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Towards an Anthropometric History of Latin America in the Second Half of the Twentieth Century

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Abstract

We examine the evolution of adult female heights in twelve Latin American countries during the second half of the twentieth century based on demographic health surveys and related surveys compiled from national and international organizations. Only countries with more than one survey were included, allowing us to cross-examine surveys and correct for biases. We first show that average height varies significantly according to location, from 148.3 cm in Guatemala to 158.8 cm in Haiti. The evolution of heights over these decades behaves like indicators of human development, showing a steady increase of 2.6 cm from the 1950s to the 1990s. Such gains compare favorably to other developing regions of the world, but not so much with recently developed countries. Height gains were not evenly distributed in the region, however. 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.

Towards an Anthropometric History of Latin America in the Second Half of the Twentieth Century, by Amílcar E. Challú and Sergio Silva-Castañeda

Introduction

In this article we introduce what we believe is the most comprehensive and updated evidence on the evolution of adult heights in Latin America in the second half of the twentieth century. The dataset allows us to trace trends by five-year periods that rely on comparable health surveys from the DHS program and from national agencies that used similar methodologies. Our dataset includes twelve Latin American countries for which we could obtain at least two health surveys: Bolivia, Brazil, Chile, Colombia, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, and Peru. By using more than two surveys in each country we were able to assess and control survey differences and hence obtain more reliable estimates. Altogether, these countries represent close to 80 percent of the population throughout the period; in terms of income per capita, both the average and the range represent well the characteristics of the entire region. The earliest survey dates from 1977 (in Brazil), and the latest from 2013 (in Dominican Republic). Since we report the average height of adults by birth cohort, our dataset tracks changes in biological wellbeing from the late 1940s to the end of the century.

Latin America provides an excellent laboratory to study the history of biological wellbeing. There are significant differences in environmental conditions as well as multiple ancestries, providing a wide range of possible responses to socioeconomic forces. Moreover, the countries share striking similarities in their economic and political configurations, as well as in their cultures. Given the strong contacts and common historical experiences, they share institutions, norms and policies (Bértola and Ocampo 2013; Bullmer-Thomas, 1995). The cycles of strong economic growth rarely served to lift the economic welfare of the poor due to devastating crises, high inequality and a skewed political system (Thorp, 1998). Still, in other facets of human development, progress is undeniable due to increased school enrolment and improvements in infant mortality and life expectancy (McGuire, 2010; Prados, 2015).

We used a total of forty-nine national health surveys from the previously-mentioned twelve Latin American countries. All surveys drew samples representative of the national population and followed similar protocols to select cases, code variables, and instruct technicians on how to measure height, weight, and other anthropometric data. We obtained most of them from the US Aid-funded DHS Program (http://dhsprogram.com) and some from national health agencies and the Global Health Data Exchange (http://ghdx.healthdata.org). The surveys diverge in some ways in their purposes and the subpopulations they tracked, but they remain largely comparable particularly given the high-quality stratified sampling and the expansion factors (sample weights) provided in each survey. The Demographic and Health Surveys (DHS) are the most common source of our data, with thirty-eight studies in total. They focus on children and their caregiver mothers and are primarily geared to obtain information on disease, malnutrition, caregiving practices and reproductive health. Most of these surveys include anthropometric data for mothers between 15 and 49 years old. DHS surveys are a common source in studies of adult heights in the twentieth century (Acosta and Meisel, 2013; Baltzer and Baten, 2008; Baten and Blum, 2012; Blum, 2013; Bozzoli, Deaton and Quintana-Domeque, 2009; Deaton, 2007; Moradi, 2010; and Morales et al., 2004). The DHS surveys are organized in phases or waves. Over time, the sample sized increased, and so did the questionnaire, but the core of the survey and the sampling design are comparable (Moradi and Baten 2005). The major difference among waves is that the first ones collected information for mothers of small children in the household, while later waves included all women of reproductive age. In addition to these DHS surveys, we used eleven comprehensive health surveys that focus on the nutritional and/or health characteristics of individuals of all ages and sex. For all practical purposes, their questionnaire and techniques are similar to the DHS surveys, but they sample all the population, as the later DHS. Finally, Honduras' 2004 Living Conditions Survey (ENCOVI 2004) relied on self-reported statures and was retained as the trends conformed to the other sources.[1]

Data availability was the main reason to select adult women, rather than men or children, as the population for this analysis. Most of our surveys do not have information on adult men or the number of cases is very limited. Female physical growth is less responsive to nutritional and disease factors than in the case of males (Camara 2015; Cole 2003); hence, the variations we show here are most likely the lower band of change across time in each country. In order to retain the largest possible number of cases, we made the decision to include women of a wide age range, from 15 to 59 years of age, using controls by age to model height gain and loss due to age.

