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**Tall and Shrinking Muslims, Short and Growing Europeans: The Long-Run Welfare
Development of the Middle East, 1840-1980**

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Abstract

In this study we estimate for the first time anthropometric trends for ten countries in the Middle East for the period 1840-1910, and we follow those countries until the 1980s using Baten's (2006) estimates. We compare those trends with GDP and real wage data and find that the Middle East had a good position in anthropometric indicators and real wages during the 19th century, less in terms of GDP/c. However, the Middle East lost after 1880 compared to Western Industrial Countries. This might have contributed to general dissatisfaction in the world region and explain some of today's political problems.

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1. Introduction

How did the standard of living develop in the Middle East over the past two centuries? When did the Western world become clearly better-off in terms of income and health? Those central questions cannot be answered easily, even if interest in this world region has grown substantially over the past years, partly as a consequence of several terrorist attacks in the U.S. and Europe. Did a long-run relative decline of living standards contribute to the widespread dissatisfaction in the Middle East?

We provide an alternative measure of living standards in the Middle East, using the - by now well-established - anthropometric technique (Komlos 1985, Steckel 1995, 1997). This technique employs human stature as an indicator of the biological components of the standard of living, as heights are normally correlated with nutrition, health, and life expectancy. With our height data sets, we can also cover the rural and farmer populations of Turkey, Iraq, Iran, Egypt, Syria, Lebanon, Palestine/Israel, Afghanistan, Yemen, and the Caucasus region (today's Armenia, Azerbaijan, and Georgia). Our primary sources are anthropological measurements which were carried out by a number of anthropologists for the birth cohorts of the 1840s to the 1930s, most notably Henry Field for Iraq, Iran and the Caucasus region, and Afet Inan for Turkey. For an analysis of the more recent period of the 1940s - 2000s, we look at demographic and anthropological surveys in the last part of this study.

We will compare the resultant height trends in the Middle East with both GDP per capita and real wages (Pamuk 2006, Maddison 2001, Özmucur and Pamuk 2002). We find that heights and real wages provide a consistent picture of relatively favorable living standards during the 19th century, whereas the development of GDP indicates a much worse situation than the height data would suggest. The discrepancy is largest for the late 19th century, i.e. before the anthropometric indicator for the Middle East declined relative to the Western world around the year 1900, resulting in a GDP and height divergence in the 20th century.

Heights are also important to study, because they tend to be correlated with life expectancy and health. Fogel (1994) stressed in his lecture to the Nobel Prize committee that a height gap of 17.5 cm meant even for modern Norwegian males in the 1960s and 1970s a higher probability of dying in the following period of not less than 71 percent, clearly a large amount. He based his work on Waaler (1984), who measured several thousands of Norwegians and followed them in a longitudinal study. Norway had one of the populations with the best nutrition in the late 20th century. Baten and Komlos (1998) estimated that a centimetre of height equals about 1.2 years of life expectancy, with only negligible coefficient change over time between the birth cohorts of 1860, 1900, and 1950, i.e. the latter being adults in the 1970s to the present. Hence, already one centimetre is clearly a meaningful amount, as living 1.2 years more or less is a substantial asset in the quality of life portfolio.

In the next section, we will discuss the concept of the biological standard of living as well as the main data sources and estimation methods. In section 3, we present maps of interregional height differences for Iraq, Afghanistan, Turkey, and Egypt. Section 4 gives an overview of height trends in the northern vs. southern part of the Middle East, while section 5 discusses differences between the Middle East and the industrialized countries in 1840 and 1910. Subsequently, we compare GDP per capita, real wages, and height estimates, before section 6 concludes this paper.

2a. The Biological Standard of Living, Real Wages, and GDP Per Capita

We use human stature as an indicator of the “Biological Standard of Living” because it tends to be correlated with the quality of nutrition, health, and longevity (Komlos 1985). How do our height estimates differ conceptually from estimates of real wages and GDP? The strength of GDP per capita is, of course, its comprehensive account of purchasing power and the possibility to compare it over time if it is given in standardized monetary units (such as the 1990 Geary-Khamis \$). The disadvantage is its potential bias against subsistence farming -

non-traded goods and goods produced and consumed within households are often underreported. Moreover, other forms of informal markets can often not be captured. In contrast, real wages have a better reputation in terms of data quality for long-run studies, as nominal wages and prices were recorded by contemporaries (whereas GDP relies on estimates produced by later generations). From studying real wages, however, we do not learn how large the return to land, capital, or perhaps the return to the exploitative activities of the rulers was. Moreover, typical subsistence goods or less standardized goods such as rooms or apartments are again difficult to include in the consumer basket. Finally, both GDP and real wages concentrate on purchasing power and do not include other living standard components such as health, longevity, and the quality of nutrition. Anthropometric techniques were developed to provide an additional welfare indicator that covers the abovementioned aspects and includes not only subsistence farmers, but also local rulers, craftsmen, and unskilled day-laborers. Although the quality of nutrition is partly determined by income, heights also reflect other living standard components quite strongly, such as the disease environment, hygienic behavior, and non-market nutrition factors such as proximity to the production of perishable proteins (e.g. milk or offals, which could not be transported and traded over longer distances before the mid-20th century, see Baten 1999, Komlos 1996, Baten and Murray 2000, Moradi and Baten 2005). Margo and Steckel found in an seminal study a remarkable deviation of height and income (Margo and Steckel 1983).

2b. Data and Methods

Our height data stem mostly from anthropological studies of the Middle East. Of particularly great value was the extraordinary data collection by Henry Field (1929-1971). He published many individual measurements, recording the height, self-reported age, and other (often physical) characteristics for every person. From these datasets, we obtained 2,476 individual adult heights. Apart from individual data, some studies reported anthropometric information

in the form of height averages, computed for groups comprising between two and 597 individuals. For example, Inan (1939) reported height by age group for 28,992 Turkish men (Table 1).

Most of anthropological information on Afghanistan was collected by Debets (1964). The data consist of 5,224 individuals from 58 ethnic groups and provide a quite detailed insight into the Afghan biological standard of living from the 1910s to the 1930s. For Iran and Iraq, Henry Field (1931, 1936, 1939, 1940, 1949, 1951, 1952, 1956) provided a lot of anthropological information and detailed investigations of demographic characteristics. As such, Field measured 299 individuals in Isfahan, Yezd-I-Khast, Kinareh, Pusht-I-Kuh, and Ravy during his Iranian expeditions. He also described the ethnic variety of both countries. For Israel and Palestine, Gloor (1950) published detailed analyses on physical anthropology. For Lebanon, Shanklin (1935, 1936) measured males of five Bedouin Tribes who were all primarily sheep or camel breeders. More specifically, he included 270 Rwala, 176 Maualy, 120 Akeydat, 70 Howeitat, and 65 Beni Sakhr tribesmen. Our Armenian, Georgian and Azerbaijani data are compiled from six different sources.¹ Particularly the publications of Chantre (1895) increased our knowledge about the situation in the Caucasus region. Seltzer (1936, 1940) published data on 101 Armenian immigrants to the U.S. who were measured in Boston. For Egypt, Craig (1912) collected height data from 10,000 criminals in Cairo in 1905.² He argued that the anthropometric information is representative of the Egyptian population because of the relatively broad social spectrum of Egyptian prisoners. However, there is still reason to believe that the sample might be biased towards the lower classes of Egypt. In sum, the total number of underlying cases was 57,334. After discarding height

¹ Deniker J. (1900), Boas F. (1924), Field H. (1953), Kherumian, R. (1943), Chantre (1895), Seltzer C. (1936, 1940

² Our Egyptian data stem from five different sources: Ammar A.M (1944), Chantre E. (1904), Craig, J.I. (1912), Field H. (1952 (a)).

extremes, our final database consists of 57,334 underlying observations.³ We focus on male heights in this study, as the aim will be to compare them to heights in the industrialized countries in the 19th century, which are almost exclusively male heights.

To which degree is our data set representative? Are the economic sectors represented by similar shares, as in the overall population? The Inan dataset, which accounts for 48% of our data, was representatively drawn from the Turkish population, also with respect to the economic dimension. For our Armenian, Afghan and partially for our Turkish individual samples, we have occupations recorded for 8,242 observations, of which 88% were engaged in the agricultural sector. Given Issawi's (1982, p.118) estimation that about four fifths of the mid-eastern population were engaged in occupations related to agriculture, our best guess is that our sample might include a slightly higher share of rural people relative to the overall population. The rural population might have enjoyed a slightly better nutritional status because of easier access to food and lacking market integration, and might thus have been relatively tall on average (Komlos 1994, p. 218).

