

# **An Anthropometric History of the World, 1810-1980: Did Migration and Globalization Influence Country Trends?**

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Economic historians have been fascinated by the cooperation with anthropologists now for at least four decades, since “New Economic Historians” discovered for their discipline that human stature could be a very useful indicator. They suggested to proxy the standard of living with the height indicator, especially for periods and countries in which no other data was available, such as national incomes or real wage evidence. The basic strategy was to use the correlation between the quality of nutrition and the disease environment on the one hand, and human height on the other. As most preindustrial societies spent a large part of their income on food, height could serve as a proxy indicator for overall income. Soon the relationship turned out to be more complicated than initially thought, partly because “quality of nutrition” could mean very different things. Moreover, parents do not always provide the highest quality to their children, even if they can afford it. For example, one bottleneck factor of early-modern nutrition was the availability of proteins, iron, and calcium. Calcium is important for bone

formation, iron deficit leads to a number of diseases, and high quality proteins allows to develop more antibodies in order to fight infectious diseases. The infectious disease environment of the 19<sup>th</sup> century was clearly different from today's disease environment in developed countries, because hygiene and a number of medical treatments were unknown at the time. Going to a hospital was often very adverse for one's health, because the knowledge of 19<sup>th</sup> century medical doctors was limited and infection probability high. The germ theory of disease was still to be discovered at that time (Komlos and Baten 2004). Therefore, high quality proteins were enormously important for 19<sup>th</sup> and early 20<sup>th</sup> century nutrition, whereas food items that we would associate today with "food quality" (fruits, vegetable) were relatively abundant. Even poor people in rural areas or small cities could use gardens and the cost of labor (which makes fruits and vegetables expensive today) was relatively low. Most poor people in Europe, East Asia and other densely settled world regions were "forced vegetarians" with meat consumption below 10 kg per year (Baten et al. 2012). An ideal item to improve 19<sup>th</sup> century diets was milk, either fresh milk, or its processed version (kefir, yoghurt etc.), which could also be consumed by lactose-intolerant persons. However, milk was costly to store and to transport, hence people living close to its production and enjoying high cattle per capita values were often characterised by tall height and high life expectancies. Only during the early 20<sup>th</sup> century, refrigerated transport, pasteurization and other techniques became widely available, which made it possible to really "buy" quality of nutrition in urban centers. Slightly later, immunization campaigns against a number of infectious diseases and new medical methods allowed a healthy life with less protein, if the purchasing power for those medical goods was high enough, or the government invested sufficiently.

Those changes are of core importance when writing an anthropometric history of the world between 1810 and 1980. We find in this article that heights were very similar across world regions during the 19<sup>th</sup> century, except where cattle per capita values were extremely high due to land abundance (such as in the U.S., New Zealand, and Argentina).

In estimating height trends by world regions each of which comprises several nations, we aim to incorporate the maximum of previously published research. We find that 156 countries can be taken into account (We include all countries with more than 400,000 inhabitants for which evidence is available, using 1990 borders, in order to permit comparison with Maddison's 2001 GDP estimates). Height estimates are organised and analysed on the basis of birth decades wherever possible since (final) average height is mainly determined during the early childhood of a birth cohort. However, continuous series are available for only some of these countries. Moreover, the series on individual countries, even some of those that are based on a substantial underlying number of cases, are prone to measurement error, since the samples' regional and social composition are difficult to ascertain, and may introduce bias. To account for this potential bias, all problematic measurement issues are denoted with dummy variables, and their degree of bias was carefully analysed in a related study (Baten and Blum 2012). For the estimation of world-region trends, data for a large number of countries is collected, with the result that most measurement errors are cancelled out. This unprecedented compilation project should facilitate further efforts of height analysis, providing as it does a realistic ground for further comparisons.

To compensate for the fact that until the middle of the twentieth century data are scarce for countries where poverty and illiteracy prevailed, we solicited a large number of recent anthropological measurements, we have taken great care to identify all the biases that may have been generated by the institutional context -- enlistment in the military, incarceration in prisons, and sale in the slave trade, chiefly -- in which heights were recorded. We also did our best to rid our data set of social, ethnic, and regional biases. Voluntary soldier samples were included only if satisfactory statistical methods had been used to eliminate the height bias of truncated samples. As for other potential biases, one way to estimate their possible effect is to regress stature on a full set of birth decade and country dummy variables.

Our estimates of world-region trends for the entire 1810-1989 period are based on the population-weighted averages of 156 countries, without interpolations (Figure 1). We used the standard world-region classifications with one exception: we aggregated the group comprising of North America, Australia, and New Zealand, because of certain demographic similarities (chiefly populations featuring European settlers and high cattle-per-capita values). We observe that this group at first had very high values but that toward the end of the 19<sup>th</sup> century they declined somewhat, converging with some of the other groups, but resuming their upward trend at the start of the next century. The first wave of globalization, at the end of the 19<sup>th</sup> century, was not a boom in terms of biological living standards for the populations of New World food-exporting regions. The shift of high-quality foodstuffs from local to export markets may not have been the only factor; immigration into these regions no doubt caused higher population pressure and

changes in agricultural practices which in turn led to a decline in protein consumption per capita.

