

2010 BSPS Conference,
Exeter
14/09/2010

Interactions between childhood mortality estimates and heights in Central Spain, 1838-1915.



Diego Ramiro-Fariñas,

Grupo Dinámicas Demográficas

Instituto de Economía, Geografía y Demografía

Spanish Council for Scientific Research

diego.ramiro@cchs.csic.es

Héctor García-Montero,

University Complutense of Madrid,

Alfredo García-Hiernaux,

University Complutense of Madrid

Projects of the Ministry of Science and Innovation:SEJ2005-06334and CSO2008-06130/SOCI.
Programa de actividades del Grupo de Estudios de Población y Sociedad-Comunidad de Madrid (Red de Grupos de Investigación UCM-CSIC-UNED 2007/HUM-0517); the Grupo Dinámicas Demográficas del CSIC and the Unidad Asociada de Estudios Demográficos y Sociales.



<http://demografia.ieg.csic.es>

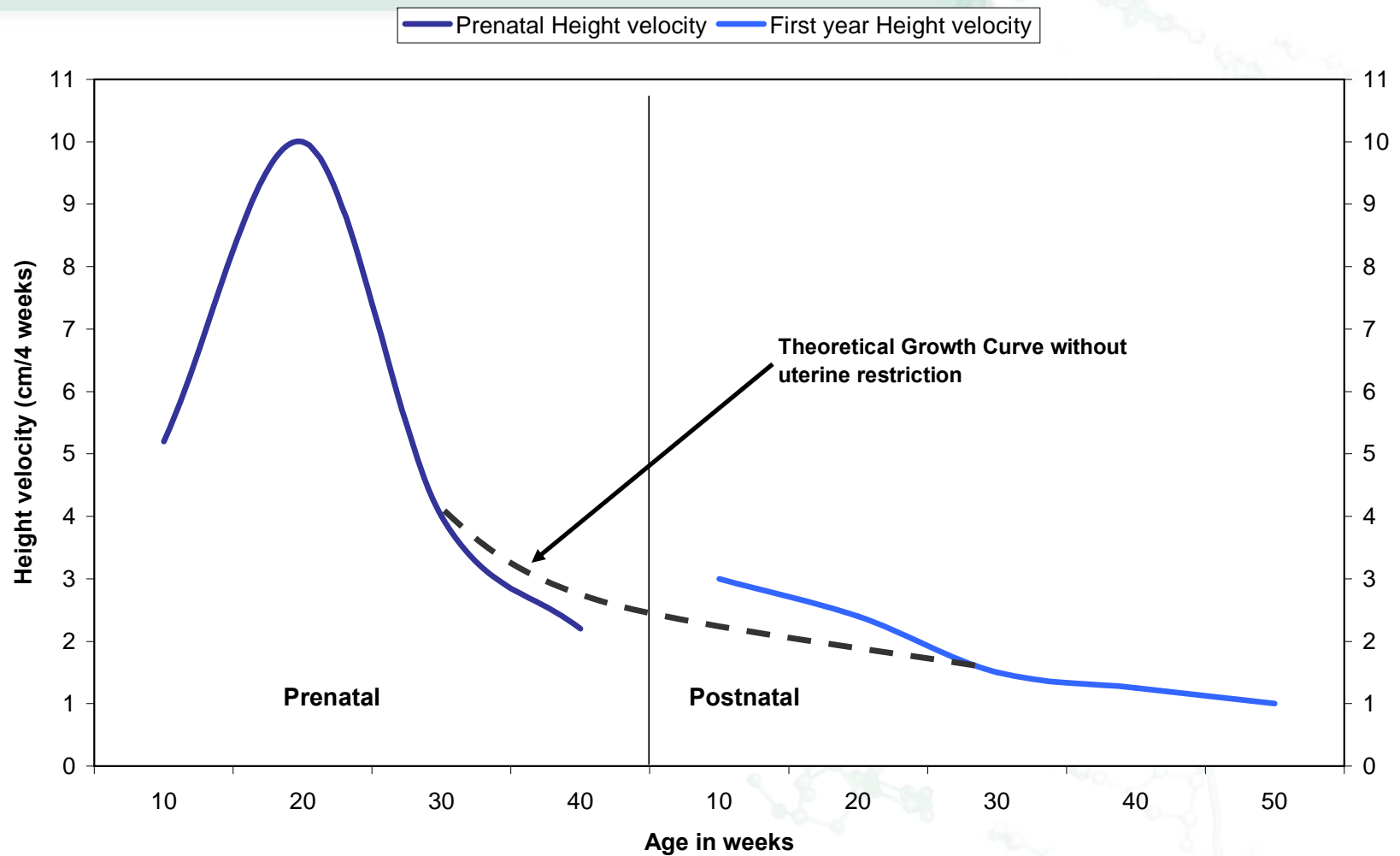


Introduction and background.

- Early life conditions can determine adult average height in later life.
 - **A great share of human growth takes place during foetal and early childhood. (see Figures).**
 - Growth can be determined by different factors at different ages. Early life conditions can determine future adult health (Barker Hypothesis).
 - However catch-up growth could compensate early life disadvantages, but there is no total consensus on this subject. During this period (1837-1915) this effect did not affect the Spanish case.



