

Supplementary Table S1. Number of live births, mean gestational age and mean birth weight by maternal nationality in the eligible population (N = 315'177); 276 days correspond to 39^{3/7} weeks.

Nationality	N	Gestational age (days) Mean (SD)	Birth weight (g) Mean (SD)	
Switzerland	194,570	276 (12)	3322 (511)	
Southern Europe				
Andorra	1	279 (-)	3080 (-)	
Italy	8337	275 (12)	3271 (496)	
Malta	13	273 (8)	3188 (427)	
Portugal	12,368	276 (12)	3235 (493)	
San Marino	2	274 (1.4)	3485 (120)	
Spain	2864	276 (12)	3263 (488)	
Western Europe				
Austria	1555	275 (14)	3328 (528)	
Belgium	583	276 (12)	3357 (482)	
Germany	16,736	276 (13)	3369 (517)	
France	6173	276 (12)	3294 (505)	
Lichtenstein	100	275 (11)	3369 (488)	
Luxembourg	55	276 (19)	3396 (636)	
Netherlands	803	276 (12)	3377 (529)	
Northern Europe				
Denmark	271	276 (13)	3383 (511)	
Estonia	81	279 (7)	3601 (466)	
Finland	312	276 (11)	3465 (523)	
Ireland	212	276 (16)	3446 (548)	
Iceland	31	272 (25)	3180 (775)	
Latvia	187	279 (9)	3493 (434)	
Lithuania	152	277 (13)	3450 (535)	
Norway	110	275 (11)	3390 (525)	
Sweden	571	276 (12)	3422 (470)	
UK	1768	276 (13)	3397 (513)	
Eastern Europe				
Czech Republic	623	275 (12)	3339 (499)	
Hungary	913	275 (13)	3341 (512)	
Poland	1778	276 (12)	3399 (497)	
Slovakia	1068	276 (12)	3348 (509)	
Albania	209	276 (12)	3406 (476)	
Bosnia & Herzegovina	1952	276 (12)	3466 (492)	
Croatia	1582	276 (12)	3448 (540)	
Kosovo	10,278	276 (13)	3421 (530)	
Macedonia	5842	276 (13)	3392 (514)	
Montenegro	212	276 (10)	3416 (466)	
Serbia	5195	276 (13)	3400 (536)	
Serbia & Montenegro	10	277 (8)	3637 (250)	
Slovenia	163	275 (15)	3366 (589)	
Cyprus	15	278 (8)	3411 (525)	
Bulgaria	406	273 (15)	3291 (559)	
Greece	375	274 (13)	3317 (516)	
Romania	971	274 (14)	3284 (537)	
Turkey	4441	275 (13)	3347 (523)	
Belarus	172	277 (13)	3385 (508)	
Moldova	135	276 (10)	3496 (515)	
Russia	1567	277 (12)	3427 (513)	
Ukraine	855	277 (11)	3412 (473)	
Other (non-Europe)				
6 most numerous:	Eritrea	2600	279 (14)	3380 (528)
	Brazil	2381	274 (12)	3312 (498)
	Sri Lanka	1391	273 (14)	3158 (553)
	USA	1291	276 (14)	3378 (532)
	China	1293	276 (13)	3425 (541)
	Morocco	1159	276 (14)	3378 (536)
	...			
Total	315,177	276 (12)	3328 (515)	

Supplementary Table S2. Comparison of results from fully adjusted model (model 3) accounting and not accounting for spatial autocorrelation. Based on complete-case population (N = 81,968).

