Quality of Demographic Data in GGS Wave 1

Jorik Vergauwen, University of Antwerp
Jonas Wood, University of Antwerp
Karel Neels, University of Antwerp[1]

INTRODUCTION

In 2000, the Population Activity Unit (PAU) of the United Nations Economic Commission for Europe (UNECE) launched the Generations and Gender Programme (GGP) to enhance the scientific understanding of the causes of demographic developments as well as their consequences (Vikat, Spéder et al. 2007). International comparability is a key feature of the GGP and several countries, mainly European, have become highly committed to the implementation of the programme. The GGP consists of two pillars. The first pillar is a set of Generations and Gender Surveys (GGS). The GGS is a panel survey that collects microdata on a representative sample of residents aged 18 to 79 years in each of the participating countries and provides information on the individual, partnership, and household level. To avoid the analytical difficulties that are associated with the retrospective research of the Fertility and Family Surveys (FFS) – the immediate predecessor of the Generations and Gender Programme - the GGS combines elements of a retrospective setup with a prospective panel design (Vikat, Spéder et al. 2007). The prospective design allows to assess the impact of values and intentions on subsequent behaviours, thus contributing to an enhanced understanding of the dynamic nature of demographic behaviour and the life-course. The Contextual Database (CDB) is the second main pillar of the GGP and provides aggregate indicators at the meso (regional) and macro (national) level. The CDB is organized around 16 topics (concerning policy, economy, population, culture, etc.) which cover both quantitative and qualitative information on an aggregate-level for each participating country, mostly from the 1970s onwards (Spielauer 2007). The possibility to combine longitudinal microdata from the GGS with contextual data from the CDB allows a more accurate analysis – through multilevel hazard-regression models - of the influence of various contexts (e.g. cultural, policy and economic) on changing demographic and social behaviours (Simard and Franklin 2005; Vikat, Spéder et al. 2007).

Because the contextual data in the CDB are frequently population data drawn from different standardized national and international sources (e.g. vital statistics), the validity of analyses that combine such contextual indicators with longitudinal microdata largely depends on the quality of demographic data collected in the GGS. To the extent that longitudinal microdata provide a biased account of past trends in demographic behaviour, this may also affect

[1] Corresponding author: Karel Neels, Sociology Department, University of Antwerp, Sint Jacobstraat 2, 2000 Antwerp, Belgium, Karel.Neels@ua.ac.be.

inferences on the effect of various contextual factors on these behaviours. Several sources of bias in retrospectively collected event-histories have been documented in the literature (Blossfeld and Rohwer 2002). Analyses of fertility may be distorted by selective non-response patterns because childless individuals, for instance, are frequently more difficult to contact (Festy and Prioux 2002). Among respondents participating in the survey, item non-response and recall errors may further affect the quality of retrospectively collected data, particularly for the oldest birth cohorts and the earliest periods included in the analysis. Finally, the collection of event-histories in surveys typically relies on survivors in the birth cohorts considered that may present a subgroup with specific patterns of nuptiality and fertility as a result of selective mortality and out-migration (Neels 2006; Kreyenfeld, Hornung et al. 2010). Although the GGS survey instruments provide definitions of final disposition codes and standardized response rates to assess survey quality (Lynn, Beerten et al. 2001; Kveder 2005), these indicators give a general indication of response patterns but provide little information on the selectivity of non-response and its implications for the validity of the longitudinal demographic data collected in the surveys. As a result, the sample design guidelines issued by UNECE recommend that (weighted) GGS estimates are validated with other sources (e.g. vital statistics) to verify that the survey-based estimates are accurate (Simard and Franklin 2005). Validation of survey-based estimates against vital registration is thus considered to constitute a complementary strategy to analysis of non-response to assess the accuracy of the information collected in the GGS. In this paper we validate demographic indicators of fertility and nuptiality calculated retrospectively from the GGS with time-series drawn from vital registration. We believe that the results from this validation may prove useful to decide on the appropriate time-frame to be considered for each of the GGS countries included in a longitudinal analysis. The results may be particularly relevant for research designs where microdata from the GGS are simultaneously combined with contextual population data drawn from the CDB.

DATA AND METHODS

The analysis uses data on 12 countries for which GGS Wave 1 data are currently available[2]. Table 1 provides an overview of country-specific information on the data that were used to retrospectively calculate indicators of nuptiality and fertility. Both weighted and non-weighted data are used whenever weights[3] are provided. The data used for validation includes female respondents only and thus all validated measures are strictly female rates that are typically collected in vital statistics (Council of Europe 2005). Various sources containing time-series of indicators on marriage and fertility are available. In this paper, the main data source for validation is the Contextual Database (CDB) of the GGP. Particularly the year of interview and the age range included in the survey determine the time scope of the validation. Table 1 provides an overview of the time range for which we are able to retrospectively estimate period and cohort measures (up to age 49) from the GGS. In order to extend the scope of the validation, the series drawn from thee CDB are complemented with additional macro data whenever other sources (Eurostat, Council of Europe, Human Fertility Database,…) provided a broader time-range.

[2] Austria, Belgium, Bulgaria, Estonia, France, Georgia, Germany, Hungary, Netherlands, Norway, Romania, Russia.

[3] Bulgaria and Romania do not have weights for the GGS wave 1 data. For the Netherlands two different weights were used.

Table 1. Descriptives for GGS Wave 1 data included in the validation

Country	HDF	Age range	Birth cohorts	Year of interview	N	Time perspective of validation: Period measures	Time perspective of validation: Cohort measures
Austria[1]	3.0	18-46	1963-1990	2008-2009	3001	-	-
Belgium	3.0	18-82	1928-1990	2008-2010	3728	1978-2005	1928-1960
Bulgaria	3.0	18-82	1922-1986	2004	6983	1977-2001	1927-1954
Estonia	3.0	21-81	1924-1983	2004-2005	5034	1974-1998	1924-1955
France	3.0	18-79	1926-1987	2005	5708	1976-2002	1926-1955
Georgia	3.0	18-80	1926-1988	2006	5595	1976-2003	1926-1956
Germany	3.0	17-85	1920-1988	2005	5407	1975-2002	1925-1955
Hungary	3.0	21-79	1926-1983	2004-2005	7517	1976-1998	1926-1955
Netherlands	3.0	18-80	1923-1985	2002-2004	4741	1973-2000	1923-1954
Norway	3.0	19-81	1927-1988	2007-2008	7541	1977-2003	1927-1958
Romania	3.0	18-80	1925-1987	2005	6009	1975-2002	1926-1955
Russia	3.0	17-81	1923-1987	2004	7038	1974-2001	1924-1954

[1] As a result of the limited age range of respondents, period and cohort measures cannot be estimated up to age 49.

For fertility following GGS-based indicators were validated against vital statistics: age-specific female fertility rates, period total fertility rate, cohort total fertility rate, period mean age at childbearing and cohort mean age at childbearing. For nuptiality, following indicators are considered: age-specific female first marriage rates, period total female first marriage rate, cohort total female first marriage rate, period mean age at female first marriage and cohort mean age at female first marriage. The subsequent sections document the estimation of the indicators considered. All rates have been calculated up to the age of 49.

- *Period measures*

Age-specific rates drawn from vital registration are routinely calculated between *exact* ages, where events at age i in completed years are related to the midyear population of women aged i last birthday (Neels 2006). Generally, age-specific fertility rates (ASFR) are calculated as:

$$ASFR_i = \frac{\text{births in year t to women aged i last birthday at age of birth}}{\text{midyear population of women aged i last birthday}}$$

Whereas age-specific female first marriage rate (ASFFMR) are calculated as:

$$ASFFMR_i = \frac{\text{number of females marrying for first time aged i}}{\text{midyear population of females aged i last birthday}}.$$

Based on the maternity and partnership histories in the GGS, age-specific rates were calculated between completed durations (i.e. parallelograms in a Lexis chart), where the number of births or first marriages in year t is related to the cohort size of the birth cohort considered. The age-specific rates estimated retrospectively from the GGS refer to events in two age groups and are centered at exact ages. To obtain a closer approximation to age-specific rates drawn from vital registration, the age-specific rates calculated from the GGS

have been averaged over adjacent ages (Neels 2006)[4]. The period total fertility rate is subsequently obtained as:

$$PTFR_t = \sum_{i=15}^{49} \frac{1}{2}\left(f_{i-1}^t + f_i^t\right)$$

where f_i^t are the age-specific fertility rates calculated between completed durations *i* and (*i* + 1) based on the GGS in a given year *t*. The period total female first marriage rate in year *t*, i.e. $PTFFMR_t$, is similarly obtained as:

$$PTFFMR_t = \sum_{i=15}^{49} \frac{1}{2}\left(g_{i-1}^t + g_i^t\right)$$

where g_i^t are the age-specific female first marriage rates calculated between completed durations i and (i + 1) in year t drawn from the GGS (Neels 2006).

The period mean age rates are likewise reconstructed from the retrospectively calculated nuptiality and fertility schedules. The period mean age at childbearing $PMAC_t$ and the period mean age at female first marriage $PMAFFM_t$ in year t are obtained as:

$$PMAC_t = \frac{\sum_{i=15}^{49} i * f_i^t}{PTFR_t}$$

$$PMAFFM_t = \frac{\sum_{i=15}^{49} i * g_i^t}{PTFFMR_t}$$

where f_i^t and g_i^t respectively represent the age-specific fertility rates and age-specific female first marriage rates calculated between completed durations i and (i + 1) in year t based on the GGP survey data for the same year.

- *Cohort measures*

In addition to the period measures, cohort measures are estimated the GGS. Cohort measures reflect completed fertility levels at age 49 or proportions ever marrying by age 49 in the cohorts considered. To optimize the comparison between GGS-based estimates and time-series drawn from vital registration, the age-specific rates calculated from the GGS were not averaged over subsequent age-groups. Using the age-specific rates between completed durations, the cohort total fertility rate is obtained as follows:

$$CTFR_t = \sum_{i=15}^{49}\left(f_i^t\right)$$

[4] The age-specific rate at age i drawn from vital registration is approximated by the arithmetic mean of the rates between completed ages i and (i – 1) because the age-specific rate between completed durations at age i is approximately equal to the rate between exact durations at age (i+ 0.5)

where f_i^t is the age-specific fertility rate between completed durations i and (i + 1), for a cohort of women born in year t. The cohort total female first marriage rate ($CTFFMR_t$) for women born in year t is similarly obtained as:

$$CTFFMR_t = \sum_{i=15}^{49} \left(g_i^t \right)$$

where g_i^t is the age-specific female first marriage rate between completed durations i and (i + 1), for a cohort of women born in year t.

Cohort mean ages at childbearing and first marriage are derived from the corresponding cohort schedules. The cohort mean age at childbearing ($CMAC_t$) and the cohort mean age at female first marriage ($CMAFFM_t$) in year t are obtained as follows:

$$CMAFFM_t = \frac{\sum_{i=15}^{49} i * g_i^t}{CTFFMR_t}$$

$$CMAFFM_t = \frac{\sum_{i=15}^{49} i * g_i^t}{CTFFMR_t}$$

where f_i^t and g_i^t are the age-specific fertility rates and age-specific female first marriage rates calculated between completed durations i and (i + 1) in year t based on the GGS.

RESULTS

To assess the reliability of demographic data in the GGS, deviation were calculated between the indicators based on the GGS and indicators drawn from vital registration for single years of calendar time (period indicators) and single-year birth cohorts (cohort indicators). For each indicator considered, appendix A provides an overview table presenting average deviations (and the variance) over subsequent 5-year intervals (period indicators) or subsequent 5-year birth cohorts (cohort indicators). Country-specific results are included in appendix B. Apart from the time-series drawn from vital registration, the country-specific graphs include demographic indicators evaluated at age 49 as well as partial indicators evaluated at age 39, the latter allowing the construction of time-series over a longer period of time. For countries that supply weighting coefficients, the demographic indicators based on the GGS have been estimated with and without weights, allowing to assess the effect of final weights on the accuracy of the estimates.

ACKNOWLEDGEMENTS

We kindly acknowledge the support from Andrej Kveder, Aat Liefbroer, Tinneke Fokkema and Nicole Hiekel at the Netherlands Interdisciplinary Demographic Institute (NIDI) who provided additional weighting coefficients for some of the countries included in the analysis.

REFERENCES

Blossfeld, H. P. and G. Rohwer (2002). Techniques of Event-history Modeling. New Approaches to Causal Analysis. Mahwah, New Jersey, Lawrence Erlbaum Associates.

Council of Europe (2005). Recent Demographic Developments in Europe, 2004. Strasbourg, Council of Europe Publishing.

Festy, P. and F. Prioux (2002). An evaluation of the FERTILITY AND FAMILY SURVEYS PROJECT. Paris, INED.

Kreyenfeld, M., A. Hornung, et al. (2010). Fertility and Union Histories from German GGS Data: Some Critical Reflections. Demographic Research. Rostock, May Planck Institute for Demographic Research (Working Paper; 2010-023).

Kveder, A. (2005). A Note on the Definitions of Final Disposition Codes. Generations and Gender Programme: Survey Instruments. N. Geneva, United Nations**:** 2.

Lynn, P., R. Beerten, et al. (2001) Recommended Standard Final Outcome Categories and Standard Definitions of Response Rate for Social Surveys. Working Papers of the Institute for Social and Economic Research

Neels, K. (2006). Reproductive strategies in Belgian fertility, 1960-1990. Brussels-The Hague, NIDI-CBGS.

Simard, M. and S. Franklin (2005). Survey Design Guidelines. Generations & Gender Programme. Survey Instruments. United Nations. New York and Geneva, United Nations, Economic Commission for Europe.

Spielauer, M. (2007). The Contextual Database of The Generations and Gender Programme. Generations and Gender Programme: Concepts and Guidelines. N. Geneva, United nations**:** 58.

Vikat, A., Z. Spéder, et al. (2007). Generations and Gender Survey: Concept and Design. Generations and Gender Programme: Concepts and Guidelines. N. Geneva, United Nations**:** 32.

Appendix A

Table A1. Period Total Fertility Rate (calculated up to exact age of 49): mean difference and standard deviation of difference between time-series estimated retrospectively from the GGS and time-series drawn from vital registration in subsequent 5-year intervals.

	Austria[1]	*Belgium*	*Bulgaria*[2]	*Estonia*	*France*	*Georgia*	*Germany*	*Hungary*	*The N'lands*[3]	*The N'lands*[3]	*Norway*	*Romania*[2]	*Russia*
1975-1979			-0,3602	-0,2756			-0,1458		-0,1105	-0,0797		-0,4336	-0,0798
			(0,0777)	(0,1577)			(0,1845)		(0,2042)	(0,1824)		(0,2478)	(0,0240)
1980-1984		-0,0437	-0,2158	-0,1240	0,0327	-0,2095	0,0443	-0,0311	-0,2246	-0,1540	-0,0126	-0,3337	0,1775
		(0,0897)	(0,2170)	(0,0785)	(0,2051)	(0,1792)	(0,0668)	(0,1127)	(0,2406)	(0,2178)	(0,1595)	(0,1078)	(0,1030)
1985-1989		0,0211	-0,1036	-0,1942	-0,0213	-0,0328	0,2553	0,0037	-0,2189	-0,1615	0,0879	-0,1160	0,0542
		(0,0983)	(0,1601)	(0,0640)	(0,0955)	(0,1176)	(0,1118)	(0,1583)	(0,2476)	(0,2282)	(0,1189)	(0,2076)	(0,1309)
1990-1994	-0,0065	0,0830	0,0789	-0,1671	0,1212	0,4876	0,1647	0,0467	-0,2824	-0,2385	0,1094	0,0314	0,0536
	(0,0752)	(0,1243)	(0,0591)	(0,1700)	(0,1246)	(0,1912)	(0,1049)	(0,1912)	(0,1147)	(0,1193)	(0,1595)	(0,1291)	(0,1394)
1995-1999	-0,0634	-0,0430	0,0796		-0,0425	0,2655	0,1833		-0,1618	-0,0871	-0,0036	0,1098	-0,0235
	(0,0643)	(0,1320)	(0,0981)		(0,1223)	(0,0820)	(0,0875)		(0,1739)	(0,1543)	(0,0707)	(0,0824)	(0,1191)
2000-2004	-0,0063	0,1324											
	(0,0734)	(0,0782)											

[1] Rates up to 24 years are used in order to maintain the comparable period
[2] No weights are available
[3] Two different weights are used

Table A2. Period Mean Age at Childbearing (calculated up to exact age of 49): mean difference and standard deviation of difference between time-series estimated retrospectively from the GGS and time-series drawn from vital registration in subsequent 5-year intervals.

	Austria[1]	*Belgium*	*Bulgaria*[2]	*Estonia*	*France*	*Georgia*	*Germany*	*Hungary*	*The N'lands*[3]	*The N'lands*[3]	*Norway*	*Romania*[2]	*Russia*
1975-1979			0,5316	0,3782			0,4178		-0,5917	-0,5204		0,2985	0,1920
			(0,3897)	(0,2465)			(0,4889)		(0,5524)	(0,4896)		(0,4373)	(0,6006)
1980-1984		0,4980	0,5880	-0,0908	-0,0153	0,3315	0,1842	-0,2258	-0,6555	-0,5844	-0,0412	0,1324	-0,0699
		(0,3696)	(0,4501)	(0,4095)	(0,3318)	(0,7240)	(0,5599)	(0,2290)	(0,6657)	(0,5872)	(0,4245)	(0,4285)	(0,4685)
1985-1989		0,2353	0,5483	0,3976	0,1810	-0,1792	-0,1130	0,0893	-0,4624	-0,4355	0,1800	0,2524	-0,2789
		(0,2866)	(0,5257)	(0,2652)	(0,3620)	(0,5623)	(0,5518)	(0,2877)	(0,3394)	(0,3866)	(0,1795)	(0,4121)	(0,2461)
1990-1994	0,4570	0,3709	0,3337	0,4916	-0,0308	-0,5461	-0,0129	0,0114	-0,8315	-0,8917	0,3316	0,1421	-0,2611
	(0,2193)	(0,3694)	(0,2458)	(0,4591)	(0,6652)	(0,1645)	(0,6071)	(0,1493)	(0,2884)	(0,2661)	(0,3371)	(0,2386)	(0,1202)
1995-1999	0,6445	0,3871	-0,0649		-0,2120	-0,3904	-0,0873		-0,3998	-0,4479	-0,0901	0,0416	-0,3839
	(0,2661)	(0,2110)	(0,3226)		(0,6445)	(0,3776)	(0,4107)		(0,3989)	(0,4341)	(0,2695)	(0,3484)	(0,3455)
2000-2004	0,2406	0,0003											
	(0,3730)	(0,5817)											

[1] Rates up to 24 years are used in order to maintain the comparable period

[2] No weights are available

[3] Two different weights are used

Table A3. Cohort Total Fertility Rate (calculated up to exact age of 49): mean difference and standard deviation of difference between time-series estimated retrospectively from the GGS and time-series drawn from vital registration in subsequent 5-year intervals.

	Austria	*Belgium*	*Bulgaria*[1]	*Estonia*	*France*	*Georgia*	*Germany*	*Hungary*	*The N'lands*[2]	*The N'lands*[2]	*Norway*	*Romania*[1]	*Russia*
1930-1934		-0,4259	-0,4383		0,1468		-0,4446	-0,2553	-0,0521	-0,0290	-0,0864	-0,5984	
		(0,4591)	(0,1673)		(0,3013)		(0,1387)	(0,0765)	(0,2327)	(0,2530)	(0,1739)	(0,1483)	
1935-1939		-0,4618	-0,4014		-0,0238	-0,3127	-0,2209	-0,2485	-0,1281	-0,1165	-0,1651	-0,3821	
		(0,2351)	(0,1281)		(0,2066)	(0,0432)	(0,0998)	(0,1233)	(0,1553)	(0,1757)	(0,1049)	(0,0874)	
1940-1944		-0,2543	-0,3423		-0,1090	-0,2344	-0,1724	-0,0849	-0,1012	-0,1020	-0,1890	-0,4324	-0,1582
		(0,2332)	(0,0974)		(0,1493)	(0,0431)	(0,1508)	(0,1150)	(0,1784)	(0,1854)	(0,0977)	(0,1715)	(0,2178)
1945-1949		-0,2036	-0,2803	0,0330	-0,0632	-0,2755	-0,2721	-0,1290	-0,2060	-0,1588	-0,0592	-0,3956	-0,0012
		(0,1907)	(0,1024)	(0,0825)	(0,1937)	(0,1534)	(0,2144)	(0,0462)	(0,1551)	(0,1319)	(0,1056)	(0,1922)	(0,0809)
1950-1954		-0,0606	-0,2495	0,0768	-0,0891		-0,1428	-0,0797	-0,0781	-0,0459	-0,0172	-0,3212	0,0196
		(0,1123)	(0,1122)	(0,1559)	(0,1455)		(0,1296)	(0,0390)	(0,2495)	(0,2418)	(0,0994)	(0,0631)	(0,0815)
1955-1959		0,0111											
		(0,1122)											

[1] No weights are available

[2] Two different weights are used

Table A4. Cohort Mean Age at Childbearing (calculated up to exact age of 49): mean difference and standard deviation of difference between time-series estimated retrospectively from the GGS and time-series drawn from vital registration in subsequent 5-year intervals.

	Austria	*Belgium*	*Bulgaria*[1]	*Estonia*	*France*	*Georgia*	*Germany*	*Hungary*	*The N'lands*[2]	*The N'lands*[2]	*Norway*	*Romania*[1]	*Russia*
1930-1934		0,4856	0,5781		-0,1607		0,1056	0,0037	0,7505	0,7016	0,2858		
		(0,7594)	(0,7387)		(0,5435)		(0,6818)	(0,5057)	(0,5767)	(0,6242)	(0,5168)		
1935-1939		0,3273	0,2706		-0,0227		0,2455	-0,3247	0,6043	0,5799	0,1020	0,1423	
		(1,0081)	(0,5555)		(0,6202)		(0,3100)	(0,4175)	(0,7414)	(0,6836)	(0,5708)	(0,2374)	
1940-1944		0,4750	0,5016		0,1258		0,2518	0,4168	0,5188	0,5217	0,0259	-0,0859	0,4205
		(0,4470)	(0,5061)		(0,4175)		(0,4942)	(0,3343)	(0,4019)	(0,3997)	(0,6009)	(0,5674)	(1,3920)
1945-1949		0,8843	0,6346	0,3680	0,0389		0,9129	0,0989	1,1507	0,9406	0,5467	0,2296	0,0804
		(0,5354)	(0,3314)	(0,6534)	(0,4959)		(1,2007)	(0,3161)	(0,5694)	(0,4258)	(0,6136)	(0,2513)	(0,6515)
1950-1954		0,3859	0,3112	0,6088	0,0274		0,7283	-0,0964	0,6314	0,5943	0,0833	0,4746	0,3021
		(0,2408)	(0,3015)	(0,4277)	(0,4849)		(0,3476)	(0,2712)	(0,5785)	(0,6120)	(0,3432)	(0,3226)	(0,2389)
1955-1959		0,3865									0,4468		
		(0,5151)									(0,2136)		

[1] No weights are available

[2] Two different weights are used

Table A5. Period Total Female First Marriage Rate (calculated up to exact age of 49): mean difference and standard deviation of difference between time-series estimated retrospectively from the GGS and time-series drawn from vital registration in subsequent 5-year intervals.

	Austria[1]	*Belgium*	*Bulgaria*[2]	*Estonia*	*France*	*Georgia*	*Germany*	*Hungary*	*The N'lands*[3]	*The N'lands*[3]	*Norway*	*Romania*[2]	*Russia*
1975-1979				0,0094			0,0115		-0,1385	-0,1630		-0,1302	-0,0184
				(0,0596)			(0,1434)		(0,1424)	(0,1414)		(0,1070)	(0,1062)
1980-1984		0,0258	-0,0262	0,0173	0,0608		0,0616	-0,0291	-0,0638	-0,0843	0,0310	-0,0225	-0,0199
		(0,1213)	(0,0485)	(0,1392)	(0,0368)		(0,1089)	(0,0585)	(0,0329)	(0,0276)	(0,0527)	(0,1617)	(0,0710)
1985-1989		0,0108	-0,0503	0,0166	0,0243		0,0480	-0,0414	-0,0865	-0,1023	0,0708	0,1047	0,0000
		(0,0761)	(0,0849)	(0,0932)	(0,0434)		(0,1263)	(0,0653)	(0,0469)	(0,0434)	(0,1133)	(0,0492)	(0,0748)
1990-1994	0,0674	0,0097	0,0465	-0,0141	-0,0061	0,1109	0,0799	-0,0303	0,0031	-0,0116	0,0370	0,0480	-0,0497
	(0,0342)	(0,0528)	(0,0360)	(0,1098)	(0,0228)	(0,1737)	(0,0812)	(0,0476)	(0,0677)	(0,0683)	(0,0704)	(0,1076)	(0,1237)
1995-1999	-0,0101	0,1094	0,0359		0,0636	0,0604	0,1225		0,1806	0,1392	0,0411	0,0775	
	(0,0390)	(0,0528)	(0,0490)		(0,0810)	(0,0660)	(0,1189)		(0,1077)	(0,1150)	(0,0632)	(0,0791)	

[1] Rates up to 24 years are used in order to maintain the comparable period

[2] No weights are available

[3] Two different weights are used

Table A6. Period Mean Age at Female First Marriage (calculated up to exact age of 49): mean difference and standard deviation of difference between time-series estimated retrospectively from the GGS and time-series drawn from vital registration in subsequent 5-year intervals.

	Austria[1]	*Belgium*	*Bulgaria*[2]	*Estonia*	*France*	*Georgia*	*Germany*	*Hungary*	*The N'lands*[3]	*The N'lands*[3]	*Norway*	*Romania*[2]	*Russia*
1975-1979				-0,0731			0,7909		0,8585	0,8995		-0,4173	0,1960
				(0,5525)			(0,8162)		(0,9624)	(0,9676)		(0,2897)	(0,3445)
1980-1984		0,2028	0,0520	0,1498	0,2421		0,4403	-0,3008	1,7272	1,6888	0,1932	0,0856	-0,0491
		(0,6953)	(0,5731)	(0,3498)	(1,0244)		(1,0687)	(0,2447)	(1,3961)	(1,4559)	(0,9117)	(0,2718)	(0,3505)
1985-1989		0,1659	0,1814	-0,3210	-0,0449		0,3959	0,0309	1,7396	1,7553	0,7968	-0,3000	-0,4125
		(0,6849)	(0,3720)	(0,3671)	(0,5473)		(0,7531)	(0,4097)	(1,0028)	(1,0923)	(0,7938)	(0,4538)	(0,5941)
1990-1994		0,5753	0,0556	0,2147	-0,1674	-1,1827	-0,7325	-0,4795	1,2330	1,2378	0,1261	-0,5081	-0,4909
		(0,9574)	(0,4305)	(0,9849)	(1,2329)	(0,2747)	(0,3323)	(0,3775)	(0,9277)	(0,9687)	(0,9651)	(0,5389)	(0,2666)
1995-1999		0,4546	-0,0753		-0,0039	-1,7041	-0,2378		1,4224	1,4522	0,0788	-0,5414	
		(1,3646)	(0,6694)		(0,9333)	(0,7212)	(0,7680)		(0,9151)	(0,9732)	(1,1175)	(0,4516)	
2000-2004		-0,6016											
		(0,5876)											

[1] No vital registration data available

[2] No weights are available

[3] Two different weights are used

Table A7. Cohort Total Female First Marriage Rate (calculated up to exact age of 49): mean difference and standard deviation of difference between time-series estimated retrospectively from the GGS and time-series drawn from vital registration in subsequent 5-year intervals.

	Austria	*Belgium*	*Bulgaria*[1]	*Estonia*[2]	*France*	*Georgia*[2]	*Germany*	*Hungary*	*The N'lands*[3]	*The N'lands*[3]	*Norway*	*Romania*[1]	*Russia*[2]
1930-1934					-0,0825			-0,0077	-0,4529	-0,4977	-0,1317		
					(0,0559)			(0,0147)	(0,0552)	(0,0502)	(0,0241)		
1935-1939		-0,1426			-0,0446		-0,2077	-0,0135	-0,2594	-0,2908	-0,1250		
		(0,0646)			(0,0402)		(0,0482)	(0,0217)	(0,1022)	(0,0948)	(0,0684)		
1940-1944		-0,1319			-0,0512		-0,1293	-0,0463	-0,2175	-0,2437	-0,0489	0,0161	
		(0,0609)			(0,0407)		(0,0351)	(0,0271)	(0,0313)	(0,0315)	(0,0138)	(0,0341)	
1945-1949		-0,0451	-0,0597		-0,0476		-0,1081	-0,0547	-0,1886	-0,2173	-0,0128	0,0025	
		(0,0406)	(0,0399)		(0,0332)		(0,0427)	(0,0243)	(0,0439)	(0,0390)	(0,0386)	(0,0590)	
1950-1954		0,0058	-0,0762		-0,0016		-0,0583	-0,0574	-0,1764	-0,2018	-0,0014	-0,0883	
		(0,0363)	(0,0218)		(0,0417)		(0,0331)	(0,0392)	(0,0276)	(0,0236)	(0,0273)	(0,0444)	
1955-1959		-0,0031											
		(0,0459)											

[1] No weights are available

[2] No vital registration data available

[3] Two different weights are used

Table A8. Cohort Mean Age at Childbearing: mean difference and standard deviation of difference between time-series estimated retrospectively from the GGS and time-series drawn from vital registration in subsequent 5-year intervals.