Are the height declines during the late 19<sup>th</sup> century in the New World economies concentrated on a few countries only? Or is this a general phenomenon in the previous European settlement colonies? In Figure 2, we see that Argentina and the U.S. had quite early and remarkable height decline tendencies, whereas in Canada the decline started only after a maximum in the 1850s. For New Zealand and South Africa, we have only quite short spans of documented height series, during which there was a mild decline. Australia has been documented by Whitwell, de Souza and Nicholas (1997) as having experienced a height decline.

Can the height decline be attributed exclusively to the high level of immigration? Were immigrants sufficiently shorter to decrease the New World height average? Actually, first generation immigrants were excluded from the series, so the decline took place among U.S. and Canadian natives. There might be an effect of second-generation immigrants, but some studies on second generation immigrants find that they had almost the same height level as Americans with native-born parents (Zehetmayr 2010, p. 94). Floud et al. (2011), Steckel (2009), Komlos (1996) and others make their point mostly that the division between agricultural production and consumption played the major role, as the decline was particularly strong among farmers who had a large within-household consumption early-on, whereas they sold a larger share later-on to the rapidly growing urban population. Higher population density might have also impacted on a worsening of the disease environment in some urban environments. Moreover, income inequality was

rising in the first phase of industrial development.

A recent study by Zehetmayr (2011) confirms this, although the trough is already reached in the 1870s/80s, and he is slightly more optimistic about the 1890s than Fogel and Steckel were (although their series is the most-cited, also included in the U.S. Historical Statistics). But even his “slightly more optimistic” view suggests that there was a problem in one major living standard component in the New World countries during this period.

## Conclusion

As a main result, we find that regional height levels around the world were fairly uniform throughout most of the 19<sup>th</sup> century, with two exceptions: above-average levels in Anglo-Saxon settlement regions and below-average levels in Southeast Asia. After 1880, substantial divergences began to differentiate other regions -- making the world population taller, but more unequal. During the late 19<sup>th</sup> century and 20<sup>th</sup> century, heights between world regions deviated significantly, when incomes also became very unequal. Interestingly, during the “breaking point period” between the two regimes, heights declined significantly in the cattle-rich New World countries, whereas they started to increase in Old Europe. We discuss in this study whether immigration was a core factor to influence the height decline in the “Anthropometric Decline of the Cowboy and Gaucho Empires”.

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Figure 1: Height development by world region (no interpolations, weighted by population size)

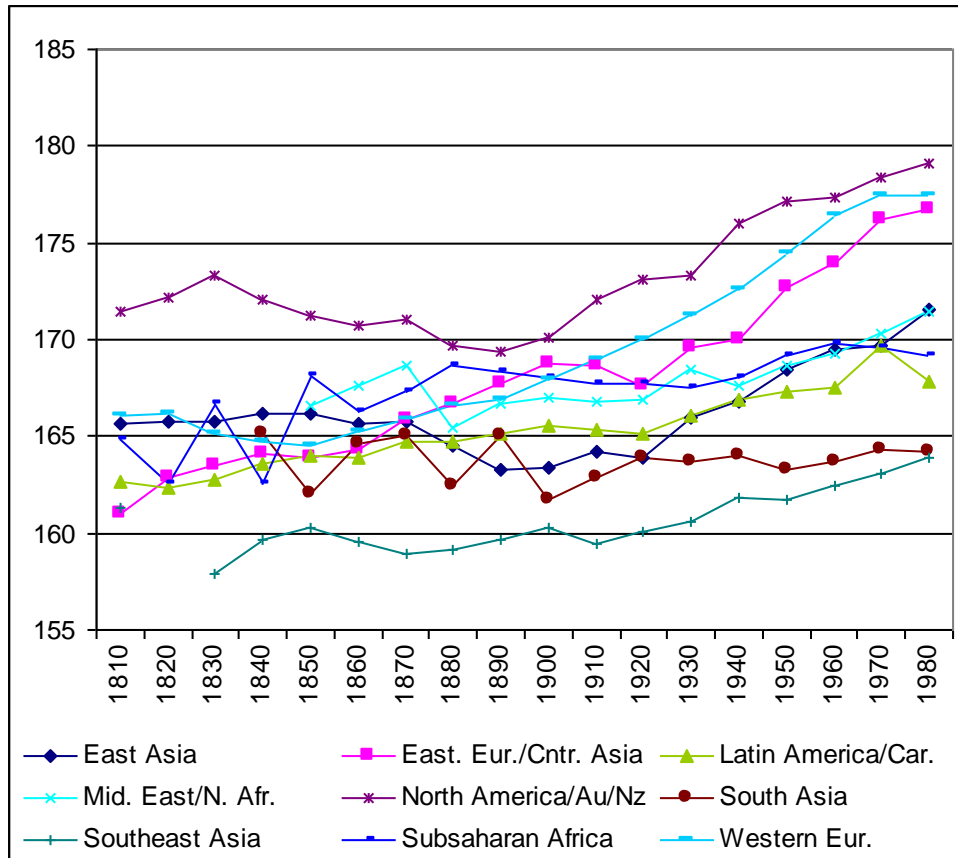




Figure 2: Height trends in countries of earlier European settlement, 1810sd-1920s

