features of the analysis under consideration, not least serving as a robustness check for the analysis performed. Generally, models have to be tested for their dependence on the sampling design. Concretely, this means that the user has to ensure that the way of sampling has no or only a negligible effect on the model results or/and that the sampling design is considered in the model definition adequately. A general description of how to test and account for the sampling design is given in Snijders and Bosker (2012, pp. 216-246), for example. Two possible strategies exist to include weights in the analysis. First, in the model-based approach, all variables employed for constructing the weights are included as explanatory variables into the model under consideration. In the second (design-based) approach design information and weights are directly included into the model. As a guideline, we recommend the first strategy. Here, it is advised to include all of the variables found to have significant effects on the participation propensities in the Waves (studies) yielding the samples used should be included as covariates in the analysis model.

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Appendix

A. Tables

Table 2: Panel progress of Starting Cohort 2 by wave.

Wave	Group	Panel Cohort			Status at the end of the wave			
		Total size	Not used	Used sample	Participants	Temporary dropout	Final dropout (in wave)	Final dropout (after wave)
1	All	^a 3007	-	3007	2949	47	11	0
2	All	2996	^b 215	2781	2727	54	0	1
3	All	9337	2419	6918	6734	184	0	6
	1	^d 6342	-	6342	6177	165	0	2
	2	2419	2419	-	-	-	-	^c 4
	3	576	-	576	557	19	0	0
4	All	9331	2732	6599	6337	236	26	22
	1	6340	296	6044	5798	221	25	15
	2	2415	2415	-	-	-	-	1
	3	576	21	555	539	15	1	6

Notes: "-" does not apply. ^a Panel size in Wave 1 is larger than the number of cases in the SUF, because of 11 final dropouts after Wave 1 and before publication of the SUF. Thus these cases are not included. ^b Cases not used left the institution they were surveyed in. These cases are tracked individually and surveyed again in Wave 6, when they are supposed to be in Grade 4. In the SUF their status is temporary dropout. ^c Final dropout in Group 2 is not included in the SUF. Here these cases are labeled as temporary dropout. ^d This table contains one additional case in Group 1, who withdrew panel consent before publication of the SUF and thus is not included in the SUF.

Table 3: Models estimating the individual participation propensities for Kindergarten children in Wave 1, Wave 2, and students in Grade 1 in Wave 3 of SC2 used to derive adjustment factors for adjusted wave-specific cross-sectional and longitudinal weights

	Wave 1	Wave 2	Wave 3		Wave 4	
			Group 3	Group 1	Group 3	Group 1
(Intercept)	3.420*** (0.299)	3.061*** (0.380)	1.839*** (0.101)	0.014 (0.279)	1.898*** (0.108)	1.701*** (0.182)
Place of residence with both parents	0.378* (0.169)					
Participation in Wave 1		0.935** (0.330)				0.421* (0.177)
Participation in Wave 3						
yes						
no						
Native language						
German				1.258*** (0.146)		
Native language				1.389*** (0.181)		
other than German				1.502*** (0.277)		
Special educational needs				1.356*** (0.350)		
no						
yes						
Random intercept						
on the Kindergarten level	1.936	2.468				
on the school level				0.794		0.624
Sample size	2996	2781	576	6341	555	6043

Notes: Reference categories are: Place of residence (not with both parents), Participation in Wave 1 (no), Native language (missing), Special educational needs (unknown). To model individual participation, the `glmex` function with a probit link provided by `lme4` package (Bates, Maechler, & Bolker, 2012) in R (R Core Team, 2015) was used. ***, **, and * denote significance at the 0.1%, 1%, and 5% level, respectively. Standard errors are given in parentheses.

Table 4: Models estimating the joint participation propensities for students and parents in Wave 1, Wave 2, and Wave 3 of SC3 used to derive adjustment factors for adjusted wave-specific cross-sectional and longitudinal weights

	Wave 1		Wave 2		Wave 3		Group 1	
	Child	Parent	Child	Parent	Student	Parent	Student	Parent
(Intercept)	1.883*** (0.112)	0.776*** (0.026)	1.360*** (0.262)	-1.625*** (0.104)	1.839*** (0.101)	-0.345* (0.149)	0.305 (0.174)	0.304* (0.151)
Place of residence With both parents	0.348** (0.131)			0.519*** (0.075)				
Target participating in Wave 1 yes			0.731** (0.269)					
German spoken at home yes				0.683*** (0.075)				
Parent participating in Wave 1 yes				1.650*** (0.067)				
Parent participating in Wave 2 yes						1.446*** (0.165)		
Native language German							0.813*** (0.077)	0.246*** (0.055)
Native language other than German							0.933*** (0.116)	-0.194** (0.063)
Special educational needs no							1.056*** (0.172)	0.598*** (0.147)
Special educational needs yes							0.850*** (0.245)	0.062 (0.173)
Correlation ^a							0.138* (0.065)	
Sample size	2996		2781		576		6341	

