Supplementary Material (Online)

A. Bounds for the selection by mortality

In the spirit of non-parametric bounds for treatment variables, as elaborated on by Lee (2009), we ask whether extreme assumptions on the extent of selection by mortality could generate the observed variations in height. The computation of a lower bound for height amounts to assuming that over-mortality killed all the children that would have ended up being the shortest at adult ages. Then, under monotonicity conditions (children who die in low mortality periods would also die when mortality is high, and vice-versa for survivors), when mortality changes between two birth cohorts, a lower bound for the counterfactual variation in the height of 'always survivors' is obtained by computing a truncated mean of the height variable in the birth year with the lowest mortality. More formally, the lower bound for the mean height of always survivors in a year τ of over-mortality, compared to benchmark year τ_0, is:

$$Y_{lb} = E(Y|t = \tau) - \left[E\left(Y\middle|t = \tau_0, Y \geq y_q\right) - E(Y|t = \tau_0)\right]$$

where y_q is the qth percentile of height in τ_0, q being the increase in mortality between τ and τ_0, in percentage points.

As in the main analysis, we choose 1872 as the post-crisis benchmark year and use estimated probabilities of dying between 0 and 20 years old from Table 1 to compute a lower bound for counterfactual mean height, absent over-mortality, for each birth year before 1872 (Figure A.2.).

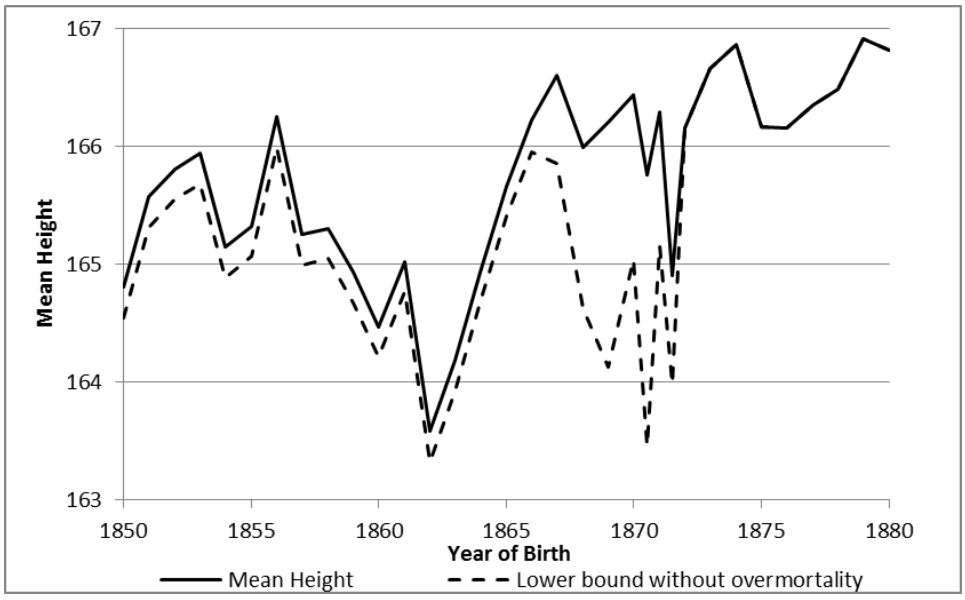
This computation suggests that selective mortality could indeed account for the rather high mean height of birth cohorts 1868-1870, as lower bounds corresponding to maximal selection always lie below observed values by more than one centimetre. In contrast, for the cohorts 1865-1867, over-mortality is not high enough to have any impact.

In the case of the 1871-S2, we can also compute the same type of bounds for the selection potentially generated by under-fertility. Given the uncertainty on the sign of the selection, either a lower bound (negative selection like for mortality) or an upper bound (positive selection) should be considered. Anyhow, the magnitude of under-fertility is so large, with the cohort size being halved, that the bounds lie below or above the observed mean height by more than 5 centimetres. On this

basis, everything is possible: the height loss in this cohort could be strongly under-estimated or purely attributable to some fertility limitation in the most favoured classes of the population.