We will proceed in two steps. Firstly, on the basis of our cartographic analysis, we are able to classify the regions of most Middle Eastern countries as “tall”, “medium” and “short” height regions.⁴ The data set contains sufficient information to permit regional estimates for Afghanistan, Turkey, Armenia, Iraq, and Egypt. Secondly, a multiple regression analysis will control for sample composition by region and age. This is useful because it could be the case that some birth cohorts contain more individuals from “tall” regions, for example. We also control for age structure. Age dummy variables indicate that time trends are not the result of

³ We excluded extreme heights above 185 and below 140. This range was chosen slightly narrower than in individual height studies, as we are mostly relying on grouped data. When the measurement year was not reported, we assumed it to be the publication date of the survey minus three year. This increases the measurement errors – but concerns only 0.75% of our sample. Our robustness tests suggested that the impact is marginal and that the broad trends are unaffected. We also tested alternative criteria for the exclusion of outliers and found the results consistent with our findings.

⁴ Because of the frequent change of borders and the changing national status of population groups during the nineteenth century it is more plausible and reader friendly to use modern borders for the following analysis.

shifts in the age composition of a sample. The resulting time coefficients are graphed for each country (Table 2, Figures 6-7).

For the analysis of grouped data, the normal estimation procedure weights each observation by the square root of its group size. According to Dickens (1990), this procedure will only generate unbiased estimates if the error terms of the individual data are independently and identically distributed, which was the case for our data. Hence, we adopted a weighted least square regression technique. Following the established anthropometric methods, we used weights which are inversely proportional to the variance of an observation. We checked the distribution of height for normality (Figure 1); the male height distribution appears normal, which confirms the validity of the estimation procedure. A modest heaping is visible at 169 cm, yet otherwise, heaping seems to be absent. Heaping on even heights is sometimes evident if the measurement was conducted by non-qualified personnel. Yet the height measurements of our sample were performed by well-qualified anthropologists. Our analysis of the data indicates that some rounding took place, but the dimension of this behavior does not affect our trend estimates. The distribution of birth cohorts from 1840 to 1930 is relatively even so that an OLS regression analysis can yield useful information about temporal trends in the development of Middle Eastern heights (Table 1 and 2). The only major exception are the last two birth decades, for which we only have heights from Afghanistan. However, Baten (2006) recently constructed height estimates for the Middle East for the 20th century based on the Demographic and Health Surveys, which we can be used to complement our data.

When studying height trends, one frequent problem regarding anthropological surveys is the paucity of the information given on birth cohorts, as many anthropologists of the late 19th and early 20th century assumed no change in height over time. Hence, we had to find out when most of the measured individuals were born, and we attributed a group's height value to the birth cohort in which the largest number of individuals was born. The time trend which

results from these estimated birth cohorts resembles moving averages insofar as it smoothes the height distribution. For example, if there had been a height decline in the 1880s but only 70% of the respective individuals had been born in the 1880s and 30% in the 1870s, the decline would be smoothened.

We can conclude from regressions of height on age dummy and birth cohort dummy variables that human growth was negligible in the Middle East after age 20 in the period under study. We can thus include all individuals aged 20 and above in our analysis without inducing a bias through growth retardation by controlling for the age 20 effect with a dummy variable (Table 2). Since the human body is subject to a shrinking process at advanced ages, we restrict our sample to individuals who were not older than 50. We also inserted a control variable for the Jewish minority within those mostly islamic countries. The background are different religious food consumption rules, or possibly occupational and education differences. Lastly, we control for regional variation.

3. Regional height differences

In order to study regional disparities among the Middle Eastern countries, we will now shift to cartographic analyses. We map mean heights for Iraq, Afghanistan, Turkey, and Egypt. Regional inequality in Iran could not be considered because of the incomplete coverage of the Iranian provinces (only six provinces were included). Height variation across regions does indeed provide some first evidence on regional inequality among the countries under study. We were able to control for regional composition in our trend regressions, but a detailed analysis of the determinants of height differences will have to be the subject of future research.

Modern Iraq consists of eighteen districts.⁵ The north and northeast are mountainous and most inhabitants are Kurdish. The regions around Mosul (Ninawa) are treeless uplands and highly dependent on irrigation from smaller rivers and rivulets. The central districts of Bagdad, Babil, and Karbala are hot flatlands. Crop cultivation was only possible by using irrigation systems. At the onset of the eighteenth century, systematic cultivation was established and controlled by Turkish garrisons, in particular around Basra, Diyala, Arbil, and Mosul. The rest of Iraq was inhabited by tribal groups (*dira*⁶) who were self-sustaining and only under limited control by the governors of Bagdad. Having large areas at their disposal, the tribesmen made use of shifting cultivation and stock-breeding (Issawi 1966, p. 129f.). Before the social transformation processes of the 19th century which are described below took place, the consumption of milk, meat, and offals was opulent. In contrast, the settled inhabitants sometimes suffered from insufficient rainfalls and the devastating annual flood of the Tigris and Euphrates (Issawi 1988, p.105). Height information on Iraq is available for the period of the 1870s to the 1910s (Figure 2). The data analyzed cover the total number of districts and amount to roughly 3,400 observations. Heights were relatively evenly distributed across regions. The average height in Iraq was 167.8 cm. The shortest men lived in the northern and northeastern districts of Dakuk and Arbil. In contrast, the tallest Iraqis came from the desert regions east of the Tigris – al Wasit and Maisan - and south of Bagdad. These regions were populated by camel-breeding Arab nomads and shepherd tribes. The difference in mean heights between al-Wasit, the district with the tallest average population, and Arbil, where the shortest people lived, was 5.4 cm, which is a large difference in comparison with other countries. We could have imagined an upward bias for Iraq from the fact that many heights refer to Bedouins. However, if we compare 251 individuals who were clearly Bedouins (their birth place started with “camp...”) and 133 inhabitants of the cities of Bagdad, Nasiriya, and Amara, the latter had a height advantage of 172.3 versus 169.0 cm.

⁵For the sake of simplicity, we shall refer to the actual administrative boundaries.

⁶ The *dira* is the area claimed by the tribe (Issawi 1996 p. 163)

Between the 1910s and 1930s, the average male height in Afghanistan was 166.3 cm (Figure 3). The shortest men lived in the southern provinces of Nimruz and Helmand. Takhar and Badakhshan in the northeast near the Tadjik and Chinese borders tended to display heights below the country mean. Ghazni, Lugar, and Khost in the southeast as well as Djudzjan and Qonduz in the north had the tallest heights. No strong spatial pattern of heights existed - tall and short regions were situated next to each other.

The anthropometric dataset of Turkey published by Inan (1939) consists of 33,447 observations from all over Turkey for the period of 1840 to 1910. Inan divided the national dataset into ten regions for which he gives specific height distributions, as illustrated in Figure 4. In general, the average height in Turkey was 164.9 cm. The shortest populations were from the Dardanelles in the northwest of Turkey, with an average height of 164.0 cm. The next-shortest average height (164.1 cm) was to be found in the Aegean (d'Egee in the map) on the southwestern coast of Turkey. On average, men were tallest in central Anatolia, with a mean height of 166.1 cm. The difference in average body stature between central Anatolia and the Dardanelles was 2.1 cm, which is not large by comparison with other countries.

In the nineteenth century, the development of agriculture in Anatolia was affected by inadequate rainfalls⁷ and a lack of political and economic security. These effects were reinforced by an unfavorable system of land tenure and the taxation of farmers, which did not provide incentives for the improvement of production (Issawi 1966, p. 65). An important part in the economic life of Turkey was livestock breeding. This was done mainly by nomads outside of the cultivated areas. Issawi (1980, p. 270) analyzed tax returns and reported that animal husbandry was prevalent primarily in the relatively dry inland while it did not figure as a common occupation in the moist coastal regions. Stock-breeding was also widespread in the European provinces of Turkey, but per capita values were not as high. Issawi (1980, p. 8)

⁷ With an annual rainfall about 300 millimetres, the plain of Malatya was/are the driest regions.

reported also that the contemporary Turkish peasant eats meat very rarely, whereas milk is available in considerable quantities.