	Accounting for spatial autocorrelation		Not accounting for spatial autocorrelation	
	Gestational age (days) Absolute differences (95% CI)	Birth weight (g) * Relative differences (95% CI)	Gestational age (days) Absolute differences (95% CI)	Birth weight (g) * Relative differences (95% CI)
Intercept	277.9 (277.6 to 278.1)	3293 (3163 to 3427)	277.9 (277.7 to 278.2)	3298 (3180 to 3420) [§]
Sex				
[¶] Female	0		0	1
Male	-0.62 (-0.78, -0.46)	1.048 (1.046, 1.049)	-0.63 (-0.79, -0.47)	1.048 (1.046, 1.049)
Birth rank				
1 [¶]	0		0	1
2	-0.34 (-0.52, -0.17)	1.039 (1.037, 1.041)	-0.34 (-0.52, -0.16)	1.039 (1.037, 1.041)
3	-0.17 (-0.45, 0.10)	1.054 (1.051, 1.056)	-0.16 (-0.44, 0.11)	1.054 (1.051, 1.057)
≥ 4	0.23 (-0.26, 0.71)	1.065 (1.059, 1.070)	0.24 (-0.25, 0.72)	1.065 (1.059, 1.070)
Maternal age (yrs)[‡]				
≥ 20-30 [¶]	0		0	1
≥ 30-40 yrs (per 5 yrs)	-0.92 (-1.06, -0.77)	0.998 (0.996, 1.000)	-0.93 (-1.07, -0.78)	0.998 (0.997, 1.000)
≥ 40 yrs (per 5 yrs)	-3.48 (-4.30, -2.66)	0.998 (0.990, 1.006)	-3.46 (-4.29, -2.63)	0.998 (0.990, 1.006)
Civil status[¶]				
Married [¶]	0		0	1
Not married	0.15 (-0.08, 0.38)	0.993 (0.990, 0.995)	0.15 (-0.08, 0.38)	0.993 (0.990, 0.995)
Nationality mother				
Switzerland [¶]	0		0	1
S Europe	0.38 (0.00, 0.77)	0.995 (0.992, 0.999)	0.39 (0.00, 0.78)	0.995 (0.991, 0.999)
W Europe	-0.08 (-0.42, 0.25)	1.007 (1.003, 1.010)	-0.08 (-0.43, 0.26)	1.007 (1.004, 1.011)
N Europe	0.30 (-0.56, 1.17)	1.022 (1.013, 1.031)	0.30 (-0.57, 1.17)	1.022 (1.013, 1.031)
E Europe	0.33 (-0.01, 0.67)	1.017 (1.013, 1.021)	0.33 (-0.01, 0.68)	1.017 (1.014, 1.021)
Other	-0.66 (-1.03, -0.29)	1.012 (1.008, 1.015)	-0.67 (-1.05, -0.30)	1.012 (1.008, 1.016)
Nationality father				
Switzerland [¶]	0		0	1
S Europe	-0.28 (-0.61, 0.06)	0.992 (0.989, 0.996)	-0.28 (-0.62, 0.06)	0.993 (0.989, 0.996)
W Europe	0.30 (-0.03, 0.64)	1.006 (1.002, 1.009)	0.30 (-0.04, 0.63)	1.006 (1.003, 1.010)
N Europe	-0.21 (-1.06, 0.63)	1.011 (1.002, 1.019)	-0.24 (-1.09, 0.62)	1.011 (1.003, 1.020)
E Europe	-0.02 (-0.38, 0.35)	1.011 (1.007, 1.015)	-0.01 (-0.38, 0.36)	1.011 (1.008, 1.015)
Other	0.49 (0.06, 0.91)	0.991 (0.987, 0.996)	0.48 (0.05, 0.90)	0.992 (0.987, 0.996)
Education mother				
Tertiary [¶]			0	1
Secondary	-0.56 (-0.75, -0.37)	0.997 (0.995, 0.999)	-0.55 (-0.74, -0.36)	0.996 (0.995, 0.998)
Compulsory	-0.92 (-1.23, -0.60)	0.993 (0.990, 0.997)	-0.90 (-1.22, -0.58)	0.993 (0.990, 0.996)
Education father				
Tertiary [¶]			0	1
Secondary	-0.16 (-0.35, 0.03)	0.997 (0.995, 0.999)	-0.16 (-0.35, 0.03)	0.996 (0.994, 0.998)
Compulsory	-0.25 (-0.57, 0.07)	0.997 (0.994, 1.001)	-0.25 (-0.58, 0.07)	0.997 (0.994, 1.000)
Altitude (m)				
500 [¶]	0		0	1
per 500 m increase	-0.05 (-0.33, 0.24)	0.991 (0.987, 0.994)	0.03 (-0.24, 0.30)	0.989 (0.987, 0.992)
Urbanization				
Urban [¶]	0		0	1
Peri-urban	-0.54 (-0.75, -0.33)	1.001 (0.998, 1.004)	-0.59 (-0.82, -0.36)	1.003 (1.000, 1.005)
Rural	-0.25 (-0.50, 0.00)	1.003 (0.999, 1.006)	-0.29 (-0.55, -0.02)	1.003 (1.001, 1.006)
Language region				
German [¶]	0		0	1
French	-0.33 (-0.75, 0.09)	0.991 (0.983, 0.998)	-0.66 (-0.88, -0.44)	0.988 (0.985, 0.990)
Italian	-1.10 (-1.50, -0.70)	0.984 (0.978, 0.989)	-1.11 (-1.55, -0.68)	0.983 (0.979, 0.987)

