The Biocultural Origins of Human Capital Formation

Oded Galor and Marc Klemp

July 4, 2015

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    - Traits associated with pre-disposition towards child quality were selected, triggering the transition from stagnation to growth

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- Have the forces of natural selection favored moderately fertile individuals (i.e., the quality strategy) during the Malthusian epoch?

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Evidence for a Quantity-Quality Trade-off

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Historical Lab: Quebec During its Demographic Explosion

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- Genealogy of nearly 500,000 individuals

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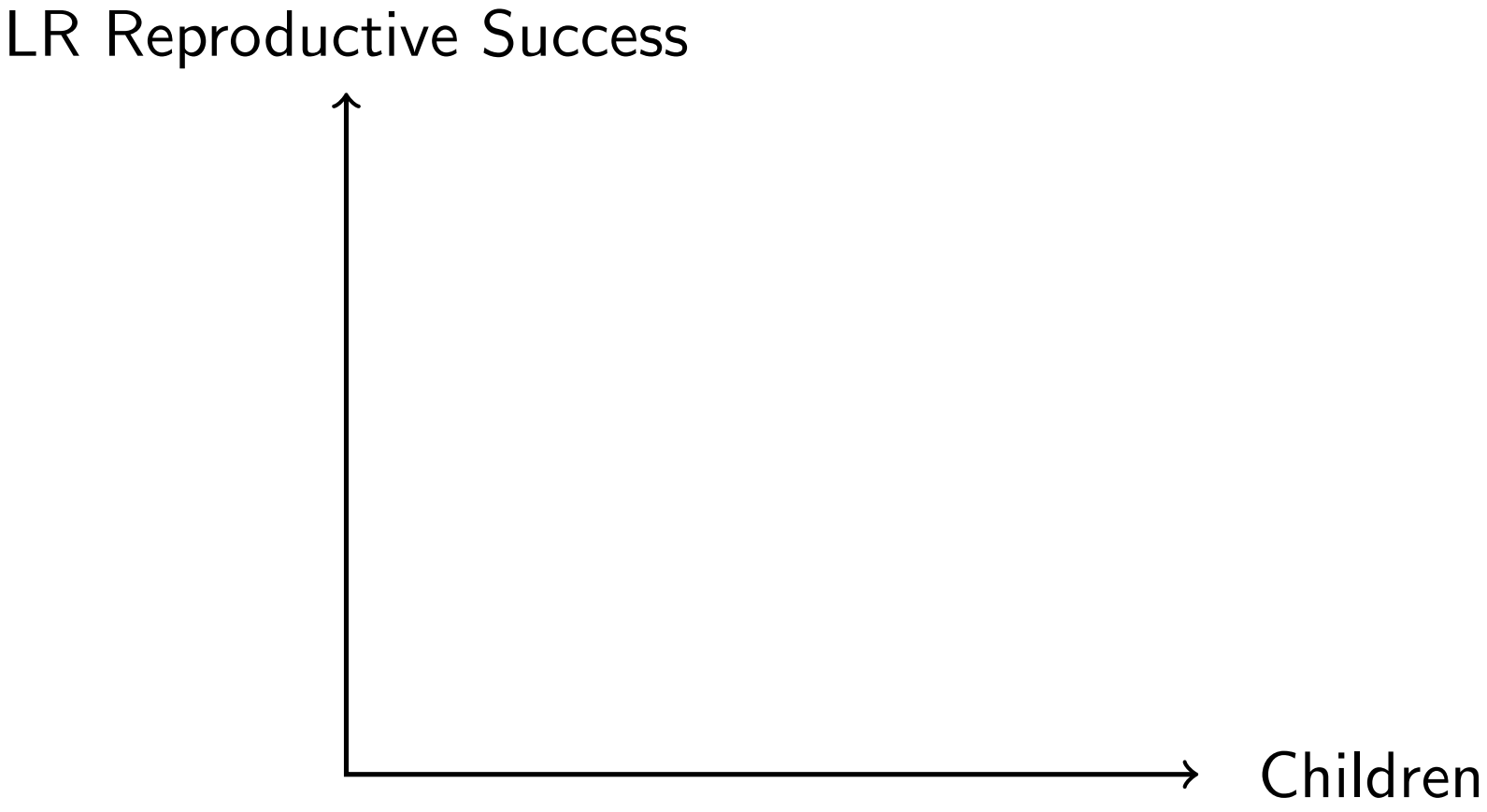
- Confirmation of selection of a quality strategy over the pre-industrial, pre-demographic transition era
  - The optimal level of fecundity is below the population mean

Main Hypothesis: Moderate Fertility Maximizes LR Reproductive Success



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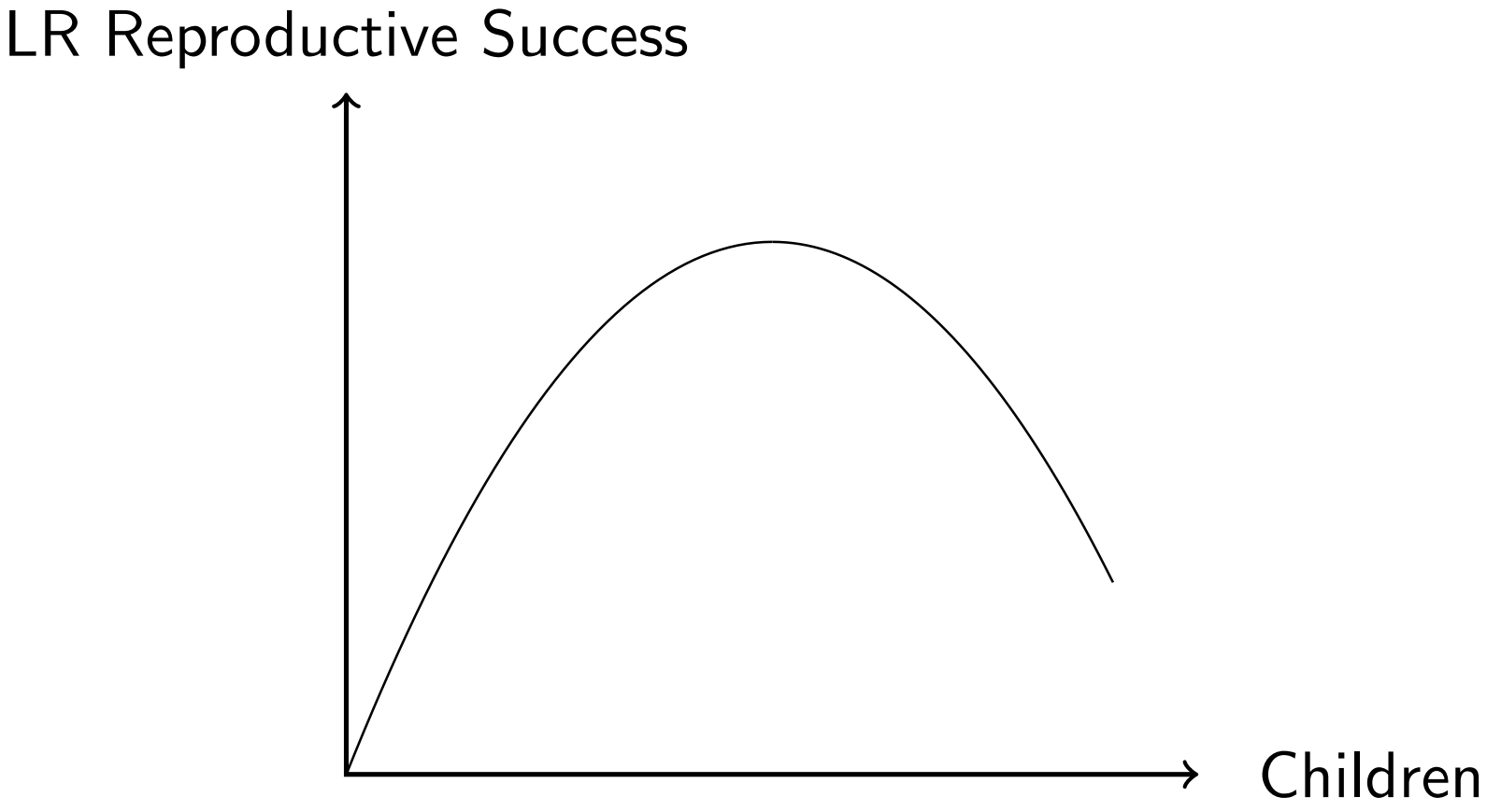

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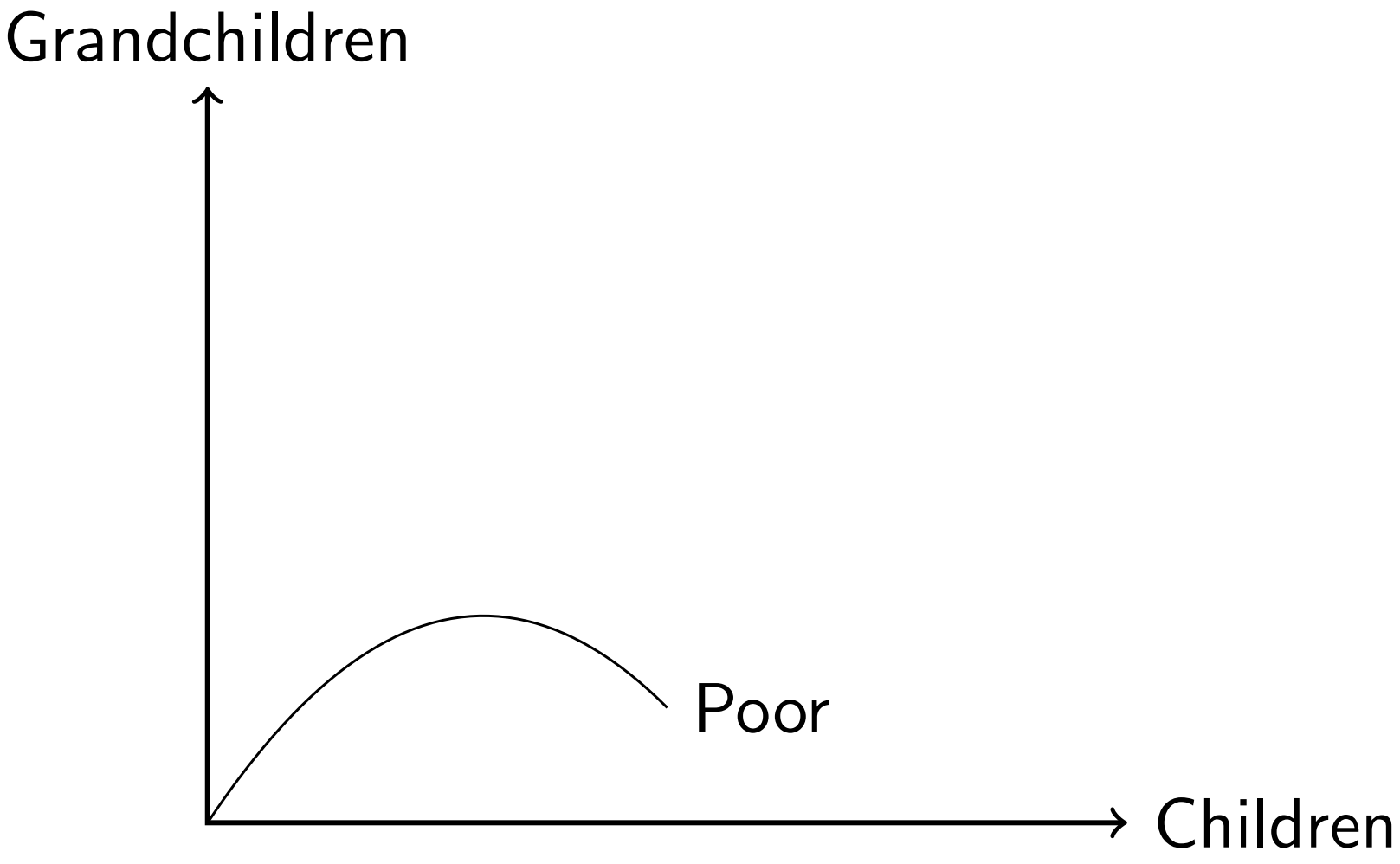
    - Biases the results towards the absence of an intergenerational trade-off

Challenge: Unobserved heterogeneity



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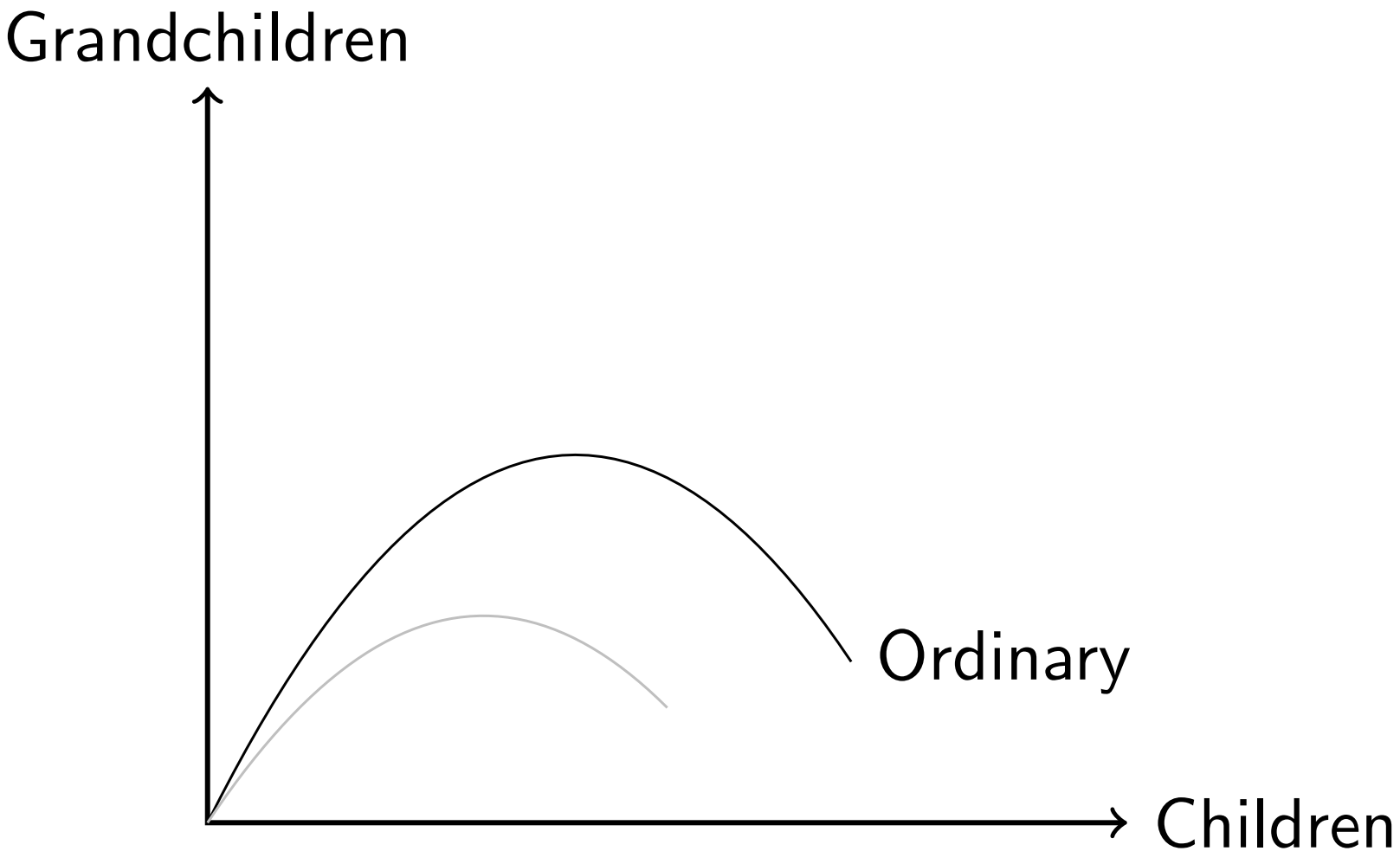

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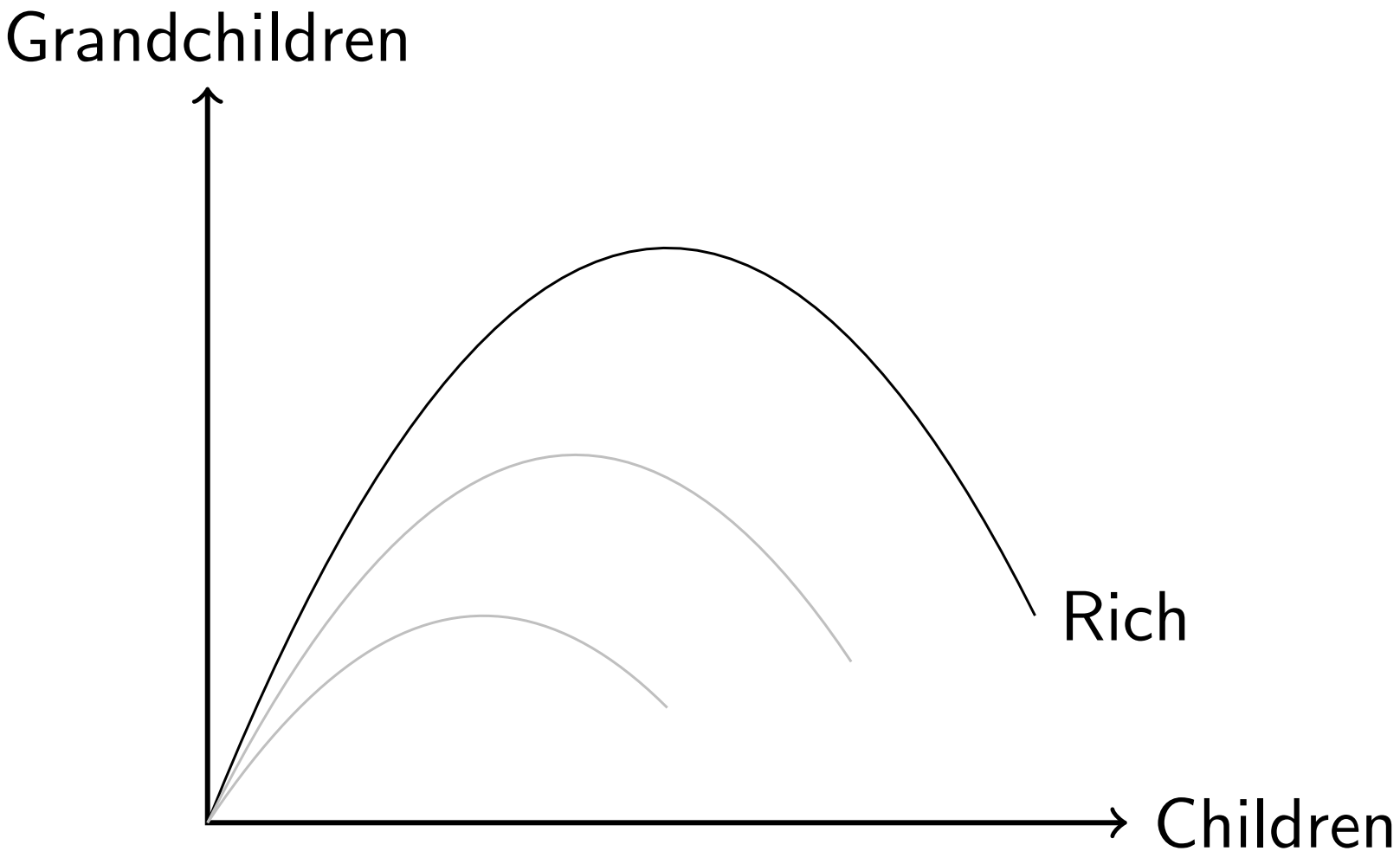

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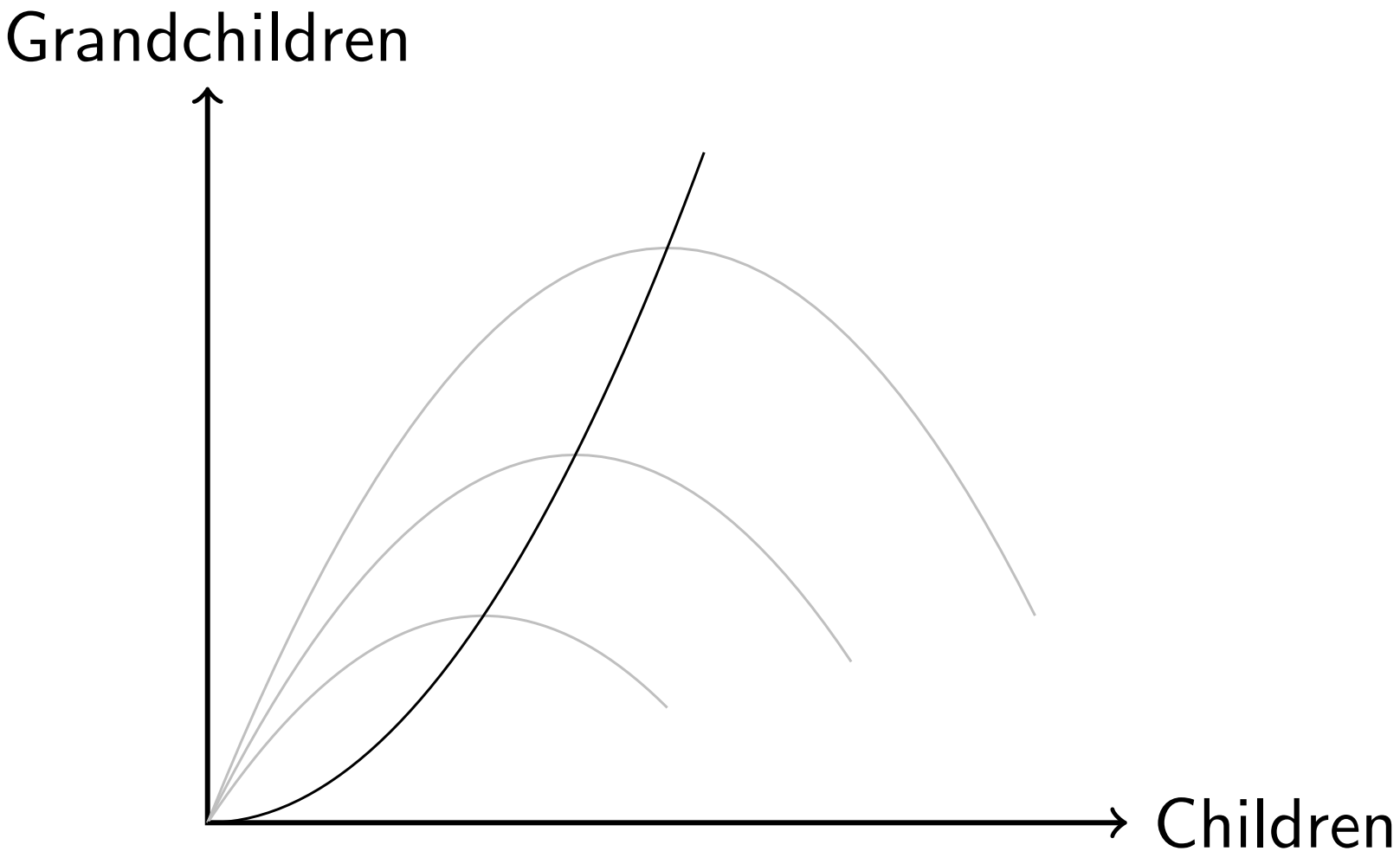