Modern Egypt is subdivided into twenty-seven governorates.⁸ Because of Egypt's aridity, most of the population has settled down along the Nile valley and delta. Otherwise, the Egyptian territory is mostly covered by sandy desert so that the population density along the Nile is very high. Only the northern coast has sufficient rainfalls. For agriculture, irrigation is a necessary precondition. In the cartographic study below, we trace the height differences in Egypt during the birth decades of 1840 to 1880. Unfortunately, no data were available for four northeastern and eastern governorates (Red Sea, Suez, Ismailia, and Kafr el-Sheikh, see Figure 5). For all other regions, our dataset of 11,066 cases provided large sample sizes for reliable height estimates. During this period, the males of southwestern Egypt (New Valley) were the shortest (163.8 cm) in the country. The regions with the tallest population were Matruh and Giza in northwestern Egypt as well as Sohag and Qena in the south of the country, both with an average human stature of around 168 cm. The interregional difference of anthropometric measures between the highest and shortest populations was 6 cm, which represents the highest regional inequality amongst all Middle Eastern countries.

4. Height Trends in the Northern and Southern Countries of the Middle East

After assessing geographic differences, we can control for regional composition and thus proceed to trend estimates. The following line graphs are calculated from the dummy variable coefficients reported in Table 2. In the northern part of the Middle East, people tended to be fairly tall, with the exception of Iran in the 1840s (Figure 6). This drop in Iranian heights might have been caused by the agricultural crisis of the 1840s, either directly or by epidemic diseases imported from the cores of the "hungry forties" in Europe. After this crisis, heights in Iran recovered during the 1850s and 1870s. In the aftermath of the "Persian famine" which

⁸ Governortes are political entities and are common in Middle East.

led to a profound restructuring of the Persian economy, the 1880s were a decade with quite low anthropometric values for Iran. Afterwards, the country recovered until the 1910s. The decline in the 1880s was subsequently found to be synchronous for almost all Middle Eastern countries, as we will see below for the southern countries.

The population of the Caucasus, consisting of Armenians, Georgians, and Azerbaijanis, did not suffer as severely during the 1840s. Especially the pastoral groups of the Armenians and Azerbaijanis were quite tall. There was some height decline in the 1850s and even more in the 1870s, but by 1900, those Caucasian ethnicities had the highest average height of all populations under study.

Turkey experienced a quite favorable situation between the 1850s and the 1870s, but was hit by the same restructuring from cattle farming to grain and cash crop production as Iran during the 1880s. The Turkish heartland of the Ottoman Empire did not recover as well in the 1890-1910 period. The Turks had substantially worse anthropometric values at the end of the “First Era of Globalization” (O’Rourke and Williamson 1999) compared to the situation of the mid-century. In the preceding period, i.e. around 1860, the central region of the Ottoman Empire had apparently still been characterized by favorable nutrition conditions, especially in the relatively land-abundant central Anatolia. At the end of the 19th and the beginning of the 20th century, however, the power center showed signs of deterioration which coincided with political statements about the “Sick Man of Europe,” until the Ottomans lost their Empire during WWI.

What were the characteristics of the restructuring process caused by the climatically induced famine period of the early 1870s? The “Persian famine” was caused by abnormal aridity and reinforced by the speculative behavior of local governors (Gilbar 1986, Okazaki 1986). The great famine (1869–1872) caused enormous structural changes, as a large share of the population died and livestock numbers decreased. The Persian famine and the increasing world trade after the opening of the Suez Canal (1869) led to a structural transformation of the

Middle-Eastern economies towards more grain and cash-crops such as opium, silk, and cotton. Especially nomadic tribes and pastoralists had considerable protein-proximity advantages, as milk and meat could only partly be sold in urban markets. Yet after the transformations of the 1870s and 1880s, those proximity advantages declined. This in turn made the Middle East shorter and less healthy. Given the Middle Eastern countries' lower competitiveness in human capital formation and industrial production during this period, they could not participate in the Western surge of health and heights which will be discussed below.

We now turn to the southern countries. The economic development of Egypt in the nineteenth century can be described as a transition from subsistence farming to an export-oriented economy which had to deal with difficulties like rapid population growth, among others. Under the reform policy of Muhammad Ali (1805-49) between the 1820s and the 1840s, Egypt's GDP rose (Issawi 1982, p. 104). However, we do not know whether this GDP growth was also translated into a height increase, as Ali accepted quite large costs for the population in pursuing his aims – for example, he required 12% of the population to serve in forced labor institutions, and 3% to serve terms of military conscription. However, he did slightly improve the catastrophic educational situation in Egypt by creating new schools. For example, while less than 5% of Egyptians reported their exact age in the 1820s, this share had slightly risen to 15% by the 1860s – a value which was still much lower than that for Turkey with its 45% (Crayen and Baten 2007). Export activities were dominated by a small group of foreigners (Issawi 1966, p.359). Improvements in perennial irrigation increased both agricultural production and cultivation area by a large amount. Yet due to the heavy burden of taxation, the situation of the peasant population did not improve. The Egyptians did not consume much meat in this period (Issawi 1966, p. 377). Nevertheless, GDP growth and marginal educational progress might have provided the ground for some welfare increase during the subsequent period of the 1850s and 1860s (Figure 7). Between the 1840s and

1860s, Egyptian heights increased by about 1 cm to more than 168 cm. Moreover, in this period, the conscription burden declined and the Crimean war boom is reported as having had a beneficial effect even for the Egyptian peasants (Issawi 1982, p. 104). In the early 1860s, the cotton boom which resulted from a supply shortage during the American Civil war provided an additional income for the Egyptian peasants, although this boom did not last long. Already in the late 1860s and especially in the 1870s did prices for Egyptian products begin to fall, and taxes to rise (Issawi 1982, p. 105). Hence, it is not surprising that heights in Egypt declined in the 1870s.

Similarly positive anthropometric values were prevalent in Palestine and Lebanon in the 1850s and 1860s. Being one of the commercial centers of the Middle East, Lebanon developed a wealthy mercantile sector early on which demanded high quality food from the surrounding countryside and invested in the silk (and later fruit) exports from this region. In general, welfare was relatively high in this economic core region of the Ottoman Empire (Issawi 1982, p. 106-7).

In contrast, Yemen displayed catastrophically low anthropometrics values. Since antiquity when Yemen was reported remarkably rich, population density was high and the economy specialized in spices, coffee, and other cash crops. Apparently, Yemen fell into a kind of Malthusian trap in the mid- to late 19th century, as conflicts did not allow the maintenance of the irrigation systems which would have been necessary for generating sufficient income for such a dense population. In the years around 1900, Yemen's territory was split into many little centers of power and its political situation was very instable due to tribal attacks against the Ottoman leadership (1872). The situation was worsened by famines (Dresch 2000, p. 4).

Finally, Iraq had the tallest population in the 1870s, but experienced a downward trend over the following half-century. In this period, grain production increased in Iraq which may have been due to the fact that the large landowners improved cultivation (Issawi 1982, p.

107). Peasants and nomadic cattle herders might have switched to agricultural labor on large landed estates and lost their proximity advantages. Perhaps even more importantly, the sheer number of sedentary workers in grain production grew strongly. The nutrition of children was quite variable, as frequent floods led to highly fluctuating food prices (Issawi 1995, p. 146).

5. An Overall Middle Eastern Height Trend

We now combine all country estimates into a Middle Eastern trend, weighted with country population and interpolated wherever necessary with the height trends of neighbouring countries (following Baten 2006). For the period after 1930, we add the trend estimates of Baten (2006) which are mainly based on the Demographic and Health surveys (DHS) for the Middle East, as well as a variety of other sources and studies on the industrialized countries (which include North America and the Asia/Pacific countries of Australia, New Zealand, and Japan). The most recent birth cohort in these series is the decade after 1980, i.e. our study covers a range of individuals from those born in the 1840s to those living today.

Heights in the Middle East rose until the 1870s when the Middle East was economically overtaken by the industrialized countries (Figure 8). The following era from 1880 to 1940 was characterized by worse anthropometric values. Only during the 1950s was the 1870 peak reached again. The secular pattern of the industrialized countries prior to 1910 appears substantially different. The Middle East prior to 1880 achieved a high level of human stature. The final height of males in 1870 was 167.8 cm on average. This figure was two cm greater than the final height of the industrialized countries. After a period of stagnation until the 1860s, the industrialized countries' heights improved substantially whereas the anthropometric values for the Middle East fell behind in relative terms. But it is remarkable, that with the exception of some Latin American countries (such as Argentina), none of today's low development countries had a height advantage in comparison with the Industrial

countries during the nineteenth century. People in Sub-Saharan Africa, South Asia and Southeast Asia were shorter than the Industrial Countries in this period.

