HEIGHT AND INEQUALITY IN POST-1950 MEXICO: A HISTORY OF STUNTED GROWTH

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ABSTRACT

Using data from two national surveys (ENSA, 2000; ENSANUT, 2006) we assess the evolution of biological standards of living of the Mexican population born during the second half of the 20th century. Our results show that there was an improvement in living standards reflected in an increase in stature, but this amelioration was limited. We observe differences across socio-economic strata, across educational levels, and between men and women. Persistent structural inequality has been byproduct of a system of security and social protection that was limited, segmented and hampered the potentially positive effects of social-welfare policies. We corroborate the relatively modest improvement in heights by comparing outcomes in Mexico with other Latin American countries.

Keywords: Mexico, anthropometric history, standards of living, education, health

JEL Code: N36

RESUMEN

Utilizando datos de dos encuestas nacionales (ENSA 2000; ENSANUT 2006) evaluamos la evolución de los niveles de vida biológicos de la población mexicana nacida durante la segunda mitad del siglo veinte. Nuestros resultados muestran que hubo una mejora en los estándares de

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vida reflejada en un aumento en la estatura, pero esta mejora fue limitada. Observamos diferencias entre los estratos socioeconómicos, los niveles educativos, y entre hombres y mujeres. La persistente desigualdad estructural ha sido producto de un sistema de seguridad y protección social limitado, segmentado y que obstaculiza los efectos potencialmente positivos de las políticas de bienestar social. Corroboramos que esta mejora en estaturas es relativamente modesta al comparar los resultados de México con otros países latinoamericanos.

Palabras clave: México, Historia Antropométrica, Niveles de Vida, Educación, Salud

1. INTRODUCTION

Since its emergence over four decades ago, anthropometric studies have shown that the evolution of human stature can be helpful to examine human welfare and that it is a relevant indicator to calculate a human development index. Although the pioneer studies in the field examined the effects of industrialisation in Great Britain (McKeown 1976; Tanner 1978; Floud *et al*. 2006; Floud 1984; Evelth and Tanner 1990) and on the institution of slavery in the United States (Steckel 1979, 1983, 1995, 1998; Margo and Steckel 1983; Fogel and Engerman 1995; Beinkman and Druker 1988; Komlos 1987, 1993, 1995a, 1995b, 1998, Prince and Steckel 1998) shortly thereafter studies on other parts of Europe began to appear such as on France (Le Roy Ladurie and Berganeau 1979), Germany (Komlos 1985), Spain, (Martínez Carrión 1986) and Sweden (Sandberg and Steckel 1987). By the 1990s there were contributions focused on other world latitudes, such as Korea and Japan (Kimura 1993; Honda 1997); Australia (Whitwell *et al*. 1987) and Canada (Ward and Ward 1984; Ward 1998). Latin American economic historians, too, contributed to the field with studies on Argentina (Salvatore 1998). The studies of Martínez-Carrión and Salvatore have been particularly influential for the study of anthropometric history of Ibero-America. The vast scholarship produced by Martínez-Carrión has given a template that has served as a point of departure for studies in Latin America (Martínez Carrión 2001; Salvatores & Baten 1998; Salvatore 2004, 2007). The Spanish case shared common features with its former colonies. Likewise, Salvatore's extensive work on Argentina has been useful by providing valuable insights on how to approach difficulties such as poor data sources. Since the early 2000s there have been studies that examine the anthropometric history of Mexico, Colombia, Brazil, Chile and Peru.

Some of these studies look at individual country experiences and others have done comparative work[1].

In this paper, we will examine the evolution of biological standards of living of the Mexican population born during the second half of the 20th century and assess how they correlated with the evolution of inequality. This paper is divided into four sections: the first provides a background of the anthropometric history of Mexico, the second reviews the evolution of recent development policies in the Mexican economy, the third analyses the data and discusses the methods and the last section sums up our conclusions.

2. ANTHROPOMETRIC HISTORY OF MEXICO: A BACKGROUND

Although some economic historians have not been convinced of the benefits of using anthropometric measures as indicators of living standards, they have had to acknowledge that they are an indicator of health status and living standards for periods in which there has not been a systematic collection of data of other indicators like prices and wages, and that for more contemporary periods it remains a good measure in countries where there is still poor data collection (Leunig and Voth 2006; Bodenhorn *et al*. 2017)[2]. The problem of poor data collection could also encompass the case of countries where a large number of people operated outside of the monetised economy and/or where the informal sector constituted an important proportion of the GDP. Mexico is a country that falls into this category, hence the possibilities presented by historical anthropometry motivated scholars to assess the evolution of living standards with this methodology. The study of the biological standards of living also proved to be useful to assess inequality. Mexican economic history implicitly assumed that inequality was at the source of many of the country's ills from the colonial period to the present. While no scholar challenged this assertion, there were no systematic attempts to measure it, until 1957, when income distribution was calculated for the first time[3].

In the past 15 years there have been studies published on the anthropometric history of Mexico that examine the second half of the 18th century and the early part of the 19th century (Challú 2009, 2010; Dobado-

[1] For individual country studies, for Mexico see López-Alonso and Porras Condey (2003); for Colombia, Meisel *et al*. (2007); Meisel and Vega 2007a, 2007b; Acosta and Meisel 2013; Baten and Baltzer, 2008; Salvatore et al 2010; for Guatemala Rios 2009; for Brazil, Monasterio *et al*. (2010); Frank and Shelhoub (2006); Franken (this issue); for Chile, Núñez and Pérez (2015); Llorca-Jaña *et al*. (2018); for comparative studies see Baten *et al*. (2009); Baten and Carson (2010); Baltzer and Baten (2008); Challú and Silva-Castañeda, (2016).

[2] Bodenhorn (2017, p. 171), Leunig and Voth (2006, pp. 410–412).

[3] Rosenzweig (1989, p. 132).

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González and García Montero 2010; Grajales-Porras and López-Alonso 2011; Dobado-González and García-Montero 2014; Dobado-González and García-Hiernaux 2017). From this scholarship a debate has arisen on whether living standards at the end of the colonial period were better or worse than in subsequent periods, or simply put, whether there was a divergence or convergence in living standards. Some argue that there was a decline in stature that started as early as the 1730s, which went until the early decades of the 19th century, and that this was due to rising prices in food. For the early decades of the 19th century, adverse climatic condition also contributed to the stunting of the population[4]. Other studies contend that the late colonial period was one of bonanza and that the stature of the Mexican population compared favourably to that of wealthy nations in other world latitudes. These studies concentrate on the military records of the 1791 Revillagigedo Census[5]. Based on the average stature of soldiers, who were the group for whom there is data on stature, at the end of the colonial period the population of Mexico enjoyed a good quality of life compared to some populations in Europe. Therefore, there was not a process of great divergence in living standards in during this period[6].

There was also a long-term study that covers the period 1850–1950 (López-Alonso 2007, 2012). This study assessed the evolution of living standards of the Mexican population with data on stature from military and passport records. In this study, it was possible to ascertain the effects on biological standards of living of the first wave of industrialisation, the Mexican Revolution, the demographic, epidemiological and urbanisation changes. It was also possible to assess whether or not in the Mexican case there had been a synchronicity with the rates of economic growth. This study found trends that challenged the official history of the post-revolutionary period, which argued that living standards of the Mexican population deteriorated during the Porfirio Diaz administration (1876–1910) and improved afterwards with the promulgation of the social legislation in post-Revolutionary era (post 1910). By examining the evolution of living standards with a different chronology, López-Alonso (2012) found that the evolution of living standards was heterogeneous during the 1850–1950 period. The trend in heights of the military moreover differs from that of the passport applicants. Passport applicants get taller over time. The military, on the other hand, experience deterioration and stagnation and do not recover their 1850s heights until 1950. There are regional disparities in both samples; the northerners and *Bajío* (centre west) dwellers are

[4] Challú, (2009, p. 37).
[5] Dobado-González and García Montero (2010); Dobado-González and García-Montero (2014); Dobado-González and García-Hiernaux (2017).
[6] Ibid.

taller than their counterparts in the centre and south. Regional differences are larger in the military sample[7]. The argument of this study is that:

> «Mexicans failed to grow taller during the 1850–1950 period for reasons related to the quality of institutions rather than due to exogenous calamities or a lack of natural resource endowment. Although Mexico underwent modernisation and industrialisation that promoted economic growth and development, these societal advances were attained with persistent social inequality. The vast majority of the population continued to live under preindustrial conditions—poverty, slow growth, poor health, widespread illiteracy and rural habitation—well into the 20th century»[8].