These bounds are, however, obtained under the very extreme assumption that only the shortest die. If instead we assume that survival chances decrease smoothly from the tallest to the shortest, for instance linearly, simulations show that selection by mortality then has a very limited impact on height variations. For instance, over-mortality in 1869 compared to 1872 reaches 10.4 percentage points (see Table 1). If we assume that these 10.4 points are linearly distributed across the 1872 height distribution such that the tallest always survives and the shortest is 17.6% likely to die, then the spurious height gain associated with over-mortality is estimated at only 1.4 mm.

Figure A.2 - Lower bounds for birth year effects on height for always survivors



Note: 1872 is taken as the benchmark year for standard mortality. The dashed line displays how mean height evolution could have appeared "at its worst" in the absence of over-mortality, particularly if mortality maximally selects the shortest and if the bottom of 1872 height distribution is a good estimate for the missing part of each year. There is one estimate for each birth year except for 1870 and 1871 which are divided in two semesters each.

Coverage: Draft of 19th district; conscripts born in Paris city and neighbouring municipalities.

Source: Conscription records of the 19th district of Paris.

B. Height developments of Paris non-natives and in Paris region

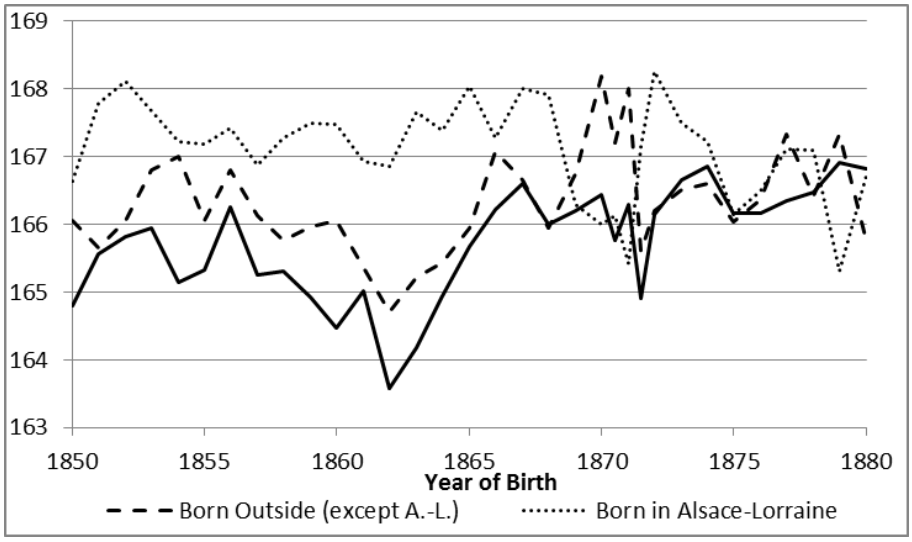
1. Conscripts listed in the 19th district yet born outside greater Paris

As it was not possible to select the conscripts born in Paris *ex ante*, we did collect all conscripts enlisted in the 19th district, whatever their place of birth. For conscripts born outside of Paris, we know they arrived in the 19th district before 20 years old, but we don't know exactly at what age. If we are to believe what little evidence is available, the share of migrants increases linearly with age, from around 3% of the total population before 1 year old to 65% at 20 years old. This is what we get from migration statistics not only in the 1870s (*Bulletins de statistique municipale*, various years), but also from the 1901 census that details Paris residents by 5-year age groups and place of birth.

In addition, we can distinguish, among the non-native recruits, migrants from "Alsace-Lorraine" – 25% of all migrants to the 19th district over the period. They certainly arrived in Paris after 1871 while fleeing Germany's annexation of their region, which was a direct consequence of the war. As we would expect, their share is actually highest in the 1851 birth cohort (drafted in 1871) and then gradually declines.

In Figure B.1., we look at whether the 1860-1864 height losses are also observed for migrants to Paris who were also recruited and measured in the 19th district. Conscripts born outside of Paris start out taller on average, but then Paris natives gradually catch up. Yet, when considering migrants from all places except Alsace-Lorraine, the correlation coefficient with mean height of Paris natives reaches 0.68, or 0.63 when linearly de-trended. That correlation might – even partially – stem from common measurement errors associated with the 19th district recruitment bureau. Nevertheless, no correlation is found between the Alsace-Lorraine mean height series and the two others. As can be seen in Figure B.1., the 1860-1864 height deficit is also observed for conscripts born outside of Paris, although it is between half and two-thirds that of Paris natives. The magnitude of attenuation is consistent with a rather large share of non-native children having migrated to Paris before they reached 6 or 10. Many of them should indeed have arrived when their parents were in their twenties or thirties. Consistently enough, migrants from Alsace-Lorraine –most of whom arrived in Paris after 1871– do not display any height deficit in birth years 1860 to 1864. We conclude that the low height of the 1860-1864 cohorts is not due to measurement error.