Based on our discussion above, we explain this relative decline of the Middle East after 1880 by the strong shift toward grain and cash-crop agriculture in the Middle East. Pastoral groups who had the advantages of proximity and mobility over large territories, and who depended less on cereal production, were able to enjoy a relatively good nutrition. However, the share of the pastoral population declined when grain production and foreign trade increased. The Middle Eastern countries concentrated on, and specialized in, a small set of commodities. Gilbar (1986) reports that in Iran, the increasing cultivation of crops such as grain, opium, cotton, and fruits implied a structural development away from cattle agriculture. In order to offset the growth of imports, merchants always searched for commodities which were competitive in the world market. After the 1860s, opium and cotton production increased (Hansen 2001). The southern and central provinces which were the main opium producers even had to import cereals in the 1880s. The picture drawn here of the fundamental structural changes in Iran could be similarly drawn for other countries in the Middle East. In the 1860s, a number of modernization and reform attempts were undertaken in the Middle East (Muhammad Ali in Egypt, Mahmud II in Turkey, and Amir-i-Kabir in Iran). After the opening of the Suez Canal in 1869, improvements in shipping and a decrease in freight costs were remarkable. Sea-borne exports and imports increased (Issawi 1995, p.49). The transition process from subsistence to an open and export-oriented economy was implemented with high velocity. The low competitiveness in human-capital intensive industries explains the gap between the Middle East and the industrialized countries which emerged around 1900 and widened continuously thereafter.

6. Comparison of GDP Per Capita, Real Wages, and Height

How does this height trend compare with existing GDP and real wage estimates? In general, both GDP per capita and heights diverged in the course of the 20th century (Figure 8). However, the picture for the 19th century is fundamentally different. In 1870 when the Middle Eastern countries still had a height advantage over the Western world, GDP per capita was already higher in the industrialized countries.

The reason for this may have been distributional, as income inequality was perhaps much higher in the West. Given that heights are quite sensitive to the lower income strata's well-being, the deviation might come from here. Hence, we will trace the real wage development of unskilled laborers and see whether it is closer to the early Western advantage estimate of GDP. Allen (2001) calculated real wage estimates for a number of countries, including the cities of London, Amsterdam, Antwerp, Milan, and Madrid, for almost every decade of the 19th century. Comparing Allen's estimations with Özmucur and Pamuk (2002) time trends for Istanbul (Figure 10), it turns out that in terms of real wages, the West was also quite ahead of Istanbul in the 1870s, with real wages for the Western cities being almost twice as high. However, this applies mainly to London and Amsterdam. If we consider the Western countries without those cities, Istanbul had in fact a real wage advantage in the early 19th century and wages were more or less equal in the period between the 1840s and the 1890s. If we remember that the UK and the Netherlands accounted for only 18.7 percent of the Western European population in 1870 (and 10.7% of Europe's population in 1890, see Maddison 2001), the gap between the richest fifth and the remaining poorer four fifths of Western Europe on the one hand and the Middle East on the other hand was not particularly large in terms of real wages. Could this have been a result of the fact that we only have decadal wage data for Istanbul? The answer is probably negative, as Özmucur and Pamuk (2002) showed that wages in Istanbul were in fact quite representative of Middle Eastern cities, with some cities (such as Edirne, Bursa, Damascus, and Jerusalem) having higher and others having lower estimated real wages.

Is the result for GDP per capita similar if we exclude the richest fifth of Western Europe? When comparing Belgium, Italy, and Spain with the Middle East, we found no country composition effect: those three countries from the poorer four fifths of Europe were still much richer than the Middle East (Figure 11). Assuming that both real wages and GDP estimates reflect the purchasing power of the respective social strata, we thus conclude that Western Europe must have had much stronger income inequality. The Middle East had some proximity advantages which made its population taller during the pre-1880 period. But its urban lower classes had similar purchasing power as those in the poorer four fifths of Europe. In contrast, urban merchants, factory owners, large land-owners, highly qualified engineers, other professionals, and similarly well-to-do persons which might have increased GDP per capita in Western Europe were probably substantially poorer in the Middle Eastern regions.

What happened after 1950? The Middle East jumped in terms of GDP per capita particularly from 1950 to 1970, but the economic development in the Industrial Countries was even stronger (Figure 9).

Conclusion

In sum, this study enlarges our understanding of the Middle Eastern living standard in the nineteenth and early twentieth centuries. In comparison with the industrialized countries, no convergence was observable. Rather, we found a strong divergence after 1900. We analyzed both individual and grouped data and produced first estimates of secular trends in the Middle East's biological standard of living since the 1840s. This yields new insights into the regional welfare implications of social, political, and environmental factors as well as globalization in the early twentieth century. Iranian heights, for example, increased strongly during the 1850s and 1870s. In the aftermath of the "Persian famine" which led to a profound restructuring of the Persian economy, with grain, cotton, and opium production replacing nomadic cattle herding, the 1880s were a decade with quite low anthropometric values for Iran. Later, the

country recovered until the 1910s. To give a second example, Turkey experienced a quite favorable situation between the 1850s and 1870s. In the mid-century, this central region of the Ottoman Empire was apparently still characterized by favorable nutrition conditions, especially in the relatively land-abundant central Anatolia. Like Iran, Turkey was hit by a process of restructuring in the 1880s. Yet in contrast to Iran, the heartland of the Ottoman Empire did not recover too well in the 1890s-1910s period.

In general, the Middle East did better than the Western industrialized countries in the mid-19th century, but around 1900, the latter started to overtake the Middle East in terms of net nutritional status. In this study we have been able to identify the point in time when the Middle East fell back relative to industrial countries, for the first time. With the income levels reached by the beginning of the 20th century and the onset of huge structural changes, a temporary economic setback significantly influenced consumption patterns and led to permanent changes in the nutritional status of the Middle Eastern populations. In short, during the early stages of modern economic growth, the integration of hitherto remote Middle Eastern regions into a larger world market had a significant impact on the heights and modest development of the following period. This dramatic relative decline might have added to the widespread dissatisfaction in this world region which became obvious in the recent conflicts with the Western world. The Islamist fundamentalists' perception of injustice cannot be fully understood without acknowledging the relative decline of this world region. The populations of the Middle East had in fact left the industrialized countries behind until the 19th century. Yet since then, the situation has changed and worsened for the Middle East in relative terms, most dramatically for those cohorts who were born after 1970s.

One could object to this view there was a widening gap in heights in favor of the Industrial Countries during the period 1880-1980 in all Less Developed countries. After all, this was the period of widening GDP per capita gap between the industrialising and less developed economies. Hence, there should have been dissatisfaction elsewhere, too. However,

with the possible exception of some Latin American countries (such as Argentina), none of today's LDC world regions had a lead over the Industrial Countries in anthropometric indicators. In this respect the Middle East was almost unique, leading us to speculate about a particular dissatisfaction. Actually, if some Latin American countries would be the other exception, where height values were higher in the 19th century than in Industrial Countries, and then declined sharply in relative terms, that might also explain dissatisfaction and anti-Western attitudes in this World region as well.

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Table 1: Number of height observations by country and birth decade

Birth Decade	AF	Caucasus	EG	IQ	IR	IS/PS	LB	SY	TR	YE	Total
1840		47	290	8	148	38		65	25		621
1850		200	784	10	125	446	1,066	1,585	48	38	4,302
1860		298	450	19	9	642	415	282	75	42	2,232
1870		876	9,912	45	47				50	22	10,952
1880			76	78	55			38	4,429	30	4,706
1890				1,904	61				5,127	10	7,104
1900		23		1,149	99				7,022	19	8,291
1910	412			306	57				12,480		13,270
1920	5,710			530							6,244
1930	1,524										1,524
Total	7,646	1,444	11,512	4,049	601	1,126	1,481	1,970	29,256	161	59,246

Abbreviation: AF-Afghanistan, EG-Egypt, IQ-Iraq, IR-Iran, IS-PS-Israel/Palestine, LB-Lebanon, SY-Syria, TR-Turkey, YE-Yemen

Table 2: Determinants of heights in the Middle East

Coefficients	
Constant	167.92**
Age dummies	
age20	-0.48**
age5155	-2.55**
Country and birth decade	
Caucasus1830	2.56
Caucasus1840	1.69
Caucasus1850	-0.43
Caucasus1860	1.30*
Caucasus1870	-1.74
Caucasus1900	2.41
Syria 1850	-1.58**
Syria 1860	0.11
Lebanon 1850	-1.34**
Lebanon 1860	-0.69*
Iran 1840	-5.67**
Iran 1850	-2.60**
Iran 1870	0.34
Iran 1880	-2.41*
Iran 1890	-1.99*
Iran 1900	-0.96
Iran 1910	-0.79
Iraq 1870	2.71*
Iraq 1880	0.77