A more recent study has tried to connect historical height databases with current census databases to assess secular trends in heights of the Mexican population in a long-term perspective looking at the period 1850–1986 (López-Alonso and Vélez-Grajales 2015, 2017). Although the data sources were of a different nature and could not be examined in the same econometric exercise, they gave a first approximation that suggested two main points: they could be used together for a long-term analysis, and the series behaved both as an indicator of human development and of the evolution of inequality.

In a study in the late 20th century, Challú and Silva-Castañeda (2016) examine the stature of adult women from different Latin American nations. They argue that the evolution of heights over the last decades of the 20th century behave like indicators of human development and show a steady increase of 2.6 cm. Furthermore, such steady increase compares favourably to other developing regions of the world, but less so with recently developed countries. However, height gains were not evenly distributed in the region. Countries that achieved higher levels of income, such as Brazil, Chile, Colombia and Mexico, gained on average 0.9 cm per decade, while countries with shrinking economies, such as Haiti and Guatemala, only gained 0.25 cm per decade[9]. Not wanting to be too conclusive in their arguments, the authors present their findings as an invitation to test their hypothesis in more country-specific studies.

Mexican anthropometric history has revealed to this point that stature is a good measure to examine the evolution of living standards in the long run and that it has been effective for assessing inequality; indeed, it has sparked interesting debates. This paper seeks to contribute to the

[7] López-Alonso (2012, p. 127).
[8] Ibid, p. 129.
[9] Challú and Silva-Castañeda (2016).

extant scholarship by picking up where previous studies stop and delving deeper into the questions that have been posed. We will assess whether the trends found in the period (1850–1950) persist or not when we examine the evolution of stature for the post-1950, based on social stratification and intergenerational mobility. Second, we will assess if there are sexual disparities among men and women beyond the height difference that is natural with sexual dimorphism[10]. Third, we will see whether or not the evolution of height of the Mexican population moved in the same direction as GDP per capita to note the effectiveness of welfare policies throughout this period, given that the government's rhetoric emphasised its commitment to improve the well-being of the population at large.

The argument that we advance in this study is that the stature of the Mexican population increased for cohorts born in the last half of the 20th century as a result of government policies geared to increasing productivity and economic growth while it enacted social legislation, land redistribution and the creation of welfare institutions. Still, the rate of growth in stature was limited by the challenges of economic downturns and persistent structural inequality. We observe differences in the trajectory of biological standards of living standards across social strata and between men and women.

The differences are the result of a welfare system that was designed to favour a limited segment of the population who needed assistance. Although government authorities assumed welfare policies would be conducive to improving the well-being of the population at large and did establish a more egalitarian state, they created a system of social security that was limited and segmented. We therefore observe a mediocre overall improvement driven by a very meagre increase in heights among the lower strata of the population.

Starting in 1950, there is an inflexion point in the economic history of Mexico that has important repercussions for the study of the evolution of living standards of the population. The quality of data collected improved significantly due to governmental efforts; there was also interest in assessing inequality that translated into the first measurement of income inequality in the country in 1957. The data produced in conjunction with the current surveys give us information on both inputs that led to improvements in living standards, namely the resources that went into social development programmes, as well as information on the outputs. The evolution of anthropometric measures in correlation with the evolution of social stratification can show how effective were those programmes.

[10] Adult men are on average 12–13 cm taller that adult women.

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3. DEVELOPMENT POLICIES IN THE MEXICAN ECONOMY FROM 1950 TO 2000[11]

In the last half of the 20th century, Mexico was already both a modern and backward nation. These contrasts were byproduct of the process of growth with inequality of the previous century and they would continue to impact its economy, its political system, its society and the well-being of its people. In the first decades of the post-revolutionary period policies were launched to promote domestic economic productivity, social legislation was promulgated and agrarian reform through land redistribution was implemented. Social-welfare institutions were also established: the Ministry of Health (Secretaría de Salud), the Institute of Social Security for workers in the private sector (IMSS) and the Institute of Social Security for Government Employees (ISSSTE). Government authorities then thought that these initiatives would improve the well-being of the population at large. While these changes did promote a more egalitarian state, the welfare system was designed in a way that made it segmented and stratified, hence obliterating the possibility of universal coverage[12]. The second half of the 20th century was marked by profound changes. In this 50 year period, the economy experienced cycles of economic growth, stagnation and crises. It went from being a highly protectionist economy until the late 1970s, then to being a free trade model by the mid-1990s and an open economy by 2000. GDP growth declined over time. Additionally, it underwent a somewhat delayed demographic transition: infant mortality declined as a result of public health investments and vaccination campaigns, but fertility rates took a rather long time to come down until family planning initiatives were launched in the mid-1970s (see Tables 1 and 2).

Starting in the 1970s, when it became evident that the development model and social security institutions were favouring only certain sector in society, policy makers centred their debate on how to reconcile economic growth with equity through redistributive policies[13]. They decided to implement targeted programmes for populations at risk like peasants. These programmes were revamped and renamed in the different presidential administrations and involved credit to peasants and subsidies for food[14]. Although the implementation of targeted programmes was able

[11] This section draws from Vélez-Grajales (2016).

[12] Yaschine (2015, p. 49).

[13] «The 1970s witnessed a transformation of the international economic environment and an attempt to change development strategy as Mexico's political leaders and policymakers became increasingly aware of the need to address the inequities that accompanied the process of economic growth and the obstacles to sustained economic. The push for redistribution was seen as a way to relieve social tensions that became openly manifest in the student movement of 1968» Moreno-Brid and Ros (2009, p. 124).

[14] The programmes of the 1970s were Pider, COPLAMAR and SAM. Ibid, p. 48.

TABLE 1
GDP 1940–2000

Period	Growth rates	Variation coefficient	Acceleration rate
1940–1951	5.6	0.47	3.28
1951–1962	5.15	0.5	–0.44
1962–1968	6.53	0.32	1.138
1968–1977	4.88	0.37	–1.65
1977–1981	7.22	0.33	2.34
1981–1988	0.16	3.06	–7.06
1988–2000	3.38	0.94	3.22

Source: Márquez (2010, p. 553).

TABLE 2
POPULATION GROWTH 1930–2000

	1921–1930	1930–1940	1940–1950	1950–1960	1960–1970	1970–1990	1990–1995	1995–2000
Average annual growth rates	1.7	1.75	2.65	3.03	3.35	2.59	2.03	1.54

Source: INEGI (2001, p. 8).

to meet important objectives, these programmes did not have the capability to substitute benefits that would have resulted from a universal security and social protection system[15].

By the early 1980s, some critics of these programmes pointed out that they yielded meagre results, were poorly managed and costly. In the context of the 1980s economic crises, there was a change in the development model that had assumed that orthodox economies policies would solve the main economic problems. The government reduced its intervention in the economy and reengineered the allocation of assistance to even more targeted programmes. The results from these adjustments were a deterioration in health, nutrition and education metrics[16]. Despite the discouraging results for these poverty alleviation policies, the government preserved its commitment to improve the living standards of the population at large in its national development plan. In the late 1980s and early 1990s different versions of poverty reduction programmes were

[15] Ibid, pp. 50–51.
[16] Ibid, p. 52.

