Electronic Supplementary Material (ESM) for

RSPB20201182 "Famine related mortality in early life and accelerated life histories in nineteenth-century Belgium"

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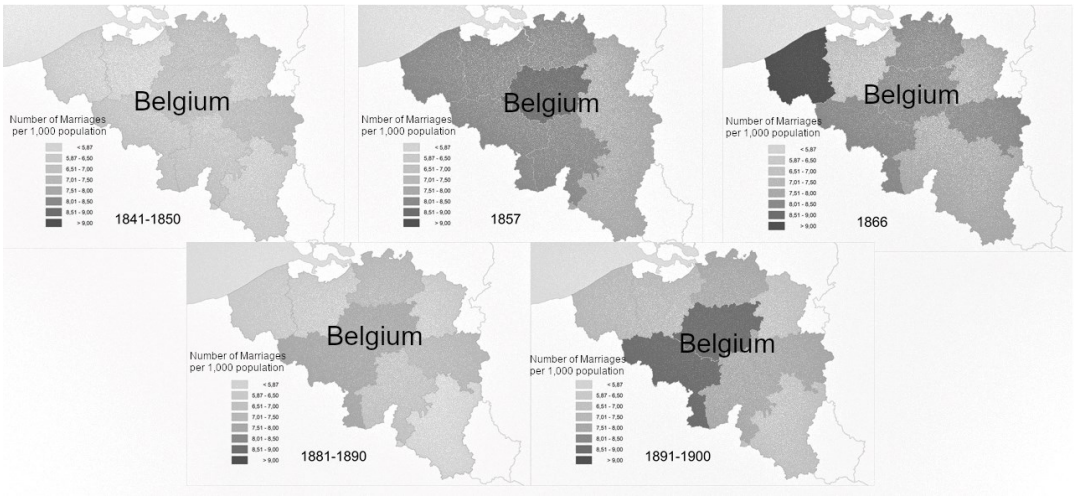
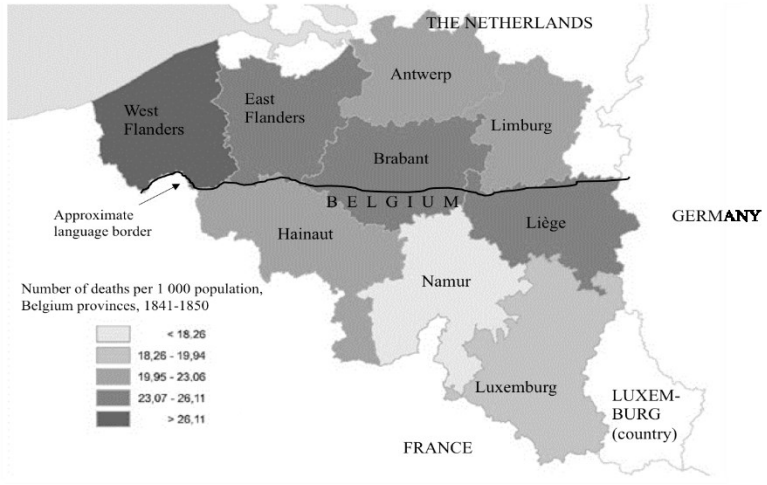
A1 – Figure 1. Number of marriages per 1 000 inhabitants in Belgium in 1841-1850, 1857, 1866, 1881-1890 and 1891-1900



A2 – Figure 2. Number of deaths per 1 000 inhabitants per province, Belgium in 1841-1850.



A3 – Brides model without theta-parameter

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Cox regression -- Breslow method for ties