*Birth weight was modelled on a log scale, which results in multiplicative effects. The model for birth weight was additionally adjusted for gestational age by a cubic spline function with knots at weeks 25, 30 and 35.

[§] In the model for BW, the intercept corresponds to an estimated mean birth weight (g) for a singleton girl born at gestational age 40 weeks as the first child (rank 1) in a German-speaking, urban region of elevation 500 m, whose mother is 20-30 years old at birth and married, and both parents have Swiss nationality and tertiary education.

[¶] Reference category

[‡] Age modelled by a piece-wise linear function: constant at reference range ≥20-30, and separate slopes for age <20, ≥30-40, and ≥40. For ages ≥40, the total estimated effect is hence addition of 10-year effect in age group ≥30-40 plus the corresponding effect in age-group ≥40.

[†] Percentage of regional variance explained by model predictors, i.e. percent reduction in variance of random effects (σ^2) when compared to model with no predictors (model 0).

Supplementary Table S3. Comparison of results from model (model 3) for birth weight, adjusted and not adjusted for gestational age.

	Birth weight - Model 3 without Gestational Age		Birth weight - Model 3 with Gestational Age*	
	Relative differences (95% CI)			
	Eligible population	Complete case population	Eligible population	Complete case population
Intercept	3188 (3181 to 3195)	3209 (3196 to 3222)	3278 (3218 to 3339) [§]	3298 (3180 to 3420) [§]
Sex				
[¶] Female	1	1	1	1
Male	1.04 (1.038, 1.041)	1.041 (1.039, 1.044)	1.045 (1.044 to 1.046)	1.048 (1.046, 1.049)
Rank				
1 [¶]	1	1	1	1
2	1.039 (1.038, 1.041)	1.041 (1.038, 1.044)	1.038 (1.037, 1.039)	1.039 (1.037, 1.041)
3	1.052 (1.049, 1.054)	1.058 (1.054, 1.063)	1.050 (1.048, 1.051)	1.054 (1.051, 1.057)
≥ 4	1.060 (1.056, 1.064)	1.071 (1.063, 1.079)	1.058 (1.056, 1.061)	1.065 (1.059, 1.070)
Age mother (yrs)[‡]				
< 20yrs (per 5 yrs decr.)	0.956 (0.935, 0.978)	-	1.002 (0.987, 1.017)	-
≥ 20-30 yrs [¶]	1	1	1	1
≥ 30-40 yrs (per 5 yrs)	0.991 (0.990, 0.992)	0.990 (0.988, 0.993)	1.000 (1.000, 1.001)	0.998 (0.997, 1.000)
≥ 40 yrs (per 5 yrs)	0.973 (0.967, 0.979)	0.967 (0.955, 0.979)	0.998 (0.994, 1.003)	0.998 (0.990, 1.006)
Civil status[§]				
Married [¶]	1	1	1	1
Not married	0.989 (0.987, 0.990)	0.992 (0.989, 0.996)	0.990 (0.989, 0.991)	0.993 (0.99, 0.995)
Nationality mother				
Switzerland [¶]	1	1	1	1
S Europe	0.996 (0.993, 0.999)	0.999 (0.993, 1.005)	0.994 (0.992, 0.996)	0.995 (0.991, 0.999)
W Europe	1.010 (1.007, 1.013)	1.006 (1.001, 1.011)	1.008 (1.006, 1.010)	1.007 (1.004, 1.011)