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implemented and in 1992 the government created a specific ministry for social development, the *Secretaría de Desarollo Social*, to better coordinate them. Eventually, targeted assistance programmes were replaced by the end of the millennium, with conditional monetary cash transfer programmes geared to households living in extreme poverty under the acronym PROGRESA. The efficacy of these programmes has gained international recognition for its designers and yet poverty and inequality continue to be a main concern of the government.

4. DATA SOURCES, METHODS AND ANALYSIS

This study employs data from the Mexican National Health Survey of 2000 (ENSA 2000), henceforth MxNHS2000, and the Mexican National Health and Nutrition Surveys of 2006 (ENSANUT 2006), henceforth MxNHNS 2006. MxNHS2000 is a national probabilistic survey conducted at the household level between September 1999 and March 2000[17]. These surveys were managed by the National Public Health Institute (*Instituto Nacional de Salud Pública*) and they are the first national ones to have information on stature and weight[18]. These surveys were designed to obtain information on accessibility, quality, coverage and use of health services. Additionally, they included information on the prevalence of infectious, degenerative and sexually transmitted diseases. The survey was taken in all 32 Mexican states and the final sample includes 47,040 households.

MxNHNS2006 is also a national probabilistic survey with a sample design similar to the 2000 survey but with added coverage at the state level. Hence, unlike the 2000 survey, this study provided information that could be used with confidence by state governments to design health, nutrition and poverty alleviation programmes[19]. Moreover, the survey collected information on health and nutrition. The survey was conducted between October 2005 and May of 2006, and also contained information on height and weight. The final sample includes 48,304 households.

We should underscore the fact that these surveys were undertaken as initiatives to have information on how to better design public health policies, not for retrospective insight; hence there are some shortcomings for the construction of historical databases. For instance, the questionnaire did not have place of birth, therefore it is not possible to ascertain regional differences or migration patterns. Regarding demography, the survey focused on reproductive health but does not provide detailed

[17] The sample design of the survey is stratified and clustered.
[18] Individuals were measured with *stadimeter*.
[19] *Encuesta Nacional de Salud y Nutrición*, 2006, p. 13.

information on changes in fertility patterns across cohorts; hence with the information available it is not possible to analyse the evolution of demographic patterns. Still, the survey has information on age, education, and location which are commonly good predictors of adult heights. While both surveys used the same methodology, they do not have the same breadth of questions. The 2000 survey focused on health indicators and the 2006 added information on nutrition. However, the height data are more complete, detailed and precise than historical sources available for previous periods, especially for national level studies.

From these surveys, we were able to construct databases for adult men and women, beginning with those born in 1951. We built a longitudinal series that stops at individuals born in 1986. Following the normal procedure for historical databases, we took the heights of adults of ages ranging from 20 to 49 to ensure that we were not counting individuals who had not reached their final heights or who had begun losing height[20]. In order to control for age heaping practices and to get sample sizes that would be large enough we used 5-year cohort groups. Therefore, we work with six 5-years cohorts: 1951–1956, 1957–1962, 1963–1968, 1969–1974, 1975–1980 and 1981–1986[21].

Prior to joining the data from the 2000 and 2006 surveys we ensured that the samples are comparable. For this we do a test for equality of means for a 16 year birth cohort: 1961–1976. Therefore, if surveys are similar, the means of the corresponding 16 year birth cohort of each should be very similar. Once we tested for mean differences, the null hypothesis of equality is rejected for both males and females. We found the height difference between surveys is relatively small: 4 mm for males and 2.6 mm for females[22]. Both surveys were representative at the national level and we wanted to avoid all potential biases; therefore, given that there was a difference in means, albeit small, we decided to use the MxNHS-2000 data for the older birth cohort, that is, the 1951–1956 cohort. For the rest of the cohorts we worked only with data obtained in the MxNHNS-2006 survey. Proceeding this way, we avoided biases from double accounting[23].

[20] Adults do not all start shrinking exactly at the same age. Lifestyle and physical factors both play a role. Moreover, there is no strong evidence to support the argument that shrinking rates shown by the same sex are homogeneous. For more details on human shrinking processes see Bogin (1999), Tanner (1978), Sorkin *et al*. (1999) and Niewenweg *et al*. (2003).

[21] As discussed in demography scholarship, less educated or older individuals (because of memory loss), tend to misreport and usually «round» their age. In surveys, it is not strange to find a higher proportion of reported ages ending in five or zero: 20, 25, 30, 35, 40 and so on.

[22] To test for differences in mean between the two surveys, we did *t* tests with the command *t test* of the statistics' software STATA, Version 12.0, assuming that the variances were equal. Weights were applied to the surveys.

[23] Given the fact that both surveys are representative at the national level, and with the objective of making correct use of the weights in the surveys we decided not to mix data when it is available in both surveys.

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TABLE 3
SAMPLE SIZES BY 6-YEAR COHORTS

Cohort	Sex	
	Males	Females
1951–1956	11,516	2,992
1957–1962	1,467	2,119
1963–1968	1,967	3,096
1969–1974	2,081	3,638
1975–1980	1,652	3,127
1981–1986	1,787	2,594
Total	10,479	17,566

Sources: ENSA (2000); ENSANUT (2006).

Following these criteria, we constructed series with 10,479 observations for males and 17,566 for females, distributed in six 5-year birth cohorts (Table 3).

Following the methodology used in anthropometric history, we assess the quality of our height data samples[24]. As it is shown in the literature, we expect a normal distribution among homogeneous populations. The first step is a visual inspection of the distributions in order to check for shortfall or any unusual shape in the height distribution[25]. A second source of potential bias is rounding problems in height samples, that is, numerically speaking, when height records show a highest proportion of measures ending in unit or half unit[26]. Histograms by birth cohort and gender are presented in Figures 1A and 1B[27]. A visual inspection shows that there are no shortfalls. While not all histograms match perfectly with the shape of the plotted normal distribution (line), there is no evidence of distributions skewed to the same side. Also, no «jumps-falls» of frequencies around similar measures are detected[28]. In brief, no systematic bias for the whole set of cohorts is identified.

[24] For a clear guide on the steps necessary to assess the quality of a height data sample see Komlos (2004).

[25] Baten (2000), Komlos (2004) and Tanner (1978).

[26] Rounding height measures is also common. The problem arises when height rounding is not symmetric (there is selectivity by social stereotypes, for example). A good example of rounding problems is explained by Komlos (1999).

[27] For such histograms sample weights were applied.

[28] Statistical tests reject normality for some distributions. The test is made with the command *sktest* of the statistics' software STATA, Version 11.0. It is based on the combination of one test for skewness and another for kurtosis.

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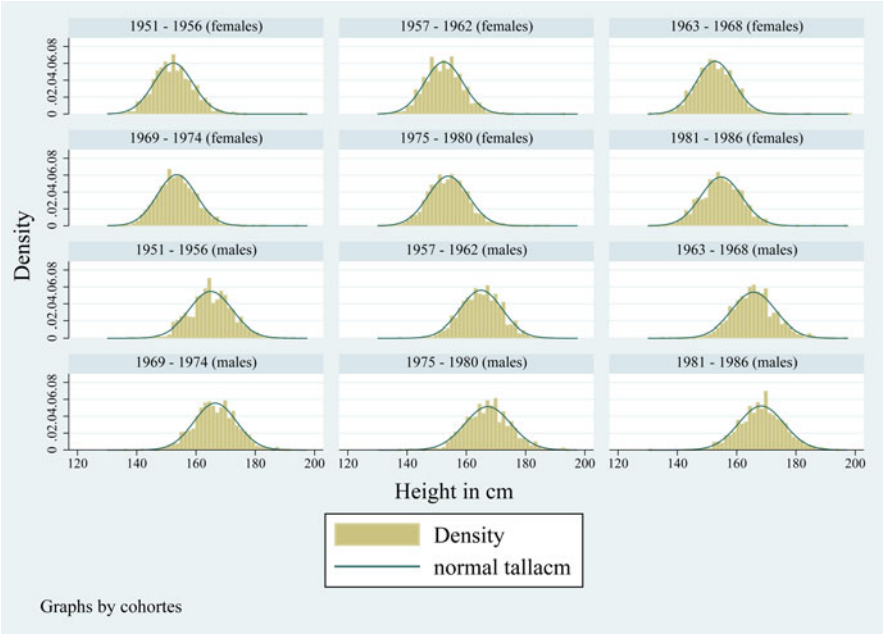
FIGURE 1
NATIONAL ADULT HEIGHT DISTRIBUTIONS BY SEX, 6 YEAR BIRTH COHORTS, 1951–1986.



