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What Are We Weighting For?

On Sampling Strategies and Weighting Procedures applied for the Austrian GGS 2022/23

Norbert Neuwirth ▪ Lorenz Wurm

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Bundesministerium
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Das Generations and Gender Programme (GGP) ist ein internationales Erhebungsprogramm zur Erfassung der Hintergründe des demografischen Wandels in Europa. Die diesem Bericht zugrundeliegende Erhebungswelle des Generations and Gender Programme Austria 2023 wurde mit Mitteln des Bundesministeriums für Bildung, Wissenschaft und Forschung sowie des Bundeskanzleramtes, Sektion Familie und Jugend, gefördert.

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1 Executive Summary

This is a compact documentation of the weighting procedures applied for the Austrian GGS conducted 2022/23. First, this procedure followed the standard procedure as developed for all GGP-countries. Austria had identified potential biases regarding parity, household size and indicators of the family type. Therefore, Austria developed additional weighting criteria that were assembled within a raking procedure especially developed for these purposes.

The sample biases for the criteria controlled for could be dampened feasibly. Therefore, it is highly recommended to employ these weights for all statistical analysis of the Austrian GGS 2022/23.

Further survey waves of the GGS should have recalculated weights according to the procedures described in this documentation.

2 Introduction

Since 2002 the Generations and Gender Programme (GGP) is conducted in the participating countries. The GGP is a panel survey programme, where each fielded survey – the Generations and Gender Surveys (GGS) – is added to the international GGP-database. Finally, comparative analysis including all or selected parts of the participating countries is one of the final goals of the GGP. With this database, researchers get to the position to analyse the driving factors of fertility, family formation, persistence and separation within one compound dataset.

For this pooled analysis over several GGP-countries a common definition and calculation of weighting factors is essential. Therefore, a common weighting procedure has been developed. Since GGP round 2 this procedure is applied to all GGS-datasets from all countries, while in GGP round 1 country-specific weights had been developed.

In GGP round 1 (2008/09) Austria had applied quite profound weighting procedures. Anyway, deeper check-ups revealed remaining biases on important issues. First of all, the parity of the respondents showed a systematic bias. Therefore, the procedures for weighting the Austrian GGS-survey were modified. Having adapted these procedures, the sample's parity came considerably closer to the population numbers.

In 2022/23, the first survey wave of GGP round 2, the same question arose: will the standard weights, now applied for all GGP-countries in round 2, be sufficient for controlling for parity and additional demographic baseline-information? The deviance from the population distribution now showed different patterns compared to round 1, but some biases did persist. Therefore, additional weighting procedures controlling for parity, household size, and family form were induced.

Chapter 3 gives an overview on the criteria of the standards weights applied within the GGP. Chapter 4 depicts the extended criteria for weighting the Austrian GGS. All the additional weighting criteria are illustrated by tables showing the distribution within the population as well as within the sample and derives the initial weighting factors (IWF) from these distributions. Chapter 5 reflects some issues of the raking procedure applied. The code of the raking procedure can be found in the appendix.

3 Criteria for standard weights in GGS

The Generations and Gender Programme is guided via a common questionnaire that all participating countries are surveying. Practically, quite distinguishable approaches to fieldwork had and have to be taken by the GGP-countries.

First, the survey mode differs between countries. While some countries preferred computer assisted face to face interviews (CAPI), others focused on telephone interviews (CATI), some even sent a printed questionnaire to the respondents or executed paper-based face to face interviews (PAPI), others mainly offered web-based questionnaires (CAWI). Standardizing the survey mode would have implied that the mode with the least technical requirements would have been prescribed. Most countries offered a second alternative to their preferred mode. The mode was chosen in regard of the technical capability of the fielding institutes as well as in taking the technical endowments of the targeted households into account. Anyway, within GGP round 2 most countries employed some “push to web mode”, offering two modes but motivating the respondents to choose the cheaper CAWI mode. This push to web strategy worked quite perfectly in Austria: of the 8247 interviews contained in the data set, only 19 (!) were conducted via CATI. 8228 interviews (99.8%) were entered directly by the respondents via CAWI. Other countries had to survey considerable parts of their samples via alternative modes, personal or telephone interviews. Although the interviews can differ via the mode taken, the results are stored in combined data sets, distinguished by a mode-marker.

Second, the sampling procedures can differ between countries. While some countries had to rely on household registers with less information on the household members, others had access to national population registers, including the necessary information on the persons to be selected. In Austria, access to the Central Register of Residents (“Zentrales Melderegister”; ZMR) is granted for all surveys in the public interest. The ‘public interest’ has to be confirmed by a commission.

At least systematic disparities in survey sampling could be compensated to a limited extent by means of weighting. Nevertheless, it is essential to keep a constant eye on differences in survey modes as well. In addition to these two profound differences between the national GGS surveys, the survey mode as well survey sampling, there are numerous others. Ultimately, these differences should be made visible in the data sets and the meta-data and/or smoothed out using documented weighting procedures.

3.1 Weights in GGS Round#1

A uniform weighting procedure across all participating countries would therefore be desirable. Nevertheless, in GGS round 1 sampling as well as ex-post weighting procedures basically stayed in the responsibility of the leading institutes of the national GGS surveys – the so called National Focal Points (NFP). The NFPs should have known best, which sampling procedure can be applied within the respective country. Therefore, ex-post stratification[1] via weights has to be developed by the NFPs as well.

In Austria, both waves of GGS round 1 (2008/09 and 2012/13) were conducted by the national central statistics institute, Statistik Austria (STAT). In 2008, STAT already had access to the newly set up Central Register of Residents (ZMR). No other fielding agency had access to the ZMR then. With this register STAT already had developed sampling procedures for collecting respondents for the Austrian Microcensus, providing the survey items of the LFS (Labour Force Survey for Eurostat) and the national housing survey. Furthermore, the sample selection of the EU-SILC and many other international surveys became based on this register. Therefore, it was obvious to draw the GGS sample via the ZMR as well.

Not only the sampling procedure, also the ex-post weighting procedures were derived from the weighting routines applied in the Austrian Microcensus. This particular raking procedure focused on region, age, sex, migrational status, educational level, and household size. Large segments of deviances from the distribution from the real Austrian population could be compensated via these weighting criteria. However, a more detailed analysis by the Vienna Institute of Demography (VID) revealed that the first wave of the Austrian GGS Round 1 showed considerable biases in the parity of respondents.[2] VID, ÖIF and STAT therefore discussed the weighting procedures again. It was agreed to include the parity of women as an additional weighting criterion.

