ESSAYS ON THE BIOLOGICAL STANDARD OF LIVING IN LATIN AMERICA AND THE CARIBBEAN

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Contents

Symbols and Abbreviations

ABCC	Transformed Whipple Index that yields an estimate of the share of individuals who report a non-rounded age
Art.	Article
BMI	Body Mass Index
cm	Centimeter
Col.	Column
Dep. Var.	Dependent Variable
dist	Distance
GDP	Gross Domestic Product
HDI	Human Development Index
km	Kilometer
log	Logarithm
Max.	Maximum
Min.	Minimum
Obs.	Number of Observations
OLS	Ordinary Least Square Estimation
S.E.	Standard Error
Std. Dev.	Standard Deviation
UK	United Kingdom
U.S.	United States
vs	Versus
WHO	World Health Organisation
WLS	Weighted Least Square Estimation

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1 Introduction

1.1 Welfare

The history as well as recent developments of welfare keeps researchers of various disciplines occupied because of its complexity and the interdisciplinary approaches of measuring welfare. By explaining welfare levels within and between countries or regions, scholars try to assess economic and social inequalities and their development to get a better understanding of today's world division, particularly the economic backwardness of many and the superiority of other countries. Interestingly, what they find is that the discrepancies in productivity between what are today the less developed regions and the industrialized economies were one major driving force and are of relatively recent origin (Coatsworth 1996). Differences between rich and poor nations originated in the 18th century, when a few economies began to grow slowly while the rest of the world did not (Maddison 2001). The benefits of growth, however, did not spread evenly across societies. Differences between social strata were common since the ruling elite in the Americas or the nobility in Europe were able to seize the gains from higher productivity and left the working class with only the basics to live on.

Most often, monetary income measures were used which give rough estimates on a particular place or group or time; however, too many countries in the past do not give us the necessary information to get a comprehensive picture of welfare. The questions about appropriate welfare measures and suitable data needed for this undertaking have already been addressed by several authors (see for example Crafts 1997, Costa and Steckel 1997, Williamson 2009). Mostly, a combination of various determinants of health including factors such as income, life expectancy at birth, infant mortality rates, adult literacy rates, and political and civil liberties, is of the uttermost interest. Resulting measures such as the human development index (HDI) were created to rank countries by a broader level of socio-economic welfare. The index measures the welfare level that an economy has reached along the path to modern living standards.

A very important determinant of economic growth and welfare is the level of schooling. Easterlin (1981) finds that it is likely that a substantial primary education system for the masses is essential for economic growth. Higher income levels as well as technology improvements are results which lead to the diffusion of advanced medical care, including simple methods such as water purification or the establishment of sewage systems. These improvements increase life expectancies and therefore the welfare of a country. However, Latin American countries were hardly known for their educational efforts in the 19th century, so that one has to look elsewhere to derive implications for welfare levels. Generally, conventional measures of economic growth can only be used to describe some part of the improvements in living conditions in the past because other factors were at least equally important in determining the well-being of the population (Crafts 1997), which leads us to the purpose of this thesis.

When in the late 1970s researchers started to rediscover the usefulness of anthropometric data, a huge wave was set in motion that would result in the creation of the new anthropometric history. While studies on height existed prior to the 1970s, those were mainly conducted by human biologists or physical anthropologists that were largely ignoring questions regarding to the fields of economics, history, and other social sciences. The pioneering works of Robert Fogel, Richard Steckel, and John Komlos, which were followed by many others, gave a new aspect to the studies on the welfare of populations. John Komlos was the first in 1987 to name this development by using the term of the *biological standard of living*. Economic historians exploit long-ignored data sets to draw inferences about comparative standards of living that complement more conventional measures like GDP or wages.

The implications of changes in height are manifold. For example, Margo and Steckel (1982) show with data from the antebellum American South that the value of slaves increased with height and weight which suggested that better fed and healthier slaves were more productive. Another study suggests that mortality rates first decline with increasing heights, but start to rise again when stature overpass a certain limit (Costa and Steckel 1997). High mortality rates could also have an effect on the distribution of human capital because incentives to invest in human capital might be lessened. It can be concluded that the distribution of health and other factors is important in determining living standards since an unequal distribution of health could slow down productivity and therefore economic growth. Inequalities between

occupational groups and other social classes such as ethnicity and urban-rural differences were widespread in the past and were negatively associated with health status (see for example Blum 2011).

This thesis makes use of anthropometric measures to assess living conditions in Latin America and the Caribbean. Direct and indirect determinants on heights are used to give a clearer picture on a continent that still has many empirical blanks to fill when it comes to the history of welfare and inequality.

1.2 Aim of the thesis

Although many studies have appeared in the recent past on biological well-being of countries all around the world (for an overview see Steckel 2009), empirical evidence for colonial and post-colonial periods in Latin America is still scarce. This thesis aims at filling the gap in Latin American and Caribbean anthropometric history with studies on countries that have not been analyzed before. For the construction of the data base, many primary sources have been used. These were mainly found in the National Archive of Peru, the National Archive of the Island of Cuba, the Historical Service of the Argentine Military, and in the Public Archive of Rio de Janeiro.

The main questions in the following paper deal with the development of stature as a measure of welfare in Argentina, Brazil, Cuba, and Peru in colonial and post-colonial times. The fact that Latin America today is known for being the world region with the highest level of inequality leads to the question of whether this has already been the case in the 19th century. The historical literature on Latin American inequality believes that levels of inequality had always been very high on the continent. Recent research, however, argues that inequality became high only during Latin America's *belle époque* (Williamson 2009) and that Bourbon America was not an especially unequal society in an international comparison (Dobado González and García Montero 2010). The focus in this thesis is laid on the 19th century and in chapter three and five, the period of observation ranges to the early 20th century. Social inequalities are studied using variables concerning the ethnic, regional, and occupational differences of individuals to determine the level of inequality in the countries analyzed here.

Additionally, educational inequality can be used to determine welfare levels since education is a determinant of income. Higher education should not only lead to a

greater awareness of health conditions, but correspondingly higher incomes should also lead to an easier access to medical care. In chapter six, the methodology of age heaping is used to study educational inequalities in colonial Cuba which adds to previous studies on Latin American educational histories and corresponding inequalities (see for example Baten and Mumme 2010, Manzel et al. 2011).

As part of a DFG funded project, the selectivity of migrants to Latin America is studied to help explaining the reasons and attractions that influenced the decision of migrants to leave their home countries and take the voyage to Latin America. Few studies exist that compare the height levels of destination to source countries because migrants were usually considered separately in previous anthropological studies since they are clearly not a random sample of the underlying population. Baten and Blum (2011) compiled a global data set of heights for over 156 countries which serves well to study the height selectivities of migrants to Argentina for the first time.

1.3 Outline of the Thesis

The thesis comprises five manuscripts which are written with the intention of publication. Three papers are compiled with different co-authors; one working paper and a research note are written by me. At the time of handing in this thesis, two of the papers are already published in *Economics and Human Biology*.

Chapter two deals with the concept of the biological standard of living in general, explaining the reasons to why this method is useful for research and how it is applied in the following chapters. It gives an overview on anthropometric history in Latin American and Caribbean countries, and emphasizes the importance of this methodology.

Chapter three, four and five examine general tendencies in the development of the well-being in various Latin American countries in the 19th and early 20th centuries. Several different aspects of each country's economic and social history are addressed, and new data samples on countries not studied before allow a closer examination of living conditions in the post-colonial period.

The first of these papers, chapter three, tests hypotheses concerning the welfare trends in Argentina, Brazil, and Peru. While Maddison's (2001) GDP per capita values are one of the first historical income trends in the economic history of Latin America,

this measure is quite sensitive to factors such as urbanisation and industrialization, and various GDP values had to be assumed because reliable data are scarce. Therefore, the new-found data on Argentina, Brazil, and Peru offer valuable alternative insights into the biological well-being of the population, and serve to measure economic and social inequalities.

Chapter four uses an extended data set on Peru which is used to answer questions about possible benefits of the guano boom in 19th-century Peru. In spite of the substantial profits generated by Peru's chief export product, guano, revenues from the latter apparently did not filter down to benefit ordinary laborers.

Chapter five examines living standards in Cuba from late colonial times until North American dependency. Data on height and weight of Cuban soldiers are applied to test hypotheses concerning the consequences of the wars of independence and possible inequalities between the black and the white population. The relationship between those ethnicities was said to have been more harmonious than in any other country where slavery had been prevalent, and the data certainly point that way.

Chapter six is conceived as a research note. The note deals with human capital data on the island of Cuba which describe a different aspect of welfare. As previous studies noticed education and biological welfare are positively correlated (see Steckel 2009 for an overview). Human capital is essential for economic growth (Weil 2007) and therefore a good proxy for economic welfare. Several censuses and lists of individuals were used to measure the extent of age heaping which was put into context with the educational history of the island. In an international comparison, Cuba seems to have done quite well in terms of numeracy.

In chapter seven, heights are applied as an explanatory variable in the context of international migration. A new source of evidence on height is used to explore the selectivity of migrants from 59 countries to Argentina during the age of mass migration. As part of the DFG financed project "The human capital of migrants and the selectivities underlying the migration process, 1800-1950", this study focuses on the characteristics of migrants coming to Argentina and the determinants that lie behind the migration process.

Chapter eight summarizes my findings and gives directions for future research.

1.4 References

Baten, J., Mumme, C., 2010. Globalization and Educational Inequality During the 18th to 20th Centuries: Latin America in Global Comparison, *Revista de Historia Económica (Journal of Iberian and Latin American Economic History)*, 28 (2), pp. 279-305.

Baten, J., Blum, M., 2011. Growing Tall, but Unequal: Biological Well-Being in World Regions and its Determinants, 1810-1989, *Working Paper*, University of Tuebingen.

Blum, M., 2011. The Influence of Inequality on the Standard of Living: Worldwide Evidence From the 19th and 20th Centuries, *Working Paper*, University of Tuebingen.

Coatsworth, J.H., 1996. Welfare, *The American Historical Review*, 101 (1), pp. 1-12.

Costa, D.L., Steckel, R.H., 1997. Long-Term Trends in Health, Welfare, and Economic Growth in the United States, in: Steckel, R.H., Floud, R. (Eds.), Health and Welfare During Industrialization, pp. 47-89, University of Chicago Press.

Crafts, N.F.R., 1997. The Human Development Index and Changes in Standards of Living: Some Historical Comparisons, *European Review of Economic History*, 1 (3), pp. 299-322.

Dobado González, R., García Montero, H., 2010. Colonial Origins of Inequality in Hispanic America? Some Evidence on Wages and Heights, *Revista de Historia Económica (Journal of Iberian and Latin American Economic History)*, 28 (2), pp. 253-77.

Easterlin, R.A., 1981. Why Isn't the Whole World Developed?, *Journal of Economic History*, XLI (1), pp. 1-17.

Maddison, A., 2001. The World Economy: A Millennial Perspective. Paris: OECD.

Manzel, K., Baten, J., Stolz, Y., 2011. Convergence and Divergence of Numeracy: The Development of Age Heaping in Latin America, 17th to 20th Century, *Economic History Review* (forthcoming).

Margo, R.A., Steckel, R.H., 1982. The Heights of American Slaves: New Evidence on Slave Nutrition and Health, *Social Science History*, 6 (4), pp. 516-538.

Steckel, R.H., 2009. Heights and Human Welfare: Recent Developments and New Directions, *Explorations in Economic History*, 46 (1), pp. 1-23.

Weil, D.N., 2007. Accounting for the Effect of Health on Economic Growth, *The Quarterly Journal of Economics*, 122 (3), pp. 1265-1306.

Williamson, J.G., 2009. Five Centuries of Latin American Inequality, NBER Working Paper No. 15305.

2 On the Concept of the Biological Standard of Living

2.1 Introduction

There is a very broad literature on the influence of nutrition on stature growth of individuals. This thesis makes use of this relationship to measure the biological standard of living in various Latin American countries. An adequate nutrition is one of the basic human necessities and helps to achieve the genetic height potential each individual has. Adequate nutrition therefore provides the fundamentals not only for a healthier, but also a wealthier living, which is discussed in the following. The first two years of life are of crucial importance for final adult height which is why, generally, decades of birth are considered to describe living standards in the past.

This chapter serves as an introduction into the general topic of heights. First, it considers the sources of stature and the corresponding selectivity of the data. Second, direct and indirect determinants of the outcome, the final adult height, are discussed. Third, some thoughts on the various fields of application are given. Fourth, Latin American heights from the existing literature are discussed, separating this world region into the Latin American continent and the corresponding Caribbean Islands. This serves to underline the importance of this thesis which fills existing gaps in the anthropometric literature.

2.1.1 Sources and Selectivity

Starting in the mid-18th century, identification of individuals was often carried out by recording their age, height, hair color, and complexion (Steckel 1995). This was done to ensure that individuals could be identified without difficulties, for example, free blacks or criminals of all kinds. The military used these features to assess fighting capabilities of regiments or to track deserters, and sometimes to assure that compensation for having served in the army could be assigned to the right individuals (Steckel 1995).

To study biological well-being in the 19th and 20th century archives all around the world were visited and hidden documents on individual records and other population counts were unveiled. Valuable information was frequently found in military and prison registers. This more than often complicates an interpretation of stature development because seldom the entire population was represented in this kind of sources. Military height samples typically suffer from truncation problems because a minimum height requirement was introduced to get only the taller part of the population to enter the army due to simple reasons: deterring the adversary and holding a gun properly. This bias can be approached with adequate statistical methods such as the truncated regression analysis (see for example Komlos and Kim 1990, Komlos 2004). Criminal records most often are representative of the lower social classes in the society which were more prone to commit petty thefts and get arrested for it. One way to address sample selectivity is to compare the composition of the data set in terms of its ethnic or occupational or demographic distribution with census data that represent the whole population in a country or region, and adjust for the unequal sample composition.

An additional important source of height records are anthropological studies which are often useful for times and places where other sources hardly exist. These studies frequently suffer from the problem that anthropologists combined height data of all ages in one measure because it was unclear to them that height could change over decades. One has to be careful when using this kind of data and remove unreliable data sources from the analysis.

Moreover, selectivity problems may occur when migrants are included in the sample because they are not representative of their home country and therefore might be positively or negatively selected, which could bias the results. Another possible problem concerns samples with individuals that self-reported their height which may lead to an overestimation or even underestimation of the mean value of the corresponding population. Each bias needs to be carefully taken into consideration for further analysis which is explained in greater detail in the following chapters.

2.1.2 Determinants of Height

Height is a net measure that captures not only the supply of inputs to health but also the demands on those inputs. Height at a particular age reflects the history of net nutrition

of each individual, which means the diet minus the claims on the diet made by physical activity and disease (Steckel 1995). The major influences on growth that changed in the past are those related to the environment, including nutrition, health care, sanitation, and work intensity. In the following the most important determinants of height are being discussed in-depth.

Nutrition: Of particular importance to an individual's final stature is the consumption of proper food, meaning that the right combination of proteins and calories will probably lead to the attainment of taller stature. Previous studies have found a positive relation between stature and consumption of the amount of meat and milk, respectively (Baten and Blum 2011, Eveleth and Tanner 1976). If a whole population consumes too little calories or proteins, particularly animal proteins, a small body size results because the body is not able to reach its full growth potential. In experiments conducted by Orr (1928) and Leighton & Clark (1929), school children in several cities in Scotland were given an extra pint of milk per day for seven months. The groups that were given the extra dose of milk increased faster in height and weight than two control groups of children of the same ages; one of them was given no supplement and the other one was given a supplement of biscuits which equalled the milk in total calories. It was concluded that milk accelerated growth whereas the biscuit supplement had no effect on growth. It is important to mention that this experiment was conducted in a country with considerable economic development. Therefore, it seems reasonable to assume that the same amount of milk has an even higher effect in less developed countries.

Today we know that milk contains several essential nutrients for the development of a strong body, including protein (amino acids) and calcium (Eveleth and Tanner 1976). In a separate experiment Takahashi (1984) describes how culture, food, and growth are related and how they interact in a society which differed enormously from Western European standards. The author finds an association between changes in dietary practices and growth in Japan. Rice has been, and still is, the dietary staple food of Japan. Changes in Japan began with the post-war period when greater contact with Western cultures and economic development was formed which altered the traditional diet. Rice consumption decreased, whereas meat and milk consumption rose. The height of school boys, aged six to 17 years, rose by an average of 0.1 cm between 1930 and 1960, a period of relatively great social and economic change, but rose by an

average of 5.3 cm between 1960 to 1975, which the author attributes to changes in diet, especially the increased consumption of milk.[1]

Disease environment: Previous literature suggests that health and economic growth are highly correlated, although the causation and magnitude has been debated much (Steckel 2009). Health is one important factor for achieving higher economic growth. We can approximate its impact on stature by using variables such as the epidemic and endemic disease environment or mortality rates.

During an illness, even quite a mild one, growth tends to slow down because the human body requires additional resources to get healthy. In countries where nutrition is adequate this slow-down is usually followed by a catch-up which in most cases can restore the child to his normal growth curve (Eveleth and Tanner 1976). In poor countries, however, a precarious disease environment can have scarring effects in the sense that adult height among survivors is reduced (Deaton 2007). Generally, poorly nourished children are more prone to infectious diseases because the body has problems fighting viruses, which further reduces the possibility of attaining the potential final height since illness consumes a great share of what could have been used for further growth.

Genetics: Differences in height are one of the most obvious visible characteristics among individuals. While genetic disposition is an important determinant of individual height and determines adult height potential, whether that potential is realized or not depends on the socio-economic environment in which the individual matures (Eveleth and Tanner 1976). Therefore, if whole populations, or large samples, are under consideration, environmental conditions play the major role in determining the health status of a country or region. Genetic differences cancel each other out when population averages are considered.

Still, it is important to both factors in the biological development of the human being because genes are inherited and everything else is developed (Bogin 1988). In the case of the Maya of Guatemala and the Aymara of Bolivia, both Native American people, the author concludes that beside their isolated regional and social position, the low economic status and undernutrition are likely to be factors that account for the relative short stature.

[1] The numbers refer to the total effect during the two periods.

Another interesting case study is Japan. One may be tempted to think that the lower average height of Japanese people in comparison to Europeans is primarily due to differences in the genes of the population, especially since the per capita income in Japan and in Europe have been at similar levels during the last decades (Bassino 2006). The author, however, offers additional explanations such as that the Japanese are still catching up. According to Cole (2003), the rate of catching-up from one generation to the next is biologically constrained to avoid the cost of too rapid a catching-up process. Therefore, it may take up to six generations for a population to reach its full potential. In the Japanese case, a number of other factors such as differences in protein intake, exposure to stress, and physical exercise could also have resulted in a growth delay (Bassino 2006). Baten and Blum (2011) suggest that lower stature in Japan could also be due to the lactose intolerance of a great part of the population, where milk consumption, however, has increased slowly in the recent past.

2.1.3 Fields of Application

Literature has shown that heights are a useful measure when it comes to the debates over demography and the quality of life. Of special interest were the realms of slavery, the standard of living during industrialization, inequality, and mortality (see Steckel (2009) for an overview). In the following, some aspects which are applied in this thesis are addressed in greater detail.

Socioeconomic status and inequality: Differences in average heights by occupation, region, and ethnicity can be used to determine inequality in biological aspects of the standard of living. Inequality between different groups is of importance because it serves as a reflection of the welfare in a society. Growth data provide a good indicator of the degree of social and economic deficits that the underprivileged strata in a society suffer from. To measure the extent of inequality in a society, individuals can be divided into different ethnic groups; that is people of white, black, Indian, Asian and other ancestry, or, for example, differences between slaves and non-slaves. Bodenhorn (2002) finds that the lighter the skin color complexion of black people in Antebellum Virginia got, the taller the people were. Carson (2009) tries to shed light on the development of black and white heights in the 19th-century American South, where ethnic inequality was widely apparent in the early decades. Heights of blacks were

increasing over the century while white heights were declining and the gap between ethnicities was therefore decreasing.

Different experiments have shown that children who belong to a lower socioeconomic class are generally smaller and mature less rapidly than children in a higher socioeconomic class (Eveleth and Tanner 1976). Hierarchy in occupational classification is used to determine the social status of an individual because it is expected that income correlates positively with stature for various reasons. Therefore, a higher socioeconomic status allows for better nutrition and better health care; physical labor for children might be reduced completely and the physical work intensity of a parent is less intensive, as Bielicki and Welon (1982) find for the case of Poland.

In this thesis, the Armstrong (1972) scheme is used on several occasions to study social differences. The data is divided into various occupational groups such as unskilled, semi-skilled, skilled, semi-professionals, professionals, farmer, merchants, and domestic workers, which gives a reflection of the socio-economic status of an individual in the past.

Human capital: Generally, education is expected to have a positive effect on heights, since education improves the health and nutritional behaviour particularly of the poorer part of the population (Moradi and Baten 2005). However, the causality is not too clear. Behrman (1996) points out that the association between education and nutrition does not necessarily imply causality between these two variables. On the one hand, it is true that better health and nutrition leads to improved educational attainment in many areas such as enrollment at younger ages, less grade repetition, less absenteeism, and better performance on test scores (Behrman 1996).

On the other hand, a mother's education can have positive effects on the growth process of her children because the mother might be more responsible in her ways of taking care of the children regarding their nutrition, hygiene and medical care. Several studies have shown that increased education of women has a positive impact on a child's health with the result of increasing adult height (see for example Handa 1999). Therefore, the correlation between nutrition and education goes in both ways and can lead to a higher standard of living.

Migration: While the literature agrees that immigrants are not a random sample of the population they leave behind, the question on how they compare to the latter has been of discussion only recently. Immigrants are selected on various characteristics

such as their educational level, occupation, skills, age, and gender (Feliciano 2005). In this thesis, heights as a measure of biological welfare differences between those who left and those who stayed behind are applied to see to what extent they actually differed. If migrants are positively selected, we can assume an economic and social gain for the country they migrate to, and an actual loss for the source country. If migrants are negatively selected, the source country is gaining, while the destination country might be suffering further consequences such as an overflow of unskilled laborers forcing down wages. Examining migrant streams in the past offers additional insights on a country's economic and social history. Previous studies on migrants' selectivity find that they were mostly positively selected in terms of heights (López 1954, Danubio 2005, Boëtsch et al. 2008) which indicates a loss for the sending country.

2.2 Biological Welfare in Latin America and the Caribbean

Just recently a special issue on Latin American anthropometrics has been published by *Economics and Human Biology* which presents several new studies on Latin American biological well-being. A summary article by the editors, Joerg Baten and Scott Carson, describes past and present studies.

On this account, I want to give a brief overview of the main findings of existing studies on Latin American countries and the Caribbean Islands to indicate the importance of this thesis which not only presents new data, but also new applications of the biological standard of living. Considering height data on Latin America compiled in Baten and Blum (2011) and my own calculations added, we can deduce a general pattern of the development of stature in the 19th and 20th century (Figure 2.1). In general, stagnating heights reflect the living conditions in Latin America throughout the late 19th century, whereas the 20th century yielded somewhat increasing heights. Various studies on social inequalities have shown that especially the lower social classes lost ground and their heights stagnated or even declined.

2.2.1 Latin America

Salvatore (2007) studies the stature of Argentines from registers of prisoners and military recruits from the 1850s to the mid-20th century. The author suggests that neither

the expansion of wool and cattle (1850-1880) nor the expansion of wheat exports (1880-1914) led to an improvement in living standards. On the contrary, during these two periods of extensive export growth he observes a situation of nutrition stress in this food rich economy. Living standards stagnated during this time. Moreover, the export boom reinforced existing regional disparities. The author concludes that besides an increase in food prices, the pressure of immigration on the labor market led to decreasing wages. Further, diseases and child labor aggravated the situation and led to the observed stagnation in living standards. The 20th-century interwar period produced then strong and sustained growth in average Argentine stature (Salvatore 2004).

Meisel and Vega (2007) study Colombian heights on the basis of National Identification Cards and passport records. They find stagnating heights for the elite group of passport holders for the birth cohorts of 1870-1919, but an estimated increase of not less than 9 cm for the average Colombian during the period 1905-1985 using the national citizenship files. However, the elite group was much taller than the average Colombian.

In a study about Mexican heights, López-Alonso and Porras Condey (2003) also find that the elite were substantially taller than the working class from the 1870s to 1910s. The lower social classes in Mexico, however, experienced stagnating living conditions until the end of the Porfiriato (1877-1911). During the revolution and its aftermath, stature declined. Only for those born after the 1940s, heights were increasing again. The authors conclude that the unequal income distribution made it impossible for the lower social classes to benefit from the economic prosperity of the country. These results are supported by Carson (2008) who studies the height development of Mexican-born and U.S.-born Mexican prisoners in the U.S. during the late 19th century. He also finds only stagnating heights for those born in Mexico in spite of considerable social and political turmoil, not the sharp decline that he had expected.

To infer about living conditions among the Brazilian poor, Frank (2006) analyzes records of the Rio de Janeiro city jail. The stature of the free population stagnated from the 1820s to the 1850s. While slaves born before 1840 were even taller than poor free Brazilians, slave heights declined until the 1860s, probably due to higher food prices and a changing disease environment especially in urban areas.

Núñez Errázuriz and Núñez (2006) study heights of Chilean boys and girls between the ages of five to 22 of different social classes in the 20th century. The authors

find that the socio-economic status had a great influence on the growth rate of the children, especially those of the middle class, which they directly trace back to the social governmental programs which were prevalent in 20th-century Chile. In the last quarter of the century, when social programs were focusing more intensely on the poor part of the population, the growth rate of the latter was increasing considerably.

This thesis adds to the existing literature with new studies on Argentina, Brazil, and Peru focusing on development of living standards, social inequalities, and migration issues.

2.2.2 The Caribbean

Studies on the Caribbean are even scarcer; however, some authors mention living conditions in the Caribbean Sea. At the beginning of the 20th century the inhabitants of the Caribbean Coast in Colombia were among the tallest (Meisel and Vega 2007). The authors claim that the reasons were mostly the large percentage of the population of African ancestry, blacks being taller than whites apparently, as well as the fact that the nutritional status in comparison to the rest of the country was good, especially because of the high consumption of meat and fish.

Godoy et al. (2006) present the first study on Puerto Ricans in comparison to non-hispanic whites on the U.S. mainland. They find that Puerto Ricans were shorter than the average male adult man on the mainland from the 1880s to the 1930s which suggests that Puerto Rico, the poorest region of the U.S., was at a disadvantage then, and remained so until now.

This thesis adds to the scarce literature on Caribbean countries by introducing a study on the biological standard of living on the island of Cuba. Chapter four studies living standards in Cuba from late Spanish colonial power to North American dependency with a special focus on the social differences between the black and white population.

2.3 References

Armstrong, W.A., 1972. The Use of Information Concerning Occupations. In: Wrigley, E. A. (Ed.), *Nineteenth-Century Society: Essays on the Use of Quantitative Methods for the Study of Social Data*. Cambridge: Cambridge University Press, pp. 191-310.

Bassino, J.-P., 2006. Inequality in Japan (1892-1941): Physical Stature, Income, and Health, *Economics and Human Biology*, 4 (1), pp.62-88.

Baten, J., Blum, M., 2011. Growing Tall, but Unequal: Biological Well-Being in World Regions and its Determinants, 1810-1989, *Working Paper*, University of Tuebingen.

Baten, J., Carson, S.A., 2010. Latin American Anthropometrics, Past and Present – An Overview, *Economics and Human Biology*, 8 (2), pp. 141-44.

Behrman, J.R., 1996. The Impact of Health and Nutrition on Education, *The World Bank Research Observer*, 11 (1), pp. 23-37.

Bielicki, T., Welon, Z., 1982. Growth Data as Indicators of Social Inequalities: The Case of Poland, *Yearbook of Physical Anthropology* 25 (3), pp. 153-67.

Boëtsch, G., Brus, A., Ancel, B., 2008. Stature, Economy and Migration During the Nineteenth Century: Comparative Analysis of Haute-Vienne and Hautes-Alpes, France, *Economics and Human Biology*, 6 (1), pp. 170-80.

Bogin, B., 1988. Patterns of Human Growth. Cambridge: Cambridge University Press.

Carson, S.A., 2005. The Biological Standard of Living in Nineteenth-Century Mexico and in the American West, *Economics and Human Biology*, 3 (3), pp. 405-19.

Carson, S.A., 2008. The Stature and Body Mass of Mexicans in the Nineteenth-Century United States, *Journal of Interdisciplinary History*, 39 (2), pp. 211-32.

Cole, T.J., 2003. A Secular Trend in Human Physical Growth: A Biological View, *Economics and Human Biology*, 1 (2), pp. 161-68.

Danubio, M. E., Amicone, E., Vargiu, R., 2005. Height and BMI of Italian Immigrants to the USA, 1908-1970, *Economics and Human Biology*, 3 (1), pp. 33-43.

Eveleth, P.B., Tanner, J.M., 1976. Worldwide Variation in Human Growth. Cambridge: Cambridge University Press.

Feliciano, C., 2005. Educational Selectivity in U.S. Immigration: How do Immigrants Compare to Those Left Behind?, *Demography*, 42 (1), pp. 131-52.

Frank, Z., 2006. Stature in Nineteenth-Century Rio de Janeiro: Preliminary Evidence from Prison Records, *Journal of Iberian and Latin American History*, 24 (3), pp. 465-90.

Godoy, R.A., Goodman, E., Levins, R., Caram, M., Seyfried, C., 2007. Adult Male Height in an American Colony: Puerto Rico and the USA Mainland Compared, 1886-1955, *Economics and Human Biology*, 5 (1), pp. 82-99.

Handa, S, 1999. Maternal Education and Child Height, *Economic Development and Cultural Change*, 47 (2), pp. 421-39.

Komlos, J., Kim, J.H., 1990. Estimating Trends in Historical Heights, *Historical Methods*, 23 (3), pp. 116–20.

Komlos, J., 2004. How to (and How Not to) Analyze Deficient Height Samples. *Historical Methods*, 37 (4), pp. 160-73.

Leighton, G., Clark, M.L., 1929. Milk Consumption and the Growth of School Children, *The British Medical Journal*, Jan. 5, pp.23-25.

López, J. S., 1954. La Estatura de los Españoles e Italianos Naturalizados en la Argentina, *Anales del Instituto Étnico Nacional*, tomo III, p. 39-52.

López-Alonso, M., Porras Condey, R. 2003. The Ups and Downs of Mexican Economic Growth: the Biological Standard of Living and Inequality, 1870–1950, *Economics and Human Biology*, 1 (2), pp. 169-86.

McEvoy, B.P., Visscher, P.M., 2009. Genetics of Human Height, *Economics and Human Biology*, 7 (3), pp. 294-306.

Meisel, A., Vega, M., 2007. The Biological Standard of Living (and its Convergence) in Colombia, 1870–2003: A Tropical Success Story, *Economics and Human Biology*, 5 (1), pp. 100-22.

Moradi, A., Baten, J., 2005. Inequality in Sub-Saharan Africa: New Data and New Insights From Anthropometric Estimates, *World Development*, 33 (8), pp. 1233-65.

Núñez Errázuriz, J., Núñez, G.P., 2006. La Estatura Como Bienestar: Evidencia para Chile, Paper presented at the CLADHE II AMHE IV, Mexico City, 2010.

Orr, J.B., 1928. Influence of Amount of Milk Consumption on the Rate of Growth of School Children, *The British Medical Journal*, Jan. 28, pp. 140-41.

Salvatore, R., 2004. Stature Decline and Recovery in a Food-Rich Export Economy: Argentina 1900-1934, *Explorations in Economic History*, 41 (3), pp. 233-55.

Salvatore, R., 2007. Heights, Nutrition and Well-being in Argentina, ca.1850-1950: Preliminary Results, *Journal of Iberian and Latin American Economic History*, 25 (1), pp. 53-86.

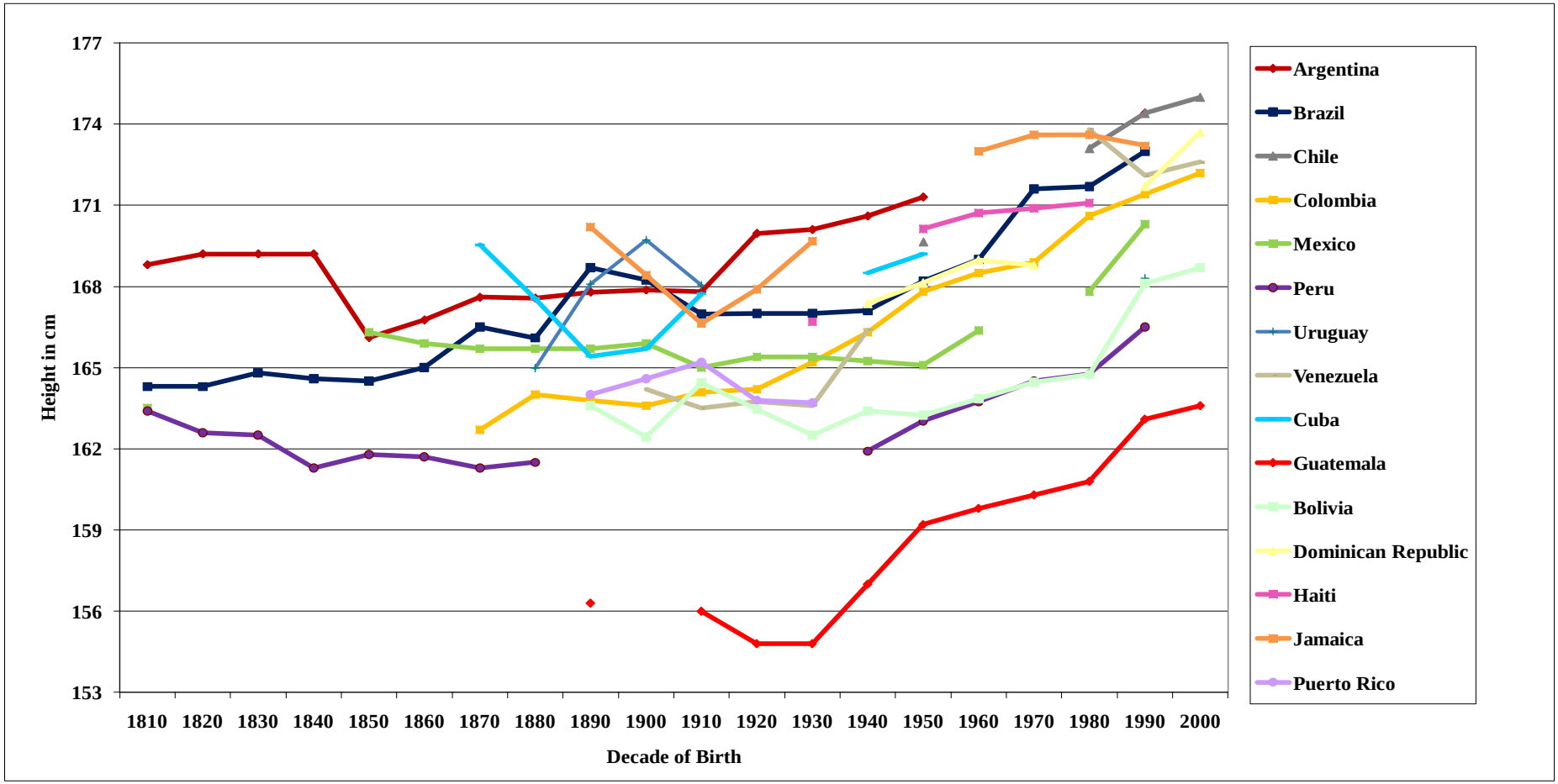
Steckel, R.H., 2009. Heights and Human Welfare: Recent Developments and New Directions, *Explorations in Economic History*, 46 (1), pp. 1-23.

Steckel, R.H., 1995. Stature and the Standard of Living, *Journal of Economic Literature*, 33 (4), pp. 1903-1940.

Takahashi, E., 1984. Secular Trend in Milk Consumption and Growth in Japan, *Human Biology*, 56 (3), pp. 427-37.

2.4 Appendix

Figure 2.1 Heights in Selected Latin American Countries



Source: Baten and Blum (2011) and author's own calculation

3 The Anthropometric History of Argentina, Brazil and Peru During the Nineteenth and Early Twentieth Century

Abstract

This anthropometric study focuses on the histories of three important Latin American countries – Brazil, Peru, and Argentina – during the 19th century, and tests hypotheses concerning their welfare trends. While non-farm Brazil and Lima, Peru, started at relatively low height levels, Brazil made substantial progress in nutritional levels from the 1860s to the 1880s. In contrast, Lima remained at low levels. Argentinean men were tall to begin with, but heights stagnated until 1910. The only exception were farmers and landowners, who benefited from the export boom.

This chapter is based on a paper published in Economics and Human Biology (2009), co-authored with Joerg Baten (University of Tuebingen) and Ines Pelger (University of Munich). The concept for the paper was developed jointly; the analyses and writing were equally shared.

3.1 Background of the Study

Anthropometric evidence can shed light on past trends in living standards, particularly in such countries as Peru and Brazil, where other data are not available for the first half of the 19th century. Maddison (2001) was the first to estimate historical income trends for Latin American countries by making subjective assumptions about certain key variables. For example, he assumed that the growth rate of GDP per capita in Brazil from 1820 to 1850 was similar to the period from 1850 to 1913, for which the first data-based estimates were published by Goldsmith (1986). For Peru, the data available are even less adequate, and Maddison (2001) assumed that during the decade before 1913, its development equalled the average growth rate of Brazil and Chile.[1] Yet the economies and populations of these three countries present distinctly different trends. It would be very important to obtain country-specific evidence on welfare trends in Brazil and Peru.

The purpose of our study is to use anthropometric indicators to compare welfare trends in the three countries under study with GDP-based welfare estimates and assumptions. Of course, height and GDP per capita do not measure the same components of welfare. GDP is much more sensitive to urbanisation and industrialisation, whereas height reflects the biological components of the standard of living and tends to correlate with health, longevity, and quality of nutrition (Steckel and Floud, 1997; Komlos and Baten, 1998). However, we can still gain insights by studying the extent to which our estimates of height trends correspond to current GDP levels and to the long-term welfare growth.[2]

Current estimates imply that: (1) Brazil experienced very modest improvements in living standards during the 19th century; (2) and that Peru had a standard of living similar to that of Brazil and Chile; (3) Argentina experienced rapid economic growth

[1] An additional estimate by Seminario and Beltrán (1998) suggests a modest upward trend from 1896-1913, but again does not cover the period which came before it.

[2] Apart from the conceptional differences between height and GDP measurement of living standards, we should also mention the general doubts about the strategy with which to estimate GDP values based on backward interpolation, see Fukao et al. (2007).

during the export boom from 1870 to 1913, which should have resulted in some height increase (Table 3.1).[3]

The hypotheses to be tested below are that anthropometric trends were similar to conventional estimates of welfare. We use new anthropometric evidence for all three countries. For Brazil, a smaller data set of the early period has been studied previously (Frank, 2006). Here we test Frank's estimates of height levels for Brazil of the 1850s to 1860s and we shall assess whether the results change when the data set is expanded from 1,142 to 6,771 observations. We also extend the anthropometric history of Brazil into the 1880s. By contributing data on Peru, we fill an important gap in Latin American anthropometric history, as previous studies considered only Mexico, Argentina, Brazil, and Colombia.[4]

The biological components of physique are interesting in themselves, as stature differences have often been found to correlate with health and life expectancy (Komlos, 1985; Steckel, 1995). In his lecture to the Nobel Prize committee, Robert Fogel (1993) stressed that for Norwegian males in the 1960s and 1970s, men who were 17.5 cm shorter than average height had at least a 71 % greater probability of dying in the following decade, clearly a significant difference (based on data by Waaler 1984). In a similar vein, Baten and Komlos (1998) estimated that each centimeter in height increases life expectancy by 1.2 years, with only negligible coefficient changes between birth cohorts of 1860, 1900, and 1950. One centimeter in height creates a meaningful difference, since 1.2 years is a considerable portion of a human's life span. There is mounting evidence that an increase in height correlates with increases in cognitive abilities, physical robustness, and higher wages. Finally, as Arora (2001) argued, it also correlates with GDP growth.

In Sections 1 to 3 we focus separately on each of the three countries, beginning with Argentina, followed by Brazil and Peru, first describing each country's social and economic history, main export goods, and food production. For each country and period of time, anthropometric evidence is discussed, and our new findings presented. Finally,

[3] There are GDP estimates for Argentina between 1870 and 1900 (Cortés Conde and Harriague, 1994). However, Maddison (2001) still assumed the same growth rates as from 1900 to 1913. For a recent GDP estimate, see also della Paolera and Taylor (2003).

[4] See Lopez-Alonso and Condey (2003), Carson (2005), Meisel and Vega (2007), Frank (2006), Salvatore (1998, 2004, 2007), Salvatore and Baten (1998), Bogin and Keep (1999).

we present our conclusions, comparing anthropometric estimates for Brazil, Peru, and Argentina with GDP estimates of Maddison and others.

3.2 Argentina

3.2.1 Social and Economic History

Between 1870 and 1913, Argentina became a major actor in the world economy. Its 56 million hectares of pampa plains, ideally suited for temperate-zone agriculture and for raising livestock production, but sparsely populated in the mid-19th century, became a magnet for European immigrants and capital (Ferrer, 1967). Argentina's society changed considerably during the 19th century as its population became increasingly dominated by recent European arrivals. They arrived in great numbers in the second half of the century, driven by a desire to escape poor living conditions in Europe and attracted by this vast territory. By 1914, the Argentinean census reported that one-third of the population was composed of immigrants (Republica Argentina, 1916).

Many economists have supported Douglass North's theory that exports increase a nation's productivity, especially in the New World, if world markets demand at least one of its export staples (North, 1966). This availability of export staples, in turn, could have a positive impact on other sectors of the economy, raising the population's standard of living. Argentina had become well-integrated into the world market by 1913 and gained large export revenues. It became well-known for producing export surpluses, mainly in beef and wheat. During the first decade of the 20th century, Argentina's growing export economy (Diaz Alejandro, 1970) provided its citizens with one of the highest per-capita incomes in the world. This period is considered the "Golden Age" in Argentinean economic history. However, as Salvatore (2007) argued, export-led growth raises the general standard of living only if export revenues also benefit lower-income groups. Whether this actually took place is an empirical question, which Salvatore (2007) answered in the negative.

3.2.2 New Anthropometric Evidence on Argentina

To learn more about its male population's military potential, Argentinean authorities measured all men in 1927, recording their heights and other physical data. The study

registered both native-born and naturalized men, born between 1820 and 1915. For our study, we consider only those between ages 17 to 52 (birth cohorts of 1875 to 1910), a total of 6,953 measurements (Table 3.2).

Our sample was drawn from a randomly chosen series of registration books preserved in a general register in the military-history archives in Buenos Aires.[5] We took a convenience sample from the following provinces and cities: Misiones, Tucumán, San Juan, Córdoba, La Pampa, Buenos Aires city, Junín city, Río Negro, and Chubut/Santa Cruz (Figure 3.1).[6]

This map also indicates global height averages by province. Average height values in the Argentinean provinces were, as it turned out, quite similar in the various regions, except for the Northwest, especially in Tucumán and to a lesser extent in San Juan, where the male population was shorter. Moreover, those in Río Negro and the city district of Buenos Aires were slightly shorter than those in the other six provinces.[7] We also included more Southern provinces in the sample because they have not been studied before (Salvatore 2004a, 2004b, 2007 and 2009 concentrated mainly on the Center and North).

How representative is our evidence? Our data for Argentina benefit from the fact that the entire male population was recorded in that country's national data sources. Our data is normally distributed or Gaussian and does not suffer from typical truncation problems (Figure 3.2).

[5] Servicio Histórico del Ejército, Archivo General del Ejército, Calle Defensa (entre C. Mexico y Chile), Capital Federal, Argentina.

[6] The youngest cohort might have had some growth potential at the time of measurement, but our conclusions would not be affected by this.

Aside from stature and occupation, categories that we found to be most useful for our work, we found additional information about the men under study. They were asked whether they could ride or swim, if they could read, and if they were proficient in telegraphy. They were asked about to describe their driving abilities, and to name the types of vehicles, motorcycles included, that they were able to operate. This information was not used by us but might contribute to future studies.

See Appendix 4 for a facsimile of the source. Unfortunately, the archives in Lima and Rio de Janeiro did not allow to take photos. http://www.uni-tuebingen.de/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/Uni_Tuebingen/Fakultaeten/WiSo/Wiwi/Uploads/Lehrstuehle/Prof._Baten/Appendix_Baten_Pelger_Twrdek.pdf&t=1304073928&hash=ac581681cbaa9fe388856651ea4f2f8eabae1fd8

[7] The city district does not include the rural province of Buenos Aires.

Because the Argentinean military census did not record the country of birth, immigrants had to be included in our study. Previous height estimates by Salvatore (1998, 2004a, 2004b, 2007) excluded immigrants since he was mainly interested in estimating the determinants of heights within Argentina. In this study, we are also interested in long-term trends in heights for the entire Argentinean population (as is done in GDP estimation).[8]

As for the question of survivor bias, we came to the conclusion that it poses no problem for the data assessed here.[9]

How can we classify occupational groups to assess social height differences? We used the Armstrong scheme of occupations to get a clearer understanding of the social structure of Argentinean society. It was developed for 19th-century censuses, and was designed to capture the skill level and social status level of different occupations during that period. Clearly, some occupations can span several social strata. However, this classification scheme has proved useful for a large number of applications. In anthropometric history, it has been employed in a number of studies (for example, Johnson and Nicholas, 1995).

The first group consists of unskilled workers, including domestic servants and similar low status occupations. The second group includes semiskilled occupations, such as housepainters, which do not feature the lengthy craftsmen-type extended sort of apprenticeship required for skilled crafts. The third group consists mainly of skilled craftsmen and other workers with higher greater craft levels and responsibilities (for example, shop assistants). Category (4) consists of semi-professionals, such as clerks and telegraphers, whose occupations clearly require a somewhat greater skill level, but not as much as Category (5), that of the professionals. The typical member of the latter group has typically attended high school and in some cases also university (e.g., lawyers and doctors), or has attained success as an entrepreneur, thus acquiring considerable social status. We coded the farmers as a separate group (6) since they might have benefited from direct access to landownership and food production (Komlos, 1987).

[8] For this reasons, also in GDP estimation, the contribution by migrants that permanently reside in a country are included.