Source: see text.

Regarding the issue of rounding off, frequencies for the first decimal (millimetres) of height records are presented in Table 4. As it normally happens in these cases, frequencies are higher for those measures ending in zero or five (the sum of these frequencies accounts for more than 30 per cent). Strictly speaking, there is rounding. However, frequency levels for both females and males do not show any serious bias problem. Moreover, frequency patterns are similar among females and males. Therefore, it can be concluded that height rounding is not a source of bias for the present analysis.

4.1. Estimations and Analysis

A simple model of individual height determinants is estimated to obtain predicted average heights for the period 1951–1986. Once it is controlled for birth cohort dummies, variables for education attainment and current residence are included; the former as a proxy of economic status and the

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TABLE 4
ROUNDING IN HEIGHT MEASURING BY SEX

	Females			Males		
Heaping	**Freq.**	**Per cent**	**Cum.**	**Freq.**	**Per cent**	**Cum.**
0.0	3,947	22.72	22.72	2,492	24.65	24.25
0.1	1,135	6.53	29.25	622	6.05	30.3
0.2	1,678	9.66	39.91	962	9.36	39.66
0.3	1,450	8.35	47.26	871	8.48	48.14
0.4	1,505	8.66	55.92	918	8.93	57.07
0.5	2,466	14.19	70.11	1,426	13.88	70.94
0.6	1,393	8.02	78.13	771	7.5	78.45
0.7	1,159	6.67	84.8	639	6.22	84.66
0.8	1,471	8.47	93.27	919	8.94	93.61
0.9	1,169	6.73	100	657	6.39	100

Sources: ENSA (2000); ENSANUT (2006).

latter to assess if there was a rural or urban penalty (see Table 5)[29]. The reference category is individuals born in the 1951–1956 cohort, with no schooling, living in urban areas. The regression estimates show that there is a slight decrease in heights for people born in the 1950s decade, followed by modest increase for the following decades. We observe that socio-economic differences reflected in education and place or residence are determinant of adult heights. The trends are similar for both men and women (see Figure 2). The overall improvement is nearly 2 cm for women and 2.5 cm for men. Regression results also show that men and women living in the countryside are shorter than urban dwellers. Men and women who had more years of schooling were also taller.

The results from the econometric analysis suggest that the increases in stature during this period were modest in light of the fact that from 1950 until 1980 GDP had the most sustained growth[30]. When the economic downturns begin in the late 1970s and early 1980s, stature continued to improve at a higher rate. Thus, biological standards of living did not match GDP growth as it went from a high rate to a very modest increase

[29] For height estimation models R^2s in regressions are always low. That happens because most of the variation in adult height is natural (genetic) and unexplained (Komlos and Lauderdale, 2007, p. 63).

[30] «The highest growth rate was recorded between 1949 and 1981, a period in which industrialization due to import substitution and the oil boo let to growth averaging 6.38» (Márquez, 2010, p. 553).

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TABLE 5
REGRESSION RESULTS FOR FEMALE AND MALE HEIGHTS

	Females	**Males**
Birth cohort		
1951–1956 (omitted)	–	–
1957–1962	–0.389*** (0.195)	–0.199 (0.289)
1963–1968	–0.95 (0.178)	0.098 (0.273)
1969–1974	0.012 (0.174)	0.540** (0.273)
1975–1980	0.159 (0.181)	0.906*** (0.284)
1981–1986	0.728*** (0.191)	1.546*** (0.284)
Education		
Incomplete primary	1.684*** (0.24)	1.000** (0.419)
Complete primary	3.223*** (0.234)	1.963*** (0.406)
Secondary	4.674*** (0.24)	3.431*** (0.407)
High school	6.004*** (0.255)	4.991*** (0.425)
Bachelor	7.616*** (0.318)	6.105*** (0.467)
Graduate studies	8.591*** (0.749)	6.983*** (0.906)
No school (omitted)	–	–
Current residence		
Dummy for rural (1)	–0.518*** (0.122)	–0.562*** (0.184)
Intercept	149.757*** (0.25)	162.936*** (0.432)
R^2	16,981	10,095
N	0.089	0.067

Note: OLS regression. Sample weights applied.
*$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.
Standard errors in parentheses.

at the end of the 1980s, while statures improved[31]. The results suggest that in times of sustained economic growth heights stagnated and in times of economic crisis the average Mexican got taller. This is evident for those born during the last of the birth cohorts we examine, 1981–1986, as they

[31] «Even as the structural problems of the Mexican economy, the oil boom of the second half of the 1970s and public spending driven by the increase in foreign debt contributed to the average growth rate exceeding 7 Per cent between 1977 and 1981… at the beginning of the 1980s, the fall in oil prices and the rise in interest rates in the international capital markets made it evident that, far from solving the problems of the import substitution model, they had worsened… for 1981–1988 the balance in terms of GDP per capita expansion was a very modest rate that barely reached 0.16 per cent… a change in the growth model… raised the growth rate to 3.38 per cent between the years 1988–2000» (Márquez 2010, p. 555).

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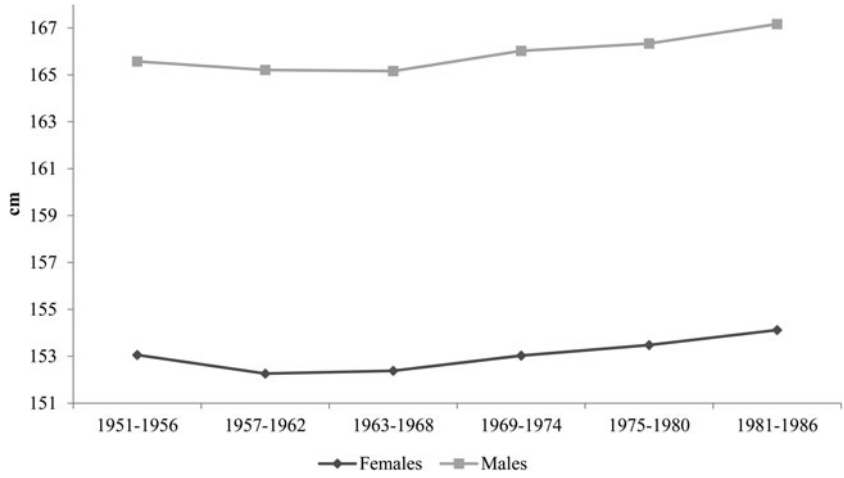
FIGURE 2
PREDICTED NATIONAL HEIGHT (IN CM) BY 6 YEAR BIRTH COHORTS, MEXICO 1951–1986 (NATIONAL SURVEYS).



Source: see text.

grew up during periods of economic stagnation. To reiterate, in the aggregate we observe in this time period the evolution of biological standards of living does not follow the cycles of economic growth. Hence it is necessary to examine other processes to assess the determinants of the trends in heights that we observe.