N Europe	1.027 (1.020, 1.034)	1.024 (1.010, 1.037)	1.025 (1.020, 1.029)	1.022 (1.013, 1.031)
E Europe	1.014 (1.011, 1.016)	1.020 (1.015, 1.026)	1.013 (1.011, 1.014)	1.017 (1.014, 1.021)
Other	1.003 (1.000, 1.006)	1.005 (0.999, 1.010)	1.007 (1.005, 1.008)	1.012 (1.008, 1.016)
Nationality father				
Switzerland [¶]	1	1	1	1
S Europe	0.988 (0.985, 0.991)	0.991 (0.986, 0.996)	0.991 (0.990, 0.993)	0.993 (0.989, 0.996)
W Europe	1.008 (1.005, 1.011)	1.009 (1.004, 1.014)	1.008 (1.006, 1.009)	1.006 (1.003, 1.010)
N Europe	1.017 (1.010, 1.024)	1.007 (0.994, 1.019)	1.013 (1.009, 1.017)	1.011 (1.003, 1.020)
E Europe	1.003 (1.000, 1.006)	1.010 (1.004, 1.015)	1.009 (1.007, 1.010)	1.011 (1.008, 1.015)
Other	0.990 (0.987, 0.993)	0.997 (0.990, 1.003)	0.992 (0.991, 0.994)	0.992 (0.987, 0.996)
missing	0.933 (0.928, 0.938)	-	0.989 (0.985, 0.992)	-
Education mother				
Tertiary [¶]	-	1	-	1
Secondary	-	0.992 (0.989, 0.995)	-	0.996 (0.995, 0.998)
Compulsory	-	0.984 (0.979, 0.989)	-	0.993 (0.990, 0.996)
Education father				
Tertiary [¶]	-	1	-	1
Secondary	-	0.995 (0.992, 0.997)	-	0.996 (0.994, 0.998)
Compulsory	-	0.995 (0.990, 1.000)	-	0.997 (0.994, 1.000)
Altitude (m)				
500 m [¶]	1	1	1	1
per 500 m increase	0.990 (0.988, 0.992)	0.989 (0.985, 0.993)	0.989 (0.988, 0.991)	0.989 (0.987, 0.992)
Urbanization				
Urban [¶]	1	1	1	1
Peri-urban	0.998 (0.996, 1.000)	0.998 (0.995, 1.002)	1.001 (1.000, 1.002)	1.003 (1.000, 1.005)
Rural	0.999 (0.996, 1.001)	1.001 (0.997, 1.005)	1.000 (0.998, 1.001)	1.003 (1.001, 1.006)
Language region				
[¶] German [¶]	1	1	1	1
French	0.985 (0.983, 0.987)	0.983 (0.980, 0.986)	0.989 (0.987, 0.990)	0.988 (0.985, 0.990)
Italian	0.977 (0.973, 0.981)	0.976 (0.970, 0.982)	0.982 (0.980, 0.985)	0.983 (0.979, 0.987)
% variation explained				
Model 3	77%	76%	87%	88%
Model 2	25%	27%	52%	56%
Model 1	2%	5%	31%	37%

*Birth weight was modelled on a log scale, which results in multiplicative effects.

[¶] Reference category

[‡] Age modelled by a piece-wise linear function: constant at reference range ≥20-30, and separate slopes for age <20, ≥30-40, and ≥40. For ages ≥40, the total estimated effect is hence addition of 10-year effect in age group ≥30-40 plus the corresponding effect in age-group ≥40.

[†] Percentage of regional variance explained by model predictors, i.e. percent reduction in variance of random effects (σ^2) when compared to model with no predictors (model 0).

Supplementary Table S4. Comparison of results from fully adjusted model without and with additionally including Swiss index of socio-economic position (SEP). Based on eligible population (N = 315,177); 277 days correspond to 39^{4/7} weeks.