[9] see Appendix A.3. http://www.uni-tuebingen.de/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/Uni_Tuebingen/Fakultaeten/WiSo/Wiwi/Uploads/Lehrstuehle/Prof._Baten/Appendix_Baten_Pelger_Twrdek.pdf&t=1304073928&hash=ac581681cbaa9fe388856651ea4f2f8eabae1fd8

Most of our sample consists of farmers, unskilled and semiskilled workers (around 74 %). As one might expect, a higher share of skilled persons are found in Buenos Aires than in the rest of the country.

The regression results for Argentina indicate that average heights remained nearly constant in Argentina during the 19th century (Table 3.3, column 1 and 2). Such insignificant time coefficients indicate that the increase compared to the 1870s constant was close to zero.[10]

The absent growth of average heights confirms, in the main, Salvatore's findings (Salvatore, 2007). In Figure 3.3, we graph the impressive amount of different data sets Salvatore collected, plus our own. Earlier historians, states Salvatore (2007), who described this period as the "Golden Age" of Argentina, did not take into account the fact that the standard of living of lower-income groups did not improve during the country's so-called Golden Age, and that heights in fact stagnated.

Modest height gaps existed between social groups. The difference between unskilled and semiskilled persons was relatively large in Argentina. Farmers were 2.04 cm taller than the unskilled group represented by the constant, and professionals were even taller.[11]

As a result, Argentinean height levels were quite impressive during the turn of the 20th century, compared with other Latin American or with European populations. However, they did not increase during the GDP boom, as we would have expected. This finding confirms earlier studies of Salvatore (1998, 2004a, 2004b, 2007), whose estimates for average heights of prisoners and soldiers indicated a stagnation of average stature during the period when exports were growing the fastest. Salvatore (2004a, 2004b) argues that the influx of large numbers of immigrants during this period contributed to the nutritional stress. Native workers competed in the labour markets with European immigrants, who were often more highly skilled. Hence Salvatore (2004a, 2004b) concludes that labour supply increased so rapidly that native Argentinean workers had difficulties to keep their real wage, and that social protection

[10] The R-squares are generally low, which is quite common in individual height regressions – we know that we cannot capture individual genetic height variation, which thus accounts for a large share of the unexplained part (as soon as heights are averaged, for instance by regions, and the genetic component averages out, R-squares increase dramatically, see Baten, 1999).

[11] Thanks to one of our referees who noted the latter point.

was insignificant. He also notes that the share of protein provided to infants and toddlers may have been relatively low during this period. At the same time, rising food and rent prices diminished real wages. In general, wages rose from 60% to 80% during the 1880s and 1890s (of the British level in 1905), and from 90 to 100% during the 1900s (Williamson, 1995).[12] However, real wage increases may have been lower actually, since higher costs of rent and non-tradable products often bias purchasing-power estimates, especially during periods of rapid urban growth. We can safely conclude that GDP per capita increased much more than did real wages, and that disparities in income increased as well (Table 3.1).

Argentina, and especially its Pampa region, was successfully integrated into the world market thanks to the international trade in beef and grain, and to the influx of immigrants (Salvatore, 2007).[13] At the same time its population suffered from marked social inequality. Unregulated child labor and crowded housing conditions in the cities mitigated against an increase in living standards, as well as the spread of infection and disease.[14]

We find that farmers benefited from the export boom slightly more than did unskilled workers. From an initial height gap during the 1870s of 1.5 cm between farmers and unskilled people, the height difference between these two groups increased by more than one centimeter in height until the 1890s, which is statistically significant (Table 3.3, Column 2). At the same time the heights of unskilled workers stagnated (Figure 3.4).

Obviously, the notable growth of wealth in Argentina from 1870 until the First World War did not benefit all sectors of the population equally. While landowners and

[12] See our appendix Figure A.1. http://www.uni-tuebingen.de/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/Uni_Tuebingen/Fakultaeten/WiSo/Wiwi/Uploads/Lehrstuehle/Prof._Baten/Appendix_Baten_Pelger_Twrdek.pdf&t=1304073928&hash=ac581681cbaa9fe388856651ea4f2f8eabae1fd8

[13] We must keep in mind that some Patagonians, for example those in the province of Santa Cruz, were recent arrivals from within or outside Argentina.

[14] During the period studied in this paper, life expectancy at birth in Argentina rose from around 33 years in 1883 to 40 years in 1905 (Somoza, 1973), and mortality rates were declining from 24 per 1000 inhabitants during the years 1881 to 1890, to 18 per 1000 inhabitants during 1901-1910 (Elizaga, 1973). However, this can also be viewed as a convergence to the more favorable levels of other countries with similar incomes at the time. For instance, life expectancy in Paris was already 47 years in 1880 and mortality rates in Paris and London were 6 to 8 per 1000 inhabitants accordingly (López-Alonso, 2002).

farmers made some gains, common workers did not enjoy a proportionate growth in their income (Cortés Conde, 1986). As the big height gap in Argentina was between unskilled workers and more skilled occupational groups, we find that a strong middle class represented by the latter groups had already emerged by the late 19th century. These results for Argentina are somewhat similar to those of Cranfield and Inwood (2007) on physical well-being in Canada. They found that during the 19th century the physical stature of Canadian-born men stagnated or declined slightly in spite of a substantial increase in income. Similar findings were recorded in the U.S. during the 1860s to the 1890s, when the agricultural-export boom began (Komlos, 1998). This divergence between height and GDP seems to be the pattern for food-exporting New World countries which initially had small populations.

3.3 Brazil

3.3.1 Social and Economic History

Throughout the 18th century, Brazil's economy was agrarian and monocultural. In 1815, Brazil became a monarchy with equal rights for its citizens, and it remained a monarchy after having gained independence from Portugal in 1822. Furthermore, Brazil made a fairly peaceful transition to independence despite repeated efforts by secessionists (Bernecker et al., 2000). Though political conditions were stable, the Brazilian economy is often assumed to have grown too slowly or even to have stagnated on account of low agricultural productivity and a lack of capital, infrastructure, and financial institutions. A slow transition to industrialization did not begin until the end of the 19th century. Latin American economic history has traditionally held that newly independent Brazil fell under the economic control of Great Britain. In fact, Brazilian trade with Great Britain was based on special treaties. Haber and Klein (1994) argue that "Brazilian policy makers were not British puppets" and that it is not clear whether this trade resulted from Brazil's independence or from its prior close relationship with Great Britain.

Slavery still played a vital role. Although the importation of slaves had been prohibited since 1850, Brazil did not abolish slavery until 1888, and then only because of British pressure, and was the last country in the world to do so. As a consequence,

prosperous coffee plantations in the south soon found themselves short of workers, as a vast southward migration of former slaves, from stagnating sugar plantations in the northeast, began. Meanwhile, European immigrants began arriving in large numbers. Coffee planters pressed Brazil's central government and the province of São Paulo to pay the transportation costs of immigrants from southern Europe (Leff, 1994), who might otherwise have sought higher wages in the United States or Argentina. Coffee planters were more willing to finance immigration from Europe than migration within Brazil, as they preferred "hardworking white people" to black Brazilian workers (Vainer and Brito, 2001). This preference was in line with the prevailing intention of "whitening" the Brazilian population, a policy that the government acknowledged in the second half of the 19th century (Skidmore, 1990).

Brazil was an agricultural economy both before and after independence. Sugar exports led the world market until 1815, but then stagnated on account of growing competition from other Latin American countries and later from European sugar-beet producers. As a result, coffee soon overtook sugar as Brazil's most important export staple. Northeastern sugar and cotton exports declined, and per-capita income fell below that of the boom region in the southeast (Leff, 1994).

Johnson and Frank (2006) point out that focusing on aggregate economic performance tends to obscure the level of wealth and economic dynamism in southeast Brazil. Moreover, Frank (2006) discovered that mean wealth in Rio de Janeiro in the first half of the 19th century was surprisingly large and growing steadily, although the period was marked by a high level of economic inequality.[15]

What can be said about the nutrition of Brazilians? As the concentration on cattle raising might suggest (Bauer, 1986), the amount of animal protein per capita was potentially higher in inland Brazil. Meat and especially milk have a positive effect on human height (Baten 2009); however, meat was consumed both in fresh and in dried forms, which had different health implications (Kiple, 1989). In the northeast in the 19th century the basic diet was nothing but dried meat and manioc flour. The diet in Rio de Janeiro and São Paulo consisted of fresh meat and beans for the rich, and dried meat and cornmeal or manioc flour for the poor. In Minas Gerais both rich and poor consumed a great deal of pork, cornmeal, and beans, while in Rio Grande do Sul the diet featured

[15] They calculated a Gini coefficient of 0.87 for the 1820s and 1850s in Rio de Janeiro and estimated a top decile share of 77 to 78 percent.

fresh meat, cereals, and vegetables. Kiple (1989) pointed out that the diet of dried meat and manioc was seriously deficient in thiamine, and that beriberi, the disease caused by this lack, was a serious health problem in Brazil during the latter half of the 19th century.[16] High consumption of beans helped overcome some of the health problems, and bean soup with offal, feijoda, became an indispensable national dish (Fish, 1978). High in protein, feijoada improved the diet of many Brazilians.

3.3.2 New Anthropometric Evidence on Brazil

Our Brazilian sample consists of 6,771 male prisoners from the Rio de Janeiro city jail, measured between 1861 and 1903.[17] Data include height, origin, occupation, birthplace, age, and skin color. Until 1879, height was measured in Portuguese feet, and from then on in meters. One Portuguese inch equals 2.75 centimeters; however, Frank (2006) found that on account of measurement error in the Rio prison, it is more accurate to calculate 2.73 centimeters to the inch. Prison records recorded the heights of some individuals in both centimeters and feet, and an analysis of the double measurements led to this correction. We have followed Frank's reasoning and have adopted this approach.[18]

The prisoners came from many regions of Brazil, and from other countries as well. We have information on migrant and immigrant status and therefore can control for it. We pooled the information on skin color into three categories -- white, black, and other (brown) -- because the description of skin color varied for mixed-race individuals, and terms used at the time could not be accurately defined.[19]

[16] The process of salting and drying destroys the thiamine and mostly also the fat in the meat.

[17] Rio de Janeiro/Brazil: Arquivo Público do Estado do Rio de Janeiro – APERJ – Depositum Casa de Detenção do Rio de Janeiro.

[18] We should note the possibility that the upward trend might be less pronounced, if the result of Frank about the inch measure being 2.73 cm is incorrect. In this case, there would also be a substantial increase, but it would be 0.7 cm smaller between the 1840s and the constant, for example (see Appendix A.2. http://www.uni-tuebingen.de/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/Uni_Tuebingen/Fakultaeten/WiSo/Wiwi/Uploads/Lehrstuehle/Prof._Baten/Appendix_Baten_Pelger_Twrdek.pdf&t=1304073928&hash=ac581681cbaa9fe388856651ea4f2f8eabae1fd8). However, we are convinced that Frank's assessment of the inch measure employed is correct and that the trends presented here are as strong as described.

[19] E.g., crioulo, moreno, acaboclado, fula, cabra.

The number of individuals in the sample pertains to the birth cohorts of the 1810s to the 1880s (Table 3.2). Standard deviations of the height distributions are relatively high, as we would expect for a country with pronounced social inequality.[20]

How representative is our evidence? In prison samples, there might be height bias and occupational bias, with height bias defined as the gap between heights of prisoners and heights of the total population. Occupational bias means that there was a greater proportion of prisoners from the lower class than exists in the overall population. Other studies have found that the height bias of prison samples is typically not as large as occupational bias, partly because greater than average height facilitates violent criminal activities (Baten, 1999). Nevertheless, we agree with Frank (2006) that the sample is somewhat biased towards the poorest portion of the population.

For Brazil, as for Argentina, we use the Armstrong scheme of occupations. Comparing our sample's measurement cohort of the 1870s with the Brazilian census of 1872, we find that the share of unskilled workers was quite similar, but the prison sample contains about 10% more semiskilled workers (Recenseamento, 1872).

On the other hand, semiprofessionals are fewer in the sample by a similar percentage. At less than 1%, professionals are nearly absent in the sample, compared with 5.5 % in the census population. The share of slaves in our data and the share in the census are almost equal. Compared with the census, our sample describes more persons (10%) as "black" and similarly fewer "other" (neither white nor black, mainly mulatto).[21]

Another strategy for assessing historical samples is to compare age heaping in the prison sample to that of the census population. Persons who cannot state their exact age often round it off to a multiple of five, and such persons are typically less educated than average (Baten, Crayen, and Manzel, 2008; Crayen and Baten 2009). Age-heaping indices correlate negatively with other human-capital indicators, such as literacy and school enrolment, and even more so with modern measures of mathematical skills (see A'Hearn, Baten, and Crayen, 2009, appendix). The Whipple Index of age heaping is calculated by dividing the number of persons reporting an age ending in 0 or 5 by the total number in the study, multiplied by 500. Values substantially higher than 100

[20] The same condition applies even more so for Peru, which is studied below.

[21] This may be a true difference, or it may reflect different definitions of skin color used by the prison and the census.

indicate problematic numeracy; the higher the number, the greater the problem. Manzel and Baten (2009) estimate a value of 205 for Brazilians born in the 1850s, while our data produce a slightly positive index of 178 due to a more urban sample than the overall population.

Are the differences large? The Whipple Index runs from 0 to 500, with typical values located between 100 (no age heaping, good numeracy) and 500 (extreme age heaping, bad numeracy).[22] Throughout the 19th century, values in the Middle East and South Asia were near 500, whereas in European industrial countries they were closer to 100. Those of Latin America were ranging from 100 (Argentina, 1890s) to 290 (Ecuador, 1880s); the difference of 27 in the two sets of data for Brazil is small but not negligible (Manzel and Baten, 2009). Those who rounded off their age were also significantly shorter (Table 3.3, Col. 4 and 5). From these figures we conclude that compared with the whole Brazilian population, the prison sample does not have a strong negative educational bias.

Brazilian height trends. We report four height regressions for Brazil (Table 3.3): Regression 3 (Col.3) excludes immigrants, Regression 4 (Col. 4) excludes immigrants and slaves, whereas Regression 5 includes both, but controlling with dummy variables for slave status and the origins of the immigrants. Regression 6 (Col. 6) is limited to the sub-sample of slaves. Interpreting the birth decade dummies, we find that Brazilian heights stagnated at first, but time coefficients after 1860 imply a distinct upward trend, a bit stronger if immigrants are included, and less strong with native-born Brazilians only.[23]

The result of an upward trend is robust in both the regression results (Table 3.3 and its graphic representation in Figure 3.5), and the raw data (Table 3.2).[24] Brazilians born in the 1880s were 2.41 cm taller than those born in the 1830s, if we consider all Brazilians, and 1.66 cm, if we include only native Brazilians. We also controlled for age composition by including dummy variables for age groups 19 to 22 and 51 to 60 in the

[22] A value of 0 would mean complete avoidance of all multiples of five.

[23] The constant is roughly one centimeter higher including immigrants, and most time dummies for the first six decades are smaller by a similar amount, hence the level of height is similar for native Brazilians and all prisoners (except for the 1880s).

[24] The Argentinean height trends are unadjusted, because for the study of Argentina we have a sample that is not socially biased.

regression. The reason for our selecting these age groups is that those in the younger group have not yet achieved their adult height, whereas some of those in the older group may have actually shrunk. The results were as expected, with the exception of those aged 51 to 60, who were not significantly shorter. Among the young men, height continued to increase until the age of 20 or 21.[25]

Were there significant regional height differences, and did migration within Brazil play a role? Because our sample is drawn from data collected in a Rio de Janeiro prison, in the booming Southern coffee-plantation region, there is potential bias for the anthropometric trend. Did the region's successful development cause the positive height trend, while heights in other parts of the country stagnated or declined? Although our data include all Brazilian convicts measured in the Rio de Janeiro prison, their places of birth varied widely. Of the adult males, only 58% were born in the Southeast, and a mere 3% in the West.

In contrast, height levels of the 39% born in the Northeast actually resembled that of those born in the South (Figure 3.6). Could this have been caused by selective migration from the Northeast to the South? Most studies focusing on this period find that migration from poorer to richer regions initially featured individuals who were richer (and often taller) than those who stayed behind, but that their human capital later declined. This trend suggests that the heights of early cohorts might be slightly overestimated, while those of later cohorts are slightly underestimated. Although this disparity supports our main finding of an upward height trend in Brazil, we conclude that selective migration was not the cause.[26]

A second possible distortion could derive from European immigration. In the second half of the 19th century Brazil was the destination of increasing numbers of immigrants, mostly from Portugal. Could the influx of taller individuals into a region bring about an upward trend in height there? When measurements exclude immigrants, the answer is no (Table 3.3, Col. 3 and 4).[27] There is also a substantial upward trend among native Brazilian prisoners only. Moreover, those who emigrated from Portugal, not to mention Italy, Spain, and France, were not statistically different from those born

[25] For regressions 5 and 6, we excluded those above 50.

[26] The upswing in 1870 is almost 3 cm in one decade which might be exaggerated. There could well have been an upswing but not of this magnitude.

[27] Figure available from the authors.

in Brazil (Table 3.3, Col. 5). In contrast, German, British, and North American immigrants were 3 to 4 cm taller.[28]

The data also provide a rough estimate of regional height differences (Figure 3.7). Our discussion of height estimates, based on over 30 observations, assumes that selective migration does not account for all the differences. The tallest Brazilians were living between São Paulo and Bahia, and in Paraíba. With the exception of residents of the latter two states, Northeasterners were relatively short, as were those in the coastal regions of Rio de Janeiro, Santa Catarina, and Espírito Santo. Looking at Bauer's map of agricultural specialization, we note that most tall men were found in grain- and cattle-producing regions. This holds true for the booming São Paulo and Minas Gerais coffee-plantation belt (Bauer, 1986).[29]

In contrast, the Northeast plantations (cotton, sugar, and tobacco) and those of Espírito Santo (cocoa), on the southern coast, had shorter-than-average people, perhaps because the diet there was based on local, low-protein foods, or because they could not afford adequate housing. The taller population of Paraíba can be explained by the favorable economy of its cattle farming and coffee plantations, which stretched to the coast. The unexpectedly moderate heights recorded in the Rio de Janeiro region may be partly due to the rapid expansion of the city itself. Frank (2006) hypothesized that Rio de Janeiro, in becoming, along with Mexico City, one of the two largest cities in Latin America (Klein, 1986), imposed an "urban penalty" on its population.

Heights by occupation in Brazil. Only modest differences in height can be observed between unskilled and skilled groups, with the exception of professionals, who were as much as 3.2 cm taller than unskilled workers, and even 5.4 cm if only native Brazilians are considered. Thus, the greatest difference in height was between the elite

[28] All those groups are based on sufficiently large numbers of cases.

[29] In other countries, very strong advantages of proximity to food have been found (Baten, 1999). The proximity to the production of perishable proteins had the effect of relatively positive health and height levels, even among populations of modest purchasing power, e.g. milk or offal, which could not be transported and traded over longer distances before the mid-20th century (see Baten, 1999; Komlos, 1996).

It should be noted that the South attracted many tall Europeans. Moreover, in Minas Gerais there was a remarkably high number of freed slaves. Characterized by smaller slave plantations, the number of slaves per slaveholder was relatively small in Minas Gerais, a situation that may have fostered social interaction between slaves and their owners (Klein, 1986).

and the rest of the population, and not between the unskilled workers and skilled craftsmen.[30]

Height differences by skin color. Controlling for occupation, slave status, birth decade and all other characteristics, black people were not significantly shorter than native Brazilian white people on average (Table 3.3, Col. 3). Including migrants, whites were even slightly shorter than blacks.[31] That black Brazilians were relatively tall in spite of their low status -- compared to whites -- probably cannot be explained genetically, as black people born in Africa were in fact much shorter than those born in those regions of Brazil where *feijoda* was an important component of the diet (Table 3.3, Col. 6). On average, black people of African birth were 161.7 cm (N=151) tall, while those born in Brazil were significantly taller, at 164.9 cm (N=921).[32]

Slaves in the United States were considerably taller than their Brazilian counterparts. According to Margo and Steckel (1982), the mean height of U.S. slaves (ages 25 to 39 in the 1790s to 1840s) was 4 cm greater than that of Brazilian slaves. The white population in the U.S. was also considerably taller than that of Brazil: around 173 cm from the 1800s to the 1830s, and then falling to 169.1 cm in the 1890s. In the U.S. South, whites were about 2.5 centimeters taller than slaves (Komlos, 1997). Fogel and Engerman (1974, 1995), Steckel (1986) and more recently Rees et al. (2003) have argued that U.S. slaveholders provided those of their slaves who reached adulthood, with reasonably nutritious food. This may have been true in Latin America as well. As

[30] In fact, farmers in the sample were shorter than all other groups, but we have only 64 observations on farmers ages 20 to 60. Perhaps those of them who were measured while living in Rio de Janeiro had gone there in search of work, having failed at farming.

[31] During the 19th century Portugal's population was the shortest in Europe, mostly on account of a low-protein, and especially a low-milk, diet (Stolz, 2008).

[32] Our results are in line with the arguments that Eltis (1982) has provided against strong height selectivity in the slave-trade. For example, he argues that if traders put a significant premium on taller slaves, prices and volumes of slaves traded in those areas with taller populations would have been higher, which does not appear to have happened in the 19th century. Second, by the 19th century, physically strong (and tall) Africans were also demanded by Africa's plantations and farms. Finally, Eltis observed that the height distributions from all regions were quite normal. If there had been something like a minimum height requirement of slaves or a height interval which was much less demanded, slaves from the regions with shorter stature should have displayed some shortfall.

importing slaves became more difficult and expensive, some slaveholders began to provide their slaves with offal and other cheap sources of protein.

3.4 Lima (Peru)

3.4.1 Social and Economic History

The pronounced stratification of Peruvian society can be traced back to the conquistadors, who took possession of most of the fertile land and introduced slavery. Peru gained independence from Spain in 1821, but the social and economic inequalities introduced during the colonial era did not diminish significantly (Gootenberg, 1990). The legacy of the Spanish Empire was a two-class system defined by rigid social rules and tax laws. A white elite held the privileged positions (Contreras, 2004). The elite appropriated the riches of the country and was able to protect its social status and profit over time. White men often had children by their Indio servants, creating a mixed racial group, mestizos. The abolition of slave trade, in the 1850s, had serious consequences for farmers, who had relied on slave labor.

Peru was an important exporter of silver throughout the colonial era, but in the early 19th century investments and profits declined during and after the independence conflicts (Contreras, 2004). In the same period, Peru launched a new export, guano; the profits there from replenished the public treasury and enabled enormous profits to be captured until the 1860s, where many middlemen and retailers could make large profits. Due to their demand for other goods, income increased also for other inhabitants of the capital city (Gootenberg, 1990).

Nevertheless, Peru's finances remained unstable. Violent political upheavals, including frequent coups d'état, made governing the country next to impossible, and contributed to a rise in government debt. The government borrowed on future revenues from guano, and then squandered the money within a few years. After three decades of frenetic prosperity, Peru sank into a recession in the mid-1870s. The country's undiversified export structure depended on the markets of Great Britain and France, and orders diminished as international trade in general slowed (Gootenberg, 1989).

Agriculture in Peru. Cotton plantations dominated the coastal region around Lima (Bauer, 1986), while sheep, llamas, and alpacas were raised in the interior of the country. In Peru's northern mountains, cattle production was more pronounced, and the

meat consumption of Lima's upper class may have therefore been fairly high.[33] However, the cost of transporting meat from the North was probably prohibitive for the urban poor. Due to the distance, milk was not consumed in large amounts in Lima, neither by rich nor by poor persons.

3.4.2 New Anthropometric Evidence from Lima

For Peru as well, we rely on a prison sample comprising 1,139 cases, mostly convicts from Lima and a modest number of immigrants.[34] They were measured in the years 1866 to 1909, allowing us to study the birth decades of the 1820s to 1880s. Since sample size for each birth decade would be too small, we aggregated Peruvian birth cohorts into 20-year birth groups.

We assess representativeness by comparing the Whipple Index of the prison sample to the overall population, as we did for Brazil. The Whipple Index of age heaping of the whole prison sample is 127 (ages 33 to 62, 1820s to 1880s). Manzel and Baten (2009) estimate a Whipple Index for Lima's population at 139 for the birth cohort of the 1880s, a much better value than in Brazil. In other words, from an age-heaping perspective, our prison sample and the overall population are quite similar.

Another approach is to compare the social and occupational structure in the mostly urban prison sample with the 1876 census of population born in the Lima district. We limited the sample to those convicts measured during the 1870s. This sample actually overrepresents skilled people in comparison to that for the Lima district,

[33] Peru had by far the smallest number of cattle per capita, with only 1 million in 1917 relative to a population somewhere between less than 3 million in 1876 and 7 million in 1940 (Mitchell 1993). Brazil had 31 million cattle in 1912 and 17 million population in 1900, and Argentina's per capita values declined from more than 7 per capita in the late 1860s/early 1870s to 4 per capita in 1910. Hence in Peru 5-6 inhabitants "shared" one cattle, whereas Brazil had initially around 2 cattle per capita and Argentina between 8 and 4 cattle per capita. The decline of cattle per capita could have contributed to the disappointing stagnation of Argentinean heights, but of course, Argentina had a much higher export of first salted, later refrigerated cattle meat, hence production does not equal consumption.

[34] Lima/Peru – Archivo General de la Nación. Archival source "penitenciaria central", the main prison in Lima, and Guadalupe prison. Libros de Entrada y Salida de Reos, Nr. 3.20.3.3.1.1.4 to 26.

which includes the city's rural surroundings (Table 3.4).[35] However, in combining semiskilled and skilled groups, the prison sample is quite representative for the Lima district, with the exception of farmers, who are, of course, underrepresented in our urban sample. In contrast, professionals and semiprofessionals are well represented, because among the prisoners were some who were slightly better off than most. This may help to explain why the standard deviations of the height distribution are relatively large: the prison population included merchants and traders, convicted of business-related crimes (Table 3.2).

The 1876 census provides more information about the social structure of Peruvian society, including such variables as skin color, religion, and nationality (Díaz, 1974). All skin-color groups except Asians (which usually meant Chinese) are well represented in our sample (Table 3.4).[36] Foreigners compose 22% of our prison sample, in contrast with the 3% reported by the census for the Lima district (not shown).

Because the prison sample is small, we restricted the regression analysis to adults. We cannot assess growth patterns or differences among immigrant groups, but we estimated one regression for native Peruvians only, and one including immigrants. Heights recorded for all the birth decades before 1859 were lower than those after 1860.[37]

Height, ethnicity and occupation in Lima. There were no significant differences in height by occupation (Table 3.5). The reason why the occupation coefficients are insignificant could be that most Indios in the sample were categorized as "unskilled" or "unknown," and as a consequence there is considerable multicollinearity between occupation and skin-color/ethnicity. However, there was large variation in height by ethnicity. Indios were shorter than whites by 5 to 6 cm, mestizos

[35] In order to compare the occupational structure, we took the census report from Pinto and Goicochea (1977) and classified all the occupations with the Armstrong scheme.

[36] This is confirmed by Kubler's study (1952) on the Indian caste in Peru. He presents information concerning the original inhabitants of this district based upon tax records and census reports, which confirms the following census results.

[37] A yellow-fever epidemic during the 1840s must have made life in Lima exceedingly difficult (Sánchez-Albornoz, 1986). Lima might have been particularly vulnerable to epidemic disease because its citizens, and small children in particular, consumed almost no milk.

by around 3 cm, and Asians (mostly Chinese) by 4 cm. Blacks were not significantly shorter than whites, and those born in Peru were even significantly taller.[38]

We can graph a time trend based on the birth group coefficients of this regression analysis. By using census weights, we can also adjust for occupational group and skin color to obtain population averages for each birth cohort (Figure 3.5). These adjusted anthropometric series are considerably lower for Lima because the procedure takes into account the higher percentage of Indios in the overall population.[39]

Height differences between whites and Indios increased during the 19th century (Figure 3.8). White people born in the 1880s were eight centimeters taller than Indios of the same age. This widening gap may indicate that the height difference was not due to genetic but rather to socioeconomic variables.

How different were the heights in Lima from those in other regions of Peru? The first representative data set on heights with a sufficient number of cases refers to birth cohorts of 1950 to 1967 (Baten and Fraunholz, 2004), when Lima recorded average female heights of 151 cm. The average height of women in the Northeast, East (Madre de Dios), and South was about 152 cm, while women in the central highlands and the Northwest measured 150 cm or less. This pattern persisted for birth cohorts of 1968 to 1979, although the region around Lima gained somewhat in height. Assuming that the 19th century and the post-1950 periods were not dramatically different, one can reasonably conclude that heights not only in Lima but in the rest of Peru as well were not dramatically different. However, this conclusion is tentative, and requires further study.

A number of anthropological studies of height using data derived exclusively from tribes in the Andes estimated the height of rural male Indios in Peru and Northern Bolivia born mostly between the 1880s and 1900s at somewhat under 159 cm (Steggerda, 1943; Bogin and Keep, 1999). The urban Indios of our sample who were born in the 1870s and 1880s were slightly taller (about 160 cm). Limiting our sample to

[38] In a separate regression model, we also checked whether occupational groups became more significant if we considered only individuals born after the 1840s, but the difference to the original regression was quite modest (not shown).

[39] The share of black people was actually slightly higher in the 19th century than our population weights suggest. However, given the insignificant coefficient for black people, the results would change only very modestly. We thank Ricardo Salvatore for this hint.

the Peruvian Indians (Farabee 1922), we obtain a mean stature of 159.7 cm, very close to our estimate. Although our Lima sample is small, it seems safe to conclude that the height level of its population was substantially shorter than that of Brazil. The height gap between white and Indio prisoners steadily widened.

3.5 Conclusion

Argentina's GDP grew substantially during the period 1870 to 1913. GDP rose from $1300 in 1870 to $3800 in 1910 (Geary-Khamis $; Table 3.1), and real wages reached European levels by the end of the Golden Age (Williamson, 1995). However, we can confirm Salvatore´s finding that in Argentina heights did not increase and therefore reject the third hypothesis mentioned in the introduction that welfare grew during the income boom of the 1870-1913 period (Salvatore, 2004a, 2004b, 2007). The only significant benefit was to farmers, a group whose height trends could be shown separately.

Brazil's economy grew little between 1820 and 1913, certainly modest by European or by Argentinean standards (Maddison, 2001; see also Goldsmith, 1986 for the post-1850 period). Furthermore, biological progress, as measured in height trends, did not increase significantly in Brazil between 1810 and the 1860s.[40] However, between the 1860s and 1880s, Brazilian heights in our urban sample increased substantially. Therefore, we must modify the first of the hypotheses about Brazilian welfare that have been presented in the introduction. While welfare stagnated from 1820 to 1860, biological components of the standard of living improved considerably between the 1860s and 1880s.

Heights in Lima, Peru, remained on a modest level. The second initial hypothesis, that the quality of life in Peru was higher than that of Brazil, needs to be modified. We find that Brazilian anthropometric indicators were at higher values than those of the inhabitants of Lima.

We assessed regional and social differences as well as welfare trends. Heights were greater in inland Brazil, in the Southern cattle- and grain-producing regions, and in the booming coffee-plantation area, whereas Brazilian prisoners born in the regions of

[40] See Morgan 2006, Baten and Hira 2006, Baten 2006.

the sugar plantations, in the Northeast, were shorter. These data support the finding that plantation economies throughout Latin America experienced a height decrease, the exception being the coffee-plantation regions of Brazil in the 1870s and 1880s.

Among the birth cohorts of the 1810s to the 1880s, the most significant height differences in Brazil distinguished the elite from the vast majority of the population. In contrast, by the 1870s Argentina's middle class was considerably taller than the lower class. In Peru, where the height gap between Indios and whites was particularly wide, skin color may have compounded the social and economic differences between the ethnicities, complicating any attempt at an analysis of heights according to occupational classifications.

3.6 References

A'Hearn, B., Baten, J., Crayen, D., 2009. Quantifying Quantitative Literacy: Age Heaping and the History of Human Capital, *Journal of Economic History*, 69 (3), pp.783-808.

Armstrong, W.A., 1972. The Use of Information Concerning Occupations. In: Wrigley, E. A. (ed.), Nineteenth-Century Society: Essays on the Use of Quantitative Methods for the Study of Social Data. Cambridge: CUP, pp. 191-310.

Arora, S., 2001. Health, Human Productivity, and Long-Term Economic Growth, *Journal of Economic History*, 61 (3), pp. 699-749.

Baten, J., 1999. Ernährung und wirtschaftliche Entwicklung in Bayern, 1730-1880. Stuttgart: Steiner.

Baten, J., 2006. Global Height Trends in Industrial and Developing Countries, 1810-1984: An Overview, *Working Paper*, University of Tuebingen.

Baten, J., 2009. Protein Supply and Nutritional Status in Nineteenth-Century Bavaria, Prussia and France, *Economics and Human Biology*, 7 (2), pp. 165-80.

Baten, J., Crayen, D., Manzel, K., 2008. Zahlenfähigkeit und Zahlendisziplin in Nord- und Westdeutschland, 16.-18. Jahrhundert. In: Jahrbuch fuer Wirtschafts-geschichte, 2008-2.

Baten, J., Hira, S., 2006. Anthropometric Trends in Southern China, 1830-1864, *Working Paper*, University of Tuebingen.

Baten, J., Fraunholz, U., 2004. Did Partial Globalization Increase Inequality? The Case of the Latin American Periphery, 1950-2000, *CESifo Economic Studies*, 50 (1), pp. 45-84.

Baten, J., Komlos, J., 1998. Height and the Standard of Living, *Journal of Economic History*, 57 (3), pp. 866-70.

Bauer, A., 1986. Rural Spanish America, 1870-1930. In: Bethell, L. (ed.), The Cambridge History of Latin America, Vol. 4, pp. 153-85. Cambridge University Press.

Bernecker, W., Pietschmann, H., Zoller, R., 2000. Eine Kleine Geschichte Brasiliens. Frankfurt am Main: Suhrkamp.

Bogin, B., Keep, R., 1999. Eight Thousand Years of Human Growth in Latin America: Economic and Political History Revealed by Anthropometry. In: Komlos, J., Baten, J., (eds.), The Biological Standard of Living in Comparative Perspective. Stuttgart: Steiner.

Carson, S.A., 2005. The Biological Standard of Living in Nineteenth-Century Mexico and in the American West, *Economics and Human Biology*, 3 (3), pp. 405-19.

Contreras, C., 2004. El Aprendizaje del Capitalismo. Estudios de Historia Económica y Social del Perú Republicano. Lima: IEP Ediciones.

Cortés Conde, R., Harriague, M.M., 1994. Estimaciones del Producto Bruto Interno de Argentina 1875-1935. Documento de Trabajo, Departamento de Economía, Universidad de San Andrés, Buenos Aires (unpublished).

Cortés Conde, R., 1986. The Growth of the Argentine Economy, 1870-1914. In: Bethell, L. (ed.), The Cambridge History of Latin America, Vol. 5, pp.327-57. Cambridge University Press.

Cranfield, J., Inwood, K., 2007. A Great Transformation: A Long-Run Perspective on Physical Well-Being in Canada, *Economics and Human Biology*, 5 (2), pp. 204-28.

Crayen, D., Baten, J. (2009). Global Trends in Numeracy 1820-1949 and its Implications for Long-Run Growth, *CESifo Working Paper*, 2218.

Díaz, A., 1974. El Censo General de 1876 en el Perú. Seminario de Historia Rural Andina.

Díaz Alejandro, C.F., 1970. Essays on the Economic History of the Argentine Republic. New Haven and London: Yale University Press.

Elizaga, J.C., 1973. La Evolución de la Población de la Argentina en los Últimos Cien Años, *Desarrollo Económico*, 12 (48), pp. 795-805.

Eltis, D., 1982. Nutritional Trends in Africa and the Americas: Heights of African, 1819-1839, *Journal of Interdisciplinary History*, 12, pp. 453-75.

Farabee, W.C., 1922. Indian Tribes of Eastern Peru, Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Vol. X. Cambridge, Massachusetts.

Ferrer, A., 1967. The Argentine Economy. University of California Press, Berkeley and Los Angeles.

Fish, W., 1978. Changing Food Use Patterns in Brazil, *Luso-Brazilian Review*, 15 (1), pp. 69-89.

Fogel, R., 1993. Economic Growth, Population Theory, and Physiology: The Bearing of Long-Term Processes on the Making of Economic Policy, *American Economic Review*, 84, pp. 369-95.

Fogel, R.W., Engerman, S.L., 1974/1995. Time on the Cross: The Economics of American Negro Slavery. Reissued edition. New York: W.W. Norton and Company.

Frank, Z., 2006. Stature in Nineteenth-Century Rio de Janeiro: Preliminary Evidence from Prison Records, *Revista de Historia Económica: Journal of Iberian and Latin American History*, 24 (3), pp. 465-90.

Fukao, F., Ma, D., Yuan, T., 2007. Real GDP in Pre-War Asia: A 1934-36 Benchmark Purchasing Power Parity Comparison with the U.S., *Review of Income and Wealth*, 53 (3), pp. 503-23.

Goldsmith, R.W., 1986. Desenvolvimento Financeiro sob um Secolo de Inflação. Harper and Row, São Paulo.

Gootenberg, P., 1990. Carneros y Chuño: Price Levels in Nineteenth-Century Peru. *Hispanic American Historical Review*, 70 (1), pp. 1-56.

Gootenberg, P., 1989. Between Silver and Guano. Commercial Policy and the State in Postindependence Peru. New Jersey: Princeton University Press.

Haber, S., Klein, H.S., 1994. The Economic Consequences of Brazilian Independence. In: Haber, S. (ed.). How Latin America Fell Behind. Stanford University Press, pp. 243-57.

Johnson, L., Frank, Z., 2006. Cities and Wealth in the South Atlantic: Buenos Aires and Rio de Janeiro before 1860, *Comparative Study of Society and History*, 48 (3), pp. 634-68.

Johnson, P., Nicholas, S., 1995. Male and Female Living Standards in England and Wales, 1812-1857: Evidence From Criminal Height Records, *Economic History Review*, 48 (3), pp. 470-81.

Kiple, K., 1989. The Nutritional Link with Slave Infant and Child Mortality in Brazil, *The Hispanic American Historical Review*, 69 (4), pp. 677-90.

Klein, H.S., 1986. African Slavery in Latin America and the Caribbean. Oxford University Press.

Komlos, J. 1987. The Height and Weight of West Point Cadets: Dietary Change in Antebellum America, *Journal of Economic History*, 47 (4), pp. 897-927.

Komlos, J., Coclanis, P. 1997. On the Puzzling Cycle in the Biological Standard of Living: The Case of Antebellum Georgia, *Explorations in Economic History*, 34, pp. 433-59.

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

Komlos, J., Baten, J., (eds.) 1998. The Biological Standard of Living in Comparative Perspective. Stuttgart: Steiner.

Komlos, J., 1996. Anomalies in Economic History: Reflections on the Antebellum Puzzle, *Journal of Economic History*, 56 (1), pp. 202-14.

Komlos, J., 1985. Stature and Nutrition in the Habsburg Monarchy: The Standard of Living and Economic Development in the Eighteenth Century, *American Historical Review*, 90 (5), pp. 1149-61.

Kubler, G., 1952. The Indian Caste of Peru, 1795-1940: a Population Study Based Upon Tax Records and Census Reports. Smithsonian Institution, Institute of Social Anthropology, Publication No. 14.

Leff, N. 1994. Economic Development in Brazil, 1822-1913. In: Haber, S. (ed.), How Latin America Fell Behind. Stanford University Press, pp. 34-61.

López, J.S., 1950. La Estatura Masculina en la Cuidad de Buenos Aires, *Anales del Instituto Étnico Nacional* 3, Ministerio del Interior, Buenos Aires, Argentina, pp. 113-38.

López-Alonso, M., Condey, R.P., 2003. The Ups and Downs of Mexican Economic Growth: The Biological Standard of Living and Inequality 1870-1950, *Economics and Human Biology*, 1 (2), pp. 169-86.

López-Alonso, M., 2002. Growth Without Growth: Heights, Health, Nutrition and Income in Mexico, 1870-1950, *Conference Paper*, XIIIth Congress of the International Economic Association, Buenos Aires 2002.

Maddison, A., 2001. The World Economy: A Millennial Perspective. Paris: OECD.

Manzel, K., Baten, J., 2009. Gender Inequality in Numeracy: the Case of Latin America and the Caribbean, 1880-1949, *Revista de Historia Económica*, 27 (1), pp. 37-74.

Margo, R., Steckel, R.H., 1983. Heights of Native Born Northern Whites During the Antebellum Period, *Journal of Economic History*, 43, pp. 167-74.

Meisel, A., Vega, M., 2007. The Biological Standard of Living (and its Convergence) in Colombia, 1870–2003: A Tropical Success Story, *Economics and Human Biology*, 5 (1), pp. 100-22.

Mitchell, B.R., 1993. International Historical Statistics. The Americas 1750-1988. New York: Stockton.

Morgan, S., 2006. The Biological Standard of Living in South China During the Nineteenth Century: Estimates Using Data From Australian Immigration and

Prison Records. Paper prepared for the Asia/Pacific Economic and Business History Conference, QUT, Brisbane, 16-18 February 2006.

North, D., 1966. The Economic History of the United States, 1790-1860. W.W. Norton: Englewood Cliff.

della Paolera, G., Taylor A.M., 2003. Tensando el Ancla: La Caja de Conversión, Argentina y la Búsqueda de Estabilidad Macroeconómica 1880-1935. Buenos Aires, FCE.

Pinto, H., Goicochea, A., 1977. Ocupaciones en el Perú: 1876. Universidad Nacional Mayor de Sam Marcos, Seminario de Historia Rural Andina, Lima.

Recenseamento Geral do Brasil 1872 – Império do Brasil, http://biblioteca.ibge.gov.br/visualizacao/monografias/visualiza_colecao_digital.php?titulo=Recenseamento Geral do Brasil 1872 - Império do Brazil&link=Imperio do Brazil, accessed on June 6th, 2008.

Rees, R., Komlos, J., Long, N. V., Woitek, U., 2003. Optimal Food Allocation in a Slave Economy, *Journal of Population Economics*, 16 (1), pp. 21–36.

República Argentina, 1916. Tercer Censo Nacional de la República Argentina 1914, 10 vols. Buenos Aires, 1916.

Salvatore, R., 1998. Heights and Welfare in Late-Colonial and Post-Independence Argentina. In: Komlos, J., Baten, J. (eds.), The Biological Standard of Living in Comparative Perspective. Stuttgart: Steiner, pp. 97-121.

Salvatore, R., 2004a. Stature Decline and Recovery in a Food-Rich Export Economy: Argentina 1900-1934, *Explorations in Economic History*, 41 (3), pp. 233-55.

Salvatore, R., 2004b. Stature, Nutrition, and Regional Convergence: The Argentine Northwest in the Twentieth Century, *Social Science History*, 28 (2), pp. 231-48.

Salvatore, R., 2007. Heights, Nutrition and Well-Being in Argentina, ca.1850-1950. Preliminary Results, *Journal of Iberian and Latin American Economic History*, 25 (1), pp. 53-86.

Salvatore, R., 2009. Stature Growth in Industrializing Argentina: the Buenos Aires Industrial Belt 1916-1950, *Explorations in Economic History*, 46 (1), pp. 70-92.

Salvatore, R., Baten, J., 1998. A Most Difficult Case of Estimation: Argentinean Heights, 1770-1840. In: Komlos, J., Baten, J. (eds.), The Biological Standard of Living in Comparative Perspective. Stuttgart: Steiner, pp. 90-96.

Sánchez-Albornoz, N., 1986. The Population of Latin America, 1850-1930. In: Bethell, L. (ed.), The Cambridge History of Latin America Vol. 4, pp. 121-51. Cambridge University Press.

Seminario, B., Beltrán, A., 1998. Crecimiento Económico en el Perú 1896-1995: Nuevas Evidencias Estadísticas. Universidad del Pacífico, Lima, Serie Documento de Trabajo 32.

Skidmore, T. 1990. Racial Ideas and Social Policy in Brazil, 1870-1940. In: Graham, R., (ed.), The Idea of Race in Latin America, 1870-1940. Edition 3. Texas University Press.

Somoza, J.L., 1973. La Mortalidad en la Argentina entre 1869 y 1960, Desarrollo *Económico*, 12 (48), pp. 807-26.

Steckel, R.H., Floud, R., 1997. Health and Welfare During Industrialization. Chicago: The University of Chicago Press.

Steckel, R., 1995. Stature and the Standard of Living, *Journal of Economic Literature*, 33 (4), pp. 1903-40.

Steckel, R., 1986. A Peculiar Population: the Nutrition, Health, and Mortality of American Slaves from Childhood to Maturity, *Journal of Economic History*, 46, pp. 721-41.

Steggerda, M., 1943. Stature of South American Indians, *American Journal of Physical Anthropology*, 1(1), pp. 5-20.

Stolz, Y., 2008. Height Development in Portugal, Angola, and Guinea Bissau, Nineteenth and Twentieth Centuries. Diploma Thesis Tuebingen.

Vainer, C. B., Brito, F., 2001. Migration and Migrants Shaping Contemporary Brazil. Presentation at the XXIVth General Population Conference, International Union for the Scientific Study of Population, Salvador, Bahia, Brazil, August 18-24, 2001. http://www.abep.nepo.unicamp.br/iussp2001/cd/Sessao_Especial_Vainer_Brito_Text.pdf

Waaler, H., 1984. Height, Weight, and Mortality: The Norwegian Experience, *Acta Medica Scandicana* (Suppl.) 679, pp. 1-56.

Williamson, J.G., 1995. The Evolution of Global Labor Markets since 1830: Background Evidence and Hypotheses, *Explorations in Economic History*, 32, pp. 141-96.