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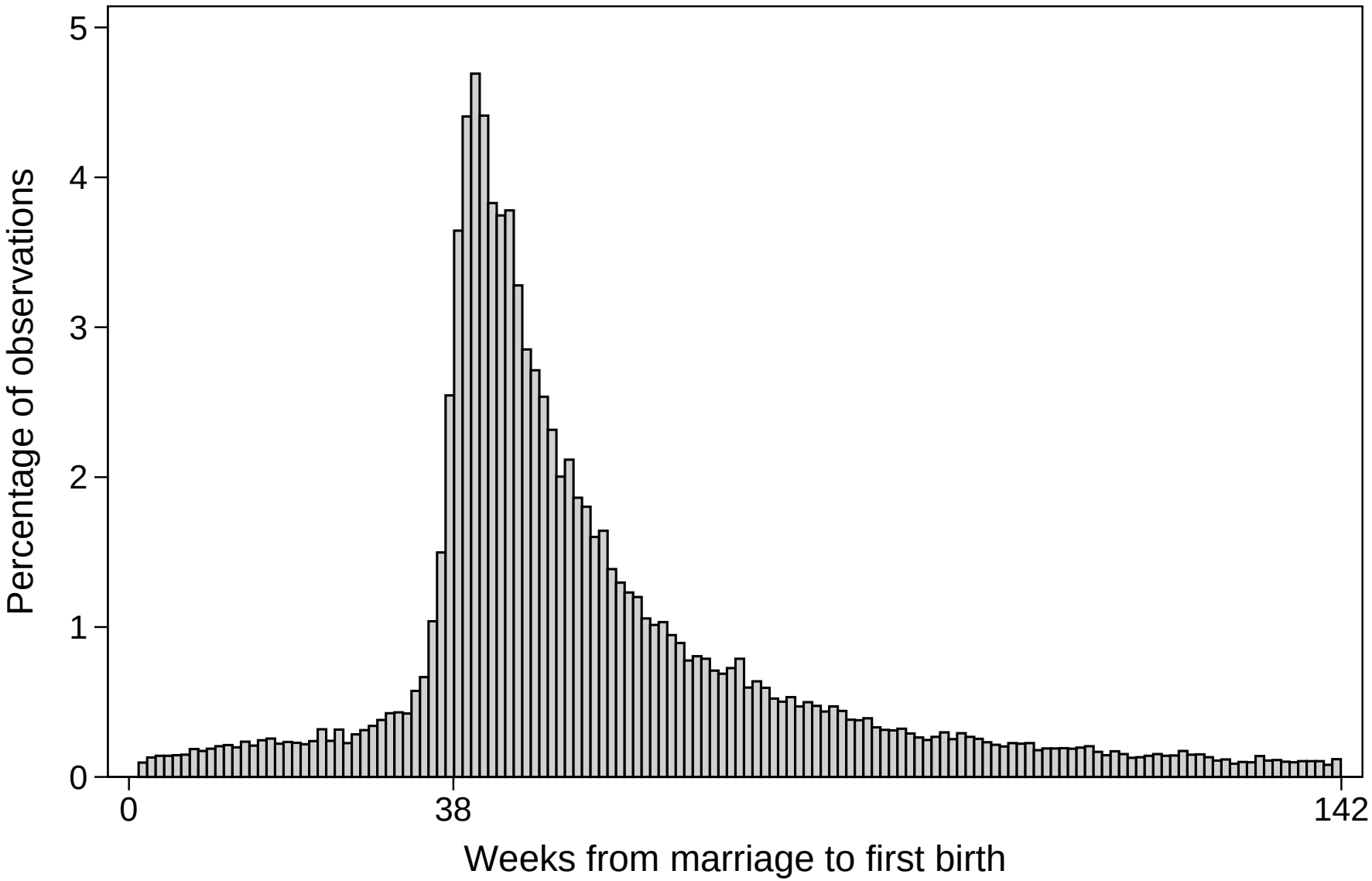
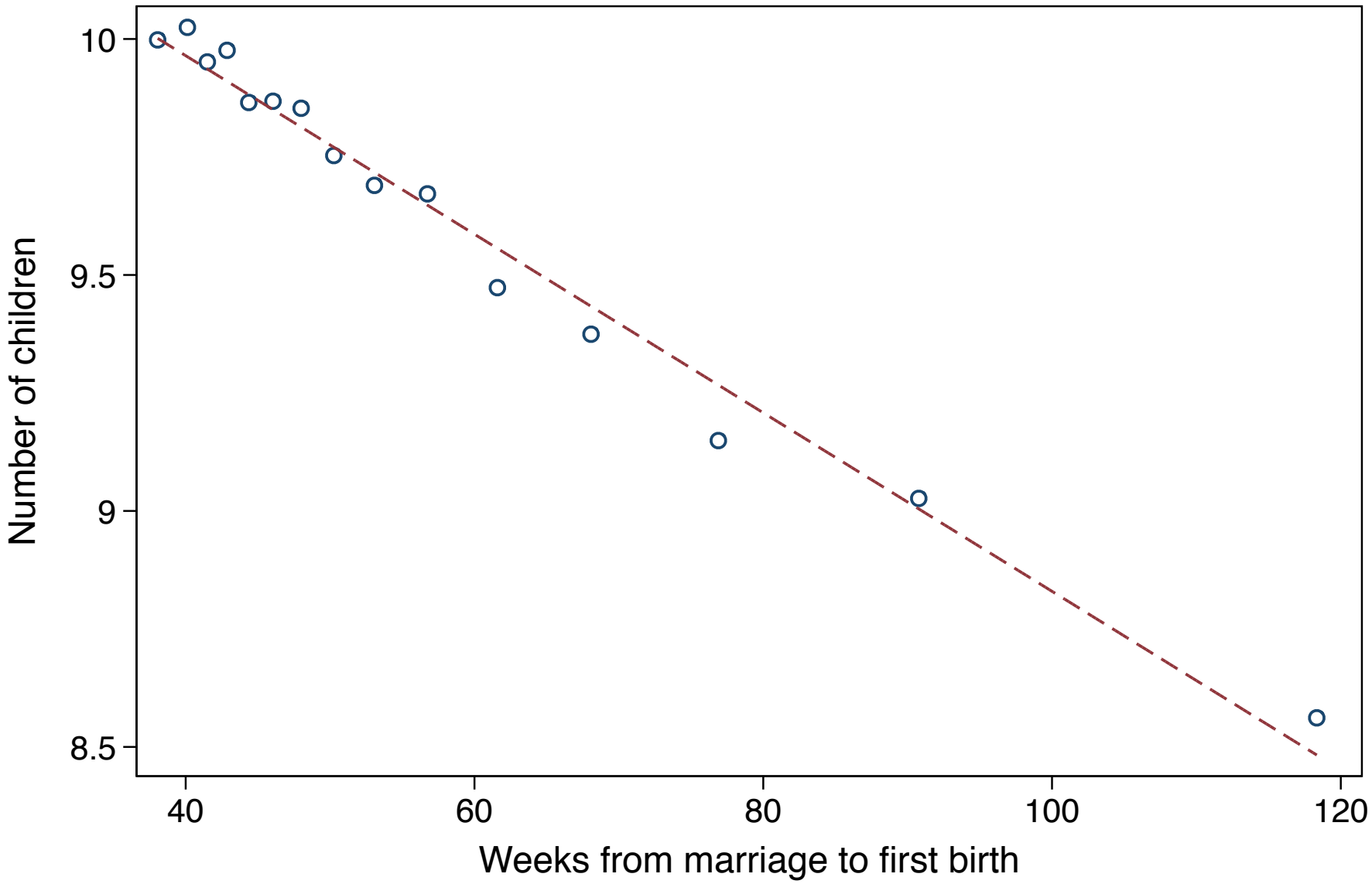
  - Identification will be based on the random variation in TFB

The Distribution of Time to First Birth (TFB)



Time to First Birth (TFB) and the Number of Children



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- Identification based on variation across siblings as opposed to the population as a whole

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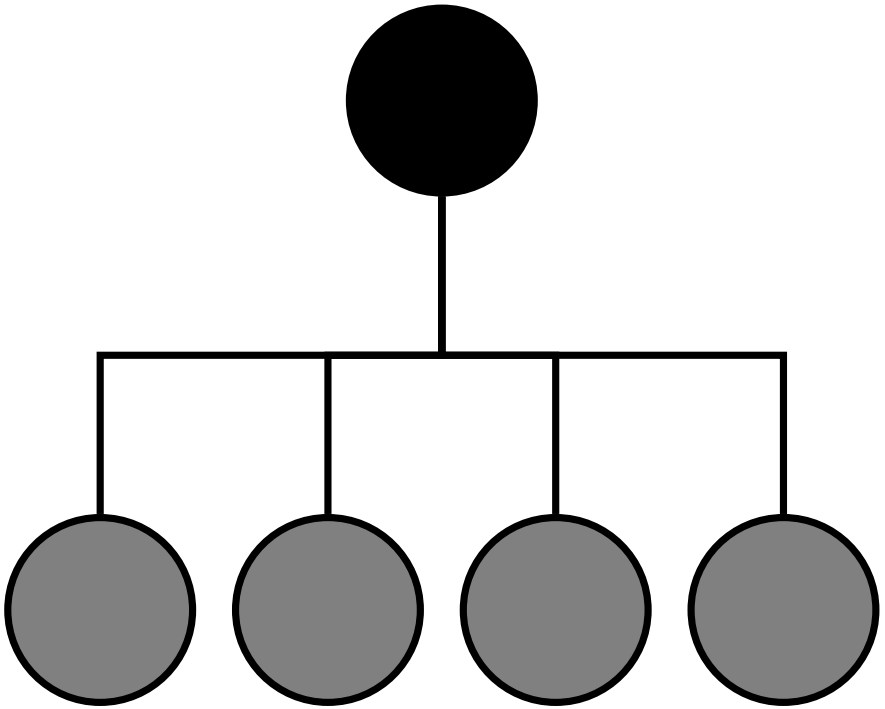

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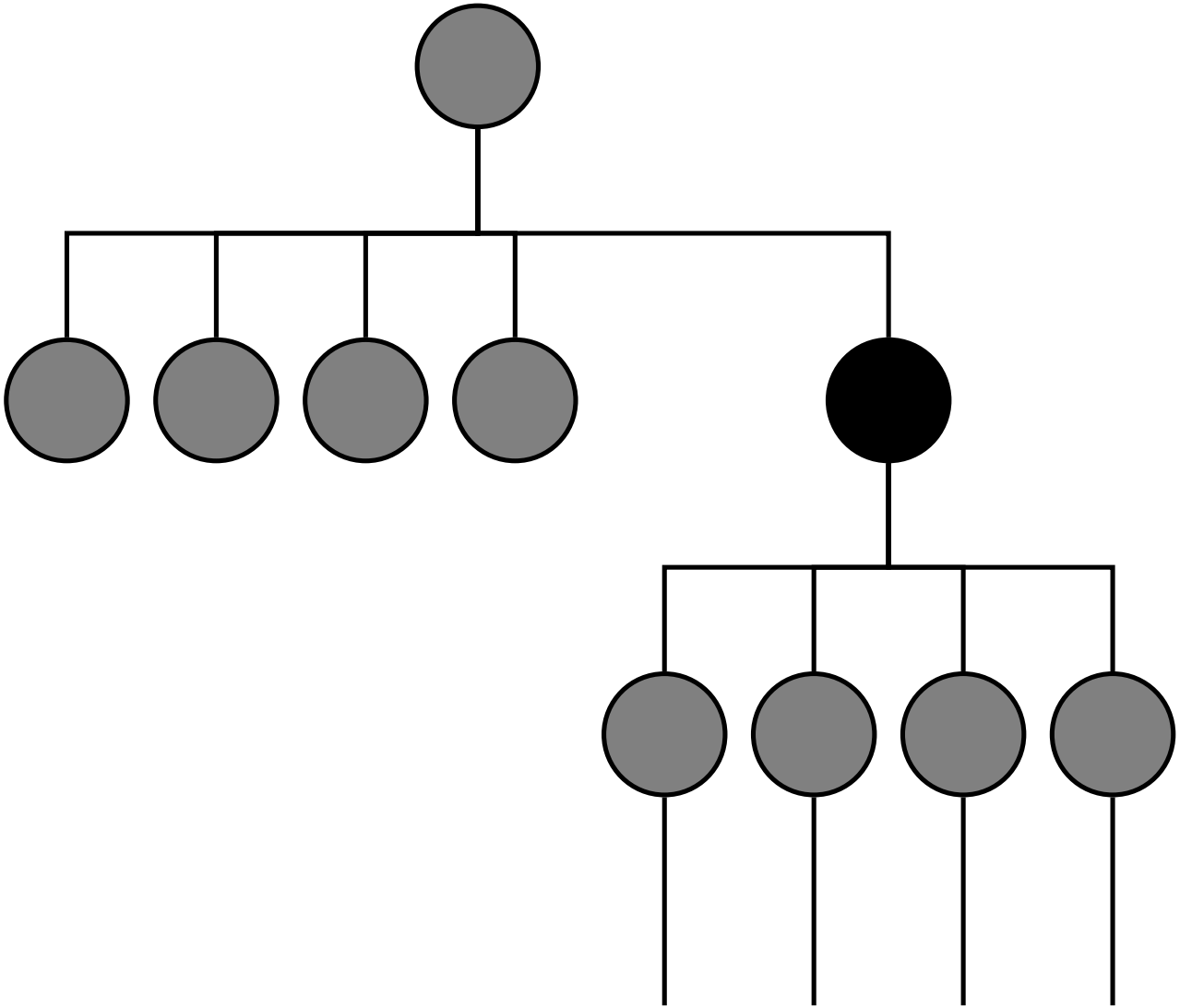

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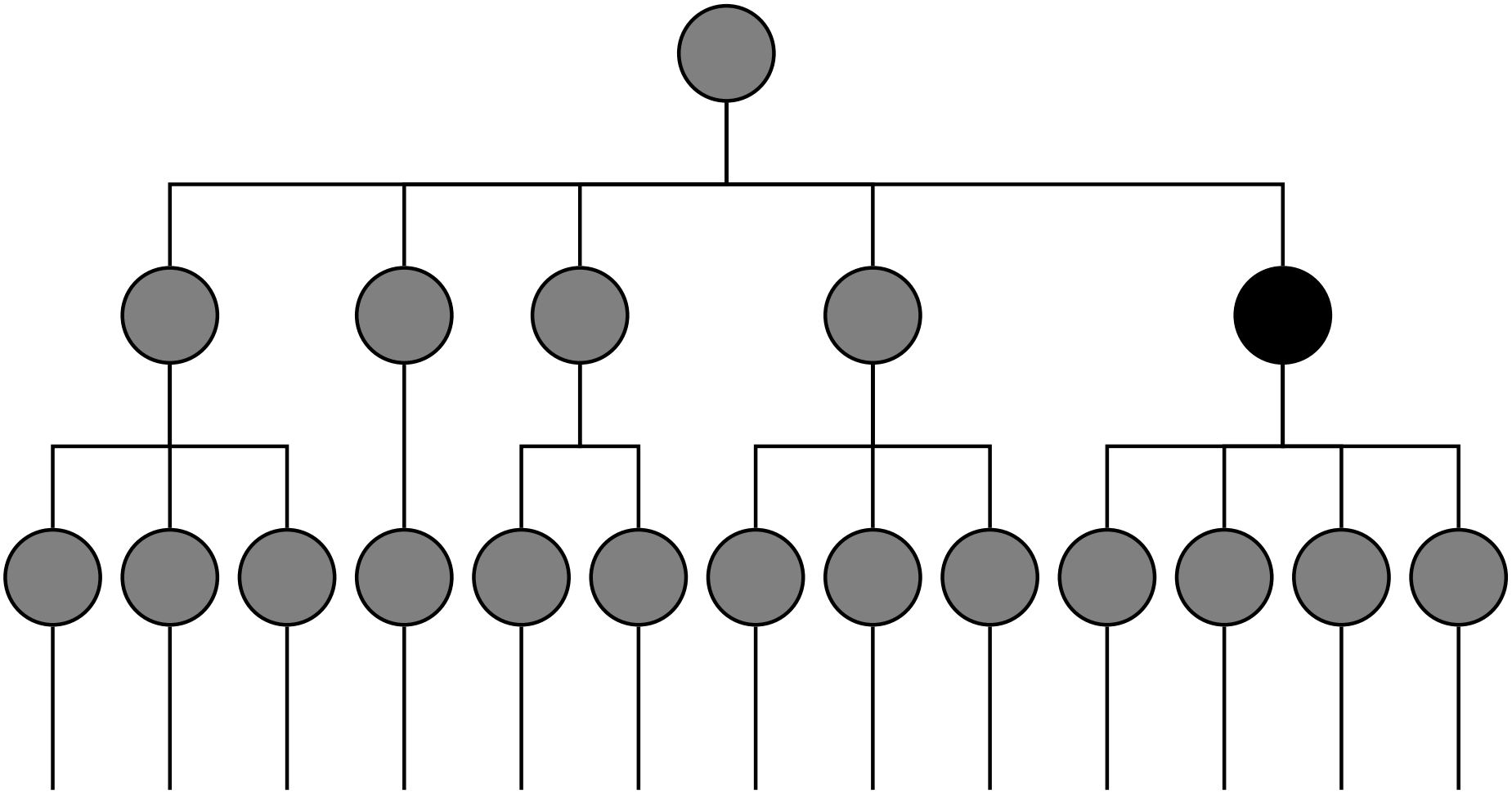

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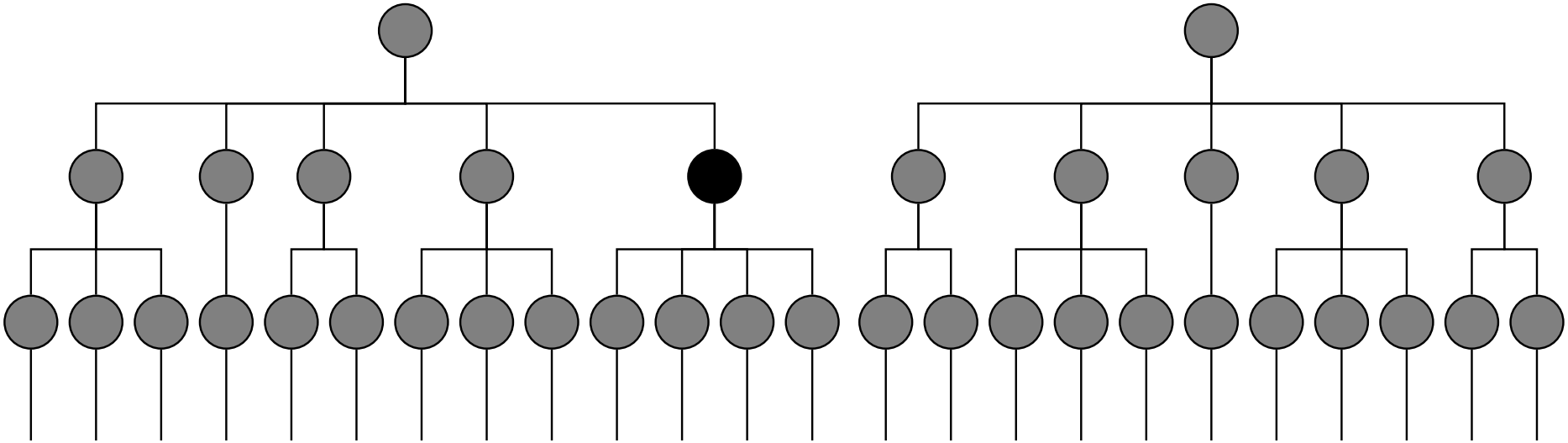