	Austria	*Belgium*	*Bulgaria*[1]	*Estonia*[2]	*France*	*Georgia*[2]	*Germany*	*Hungary*	*The N'lands*[3]	*The N'lands*[3]	*Norway*	*Romania*[1]	*Russia*[2]
1930-1934					-0,2020			-0,5623	1,7968	1,7303	-0,1227		
					(0,6441)			(0,4948)	(0,8051)	(0,8364)	(0,4892)		
1935-1939		0,4853			-0,1221		0,7315 (0,5077)	-0,0917	0,9351	0,9294	0,8346		
		(0,9865)			(0,5286)			(0,3246)	(1,5184)	(1,5025)	(0,8511)		
1940-1944		0,9144			0,0725		1,1081	0,2482	1,4779	1,5014	0,5081	-0,0641	
		(0,4621)			(0,7552)		(0,6075)	(0,1399)	(0,6642)	(0,7621)	(1,0462)	(0,2580)	
1945-1949		0,3817	0,8745		0,1207		0,5484	0,0787	1,2412	1,1221	0,5358	-0,0715	
		(0,4395)	(0,6108)		(0,6236)		(0,7331)	(0,0229)	(0,3120)	(0,2763)	(0,2162)	(0,5532)	
1950-1954		0,8732	0,0013		0,3607		0,6031	0,0685	2,0268	2,0841	0,2166	0,0425	
		(0,4492)	(0,6328)		(0,2323)		(0,3355)	(0,2371)	(0,8149)	(0,7666)	(0,2219)	(0,4969)	
1955-1959		0,3916											
		(0,7489)											

[1] No weights are available

[2] No vital registration data available

[3] Two different weights are used

Appendix B

Table B1. Overview of country-specific graphs

Austria

Figure B1. Period Total Fertility Rate Austria

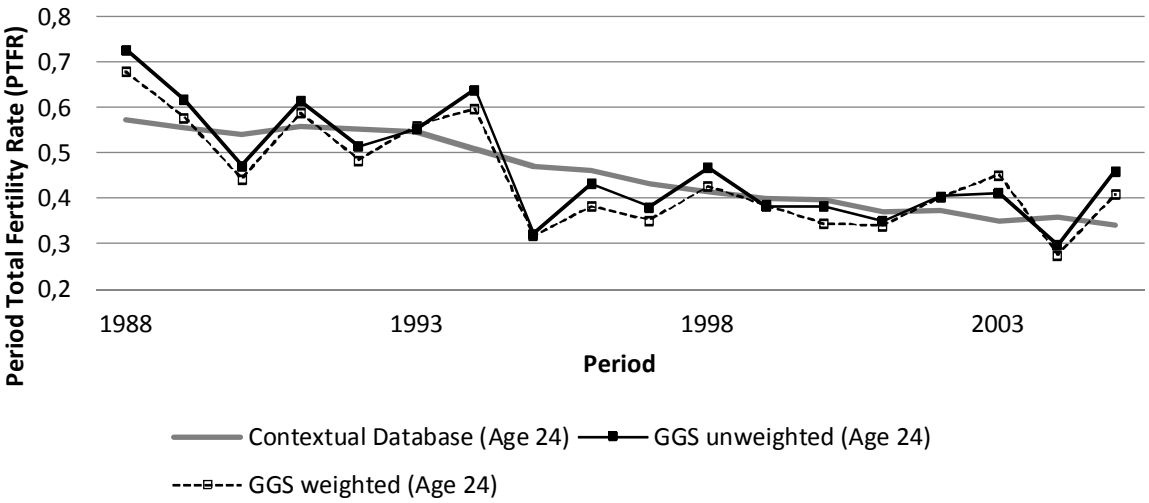


Figure B2. Period Total Female First Marriage Rate Austria

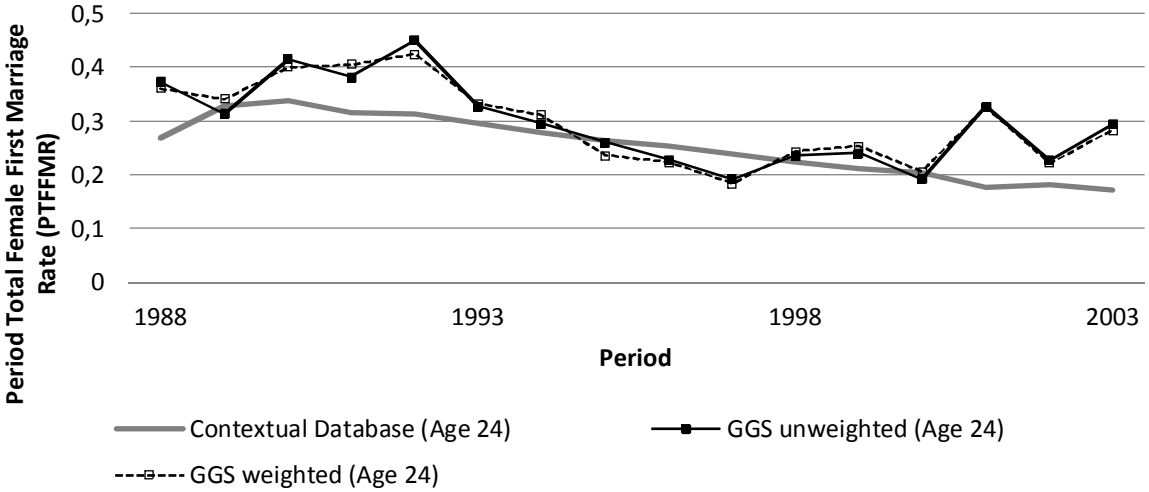


Figure B3. Period Mean Age at Childbearing Austria

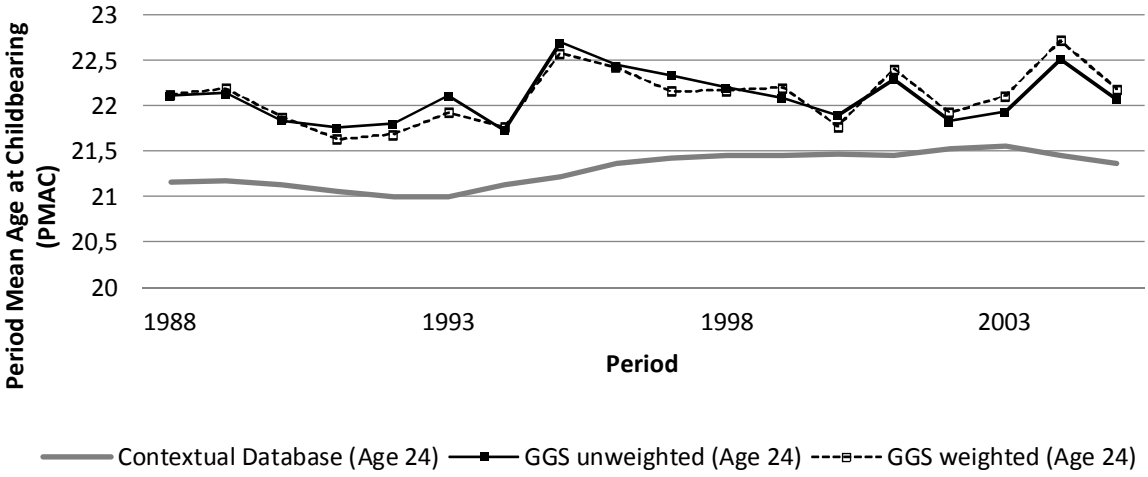
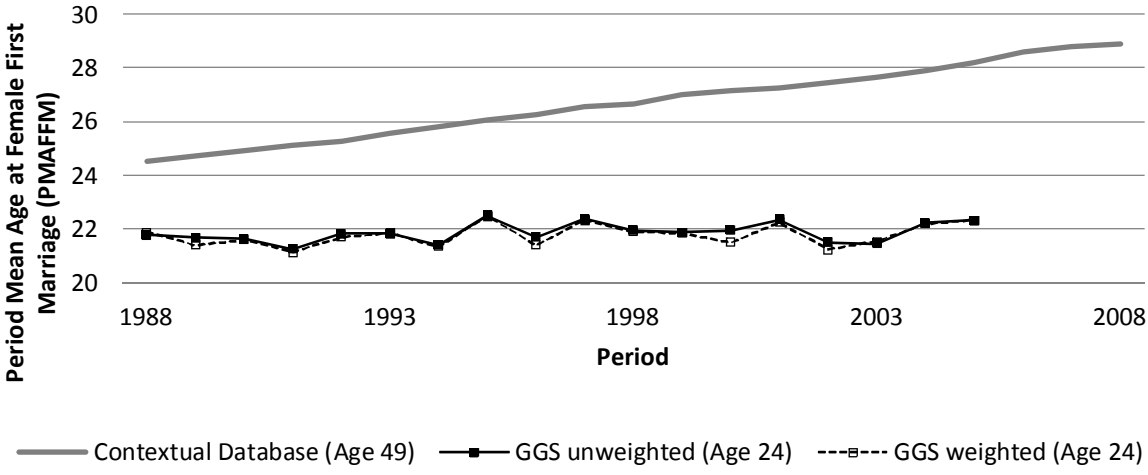


Figure B4. Period Mean Age at Female First Marriage[1] Austria



[1] No data for period mean age at female first marriage rate up to 24 years in vital registration

Figure B5. Cohort Total Fertility Rate Austria

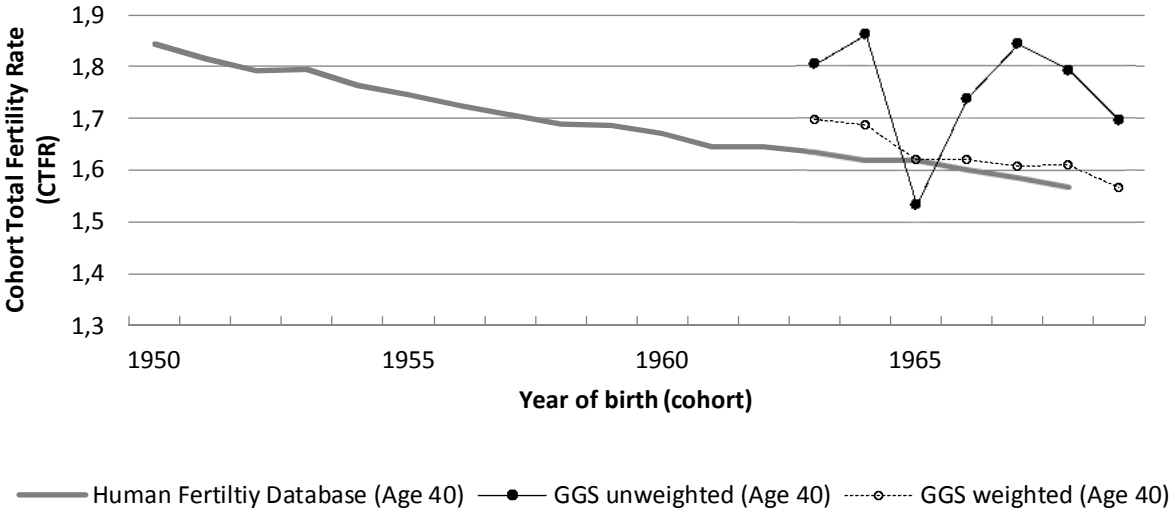


Figure B6. Cohort Total Female First Marriage Rate Austria

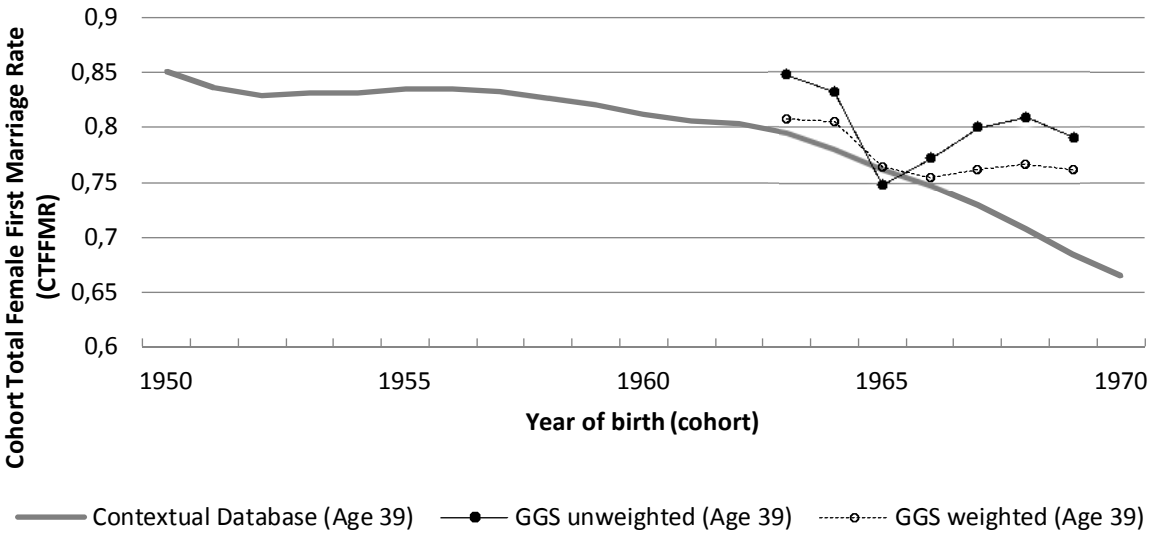


Figure B7. Cohort Mean Age at Childbearing Austria

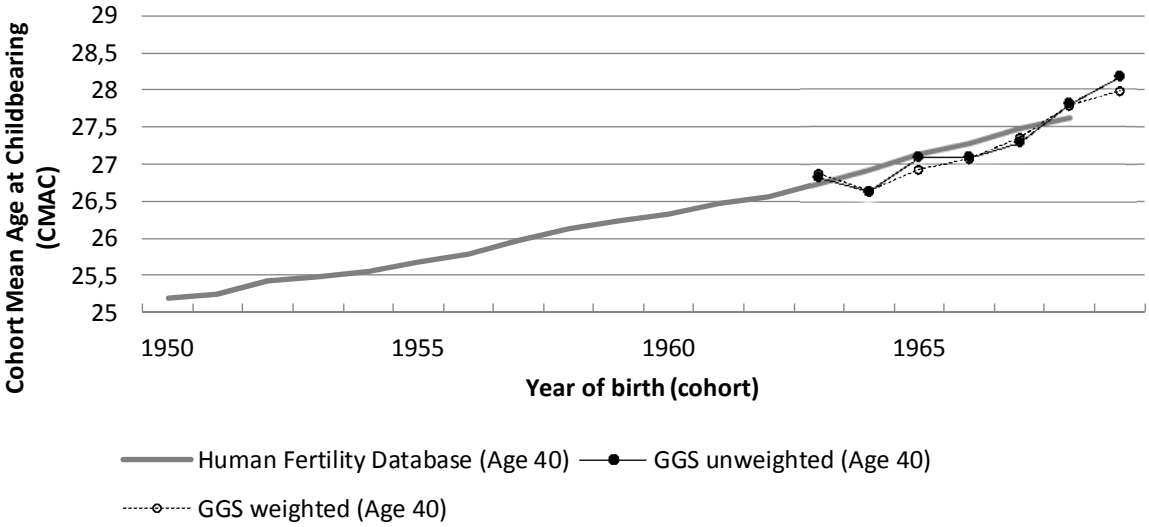
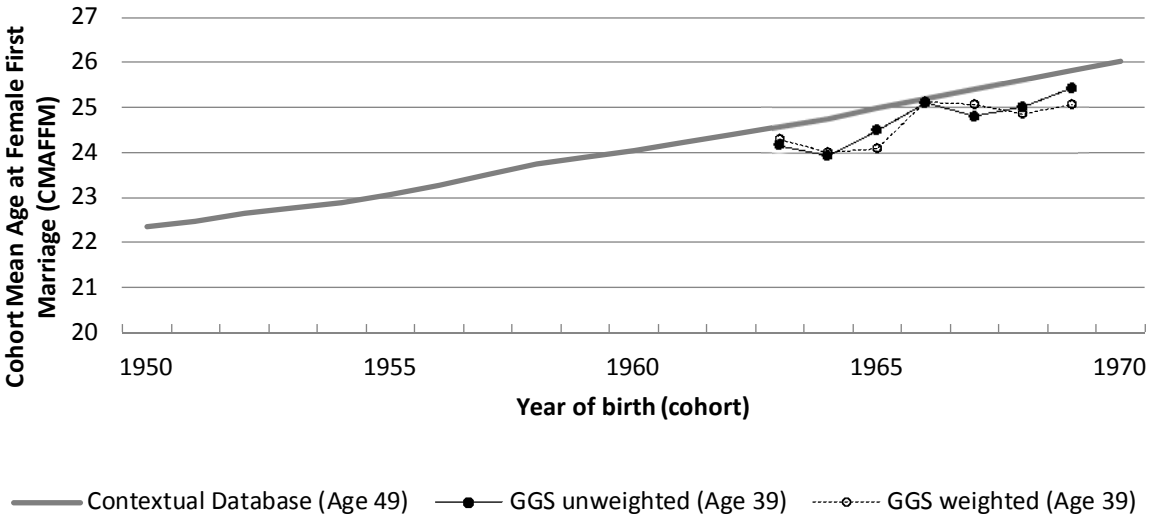


Figure B8. Cohort Mean Age at Female First Marriage Austria



Belgium

Figure B9. Period Total Fertility Rate Belgium

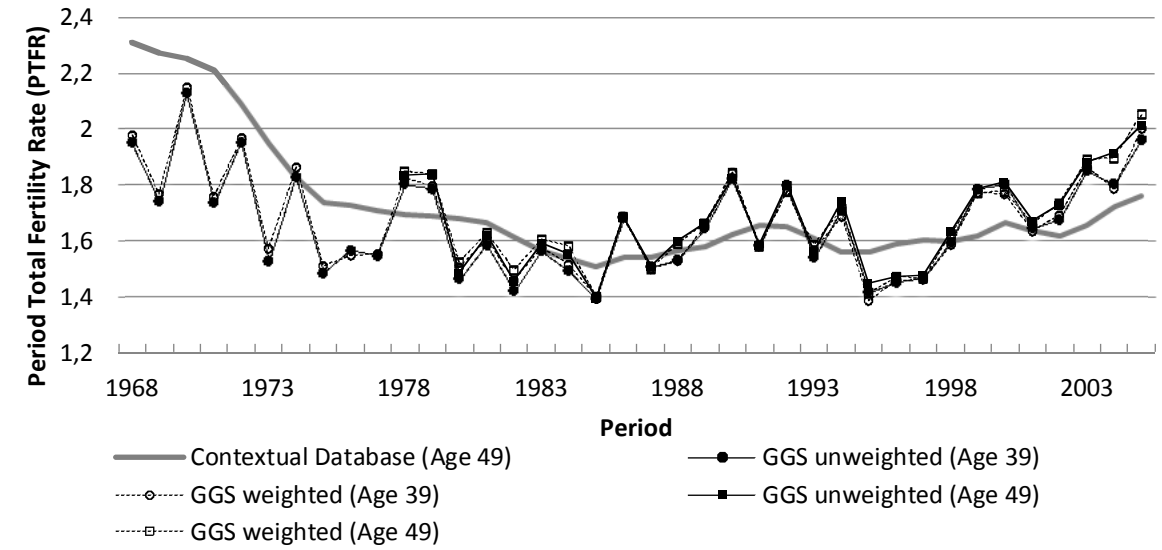


Figure B10. Period Total Female First Marriage Rate Belgium

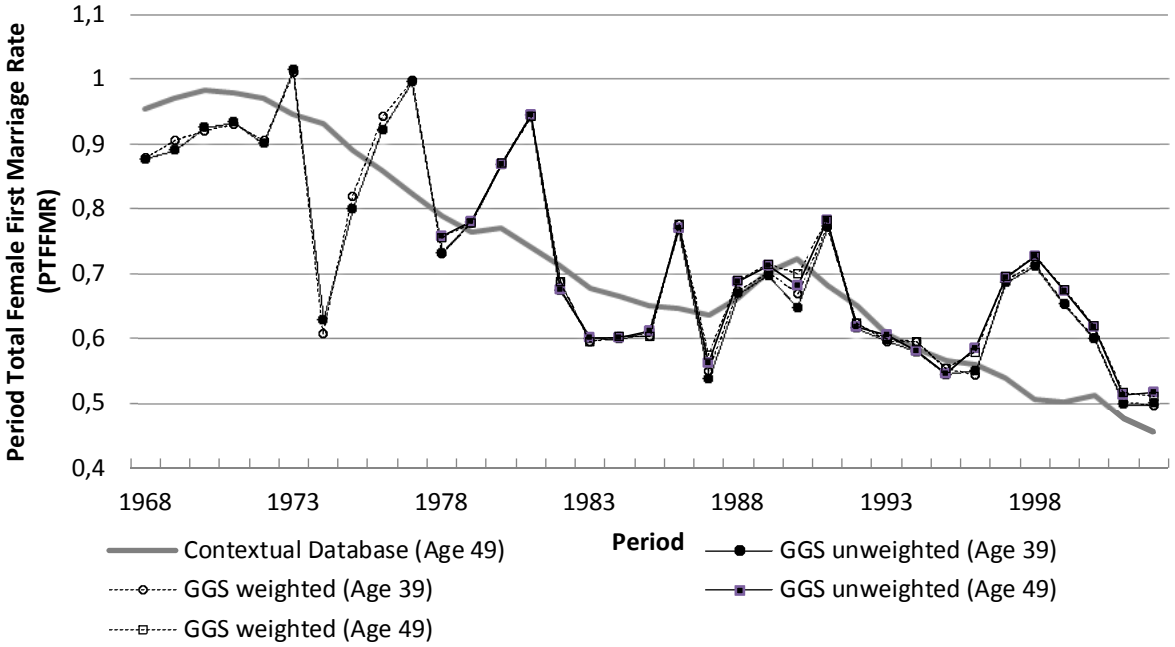


Figure B11. Period Mean Age at Childbearing Belgium

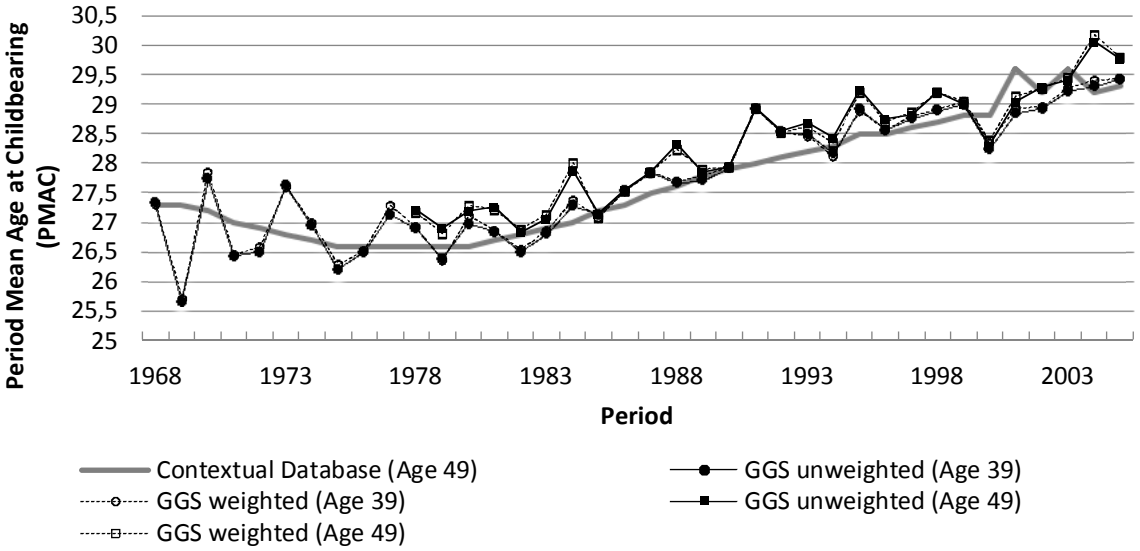


Figure B12. Period Mean Age at Female First Marriage Belgium

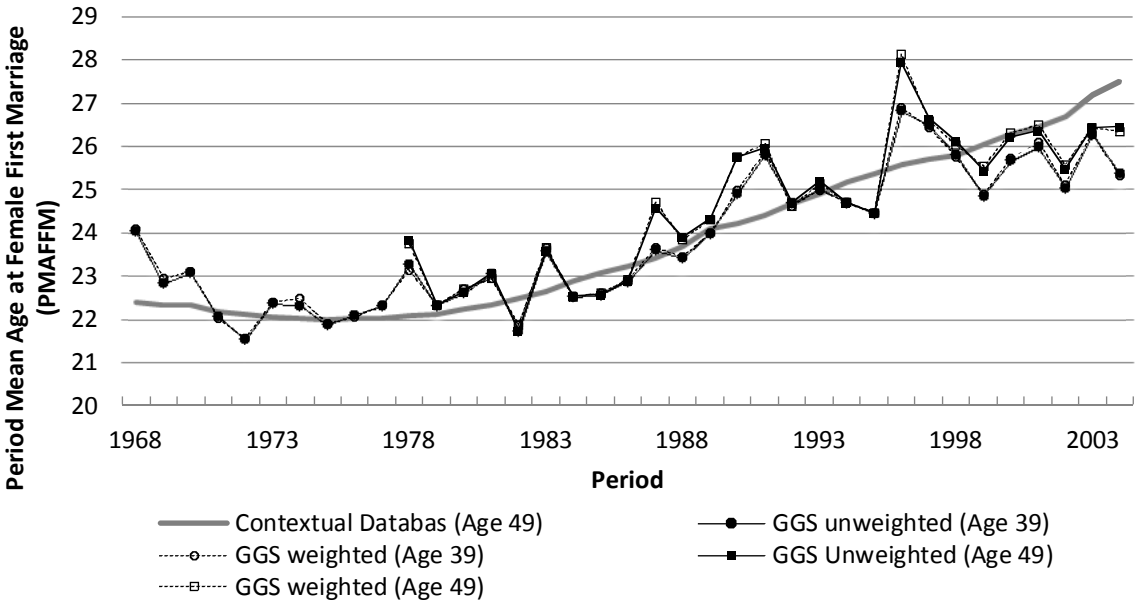


Figure B13. Cohort Total Fertility Rate Belgium

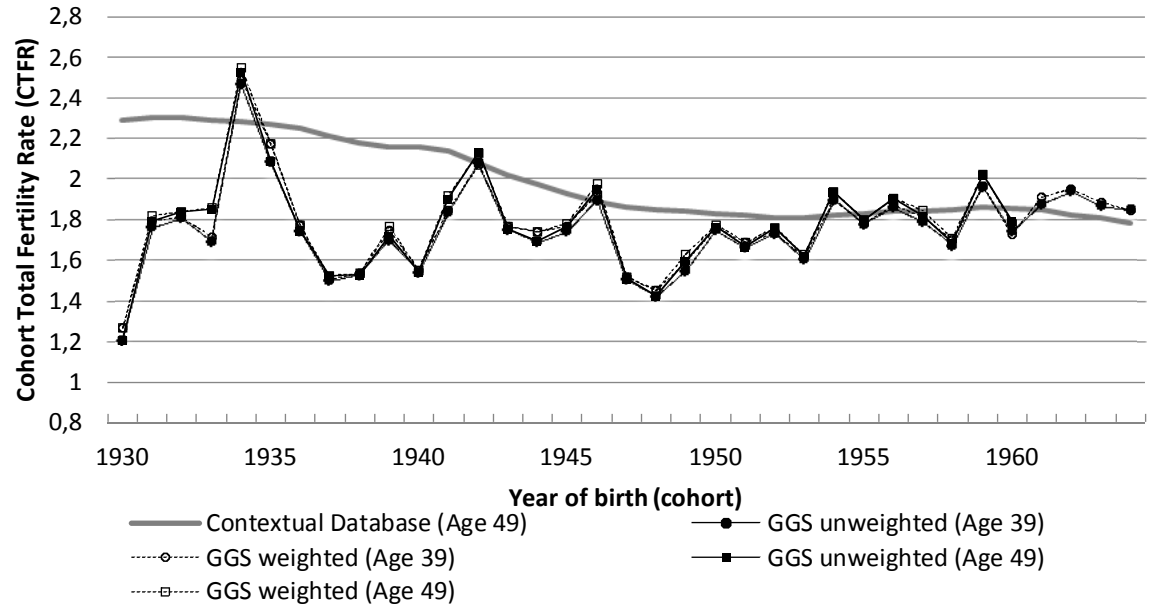


Figure B14. Cohort Total Female First Marriage Rate Belgium

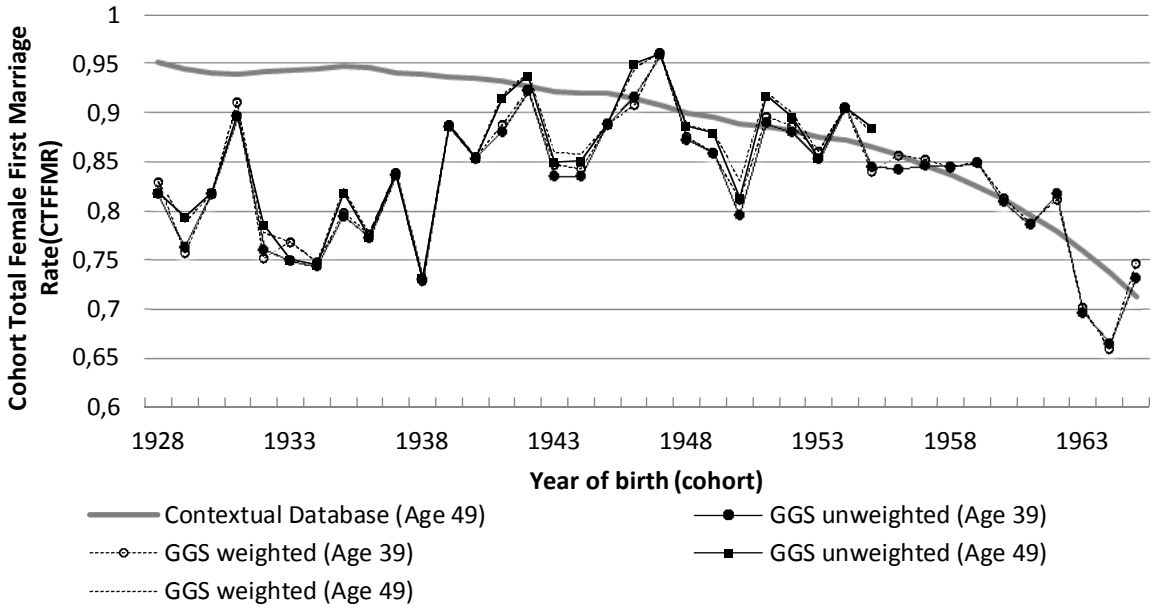


Figure B15. Cohort Mean Age at Childbearing Belgium

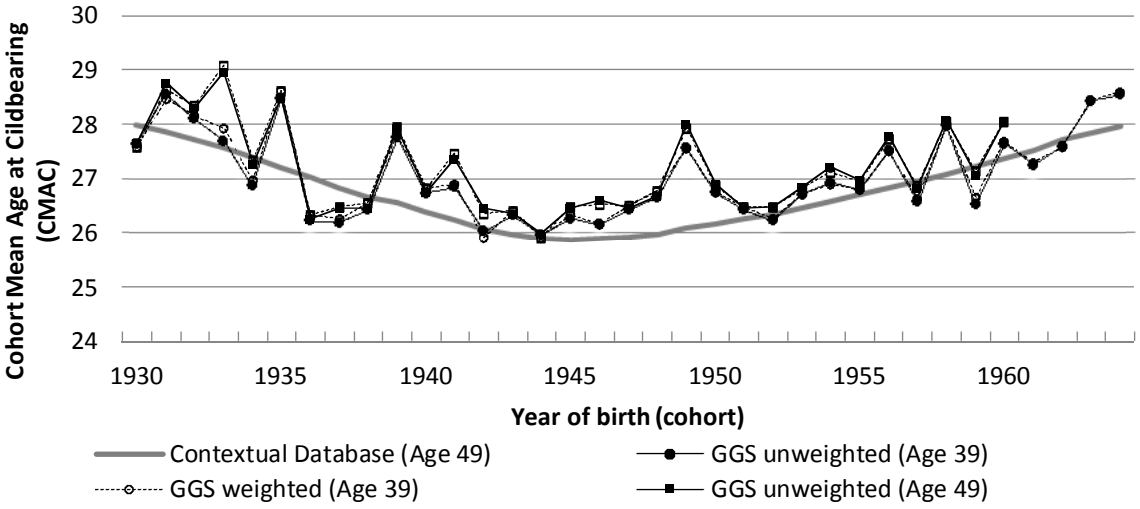
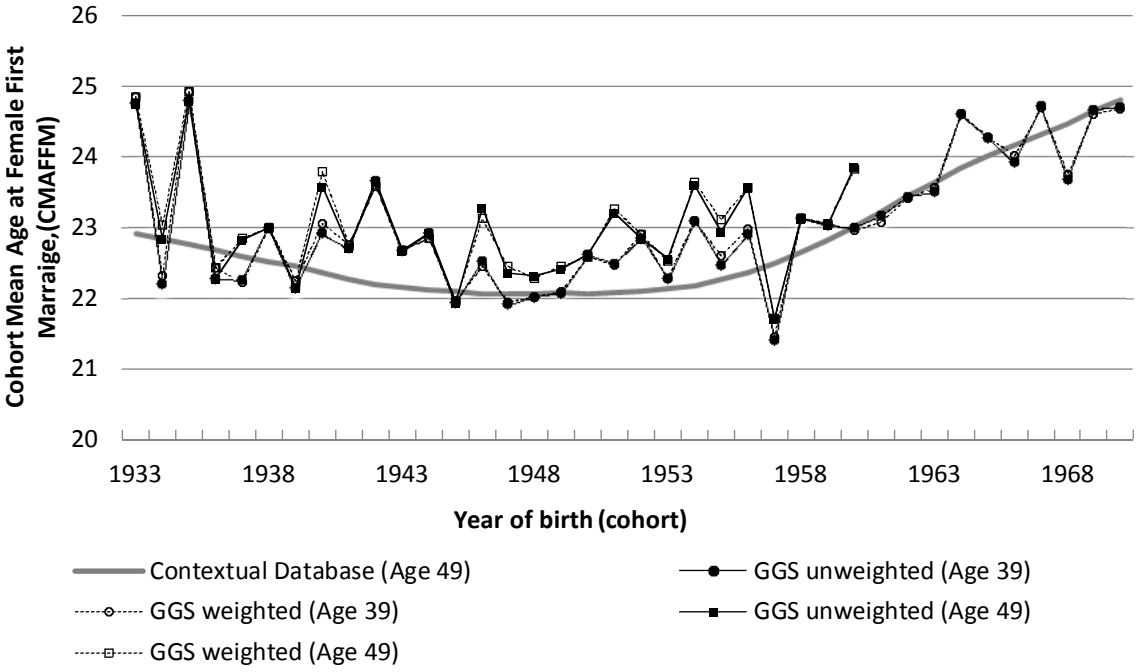