3.7 Appendix

3.7.1 Tables

Table 3.1: GDP per Capita in Selected Latin American Economies (Source: Maddison, 2001)

	1820	1850	1870	1890	1900	1910	1913	2001
Argentina			1,311	2,152	2,756	3,822	3,797	8,137
Brazil	646	686	713	794	678	769	811	5,570
Peru					817	975	1,037	3,630
Uruguay			2,181	2,147	2,219	3,136	3,310	7,557
Total Latin America	692		681		1,109		1,481	5,811

Table 3. 2: Numbers of Cases by Country and Birth Decade

Numbers of cases

Decades of birth	Argentina	Brazil	Lima (Peru)
1810		75	
1820		323	65
1830		705	205
1840		1265	317
1850		1604	146
1860		1740	78
1870	668	887	158
1880	1475	172	170
1890	1842		
1900	2066		
1910	902		
Total	6953	6771	1139

Raw average height

Decades of birth	Argentina	Brazil	Lima (Peru)
1810		164.3	
1820		164.3	162.8
1830		164.8	165.0
1840		164.6	162.2
1850		164.5	164.5
1860		165.0	164.3
1870	167.6	166.5	163.5
1880	167.6	166.1	164.0
1890	167.8		
1900	167.9		
1910	167.8		

Standard deviation

Decades of birth	Argentina	Brazil	Lima (Peru)
1810		6.58	
1820		7.38	7.15
1830		7.30	8.47
1840		7.04	8.08
1850		6.85	7.13
1860		6.71	6.16
1870	6.49	6.77	6.68
1880	6.39	6.53	6.85
1890	6.28		
1900	6.58		
1910	6.60		

Table 3.3: Determinants of Heights (cm) in Argentina and Brazil

Dep. Var.: Height in cm		(1)	(2)	(3)	(4)	(5)	(6)
Country		Argentina	Argentina	Brazil	Brazil	Brazil	Brazil
Decade of Birth	1810			-1.60	-1.83	-2.42*	0.00
	1820			-0.87	-1.24	-2.06***	0.20
	1830			-1.66**	-1.36*	-2.41***	-1.50
	1840			-1.78***	-1.61**	-2.45***	-2.04
	1850			-1.81***	-1.60**	-2.48***	-2.47
	1860			-2.28***	-2.19***	-1.81***	-2.74
	1870	0.00		-0.18	-0.15	-0.25	0.00
	1880	-0.00	0.94	ref.cat.	ref.cat.	ref.cat.	ref.cat.
	1890	0.25	1.13*				
	1900	0.40	1.04				
	1910	0.30					
Occupational Group	Unskilled	ref.cat.	ref.cat.	ref.cat.	ref.cat.	ref.cat.	ref.cat.
	Semiskilled	1.64***		0.30	0.54*	0.52**	
	Skilled	0.59**		1.30***	1.22***	0.82***	
	Semi-professional	1.58***		1.10*	1.20*	0.74*	
	Professional	2.88***		5.39***	5.38***	3.21***	
	Farmer	2.04***		-0.73	-0.78	-1.41*	
Controlling for Ages	Round Age			-1.16***	-1.13***	-0.77***	-0.97
	Age 19			-1.73***	-1.62***	-1.89***	-2.38
	Age 20			-0.21	-0.18	-1.00***	0.04
	Age 21			-0.36	-0.21	-0.66	-1.69
	Age 22			0.14	0.23	-0.48	-0.03
	Age 51-60			0.27	0.37		
Ethnicity	Black			0.29	0.39	ref.cat.	
	White			-0.29	-0.27	-0.65**	
	Brown			ref.cat.	ref.cat.	-0.40	
	Slave					-0.99**	
Origin	Africa						-3.59***
	France					0.49	
	Germany					3.71***	
	UK					3.48***	
	U.S.					3.24***	
	Spain					0.18	
	Portugal					-0.13	
	Italy					0.26	
	Other					1.56***	
	Constant	166.42***	168.02***	166.56***	166.37***	167.36***	166.53***
	Observations	6951	1356	3827	3469	6491	430
	R-squared	0.03	0.00	0.03	0.03	0.03	0.03

See notes on Table 3.3 on p. 50.

Notes: The Argentina regression constant in model (1) refers to an unskilled male of age 52, born in the 1870s; model (2) refers to farmers only, and excludes the 1910s. The Brazil regression constants refer to a criminal unskilled free male of brown (Col. 3-5) or black (Col. 6) skin color aged 23-50 (Col. 3 and 4: aged 23-60), born in Brazil in the 1880s.

Table 3.4: Occupational and Social Structure, in Lima in 1876 and in Brazil in 1872

	Lima Census share 1876	Lima sample share 1870s	Brazil Census share 1872	Brazil sample share 1870s
Occupational group				
No occupation	0.1	0.6	n.a.	3.1
Unskilled	16.3	16.5	33.9	35.9
Farmers	47.8	18.4	n.a.	1.7
Semiskilled	21.7	14.6	26.5	34.5
Skilled	9.4	34.8	20.6	21.1
Semi-professionals	4.2	12.0	13.5	3.0
Professionals	0.5	3.2	5.5	0.7
Slaves				
free	100	100	84.29	82.88
slave	0	0	15.71	17.12
Skin color				
White	22.7	20.7	38.5	41.6
Indio	44.1	43.0	n.a.	n.a.
Mestizo	15.7	21.8	41.5	30.4
Black	6.8	10.5	20.0	28.0
Asian	10.7	3.2	n.a.	n.a.

Notes: Brazil without considering farmers.

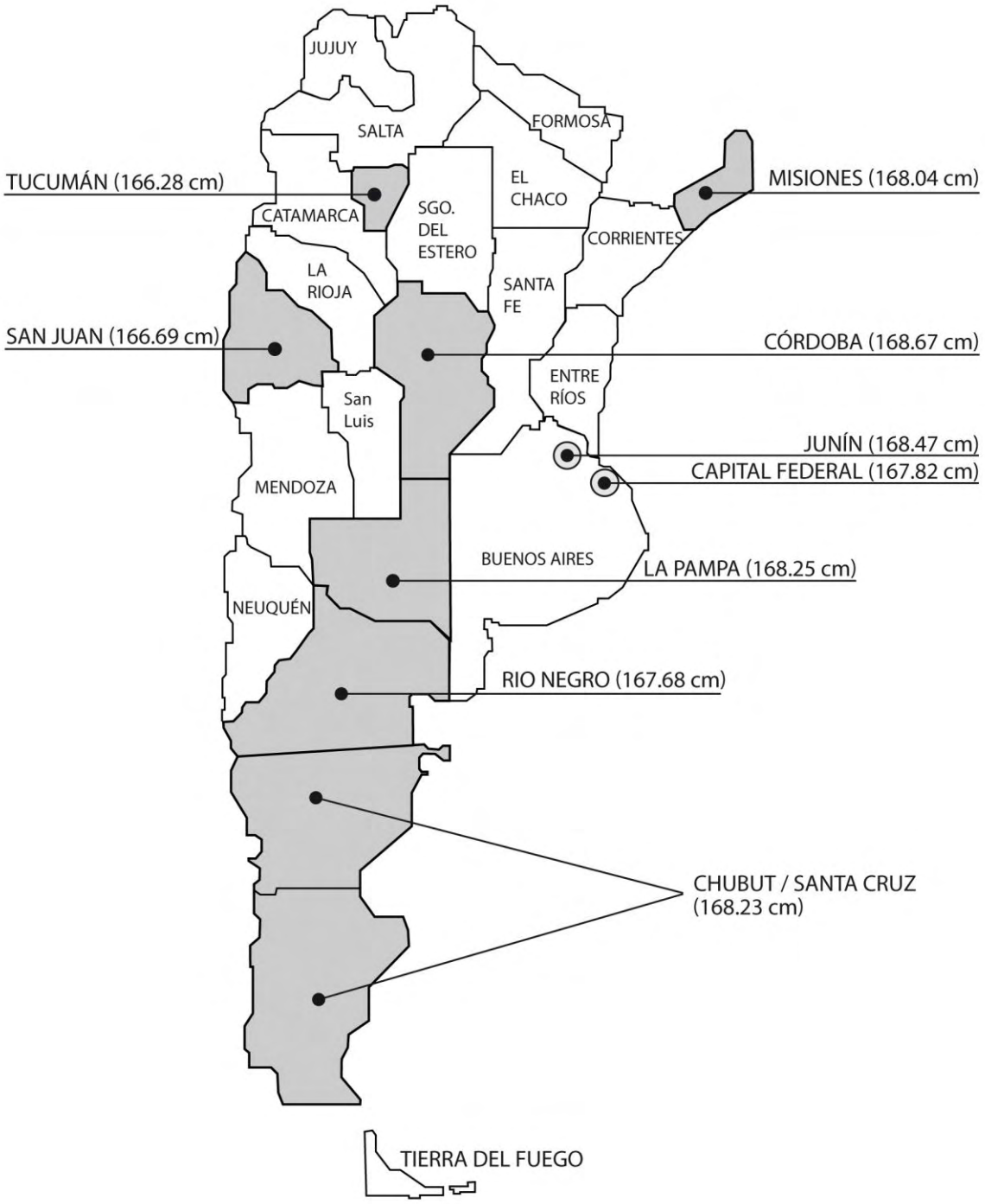
Table 3.5: Determinants of Heights (cm) in Lima

Dep. Var.: Height in cm		(1)	(2)
Decades of Birth	**1820/30**	-2.22*	-2.34**
	1840/50	-2.27***	-2.31***
	1860/70	0.11	0.07
Occupational Group	**Unskilled**	ref.cat.	ref.cat.
	Semiskilled	0.75	0.39
	Skilled	0.32	0.21
	Semi-professional	0.58	0.24
	Professional	-1.62	0.47
	Farmer	-0.34	-0.4
Ethnicity	**Indio/Cholo**	-5.02***	-6.03***
	Mestizo	-2.91***	-3.37***
	Zambo	0.73	-0.45
	Black	2.25*	1.01
	Asia (Immigrants)		-3.58***
	Constant	165.78***	166.88***
	Observations	884	1139
	R-squared	0.14	0.13

Notes: the Peru regression constant refers to a criminal unskilled male of white skin color and age 23-50, born in the 1880s.

3.7.2 Figures

Figure 3.1: Spatial Distribution of Heights in Argentina



Note: the grey-shaded provinces plus the cities of Buenos Aires and Junín are included in the sample. Their mean heights in cm are reported in parentheses.

Figure 3.2: Distribution of Heights in Argentina, Brazil, and Lima

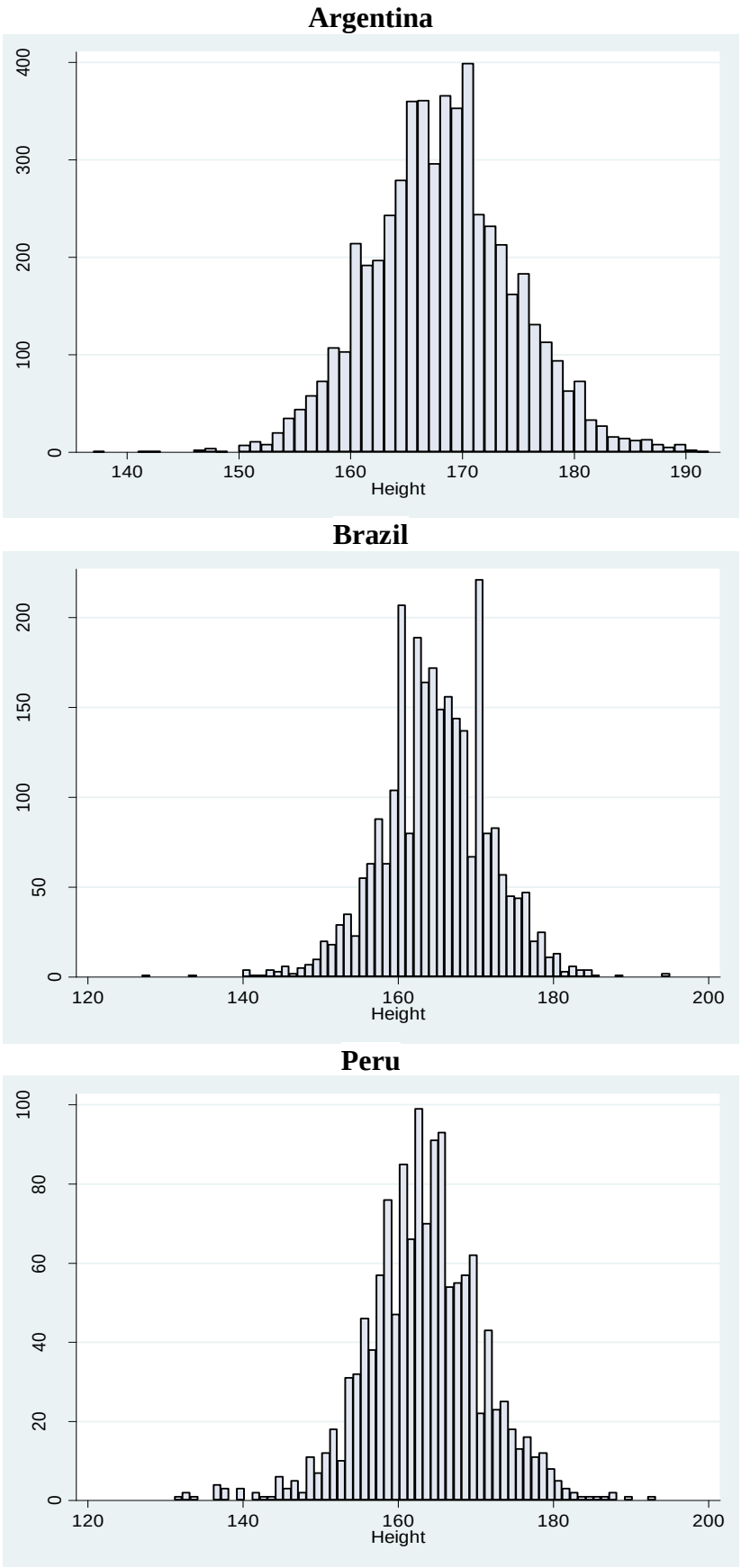


Figure 3.3: Comparison of Various Height Estimates for Argentina

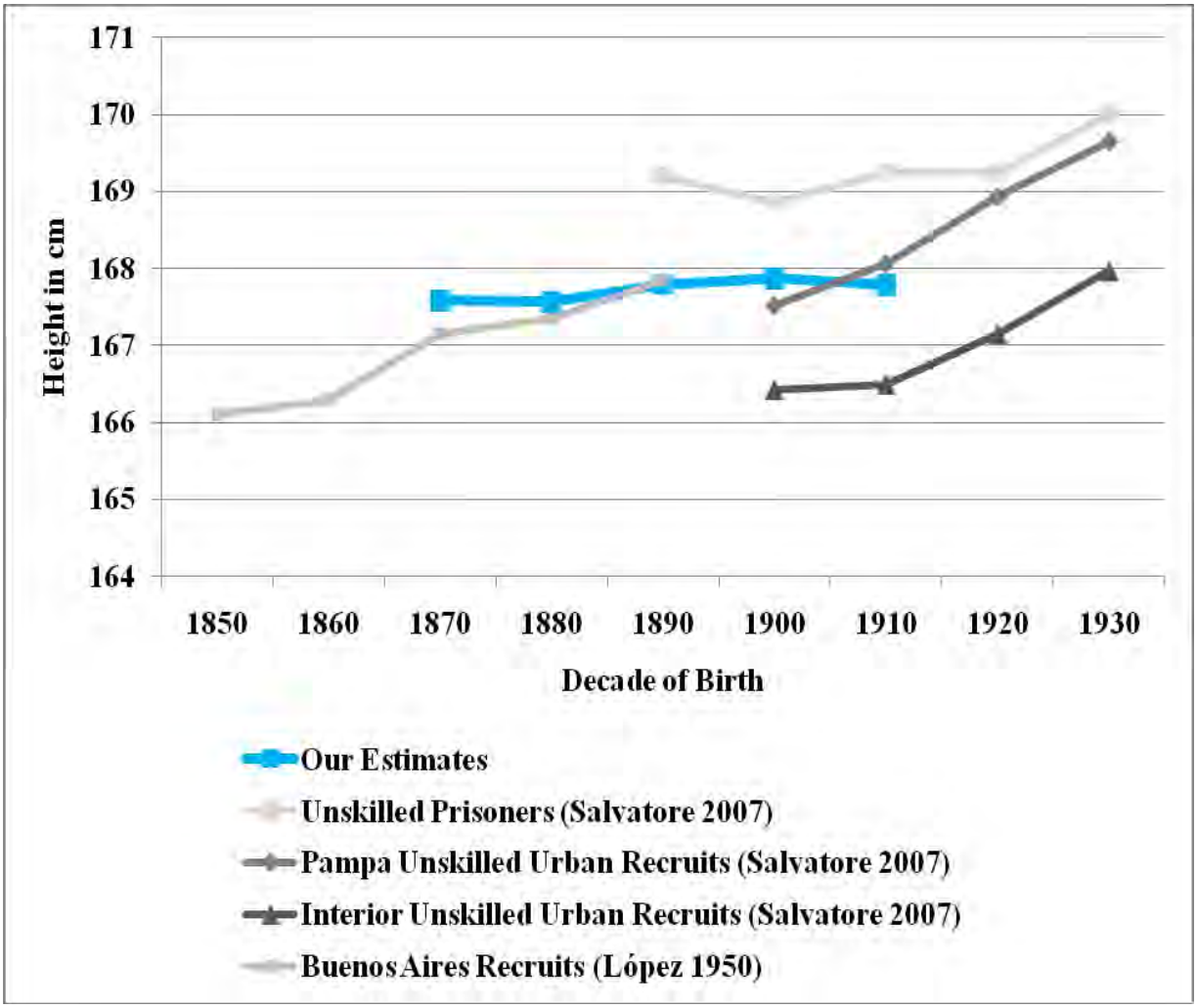


Figure 3.4: Height Trends of Farmers and Unskilled Workers in Argentina

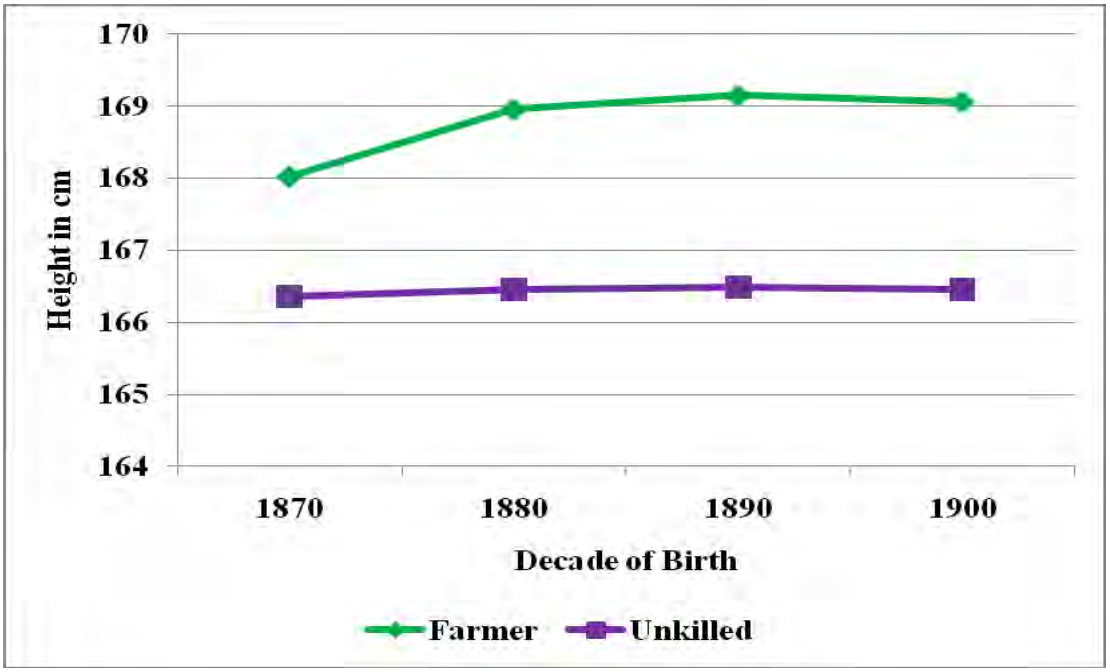
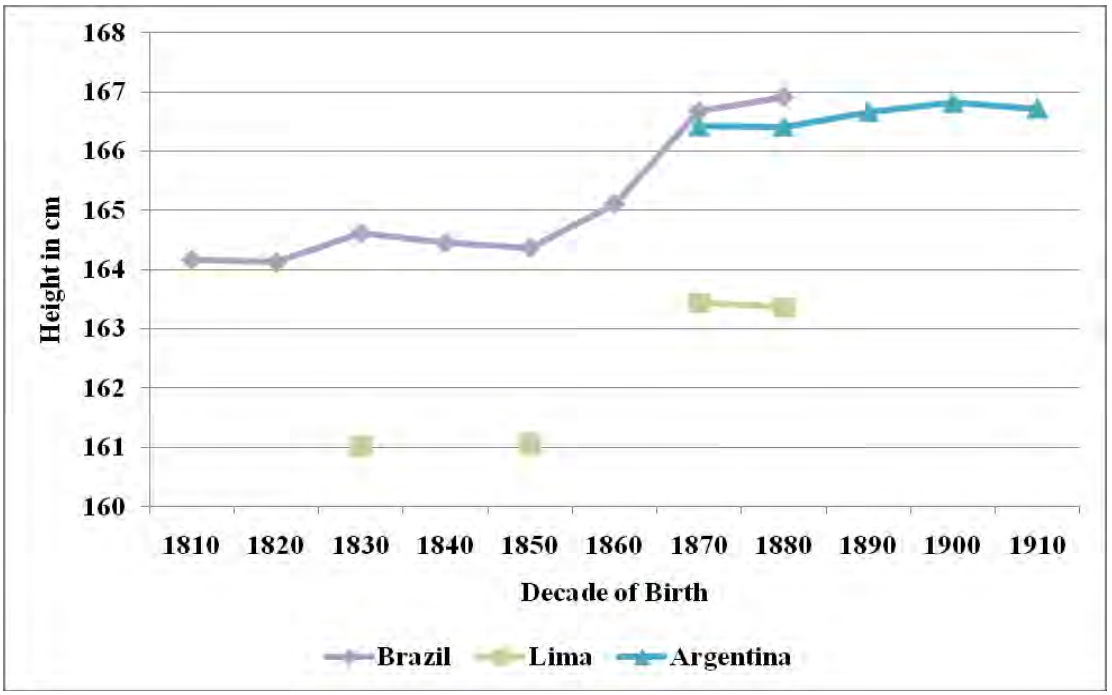
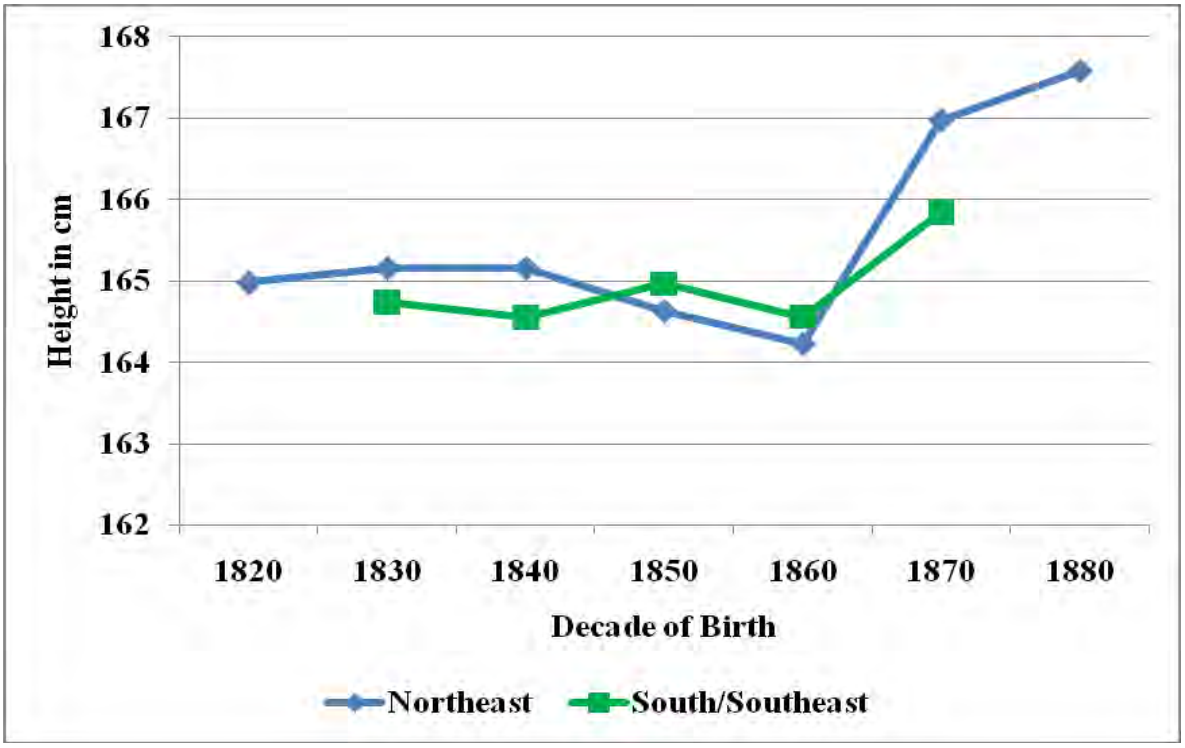


Figure 3.5: Height Trends in Argentina, Brazil, and Lima by Birth Decade (Brazil, Argentina), and 20- or 10-Year Birth Cohort (Lima)



Note: The Lima value for 1830 refers to those born 1820-39, the one for 1850 to 1840-59, the one for 1870 to 1860-1879, the one for 1880 to 1880-89. The years denote the beginning of a birth decade for Brazil and Argentina (1810 for 1810-19 etc.). We adjusted for occupational group and for skin color by using the coefficients of the main regression tables, and census weights so as to obtain unbiased population averages for each birth cohort and country (the census weights were derived from the Peruvian census of 1876, values for the Lima region, and the Brazilian census of 1872)

Figure 3.6: Height Trend in Northeast and South/Southeast Brazil



Notes: "Northeast" refers to Pernambuco, Bahia, Sergipe, Alagoas, Paraíba, Rio Grande do Norte, Ceará, Piauí, and Maranhão. "South/Southeast" refers to Rio de Janeiro, São Paulo, Minas Gerais, Espírito Santo, Paraná, Santa Catarina, and Rio Grande do Sul. We included only birth decades with at least 50 observations, and only adult males aged 23-60.

Figure 3.7: Height by Province in Brazil

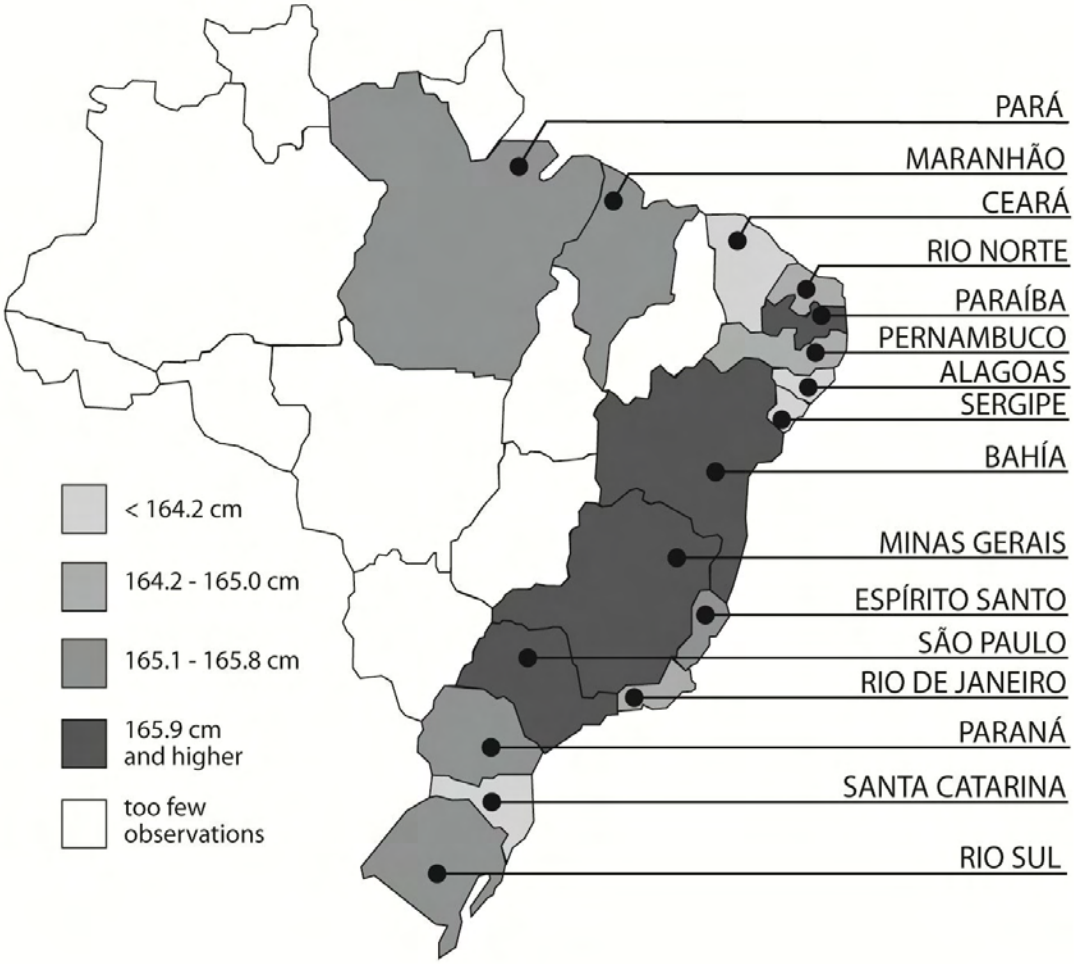
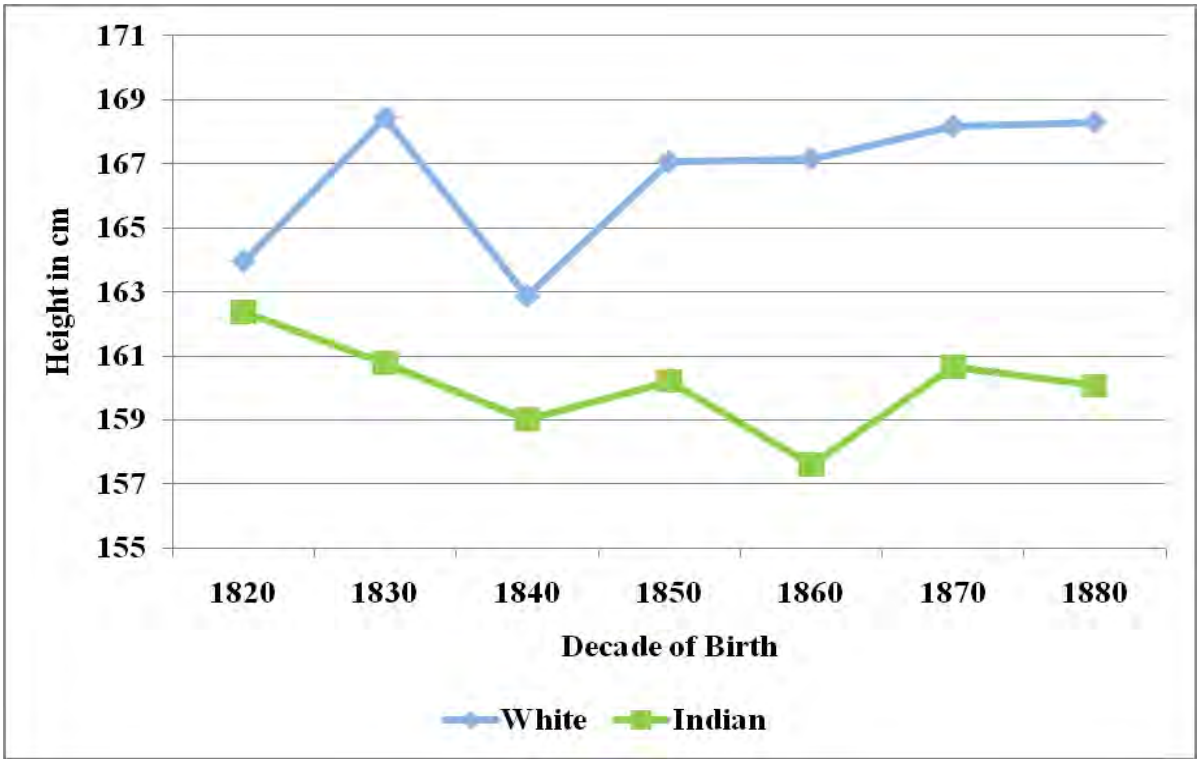


Figure 3.8: Height Differences by Ethnicity in Peru



4 The Seed of Abundance and Misery[1]

Peruvian Living Standards from the Early Republican Period to the End of the Guano Era (1820–1880)

Abstract

This paper examines 19th-century Peruvian heights from the early republican period to the end of the guano era (1820–1880). Analyzing male and female prisoner heights from the Lima penitentiary, we find that the physical stature of the lower classes stagnated throughout the period. In spite of the substantial profits generated by Peru's chief export product, guano, these revenues apparently did not filter down to benefit ordinary laborers.

This chapter is based on a paper published in Economics and Human Biology (2010), co-authored with Kerstin Manzel (University of Tuebingen). The concept for the paper was developed jointly; the analyses and writing were equally shared.

[1] Enrique Bunster, Chilean journalist (cited in Romero 1949, p. 410)

4.1 Introduction

Nineteenth-century Peru was rich in natural resources that made for a thriving economy: highland silver mining, coastal sugar and cotton plantations, and rainforest rubber production. Practiced since Incan times, exploitation was discontinued after the demise of the Spanish colonial system, but gradually rediscovered during the 19th century. In the early1840s, large guano deposits were found on islands off the Peruvian coast. Nonetheless, this period is often called the ‘‘lost century’’ and its prosperity described as ‘‘fictitious’’, because by 1880 all that remained was a country deep in debt, dependent on other countries’ benevolence (Hunt, 1985; Bonilla, 1974, 1985; Gootenberg, 1993). This paper analyzes 19th-century Peruvian heights to describe living standards from the early republican period to the end of the guano era (1820–1880).

Throughout the 19th century, Peru had few disparities in economic wealth and living conditions, although ethnic differences were clearly evident and remained so until the end of the century. The colonial system structured ordinary life and largely determined social status. This study illustrates that poverty rates were high and that inequality increased among the three main ethnic groups: Indians, blacks, and whites. Latin American living standards reflected in life expectancy at birth and infant-mortality rates stagnated from the early to the late 19th century and improved slowly but steadily thereafter (Coatsworth, 2005).

While there are several studies devoted to Peruvian economic development, this is the first such study to connect trends in living standards throughout the whole country directly with economic and social issues (Bonilla, 1974; Gootenberg, 1989; Hunt, 1985).

4.2 Historical Background: Peru During the Guano Era

With the rediscovery of guano, 19th-century Peru looked like it would be a national rags-to-riches story, but before long the classic Latin American boom-to-bust

pattern emerged, and Peruvian economic conditions stagnated throughout the rest of the century (Klarén, 2000). Minerals remained the main export, but their production declined considerably after Peru had won independence from Spain, in 1824. During the Wars for Independence, which were followed by frequent political changes, with the governing elite incapable of adjusting to new political realities, the agricultural sector contracted, and domestic production was disrupted (Gootenberg, 1990). These conditions persisted throughout the 1820s and 1830s.

In the early 1840s, large guano deposits were discovered on the Chincha Islands and changed 19th-century Peruvian economic development. The Incas used guano (the excrement of cormorants, pelicans, and other seabirds) as a first-rate fertilizer, rich in nitrogen and phosphorous. Although minor guano deposits were also found on several smaller Pacific islands, Peru became the world's leading guano exporter. Guano extraction required little capital investment, and no land-transportation system (Hunt, 1985, p. 269). Nevertheless, other sectors of Peru's economy lagged. Agricultural and timber industries decayed, partly because of the state's failure to subsidize them, but also because of an unskilled labor shortage (Hunt, 1985, p. 267). Although in the 1860s and 1870s cotton and sugar industries expanded, they remained of minor importance. With the depletion of the guano supply in the early 1870s, nitrate became a promising export product, but economic turmoil created due to Peru's 1883 defeat by Chile disrupted the emerging nitrate industry (Hunt, 1985, p. 258).

Characteristic of the guano era was the Peruvian elite's utter disregard for the government's fiscal needs, and revenues generated by the guano industry were not distributed equitably. Debt services soon consumed 90% of total guano income, and in 1876, Peru defaulted on its foreign debt (Klarén, 2000).

We argue that guano exports were associated with a stagnation in middle-and lower-class living standards due to the Dutch disease, the appreciation in the exchange rate that was triggered by an increase in the guano-extraction rate, rendering more difficult the development of other industrial sectors. Evidence is presented demonstrating that the white elite profited from commercial exploitation of Peru's natural resources. However, despite this economic prosperity, why did living standards not improve, and how were social and regional inequality related to height stagnation?

4.3 Data

4.3.1 General Description

Anthropometric history provides a technique for analyzing historical living conditions that is especially useful in the case of times and places for which conventional economic data are unavailable (Steckel, 1995; Komlos, 1998). Trends in physical stature also provide insights into biological living standards across the social strata, and provide insights into the well-being of individuals who are in the lower socio-economic groups and are particularly vulnerable to economic variation (Baten and Fraunholz, 2004, p. 48). Therefore physical stature provides information about net cumulative nutritional and epidemiological conditions over time.

The recent contributions to the literature are beginning to provide an overall pattern of 19th-century Latin American stature variation. On account of widespread poverty and extreme inequality, Latin American physical stature tended to stagnate throughout the 19th century, not increasing until the 20th century (López-Alonso and Porras Condey, 2003; Salvatore, 2004, 2007; Carson, 2005, 2008; López-Alonso, 2007; Frank, 2006; Meisel and Vega, 2007; Baten et al., 2009). Peruvian heights are the object of one study comparing 19th-century Limeño[2] height variation with that in Argentina and Brazil. Baten et al. (2009) find that heights in Lima stagnated from the 1820s to the 1850s, increased from the 1850s to the 1860s, and then stagnated again from the 1860s to the 1880s. We triple their sample size, to 2716 males and 380 females.[3] Data from the Lima penitentiary were recorded between 1866 and 1909, allowing us to study birth cohorts from the 1820s through the 1880s. The prison records comprise information on each inmate's place of birth, religion, age, occupation, ethnic group, and stature. While the sample is nationwide, most men and women were either Limeños or inhabitants of the coastal zones (Table 4.1).[4] Aguirre (2005) presents a statistical profile for Lima's prison-inmate population. It is evident that heights in this sample are skewed, under-representing the economic elite (white professionals), and over-representing lower

[2] Inhabitants of Lima.

[3] Baten et al. (2009) had too few female observations to be included in their analysis.

[4] We restrict our analysis to Peruvian males aged 20–50, since adolescents have further growth potential, a factor that could have skewed the results. We conducted several tests to define a limit to growth potential. The same restrictions are applied to women and immigrants.

socio-economic groups, even if it is likely that inmates were shorter than the non-criminal poor.[5]

4.3.2 Ethnicity

We divide the data into ethnic and occupational groups to determine the extent to which Peruvian society was influenced by skin color, personal wealth, and education. We adopt the ethnic classification used in the 1876 official census: whites, blacks, mestizos, Indians, and Asians (Díaz, 1974, p. 29).[6] For the sake of simplicity, we classify zambos[7] as blacks, because they are of the same height. Since skin color in Peru is an accurate indicator of sociocultural as well as biological background, it is a good proxy for overall well-being. For example, a large number of non-white Peruvians were classified as white because of their wealth or political influence (Middendorf, 1893, p. 204). The black portion of the population is over-represented in our data set (Díaz, 1974); blacks constituted only 2% of the Peruvian population.

Nearly all Indians and blacks were categorized as unskilled workers and were at the bottom of the social hierarchy. Indians became slaves or laborers and were obliged to pay a burdensome tribute (Gibson, 1984, p. 381). Blacks were treated as an investment, and were regarded as socially superior to Indians because the slave owner had spent money for their acquisition (Díaz, 1974, p. 27). Although blacks were freed slaves, they were probably better off than the indigenous population. Indians who left the Andean highlands had no choice but to work in mines or haciendas as bond-slaves; blacks found less brutal work as servants in the elite houses of Lima or on haciendas elsewhere on the coast. Indians remained socially isolated, at the bottom of the socio-economic hierarchy, whereas the widespread practice of manumission (especially after the country had won independence from Spain) meant that ex-slaves found satisfactory social standing in Peruvian society (Tannenbaum, 1946, p. 41). Most mestizos were

[5] Baten (1999) compares Bavarian military samples with prison populations for the 18th and 19th centuries and finds that both of them are representative of lower socio-economic groups.

[6] Mestizos are of mixed European and American Indian ancestry. In our analysis Asians are excluded because their case numbers are too small, and during the period under study, they fell into the migrant category, whereas in today's population composition they play a considerable role.

[7] Zambos are of black, mulatto, and Indian background, while mulattos are descended from whites and blacks.

skilled craftsmen. Constituting Peru's middle class, they identified with the white elite, since social advancement meant a rise in one's standard of living.

4.3.3 Region and Urbanization

The country is composed of three distinct geographical regions, the *costa* (coast), the *selva* (Amazon basin), and the *sierra* (Andean highlands) (Figure 4.1). Because the populations of the sierra and the selva are under-represented in our sample, these groups are combined (interior). On the other hand, because of the possibility that living conditions in Lima were exceptional, prisoners born in the capital are distinguished from those born elsewhere in the costa. For reasons such as a rising export market in Lima, the cultivation of cash crops on the costa, and the mining activity in the sierra, we maintain that there were few regional disparities in the biological standard of living in Peru throughout the period under consideration.

4.3.4. Occupations

A simplified Armstrong (1972) scheme (the prison records listed approximately 300 occupations[8]) is used for occupation identification: unskilled, farmers, skilled, and professionals.[9] Farmers are coded separately because they may have benefited from land ownership and close proximity to protein-rich diets. Moreover, there is little evidence of an occupational bias among the inmate population; the large percentage of day laborers is roughly equivalent to that of the non-prison population.

According to the 1876 occupational census, farmers constituted about half of the Peruvian population and are under-represented in the prison sample (Pinto and

[8] Within each category, we list the most numerous occupations: **Unskilled**: butcher, baker, cook, day laborer, launderer, loader, muleteer, peasant, servant, tailor, wagoner, worker; **Farmer**: agriculturist, cattleman, cultivator, farmer; **Skilled**: blacksmith, bookbinder, cabinetmaker, carpenter, caretaker, clerk, confectioner, deliveryman, enlistee, hatter, mason, mechanic, merchant, painter, plumber, printer, saddler, silversmith; **Professionals**: doctor, engineer, industrialist, journalist, lawyer, professor, business owner, schoolteacher, student.

[9] Armstrong (1972) uses two more categories in his 19th century censuses studies, the semi-skilled and semi-professionals.

Goichochea, 1977). For further analysis, we adjust our estimated means by population weights.[10]

4.4 Peruvian Welfare Development

4.4.1 Time Trend

Using OLS regression, we estimate stature models for Peruvian males and females by decade of birth (Table 4.2 and Figure 4.2).[11] Results illustrate that between 1820 and 1880 Peruvian male heights declined from around 162.4 to 161.4 cm. Although this decrease appears small, the fact that Peruvian heights declined at all during the guano export boom is astonishing, because guano revenues increased considerably. Male heights decreased significantly in the 1840s and improved only slightly thereafter, remaining below the 1820s and 1830s levels. Greater height variation among Peruvian women is probably due to the small number of observations. Hence, the fact that from 1830 to 1860 their average height increased by about 1 cm does not necessarily mean that their living standards improved.[12] Middendorf (1893, p. 212), however, also observes a similar height increase during the 1870s and 1880s, and credits it to improved nutrition, and more specifically to increased meat consumption.

The stagnation in male heights was the result of a deteriorating disease environment, a shift in agriculture from foodstuffs for the domestic market to export crops, rising prices, and stagnating wages. Sanitation during this period was precarious, and during the second half of the 19th century, Lima's mortality rate exceeded its birth rate (Moreno, 1897). Life expectancy at birth in the first half of the 19th century was around 30 years and by 1859 had barely improved for men aged 30–32 and women aged 32– 34 (Huenefeldt, 2000, p. 21). Tuberculosis and various fevers were widespread. Epidemics – of smallpox, for instance, in 1822 and of yellow fever around 1855 – could

[10] Throughout this study, we were cautious in our use of the term ''lower classes,'' since prisoners do not represent a cross-section of any socioeconomic class. We believe, however, that our data set provides a fairly accurate picture of 19th-century Peru, particularly of its lower classes, and thereby offers insights into their standard of living; previous studies (Carson, 2006) based on similar data encourage us to believe that ours are of value, too.

[11] Estimates are adjusted with population weights taken from the 1876 census.

[12] Only birth decade 1850 yields a significant result.

not be controlled, much less eradicated. A series of municipal initiatives failed to remedy Lima's deplorable hygienic conditions. Contaminated food, particularly bread and vegetables, transmitted dysentery. It was not until an attack of yellow fever in the late 1860s which affected members of the national legislature that the government managed to improve Lima's sanitation system (Zárate Cárdenas, 2006).

In contrast with the disease environment, the provision of nutrition at the beginning of the guano era was quite good. Low food prices in Peru during the first half of the 19th century meant that rich and poor alike could afford basic foodstuffs, such as bread and meat; local diets primarily featured mutton.[13] During the 1860s the average Lima family spent around 34% of its food budget on meat, 5% on lard and sugar, and 8% on beans and rice (Gootenberg, 1990).

4.4.2 Ethnicity

There is no evidence of stature convergence in the four ethnic groups; trends remain parallel until the end of the guano era (Table 4.2 and Figure 4.3). In fact, we conclude that the economic boom that began in the 1840s did not have a positive effect on living standards (Romero, 1949; Hunt, 1985; Gootenberg, 1990). Moreover, living standards varied according to ethnicity. Blacks were tallest: they averaged 167.4 cm in both the 1820s and the 1880s, losing nearly 1 cm in height between 1820 and 1854, the year after slavery had been abolished, but then regaining it. In the 1820s blacks were on average 4.9 cm taller than Indians; by the 1880s, the gap had widened to 7.1 cm. Although there is a slight increase, of 0.8 cm from the 1850s to the 1860s, in Indian heights, the overall decline since 1820 remains steep, at 2.1 cm.

Indians were the ethnic group that suffered the most during the 19th century. Their average height declined by 3 cm between 1820 and 1860, reflecting a steep decline in their standard of living. The fact that the tribute, a tax that only indigenous people had to pay, remained in effect after Independence goes far to explain this decline. The only significant tax was this tribute, and any taxes that non-Indians owed

[13] Moreno (1897) and Peloso (1985) estimate that Limeños consumed about 98kg of meat per capita per year.

were never properly collected (Kubler, 1952).[14] In 1854, the government abolished the *contribución de indígenas*, confident that the guano-export tax revenues would compensate. As a result, Indians could return to their subsistence farms, which they had had to leave in order to make enough money to pay the tribute, as unskilled workers on haciendas or in the mines (Contreras, 2007, p. 143).

