EARLY-LIFE CONDITIONS,
SOCIAL MOBILITY, AND
LONGEVITY

**Working Paper Series 2002: No. 6**
23 August 2002

# STATURE IN TRANSITION:
# A MICRO-LEVEL STUDY FROM NINETEENTH-CENTURY BELGIUM

George Alter, Indiana University
Muriel Neven, University of Liège
Michel Oris, University of Geneva

**ELC is a collaborative research project of Indiana University's Population Institute for Research and Training, University of Geneva's Department of Economic History, University of Liège's Laboratory of Demography, Lund University's Department of Economic History, and the Netherlands Interdisciplinary Demographic Institute.**

http://www.indiana.edu/~pirt/

# Stature in Transition: A Micro-level Study from Nineteenth-century Belgium

George Alter, Indiana University
Muriel Neven, University of Liège
Michel Oris, University of Geneva

Draft: August 28, 2002

Acknowledgements: We are grateful for helpful comments from John Komlos and participants in the International Conference on Economics and Biology, Tübingen, July 11-14, 2002. This research was made possible by a grant from the National Institute on Aging (AG18314-01).

The early nineteenth century was a time of transition in Western Europe, and the balance of costs and benefits continues to be controversial. While an earlier generation of economic historians debated trends in the standard of living in terms of wages and consumption patterns (Taylor 1975; Mokyr 1988), more recent studies have drawn attention to mortality and heights (Szreter and Mooney 1998; Floud, Wachter, and Gregory 1990; Nicholas and Steckel 1991; Komlos 1995). Both of these measures tend to support the "pessimists'" view that most people experienced more of the costs than of the benefits of early industrialization. Komlos (Komlos 1998) offers a number of possible explanations for this "early-industrial-growth puzzle," including increasing inequality, shifts in the relative prices and consumption of types of food, and growing sensitivity to cyclical unemployment. This debate has also divided historians of Belgium (Scholliers 1989), which was the first industrial nation on the European continent. The anthropometric data described here shows that the transition to an industrial society was as costly in Eastern Belgium as it was elsewhere, and it provides a new perspective on both the "puzzle" and the improving standard of living in the second half of the nineteenth century.

Eastern Belgium provides a range of examples of early industrialization. By the eighteenth century it had advanced proto-industrial manufacturing and commerce in woolen textiles and iron goods. In 1799, two rich families of clothiers, the Simonis and the Biolleys, brought English engineer William Cockerill to Verviers to build textile machinery (Desama and Bauwens 1995: 87). A few years later, his son John established an industrial empire in metallurgy and engineering based on the abundant coal in the subsoil around the city of Liège (Soete 1995: 145). Rural areas were also dramatically affected by the process of industrialization. During the eighteenth century, proto-industrial textile production had complemented labor-intensive mixed agriculture (Servais 1982; Neven 2000b). Mechanization

undermined this arrangement, and rural population left the overpopulated but relatively healthy rural areas for higher wages in the cities (Oris 1998; Oris and Alter 2001; Williamson 1981).

In this paper we look at trends in stature in a selection of communities in Eastern Belgium with contrasting histories. We have unusually rich documentation of the anthropometric consequences of these changes in military conscription registers for this area. Since very short (under 155 cm) men were exempt from military service, these registers provide heights, as well as information about occupation, literacy, and sometimes parents' occupations. Men in this area were unusually short in the early nineteenth century, but they were notably taller after 1850. There is also some evidence that rapidly growing urban areas experienced setbacks, as others have found in contemporary populations (Szreter and Mooney 1998).

We also examine differences in height among occupations, which show dramatic differences between rich and poor. The gap between the poorest and the wealthiest was at least eight centimeters. However, gains in height were larger among the poor, reducing differences within the working class by mid-century. This suggests that inequalities in the biological standard of living narrowed after the first stages of industrialization had been achieved.

## Setting: Seven Communities in Eastern Belgium

The territory of what is now the Province of Liège in Eastern Belgium includes a variety of both urban and rural forms (Figure 1). Two distinct urban-industrial agglomerations developed during the nineteenth century: a woolen textiles producing area centered on Verviers and a coal and iron complex in Liège and its suburbs. The region also includes several distinct rural areas with contrasting agricultural histories. Military conscription lists have been examined for the following seven communities[1].

***Charneux***

Charneux lies on a broad plateau north of Verviers known as the "Land of Herve," which is characterized by rich meadows and intensive cattle and dairy production. As early as the 17th Century, the Pays de Herve was transformed from subsistence farming based on cereals to a commercial agriculture based on grazing, meat, milk, butter, and cheese. These new activities required less labor and developed in conjunction with expansion of proto-industrial woolen textile production (Gutmann 1988; Neven 2000a). As the textile industry was mechanized, however, the "Land of Herve" was de-industrialized and textile workers migrated to Verviers and its suburbs. Property ownership, which had been widespread in the eighteenth century, became far more restricted as farmland was consolidated into larger units (Servais 1982; Neven 2000a).

***Polleur and Sart***

In contrast to the rich commercial agriculture in the Land of Herve, farming in the Ardennes region south of Verviers was not as developed. Poor soils and steep slopes were unproductive, and "slash and burn" techniques persisted into the nineteenth century (Vliebergh and Ulens 1912). The commune of Sart covers a large area much of which is a peat bog known as the Hautes Fagnes. In the eighteenth century small iron forges were common, but these had largely disappeared by 1800. The population of Sart grew in the first half of the nineteenth century, amid signs of growing population pressure. Out-migration after 1850 lead to a falling population, and modern agricultural techniques were adopted (Alter and Oris 2000). Polleur is a smaller commune adjacent to Sart. It had similar characteristics, but also included some textile production.

### *Limbourg*

In the Middle Ages Limbourg was the capital of the duchy of the same name, and even in the eighteenth century it was a local market and administrative center. Although its population in 1806 was about the same size as Sart, it covered a much smaller area and had a distinctly urban character. During the nineteenth century Limbourg was integrated into the industrial agglomeration surrounding Verviers, and it included new neighborhoods of industrial workers (Capron 1996).

### *Seraing*

In 1817 Seraing became the focal point for the industrial revolution in Belgium when the Dutch crown gave the Chateau of Seraing to John Cockerill. The Cockerills expanded into iron, steel, and machine building with one of the most modern production facilities in the world (Leboutte 1997: 78; Oris 1995).

### *Tilleur*

In 1806 Tilleur was still a village on the outskirts of Liège. However, Tilleur grew explosively in the 1840s as the *Society of Sclessin* expanded and diversified its activities from coal mining into blast furnaces and iron and steel production (Neven 2000b).

### *Verviers*

Verviers was an important center of woolen textile production as early as the seventeenth century, importing raw wool from Spain and exporting finished cloth to Germany. Before 1800, spinning and weaving mostly took place in peasant cottages in surrounding rural areas, while finishing was done in mills in the city (Gutmann 1988).

Nineteenth-century mechanization resulted in rapid population growth (Desama 1985; Alter 1988).

Contrasting patterns of growth are evident in the population counts given in Table 1. The rural communities (Charneux, Polleur, and Sart) reached their maximum populations around the middle of the nineteenth century. After this point out-migration exceeded natural increase, and their populations decreased. In contrast, our urban localities were boom towns, especially Seraing and Tilleur, which started the century as villages and ended as cities. The growth of Verviers is possibly understated by these figures, since its population spilled over into adjacent communes, like Hodimont and Dison. Limbourg grew more slowly, but it always had a more urban character.