No. of subjects =       11,892                 Number of obs    =      11,892
No. of failures =       11,892
Time at risk    =  309128.2244
                                               LR chi2(12)      =      724.39
Log likelihood  =   -99344.858                 Prob > chi2      =      0.0000
```

_t	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
CDR_total_cat						
2	1.093743	.0310585	3.16	0.002	1.034533	1.156343
3	1.669239	.0614095	13.93	0.000	1.553116	1.794045
HISCLASS4_BrideFa						
1	1.178489	.1122893	1.72	0.085	.9777348	1.420464
2	.9283978	.0893371	-0.77	0.440	.7688212	1.121096
3	1.018189	.0977299	0.19	0.851	.8435808	1.228939
signed_bride	.8582335	.016934	-7.75	0.000	.8256771	.8920737
PG_average	1.024906	.0054236	4.65	0.000	1.014331	1.035592
migration_bride_urbanrural						
1	.8705966	.0212472	-5.68	0.000	.8299331	.9132523
2	.8932608	.0279921	-3.60	0.000	.8400482	.9498442
3	.4900226	.0383579	-9.11	0.000	.4203257	.5712763
4	.7776841	.0535147	-3.65	0.000	.6795628	.889973
byear_bride	1.049679	.0067511	7.54	0.000	1.036531	1.062995

A4 – Grooms model without theta-parameter

```
Cox regression -- Breslow method for ties

No. of subjects =       14,140                 Number of obs    =      14,140
No. of failures =       14,140
Time at risk    =  417357.1307
                                               LR chi2(12)      =      551.73
Log likelihood  =   -120725.61                 Prob > chi2      =      0.0000
```

_t	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
CDR_total_cat						
2	1.129672	.0287181	4.80	0.000	1.074765	1.187384
3	1.32952	.0456321	8.30	0.000	1.243025	1.422034
HISCLASS4_groom						
1	1.261144	.0746799	3.92	0.000	1.122948	1.416346
2	.9812339	.0594698	-0.31	0.755	.8713318	1.104998
3	1.252248	.0739064	3.81	0.000	1.115459	1.405813
signed_groom	.8729675	.0170802	-6.94	0.000	.8401247	.9070942
PG_average	1.040524	.0050563	8.17	0.000	1.030661	1.050482
migration_groom_urbanrural						
1	.8659548	.0167506	-7.44	0.000	.8337389	.8994156
2	.8641417	.024115	-5.23	0.000	.8181464	.9127227
3	.7240466	.0464527	-5.03	0.000	.6384927	.8210642
4	.7176917	.0389384	-6.11	0.000	.6452915	.798215
birthyear_groom	1.008697	.0059779	1.46	0.144	.997048	1.020481

A5 – Brides model without socioeconomic control variables

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Cox regression -- Breslow method for ties

No. of subjects =       11,892                 Number of obs    =      11,892
No. of failures =       11,892
Time at risk    =  309128.2244
                                               LR chi2(8)       =      494.28
Log likelihood  =   -99459.913                 Prob > chi2      =      0.0000
```

_t	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
CDR_total_cat						
2	1.091419	.0309926	3.08	0.002	1.032334	1.153886
3	1.710331	.0616042	14.90	0.000	1.593753	1.835437
PG_average	1.029872	.005396	5.62	0.000	1.01935	1.040502
migration_bride_urbanrural						
1	.9518836	.0223295	-2.10	0.036	.9091094	.9966703
2	.9325196	.0272566	-2.39	0.017	.8805991	.9875015
3	.5137468	.0402227	-8.51	0.000	.4406625	.5989522
4	.7679185	.0527654	-3.84	0.000	.6711618	.8786239
byear_bride	1.045313	.0067097	6.90	0.000	1.032245	1.058547

A6 – Grooms without socioeconomic control variables

```
Cox regression -- Breslow method for ties

No. of subjects =       14,140                 Number of obs    =      14,140
No. of failures =       14,140
Time at risk    =  417357.1307
                                               LR chi2(8)       =      318.95
Log likelihood  =      -120842                 Prob > chi2      =      0.0000
```

_t	Haz. Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
CDR_total_cat						
2	1.142792	.0290278	5.25	0.000	1.087291	1.201125
3	1.396945	.0470652	9.92	0.000	1.307679	1.492305
PG_average	1.047197	.0050607	9.54	0.000	1.037325	1.057162
migration_groom_urbanrural						
1	.8929407	.0171008	-5.91	0.000	.860045	.9270947
2	.9212438	.0244813	-3.09	0.002	.8744896	.9704978
3	.7297351	.0468134	-4.91	0.000	.6435164	.8275054
4	.7231478	.0391925	-5.98	0.000	.6502712	.8041919
birthyear_groom	1.008585	.0059803	1.44	0.149	.9969311	1.020374

A7 – Table 1.: Brides' mean age at first marriage, total number of individuals in each CDR category and total number of individuals in each HISCLASS category sorted by province.

