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Anthropometric Research and the Development of
Social Science History

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“Looking Backward and Looking Forward: Anthropometric Research and the Development of
Social Science History”

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The contributions included in this issue celebrate the 22nd-year anniversary of the Fall, 1982 issue of *Social Science History* (vol. 6, no. 4) devoted to “Trends in Nutrition, Labor Welfare, and Labor Productivity”.¹ The guest editors then were Robert Fogel and Stanley Engerman, and all but one of the eight contributions were dedicated to anthropometric history (Fogel and Engerman 1982; Fogel et al. 1982; Floud and Wachter 1982; Friedman 1982; Margo and Steckel 1982; Sokoloff and Villaflor 1982; Tanner 1982).² The issue had a considerable impact on the fledgling field of “anthropometric history,” even if a few publications preceded it in other journals (Fogel et al. 1978; Steckel 1979; Trussell and Steckel 1978).³

The editor of *Social Science History* at the time, James Q. Graham, hoped to expand the exploration of human heights and their economic and social correlates. He was one of the few journal editors convinced early on that such an agenda fit well into an interdisciplinary historical perspective.⁴ The collection gave a sense of excitement to the field by demonstrating the applicability of evolving methods to a wide range of problems; showing the availability of data; indicating the growing number of researchers in the field; and convincingly illustrating how new methods illuminated significant historical issues. Consequently, the issue attracted new researchers to the field, including one of the guest editors of this anniversary issue.

Some of the interesting insights of the anthropometric research program were already hinted at in that issue: the negative relationship between height and mortality, the positive relationship between height and labor productivity, the cycling of heights, the antebellum puzzle, the

miserable biological condition of the London underclass at the time of the Industrial Revolution, the biological advantages of the New World, and the high nutritional status of American slaves.

Anthropometric history found a niche in scholarship because conventional approaches to living standards were not helpful in answering questions of interest to historians. There are many weaknesses in using conventional living-standard indicators such as per-capita GNP, per-capita income, or the hourly (daily) wages to assess the welfare of a population. The related issues are too complex to be discussed here in detail. Suffice it to say, that they do not incorporate the effect of environmental externalities, of cyclical fluctuations, of distribution of resources within the family, or inequalities at the societal level (Crafts 1997; Steckel and Floud 1997).

In a historical context, the limitations of the conventional measures are accentuated by the fact that income data are generally unavailable and records of wages limited to some segments of the labor force. Moreover, their deflation by a consumer price index is typically rudimentary due to the lack of a representative “basket” of consumer goods. In addition, no obvious welfare indicators exist at all for very large segments of historical populations that were outside the paid labor force, including women, children, aristocrats, slaves, but prior to the onset of modern economic growth also the self-sufficient peasantry or farmers (Johnson and Nicholas 1995). These segments were by no means negligible -- they made up well over three-quarters of most societies prior to industrialization. Moreover, the spatial component of welfare is also difficult, if not impossible, to study in a historical context using conventional approaches because of the scarcity of regional-level evidence. Hence, the limitations of conventional living-standard indicators are widespread and systematic, and often include modern societies for which data are lacking or are unreliable (Baten and Wagner 2003; Cameron 2003; Komlos and Kriwy 2003; Morgan 1998; Nicholas and Kimberly 1998; Prince and Steckel 2003).

As a consequence, the use of complementary measures such as the Human Development Index (HDI) or biological indicators such as physical stature is warranted and affords us new opportunities to assess the effect of historical processes on welfare (Dasgupta 1993). The HDI

includes indexes of life expectancy and education in addition to income, while height is a component of the biological welfare that reflects how well the human organism itself thrives in its socio-economic and epidemiological environment during childhood and adolescence (Bogin 1988). It captures the biologically relevant component of the quality of life. Such extensions of conventional measures emphasize that the human experience is inherently multidimensional: well-being encompasses much more than the command over goods and services. Health -- the frequency and duration of sickness -- and longevity both contribute to welfare, independent of income. The consideration of such indexes provides a more nuanced view of a society's welfare for comparative purposes than income by itself.⁵

Anthropometric historians unearthed a large number of new sources for the study of human welfare: military, criminal, hospital and school records, voter registration cards, servant contracts, newspaper advertisements, and certificates of freedom (Nicholas and Steckel 1991; Komlos 1992; Komlos 1990, 1994a; Wu 1994). With close to a million records studied so far, we have merely revealed the tip of the iceberg: the number of available sources is immense. The ways findings of anthropometric history already have enriched our understanding of historical processes are too numerous to recall within the confines of a short introduction (for an overview see, Harris 1994; Steckel 1995; Komlos 1998). In what follows, we note only some of the more important to date.