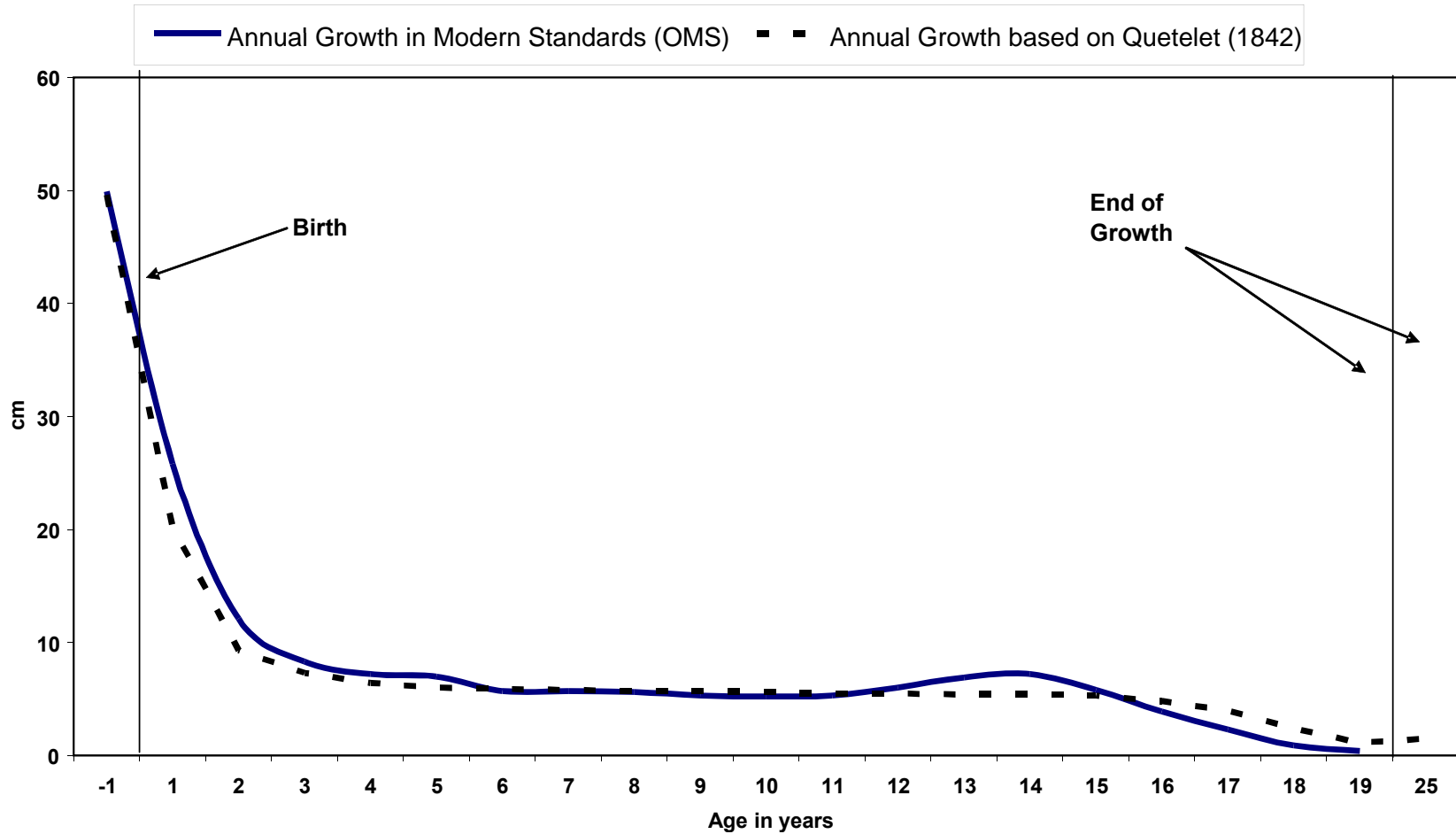
Figure 1.- Height velocity evolution during prenatal period and during the first year of life.