Province	Mean Age at Marriage (s.d.)	Number of Individuals (%)	Total Number of Individuals per CDR			Total Number of Individuals per combined HISCLASS Bride and Father Bride			
			Low (%)	*Middle (%)*	*High (%)*	*Low (%)*	*Farmer (%)*	*Middle (%)*	*High (%)*
Antwerp	25.74 (± 4.58)	352	63	257	32	201	42	108	1
		(2.96)	(17.90)	(73.01)	(9.09)	(57.10)	(11.93)	(30.68)	(0.28)
Brabant	25.92 (± 4.61)	10,503	1,199	7,311	1,993	5,022	3,583	1,804	94
		(88.32)	(11.42)	(69.61)	(18.98)	(47.81)	(34.11)	(17.18)	(0.89)
Hainaut	26.76 (± 5.24)	223	35	169	19	108	28	79	8
		(1.88)	(15.70)	(75.78)	(8.52)	(48.43)	(12.56)	(35.43)	(3.59)
Liége	27.05 (± 4.81)	225	109	107	9	115	37	69	4
		(1.89)	(48.44)	(47.56)	(4.00)	(51.11)	(16.44)	(30.67)	(1.78)
Limburg	27.07 (± 4.49)	133	11	122	-	95	6	29	3
		(1.12)	(8.27)	(91.73)		(71.43)	(4.51)	(21.80)	(2.26)
Luxemburg	31.80 (±4.53)	25	8	17	-	11	-	14	-
		(0.21)	(32.00)	(68.00)		(44.00)		(56.00)	
Namur	27.66 (± 5.00)	69	33	36	-	34	1	34	-
		(0.58)	(47.83)	(52.17)		(49.28)	(1.45)	(49.28)	
East Flanders	26.20 (± 4.91)	276	7	220	49	177	9	88	2
		(2.32)	(2.54)	(79.71)	(17.75)	(64.13)	(3.26)	(31.88)	(0.72)
West Flanders	26.45 (± 5.12)	86	-	34	52	49	10	24	3
		(0.72)		(39.53)	(60.47)	(56.98)	(11.63)	(27.91)	(3.49)
Total (%)		11,892	1,465	8,273	2,154	5,812	3,716	2,249	115
			(12.32)	(69.57)	(18.11)	(48.87)	(31.25)	(18.91)	(0.97)

A8 – Table 2.: Grooms' mean age at first marriage, total number of individuals in each CDR category and total number of individuals in each HISCLASS category sorted by province.

Province	Mean Age at Marriage (s.d.)	Number of Individuals (%)	Total Number of Individuals per CDR			Total Number of Individuals per HISCLASS Groom			
			Low (%)	*Middle (%)*	*High (%)*	*Low (%)*	*Farmer (%)*	*Middle (%)*	*High (%)*
Antwerp	29.60 (± 6.26)	515	95	371	49	223	77	189	26
		(3.64)	(18.45)	(72.04)	(9.51)	(43.30)	(14.95)	(36.70)	(5.05)
Brabant	29.29 (± 6.15)	11,767	1,418	8,413	1,936	4,620	3,328	3,639	180
		(83.22)	(12.05)	(71.50)	(16.45)	(39.26)	(28.28)	(30.93)	(1.53)
Hainaut	30.75 (± 6.53)	291	55	210	26	117	25	125	24
		(2.06)	(18.90)	(72.16)	(8.93)	(40.21)	(8.59)	(42.96)	(8.25)
Liége	31.20 (± 6.39)	326	131	187	8	142	42	122	20
		(2.31)	(40.18)	(57.36)	(2.45)	(43.56)	(12.88)	(37.42)	(6.13)
Limburg	30.73 (± 6.05)	205	28	177	-	112	21	61	11
		(1.45)	(13.66)	(86.34)		(54.63)	(10.24)	(29.76)	(5.37)
Luxemburg	33.23 (± 7.51)	43	23	20	-	15	2	24	2
		(0.30)	(53.49)	(46.51)		(34.88)	(4.65)	(55.81)	(4.65)
Namur	31.89 (± 6.37)	116	64	52	-	44	-	64	8
		(0.82)	(55.17)	(44.83)		(37.93)		(55.17)	(6.90)
East Flanders	30.76 (± 6.63)	674	30	540	104	285	102	263	24
		(4.77)	(4.45)	(80.12)	(15.43)	(42.28)	(15.13)	(39.02)	(3.56)
West Flanders	30.52 (± 6.72)	203	1	97	105	69	12	109	13
		(1.44)	(0.49)	(47.78)	(51.72)	(33.99)	(5.91)	(53.69)	(6.40)
Total (%)		14,140	1,845	10,067	2,228	5,627	3,609	4,596	308
			(13.05)	(71.20)	(15.76)	(39.79)	(25.52)	(32.50)	(2.18)