Austria thus delivered two weights in the GGS, round 1 survey wave 1: A sample weight[3] and the corresponding population weight[4] for the Austrian population aged 18 to 44. This weighting procedure was also used in the second survey wave. The age range now included all people aged 18 to 49. Here, however, some refreshers were added, primarily people aged 18 - 22. Different weighting procedures had to be calculated for refreshers and panel respondents. Finally, the aim was to create cross-sectional weights for all respondents in the second survey wave on the one hand and panel weights for the panel respondents on the other. Finally, Austria came up with four weights: a cross-sectional sample weight and its corresponding population weight as well as the panel weight plus it's projection to the population volume. So, refreshers did exhibit the cross-sectionals but showed missing values for the panel weights.

The international GGS file for round 1 included quite different kinds of weights provided by the GGP-countries. Some, like Austria, showed quite differentiated weights, others just applied

[1] Ex-post stratification corrects biases within a conducted sample. Ex-ante stratification tries to lower biases by constructing the sample itself.
[2] See Buber I. (2013a)
[3] Averaging on an expected value of 1.0
[4] Often referred as "frequency weight", adding up to the total population volume of persons aged 18-44 living in private households on Austrian national territory

comparably simple weighing criteria so that a compact number of possible values entered the weights item. Some even did not provide any ex-post weights. This had set limits to the comparability of the national datasets. Joint studies pooling groups of GGP-countries often were restricted to analysis without ex-post weights.

3.2 Weights in GGS Round#2

The second round of the Generations and Gender Programme (GGP) improved this situation considerably. The international GGP-consortium decided to develop a common weighting procedure applied for all GGP-countries in round 2.

3.2.1 Starting point: ESS-weights

Initially, one question dominated: Which weighting criteria can be provided by the participating countries in a comparable form? Is there some proven template for arranging and calculating these weights for each country? Members of the GGP-working group on weights quickly identified the weighting procedures developed within the European Social Survey (ESS) to be a suitable template.

Basically, three elements of the sampling process are important to take into account[5]:
1. Clustering and stratification
2. Selection probabilities
3. Selective response

Standard textbooks' sampling theory states that simple random sampling (SRS) is the most efficient way of sampling respondents for a survey, as the selection probability of each member of the population should be the same. However, for various reasons, the sampling design chosen may differ from SRS. Stratification is often used to make sure that respondents from different groups are well-represented in the sample. These strata should lead to smaller standard errors of estimates regarding the groups selected, but larger deviations within other groups. Clustering is often used for monetary reasons, where it seems inefficient to draw a random sample. The consequence of clustered sampling is that the selection probability differs between clusters. Moreover, many surveys using clustered samples face the fact that some clusters are employed to a high extent while others can even be left out completely. Especially surveys with sample-point based sampling, where respondents were taken from a couple of regions leaving out all other areas, face this fact[6]. These sample points should be selected regarding all possible sources of selection biases, but in most cases just a couple of characteristics are controlled for. Some control for municipality size, distribution in education level, income classes, age structure, but the number of controlling criteria stays quite limited. If these facts are not taken into account, the probability of an underestimation of the standard errors of population estimates could rise. Additional information at the respondent level on the strata and/or clusters can be used to take the sampling design features into account and arrive at more proper estimates of population characteristics and their standard errors.

[5] See Kaminska, Olena (2020)
[6] Sampling points are often applied in face to face interviews, where a representative couple of municipalities is selected in order to reduce commuting costs of the interviewers.

Given the importance of accounting for the sampling design and of accounting for selective non-response, the GGP hub decided the GGS should move towards the model employed by the European Social Survey (ESS). To do so, information on the survey design is needed, as well as information on the probability of inclusion in the sample and information on selective non-response.

3.2.2 The GGP-weighting criteria for all countries

ESS calculates post-stratification weights based on four items:

1. A: Age 1: [18:30], 2: [31:45], 3: [46:60][7],
2. S: Sex/Gender 1: male, 2: female,
3. E: Educational level 1: ISCED 0-2, 2: ISCED 3-4, 3: ISCED 5-8 and
4. R: Region (NUTS1) 1: Eastern, 2: Southern, 3: Western Austria.

In addition, the GGS also includes information on

5. M: Marital status 0: never ever married; 1: married at least once before[8].

In some countries population-level information on educational levels and marital status is hard to get. In those countries, post-stratification weights will only be based on variables for which sufficiently reliable population data are available.

In best of all cases, the respective GGP-country has access to register data that make it possible to cross-classify all five variables to the so called ASEMR-weighting-table[9]. This was the case for Austria, but many countries had to build up auxiliary tables with combinations like ASRE + ASRM or even ASR+SRE+ASM. Even some countries had no reliable information on one or more of the five variables mentioned above, so information had to be provided only on those variables for which such information was available. In that instance, weights were calculated based on the remaining.

As the GGS is based on persons, not on households, individual sampling weights are calculated, but no household sampling weights are derived. In some countries, where the samples were drawn from a household register, the intra-household sampling procedure should ensure a random-like sample draw within the household.

Nevertheless, although not identical, the countries' weighting procedures provided quite comparable outcomes.

3.2.3 On the adequacy of the standard weights

The large groups within every criterion and therefore the low number of values to be separated increased the probability that every combination has sufficient sample cases to calculate with. Nevertheless, this procedure, where ASEMR is calculated in full cross-classification, needs

[7] although the age range is limited to [18:59] by design, some respondents that entered the survey at the end of the fielding period had already turned 60.
[8] disregarding the actual marital status, so the respondent can be married, divorced or widowed
[9] ASEMR is a shortcut for Age * Sex * Educational level * Marital status * Region

108 cells[10] to be calculated and weighted for. The number of 108 separate weight values is comparatively high, but, given the cross-calculation from register data is technically feasible, the weighting procedure could be applied directly.

Given the case that some sets of combination of the weighting criteria have to be calculated from different data sources, as no data source provides the full combination of the items in question[11], an iterative weighting procedure has to be employed. In the literature, these procedures are known as "raking procedures".