An increase of 1 cm over the years 1840 to 1860 in the average height of whites may be due to their benefiting from the guano boom. However, it took another decade for this average to decline to its 1830s level, of 165.3 cm. Because height samples for the 1820s, 1870s, and 1880s are small, the lines by which they are indicated on the graph are faint. Assuming, however, that they are fairly accurate, we ascertain that the average white heights increased by 4.2 cm, from 163.2 cm in the 1820s to 167.4 cm in the 1880s. Therefore only the whites benefited from the guano-export boom, and height stagnation among the other Peruvian socio-economic groups suggests that at the two ends of the spectrum the white-Indian ethnic gap increased over time, by 7.8 cm.

Considered by place of birth, those born in Peru remain the shortest: 1.8 cm shorter than prisoners born in Colombia and 0.9 cm shorter than prisoners born in Chile (Table 4.3 and Figure 4.4).[15] The differences between Peruvians and both Spanish-and Italian-born prisoners are significant: Spaniards and Italians are about 2.8 cm and 3.1 cm taller, respectively. However, these differences may be explained by the immigrant occupational structure; 63% of Italians and 83% of Spaniards were classified as either ‘‘skilled’’ or ‘‘professional,’’ as opposed to only 46% of Peruvians.

4.4.3 Region and Urbanization

Male heights stagnated or deteriorated in all regions, when we control by ethnicities. Limeño adult heights surpass those of all other Peruvians, apart from the 1820s; prisoners from the interior and the coast were the shortest (Figure 4.5). Substantial height differences may be due in part to the small size of the samples as well as to their ethnic composition. While most white Peruvians lived in or near Lima, most of the indigenous population lived in the Amazon basin. Living conditions in the interior

[14] The definition of ‘‘non-Indian’’ included whites, blacks, mestizos, and other non-Indian ethnicities, but was generally understood to refer to mestizos alone.

[15] Information on the year of immigration is not available from the prison sources.

stagnated. The geographical isolation of these regions may have served as a buffer from the economic and political turmoil centered in the capital. However, controlling for ethnicity, we find regional differences to be insignificant (Table 4.2, column II).

In 1876, Peru had only six cities with a population of more than 10,000 (Smith, 1987).[16] In the 1820s, living in an urban area meant a disadvantage of 3.8 cm to rural areas, which, however, dissolves in the following decade (Figure 4.6). From the birth decade of the 1830s through that of the 1860s urban heights decreased. In contrast, a decline in rural heights ended in 1840, and then the trend reversed course. In other words, there was no height advantage in neither urban nor rural areas from the 1830s to the 1860s, when we control for ethnicities. If we consider urban-rural disparities for the different ethnic groups separately, only the mestizos register an urban height advantage, of 1.3 cm (Figure 4.7). However, the regression results indicate no significant effect of the urban dummy variable after controlling for ethnicity (Table 4.2, column III). It seems that for Peru's lower classes the advantages and disadvantages of urban life cancelled each other out.

We therefore conclude that although regional disparities in living standards existed, they were mainly due to differences in the ethnic composition of the regions, for once we control for ethnicity these differences disappear, leaving the social and ethnic composition as the best explanation for these disparities.

4.4.4 Occupations

To interpret occupation differences, three periods are considered: the early post-independence period (1820– 1840); the guano era (1840–1870); and the beginning of the post-guano period (1870–1890), during which the dependence on guano revenues drastically declined (Figure 4.8). The height of unskilled workers declined by 2.6 cm during the guano boom when we control for ethnicities; only after the boom did this downward trend reverse course, reducing the total loss to 1.6 cm. The height of skilled workers declined as well, by 0.8 cm for the whole period. The only occupational group to benefit from the guano boom was that of professionals, their average height increasing by 1.4 cm. The most striking figures are for Peruvian farmers, who lost 1.7 cm in height over the course of the 19th-century to become the shortest. As the state

[16] Lima, Callao, Chiclayo, Arequipa, Cuzco, and Iquique. See Fig. 1 for cities.

favored the guano-export trade at the expense of Peru's other industries, the price of less profitable cotton and sugar soared, prompting a shift away from the production of food crops. These results confirm the hypothesis that one's occupational status is an accurate predictor of one's biological standard of living.

4.5 Conclusions

We demonstrate not only that 19th-century whites benefited from guano wealth but also that lower class Peruvians did not benefit from profits generated by the guano-export market and suffered from rising prices and unemployment, when wages did not keep pace with prices. The disease environment remained unhealthy throughout the century. Food production was reduced in favor of more profitable economic enterprises that benefited nobody but the white elite. As a result, more foodstuffs were imported, but they were prohibitively expensive for the poor (Bonilla, 1985).

Social inequality did not change during the 19th century, and Independence seems not to have altered the colonial structure: the white elite remained in power, and most of the rest of the population remained near the subsistence level (Contreras, 2004). Not only did inequality between Indians and blacks persist but also the socio-economic gap between Indians and whites actually widened. That Peruvian blacks were tall is consistent with similar studies of American slaves; freed blacks were tall by modern standards as they towered over contemporary Europeans (Bodenhorn, 1999; Komlos, 1998). Occupation in 19th century Peru was largely determined by the socio-economic system, which in turn could have served to diminish, even eliminate, inequalities based on ethnic discrimination, if it had been modified in response to contemporary events.

4.6 References

Aguirre, C., 2005. The Criminals of Lima and Their Worlds: The Prison Experience, 1850–1935. Duke University Press, Durham/London.

Armstrong, W.A., 1972. The Use of Information Concerning Occupations. In: Wrigley, E.A. (Ed.), Nineteenth-Century Society: Essays on the Use of Quantitative Methods for the Study of Social Data. Cambridge University Press, Cambridge, pp. 191–310.

Baten, J., 1999. Ernährung und wirtschaftliche Entwicklung in Bayern, 1730–1880. Stuttgart.

Baten, J., Fraunholz, U., 2004. Did Partial Globalization Increase Inequality? The Case of the Latin American Periphery, 1950–2000, *CESifo Economic Studies* 50 (1), pp. 45–84.

Baten, J., Pelger, I., Twrdek, L., 2009. The Anthropometric History of Argentina, Brazil, and Peru During the Nineteenth and Early Twentieth Century, *Economics and Human Biology*, 7 (3), pp. 319–33.

Bodenhorn, H., 1999. A Troublesome Caste: Height and Nutrition of Antebellum Virginia's Rural Free Blacks, *Journal of Economic History*, 59 (4), pp. 972–96.

Bonilla, H., 1974. Guano y Burguesía en el Perú. Instituto de Estudios Peruanos, Lima.

Bonilla, H., 1985. Peru and Bolivia From Independence to the War of the Pacific. In: Bethell, L. (Ed.), The Cambridge History of Latin America, From Independence to 1870, vol. 3. Cambridge University Press, Cambridge, pp. 539–82.

Carson, S.A., 2005. The Biological Standard of Living in Nineteenth-Century Mexico and in the American West, *Economics and Human Biology*, 3 (3), pp. 405–19.

Carson, S.A., 2006. The Biological Living Conditions of Nineteenth-century Chinese Males in America, *Journal of Interdisciplinary History*, 37 (2), pp. 201–17.

Carson, S.A., 2008. The Stature and Body Mass of Mexicans in the Nineteenth-Century United States, *Journal of Interdisciplinary History*, 39 (2), pp. 211–32.

Coatsworth, J.H., 2005. Structures, Endowments, and Institutions in the Economic History of Latin America, *Latin American Research Review*, 40 (3), pp. 126–44.

Contreras, C., 2007. Historia del Perú Contemporáneo. Instituto de Estudios Peruanos, Lima.

Contreras, C., 2004. El Aprendizaje del Capitalismo. Estudios de Historia Económica y Social del Perú Republicano. Instituto de Estudios Peruanos, Lima.

Díaz, A., 1974. El Censo General de 1876 en el Perú. Seminario de Historia Rural Andina, Lima.

Frank, Z., 2006. Stature in Nineteenth-Century Rio de Janeiro: Preliminary Evidence From Prison Records, *Journal of Iberian and Latin American History*, 24 (3), pp. 465–90.

Gibson, C., 1984. Indian Societies Under Spanish Rule. In: Bethell, L. (Ed.), The Cambridge History of Latin America, Colonial Latin America, vol. 2. Cambridge University Press, Cambridge, pp. 381–419.

Gootenberg, P., 1989. Between Silver and Guano: Commercial Policy and the State in Post-independence Peru. Princeton University Press, Princeton, NJ.

Gootenberg, P., 1990. Carneros y Chuño: Price Levels in Nineteenth-Century Peru, *The Hispanic American Historical Review*, 70 (1), pp. 1–56.

Gootenberg, P., 1993. Imagining Development: Economic Ideas in Peru's ''Fictitious Prosperity'' of Guano, 1840-1880. University of California Press, Berkeley.

Huenefeldt, C., 2000. Liberalism in the Bedroom: Quarrelling Spouses in Nineteenth-Century Lima. Penn State Press, University Park, PA.

Hunt, S., 1985. Growth and Guano in Nineteenth-Century Peru. In: Cortés Conde, R., Hunt, S. (Eds.), The Latin American Economies. Holmes, Meier, New York.

Klarén, P.F., 2000. Peru. Society and Nationhood in the Andes. Oxford University Press, Oxford, New York.

Komlos, J., 1998. Shrinking in a Growing Economy? The Mystery of Physical Stature During the Industrial Revolution, *The Journal of Economic History*, 58 (3), pp. 779–802.

Kubler, G., 1952. The Indian Caste of Peru, 1795–1940: A Population Study Based Upon Tax Records and Census Reports, Institute of Social Anthropology, publication No. 14. Smithsonian Institution, Washington, DC.

López-Alonso, M., Porras Condey, R., 2003. The Ups and Downs of Mexican Economic Growth: the Biological Standard of Living and Inequality, 1870–1950, *Economics and Human Biology*, 1 (2), pp. 169–86.

López-Alonso, M., 2007. Growth with Inequality: Living Standards in Mexico, 1850–1950, *Journal of Latin American Studies*, 39 (1), pp. 81–105.

Meisel, A., Vega, M., 2007. The Biological Standard of Living (and its Convergence) in Colombia, 1870–2003: A Tropical Success Story, *Economics and Human Biology*, 5 (1), pp. 100-22.

Middendorf, E.W., 1893. Peru: Beobachtungen und Studien über das Land und seine Bewohner während eines 25-jährigen Aufenthalts. Oppenheim, Berlin.

Moreno, F., 1897. Crecimiento, Decrecimiento y Mortalidad de la Ciudad de Lima, *Boletín de la Sociedad Geográfica de Lima*, pp. 145–200.

Peloso, V.C., 1985. Succulence and Sustenance: Region, Class, and Diet in Nineteenth-Century Peru. In: Super, J., Wright, T.C. (Eds.), Food, Politics and Society in Latin America. University of Nebraska Press, Lincoln/London, pp. 46–64.

Pinto, H., Goichochea, A., 1977. Ocupaciones en el Perú: 1876. Universidad Nacional Mayor de San Marcos, Seminario de Historia Rural Andina, Lima.

Romero, E., 1949. Historia Económica del Perú. Edición Sudamericana, Buenos Aires.

Salvatore, R., 2004. Stature Decline and Recovery in a Food-Rich Export Economy: Argentina 1900–1934, *Explorations in Economic History*, 41 (3), pp. 233–55.

Salvatore, R., 2007. Heights, Nutrition and Well-Being in Argentina, ca.1850-1950. Preliminary Results, *Journal of Iberian and Latin American Economic History*, 25 (1), pp. 53-86.

Smith, C.T., 1987. Patterns of Urban and Regional Development in Peru on the Eve of the Pacific War. In: Miller, R. (Ed.), Region and Class in Modern Peruvian History. Institute of Latin American Studies, Liverpool.

Steckel, R., 1995. Stature and the Standard of Living, *Journal of Economic Literature*, 33 (4), pp. 1903-40.

Tannenbaum, F., 1946. Slave and Citizen. The Negro in the Americas. Knopf, New York.

Zárate Cárdenas, E., 2006. Los Inicios de la Higiene en Lima: los Médicos y la Construcción de la Higiene, *Investigaciones Sociales,* X (16), 459– 84.

4.7 Appendix

4.7.1 Tables

Table 4.1: Characteristics of the Peruvian Convict Data Set

Feature		Share in the Sample	Cases
	Total Data Set	100	4,392
	Peruvian Male	61.2	2,688
	Peruvian Female	10.5	460
	Literate (all incl.)	49.7	2,183
	Migrant	28.3	1,244
Ethnicity (Only Male Peruvians)	**Black**	25.8	601
	White	13.7	319
	Indian	32.5	757
	Mestizo	27.0	628
Region (Only Male Peruvians)	**Coast**	49.7	1,157
	Capital	31.3	729
	Interior	19.1	417
Occupation (Only Male Peruvians)	**No Occupation**	0.4	10
	Unskilled	38.4	895
	Skilled	42.7	994
	Professional	4.3	99
	Farmer	13.9	323

Note: Additionals up to 100% for each feature are always included in minor variables, but are not shown here. Only Peruvian men between the ages 20 to 50 are included in the columns ethnicity, region, and occupation. Source: Archivo General de la Nación, Peru, Lima. Archival source: Libros de Entrada y Salida de Reos, No. 3.20.3.3.1.1.4 to 26.

Table 4.2: Regression Results

Dep. Var.: Height in cm		(I)	(II)	(III)	(IV)	(V)
		Males			Females	
Decade of Birth	1820	0.98	0.89	0.98	-	-
	1830	0.87	0.84	0.89	-1.22	-1.21
	1840	-0.31	-0.34	-0.29	-0.43	-0.31
	1850	0.24	0.31	0.23	-2.26*	-2.12
	1860	0.17	0.23	0.14	-	-
	1870	-0.16	-0.15	-0.13	-	-
Ethnicity	Indian	-3.04***	-2.89***	-2.95***	-2.38**	-2.36**
	Black	3.52***	3.65***	3.46***	3.70***	3.53***
	White	2.30***	2.05***	2.20***	3.26	3.08
	Asian	-3.81**	-3.51	-3.87**	-	-
	Other[17]	-2.21	-1.87	-2.27	-	-
Region	Capital	-	0.12	-	-	0.99
	Interior	-	0.01	-	-	0.77
	Urban	-	-	0.34	-	-3.59
Occupational Group	No Occupation	-	1.75	-	-	-
	Skilled	-	1.00***	-	-	-
	Farmer	-	1.18***	-	-	-
	Professional	-	0.75	-	-	-
	Constant	162.91***	162.18***	162.76***	153.85***	153.45***
	Observations	2330	2330	2330	386	386
	Adj. R^2	0.14	0.14	0.14	0.14	0.13

Notes: ***/**/* implies significance at 1; 5 or 10% significance level, respectively. T-values in parentheses. The constant refers to mestizos born in 1880, living in a coastal province, and with an occupation classified as unskilled. In (III) the constant refers to mestizos born in 1880, living in a rural area. In (IV) and (V) the constant refers to women born in the 1860s.
The number of cases decreases because we included only individuals aged 20-50.
Standard errors are robust to heteroskedasticity.

[17] This category contains individuals who did not belong to one of the other important races in Peru: e.g., Jews.

Table 4.3: Regression (migrants)

Dep. Var.: Height in cm		
Country	**Ecuador**	0.07
	Colombia	1.82
	Chile	0.85
	Italy	3.12***
	Spain	2.84**
Decade of Birth	**1830**	0.23
	1840	-1.81***
	1850	-1.36**
	1860	-1.29*
	1870	-0.95
	1880	-1.07
	Constant	164.53***
	Observations	2859
	Adj. R^2	0.02

Notes: ***/**/* implies significance at 1; 5 or 10% significance level, respectively.
T-values in parentheses. The constant refers to male Peruvians. Migrants are all prisoners who were born outside Peru.
The number of cases decreases because we included only individuals aged 20-50.
Standard errors are robust to heteroskedasticity.

4.7.2 Figures

Figure 4.1: Regions and Cities in 19th-Century Peru

Figure 4.2: Secular Height Trend in Peru Weighted by Share of Ethnicity, 1820-80 (with 95% confidence intervals)

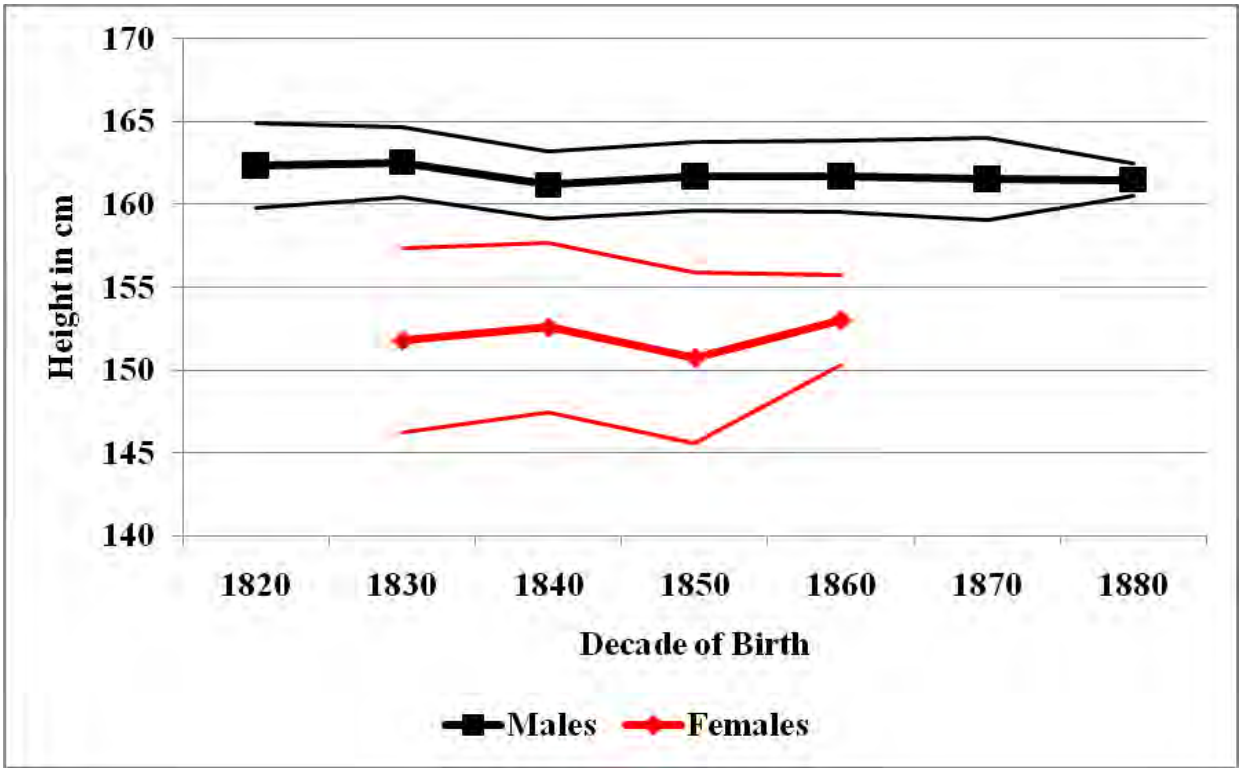


Figure 4.3: Trend of Mean Adult Male Height by Ethnicity in Peru, 1820-80

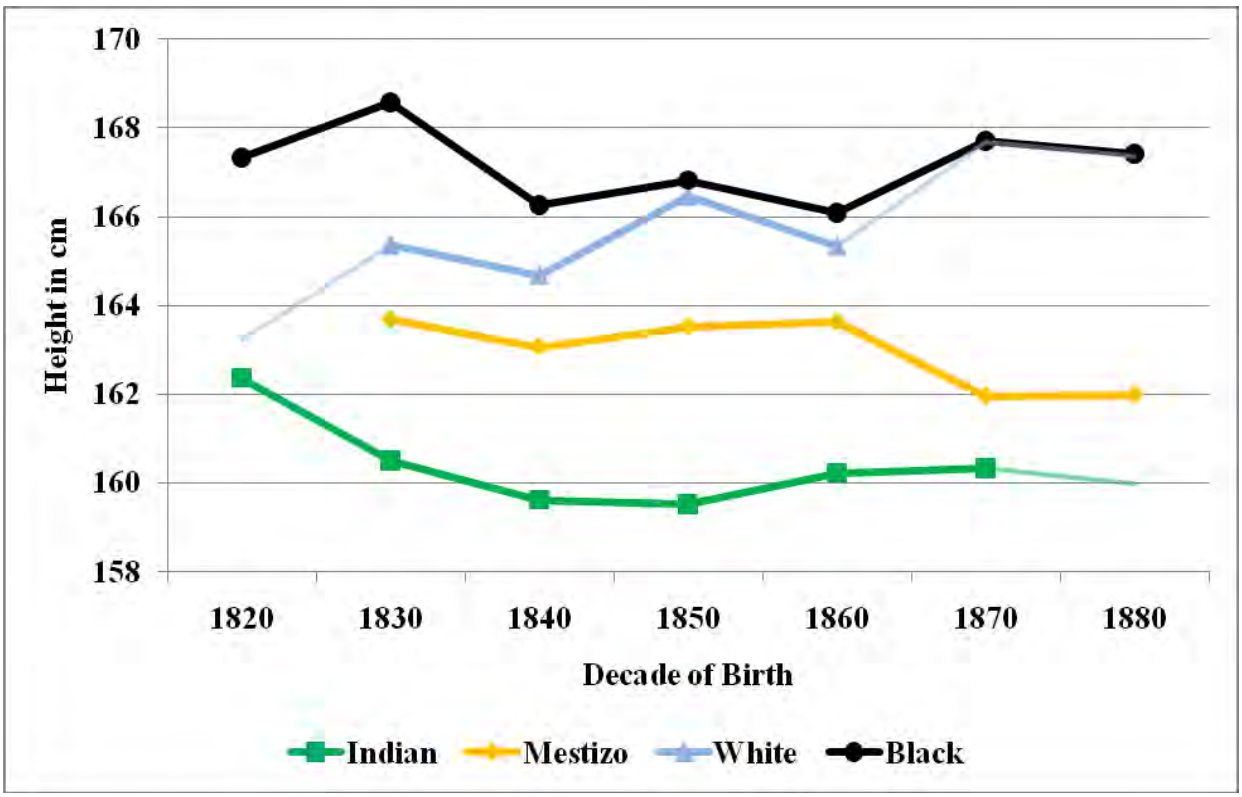


Figure 4.4: Peruvian Male Heights in International Comparison, for all Birth Decades, 1820-80

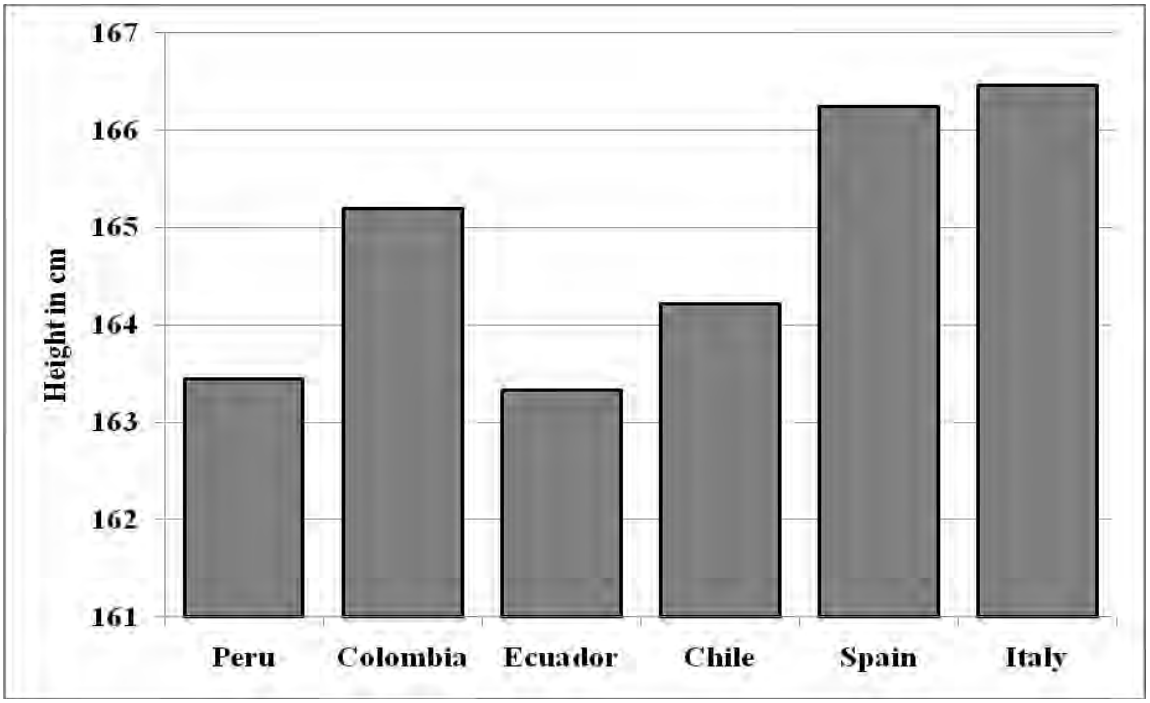


Figure 4.5: The Regional Development of Male Adult Height in Peru Weighted by Share of Ethnicity, 1820-80

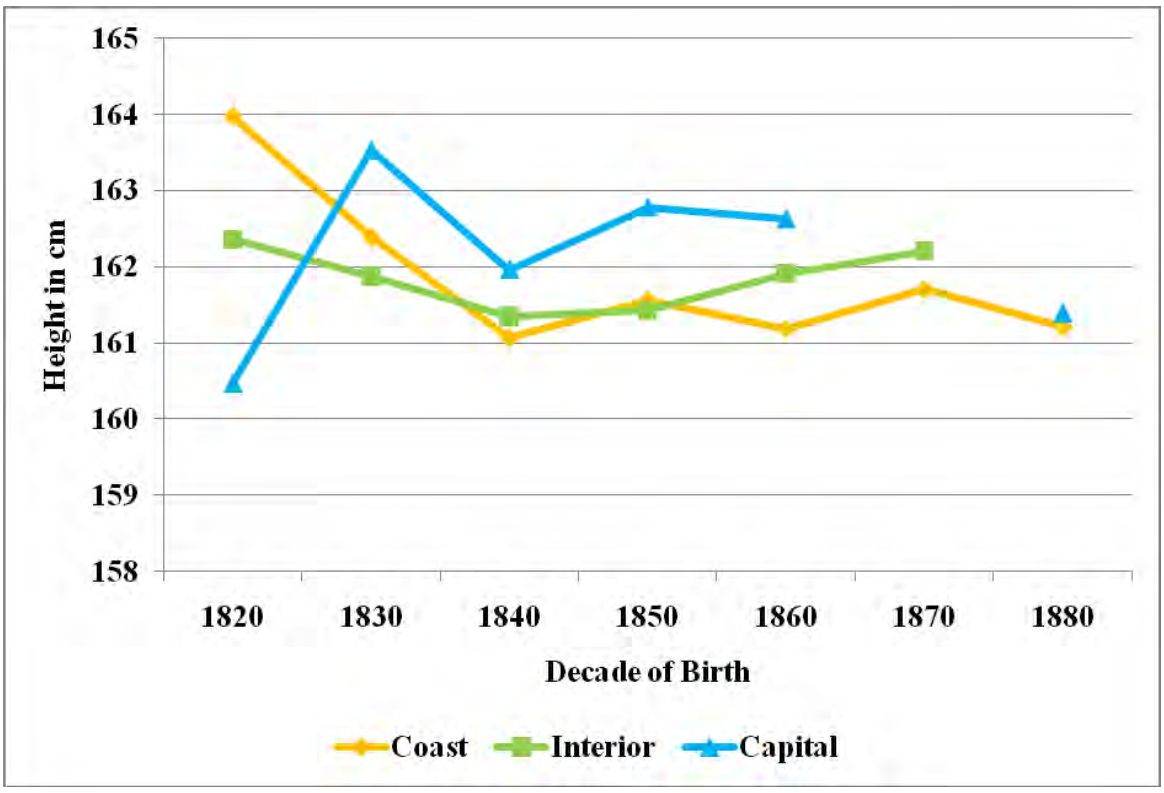


Figure 4.6: Development of Male Adult Height in Urban and Rural Areas Weighted by Share of Ethnicity, 1820-80

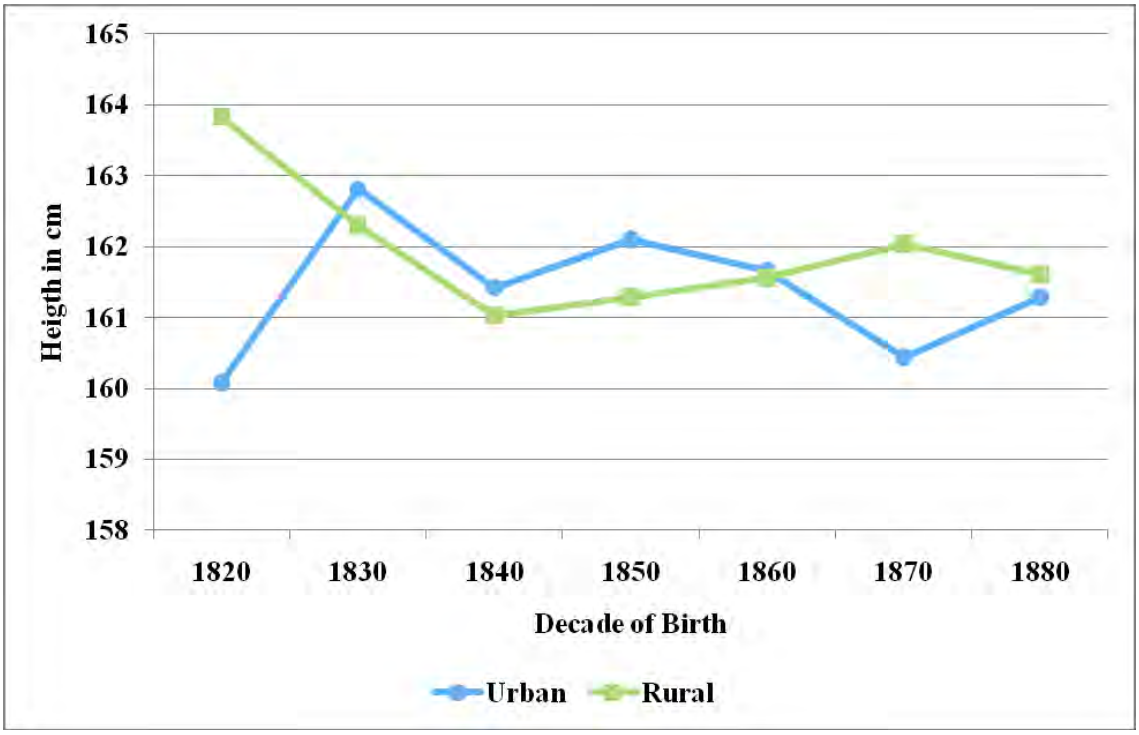


Figure 4.7: Urban and Rural Mean Heights by Ethnicity, for all Birth Decades 1820-80

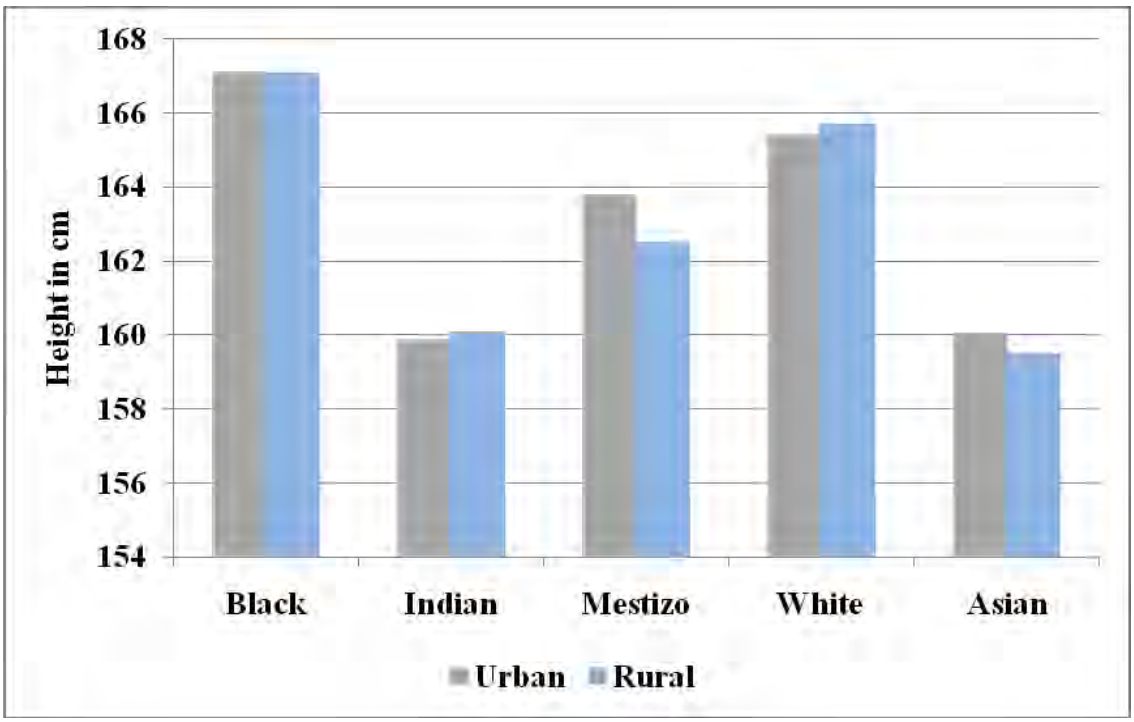
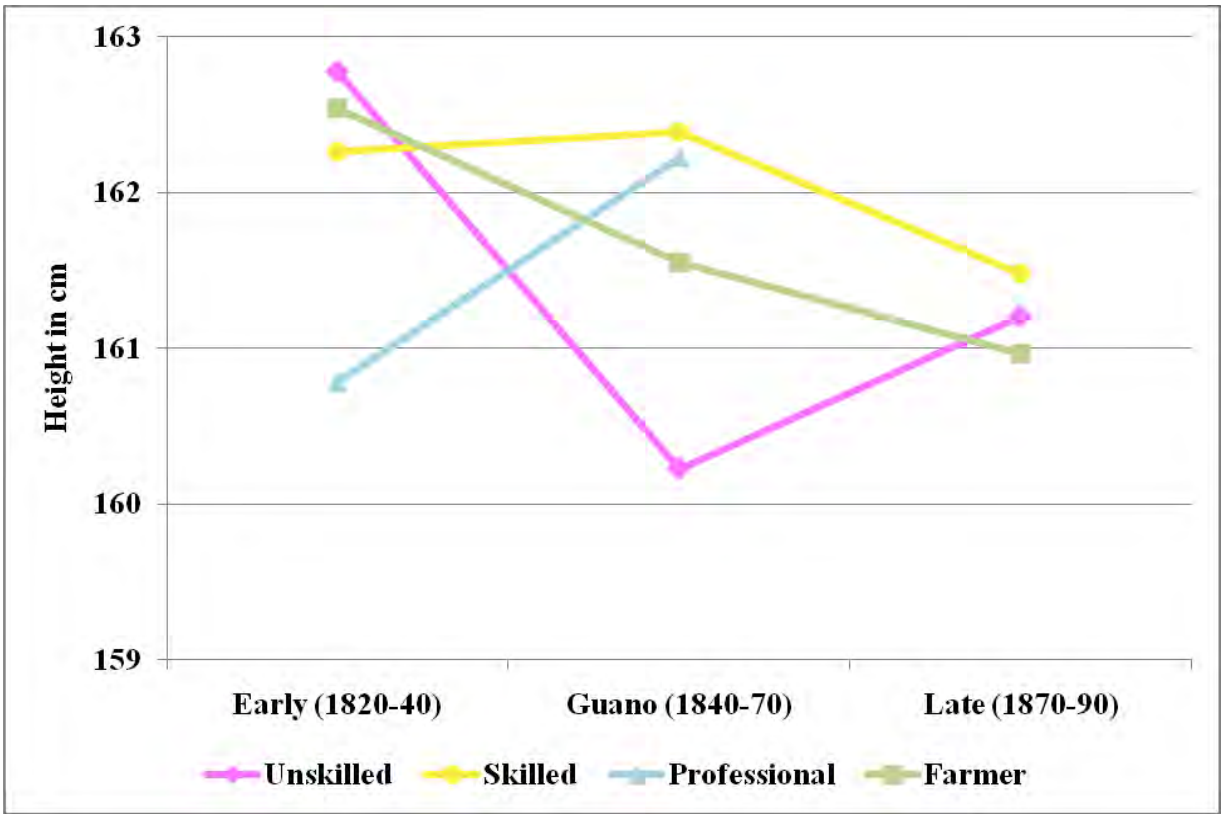


Figure 4.8: Development of Male Adult Height by Occupational Group Weighted by Share of Ethnicity



5 Cuba, the 'Always Most Faithful Island[1]': Biological Welfare from Spanish Colonial Rule to North American Dependency (1870-1930)

Abstract

This paper is the first to examine living standards in Cuba with the use of anthropometric data from the first war of independence (1868-78) until the beginning of World War I. Under late Spanish colonial power living standards deteriorated, the wars of independence had left its mark on the population, and the quinquennium of the Spanish-American War (1895-98) was characterized by the worst conditions for the preceding 30 years. Analyzing height data on the Cuban army this paper finds that US hegemony led to an improvement in living conditions of the Cuban population in the early 20th century. Investments in sanitation and the reduction of endemic diseases might be an explanation for this improvement. BMI values suggest that the nutritional situation was acceptable, although not satisfactory, in the first four decades of the 20th century.

[1] Cuba was given the name of the 'always most faithful island' (*la siempre fidelísima isla*) by the Spanish Crown because it remained loyal in spite of the independence struggles in the other Spanish colonies at the beginning of the 19th century.

5.1 Introduction

Cuba has always been a little different from the rest of the world, even in the 19th century when the belief of the 'always most faithful island' still prevailed. The country did not participate during the independence struggles in Latin America at the beginning of the 19th century. Only in 1898, with North American involvement, did the Cubans become free from Spanish colonial power; however, only to become dependent on its northern neighbor.

This paper investigates if there were any benefits related to living standards due to Cuba's loyalty. The development of biological well-being is analyzed with data on male heights in the period from the first war of independence (1868-78) until the beginning of World War I. Data on weights span over the period from the 1900s to the 1930s. During this time, the country was undergoing major social, political, and structural changes. It is assumed that living standards must have been dire for the population after too many years of war. Differences between ethnicities were probably small because the black population was already well integrated in the society and fought side by side with white Cubans for independence. The disease environment was particularly devastating and the wars of independence had left the population temporarily with little to live on. Until now, an actual outcome of how living standards were affected is hard to estimate, apart from the decimation of the population and the scarcity of products. This study is the first to assess living conditions of the Cuban population during its most crucial period, from Spanish colonial power to North American dependency. It adds new data on height and weight to the literature on anthropometrics in order to describe changes and impacts of biological welfare on the island of Cuba.

The paper is structured as follows. First, this study is embedded into its historical context to better understand possible implications. Then, the methods used are presented accompanied by a review of the literature on anthropometrics. After discussing the data, truncated regression analysis is applied with the results of a general trend of living conditions in Cuba and several interpretations are offered. This is followed by a separate analysis on biological welfare by ethnicity and other socio-economic determinants. Finally, the BMI distribution of Cuban soldiers is analyzed where the impact of ethnicity is tested on the latter. The last section concludes.

5.2 Cuban History

Cuba's colonial past stretched over a span of almost four centuries and ended as one of the last in Latin America at the turn of the 20th century. What distinguished Cuba from other Latin American countries was not only its late disengagement from Spanish colonial power, but the constitution of its population as well. The indigenous inhabitants had disappeared quickly as an ethnic group due to the clash between them and the Spaniards, and also due to sickness brought from the European continent. Blacks and whites were almost equally dominant on the island and became unified for fighting the wars of independence (Cuban Economic Research Project, 1965). During the Ten Years War fighting against Spain, the United States remained indifferent towards the elite's wish for annexation to the northern neighbor since they believed that it was in their best interest to keep the island with a weak colonial power. Slavery had been abolished gradually by proclaiming laws which conceded freedom to a certain group of slaves, starting in 1868. A royal decree in 1880 abolished the institution of slavery legally, and the system of slaveholding disappeared in 1888 (Friedlaender, 1944). Hence, in the census of 1887, all the inhabitants of the Cuban republic were considered free and equal. This history leads to the hypothesis that living standards between ethnicities were probably affected similarly.

After the first war of independence, Cuba's economy was on the verge of collapse. The sugar sector had to suffer the loss of three-quarters of its production centers and was particularly vulnerable (Pérez, 1983). The economic situation of this important industry was not good, due to a combination of various factors. The abolition of slavery without due compensation, frequent droughts, extraordinarily high taxes imposed by Spain on account of the war, and growing competition from European sugar beet presented serious problems. At the same time, the destruction of Cuban agriculture and livestock left the population with a shortage of food supply. The production of dairy products had been difficult throughout the 19th century, but after the first war of independence the availability of fresh milk and meat declined even further (Pérez, 1983).

The interwar period was marked by several crisis and economic downturns.[2] While by the end of the 1880s the Cuban sugar economy had recovered more or less,

[2] 1884-89, 1890-91: sugar price crisis.

1894: new tariff duty imposed by Spain on sugar entering the United States.

this had only been made possible by access to American markets and investments of the latter. The instable economic conditions had probably a negative impact on the standard of living of the Cuban population.

The second war of independence (1895-98) left Cuba with an American Military Government which ran the island for the following three years. The Peace Treaty signed by Spain and the United States put an end to the Spanish-American War, but did not acknowledge the role played by those Cubans who had fought for independence and their national identity. The treaty provided that Cuba was to establish a permanent government and that it should be able to maintain the order to fulfil international obligations if it wanted to achieve independence. In addition, the infamous Platt Amendment, which the U.S. imposed on the Cuban constitution as the price of Cuban independence, gave them the right to intervene in the affairs of the country should events threaten U.S. life or property. Americans were watching carefully on the fulfilment of their conditions, and saw the need to intervene again from 1906 to 1909.[3]

Changing dependencies from Spanish colonial power to North American omnipresence was not what Cubans had in mind when they fought for their national identity. However, since Spain hardly showed any interest in the well-being of the population, the overruling by North Americans could have resulted in favorable living conditions for Cubans since investments were made in all kinds of fields (Cuban Economic Research Project, 1965).[4] In the following, previous assumptions on the development and impacts on the standard of living in Cuba are addressed.

5.3 Methods

Living standards measured by height and body mass indices (BMI) are conveniently applicable in a historical context where heights and BMIs tend to increase when economic conditions improve and decrease when they worsen. Hence, nutritional status, as reflected in height and weight, connects improvements in diets and the surrounding environment to improvements in human physiology, a concept which takes human capital as well as health capital into consideration (Fogel, 2004).

[3] The second North American military occupation took place because they saw the peace on the island threatened by independence war veterans.

[4] For example, in the fields of sanitation and infrastructure.

Height and BMI measure different aspects of nutritional status. Stature measures net cumulative nutrition from conception to the time of measurement (in the case of a child) or until the age that adult height was attained. Thereby, the demands of disease are most crucial during early childhood which suggests mortality selection of final adult height among populations. In that sense, scarring is another issue which could reduce final height in case of a very high disease environment in childhood. There is a genetic component to heights within populations, which, however, balances out if one considers mean heights across populations (Deaton, 2007). Conditions during the earliest years of infancy and childhood have the greatest impact on final height. On this account, average height is arranged by birth cohorts to describe living standards in the past.

BMI reflects the net current balance between dietary intakes and claims on those intakes made by maintenance, work, and disease (Steckel and Floud, 1997).[5] The correlation between height and weight is not very strong at the individual level, but is more appropriate for describing the variation between large groups. Hence, BMI provides significant insights into historical health and nutrition concepts.

Studies on BMI often deal with the questions of overweight and obesity problems of the underlying population to derive health implications from it (see for example Cuff, 1993). In the past, however, these problems are rarely of concern, and being underweight might have been the greater problem in very unequal societies. In this study, the BMI distribution and development is analysed for the first four decades of the 20th century.

5.4 Data

This study uses data from the *Ejército de Cuba* which has its origins in the *Guardia Rural*, a corps of volunteers which was created after the dissolution of the liberation army by the United States. The data were collected at the *Archivo Nacional de la Isla de Cuba*. A random sample of 1442 individuals was taken, registered between the years 1902-51.[6] Around one third of the individual height data was measured in *pies, pulgadas and líneas*; weight was measured in *libras* accordingly. The English conversion measures were used (see for example Schroeder, 1982). Particularly, the

[5] BMI=(weight in kilograms)/(height in meters)²

[6] Source: Fondo: Ejército de Cuba, Legajos: 1-70

high influence of North Americans in social, political and economic fields on the island suggests that inches and pounds were applied to measure the height and weight of a soldier.

Since the data stem from individual records from the military department, one has to keep in mind that minimum height requirements could have been an issue. Figure 5.1a-b show that this was indeed the case. For the period from 1902 to 1913, the army imposed several requirements on Cubans who wanted to enter the army voluntarily. The Cuban male had to be physically and mentally healthy, know to read and write the Spanish language, be at least 5 *pies* and 4 *pulgadas* (162.56 cm) tall and weigh at least 120 *libras* (54.4 kilograms). Blacks could join the army just as well, but since most of them did not know to read and write, a smaller portion of the black population was recruited (Uralde Cancio, 2006). Still, the data show that these criteria were not strictly enforced. Blacks are represented quite well in the sample with 32.6 percent. Moreover, the height distribution is not exactly cut at the truncation point, but some below it were accepted as well (Figure 5.1a). From the 1914 recruitment year onwards, minimum height requirements were lowered to 157 cm (Figure 5.1b). Weight requirements seem to have not been altered.[7]

The proportion of whites and blacks in the sample fits the numbers of the percentage distribution of the Cuban population given in the censuses of 1877, 1887, and 1899 (Table 5.1). The percentages in the three censuses of black and white people barely changed, remaining around 32 percent being black and 67 percent being white. Only in the census years from 1907 to 1931 did the white population increase to 72 percent.

Many of the soldiers were between 21 and 24 years old, but there was also a substantial proportion of people aged 25-31.[8] The classification of occupations using the Armstrong scheme suggests that around 50 percent were unskilled laborers, and quite a high number of 30 percent exercised skilled occupations, which might be traced back to the requirements mentioned above. The data permitted identification of the place of birth; it seems reasonable to divide the island into the east and west (Figure 5.2). The provinces of Camagüey, Las Villas and Oriente belonged to the eastern part of the island, Matanzas, Habana and Pinar del Río to the western part. The rationale behind

[7] Figures available upon request from author.