Notes: Reference categories are: Place of residence (not with both parents), Target participating in Wave 1 (no), German spoken at home (no), Parent participating in Wave 1/2 (no), Native language (missing), Special educational needs (unknown). To model joint participation decisions, the `ze1.i.g` function with `bpr.obit` link provided by `Ze1.i.gChoice` package (Owen, Imai, Lau, & King, 2012) in R (R Core Team, 2015) was used.

^a Correlation parameter from the model output is transformed according to Honaker, Owen, Imai, Lau, and King (2013).

***, **, and * denote significance at the 0.1%, 1%, and 5% level, respectively. Standard errors are given in parentheses.

Table 5: Models estimating the individual propensities for Grade 1 students to participate in the panel study used to derive adjustment factors for adjusted design weights for the groups 1 and 3

	Initial sample Grade 1
(Intercept)	−3.955*** (0.265)
Age group older half	2.503*** (0.252)
Age group younger half	2.549*** (0.252)
Started schooling earlier	0.693*** (0.183)
Started schooling later	0.173 (0.181)
Started schooling regular	0.464** (0.175)
Special educational needs no	0.979*** (0.107)
Special educational needs yes	0.780*** (0.119)
Random intercept on the school level	0.562 (0.750)
Sample size	16,784 ^a

Notes: Reference categories are: Age group (missing), Started schooling (missing), Special educational needs (unknown). ^a Data was only delivered by school administrations for 16,784 students. The initial sample contained 19,205 cases. To model individual participation, the `glmer` function with a probit link provided by `lme4` package (Bates et al., 2012) in R (R Core Team, 2015) was used.

***, **, and * denote significance at the 0.1%, 1%, and 5% level, respectively. Standard errors are given in parentheses.

Table 6: Variables included in the weighting data for SC2 version 4.0.0 of the SUF

Variable	Applies to	Content
<i>Identifier</i>		
ID_t	all targets	Identifier for target person
ID_i	all targets	Identifier for the school the target person was initially sampled in
<i>Design information</i>		
tstud_st	all targets	Study number the target person was first surveyed in (A12, A14, A14A)
group	all targets	Grouping variable for children in Kindergarten and school context
stratum_imp2	schools	Implicit sampling stratum (Federal State the school is located in according to sampling frame)
stratum_imp3	schools	Implicit sampling stratum (regional classification according to sampling frame)
stratum_imp4	schools	Implicit sampling stratum (funding according to sampling frame)
<i>Weights referring to Kindergarten children (groups 2 and 3)</i>		
w_i	2,996 cases	Nonresponse adjusted design weight for Kindergarten
w_t	2,996 cases	Nonresponse adjusted design weight for target
w_t_cal	2,996 cases	Calibrated nonresponse adjusted design weight for target
w_t1	2,949 cases	Cross-sectional weight for targets participating in Wave 1
w_t2	2,727 cases	Cross-sectional weight for targets participating in Wave 2
w_tp1	2,309 cases	Cross-sectional weight for targets jointly participating with one parent in Wave 1
w_tp2	1,965 cases	Cross-sectional weight for targets jointly participating with one parent in Wave 2
w_t12	2,685 cases	Longitudinal weight for targets participating in Wave 1 and 2
w_t123	539 cases	Longitudinal weight for targets participating in Wave 1, 2, and 3
w_t1234	504 cases	Longitudinal weight for targets participating in Wave 1 up to Wave 4
w_tp12	1,804 cases	Longitudinal weight for targets jointly participating with one parent in Wave 1 and 2
w_tp123	388 cases	Longitudinal weight for targets jointly participating with one parent in Wave 1, 2, and 3
<i>Weights referring to elementary schools students (groups 1 and 3)</i>		
w_i	6,917	Nonresponse adjusted design weight for elementary school
w_t	6,917	Nonresponse adjusted design weight for target (Grade 1 student)
w_t3	6,733 cases	Cross-sectional weight for targets participating in Wave 3
w_t4	6,336 cases	Cross-sectional weight for targets participating in Wave 4
w_t34	6,185 cases	Longitudinal weight for targets participating in Wave 3 and 4
w_tp3	5,636 cases	Cross-sectional weight for targets jointly participating with one parent in Wave 3