Source: Tanner 1990



Figure 2.- Height velocity evolution from conception to adulthood



Source: Tanner 1990 and Quetelet 1842

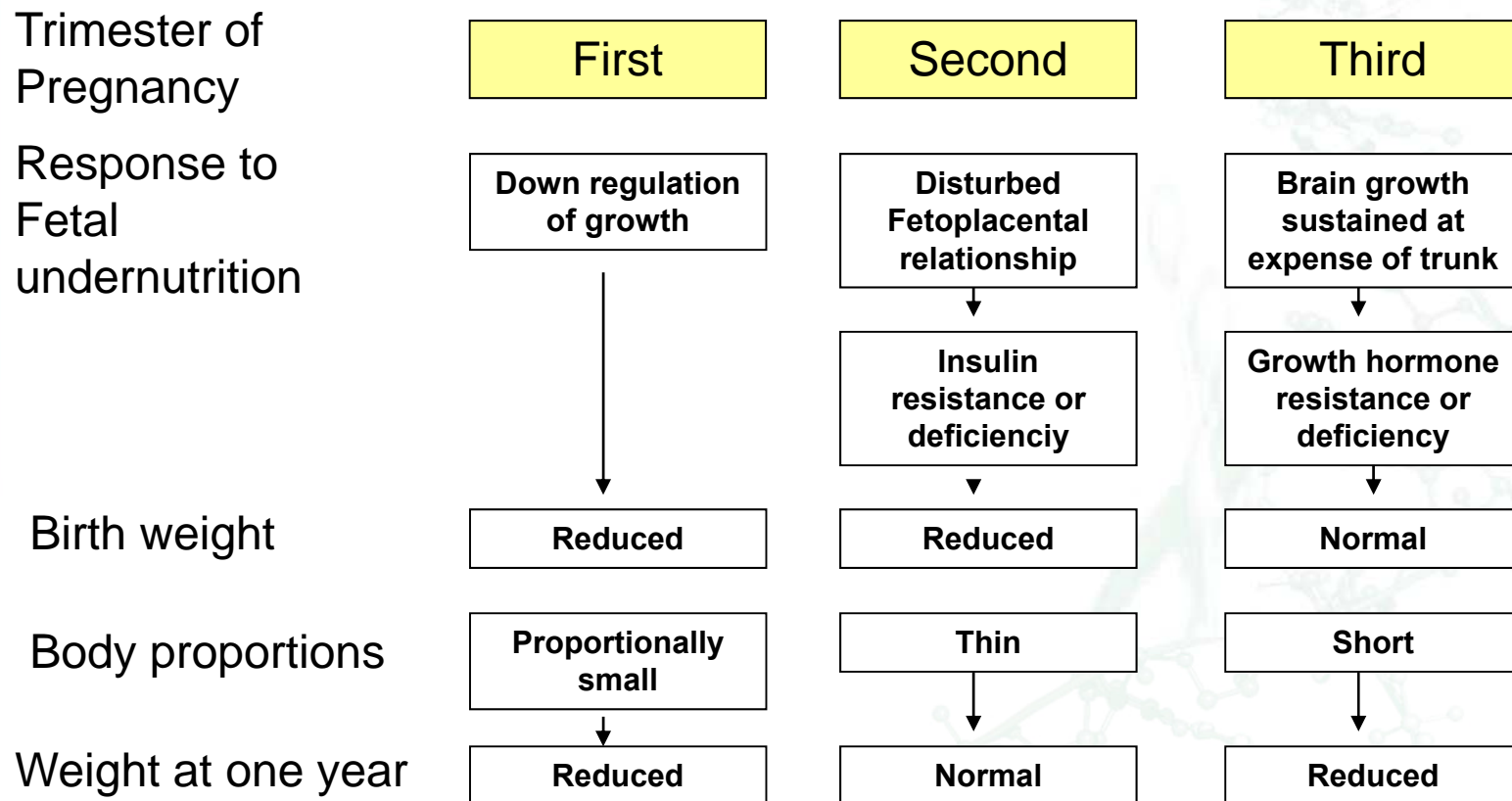


Introduction and background.

- Early life conditions can determine adult average height in later life.
 - A great share of human growth takes place during foetal and early childhood. (see Figures).
 - **Growth can be determined by different factors at different ages. Early life conditions can determine future adult health (Barker Hypothesis).**
 - However catch-up growth could compensate early life disadvantages, but there is no total consensus on this subject. During this period (1837-1915) this effect did not affect the Spanish case.



Introduction and background. Framework of ideas in the fetal origins hypothesis linking fetal undernutrition with later abnormalities.



Source: Barker, D.J (1995 311: 171-174) and Juárez (2010)



Introduction and background.

- Early life conditions can determine adult average height in later life.
 - A great share of human growth takes place during foetal and early childhood. (see Figures).
 - Growth can be determined by different factors at different ages. Early life conditions can determine future adult health (Barker Hypothesis).
- **However catch-up growth could compensate early life disadvantages, but there is no total consensus on this subject. During this period (1837-1915) this effect did not affect the Spanish case.**



Introduction and background. Problems and limitations

There is no consensus on whether height distribution of those who died was equal to the same distribution for those who survived to adulthood (Deaton, 2006; Steckel, 2007, Baten and Moradi, 2005, Hatton 2010).

Mortality, or infant mortality, will be used as a proxy of morbidity and health, as it has been used by others to relate with height at adulthood (Steckel, 1995 and 2009, Fogel 2004, María-Dolores and Martínez-Carrión, 2009, Bozzoli et al. 2009, Hatton, 2010, between others) when there has been important debates on the relationship between mortality and morbidity through time (Riley, 1997, Johansson, 1992, Harris, 1999, Woods, 1997 and 2007).

Final height is accomplished after 21 years, plus 9 months of uterine growth plus some intergenerational effects. During all this growth, nutrition and disease (specially respiratory and gastrointestinal diseases) played an important role (Silventoinen, 2003 and Hatton, 2010 for a summary of literature on this subject).



Aim

- The interactions between standards of living and other estimations of health have been normally approached using as a proxy of health of the populations estimates of infant mortality. We consider that other estimates of childhood mortality such as mortality at different ages during the first year of life and during childhood are better to understand these interactions.
- We intend to analyze if there is cointegration between series of childhood mortality estimates and height at 21 years, if that exist, both time series shared a common trend and there was a stable equilibrium on the long run between both estimates.



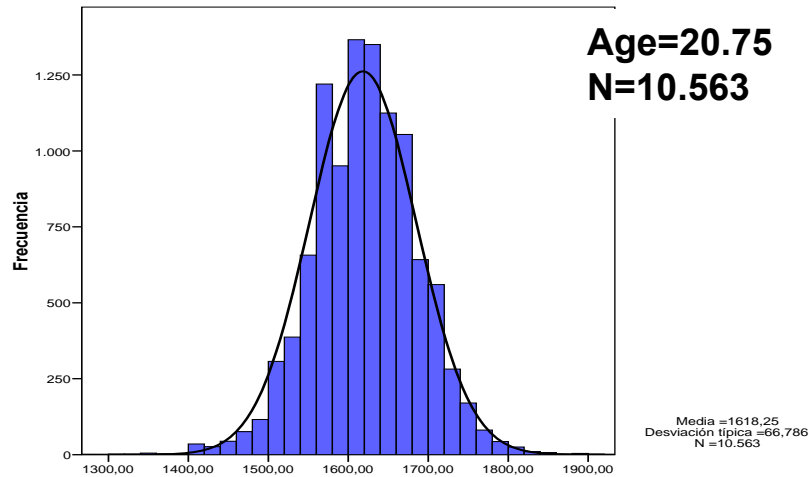
Sources and data.