Figure B.1. Mean height of conscripts born outside Paris



Note: Alsace-Lorraine corresponds to the 4 following *départements*: Meurthe, Moselle, Haut Rhin and Bas Rhin, all of which were either entirely or partially annexed by Germany in 1871. There is one estimate for each birth year except for 1870 and 1871 which are divided in two semesters each.

Coverage: Draft of 19th district.

Source: Conscription records of the 19th district of Paris.

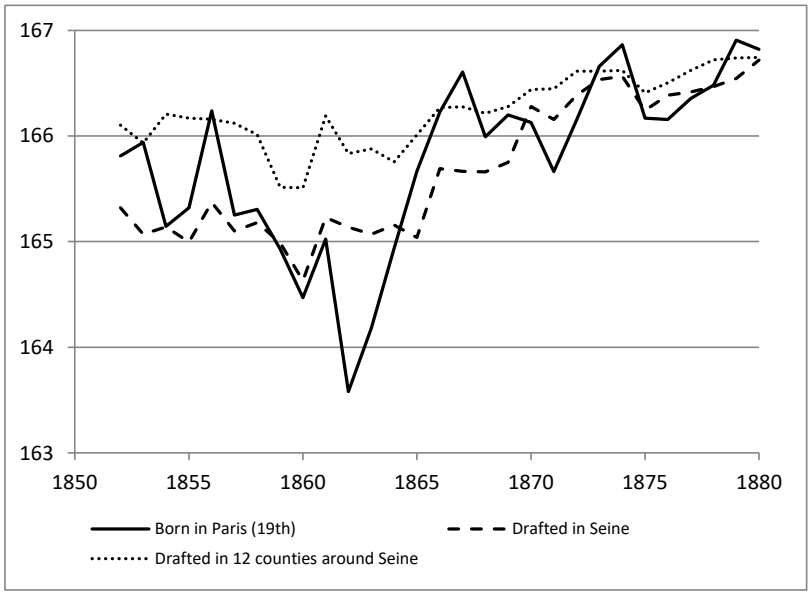
2. Height developments in Paris region

War Ministry reports on conscription provide data on height stature distributions for each county (*département*) from 1872 to 1912 (Ministère de la Guerre 1872-1912), and in particular for the *Seine département*, including Paris. For each year and each county in metropolitan France, the frequency distribution of height is reported in eleven bins. In order to estimate mean height, we fit a normal distribution to the frequency data; we can also abstract from the normality assumption by analysing cumulative distribution coordinates from the raw data, like the proportion of conscripts shorter than 154 cm or taller than 170 cm.

In contrast with our individual data for the 19th district, coverage was limited before 1886. The young men who had been exempted for medical reasons (15% of total) or for family reasons (25% of total) were not included in published height tables. Banerjee et al. (2010) argue that this should not lead to significant biases. In the case of the 19th district, we checked that withdrawing the two kinds of exemptions brought little change to the main features of mean height evolutions.

We compare the 19th district with Seine and also with the average of 12 counties surrounding Seine (Figure B.2.). In the case of large and selective out- or in-migrations between ages 0 and 20, recruits' mean height could differ from natives. Like London (Humphries and Leunig 2009), Paris indeed received large migration inflows, and half of the conscripts recruited at 20 years old in Seine were not born there (Farcy and Faure, 2003). Yet, as shown in Figure B.1., the time profiles of height stature for Paris natives and for Seine display rather high correlations, with a Pearson coefficient reaching 0.78; when linearly de-trended, the series are still correlated at 0.67. Height developments for Seine are also correlated with those of neighbouring counties at 0.92 (de-trended 0.83). In contrast, de-trended correlations with Rhône (Lyon region) or metropolitan France averages are, respectively, -0.09 and 0.12. All three series tell the story of a great improvement in living conditions through an acceleration of height gains after the year 1866. Cohorts born between 1868 and 1871 do not exhibit any height anomalies in the Seine series. This is confirmed when looking at deviations from a linear time trend, and as well at double-differences with other groups of counties: (i) 12 counties around Seine, (ii) Rhône (Lyon region), (iii) average of Rhône, Bouches-du-Rhône and Nord, all major industrial regions (Lyon, Marseille and Lille), and (iv) the whole of metropolitan France (results not shown).