[8] Around 66 percent of the sample was between the ages 21 to 24.

this classification lies in the shift of economic concentration and higher investments in the sugar industry from the west to the east around the time of the North American military occupation. In addition, possible biases arising from small case numbers can be avoided if a smaller disaggregation was used instead.

5.5 Height Trend

There are several models for investigating trends of military heights which have to deal with the problem of truncation (see for example A'Hearn, 2003; Komlos and Kim, 1990; Komlos, 2004). The data used here reveal two truncation points: recruitment before 1913 adapted to North American standards at 5 pies 4 pulgadas (162.56 cm), and reduced to 157 cm after 1913. The change and its timing correspond well with the evolution of historical and political events. An additional complication concerns selection effects; for example, Spanish reading and writing requirements before 1913 might result in a positive, but diminishing selection bias over time which could lead to slightly overestimated heights. The occupational structure also suggests that heights could be higher than expected, but this effect is controlled for in the regression.

Samples with a truncation point from below obviously lead to upward estimated mean heights, relative to the underlying population means. Truncated regression analysis using a maximum likelihood estimator is appropriate when one wants to account for the compositional effect of the data to estimate the effect of independent variables. Therefore, the regression controls for the ethnic distribution, regional composition as well as occupational structure, and dummy variables for each quinquennium of birth were included. Dummy variables for the ages 18 to 20 were added to see if there is any growth potential left among the younger ones. One of the advantages using truncated regression analysis is the possibility to obtain consistent and unbiased estimates of the coefficients of the independent variables, as well as their standard errors, which allows for further statistical inference. In addition, it estimates the sigma σ of the height distribution. Summary statistics of the variables are presented in Table 5.2.

While the literature is scarce on general living conditions in Cuba during the colonial period and North American military occupation afterwards, the data analysis reveals an interesting insight into the well-being of the population. Figure 5.3 describes

the development of Cuban heights calculated with truncated regression analysis and weighted by the ethnic distribution. Two models are performed since the truncation point changed with the beginning of World War I. Table 5.3 describes the corresponding results controlling for ethnicity, place of birth and the occupational status.

During the first war of independence, heights seemed to be at their peak, with an extraordinary 169.5 cm for the Cuban population.[9] However, right after the end of the war, heights were declining subsequently, reaching their lowest point at 164.5 cm from 1895 to 1899. This precipitous decline reminds of the adverse nutritional circumstances immediately after the Ten Years War and during the second war of independence which lasted from 1895 to 1898 and is described as a most destructive period for the country. However, right after the second war, the first military occupation by the U.S. began, lasting until 1902, which is when heights experienced a rapid recovery until 1910 to 1914, reaching 168 cm, but remaining below the pre-war values. Heights were expected to be declining after the second war of independence, just as they had after the first war, because of its destructive nature; however, Figure 5.3 reveals that North American methods applied to the island actually benefitted living standards for the masses. Independence from Spanish colonial power favored the well-being of the population, although generally, other Latin American countries experienced great difficulties in the short run when the colonial power had left the continent. Peruvian living standards, for example, declined slightly in the first decade of independence to remain stagnant at quite a low level during the 19th century (Twrdek and Manzel, 2010). Argentinean heights declined in the early post-independence period and stagnated for the remaining decades of the 19th century (Baten and Carson, 2010).

Cuba, however, was different in many ways, particularly due to its late timing to gain independence in the 20th century. Living standards deteriorated after the first war of independence, although independence had not been achieved yet. Another revolutionary attempt followed the first war, the Little War lasting from 1879-80, and it was only 15 years later that the last war against Spain was successful, and living standards were improving again.

[9] The sample size is quite small, so one has to be careful when regarding those numbers.

5.6 Interpretation

What possible reasons are there to explain this interesting pattern of Cuban heights? In terms of cattle production the effects of the two wars of independence that afflicted Cuba were noted clearly. Schroeder (1982) reports total number of cattle for most years in the analysis. Cattle per capita for each quinquennium of birth is calculated to see if this has any correlation with the development of heights. The greater availability of cattle per capita and the entailing milk and meat production are expected to have a positive influence on average height, increasing the latter when more meat and milk are available for the Cuban population. Previous studies on this subject find a strong positive relationship between the availability of protein and meat which resulted in increasing heights for the underlying population (see for example Baten, 1999; Baten and Blum, 2011). Moreover, higher protein availability during adolescence might lead to catch-up growth resulting in taller adult heights. Figure 5.4 describes the trend in heights on the left y axis and the value for cattle per capita on the right y axis. The correlation is positive: A higher availability of cattle per capita leads to taller stature. Particularly the quinquennium of 1895-99 seems to provide evidence for the strong relationship between low cattle per capita and the respective low heights. At the same time that Cuban agriculture was ruined physically due to the wars of independence, the depopulation of the countryside additionally led to a reduction of domestic food availability because agricultural output could hardly meet the demands. The dependency on imported foodstuffs increased, and so did prices (Pérez, 1983). This pattern probably explains some part of the height reduction during Spanish colonial times, and rising cattle per capita in the 20th century the subsequent increase in heights.

During the first two decades of the 20th century, Cuba rivalled Argentina in its rate of net immigration (Collver, 1965). Especially during the years of World War I a great wave of immigrants came to Cuba which was directly connected with the sugar boom on the island. A rising number of immigrants could have put pressure on the availability of staples and therefore could have forced down living standards. Those were, however, rising in the 20th century. The effect of migration before North American intervention is hard to estimate because data on migration for Cuba prior to 1900 do not exist (Collver, 1965).

Another possible explanation for the development of heights might have been an improvement of the disease environment in the late 19th century. Epidemics such as

yellow fever and malaria were widespread on the island. The Spanish authorities had shown little interest in sanitation in Cuba, but were more occupied with war (Cuban Economic Research Project, 1965). Diseases such as smallpox, yellow fever or malaria were probably endemic on the island since the 18th century. Though death rates among slaves were as high as eight to ten percent annually of the total slave population, the loss was made up by the continued illegal importation of slaves (Stepan, 1978). The willingness of slaveholders to invest in hygienic concepts was quite low. It was not until the end of the first war of independence that Cubans and Spaniards alike realized that slavery's abolition was inevitable and growing demand for workers had to be satisfied somehow else (Stepan, 1978). Hence, endemic diseases acquired new importance since they posed an obstacle to white immigration, and several previous outbreaks of malaria, smallpox and yellow fever had slowed down population growth. Although the transmitter of yellow fever has been known since the early 1880s, it was only when American intervention saw the need to eradicate those diseases from the island that hygienic conditions were ameliorated (Stepan, 1978). Le-Roy Y. Cassá (1920) reports absolute and relative numbers of deaths caused by epidemics of smallpox, yellow fever and malaria. By simply looking at these numbers it can be seen that smallpox and yellow fever were eradicated by 1901/2. Figure 5.5 presents Le-Roy Y. Cassá's total numbers of deaths from smallpox, malaria, yellow fever, and typhoid fever in Havana city, where one observes that deaths from diseases were increasing from the 1870s to the 1890s, and abruptly falling in the 1900 and 1910s. The author also mentions that sanitary authorities have already taken measures as to the milk supply of infants, and that dispensaries and other institutions have begun the maternal education in order to overcome popular errors and ignorance in regard to infant feeding.

Many Cubans acquired immunity through mild illnesses in childhood; however, these diseases have been found to exert a considerable influence on final height (Steckel, 1995). Disease tends to reduce individual height by interfering with nutrition, reducing the energy available for growth by forcing the body to cure the infection. At the same time, it can increase average height through selection, because short people are more likely to die and the average height of a population increases as they grow older. Therefore, the effects of the disease environment can go in both directions (Alter, 2004). Hence, the endemic and epidemic disease environment is a very likely factor to

explain another part of the strong decline in Cuban heights. When the sanitary campaign started with North American occupation, heights were increasing again.

In an international comparison, Cubans were as tall as Western Europeans in the 1870s, even taller in the 1880s, and remained tall in comparison with the industrialized world (see Baten and Blum, 2011). In a Latin American and Caribbean comparison they over towered the general trend presented by Baten and Blum (2011) by an average of around 2 cm. Comparing them directly with other Latin American countries it can be seen that Mexican heights, for example, stagnated throughout the period under study on a level of around 166 cm (López-Alonso and Porras Condey, 2003). Argentineans, on the other hand, were already at around 168 cm tall in the 1870s; however, heights were stagnating on that level until the early 20th century (Baten et al., 2009).

An interesting case to compare Cuba with is Puerto Rico whose living standards have been studied by Godoy et al. (2007). The island was ruled as a colony until the end of the Spanish-American War and began the 20th century under US military rule, just as Cuba did. Investments in all kinds of fields (sanitation, education) were made and economic inequality declined with US leadership (Godoy et al., 2007). Comparing the trend in heights of Puerto Ricans and Cubans, it can be seen that Puerto Ricans were much smaller than Cubans although the population structure was ethnically similar (a high proportion of black people as well). Therefore, living standards during colonialism must have been worse on this small island. Puerto Ricans did not experience such dramatic declines in height under Spanish colonial power, but stagnated more or less. The 20th century, then, is marked by slight increases, but they remain on a low level in comparison to Cubans and their counterparts on the U.S. mainland (Godoy et al., 2007). Differences might be explained by the fact that the Cuban economy, although highly dependent on sugar exports and, particularly during the first half of the 20th century, on the U.S. market, was in a better shape to satisfy the basic needs of its population than Puerto Rico was. Cuba was one of the most valuable and richest colonial possessions Spain ever had, and living standards measured with anthropometric data certainly point that way.

5.7 Height Pattern by Ethnicity

Anthropometric evidence by ethnicity is limited to some birth decades because case numbers only allow a general examination for the whole period. Non-white people in this sample were born in Cuba, but could probably have been slaves around the time of their birth since slavery was abolished only in 1888. However, the information on their specific background is lacking.

Truncated regression is applied in order to determine differences between the black and white population (Table 5.4, Figure 5.6). The results show that blacks were actually 2 cm taller than whites throughout the decades of the 1870s, 1880s, and 1890s. The overall trends of the black and white population are both characterized by the same decline until the end of the colonial period. Until the 1900s, black heights experienced a drop of more than 5 cm from 170.9 cm to 165.7 cm, and white heights a drop of 3 cm from 168.7 cm to 165.7 cm. In the 1900s, blacks and whites were on the same level. Heights for the white population were rising again in the 1910s, about 0.7 cm; values for blacks are missing.

This major puzzle about tall black heights needs to be observed in greater detail. What factors played a role in determining taller stature for blacks than whites, thinking in terms of ethnic inequality or different nutritional habits? A growing body of evidence suggested that black people were nearly as tall as white people in the United States (Komlos and Coclanis, 1997; Komlos and Lauderdale, 2007), and even taller than whites in 19th-century Peru (Twrdek and Manzel, 2010) and 19th-century Brazil (Baten et al., 2009). During the time slaves were held, owners were interested in providing them with housing, food, clothing, rudimentary medical attention, and a small salary of between one to three pesos monthly, according to their age and faculties (Cuban Economic Research Project, 1965). Most slaves, however, had been freed already by the end of the first war, which is why it can be safely assumed that many blacks in the data set were not born in slavery. The black population in Cuba had hardly ever represented a seriously conflicting ethnic element in the economic and political process of the country.[10] Blacks were active parts in the independence struggles, and later were assimilated quite rapidly (Cuban Economic Research Project, 1965). All this gives

[10] In contrast stands the case of Haiti where in 1791 the black revolution ruined the economy of the island.

reason to believe that living standards should not have differed too much between the black and white population.

Blacks may have a general predisposition of becoming quite tall because of their different genetic endowment. Deaton (2007), for example, finds that Africans are deprived in almost all dimensions (nutrition, disease environment, income per capita), yet are taller than less-deprived people elsewhere. The author concludes that people may manage to grow tall even at low incomes or low calorie intake. However, he admits that there is no general rule for Africans becoming so tall, and he neglects the impact of protein consumption which differed greatly in African countries. Baten and Blum (2011) report that once they control for local protein consumption, the coefficient of African heights gets negative. Hence, heights of Africans were lower if protein consumption was low. In the case of Cuba, it seems reasonable to assume that blacks can be as tall as whites, and even taller, when they are integrated in the society like they were on the island.

Taking in mind that people had to know to read and write to enter the army, it has already been suspected that there was a positive bias of Cuban heights. Considering that only 12 percent of the colored population were classified as knowing to read and write in the census of 1887, a number that increases to 24.5 percent in the 1907 and 1919 censuses, might help explain another part of the tall blacks in the sample. Having acquired certain skills might speak for a better social environment, including nutritional habits and medical care. In contrast, 50 percent of the Cuban white population were literate in 1887; this number increased to 75 percent in the 1907 and 1919 censuses. Hence the probability of a positive bias for white heights can be neglected, but has to be considered strongly for black male heights. In addition, it is known that death rates in Cuba among blacks had been very high in the mid-19th century (Fraginals, 1977), which leads to the assumption that blacks in this sample might be positively selected in terms of height if they survived until later years (see Alter 2004). However, this assumption is vague because death rates by ethnicity are hard to estimate since the censuses following the abolition of slavery stopped enumerating people by ethnicity.

Studying heights of 20-year old boys in Havana measured in the early 1960s reveals that blacks had a height advantage of 3 cm over whites (Laska-Mierzejewska, 1970). The author records a mean height of 168.5 cm for the Cuban population which leads to the conclusion that living standards remained at a high level in the 20th century.

He considers that the superior height and weight of blacks are caused by genetics and excludes the notion that blacks might have had a superior living standard than whites.

5.8 Cross-Sectional Effects: Geographic Variation and Socio-Economic Status

It seems reasonable to suggest that nativity might have had an influence on final adult height. The material damages that during the Ten Years War had been limited to the eastern part of the country, later spread all over the island. With North American occupation, and even a decade before, new credit and investment capital, largely from the United States, provided planters with resources to expand (Le Riverend, 1967, p.204 ff.). Planters could improve their variety of cane, innovations and technological advances became available. This process favored especially the eastern part of the island, where agricultural units were replaced with large sugar latifundia.

Individuals born in the east and recruited before 1913 were significantly smaller than those in the west (Table 5.3). The scheme reverses when one looks at the second model: those recruited after 1913 were actually taller than people born in the west. This finding is consistent with the narrative of traditional historiography. While during the colonial period all economic activities concentrated in the west because of the closeness to Havana harbor, a shift can be observed in the structure when Americans placed their investments mostly in the east (Aguilar, 1992, p.231).

In most societies, socio-economic class is an important determinant of stature. Large height differentials between social classes existed in the past. Social classes are often approached by using the occupational information of the individual. In 19th-century Cuba, inequalities between occupational classes seem to be nearly inexistent (Table 5.3). Only farmers describe a significant height disadvantage to the unskilled. The picture, however, changes in the 20th century when one takes a look at model two: professionals are significantly taller than unskilled people. All other indicators stay insignificant. It can be concluded that because of the long lasting wars of independence all social classes were affected similarly, loosing in height and suffering from the current situation. Only at the turn of the century did professionals gain faster in height than other occupational groups.

5.9 Body Mass Index

Weight can be used as another measure of how well humans adapt to their socio-economic and epidemiological environment. In today's world, obesity has reached epidemic proportions, not only in industrialized countries, but in some developing countries as well (WHO, 2010). The health consequences range from increased risk of premature death, to serious chronic conditions that reduce the overall quality of life. In historical populations, however, the opposite was often the case where obesity was all but absent and under-nutrition was of major concern. By considering a population's mean body mass, genetic differences are mitigated, leaving only the influence of current economic and physical environment.

BMI values in this study are slightly right skewed which is probably caused by the introduction of a minimum weight requirement, besides the height requirement mentioned earlier (Figure 5.7). Hence, mean BMIs might be somewhat overestimated because underweighted people might not have been able to enter the army. Moreover, the taller ones probably had higher weight just because of the fact that they were taller; therefore, the sample leaves out the small and light ones. The classification coding system of the World Health Organisation is followed which considers people with BMI less than 18.49 as underweight; BMI values between 18.5 and 24.9 are normal; BMI between 25 and 29.9 are overweight, and those greater than 30 are obese. It can be observed that most Cubans were found in the normal range of the BMI distribution. Table 5.5 offers actual numbers: 2 percent of the Cuban population were underweight by modern standards and 5 percent were overweight and obese.

Nineteenth-century Mexican BMIs studied by Carson (2007) reveal that there were few Mexicans underweight or obese by modern standards. A comparison of Mexicans and the Cuban black and white population reveals that although Cuban BMIs were in the normal range by today's standards, their BMI values were on average 1 point less than those of Mexican prisoners (Figure 5.8). Adult Mexicans in 19th-century American prisons reached a mean BMI value of 23.1 (Carson, 2007). In a historical context this might imply that nutrition among Mexicans was much better than on the Cuban island. However, data for Mexicans stem from imprisoned migrants in the United States which indicates that those Mexicans were probably heavier than those left behind because nutrition might have been better in the U.S.. Blacks in Cuba also reveal slightly higher BMI values than whites, a result which is consistent with Carson (2009).

The author finds that black BMIs were heavier than whites in 19th-century Texas. Laska-Mierzejewska (1970) also states that values for body weight of Cuban blacks were higher in comparison to Cuban whites. To explore this relationship further, this study wants to test the influence of being black in the different quantiles of the BMI distribution. The impact of ethnicity on BMI is especially interesting because it is generally said that those with poor health are defined as being in the tail of a distribution. BMIs might respond differently when belonging to a certain ethnic group, which further might increase or decrease the probability of becoming overweight or underweight.

The approach of Smith et al. (2003) is followed using quantile regression analysis to test hypothesis about ethnic differences and the development of Cuban BMI values. Using an OLS regression, the model seeks to describe the mean of a random variable as a function of the observed variables. Applying quantile regression, the model uses the quantiles of a random variable as functions of the observed variables. For example, there is the quantile 75th (or percentile 75 per cent) of the BMI distribution which refers to the proportion 75 of the BMI distribution with BMI at least (or higher) than BMI=BMI(75). Quantile regression is a statistical technique used to estimate and conduct inference about conditional quantile functions. Similarly to traditional regression techniques which seek to estimate the conditional mean by minimizing the sum of squared errors, quantile regression seeks to estimate the conditional quantile function by estimating coefficients to minimize the weighted sum of deviations from the estimated quantile.

The question is asked whether the effect of being black changes at the 10th, 25th, 50th, 75th and 90th percentile of the BMI distribution because blacks might have a general predisposition of becoming heavier than whites. The data are approached with simultaneous quantile regression analysis to perform hypothesis tests concerning the coefficients both within and across equations, and the variance-covariance matrix and standard errors are estimated by bootstrapping.[11] When this method is used, a new sample of *n* BMI values is extracted randomly out of the *N* sampled data, where each individual can be picked out at most *t* times. Bootstrapping performs this exercise several times which creates a large number of data sets that might be possible, and it

[11] This procedure is used to overcome truncation problems of the data.

computes the statistics for each of these data sets. The results of the covariance matrix are based on a theoretical possible distribution of the data and the minimization of its error terms. All in all, the regression estimates the impact of the independent variable (black) on various quantiles along the entire distribution of the dependent variable and allows variation along the distribution, not just at one particular point. Additionally, it is controlled for the different timing of the values. Because BMI is sensitive to age, only Cubans aged 20-50 were considered in the analysis, as suggested by the World Health Organization.

Figure 5.9 and Table 5.6 present the relationship between "black" and BMI. Bootstrapping with 1000 replications and the same starting point were used to get the most possible consistent results. Only at the upper tail and in the middle of the distribution does being black have a statistically significant, and positive, impact on BMI. This means that among the heaviest man, being black increases BMI relative to white Cubans. However, this kind of increase is unrelated to a positive weight bias, since Cubans generally had a low BMI. Blacks were therefore not only taller than whites, but showed greater body proportions than whites as well. It can be concluded that nutrition was acceptable on the island between the 1900s to the 1930s. Being overweight was hardly an issue in early 20th-century Cuba and people being underweight were few as well. However, low BMI values in comparison to other historical populations indicate a possible difficult nutritional environment.

5.10 Conclusion

Cuban history from the wars of independence until the early 20th century is unique in many ways. The island had been one of Spain's most valuable possessions, not only because of its strategic position in the Atlantic Ocean, but also because of its economic wealth. It was one of the last countries in Latin America to become independent from Spanish colonial power. The development of living standards, however, revealed that the country was in a deplorable state in the last two decades of Spanish colonial power, and measures to improve conditions needed to be implemented the sooner the better. When the North American government intervened in the second war of independence, Cubans saw themselves ruled by another power which would strongly influence life on the island for the following three decades. The good thing was that Americans wanted

to improve not only the hygienic situation, but invest in infrastructure and existing industries as well to profit from future prosperity. As a result, living standards began to rise again during the North American military occupation.

Despite the late abolition of slavery in the 1880s, living standards of black people seemed not to have been affected by any conceivable system of ethnic discrimination that slave societies had underlain. It is even said that the relationship between blacks and whites was more harmonious than in any other country (Cuban Economic Research Project, 1965). Therefore, it can be concluded that blacks can be as tall as whites, even taller in the Cuban case, when they are part of the society like they were in Cuba.

Data on BMI in the early 20th century revealed that Cubans were almost exclusively in the normal range of the distribution. Blacks generally tend to have higher BMI values than whites, which is found in the data and might be ascribed to the fact that blacks and whites differ in their body composition. This notion adds to the finding that being black increases BMI values in the upper percentiles of the underlying BMI distribution.

It would be quite interesting to pursue the development of living standards under North American influence over the whole first half of the 20th century and to study whether this improvement was not only a short lived recovery but of long-term value. That is to say, it could be possible that the upcoming crisis in the early 1920s and the worldwide great depression in the early 1930s might have slowed down any improvements. A fuller picture of the development of living standards in 20th-century Cuba might even lead to a better understanding of the events that followed North American intervention.

5.11 References

A'Hearn, B., 2003. Anthropometric Evidence on Living Standards in Northern Italy, 1730-1860, *Journal of Economic History*, 63 (2), pp. 351-81.

Aguilar, L.E., 1992. Cuba, c. 1860-1934. In: Bethell, L. (Ed.), Historia de América Latina, T. 9, México, América Central y el Caribe, c. 1870-1930, Barcelona, pp. 210-39.

Alter, G., 2004. Height, Frailty, and the Standard of Living: Modelling the Effects of Diet and Disease on Declining Mortality and Increasing Height, *Population Studies,* 58 (3), pp. 265-79.

Baten, J., 1999. *Ernährung und wirtschaftliche Entwicklung in Bayern, 1730-1880*. Stuttgart: Steiner.

Baten, J., Pelger, I., Twrdek, L., 2009. The Anthropometric History of Argentina, Brazil, and Peru During the Nineteenth and Early Twentieth Century, *Economics and Human Biology*, 7 (3), pp. 319–33.

Baten, J., Blum, M., 2011. Growing Tall, but Unequal: Biological Well-Being in World Regions and its Determinants, 1810-1989, *Working Paper*, University of Tuebingen.

Baten, J., Carson, S.A., 2010. Latin American Anthropometrics, Past and Present - an Overview, *Economics and Human Biology*, 8 (2), pp. 141-44.

Carson, S.A., 2007. Mexican Body Mass Index Values in the Late-Nineteenth-Century American West, *Economics and Human Biology*, 5 (1), pp. 37-47.

Carson, S.A., 2009. Racial Differences in Body Mass Indices of Men Imprisoned in Nineteenth Century Texas, *Economics and Human Biology*, 7 (1), pp. 121-27.

Collver, O.A., 1965. Birth Rates in Latin America: New Estimates of Historical Trends and Fluctuations. Institute of International Studies, University of California, Berkeley.

Cuban Economic Research Project, 1965. A Study on Cuba. The Colonial and Republican Periods. The Socialist Experiment. University of Miami Press, Florida.

Cuff, T., 1993. The Body Mass Index Values of Mid-Nineteenth-Century West Point Cadets. A Theoretical Application of Waaler's Curves to a Historical Population, *Historical Methods*, 26 (4), pp. 171-82.

Deaton, A., 2007. Height, Health, and Development, *Proceedings of the National Academy of Sciences of the USA*, 104 (33), pp. 13232-7.

Fogel, R.W., 2004. Health, Nutrition, and Economic Growth, *Economic Development and Cultural Change*, 52 (3), pp. 643-58.

Friedlaender, H.E., 1944. Historia Económica de Cuba. La Habana.

Fuente, de la A., 1998. National Discourse and Politics in Cuba, *Latin American Perspectives*, 25 (3), pp. 43-69.

Godoy, R.A., Goodman, E., Levins, R., Caram, M., Seyfried, C., 2007. Adult Male Height in an American Colony: Puerto Rico and the USA Mainland Compared, 1886-1955, *Economics and Human Biology*, 5 (1), pp. 82-99.

Komlos, J., Coclanis, P., 1997. On the Puzzling Cycle in the Biological Standard of Living: The Case of Antebellum Georgia, *Explorations in Economic History*, 34 (4), pp. 433-59.

Komlos, J., Kim, J.H., 1990. Estimating Trends in Historical Heights, *Historical Methods*, 23 (3), pp. 116–20.

Komlos, J., 2004. How to (and How Not to) Analyze Deficient Height Samples, *Historical Methods*, 37 (4), pp. 160-73.

Komlos, J., Lauderdale, B.E., 2007. The Mysterious Trend in American Heights in the Twentieth Century, *Annals of Human Biology*, 34 (2), pp. 205-15.

Laska-Mierzejewska, T., 1970. Morphological and Developmental Differences Between Negro and White Cuban Youths, *Human Biology*, 42 (4), pp. 581-97.

Le Riverend, J., 1967. Economic History of Cuba. Havana.

Le-Roy Y. Cassá, J., 1920. Sanitary Improvement in Cuba as Demonstrated by Statistical Data, *The American Journal of Public Health*, XI, pp. 255-62.

López-Alonso, M., Porras Condey, R., 2003. The Ups and Downs of Mexican Economic Growth: The Biological Standard of Living and Inequality, 1870-1950, *Economics and Human Biology*, 1 (2), pp. 169-86.

Maloney, T.N., Carson, S.A., 2008. Living Standards in Black and White: Evidence From the Heights of Ohio Prison Inmates, 1829-1913, *Economics and Human Biology*, 6 (2), pp. 237-51.

Pérez, L.A., 1983. Toward Dependency and Revolution: The Political Economy of Cuba between Wars, 1878-1895, *Latin American Research Review*, 18 (1), pp. 127-42.

Schroeder, S., 1982. Cuba: A Handbook of Historical Statistics. Boston, Massachusetts.

Smith, P.K., Bogin, B., Varela-Silva, M.I., Loucky, J., 2003. Economic and Anthropological Assessments of the Health of Children in Maya Immigrant Families in the US, *Economics and Human Biology*, 1 (2), pp. 145-60.

Steckel, R.H., Floud R. (Eds.), 1997. Health and Welfare During Industrialization. Chicago.

Stepan, N., 1978. The Interplay Between Socio-Economic Factors and Medical Science: Yellow Fever Research, Cuba and the United States, *Social Studies of Science*, 8, pp. 397-423.

Twrdek, L., Manzel, K., 2010. The Seed of Abundance and Misery: Peruvian Living Standards from the Early Republican Period to the End of the Guano Era, *Economics and Human Biology*, 8 (2), pp. 145-52.

Uralde Cancio, M., 2006.Guardianes del Orden en Cuba, 1898-1902. Instituto de Historia de Cuba, Ciudad de la Habana.

Waaler, H.T., 1984. Height, Weight, and Mortality: The Norwegian Experience, *Acta Medica Scandinavica*, Supplement 679, pp. 1-51.

World Health Organisation. Obesity and Overweight, 2003. http://www.who.int/dietphysicalactivity/media/en/gsfs_obesity.pdf (Accessed on September 2010).

5.12 Appendix

5.12.1 Tables

Table 5.1: Characteristics of the Sample

Feature		Share in the Sample	Cases
Total Data Set		100	1,442
Ethnicity	**Black**	32.6	470
	White	67.4	972
Region (Place of Birth)	**East**	48.9	705
	West	51.1	737
Occupation	**Unskilled**	52.4	756
	Skilled	28.4	409
	Professional	5.4	78
	Farmer	13.8	199
Birth Cohort	**1870-79**	3.3	48
	1880-84	9	129
	1885-89	14.9	215
	1890-94	15.7	226
	1894-99	19.1	275
	1900-04	24.8	358
	1905-09	9.5	137
	1910-14	2.4	35

Table 5.2: Descriptive Statistics

	Median	Mean	Min.	Max.	Std. Dev.	Observations
Height	166	166.74	154	186	5.031585	1442
Weight	58.74	59.71	47	92	5.542377	1424
Age	22	22.96	18	59	3.48669	1442
BMI	21.19	21.47	17.49	31.96	1.781792	1424

Table 5.3: Truncated Regression Analysis

Truncation points		(1) 162.56cm	(2) 157cm
Birth Cohort	1870-79	2.04 (0.170)	-
	1880-84	1.57 (0.193)	2.80* (0.085)
	1885-89	0.67 (0.552)	-0.96 (0.421)
	1890-94	ref.cat.	-0.32 (0.591)
	1895-99	-	-1.10** (0.032)
	1900-04	-	ref.cat.
	1905-09	-	0.27 (0.656)
	1910-14	-	2.16* (0.052)
Color	Black	0.57 (0.474)	1.06** (0.015)
	White	ref.cat.	ref.cat.
Region	East	-1.71** (0.034)	0.42 (0.291)
	West	ref.cat.	ref.cat.
Occupation	Unskilled	ref.cat.	ref.cat.
	Skilled	-0.83 (0.340)	0.50 (0.284)
	Professional	-1.60 (0.357)	1.49* (0.102)
	Farmer	-2.46* (0.063)	0.98* (0.090)
	Sigma	5.36	5.45
	Constant	167.31*** (0.000)	165.22*** (0.000)
	N	354	982

Note: The regressions were estimated with STATA's truncated regression routine. The constant refers to an unskilled white man born in 1890-94 in the west (1) and born in 1900-04 (2).

Table 5.4: Truncated Regression Analysis by Ethnicity

Truncation points		(1) White 162.56cm	(2) White 157cm	(3) Black 162.56cm	(4) Black 157cm
Decade of Birth	1870	1.24 (0.432)	-	0.89 (0.623)	-
	1880	ref.cat.	-0.17 (0.886)	ref.cat.	0.93 (0.587)
	1890	-0.98 (0.436)	-1.22 (0.017)	-0.71 (0.720)	-0.35 (0.646)
	1900	-	ref.cat.	-	ref.cat.
	1910	-	0.72 (0.537)	-	-
Region	East	-0.31 (0.763)	0.45 (0.343)	-3.29 (0.007)	0.05 (0.944)
	West	ref.cat.	ref.cat.	ref.cat.	ref.cat.
Occupation	Unskilled	ref.cat.	ref.cat.	ref.cat.	ref.cat.
	Skilled	-0.30 (0.784)	-0.10 (0.861)	-1.22 (0.386)	1.72 (0.035)
	Professional	-0.87 (0.693)	1.92 (0.059)	-2.30 (0.403)	0.36 (0.858)
	Farmer	-1.71 (0.269)	0.05 (0.938)	-3.74 (0.140)	3.50 (0.001)
	Sigma	5.30	5.42	5.34	5.40
	Constant	167.47*** (0.000)	165.74*** (0.000)	170.01*** (0.000)	165.65*** (0.000)
	N	208	687	146	295

Note: The regressions were estimated with STATA's truncated regression routine. The constant refers to an unskilled male born in the west in 1880 (1)+(3) and in 1900 (2)+(4).

Table 5.5: Descriptive Body Mass Index Statistics

BMI	Ages 20 to 50	
	Black	White
N	450	866
Mean	21.73583	21.3895
Std. Dev.	1.820632	1.761746
Skewness	0.5845401	1.234129
10% Quantile	19.69849	19.4674
25% Quantile	20.44674	20.20202
Median	21.5212	21.09375
75% Quantile	22.86237	22.26563
90% Quantile	24.05966	23.62445
<18.5 kg/m²	1.98%	1.82%
18.5-25 kg/m²	92.75%	93.51%
25-30 kg/m²	4.18%	3.08%
>30 kg/m²	1.10%	1.59%

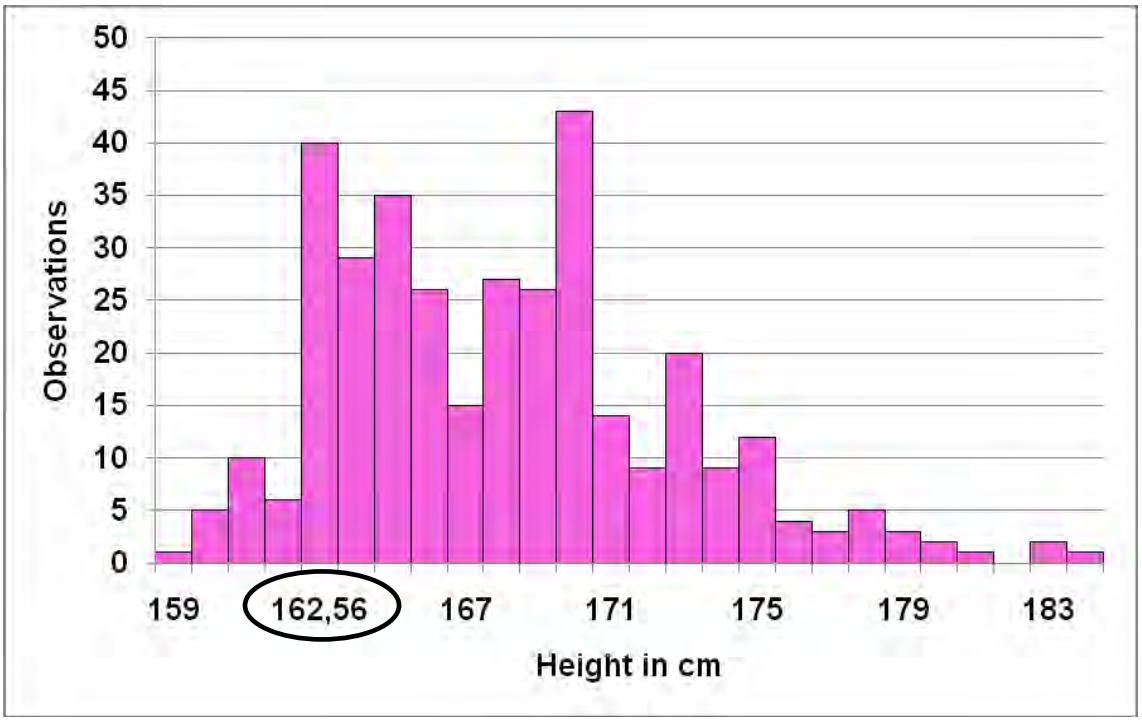
Table 5.6: Quantile Regression Estimates for BMI

Coefficient	Quantile 10	Quantile 25	Quantile 50	Quantile 75	Quantile 90
Constant	19.37***	20.17***	20.83***	22.13***	23.28***
S.E.	0.1304	0.1258	0.1159	0.2321	0.4676
Black	0.21	0.19	0.46***	0.63***	0.59**
P-value	0.104	0.122	0.000	0.000	0.019
S.E.	0.1305	0.1258	0.1220	0.1684	0.2525

5.12.1 Figures

Figure 5.1: Height Distribution of Male Cubans

(a) recruited before 1913



(b) recruited after 1913

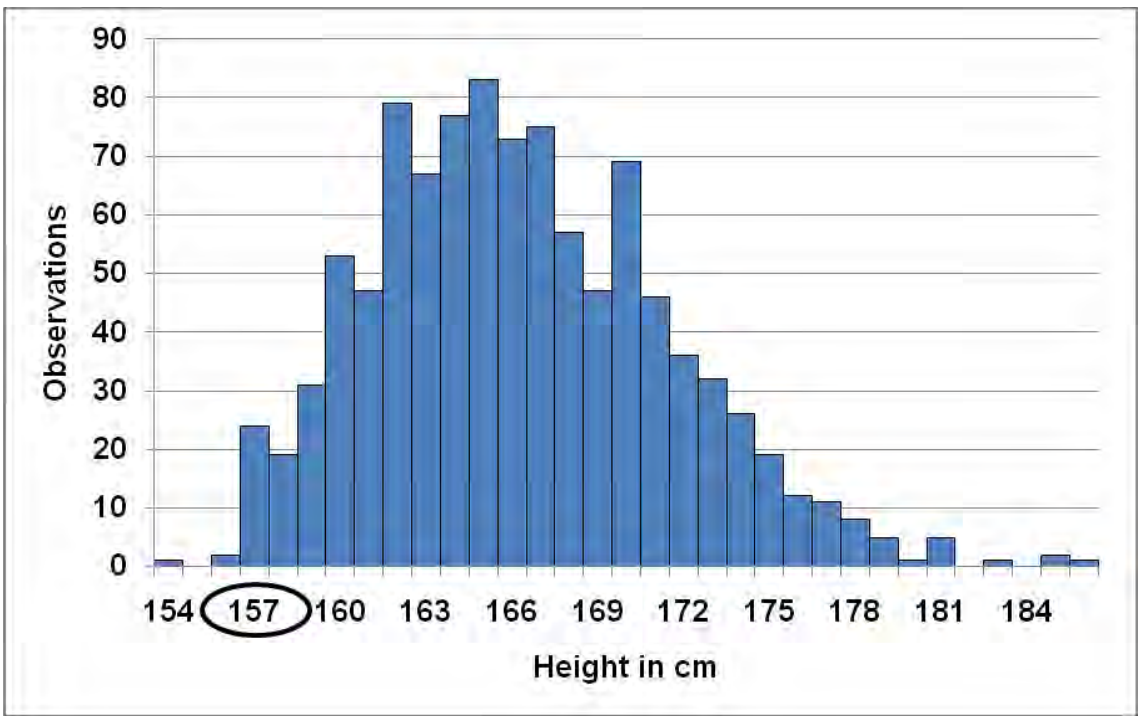


Figure 5.2: Map of Cuban Provinces

Figure 5.3: Trend of Male Heights in Cuba Weighted by Share of Ethnicity, 1870-1910

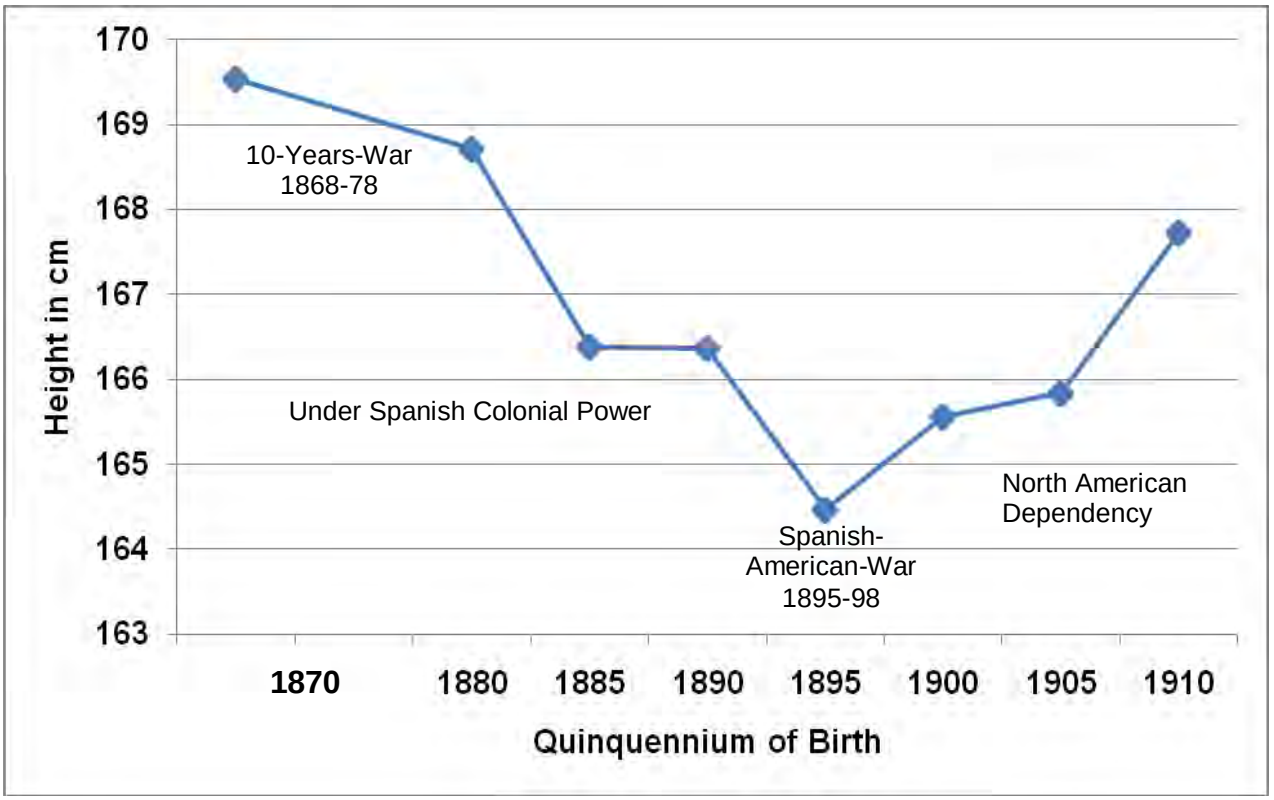


Figure 5.4: Correlation Between Heights and Cattle per Capita

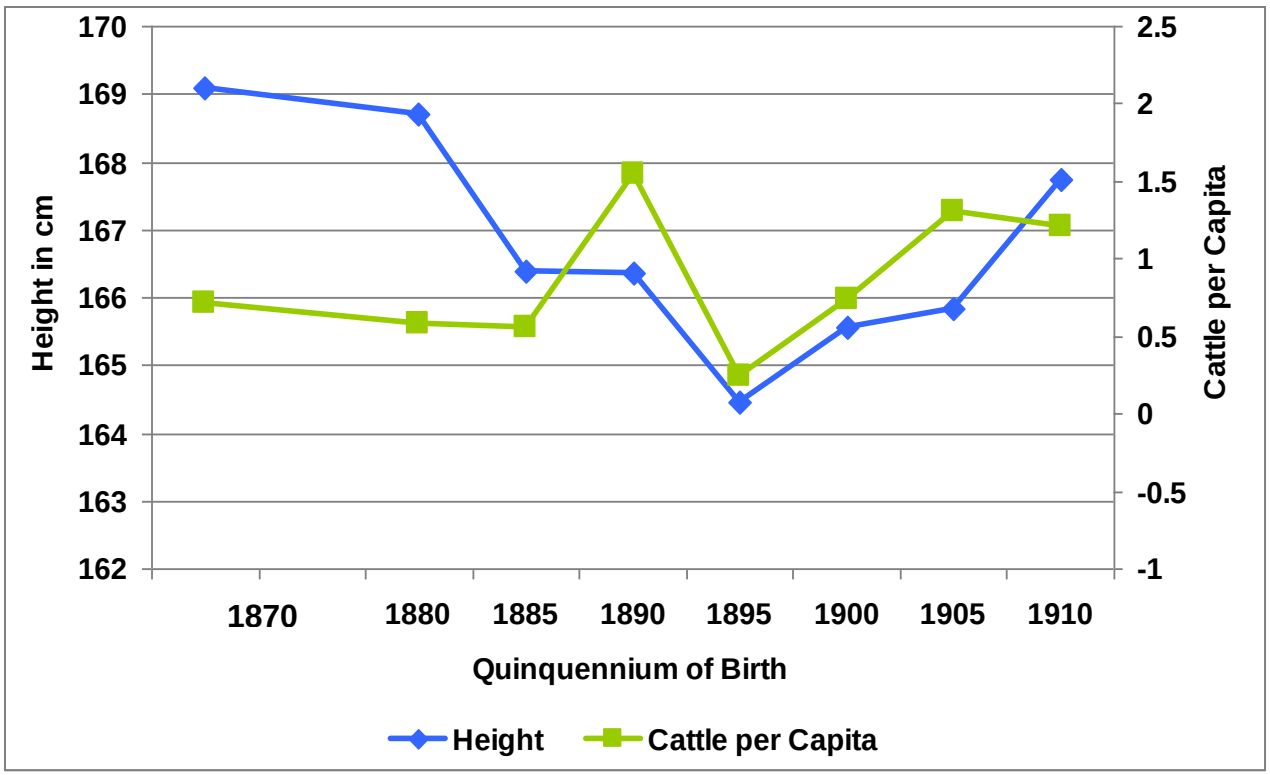
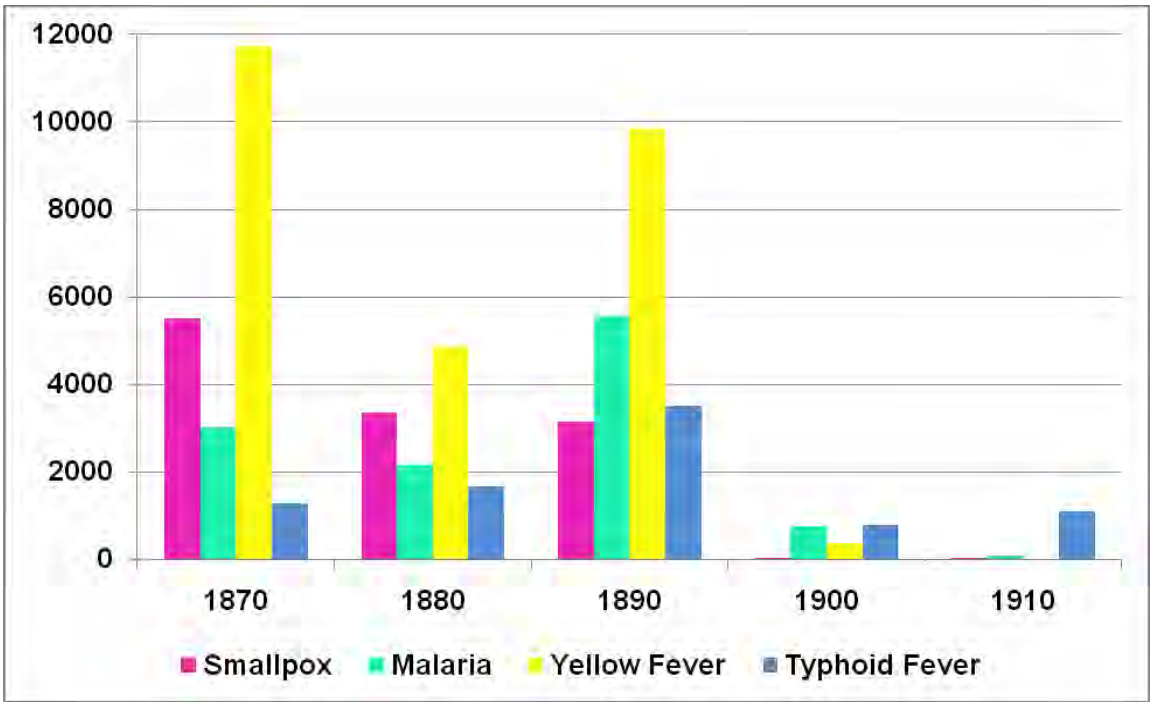