The average height of soldiers who fought in the American Revolutionary War was an astonishing 173 cm (68 inches), well above European standards for a very long time to come (see Figure 1) (Sokoloff and Villaflor 1982: 457; Fogel 1994: 511; Komlos 2001).⁶ This result made it clear that the abundant natural resources of parts of the New World, combined with the propitious disease environment, low population density, and productivity of the American population, conferred considerable -- until then unknown -- biological advantages on its inhabitants. Even American adult slaves were tall by modern standards. Indeed, they were about as tall as American urban workers. More importantly, those born on American soil were actually taller

–had a higher nutritional status–than the African populations from which they originated (Eltis 1982; Steckel 1979, 1986; Trussell and Steckel 1978).

Figure 1 about here

The proximity to nutrients conferred considerable biological advantages prior to the advent of refrigerated railroads (Komlos 1985: 1156). The pattern has been found in a large number of population (Baten 2000; Nicholas and Steckel 1997: 115; Sandberg and Steckel 1987). It holds true for Maryland as well as for Japan, and accounts for the height advantage of the Irish and Scotch over the English (Mokyr and O'Grada 1994; Riggs 1994; Shay 1994; Komlos 1992). This makes sense insofar as those who were self-sufficient did not have to pay for the services of middlemen, saved transport costs and were thus less likely to consume spoiled or contaminated products (Craig and Weiss 1998). The discovery of refrigeration and the decline in transportation costs with the coming of the railroad changed this relationship, as the Craig et al. study in this issue emphasizes. The relationship between propinquity to nutrients and nutritional status came to an end in the US sometime in the second half of the 19th century.

The availability of digestible milk was particularly important for physical growth. Given the limitations of transport systems before the late 19th century, the advantage of propinquity to nutrient production was extremely important (Baten 1999). In Southern Germany and in most of Northern and Western Europe, grain production and grain prices were central to the lives of urban populations, but overall milk provided as much protein as did grain and double that of meat and half its calories (Böhm 1995). Milk played an extremely important role in the lives of the vast majority of rural populations. Yet, the amount produced was not recorded because the peasants were not obliged to pay taxes on it. This should be taken into account, for example, in the debate about the "Great Divergence" between economic development in Asia and in Europe, in which the parties can argue only in terms of grain wages due to data limitations. However, Europe traditionally had much higher protein production per capita, which resulted in a higher

total product, even if it might not seem much richer when "grain wages" alone are used as the basis for comparisons.

Urban populations were generally shorter than rural ones until the early 20th century (Komlos 1998: 790).⁷ Towns were also less healthful places to live, as the Haines's study in this issue emphasizes. The "urban penalty" was substantial during the early stages of industrialization. However, there were some exceptions, including Eastern Belgium analyzed in the Alter et al. paper (below). Munich was another such exception, on account of its proximity to the dairy-rich regions in the Alps and the large number of civil servants among its inhabitants (Baten 2001). In the 20th century, the relationship reversed. Town populations enjoyed better medical services and facilities and were invariably taller than rural ones.⁸

However, urbanized regions were more vulnerable than rural ones in some cases even in the 20th century. Baten and Wagner (2003) document that in national socialist Germany, there was a crisis in the biological standard of living as measured by life expectancy, morbidity rates and heights. The crisis affected the urban populations in particular. Urban and rural markets became segmented as farmers faced a complicated fixed-price system and consumed a higher share of their high-quality food themselves instead of selling it in urban markets. Other important detrimental influences included the autarchy policy that changed the regional distribution of nutrients, and the neglect of public health investments.