A9 – Table 3.: Effects of municipality level mortality on women's age at first marriage.

Variable	HR	St.Err.	z	p-value	95% CL	
Total CDR (Ref.Cat.: Low <20/1000)						
Middle (20 – 32/1000)	1.079	.031	2.65	0.008	1.020	1.142
High (>32/1000)	1.661	.063	13.37	< 0.001	1.542	1.789
HISCLASS Combi bride&father (Ref.Cat.: High)						
Low	1.169	.111	1.64	0.102	.970	1.410
Farmer	.918	.089	-0.89	0.357	.760	1.109
Middle	1.016	.098	0.17	0.865	.842	1.227
Bride literate	.861	.017	-7.57	< 0.001	.828	.895
Total population growth	1.024	.006	4.46	< 0.001	1.014	1.035
Bride migration status (Ref.Cat.: Not migrated)						
Rural-rural migration	.886	.022	-4.79	< 0.001	.844	.931
Rural-urban migration	.971	.035	-0.80	0.424	.904	1.043
Urban-rural migration	.486	.0380	-9.22	< 0.001	.417	.566
Urban-urban migration	.770	.053	-3.79	< 0.001	.673	.882
Birth year bride	1.052	.007	7.83	< 0.001	1.039	1.065
N	11,892					
Theta	.023	.017				
Likelihood ratio test	24.61					
p-value likelihood	< 0.001					

A10 – Table 4.: Effects of municipality level mortality on men's age at first marriage.

Variable	HR	St.Err.	z	p-value	95% CL	
Total CDR (Ref.Cat.: Low <20/1000)						
Middle (20 – 32/1000)	1.114	.029	4.19	< 0.001	1.059	1.172
High (>32/1000)	1.327	.047	8.01	< 0.001	1.238	1.422
HISCLASS groom (Ref.Cat.: High)						
Low	1.236	.073	3.58	< 0.001	1.101	1.389
Farmer	.953	.058	-0.79	0.431	.846	1.074
Middle	1.228	.073	3.48	< 0.001	1.094	1.380
Groom literate	.875	.017	-6.79	< 0.001	.842	.910
Total population growth	1.039	.005	7.67	< 0.001	1.029	1.049
Groom migration status (Ref.Cat.: Not migrated)						
Rural-rural migration	.894	.018	-5.56	< 0.001	.860	.930
Rural-urban migration	.947	.029	-1.75	0.081	.892	1.006
Urban-rural migration	.718	.046	-5.16	< 0.001	.633	.814
Urban-urban migration	.712	.039	-6.25	< 0.001	.640	.792
Birth year groom	1.010	.006	1.73	.083	.999	1.022
N	14,140					
Theta	.009	.006				
Likelihood ratio test	43.45					
p-value likelihood	< 0.001					

A11 – Table 5.: Aggregated regional cohort size of men and women aged 21-25 in census years 1846, 1856, 1866 and 1880.