Figure 5.5: Total Number of Deaths in Havana From Smallpox, Malaria, Yellow Fever, and Typhoid Fever



Note: Numbers were taken from Le-Roy Y. Cassá (1920)

Figure 5.6: Trend of Male Heights in Cuba by Ethnicity, 1870-1910

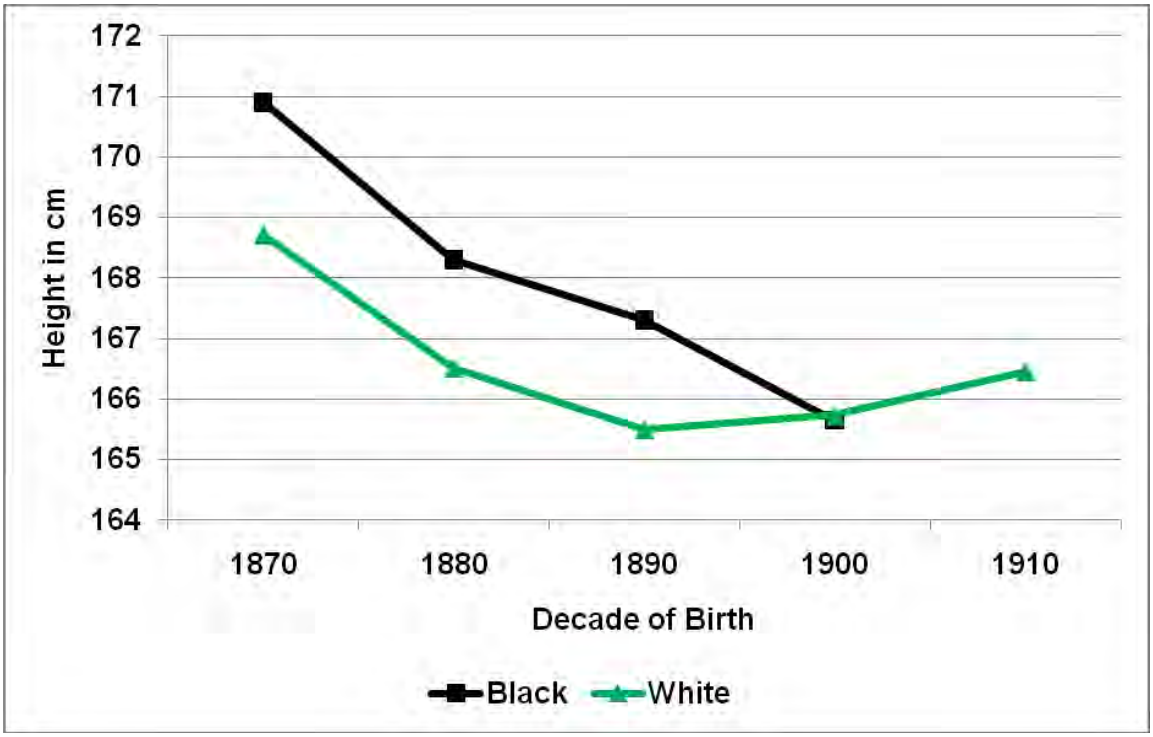


Figure 5.7: BMI Distribution of Cuban Males Aged 20 to 50

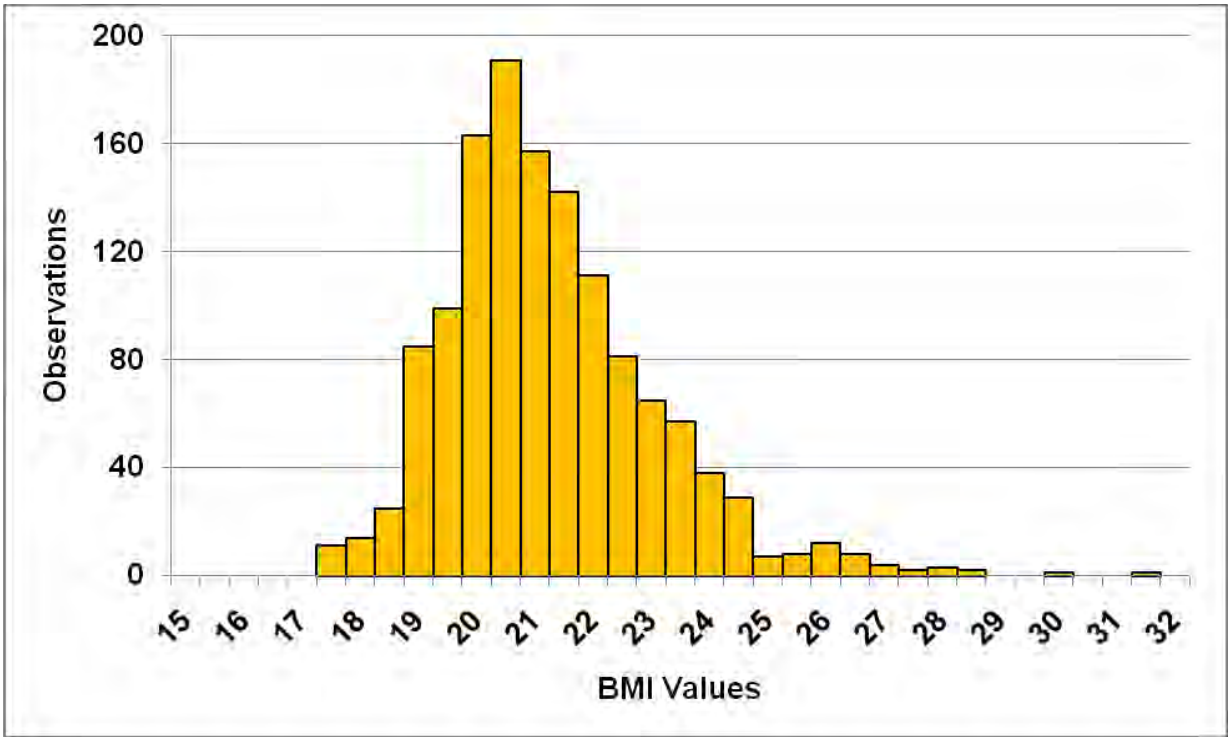
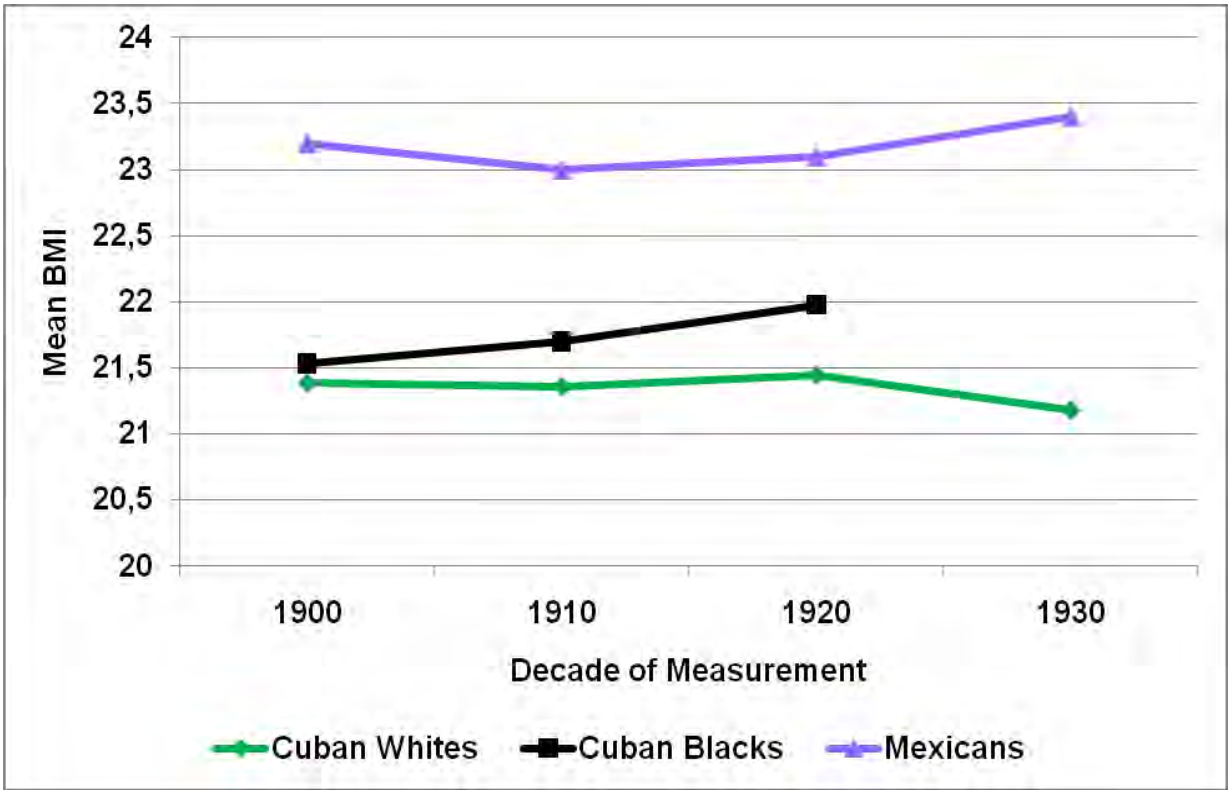
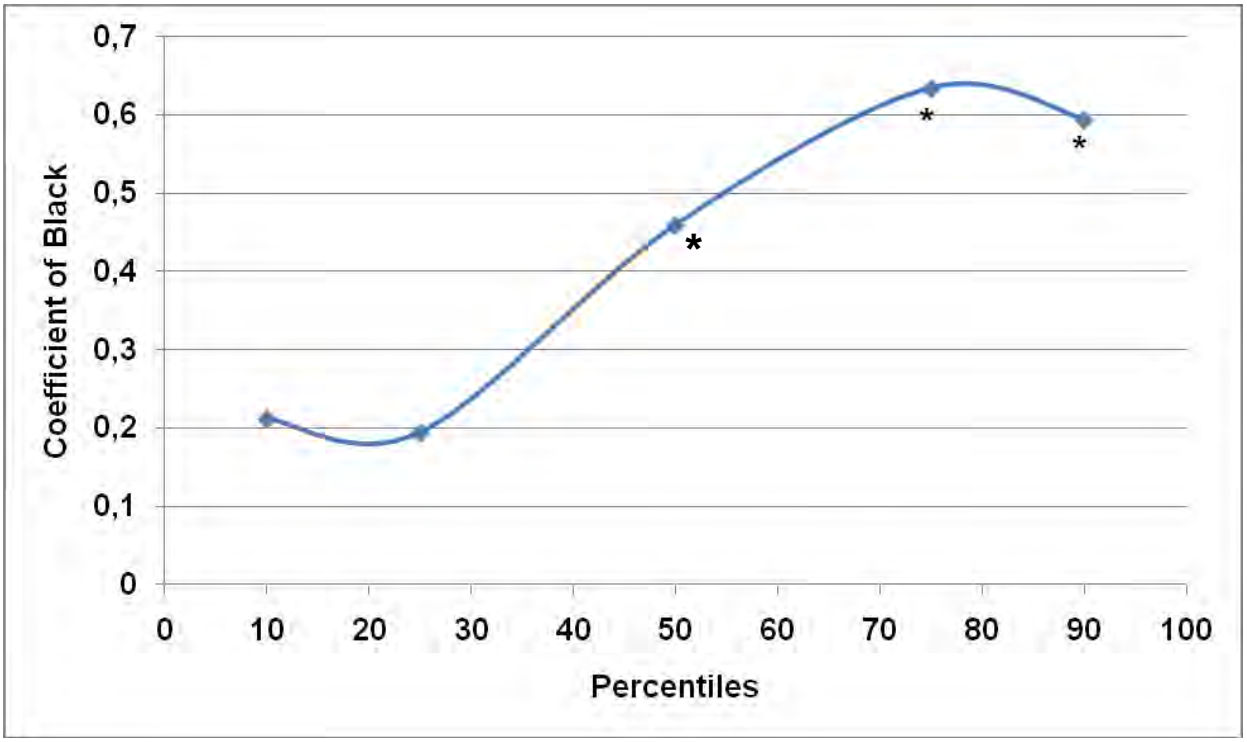


Figure 5.8: Trend in Mean BMI of Cuban Whites and Blacks and Mexicans, 1900-1930



Note: Values for Mexicans were taken from Carson (2007).

Figure 5.9: Quantile Regression Estimates of the Impact of Black on BMI



Note: * statistically significant at the 1% level

6 Numeracy Development on the Island of Cuba. History, Characteristics, and Impacts, 1770-1850

Research Note

6.1 Introduction

In his miscellany on Cuban history, Marrero (1988, p.89) states that the riches brought by the sugar plantation system should be reflected in the level of education of the population. This was, however, only true in a very inadequate way because simply the upper class had access to the only university in the country in Havana. Early educational efforts in Cuba were largely of private character because the colonial government failed to give adequate attention to educating the masses (Fitchen, 1974). These studies on the Cuban colonial educational system seldom reveal comparable numbers because data are hardly available. In this research note, we address this lack of information on education by measuring human capital based on the concept of age misreporting which can be used to compare colonial Cuba with other countries during this period.

In the recent past, various studies have appeared applying the methodology of age heaping to census data in order to estimate numerical skills of the population (A'Hearn et al., 2009; Baten et al., 2010; Manzel et al., 2011). Indices such as the Whipple index and the corresponding linear transformation into the ABCC index provide a very basic measure of human capital, which are comparable across different times and places. Data in previous studies were often collected for entire populations in a district/town/rural area/country, in which case numerical skills of all social classes are reflected in the index. Individuals that were asked to self-report their age showed the tendency to round their age. The main reasons for this phenomenon were a lack of knowledge about one's age or insufficient numerical skills. These major frequencies of ages mostly ending on multiples of five were typical for societies in the past but did not coincide with the true age distribution in a population. Bachi (1951) and Myers (1940, 1954) were the first statisticians and demographers to find a substantial correlation between the degree of an individual's education and the degree of age heaping. Hence, age heaping is a good proxy for numeracy; other authors find this measure to be highly correlated with literacy and primary schooling rates (A'Hearn et al., 2009).

This research note deals with the numeracy development on the Cuban island from the 1770s to the 1850s. New data on the distribution of ages of several Cuban provinces allow a closer look at a country that has not been studied before in this context. Unlike other Latin American countries, Cuba remained loyal to the Spanish colonial power in the 19th century. The question arises whether and how Cuba differed

in its educational development from the rest of the Latin American continent because of its loyalty to Spain. Manzel et al. (2011) provide trends of age heaping from colonial and post-colonial Latin America, which allow a general comparison. Educational equality between sexes is another issue which is addressed in this study. While some of the literature claim that most women in colonial Latin America were illiterate and only taught in domestic work, other also emphasize that education for women was made available by the end of the 18th century with the appearance of public schools (Lavrín 1984). In general, better female education tends to have positive effects on the hygienic life in the family, reducing child mortality and ameliorating nutritional habits. Therefore it seems interesting to measure whether gender inequality in numeracy was prevalent in colonial Cuba and whether it differed among the different social classes.

This study first introduces a framework on Cuban history regarding the aspects of demography, economy, and educational history from the late 18th to the mid-19th century. A glance at the development of these perspectives might help understanding the numeracy trends on the island of Cuba. In a following section, a logit regression model is used to analyze determinants on numeracy. The following chapter deals with gender issues, and the last section concludes.

6.2 Cuban History

6.2.1 Demography

The Cuban population was different from other Latin American countries because it was highly influenced by its slave system and colonial power. People of African and Spanish origin were predominant on the island and the indigenous population was almost totally absent. They had disappeared quickly after the Spanish had conquered the island in the 16th century, due to sickness and murder (Cuban Economic Research Project, 1965). Immigrants from the Canary Islands formed the largest group of settlers in Cuba during the 17th and 18th centuries (Corbitt, 1942). Canary Islanders were mostly tobacco growers and had been farmers in the minor branches of agriculture in their own country (Le Riverend, 1967). In the 19th century, immigrants from the Iberian Peninsula exceeded the number of Canary Islanders; Spaniards were mostly office-holders and traders, and influenced politics in Cuba greatly (Humboldt, 1856). Hence we expect Canary Islanders to be less numerate than Spanish people.

African slaves in Cuba were mostly the Lucumí, Carabalí, Congo and Gangá (Fraginals, 1977).[1] On the one hand, the literature states that they lived in miserable barracks, those on commercial crop plantations, that they had no opportunity to earn some extra money that might have enabled them to buy their freedom, and as for education, they received none (Le Riverend, 1967). On the other hand, manumission was very frequent in Cuba, for the Spanish legislation, in contrast to the English or French one, favored the attainment of freedom (Humboldt, 1856). Hence, towards the official end of slavery in the early 1880s only around 100,000 were left to be freed (Cuban Economic Research Project, 1965). Numeracy values for blacks might therefore differ only slightly from whites, although we could think that they were probably still less educated because their occupational structure suggested more unskilled people than their white counterpart.

Defining creoles in Cuban society is challenging, because the term itself does not apply directly to a specific ethnicity, but more to all those who were born in the New World, whether they had African or European ancestry; however, without an indigenous component. It then often depends on the context which group is referred to. In this study, we treat *criollos* as Cubans because we know for sure that they were born in Cuba. They, however, cannot be included in any analysis about the ethnic character of the population because the sources do not contain the specific information on their ancestry.

Because of the impossibility to provide Cuba with a sufficient number of white laborers, namely the Spanish or other Europeans, and the increasingly stringent enforcement of treaties with England (1817 and 1836), designed to stop the slave trade, more than 100,000 Chinese and some thousands of Mexican Indians were contracted between 1847 and 1868 (Marrero, 1985). These Chinese, called *coolies*, were mostly purchased at the Portuguese colony of Macao and entered the Cuban labor force conjoined with African slaves (Le Riverend, 1967). It might be interesting to explore how the Chinese differed from African slaves in terms of numeracy, since previous studies found that already in the 19th century the Chinese describe high values of numeracy in comparison to several other populations (Baten et al., 2010). In this study, we can, however, only refer to free blacks in comparison to Chinese laborers.

[1] To use today's country borders: Benin and Nigeria (Lucumi), Nigeria and Cameroon (Carabali), Angola (Congo), Sierra Leone (Ganga).

6.2.2 The Economy

In the early stages of Spanish colonialism, Spain paid little attention to Cuba because only a limited supply of precious metals were found on the island which quickly became exhausted (Cuban Economic Research Project, 1965). However, at the end of the 18th century Cuba became most valuable due to the Spanish re-interest in investing in coffee and sugar production, as well as cattle and tobacco output. The socio-economic regime was characterized by a high external sugar demand and a free slave trade (1790-1820), which influenced the status of the island significantly (LeRiverend, 1967). Cuba transformed into a wealthy sugar colony because new export markets procured new possibilities to land owners and the country itself. The rising import of great numbers of African slaves facilitated the construction of a plantation economy as well as the gradual decline of other Caribbean islands as sugar producers.[2] In addition, the right of free trade with foreigners, which was permanently established in 1818, helped to promote economic growth. When the wars of independence affected the Latin American continent, Cuba remained the "always most faithful island[3]", although British and U.S. interests would be dominant in the following decades and might influence the educational system as well.

In the 18th century the western region was dominated and influenced by the commercial impulses of Havana; the central and eastern parts of the island remained stationary, with the original large cattle estates predominating. With sugar production on the march, the introduction of railroads came to Cuba as early as 1837, connecting the interior to the western part of the island with the harbors of Habana and Matanzas and facilitating the transportation problem (Le Riverend, 1967).[4] In western Cuba the process of commercial agricultural growth produced the dissolution of original latifundia, but in the central zone, the most backward forms of operation remained and it was not until the 1840s that the sugar industry expanded to the center, and later to the east as well (Le Riverend, 1967). In the 1850s Cuban sugar production made up one

[2] See for example the case of Haiti where in 1791 the black revolution ruined the economy of the island and the demand for Cuban sugar exports was therefore rising.

[3] Cuba was given the name of the "always most faithful island" (*la siempre fidelísima isla*) by the Spanish Crown because it remained loyal in spite of the independence struggles in the other Spanish colonies at the beginning of the 19th century.

[4] Cuba was the first country in Latin America to construct a railway.

quarter of total world production (Bethell, 1998). The sugar boom and the wealth it produced should have an influence on the level of education; however, Marrero (1988) claims that this was hardly the case in at the end of the 18th century. We want to test the correlation of this hypothesis with our ABCC measure in the following.

6.2.3 Education

Primary education at the end of the 18th century was limited to the instruction procured by religious congregations and the isolated efforts of certain individuals and organizations. As in Spain and other European countries, higher education of fewer individuals was receiving more attention than primary education of the masses (Cuban Economic Research Project, 1965). Educating the poor white classes was mostly neglected. When in 1767 the Jesuits were expelled, not only did the secondary educational system become seriously affected, but those who were lacking the resources to send their children to school were even more struck because of the lack of teachers (Marrero, 1988). Conditions did not improve much in the following decades. It was only in 1842 when Spain became aware of these alarming circumstances and promulgated the Law of Public Instruction in order to assimilate the educational system of its colonies. However, it was only in 1857 that compulsory education for the children from six to nine years of age was established; however, not legally enforced (Cuban Economic Research Project, 1965).

Cuban primary education, as observed by Bachiller y Morales (1938), during the colonial period can be divided into five different stages:

1) the period of preparation from the 16th century until 1794,

2) the period of organization from 1794 to 1824,

3) the period of decadence from 1824 to 1833,

4) amplification and betterment from 1833 to 1846, and

5) centralization from 1846 on.

The author states that, in spite of some positive achievements, the number of free schools was very limited during the second phase of the history of primary education, and many villages did not have a public school at all. In the third phase the availability of primary schools was even declining and the previously established contribution in 1816 made by the Real Hacienda disappeared again in 1824. In the fourth phase the

interest in primary education was revitalized, offering more facilities and a better preparation of competent teachers. However, following the numbers given by Bachiller y Morales (1938), only 11.6 percent of the white school-aged children in 1836 were actually attending school; the percentage of two percent of black children was even worse. Interpreting the descriptions of the author leads to the conclusion that the educational system in colonial Cuba was miserable compared to communist Cuba in the 20th century.

In the following, and for the first time, we want to assess the human capital of Cubans by analysing their level of basic numeracy which serves as a means to compare the educational level of Cubans to other Latin Americans. We want to test whether the descriptions on the primary educational system made by Bachiller y Morales (1938) fit the development of Cuban numeracy levels.

6.3 Data

The first data set stems from various *padrones* collected in the National Archive of Cuba, which have been conducted in the years 1884, 1885, 1886, and 1887 in the provinces of Pinar del Río and Habana (see Figure 6.1).[5,6] Migrants from various countries were added as well as all free black people. Individuals were asked to name their age, marital status, occupation, situation of residence, and the place they were born. All inhabitants of 13 different localities in the provinces of Habana and Pinar del Río were recorded in those sources. Therefore, we have a biased sample of the western part of the island; however, representing all social classes in the area. According to the population census taken in 1887, 42 per cent of the Cuban population were living in these two provinces, which represents a good deal of the entire country's numeracy values. The data set contains information on 7724 Cuban individuals as well as 3207 foreigners, male and female, all numbers after children and the elderly have been excluded.[7] Blacks in this study are part of the Cuban population, especially since only free blacks were enumerated in the *padrones*, although their place of birth was given as

[5] Archivo Nacional de la Isla de Cuba (ANC), Legajo: 276, Expediente: 13704/13705/13707/13711; Legajo: 277, Expediente: 13715/13713; Legajo: 278, Expediente: 13716

[6] *Padrones* are population counts of a limited geographical or social realm.

[7] We included the ages 23 to 72 in each analysis.

Africa. Criollos are included in the Cuban population as well, since we know that they were born in Cuba.

Various lists about the twelve most notable residents in the province of Oriente from the years 1837 and 1838 contain extensive information on an even earlier period, birth decades 1770s to 1810s, which form the second data set.[8] These lists were compiled to name the most distinguished residents in a particular region with the mention of the hacienda they possess, the number of slaves they hold, and their place of residence. The sample reveals that around 12 per cent were of French nationality and 15 per cent were from Spain which gives an idea about the elite's structure on the eastern part of the island. However, case numbers for migrants are too small to be included in the analysis. Only 5 per cent were females which is why we cannot distinguish between sexes for the early decades.[9] We also need to keep in mind that this sample represents the wealthiest individuals of the country. This might result in overestimated values of our ABCC measure because education might have been easier available for the latter in their childhood.

6.4 Human Capital in the Long Run

The *padrones* and *residents* describe age statements that reveal a clear tendency to round at the ages ending on 0 or 5 (Figure 6.2a & b). In the *padrones* sample the ages ending on 0 were predominant. This lack of knowledge about a person's real age gives us the possibility to calculate the ABCC index by decades of birth to attain information about the numeracy level of the underlying population.

Figure 6.3 provides evidence on numeracy levels for Cubans and immigrants in the *padrones* sample starting in the decade of birth of 1810. Cuban numeracy started at a relatively high level for such an early period, around 87 per cent of the population reported an exact age, and it increased until the mid-19th century to 92 per cent. Immigrants from the Canary Islands, Spain and Asia can be analysed separately, and we observe that they were almost always less numerate than Cubans; however, on a high

[8] ANC, Legajo: 489, Expediente: 25120/25127/25130; Legajo: 269, Expediente: 13480; Legajo: 491, Expediente: 25168

[9] To distinguish the samples because we cannot combine them that easily, in the following, this sample will be called *residents* and the previous one will be called *padrones*.

level. Canary Islanders performed the worst, although by the 1850s the gap between Cubans and Canaries had narrowed down slightly. Asians seemed to be the most numerate among immigrants in Cuba, however, with a similar slight decline in the 1840s that Baten et al. (2009) find for China as well. The authors relate this phenomenon to the mid-19th-century crisis in China when malnutrition was prevalent and the social order and traditional schooling system broke down. Still, human capital among Asians was high which the authors trace back to the long lasting institutions, among other things, in China.

In a next step we compare numeracy levels for Cubans with those of Argentina and Peru for the period dating from the 1770s to the 1860s (Figure 6.4). We took Argentina and Peru as comparative examples since both countries were also highly influenced by immigration in the 19th century and a comparison might reveal similarities. The numeracy levels for the early period in Cuba stem from the *residents* sample which consists of people living in the province Oriente. Manzel et al. (2010) already found that in terms of human capital, Argentina performed as one of the best among various Latin American countries which they contribute to the early introduction of compulsory primary schooling in 1884 and the impact of highly numerate European immigration for the second half of the 19th century. For the late 18th century and the first half of the 19th century they suggest a stagnating trend in numeracy for Argentina.

Cuban numeracy levels for the most notable inhabitants were quite low, at around 57 per cent in the 1770s, which we find surprising because we could have expected that those values might be overestimated due to a strong bias towards the higher strata of the population. However, we observe a positive trend until the 1810s. While in the 1770s and 1780s Argentina performed better by around 10 percentage points, both countries reach similar levels in the 1790s. For the *padrones* sample we find high and increasing values apart from a small fallback in the 1820s which Bachiller y Morales (1938) had clearly marked as a period of decadence in Cuban primary education, which we assume to be correlated with numeracy values. In comparison to the Peruvian sample, Cubans were only slightly less numerate.

Regional differences can be analyzed mainly for the provinces of Habana and Pinar del Río, the western part of the island, where the population density was highest

for the period under study (Figure 6.5).[10] We could expect that population density correlates positively with higher educational attainment because schools are easier available in places where people tend to concentrate. On the other hand, we could also imagine that less densely populated areas show similar numeracy values because people were taught at home or, as in the case of Cuba, on the plantation. What we find is that people from Pinar del Río were more numerate compared to their counterparts living in the capital province. The inhabitants of Pinar del Río were highly numerate at the beginning of the 19th century. These differences might also be explained by considering that census places in Pinar del Río might have been more densely populated localities than those in Habana province which could indicate a positive bias on the numeracy values.[11] All other provinces which include the people stemming from the east show inferior values than those for the western part.

6.5 Differences by Socio-Economic Status

Nineteenth-century Cuban society was divided into two large groups, those of European origin and those of African origin, physical appearance serving as one criterion of distinction. If this measure was considered to be unsatisfactory, then real and legal color was resorted to (Martinez-Alier, 1974). The Cuban economy run with slave labor maintained color prejudice as a conventional device to justify slavery. Due to this prevailing system we think that it is important to distinguish between ethnicities because it seems reasonable to assume that blacks were less educated than whites because of their inferior social status. Blacks in this study, however, were free people because otherwise they would not have been enumerated in the *padrones*. Figure 6.6 compares the numeracy levels for the black and white Cuban population. We find that numeracy levels for whites were stagnating for half a century; however, on a relatively high level at around 91 percentage points. Blacks were less numerate than whites, but by the 1850s they had caught up to attain the same level as whites. We could probably explain this with the fact that Cuban free blacks were always well integrated in the

[10] For the year 1861: Habana: 71.4 inhabitants per km²; Pinar del Río: 9.8 inhabitants per km². In comparison: Oriente: 7.3 inhabitants per km² (Censo de Población).

[11] We use information on the provincial level and lack the information whether the place of enumeration was considered urban or rural.

society (Cuban Economic Research Project, 1965). Marrero (1988) reports that many white families even entrusted the education of their children to colored people.

Occupational classifications are an additional measure to discern inequalities of numeracy between different social classes. The data allows distinguishing four occupational groups based on the classification by Armstrong (1972): the unskilled, homemakers (domestic work), skilled, and professionals. These can be used to classify upper versus lower income group individuals. Figure 6.7 describes the ABCC index by occupational group. We find what we had expected: there were hardly any differences between the unskilled and homemakers, and professionals did not misreport their age at all. People with a supposedly higher income assessed their age more accurately, partly because they presumably have benefited from a formal educational training.

6.6 Determinants of Numeracy

In order to test whether the above discussed variables have a systematic influence on the development of our ABCC values, we conduct a logit regression model. We control for time variance by including birth decade dummies and use dummy variables for the different social classes (occupation and ethnicity). We can distinguish between sexes and additionally add dummy variables for immigrant origin as well as regional variation for Cubans. We expect higher occupational status to be positively correlated with ABCC values, and blacks to show less numerical abilities than whites because they might have been more restricted in their decision of sending their children to school.

Table 6.1 describes the results of our three different models. In comparison to white Cubans, black Cubans had a higher probability of reporting an age ending on the digits of 0 or 5 which is significant in both model 1 and 2. Females did not show significantly higher probabilities of rounding their age than men. The significant negative coefficient for people born in Pinar del Río explains the lesser probability of rounding ages than for people born in Havana. Professionals and farmers had both a significant lower probability of reporting a rounded age than those working in the unskilled sector. Considering the different immigrant groups we find that all immigrants had a greater probability of age heaping than Cubans, a result which might reflect worse educational conditions in their home countries than on the island of Cuba. We can conclude that belonging to a certain social class and having been born in a certain

country or region of Cuba did have a systematic influence on people's numerical abilities.

In addition, there is the possibility that the sugar boom and its therefore increasing government revenues had a positive influence on the numerical abilities of the Cuban population, since more educational facilities might have been put up with taxpayer's money. Pezuela (1863) and Sagra (1831) report revenues of all kinds collected on the island of Cuba which we plotted against our ABCC values in Figure 6.8.[12] The plot reveals that revenues were increasing strongly from the 1820s on, when we also observe a strong increase in the numerical abilities of the population. We lack the information on the exact amount spent on public education, but assume that expenses must have been growing because the number of public educational facilities had increased from the late 1830s until the 1860s (Cuban Economic Research Project, 1965).[13]

6.7 Gender Inequality

The 19th-century censuses reveal that more men than women lived in Cuba which was due to the fact that immigrants and African slaves were mostly males (Marrero, 1983). However, after the wars of independence the distribution of the population by sex became almost equal. Women's social role in 19th-century Cuba was mostly confined to domestic services and child care, a general phenomenon in all Latin American and Caribbean countries. Still, typical in slave societies, gender always played a subordinate role because color and class were the main driving forces for generating inequalities (Ellis, 2003). Therefore, it is hardly surprising that numeracy values for males and females reveal no differences at all from the 1820s to the 1850s (Figure 6.9). For the 1810s females even display higher values than males, an educational advantage in terms of numeracy.

To analyze gender disparities in greater detail, we follow the approach of Manzel and Baten (2009) and define a measure of gender equality to be able to compare the outcome with their study. If the gender equality index turns out positive (negative),

[12] A summary can be found in Schroeder (1981) and in Cuban Economic Research Project (1965).

[13] The statistics are shown in Cuban Economic Research Project (1965, p.18); the authors, however, claim that primary education on the island was still deficient.

females (males) display a numeracy advantage.[14] Figure 6.10 distinguishes gender equality of the Cuban population as a whole as well as gender equality among blacks and among whites. Surprisingly, the gender equality index is highly positive for the 1810s indicating that women were more numerate than men. In the following decades we can hardly find any gender differences at all. Gender equality seems to be especially pronounced among the black population where females always show a slight numeracy advantage. In the 1810s white and black females report their age more accurately than their male counterparts.

The first bits of information with respect to the state of education were revealed by the *Sociedad Económica*. In 1816, 39 schools were already operating in the city of Habana with 1,700 students enrolled. Out of these, 32 schools were for women and girls, and only 7 for boys (Bachiller y Morales, 1938). Another statistic of free schools of primary elementary and higher education paid for with municipal funds revealed that out of 252 mentioned schools on the island, 193 were created for girls (Bachiller y Morales, 1938). These numbers might indicate why equality in numeracy among sexes was quite high in the first half of the 19th century, although one has to keep in mind that other educational institutions were operating as well and are not reflected in this statistic.[15]

Comparing our results with those of Manzel and Baten (2009) we find that Cuba did quite well in comparison with other Latin American and Hispanic Caribbean countries. Slave and plantation societies displayed less traditional gender roles as on the Latin American continent. Ethnicity and social class always played a more important role in these societies than gender distinctions. Especially among slaves differences were minor because women often had to perform the same tasks men were imposed to do.

6.8 Conclusion

Age heaping as an index for basic numeracy permitted new insights into the educational level of the Cuban population from the late 18th to the mid-19th century. Although the

[14] Gender equality index=(abccfemale-abccmale)/abccfemale*100

[15] Other educational institutions were private schools which had to be paid for and only the rich could afford, private tutoring or religious institutions (Marrero, 1988)

literature described the Cuban educational system as hardly progressive, we found that basic numerical skills among Cubans, male and female, were quite well pronounced, and Cubans performed better in a general comparison than their immigrant counterparts. In a Latin American comparison, ABCC levels were high. Especially in the first half of the 19th century, numeracy values were among the highest in a Latin American comparison (see Manzel et al., 2011).

Blacks were less educated than whites, although they had caught up by the 1850s when differences by ethnicity were hardly discernible. Gender inequality was also quite low which we attributed to the strong influence of the plantation system and its corresponding slave society existent on the island until the end of the 19th century.

The logit regression analysis showed that being an individual with a professional or agricultural occupation and having been born in either Pinar del Río or a foreign country had a systematic influence on one's numerical abilities.

To determine the development of numeracy until the republican period, further research is necessary which might reveal interesting results since Cuba remained under the influence of Spanish colonial power until the end of the 19th century. Future work might shed some light on the influence of the wars of independence on the educational system in the second half of the 19th century, and whether North American military occupation in the early 20th century was advantageous for educating the masses. The decades right before the first war of independence, 1840s to 1850s, already described a stagnating trend of our numeracy values.

6.9 References

A'Hearn, B., Baten, J., Crayen, D., 2009. Quantifying Quantitative Literacy: Age Heaping and the History of Human Capital, *Journal of Economic History*, 69 (3), pp.783-808.

Armstrong, W. A., 1972. The Use of Information Concerning Occupations. In: Wrigley, E. A. (Ed.), Nineteenth-Century Society: Essays on the Use of Quantitative Methods for the Study of Social Data. Cambridge, Cambridge University Press, pp. 191-310.

Bachi, R., 1951. The Tendency to Round off Age Returns: Measurement and Correction, *Bulletin of the International Statistical Institute*, 33, pp. 195-221.

Bachiller y Morales, A., 1938. Apuntes Para la Historia de las Letras y de la Instrucción Pública en la Isla de Cuba, Tomo 1, La Habana – Cultural.

Baten, J., Ma, D., Morgan, S., Wang, Q., 2010. Evolution of Living Standards and Human Capital in China in the 18–20th centuries: Evidences from Real Wages, Age-Heaping, and Anthropometrics, *Explorations in Economic History*, 47 (3), pp. 347–59.

Bethell, L. (ed.), 1998. La Colonia Espanola de Cuba. In: Bethell, L. (ed.), Historia de América Latina, Tomo 5, La Independencia, Barcelona, pp. 154-70.

Censo de Población de Cuba en los Años 1774, 1792, 1817, 1827, 1841, 1846, 1861, 1862.

Corbitt, D.C., 1942. Immigration in Cuba, *The Hispanic American Historical Review*, 22 (2), pp. 280-308.

Cuban Economic Research Project, 1965. A Study on Cuba. The Colonial and Republican Periods. The Socialist Experiment, University of Miami Press, Florida.

Ellis, P., 2003. Women, Gender and Development in the Caribbean: Reflections and Projections, London: Zed Books.

Fitchen, E.D., 1974. Primary Education in Colonial Cuba: Spanish Tool for Retaining "La Isla Siempre Leal?", *Caribbean Studies*, 14 (1), pp. 105-20.

Fraginals, M.M., 1977. Africa in Cuba: A Quantitative Analysis of the African Population on the Island of Cuba, Annals New York Academy of Sciences, Comparative Perspectives on Slavery in New World Plantation Societies 292.

Humboldt von, A., 1856. The Island of Cuba, New York: Derby and Jackson.

Lavrín, 1984. La Mujer en la Sociedad Colonial Hispanoamericana. In: Bethell, L. (ed.), 1984, Historia de América Latina, 4 (4), pp. 109-37, Cambridge University Press.

Le Riverend, J., 1967. Economic History of Cuba, Havana.

Manzel, K., Baten, J., Stolz, Y., 2011. Convergence and Divergence of Numeracy: The Development of Age Heaping in Latin America, 17th to 20th Century, *Economic History Review* (forthcoming).

Manzel, K., Baten, J., 2009. Gender Equality and Inequality in Numeracy: The Case of Latin America and the Caribbean, 1880-1949, *Revista de Historia Económica (Journal of Latin American and Iberian Economic History)*, 27 (1), pp. 37-73.

Marrero, L., 1983. Cuba: Economía y Sociedad. Azúcar, Ilustración y Conciencia (1763-1868) (I), Madrid.

Marrero, L., 1985. Cuba: Economía y Sociedad. Azúcar, Ilustración y Conciencia (1763-1868) (IV), Madrid.

Marrero, L., 1988. Cuba: Economía y Sociedad. Azúcar, Ilustración y Conciencia (1763-1868) (VI), Madrid.

Martinez-Alier, V., 1974. Marriage, Class and Colour in Nineteenth-Century Cuba. A Study of Racial Attitudes and Sexual Values in a Slave Society, Cambridge University Press.

Myers, R.J., 1940. Errors and Bias in the Reporting of Ages in Census Data. In: U.S. Bureau of the Census (Ed.), Handbook of Statistical Methods for Demographers, Washington D.C., Gov. Print. Off.

Myers, R.J., 1954. Accuracy of Age Reporting in the 1950 United States Census, *Journal of the American Statistical Association*, 49 (268), pp. 826-31.

Pezuela de la, J., 1863. Diccionario Geográfico, Estadístico, Histórico de la Isla de Cuba, Madrid.

Sagra de la, R., 1831. Historia Económico-Política y Estadística de la Isla de Cuba, Habana.

Schroeder, S., 1982. Cuba: A Handbook of Historical Statistics, Boston, Massachusetts.

6.10 Appendix

6.10.1 Tables

Table 6.1: Logit Regression Model

Dep. Var. Multiples of 5		1	2	3
Ethnicity	**Black**	0.3141442*** (0.000)	0.1945658* (0.025)	-
Sex	**Female**	-0.0186326 (0.721)	-0.003474 (0.956)	-0.0123682 (0.793)
Province	**Pinar del Río**	-0.3905764*** (0.000)	-	-
	Other Provinces	0.2137452 (0.223)	-	-
Occupational Group	**Skilled**	-	0.1350925 (0.375)	-
	Professional	-	-0.5156303** (0.009)	-
	Domestic	-	-0.1225665 (0.156)	-
	Farmer	-	-0.2421334*** (0.000)	-
Immigrants	**Spain**	-	-	0.1904815** (0.004)
	Canaries	-	-	0.4562009*** (0.000)
	Africa	-	-	0.5098048*** (0.000)
	Asia	-	-	0.2841144** (0.018)
	Europe	-	-	0.1926163 (0.537)
Time dummies included		YES	YES	YES
	Constant	-0.5480976*** (0.000)	-1.010402*** (0.000)	-0.7925616*** (0.000)
	N	7724	7724	10931
	Pseudo R squared	0.0163	0.0212	0.0102

Note: The constant refers to a white male Cuban born in Habana province (1), a male white Cuban with an unskilled profession (2), and a male Cuban (3).

6.10.2 Figures

Figure 6.1: Map of Cuban Provinces in the 19th Century

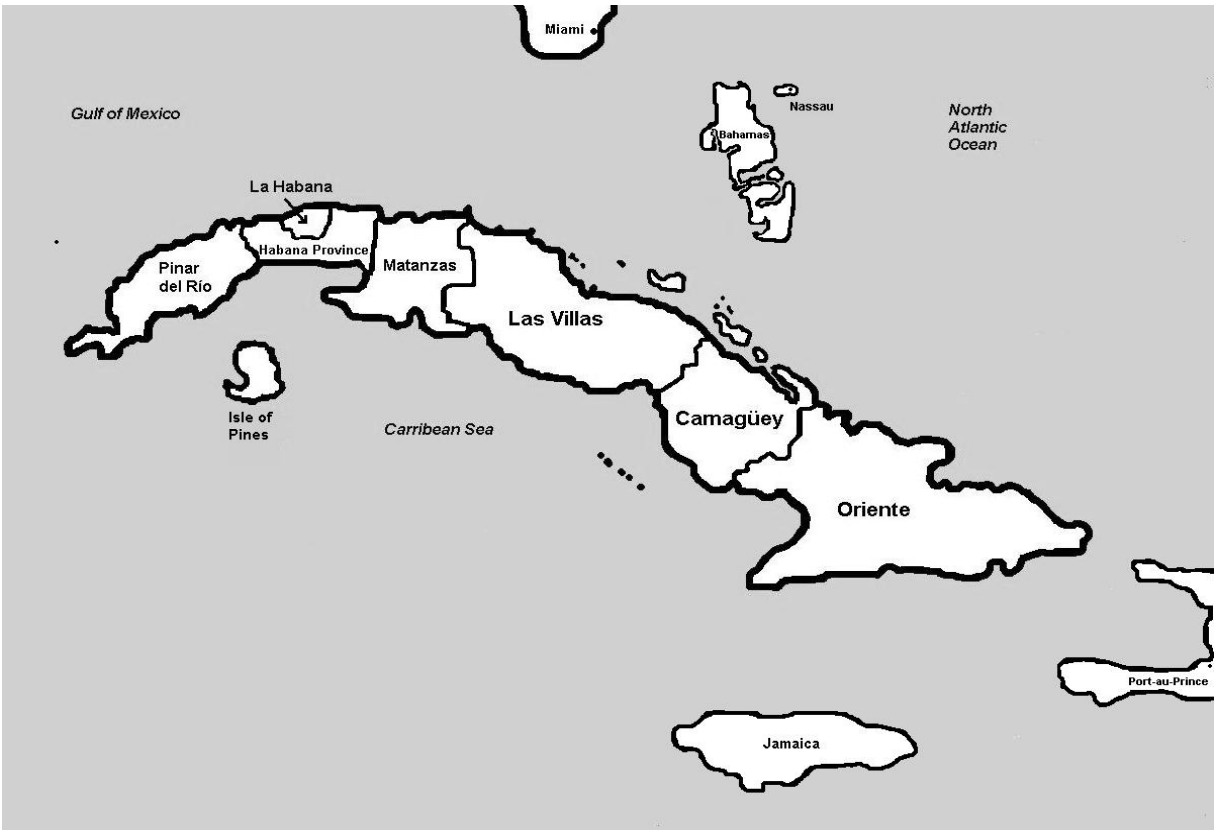
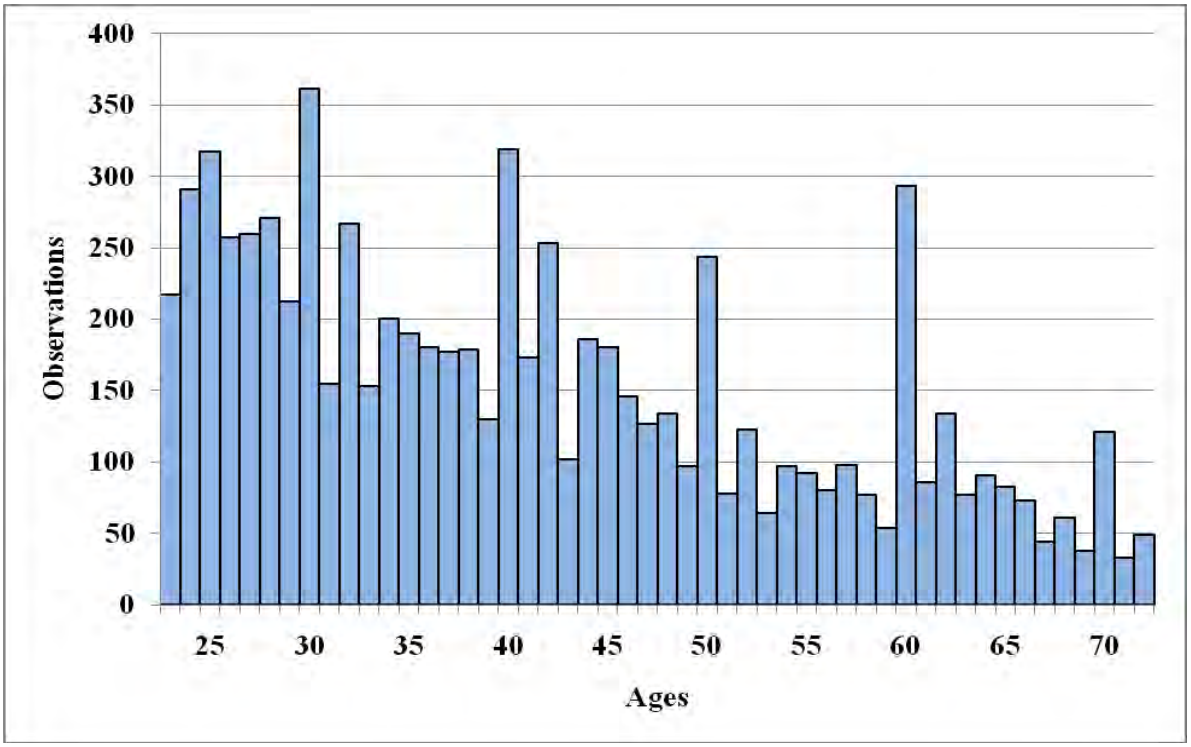


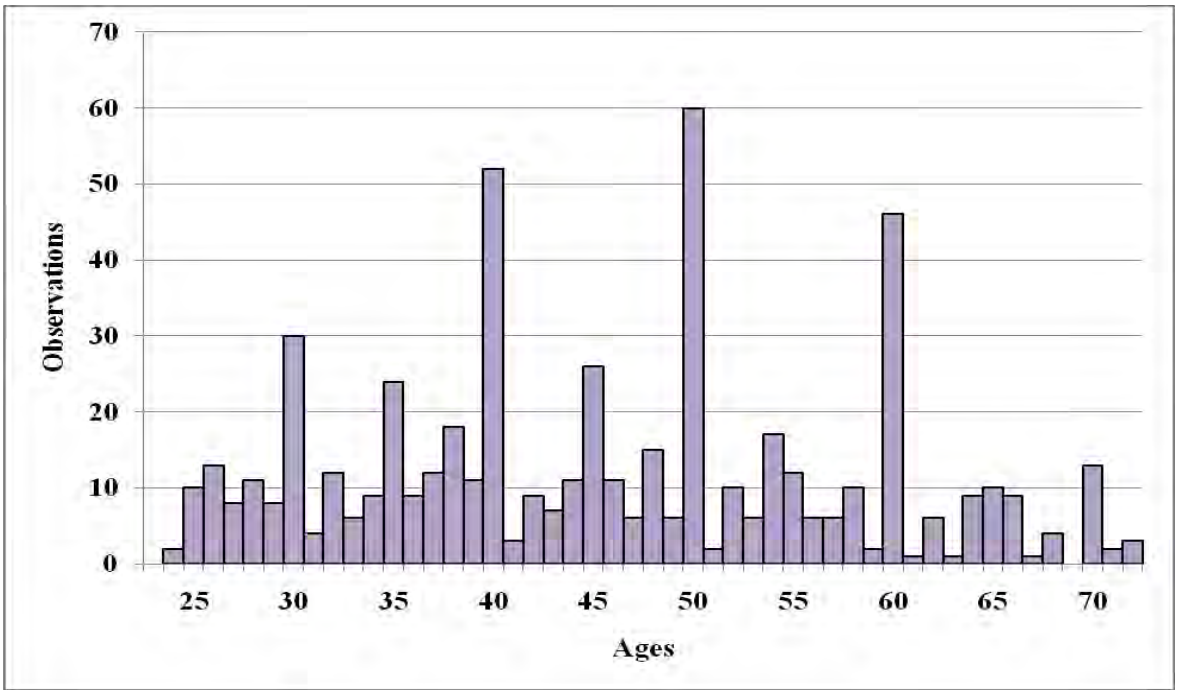
Figure 6.2: Heaping Pattern: Distribution of Ages 23-72

a) ***Padrones***



Note: based on 7724 observations, males and females, blacks and whites.

b) ***Residents***



Note:based on 581 observations, Cuban white males.