Commercialization also had a negative impact on the human growth process of some segments of the society in the early industrial period. Because the integration of markets meant that relative prices of nutrients were altered, access to markets was often accompanied by a decline in physical stature of farmers or self-sufficient peasants in the 18th and early 19th centuries. This was the case as farmers and peasants traded away nutrients that otherwise would have been available for children. Thus, Haines (this issue) finds that the three countries he analyzed, the US, England and Netherlands where heights declined in the first half of the 19th century, "...were also all

experiencing the initial pangs of modern economic growth, along with increased transport and market integration.”

There were cycles in physical stature of various durations with an amplitude of circa 5 cm within the range of about 165 to 170 cm. Some of the cycles were several generations long while others had lengths surprisingly similar to normal business cycles (Woitek 2003). The cycles were related to climatic conditions, demographic developments and economic growth. Steckel’s article in this issue corroborates the fact that heights varied considerably over time, reaching a maximum in Europe during the high Middle Ages, and declining markedly thereafter.⁹ The cycles disappeared – as far as we know - after World War I, when markets in food products became more efficient so that local shortages were alleviated quickly. Child labor declined or was entirely eliminated, freeing up calories for the biological growth process (Mosk 1996). Because food consumption became a much smaller fraction of family income, it was possible to protect one's nutritional intake from the effects of short-term income fluctuations. Moreover, the stock of savings increased so that the reliance on current income was less than before. As a consequence, the effect on heights of even such a major downturn in economic activity as the Great Depression of the 1930s was hardly evident (Harris 1994; Wu 1994). In contrast, the economic downturn of the 1890s still had a noticeable impact on physical stature (Coclanis and Komlos 1995; Steckel and Haurin 1994).

Heights declined everywhere in Europe in the second half of the 18th century. Rapid demographic expansion, coupled with such exogenous factors as the deterioration in weather conditions, brought about diminishing returns to labor in agriculture, making it much more difficult to maintain the nutritional status of the population (Clark, Huberman and Lindert 1995; Crafts and Mills 1994) (see Figure 1). The substantial rise in food prices and the concomitant rise in malnutrition bear similarities to a “Malthusian crisis.”¹⁰ The diminution in male heights has been found in all regions studied so far: the United Kingdom, Sweden, the Habsburg Monarchy, Northern Italy, France, and Bavaria (Baten 2001; Komlos 1985, 1989: 58, 1993; Heintel, Sandberg, and Steckel 1998; Steckel 1995: 1920).¹¹ Insofar as real wages fell consistently throughout much of that

period, the decline in physical stature in the second half of the 18th century is not paradoxical (Figure 2).¹² However, the crisis was relatively modest compared to the deep crisis of the 17th century (see Figures 1 and 3) because the Industrial Revolution provided more income than was available to the populations in the 17th century (Komlos 2000).¹³

Figures 2 and 3 about here

Anthropometric history has also shed light on the nature of Malthusian crises. A crisis caused by endemic malnutrition rather than by an acute subsistence crisis probably began with an initial response of the human organism to accommodate to the changing nutritional circumstances by becoming smaller. It did not have to begin immediately with an increase in the mortality rate. Moreover, the French Revolution was not associated with a nutritional crisis that was more severe than in other parts of Europe (see Figure 2) (Komlos, Hau, and Bourguinat 2003).

Major socio-economic transformations have been generally accompanied by considerable biological stress on the human organism. This was the case in the Neolithic Agricultural Revolution as well as during the Industrial Revolution, the onset of modern economic growth, or closer to our own time, the transition from communism to capitalist economic systems in Russia and Eastern Europe.

Anthropometric history has also contributed to the long-standing and needlessly acerbic debate over the standard of living of workers during the Industrial Revolution. It has shown that the transition to an industrial society carried with it certain negative externalities that are not easily captured by conventional economic indicators. The Alter et al. study (this issue) underlines the difficulties of the transition to modern economic growth. Social differences in height were enormous in the early-industrial period, with a 20 cm difference between the wealthy and the poor at adolescence documented in both London and Stuttgart at the end of the 18th century (see Figure 4) (Komlos 1993). Alter et al. document an 8 cm difference between lower- and upper-class adults, which was quite normal for European adults of the time (Komlos, Hau, and Bourguinat 2003).