- Mortality data
 - Cohorts born between 1785 and 1960.
 - Data by sex, age at death and cause of death.
 - Referring to 25 municipalities, from 2000 to 14000 inhabitants. (total population of 100.000 inhabitants in 1900).
 - 20% of rural population of the province of Toledo, 6% of Cáceres.
- Height data:
 - Cohorts of conscripts born between 1837-1915.
 - N= 48242 men.
 - Age measurement standardized to 21 years old
 - Data include those bellow minimum height requirement. (see histograms).
 - Data have been homogenized with Intervention Analysis.

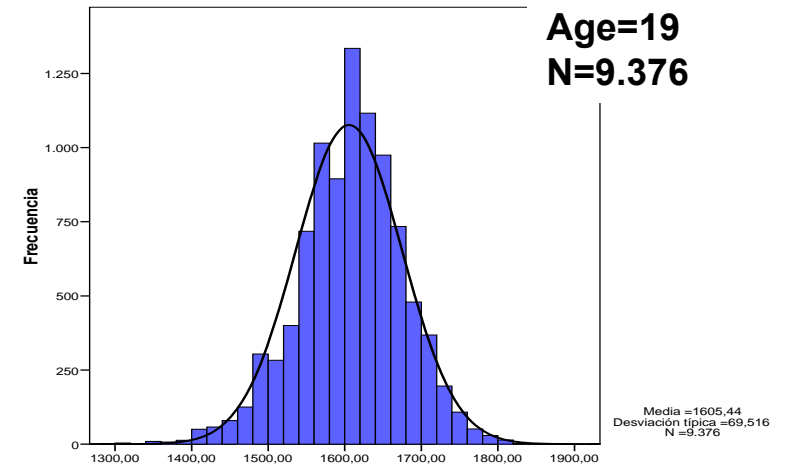


Figure 3.- Histograms of frequencies of height by birth cohort, 1837-1915.