Figure 6.3: ABCC Index of Basic Numeracy, Cubans and Immigrants, 1810-50

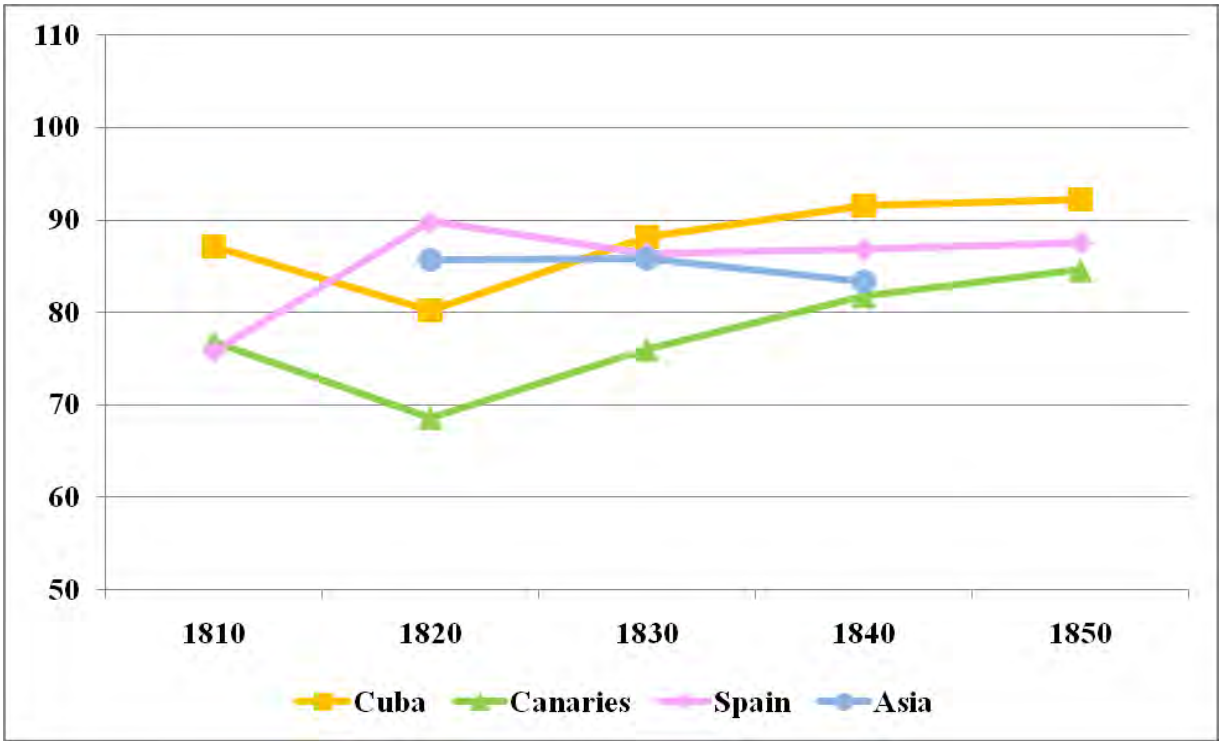
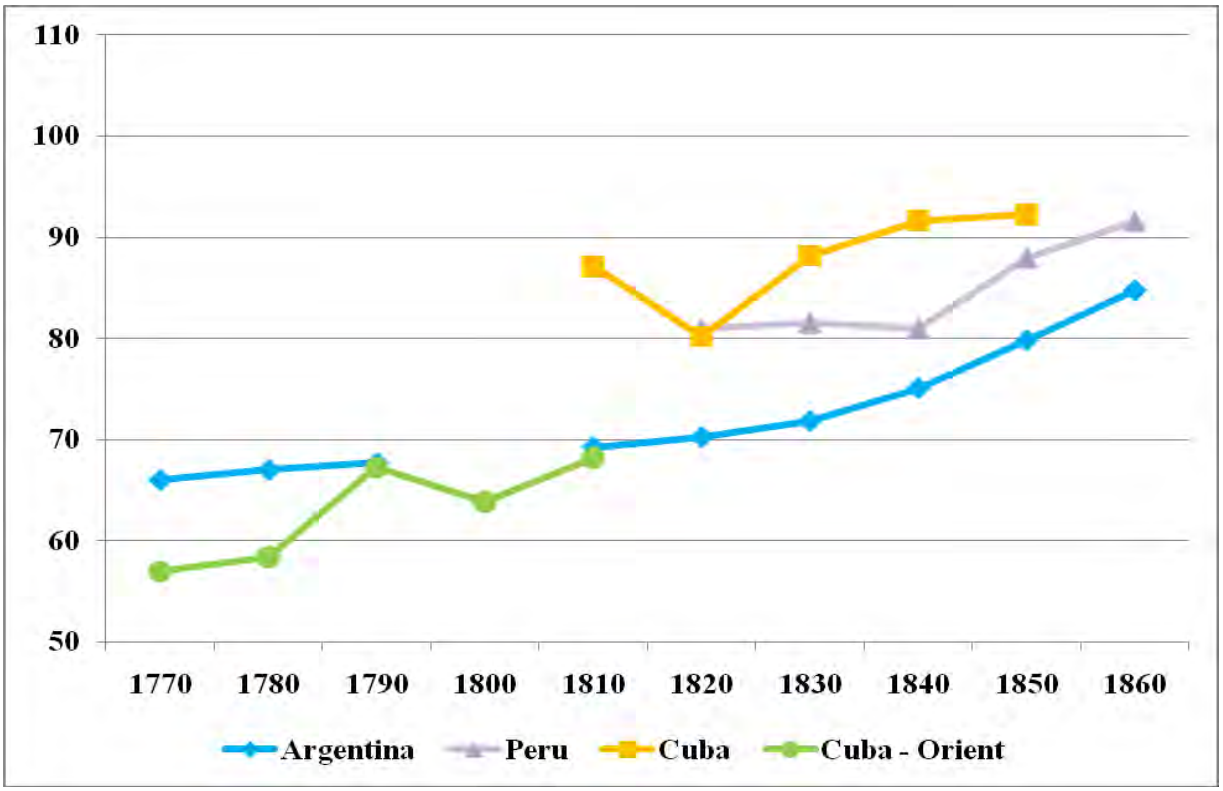


Figure 6.4: ABCC Index of Basic Numeracy, Argentina, Peru, and Cuba in Comparison, 1770-1860



Source: Values for Argentina and Peru are taken from Manzel, Baten, Stolz (2011)

Figure 6.5: ABCC Index of Basic Numeracy by Province, 1810-50

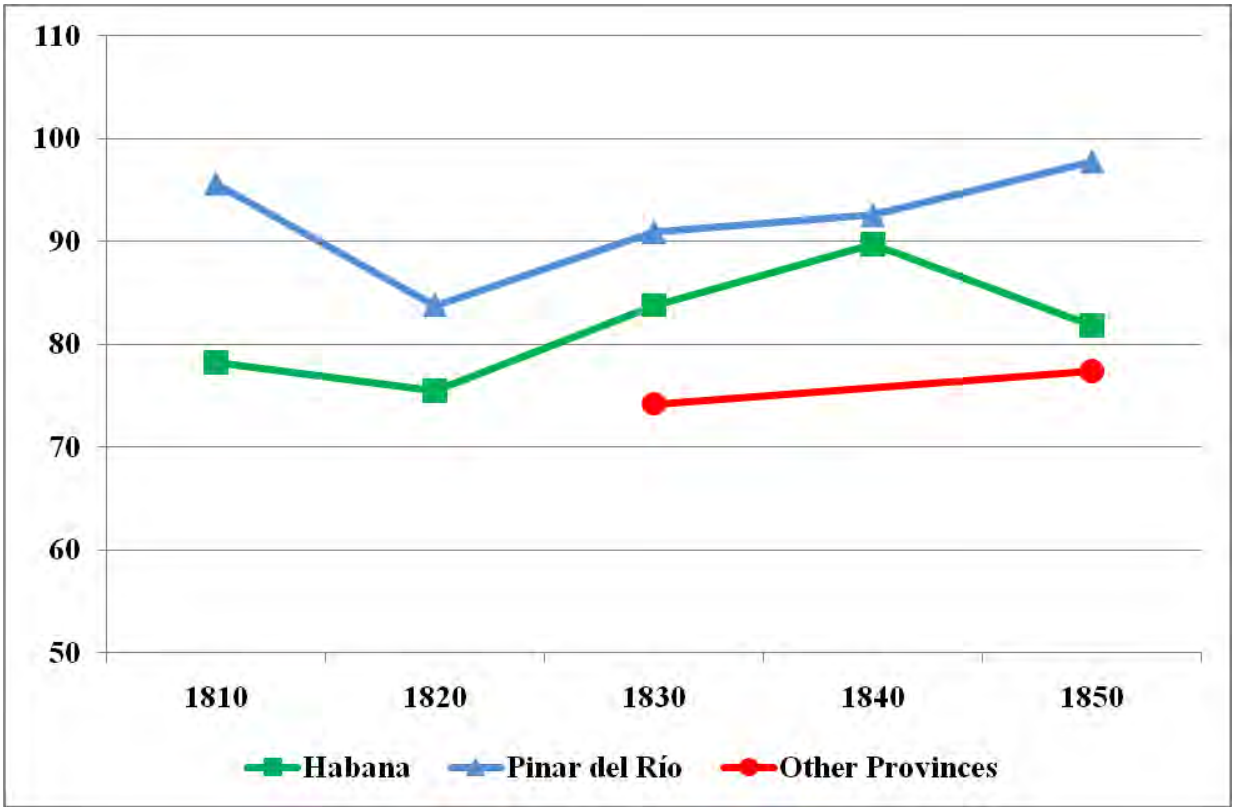


Figure 6.6: ABCC Index of Basic Numeracy by Ethnicity (Cubans), 1810-50

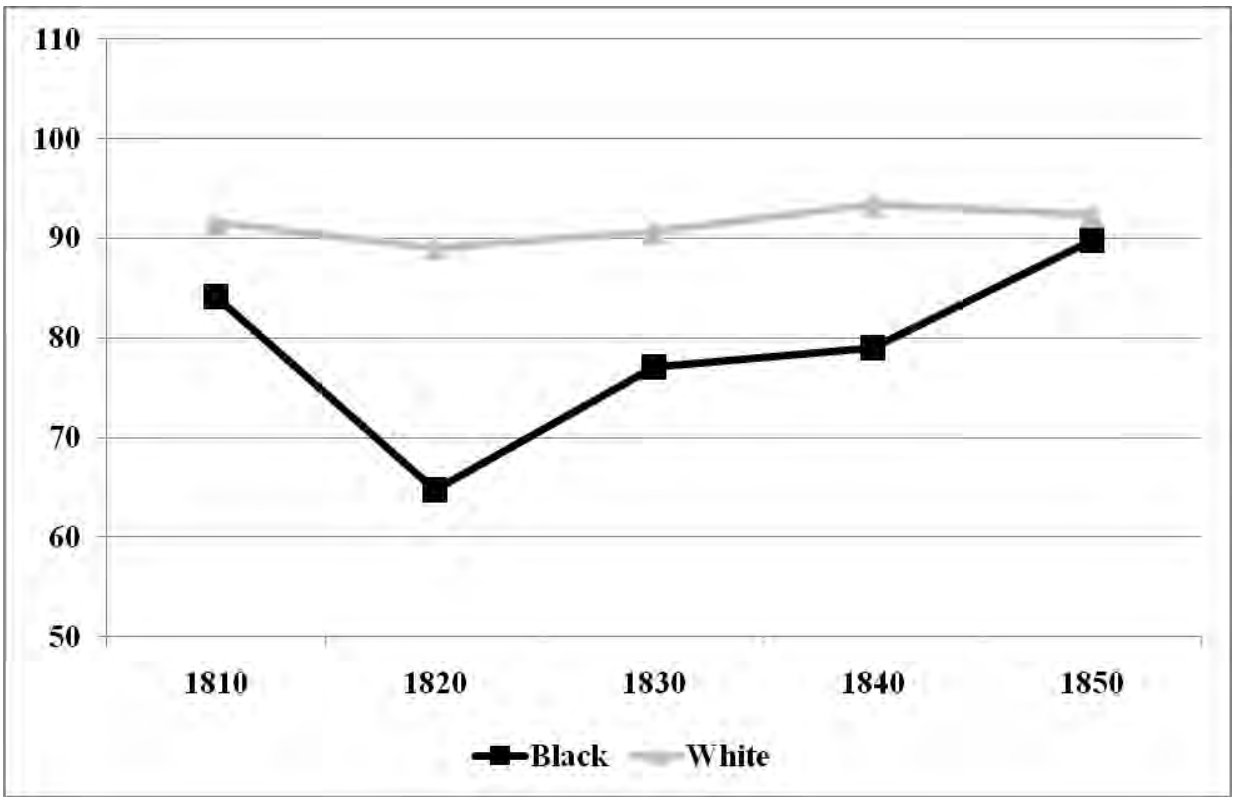


Figure 6.7: ABCC Index of Basic Numeracy by Occupational Group (All Ethnicities and Sexes, Cubans), 1810-50

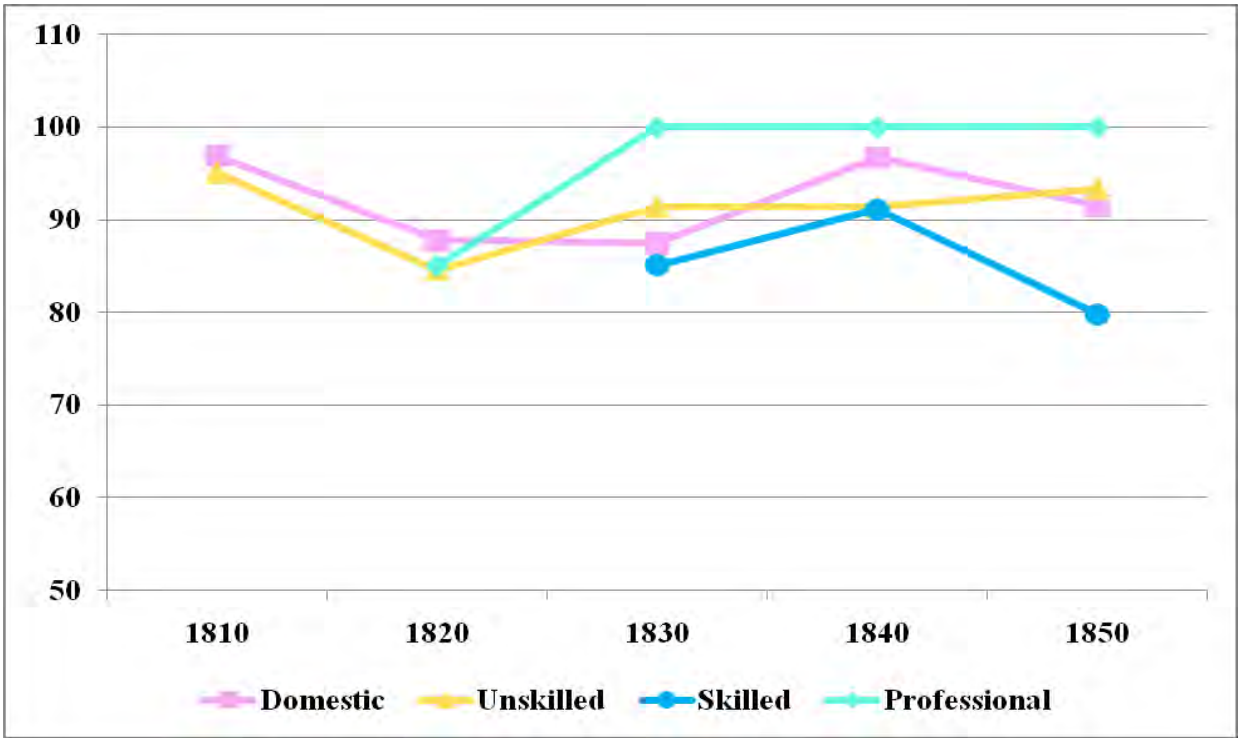
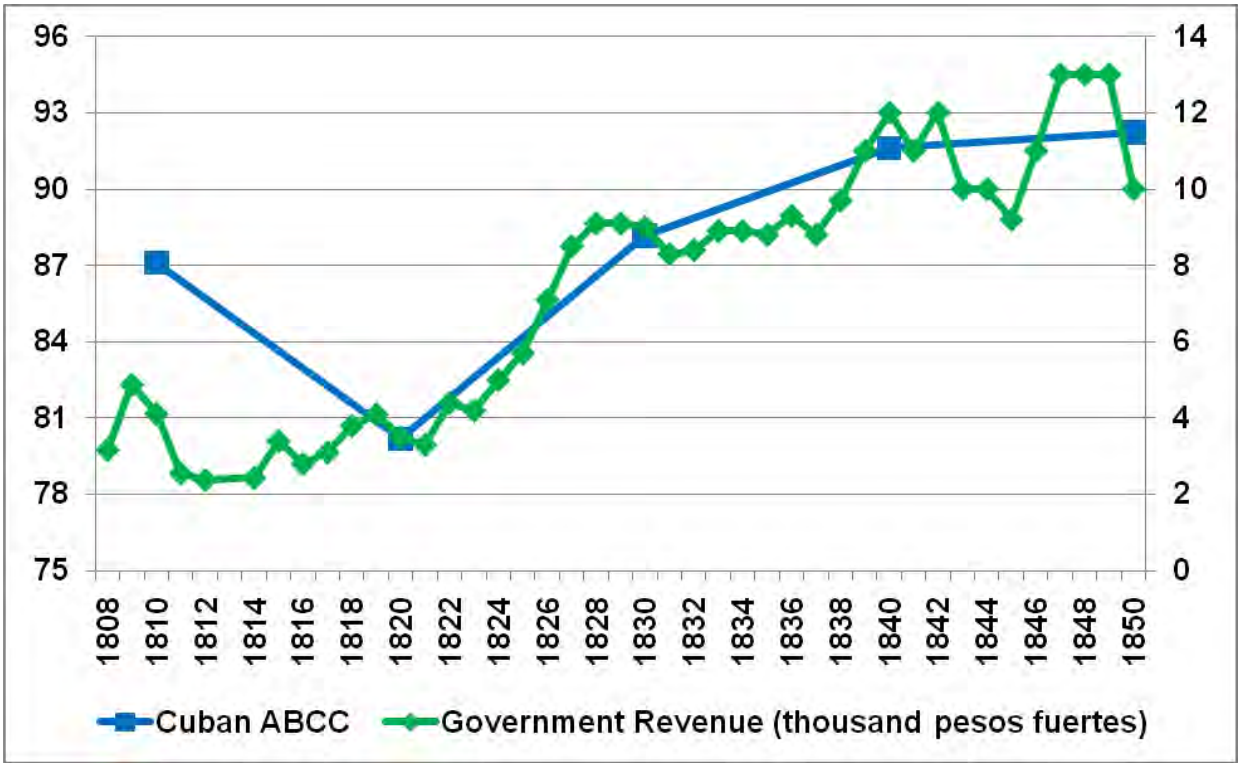


Figure 6.8: Government Revenues in Thousand Pesos Fuertes and Cuban ABCC



Source: Pezuela (1863)

Figure 6.9: ABCC Index of Basic Numeracy by Sex, 1810-50

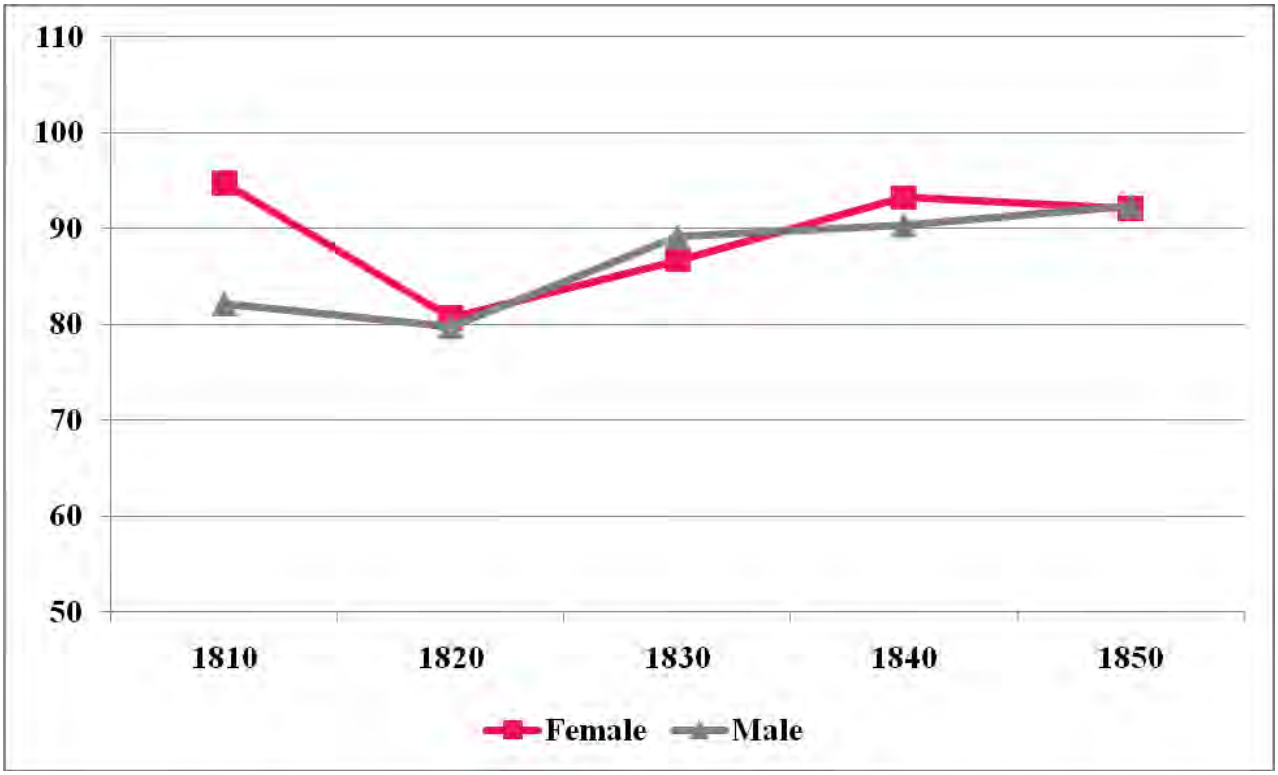
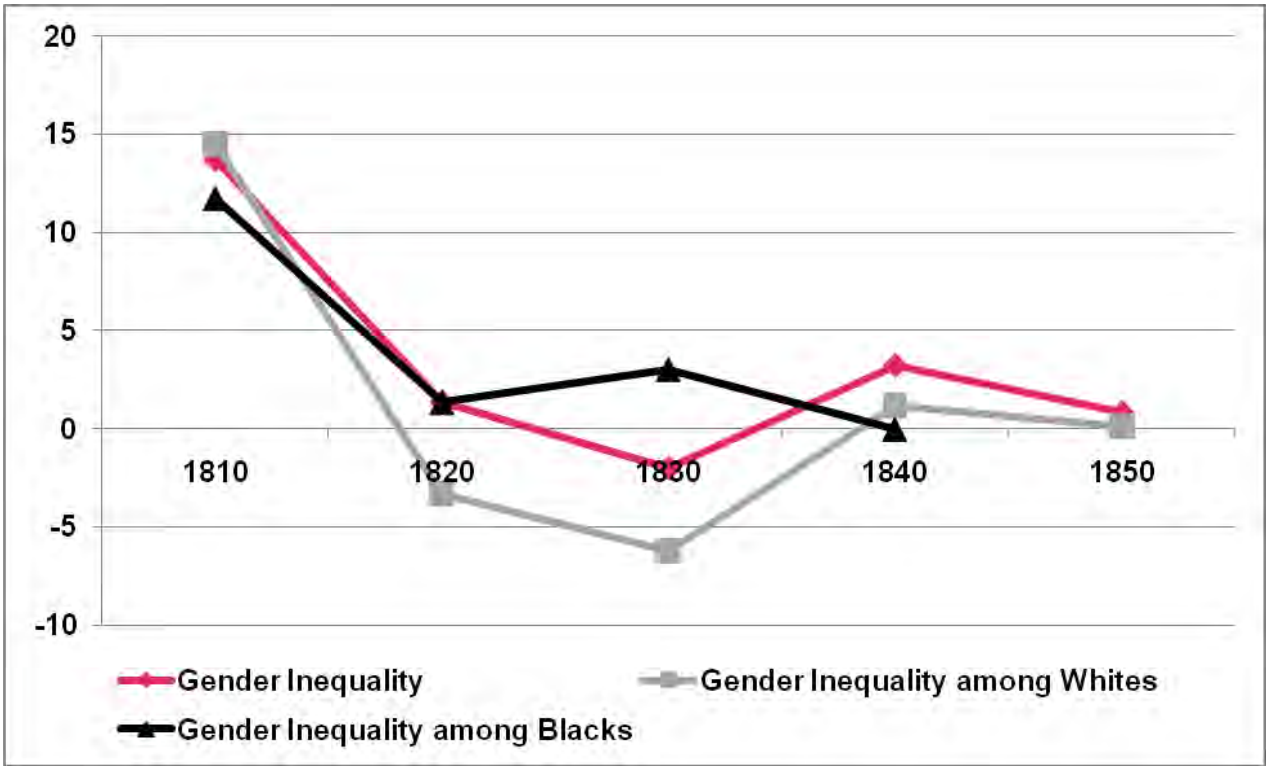


Figure 6.10: Gender Inequality (All and by Ethnicity), 1810-50



7 The Selectivity of Argentina's Immigrants: Characteristics and Determinants (1900-1930)

Abstract

It is often assumed that immigrants are the best and the brightest, that on average they are more skilled, more ambitious and more enterprising than those they leave behind. Using a new source of evidence on height, we explore the selectivity of migrants from 59 countries to Argentina during the age of mass migration. Comparing the biological welfare of those who left and those who stayed behind, we observe that immigrants from Europe, the Middle East and Latin America were positively selected. In addition, evidence is found that the chain migration effect, which was based on remittances and pre-paid tickets sent back home influenced migrants' composition significantly. Argentina's restrictive immigration policy in the 20th century introduced a bias to migrant selectivity, and poverty constraints in European countries enabled only the higher strata to emigrate.

This chapter is based on a working paper co-authored with Jörg Baten (University of Tuebingen). The concept for the paper was developed jointly; the analyses and writing were equally shared.

El Gobierno Federal fomentará la inmigración europea y no podrá restringir, limitar ni gravar con impuesto alguno la entrada en el territorio argentino, de los extranjeros que traigan por objeto labrar la tierra, mejorar las industrias é introducir y enseñar las artes y las ciencias.

Constitución Nacional, art. 25, 1853[1]

7.1 What's the Story?

One famous Argentinean intellectual once said "to govern is to populate", from which Juan Bautista Alberdi provided a dictum that epitomized half a century of efforts to attract immigrants. If Argentina was to become affluent and powerful, what it needed most were people to work on its vast lands. Immigration was the answer to Argentina's population problem; declining transport costs and large wage gaps between the Old and the New World allowed for more than 4.5 million people to enter the country between 1890 and 1914 (Hatton and Williamson, 1993).[2]

This study deals with the selectivity of Argentina's male immigrants during the crucial period from the 1900s to 1930s, the age of Latin American mass migration. We use height as a measure of social status to compare migrants to the population remaining in the source country. Anthropometric indicators in previous studies found a strong relationship of height differentials by income groups for the 19th and early 20th century (Steckel, 2009; Komlos and Baten, 2004). We define selectivity as the difference between migrants' heights and heights of the average population in the source country. Migrants are positively selected if relatively taller individuals are migrating to Argentina, and negatively selected if smaller individuals are entering

[1] National Constitution, article 25, 1853: The federal government will encourage European immigration and will not be able to confine, limit or impose any tax on the entrance of immigrants on the Argentine territory; those foreigners that mean to work land, enhance the industries and introduce as well as teach the arts and science.

[2] Net migration over the period 1881-1930 reached 3.8 million (Sánchez-Alonso, 2007).

Argentina during the period under observation. Additionally, we want to identify the determinants of the self-selection process of migrants to Argentina.[3]

Immigrants are not a random sample of their home countries' population, but are selected on various characteristics such as educational level, occupation, skills, age, and gender (Feliciano, 2005). However, whether they are positively or negatively selected in comparison to their country of origin has been on debate in the literature. Lee (1966) contended that various factors play a role in determining the positive or negative composition of a migrant stream. There are positive and negative factors associated with the area of origin (e.g. good climate versus bad climate) and with the area of destination (e.g. good educational system versus bad educational system). The author then describes intervening obstacles such as distance or immigration laws, and adds personal factors such as relatives already abroad. Hence, immigrants can be positively or negatively selected which most often varies by source country. On the other hand, some immigrants might be less positively selected than others, which is, however, still related to a loss of skills in the source country. Consequently, examining migrant streams in the past might offer additional insights on a country's economic and social history.

A number of questions about Argentine immigration have been addressed earlier in the literature to which we make a contribution: Do we find that migration from Southern European countries was income constrained, as Sánchez Alonso (2000) points out for the cases of Italy and Spain? Does this lead to the conclusion that only the richest could afford to migrate? Or were immigrants to Argentina mostly poor and of modest skills, as part of the migration literature claims (for an overview see Gould 1979)? How much influence on the selectivity of migrants can be attributed to Argentine immigration policy? Answering these questions, we try to shed light on the characteristics of immigrants, their pattern and the determinants of the selection process which might have been crucial for our understanding of the future progress of the country.

Generally, we take a look at political, cultural, social, and geographical factors to determine the selectivity of our migrants. Adding to previous studies about

[3] This study does not deal with the reasons why people were migrating. To get an idea about the latter, Hatton and Williamson (1998) offer a number of explanations for European mass emigration, such as demographic pressure, industrialization and urbanization, and huge wage gaps.

immigration to Argentina (Sánchez-Alonso, 1988; Cortés-Conde, 1979; Devoto, 2003), we focus on the social characteristics of migrants from all over the world.

The first section describes the data set and its special characteristics, including a general data analysis. Section two gives a brief overview of Argentine migration history and deals with the expectations of factors possibly influencing the selectivity of migrants as derived from migration theory. In the following section the determinants of migrant selectivity are analysed using a panel regression model. Finally, section four provides conclusions.

7.2 Data

7.2.1 General Description

The evidence comes from a military census taken in the Argentine Republic in 1927, where all male Argentines and naturalized Argentines were registered for military enrolment and voting purposes. A number of non-naturalized immigrants were included as well. Immigrants were added on the last pages of each enrolment office in all 68 districts of Argentina from 1927 to 1952. Based on their age and the year in which they appeared at the registration office we can calculate their birth decades which allow studying decades of migration from the 1900s to the 1930s (Table 7.1). Their height organized by birth decades minus the male height of the same birth decade in their country of origin is used in the following as the selectivity indicator. An ideal data set would report the decade of their migration decision. This information is not available in the sources. However, we know from other sources that the vast majority of migrants came around the ages 20 to 29, and only a small share migrated as children or at very high ages. Hence we work in the following with the assumption that the decision to migrate was taken around two decades after birth. [4] The sources contain information about the immigrant's date and place of birth, his occupation and the corresponding

[4] This assumption was analyzed by Stolz and Baten (2010). The authors assessed the correlation between the human capital of migrants from censuses (for migrants with insufficient information for whom the ages 20 to 29 was assumed as well), and a smaller sample from ship lists (for those migrants with published year of arrival), and the correlation was very high. See also Hatton and Williamson (1998).

specialty in this professional sector[5], age, literacy, place of residence and in some cases, time of death.[6] Since the data stem from a military source, we only have male immigrants to consider. We include the ages 20 to 58; in this age bracket height does not change much.

We took a sample mostly from provincial capitals scattered all over the country where immigrants were to be found preferably due to better employment possibilities.[7] In order to assess the representativeness of our sample, we can compare the urban share of the sample with census statistics on the urban shares of migrants. Nearly 86 per cent of our sample migrants fall into the category "urban".[8] The census of 1914 reports that 65 per cent of male immigrants lived in urban centers. This number increases to 80 per cent in 1947, from which we can conclude that although we might have a modest urban bias, the overall representativeness of our male migrant sample is quite acceptable.

We observe that some of our migrants were naturalized, whereas others did not yet receive Argentine citizenship at the time of measurement. To avoid any possible source of bias, which might occur due to the fact that naturalized migrants might be referred to as the elite of migrants and hence be taller, we compare mean heights of those nationalities that have been naturalized and those that have not (Figure 7.1). We do not observe that non-naturalized immigrants were shorter than naturalized immigrants, which is why we do not detect any bias in this case.

7.2.2 Occupation

The popular view that high proportions of immigrants to Latin America were illiterate and had mostly unskilled urban occupations is not reflected in our sample. Literacy rates among the migrants in this sample were even as high as 94 percent. Occupations can be classified as follows: unskilled workers (day-laborers and other people without formal training); farmers, employees, and skilled workers (artisans); people working in

[5] For example a farmer working with cattle or sheep or vegetables etc.

[6] Some immigrants were additionally asked whether they knew to swim, to ride, or to drive a car.

[7] Buenos Aires, Córdoba, Corrientes, Paraná, Mendoza, Salta, Santa Fe, Santiago del Estero, and Tucumán.

[8] Urban being defined as living in the provincial capital.

commerce, and professionals (Table 7.2).[9] People from Eastern European countries were mostly skilled people (29 percent) and working in commerce (28 percent) and less than one fifth were classified as unskilled. Italians and Spaniards had a quite similar occupational structure; the majority worked as employees, day-laborers, and artisans (around 70 to 80 percent). Latin Americans featured the same structure as the European Latinos. Nearly 60 per cent of the people from the Middle East were engaged in commerce, and Western Europeans were highly skilled, as we would have expected, based on the occupational structure in their home countries.

Earlier studies on U.S. immigrants' labor market skills during the 19th century differ in their arguments; while some point out that the skills of migrants declined with the shift in origin toward Southern and Eastern Europe by the end of the 19th century, others disagreed, and Hatton and Williamson (1998) point out that it is not clear whether immigrant skill indices are a useful indicator of quality since immigrants often changed country and occupation at the same time. We assume that it could have been easier for later migrants to assimilate and maintain some of their culture and customs while integrating into a new country since social and kinship networks provided more information and easier access to the job market. Figure 7.2 gives an overview of the occupational structure of the entire sample for each decade of migration. We can clearly observe that the relative importance of the occupational groups changed. Unskilled people were less represented in the later decades, whereas employees and professionals were increasing in numbers. The observed scheme from the 1900s to 1930s is therefore one that goes from less skilled to more skilled people. The low percentage of farmers might be explained by the fact that immigrants possibly identified themselves as farmers (or farm laborers) when they entered the country, but adapted quickly to the needs of the urban labor markets and became, for example, employees in urban companies (Cortés Conde, 2009).

7.2.3 Region

Classifying the 59 countries named in the sample into world regions, we find that 35.8 percent of the immigrants came from Italy and 31.7 percent from Spain. Eastern

[9] Employees are working in offices, shops, on the railroad construction, and many other fields but very often could not be allocated to a certain category, which is why we assume they dispose of similar skills.

European countries are represented with 10.2 percent in the data set, Latin America and Middle Eastern countries with 9.6 and 6.7 percent, respectively. Only 4.4 percent have their origin in Western Europe, which had been the most desired immigrant group of Argentine politicians in the second half of the 19th century (Table 7.1).

A general overview about the development of mean heights of migrants from our world regions and countries in comparison to those of Argentina is shown in Figure 7.3. Please note that we show the raw heights here for descriptive purposes, and not the height selectivity values that will be analyzed below. Heights of all migrants and native Argentineans were increasing at the beginning of the 20th century, although some regions seemed to have lost in comparison. Italians and Spaniards were initially about 2 cm shorter than people born in Argentina, but they added on height until the 1930s, when differences between the Romanic countries became smaller. Argentinean heights stagnated until the 1920s, and gained around 1 cm in the 1930s, to become nearly the shortest in the sample (Baten, Pelger, Twrdek, 2009; Salvatore, 2007; Twrdek, 2010). Western European migrants towered over all other migrants with around 4 cm during the period under observation.

7.3 Historical Context and Determinants of Selectivity

7.3.1 History of Immigration to Argentina

Latin America was a latecomer to the age of mass migration, with large and significant migratory flows only in the late 19th and early 20th century. Studies on Italian migration to the Americas point out that Southern Italians displayed a higher propensity to move to the U.S. compared to Argentina, where people from Northern Italy immigrated; Southern Italians were on average less skilled and literate, whereas those from the North were normally more qualified and literate immigrants who may have had more to gain by migrating to Argentina (Klein, 1983). Baily (1983) finds that Italians were less successful in New York than in Buenos Aires, where they engaged more actively in occupational careers than the native Argentine. Spanish migrants to Argentina were mostly from the Basque region and Galicia, which were two regions of distinct educational levels, hence migrants were quite heterogeneous in their skill background (Manzel, 2009).

Migration flows to Argentina consisted of two main components: the "golondrinas" ("swallows" or "birds of passage"), which were seasonal migrants who went back and forth across the ocean. They were Europeans who went to Argentina in November or December, working in the fields during the crop season and returned to their homes in May or June with their savings. The second component were permanent settlers. They will be in the focus of this study.[10] An important stream of migrants came from the Middle East, mainly what is today Syria, Lebanon, and Turkey. It was caused by the tensions accompanying the economic and social transformation and the ultimate decline of the Ottoman Empire. For example, the imposition of military conscription in Syria before World War I stimulated emigration in a land not accustomed to military service (Saliba, 1983, p.34); many left their homes and lands to escape the draft, others deserted the army. During this period we find especially high rates of emigrants to Argentina. In the period 1860-1914, total emigration was estimated at 330,000 (Issawi, 1966, p.269). Political insecurity and the lack of political freedom motivated many professionals and tradesmen to leave; religious persecution was an additional factor in emigration because Christians and other minorities migrated from this mostly Islamic region. Karpat (1985) estimates though that 39 percent of the immigrants to Argentina from Syrian ports in 1911 were Muslims. However, the latter usually intended to return home and failed to establish strong communities in their adopted countries.

7.3.2 Determinants of Selectivity

The literature on migration often indicates that migrants are highly motivated and more able than the population they leave behind, which is why we expect especially the tall and the literate to be more likely to self-select into migration (Hatton and Williamson, 2004; on regional migration see Humphries and Leunig, 2009). Earlier anthropometric studies on migrants showed that Italians in the United States were taller than contemporaries in Italy (Danubio et al., 2005). Italian migrants in Southern France were characterized by the same pattern (Boëtsch et al., 2008). López (1954) studied heights of naturalized Spaniards and Italians in Argentina from birth years 1890-95 and found

[10] Despite Argentina's high migration numbers from the 1880s to the 1930s, the country actually recorded a negative net migration during the crisis years of the early 1890s and World War I (Adelmann, 1995).

that immigrants to Argentina were taller than residents in their home countries. The author attributed his findings to a better alimentation and a higher standard of living.

In this study we measure the selectivity of migrants with height data. Anthropometric studies ascertain that adult body height is very useful in determining nutritional and environmental conditions around the time of birth, and that higher social status is associated with taller stature (Steckel, 1995; Komlos, 1998). From the latter we conclude that, at first, we expect our migrants to be positively selected.

We are concentrating on the following questions: What determines the selectivity of migrants? Is there a pattern that describes migrant selectivity from different world regions? Various theories have been offered to explain the empirical regularities of late-19th-century emigration. They draw on perspectives from economics, sociology, demography, and geography. This study does not attempt to explain the causes of emigration, but rather use these factors to explain the composition of migrants from different regions of the world.

A potentially important component is the chain migration effect which is partly caused by remittances that earlier migrants might have provided. Friends and relatives sent not only letters containing information about prospects overseas, but also large remittances or prepaid tickets for the intercontinental passage. There is abundant evidence that current emigrants' cost of passage was financed by previous emigrants (Hatton and Williamson, 1998). Hatton and Williamson (1998) therefore argue that past emigration encourages present emigration. To include this "friends and relatives effect" in our analysis, we use the share of migrants coming from a specific country from the 1895 and 1914 censuses, and we interpolate missing values of the 1900s and 1920s. This allows estimating the migrant share of the respective nationality in the destination country, lagged by one decade.[11] We expect a negative influence on our migrants' selectivity since emigration was facilitated for the poorer social strata.

Prepaid tickets are likely to have been a support for those who could not afford to travel otherwise; on the other hand, the cost of passage must have been a hindrance for the lower social classes without relatives abroad. While it is true that the cost of passage declined sharply in the 1860s with the shift from sail to steam ships on the Atlantic, it is noteworthy that prices for third-class passengers from Galician ports had

[11] Following Ulyses Balderas and Greenwood (2009) who use the number of persons born in i and living in j in year t as migrant stock.

actually risen between 1880 and 1930, the exception being the years during World War I (Vázquez González, 1988). Travel costs were certainly more expensive from places that were more distant to Buenos Aires harbor. To measure the effect of distant countries and the development of transport costs, we construct a variable using the log distance from the source country's capital to the destination country's capital multiplied with the decade specific transportation cost per kilometer.[12] With an increase in distance, migrants are expected to be more positively selected because only the richer strata could afford the move.

The question whether poverty constrained migrant mobility has been addressed earlier when the late timing of emigration of the Latin countries was discussed (Hatton and Williamson, 1993). We introduce mean heights of the source country in the following to control for (the absence of) poverty constraints. Intuitively, migrants from countries with a less favorable standard of living are supposed to be positively selected, hence we expect a negative sign.

Moreover, political freedom might have attracted more fortunate migrants. Argentina at the end of the 19th century claimed to be one of the most liberal states in the world, which entitled the immigrants to the same rights as the native population and offered access to universal education. Although it was in theory a constitutional republic in which popular sovereignty prevailed, in practice the large landed interests of the littoral provinces dominated the central government (Solberg, 1970). The first free election with universal male suffrage and secret ballot took place in 1916, which is when the new president Hipólito Yrigoyen enacted social and economic reforms and extended assistance to families running farms and small businesses. Political freedom could have been an attractive reason for people leaving countries where they might not have had freedom of speech. We therefore want to test if the degree of democracy in the destination country, relative to the source country, had a positive impact on the selectivity of migrants. Supposedly the more fortunate valued political freedom even more.[13] In addition, civil war outbreaks in source countries might have led to people emigrating for two main reasons: first, they might have fled political persecution, or

[12] Since we have passage costs available only from Galician ports (Váquez González, 1988), we have to assume that the price development was similar for other origins as well.