	Model 3 without SEP		Model 3 with SEP	
	Gestational age (days) Absolute differences (95% CI)	Birth weight (g) * Relative differences (95% CI)	Gestational age (days) Absolute differences (95% CI)	Birth weight (g) * Relative differences (95% CI)
Intercept	277.3 (277.2 to 277.5)	3278 (3218 to 3339) ^{&}	277.3 (277.2 to 277.5)	3278 (3218 to 3339) ^{&}
Sex				
[¶] Female	0	1	0	1
Male	-0.56 (-0.65, -0.48)	1.045 (1.044 to 1.046)	-0.56 (-0.65, -0.48)	1.045 (1.044 to 1.046)
Birth rank				
1 [¶]	0	1	0	1
2	-0.39 (-0.49, -0.29)	1.038 (1.037, 1.039)	-0.39 (-0.49, -0.29)	1.038 (1.037, 1.039)
3	-0.37 (-0.52, -0.22)	1.050 (1.048, 1.051)	-0.37 (-0.52, -0.22)	1.050 (1.048, 1.051)
≥ 4	-0.24 (-0.50, 0.02)	1.058 (1.056, 1.061)	-0.24 (-0.49, 0.02)	1.058 (1.056, 1.061)
Age mother (yrs)[‡]				
< 20 (per 5 yrs decr.)	-4.10 (-5.59, -2.61)	1.002 (0.987, 1.017)	-4.10 (-5.59, -2.61)	1.002 (0.987, 1.017)
20 - <30 [¶]	0	1	0	1
≥ 30-40 (per 5 yrs)	-0.99 (-1.06, -0.91)	1.000 (1.000, 1.001)	-0.99 (-1.07, -0.92)	1.000 (1.000, 1.001)
≥ 40 (per 5 yrs)	-2.93 (-3.36, -2.50)	0.998 (0.994, 1.003)	-2.92 (-3.35, -2.50)	0.998 (0.994, 1.003)
Civil status[§]				
Married	0	1	0	1
Not married	-0.01 (-0.13, 0.10)	0.990 (0.989, 0.991)	-0.01 (-0.13, 0.10)	0.990 (0.989, 0.991)
Nationality mother				
Switzerland [¶]	0	1	0	1
S Europe	0.20 (-0.01, 0.40)	0.994 (0.992, 0.996)	0.20 (0.00, 0.41)	0.994 (0.992, 0.996)
W Europe	0.20 (0.02, 0.38)	1.008 (1.006, 1.010)	0.20 (0.02, 0.37)	1.008 (1.006, 1.010)
N Europe	0.37 (-0.07, 0.81)	1.025 (1.020, 1.029)	0.36 (-0.08, 0.80)	1.025 (1.020, 1.029)
E Europe	0.21 (0.04, 0.38)	1.013 (1.011, 1.014)	0.22 (0.05, 0.39)	1.013 (1.011, 1.015)
Other	-0.32 (-0.49, -0.14)	1.007 (1.005, 1.008)	-0.31 (-0.48, -0.14)	1.007 (1.005, 1.008)
Nationality father				
Switzerland [¶]	0	1	0	1
S Europe	-0.46 (-0.64, -0.28)	0.991 (0.990, 0.993)	-0.45 (-0.63, -0.27)	0.992 (0.99, 0.993)
W Europe	0.07 (-0.11, 0.25)	1.008 (1.006, 1.009)	0.07 (-0.11, 0.25)	1.008 (1.006, 1.009)
N Europe	0.51 (0.08, 0.94)	1.013 (1.009, 1.017)	0.50 (0.07, 0.93)	1.013 (1.009, 1.017)
E Europe	-0.46 (-0.64, -0.28)	1.009 (1.007, 1.010)	-0.45 (-0.63, -0.27)	1.009 (1.007, 1.011)
Other	-0.02 (-0.22, 0.18)	0.992 (0.991, 0.994)	-0.01 (-0.21, 0.19)	0.993 (0.991, 0.995)
missing	-3.87 (-4.24, -3.50)	0.989 (0.985, 0.992)	-3.86 (-4.23, -3.49)	0.989 (0.985, 0.993)
SEP index				
1st quintile	-	-	-0.08 (-0.25, 0.08)	0.997 (0.996, 0.999)
2nd quintile	-	-	-0.09 (-0.24, 0.06)	0.998 (0.997, 1.000)
3rd quintile	-	-	-0.02 (-0.17, 0.13)	0.998 (0.997, 0.999)
4th quintile	-	-	0.02 (-0.12, 0.17)	1.000 (0.999, 1.002)
5th quintile [¶]	-	-	0	1
Altitude (m)				
500 [¶]	0	1	0	1
per 500 m increase	0.07 (-0.09, 0.23)	0.989 (0.988, 0.991)	0.08 (-0.08, 0.23)	0.989 (0.988, 0.991)
Urbanization				
Urban [¶]	0	1	0	1
Peri-urban	-0.43 (-0.57, -0.28)	1.001 (1.000, 1.002)	-0.43 (-0.57, -0.28)	1.001 (1.000, 1.002)
Rural	-0.15 (-0.32, 0.02)	1.000 (0.998, 1.001)	-0.13 (-0.30, 0.04)	1.001 (0.999, 1.002)
Language region				
German [¶]	0	1	0	1
French	-0.62 (-0.77, -0.47)	0.989 (0.987, 0.990)	-0.61 (-0.76, -0.46)	0.989 (0.987, 0.990)
Italian	-0.94 (-1.26, -0.63)	0.982 (0.980, 0.985)	-0.93 (-1.24, -0.61)	0.982 (0.980, 0.985)
% variation explained				
Full model	31%	87%	31%	88%
Model without Lang. region	14%	66%	15%	68%