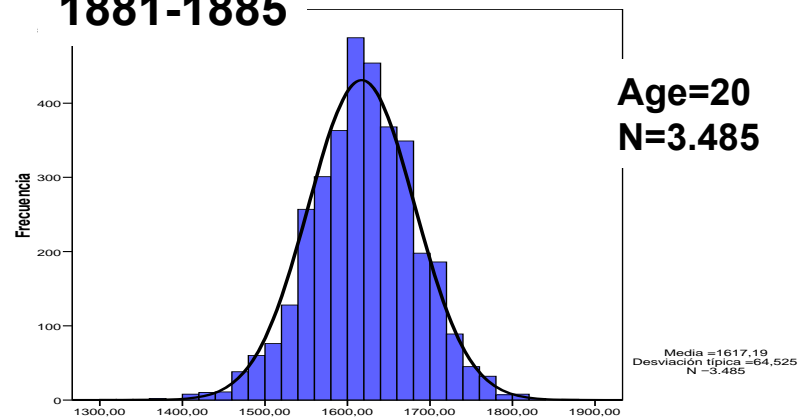
1837-1865



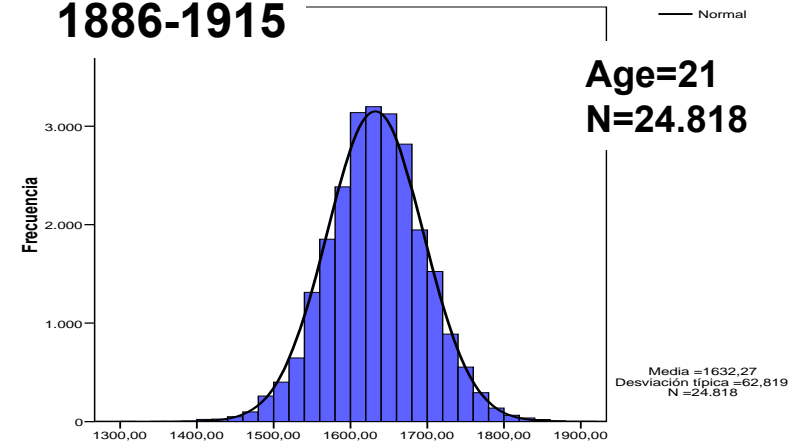
1866-1880



1881-1885



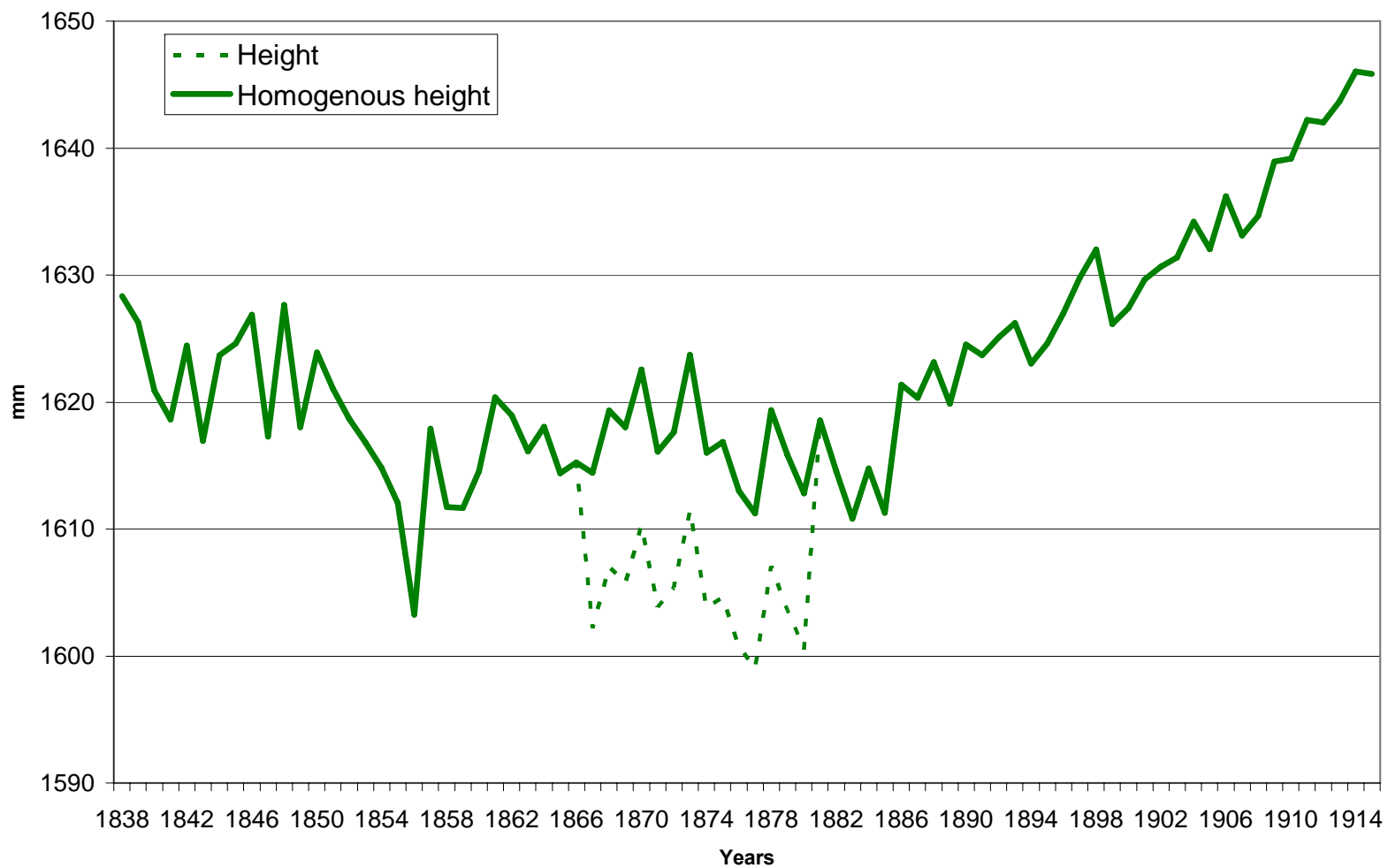
1886-1915



N total= 48.242 cases. 91 % of total recruitment.

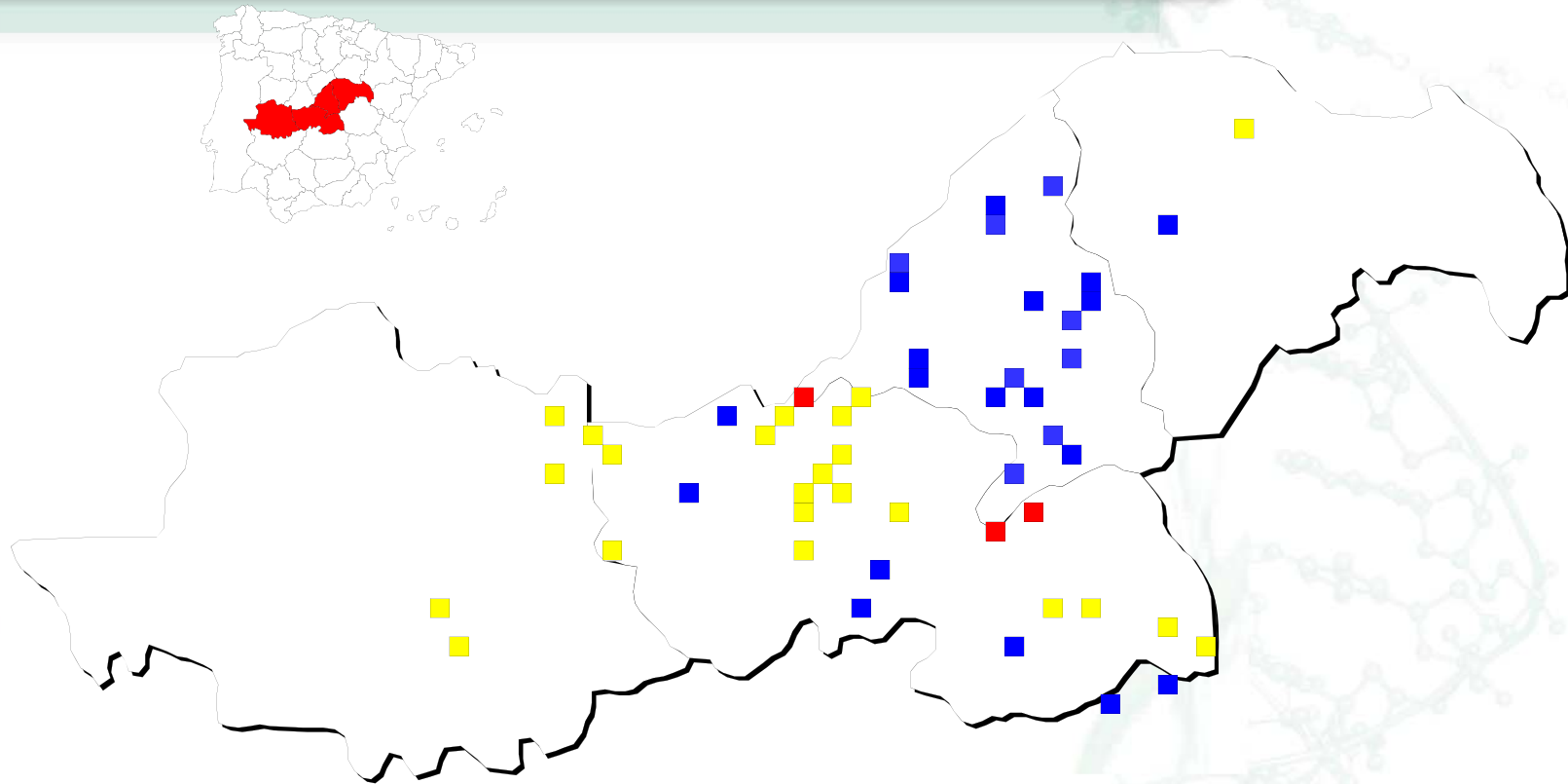


Figure 4.- Height and homogenous height at 21 years in Central Spain, 1838-1915.