The coefficient that we obtain for the different independent variables suggests that current residence and education matter. There is a rural penalty. Those living in the countryside were shorter; in a period of rapid urbanisation, those left in the rural areas tended to be those worse off or those having tried their luck in the city unsuccessfully went back to their rural dwellings. This finding is consistent with public policy studies throughout the period that evaluated the groups in more need of social assistance[32]. Rural areas always scored lower in human development indicators and their participation in the economy also declined during this period.

Those with more education are taller, but education, especially higher education, takes place close to the age when people have already passed their growth spurts. In this case we argue that children of parents with more education may tend to enjoy better living conditions than those

[32] PIDER and COPLAMAR, the first poverty alleviation programmes launched in the 1970s, were geared towards the rural marginalized areas.

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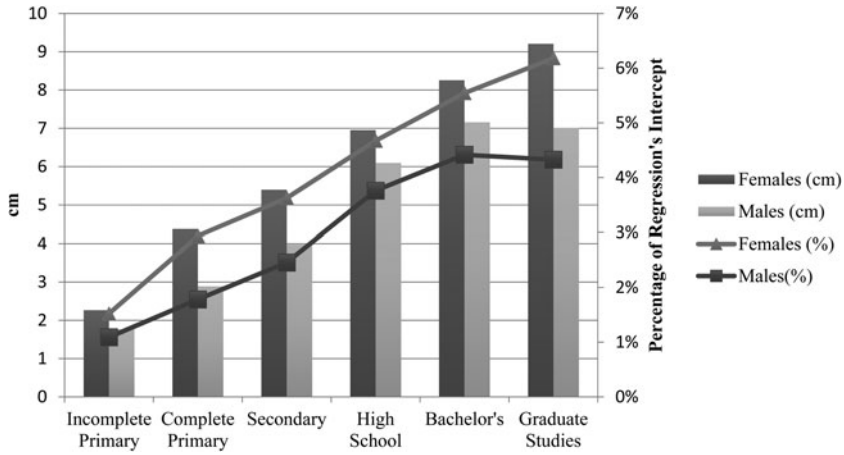
FIGURE 3
THE EDUCATION PENALTY: NO SCHOOLING VS. OTHER EDUCATION LEVELS BY SEX.



Source: see text.

with parents with no schooling. In Figure 3 we test this hypothesis. Individuals who have less schooling tend to be shorter and women are more at a disadvantage than men.

4.1.1 Education as Mirror of Inequality

We look closer at the relevance of schooling as an indicator of human well-being and inequality. In Figure 3 we can trace the education penalty, the reference category as people with no schooling. Women with no schooling are shorter than those with incomplete primary education by 2.3 cm. The tallest individuals had more schooling, and the difference between those with graduate degrees and those with no schooling is 9.2 cm for women. Absolute differences between women are sharper than between men; the difference is larger when measured in relative terms (lines in Figure 3). This result highlights the fact that socioeconomic inequality captured by school attainment is more profound for females. This is evident that women are more vulnerable to the poverty and inequality traps[33].

[33] «The idea that males are buffered than females against the effects of the environment during growth and development is a pervasive one the physical anthropological literature, still results are sometimes contradictory because of the fact that male children are given preferential treatment in many societies». See Stinson (1985, p. 132). Our results suggest that male children and adolescents receive a substantially better treatment than girls.

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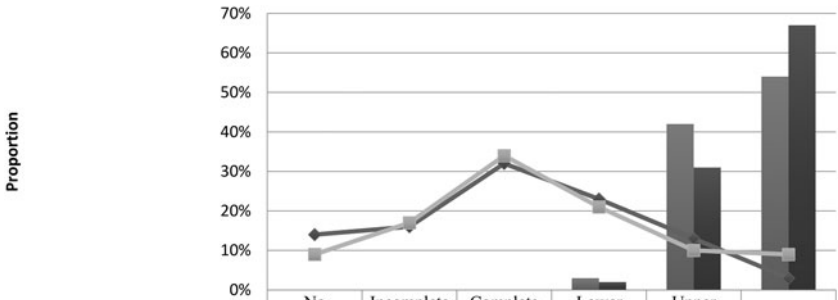
FIGURE 4
EDUCATIONAL ATTAINMENT BY FATHER'S EDUCATION LEVEL IN MEXICO, BY SEX: BIRTH COHORT 1947–1986.



	No Schooling	Incomplete Primary	Complete Primary	Lower Secondary	Upper Secondary	Tertiary
Females (father with tertiary education)	0%	0%	0%	3%	42%	54%
Males (father with tertiary education)	0%	0%	0%	2%	31%	67%
Females (father no schooling)	14%	16%	32%	23%	13%	3%
Males (father no schooling)	9%	17%	34%	21%	10%	9%

Source: see text.

We have mentioned that throughout the period under study the government maintained a discourse of commitment to improve well-being through investment in healthcare services and education. But how effective have been these programmes at helping vulnerable populations leave the cycles of poverty and inequality? One way to measure the effectiveness of these policies is by estimating the intergenerational mobility on education. The 2013 report on social mobility in Mexico argues that «Educational coverage has widened over the recent decades, and absolute educational opportunities for the Mexican people have increased along with it. However, … it becomes apparent that educational mobility in Mexico is limited at particular levels. For the first levels of education, primary and lower secondary school, socioeconomic origin has hardly any achievement in upper secondary school and even more so in tertiary education»[34]. Figure 4 shows that the educational achievement conditional on the father's education for people born in the 1947–1986 cohort is lower for women than for men. These results suggest that inequalities persist, especially for women. There is a particular barrier related to socioeconomic origins that limits the access to upper secondary education to women.

[34] Vélez-Grajalez *et al*. (2013, pp. 31–34).

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TABLE 6
HEIGHT COMPARISON: BRAZIL, COLOMBIA AND MEXICO, BY GENDER, 1951–1986

	Males			Females	
Birth cohort	**Brazil, Monasterio *et al*. (estimated)**	**Colombia, Meisel and Vega (estimated)**	**Mexico (predicted)**	**Colombia, Meisel and Vega (estimated)**	**Mexico (predicted)**
1951–1956	168.3	167.9	165.6	156.5	153.1
1957–1962	168.8	168.3	165.2	157.0	152.3
1963–1968	169.2	168.8	165.2	157.3	152.4
1969–1974	169.8	168.9	166.0	157.2	153.0
1975–1980	170.3	169.8	166.3	158.0	153.5
1981–1986		170.6	167.2	158.7	154.1

Sources: Mexico: author's estimations; Colombia: Meisel and Vega (2007a); Brazil: Monasterio *et al*. (2010).

Estimated values correspond to raw means and predicted values correspond to regression values.

Moreover, women of the lower socioeconomic strata have more obstacles to access education than men in the same strata. Interestingly, women from the higher strata also have a lower achievement than men in their same strata, suggesting that gender inequalities are pervasive at all socioeconomic levels.

4.1.2 International Comparisons

We argue that a 2 cm height improvement is mediocre for post 1950 Mexico because of the size of its economy; the amount of government resources applied to improve living standards of the population as a whole; and because of data about other Latin American countries. We can compare the results with height data in Brazil and Colombia. For Colombia we have information for men and women (Table 6). The average stature of males and females of Brazilians and Colombians is higher than that of Mexicans[35]. The gap is larger between women. These suggests that on average the Brazilian and Colombian populations have a better

[35] In recent years there have been studies that suggest that there could be genetic differences between populations that could contribute to adult height differences (Bogin 2013), the results are currently inconclusive given that there is a competing hypothesis that suggests that environmental conditions, like community effects and quality of nutrition are stronger determinants of final stature.

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biological standard of living and government efforts to improve the well-being of the Mexican population were thwarted.

4.1.3 Human plasticity

We should also add that, from the point view of human biology this result could have been better in light of the fact that there was a constant stream of resources invested in improving well-being through social development programmes. Human plasticity allows for increases in stature to improve significantly within one generation[36]. There is the case of the Japanese in the era of industrialisation, but closer to Mexico there is the case of Guatemalan children migrating to the United States in the same period that this study covers: for such Guatemalans, there was as much as 10 cm of height increase between cohorts due improving health and nutrition[37].