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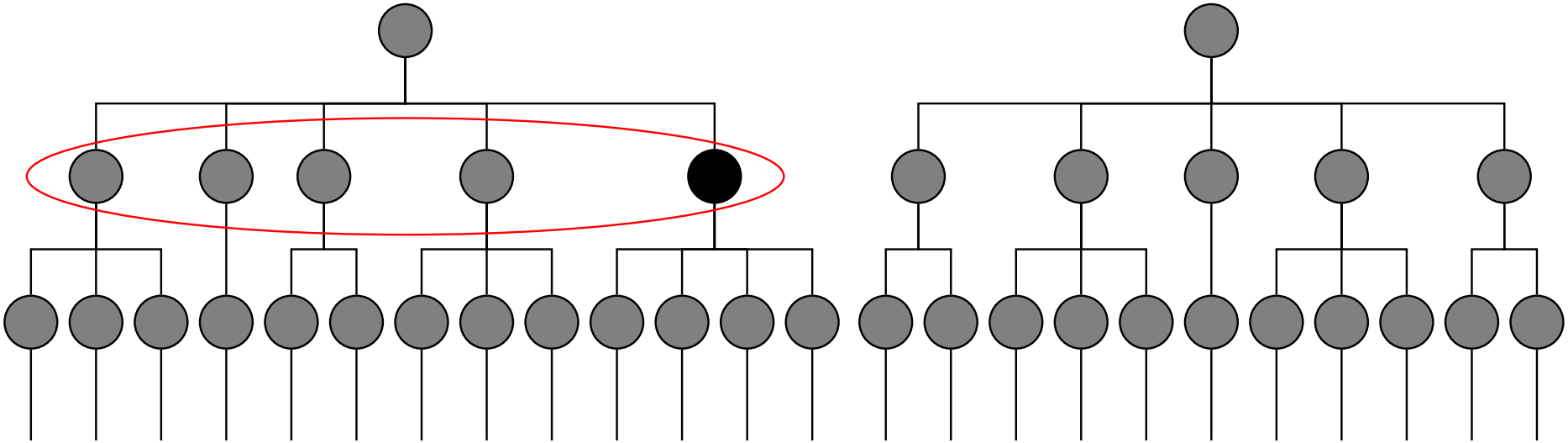
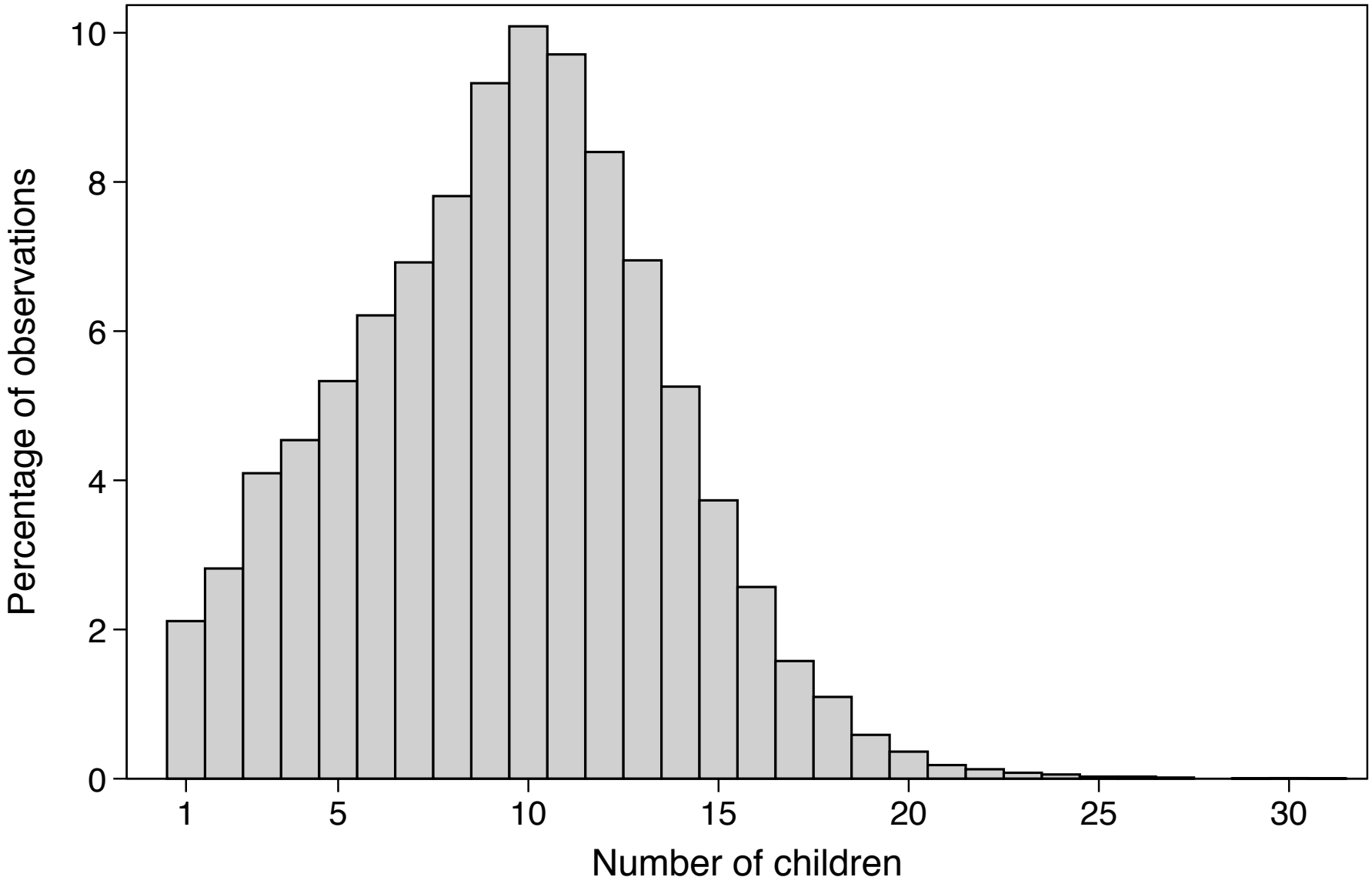
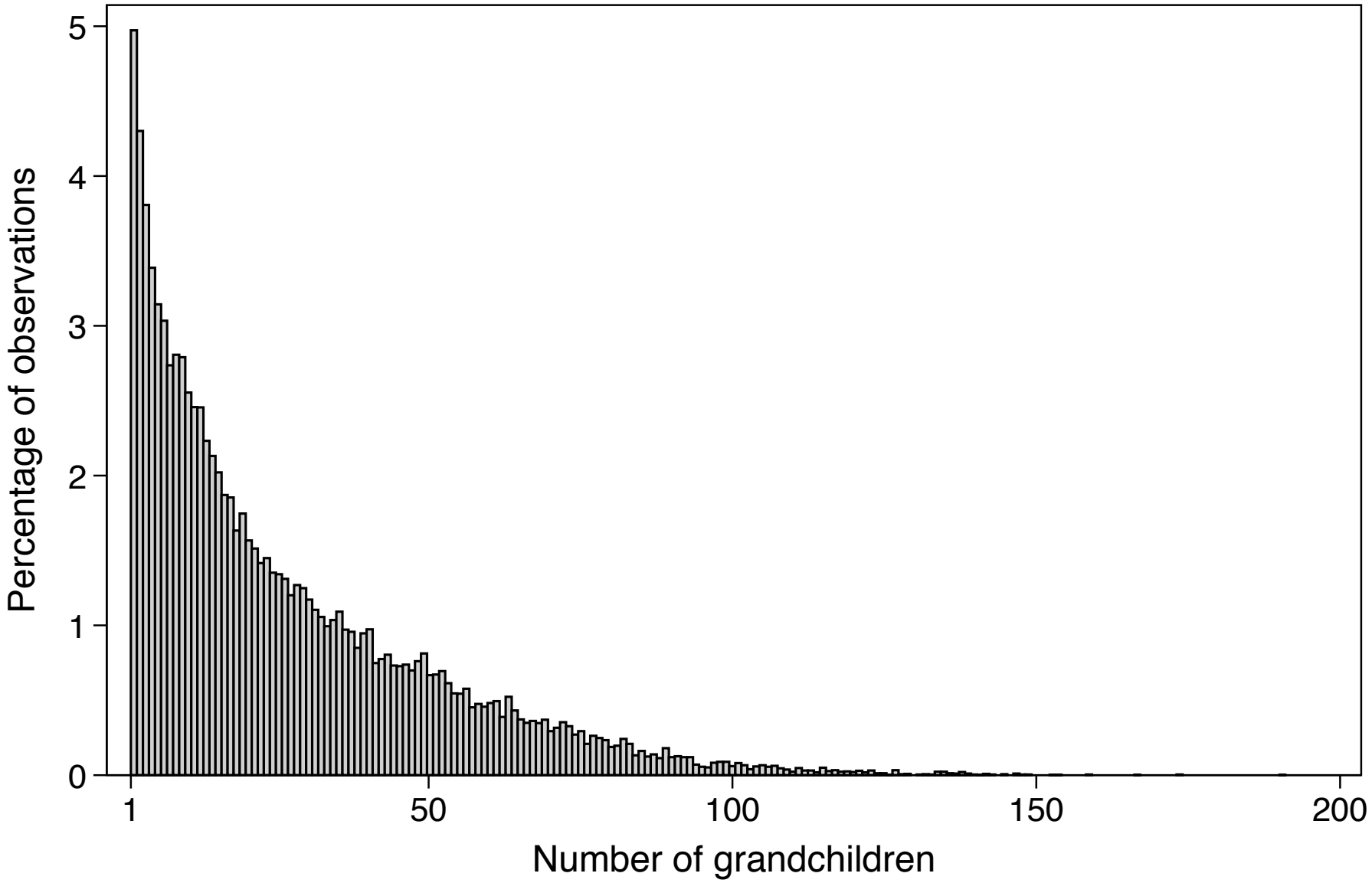


Number of Children



Number of Grandchildren



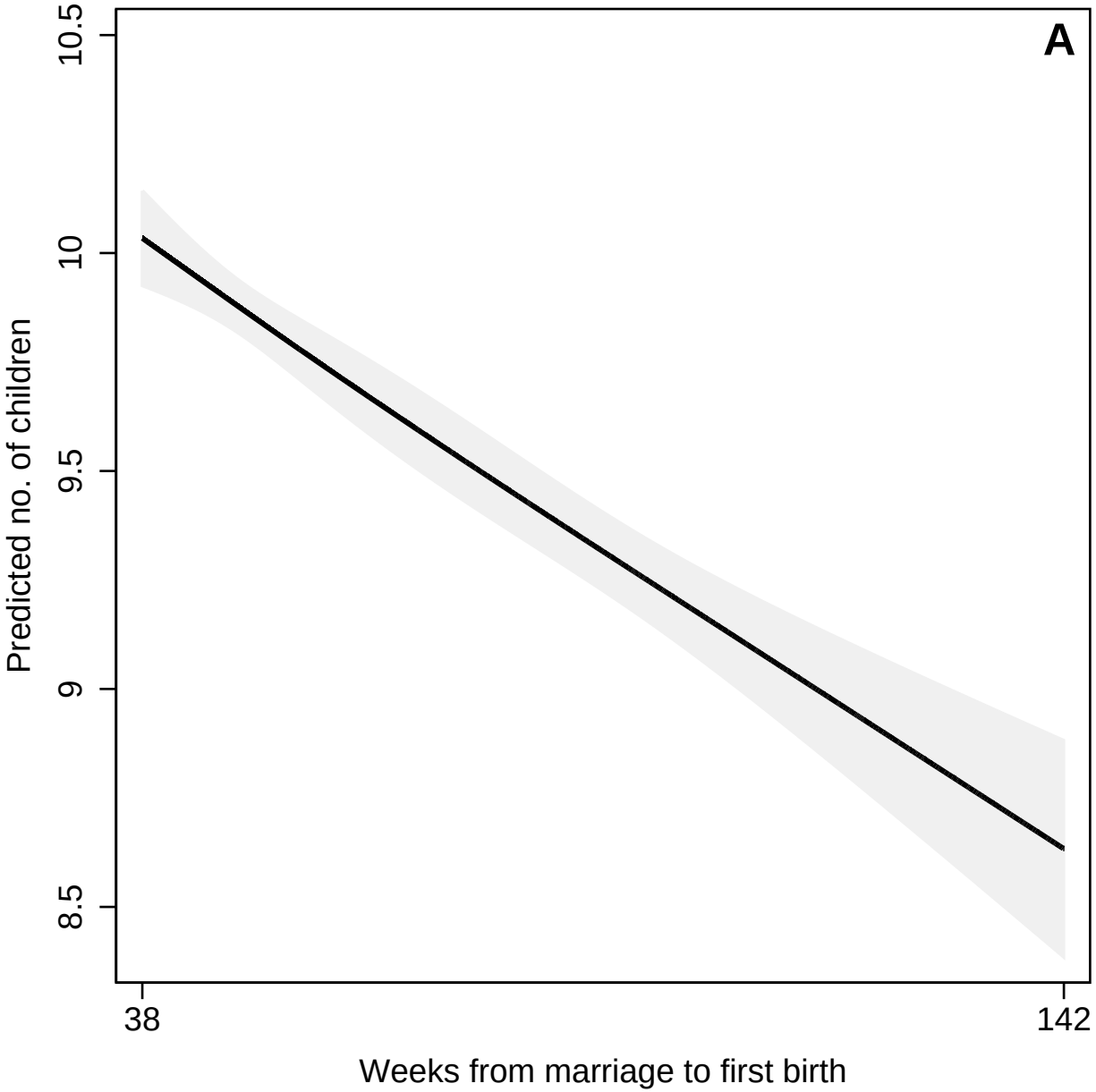
Summary Statistics

	Mean (1)	Median (2)	S.D. (3)	Count (4)
Children	9.70	10	3.99	3,798
Surviving children[a]	4.63	4	2.59	3,798
Grandchildren	47.35	44	28.07	3,798
Great-grandchildren	187.59	159	140.17	3,798
Great-great-grandchildren[b]	294.01	171	363.58	3,798
Years from marriage to first birth (TFB)	1.20	1.02	0.47	3,798
Literate	0.66	1	0.47	2,222
Fraction of literate children	0.74	1	0.35	3,448
Fraction of surviving children[a]	0.49	0.50	0.21	3,798
Fraction of surviving children with known literacy[a]	0.76	0.67	0.56	3,727
Age at first marriage	22.67	22.2	5.46	3,798
Age at last delivery	41.95	42.1	8.61	3,798

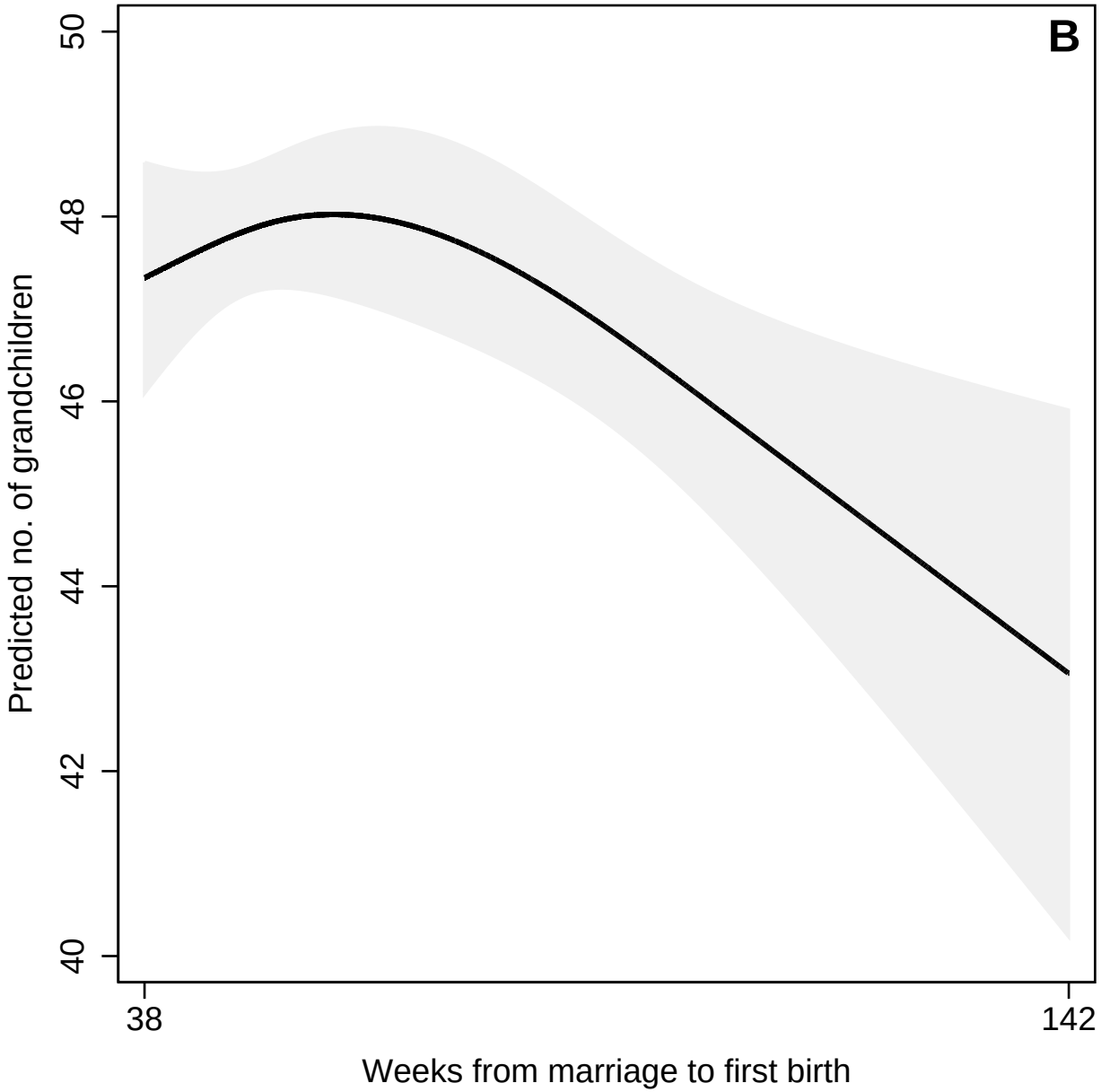
[c] Survival is recorded at age 40.

[b] The moderate increase in the mean and median number of descendants from the third to the fourth generation (i.e. from great-grandchildren to great-great-grandchildren) reflects the fact that these cohorts are less fully observed. Furthermore, since men produce children at later ages than women, this effect is more pronounced among men.

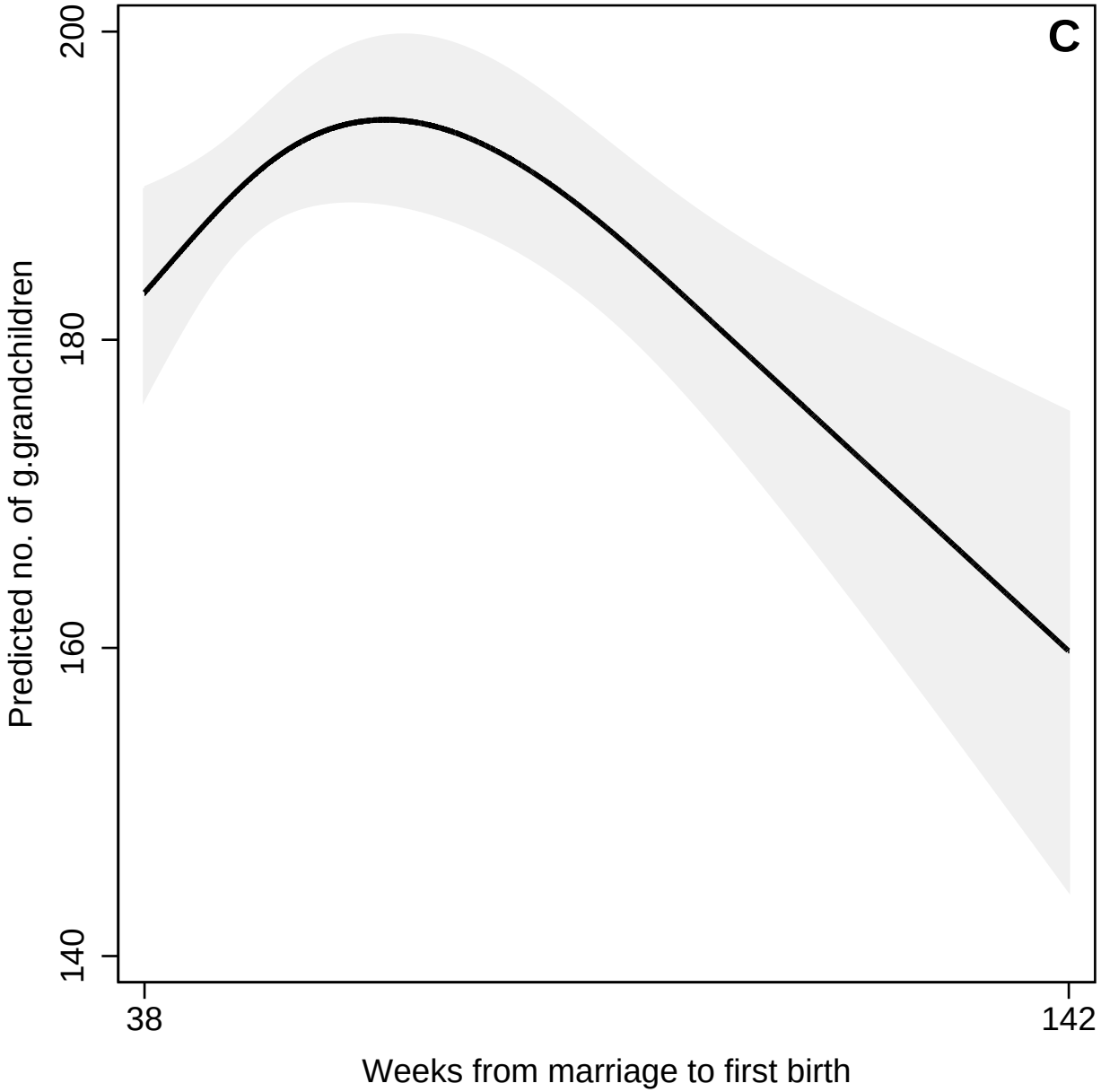
Children vs. TFB: restricted cubic splines