Map 1. Geographical distribution of the sample municipalities, height and mortality data.



- Municipalities with data on heights
- Municipalities with data on mortality.
- Municipalities with data on heights and mortality..



Figure 5.- Height and male probability of surviving to age 10 in Central Spain, 1838-1915.

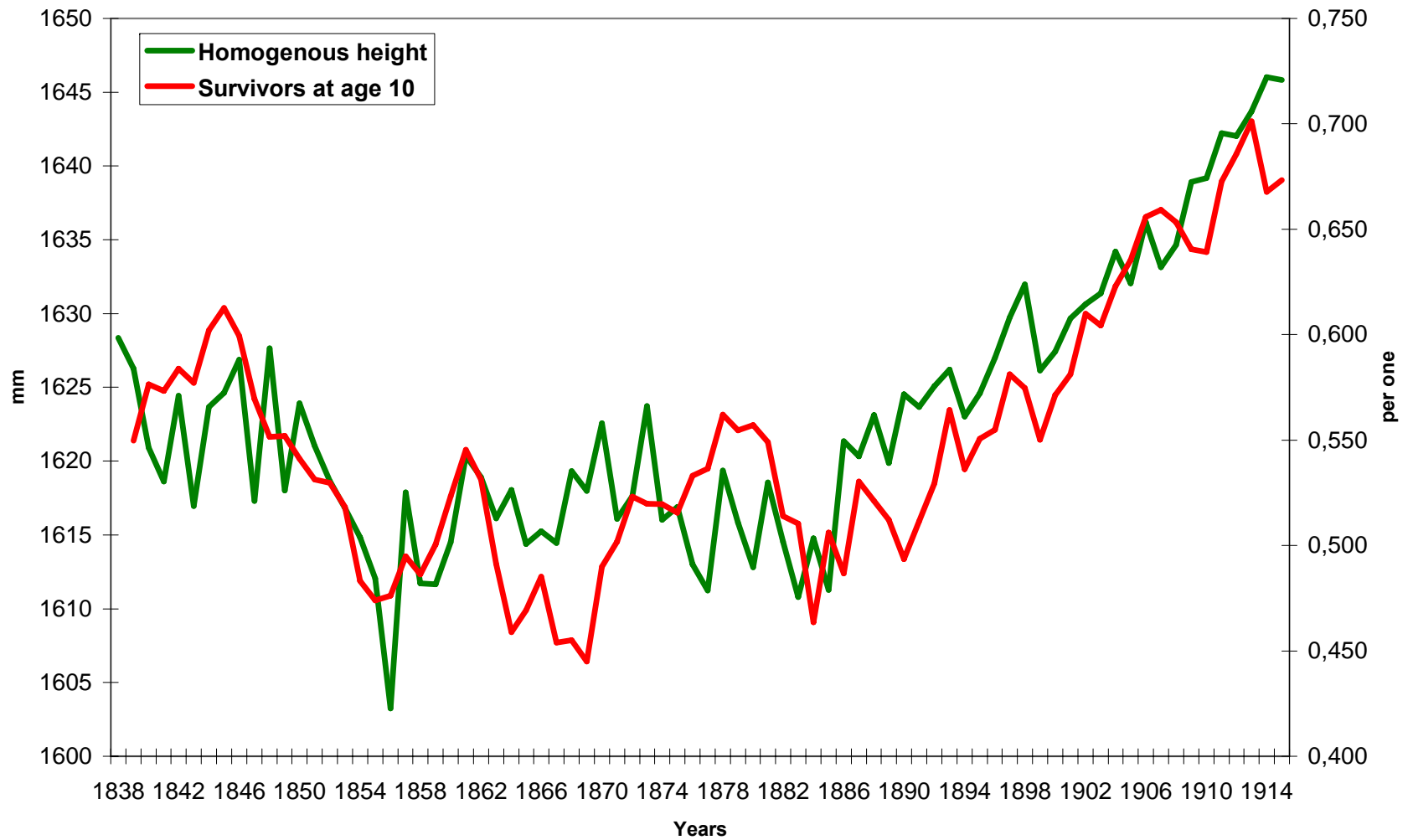




Figure 6.- Height and male probability of surviving to the third year of life in Central Spain, 1838-1915.