4 Extended criteria for weighting the Austrian GGS

As mentioned above, Austria was in the position to calculate all 108 values for the combined cross-classification of all five ASEMR weighting criteria. This was made possible by the Austrian "Abgestimmte Erwerbsstatistik" (AES; reconciled employment statistics) that provides – alongside others – all five items on personal level. This database is updated on a yearly basis. As the Austrian weights were calculated by the Austrian National Focal Point (ÖIF) in May 2023, the most recent values were given for 2022.[12]

The question that had arisen in GGS round 1 came up again: Does the demographic parity influence the willingness to participate in a family survey? In addition: is this differential in responsiveness already compensated by the weighting criterion "marital status" or do we need additional weighting criteria? Can these additional weighting criteria be added to the cross-classification directly from the AES or has a raking procedure to be employed to implement this information from other data sources?

In short: Austria decided to employ extended weights. To do so, first the weights developed by the GGP hub, the ASEMR (age, sex, educational level, marital status, and region) were calculated as base module. In addition, three additional modules were added subsequently to the raking procedure.

4.1 Sample Selection

First a short note on the sampling procedure. Austria used a gross sample of 22,000 potential respondents. At least 6,600 were expected to be gained for complete interviews. To ensure that the heterogeneity of the collected sample corresponds to the population's diversity, Austria developed a sampling process consisting of three sample tranches with following gross sample sizes:

- Tranche#1 14.000 simple random sampling (SRS)
- Tranche#2 5.000 probability-proportional to size sampling (PPS) and
- Tranche#3 3.000 probability-proportional to size sampling (PPS).

10 3 (age) * 2 (gender) * 3 (education) * 2 (marital status) * 3 (region) = 108 combinations
11 like ASRE + ASRM or ASR+ASE+ASM
12 Later, data for 2023 just showed little shifts in the values calculated.

In tranche #1 more than 60 % of the gross sample were chosen via a simple random sampling (SRS). This tranche already generated broad response, some groups turned out to be slightly underrepresented while other groups already had reached their calculated final volume within the net sample's target size of 6,600.[13] Having collected the data from tranche#1[14] analysis showed some deviations regarding gender, age class and region type.

These deviations were used to calculate the composition of the gross sample of 5,000 drawn for tranche #2. The probability-proportional-to-size-sampling procedure (PPS) was designed to compensate the deviations of tranche#1 by selecting the gross-sample of tranche#2 via the inverse of the representativity shares of the net sample that came out in tranche#1.

$$\text{Proportional factors of the PPS} \coloneqq \frac{\frac{\mathrm{N}_{\text{population.group}}}{\mathrm{N}_{\text{population}}}}{\frac{\mathrm{n}_{\text{sample.group}}}{\mathrm{n}_{\text{sample}}}}$$

After fielding period for tranche#2 the new proportional factors for the PPS for tranche#3 (gross sample: 3,000) were calculated. Now gender, age class, regions type as well as migrational background[15] entered the calculation.

In the end we wanted to get off with at least 40% males, representative age structures and region types (urban, landside).[16] Finally, we had quite exactly 40% males in completed interviews (a higher share of men entered the survey, but we had more male breakups), age structure showed some deviances first – with T#2 and T#3 we dampened this effect. Region type did fit quite perfectly from the beginning, but migrational status showed increasing differences within the fielding period.

Although more than a third of the gross sample was selected by some kind of PPS, this procedure is not to be confused with a standard PPS, where fixed shares of the population or people from selected clusters are contacted to participate in the survey. The applied kind of PPS was developed to dampen the deviances that already had happened. Therefore, the Austrian team decided to solely employ ex-post-weighting.

4.2 Starting Point: Standard GGP-Weights

The ex-post weighting procedures started off with the ASEMR-weights according to the definition of the GGP Central Hub. The weights depicted in the following tables are initial weighting

13 According to the age structure within the Austrian population the final minimum volume of the 5-years age cohorts by gender layed between 360 to 440 persons.

14 some respondents from tranche#1 entered the survey later so they could not be regarded in computing the composition of tranche#2

15 Some information regarding the migrational background can also be derived from the ZMR

16 In GGP round 1 exactly 40 % of the sample consisted of males. This was a sample design decision that could be easily carried out conducting a CAPI survey. The change in survey mode to CAWI implied that these 40 % changed from a strict quota criterion to a minimum requirement. The 40 % quota was derived from the need of a higher sample size of females. Anyway, the gross sample in tranche#1 consisted of 50 % males.

factors (IWF)[17]. If they were applied alone, these IWF would be the weighting factors for the whole survey. In case of the ASEMR-weights, 108 different weighting values would be implemented.

Table 1: Summary of the initial weighting factors (IWF) of the GGS-standard weights

ASEMR	N	n	N.share	n.share	IWF
sum	5,076,689	8,247	100%	100%	1.203
min	2,879	2	0.1%	0.0%	0.464
max	170,753	349	3.4%	4.2%	3.225

Data source: Austrian reconciled employment statistics (AES 2022)

The detailed tables of IWF for the ASEMR procedure are depicted in the Appendix. Table 1 shows the summary of the respective values: Following the Austrian reconciled employment statistics (AES) we had about 5,076,700 inhabitants in 2022.[18] The smallest group within the ASEMR-combination contends about 2,900 persons[19] while the largest group[20] comprises about 170,800. The sample distribution behaves quite accordingly. The maximum initial weighting factor (IWF) for correcting the most underrepresented cell rises up to the value of 3.23 while the most overrepresented group has to be dampened by an IWF of 0.46. Over all 108 cells of the ASEMR-table the weighing factor averages around 1.2 indicating relatively more cells representing smaller populations have to be upweighted than cells with larger population have to be downsized. The overall average on the individuals' weights of course equals exactly 1.0.

Technically, just applying the IWF for the ASEMR criteria, the initial weighting factors (IWF) are in fact the final weighting factors, as no iterative raking for approximating the final weights is necessary. Adding additional weighting criteria, the raking procedure becomes relevant, as it has to approximate the final weight values from the IWF of all relevant weighing criteria activated.

4.3 Additional weighting criteria necessary

Although the ASEMR weight in fact dampened quite some deviances in the sample population, three additional combinations of weighing criteria had to be induced. Therefore, the number of possible weighting values increases significantly, as every product of all initial weighting factors (IWF) could be a possible outcome. Moreover, the raking procedure employed creates additional values within its approximation process. In principle, each weighting criterion in the survey should be sufficiently filled. The combined criteria in the ASEMR-weights already showed some cells with low occupancy, additional weighting criteria should represent broader parts of the population and the sample.