Iraq 1890	-0.80**
Iraq 1900	0.98**
Iraq 1910	-1.87
Iraq 1920	0.97**
Yemen 1850	-5.47**
Yemen 1860	-6.62**
Yemen 1880	-7.19**
Yemen 1890	-5.02*
Yemen 1900	-5.76**
Turkey 1850	0.90
Turkey 1860	1.00
Turkey 1870	2.22*
Turkey 1880	-0.52**
Turkey 1890	0.50**
Turkey 1900	0.48**
Afghanistan 1910	-1.71**
Afghanistan 1920	-1.54**
Afghanistan 1930	-1.25*
Palestine/Israel 1840	4.80*
Palestine/Israel 1850	0.83*
Palestine/Israel 1860	0.71*
Egypt 1840	-0.76*
Egypt 1850	-0.57*
Egypt 1860	0.36
Egypt 1870	-0.74**

Inequality between provinces

Small province Afghanistan	-1.63**
Tall province Afghanistan	2.31**
Small province Egypt	-1.17**
Tall province Egypt	0.36*
Small province Armenia	-2.10*
Tall province Armenia	3.67*
Small province Iraq	-0.93*
Tall province Iraq	-0.06

Religion

Jews	-2.52**
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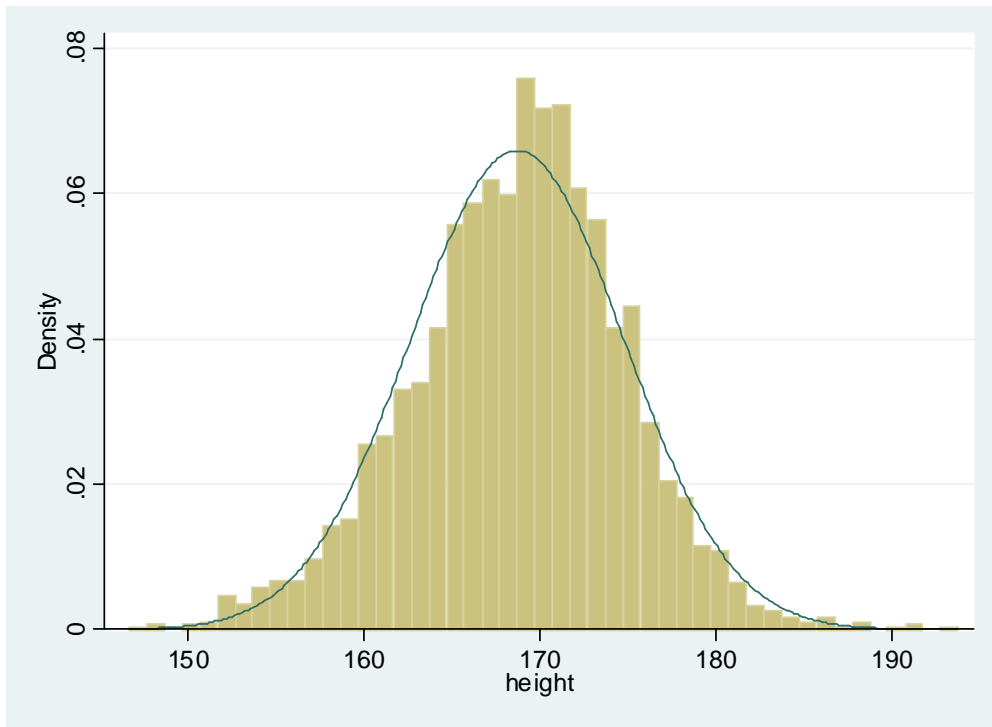
Number of observations	57,334
R-squared	0.3641
Adjusted R-squared	0.3470

** significant at the 0.01 level

* significant at the 0.05 level

Notes: Intercept represents a 20-50 year old male who lived in a medium-height province in Turkey in 1910. "Caucasus" represents the population of today's Armenia, Azerbaijan, and Georgia.

Figure 1: Distribution of height (males)



Sources: see text under “Data and Methods”