*Birth weight was modelled on a log scale, which results in multiplicative effects. The model for birth weight was additionally adjusted for gestational age by a cubic spline function with knots at weeks 25, 30 and 35.

[&] In the model for BW, the intercept corresponds to an estimated mean birth weight (g) for a singleton girl born at gestational age 40 weeks as the first child (rank 1) in a German-speaking, urban region of elevation 500m, whose mother is 20-30 years old at birth and married, and both parents have Swiss nationality and tertiary education.

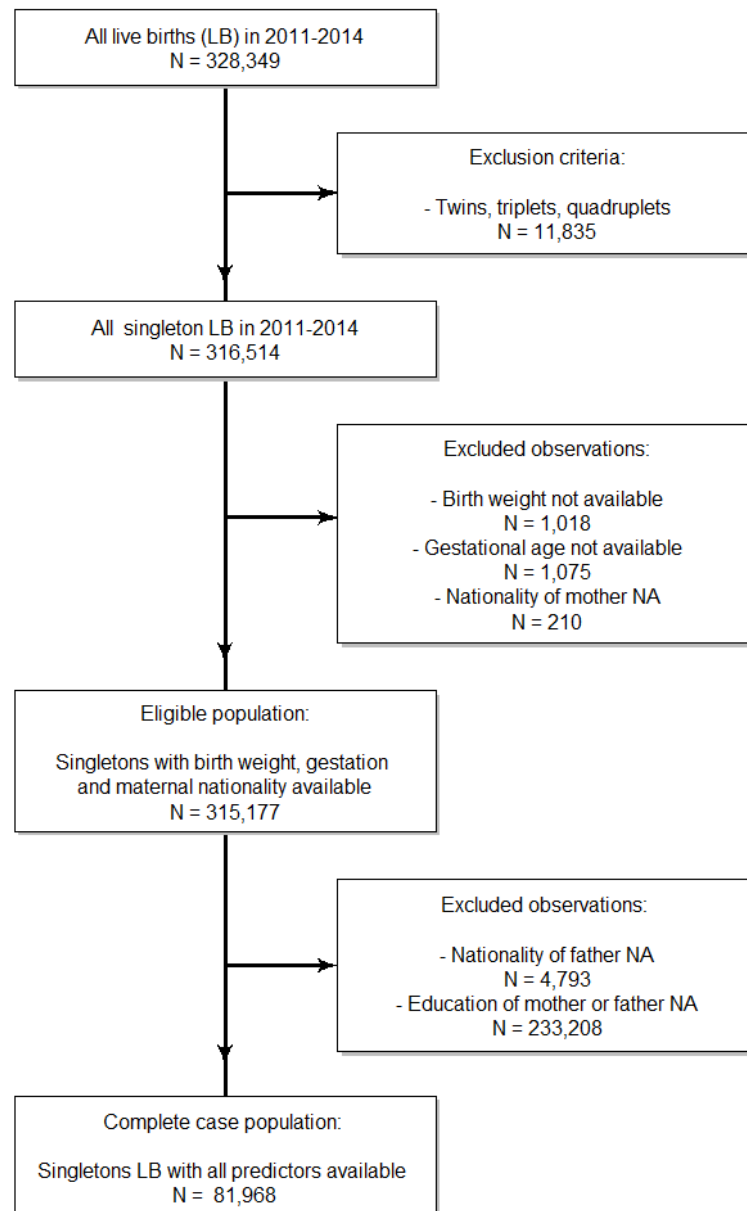
[¶] Reference category

[‡] Age modelled by a piece-wise linear function: constant at reference range ≥20-30, and separate slopes for age <20, ≥30-40, and ≥40.