Figure B16. Cohort Mean Age at Female First Marriage Belgium



Bulgaria

Figure B17. Period Total Fertility Rate Bulgaria

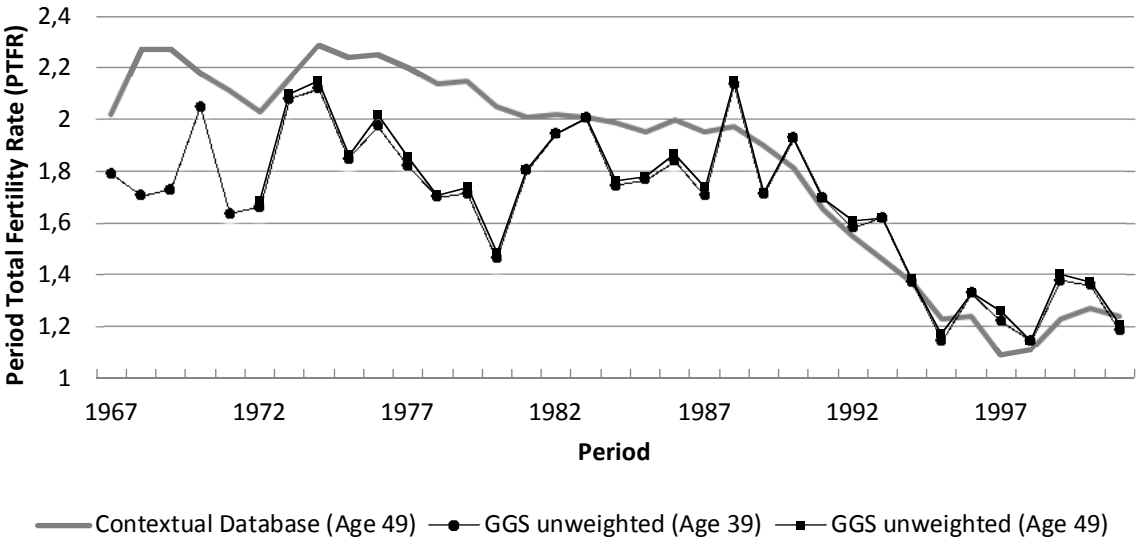


Figure B18. Period Total Female First Marriage Rate Bulgaria

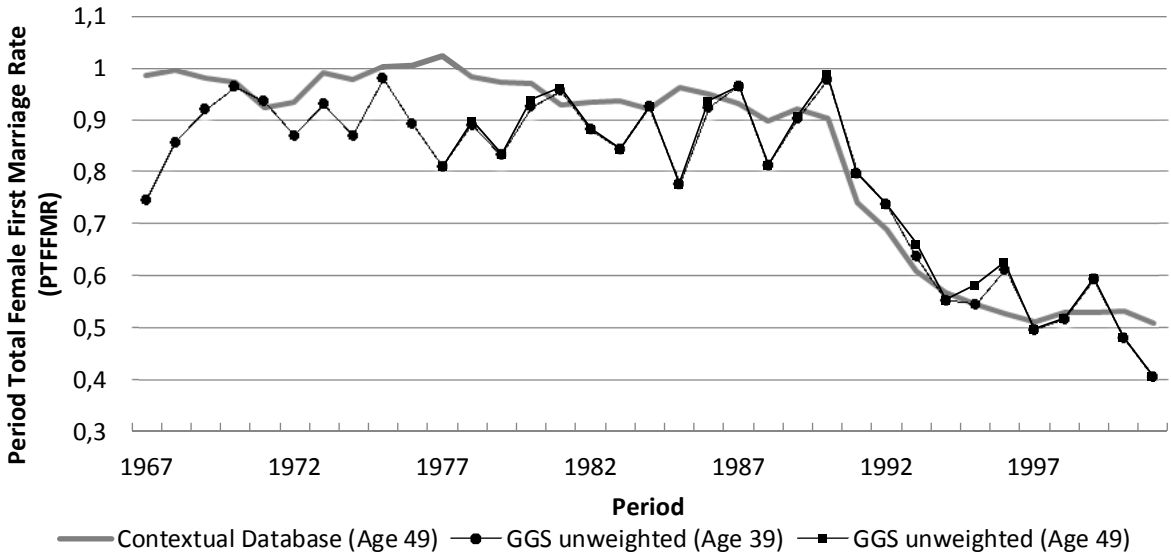


Figure B19. Period Mean Age at Childbearing Bulgaria

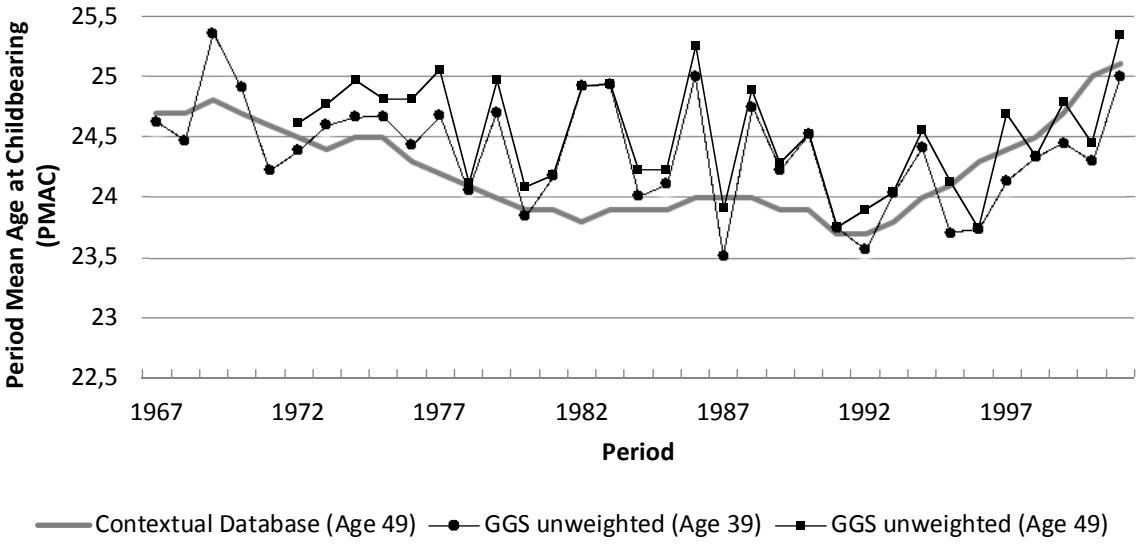


Figure B20. Period Mean Age at Female First Marriage Bulgaria

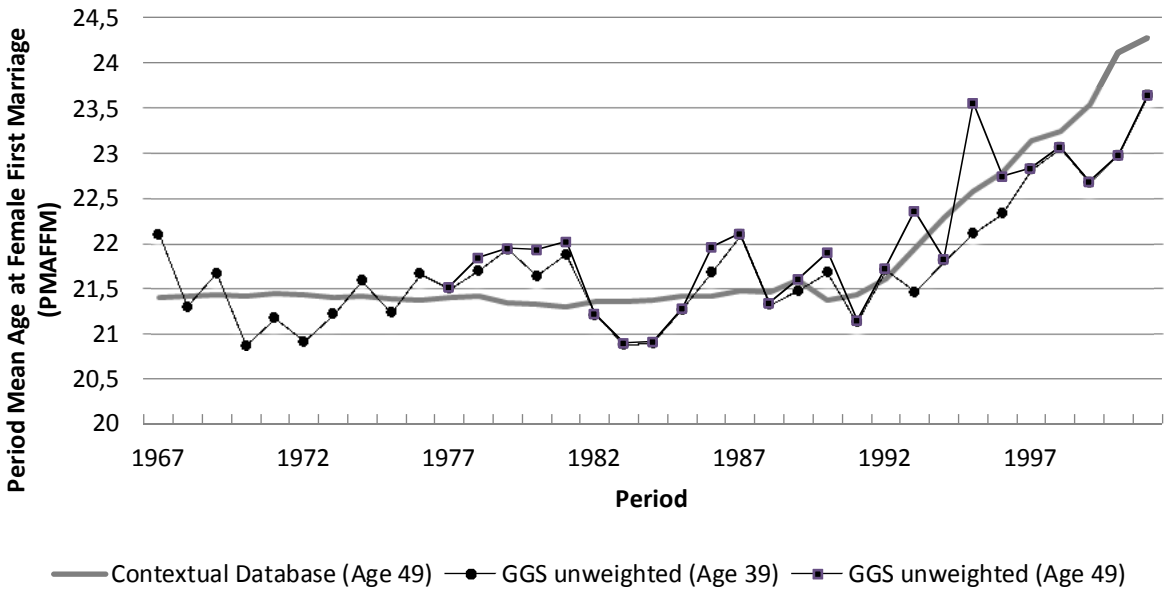


Figure B21. Cohort Total Fertility Rate Bulgaria

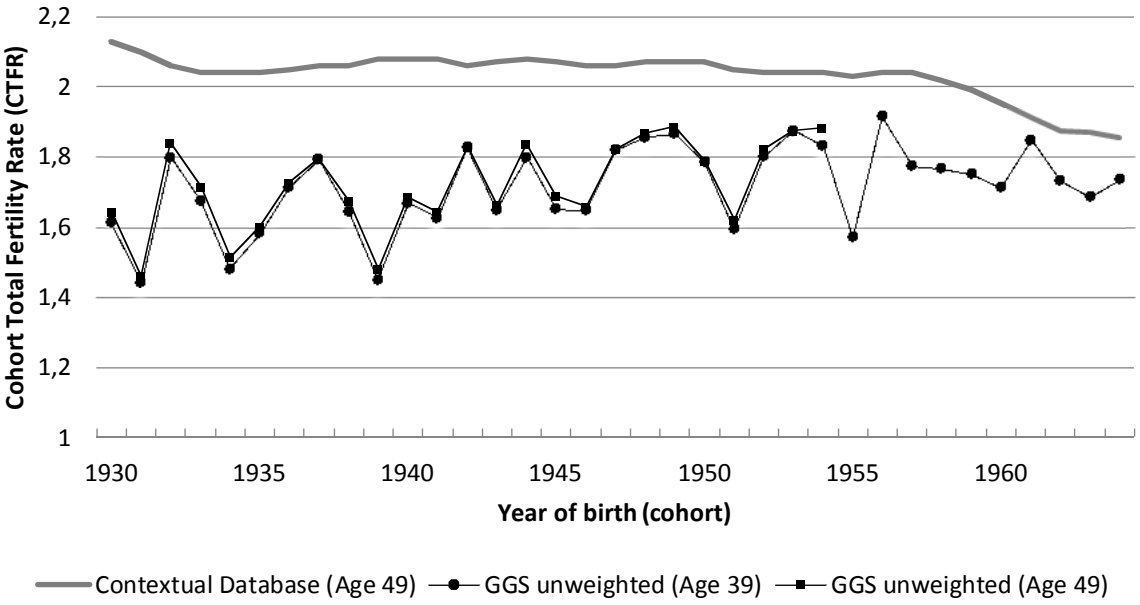


Figure B22. Cohort Total Female First Marriage Rate Bulgaria

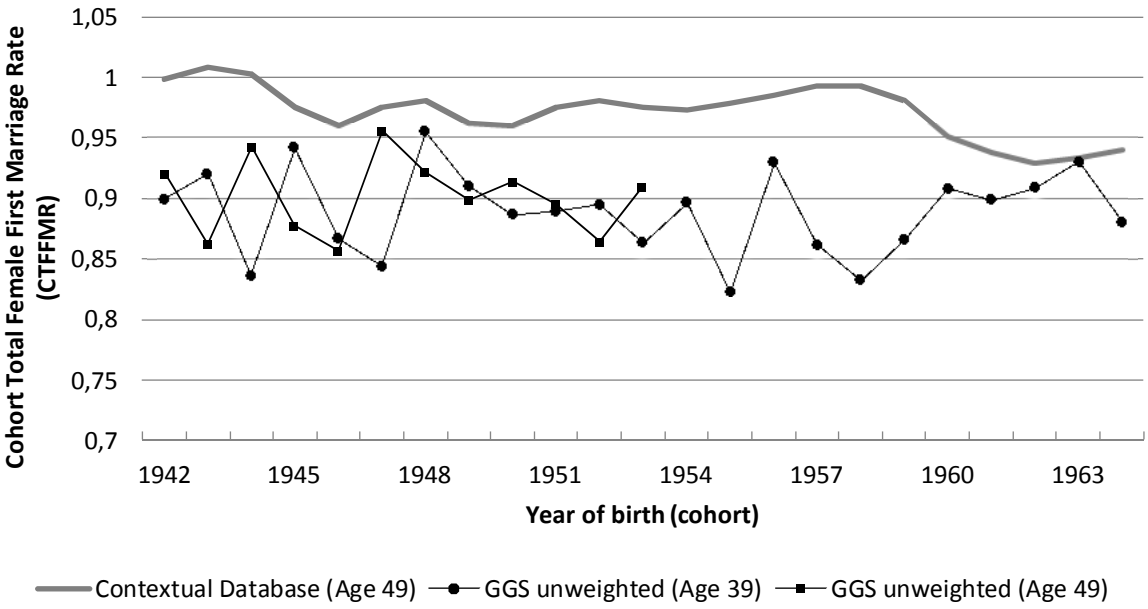


Figure B23. Cohort Mean Age at Childbearing Bulgaria

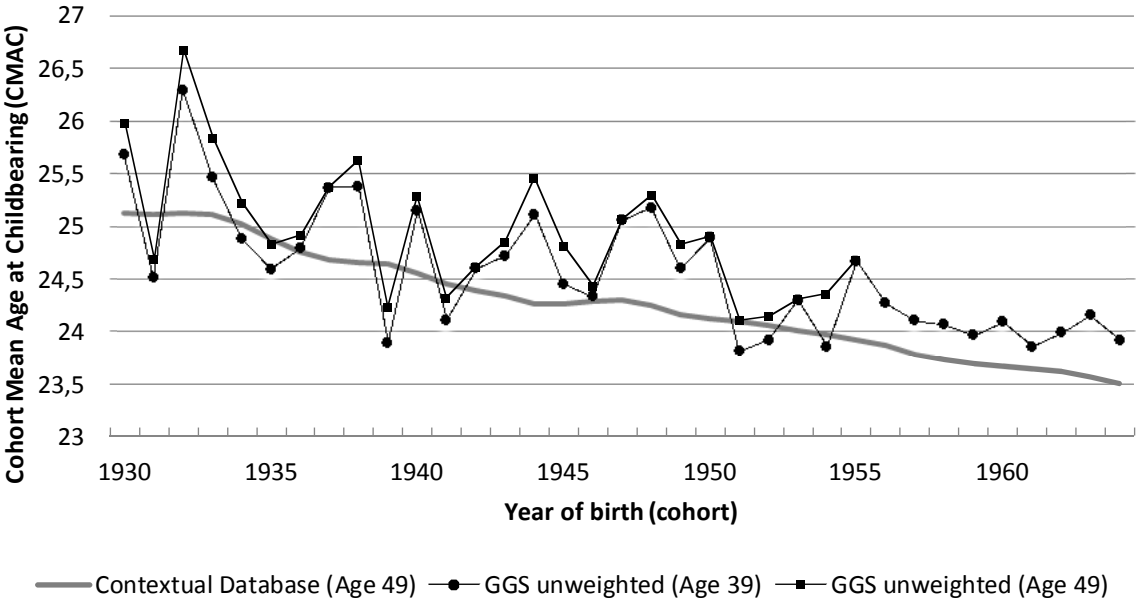
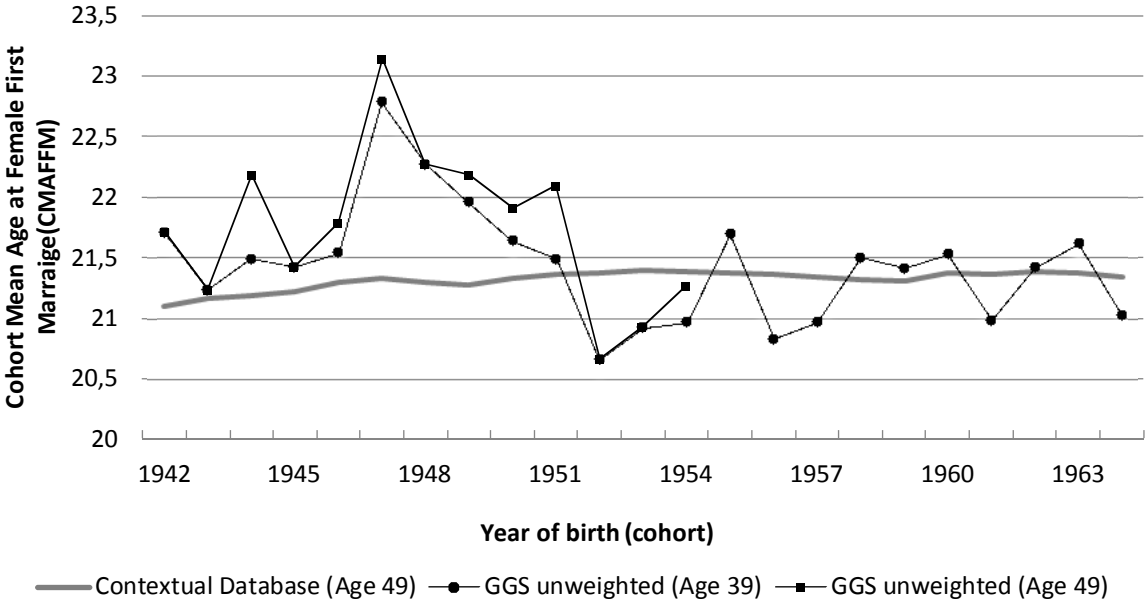


Figure B24. Cohort Mean Age at Female First Marriage Bulgaria



Estonia

Figure B25. Period Total Fertility Rate Estonia

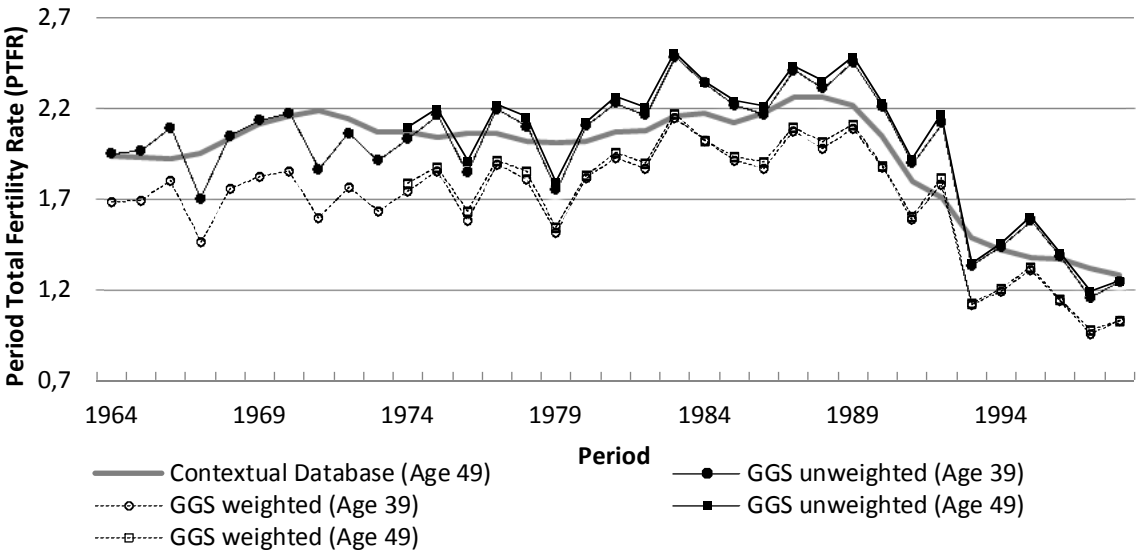


Figure B26. Period Total Female First Marriage Rate Estonia

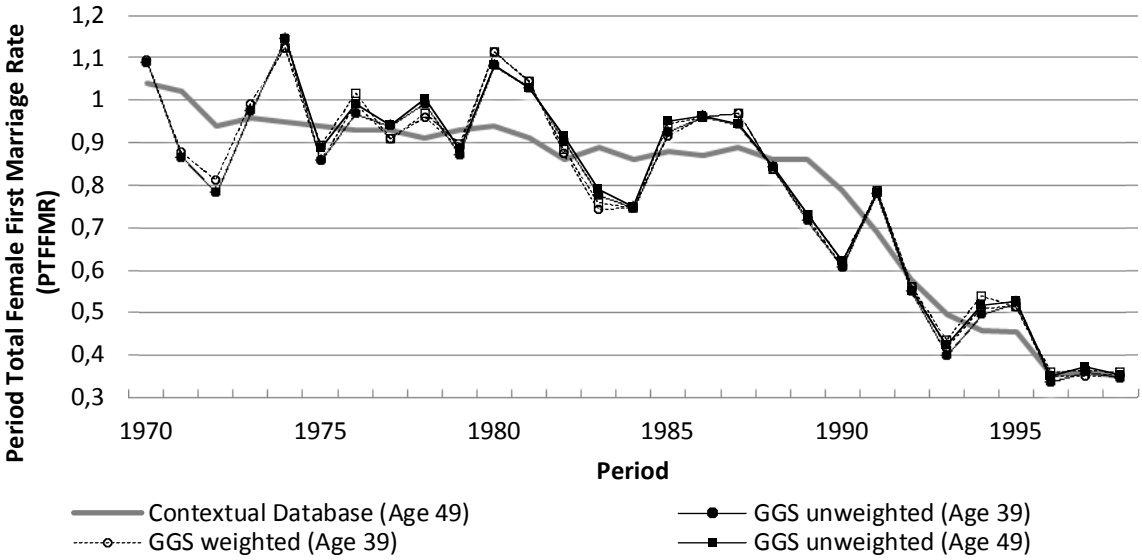


Figure B27. Period Mean Age at Childbearing Estonia

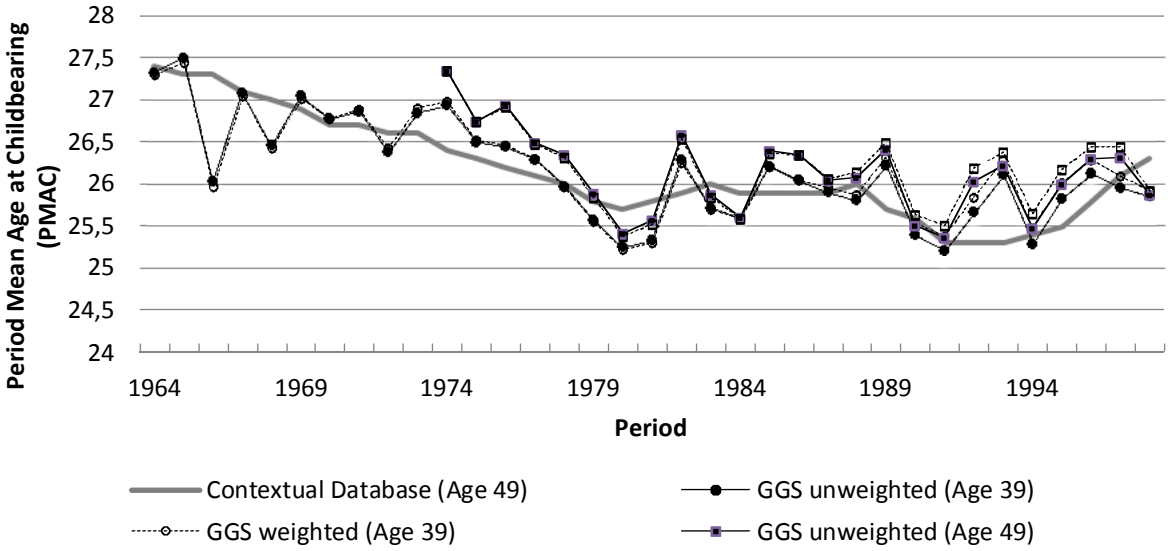


Figure B28. Period Mean Age at Female First Marriage Estonia

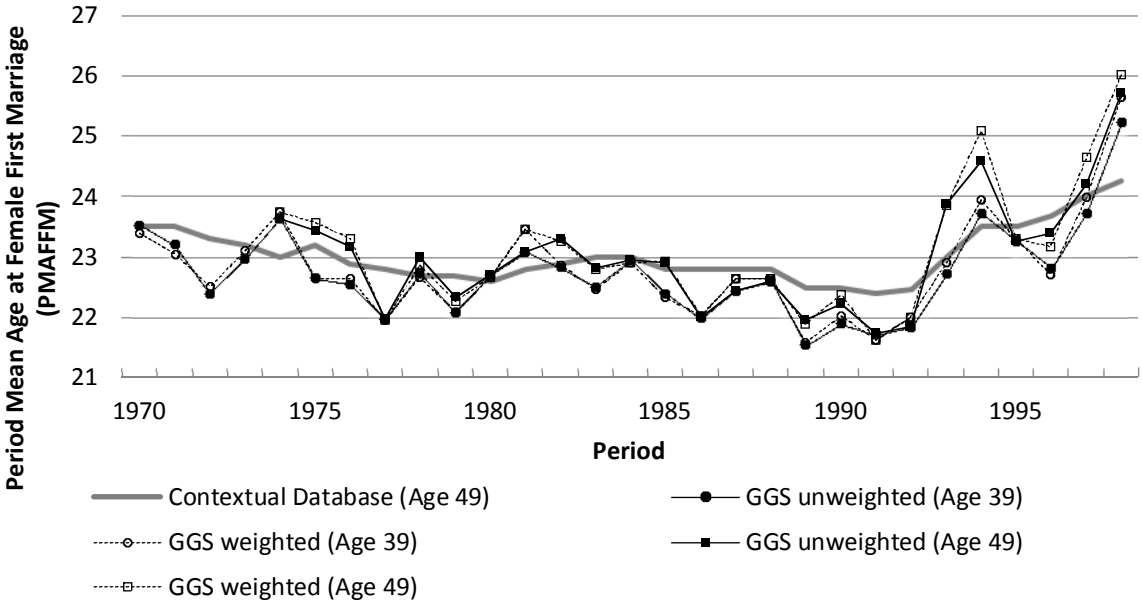


Figure B29. Cohort Total Fertility Rate Estonia

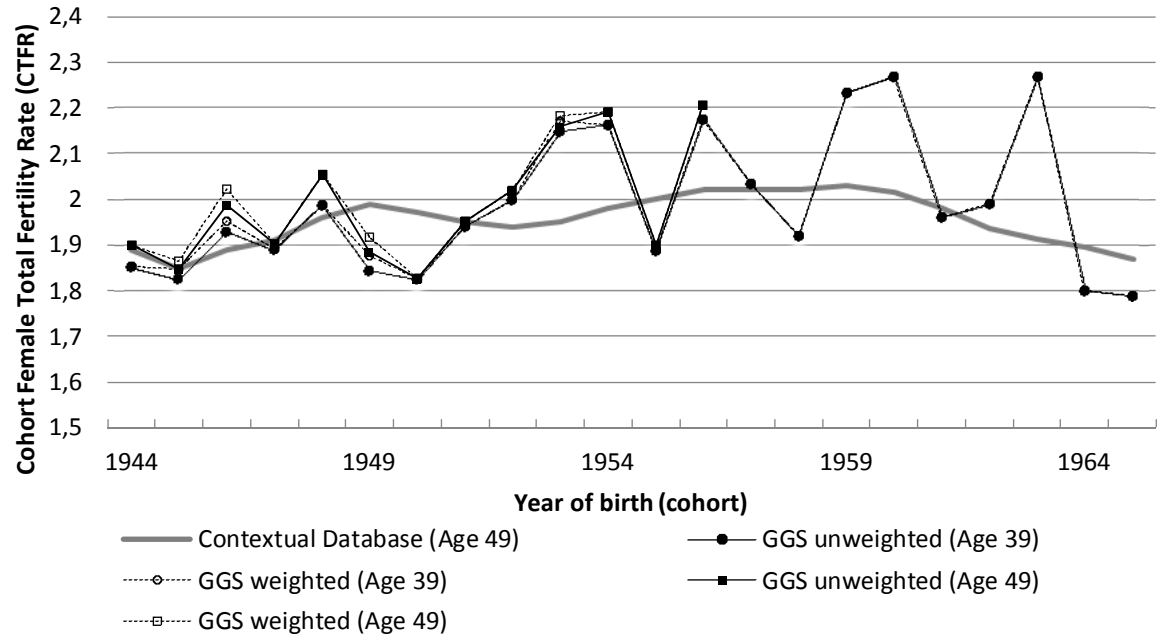
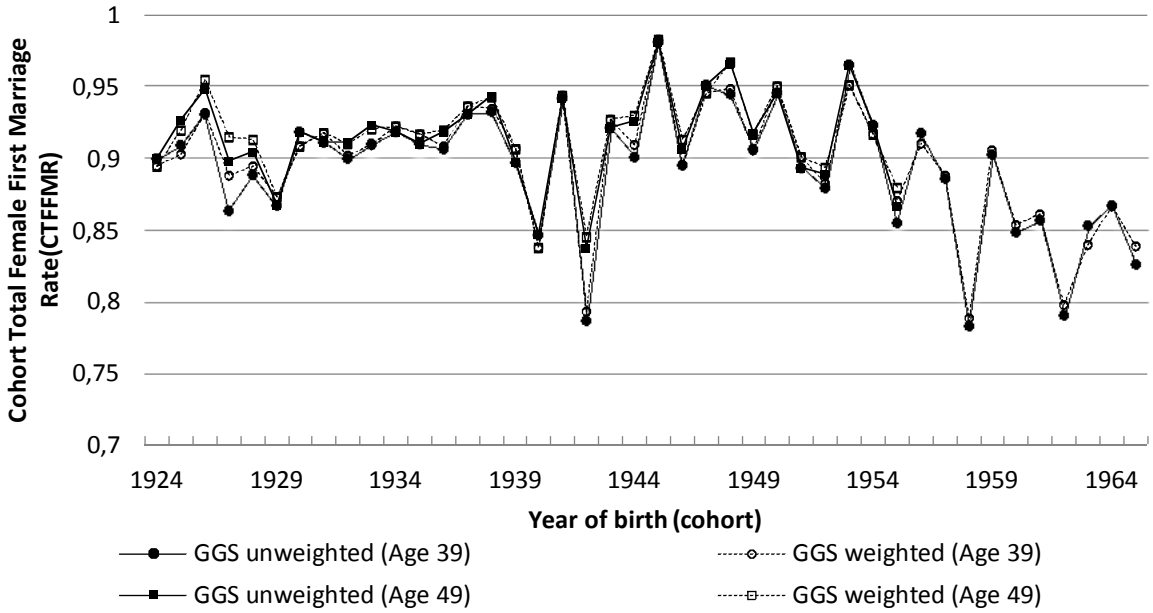


Figure B30. Cohort Total Female First Marriage Rate Estonia[1]



[1] No vital registration data available

Figure B31. Cohort Mean Age at Childbearing Estonia

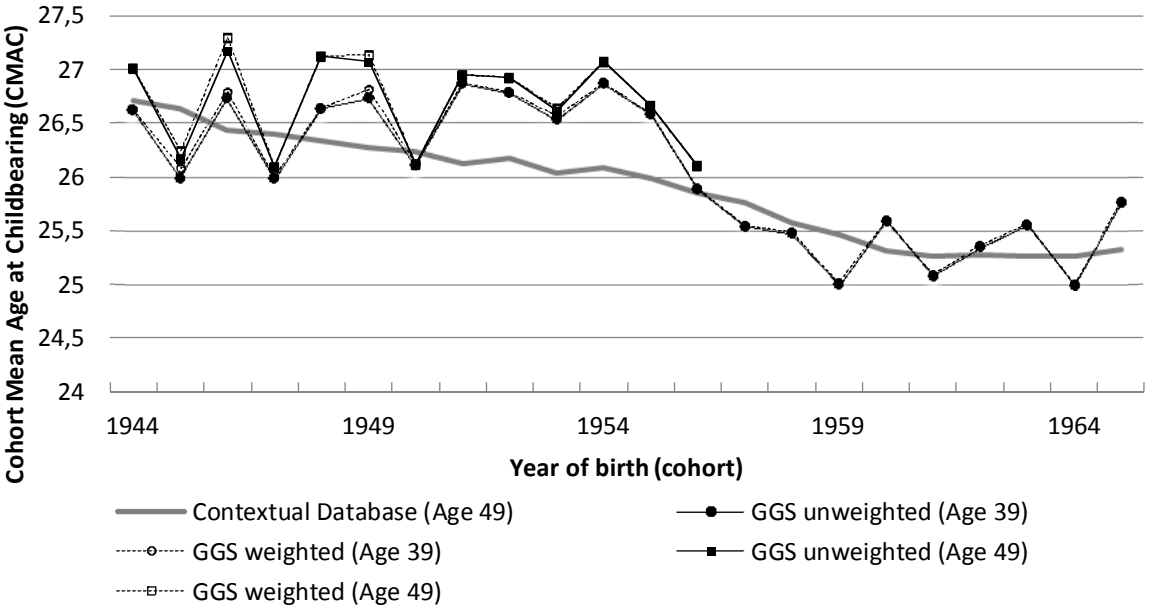
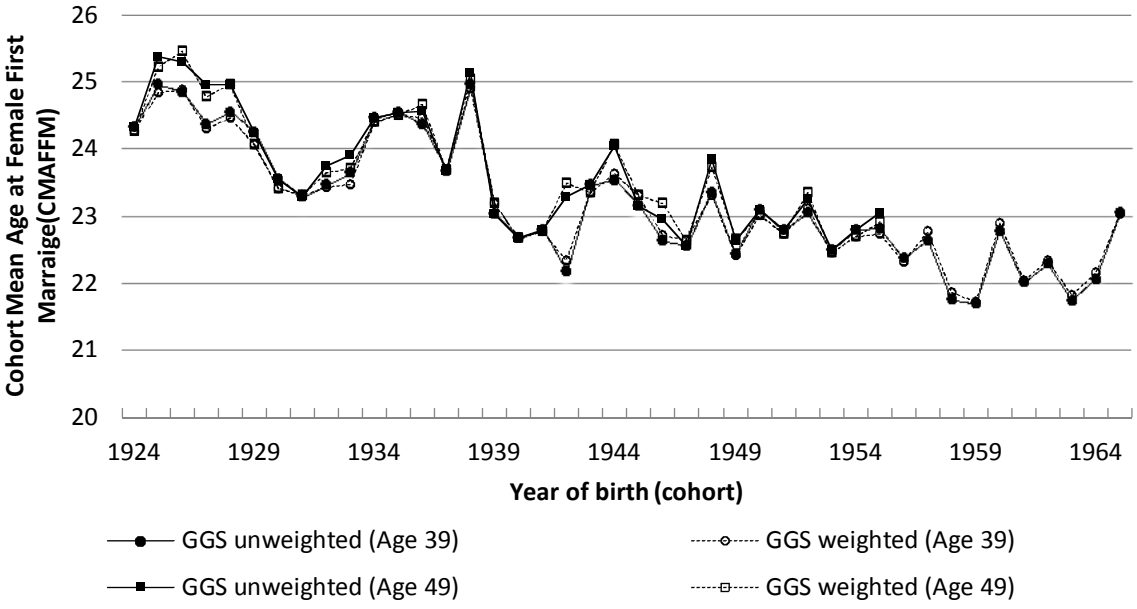