Figure 2: Regional mean stature of male Iraqis, 1870-1910

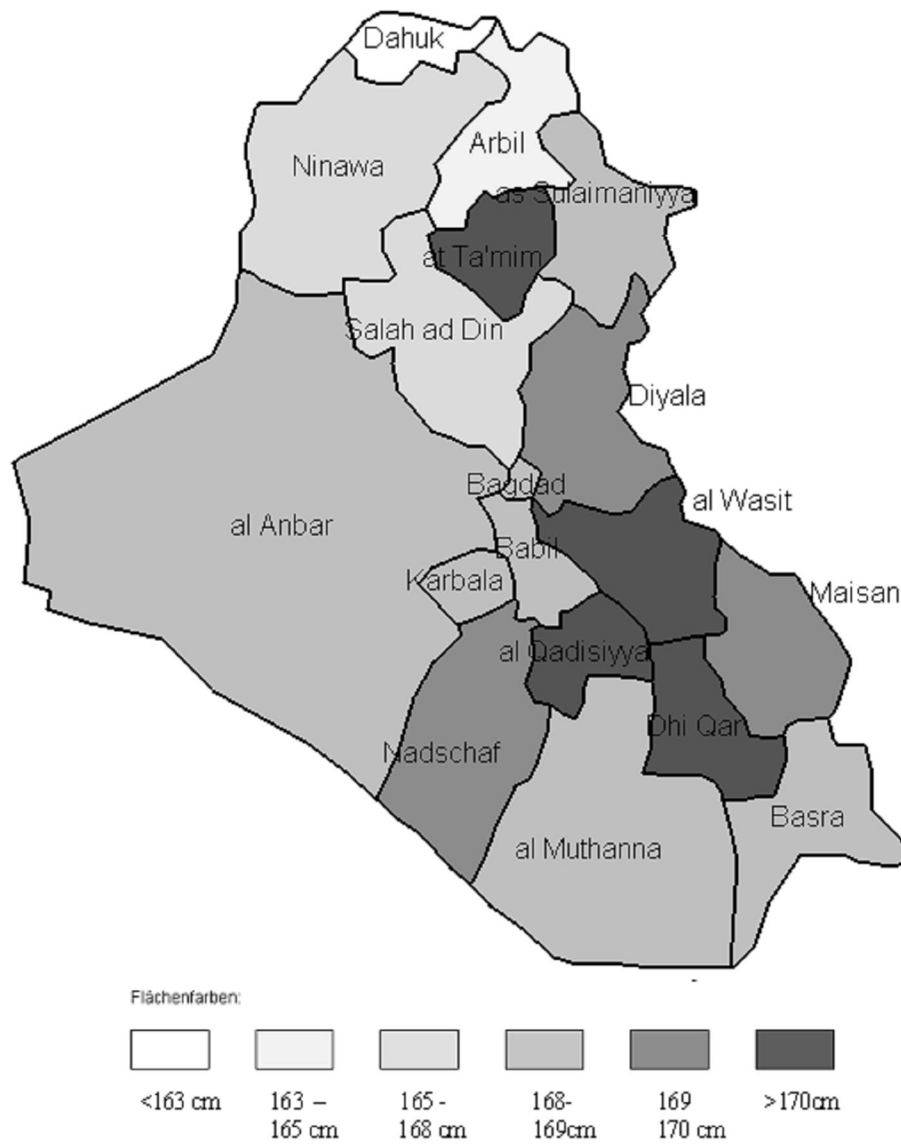


Figure 3: Regional mean stature of male Afghans, 1910-1930

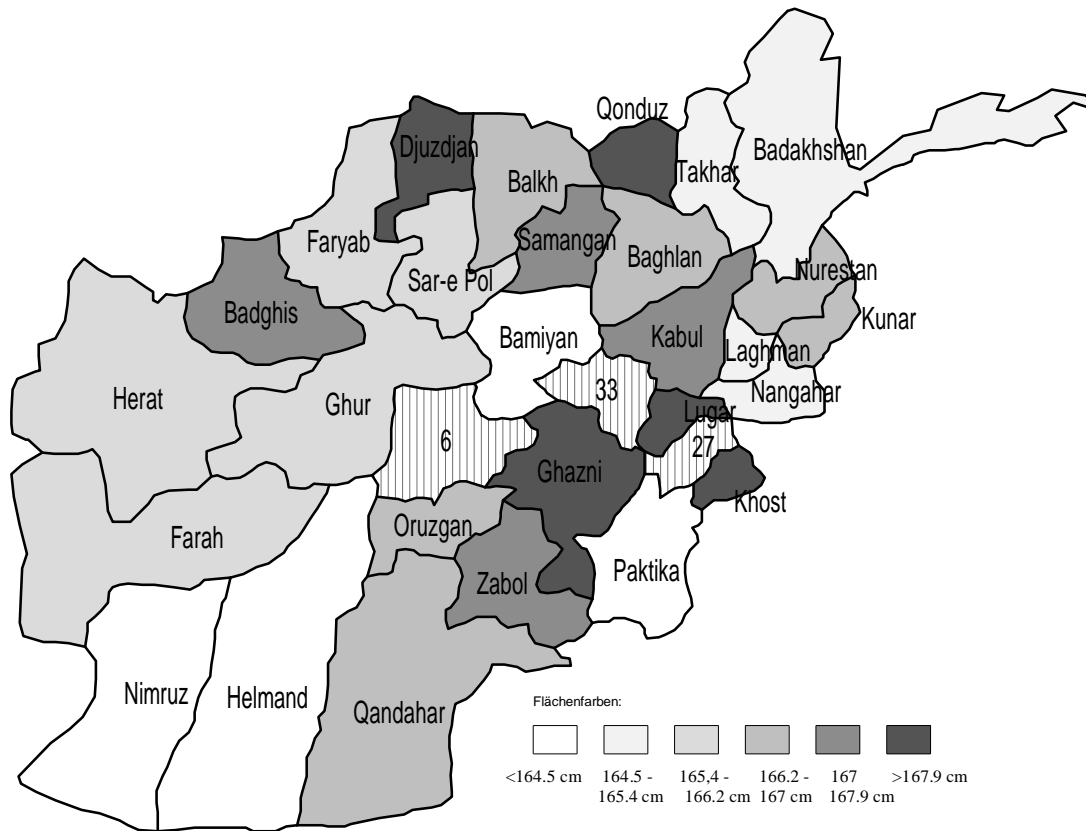


Figure 4: Regional mean stature of Turkish males, 1840-1910

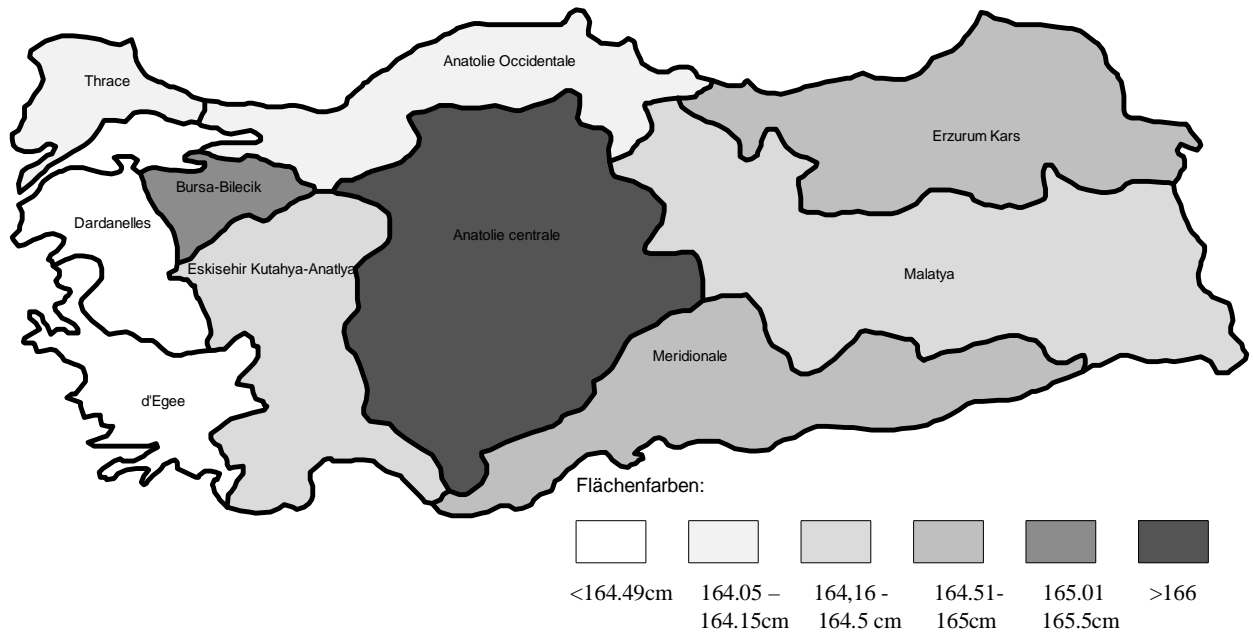


Figure 5: Regional mean stature of Egyptian males, 1840-1880

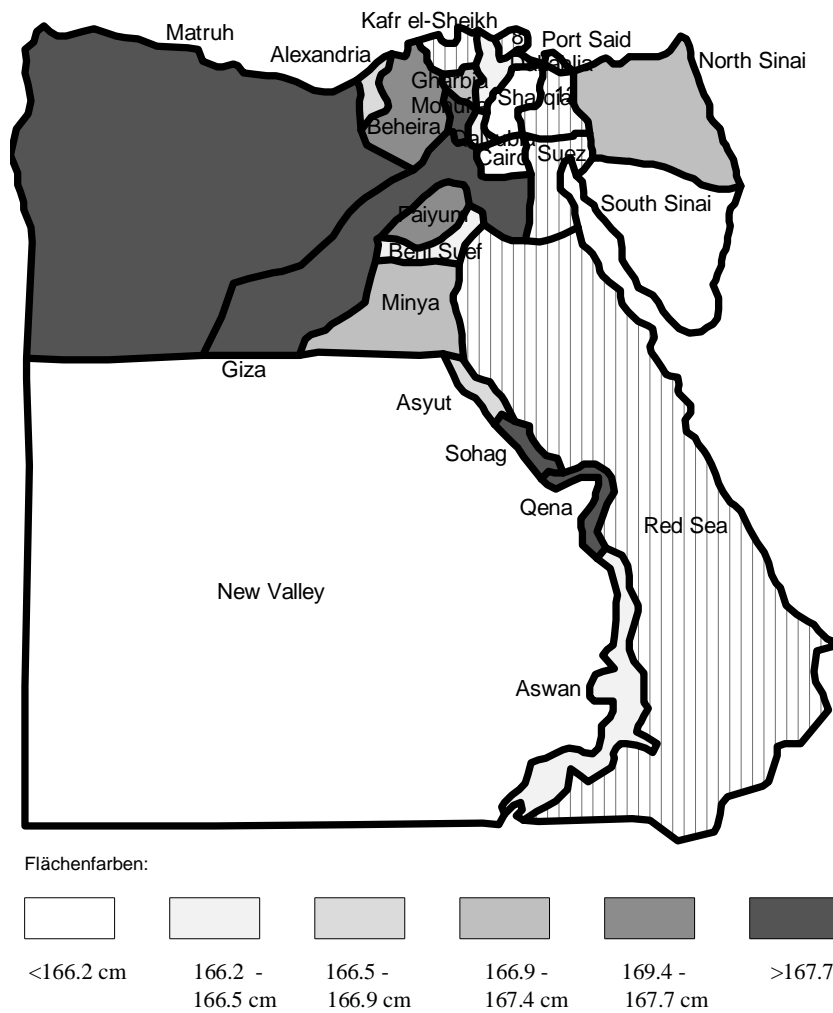
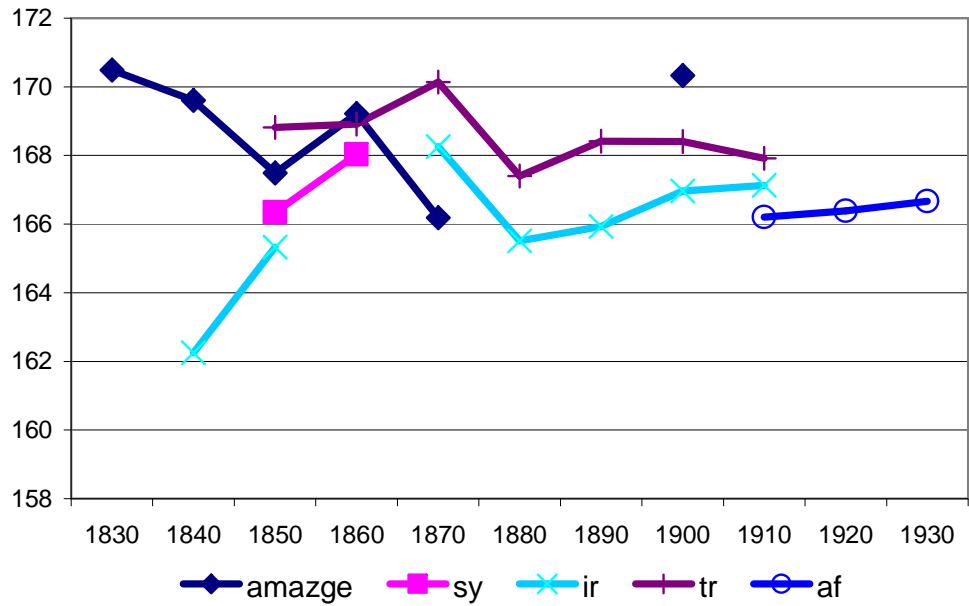
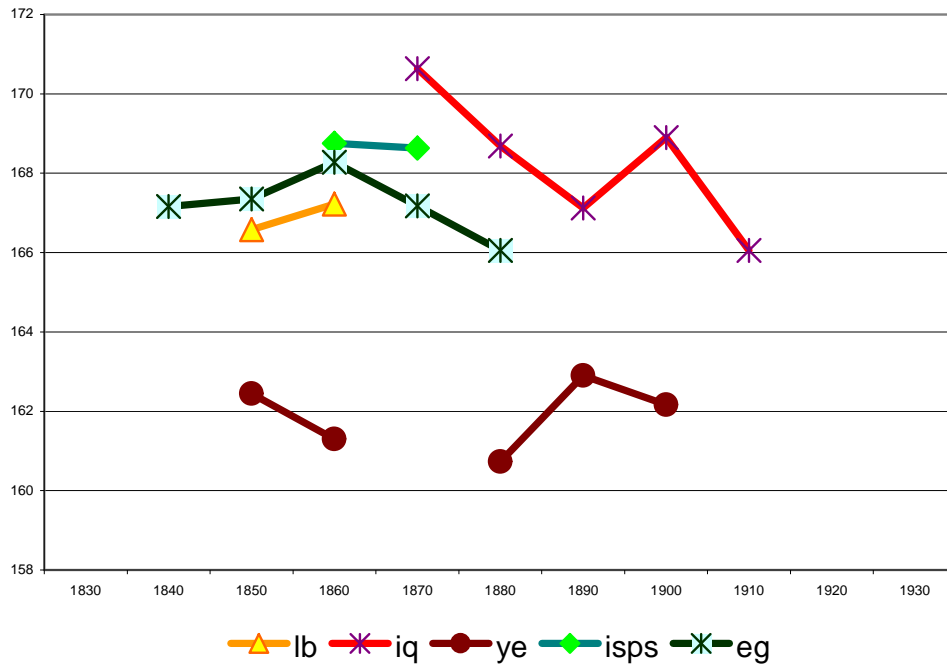