Grandchildren vs. TFB: restricted cubic splines



Great-Grandchildren vs. TFB: restricted cubic splines



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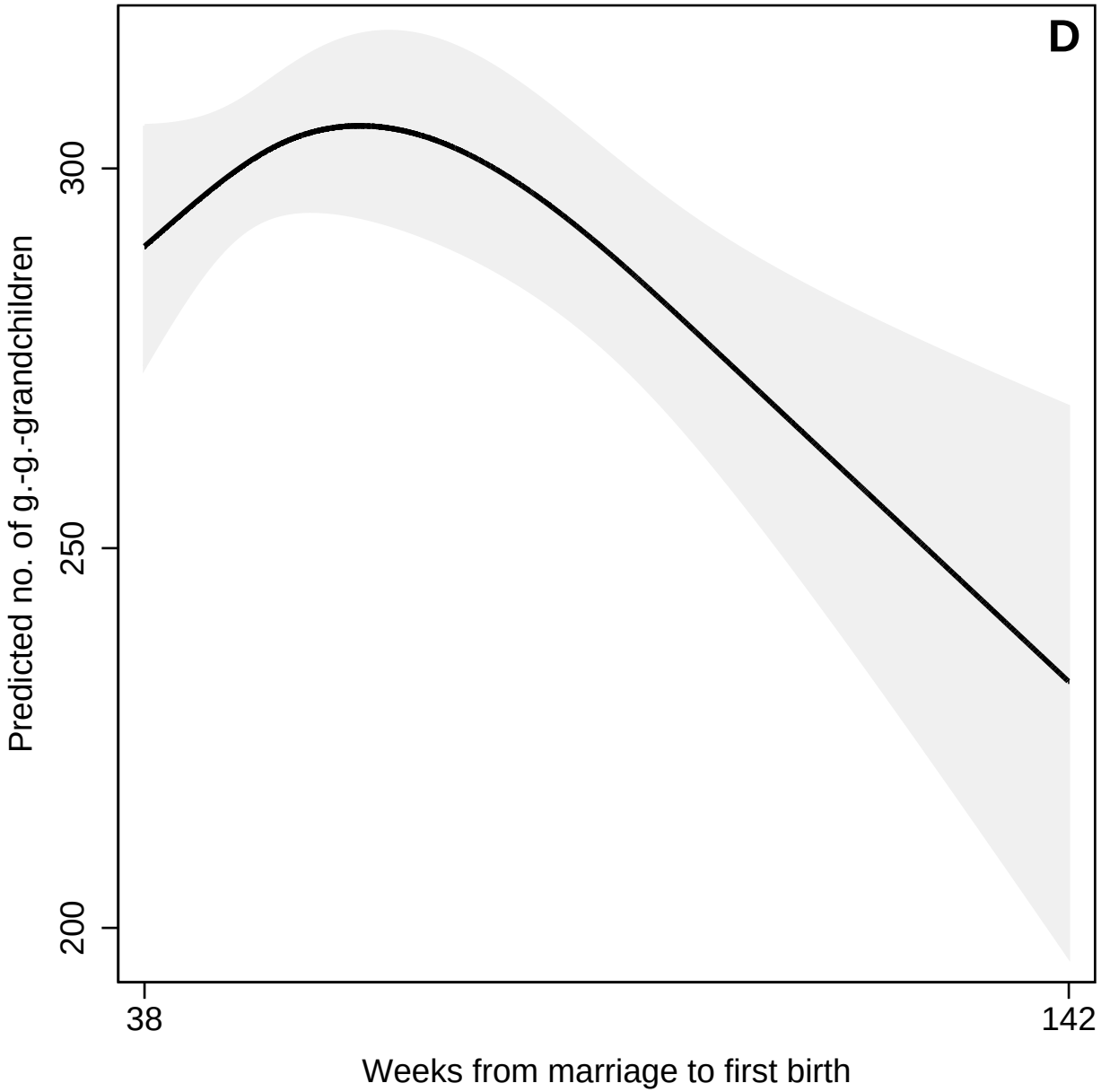

Econometric Specification

The effect of TFB on the number of children:

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The effect of TFB on the number of offspring in generation $t = 2, 3, 4$:

$$\ln D_{i,t} = \beta_{0,t} + \beta_{1,t} TFB_i + \beta_{2,t} TFB_i^2 + Z_i \beta_{3,t} + \varepsilon_{i,t},$$

TFB and Number of Descendants for Head of Lineages Born before 1685 (Accounting for Maternal Founder FE)

	Log number of descendants in:									
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TFB	-.052**	.167	.505**	.783***	-.062***	.140	.463**	.773***	-.077***	.810***
	(.024)	(.163)	(.205)	(.264)	(.024)	(.162)	(.204)	(.264)	(.011)	(.258)
TFB^2		-.068	-.193***	-.310***		-.063	-.183***	-.309***		-.325***
		(.053)	(.067)	(.087)		(.053)	(.067)	(.087)		(.084)
Literate					-.006	.063	.148***	.138**	-.027*	.109*
					(.030)	(.040)	(.051)	(.066)	(.014)	(.066)
Male					.220***	.254***	.299***	.131**	-.028*	.036
					(.031)	(.039)	(.047)	(.060)	(.015)	(.063)
Stoppage age fixed effects	No	No	No	No	No	No	No	No	Yes	Yes
Number of observations	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798
Adjusted R^2	.015	.016	.038	.306	.032	.029	.052	.307	.799	.355
Joint sign.-level of TFB & TFB^2	.031	.196	.002	.000	.010	.130	.002	.000	.000	.000
Maximizing TFB		1.224	1.307	1.261		1.113	1.263	1.249		1.247
Lower limit of 90% CI		-	.961	.999		-	.827	.976		1.002
Upper limit of 90% CI		-	1.467	1.398		-	1.435	1.389		1.376

This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in columns 9–10. A dummy indicating unknown literacy is included in the regressions underlying column 5–10. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TFB and Number of Descendants for Head of Lineages Born 1685 1660–1685 (accounting for Maternal Founder FE)

	Log number of descendants in:									
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TFB	-.065**	.237	.544**	.830***	-.075***	.193	.487**	.802***	-.079***	.773***
	(.025)	(.175)	(.216)	(.280)	(.025)	(.174)	(.216)	(.282)	(.012)	(.277)
TFB^2		-.096*	-.214***	-.337***		-.086	-.199***	-.330***		-.323***
		(.057)	(.071)	(.092)		(.057)	(.071)	(.093)		(.091)
Literate					-.031	.023	.120**	.116*	-.035**	.087
					(.033)	(.042)	(.054)	(.070)	(.015)	(.070)
Male					.219***	.279***	.315***	.177***	-.035**	.115*
					(.032)	(.040)	(.049)	(.063)	(.015)	(.066)
Stoppage age fixed effects	No	No	No	No	No	No	No	No	Yes	Yes
Number of observations	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376
Adjusted R^2	.019	.020	.042	.335	.036	.036	.058	.337	.804	.379
Joint sign.-level of TFB & TFB^2	.010	.066	.001	.000	.003	.042	.000	.000	.000	.000
Maximizing TFB		1.230	1.270	1.232		1.124	1.219	1.214		1.196
Lower limit of 90% CI		-11.448	.923	.961		-	.761	.919		.886
Upper limit of 90% CI		1.505	1.427	1.37		-	1.392	1.357		1.343

This table presents the results of a series of fixed-effects OLS regressions of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2 for heads of lineages born in the period 1660–1685. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in columns 9–10. A dummy indicating unknown literacy is included in the regressions underlying column 5–10. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to Alternative Cohorts: No Restrictions on Cohorts (Accounting for Maternal Founder FE)

	Log number of descendants in:									
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TFB	-.064***	.055	.319**	.409**	-.071***	.031	.293**	.393**	-.090***	.459**
	(.017)	(.120)	(.141)	(.199)	(.017)	(.119)	(.140)	(.199)	(.008)	(.198)
TFB^2		-.039	-.133***	-.192***		-.033	-.126***	-.187***		-.212***
		(.040)	(.046)	(.065)		(.039)	(.046)	(.065)		(.065)
Literate					.007	.078***	.133***	.134***	-.014	.121**
					(.023)	(.030)	(.037)	(.049)	(.011)	(.048)
Male					.222***	.220***	.191***	.088**	-.013	.019
					(.018)	(.023)	(.027)	(.036)	(.009)	(.038)
Stoppage age fixed effects	No	No	No	No	No	No	No	No	Yes	Yes
Number of observations	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664
Adjusted R^2	.026	.022	.067	.413	.049	.036	.077	.414	.789	.431
Joint sign.-level of TFB & TFB^2	.000	.015	.000	.000	.000	.008	.000	.000	.000	.000
Maximizing TFB		.694	1.200	1.065		.457	1.166	1.049		1.079
Lower limit of 90% CI		-	.741	.466		-	.604	.396		.610
Upper limit of 90% CI		-	1.376	1.269		-	1.355	1.261		1.264

This table presents the results of a series of fixed-effects OLS regressions of the number of descendants in generation t on time to first birth measured in years, i.e. *TFB* and TFB^2 for heads of lineages born in the entire sample period. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in columns 9–10. A dummy indicating unknown literacy is included in the regressions underlying column 5–10. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Mechanisms

- The observed patterns may reflect the positive effect of reduced fertility and thus higher child quality on the reproductive success of each child

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  - Reach the reproductive age and marry – a preconditions for reproductive success
  - Marry early – a preconditions for large number of children
  - Be educated and thus would have higher earning capacity and reproductive success

The Effect of TFB on the Fraction of Children Surviving to Age 40 and Marry

	Fraction of children surviving to age 40 that got married			
	(1)	(2)	(3)	(4)
TFB	.299***	.256**	.235**	.232**
	(.113)	(.112)	(.111)	(.110)
Literate		.770***	.763***	.779***
		(.110)	(.110)	(.109)
Male			.396***	.365***
			(.112)	(.120)
Stoppage age fixed effects	No	No	No	Yes
Number of observations	3,727	3,727	3,727	3,727

This table presents the results of a series of fractional logit regressions of the fraction of children, i.e., individuals in the first generation, surviving to age 40 that got married on time to first birth measured in years, i.e., *TFB*, for heads of lineages with at least one child surviving to age 40. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in column 4. A dummy indicating unknown literacy is included in the regressions underlying column 2–4. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The Effect of TFB on the on the Average Marriage Age

	Average marriage age of children			
	(1)	(2)	(3)	(4)
TFB	-.430***	-.400***	-.376**	-.339**
	(.005)	(.008)	(.013)	(.023)
Literate		-.629***	-.621***	-.705***
		(.001)	(.001)	(.000)
Male			-.406***	-.720***
			(.009)	(.000)
Stoppage age fixed effects	No	No	No	Yes
Number of observations	3,796	3,796	3,796	3,796
Adjusted R^2	.006	.010	.011	.036

This table presents the results of a series of OLS regressions of the average marriage age of childre,, i.e., individuals in the first generation, on time to first birth measured in years, i.e., *TFB*. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in column 4. A dummy indicating unknown literacy is included in the regressions underlying column 2–4. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The Effect of TFB on the on Share of Literate Offspring

	Fraction of literate children			
	(1)	(2)	(3)	(4)
TFB	.401***	.351***	.322***	.337***
	(.090)	(.090)	(.091)	(.091)
Literate		1.308***	1.307***	1.305***
		(.094)	(.094)	(.095)
Male			.563***	.407***
			(.090)	(.098)
Stoppage age fixed effects	No	No	No	Yes
Number of observations	3,448	3,448	3,448	3,448

This table presents the results of a series of fractional logit regressions of the share of children, i.e., individuals in the first generation, obtaining literacy on time to first birth measured in years, i.e., *TFB*, for heads of lineages with at least one surviving child with observed literacy status. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in column 4. A dummy indicating unknown literacy is included in the regressions underlying column 2–4. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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    - 0.4 more grandchildren

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  - An intermediate TFB maximizes long-run reproductive success
  - In comparison to highly fertile couples whose first child is born without any delays (i.e., 38 weeks after the marriage) they have:
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    - 0.4 more grandchildren
    - 8.4 more great-grandchildren

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  - In comparison to highly fertile couples whose first child is born without any delays (i.e., 38 weeks after the marriage) they have:
    - 0.3 fewer children
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    - 8.4 more great-grandchildren
    - 15.7 more great-great-grandchildren

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  - In comparison to highly fertile couples whose first child is born without any delays (i.e., 38 weeks after the marriage) they have:
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    - 0.3 fewer children
    - 0.4 more grandchildren
    - 8.4 more great-grandchildren
    - 15.7 more great-great-grandchildren
- Selection of a quality strategy
  - The optimal level of TFB and fertility is below the population median

TFB and number of descendants for head of lineages born –1685 (accounting for Maternal Founder FE)

	Log number of descendants in:															
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
TFB	-.052**	.167	.505**	.783***	-.053**	.170	.499**	.788***	-.062***	.140	.463**	.773***	-.077***	.208	.535***	.810***
	(.024)	(.163)	(.205)	(.264)	(.024)	(.163)	(.205)	(.264)	(.024)	(.162)	(.204)	(.264)	(.011)	(.130)	(.181)	(.258)
TFB^2		-.068	-.193***	-.310***		-.070	-.191***	-.313***		-.063	-.183***	-.309***		-.089**	-.210***	-.325***
		(.053)	(.067)	(.087)		(.053)	(.067)	(.087)		(.053)	(.067)	(.087)		(.042)	(.059)	(.084)
Literate					-.008	.060	.145***	.136**	-.006	.063	.148***	.138**	-.027*	.044	.125***	.109*
					(.031)	(.040)	(.051)	(.066)	(.030)	(.040)	(.051)	(.066)	(.014)	(.032)	(.046)	(.066)
Male									.220***	.254***	.299***	.131**	-.028*	.025	.085*	.036
									(.031)	(.039)	(.047)	(.060)	(.015)	(.031)	(.043)	(.063)
Stoppage age fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798
Adjusted R^2	.015	.016	.038	.306	.017	.016	.041	.307	.032	.029	.052	.307	.799	.442	.296	.355
Joint sign.-level of TFB & TFB^2	.031	.196	.002	.000	.026	.184	.003	.000	.010	.130	.002	.000	.000	.002	.000	.000
Maximizing TFB		1.224	1.307	1.261		1.223	1.304	1.260		1.113	1.263	1.249		1.163	1.272	1.247
Lower limit of 90% CI		-	.961	.999		-	.948	1.000		-	.827	.976		-.141	1.012	1.002
Upper limit of 90% CI		-	1.467	1.398		-	1.466	1.397		-	1.435	1.389		1.393	1.403	1.376

This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. *TFB* and TFB^2. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in columns 13–16. A dummy indicating unknown literacy is included in the regressions underlying column 5–16. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TFB and number of descendants for head of lineages born 1660–1685 (accounting for Maternal Founder FE)

	Log number of descendants in:															
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
TFB	-.065**	.237	.544**	.830***	-.066***	.238	.537**	.830***	-.075***	.193	.487**	.802***	-.079***	.201	.498***	.773***
	(.025)	(.175)	(.216)	(.280)	(.025)	(.175)	(.217)	(.282)	(.025)	(.174)	(.216)	(.282)	(.012)	(.139)	(.191)	(.277)
TFB^2		-.096*	-.214***	-.337***		-.097*	-.212***	-.337***		-.086	-.199***	-.330***		-.088*	-.203***	-.323***
		(.057)	(.071)	(.092)		(.057)	(.071)	(.093)		(.057)	(.071)	(.093)		(.046)	(.063)	(.091)
Literate					-.028	.027	.124**	.118*	-.031	.023	.120**	.116*	-.035**	.016	.110**	.087
					(.033)	(.043)	(.055)	(.070)	(.033)	(.042)	(.054)	(.070)	(.015)	(.035)	(.049)	(.070)
Male									.219***	.279***	.315***	.177***	-.035**	.056*	.116***	.115*
									(.032)	(.040)	(.049)	(.063)	(.015)	(.032)	(.044)	(.066)
Stoppage age fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376	3,376
Adjusted R^2	.019	.020	.042	.335	.020	.020	.045	.335	.036	.036	.058	.337	.804	.451	.306	.379
Joint sign.-level of TFB & TFB^2	.010	.066	.001	.000	.009	.066	.001	.000	.003	.042	.000	.000	.000	.005	.000	.000
Maximizing TFB		1.230	1.270	1.232		1.230	1.268	1.231		1.124	1.219	1.214		1.137	1.224	1.196
Lower limit of 90% CI		-11.448	.923	.961		-11.038	.910	.959		-	.761	.919		-1.02	.883	.886
Upper limit of 90% CI		1.505	1.427	1.37		1.504	1.427	1.369		-	1.392	1.357		1.387	1.375	1.343

This table presents the results of a series of fixed-effects OLS regressions of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2 for heads of lineages born in the period 1660–1685. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in columns 13–16. A dummy indicating unknown literacy is included in the regressions underlying column 5–16. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to alternative cohorts: no restrictions on cohorts (accounting for Maternal Founder FE)

	Log number of descendants in:															
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
TFB	-.064***	.055	.319**	.409**	-.064***	.050	.310**	.400**	-.071***	.031	.293**	.393**	-.090***	.096	.378***	.459**
	(.017)	(.120)	(.141)	(.199)	(.017)	(.120)	(.141)	(.199)	(.017)	(.119)	(.140)	(.199)	(.008)	(.094)	(.125)	(.198)
TFB^2		-.039	-.133***	-.192***		-.038	-.129***	-.189***		-.033	-.126***	-.187***		-.060*	-.158***	-.212***
		(.040)	(.046)	(.065)		(.040)	(.046)	(.065)		(.039)	(.046)	(.065)		(.031)	(.041)	(.065)
Literate					.007	.078**	.133***	.133***	.007	.078***	.133***	.134***	-.014	.057**	.110***	.121**
					(.023)	(.030)	(.037)	(.049)	(.023)	(.030)	(.037)	(.049)	(.011)	(.024)	(.033)	(.048)
Male									.222***	.220***	.191***	.088**	-.013	.005	.019	.019
									(.018)	(.023)	(.027)	(.036)	(.009)	(.019)	(.025)	(.038)
Stoppage age fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664	7,664
Adjusted R^2	.026	.022	.067	.413	.026	.023	.070	.414	.049	.036	.077	.414	.789	.420	.282	.431
Joint sign.-level of TFB & TFB^2	.000	.015	.000	.000	.000	.018	.000	.000	.000	.008	.000	.000	.000	.000	.000	.000
Maximizing TFB		.694	1.200	1.065		.663	1.198	1.060		.457	1.166	1.049		.798	1.196	1.079
Lower limit of 90% CI		-	.741	.466		-	.708	.434		-	.604	.396		-3.176	.924	.610
Upper limit of 90% CI		-	1.376	1.269		-	1.378	1.268		-	1.355	1.261		1.167	1.333	1.264

This table presents the results of a series of fixed-effects OLS regressions of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2 for heads of lineages born in the entire sample period. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in columns 13–16. A dummy indicating unknown literacy is included in the regressions underlying column 5–16. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Summary statistics for females

	(1) Mean	(2) Median	(3) S.D.	(4) Count
Children	9.42	10	3.66	2,058
Grandchildren	45.99	43	27.40	2,058
Great-grandchildren	187.65	159	142.74	2,058
Great-great-grandchildren	341.04	206.5	408.07	2,058
Years from marriage to first birth (TFB)	1.23	1.04	0.49	2,058
Literate	0.68	1	0.47	1,192
Fraction of literate children	0.72	1	0.36	1,872
Fraction of surviving children[b]	0.59	0.60	0.20	2,058
Fraction of surviving children with known literacy[b]	0.62	0.60	0.40	2,044
Age at first marriage	19.34	18.7	3.79	2,058
Age at last delivery	38.27	40.3	6.46	2,058

[a] The moderate increase in the mean and median number of descendants from the third to the fourth generation (i.e. from great-grandchildren to great-great-grandchildren) reflects the fact that these cohorts are less fully observed. Furthermore, since men produce children at lager ages than women, this effect is more pronounced among men.

[b] Survival is recorded at the average marriage age, i.e. 23 years.

Summary statistics for males

	(1) Mean	(2) Median	(3) S.D.	(4) Count
Children	10.03	10	4.32	1,740
Grandchildren	48.94	45	28.77	1,740
Great-grandchildren	187.53	159	137.10	1,740
Great-great-grandchildren	238.38	136.5	293.17	1,740
Years from marriage to first birth (TFB)	1.16	0.99	0.44	1,740
Literate	0.64	1	0.48	1,030
Fraction of literate children	0.76	1	0.34	1,576
Fraction of surviving children[b]	0.60	0.60	0.20	1,740
Fraction of surviving children with known literacy[b]	0.57	0.50	0.39	1,728
Age at first marriage	26.62	25.9	4.41	1,740
Age at last delivery	46.31	46.9	8.81	1,740

[a] The moderate increase in the mean and median number of descendants from the third to the fourth generation (i.e. from great-grandchildren to great-great-grandchildren) reflects the fact that these cohorts are less fully observed. Furthermore, since men produce children at lager ages than women, this effect is more pronounced among men.