In the first half of the nineteenth century incomes were generally higher in urban areas, but mortality was higher as well. Industrial wages in Belgium were low in comparison to England or the Netherlands (Mokyr 1976) (Scholliers 1996), but the industrial revolution undoubtedly benefited the more skilled workers. Rural areas faced both the loss of proto-industrial employments and growing Malthusian pressure from increasing populations. On the other hand, cities could not expand fast enough to accommodate the migrants streaming into their factories. Consequently, expectations of life at birth were more than ten years lower in urban areas (Table 1). This "urban penalty" increased when growth was most rapid, resulting in an "epidemiological depression" in the first part of the nineteenth century (Szreter and Mooney 1998; Neven 1997; Oris 1998).

**Belgian Military Conscription Lists**

From the time that Eastern Belgium was annexed to France in 1794, military service was universal and obligatory for all men. It is obvious that some men evaded military service during the French regime, when there was almost continual warfare (Quetelet 1843) (Darquenne 1970). However, Belgium was at peace from 1840 to 1914, and even its war of independence against the Netherlands (1830 to 1839) involved little intense fighting. Documentation of military service was also required for other purposes. For example, young men needed to produce a certificate from the local militia to be married. Only the very rich could afford to pay a replacement to serve for them.

All young men were required to report for examination at age 19 or 20, and the data used here come from the lists compiled by local examiners. Unfortunately, complete series of conscription lists have not survived for any of the communes examined here. Table 2 summarizes the conscription lists available for each commune. Internal evidence suggests that these lists were nearly complete. Men of all social classes are included, including a viscount examined in Verviers in 1899, and our efforts to link conscription lists to population registers have been very successful.

The age at which men were measured changed twice during the period from which our data are drawn. Men were measured at age 20 under the French regime, but they were examined at age 19 under Dutch rule from 1816 to 1829[2]. Belgian authorities continued to use age 19 until 1849, when the age of examination was raised to 20 again. Final height is often reached at a later age when nutrition is poor (Bogin 1999: 92), and even the 20 year-olds in our samples were probably still growing. This is apparent in Figure 2, which shows distributions of heights for 19 and 20 year old men. The mean height of 19 year-olds was 161.3 cm (standard deviation 8.8)

compared to 164.7 (standard deviation 7.4) for the 20 year-olds. However, this overstates the growth between 19 and 20, because most of the older men were in later birth cohorts. In the analysis below we include age in the regression models to account for differences in ages when height was measured.

Since men who failed to reach the minimum height (155 centimeters) were exempt from service, heights were carefully recorded. Table 3 shows that almost one third of recorded heights were given in millimeters. There was some tendency to heap on digits ending in 0 and 5.[3] Figure 2 also shows that the distribution of heights was not truncated by a minimum height requirement, as it would be if we had only the heights of men who served in the military. We have no reason to believe that the heights that we do have are an unrepresentative sample, but heights were sometimes not reported, especially in the surviving lists from Charneux. Since heights were most often omitted when men were exempt from military service, Table 4 examines the average heights of men by type of exemption in the data from Sart. Of course, men who were exempt because they were too short were generally under 155 cm, but other types of exemptions did not favor the very short.

The other information available in the conscription lists varied over time. The subject's occupation was always given, and usually the occupation of his mother and father was there as well. Some registers also record literacy and numeracy.

**Trends in Height**

In the early nineteenth century Belgian men were short by contemporary standards. The average height of 19-year olds measured between 1816 and 1847 in our seven communes was only 161.3 centimeters. Even allowing three additional centimeters for catch-up growth, they would not have reached 165 centimeters, which had already been exceeded by young men in

England, Sweden, Denmark, and France (Fogel 1994: Table 1; Floud 1994). The 20-year olds measured after 1849 were 164.7 centimeters, which is close to the average of 164.3 computed by Quetelet for Belgian conscription lists from 1842 to 1865 (Quetelet, Vilquin, and Sanderson 1997: 354), but still well below other West Europeans[4].

Clear evidence of increasing stature is found in Figure 3, which shows distributions of heights for men examined 1806-1814, 1816-1847, and 1849-1900. Since men were examined at age 19 in the middle period, Figure 3 includes an additional curve in which that distribution is shifted 2 centimeters to the right. Men examined after 1849 (born after 1828) were not only taller, the distribution was also narrower with a higher proportion men concentrated around the median. We will return to this reduction in the variance of heights in our analysis of heights by occupation below.

Table 5 and Figures 4 and 5 examine the trends in height in more detail. In Sart, which was very poor at the start of the century, heights increased steadily after 1820. It is far more difficult to describe trends in the other places. The urban areas are consistent with the interpretation that worsening urban conditions reduced heights in the first half of the nineteenth century. Limbourg, Tilleur, and Verviers all show periods of falling heights. In Tilleur, heights dropped by about two centimeters in the cohort born in the 1840s, who would have been children when it was changing from a village to a town.

These data do not suggest that heights were lower in urban areas. Indeed, the lowest heights tended to be in Sart and Polleur, which were known as very poor rural areas. While men raised in nineteenth-century cities were often shorter than their rural counterparts, Quetelet also found that men from Brussels and two other cities were taller than those from surrounding rural communes (Quetelet 1969: 59).

## Height and Occupation

Differences in income and living conditions can result in large differences in stature among socio-economic groups. For example, Komlos (Komlos 1990) found that the heights of eighteenth-century German school children were strongly related to social class, and similar differences are observed among children in both developed and developing countries today (Bogin 1999: 304-312). Kuh, Power, and Rodgers (Kuh, Power, and Rodgers 1991) found that British men in non-manual occupations were almost two centimeters taller than those in manual occupations, a difference that persisted in birth cohorts from 1900 to 1960.

In this section we compare the heights of selected occupations reported in the conscription lists. In our view, these occupations tell us more about the socio-economic standing of their families than about the young men themselves. Occupational inheritance was common in both rural and urban areas during the nineteenth century, when skills were often handed down. Furthermore, the occupations of these young men often reveal distinctions not apparent in their fathers' occupations. For example, two thirds of adult men in Sart were listed as "*cultivateurs*" (farmers), but men in the conscription lists were much more likely "*domestiques*" (servants) or "*journaliers*" (day laborers). It is quite likely that the young men described as "*cultivateurs*" came from families that owned more land than their peers. Similarly, men who were still "*étudiants*" (students) at age 20 came from families that could afford them the leisure to remain in school.

Since occupations varied by location and the age at measurement changed, we use regression models to create synthetic estimates of height by occupation. Separate models were estimated for cohorts born 1800-49 and 1850-99 to look for changes in the relative heights of occupations. These models include age, year of measurement to capture the upward trend in

height, and dummy variables for communes (Limbourg omitted) and the most common occupations (urban day laborers omitted). Table 6 presents the full models. In Table 7 and Figure 6 we present mean heights for selected occupations in cohorts born in1825 and 1875 predicted by the regression models.

The regression models provide little evidence of trend within each half century, but men born after 1850 were substantially taller. Both models have small positive coefficients for the year of measurement, neither of which is statistically significant. Nevertheless, when we compute the predicted heights for specific occupations (Table 7), we find growth. Urban day laborers, for example, were 6.5 centimeters taller in 1875 than in 1825.

Both regression models also suggest significant growth between ages 19 and 20[5]. One year of age added 1.63 and 1.47 centimeters in the first and second halves of the century respectively.