Figure 4 about here

Industrialization generated additional income that enabled populations to survive that would not have been able to do so in earlier centuries. Even if industrialization in the early stages meant that the per-capita production of food declined, people were able to survive even if they were shorter than their parents. Mortality rates did not increase, though, as in prior centuries, in spite of the rapid demographic expansion. However, as Oxley argues in her study in this issue, the additional income generated by industrialization was at times sufficient to overcome the adverse negative externalities of modernization. This was the case among Ulster women, particularly among protestant women.

Anthropometric history has also increased our awareness of the effect of regional differences in economic development on living standards. For example, New England, the first region to industrialize in the United States had the shortest population in 19th century US. The same was the case in Bohemia in the Habsburg Monarchy. However, Oxley (below) shows below that the shortest Irish women in the first half of the 19th century were found in Connaught in the West, among the more isolated and least developed regions of the country.

The biological standard of living of the common man declined unexpectedly in both Europe and North America the 1830s and 1840s (A'Hearn 1998; Margo and Steckel 1983; Haines 1998; Komlos 1987, 1996) (Figure 5). This finding has become known as the “Antebellum Puzzle”, because it contradicts a basic historical assumption: that rapid and widespread economic expansion after 1825 brought about an unambiguous improvement in the human condition.¹⁴ The biological standard of living was not expected to decline at a time of general economic prosperity, when, in the US per capita output was increasing by some 40 percent per generation (Weiss 1992). However, the diminution in heights of the early-industrial epoch was not caused primarily by deterioration in the disease environment, because then one would expect that all segments of society would have been affected. That the physical stature of several groups, including German high status students, American middle class cadets (Figure 6), and male slaves did not decrease at the outset of modern economic growth, and the height of females frequently declined earlier than that of men implies that

an increased incidence of disease does not, by itself, explain the "early-industrial-growth puzzle" or the "antebellum puzzle" (Cuff 1998; Floud, Wachter, and Gregory 1990: 175; Lang and Sunder 2003; Komlos and Coclanis 1997; Komlos 1990, 1992, 1998; Murray 1997). Haines's paper in this volume is dedicated to exploring this issue in an international perspective, and lends further credence to the notion that the decline in the biological standard of living in the 1830s and 1840s was rooted in the socio-economic processes accompanying the first pangs of industrialization. However, The physical stature of male slaves in the United States increased in the antebellum decades, in stark contrast to that of the free population (black and white), because an increase in their productivity raised the incentive for slave owners to improve their diet (Rees et al 2003).

Figures 5 and 6 about here

The disease environment has had a substantial impact on the nutritional status of the population, as Haines notes in his study in this issue, but there is no evidence that the epidemiological circumstances changed substantially in the late 18th - and first half of the 19th centuries. In almost every case, higher mortality rates have been associated with lower nutritional status and shorter people, though the direction of causation is not always clear, since nutritional quality can influence the lethality of nutrition-related diseases. This relationship was true even at the end of the twentieth century. The problem of incorporating infectious and endemic disease incidence into the analysis is the scarcity of evidence on trends in these variables, particularly at the regional level. Evidence on sickness rates are lacking, in the main, until the 20th century. Hence, the best we can do is to use mortality trends or consider cross-sectional evidence to note that regions that were known to have harbored malaria (i.e., Murcia in Spain or South Carolina in the 19th century) were likely to have shorter people (Carrion 1994; Coclanis and Komlos 1995).

Anthropometric history has increased our understanding of how economic processes led to a convergence or a divergence in height depending on the intensity of the specific factors at work (Baten 1999). Such regional convergences are quite frequent. This is the pattern that Salvatore

documents among the areas of Argentina's Northwest province in his study in this issue. Alter et al. (in this issue) also find a convergence in height among workers in the Walloon region of Belgium.