[b] Survival is recorded at the average marriage age, i.e. 23 years.

TFB and number of descendants for head of lineages born –1685 (using GLM w/ neg. binom.)

	Number of descendants in:															
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
TFB	-.063***	.120	.371**	.616***	-.063***	.090	.324*	.573**	-.081***	.028	.260	.525**	-.090***	.049	.346**	.573**
	(.018)	(.148)	(.185)	(.230)	(.018)	(.148)	(.186)	(.231)	(.017)	(.145)	(.184)	(.231)	(.010)	(.121)	(.167)	(.227)
TFB^2		-.047	-.133**	-.232***		-.039	-.119*	-.219***		-.026	-.106*	-.209***		-.035	-.137**	-.224***
		(.048)	(.060)	(.074)		(.049)	(.061)	(.074)		(.048)	(.060)	(.074)		(.039)	(.054)	(.073)
Literate					-.002	.143***	.222***	.227***	-.009	.138***	.219***	.225***	-.056***	.098***	.180***	.195***
					(.020)	(.030)	(.038)	(.046)	(.019)	(.030)	(.038)	(.046)	(.011)	(.025)	(.035)	(.047)
Male									.295***	.379***	.402***	.306***	-.004	.094***	.150***	.194***
									(.019)	(.027)	(.035)	(.041)	(.011)	(.023)	(.032)	(.042)
Stoppage age fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798
Joint sign.-level of TFB & TFB^2	.000	.446	.059	.000	.000	.445	.086	.001	.000	.139	.041	.000	.000	.016	.001	.000
Maximizing TFB		1.273	1.399	1.328		1.159	1.363	1.306		.546	1.229	1.255		.702	1.262	1.277

This table presents the results of a series of GLM regressions, with a negative binomial distribution and a logarithmic link function, of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2. Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in columns 13–16. A dummy indicating unknown literacy is included in the regressions underlying column 5–16. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TFB and number of descendants for head of lineages born –1685 (using GLM w/ neg. binom. – accounting for Maternal Founder FE)

	Number of descendants in:															
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
TFB	-.041**	.126	.412**	.547**	-.042**	.131	.414**	.557***	-.052***	.101	.387**	.547**	-.073***	.195*	.468***	.595***
	(.020)	(.146)	(.179)	(.215)	(.020)	(.146)	(.178)	(.215)	(.020)	(.145)	(.177)	(.215)	(.010)	(.118)	(.160)	(.216)
TFB^2		-.054	-.162***	-.234***		-.056	-.163***	-.238***		-.050	-.158***	-.236***		-.087**	-.191***	-.256***
		(.047)	(.058)	(.068)		(.047)	(.058)	(.069)		(.047)	(.058)	(.068)		(.038)	(.052)	(.069)
Literate					-.006	.059*	.121***	.119**	-.006	.061*	.124***	.121**	-.020	.055*	.118***	.104*
					(.026)	(.036)	(.045)	(.056)	(.025)	(.036)	(.045)	(.056)	(.013)	(.029)	(.040)	(.055)
Male									.248***	.280***	.282***	.127**	-.015	.044	.083**	.072
									(.027)	(.036)	(.044)	(.054)	(.014)	(.029)	(.040)	(.055)
Stoppage age fixed effects	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798
Joint sign.-level of TFB & TFB^2	.045	.207	.001	.000	.037	.189	.001	.000	.009	.097	.000	.000	.000	.000	.000	.000
Maximizing TFB		1.172	1.271	1.169		1.174	1.27	1.169		1.01	1.226	1.155		1.116	1.225	1.159

This table presents the results of a series of GLM regressions, with a negative binomial distribution and a logarithmic link function, of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2. All regressions include dummies for Maternal Founder fixed effects (the results without the Maternal Founder Fixed Effects is presented in Table A.7). Birth year and marriage age dummies are included as controls. Furthermore, stoppage age dummies are included in columns 13–16. A dummy indicating unknown literacy is included in the regressions underlying column 5–16. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to including extinct lineages – accounting for Maternal Founder fixed effects

	Log number of descendants in:				Log 1+number of descendants in:			
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFB	-.046*	.151	.462**	.773***	-.041*	.414*	.822***	1.169***
	(.026)	(.172)	(.208)	(.264)	(.021)	(.215)	(.294)	(.336)
TFB^2		-.071	-.180***	-.309***		-.149**	-.293***	-.427***
		(.057)	(.068)	(.087)		(.068)	(.093)	(.108)
Literate	-.022	.060	.153***	.138**	-.014	.058	.144*	.180**
	(.033)	(.042)	(.053)	(.066)	(.027)	(.056)	(.076)	(.087)
Male	.321***	.321***	.349***	.131**	.276***	.456***	.597***	.478***
	(.033)	(.040)	(.050)	(.060)	(.027)	(.051)	(.069)	(.076)
Number of observations	4,240	4,002	3,933	3,798	4,240	4,240	4,240	4,240
Adjusted R^2	.052	.044	.068	.307	.054	.065	.084	.241
Joint sign.-level of TFB & TFB^2	.073	.083	.003	.000	.053	.046	.002	.000
Maximizing TFB		1.067	1.283	1.249		1.387	1.403	1.368

This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. A dummy indicating unknown literacy is also included in the regressions. In columns 1–4, the restriction of at least one observed great-great-grandchild is relaxed and extinct lineages drop out of the sample in the relevant generations. In columns 5–8, the same extended sample is used, but the outcome is $\ln(1 + D_{i,t})$, where the added number 1 ensures that the logarithmic transformation is defined and all lineages remains included. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to additional sample restrictions: more than one child and marriage occurring after turning 15 years – accounting for Maternal Founder fixed effects

	Log number of descendants in:							
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFB	-.053**	.204	.560***	.891***	-.052**	.129	.461**	.779***
	(.021)	(.157)	(.201)	(.263)	(.025)	(.175)	(.218)	(.279)
TFB^2		-.082	-.211***	-.344***		-.057	-.180**	-.310***
		(.051)	(.066)	(.086)		(.058)	(.073)	(.093)
Literate	.025	.090**	.175***	.162**	-.016	.052	.139***	.123*
	(.027)	(.038)	(.050)	(.065)	(.031)	(.041)	(.052)	(.068)
Male	.251***	.272***	.314***	.135**	.225***	.269***	.318***	.153**
	(.029)	(.038)	(.047)	(.061)	(.031)	(.039)	(.048)	(.061)
Number of observations	3,738	3,738	3,738	3,738	3,604	3,604	3,604	3,604
Adjusted R^2	.044	.037	.060	.318	.035	.031	.055	.314
Joint sign.-level of TFB & TFB^2	.011	.104	.001	.000	.038	.294	.009	.000
Maximizing TFB		1.248	1.323	1.296		1.140	1.282	1.256
Lower limit of 90% CI		-	1.059	1.095		-	.798	.973
Upper limit of 90% CI		-	1.464	1.417		-	1.458	1.396

This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. A dummy indicating unknown literacy is also included in the regressions. In columns 1–4, the sample is restricted to heads of lineages who produced at least two children. In columns 5–8, the sample is restricted to heads of lineages who were married after their 15th birthday. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to additional control variables: number of marriages and spousal migration (accounting for Maternal Founder FE)

	Log number of descendants in:							
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFB	-.059***	.282*	.590***	.828***	-.059**	.117	.423**	.720***
	(.022)	(.157)	(.200)	(.263)	(.024)	(.161)	(.204)	(.264)
TFB^2		-.109**	-.225***	-.328***		-.054	-.168**	-.289***
		(.051)	(.066)	(.087)		(.052)	(.067)	(.087)
Literate	-.013	.059	.143***	.135**	-.007	.067*	.148***	.140**
	(.028)	(.039)	(.050)	(.066)	(.030)	(.040)	(.051)	(.066)
Male	.168***	.204***	.255***	.116*	.198***	.206***	.232***	.037
	(.028)	(.037)	(.046)	(.060)	(.032)	(.039)	(.047)	(.061)
Total number of marriages fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Total number of marriages of spouse fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Immigration status of spouse fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Emigration status of spouse fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798
Adjusted R^2	.188	.116	.097	.312	.035	.035	.062	.315
Joint sign.-level of TFB & TFB^2	.009	.027	.000	.000	.013	.169	.005	.000
Maximizing TFB		1.289	1.311	1.263		1.073	1.260	1.244
Lower limit of 90% CI		.420	1.063	1.024		-	.716	.935
Upper limit of 90% CI		1.509	1.446	1.393		-	1.445	1.392

This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. *TFB* and TFB^2. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. A dummy indicating unknown literacy is also included in the regressions. In columns 1–4, dummies for the total number of marriages experienced during the lifetime of the heads of lineages, as well as dummies for the total number of marriages experienced by the first spouses of the heads of lineages, are included. In columns 5–8, dummies indicating the immigration and emigration statuses of the head of the first spouses of the heads of lineages are included. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to gender distinction – sample restricted to females (accounting for Maternal Founder FE)

	Log number of descendants in:							
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFB	-.079***	.374*	.985***	1.568***	-.080***	.380*	.993***	1.581***
	(.030)	(.214)	(.278)	(.349)	(.030)	(.215)	(.278)	(.349)
TFB^2		-.140**	-.347***	-.560***		-.142**	-.349***	-.564***
		(.069)	(.088)	(.109)		(.069)	(.088)	(.110)
Literate					-.040	.072	.120	.145
					(.043)	(.067)	(.084)	(.107)
Number of observations	2,058	2,058	2,058	2,058	2,058	2,058	2,058	2,058
Adjusted R^2	.089	.064	.091	.267	.089	.064	.092	.267
Joint sign.-level of TFB & TFB^2	.008	.057	.000	.000	.007	.056	.000	.000
Maximizing TFB		1.334	1.418	1.401		1.339	1.422	1.402
Lower limit of 90% CI		.366	1.24	1.263		.428	1.247	1.267
Upper limit of 90% CI		1.58	1.538	1.500		1.583	1.542	1.501

This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. *TFB* and TFB^2 for female heads of lineages. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. A dummy indicating unknown literacy is also included in the regressions. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to additional control variables: location of birth and death – accounting for Maternal Founder fixed effects

	Log number of descendants in:							
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFB	-0.062***	0.106	0.416**	0.695***	-0.062***	0.032	0.391*	0.653**
	(0.024)	(0.163)	(0.205)	(0.267)	(0.023)	(0.161)	(0.202)	(0.255)
TFB^2		-0.052	-0.168**	-0.284***		-0.023	-0.154**	-0.262***
		(0.053)	(0.067)	(0.088)		(0.053)	(0.066)	(0.084)
Literate	-0.008	0.062	0.149***	0.144**	-0.015	0.037	0.097*	0.074
	(0.031)	(0.040)	(0.051)	(0.066)	(0.031)	(0.040)	(0.052)	(0.067)
Male	0.214***	0.253***	0.298***	0.134**	0.203***	0.208***	0.226***	0.033
	(0.031)	(0.039)	(0.048)	(0.061)	(0.031)	(0.038)	(0.046)	(0.059)
Constant	3.861***	5.949***	6.288***	6.228***	2.256***	4.130***	5.229***	4.676***
	(0.366)	(0.649)	(0.667)	(0.935)	(0.428)	(0.681)	(0.703)	(0.921)
Birth parish fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Death parish fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798
Adjusted R^2	0.034	0.030	0.050	0.308	0.066	0.098	0.130	0.370
Joint sign.-level of TFB & TFB^2	.009	.155	.002	.000	.009	.425	.011	.000
Maximizing TFB		1.024	1.234	1.223		.700	1.264	1.243
Lower limit of 90% CI		-	.646	.875		-	.607	.892
Upper limit of 90% CI		-	1.424	1.379		-	1.461	1.402

This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. *TFB* and TFB^2. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. A dummy indicating unknown literacy is also included in the regressions. In columns 1–4, dummies indicating the birth (or baptism) parish of the heads of lineages are included. In columns 5–8 dummies indicating the death (or burial) parish of the heads of lineages are included. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to additional control variables: month of marriage and first birth – accounting for Maternal Founder fixed effects

	Log number of descendants in:							
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFB	-0.061**	0.151	0.482**	0.798***	-0.050**	0.181	0.500**	0.787***
	(0.024)	(0.163)	(0.205)	(0.265)	(0.024)	(0.166)	(0.208)	(0.274)
TFB^2		-0.067	-0.190***	-0.318***		-0.073	-0.194***	-0.314***
		(0.053)	(0.067)	(0.087)		(0.054)	(0.068)	(0.089)
Literate	-0.008	0.062	0.146***	0.137**	-0.004	0.065	0.153***	0.140**
	(0.030)	(0.040)	(0.051)	(0.067)	(0.030)	(0.040)	(0.051)	(0.067)
Male	0.224***	0.255***	0.296***	0.123**	0.220***	0.257***	0.298***	0.129**
	(0.031)	(0.039)	(0.048)	(0.060)	(0.031)	(0.039)	(0.047)	(0.060)
Month of marriage fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Month of birth of firstborn fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798
Adjusted R^2	0.032	0.028	0.051	0.307	0.032	0.032	0.056	0.308
Joint sign.-level of TFB & TFB^2	.010	.109	.001	.000	.037	.169	.001	.000
Maximizing TFB		1.126	1.267	1.253		1.242	1.286	1.254
Lower limit of 90% CI		-	.865	.994		-	.904	.968
Upper limit of 90% CI		-	1.433	1.389		-	1.452	1.398

This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. A dummy indicating unknown literacy is also included in the regressions. In columns 1–4, dummies indicating the months of marriage of the heads of lineages are included. In columns 5–8, dummies indicating the month of birth of the the firstborn of the heads of lineages are included. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness to additional control variable: birth order (accounting for Maternal Founder FE)

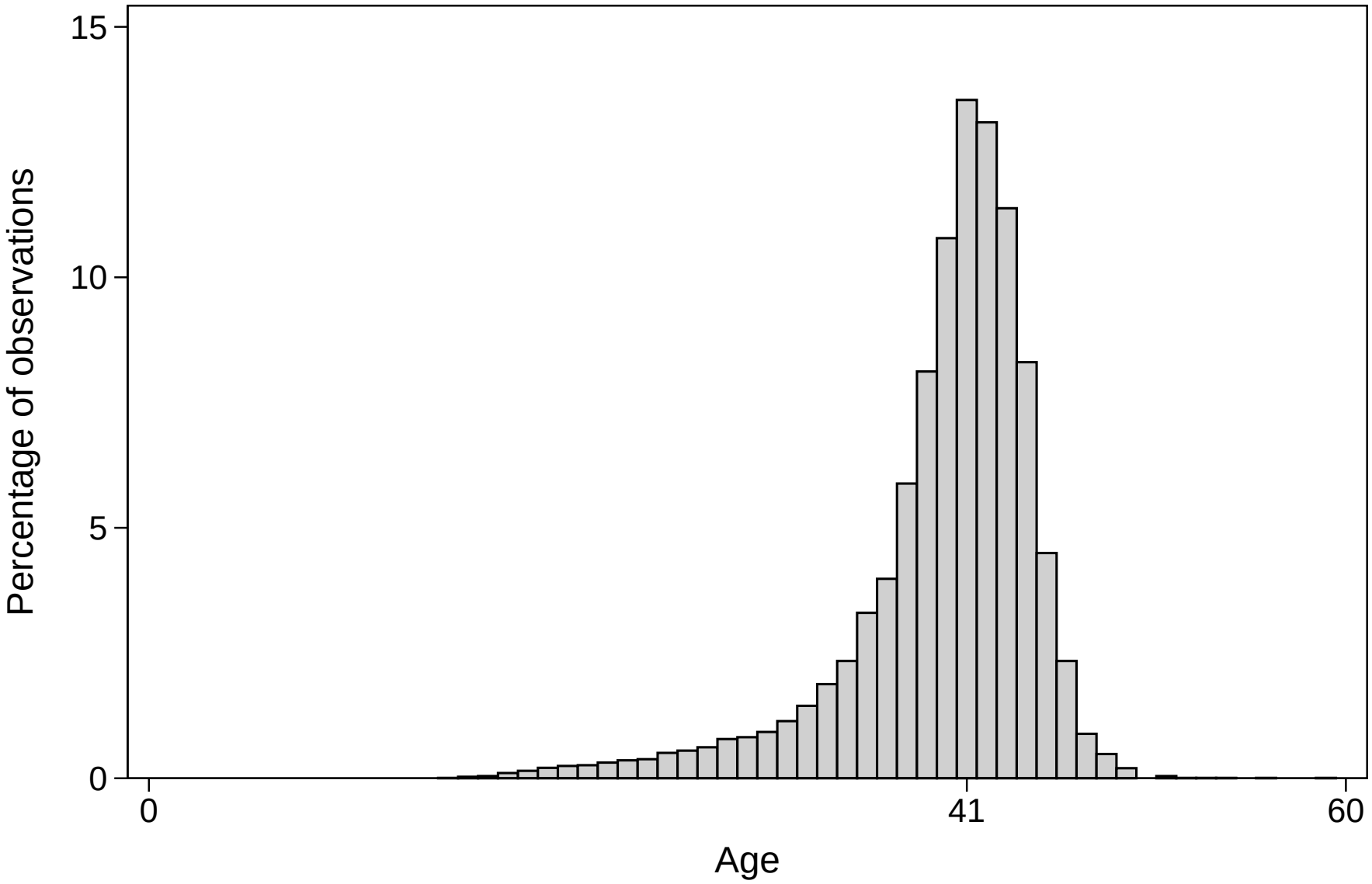
	Log number of descendants in:							
	Gen. 1	Gen. 2	Gen. 3	Gen. 4	Gen. 1	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFB	-.062***	.139	.462**	.773***	-.062***	.144	.456**	.752***
	(.024)	(.162)	(.204)	(.264)	(.024)	(.162)	(.204)	(.265)
TFB^2		-.062	-.183***	-.309***		-.063	-.181***	-.303***
		(.053)	(.067)	(.087)		(.053)	(.067)	(.087)
Literate	-.006	.064	.149***	.137**	-.008	.064	.149***	.141**
	(.030)	(.040)	(.051)	(.066)	(.030)	(.040)	(.051)	(.067)
Male	.219***	.250***	.296***	.132**	.220***	.248***	.293***	.131**
	(.031)	(.039)	(.047)	(.060)	(.031)	(.039)	(.047)	(.061)
Firstborn	.016	.064**	.042	-.019				
	(.023)	(.031)	(.038)	(.047)				
Birth order fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Number of observations	3,798	3,798	3,798	3,798	3,798	3,798	3,798	3,798
Adjusted R^2	.032	.030	.052	.307	.031	.030	.052	.308
Joint sign.-level of TFB & TFB^2	.010	.135	.002	.000	.009	.139	.002	.000
Maximizing TFB		1.117	1.264	1.249		1.133	1.261	1.240
Lower limit of 90% CI		-	.828	.976		-	.807	.949
Upper limit of 90% CI		-	1.436	1.388		-	1.434	1.384

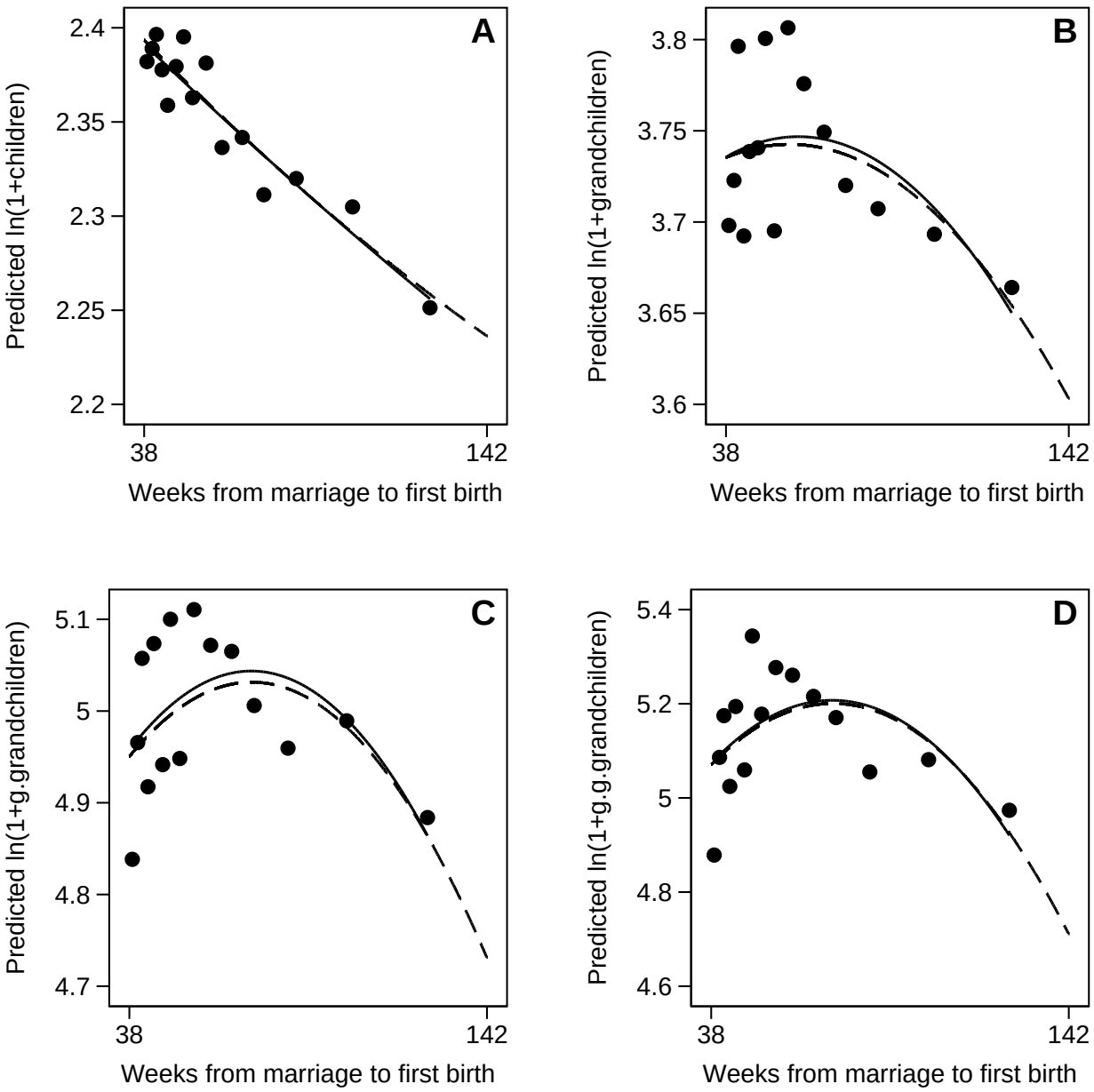
This table presents the results of a series of fixed-effects regressions of the number of descendants in generation t on time to first birth measured in years, i.e. TFB and TFB^2. All regressions account for Maternal Founder fixed effects. Birth year and marriage age dummies are included as controls. A dummy indicating unknown literacy is also included in the regressions. In columns 1–4, a dummy for the firstborn status of the heads of lineages is included. In columns 5–8, dummies the birth order of the heads of lineages are included. Standard errors clustered at the level of the firstborn are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