There are very large differences in heights by occupation among men born before 1850. Several occupations were notably short with average heights around 160 centimeters, while skilled and white collar occupations were more than five centimeters taller. For example, day laborers in both rural and urban areas were 161-162 centimeters. In contrast, most artisans and skilled industrial workers were 166-167 cm, while students averaged almost 170 centimeters.

Every occupational group made progress after 1850, but the largest increases tended to occur among the poorest and shortest occupations. For example, urban day laborers grew from 160.9 in 1825 to 167.4 cm in 1875, a 6.5 cm increase, while joiners grew by only one centimeter (166.2 to 167.2). Consequently, differences in height were substantially reduced. Tests of statistical significance in the regression model support the impression of convergence. In the model for those born before 1850, we can reject the hypothesis that men were the same height as

urban day laborers for all occupations except rural day laborers, coal miners, factory workers, servants, iron rollers, and *laineurs*[6]. For cohorts born after 1850, only students, mechanics, and employees were significantly taller than urban day laborers, while coal miners and wool workers were shorter. Students, who came from the most advantageous backgrounds, were 8.5 centimeters taller than day laborers in the first half of the century, and they remained 3.3 centimeters taller after 1850.

Thus, differences within the working class diminished after 1850, while the advantage of the bourgeoisie was smaller but still important. The tendency toward convergence is also reflected in a lower variance in the distribution of heights after 1850. This can be observed visually in Figure 3 in which the distribution of heights measured between 1849 and 1900 is noticeably taller and thinner than the two earlier distributions. The standard deviations of the distributions for 1806-1814 and 1816-1847 were 9.0 and 8.9 centimeters, but the standard deviation for men measured between 1849 and 1900 was 7.3 centimeters. Floud et al. (1990: 221-223) report a similar convergence in heights by occupation during the English industrial revolution.

## Conclusion

The early nineteenth century was a time of transition in Eastern Belgium, and the military conscription lists show how costly that transition was. Men who reported for military service were short even by contemporary standards. Moreover, there were very large differences among them. Members of the bourgeoisie literally looked down upon the poor. Until 1850, economic modernization seems to have produced as many losers as winners. In rural areas, populations were rising, and opportunities for proto-industrial employment were contracting. Rural migrants dampened the growth of wage rates and worsened sanitary conditions in the rapidly growing

towns. Eventually, migration relieved rural population pressure, and industrial expansion raised incomes for even the poor. Anthropometric studies of other places in Europe and North America suggest that men were shorter in the early nineteenth century than in the eighteenth century. Since we do not have comparable eighteenth-century information, we do not know whether men were taller then, but it is a reasonable speculation.

The patterns described here suggest that many people went hungry in early nineteenth-century Eastern Belgium. Analyses of Flemish urban and rural areas have shown a decline in per capita consumption (Oris, Alter, and Neven Forthcoming), but our data are the first identifying the same trend in the Walloon areas. While the metabolic costs of fighting disease can also result in short stature, differences in height among occupational groups are more likely to reflect differences in income than in exposure to disease. Only the very wealthy could have separated themselves from sources of infection, which may account for part of the persistent advantage of the students in our data. On the other hand, average heights in three of our urban areas seem to drop before rising again, which may have been caused by worsening health conditions.

The convergence of heights across occupations after 1850 is just as striking as the differences before that date. Although the elite maintained an advantage, the benefits of industrialization were finally spreading downward.

**Table 1.**
**Principal Activity and Population in Seven East Belgium Communes**

| Commune | Principal activity | Population 1806 | Population 1846 | Population 1910 | Life expectancy circa 1846 |
|---|---|---|---|---|---|
| Charneux | Agriculture | | 2,120 | 1,527 | 42 |
| Polleur | Agriculture | 1,046 | 1,350 | 1,286 | 47 |
| Sart | Agriculture | 1,791 | 2,380 | 2,175 | 40 |
| Limbourg | Textiles | 1,945 | 1,763 | 4,699 | 40 |
| Seraing | Coal, iron, and machinery | 1,955 | 10,540 | 41,015 | 34 |
| Tilleur | Coal and iron | 496 | 1,356 | 6,750 | 30 |
| Verviers | Textiles | 10,659 | 23,363 | 46,948 | 32 |

Sources: (Alter 1978; Capron 1998; Neven 2000a).

**Table 2.**
**Years of Available Conscription Lists and Number of Observations in Seven East Belgian Communes**

| Commune | Years observed: Earliest | Years observed: Latest | Number observed | Number with height | Percent with Height |
|---|---|---|---|---|---|
| Rural: | | | | | |
| Charneux | 1825 | 1881 | 1308 | 456 | 35% |
| Polleur | 1806 | 1879 | 237 | 226 | 95% |
| Sart | 1806 | 1880 | 1280 | 1130 | 88% |
| Urban: | | | | 0 | |
| Limbourg | 1813 | 1890 | 1480 | 1446 | 98% |
| Seraing[a] | 1835 | 1889 | 700 | 654 | 93% |
| Tilleur | 1830 | 1900 | 1914 | 1553 | 81% |
| Verviers[a] | 1822 | 1862 (1899) | 1310 | 1164 | 89% |
| Total | 1806 | 1900 | 8229 | 6629 | 81% |

[a] Samples were drawn for Seraing and Verviers consisting of men whose surnames began with the letter "b."

Sources: Conscription lists are found in the Archives de l'Etat Liège in the "Fonds Francais," "Fonds Hollandais," and "Communes" under the heading "Miliciens" and in the Archives de la Ville de Verviers.

**Table 3.**
**Number of Heights Recorded in Millimeters, Seven East Belgium Communes**

| Millimeters | Number | Percent |
|---|---|---|
| 0 | 4559 | 68.8 |
| 1 | 83 | 1.3 |
| 2 | 189 | 2.9 |
| 3 | 133 | 2.0 |
| 4 | 125 | 1.9 |
| 5 | 1018 | 15.4 |
| 6 | 125 | 1.9 |
| 7 | 130 | 2.0 |
| 8 | 177 | 2.7 |
| 9 | 90 | 1.4 |
| Total | 6629 | 100.0 |

Sources: See Table 2 and text.

**Table 4.**
**Mean Height by Type of Exemption from Service, Sart, Conscription Lists 1851-1880**

| Type of exemption | Mean height | Number | % reporting height | % of exempt |
|---|---|---|---|---|
| No information | 162.8 | 808 | 93.0% | |
| Designated for service (not exempt) | 164.6 | 251 | 95.4% | |
| Too short | 150.5 | 173 | 79.7% | 58.6% |
| Only child | 169.6 | 2 | 11.1% | 0.7% |
| Brother in military service | 164.4 | 32 | 59.3% | 10.8% |
| Definitive exemption | 161.7 | 49 | 98.0% | 16.6% |
| Exempt for one year | 160.1 | 36 | 80.0% | 12.2% |
| Sole support of parents | 164.7 | 3 | 60.0% | 1.0% |
| All | 161.5 | 1354 | 89.0% | |

Sources: See Table 2 and text.

**Table 5.**
**Mean Height at Age 20 by Decade of Birth from Military Conscription Lists in Seven Communes in East Belgium**
(Estimated by regression models to adjust for differences in age at examination.)

| Decade of Birth | Charneux | Limbourg | Polleur | Sart | Seraing | Tilleur | Verviers |
|---|---|---|---|---|---|---|---|
| 1780s | | | | 158.7 | | | |
| 1790s | | 163.6 | | 160.5 | | | |
| 1800s | 159.7 | 163.6 | | | | | 164.7 |
| 1810s | 161.1 | 162.3 | 162.6 | 160.2 | 162.2 | 164.4 | 162.3 |
| 1820s | | 161.7 | | 159.7 | 164.3 | 165.6 | 162.8 |
| 1830s | | 162.5 | | 160.7 | 165.8 | 164.0 | 162.4 |
| 1840s | 168.3 | 165.1 | 163.8 | 162.7 | 165.6 | 162.1 | 161.6 |
| 1850s | 167.4 | 166.1 | 162.5 | 164.2 | 165.4 | 165.8 | |
| 1860s | | 166.9 | | 165.6 | 164.2 | 166.0 | |
| 1870s | | 166.5 | | | | 166.0 | 164.7 |
| 1880s | | | | | | 166.2 | |

Sources: See Table 2 and text.