Figure B32. Cohort Mean Age at Female First Marriage Estonia[1]



[1] No vital registration data available

France

Figure B33. Period Total Fertility Rate France

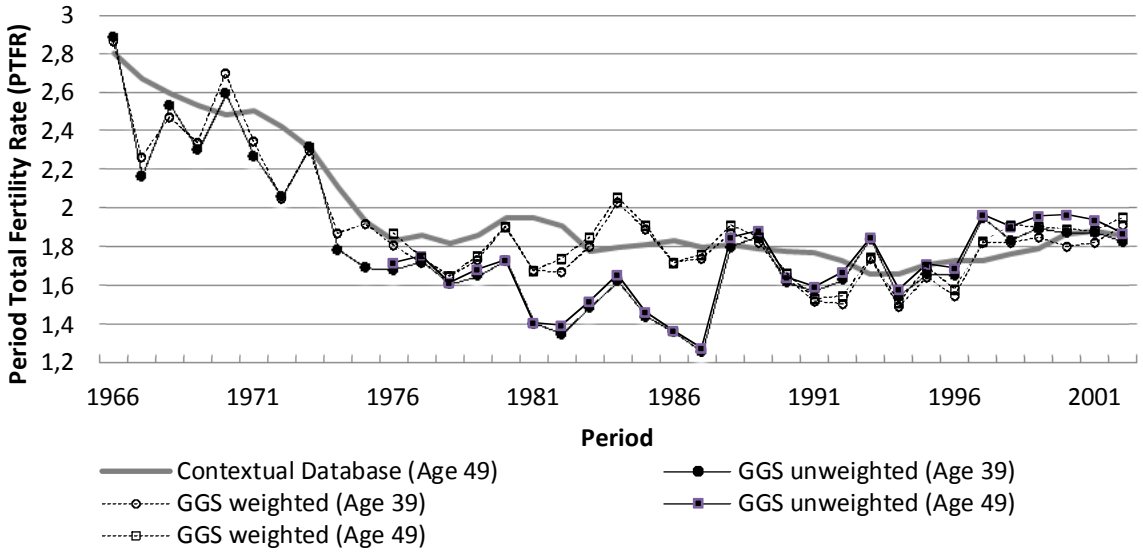


Figure B34. Period Total Female First Marriage Rate France

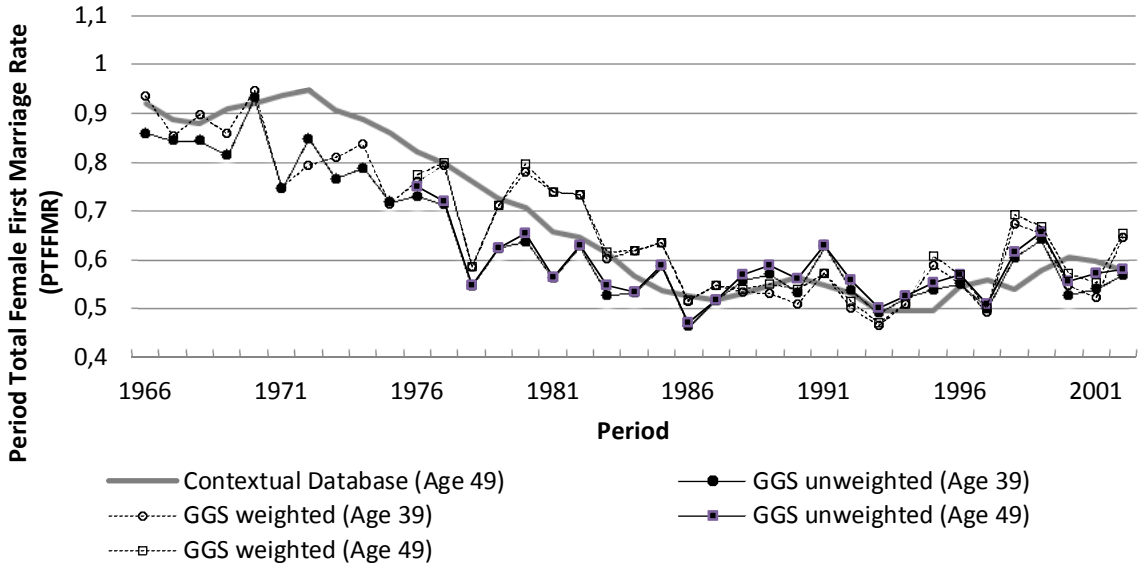


Figure B35. Period Mean Age at Childbearing France

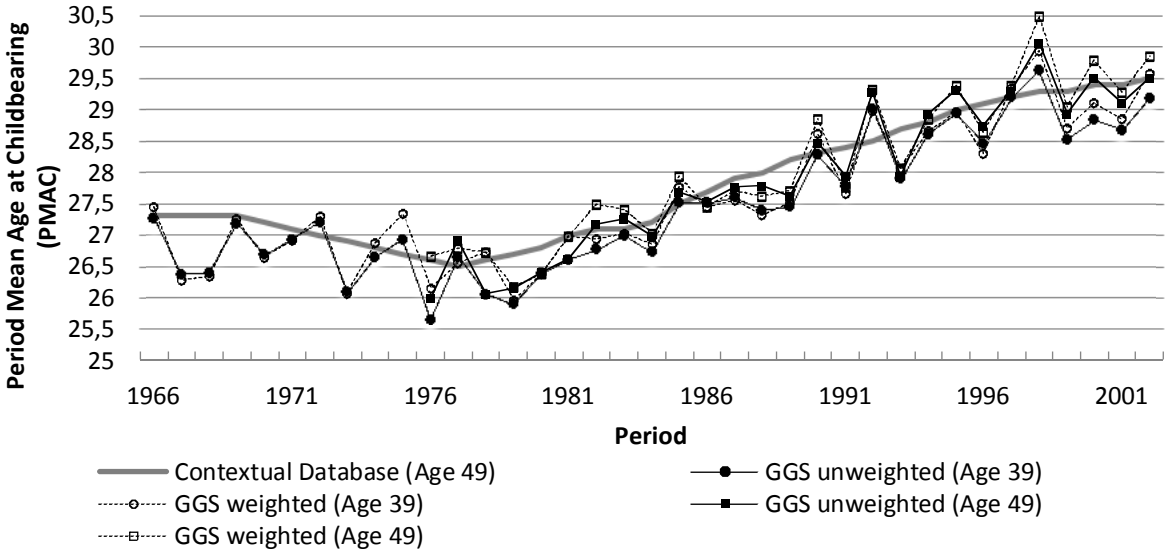


Figure B36. Period Mean Age at Female First Marriage France

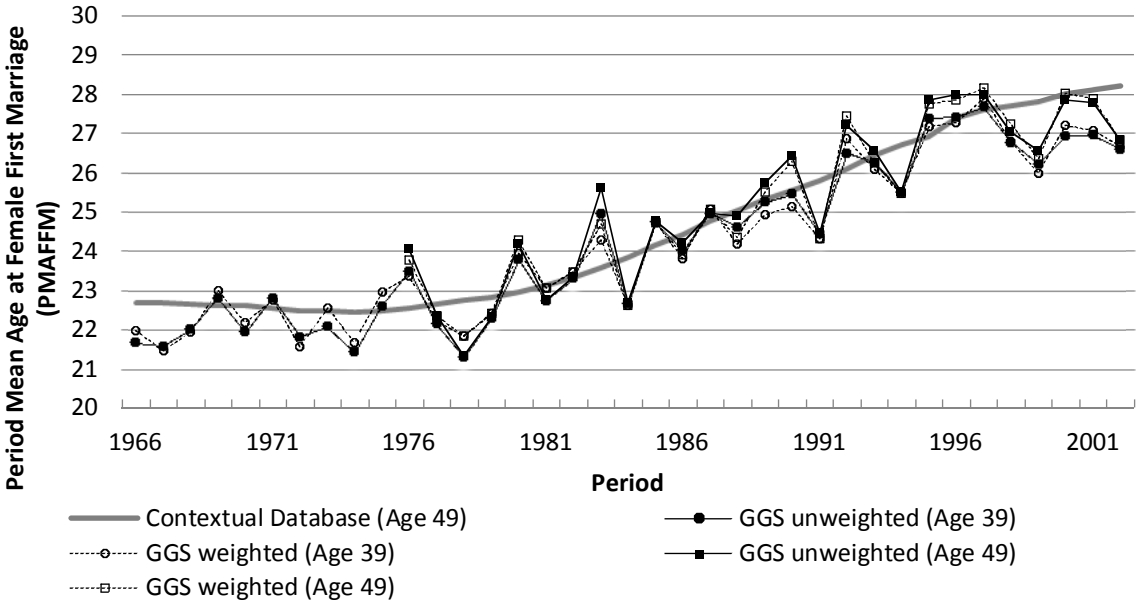


Figure B37. Cohort Total Fertility Rate France

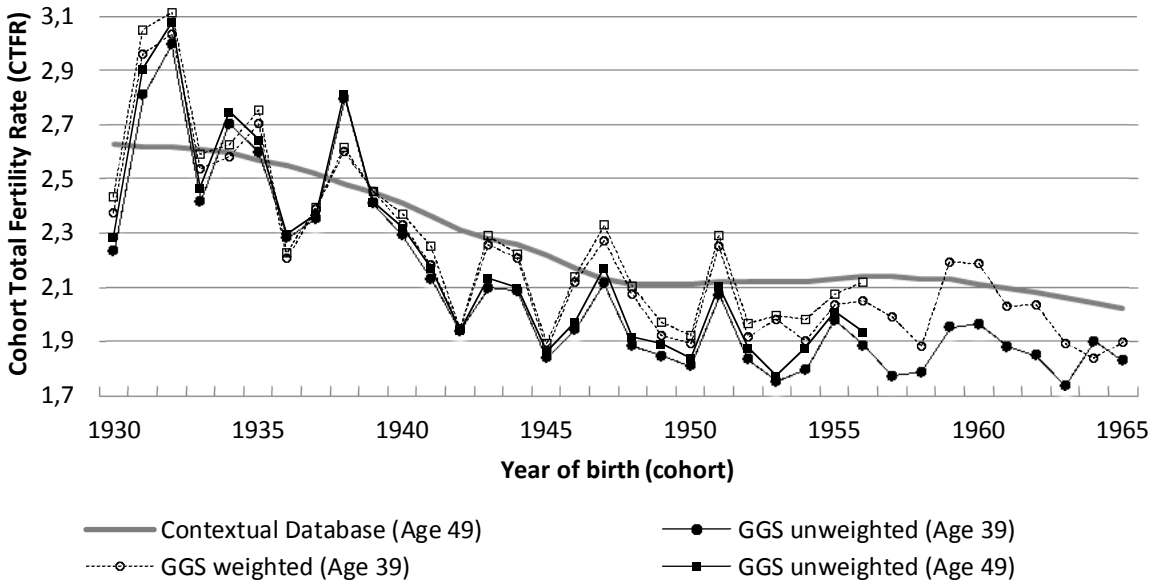


Figure B38. Cohort Total Female First Marriage Rate France

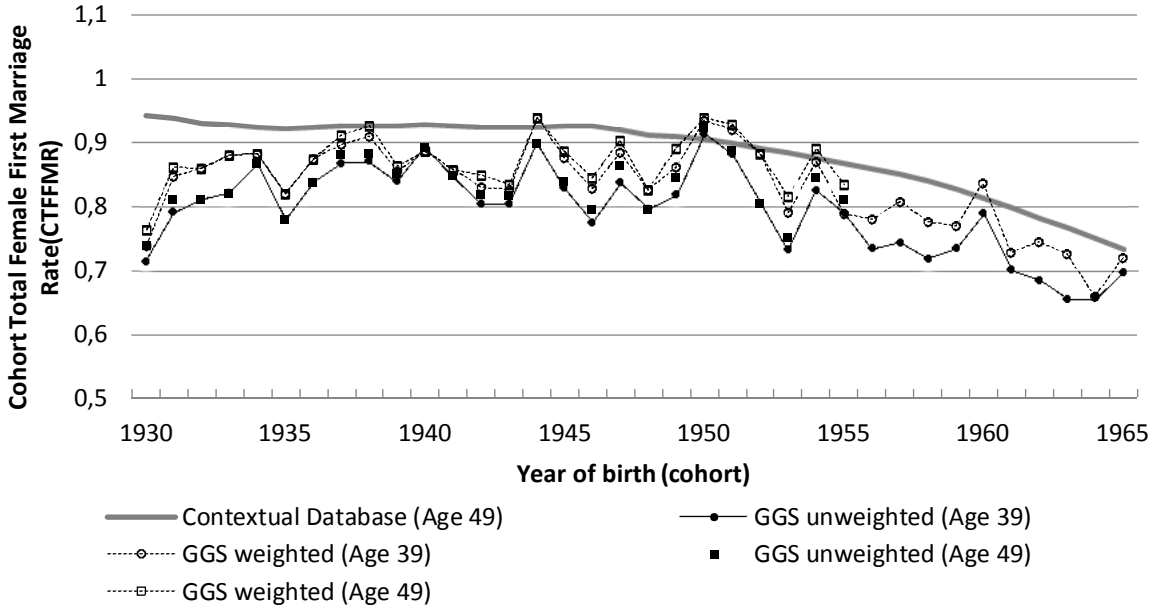


Figure B39. Cohort Mean Age at Childbearing France

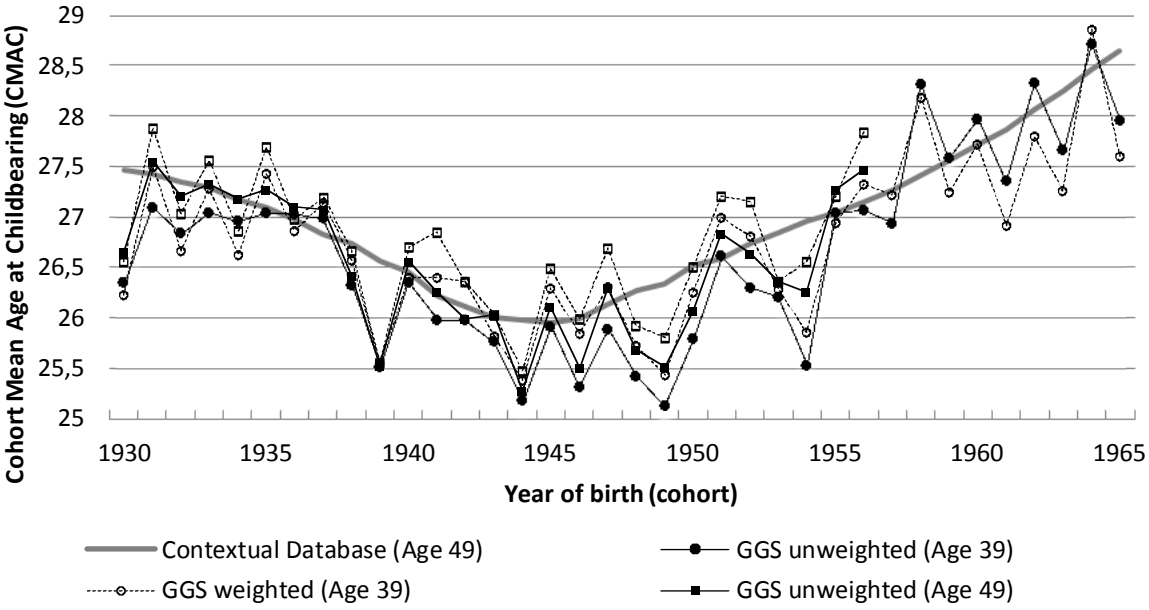
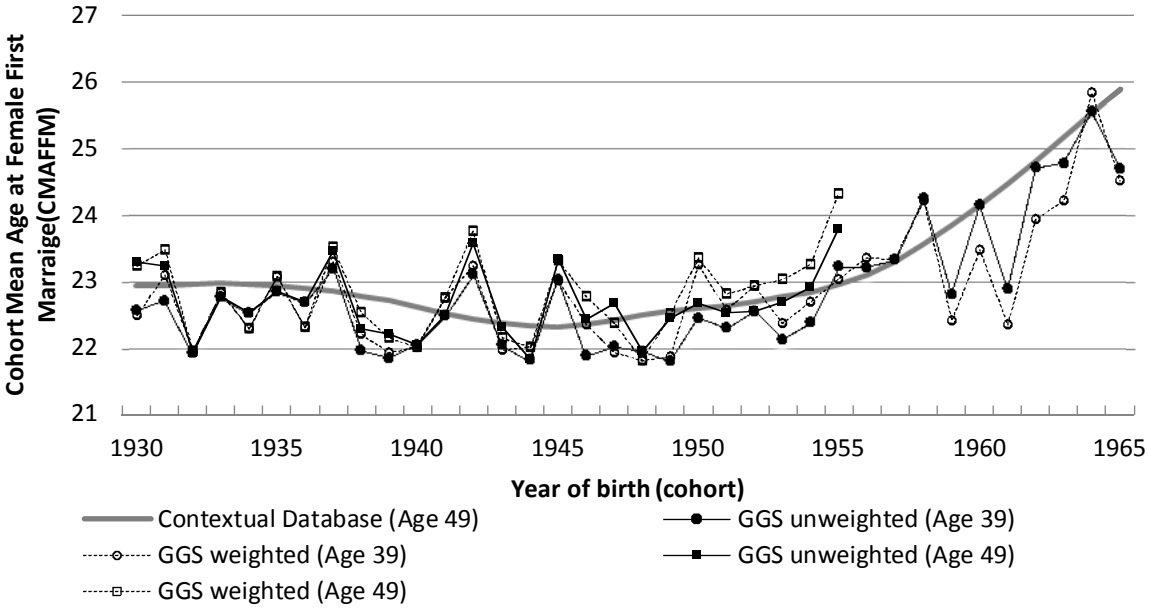


Figure B40. Cohort Mean Age at Female First Marriage France



Georgia

Figure B41. Period Total Fertility Rate Georgia

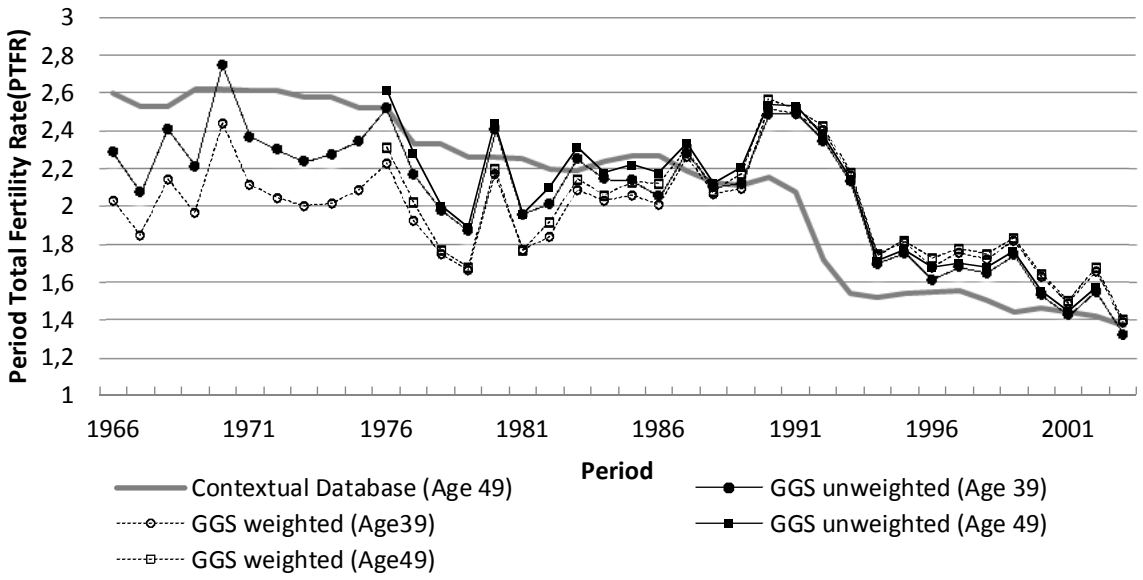


Figure B42. Period Total Female First Marriage Rate Georgia

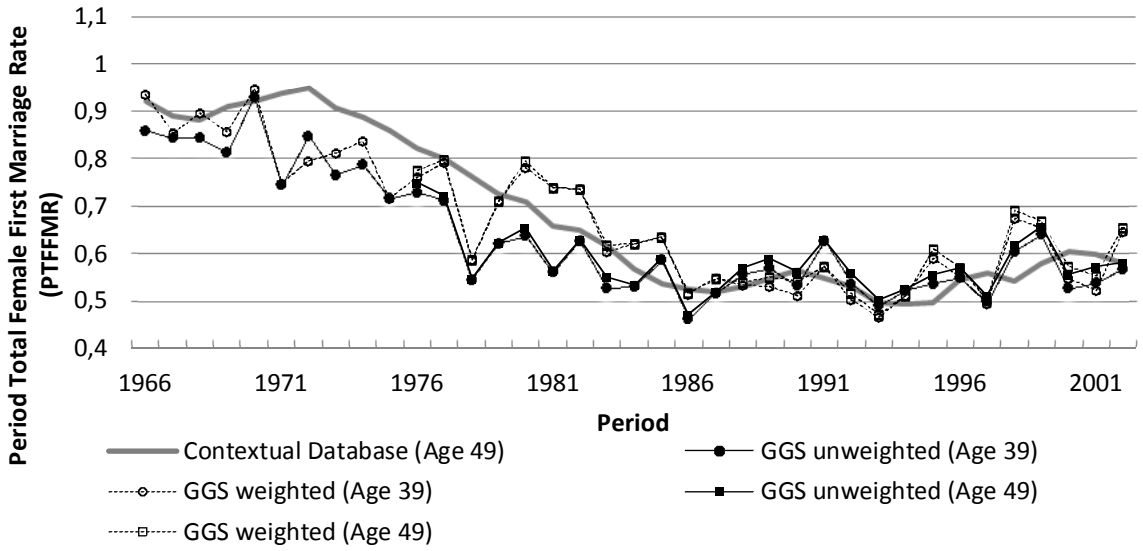


Figure B43. Period Mean Age at Childbearing Georgia

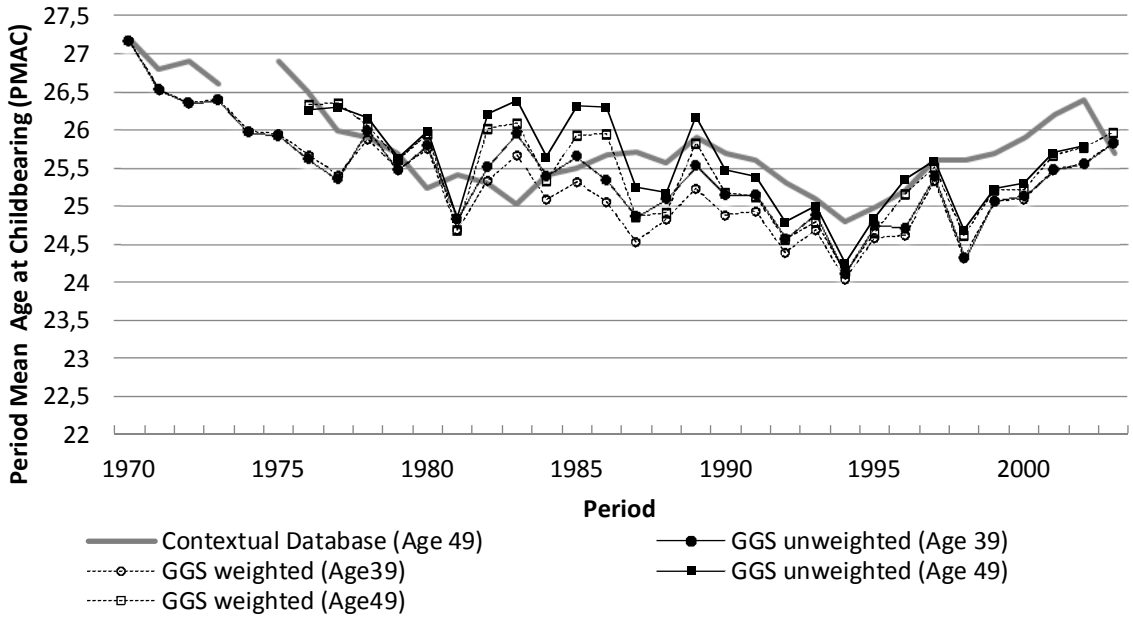


Figure B44. Period Mean Age at Female First Marriage Georgia

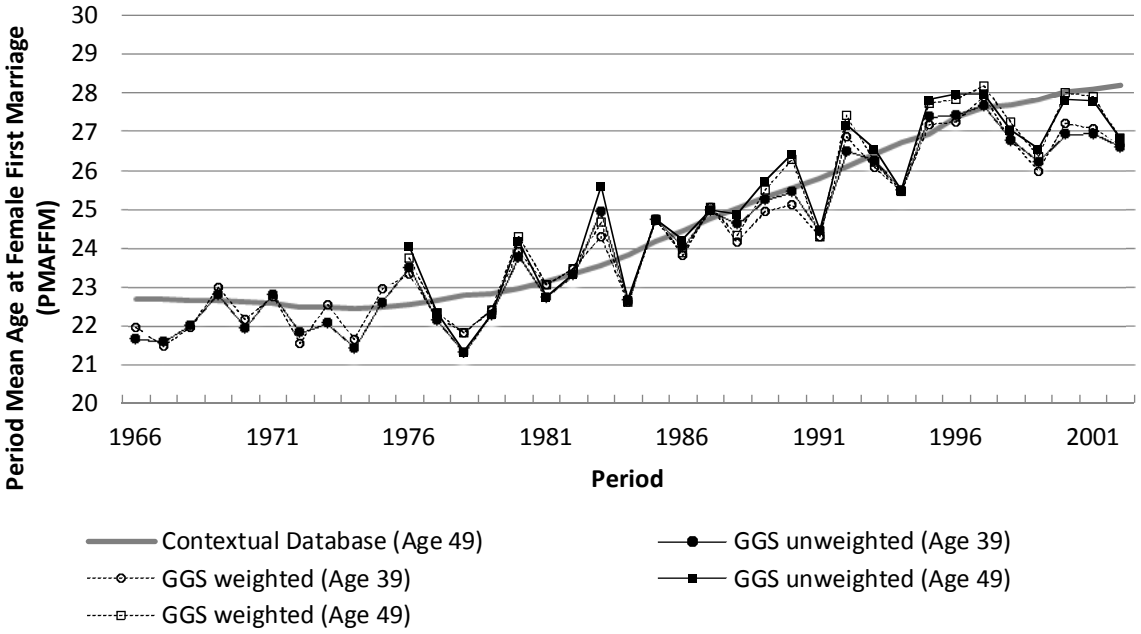


Figure B45. Cohort Total Fertility Rate Georgia

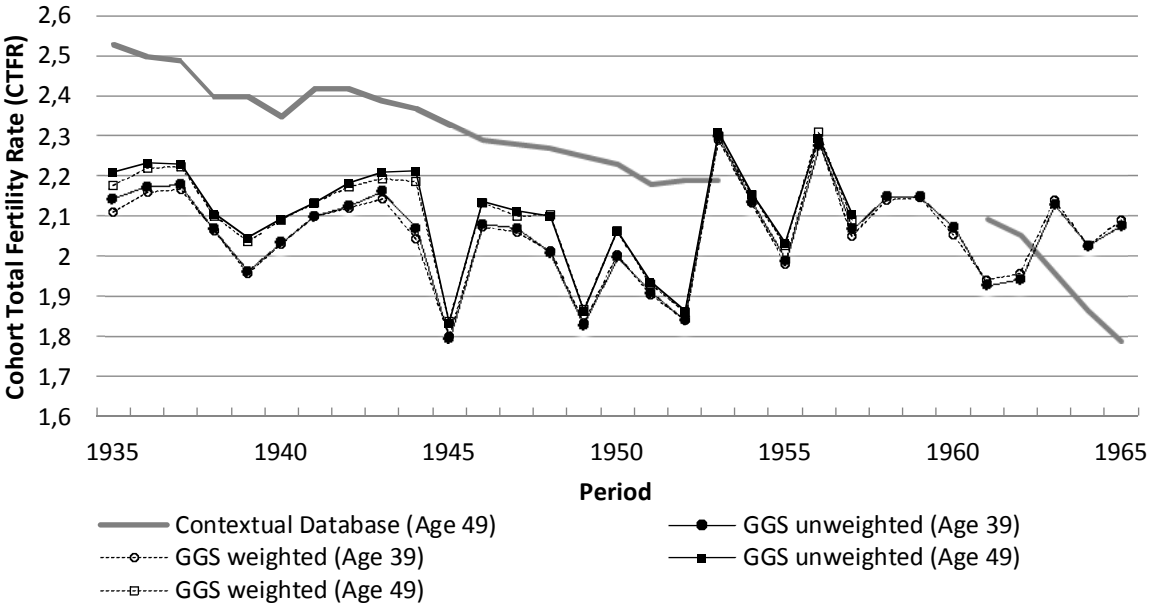
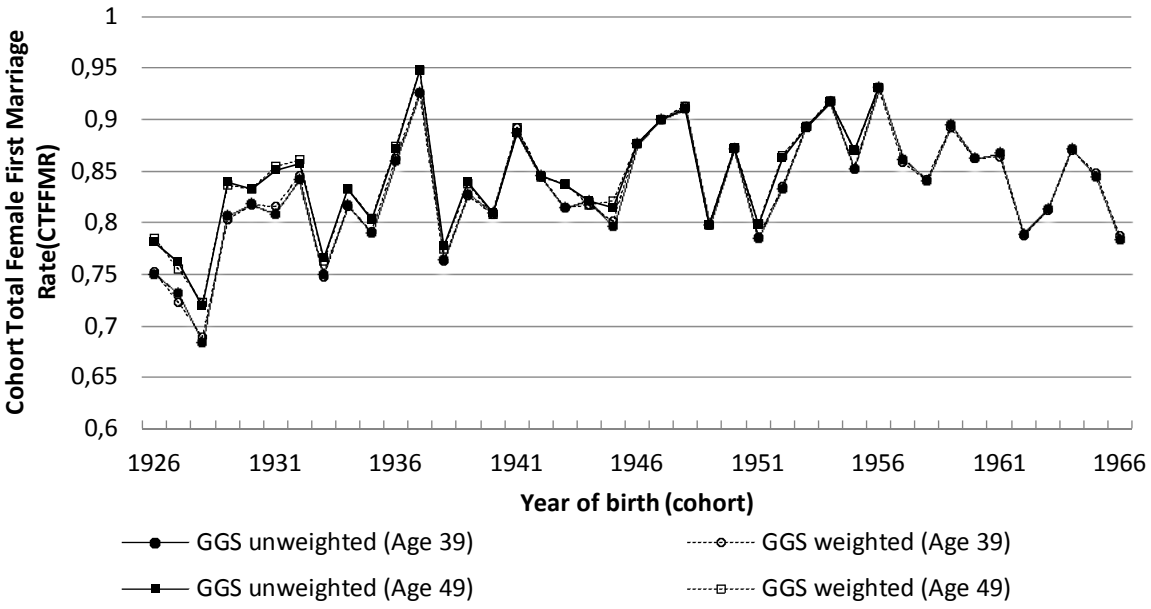


Figure B46. Cohort Total Female First Marriage Rate Georgia[1]