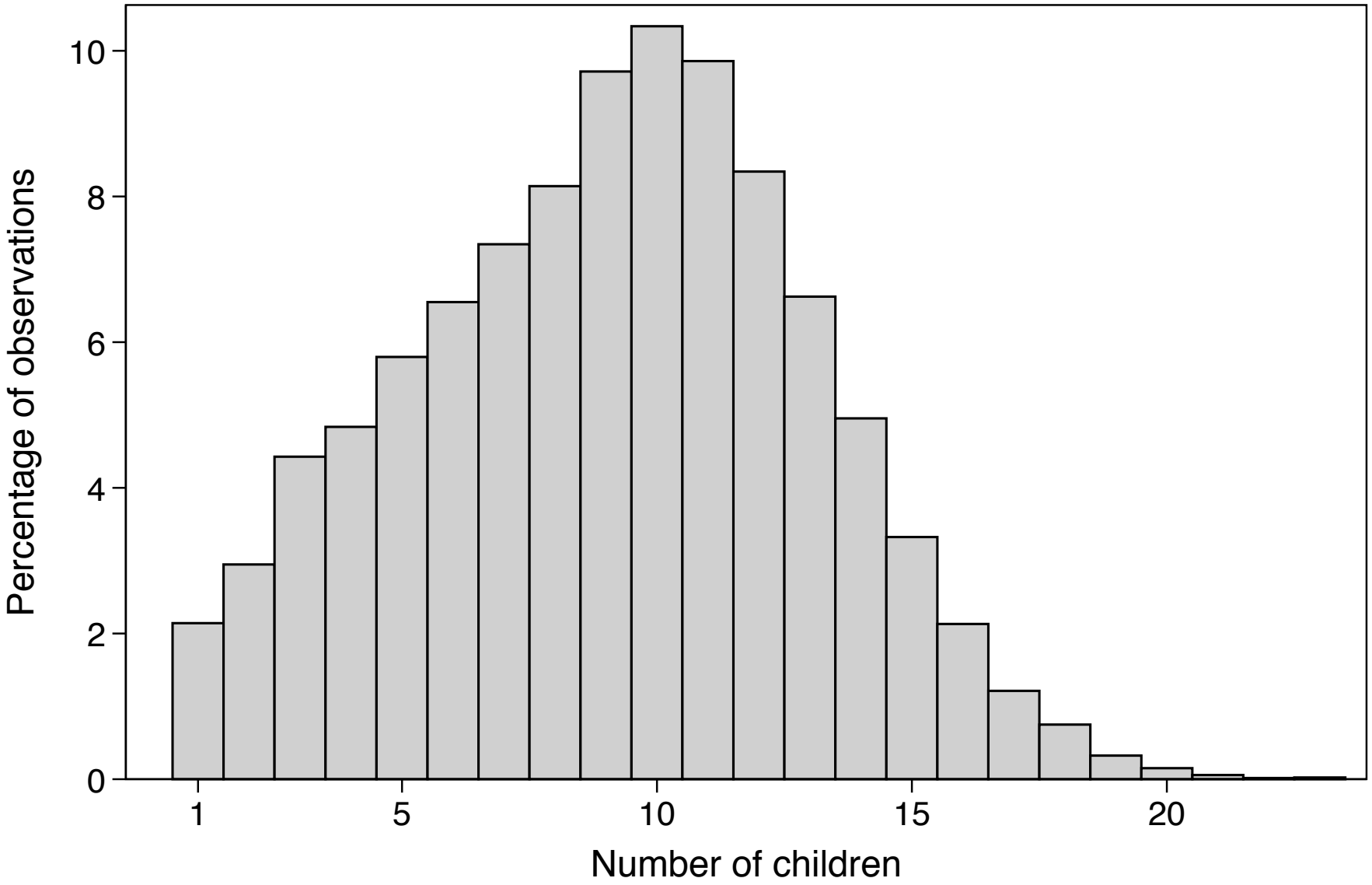
Effect of number of children on long-run reproductive success – accounting for Maternal Founder fixed effects

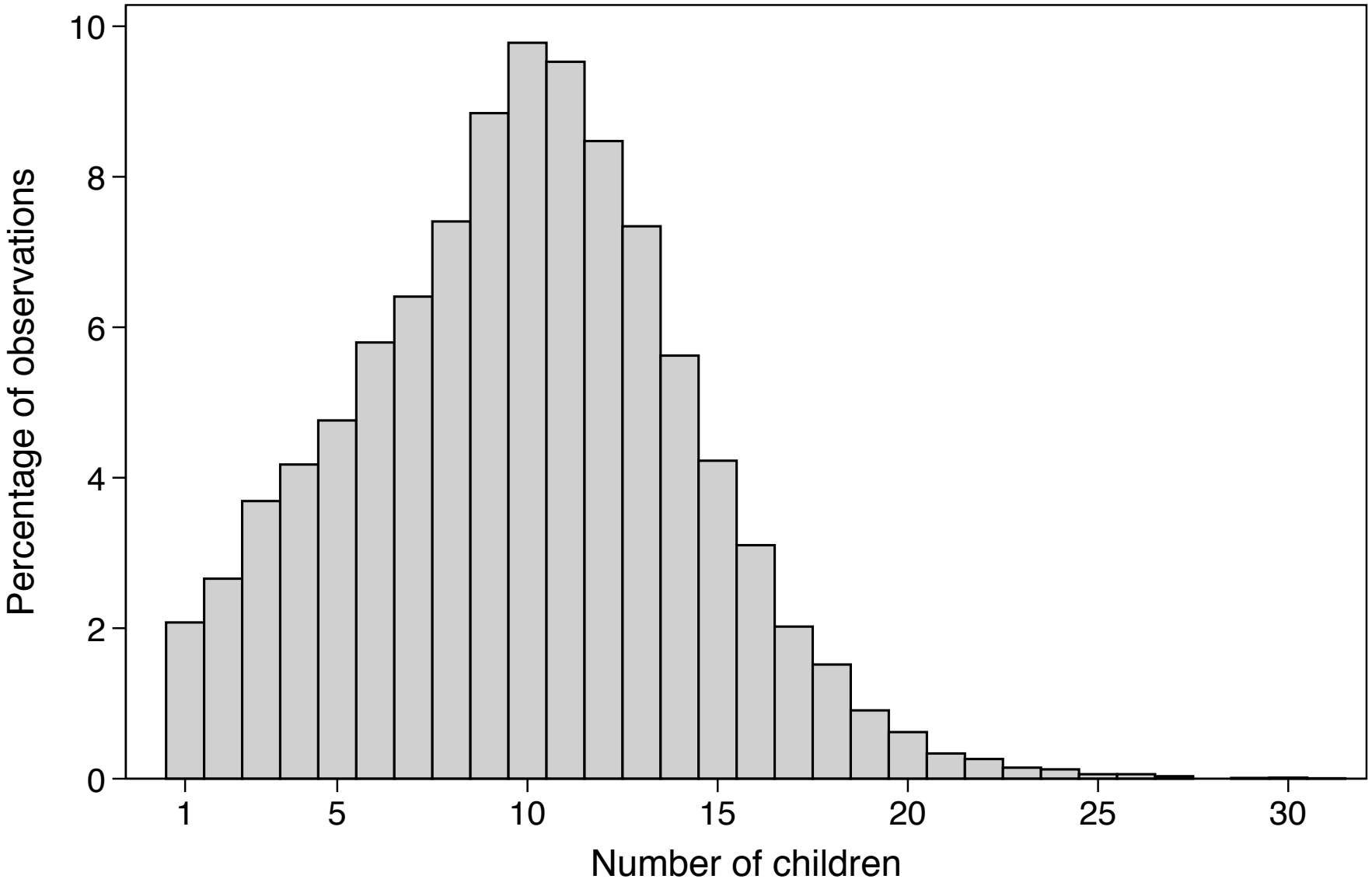
	Log number of descendants in:								
	Gen. 2	Gen. 3	Gen. 4	Gen. 2	Gen. 3	Gen. 4	Gen. 2	Gen. 3	Gen. 4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Number of Children	2.334***	3.446***	4.491***	2.339***	3.459***	4.545***	2.384***	3.515***	4.619***
	(.524)	(.842)	(1.078)	(.525)	(.851)	(1.091)	(.520)	(.837)	(1.075)
(Log Number of Children)^2	-.371	-.728**	-1.280***	-.376	-.738**	-1.306***	-.388*	-.749**	-1.324***
	(.229)	(.367)	(.474)	(.230)	(.373)	(.481)	(.228)	(.366)	(.474)
Literate				.068	.151**	.171*	.067	.150**	.170*
				(.047)	(.070)	(.092)	(.047)	(.070)	(.092)
Male							.129***	.266***	.307***
							(.046)	(.071)	(.092)
Number of observations	4,240	4,240	4,240	4,240	4,240	4,240	4,240	4,240	4,240
First stage F (Kleibergen-Paap)	30.701	30.701	30.701	33.094	33.094	33.094	31.891	31.891	31.891
Joint sign. of linear and squared terms	.000	.000	.000	.000	.000	.000	.000	.000	.000
Maximizing number of log(1+D)	3.142	2.367	1.754	3.113	2.343	1.74	3.069	2.345	1.744
Exp(Maximizing log(1+D))	22.15	9.665	4.777	21.488	9.412	4.697	20.52	9.433	4.72
Lower limit of 90% CI	1.618	1.770	1.473	1.473	1.756	1.465	2.081	1.767	1.472
Upper limit of 90% CI	6.012	8.556	2.805	2.805	8.445	2.757	57.776	7.475	2.702

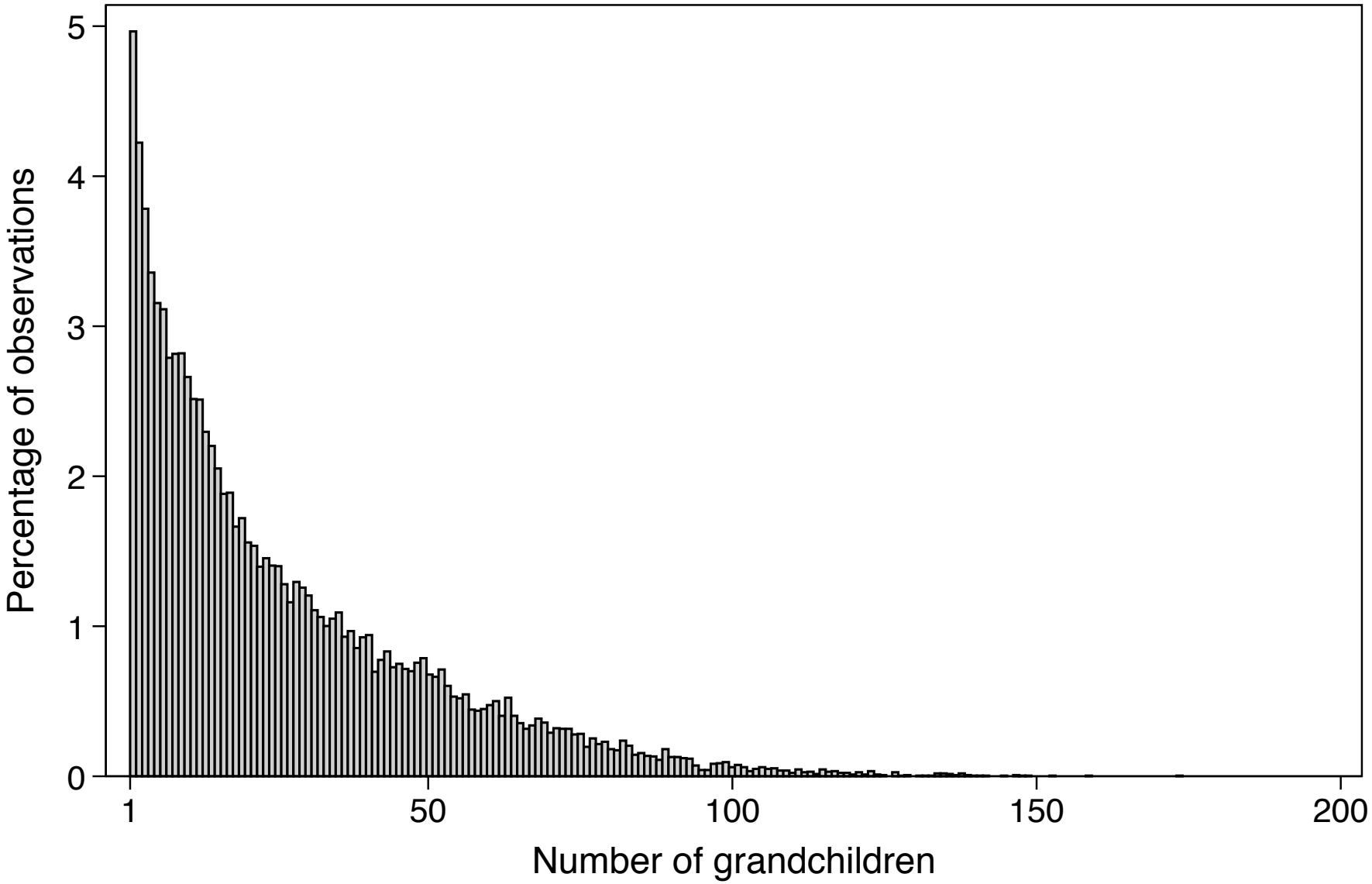
This table presents the results of a series of fixed-effects 2SLS regressions of the log number of descendants in generation t, i.e. $\ln(1+D_{i,t})$, where $D_{i,t}$ is the number of descendants that the head of household i has in generations t, $t = 2, 3, 4$, on the number of children and the number of children squared, i.e., $\ln(1+D_{i,1})$ and $(\ln(1+D_{i,1}))^2$, instrumented by variation in *TFB*. The added number 1 ensures that the logarithmic transformation is defined for extinct lineages and all that lineages remain in the sample. All regressions account for Maternal Founder fixed effects. Birth year, marriage age, and stoppage age dummies are included as controls. Since the second stage of these 2SLS regressions is quadratic in the endogenous regressor, it is necessary to instrument for both the linear and the squared terms in order to identify the parameters. Thus, following Wooldridge (2010), pp. 267–268, a zeroth stage is introduced to the analysis, where $D_{i,1}$ is first regressed on *TFB* and all the second-stage controls to obtain predicted values of the number of children. The predicted number of children from the zeroth stage, $\hat{D}_{1,i}$ is transformed by $\ln(1+\hat{D}_{1,i})$ as well as $(\ln(1+\hat{D}_{1,i}))^2$, and these transformed terms are then used as excluded instruments in the second stage. A dummy indicating unknown literacy is included in the regressions underlying columns 4–9. Standard errors clustered at the level of the firstborn are reported in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

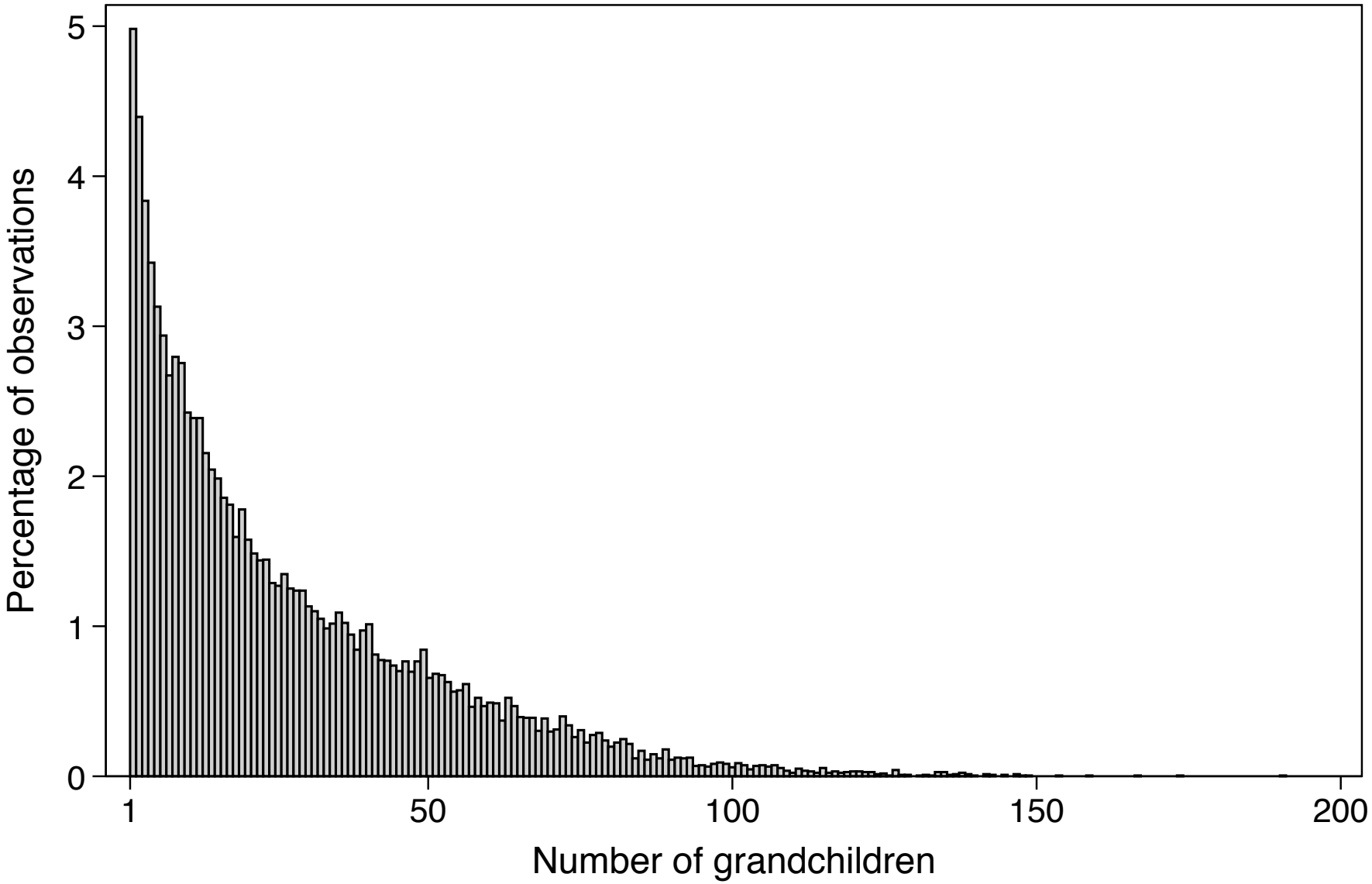

15
10
5
0
Percentage of observations
0
41
60
Age

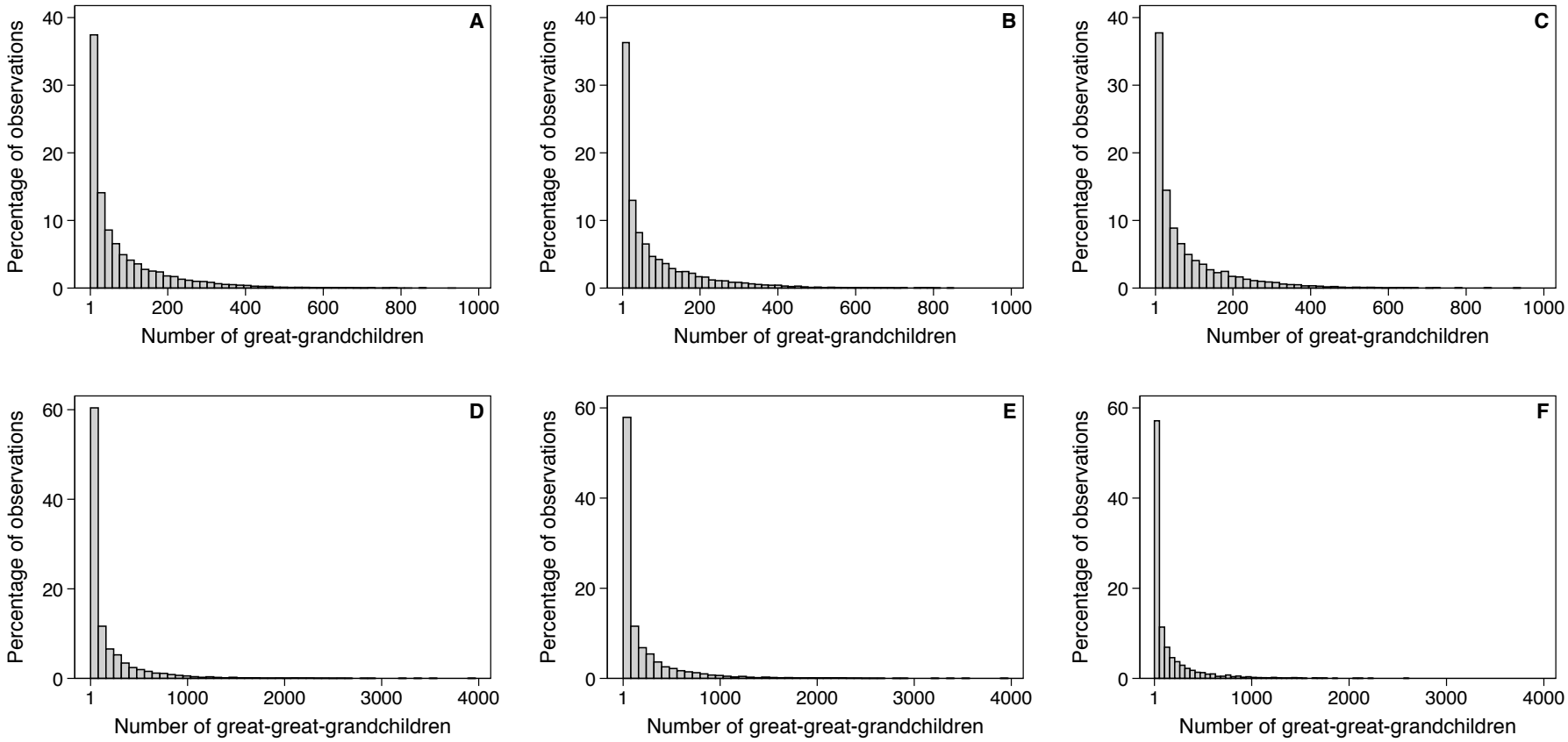

A
Predicted ln(1+children)
2.4
2.35
2.3
2.25
2.2
38
142
Weeks from marriage to first birth
B
Predicted ln(1+grandchildren)
3.8
3.75
3.7
3.65
3.6
38
142
Weeks from marriage to first birth
C
Predicted ln(1+g.grandchildren)
5.1
5
4.9
4.8
4.7
38
142
Weeks from marriage to first birth
D
Predicted ln(1+g.g.grandchildren)
5.4
5.2
5
4.8
4.6
38
142
Weeks from marriage to first birth