**Table 6.**
**Regression Models of Height in Military Conscription Lists, Cohorts Born 1800-49 and 1850-80, Seven East Belgium Communes**

| | 1800-49 | | | 1850-80 | | |
|---|---|---|---|---|---|---|
| **Covariate** | **Coefficient** | **SE** | **p-value** | **Coefficient** | **SE** | **p-value** |
| Year | 0.01 | 0.02 | 0.66 | 0.01 | 0.02 | 0.78 |
| Age | 1.63 | 0.37 | 0.00 | 1.47 | 0.41 | 0.00 |
| Commune | | | | | | |
| Charneux | 0.01 | 0.61 | 0.99 | 0.84 | 0.67 | 0.22 |
| Polleur | -0.03 | 0.95 | 0.98 | -4.41 | 3.38 | 0.19 |
| Sart | -1.48 | 0.60 | 0.01 | -3.21 | 0.64 | 0.00 |
| Limbourg | 0.00 | (Reference) | | 0.00 | (Reference) | |
| Seraing | 4.08 | 0.71 | 0.00 | -1.44 | 0.50 | 0.00 |
| Tilleur | 2.14 | 0.81 | 0.01 | -0.27 | 0.42 | 0.52 |
| Verviers | 0.20 | 0.43 | 0.65 | -2.77 | 0.58 | 0.00 |
| Occupation | | | | | | |
| Cultivateur | 4.52 | 0.86 | 0.00 | 1.25 | 0.83 | 0.13 |
| Laborer - rural | 0.92 | 0.96 | 0.34 | -0.61 | 0.82 | 0.46 |
| Coal miner | -1.65 | 0.98 | 0.09 | -2.16 | 0.63 | 0.00 |
| Weaver | 3.31 | 0.90 | 0.00 | -1.39 | 1.15 | 0.23 |
| Factory worker | -0.71 | 1.28 | 0.58 | -1.47 | 0.79 | 0.06 |
| Joiner | 5.36 | 1.10 | 0.00 | -0.18 | 1.01 | 0.86 |
| Shoemaker | 4.23 | 1.06 | 0.00 | -0.78 | 1.05 | 0.45 |
| Student | 8.51 | 1.30 | 0.00 | 3.28 | 0.96 | 0.00 |
| Spinner | 3.47 | 1.01 | 0.00 | -0.16 | 1.31 | 0.90 |
| Laborer - urban | 0.00 | (Reference) | | 0.00 | (Reference) | |
| Domestique | 1.35 | 1.34 | 0.31 | -0.51 | 1.32 | 0.70 |
| Wool worker | 2.93 | 1.10 | 0.01 | -2.00 | 0.87 | 0.02 |
| Roller | 3.10 | 2.27 | 0.17 | -0.59 | 0.90 | 0.51 |
| Laineur | 1.22 | 1.03 | 0.24 | 5.39 | 6.67 | 0.42 |
| Mechanic | 7.98 | 1.67 | 0.00 | 2.18 | 0.98 | 0.03 |
| Employee | 4.71 | 1.73 | 0.01 | 0.95 | 0.84 | 0.26 |
| Other | 2.41 | 0.72 | 0.00 | 0.45 | 0.60 | 0.46 |
| Constant | 112.79 | 28.45 | 0.00 | 127.53 | 36.04 | 0.00 |
| R-squared | 0.07 | | | 0.06 | | |
| F | 10.09 | | | 7.53 | | |
| p-value | 0.00 | | | 0.00 | | |
| df | 24 / 3115 | | | 24 / 3076 | | |
| N | 3139 | | | 3100 | | |

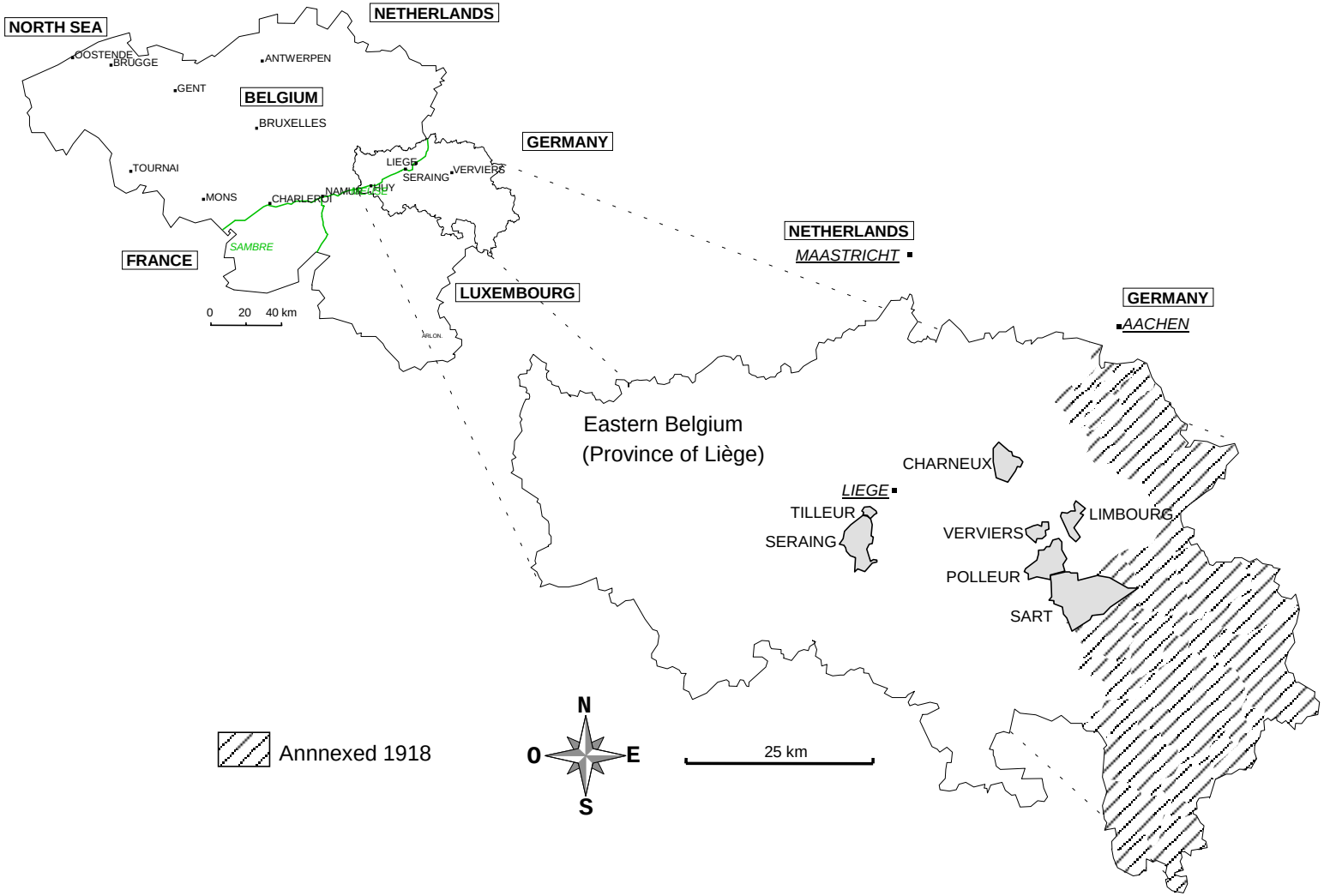
Sources: See Table 2 and text.