Ultimately, this information was summarized in five-year national age-standardized averages through a procedure involving two steps. First, we created single-country datasets

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[1] On self-reported versus measured heights, see Camara (2015) and Unikel-Santoncini, Ocampo-Ortega, and Zambrano-Ruiz (2009).

organized by year of birth and survey built from the microdata. We eliminated heights below 130 centimeters and above 200 centimeters, since they represent in all likelihood errors in measurement and create a bias in the annual averages. The standard deviation of heights within the surveys ranged from 5.6 to 7.2 cm and conformed to the normal distribution. Using the expansion factors (weights), provided in each survey, we created height averages per birth year and survey of each country. The variables included:

1. Survey (panel)
2. Birth-year cohort (time unit)
3. Height average in mm
4. Standard Deviation in mm
5. Average age at time of measurement
6. Number of cases

Among all countries, we had 1781 survey-birth year observations. The average number of cases in each birth-year cohort is 266 cases; 79 percent of the panel cells are based on at least 100 cases, and 94 percent on more than 25 cases. For the same birth cohort and country, most differences between DHS surveys were less than 0.6 cm, although we noticed a downward bias in the earlier waves (II and III) close to 1 cm. The earlier versions of the DHS sampled mothers in care of small children; hence they biased the sample toward the poorer groups of society. Non-DHS surveys tended to show heights 1.3 cm higher on average. The only outlier (3.6 cm, relative to a DHS in the same country and period) was the 2004 Honduras survey based on self-reported stature. In all, the differences between surveys are predictable and can be controlled with fixed effects.

In the second step we created a panel dataset of five-year national height averages based on the annual tabulations per survey of the previous step. We used country-specific regressions to remove the effects of height gain and loss among the young and the old, as well as the differences in averages among surveys. The following equation indicates the parameters of the regression:

Average Height $(i,t) = \alpha(i) + \beta 1(t) + \beta 2 \times$ (Squared Young Age) $+ \beta 3 \times$ (Squared Old Age) $+ u(i,t)$

The subindexes ‘i’ and 't' denote the panel and time units, which are the surveys and year of birth, respectively.[2] $\alpha(i)$ identifies fixed effects for each survey, and $\beta 1(t)$ is a vector that corresponds to one dummy variable per five-year period. The use of five-year periods eliminates the variability caused by random variation between smaller annual samples and

[2] This approach yields similar results to a random-effects panel regression that considers fixed effects for each general type of survey.

increases the number of cases on which the average is based which makes it possible to have more reliable estimates.[3] β2 and β3 apply the height gain and loss corrections. Between ages 21 to 40, height does not significantly change as a function of age. The variable for young (old) age is set to zero if age is in the 21-40 range, otherwise it is the squared difference of 21 (40) minus the age of the annual birth cohort. That is, women of ages 19, 30 and 45 have young-age values of 4, 0 and 0, and old-age values of 0, 0 and 25. The squared value efficiently captures the gain and loss of height and was not significantly different from a model that used age dummies. In all countries, the β2 parameter was negative and significant; β3 was typically negative, but it was positive (but not significant) in some surveys that covered the population through age 49.[4] The resulting dataset is an unbalanced panel where the group is the country and the time unit is the five-year period. The height averages and frequencies are shown in Table 1.

[3] This is common practice in similar studies: Acosta and Meisel (2013); Baltzer and Baten (2008); Blum (2013); Camara (2015); López-Alonso and Vélez Grajales (2015); Moradi and Baten (2005).

[4] A positive coefficient on the old age variable is not surprising since the loss of stature after 40 is moderate, and it becomes more pronounced only after the age of 50. Even more, in some countries with low life expectancy, we can expect that women who reached 40 years old are healthier and, hence taller (on average) than those who did not survive (Bozzoli, Deaton and Quintana-Domeque 2007). In all our statistical analysis, we confirmed that the results we present here also held for the subset of those in the 21-39 age range, which is more common in other anthropometric studies.

Table 1: Height and frequency by country and five-year birth cohort

Panel A: Normalized average height in millimeters											
Country	**1940**	**1945**	**1950**	**1955**	**1960**	**1965**	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**
Bolivia (BO)		1490	1503	1506	1510	1514	1514	1519	1526	1532	1537	
Brazil (BR)	1546	1552	1552	1555	1561	1565	1569	1575	1580	1585	1590	
Chile (CL)		1562	1556	1551	1560	1566	1566	1583	1586	1586	1586	
Colombia (CO)			1530	1540	1546	1548	1550	1554	1559	1564	1568	
Dominican R. (DO)		1570	1565	1566	1573	1574	1570	1578	1580	1587	1591	1591
El Salvador (SV)				1518	1512	1518	1524	1528	1527	1531	1544	
Guatemala (GT)		1465	1470	1473	1478	1484	1482	1485	1486	1487	1495	
Haiti (HT)		1579	1581	1585	1588	1589	1587	1590	1593	1593	1590	1588
Honduras (HN)			1530	1527	1526	1524	1529	1529	1532	1536	1542	1547
Mexico (MX)	1522	1526	1522	1525	1530	1531	1534	1538	1546	1555	1560	1558
Nicaragua (NC)		1539	1537	1538	1540	1539	1541	1546	1546	1545	1548	1549
Peru (PE)		1497	1500	1505	1508	1512	1514	1517	1520	1524	1526	1529
Panel B: Number of individual observations												
Country	**1940**	**1945**	**1950**	**1955**	**1960**	**1965**	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**
Bolivia		75	635	2902	4805	5784	6257	6156	5819	6021	2348	
Brazil	1332	8291	5970	17561	10534	11760	9799	9672	9872	9754	7060	
Chile		126	272	358	416	515	410	360	434	314	290	
Colombia			252	4406	10442	12478	12491	12574	12937	13132	8394	
Dominican Republic		363	874	1276	1894	2989	2851	2854	1874	1404	1728	1245
El Salvador				249	1010	1389	2063	2744	2667	1965	1194	
Guatemala		75	661	1712	3507	4373	5675	5735	4676	3489	2385	
Haiti		62	997	1608	2465	3079	3580	3794	4616	3274	2390	1057
Honduras			349	1647	3590	5223	6478	7813	8164	8888	5751	2341
Mexico	360	1968	5364	7422	9060	10390	11291	10927	11664	10311	5676	1458
Nicaragua		288	1620	3097	5318	7084	8255	9532	10709	6572	5388	2240
Peru		357	3216	6620	15739	19639	20818	19395	19644	15627	14597	2883