Anthropometric history has contributed to the study of the living standards of women as distinct from that of men. Before the 20th century, evidence on the height of females is quite scarce, because they were less likely than males to be part of institutions, such as the military, that kept records on physical stature. However, two major sources of female heights of the early nineteenth century do exist, i.e., slaves and criminal records (Baten and Murray 2000). These indicate that females often, though not always, experienced a decline in their physical stature prior to that of males. This was the case among the free blacks of Maryland and among Scottish convicts, but not among English women of the early 19th century (Komlos 1993; Riggs 1994; Nicholas and Oxley 1993).

Anthropometric history has flourished in the two decades subsequent to the publication of the 1982 special issue of *Social Science History*. It has attracted many researchers around the globe and illuminated processes of socio-economic change that would have otherwise surely eluded us. New techniques have been developed since 1982 for analyzing truncated data which are often obtained in military samples prior to universal conscription (Heintel and Baten 1998; Komlos and Kim 1990; Komlos 2003b; A'Hearn and Komlos 2003). Fortunately none of the samples analyzed in this volume are based on such truncated distributions, which means that they can employ conventional methods of analysis.

The test of the importance of findings reported in any journal is surely not the extent to which ideas and results remain part of a permanent orthodoxy, for few ever do. The real measure is the extent to which they become an inspiration for others. With this criterion in mind, it is clear that the Fall 1982 issue of *Social Science History* was a milestone. Work in the field mushroomed thereafter, as evidenced in the number of books and anthologies devoted to anthropometric history that appeared thereafter (Floud, Wachter, and Gregory 1990; Komlos 1989, 1994b, 1995a, 1995b, 2000, Komlos and Baten 1998; Komlos and Cuff 1998; Steckel and

Floud 1997; Steckel and Rose 2002). Most recently, existing journals have not been able to keep up with the pace of output, as the recent founding of the new journal, *Economics and Human Biology*, testifies. We hope that readers of this issue who are new to anthropometric history as well as its adherents will welcome new results of our efforts to understand better the complex forces shaping the welfare of populations.