**Table 7.**
**Mean Height for Men Born in 1825 and 1875 by Occupation from Regression Models, Military Conscription Lists, Cohorts Born 1800-49 and 1850-80, Seven East Belgium Communes**

| Occupation | 1825 | 1875 | Difference |
|---|---|---|---|
| Coal miner | 159.2 | 165.2 | 6.0 |
| Factory worker | 160.2 | 165.9 | 5.8 |
| Laborer - urban | 160.9 | 167.4 | 6.5 |
| Laborer - rural | 161.8 | 166.8 | 5.0 |
| Laineur | 162.1 | | |
| Domestique | 162.2 | 166.9 | 4.7 |
| Wool worker | 163.8 | 165.4 | 1.6 |
| Roller | 164.0 | 166.8 | 2.8 |
| Weaver | 164.2 | 166.0 | 1.8 |
| Spinner | 164.3 | 167.2 | 2.9 |
| Shoemaker | 165.1 | 166.6 | 1.5 |
| Cultivateur | 165.4 | 168.6 | 3.3 |
| Employee | 165.6 | 168.3 | 2.8 |
| Joiner | 166.2 | 167.2 | 1.0 |
| Mechanic | 168.8 | 169.6 | 0.7 |
| Student | 169.4 | 170.7 | 1.3 |

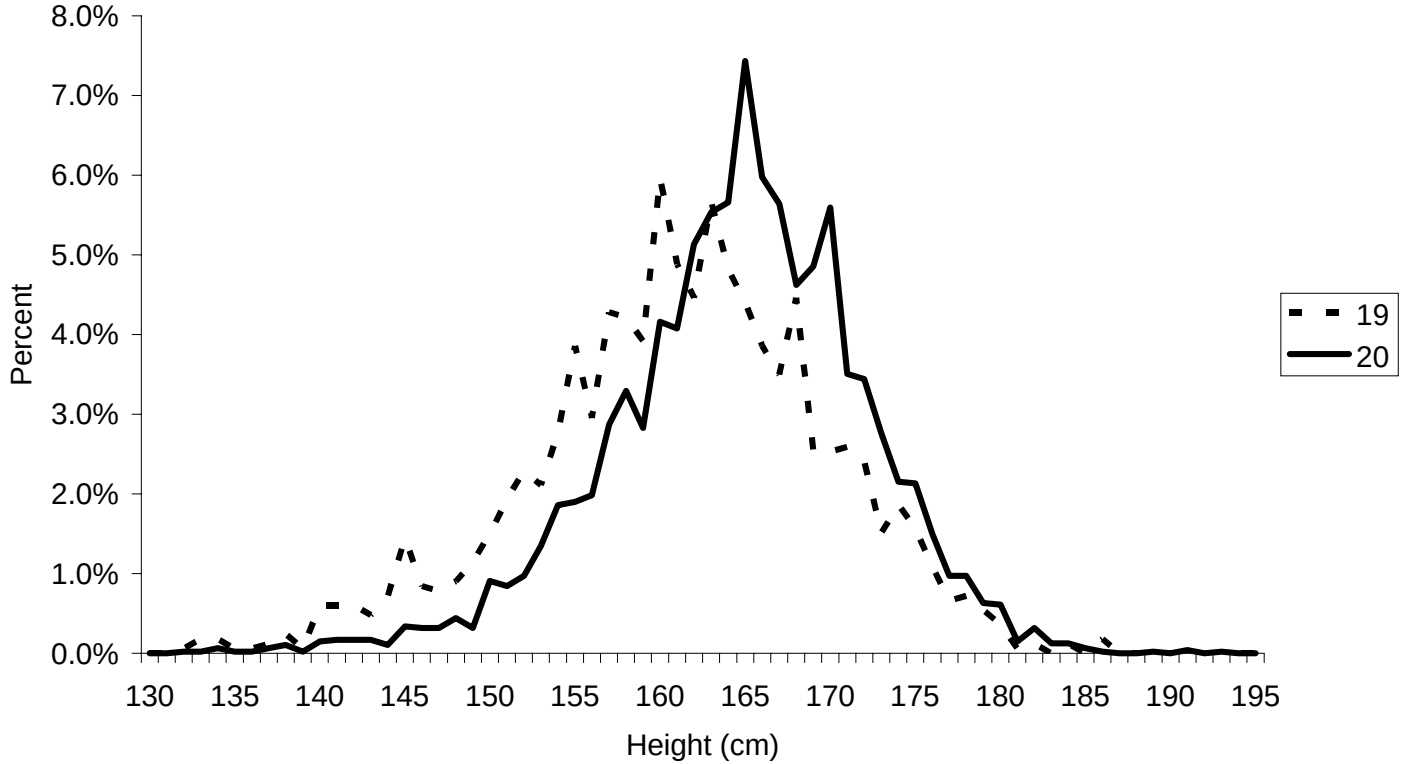
Sources: See Table 2 and text.

# Figure 1. Map of the Province of Liège



## Figure 2

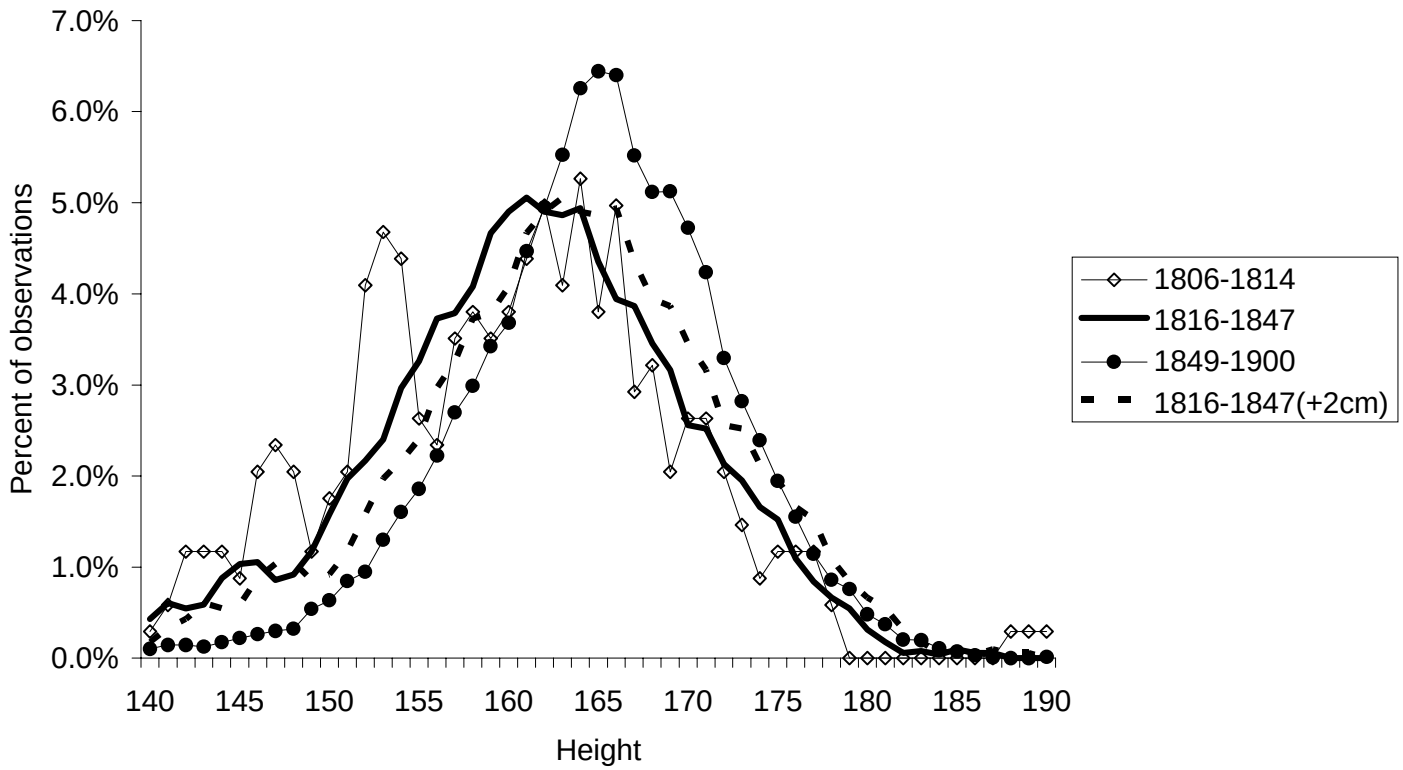
Percent of Cases by Height for Ages 19 and 20,
Military Conscription Lists from Seven East Belgian Communes, 1806-1900