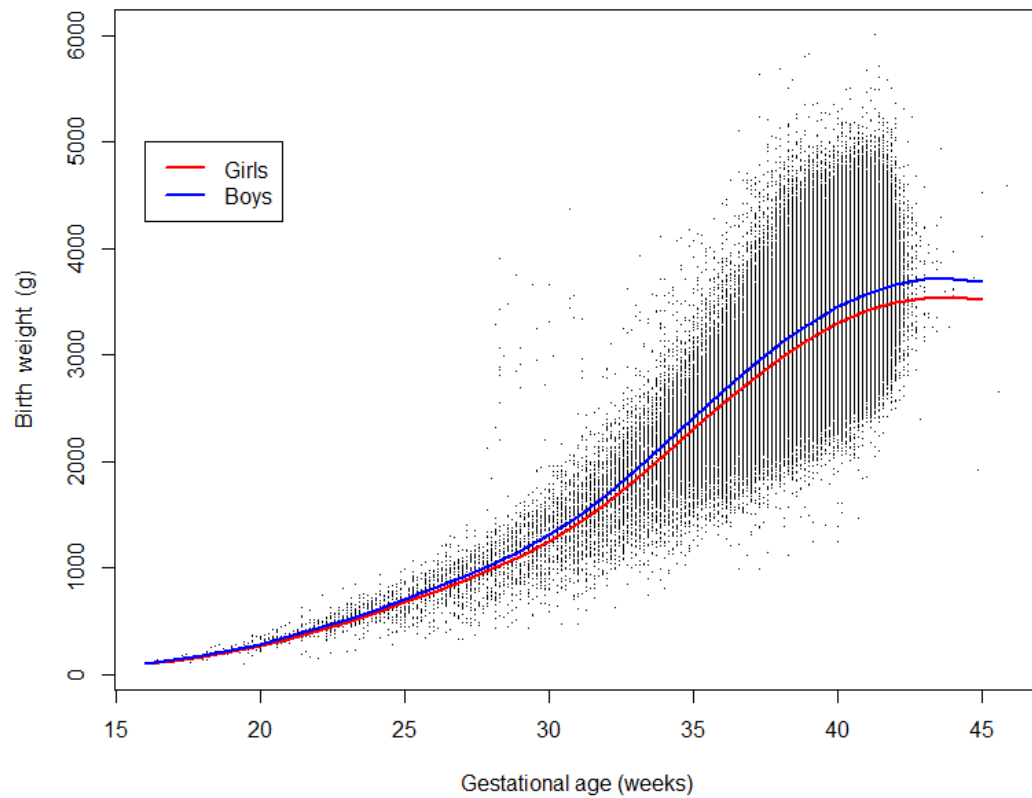
[§] Married or in registered partnership / Not married: Single, widow, divorced or in dissolved partnership

[†] Percentage of regional variance explained by model predictors, i.e. percent reduction in variance of random effects (σ^2) when compared to model with no predictors (model 0).

Supplementary Figure S1. Selection of eligible and complete case study populations among live births in Switzerland 2011 to 2014.



Supplementary Figure S2. Relationship between birth weight and gestational age at birth modelled by a cubic spline function. Separate fitted curves are shown for newborn girls and boys, with all other predictors corresponding to the reference categories shown in Table 2.



Supplementary Figure S3. Relationship between mean gestational age and proportion of preterm live births (<37 weeks) among eligible live births across 705 regions (upper panel) and between mean birth weight and proportion of low birth weight births (<2500g) (lower panel). Results from linear regression weighted by the number of live births in each region. Prediction intervals displayed for an average-size region (n=447). GA = gestational age; BW= birth weight; 276 days correspond to 39^{3/7} weeks.