4.2. The Demographic Dynamics

We have mentioned that MxNHS-2000 and MxNHNS-2006 do not provide the data to analyse demographic trends, therefore we cannot test the effects of the demographic transition experienced on the scanty growth in stature during the period we are examining. Still, the results have a demographic explanation. Some scholarship on the disappointing performance of the Mexican economy during this period has commented about the relevance of the effects of the demographic transition[38], following the hypothesis and findings of Williamson (1998) on demographic transition that states that «demographic forces can have an impact on growth or distribution depending on the historical time and place. For demography to matter, the demographic shocks must be big, they must be exogenous with respect to growth itself and they must translate into changes in the age distribution»[39]. We should clarify that Williamson referred to growth in the economic sense not in the biological one. Gómez-Galvarriato and Silva-Castañeda argue that the Mexican demographic transitions of the mid-20th century was long, deep and not fully achieved by the end of the

[36] «Human plasticity allows the individual to adjust to a very wide range of stressful environmental conditions and gives the human species an adaptive advantage not found in those species obligated to develop according to a rigid predetermined genetic plan. Plasticity also means that when environmental conditions improve, individuals can recover quickly and return to a more optimal size and shape.» Bogin (2001, p. 254).

[37] For the case of Japan see Honda (1997, pp. 251–284); for the Guatemalan case see Bogin and Rios (2003) and Bogin *et al*. (2007).

[38] Gómez-Galvarriato and Silva-Castañeda (2007).

[39] Williamson (1998).

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century, resulting in an increase in the dependency ratio[40]. This suggests that regardless of the evolution of the Mexican economy, which was expanding yet without good income distribution across social classes, the average Mexican household had more children to feed with the same salary. This would have repercussions in the quality of nutrition and the final height of children growing up during the last decades of the 20th century.

Márquez (2010) also touches on the importance of demography in her study on the evolution and structure of GDP from 1921 to 2010. Márquez explains that in Mexico the growth of the service sector during the second half of the 20th century was not the byproduct of industrialisation and an improvement in per capita income as it was the case in many developed economies. In Mexico, the service sector increased at a time when the rate of growth was declining. The rapid rate of demographic growth from the mid-1960s through the 1970s resulted in an increasing number of people entering the labour force in the 1980s. Economic slowdown in the 1980s provoked by the debt crisis decreased the number of jobs available in highly productive sectors. Therefore, youth entering the labour force had to take low productivity, low wage jobs (Márquez 2010, p. 560). More schooling then did not translate into higher income or possibilities for an improvement in living conditions.

5. CONCLUSIONS

In this study, we have examined the evolution of biological standards of living of the Mexican population during the last half of the 20th century. We have shown that there was a moderate increase in stature for the population as a whole. This result can be deemed as disappointing in light of the fact that throughout the period the government discourse emphasised its commitment to improving the living standards of the entire population. While it is true that during the 1970s and 1980s the country experienced several economic downturns, the government did not terminate its social development programmes. Social-welfare policies were revised over time in search of obtaining results that could effectively decrease poverty and inequality. Nevertheless, the policies failed in light of outcomes.

In 1993, the National Institute of Nutrition (INNSZ) published a study showing preliminary results on the evolution of diabetes and overweight, arguing that at the end of the 20th century, the Mexican population was caught in an epidemiological trap, where people could be anaemic and obese at the same time: the diseases of the past were not eradicated while there were the growing perils of the diseases of modern lifestyle, derived from sedentarism and changes in dietary

[40] Gómez-Galvarriato and Silva-Castañeda (2007, p. 791).

habits[41]. At the beginning of the millennium the MxNHS-2000 and MxNHNS-2006 of the National Health Institute (INSP) substantiated these findings. The evolution of stature during the second half of the 20th century is a product of this phenomenon despite the efforts to improve social welfare.

In 1998, Miguel Székely published an influential work on the economics of poverty, inequality, and wealth accumulation, where he stated that «[…] In Mexico, extreme poverty has not declined consistently as a natural outcome of the development process.» His assessment of the previous decades was that between 1950 and 1992 moderate poverty declined faster than extreme poverty, which suggests that the gains from development had some relation with the initial position of individuals: those who were relatively better off among the poor, were more able to improve their standard of living. This explains the expansion of the middle classes in the 1950s. In the 1960s there were significant gains for the extreme poor but this improvement was lost in the 1970s. The growth experienced until 1984 favoured some income distribution but this did not imply that the poorest of the poor were benefiting from the development process[42]. On the 1984–1992 period Székely argues that it was a turn point in the inequality and poverty–development relationship. The debt crisis of the 1980s and the introduction of large economic liberalisation programmes coincided with a deterioration in income distribution that generated a substantial welfare loss for the poorest 15 per cent of the population. In 1998, Székely contended that the costs inherent in the economic liberalisation measures were disproportionately borne by the individuals at the lower tail of the income distribution[43]. He shows further that the reason why some individuals were initially in a better position to benefit from the 35 per cent economic expansion registered in Mexico between 1984 and 1992 was they were better endowed with human and physical capital[44]. The MxNHS-2000 and MxNHNS-2006 surveys substantiate this argument along with the results on the evolution of stature in correlation with education that we have presented.

The evolution of heights for the population as a whole for the post 1950 period is disappointing in view the evolution of GDP growth. While the results are not catastrophic for biological standards of living during the years of crisis they do not yield the results that meet the expectations of the social policy makers. There is no one single determinant for this paucity of results but rather a combination of factors: some exogenous, such as economic crisis and lifestyle changes normally observed in urban post-industrial societies; and some are related to structural inequality stemming

[41] Chávez *et al*. (1993).
[42] Székely (1998, pp. 12–13).
[43] Székely (1998, p. 36).
[44] Székely (1998, p. 52).

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from the shortcomings of the social security system. Gender disparities put women at a more disadvantaged position. These results seem to be a continuation of the inequality trends observed between 1850 and 1950 across social strata. There were, however, some differences because the post-1950 population has lived longer, had more education and on average, had a higher rate of urbanisation, which could have translated into larger gains in average stature. However, persistent inequality stunted the growth in stature of the average Mexican.

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REFERENCES

Acosta, K., and Meisel, A. (2013): «Anthropometric Measurements by Ethnicity in Colombia, 1965–1990». *Economics and Human Biology* 11 (4), pp. 416–425.

Baten, J. (2000): «Economic Development and the Distribution of Nutritional Resources in Bavaria, 1797–1839». *Journal of Income Distribution* 9 (1), pp. 89–106.

Baltzer, M., and Baten, J. (2008): «Height, Trade, and Inequality in the Latin American Periphery, 1950–2000». *Economics & Human Biology* 6 (2), pp. 191–203.

Baten, J., and Carson, S. (2010): «Latin American Anthropometrics, Past and Present—An Overview». *Economics and Human Biology*, Special Issue Section: Latin American Anthropometrics 8 (2), pp. 141–144.

Baten, J., Pelger, I., and Twrdek, L. (2009): «The Anthropometric History of Argentina, Brazil and Peru during the 19th and Early 20th Century». *Economics and Human Biology* 7, pp. 319–333.

Bodenhorn, H., Guinnane, T., and Mroz, A. (2017): «Sample Selection Biases and the Industrialization Puzzle». *Journal of Economic History* 77 (1), pp. 171–207.

Bogin, B. (2001): *The Growth of Humanity*. New York: Wiley-Liss.

Bogin, B. (2013): «Secular Changes in Childhood, Adolescent and Adult Stature». *Nestlé Nutrition Institute Workshop Series* 71, pp. 115–26.

Bogin, B., and Rios, L. (2003): «Rapid Morphological Change in Living Humans: Implications for Modern Human Origins». *Comparative Biochemistry and Physiology Part A: Molecular and Integrative Physiology* 136 (1), pp. 71–84.