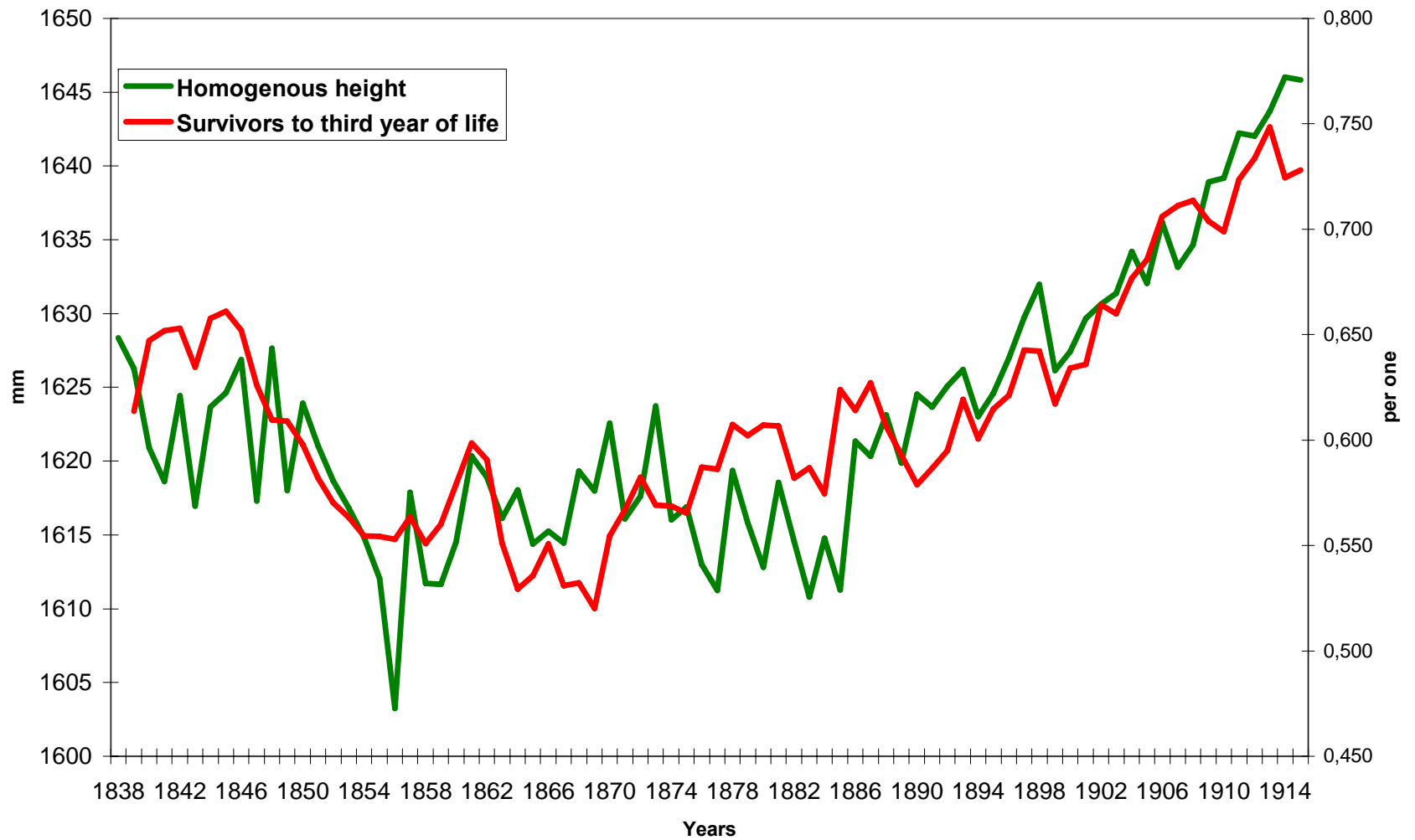




Figure 7.- Height and male probability of surviving to the first month of life in Central Spain, 1838-1915.