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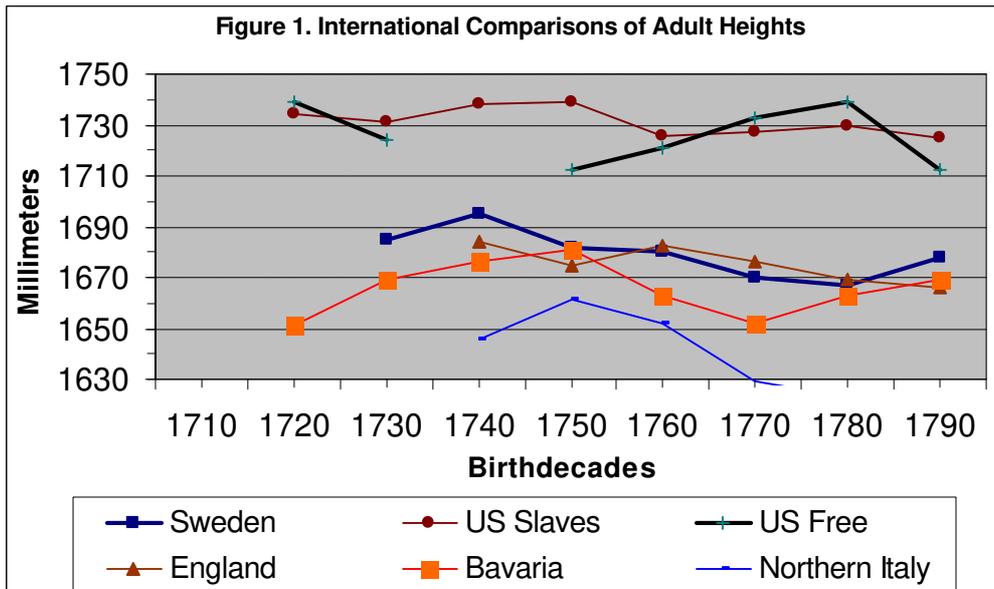
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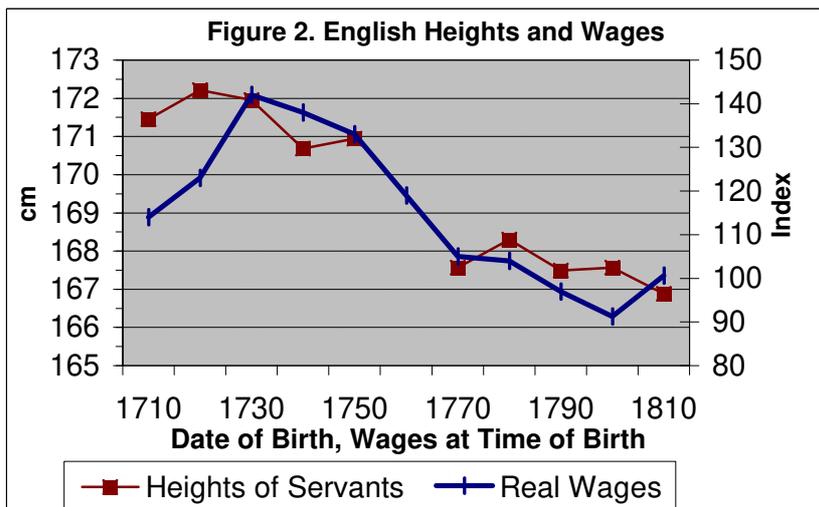
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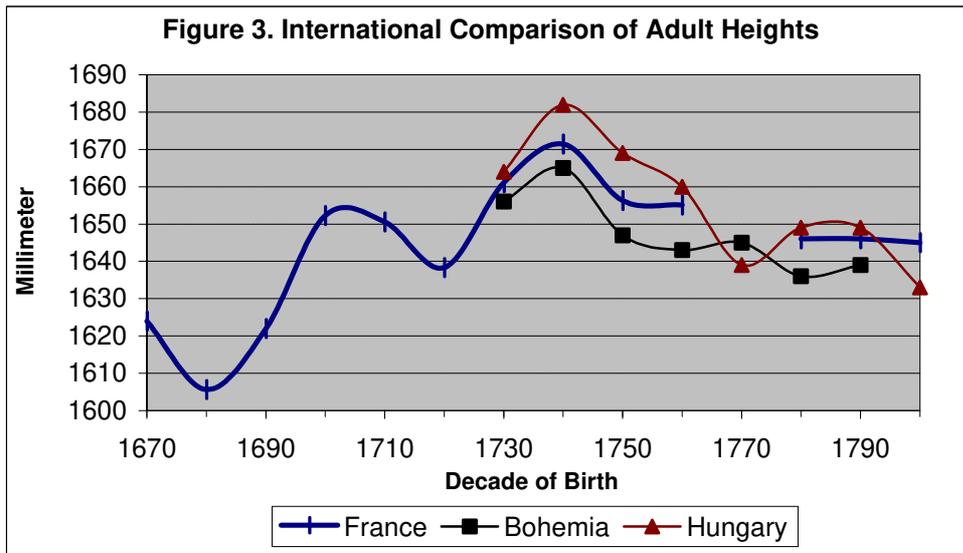
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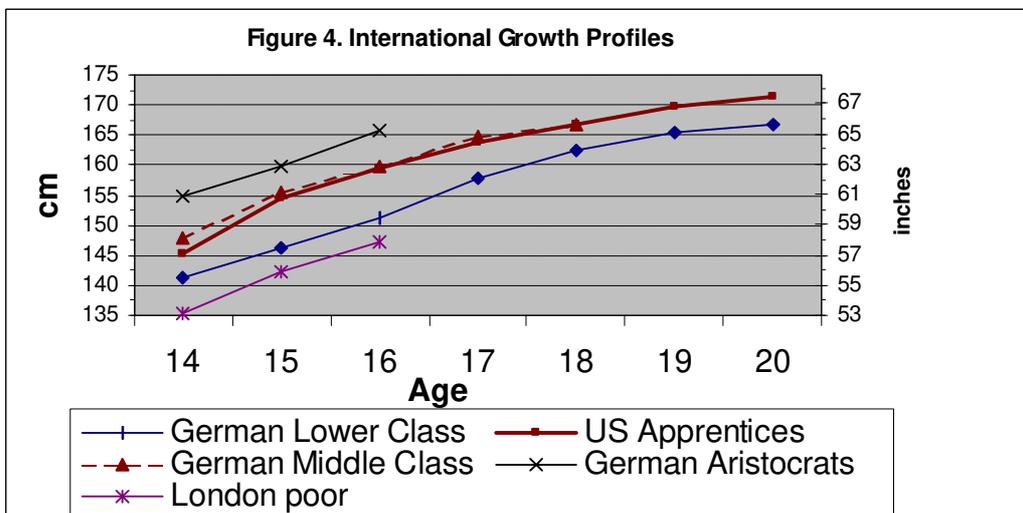
Sources: A'Hearn forthcoming; Baten 2001; Heintzel, Sandberg, and Steckel 1998; Komlos 1996, 2001.