[13] Values taken from the Polity IV project. See data appendix.

secondly, war-induced poverty. We include a dummy variable for a civil war outbreak in the respective decade to control for this effect.

Apart from economic incentives, geographical and political factors, cultural ties might have played a role as well. In this sense, we use language as a proxy for the selectivity which is associated with assimilation and transferability of skills. Having to acquire a new language would certainly demand further skills and less opportunity to transfer already existing language-related skills. Therefore, we expect people coming from other Spanish speaking countries to be less positively selected. On the other hand, migrants might be positively selected if better skilled people such as professionals can only achieve a higher income in their own language.

Finally, one factor that deserves special attention in determining migrant selectivity is the effect of immigration policy.[14] During the mid-19th century Argentina welcomed all kinds of immigrants and facilitated immigrant settlements by offering free housing and food for up to five days upon arrival and even subsidizing passage fares. Immigration policy became more and more restrictive in the first decades of the 20th century, when the government decided to chose to welcome only certain immigrant groups (Adelman, 1995). The next chapter outlines the basic features of the Argentine immigration policy, which is expected to result in positively selected immigrants the more restrictive immigration policy becomes.

7.3.3 Argentine Immigration Policy

During the 19th century the preference for non-Romanic Europeans in the governing elite's minds prevailed. It is important, therefore, to understand the distinguished cultural prejudices against the Spanish people and in favor of Northern Europeans within Argentina. Those of Spanish origin were perceived as poor, often of mixed Spanish and Indian ancestors, and living in the interior, hence the inheritors of Spanish culture and values which were the "undesirable". The other Europeans were perceived as being rich and "white", and lived more often on the coast. The thoughts of the generation of 1837, a group of young Argentine intellectuals, marked an influential milestone in the history of partially racist immigration policies, when two of their members, Sarmiento and Alberdi, described the Argentine future as in need for progress

[14] Values taken from Timmer and Williamson (1998)

and civilization; therefore, the Argentine base population should be destroyed in their view (the eradication of the Indians was achieved in a campaign in the late 1870s), and the Spanish Creole heritage was considered a negative influence. The constitution adopted in 1853 and inspired by Alberdi's thoughts was very open towards immigration. The foreign born were in some respect in a better position than Argentine citizens, since they were given all the advantages the latter enjoyed and were exempt from certain obligations, like military service, that weighed upon the citizens (Willcox, 1931).

The period up to 1876 was marked by spontaneous immigration, because the government believed that the necessity was not given for reinforcing "artificial" immigration (i.e. immigration with subsidies). However, during the following years artificial immigration was set up. It was encouraged by the government in forms of advancing passage money to immigrants in the 1880s. In addition, agents were sent to and hired in European countries to encourage emigration to Argentina. Subsidies were abandoned in 1890, when the government realized that huge waves of immigrants came even without artificial incentives. First restrictions on the entry of second and third class passengers were formulated in the mid-1890s and by the beginning of the new century the "open door" policy was gradually replaced by a "closing the doors" policy (Castro, 1991). [15]

Timmer and Williamson (1998) constructed an immigration policy index (Figure 7.4). We inverted this index so that higher values in the figure indicate a more restrictive immigration policy, and compare the index to the development of height selectivity of Southern Europeans (Spaniards and Italians). Height selectivity is defined as the difference of mean heights of migrants minus mean heights of those remaining in the source country. Immigrants were mostly positively selected when the immigration index turned restrictive after the early 1890s. The selectivity series of Italy and Spain moved with the policy index towards more positive selectivity.

Studying real wages in the Americas, Timmer and Williamson (1996) point out that the inequality increase in immigrant nations had become a motivation to make immigration policy more restrictive, because workers perceived immigrants as

[15] Restricting the entry of disabled people or individuals suffering from disease, of people exercising immoral professions, criminals and the political undesirable (anarchists), and individuals over 60 years old.

competitors on the labor market segment of low incomes. In the 19th century landed interests were largely in control of immigration policy and encouraging immigration. With the start of the 20th-century immigration policies, Argentina became more restrictive, reflecting partly the fears of native-born unskilled Argentineans. Furthermore, some political left-wing immigrants were challenging the traditional elite's political and social predominance, which is why restrictions were imposed to the entry of politically undesirable migrants (Solberg, 1970).

When the Great Depression shattered the international economic system, the resulting unemployment crisis in Argentina compelled the government in 1931 to abandon the "open-door" policy. The admission of immigrants was strongly regulated which resulted in an almost complete stop of persons entering the country. The only exceptions were those who possessed a capital of 1,500 pesos or had relatives in the country or were returning after a temporary absence. Moreover, the Argentine government continued settlement projects for which migration was admitted (International Labour Office, 1937).

7.4 Results

7.4.1 Selectivity of Regions

Our interest is in determining how Argentine immigrants were selected and what factors influenced the process of self-selection into migration. For that purpose, we first take a glance at our selectivity variable during the decades from the 1900s to the 1930s (Figure 7.5). Migrants were almost entirely positively selected, just as we basically would expect. The only exceptions were the Eastern Europeans in the 1920s and 1930s. The development of Eastern European selectivity might be explained by chain migration effects. In the first two decades of the 20th century, migrants were positively selected, whereas during the following two decades negatively selected migrants came from Eastern Europe. During the 1920s and 1930s Eastern European migrants with shorter height might have followed friends and relatives to Argentina after receiving remittances and pre-paid tickets. Hence, we conclude that the upward trend of selectivity of Figure 7.4 was not the only development, but other factors played a role as well.

The Spanish case is quite interesting because we find very strong positive selection which was rising over time. Migrants were even 2.8 cm taller during the later period, compared to the population remaining in Spain in the 1930s.[16] The restrictive Argentine immigration policy might have played a role in selecting only the most fortunate people to immigrate. Another determining factor of the overall positive selectivity might have been poverty constraints. Sánchez-Alonso (2000) argued that Spanish emigration was income constrained; especially the impact of the Spanish currency depreciation from 1892-1905 made it more difficult to migrate, so that only the wealthier social strata could afford the move.

Italians were less positively selected than Spanish people. Hatton and Williamson (1998) suggest that the chain migration effect was particularly important for Italian emigration. This might be a possible explanation why Italian migrants were less than 1 cm taller than those who stayed at home.

Turning to Middle East countries, we find that migrants were positively selected. The Ottoman emigration to Europe and the Americas was not only religiously determined, as suspected by the early literature, but followed partly a similar economic and political logic as other migration streams (Karpat, 1985). İpek and Çağlayan (2006) describe high emigration rates after the Ottoman administration introduced compulsory military service for the entire population. Potential migrants aimed at escaping the law. Karpat (1985) mentions that later Middle Eastern emigrants were often people of some means, drawn to the New World by the prospect of increasing their wealth, such as merchants.

Latin Americans were positively selected, with declining height differences until the 1920s, but their selectivity values always remained high. In the 1930s it rose again to a difference of 4 cm. Poverty constraints might have played a strong role and kept poorer people from immigrating to Argentina.

While the literature argued that only some immigrants were positively selected depending, for example, on the level of unequal income distribution at home (Borjas, 1987) or social networks abroad (Massey, 1988), we find that in terms of biological well-being, immigrants to Argentina during the period from the 1900s to the 1930s were almost exclusively positively selected. We find sufficient variability in the level of

[16] Moreover, the Spanish Civil War in the late 1930s probably compelled some highly skilled Spaniards which were not inclined to support an upcoming dictatorship.

selectivity by region of origin which suggests testing the influences on our selectivity measure with multiple regression analysis.

7.4.2 Determinants of Selectivity: Regression Analysis

To determine which factors influence the selectivity of migrants, we use panel data consisting of ten-year averages of the different political, cultural, social, and geographical variables. Among the 59 countries of origin, 22 showed a sufficient number of migrants to be analyzed. The regressions are displayed in Table 7.3; the corresponding descriptive summary of the analysed variables are reported in Table 7.4; the dependent variable is the selectivity of migrants (the height difference of migrants to source country inhabitants). We control with dummy variables for unobserved time effects in all regression models, and for country fixed effects in model 4. Additionally, all regressions are weighted by the square root of the number of cases to increase the efficiency of the estimates. All standard errors are heteroskedasticity-robust estimates, and adjusted for clustering at the country level.

Immigration policy seems to have played the expected role in determining the selectivity of our migrants. It always shows the expected positive sign, and the results are statistically significant. The idea that more restrictive policy leads to a set of immigrants who are taller and probably healthier is confirmed in the results of our analysis. Chiswick (1986) suggested similar results for US post-war policy favoring skills that resulted in an increase in highly selected immigrants from Asia, but this study is the first to find such an effect for the pre-1950 migration experience.

The friends and relatives effect -- measured as the share of migrants from a specific source country and migrating to a destination country in the previous decade -- yields also quite a consistent result. The coefficient has always the expected negative sign, and is significant in the first three models. Only if we include both time and country fixed effects, the coefficient gets insignificant. We conclude that if the existing migrant stock is large in the destination country, the shorter part of the population will follow on pre-paid tickets and remittances sent by their families and friends. This finding supports similar results of the literature. Massey (1988) argues that social networks steadily lower the costs of emigration, maximize earnings, and minimize risks.

The author uses the Mexican case to demonstrate how migrant networks in the United States later influenced migrants' selectivity negatively.

Another consistent result is our poverty constraint variable, which is approximated by height in source country. The shorter the population in a source country, the more should immigrants be constrained by poverty. All four models display a highly significant negative coefficient. Migrants from countries with a poorer standard of living are positively selected. We can conclude that poverty constrained the mobility of the lower social classes because transportation costs might have been too expensive. This result confirms the findings of Sánchez-Alonso (2000) for Spain and the author's theory of income restrained emigration in the late 19th and early 20th century. Following the argument, we introduce a variable to our model, which measures the raw distance between the most populated places in our countries and includes the decade specific transportation costs.[17] The coefficients are not statistically significant.

Language affinity and cultural similarities reflect the degree to which immigrants were easily able to acquire the relevant skills and knowledge to compete with native-born workers on equal terms (Hatton and Williamson, 1998). We use a dummy variable for source countries with a common language which results in a positive selection of our migrants; however, the coefficient is not significant.

We also test for relative democracy because migrants could have been attracted by higher democracy values in the destination country, relative to the source country. Please note that even if Argentina would have lower democracy values than the source country, this variable could have an effect on preventing immigration of highly skilled individuals for whom the relative participation possibility might be an issue in the migration destination decision. A dummy variable for civil war in a certain decade is introduced to measure the effect on migrants; however, both political determinants do not yield any significant result. One possible explanation could be that only a minority might have migrated for political reasons – or did not migrate, if the relative democracy values in the target were not attractive. Most of the migrants probably based their decision on economic reasoning.

[17] Values from Vázquez-Gonzalez (1988)

7.5 Conclusion

This study demonstrates that height information is useful to assess the selectivity of migrants. We find that most immigrants to Argentina during the period from the 1900s to 1930s were positively selected in comparison to the population in the source country. To explain these differences, we included political, social, cultural, and geographical factors in the analysis. Results show that, most notably, immigration policy, poverty constraints, and chain migration played an important role in determining the selectivity of migrants. The Spanish and Italians made up almost 70 percent of the immigration stream to Argentina and it becomes quite clear that existing networks abroad and prevailing poverty in Europe had been an important issue for these countries. The distance to Argentina seemed to be less of a concern for migrants, which might be due to the strong and consistent friends and relatives effect, consisting of pre-paid tickets and remittances that were sent home, as well as letters that contained information about prospects abroad. Other possible determining factors of migrant selectivity do not yield significant results, apart from a small positive effect of speaking the same language.

We placed our focus on the characteristics of migrants and the determinants of their selective behavior. Most importantly, this study provides further aspects to research for anthropometric historians, demographers and economists interested in the selectivity of migrants. The use of height proved once more to be a useful measure of the quality of life and to explain migration patterns. Moreover, the positive selection of migrants to Argentina at the beginning of the 20th century could be seen as part of the growth process of the country. The country's economic success during the turn of the 20th century was mainly achieved due to the great help of hard working immigrants.

7.6 References

Adelman, J., 1995. European Migration to Argentina, 1880-1930. In: Cohen, R. (Ed.), The Cambridge Survey of World Migration, Cambridge University Press, pp. 215-19.

Baily, S. L., 1983. The Adjustment of Italian Immigrants in Buenos Aires and New York, 1870-1914, *The American Historical Review*, 88 (2), pp. 281-305.

Baten, J., Pelger, I. and Twrdek, L., 2009. The Anthropometric History of Argentina, Brazil, and Peru During the Nineteenth and Early Twentieth Century, *Economics and Human Biology*, 7 (3), pp. 319-33.

Boëtsch, G., Brus, A., Ancel, B., 2008. Stature, Economy and Migration During the Nineteenth Century: Comparative Analysis of Haute-Vienne and Hautes-Alpes, France, *Economics and Human Biology*, 6 (1), pp. 170-80.

Borjas, G.J., 1987. Self-Selection and the Earnings of Immigrants, *American Economic Review*, 77, pp. 531-53.

Castro, D. S., 1991. The Development and Politics of Argentine Immigration Policy, 1852-1914: to Govern is to Populate. Mellen Research University Press, San Francisco.

Chiswick, B.R., 1986. Is the New Immigration Less Skilled Than the Old?, *Journal of Labor Economics*, 4 (2), pp. 168-92.

Cortés Conde, R., 2009. The Political Economy of Argentina in the Twentieth Century. Cambridge University Press, New York.

Cortés Conde, R., 1979. El Progreso Argentino, 1880-1914. Editorial Sudamericana, Buenos Aires.

Danubio, M. E., Amicone, E., Vargiu, R., 2005. Height and BMI of Italian Immigrants to the USA, 1908-1970, *Economics and Human Biology*, 3 (1), pp. 33-43.

Devoto, F. J., 2003. Historia de la Immigración en la Argentina. Editorial Sudamericana, Buenos Aires.

Feliciano, C., 2005. Educational Selectivity in U.S. Immigration: How do Immigrants Compare to Those Left Behind?, *Demography*, 42 (1), pp. 131-52.

Gould, J., 1979. European Inter-Continental Emigration 1815-1914: Patterns and Causes, *Journal of European Economic History*, 8 (3), pp. 593-679.

Hatton, T. J., Williamson, J. G., 2004. International Migration in the Long Run: Positive Selection. Negative Selection and Policy. IZA DP No. 1304.

Hatton, T. J., Williamson, J. G., 1998. The Age of Mass Migration: Causes and Economic Impact. Oxford University Press, New York.

Hatton, T. J., Williamson, J. G., 1993. Late Comers to Mass Emigration: the Latin Experience, *NBER Historical Paper* No. 47.

Humphries, J., Leunig, T., 2009. Was Dick Whittington Taller Than Those He Left Behind? Anthropometric Measures, Migration and the Quality of Life in Early Nineteenth Century London, *Explorations in Economic History*, 46, pp. 120-31.

International Labour Office, 1937. International Labour Review, Vol. XXXV, January-June, Geneva.

İpek, N., Çağlayan, K. T., 2006. The Emigration From the Ottoman Empire to America, *International Journal of Turkish Studies*, 12 (1&2), pp. 29-43.

Issawi, C. (Ed.), 1966. The Economic History of the Middle East 1800-1914. University of Chicago Press, Chicago and London.

Karpat, K.H., 1985. The Ottoman Emigration to America, 1860-1914, *International Journal of Middle East Studies*, 17 (2), pp. 175-209.

Klein, H. S., 1983. The Integration of Italian Immigrants into the United States and Argentina: A Comparative Analysis, *American Historical Review*, 88 (2), pp. 306-29.

Komlos, J., Baten, J., 2004. Looking Backward and Looking Forward: Anthropometric Research and the Development of Social Science History, *Social Science History*, 28 (2), pp. 191-210.

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

Lee, E.S., 1966. A Theory of Migration, *Demography*, 3 (1), pp. 47-57.

López, J. S., 1954. La Estatura de los Españoles e Italianos Naturalizados en la Argentina, *Anales del Instituto Étnico Nacional*, tomo III, p. 39-52.

Manzel, K., 2009. Human Capital Development and the Impact of the Hungry Forties in Spain, *Working Paper*, University of Tuebingen.

Massey, D.S., 1988. Economic Development and International Migration in Comparative Perspective, *Population and Development Review*, 14 (3), pp. 383-413.

República Argentina, 1916. Tercer Censo Nacional, 1914, 10 vols. Buenos Aires, 1916.

Saliba, N. E., 1983. Emigration from Syria. In: Abraham, S.Y., Abraham, N. (Ed.), Arabs in the New World. Studies on Arab-American Communities, Wayne State University, pp. 30-43.

Salvatore, R., 2007. Heights, Nutrition and Well-Being in Argentina, ca.1850-1950: Preliminary Results. *Journal of Iberian and Latin American Economic History*, 25 (1), pp. 53-86.

Sánchez-Alonso, B., 2000. Those Who Left and Those Who Stayed Behind: Explaining Emigration from the Regions of Spain, 1880-1914, *Journal of Economic History*, 60 (3), pp. 730-55.

Sánchez-Alonso, B., 2007. The Other Europeans: Immigration Into Latin America and the International Labor Market, 1870-1930, *Revista de Historia Económica (Journal of Iberian and Latin American Studies)*, XXV (3), 2007, pp. 395-426.

Sánchez-Alonso, B., 1988. La Emigración Española a la Argentina, 1880-1930. In: Sánchez-Albornoz, N. (Ed.), *Españoles Hacia América. La Emigración en Masa, 1880-1930*, Alianza Editorial Madrid, pp. 205-34.

Solberg, C., 1970. Immigration and Nationalism. Argentina and Chile, 1890-1914. University of Texas Press, Austin and London.

Steckel, R. H., 2009. Heights and Human Welfare: Recent Developments and New Directions, *Explorations in Economic History*, 46 (1), pp. 1-23.

Steckel, R. H., 1995. Stature and the Standard of Living, *Journal of Economic Literature*, 33 (4), pp. 1903-40.

Stolz, Y., Baten, J., 2010. Brain Drain, Skill Premia and Human Capital Selectivity of International Migrants, 1850-1910: Reassessing the Roy-Borjas Model, *Working Paper*, University of Tuebingen.

Timmer, A. S., Williamson, J. G., 1996. Racism, Xenophobia or Markets? The Political Economy of Immigration Policy Prior to the Thirties, *NBER Working Paper* No. 5867.

Timmer, A. S., Williamson, J. G., 1998. Immigration Policy Prior to the 1930s: Labor Markets, Policy Interactions, and Globalization Backlash, *Population and Development Review*, 24 (4), pp. 739-71.

Twrdek, L., 2010. Argentine Biological Welfare: a Case of Convergence? A Study About Inter-/Intra-Regional Differences in the Interior Provinces During Argentina's Golden Age, 1875-1914, *Working Paper*, University of Tuebingen.

Ulyses Balderas, J., Greenwood, M.J., 2010. From Europe to the Americas: a Comparative Panel-Data Analysis of Migration to Argentina, Brazil, and the United States, 1870-1910, *Journal of Population Economics*, 23 (4), pp. 1301-18.

Vázquez González, A., 1988. La Emigración Gallega. Migrantes, Transporte y Remesas. In: Sánchez-Albornoz, N. (Ed.), Españoles Hacia América. La Emigración en Masa, 1880-1930, Alianza Editorial Madrid, pp. 80-104.

Willcox, W. (Ed.), 1931. International Migrations, Volume II, Interpretations, New York.

7.7 Appendix

7.7.1 Tables

Table 7.1: Characteristics of the Sample

Feature		Share in the Sample	Cases
Total Data Set		100.0	11066
World Region	Eastern Europe	10.2	1,132
	Western Europe	4.4	484
	Latin America	9.6	1,063
	Middle East	6.7	742
	Italy	35.8	3,959
	Spain	31.7	3,505
Skills	Literate	93.5	10,350
	Drive	26.1	2,885
Decade of Migration	1900	21.9	2,420
	1910	29.4	3,249
	1920	39.6	4,381
	1930	9.2	1,016
Residence	Urban	86.2	9,541
	Rural	13.8	1,525

Notes: The following countries were grouped into world regions:

Western Europe: Germany/Prussia, Austria, Belgium, Denmark, Finland, France, Netherlands, Great Britain, Ireland, Luxemburg, Norway, Sweden, Switzerland

Eastern Europe: Albania, Bulgaria, Czech Republic, Croatia, Estonia, Hungary, Lithuania, Poland, Romania, Russia, Ukraine, Yugoslavia, Montenegro

Southern Europe: Italy, Spain, Portugal, Greece, Gibraltar

Middle East: Arabia, Armenia, Egypt, Israel, Lebanon, Morocco, Ottoman Empire, Persia, Syria, Turkey

Latin America: Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Honduras, Mexico, Nicaragua, Paraguay, Peru, Uruguay, Venezuela

Other: South Africa, Australia, China, India/"Indostan", Japan, North America

Table 7.2: Occupational Structure of Migrants from World Regions (as a Percentage of Total Number of Migrants From Region), All Decades Included

Eastern Europe		**Italy**		**Spain**	
Skilled	29.2	**Unskilled**	32.7	**Employees**	30.5
Commerce	27.6	**Skilled**	32.3	**Unskilled**	25.4
Unskilled	17.8	**Employees**	15.9	**Skilled**	17.1
Professional	12.4	**Commerce**	9.9	**Commerce**	14.0
Employees	10.4	**Professional**	6.0	**Professional**	9.1
Farmers	1.6	**Farmers**	2.4	**Farmers**	3.2
Western Europe		**Middle East**		**Latin America**	
Skilled	31.2	**Commerce**	58.2	**Unskilled**	31.1
Professional	24.0	**Unskilled**	20.5	**Employees**	29.2
Employees	20.7	**Employees**	8.4	**Skilled**	19.3
Commerce	12.6	**Skilled**	5.9	**Professional**	10.8
Unskilled	8.5	**Professional**	5.7	**Commerce**	5.7
Farmers	2.7	**Farmers**	0.8	**Farmers**	2.5

Table 7.3: WLS Regression Analysis: Determinants of Migrant Selectivity

Dep. Var.: Height Difference in cm	(1)	(2)	(3)	(4)
Selective Policy	0.62***	0.71***	0.69***	0.56*
	(0.0088)	(0.0035)	(0.0034)	(0.066)
Friends & Relatives	-0.41***	-0.41***	-0.41***	-0.94
(log Migrant Share)	(0.0037)	(0.0039)	(0.00075)	(0.51)
Absence of Poverty Constraint	-0.58***	-0.62***	-0.63***	-0.97***
(Height in Source Country)	(0.000047)	(0.0000030)	(0.00000012)	(0.0018)
Migration Cost	0.06	-0.11		
(log dist*cost per km)	(0.77)	(0.67)		
Language	0.56*			
	(0.076)			
Civil War		-0.59		
		(0.25)		
Relative Democracy				-0.06
				(0.53)
Time Fixed Effects?	YES	YES	YES	YES
Country Fixed Effects?	NO	NO	NO	YES
Constant	96.40***	104.84***	106.27***	164.13***
	(0.000029)	(0.00000087)	(0.000000089)	(0.0017)
Observations	74	74	74	61
R-Squared	0.54	0.54	0.53	0.85

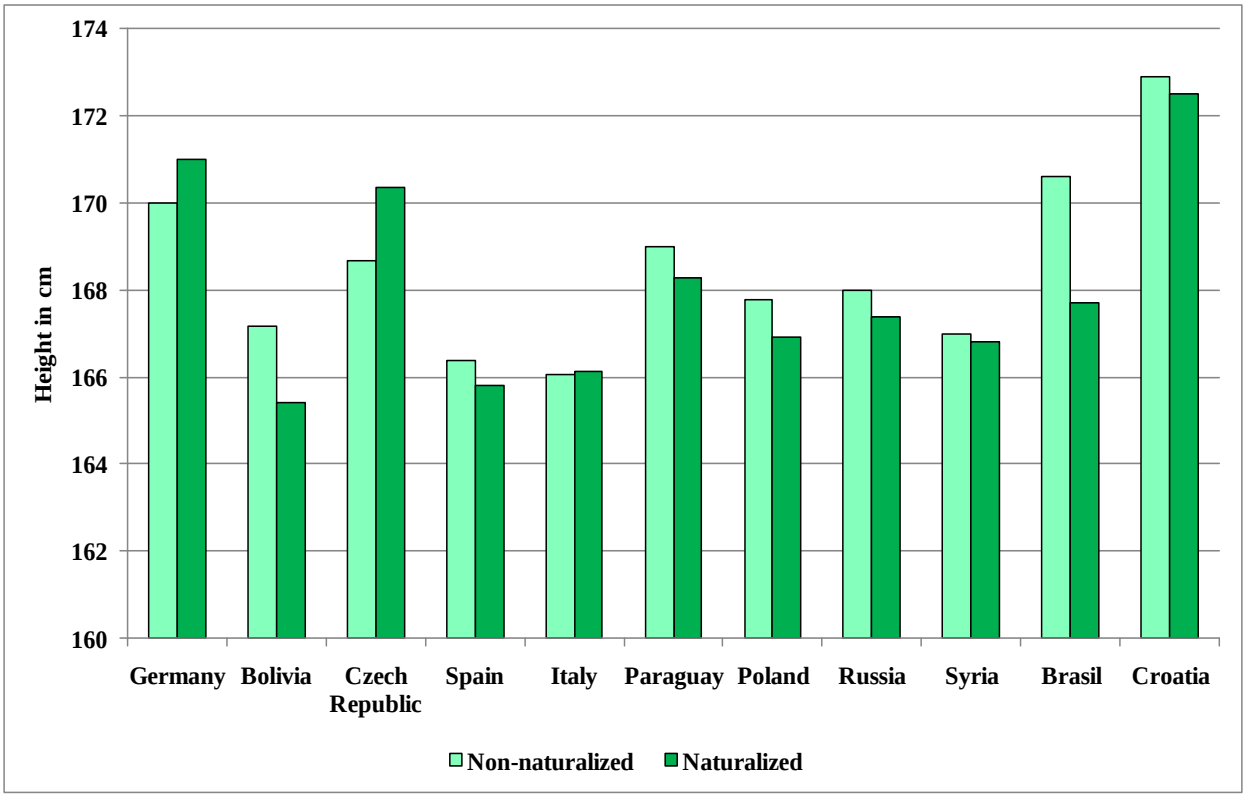
Notes: ***/**/* indicates significance at 1, 5 or 10% significance level, respectively. P-values based on robust standard errors in parentheses. All regressions are weighted by the square root of the number of cases. Regression 1-3 are specified as random effects, regression 4 includes country fixed effects. We use cluster-adjusted standard errors (for the countries). Cases with more than 10 height observations were included. Countries that could be included due to sufficient sample size were: Austria, Brazil, Switzerland, Czech Republic, Germany, Spain, France, Greece, Croatia, Hungary, Chile, Italy, Ottoman Empire, Lithuania, India, Poland, Rumania, Russia, Peru, Portugal, Bolivia, Paraguay.

Table 7.4: Descriptive Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
Height Selectivity	74	1.75	2.56	-3.54	9.64
Selective Policy	74	1.70	0.83	0.50	2.5
Height in Source Country	74	166.71	2.98	160.00	175.1
Friends & Relatives (log Migrant Share)	74	-0.19	2.12	-4.94	3.809
Migration Cost (log dist*cost per km)	74	7.53	0.89	5.32	8.461
Relative Democracy	61	-0.91	3.20	-8.20	4
Language	74	0.24	0.43	0.00	1
Civil War	74	0.14	0.34	0.00	1
Migration Decade	74	1914.46	10.49	1900	1930

7.7.2 Figures

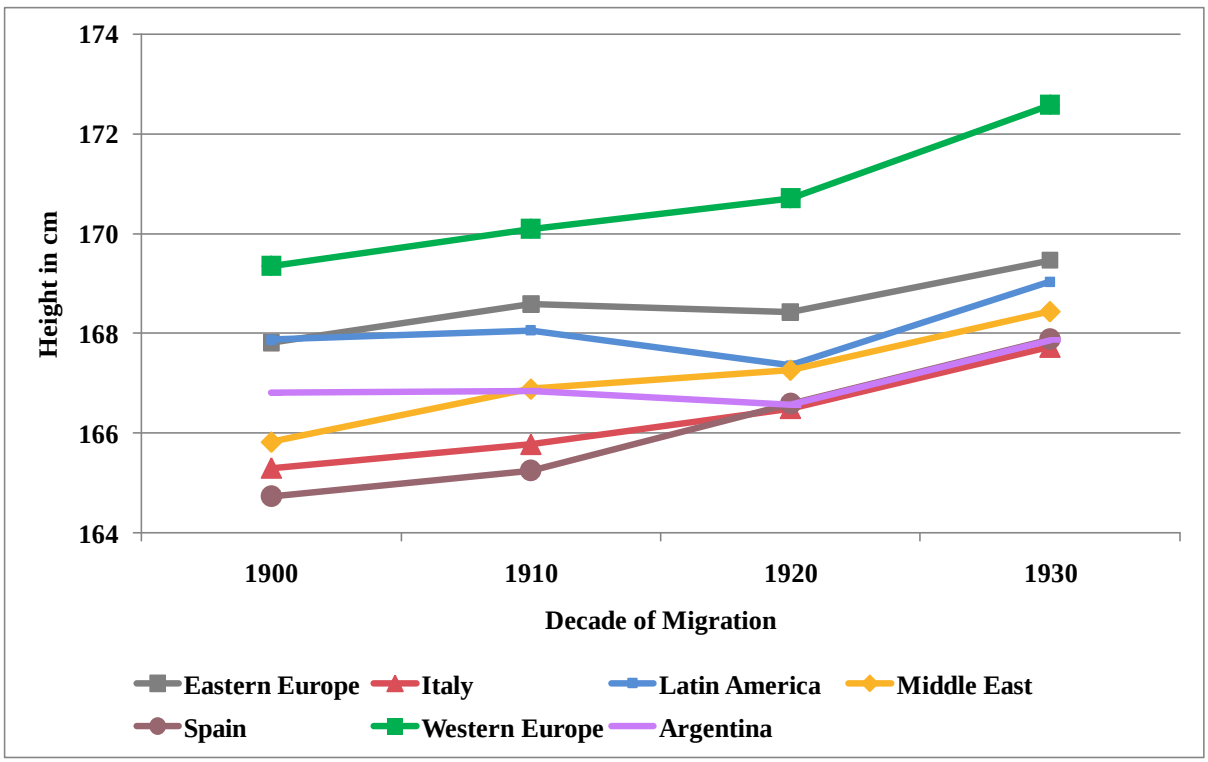
Figure 7.1: Mean Heights of Naturalized vs. Non-Naturalized Immigrants



Note: For the comparison, only countries with case numbers>20 have been included. Please note that we organized all countries by modern borders (as of 1990), using the place-level information in the sources.

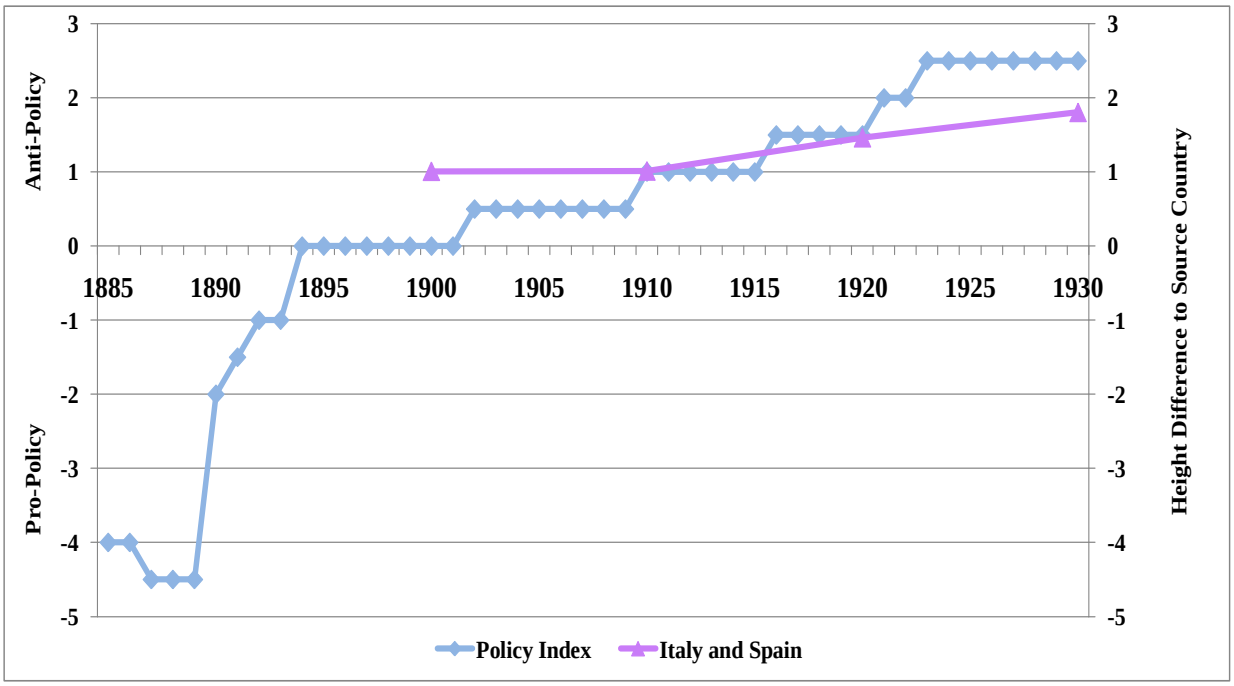
Figure 7.2: Migrants From All Countries by Occupation and Migration Decade (as a Percentage of Total Number of Migrants), 1900-30

Figure 7.3: Height Trends of Migrants by World Region in Comparison to Argentina, Decades of Migration 1900-30



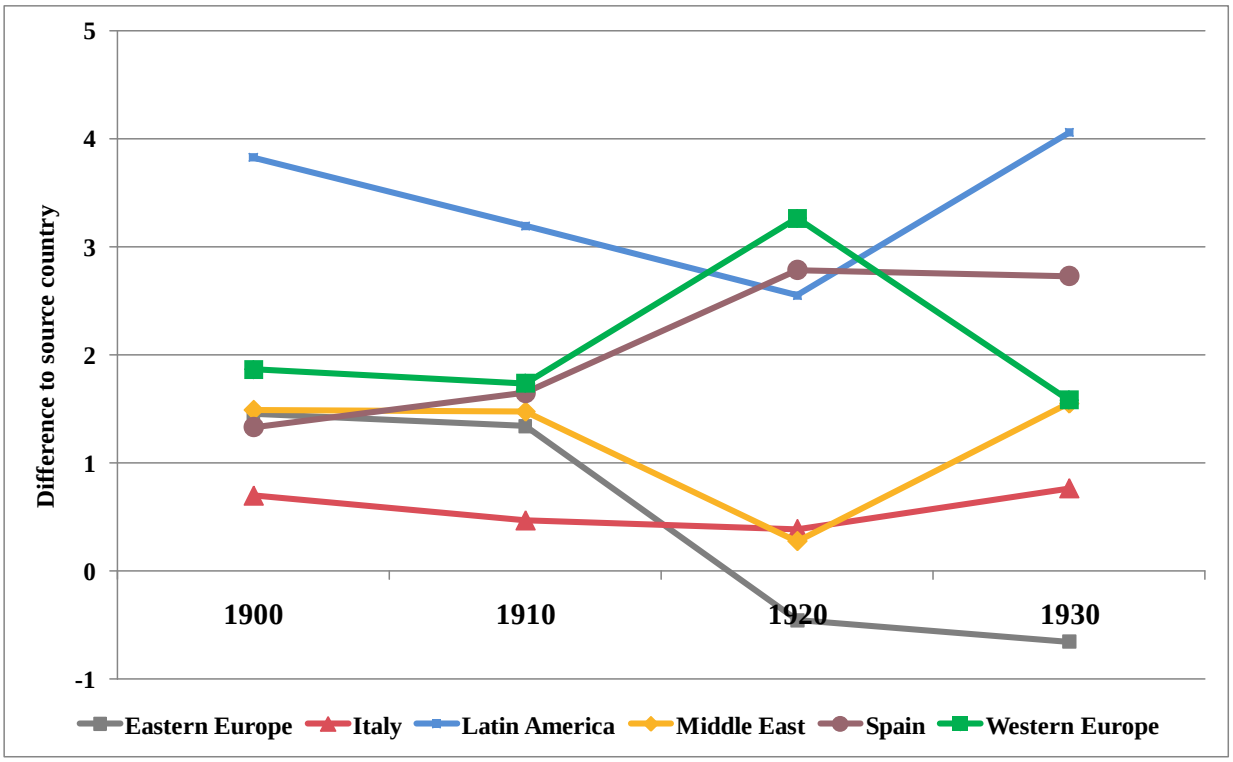
Source heights for Argentina: see Baten, Pelger, Twrdek (2009) and Twrdek (2010).

Figure 7.4: Immigration Policy Index and Selectivity of Migrants, 1885-1930



Source Immigration Policy Index: Timmer, A.S., Williamson, J.G. (1998)

Figure 7.5: Height Selectivities, 1900-30



7.7.3 Sources of Independent Variables

- **Immigration Policy**

We thank Jeffrey G. Williamson for making his data set available to us.

Timmer, A.S., Williamson, J.G., 1998. Immigration Policy Prior to the 1930s: Labor Markets, Policy Interactions, and Globalization Backlash, *Population and Development Review*, 24 (4), pp. 739-71.

- **Relative Democracy**

Estimates of democracy produced by Polity IV project available at:

http://www.systemicpeace.org/polity/polity4.htm

Missing values were created for the years where special values were given (-66, -77, -88). Mean values of democracy index for each decade were used.

- **Civil War**

Data from the Correlates of War project available at:

http://www.correlatesofwar.org/

- **Height in Source Country**

Comparison of heights in source country with other source country heights, based on Baten and Blum (2011): Growing Tall, but Unequal: Biological Well-Being in World Regions and its Determinants, 1810-1989, *Working Paper*, University of Tuebingen. see http://www.uni-tuebingen.de/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/Uni_Tuebingen/Fakultaeten/WiSo/Wiwi/Uploads/Schulung/Schulung5/Paper/baten_blum_wh101025.pdf&t=1303376887&hash=456db2e27532c5f2e37b3709770c8727fabad1bc last accessed September 24th, 2010.

- **Migrant Stock (Friends and Relatives Effect)**

The migrant stock is calculated using the percentage of immigrants from a specific country (relative to all immigrants) in the 1895 and 1914 censuses. For the missing decade of migration of 1900 we interpolated linearly. For the missing decades of the 1920s and 1930s we used growth rates of all migrants (without nationality information)

from the 1947 census and added this to the particular migrant group from the 1914 census.

Since we only have the information about the total number of migrants from the Austro-Hungarian Empire, we calculated the share of a particular migrant group from our data set for the following countries: Austria, Hungary, Croatia, Czech Republic and Poland, to derive absolute migrant stock numbers for those countries. Corresponding values for Lithuania are derived from the Russian Empire.

- **Distance**

This variable is measured by distance in kilometers from main city in source country to destination Buenos Aires. Source: http://www.cepii.fr/anglaisgraph/bdd/distances.htm Additionally, transportation costs taken from: Vázquez-Gonzalez, A., 1988. La Emigración Gallega. Migrantes, transporte y remesas. In: Sánchez-Albornoz, N. (Ed.), Españoles hacia América. La Emigración en Masa, 1880-1930, Alianza Editorial Madrid, pp. 80-104. Costs of passage in constant prices (pesetas 1913) from Galician port, where most Spaniards came from, used as a reflection of average worldwide transportation costs (passage fares).

8 Summary and Directions for Future Research

Heights are by now a well established measure of living standards and are used extensively in the fields of economic history and other social sciences. This measure captures various aspects of well-being that conventional measures such as GDP per capita or incomes can hardly seize. Average height is influenced by the consumption of basic necessities, which are nutrition, housing, and adequate clothing, among others. These inputs to health have a direct influence on final adult stature, and the demands on those inputs such as physical activities or disease are indirectly influencing the outcome of each individual's stature.

New methods give anthropometric measures a great potential to study research questions concerning the socio-economic performance of a country, inequalities, or gender issues. Data sources are still being uncovered, and times and places can be studied for which conventional measures are lacking.

One of those places is the Latin American continent. This region seems promising when one compares the latest development of real GDP growth or the Human Development Index with more advanced countries. Still, social and economic inequality is the major problem on the continent because it hinders the countries to develop their full economic potential and has a negative impact on living standards.

Research on Latin American anthropometrics describes different socio-economic factors that can serve for a better understanding of the well-being during the colonial and post-colonial period. Differences by occupational groups or between ethnicities can help explaining the degree of inequality within a population.

Chapter 3 dealt with the anthropometric history of Argentina, Brazil, and Peru, where regional and social differences as well as welfare trends were assessed. While Argentina grew substantially during the late 19th and early 20th century in terms of GDP, heights stagnated on a relatively high level. This result confirmed Salvatore's earlier findings on Argentine biological welfare that seemed puzzling because in spite of high

economic welfare, biological welfare did not increase. Still, the middle class in Argentina fared much better than the lower class. Farmers were the only social group that benefitted from the wheat and meat export boom.

Brazil, on the other hand, grew little in terms of GDP during the 19th century. Biological welfare increased only by the end of the 19th century, and regional differences were clearly visible; people from the South/Southwest had a higher standard of living than people in the Northeast. These findings support the notion that plantation economies throughout Latin America experienced worse living conditions than cattle- and grain-producing regions. Additionally, significant height differences among the rich and poor strata of the society were well pronounced.

A smaller data set on heights in Lima, Peru, was studied in this chapter which revealed that living standards in Lima remained on a modest level, and were stagnant throughout the 19th century. Comparing the values with those of Brazil described a better standard of living in Brazil than for the inhabitants of Lima.

Chapter 4 dealt with Peruvian living standards in greater detail. With an extended data set on heights covering the entire country, it could be demonstrated that 19th-century Peruvian whites benefited from guano wealth, and that the lower class did not benefit from profits generated by the guano-export market. Instead, the latter suffered from rising prices and unemployment, and the disease environment remained unhealthy throughout the century.

Social inequality was very pronounced during the 19th century, and did hardly change. Inequality between Indians and blacks was persistent and high; so was the socio-economic gap between Indians and whites which actually widened during the period under observation. Peruvian blacks were quite tall and over towered even the white population. Occupational and regional inequalities in 19th-century Peru were largely determined by the ethnic classification, which led to the conclusion that ethnicity was the driving force behind the process of generating a separated society in the 19th century.

The ethnic classification of the society is also of importance in Cuban colonial history. Chapter 5 dealt with the development of living standards in Cuba from the first war of independence until the early 20th century with a special focus on inequality between the black and white population. Cuba was one of the last countries in Latin America to become independent from Spanish colonial power in 1898, and the

development of living standards revealed that the country was in a deplorable state by that time. The wars of independence and further the disadvantageous disease environment in general marked this period as very devastating. It was only at the beginning of the 20th century during North American military intervention that living standards began to rise. Investments in sanitation and the reduction of endemic diseases, which was accomplished with foreign assistance, were an indication for this improvement.

The late abolition of slavery in the 1880s did not seem to have an effect on living standards for blacks. Blacks in the underlying sample were actually taller than whites at the end of the 19th century which supports other studies on tall black stature. The relationship between blacks and whites in Cuba was quite harmonious against the end of the colonial period, and it can be concluded that blacks can be as tall as whites when they were integrated in the society like they were in Cuba.

Additionally, data on BMI in the early 20th century was studied which revealed that Cubans were almost exclusively in the normal range of the distribution by modern standards. Still, by historical standards, their BMI could have been higher when one compares them with their Mexican contemporaries.

To study further developments in the 20th century, more data is needed. It would be interesting to study whether this improvement with North American intervention was not only a short lived recovery but of long-term value. Of special interest would also be a fuller picture of the post-North American influence which might even lead to a better understanding of the events that followed it.

Subsequent to living standards in Cuba, chapter 6 emphasized another important aspect of Cuban economic history. It discussed Cuban human capital from the late 18th to the mid-19th century. Using the methodology of age heaping as a proxy for basic numeracy served to gain new insights into the educational level of the Cuban population. The literature described the Cuban educational system as hardly progressive, but it could be shown that numerical skills among Cubans were quite well pronounced in the first half of the 19th century. In a comparison with immigrant groups residing in Cuba, Cubans had higher numeracy values, and compared to other Latin American countries, ABCC levels were among the highest in the 19th century.

Ethnic inequality was observed in the early 19th century, but numeracy values for free black people were increasing until the 1850s, so that differences were hardly

discernible during that time. Gender inequality measured with ABCC values was quite low on the island which could be attributed to the strong influence of the plantation system where man and women often had to perform similar tasks.

Further research is required to determine the development of numeracy until the republican period, which might reveal interesting results since Cuba remained under Spanish colonial influence until the end of the 19th century. The decades right before the first war of independence described a stagnating trend of numeracy values which might be reduced again because of the destructive period that followed. It was only in the early 20th century with the help of North American occupants that the government showed interest in educating the masses.

Chapter 7 demonstrated that heights are a useful measure when it comes to determining the selectivity of migrants to Argentina. In this study we found that most immigrants to Argentina in the first three decades of the 20th century were positively selected in comparison to the population in the source country. The focus was placed on the characteristics of migrants and the determinants of their selective behavior. Political, social, cultural, and geographical factors were included in the analysis to explain the reasons behind the selectivity of migrants. The variables that most notably mattered were the Argentine immigration policy, poverty constraints, and chain migration. For countries such as Spain and Italy which made up almost two thirds of the immigration stream to Argentina, existing networks abroad and prevailing poverty in Europe had been important issues in determining who migrated and who stayed at home. This strong friends-and-relatives effect might be the reason why the great distance to Argentina hardly seemed to matter because pre-paid tickets and remittances were sent home regularly by kinship already abroad, as well as letters that contained information about future prospects in the destination country.

The way for future research on the selectivity of migrants has been paved in this study which showed that heights are a useful measure of the quality of life and serves to explain migration patterns. Studying the history of welfare is considered as one of the most important factor that serves to answer questions on human behavior and the corresponding economic and social consequences. People that migrate are mostly looking for improving their current situation and achieving a better standard of living to, I presume, experience greater prosperity and well-being in life.