Sources: See Table 2 and text.

## Figure 3

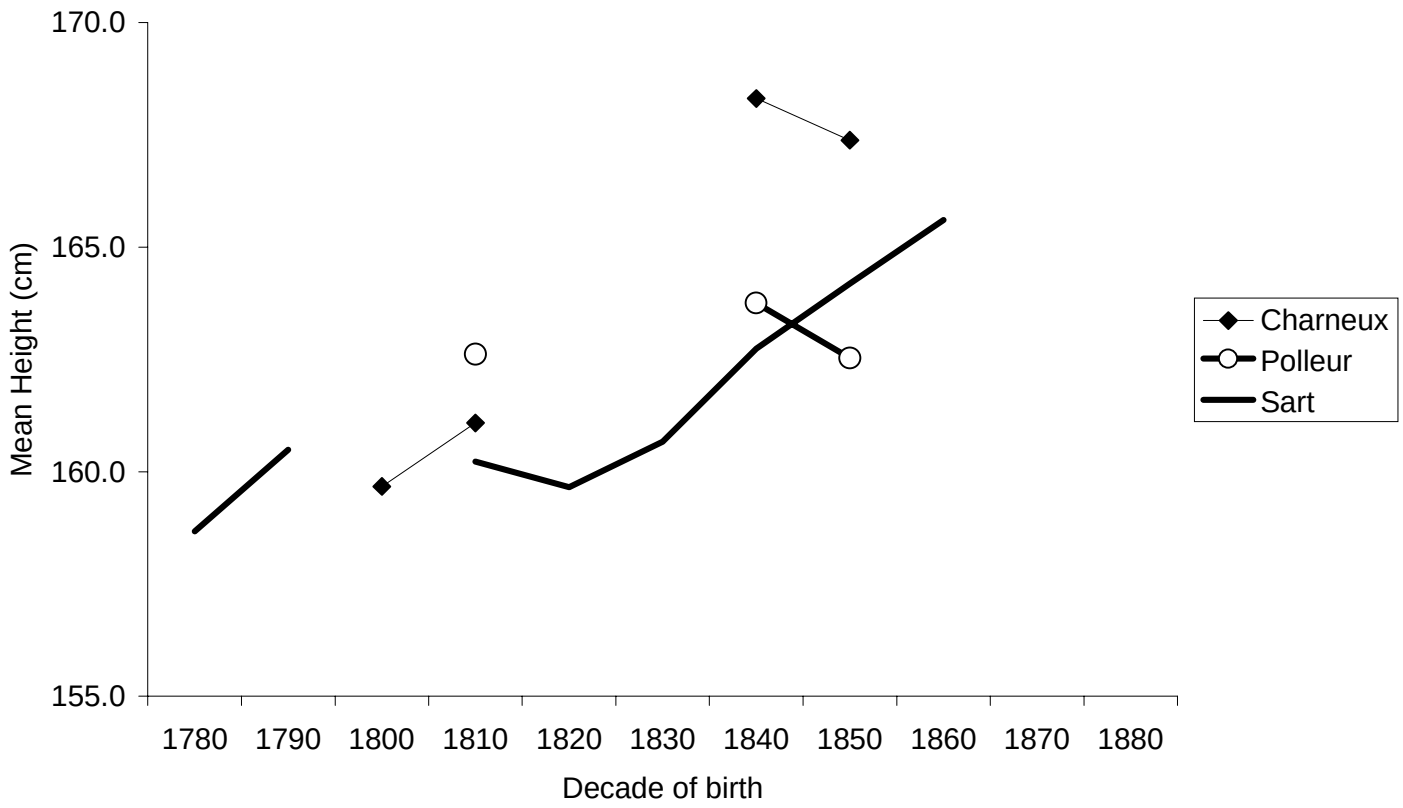
Percent of Observations by Height and Year of Registration, Military Conscription Lists in Seven East Belgian Communes
(3-point moving average)




Sources: See Table 2 and text.