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17 The IWF is calculated exactly the same way the proportional factors of the PPS are.

18 This number comprises people in private households as well as about 53,000 institutionalized inhabitants, all aged 18-59.

19 Males in age group 1 (up to 30 yrs), tertiary education completed, at least once married, living in southern Austria

20 Females in the highest age group (46-59) with completed secondary education, at least once married from eastern Austria.

4.3.1 Household size

First, the simplest criterion is the household size. This criterion does not need to be controlled for gender or age. Although the survey addresses to individual persons, the size of the households these persons are living in stays a necessary additional criterion for the complete weighting procedure.

Table 2: Initial weighting factors (IWF) for household size

HH size	N	n	N.share	n.share	IWF
1	814 391	1 632	16.2%	19.8%	**0.8192**
2	1 242 372	2 300	24.7%	27.9%	**0.8867**
3	1 179 342	1 712	23.5%	20.8%	**1.1309**
4	1 113 130	1 736	22.2%	21.1%	**1.0526**
5+	674 476	867	13.4%	10.5%	**1.2771**
sum	**5 023 711**	**8 247**	**100%**	**100%**	**1.0333**
min	**674 476**	**867**	**13.4%**	**10.5%**	**0.8192**
max	**1 242 372**	**2 300**	**24.7%**	**27.9%**	**1.2771**

Data source: Austrian Microcensus (MZ 2022)

This weighting criterion does not need additional differentiation for gender or age, as family related weighting criteria below will sufficiently control for age and gender effects. As the database for this indicator, the Austrian Microcensus 2022, focuses on persons in private households, institutionalized persons are not included. Although the Austrian Microcensus is a survey itself, sampling up to 1% of the Austrian households per year, it is quite exceptional compared to all other surveys: respondents may not refuse to participate. Therefore, the Austrian Microcensus shows robust results in nearly all items surveyed.

The IWF values for household type indicate that persons in smaller households are marginally overrepresented so the weights should dampen their number. The number of persons living in households with at least three inhabitants should be increased to some extent.

4.3.2 The role within the family

Second, the role of the respondents within their family is a crucial weighting criterion, especially for a family survey. Again, the database for this indicator is the Austrian Microcensus 2002. As the role in the family shows considerable differences by gender, especially in case of single parents, the weights are calculated for males and females separately. Men still living at their parents' place as well as male single parents showed highest weighting requirements.

Table 3: Initial weighting factors (IWF) for role in family

	Role in family	SF	N	n	N.share	n.share	IWF
males	Child of …	10	469 933	311	9.35%	3.77%	**2.4805**
males	Single	11	588 131	852	11.71%	10.33%	**1.1332**
males	Single parent	12	28 355	129	0.56%	1.56%	**0.3608**
males	Partner/spouse with children	13	978 217	1 265	19.47%	15.34%	**1.2695**
males	Partner/spouse no kids	14	464 862	807	9.25%	9.79%	**0.9456**
females	Child of …	20	310 621	379	6.18%	4.60%	**1.3454**
females	Single	21	416 614	1 011	8.29%	12.26%	**0.6765**
females	Single parent	22	178 567	424	3.55%	5.14%	**0.6914**
females	Partner/spouse with children	23	1 050 634	1 938	20.91%	23.50%	**0.8900**
females	Partner/spouse no kids	24	537 776	1 131	10.70%	13.71%	**0.7806**
		sum	**5 023 710**	**8 247**	**100%**	**100%**	**1.06**
		min	**28 355**	**129**	**0.56%**	**1.56%**	**0.3608**
		max	**1 050 634**	**1 938**	**20.91%**	**23.5%**	**2.4805**

Data source: Austrian Microcensus (MZ 2022); SF: controlled for sex & family role

Anyway, including gender to the combined weighting criterion, females tend to be down-weighted as men are upweighted, as approximately just 40% of the respondents were males.

4.3.3 Parity / number of coresident children

Finally, the driving motivation for extending the standard weighting procedure in GGS.at round 1 was the differences in parity numbers for females. This round, parities for females by age cohort were implemented again. On males' side, the number of coresident children within the household had to be taken as substitute, as parity numbers for men are not completely available and presumably will never be. Therefore, two different data sources for men and women had to be engaged: the Human Fertility Database run by the Vienna Institute for Demography (VID) for women's parity and the Austrian Microcensus for number of children[21] within the household from the men's view. Finally, it makes sense to develop a structurally uniform weighting table for men and women, even if the information on the population structure in this case arrives from different databases.

[21] Within the Microcensus men are identified as "father" from each child's perspective. This can be a biological father, stepfather or even a foster relationship. These relations were mirrored within the GGS.

Table 4: Initial weighting factors (IWF) for males by age and number of coresident children

S		A	P	SAP	N	n	N.share	n.share	IWF
males	1	18-29	0 kids	110	592 644	831	23.4%	24.7%	**0.9485**
			1 kid	111	24 345	41	1.0%	1.2%	**0.7897**
			2 kids	112	12 535	20	0.5%	0.6%	**0.8335**
			3+ kids	113	2 818	4	0.1%	0.1%	**0.9369**
	2	30-34	0 kids	120	201 085	280	7.9%	8.3%	**0.9551**
			1 kid	121	55 261	84	2.2%	2.5%	**0.8749**
			2 kids	122	43 966	61	1.7%	1.8%	**0.9585**
			3+ kids	123	16 022	22	0.6%	0.7%	**0.9685**
	3	35-39	0 kids	130	149 516	189	5.9%	5.6%	**1.0521**
			1 kid	131	55 996	81	2.2%	2.4%	**0.9194**
			2 kids	132	71 739	125	2.8%	3.7%	**0.7633**
			3+ kids	133	31 658	26	1.3%	0.8%	**1.6193**
	4	40-44	0 kids	140	107 053	122	4.2%	3.6%	**1.1670**
			1 kid	141	55 689	70	2.2%	2.1%	**1.0580**
			2 kids	142	88 771	134	3.5%	4.0%	**0.8810**
			3+ kids	143	44 117	44	1.7%	1.3%	**1.3334**
	5	45-49	0 kids	150	107 114	120	4.2%	3.6%	**1.1871**
			1 kid	151	55 840	86	2.2%	2.6%	**0.8635**
			2 kids	152	85 443	146	3.4%	4.3%	**0.7783**
			3+ kids	153	40 901	38	1.6%	1.1%	**1.4314**
	6	50-59	0 kids	160	365 514	428	14.5%	12.7%	**1.1357**
			1 kid	161	165 682	185	6.6%	5.5%	**1.1910**
			2 kids	162	115 847	172	4.6%	5.1%	**0.8957**
			3+ kids	163	39 940	55	1.6%	1.6%	**0.9658**
				sum	**2 529 496**	**3 364**	**100%**	**100%**	**1.0212**
				min	**2 818**	**4**	**0.1%**	**0.1%**	**0.7633**
				max	**592 644**	**831**	**23.4%**	**24,7%**	**1.6193**