Percentage of observations
0
2
4
6
8
10
1
5
10
15
20
Number of children

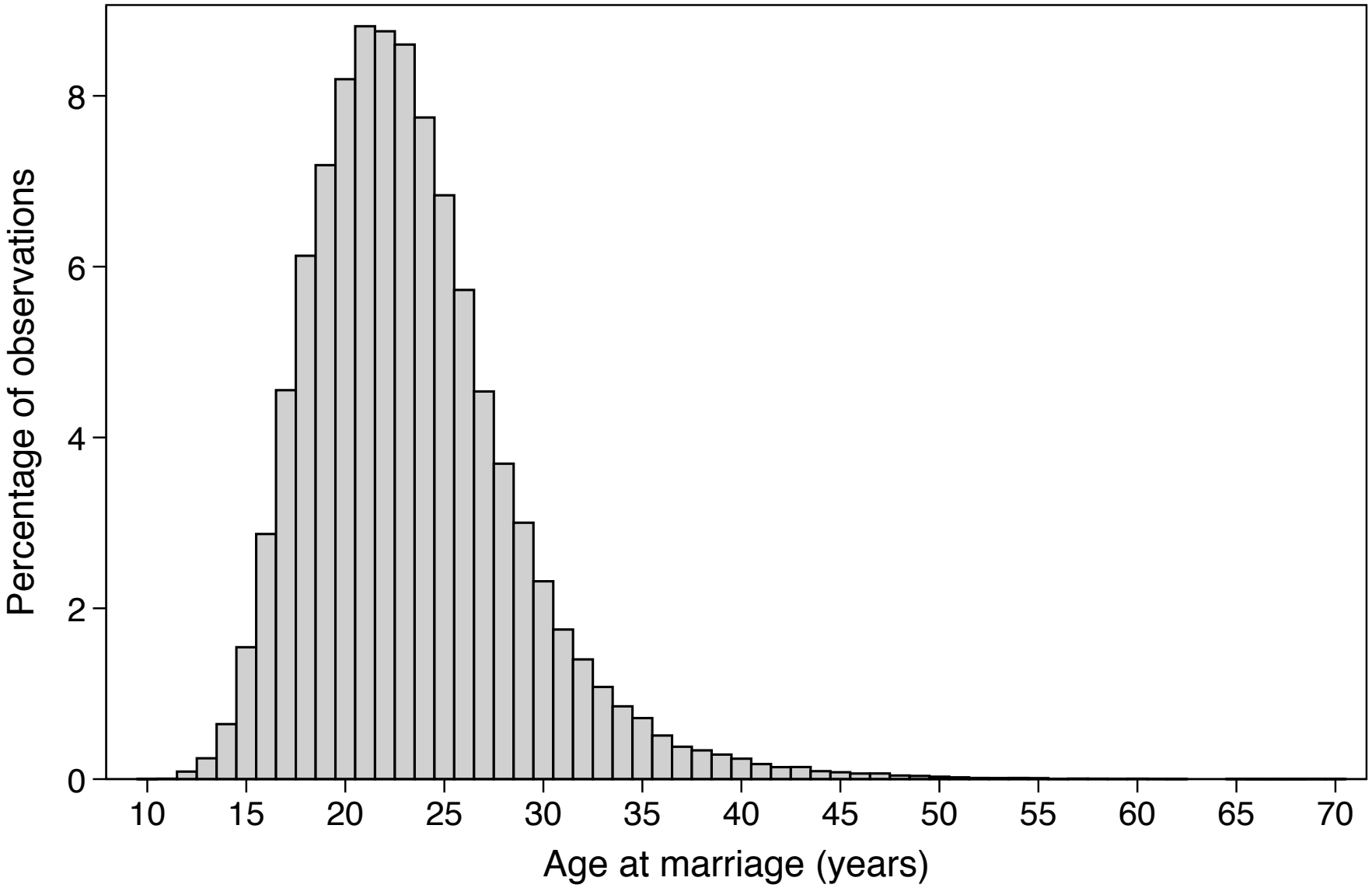

Percentage of observations
0
2
4
6
8
10
1
5
10
15
20
25
30
Number of children


Percentage of observations
0
1
2
3
4
5
1
50
100
150
200
Number of grandchildren

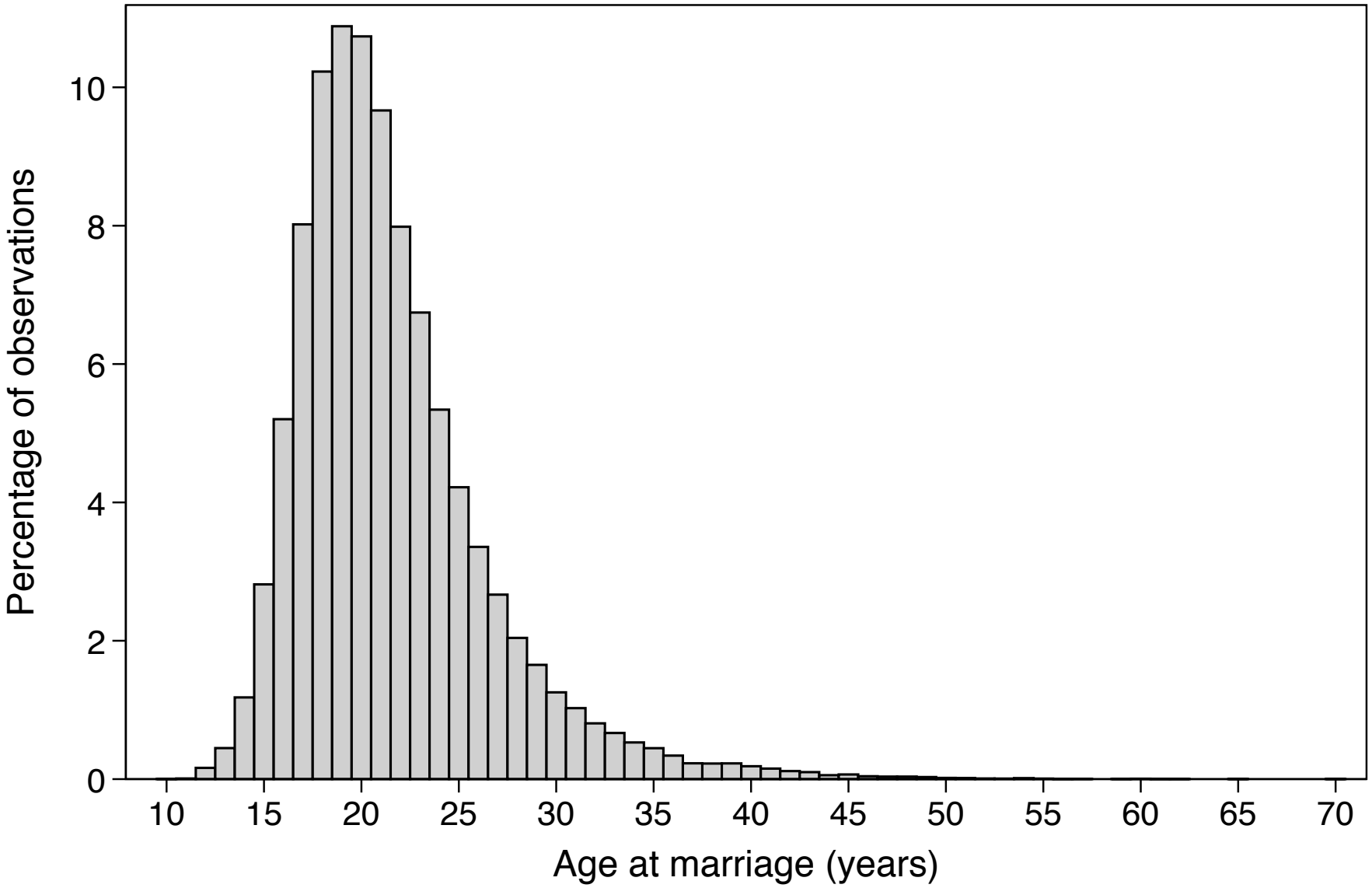

Percentage of observations
0
1
2
3
4
5
1
50
100
150
200
Number of grandchildren


A
B
C
D
E
F
Percentage of observations
Number of great-grandchildren
Number of great-great-grandchildren
0
10
20
30
40
60
1
200
400
600
800
1000
2000
3000
4000

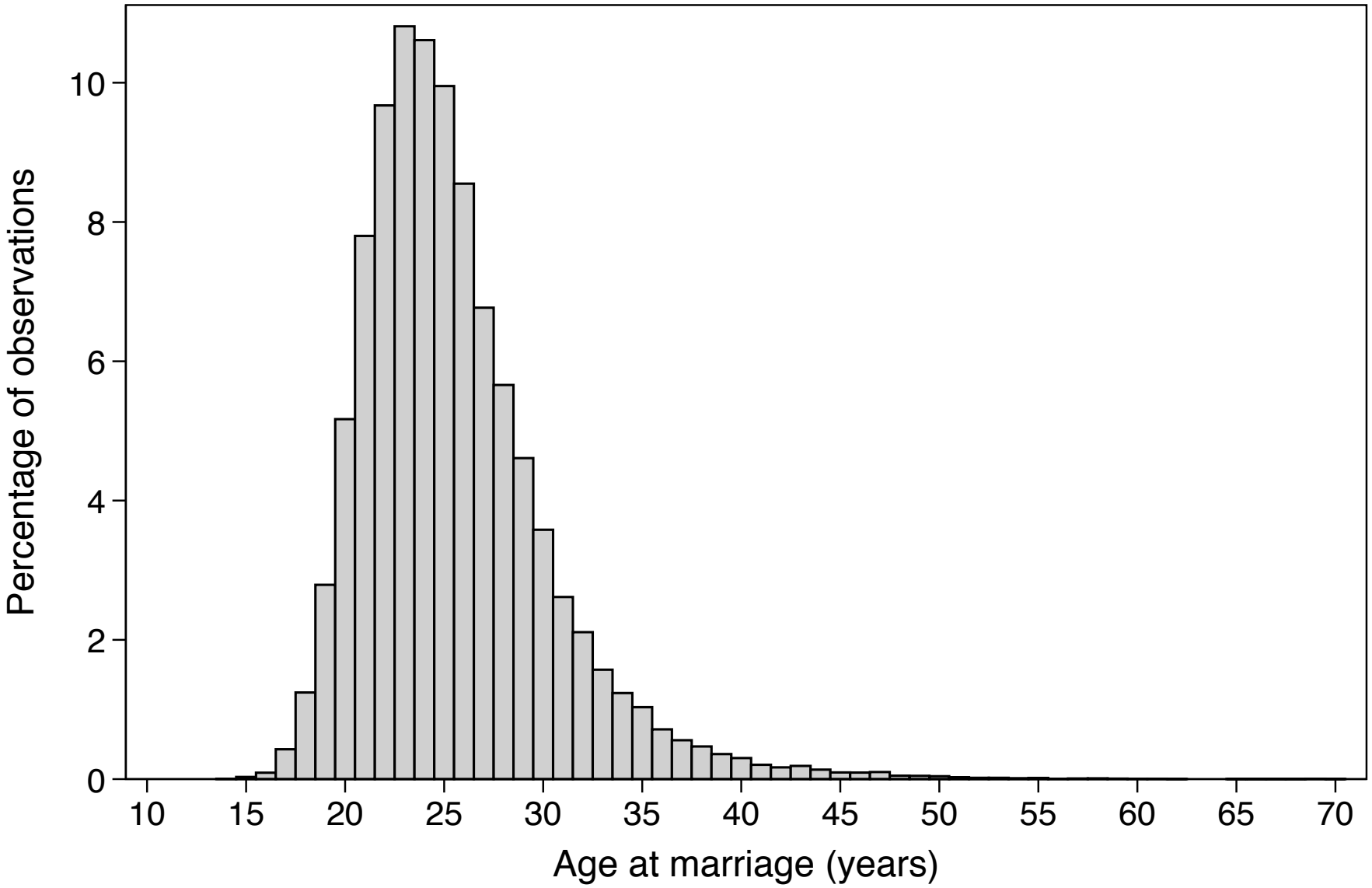
Age at first marriage (All)

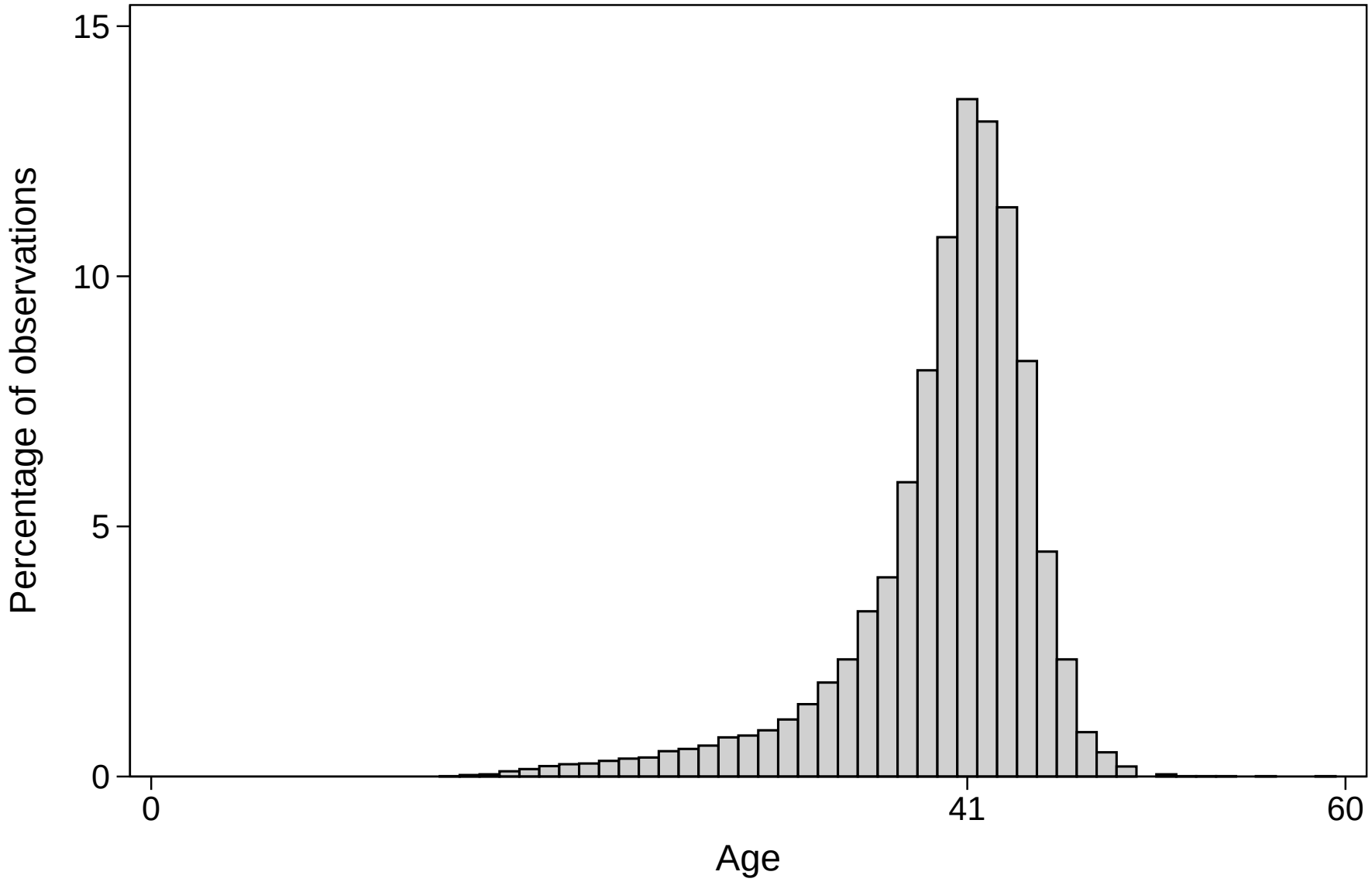


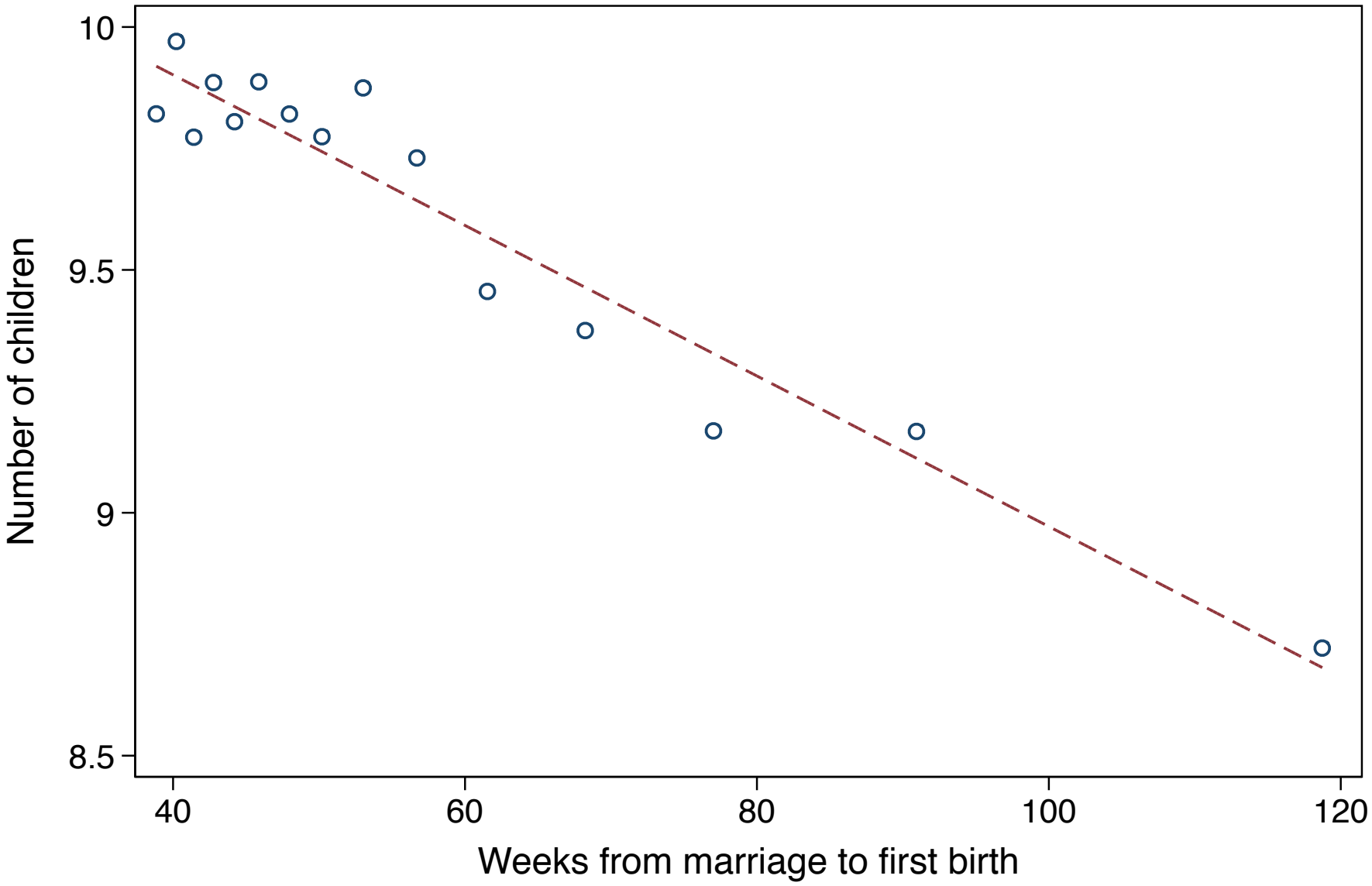
Age at first marriage (Females)