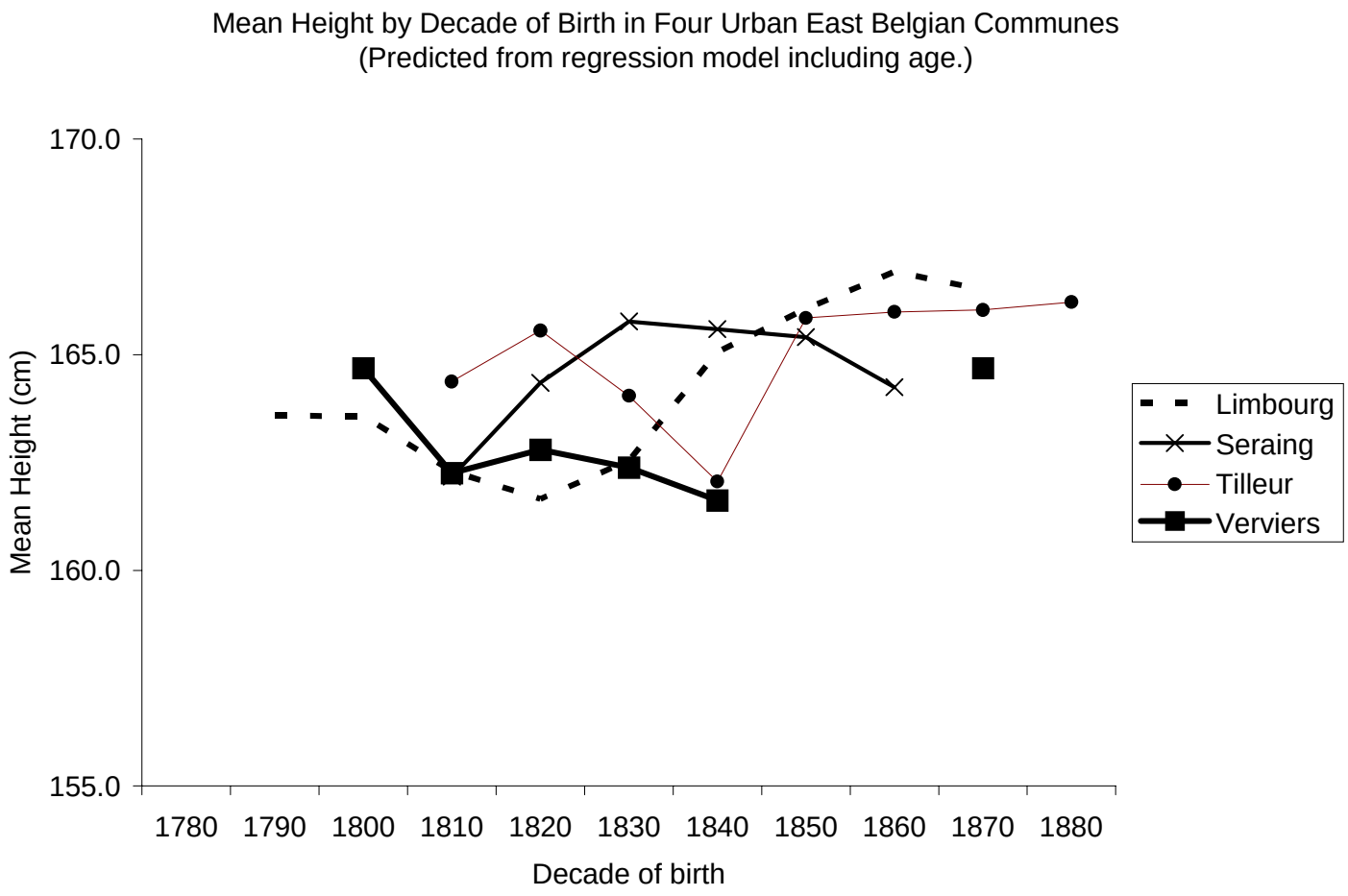
# Figure 4

Mean Height by Decade of Birth in Three Rural East Belgian Communes
(Predicted from regression model including age.)



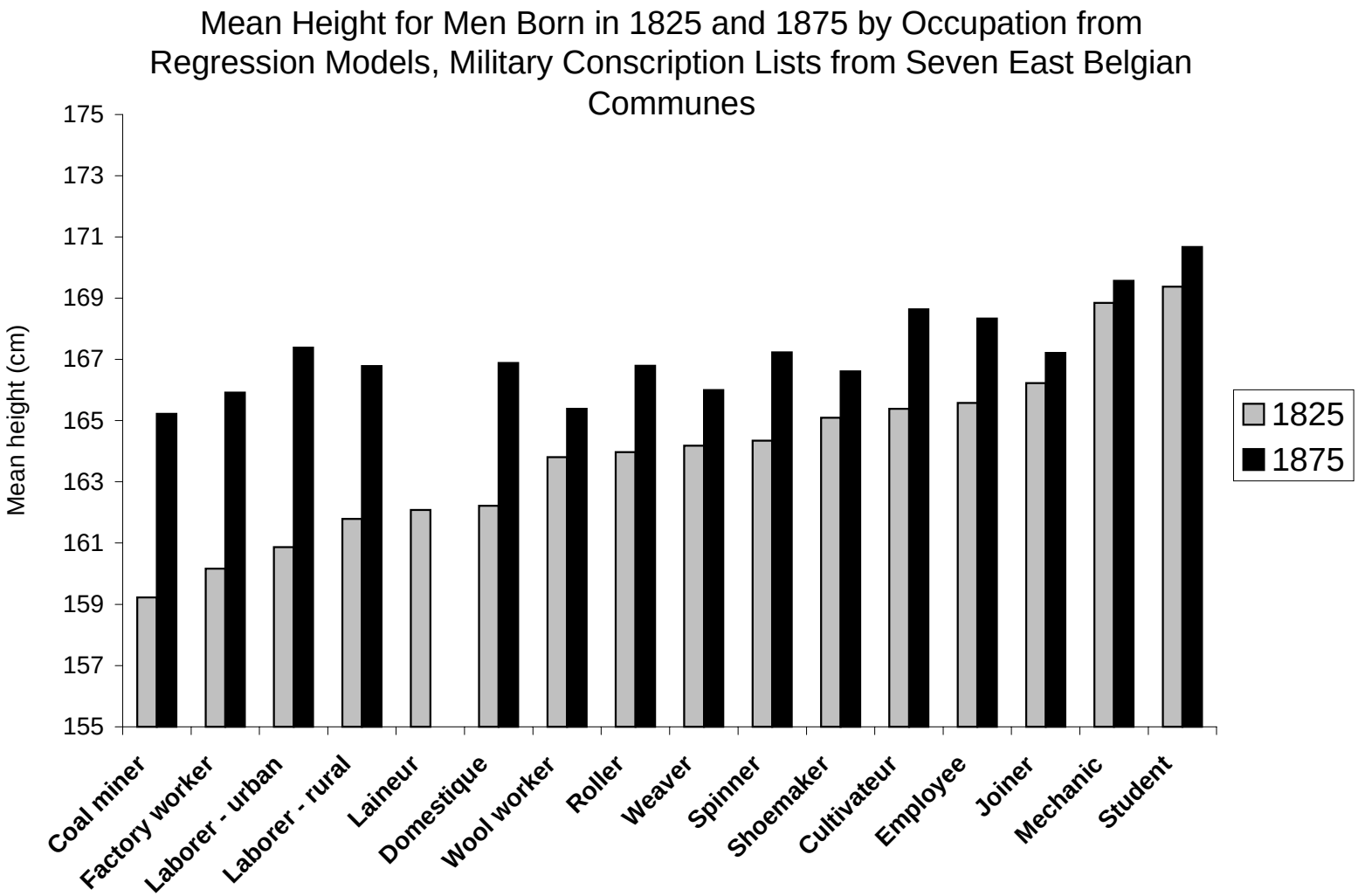

Sources: See Table 2 and text.

# Figure 5




Sources: See Table 2 and text.

# Figure 6




Sources: See Table 2 and text.

# References


Alter, George. 1978. "The Influence of Social Stratification on Marriage in Nineteenth-Century Europe." University of Pennsylvania, Philadelphia, PA.

Alter, George. 1988. *Family and the Female Life Course: The Women of Verviers, Belgium, 1849-1880*. Madison, Wis.: University of Wisconsin Press.

Alter, George and Michel Oris. 2000. "Mortality and Economic Stress: Individual and Household Responses in a Nineteenth-Century Belgian Village." Pp. 335-70 in *Population and Economy: From Hunger to Modern Economic Growth*, editors Tommy Bengtsson and O. Saito. Oxford: Oxford University Press.

Bogin, Barry. 1999. *Patterns of Human Growth*. 2nd ed ed. New York: Cambridge University Press.

Capron, Catherine. 1996. "La Population De Limbourg Au Milieu Du 19e Siècle: Un Essai De Démographie Différentielle." University of Liège, History.

———. 1998. "Mortalité Différentielle Et Causes De Décès à Limbourg Au Milieu Du 19e Siècle." *Bulletin Du Crédit Communal* 52(203):45-62.

1970. Mons: Cercle archéologique de Mons.

Desama, Claude. 1985. *Population Et Révolution Industrielle. Evolution Des Structures Démographiques à Verviers Pendant La Première Moitié Du 19e Siècle*. Paris: Les Belles-Lettres.