[1] No vital registration data available

Figure B47. Cohort Mean Age at Childbearing Georgia

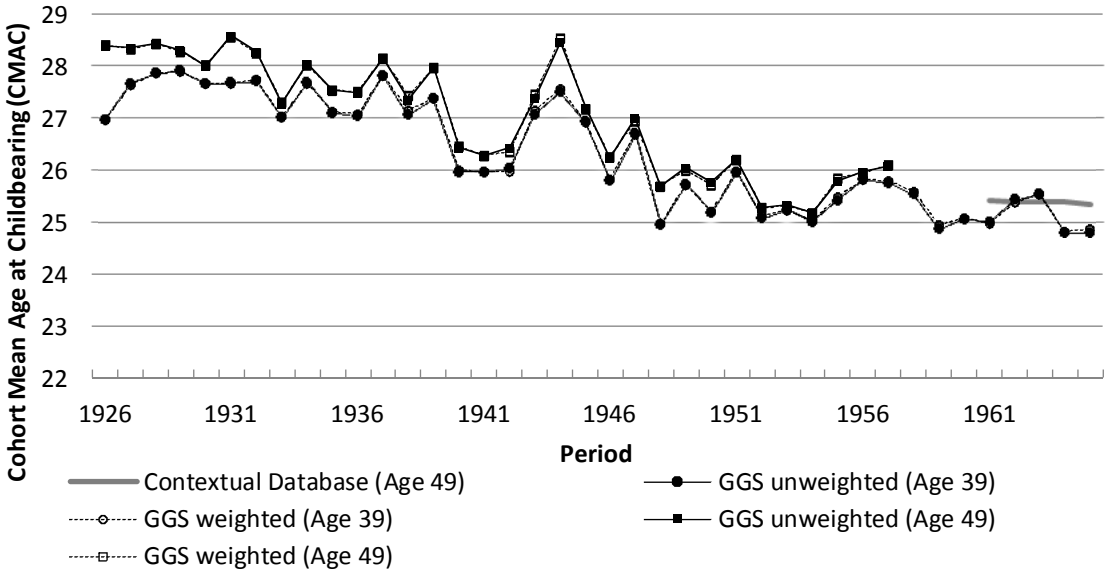
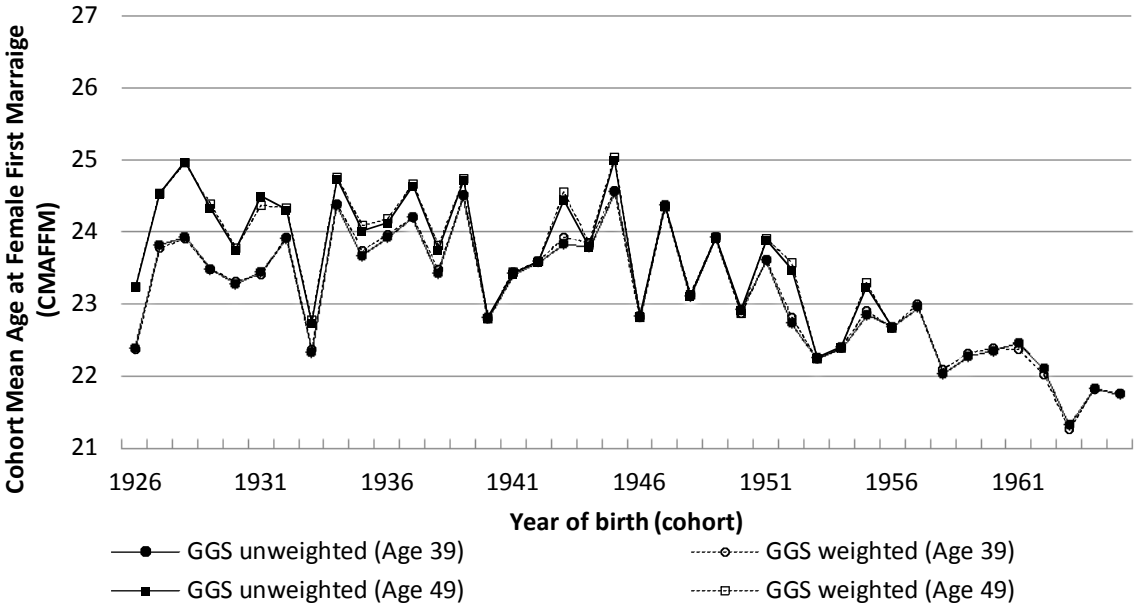


Figure B48. Cohort Mean Age at Female First Marriage Georgia[1]



[1] No vital registration data available

Germany

Figure B49. Period Total Fertility Rate Germany

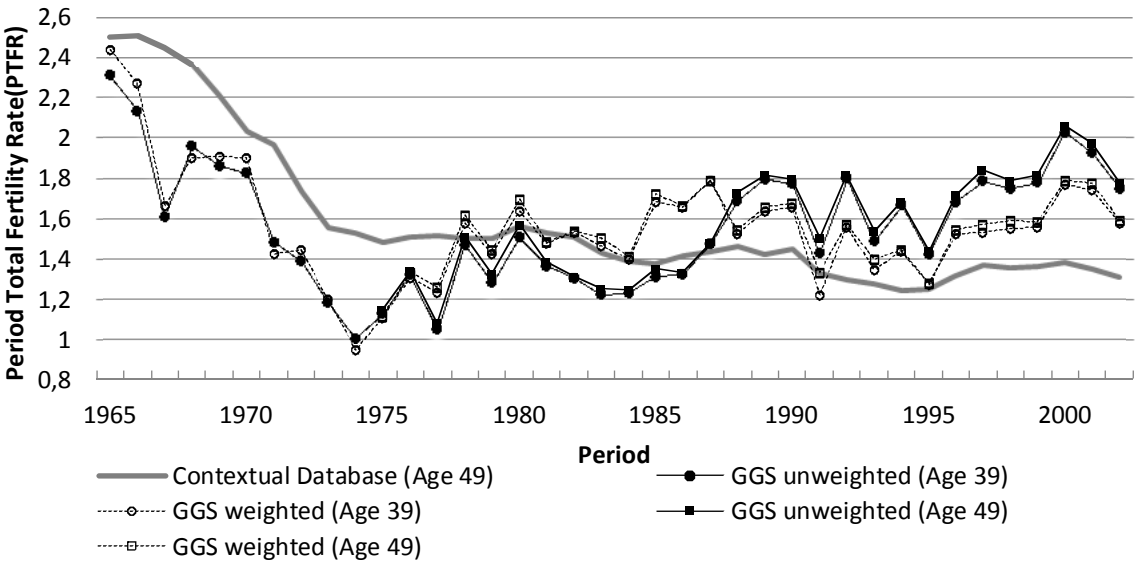


Figure B50. Period Total Female First Marriage Rate Germany

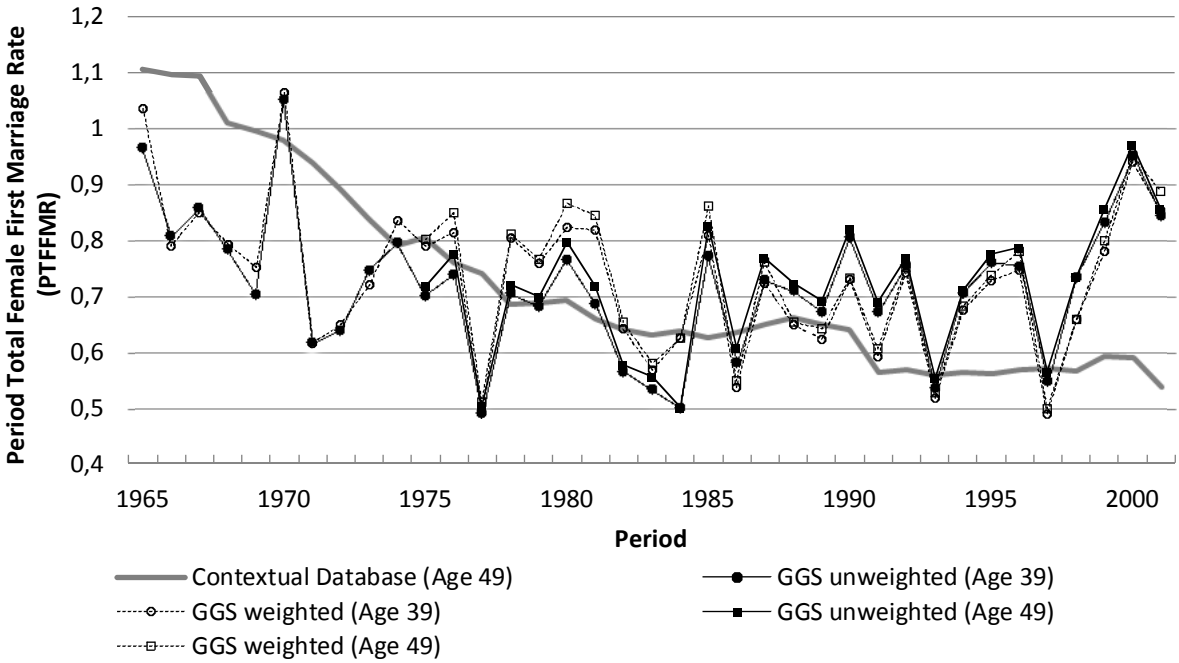


Figure B51. Period Mean Age at Childbearing Germany

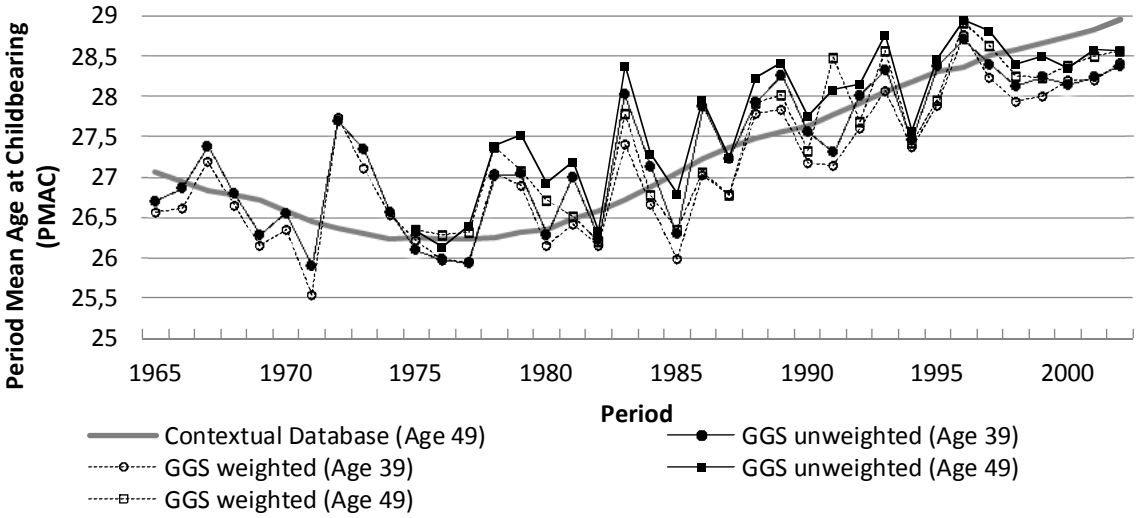


Figure B52. Period Mean Age at Female First Marriage Germany

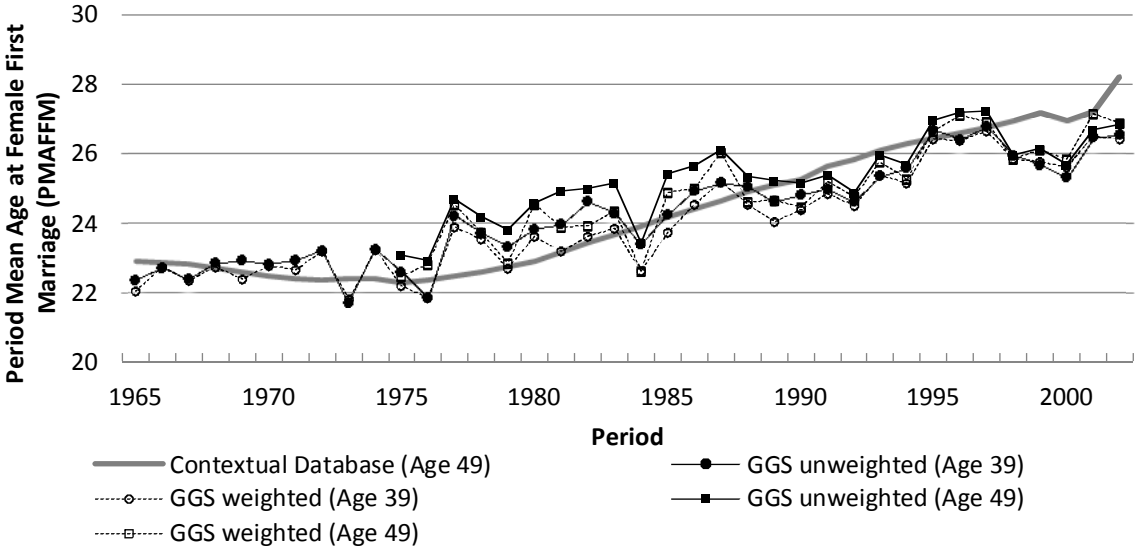


Figure B53. Cohort Total Fertility Rate Germany

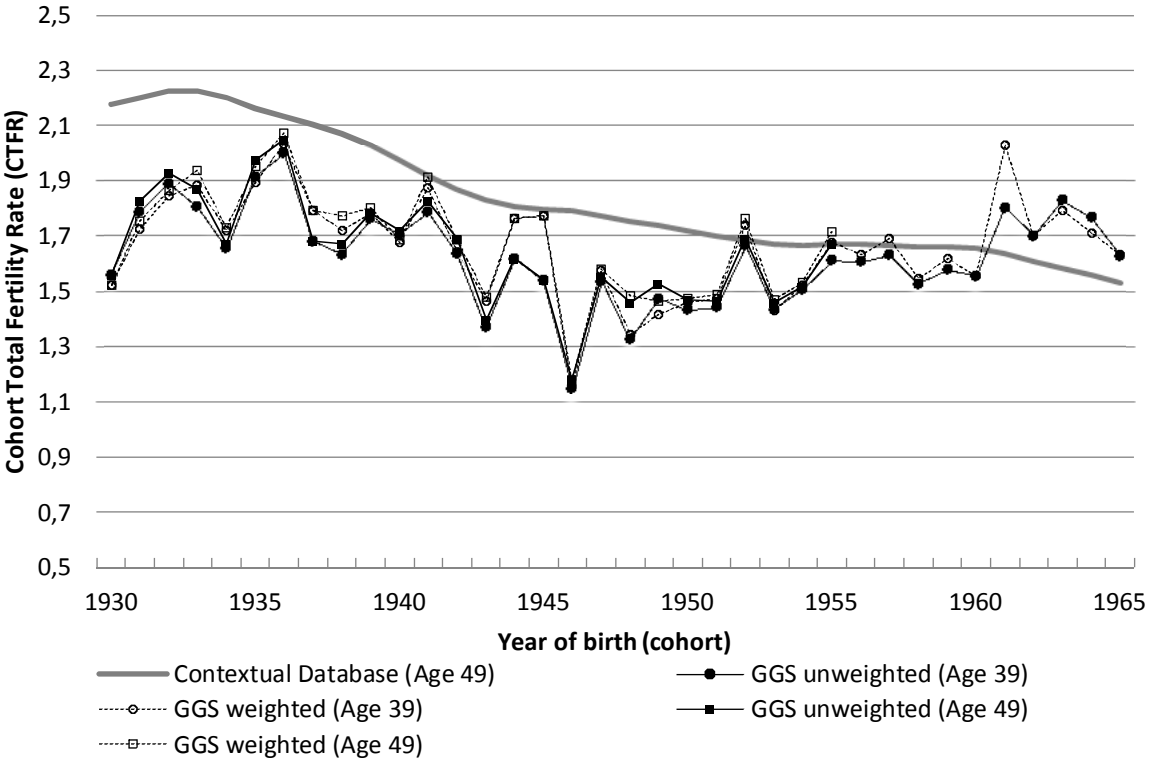


Figure B54. Cohort Total Female First Marriage Rate Germany

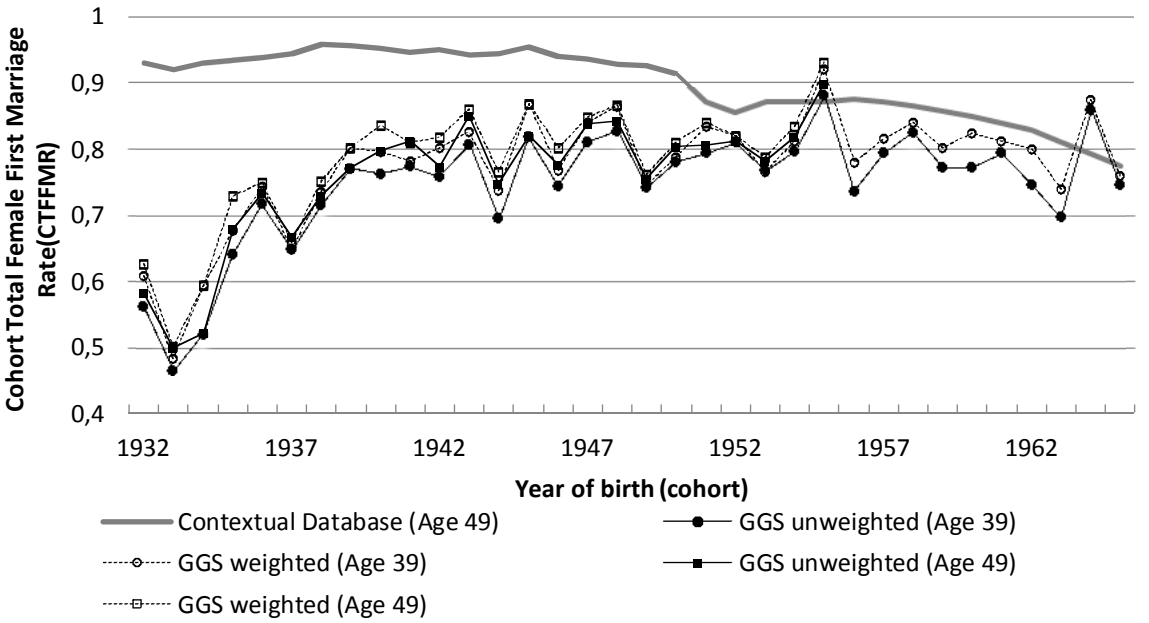


Figure B55. Cohort Mean Age at Childbearing Germany

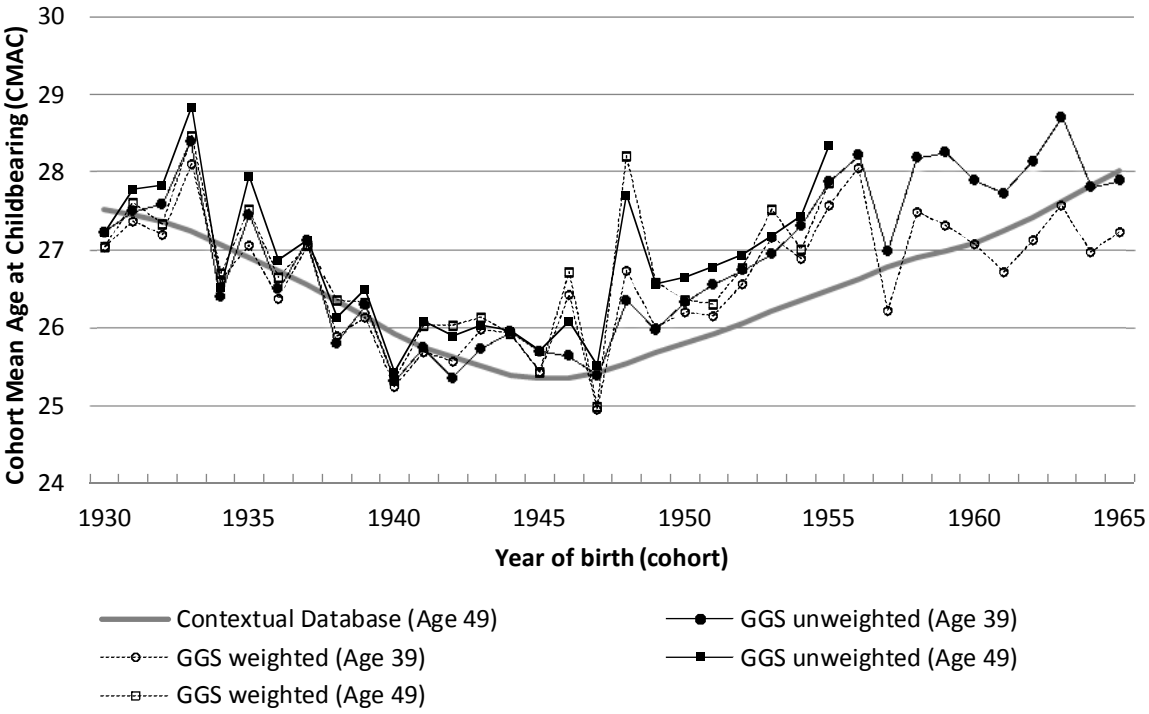
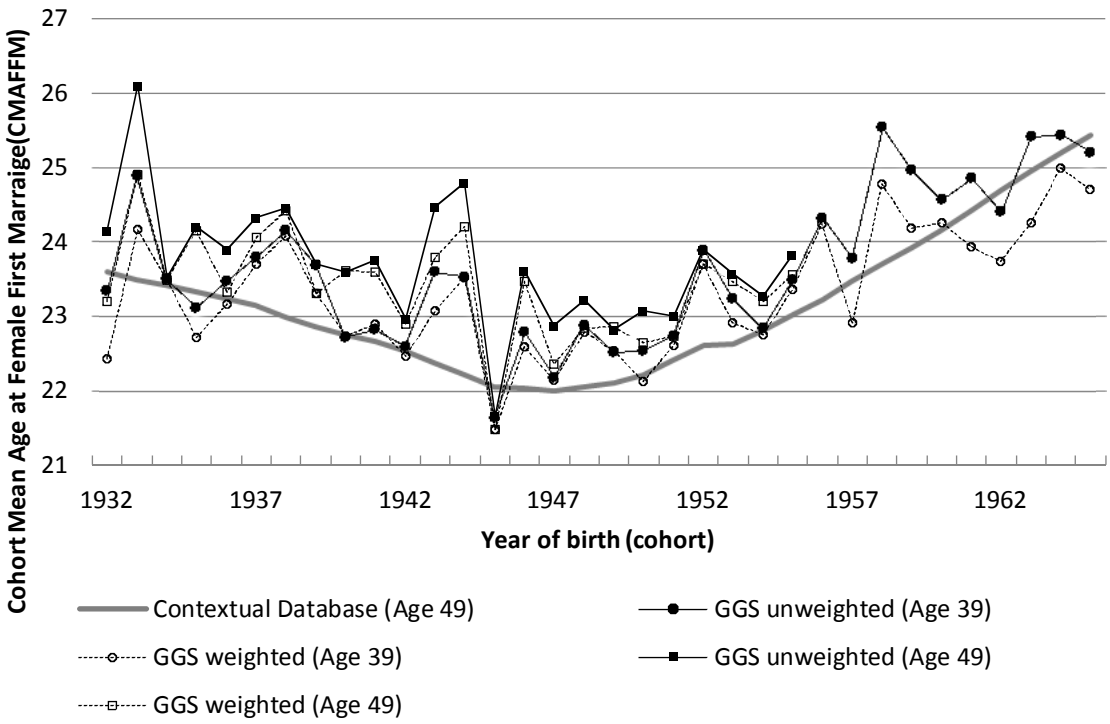