Figure 6: Northern Middle East Height Trend



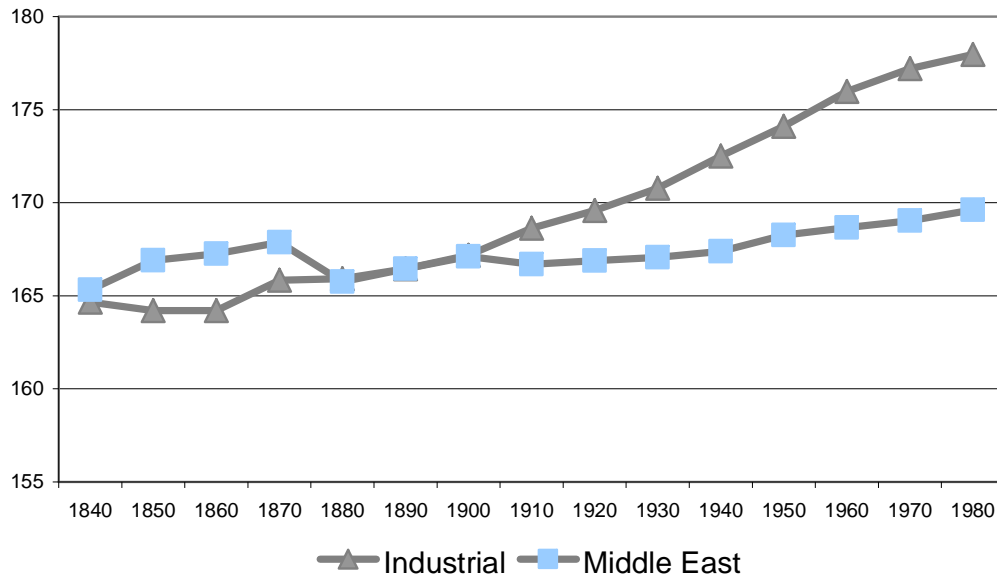
Sources: see text under "Data and Methods" and Table 1a

Figure 7 : Southern Middle East height trend



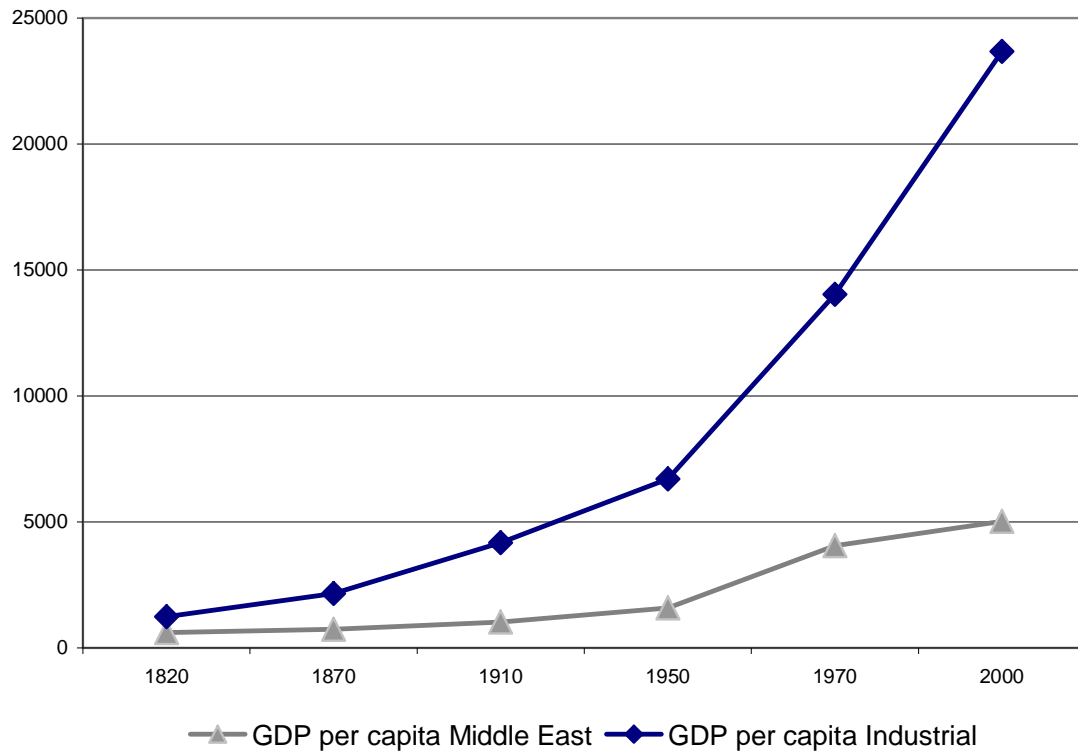
Sources: see text under “Data and Methods” and Appendix Table A-1

Figure 8: Heights trend in the Middle East and industrialized countries, weighted by population size



Sources: for 1840-1930: see text under “Data and Methods” and Appendix Table A-1; for 1930-1980: Demographic and Health surveys (DHS)