Data source: Austrian Microcensus (2022); SAP: controlled for sex, age and parity (for males: number of children within the household)

Especially the weights on parity (for females) or number of children within the household (for males) should be finely structured. On the one hand, it is important to accurately reflect the population structure by number of children, and on the other hand to refine the existing, still rather rough age differentiation of the ASEMR weight component. A number of simulations were carried out for this purpose. Basically, 5-year age cohorts were applied. Again, it was confirmed that the desired differentiation in the number of children (0–3+ children) is still too rare for the youngest age cohort at higher parities. Even in the highest age cohort a higher number of children within the household – as calculated for men – becomes rare again, as most adult children have moved out before. Therefore, the age brackets of the youngest age cohort had to be widened to 18–29 while the highest two cohorts also had to be pooled to the age range 50–59.

Table 5: Initial weighting factors (IWF) for females' parity by age

S		A	P	SAP	N	n	N.share	n.share	IWF
females	1	18-29	0 kids	210	515 203	1 074	20.54%	21.99%	**0.934**
			1 kid	211	60 526	105	2.41%	2.15%	**1.122**
			2 kids	212	30 112	46	1.20%	0.94%	**1.275**
			3+ kids	213	8 164	10	0.33%	0.20%	**1.590**
	2	30-34	0 kids	220	133 319	300	5.32%	6.14%	**0.865**
			1 kid	221	74 712	129	2.98%	2.64%	**1.128**
			2 kids	222	70 358	116	2.81%	2.38%	**1.181**
			3+ kids	223	25 206	36	1.01%	0.74%	**1.363**
	3	35-39	0 kids	230	80 444	187	3.21%	3.83%	**0.838**
			1 kid	231	73 754	140	2.94%	2.87%	**1.026**
			2 kids	232	104 806	207	4.18%	4.24%	**0.986**
			3+ kids	233	44 857	86	1.79%	1.76%	**1.016**
	4	40-44	0 kids	240	58 685	144	2.34%	2.95%	**0.793**
			1 kid	241	67 249	123	2.68%	2.52%	**1.064**
			2 kids	242	111 178	216	4.43%	4.42%	**1.002**
			3+ kids	243	53 257	80	2.12%	1.64%	**1.296**
	5	45-49	0 kids	250	56 092	140	2.24%	2.87%	**0.780**
			1 kid	251	69 087	146	2.75%	2.99%	**0.921**
			2 kids	252	115 518	230	4.61%	4.71%	**0.978**
			3+ kids	253	58 021	102	2.31%	2.09%	**1.108**
	6	50-59	0 kids	260	122 773	307	4.90%	6.29%	**0.779**
			1 kid	261	165 134	271	6.58%	5.55%	**1.186**
			2 kids	262	272 073	477	10.85%	9.77%	**1.111**
			3+ kids	263	137 445	211	5.48%	4.32%	**1.268**
				sum	**2 507 973**	**4 883**	**100%**	**100%**	**1.0670**
				min	**8 164**	**10**	**0.33%**	**0.20%**	**0.7786**
				max	**515 203**	**1 074**	**0.54%**	**21.99%**	**1.5896**

Data source: Human Fertility Database (HFD); SAP: controlled for sex, age and parity

In contrast to the ASEMR-weights or the IWF controlling for the role within the family the combined weighting criterion SAP (sex, age, partity) shows less variances. This holds true for men as well as for women. Therefore, we could assume that higher parities do not bear the risk of overrepresentation like they did in GGP.at round 1. At least in case of women, the opposite seems to have emerged now: childless women of all age classes seemed to be overrepresented and therefore had to be dampened by the parity-specific IWF, while the majority of mothers had to be weighted up slightly. For men, there is probably a less clear dependency on the number of dependent children in the household.

This result seemed quite astonishing. In GGP.at round 1, mothers were more willing to participate in the survey. Obviously, the survey mode (CAPI in GGP round 1; CAWI in this round) had a deep impact on the participation selection. Without this weighting criterion even lower parity levels and therefore lower estimated total fertility intentions (existing children plus intended) would be expected.

4.4 Additional extensions on their way?

The weighting criteria presented above cover wide areas of possible and identified sample biases. The GGS, a survey on family dynamics – partnership formation, fertility intentions, family life, separation and possible rematching – focuses on the family-related items. Therefore, these areas have to be handled with high emphasis regarding data quality as well as possible sample biases.

4.4.1 Extensions for special scopes

But the issues of family dynamics are not the only scope of interest that can be covered by the GGS. Some issues to be investigated could raise the need of more specialized weights. As the raking procedure applied is characterized by its modular design, it could still be possible to add specific weighing criteria to the process, like the Austrian team had added its additional weighting criteria to the standard ASEMR-weights applied to all GGP countries.

For instance, weights on labour force participation, migrational status, more specified regional characteristics, or income levels could be added. Anyway, these extensions can come in from different databases. The only point: the definitions on the respective items have to harmonize with the definitions of the external data source.

4.4.2 Raising up panel weights

Later, having fielded GGS.at round 2 wave 2, panel weights will have to be calculated. These procedures could include some estimates of the survival probability or – vice versa – the risk of attrition of predefined or empirically identified high-risk-groups.

Basically, panel weights should compensate for the within-group attrition by weighting up the survivors accordingly. In addition, shifts in the population groups have to be regarded. Significant shifts are not to be expected within the weighting criteria applied, possible extensions of the weighting scheme, like additional weighting criteria on labour market issues, migrational status or income distribution could be more vulnerable.

5 The raking procedures assembling final weights

Raking procedures were developed to extend the capabilities of simple weighting procedures that refer solely to a limited number of cells from exactly one data source. With raking procedures the weights can be adjusted in several iterations until the closest approximation value to different tables from one or more data sources can be found.