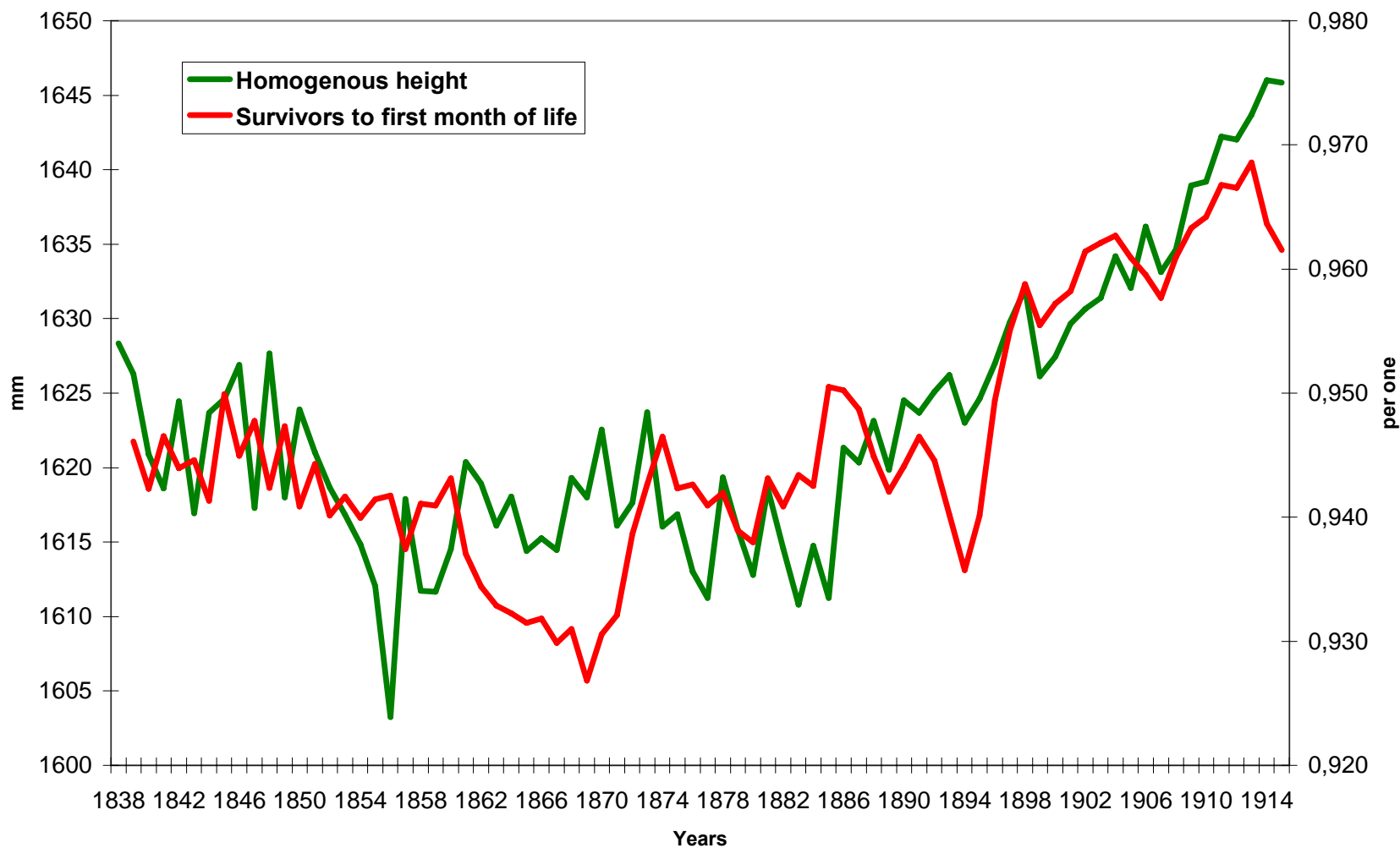




Table 1: Univariate analysis of height and mortality series.

Variable	$\nabla z_t = (1-\theta)B$	Residuals		DCD ¹	Interventions
	$\hat{\sigma}$ (s.e. [^])	s.e. [^] (%)	Qlb(10)	H0: $\theta = 1$	Impulse (year)
Homog. Height	0,474 (0.101)	366,550	9,79	100.84*	1856 (Compensated imp).
NEONAT	0,696 (0.082)	0,785	14,21	36.13*	-
POSNAT	0,766 (0.074)	2,238	13,71	28.80*	-
QM12	0,833 (0.064)	0,654	7,33	11.34*	1839.
QM35	0,736 (0.077)	0,836	12,66	34.95*	-
QM68	0,778 (0.072)	0,987	24,71	17.80*	-
QM911	0,747 (0.076)	0,743	7,49	17.00*	-
VQ0	0,700 (0.082)	2,895	9,82	37.23*	-
VQ1	0,665 (0.086)	1,697	2,74	42.19*	1874-75, 1883.
VQ2	0,678 (0.084)	1,943	3,73	32.58*	-
VQ3	0,877 (0.056)	1,505	7,55	3.13**	1855, 1868, 1885.
VQ4	0,826 (0.065)	0,607	11,11	3.27**	1868, 1883-90.
VQ5	0,822 (0.071)	0,586	6,40	0,54	1855, 1885, 1886.
VQ6	0,896 (0.052)	0,733	7,39	0,88	1887
VQ7	1,000 (0.001)	0,397	7,81	0,00	1887, 1883.
VQ8	0,855 (0.068)	0,481	4,41	0,00	1841, 1843, 1885.
VQ9	1,000 (0.002)	0,331	9,76	0,00	1861, 1885.

Notes: (1) Critical values of the DCD statistic at 1%, 5% y 10% level are, respectively, 4.41, 1.94 and 1.0

* means that H0 is rejected at 1%.

** means that H0 is rejected at 5%.

*** means that H0 is rejected at 10%.

s.e.[^] is the estimated standard error.



Table 2: Analysis of the residuals from regressing the homogenous height on the mortality specified in the column "Variable".

Variable	$(1-\phi B)z_t = (1-\theta B)$		SF ¹	Residuals		DCD ²	Interventions
	$\hat{\phi}$ (s.e.^)	$\hat{\theta}$ (s.e.^)	H0: $\phi = 1$	s.e.^(%)	$Q_{lb}(10)$	H0: $\theta = 1$	Impulse (year)
NEONAT	0,877 (0.082)	0,509 (0.150)	6.20*	478,570	7,22	-	
POSNAT	0,976 (0.024)	0,628 (0.101)	2.40**	498,540	10,12	-	
QM12	1,000 -	0,666 (0.086)	0,07	470,100	19,09	37.68*	1839
QM35	1,000 -	0,569 (0.094)	0,26	439,380	9,90	40.08*	
QM68	1,000 -	0,638 (0.088)	0,06	512,760	9,28	30.40*	
QM911	1,000 -	0,512 (0.098)	0,04	442,120	8,77	53.39*	
VQ0	0,957 (0.036)	0,545 (0.113)	1.51***	450,120	7,46	-	1869, 1871
VQ1(+1)	0,923 (0.068)	0,679 (0.132)	4.38*	471,230	6,91	-	1874, 1883
VQ2(+2)	0,917 (0.065)	0,608 (0.132)	4.11*	500,360	7,04	-	1863, 1894
VQ3(+3)	0,976 (0.025)	0,701 (0.096)	0,349	528,860	9,01	29.36*	
VQ4(+4)	0,978 (0.022)	0,611 (0.101)	0,763	445,060	13,92	62.17*	1862, 1886

Notes: (1) Critical values of the SF statistic at 1%, 5% y 10% level are, respectively, 3.41, 1.75 and 1.07.

(2) Critical values of the DCD statistic at 1%, 5% y 10% level are, respectively, 4.41, 1.94 and 1.00.

* means that H0 is rejected at 1%.

** means that H0 is rejected at 5%.

*** means that H0 is rejected at 10%.

s.e.^ is the estimated standard error.



Conclusions.

We found different levels of interaction between height and mortality estimates by age with stronger relationship, with some signs of Cointegration, between neonatal mortality and mortality during the second and third year of life, and weaker ones with Postneonatal and infant mortality as a whole.

We did not find interactions with the rest of the ages during childhood.