Bogin, B., Varela Silva, M. I., and Rios, L. (2007): «Life History Trade-Offs in Human Growth: Adaptation or Pathology?» *American Journal of Human Biology* 19 (5), pp. 631–642.

Brinkman, H. J., Drukker, J. W., and Slot, B. (1988): «Height and Income: A New Method for the Estimation of Historical National Income Series». *Explorations in Economic History* 25 (3), pp. 227–264.

Challú, A. E. (2009): «Agriculture Crisis and Biological Well-Being in Mexico, 1730–1835». *Historia Agraria* 47, pp. 21–44.

Challú, A. E. (2010): «Living Standards and the Great Decline: Biological Well-Being in Mexico, 1730–1840», in Ricardo d. Salvatore, John H. coatsworth and Amílcar

Challú (eds), *Living Standards in Latin American History: Heights, Welfare and Development, 1750–2000*. Cambridge, MA: David Rockefeller Center for Latin American Studies/Harvard University Press, pp. 23–68.

Challú, A. E., and Silva-Castañeda, S. (2016): «Towards an Anthropometric History of Latin America in the Second Half of the Twentieth Century». *Economics and Human Biology* 23, pp. 226–234.

Chávez, A., De Chávez, M. M., Roldán, J. A., and Ávila, A. (1993): *La nutrición en México y la transición epidemiológica*. Mexico D.F.: Instituto Nacional de Nutrición Salvador Zubirán.

Dobado, R., Gómez-Galvarriato, A., and Márquez, G. (2007): *México y España: ¿historias económicas paralelas?* México: Fondo de Cultura Económica.

Dobado-González, R., and García Montero, H. (2010): «Colonial Origins of Inequality in Hispanic America? Some Reflections Based on New Empirical Evidence». *Revista de Historia Económica/Journal of Iberian and Latin American Economic History* 28 (2), pp. 253–277.

Dobado-González, R., and García-Montero, H. (2014): «Neither So Low nor So Short: Wages and Heights in Bourbon Spanish America from an International Comparative Perspective». *Journal of Latin American Studies* 46 (2), pp. 291–321.

Dobado-González, R., and García-Hiernaux, A. (2017): «Two Worlds Apart: Determinants of Height in Late 18th Century Central Mexico». *Economics and Human Biology* 24, pp. 153–163.

Encuesta Nacional De Salud (2000): ENSA México 2000.

Encuesta Nacional De Salud Y Nutrición (2006): ENSANUT México 2006.

Eveleth, P. B., and Tanner, J. M. (1990): *Worldwide Variation in Human Growth*, 2nd edn, 2006. Cambridge: Cambridge University Press.

Floud, R. (1984): «The Heights of Europeans since 1750: A New Source for European Economic History». *NBER Working Paper Series* no. 1318.

Floud, R., Wachter, K., and Gregory, A. (2006): *Height, Health and History: Nutritional Status in the United Kingdom, 1750–1980*. Cambridge: Cambridge University Press.

Fogel, R. W., and Engerman, S. L. (1995): *Time on the Cross: The Economics of American Negro Slavery*. New York, London: W. W. Norton & Company.

Fogel, R. W., Galantine, R. A., Manning, R. L., and Cardell, S. (1992): *Without Consent or Contract: The Rise and Fall of American Slavery: Evidence and Methods*. New York: Norton.

Frank, Z., and Shelhoub, S. (2006): «Stature in Nineteenth-Century Rio de Janeiro: Preliminary Evidence from Prison Records». *Revista de Historia Económica/ Journal of Iberian and Latin American Economic History* 24 (3), pp. 465–489.

Gómez-Galvarriato, A., and Silva-Castañeda, S. (2007): «La divergencia económica entre México y España: 1950–2000», in Rafael Dobado, Aurora Gómez-Galvarriato and Graciela Márquez (eds), *México y España ¿Historias económicas paralelas?* México: El Trimestre Económico Fondo de Cultura Económica, pp. 781–829.

Grajales-Porras, A., and López-Alonso, M. (2011): «Physical Stature of Men in Eighteenth Century Mexico: Evidence from Puebla». *Economics and Human Biology* 9 (3), pp. 265–271.

Haines, M. R., Craig, L. A., and Weiss, T. (2003): «The Short and the Dead: Nutrition, Mortality, and the «Antebellum Puzzle» in the United States». *The Journal of Economic History* 63 (2), pp. 382–413.

Honda, G. (1997): «Differential Structure, Differential Health: Industrialization in Japan, 1868–1940», in R. Steckel, and R. Floud (eds), *Health and Welfare during Industrialization*. Chicago: University of Chicago Press, pp. 251–284.

INEGI (2001): *Indicadores sociodemográficos de México. (1930–2000)*. Aguascalientes, México: Instituto Nacional de Geografía, Estadística e Informática.

Kimura, M. (1993): «Standards of Living in Colonial Korea: Did the Masses Become Worse off or Better off under Japanese Rule?» *Journal of Economic History* 53, pp. 629–652.

Komlos, J. (1985): «Sature and Nutrition in the Habsburg Monarchy: The Standard of Living and Ecnomic Development in the Eighteenth Century». *American Historical Review* 90, pp. 1149–1161.

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

Komlos, J. (1993): «The Secular Trend in the Biological Standard of Living in the United Kingdom, 1730–1860». *The Journal of Economic History* 46 (1), pp. 115–144.

Komlos, J. (1995a): «Stature and Nutrition in the Habsburg Monarchy: The Standard of Living and Economic Development in the Eighteenth Century». *American Historical Review* 90, pp. 1149–1161.

Komlos, J. (1995b): *The Biological Standard of Living on Three Continents: Further Explorations in Anthropometric History*. Boulder: Westview Press.

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.

Komlos, J. (1999): «On the Nature of the Malthusian Threat in the Eighteenth Century». *The Economic History Review* 52 (4), pp. 730–748. New Series.

Komlos, J. (2004): «How To (and Now Not To) Analyse Deficient Height Samples». *Historical Methods* 37 (4), pp. 160–173.

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

Komlos, J., and 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., and Kim, J. H. (1990): «Estimating Trends in Historical Heights». *Historical Methods* 23 (3), pp. 116–120.

Komlos, J., and Lauderdale, B. E. (2007): «Spatial Correlates of US Heights and Body Mass Indexes». *Journal of Biosocial Science* 39, pp. 59–78.

Kuntz Ficker, S. (coord.) (2010): *Historia económica general de México. De la Colonia hasta nuestros días*. Mexico: El Colegio de México y Secretaría de Economía.

Le Roy Ladurie, E., and Berganeau, N. (1979): «The Conscripts of 1868: A Study of the Correlation Between Geographical Mobility, Delinquency and Physical Stature, and Other Aspects of the Situation», in E. Le Roy Ladurie (ed.), *The Territory of the Historian*. Chicago: University of Chicago Press.

Leunig, T., and Voth, H. J. (2006): «Height and the High Life», in P. A. David and M. Thomas (eds), *The Economic Future in Historical Perspective*. Oxford: Oxford University Press, pp. 419–430 (paper back edition).

Llorca-Jaña, M., Droller, F., and Araya-Valenzuela, R. (2018): «Height in Eighteenth-Century Chilean Men: Evidence from Military Records, 1730–1800s». *Economics and Human Biology* 29, pp. 168–178.

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

López-Alonso, M. (2012): *Measuring up: A History of Living Standards in Mexico, 1850–1950*. Stanford, CA: Stanford University Press.

López-Alonso, M., and Porras Condey, R. (2003): «The Ups and Downs of Mexican Economic Growth: Biological Standard of Living and Inequality, 1870–1950». *Economics and Human Biology* 1, pp. 169–186.