Birth cohort	Census year	Total N	N Male	N Female	Sex ratio (N Male/N Female)	N per 1,000 population
1821-1825	1846	387,948	195,975	191,973	1.021	89.45
1831-1835	1856	386,426	198,695	187,731	1.058	85.32
1841-1845	1866	410,507	206,506	204,001	1.012	85.03
1855-1859	1880	445,621	224,158	221,463	1.012	80.73

Source: Annuaire Statistique 1890, p. 54-57. See http://extranet.arch.be/BIB_A4P131/BIB_A4P131_1890.pdf#search=%22age%22

Varying cohort size may change competition for mates: when the size of a cohort entering the marriage market is much smaller than that of a preceding cohort, this may decrease competition for spouses and hence lead to lower age at first marriage (Bronson & Mazzocco, 2018) – and vice versa. The specific history of
Belgium, which became independent only in 1830, makes that data available were not sufficiently fine-grained or systematic over time to include cohorts before 1841 or after 1846 into our model analyses as a control.

However, country-level information on cohort size is available for census years. We looked into the sizes of cohorts aged 21-25 during the census years 1846, 1856, 1866 and 1880 to verify whether, around the time they entered the marriage market, the cohorts born between 1841-1845 were smaller than their counterparts born before or after. The ages used for the comparison are somewhat below the average age at first marriage (data from the census 1846 and 1856 indicate that women's mean age of marriage was 28.6 years and men's mean age at marriage was 30.8 years) but still close enough to marriageable age, and enable us to cover the 1841-1845 cohorts, captured at young adulthood.

This snapshot shows that the cohort size of the birth years 1841-1845 at ages 21-25 was in fact bigger than the size of the cohort ten years before (+6.23%). Of course, this is an indirect measurement, and it does not preclude higher mortality for the 1841-1845 cohorts overall, nor does it inform us about municipality-level deviations from this average trend. But it does show that near marriage age, measured at the country level these cohorts overall were not smaller than the birth cohorts of 1821-1825 or 1831-1835. To our knowledge there were no events that caused high mortality cues in the birth cohorts 1821-1825 and 1831-1835.

Admittedly, we do not have information on the size of the cohorts born 1836-1840, the immediate marriage candidates for the female cohorts of 1841-1845 affected by high mortality, at ages 21-25. However, the size of the 1836-1840 male cohorts was N=211 318 in 1856, at ages 16-20 and N=187 331 in 1866, at ages 26-30. At ages 21-25, the male cohort born 1836-1840 consisted of approximately 199 325 individuals (not accounting for the rise of mortality rates across ages 16-30). The cohort of men who formed the prime marriage candidates for women who had been affected by the mortality crisis was therefore approximately the same in size as the preceding cohort of men (see Table 5). Therefore, there are no indications for reduced competition for marriage partners slightly older than themselves among females born in the famine years (in fact, the shift in sex ratios suggests that there might have been more women relative to slightly older men than before for the 1841-1845 female cohort, so increasing competition).

Theoretically, it seems logical that for men, lower marriage ages might have resulted from the ability to choose from a larger female cohort, especially since the 1855-1859 cohorts were considerably larger than the 1841-1845 cohorts. However, in fact, the 1846-1850 born female cohorts were not larger than the 1841-1845 cohorts: at ages 16-20, in 1866, their N was 204 682; in 1880 their N was 176 299. Under the same rough calculation as for men, attributing 5/14 of the mortality occurring between ages 16-30 to the 5 years that turned the 16-20 year old women into 21-25 year old women (again not accounting for progressiveness of mortality rates), the female cohort born between 1855-1859 would have consisted of about 194 545 individuals aged 21-25 years. At that size, this cohort was considerably smaller than the 1841-1845 cohort. Given the fact that fewer young women were available to them to choose from as marriage partners, therefore, men exposed to mortality crisis during their early childhood neither had an easier time at the marriage market.

The fact that the cohorts immediately following the mortality crisis cohorts were not bigger, might, we suspect be due to the economic conditions around the time of the crop failure crisis: in demography, it has been demonstrated that periods of economic crisis tend to lead to postponement of fertility.

The cohorts born 1855-1859, however, were larger than the 1841-1845 cohorts. This can be explained by a rise in the proportion of the population married. From 1856 the index of the proportion of the population married (I_m) started to increase. It rose from .366 in the 1856 census to .435 in the 1880 census. This trend led to an increase in marital fertility, which in turn led to higher fertility and therefore population growth (see Lesthaeghe, 2015).