Figure B56. Cohort Mean Age at Female First Marriage Germany



Hungary

Figure B57. Period Total Female First Marriage Rate Hungary

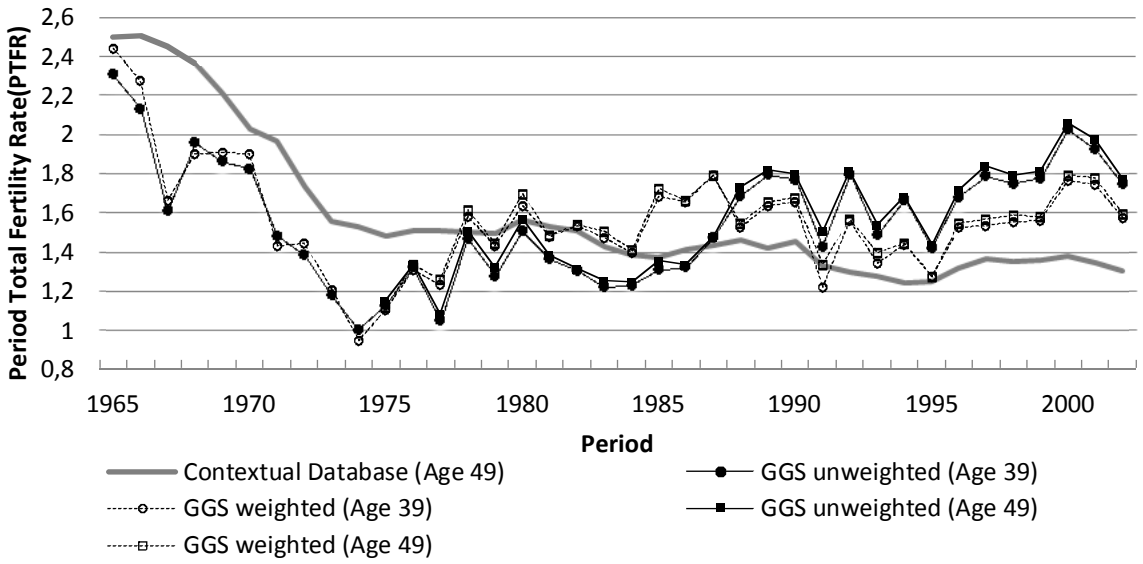


Figure B58. Period Total Female First Marriage Rate Hungary

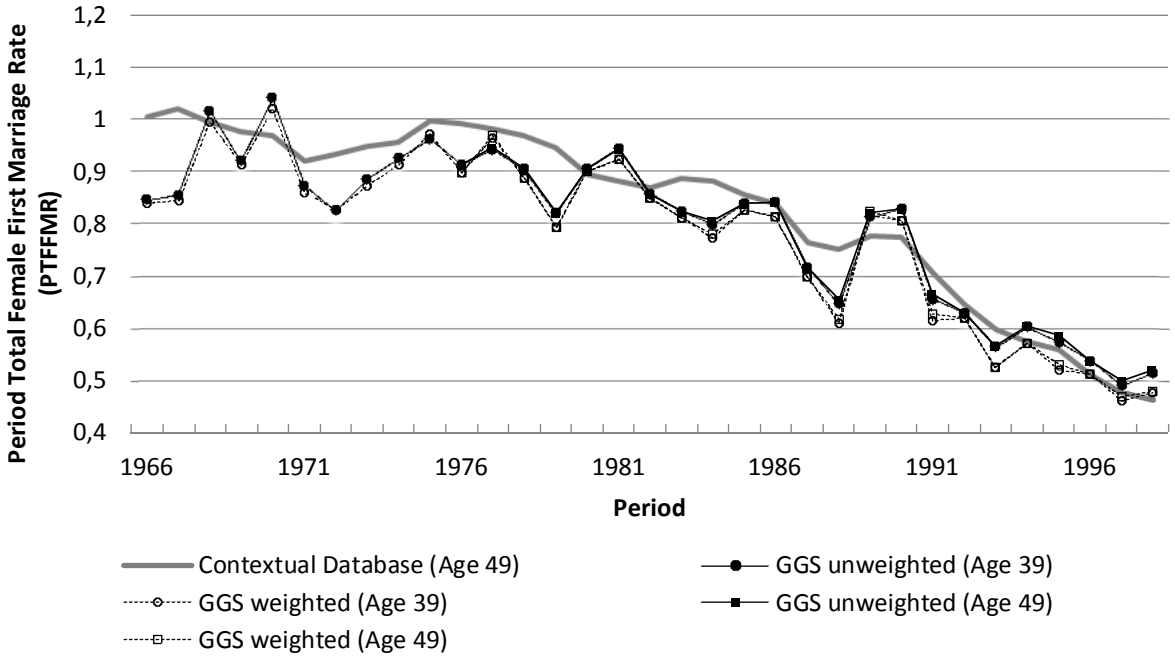


Figure B59. Period Mean Age at Childbearing Hungary

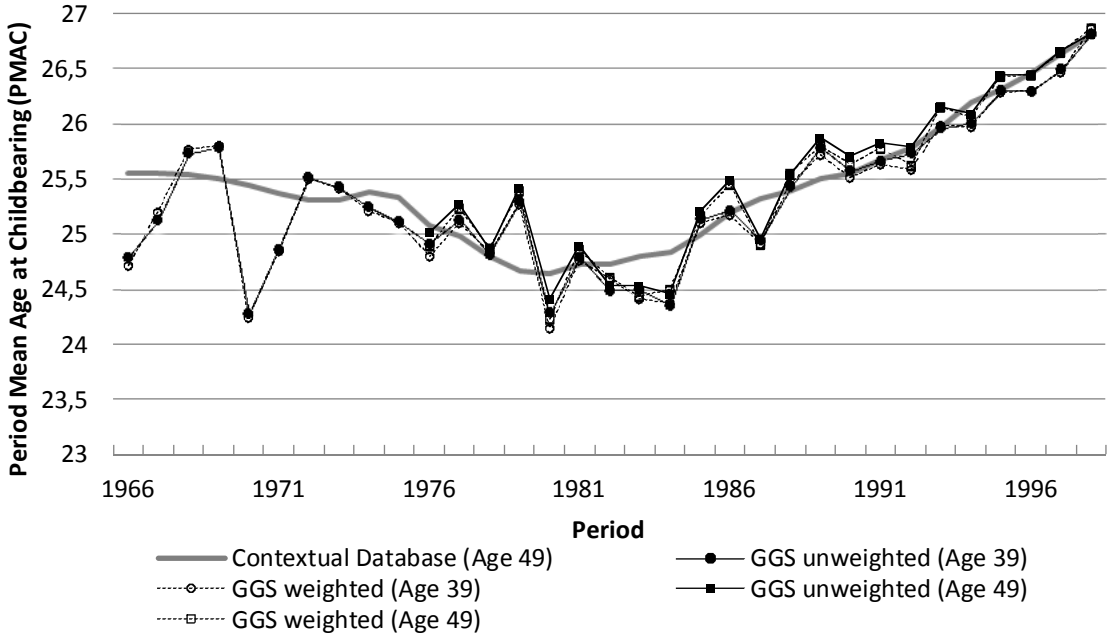


Figure B60. Period Mean Age at Female First Marriage Hungary

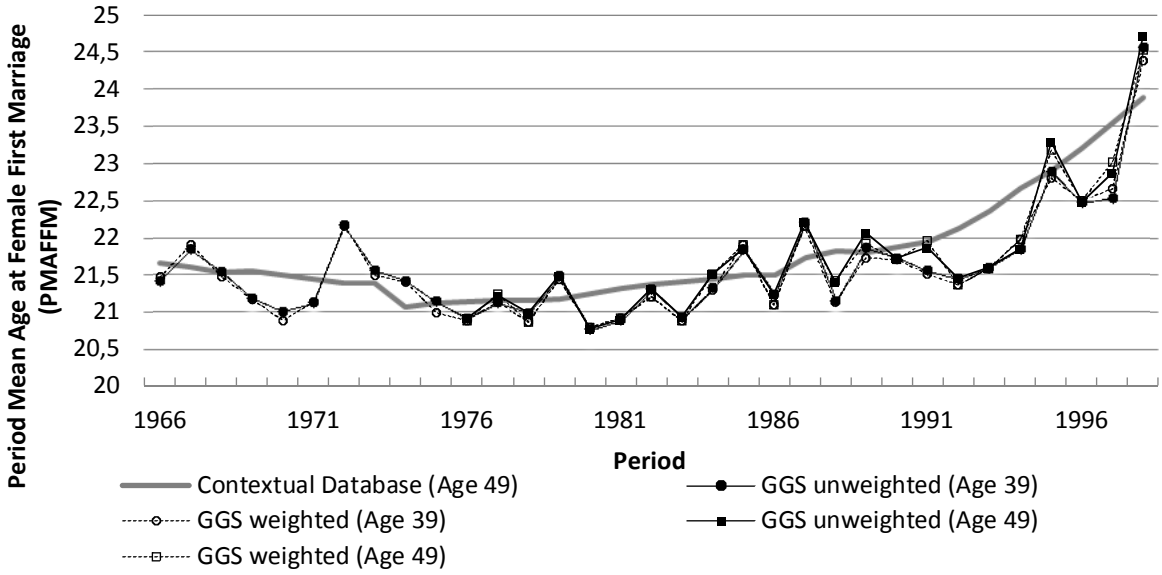


Figure B61. Cohort Total Fertility Rate Hungary

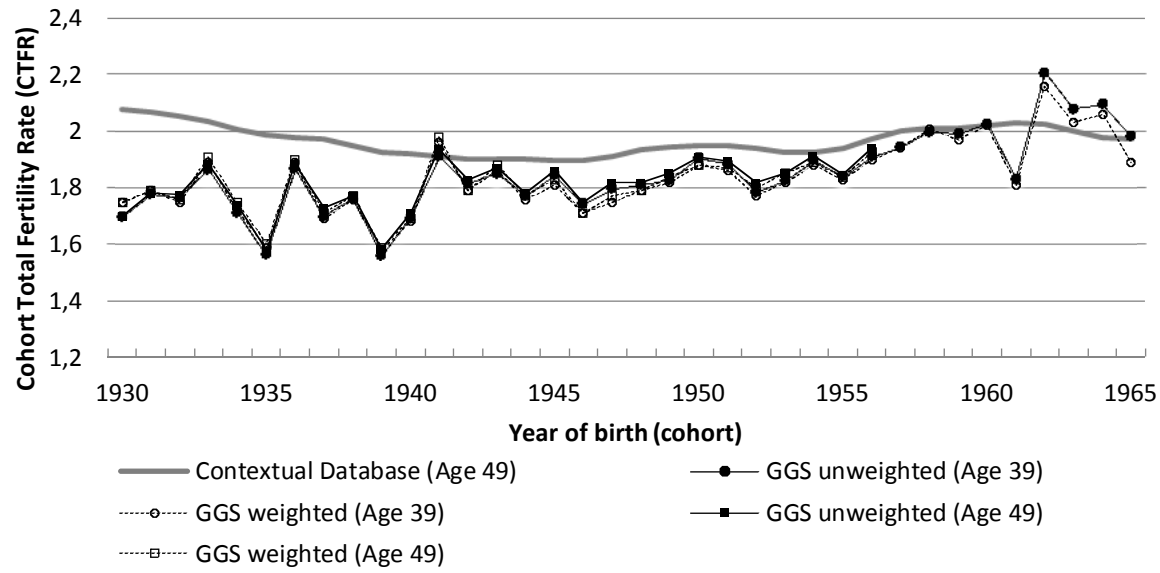


Figure B62. Cohort Total Female First Marriage Rate Hungary

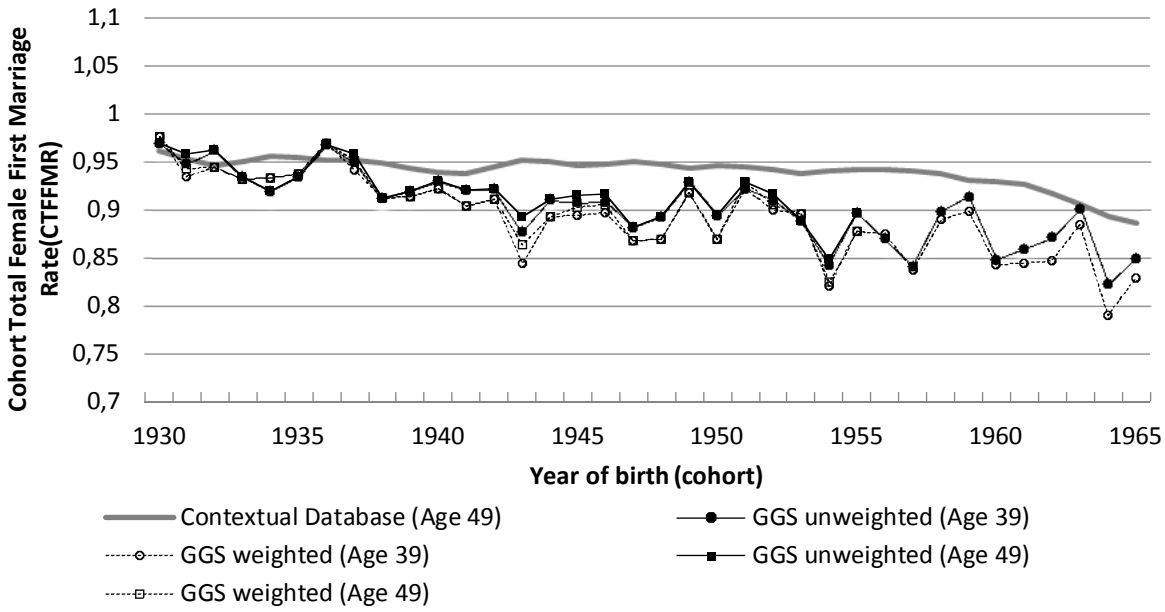


Figure B63. Cohort Mean Age at Childbearing Hungary

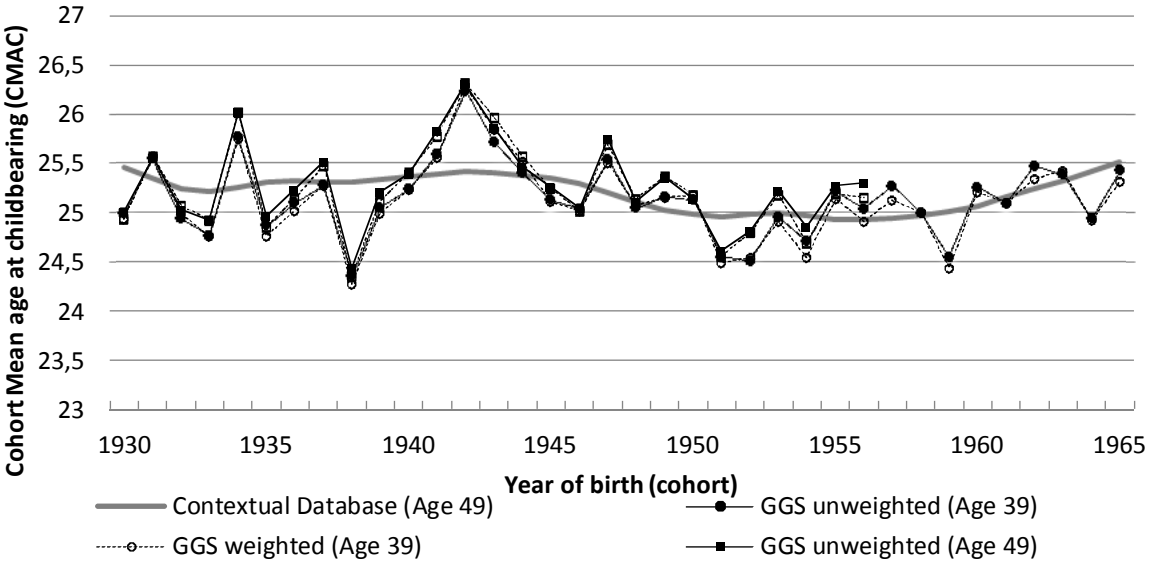
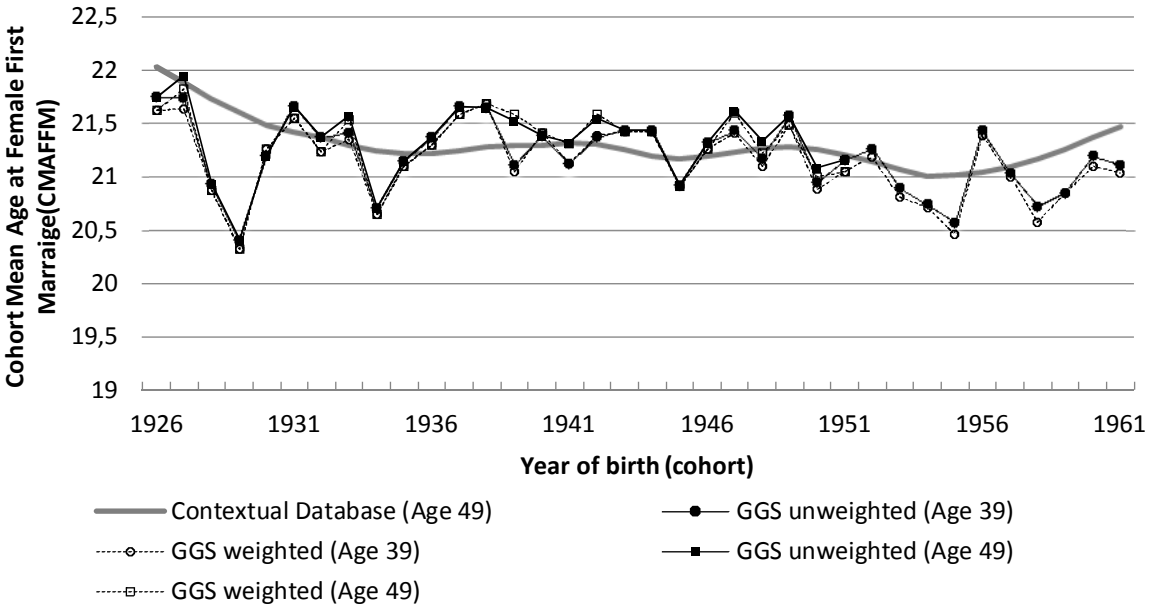


Figure B64. Cohort Mean Age at Female First Marriage Hungary



The Netherlands

Figure B65. Period Total Fertility Rate The Netherlands (weights 0)

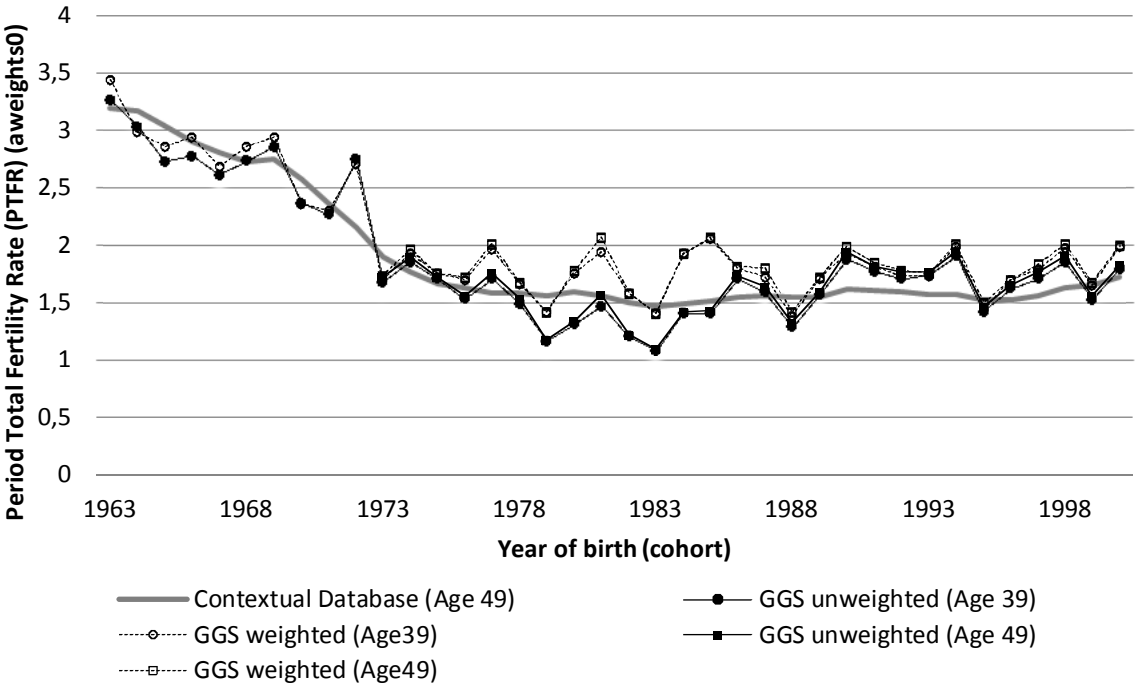


Figure B66. Period Total Fertility Rate The Netherlands (weights 1)

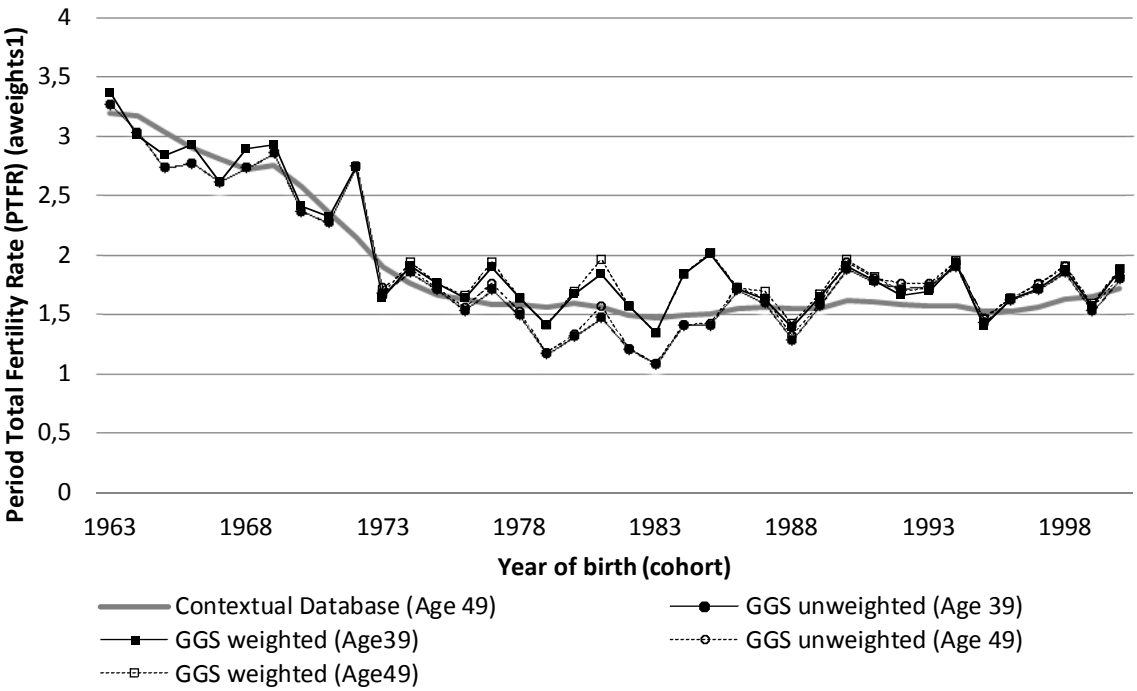


Figure B67. Period Total Female First Marriage Rate The Netherlands (both weights)

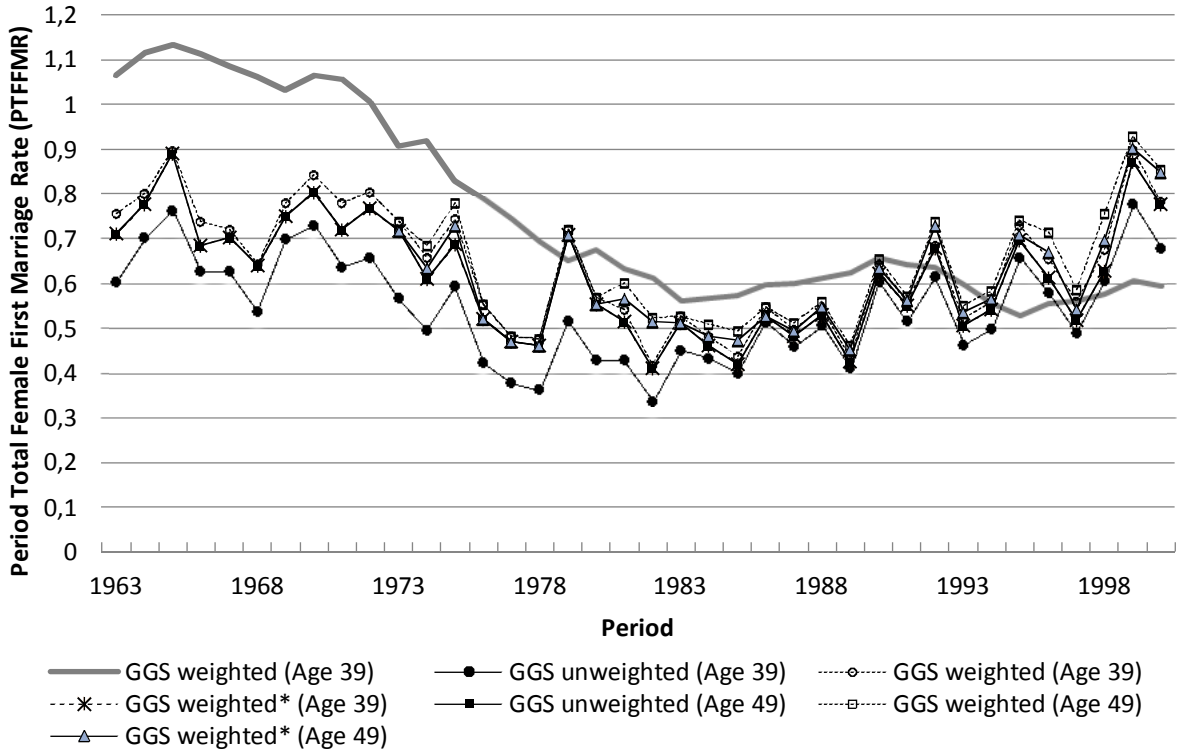


Figure B68. Period Mean Age at Childbearing The Netherlands (weights 0)

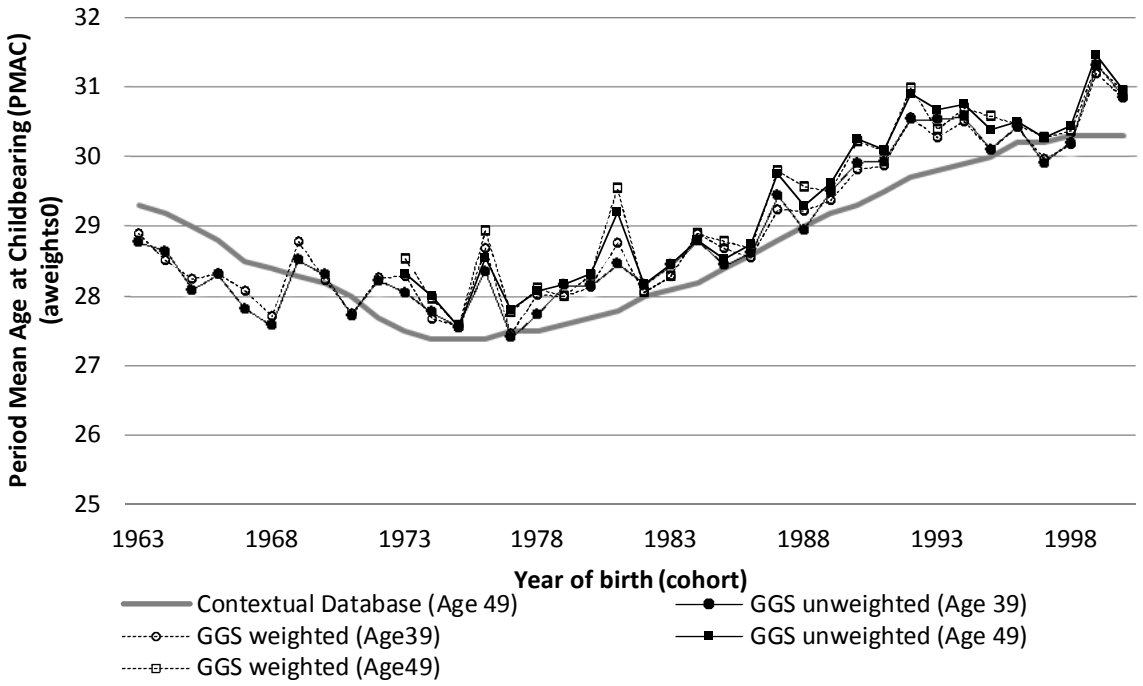


Figure B69. Period Mean Age at Childbearing The Netherlands (weights 1)

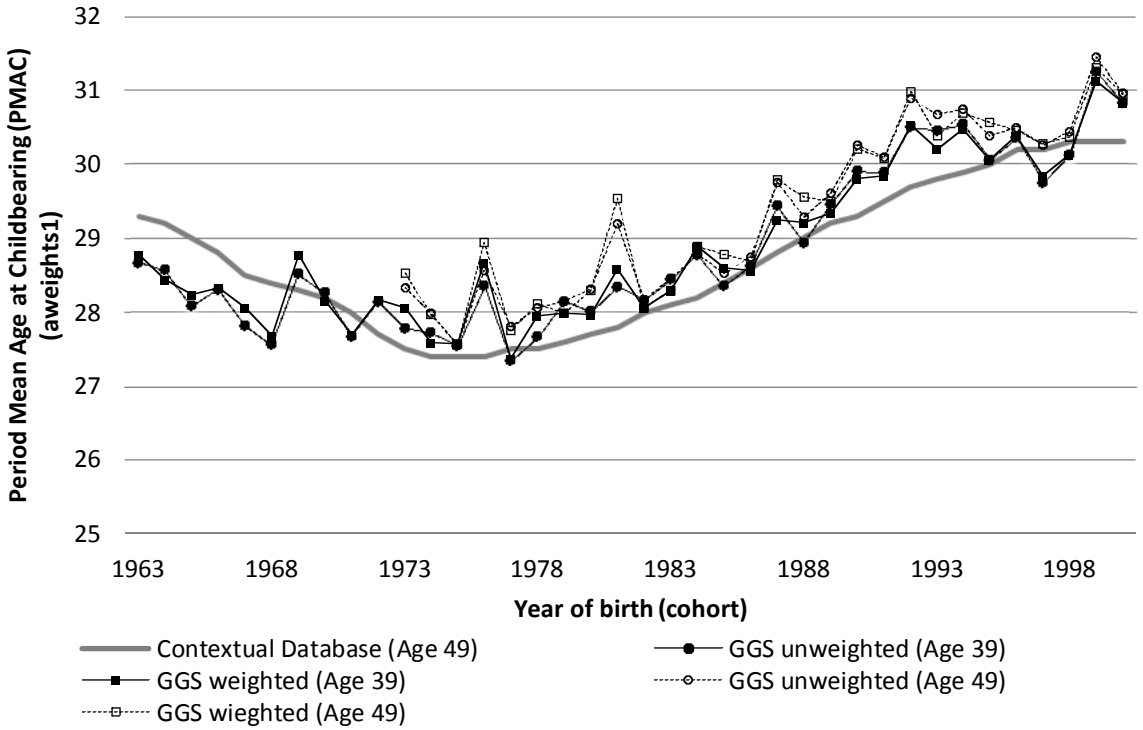


Figure B70. Period Mean Age at Female First Marriage The Netherlands (both weights)

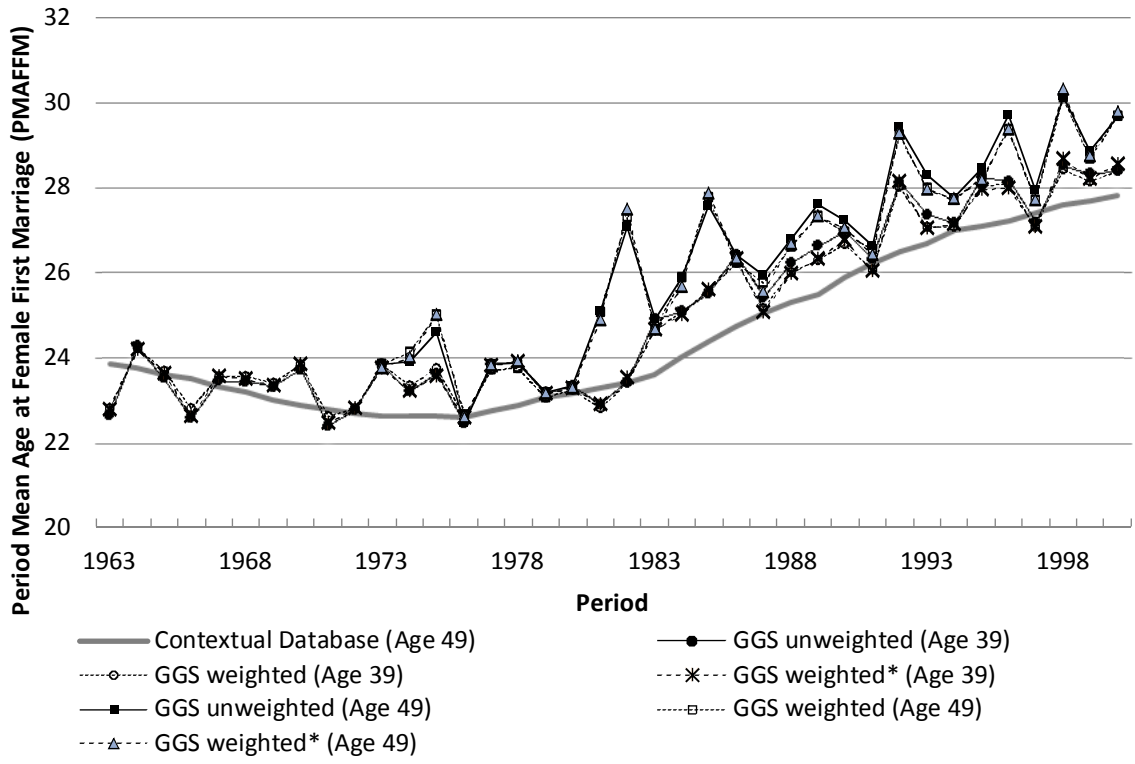


Figure B71. Cohort Total Fertility Rate The Netherlands (weight 0)

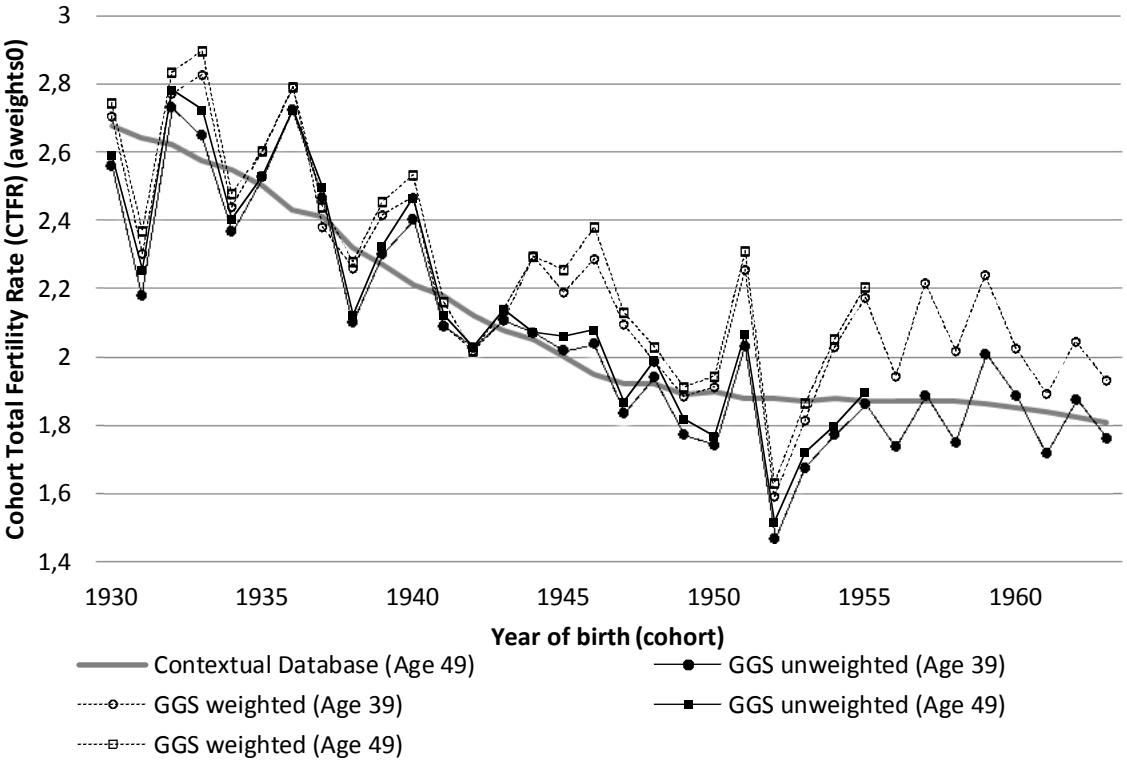


Figure B72. Cohort Total Fertility Rate The Netherlands (weight 1)

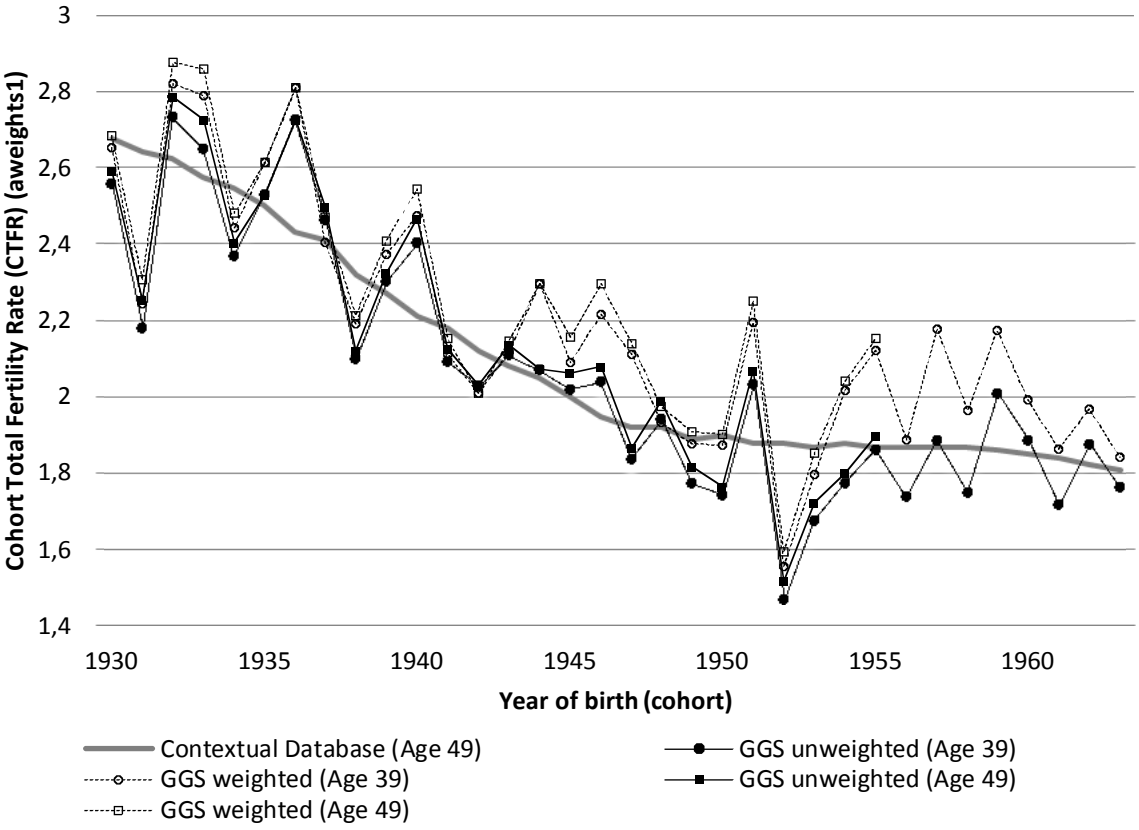


Figure B73. Cohort Total Female First Marriage Rate The Netherlands (both weights)

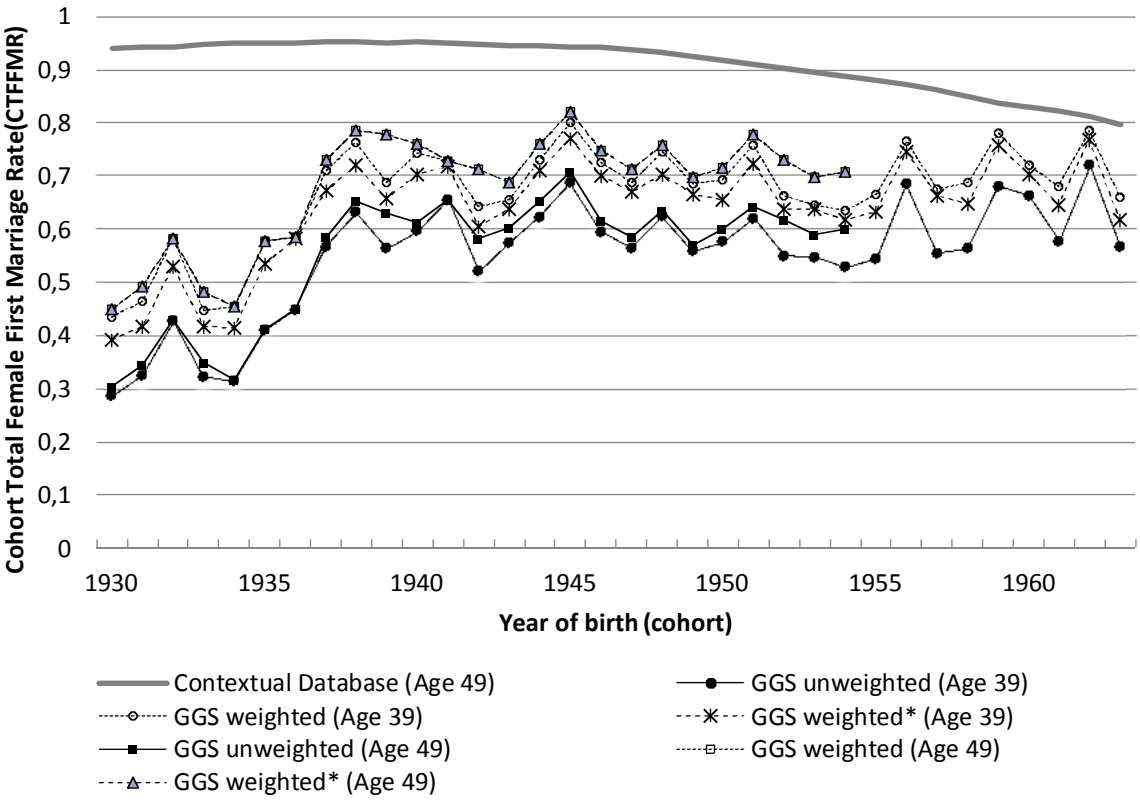


Figure B74. Cohort Mean Age at Childbearing The Netherlands (weight 0)