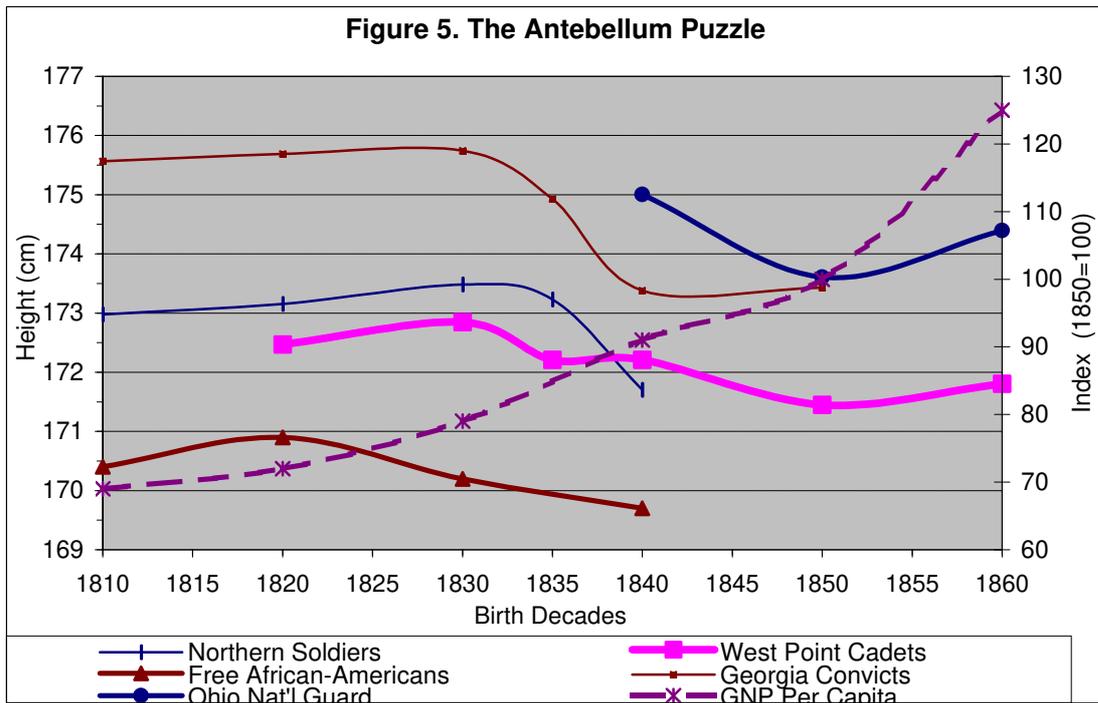
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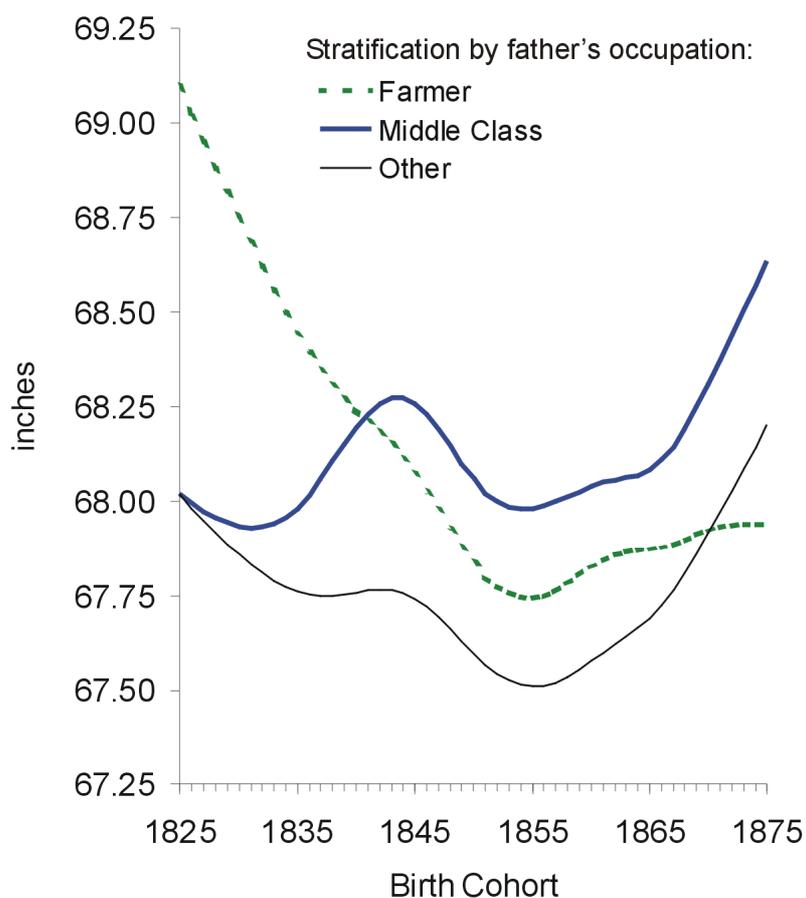
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Komlos and Coclanis 1997; Steckel and Haurin 1994; Weiss 1994: 24.