Desama, Claude and C. Bauwens. 1995. "Une Petite Ville Au Cœur De La Révolution Industrielle: Verviers Et Le Travail De La Laine." Pp. 87-128 in *La Belgique Industrielle En 1850*, editors Bart Van der Herten, Michel Oris, and Jan Rogiers. Brussels: Crédit Communal.

Floud, Roderick. 1994. " The Heights of Europeans Since 1750: A New Source for European Economic History." Pp. 9-24 in *Stature, Living Standards, and Economic Development.*

*Essays in Anthropometric History*, editor John Komlos. Chicago: University of Chicago Press.

Floud, Roderick, Kenneth W. Wachter, and Annabel Gregory. 1990. *Height, Health, and History: Nutritional Status in the United Kingdom, 1750-1980*. Cambridge; New York: Cambridge University Press.

Fogel, R. W. 1994. "Economic-Growth, Population Theory, and Physiology - the Bearing of Long-Term Processes on the Making of Economic-Policy." *American Economic Review* 84(3):369-95.

Gutmann, Myron P. 1988. *Toward the Modern Economy Early Industry in Europe, 1500-1800*. 1st ed ed. Philadelphia: Temple University Press.

Komlos, J. 1990. "Height and Social-Status in 18th-Century Germany." *Journal of Interdisciplinary History* 20(4):607-21.

———. 1998. "Shrinking in a Growing Economy? The Mystery of Physical Stature During the Industrial Revolution." *Journal of Economic History* 58(3):779-802.

Komlos, John. 1995. *The Biological Standard of Living in Europe and America, 1700-1900 Studies in Anthropometric History*. Aldershot, Great Britain: Brookfield, Vt. Variorum.

Kuh, D. L., C. Power, and B. Rodgers. 1991. "Secular Trends in Social-Class and Sex-Differences in Adult Height." *International Journal of Epidemiology* 20(4):1001-9.

Leboutte, René. 1997. *Vie Et Mort Des Bassins Industriels En Europe 1750-2000* . Paris: L'Harmattan.

Mokyr, J. 1988. "Is There Still-Life in the Pessimist Case - Consumption During the Industrial-Revolution, 1790-1850." *Journal of Economic History* 48(1):69-92.

Mokyr, Joel. 1976. *Industrialization in the Low Countries, 1795-1850*. New Haven: Yale University Press.

Neven, Muriel. 1997. "Epidemiology of Town and Countryside. Mortality and Causes of Death in East Belgium, 1850-1910." *Revue Belge D'Histoire Contemporaine* 27(1/2):39-82.

———. 2000a. "Dynamique Individuelle Et Reproduction Familiale Au Sein D'Une Société Rurale. Le Pays De Herve Dans La Seconde Moitié Du 19e Siècle." dissertation, University of Liège.

———. 2000b. "Mortality Differentials and the Peculiarities of Mortality in an Urban-Industrial Population: A Case-Study of Tilleur, Belgium." *Continuity and Change* 15(2):297-329.

Nicholas, S. and R. H. Steckel. 1991. "Heights and Living Standards of English Workers During the Early Years of Industrialization, 1770-1815." *Journal of Economic History* 51(4):937-57.

Oris, M. 1995. "Public Health and Medical Care in an Industrial City - Seraing in the 19th-Century and Early 20th-Century." *Revue Belge De Philologie Et D Histoire* 73(4):983-1009.

Oris, Michel. 1998. "Mortalité, Industrialisation Et Urbanisation Au 19e Siècle." Pp. 289-322 in *Dix Essais Sur La Démographie Urbaine De La Wallonie Au 19e Siècle*, editors Claude Desama and Michel Oris. Brussels: Crédit communal.

Oris, Michel and George Alter. 2001. "Paths to the City and Roads to Death. Mortality and Migration in East Belgium During the Industrial Revolution." *Revue Belge D'Histoire Contemporaine* XXXI(3-4):453-95.

Oris, Michel, George Alter, and Muriel Neven. Forthcoming. "Individuals, Households and Communities Facing Economic Stresses: a Comparison of Two Rural Areas in 19th Century Belgium." *New Evidence on the Standard of Living in Pre-Industrial Europe and Asia*, editors R. C. Allen, T. Bengtsson, and M. Dribe.

Quetelet, Adolphe. 1843. "Sur La Répartition Du Contingent Des Communes Dans Les Levées De Milice." *Bulletin De La Commission Centrale De Statistique* I:345-82.

———. 1969. *A Treatise on Man and the Development of His Faculties A Facsim. Reproduction of the English Translation of 1842*. Gainesville, Fla: Scholars' Facsimiles & Reprints.

Quetelet, Adolphe, Eric Vilquin, and Jean-Paul Sanderson. 1997. *Physique Sociale, Ou, Essai*

*Sur Le Développement Des Facultés De L'Homme*. Brussels: Académie royale de Belgique.

Scholliers, Peter. 1989. "Introduction." Pp. 3-12 in *Real Wages in 19th and 20th Century Europe: Historical and Comparative Perspectives*, editor Peter Scholliers. New York-Oxford: Berg.

———. 1996. "Real Wages and the Standard of Living in the Nineteenth- and Early Twentieth Centuries." *Vierteljahrschrift Fur Sozial- Und Wirtschaftesgeschichte* 83(3):307-33.

Servais, Paul. 1982. "Industries Rurales Et Structures Agraires: Le Cas De L'Entre-Vesdre-Et-Meuse Aux XVIIIe Et XIXe Siččles." Pp. 179-206 in , vol. 13.

Soete, A. 1995. "De Cockerill à Bessemer: L'Industrie Métallurgique Lourde." Pp. 145-76 in *La Belgique Industrielle En 1850*, editors Bart Van der Herten, Michel Oris, and Jan Rogiers. Brussels: Crédit Communal.

Szreter, S. and G. Mooney. 1998. "Urbanization, Mortality, and the Standard of Living Debate: New Estimates of the Expectation of Life at Birth in Nineteenth- Century British Cities." *Economic History Review* 51(1):84-+.

Taylor, Arthur J. 1975. *The Standard of Living in Britain in the Industrial Revolution*. London: Methuen.

Vliebergh, Emile and Robert Ulens. 1912. *L'Ardenne. La Population Agricole Au XIXe Siècle* . Brussels: Librairie Albert Dewit.

Williamson, Jeffrey G. 1981. "Urban Disamenities, Dark Satanic Mills, and the British Standard of Living Debate." *Journal of Economic History* 41(1):75-83.

## Endnotes

[1] We are in the process of building a regional database that will allow comparative studies of both urban and rural areas as well as migrants moving between them during the nineteenth century. Communities included in the database have been selected for their economic and social characteristics and for the availability of documentation, including population registers and conscription lists.

[2] Men who were slightly below the minimum height (155 centimeters) could be recalled and measured again the next year. Some of these records are included in our database, but only men who were 19 or 20 at the time of measurement are included in the analysis presented here.

[3] The ratio between men counted at heights ending with these preferred digits and those at the surrounding non-preferred heights was about .31, instead of .20 as we would expect. At the modal height of 165 cm this ratio was only .26.

[4] The documents available to Quetelet did not give detailed heights on men shorter than 156 centimeters, who were not accepted for military service. Quetelet estimated mean height by applying a normal curve to these data.

[5] The source documents record exact dates of birth (day, month, year), but they do not record the date of measurement. For this reason, we calculate age on December 31 of the year of measurement.

[6] *Laineurs* (teaselers in English) raised the nap on woven cloth before it was sheared. This occupation disappeared after 1850 when the operation was mechanized.