As some GGP-countries face the situation that they cannot provide the information for the ASEMR-weights from one data source, combinations of population tables have to be calculated and the weights will have to be adapted via iterative raking. This was not the case for Austria, where the complete ASEMR-table was drawn from the Austrian reconciled employment statistics (AER, “Abgestimmte Erwerbsstatistik”). As described above, necessary further data sources on family structures, household size and parities had to be implemented from other data corpses. Therefore, a Stata-routine was developed that combines the population data tables depicted above.

The complete Stata-routine, based on the” ipfraking” package[22], is attached in the appendix. A couple of elements should be discussed in detail:

As described above, the international GGP working group on weights decided to take large age ranges, so that just three age groups were to be defined. NUTS1 regions were chosen to control for regional disparities. The educational levels, derived from the 8-points ISCED-scale, were aggregated to three groups. Marital status just showed two values, ever or never married. Gender stays with two. This grouping seems to be quite crude, but, as all possible combinations should be covered well by the survey data, no further differentiation would have been appropriate.

Some imputations to the items for the ASEMR-weight had to be implemented. A couple of respondents chose “diverse” for their sex. The gender-information from the register data were taken to assign them to one of the two standard values. Quite some respondents did not categorize themselves to an ISCED-value for their educational level. From other surveys we know that assigning to a standardized ISCED-value does not feel appropriate for some persons. These respondents often had undergone some company-based training that did not dissolve in a formal apprenticeship certificate. Quite some have no other secondary education completed, so formally they still belong to ISCED level 2. For that reason, missing values for educational levels were substituted by ISCED 0-2. For some respondents with missing values for education this might not be appropriate, but assigning a valid value for education keeps them in the weighting procedure.

In contrast to the ASEMR-weight, the additional weighting criteria did not need any imputations. Nevertheless, one survey variable, the item [numbiol] “number of biological children” that was automatically produced by an iteration counter, did not always produce correct results. Some respondents denied the counted sum of children and corrected the information afterwards [LHI21]. Anyway, this did not affect the total weighting scheme too much.

22 see Kolinikov (2014)

Although this weighting scheme has grown to a comparably complex model, the raking procedures worked quite well. This is partly due to the fact that the cutoff-limit was set quite high: Weighting factors exceeding the value of 5.0 or dropping below it's inverse (0.2) were set to this maximum or minimum value and the next iteration recalculated this weighting factor. It took just 12 iterations until the final convergence criteria were met.

6 Summary and outlook

The Generations and Gender Programme (GGP) consists of several survey waves. In each wave several countries participated and contributed their respective Generations and Gender Surveys (GGS). Within the latest round, GGP round 2, all GGS surveys were weighted to a harmonized weighting scheme. This improved the data quality of the GGP considerably. Nevertheless, some important weighting criteria were not included in this weighting scheme. As already found in the first wave of the Austrian GGP round 1 in 2008/09, additional weighting for parity is essential for generating survey data unbiased for the most important characteristics in a survey programme on demographic issues.

For the Austrian GGS-survey conducted in 2022/23 the parity and additional weighting criteria were added to the standard weighting scheme. With this documentation the initial impacts of all weights criteria are illustrated. Looking on the initial weighting factors (IWF) of these criteria it can easily be seen that including these weighting factors narrow the composition of the survey sample to the real Austrian population considerably. All weighting criteria illustrated were assembled by a raking procedure especially designed for this purpose.

Given a follow-up survey of the GGP will be held in Austria, the procedures described could be applied again. Even extensions could be calculated, for the GGS conducted in 2022/23 as well as for future surveys.

7 Literature

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8 APPENDIX

8.1 ASEMR.1 – age class = 1 (18-30)

ASEMR	N	n	N.share	n.share	IWF
11101	66 885	63	1.317%	0.764%	1.725
11102	24 913	24	0.491%	0.291%	1.686
11103	51 201	49	1.009%	0.594%	1.697
11111	11 295	6	0.222%	0.073%	3.058
11112	3 401	2	0.067%	0.024%	2.762
11113	8 954	8	0.176%	0.097%	1.818
11201	136 986	272	2.698%	3.298%	0.818
11202	67 482	100	1.329%	1.213%	1.096
11203	126 120	193	2.484%	2.340%	1.062
11211	16 903	17	0.333%	0.206%	1.615
11212	5 842	10	0.115%	0.121%	0.949
11213	13 441	22	0.265%	0.267%	0.992
11301	77 807	99	1.533%	1.200%	1.277
11302	33 823	34	0.666%	0.412%	1.616
11303	56 500	61	1.113%	0.740%	1.505
11311	8 164	8	0.161%	0.097%	1.658
11312	2 879	7	0.057%	0.085%	0.668
11313	5 279	10	0.104%	0.121%	0.858
12101	38 795	72	0.764%	0.873%	0.875
12102	14 675	17	0.289%	0.206%	1.402
12103	28 572	45	0.563%	0.546%	1.031
12111	17 165	17	0.338%	0.206%	1.640
12112	5 182	5	0.102%	0.061%	1.684
12113	12 580	7	0.248%	0.085%	2.919
12201	115 923	310	2.283%	3.759%	0.607
12202	54 363	139	1.071%	1.685%	0.635
12203	101 135	270	1.992%	3.274%	0.608
12211	25 210	35	0.497%	0.424%	1.170
12212	9 050	22	0.178%	0.267%	0.668
12213	22 017	36	0.434%	0.437%	0.994
12301	95 248	167	1.876%	2.025%	0.927
12302	38 417	63	0.757%	0.764%	0.991
12303	68 772	86	1.355%	1.043%	1.299
12311	16 445	36	0.324%	0.437%	0.742
12312	5 800	13	0.114%	0.158%	0.725
12313	11 158	22	0.220%	0.267%	0.824