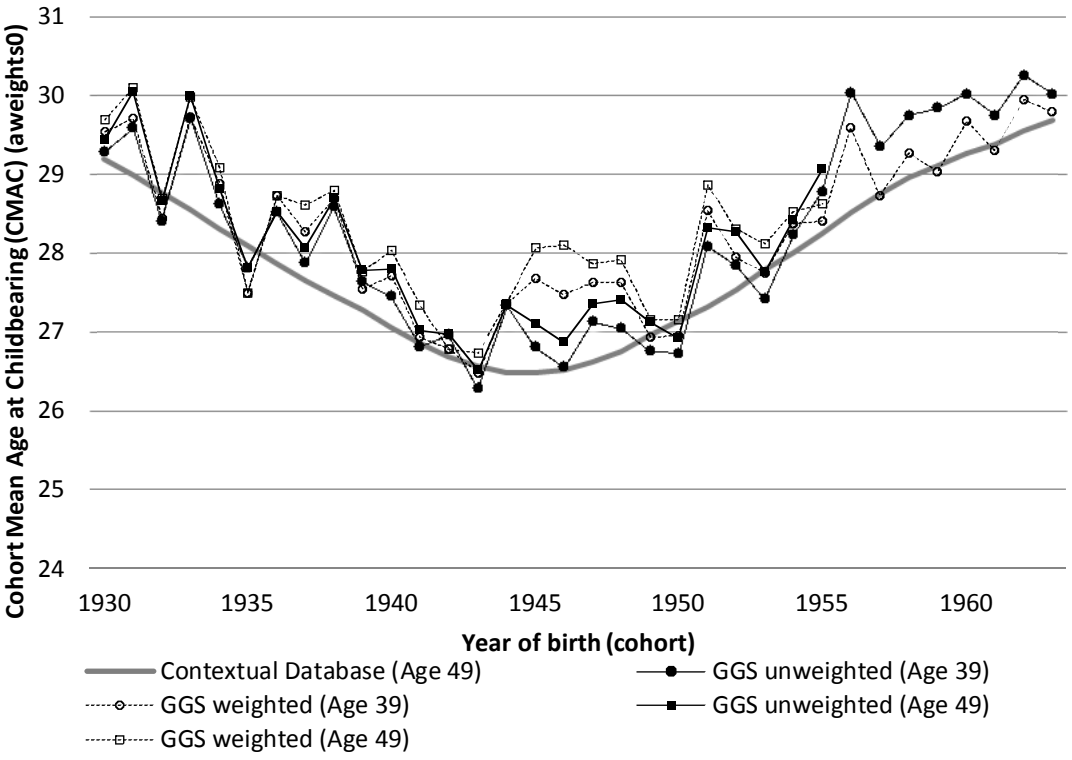


Figure B75. Cohort Mean Age at Childbearing The Netherlands (weight 1)

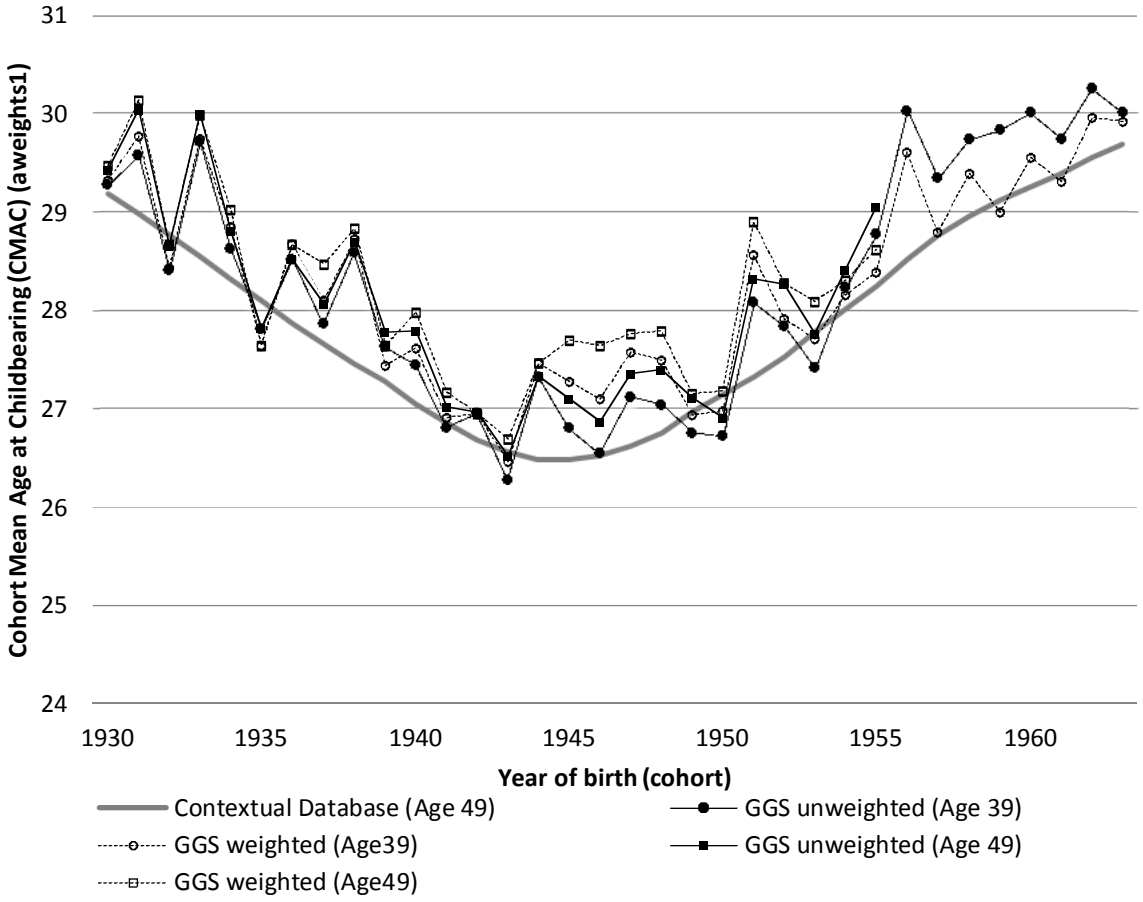
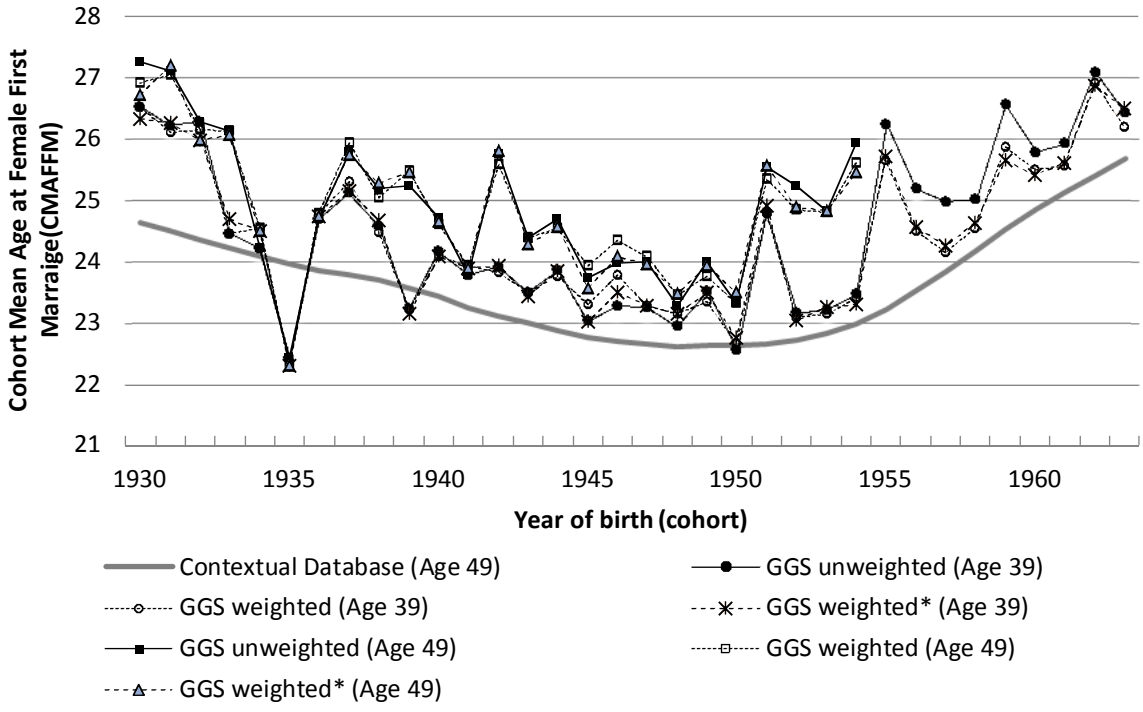


Figure 76. Cohort Mean Age at Female First Marriage The Netherlands (both weights)



Norway

Figure B77. Period Total Fertility Rate Norway

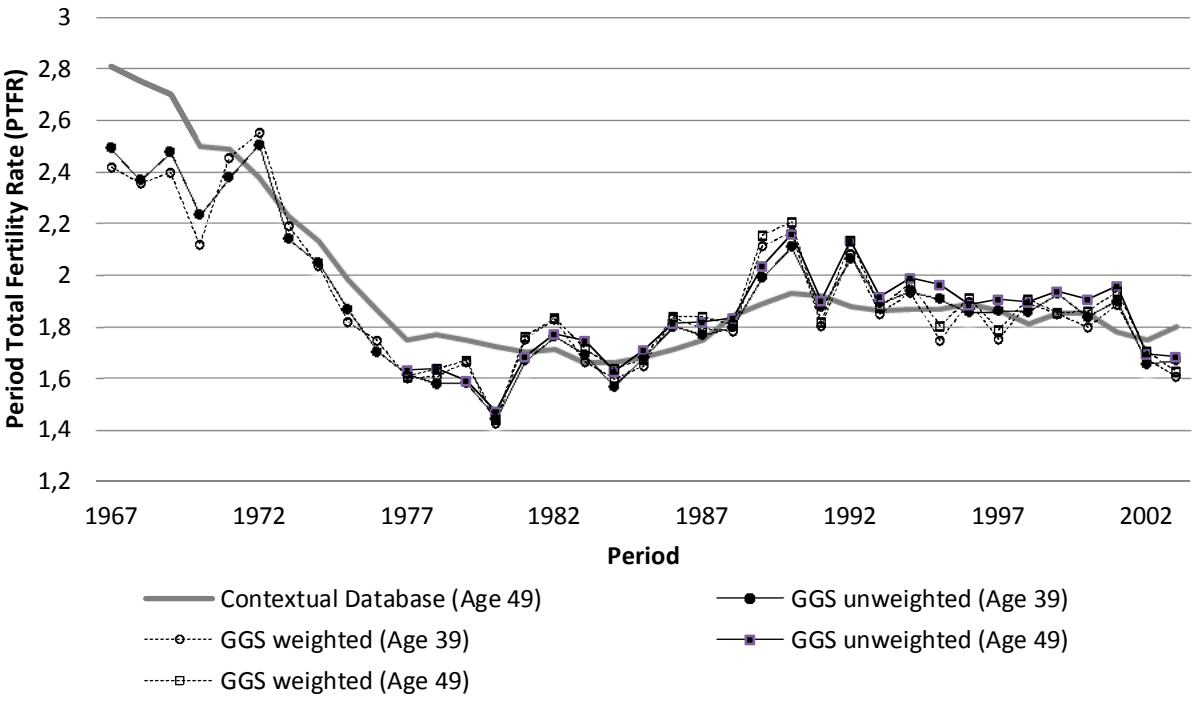


Figure B78. Period Total Female First Marriage Rate Norway

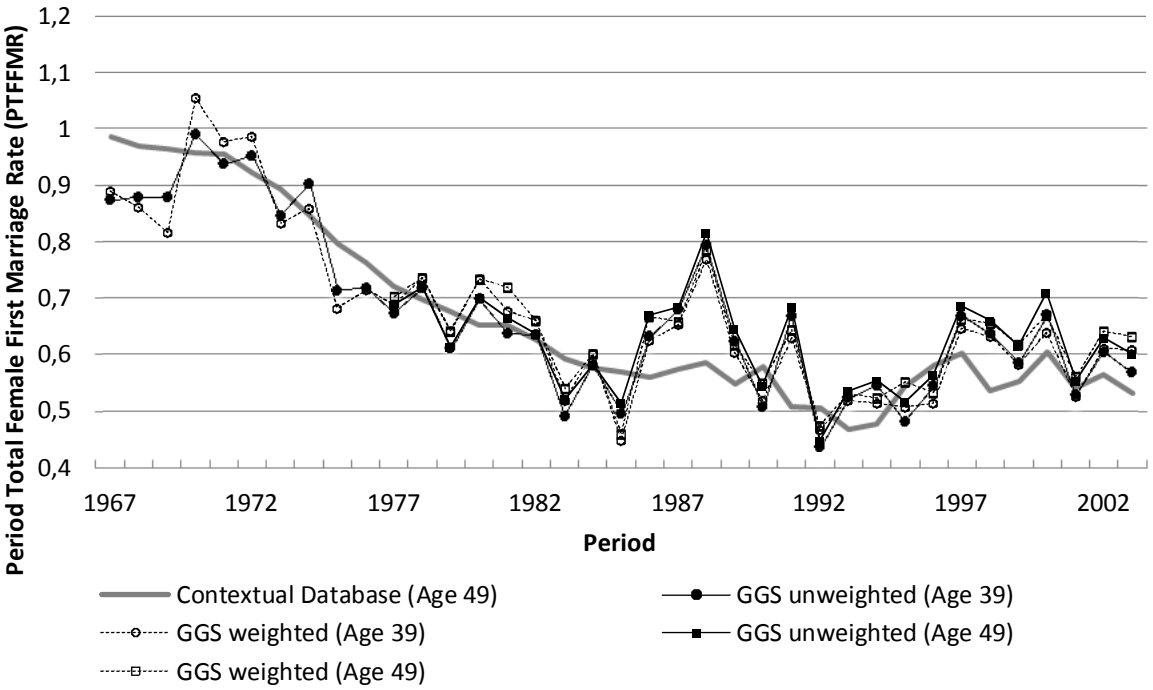


Figure B79. Period Mean Age at Childbearing Norway

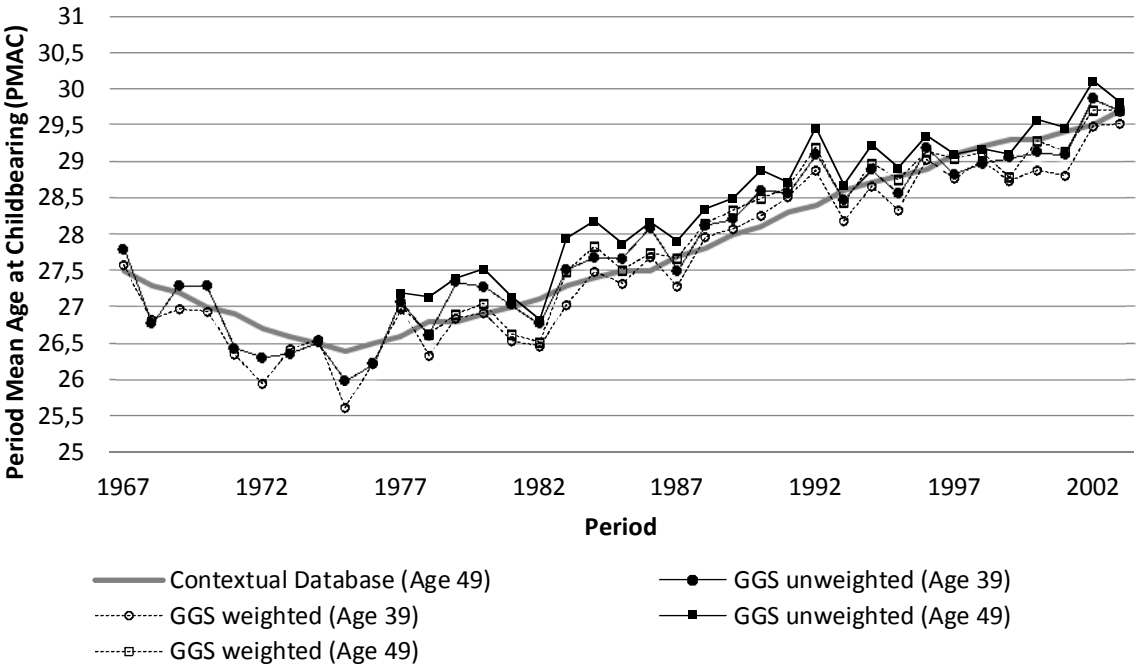


Figure B80. Period Mean Age at Female First Marriage Norway

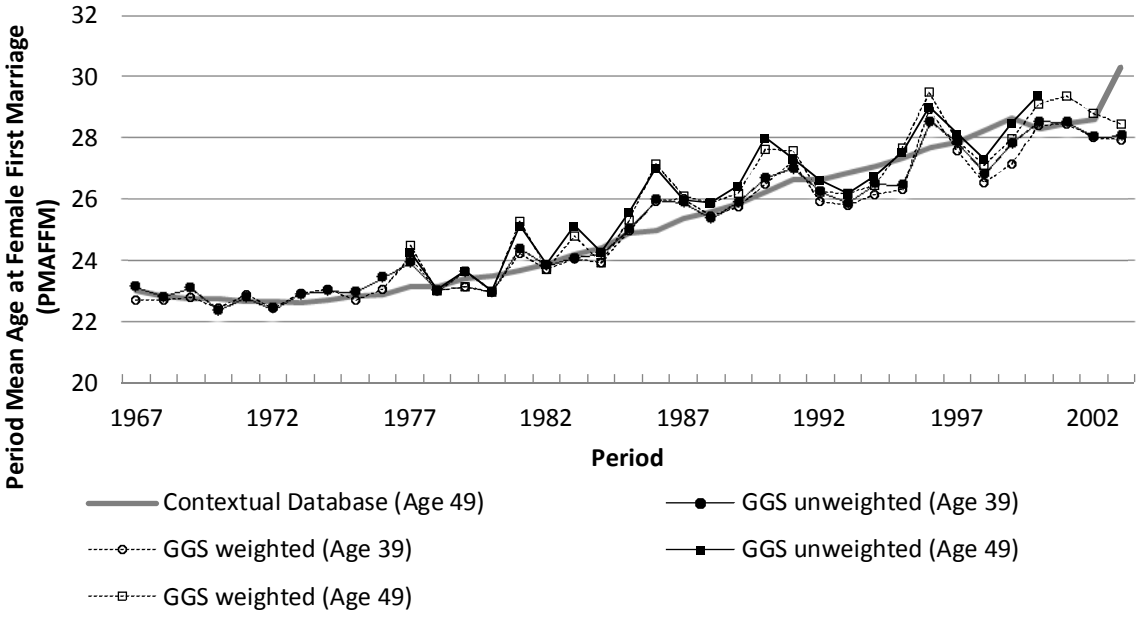


Figure B81. Cohort Total Fertility Rate Norway

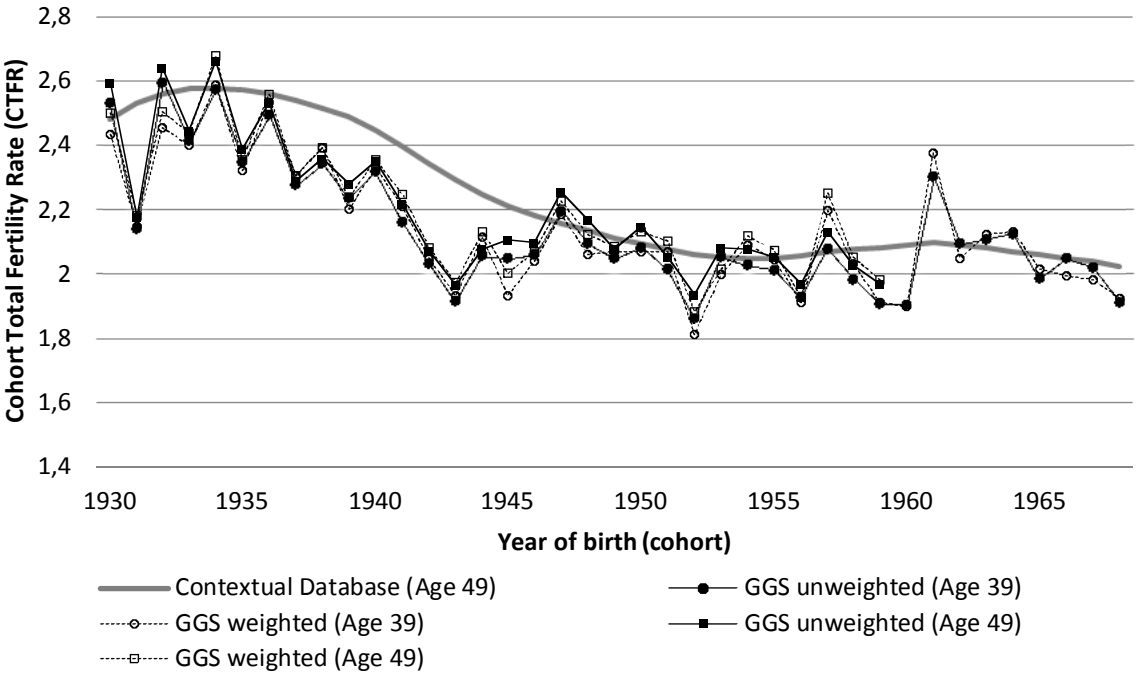


Figure B82. Cohort Total Female First Marriage Rate Norway

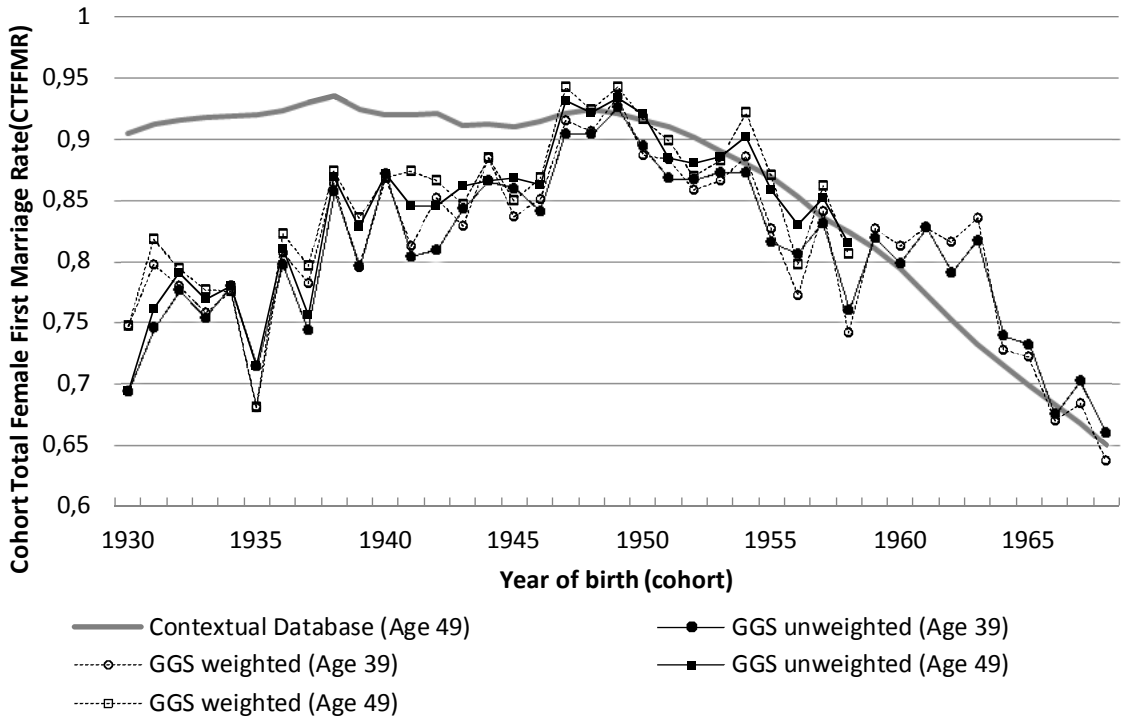


Figure 83. Cohort Mean Age at Childbearing Norway

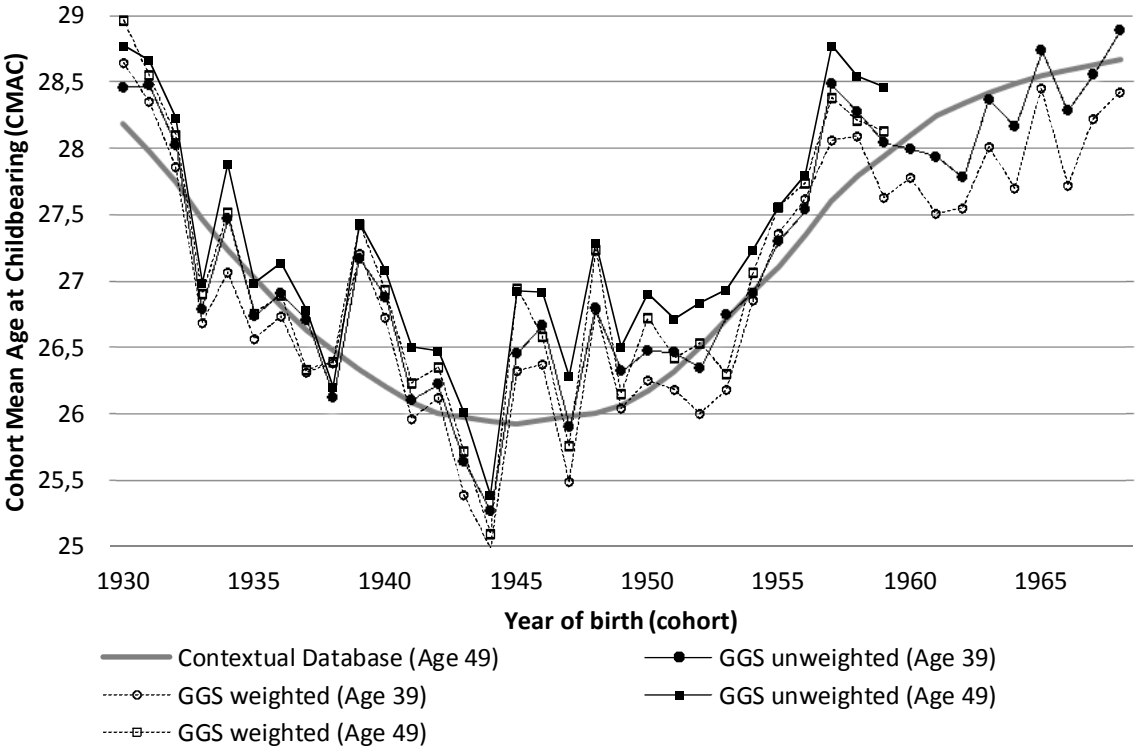
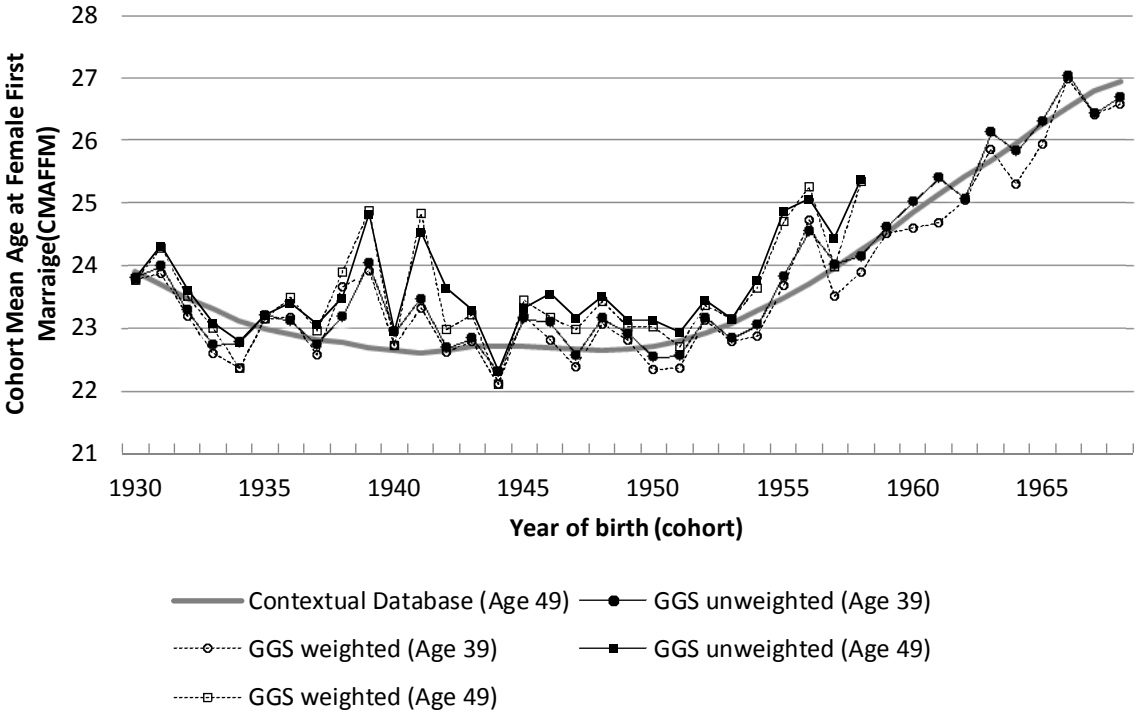