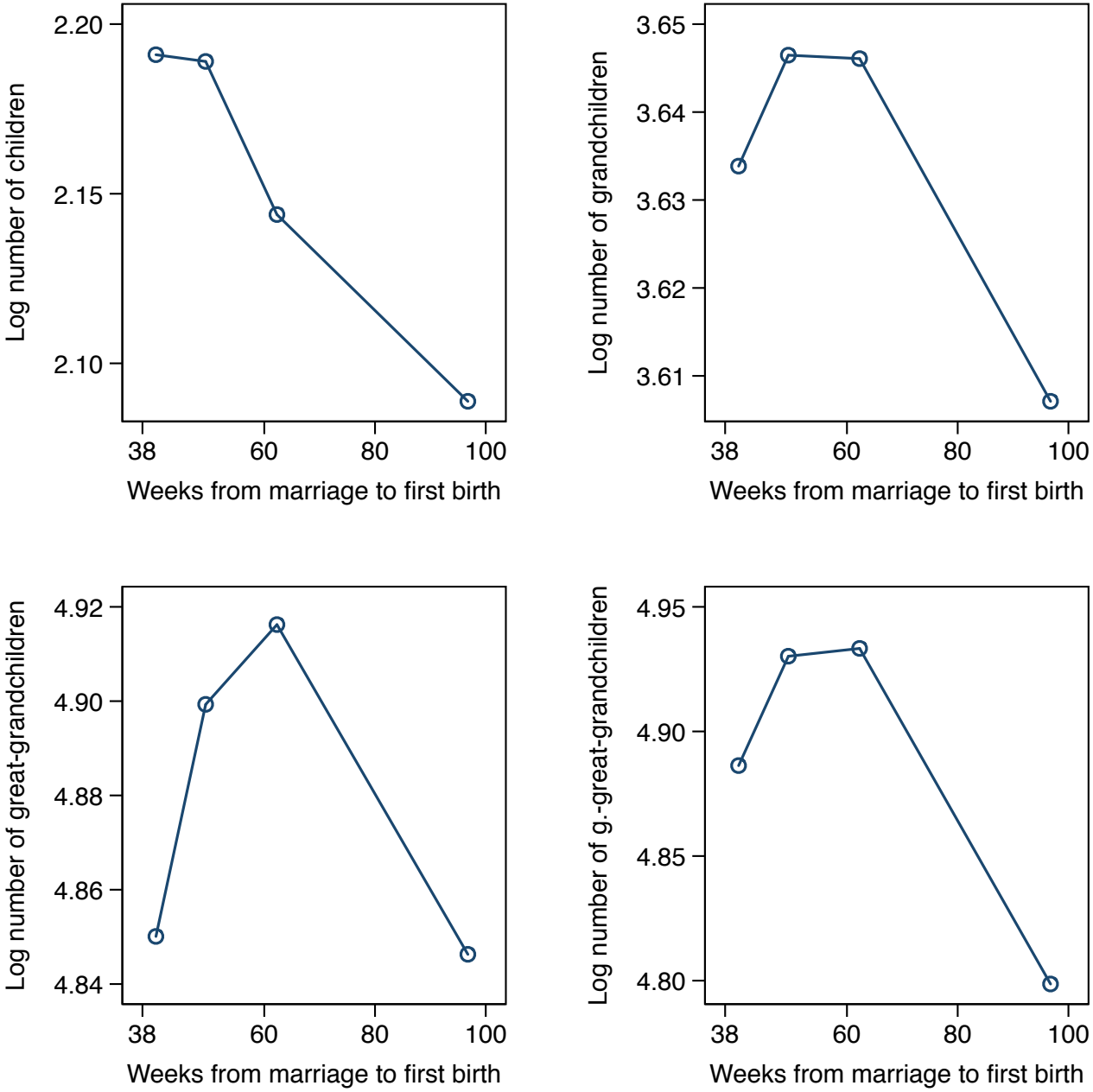
Age at first marriage (Males)

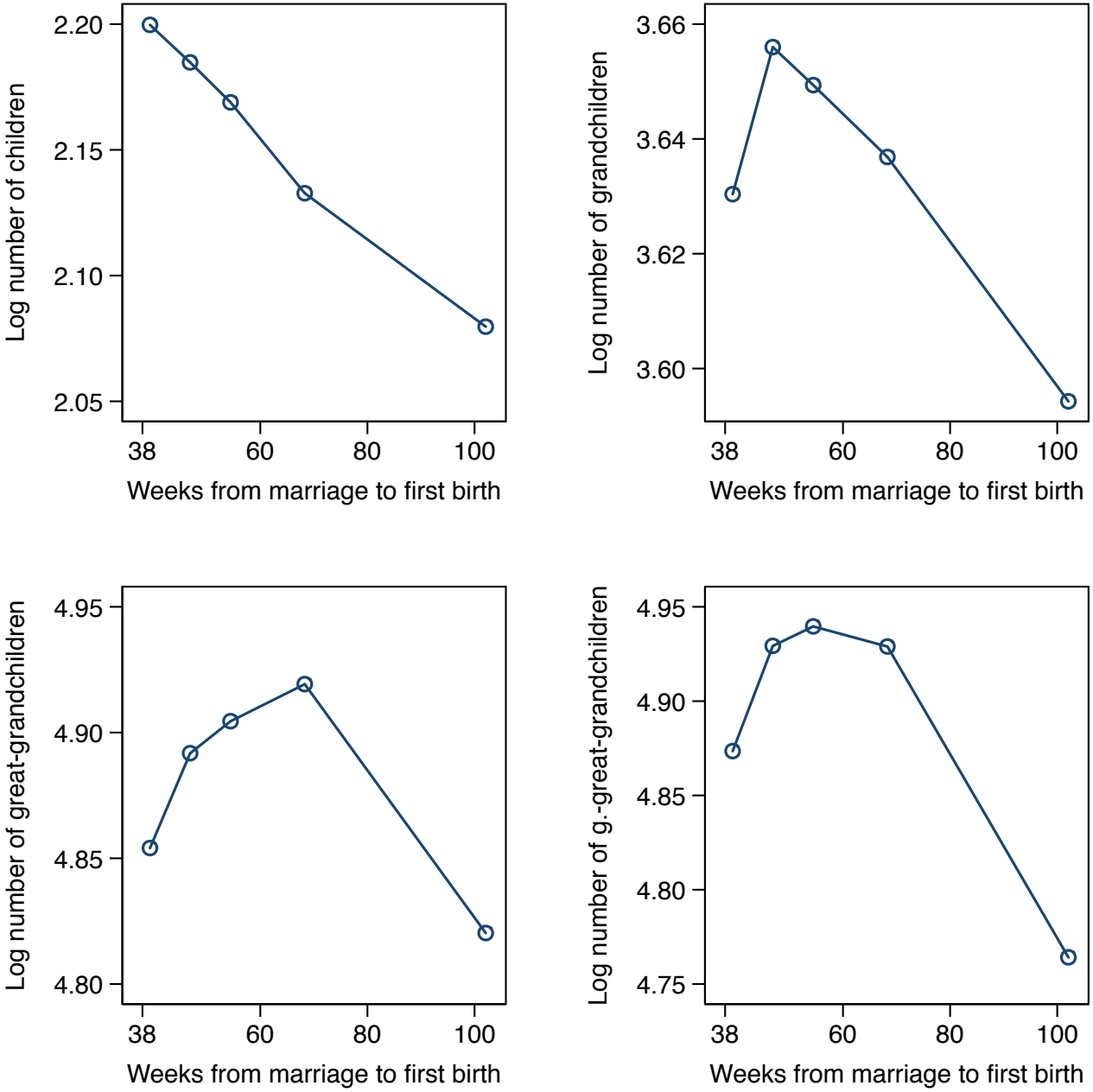


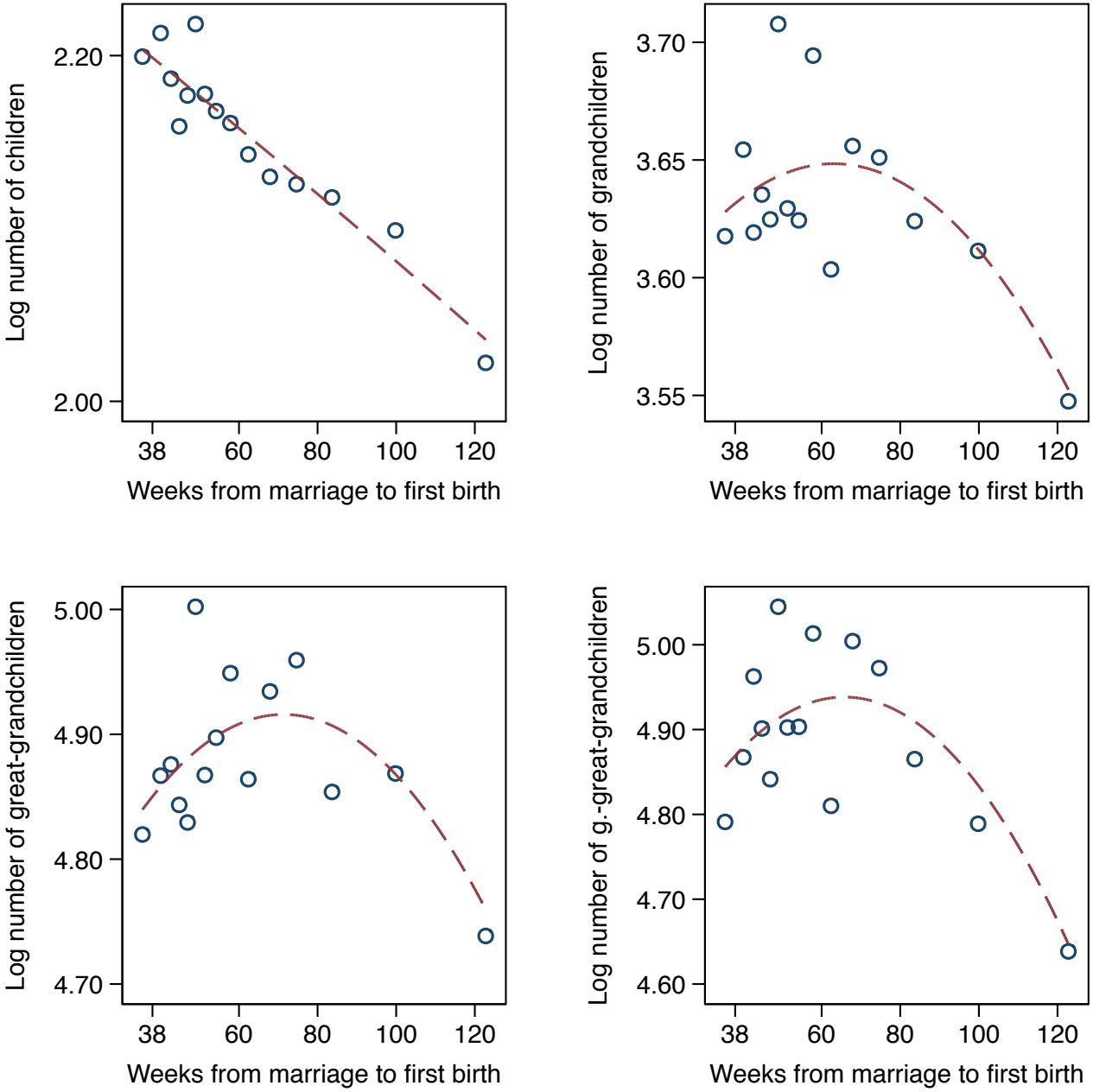

15
10
5
0
Percentage of observations
0
41
60
Age

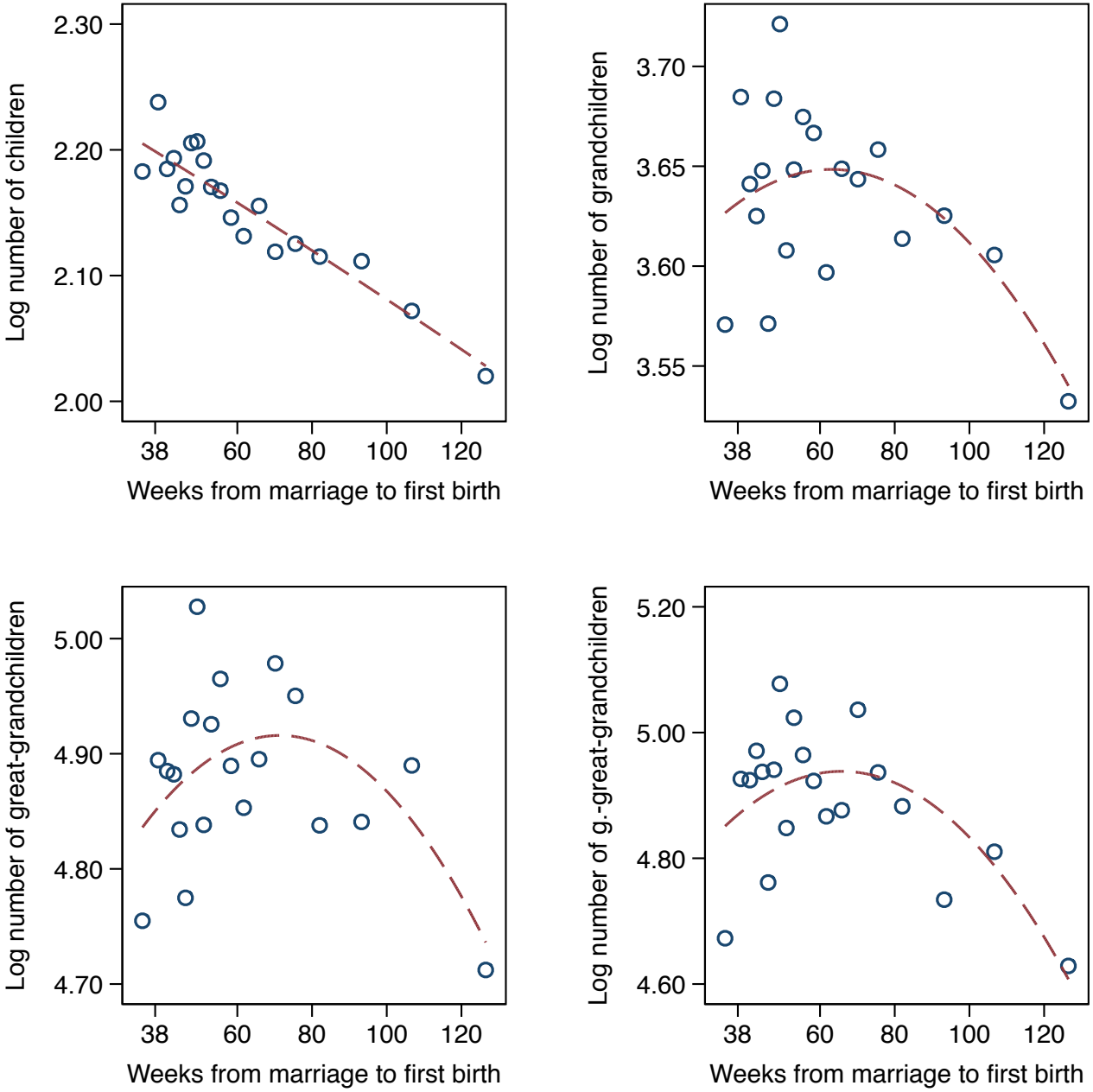


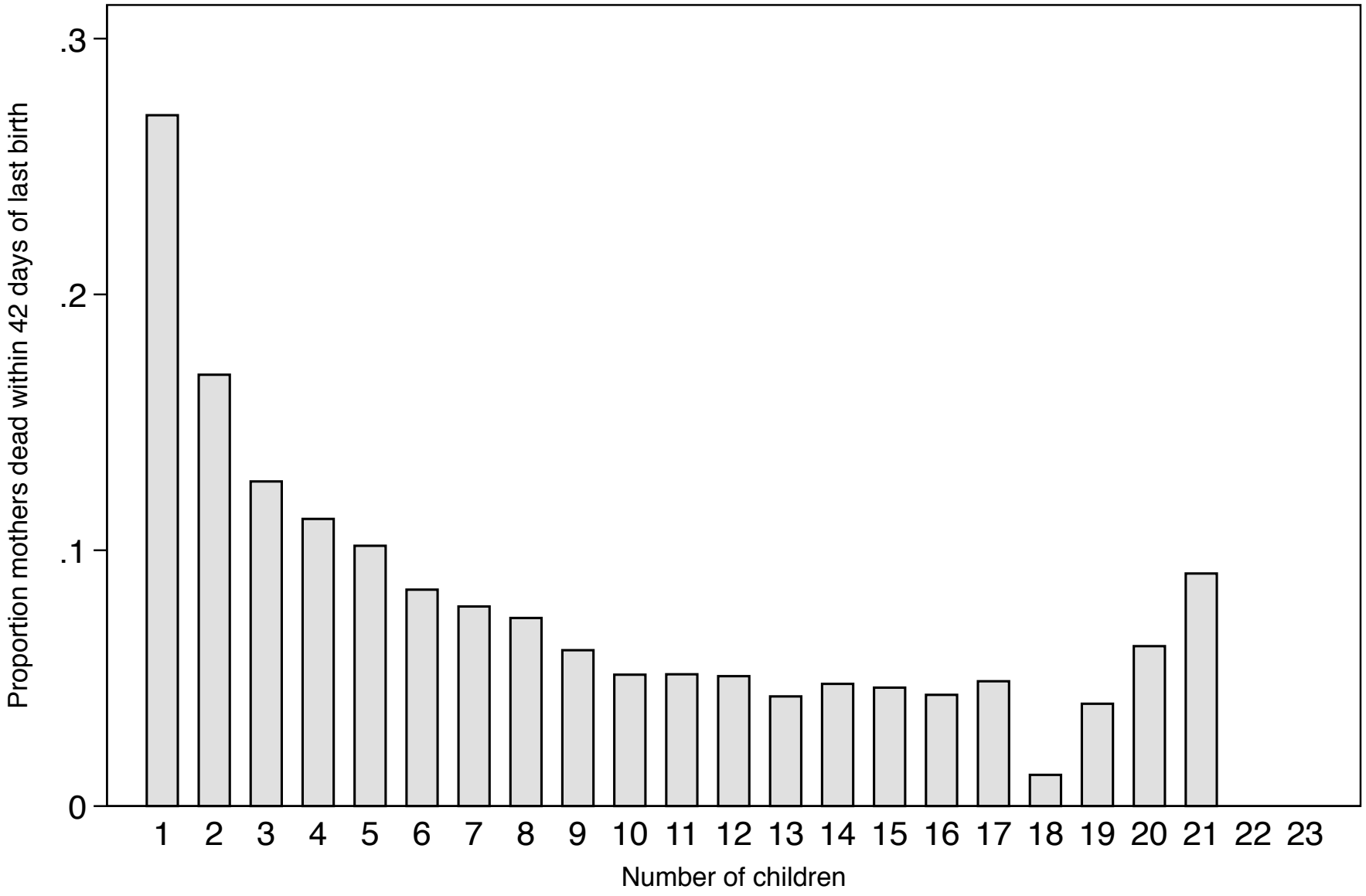
Return to presentation


Log number of children
2.20
2.15
2.10
38
60
80
100
Weeks from marriage to first birth
Log number of grandchildren
3.65
3.64
3.63
3.62
3.61
38
60
80
100
Weeks from marriage to first birth
Log number of great-grandchildren
4.92
4.90
4.88
4.86
4.84
38
60
80
100
Weeks from marriage to first birth
Log number of g.-great-grandchildren
4.95
4.90
4.85
4.80
38
60
80
100
Weeks from marriage to first birth


Log number of children
2.20
2.15
2.10
2.05
38
60
80
100
Weeks from marriage to first birth
Log number of grandchildren
3.66
3.64
3.62
3.60
38
60
80
100
Weeks from marriage to first birth
Log number of great-grandchildren
4.95
4.90
4.85
4.80
38
60
80
100
Weeks from marriage to first birth
Log number of g.-great-grandchildren
4.95
4.90
4.85
4.80
4.75
38
60
80
100
Weeks from marriage to first birth


Log number of children
2.20
2.00
38
60
80
100
120
Weeks from marriage to first birth
Log number of grandchildren
3.70
3.65
3.60
3.55
38
60
80
100
120
Weeks from marriage to first birth
Log number of great-grandchildren
5.00
4.90
4.80
4.70
38
60
80
100
120
Weeks from marriage to first birth
Log number of g.-great-grandchildren
5.00
4.90
4.80
4.70
4.60
38
60
80
100
120
Weeks from marriage to first birth


Log number of children
2.30
2.20
2.10
2.00
38
60
80
100
120
Weeks from marriage to first birth
Log number of grandchildren
3.70
3.65
3.60
3.55
38
60
80
100
120
Weeks from marriage to first birth
Log number of great-grandchildren
5.00
4.90
4.80
4.70
38
60
80
100
120
Weeks from marriage to first birth
Log number of g.-great-grandchildren
5.20
5.00
4.80
4.60
38
60
80
100
120
Weeks from marriage to first birth


Proportion mothers dead within 42 days of last birth
.3
.2
.1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Number of children