Figure 6. Height of West Point Cadets by Social Class



Source: Lang and Sunder 2003.

Endnotes

¹ All but one of the contributions in this issue were discussed at the First International Conference on Economics and Human Biology, Tuebingen, July 11-14, 2002.

² Villaflor and Sokoloff (1982) was the one exception.

³ The the field was not yet christened as such until 1989 (Komlos 1989). The French *Annales* school had developed a literature independently beginning in 1969, but American cliometricians remained unaware of those publications (Le Roy Ladurie et al. 1969; Le Roy Ladurie and Bernageau, 1971; Aron et al. 1972; Le Roy Ladurie and Demonet, 1980)

⁴ The issue was co-sponsored by the National Bureau of Economic Research, which meant that it had double the press run of regular issues.

⁵ For instance, the fact that Sweden in 1870 had already reached the HDI of today's Egypt, and by 1960 exceeded that of the United States, which had been the world's leader until then, enriches our historical knowledge these societies (Sandberg and Steckel, 1997, p. 152).

⁶ These results were confirmed in Steegmann and Haseley (1988), who report a mean height of 172.2 cm for those born in the 1730s. In contrast, 20-year-old German aristocrats were 169 cm tall. (Komlos, 1990).

⁷ “Individuals who bought their food had to pay for transportation costs and for the efforts of middlemen, whereas subsistence farmers did not” (Komlos, 1989, p. 97).

⁸ This was the case also in the German Democratic Republic (Komlos and Kriwy 2003).

⁹ They were actually as tall as their descendents living in Europe's overseas colonies in the 18th century (see also Koepke 2002).

¹⁰ Even the size of horses declined probably on account of the decline in the availability of pasture grasses (Komlos 2003a).

¹¹ Female heights, too, decreased in Scotland, and among the free blacks of Maryland (Riggs, 1994; Komlos, 1992, 1993).

¹² Wages did not begin to rise in Britain until the third decade of the nineteenth century (Crafts and Mills 1994).

¹³ Both economic and demographic growth were ubiquitous, even if regionally confined, in late-18th-century Europe. So was growth in per-capita product. We use the concept of modern economic growth in this Kuznetsian sense (Kuznets, 1966).

¹⁴ For a downward trend in longevity see Haines's study in this issue (Pope, 1992; Huck, 1995). 19th century Americans were also underweight (Cuff 1993).