Figure B.2. Mean height in Paris county and other surrounding counties (*départements*)



Source: Conscription records of the 19th district of Paris and War Ministry reports 1872-1912.

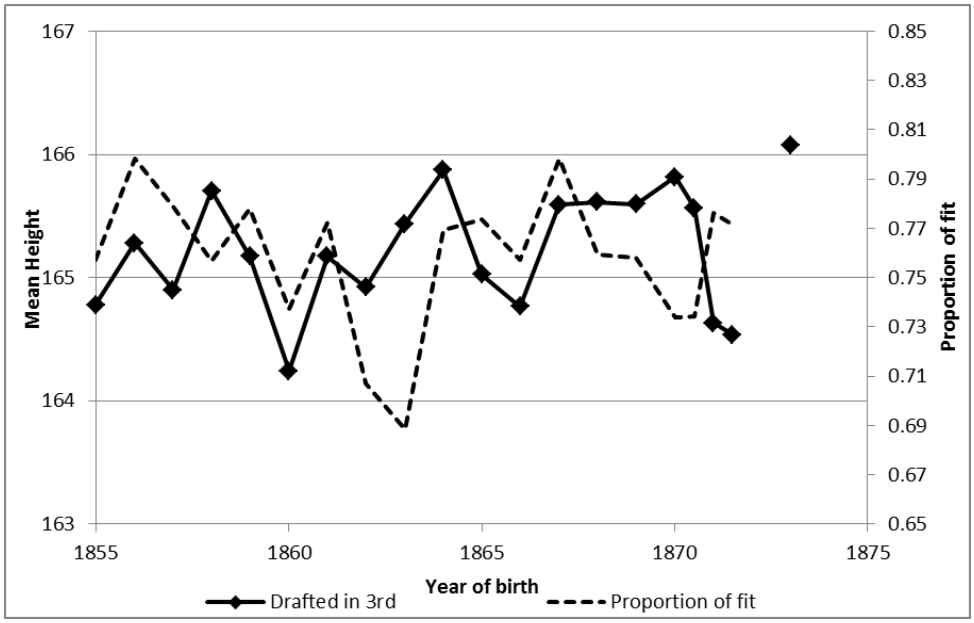
Yet, in contrast with the 19th district, no anomaly is detected here for cohorts born 1860 to 1864. In particular, the very large height deficit for cohorts 1862 and 1863 is no longer observed. Two main factors may explain this difference: (i) Seine data mixes poor neighbourhoods like the 19th district of Paris with rich ones like the 8th; (ii) Seine data is composed for about half of migrants, and between one-half and two-thirds of the 1860-1864 cohorts were not yet in Seine during the siege. Furthermore, the absence of exempted recruits (for birth years before 1866) also adds a source of uncertainty.

C. The 3rd district of Paris and the 4th district of Lyon

1. The 3rd district of Paris

We collected a few data points on conscripts born in Paris and examined for military service in the 3rd district, another rather poor district of Paris. In contrast with the 19th district, no long-term height gain is observed; recruits remain significantly shorter after 1865 (Figure C.1.). The 1862 and 1863 birth cohorts do not suffer from a height loss unlike in the 19th district, yet are more often declared unfit like in the 19th district. Finally, the two cohorts born in 1871, both in the first and the second semester, end up much shorter than the post-crisis 1873 birth cohort, and shorter as well than the pre-crisis average or even the survivors from the 1870 birth cohort. Yet, like for the 1871-S2 cohort in the 19th district, they are not significantly more unfit.