8.2 ASEMR.2 – age class = 2 (31-45)

ASEMR	N	n	N.share	n.share	IWF
21101	25 584	42	0.504%	0.509%	0.990
21102	10 801	16	0.213%	0.194%	1.097
21103	20 480	23	0.403%	0.279%	1.446
21111	49 033	31	0.966%	0.376%	2.569
21112	13 896	7	0.274%	0.085%	3.225
21113	34 705	23	0.684%	0.279%	2.451
21201	82 107	105	1.617%	1.273%	1.270
21202	47 127	76	0.928%	0.922%	1.007
21203	78 307	98	1.542%	1.188%	1.298
21211	97 734	148	1.925%	1.795%	1.073
21212	43 872	67	0.864%	0.812%	1.064
21213	85 799	115	1.690%	1.394%	1.212
21301	70 937	95	1.397%	1.152%	1.213
21302	29 452	39	0.580%	0.473%	1.227
21303	47 326	76	0.932%	0.922%	1.012
21311	77 447	124	1.526%	1.504%	1.015
21312	30 109	42	0.593%	0.509%	1.165
21313	56 430	88	1.112%	1.067%	1.042
22101	15 218	45	0.300%	0.546%	0.549
22102	7 826	18	0.154%	0.218%	0.706
22103	12 389	23	0.244%	0.279%	0.875
22111	58 776	47	1.158%	0.570%	2.032
22112	19 276	15	0.380%	0.182%	2.088
22113	42 438	29	0.836%	0.352%	2.377
22201	51 425	126	1.013%	1.528%	0.663
22202	30 171	78	0.594%	0.946%	0.628
22203	52 484	127	1.034%	1.540%	0.671
22211	103 788	239	2.044%	2.898%	0.705
22212	48 512	111	0.956%	1.346%	0.710
22213	98 142	224	1.933%	2.716%	0.712
22301	71 937	161	1.417%	1.952%	0.726
22302	27 370	50	0.539%	0.606%	0.889
22303	43 401	77	0.855%	0.934%	0.916
22311	99 656	199	1.963%	2.413%	0.814
22312	37 255	62	0.734%	0.752%	0.976
22313	65 688	126	1.294%	1.528%	0.847

8.3 ASEMR.3 – age class = 3 (46-60)

ASEMR	N	n	N.share	n.share	IWF
31101	10 915	26	0.215%	0.315%	0.682
31102	6 132	9	0.121%	0.109%	1.107
31103	11 269	15	0.222%	0.182%	1.220
31111	48 776	45	0.961%	0.546%	1.761
31112	14 541	23	0.286%	0.279%	1.027
31113	37 319	44	0.735%	0.534%	1.378
31201	46 595	58	0.918%	0.703%	1.305
31202	30 813	34	0.607%	0.412%	1.472
31203	43 701	54	0.861%	0.655%	1.315
31211	169 851	198	3.346%	2.401%	1.394
31212	90 777	105	1.788%	1.273%	1.404
31213	149 910	189	2.953%	2.292%	1.288
31301	28 555	42	0.562%	0.509%	1.104
31302	11 820	16	0.233%	0.194%	1.200
31303	19 351	24	0.381%	0.291%	1.310
31311	102 716	109	2.023%	1.322%	1.531
31312	41 765	46	0.823%	0.558%	1.475
31313	78 223	127	1.541%	1.540%	1.001
32101	9 715	34	0.191%	0.412%	0.464
32102	6 569	14	0.129%	0.170%	0.762
32103	10 411	16	0.205%	0.194%	1.057
32111	85 392	80	1.682%	0.970%	1.734
32112	35 600	37	0.701%	0.449%	1.563
32113	72 724	70	1.433%	0.849%	1.688
32201	28 004	93	0.552%	1.128%	0.489
32202	17 395	46	0.343%	0.558%	0.614
32203	27 800	71	0.548%	0.861%	0.636
32211	170 753	349	3.363%	4.232%	0.795
32212	89 688	165	1.767%	2.001%	0.883
32213	156 809	308	3.089%	3.735%	0.827
32301	25 972	56	0.512%	0.679%	0.753
32302	9 637	17	0.190%	0.206%	0.921
32303	15 020	18	0.296%	0.218%	1.356
32311	92 751	216	1.827%	2.619%	0.698
32312	36 271	60	0.714%	0.728%	0.982
32313	57 869	114	1.140%	1.382%	0.825