López-Alonso, M., and Vélez-Grajales, R. (2015): «Measuring Inequality in Living Standards with Anthropometric Indicators: The Case of Mexico 1850–1986». *Journal of Human Development and Capabilities* 16 (3), pp. 374–396.

López-Alonso, M, and Vélez-Grajales, R. (2017): «Using Heights to Trace Living Standards and Inequality in Mexico since 1850», in L. Bértola, and J. Williamson (eds), *Has Latin American Inequality Changed Direction? Looking Over the Long Run*. Cham, Switzerland: Springer International Publishing, pp. 65–87.

Margo, R. A., and Steckel, R. H. (1983): «Heights of Native-Born Whites during the Antebellum Period». *The Journal of Economic History* 43 (1), pp. 167–174.

Márquez, G. (2010): «Estructura y evolución del PIB, 1921–2010», in S. Kuntz Ficker (coord.), *Historia económica general de México. De la Colonia hasta nuestros días*. Mexico: El Colegio de México y Secretaría de Economía, pp. 549–572.

Martínez Carrión, J. M. (1986): «Estatura, nutrición y nivel de vida en Murcia, 1860–1930». *Revista de Historia Económica* 4 (1), pp. 67–99.

Martínez Carrión, J. M. (2001): «Estatura, salud y bienestar en las primeras etapas del crecimiento económico español. Una perspectiva comparada de los niveles de vida». Documento de Trabajo, Asociación española de historia económica, DT-AEHE no. 102.

Mckeown, T. (1976): *The Modern Rise in Population*. New York: Academic Press.

Meisel, A., and Vega, M. (2007a): *La calidad de vida biológica en Colombia: antropometría histórica 1870–2003*. Colombia: Banco de la República.

Meisel, A., and Vega, M. (2007b). «The Biological Standard of Living (and its Convergence) in Colombia, 1870–2003: A Tropical Success Story». *Economics and Human Biology* 5 (1), pp. 100–122.

Monasterio, L. M. (2013): «Estatura e inmigración en el sur de Brasil (1889–1914)». *América Latina en la Historia Económica* 21 (1), pp. 115–133.

Monasterio, L. M., Nogueról, L. P., Shikida, C. D. (2010): «Growth and Inequalities of Height in Brazil, 1939–1981», in Ricardo D. Salvatore, John H. Cotasworth and Amílcar E. Challú (eds), *Living Standards in Latin American History: Heights, Welfare & Development, 1750–2000*. Cambridge, MA: David Rockefeller Center for Latin American Studies/Harvard University Press, pp. 167–196.

Moreno-Brid, J. C., and Ros, J. (2009): *Development and Growth in the Mexican Economy: A Historical Perspective*. Oxford: Oxford University Press.

Niewenweg, R., Smit, M. L., Walenkamp, M. J. E., and Witt, J. M. (2003): «Adult Height Corrected for Shrinking and Secular Trend». *Annals of Human Biology* 30 (5), pp. 563–569.

Núñez, J., and Pérez, G. (2015): «Trends in Physical Stature across Socioeconomic Groups of Chilean Boys, 1880–1997». *Economics and Human Biology* 16, pp. 100–114.

Prince, J. M., and Steckel, R. H. (1998): «The Tallest in the World: Native Americans of the Great Plains in the Nineteenth Century». Working Paper. National Bureau of Economic Research.

Ríos, L. (2009): «Guatemala: una revisión de las fuentes antropométricas disponibles». *Historia Agraria* 47, pp. 217–238.

Rosenzweig, F. (1989): *El desarrollo económico de México, 1800–1910*. Toluca, Mexico: Colegio Mexiquense.

Salvatore, R. D. (1998): «Height and Welfare in Late Colonial and Post-Independence Argentina», in J. Komlos, and J. Baten (eds), *The Biological Standard of Living in Comparative Perspective*. Stuttgart: Franz Steiner Verlag, pp. 97–121.

SALVATORE, R. D. (2004): «Stature Decline and Recovery in a Food-Rich Export Economy: Argentina 1900–1934». *Explorations in Economic History* 41 (3), pp. 233–255.

SALVATORE, R. D. (2007): «Heights, Nutrition, and Well-Being in Argentina, ca. 1850–1950. Preliminary Results». *Revista de Historia Económica/Journal of Iberian and Latin American Economic History* 25 (1), pp. 53–85.

SALVATORE, R. D., and BATEN, J. (1998): «A Most Difficult Case of Estimation: Argentinian Heights 1770–1840», in J. Komlos, and J. Baten (eds), *The Biological Standard of Living in Comparative Perspective*. Stuttgart: Franz Steiner Verlag, pp. 90–96.

SALVATORE, R. D., COATSWORTH, J. H., CHALLÚ, A. E. (2010): *Living Standards in Latin American History: Height, Welfare, and Development, 1750–2000*. Harvard University Press, David Rockefeller Center for Latin American Studies.

SANDBERG, L., and STECKEL, R. (1987): «Heights and Economic History: The Swedish Case». *Annals of Human Biology* 14, pp. 101–110.

SORKIN, J. D., MULLER, D. C., and ANDRES, R. (1999): «Longitudinal Change in Height of Men and Women: Implications for Interpretation of the Body Mass Index». *American Journal of Epidemiology* 150 (9), 969–977.

STECKEL, R. H. (1979): «Slave Height Profiles deom the Coastwise Manifest». *Explortions in Economic History* 16, pp. 363–380.

STECKEL, R. H. (1983): «Height and Per Capita Income». *Historical Methods* 16 (1), pp. 1–7.

STECKEL, R. H. (1995): «Stature and the Standard of Living». *Journal of Economic Literature* 33 (4), pp. 1903–1940.

STECKEL, R. H. (1998): «Strategic Ideas in the Rise of the New Anthropometric History and their Implications for Interdisciplinary Research». *The Journal of Economic History* 58 (3), pp. 803–821.

STINSON, S. (1985): «Sex Differences in Environmental Sensitivity during Growth and Development». *Yearbook of Physical Anthropology* 28, pp. 123–147.

SZÉKELY, M. (1998): *The Economics of Poverty, Inequality and Wealth Accumulation in Mexico*. New York, NY: Macmillan Press.

TANNER, J. M. (1978): *Foetus into Man: Physical Growth From Conception to Maturity*. Cambridge, MA: Harvard University Press.

VÉLEZ-GRAJALES, R. (2016): «*The Biological Standard of Living during Post-Revolutionary Mexico*». University of Oxford, PhD dissertation.

VÉLEZ- GRAJALEZ, R., CAMPOS VÁZQUEZ, R. M., and HUERTA WONG, J. E. (2013): *Informe Movilidad Social en México 2013. Imagina tu futuro*. Mexico: Centro de Estudios Espinosa Yglesias.

WARD, W. P. (1998): «Birth Weight and the History of Modern Biological Living Standards», in J. Komlos, and J. Baten (eds), *The Biological Standard of Living in Comparative Perspective*. Stuttgart: Franz Steiner Verlag, pp. 302–320.

WARD, W. P., and WARD, P. C. (1984): «Infant Birth Weight and Nutrition in Industrializating Montreal». *American Historical Review* 89, pp. 324–345.

WILLIAMSON, J. G. (1998): «Growth, Distribution, and Demography: Some Lessons from History». *Explorations in Economic History* 35 (3), pp. 241–271.

WEBER, G., SEIDLER, H., and HAUSER, G. (1995): «Secular Change in Height in Austria: An Effect of Population Stratification?» *Annals of Human Biology* 22 (4), pp. 277–288.

WHITWELL, G., DE SOUZA, C., NICHOLAS, S. (1997): «Height, Health, and Economic Growth in Australia, 1860–1940», in R. Steckel, and R. Floud (eds), *Health and Welfare during Industrialization*. Chicago: The University of Chicago Press, pp. 379–422.

YASCHINE, I. (2015): *¿Oportunidades? Política social y movilidad intergeneracional en México*. Mexico: El Colegio de México.