Figure C.1. Mean height and proportion of fit of Paris natives recruited in 3rd district



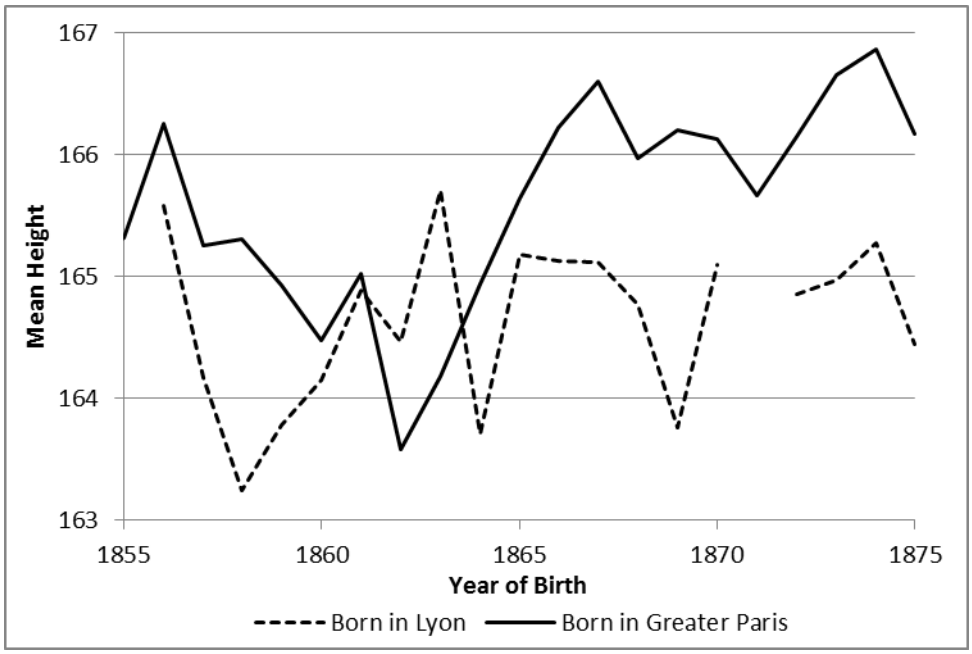
Note: There is one estimate for each birth year except for 1870 and 1871 which are divided in two semesters each.
Source: Conscription records of the 3rd district of Paris. Farcy and Faure (2003) database for 1860.
Coverage: Recruits born in Paris examined for military service in the 3rd district.

2. The 4th district of Lyon

We also collected height data in one of the working-class districts of Lyon (4th district), the second largest city of France, which was quite industrialized at the time. Although Lyon might have suffered indirect effects from the country's state of war, there was nothing comparable to the great

famine that struck Paris. There was also a Commune revolutionary attempt in Lyon but, despite being led by one key anarchist figure (Mikhail Bakounine) it failed twice to establish itself (in September 1870 then March 1871, in both cases in relation with Paris' events). In contrast with Paris, mean height of recruits from Lyon exhibits a narrower range of variation and seems to oscillate around a steady-state level at 164.5 centimetres (Figure C.2.). The two series are little correlated with each other: Pearson's correlation coefficient is equal to 0.33, and 0.22 when de-trended. This suggests that Paris height developments do not reflect nationwide shocks that affected other comparable urban areas.

Figure C.2. Mean height and proportion of fit of Lyon natives recruited in 4th district



Coverage: Recruits born in Lyon examined for military service in the 4th district of Lyon.

Source: Conscription records of the 4th district of Lyon.

D. References

BANERJEE Abhijit, **DUFLO** Esther, **POSTEL-VINAY** Gilles, **WATTS** Tim, 2010, "Long-Run Health Impacts of Income Shocks: Wine and Phylloxera in Nineteenth-Century France", *Review of Economics and Statistics*, 92(4), pp. 714–728.

FARCY Jean-Claude, **FAURE** Alain, 2003, *La mobilité d'une génération de Français : recherche sur les migrations et les déménagements vers et dans Paris à la fin du XIXe siècle*, Paris, INED, Les Cahiers de l'INED, XV–591 p.

HUMPHRIES Jane, **LEUNIG** Tim, 2009, "Was Dick Whittington taller than those he left behind? Anthropometric measures, migration and the quality of life in early nineteenth century London?", *Explorations in Economic History*, 46(1), pp. 120–131.

LEE David S., 2009, "Training, Wages, and Sample Selection: Estimating Sharp Bounds on Treatment Effects", *The Review of Economic Studies*, 76(3), pp. 1071–1102.

MINISTÈRE DE LA GUERRE, various year (1872-1912), Compte-rendu sur le recrutement de l'armée pendant l'année … , Paris, Imprimerie Nationale.