Figure 84. Cohort Mean Age at Female First Marriage Norway



Romania

Figure B85. Period Total Fertility Rate Romania

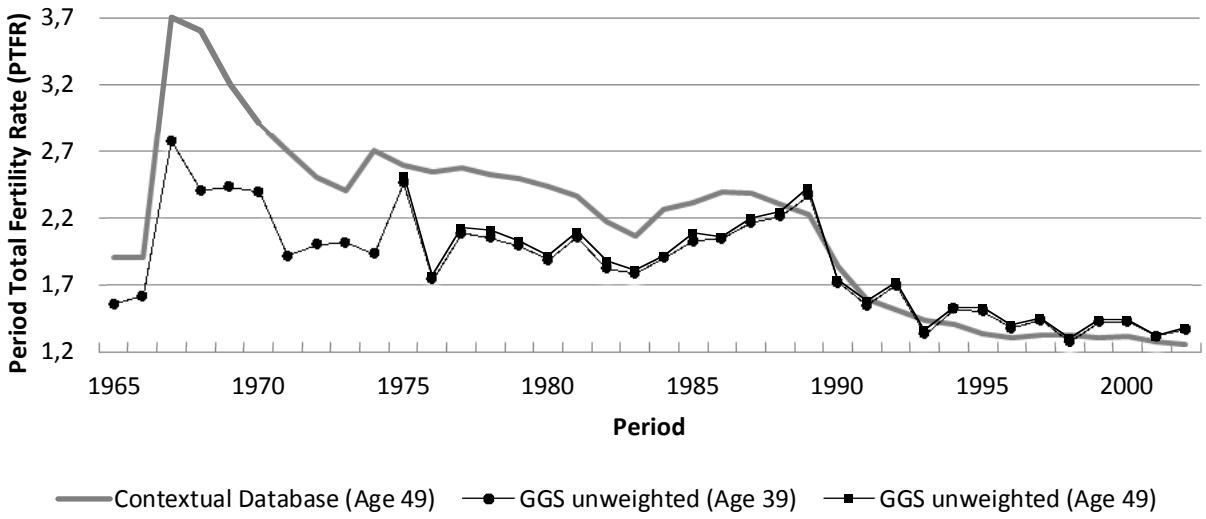


Figure B86. Period Total Female First Marriage Rate Romania

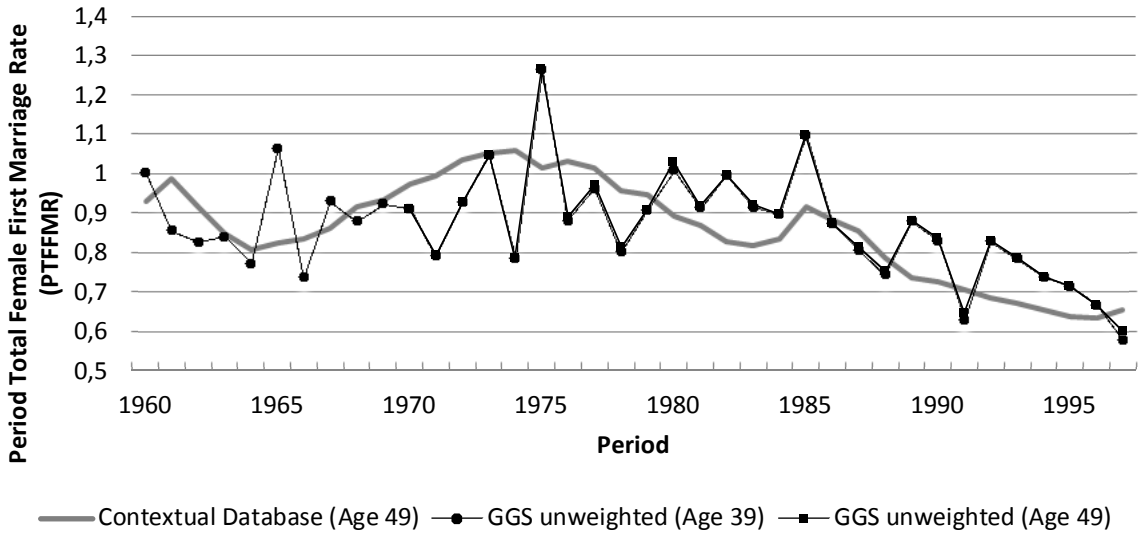


Figure B87. Period Mean Age at Childbearing Romania

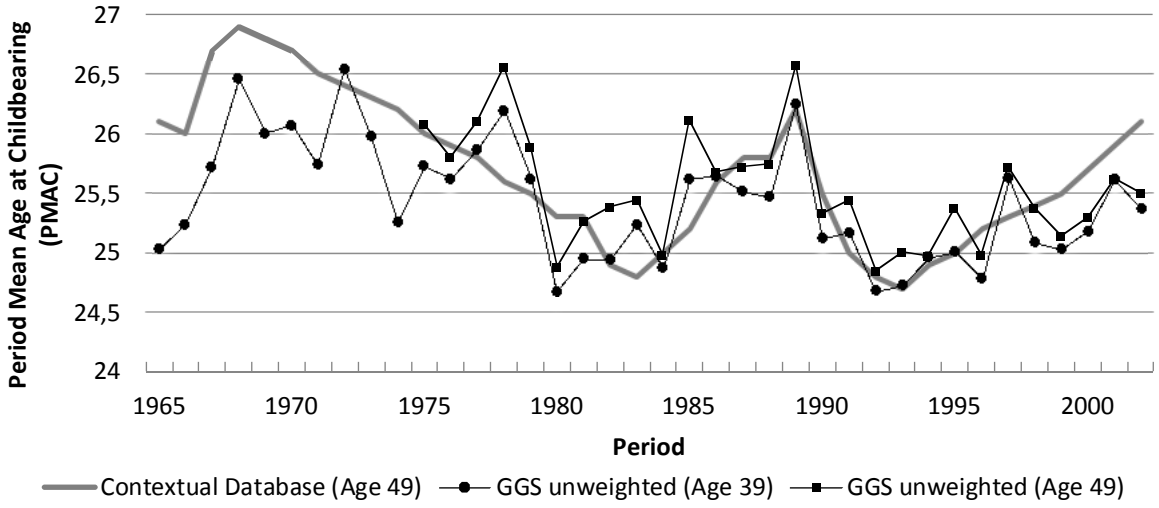


Figure B88. Period Mean Age at Female First Marriage Romania

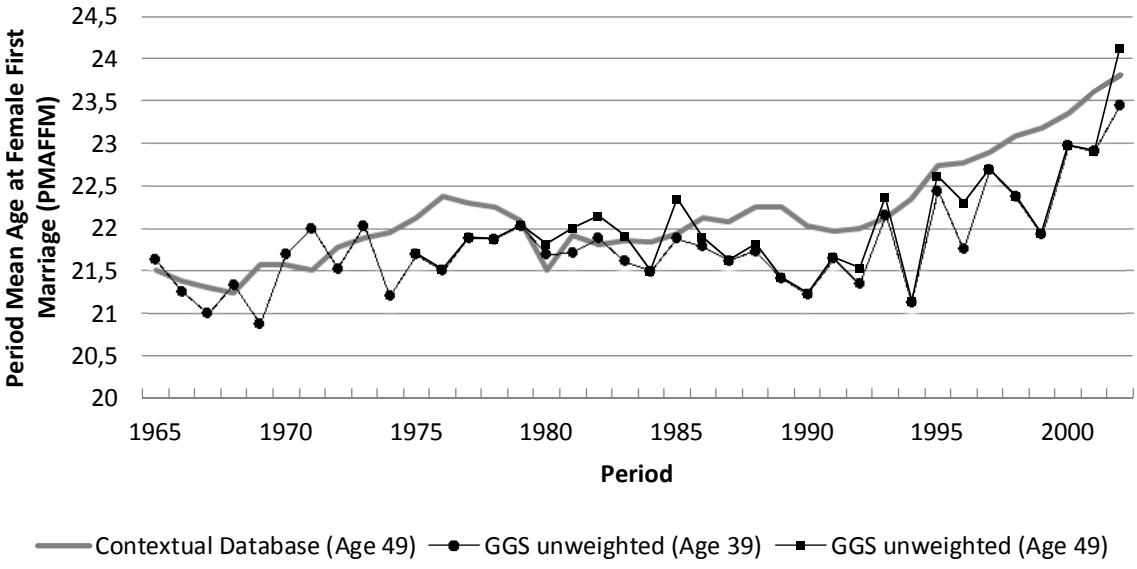


Figure B89. Cohort Total Fertility Rate Romania

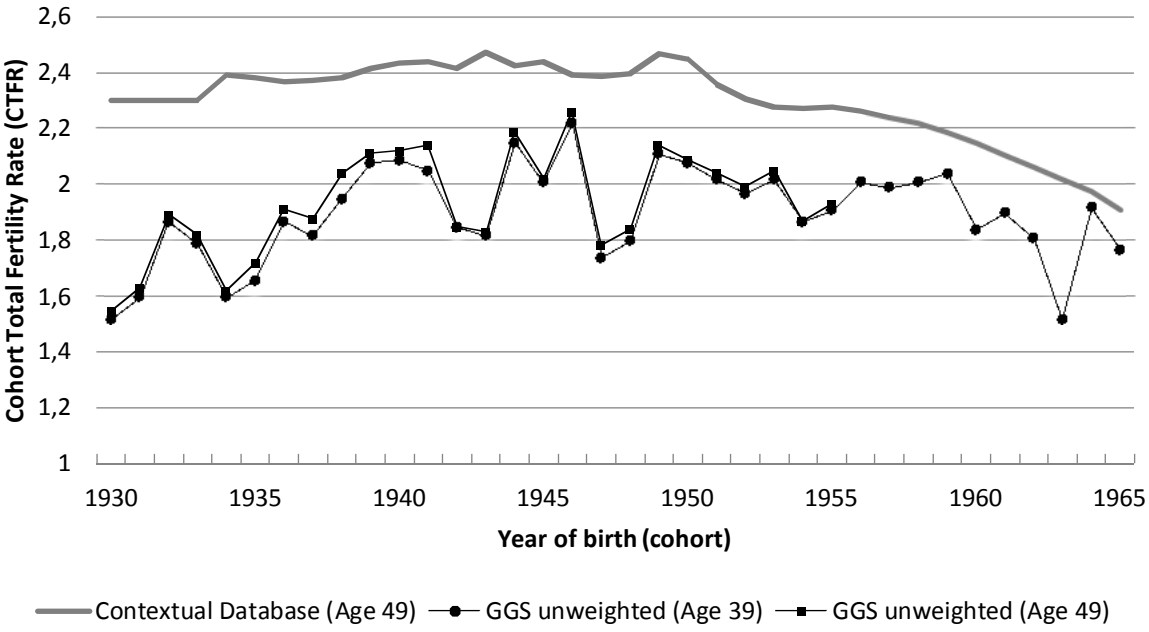


Figure B90. Cohort Total Female First Marriage Rate Romania

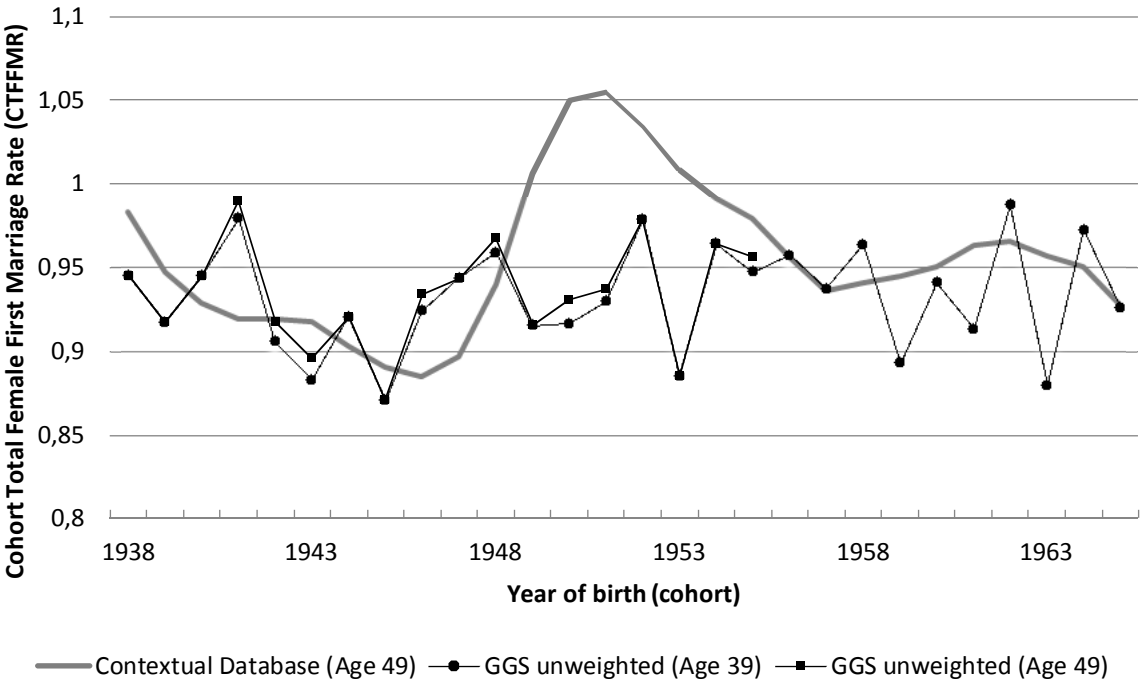


Figure B91. Cohort Mean Age at Childbearing Romania

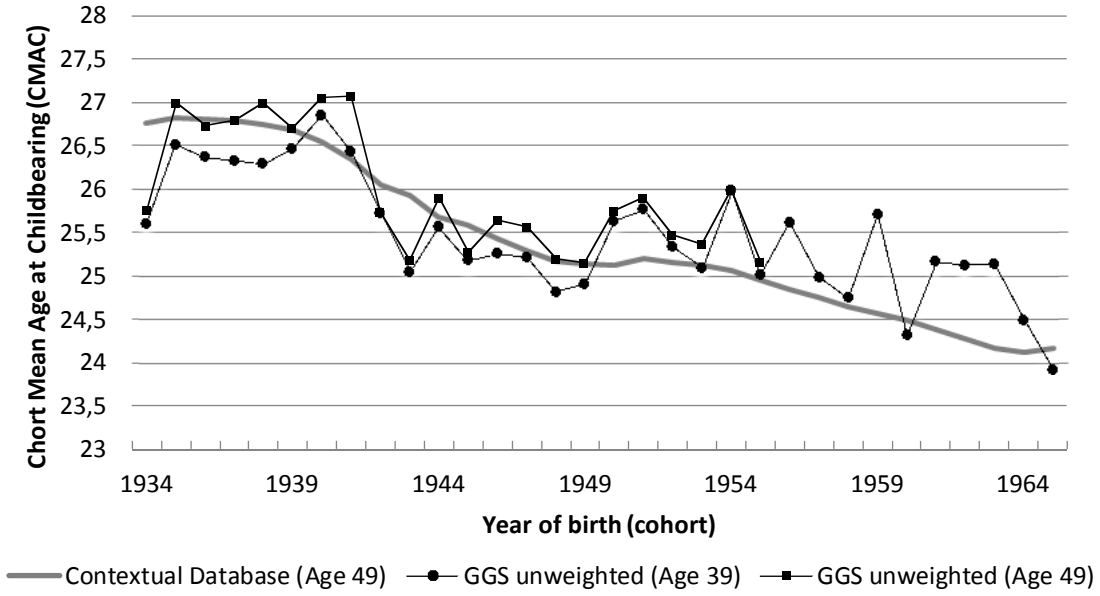
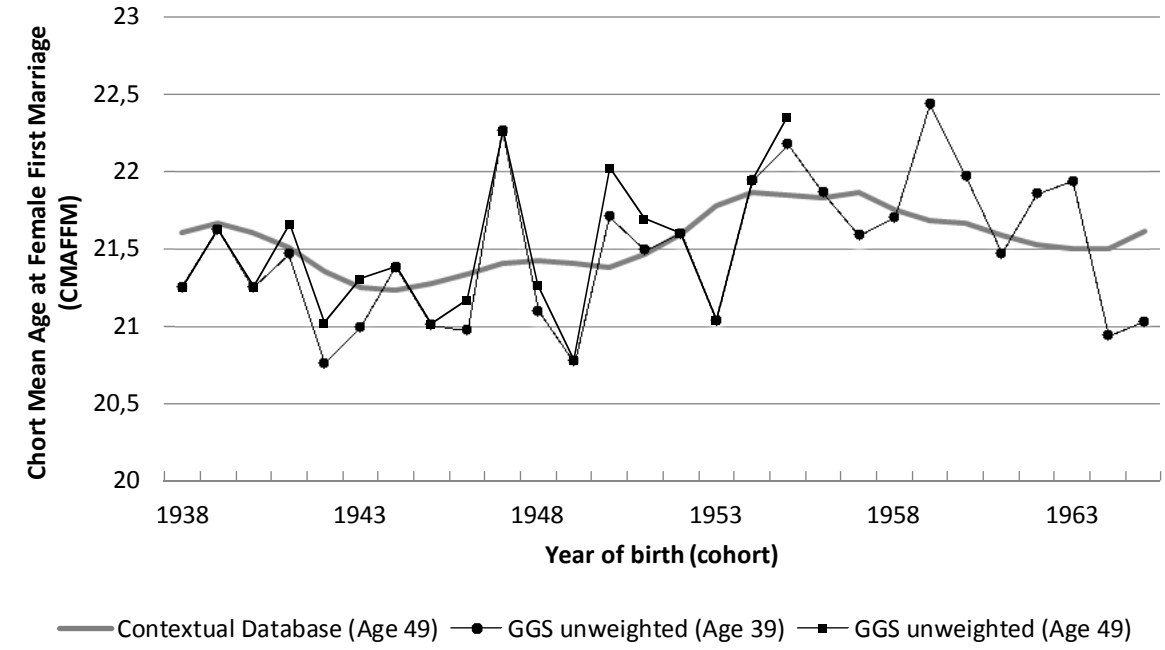


Figure B92. Cohort Mean Age at Female First Marriage Romania



Russia

Figure B93. Period Total Fertility Rate Russia

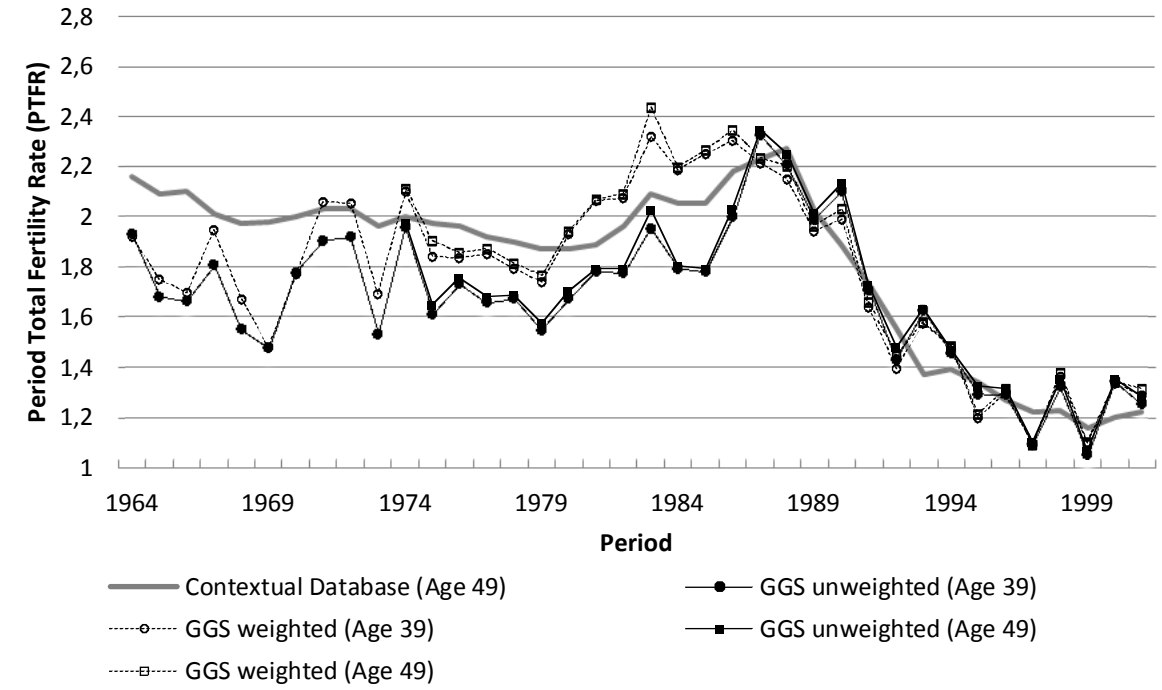


Figure B94. Period Total Female First Marriage Rate Russia

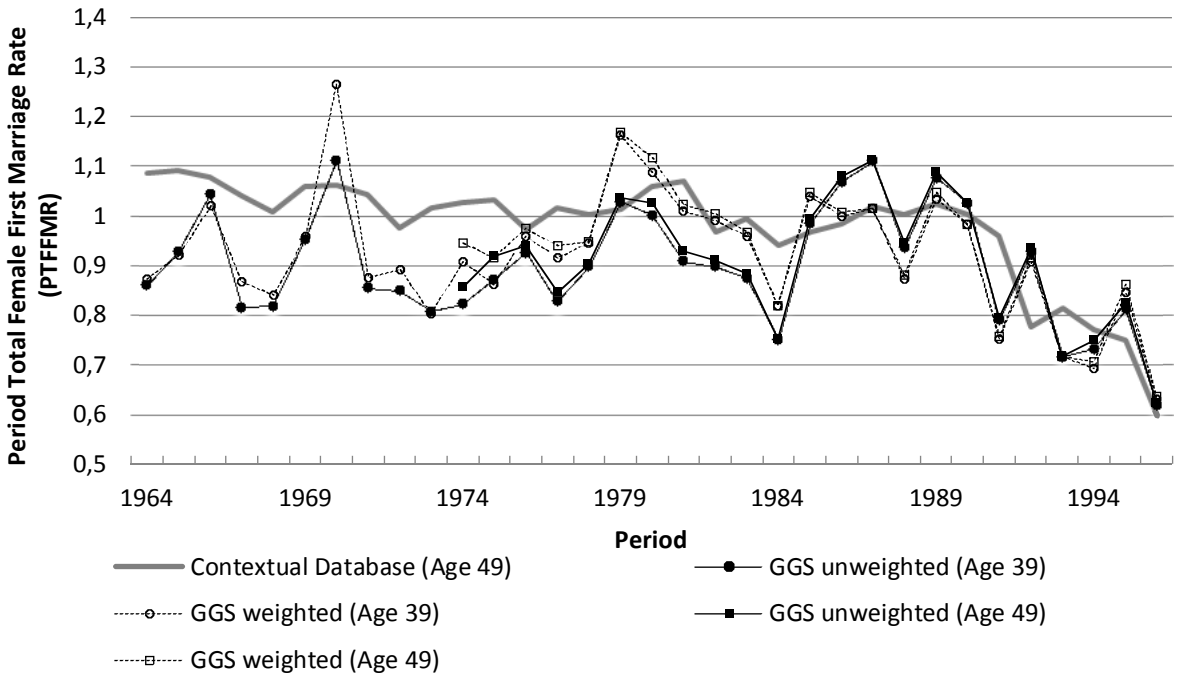


Figure B95. Period Mean Age at Childbearing Russia

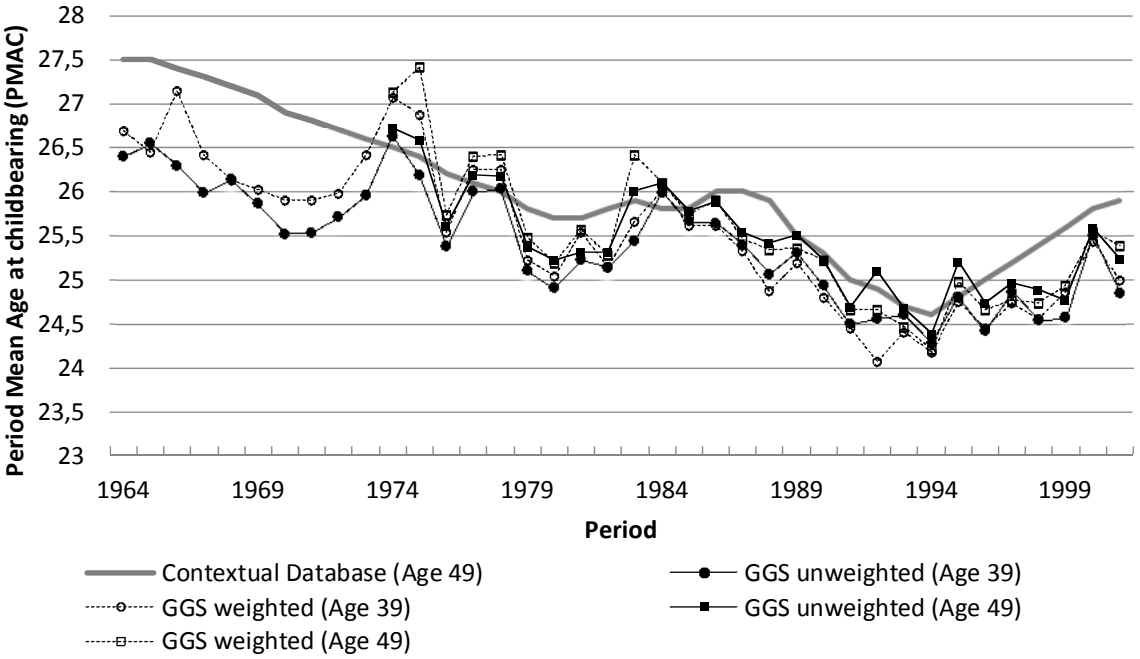


Figure B96. Period Mean Age at Female First Marriage Russia

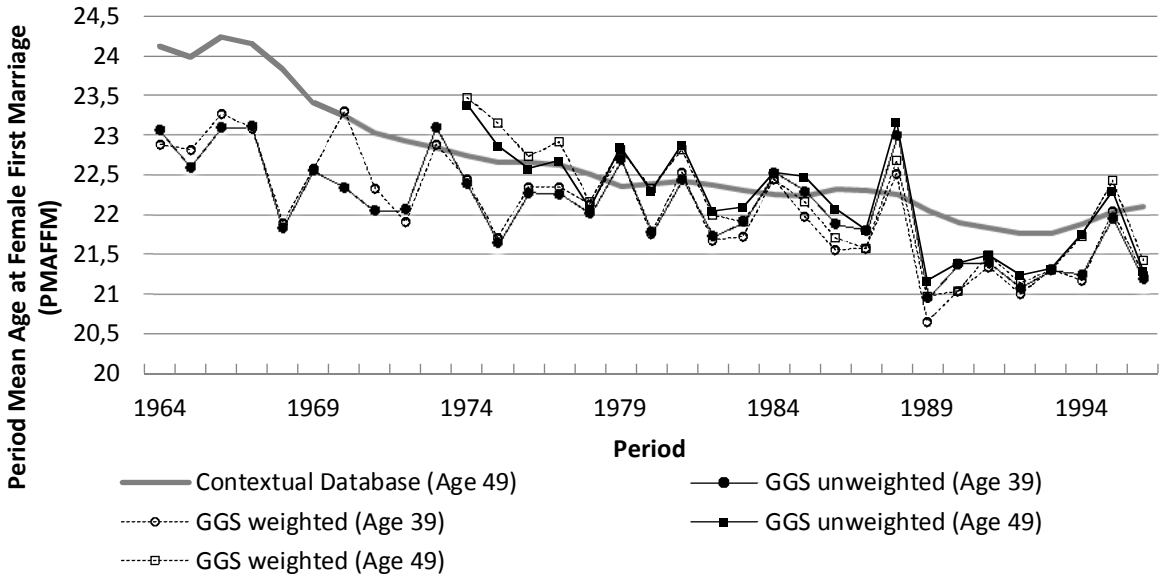


Figure B97. Cohort Total Fertility Rate Russia

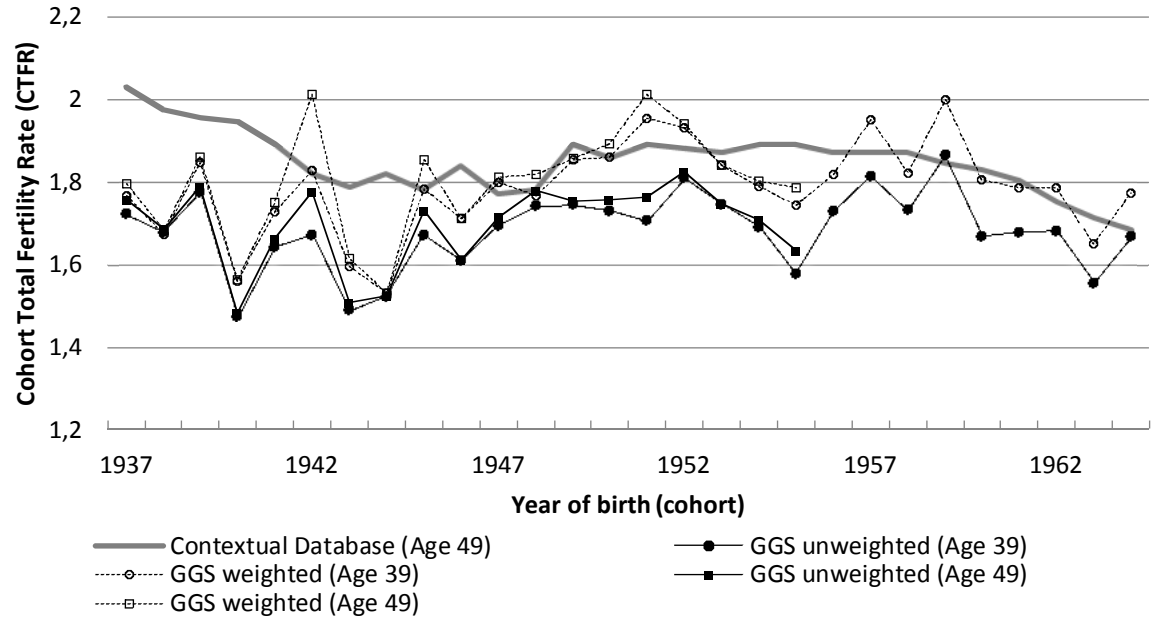
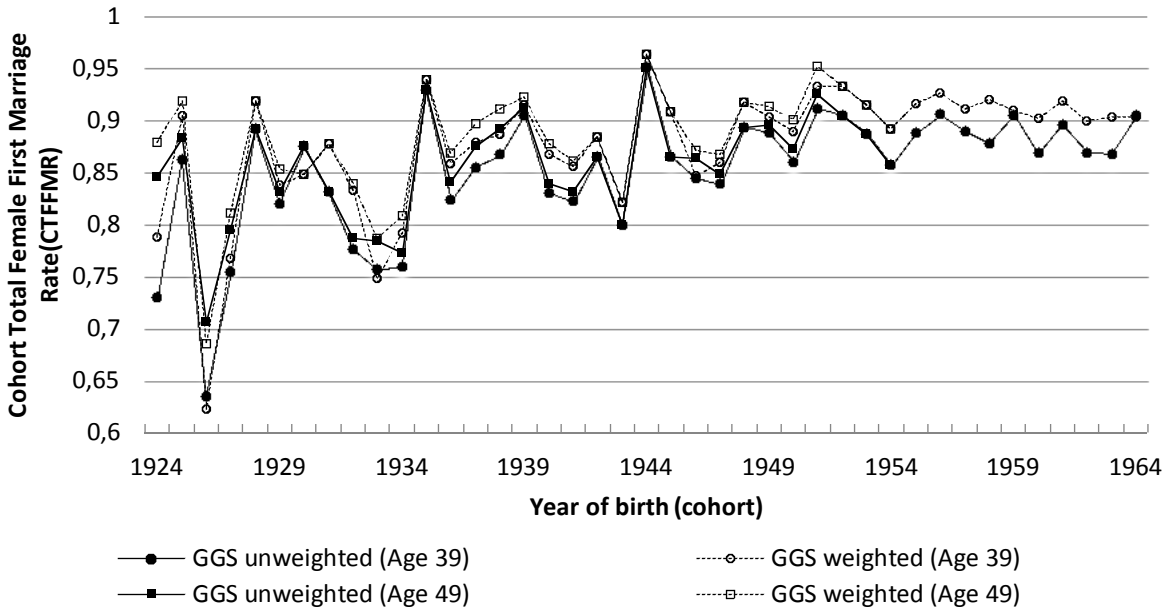


Figure B98. Cohort Total Female First Marriage Rate Russia[1]



[1] No vital registration data available

Figure B99. Cohort Mean Age at Childbearing Russia

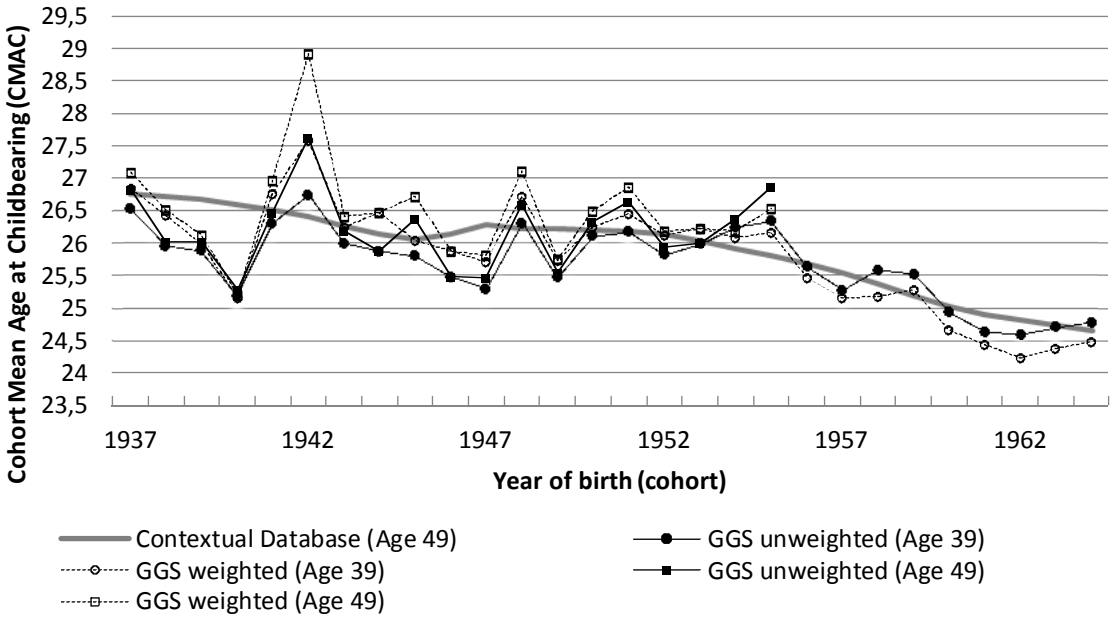
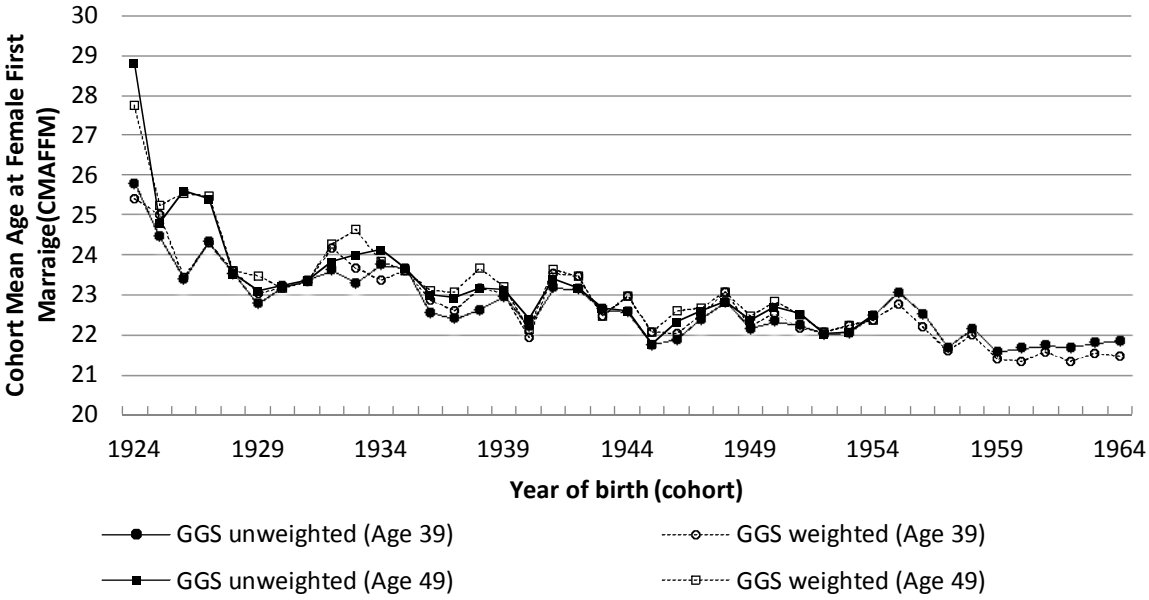


Figure B100. Cohort Mean Age at Female First Marriage Russia[1]



[1] No vital registration data available