8.4 STATA code for raking procedures of Austrian weights.

```
*** GGP.at ***
* Weights *
* weights : Lorenz Wurm ; Norbert Neuwirth *
* Daten --> GGPat -sip -w7.dta
* --set cd here --
*use "[...]¥ GGPat_sip -w7.dta"
* **********************************
* * 1. Prepare Dataset for weights
* **********************************
* Out of Age range
drop if age ==.
* **********************************
* Region ( NUTS 1)
* **********************************
gen region =.
cap lab var region " NUTS 1"
replace region = 1 if dem04c == 1 | dem04c == 3 | dem04c == 9
// NUTS 1: East - Austria
replace region = 2 if dem04c == 2 | dem04c == 6 // NUTS 1:
South - Austria
replace region = 3 if dem04c == 4 | dem04c == 5 | dem04c == 7
| dem04c == 8 // NUTS 1: West - Austria
replace region = 1 if respid == " A00B48N72 "  /*[...]*/
/* about 135 respondents did not enter the federal state they are living in.
For these respondents the NUTS1 had to be derived from the
address register */
drop if region ==. // 3 obs , that did not finish
* **********************************
* Marital status ( ever married )
* **********************************
egen GGPat_marstat_w = anycount ( dem28a lhi05a_ *), v (1)
recode GGPat_marstat_w (0=0) (1/4=1)
replace GGPat_marstat_w = 1 if respid == " A13G09W77 "
cap lab var GGPat_marstat_w " Marital status ( ever married )"
* **********************************
* Education Level
* **********************************
recode dem07 (0/2 =1) (3/4 = 2) (5/8 = 3) , gen( educ )
replace educ = 1 if educ == .
replace educ = 1 if educ == .a
replace educ = 1 if educ == .b
cap lab var educ " Education Level "
* ****************************
* GGPat_sex_w
* ****************************
```

```
gen GGPat_sex_w = asex
cap lab var GGPat_sex_w " GGPat_sex_w , taken from
registerdata "
* fixing diversees with entries from registerdata
replace GGPat_sex_w = 2 if respid == " A06P15X87 "  /*[...]*/
/*  24 respondents reported "diverse" for gender.
As this group is not represented sufficiently in the register data
(most diversees were reported as males or females when registering)
the gender was "set back" to its initial value within the register data  */
* **********************************
* Household Size
* **********************************
gen GGPat_hhsize_w = hhsize
replace GGPat_hhsize_w = 5 if GGPat_hhsize_w >5
cap lab var GGPat_hhsize_w " Household Size "
* **********************************
* Role in Family
* **********************************
* Child of ... 0
* Single ... 1
* Single parents ... 2
* Partner / spouse with children ... 3
* Partner / spouse without childen ... 4

gen famrole =.
cap lab var famrole " Role in Family "
forval i = 1/20 {
replace famrole = 0 if famrole == . & hhd04_ 'i' == 7
replace famrole = 0 if famrole == . & hhd04_ 'i' == 8
}
replace famrole = 3 if corespartner == 1 & coreskids > 0
replace famrole = 4 if corespartner == 1 & coreskids == 0
replace famrole = 2 if corespartner == 0 & coreskids > 0
replace famrole = 1 if corespartner == 0 & coreskids == 0 & hhsize == 1
replace famrole = 1 if corespartner == 0 & coreskids == 0 & hhsize > 0 & famrole != 0
* **********************************
* Agegroups (6. Categories )
* **********************************
generate agegroup = age
recode agegroup (18/29=1) (30/34=2) (35/39=3) (40/44=4) (45/49=5) (50/59=6)
cap lab var agegroup " Agegroups (6. Categories )"
* **********************************
* Age (3. Categories )
* **********************************
gen GGPat_age_w = age
recode GGPat_age_w (18/30=1) (31/45=2) (46/60=3)
cap lab var GGPat_age_w "Age (3. Categories )"
```

```
* **********************************
* Parity proportion
* **********************************
* Female : number of biological children ( numbiol )
* Male : coresident children ( coreskids )
* number of total children 0 ,1 ,2 ,3+
gen GGPat_numbiol_w = numbiol
cap lab var GGPat_numbiol_w " number of biological children "
replace GGPat_numbiol_w = 3 if GGPat_numbiol_w >= 3 // PF
worksheet in excel
* number of coresident children 0 ,1 ,2 ,3+
gen GGPat_coreskids_w = coreskids
cap lab var GGPat_coreskids_w " number of coresident children
"
replace GGPat_coreskids_w = 3 if GGPat_coreskids_w >= 3
gen GGPat_parity_w =.
cap lab var GGPat_parity_w " Parity proportion "
replace GGPat_parity_w = GGPat_coreskids_w if GGPat_sex_w == 1
replace GGPat_parity_w = GGPat_numbiol_w if GGPat_sex_w == 2

* **********************************
* * 2. Prepare group identifier (ASEMR /H/SF/SAP)
* **********************************
tab1 GGPat_age_w GGPat_sex_w educ GGPat_marstat_w region ,m
tostring GGPat_age_w , replace
tostring GGPat_sex_w , replace
tostring educ , replace
tostring GGPat_marstat_w , replace
tostring region , replace force
* **********************************
* ASEMR (Age/ GGPat_sex_w / Education / Marital status / Region )
* **********************************
gen group =""
replace group = GGPat_age_w + GGPat_sex_w + educ +
GGPat_marstat_w + region
sort group
tab group ,m
destring group , force gen(ASEMR )
cap lab var ASEMR "Age /Sex / Education / Marital status / Region "
* **********************************
* H ( Household size )
* **********************************
cap gen H= GGPat_hhsize_w
cap lab var H " Household size "
* **********************************
* SF ( GGPat_sex_w / Role in Family )
* **********************************
```

```
drop group
gen group =""
tostring famrole , replace
replace group = GGPat_sex_w + famrole
tab group ,m
destring group , force gen(SF)
cap lab var SF "Sex / Role in Family "
* **********************************
* SAP ( GGPat_sex_w /Age/ Parity )
* **********************************
tostring GGPat_parity_w , replace
tostring agegroup , replace
drop group
gen group =""
replace group = GGPat_sex_w + agegroup + GGPat_parity_w
tab group ,m
destring group , force gen(SAP)
cap lab var SAP "Sex /Age / Parity "
drop group
* **********************************
* * 3. Calculate weights
* **********************************
* **********************************
* ASEMR matrix for Austria
* **********************************
svyset _n
cap drop _one
generate byte _one = 1
svy : total _one , over (ASEMR , nolab )
matrix sample_ASEMR = e(b)
matrix rownames sample_ASEMR = ASEMR
matrix coleq sample_ASEMR = _one
matrix list sample_ASEMR
* **********************************
* H matrix for Austria
* **********************************
svy : total _one , over (H, nolab )
matrix sample_H = e(b)
matrix rownames sample_H = H
matrix coleq sample_H = _one
matrix list sample_H
* **********************************
* SAP matrix for Austria
* **********************************
svy : total _one , over (SAP , nolab )
matrix sample_SAP = e(b)
matrix rownames sample_SAP = SAP
```

```
matrix coleq sample_SAP = _one
matrix list sample_SAP

* **********************************
*SF matrix for Austria
* **********************************
svy: total _one , over (SF , nolab )
matrix sample_SF = e(b)

matrix rownames sample_SF = SF
matrix coleq sample_SF = _one
matrix list sample_SF
* **********************************
* Import Dataset from excel on population groups
* **********************************
xls2row ASEMR using " _WEIGHTSat " , cellrange (B2: B109 )
sheet (" ASEMR ") over ( ASEMR ) scale (8247)
xls2row H using " _WEIGHTSat " , cellrange (B2:B6)
sheet ("H") over (H) scale (8247)
xls2row SF using " _WEIGHTSat " , cellrange (B2: B11)
sheet ("SF") over (SF) scale (8247)
xls2row SAP using " _WEIGHTSat " , cellrange (B2: B49)
sheet ("SAP") over (SAP) scale (8247)
cap drop weight
gen weight = 1
* **********************************
* Weight only using ASEMR
* **********************************
ipfraking [pw= weight ], ctotal ( ASEMR ) trimloabs (0.2)
trimhiabs (5) trimfrequency ( often ) no - graph replace
gen weight_ASEMR = weight
cap lab var weight_ASEMR " ASEMR Weight "
replace weight = 1
* **********************************
* Weight using ASEMR H SF SAP
* **********************************
ipfraking [pw= weight ], ctotal ( ASEMR H SF SAP) trimloabs (0.2)
trimhiabs (5) trimfrequen -cy( often ) nograph replace
tab weight
format weight %9.2 f
rename weight weight_AUT
cap lab var weight_AUT " Austria Weight "
* **********************************
* Population Weight
* **********************************
gen fweight_AUT = weight_AUT * 5023584/8247
cap lab var fweight_AUT " Population Weight Austria "
```

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