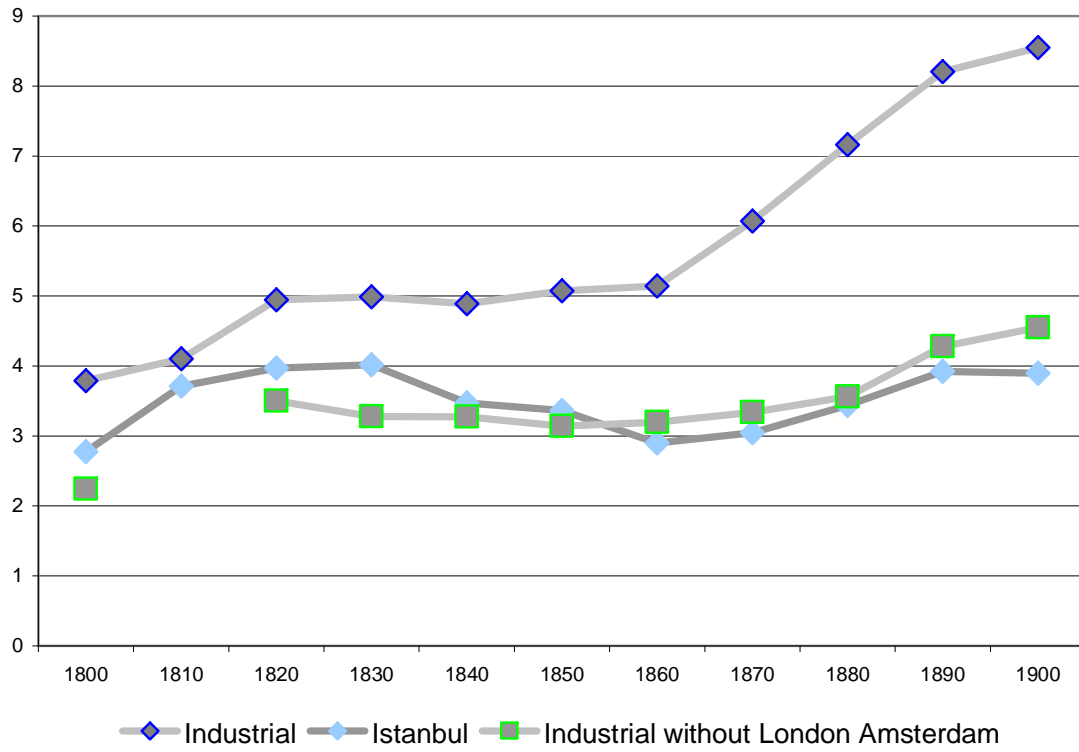
Figure 9 : GDP per capita in 1990 PPP Dollars - weighted by population size



Source: S. Pamuk (2006)

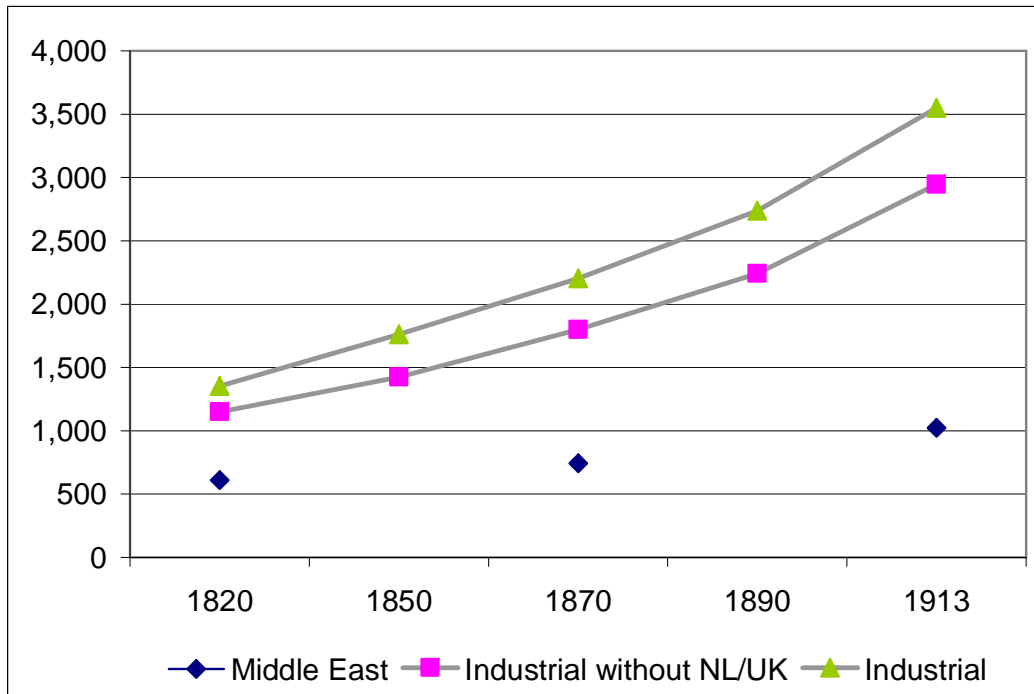
Figure 10: Real wages in Istanbul and industrialized countries in grams of silver per day

- weighted by population size



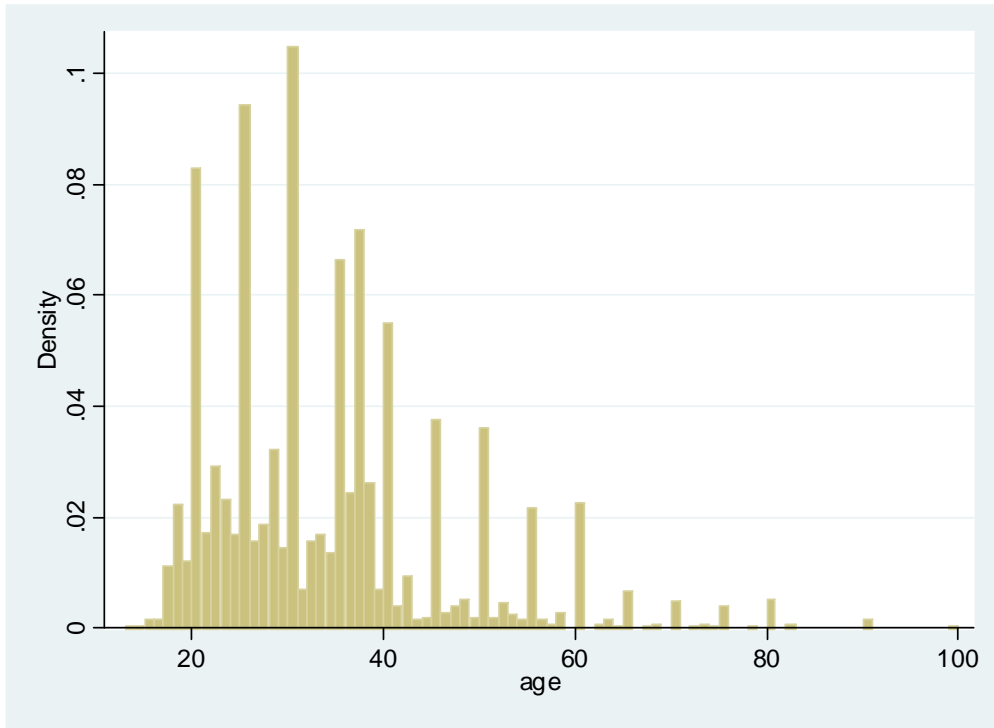
Sources: Istanbul: S. Özmucur, S. Pamuk (2002), Industrial: Allen (2001)

Figure 11: GDP per capita Per Capita GDP (1990 International Geary-Khamis dollars)



Source: Maddison (2001); Pamuk (2006).

Appendix Figure A-1: Distribution of male age



Sources: see text under “Data and Methods” and Appendix Table A-1

Appendix Table A-1: Anthropometric data sources 1840 -1930

Country	country code	Height sources:
Afghanistan	af	Debets G.F. (1964)
Armenia, Azerbaijan, Georgian	am az ge	Deniker J. (1900), Boas F. (1924), Field H. (1953), Kherumian R. (1943), Chantre E. (1895), Seltzer C. (1936, 1940)
Egypt	eg	Ammar A.M (1944), Chantre E. (1904), Craig J.I. (1912), Field H. (1952 (a)), Orensteen M. M (1915)
Iran	ir	Weissenberg S. (1913), Field H. (1939), Pardini E. (1975)
Iraq	iq	Field H. (1929, 1931, 1936, 1940, 1951, 1952, 1956)
Palestine/Israel	is ps	Genna G. E. (1938), Gloor (1950), Vallois H.V. (1964), Huxley H.M. (1939)
Lebanon	lb	Seltzer C. (1936, 1940), Shanklin W. M. (1946)
Syria	sy	Seltzer C. (1940), Shanklin W. M. (1938), Weissenberg S. (1911)
Turkey	tr	Inan A. (1939), Chantre E. (1895), Wagenseil F. (1925), Crowfoot J. W. (1900), Field H. (1956)
Yemen	ye	Weissenberg S. (1909), Cipriani L. (1938), Thomas, B. (1929, 1931, 1932)