Notes: Heights are normalized to women age 21-40 using the method and sources indicated in the Appendix.

Compared to most anthropometric studies, our method makes use of heights from a wider range of ages. The trends obtained from our data are very similar to other male and female height series for Latin American countries from the 1940s to the 1980s. The R squared of our data and similarly constructed series for males in Brazil (Monasterio et al. 2010) and Mexico (López-Alonso and Vélez-Grajales, 2015) are 0.96 and 0.99 respectively. For Guatemala, Rios and Bogin (2010), estimated a decadal series based on a rural sample of identification cards, instead of a national random sample; the R squared is smaller (0.59), but still significant. In these comparisons, dimorphism, the gap between male and female heights, is within an expected range (10 to 13 cm), while the overall growth in heights is also comparable. The correlations with other female height series are similarly high. Meisel and Vega's series for Colombia is based on millions of identification cards that are broadly representative of young women (2007). Our average is about three centimeters lower because surveys of mothers of young children are often among poorer strata of population compared to single and married women; still, the R squared between the two series is 0.91 indicating common trends. The correlation with Baltzer and Baten (2008)'s regional averages for the 1950-1979 subperiod is 0.80. Another difference with Baltzer and Baten data is that our averages are 0.5 to 1.0 cm higher. The comparison with Deaton (2007)'s average for Latin America in the same period further validates our findings. The R squared is 0.77 and the height difference is less than 5 mm. Our more extensive dataset and methods yield estimates of heights comparable to previous evidence from other studies, but our data also indicate a higher increase in heights, from 0.1 to 0.8 cm more than the other series, from beginning to end of the period.[5]

Our first step in describing and analyzing height data is by first looking at differences in levels, that is in the average height regardless of their evolution in time. The average height of each country is mapped in Figure 1. A first issue that stands out in comparing the levels is the wide gap between tall populations such as Haiti (1588 mm) and Dominican Republic (1577 mm) and short populations such as Guatemala (1481 mm), Peru (1514 mm) and Bolivia (1515 mm). Sometimes these differences in height are reported as testimony of wide gaps in development; however, Haiti is the country with the lowest indicators of development in the region and the tallest population for most of the period. Second, it is clear that the heights of similar neighboring countries are a relatively good predictor of a country's heights. Dominican Republic and Haiti share the same island; both have evolved from plantation societies and have a long history of mutual migration and contacts. They are separated by 11 mm and even less more recently. With the exception of Guatemala, the Mesoamerican region is within a relatively narrow margin of 18 mm. Bolivia and Peru have only 1 mm of difference. These groups of countries share similar ethnic characteristics, they have a long history of demographic contact and their populations share similar environmental characteristics.

[5] More recently, Benthan, Di Cesare et al (2016) estimated average heights by birth cohorts relying on a polynomic trend based on actual height observations, trend interpolations and imputation from regional averages. The median R squared of their country series with our own is 0.79. The cases of greater deviation with our estimates are the ones with more seeming reliance on interpolation (e.g. Nicaragua and Honduras).

Geographic proximity implies that two factors are likely at play. First, similar ancestries in their populations, meaning similar genetic characteristics developed over long-term interactions with the environment. It is worth looking at the central Andean countries (Bolivia and Peru) and the Hispaniola Island in this regard. The first pair, which stands out by its short stature, is defined by the presence of Quechua- and Aymara-speaking ethnicities and their Hispanicized descendants, as well by a high-altitude environment that taxes the body and restraints growth compared to lowland populations. Dominican Republic and Haiti, share a similar environment, a plantation past and also the highest percentage of African descendants in Latin America. Ethnic and geographic similarity seems to be more important than gaps in development.

Differences in development play a limited role in terms of levels of height. It is true that Guatemala (the country with the shortest population) lags other Mesoamerican countries in nutrition and health; on the other end, the wealthiest country in the sample, Chile, was the third tallest in the sample. Yet, the correlation of average heights and income is weak and statistically insignificant. The stronger influence of human development on heights, however, is seen in the evolution of height over time rather than in levels.

Figure 1: Average Female Height in Twelve Latin American Countries, 1950-1995

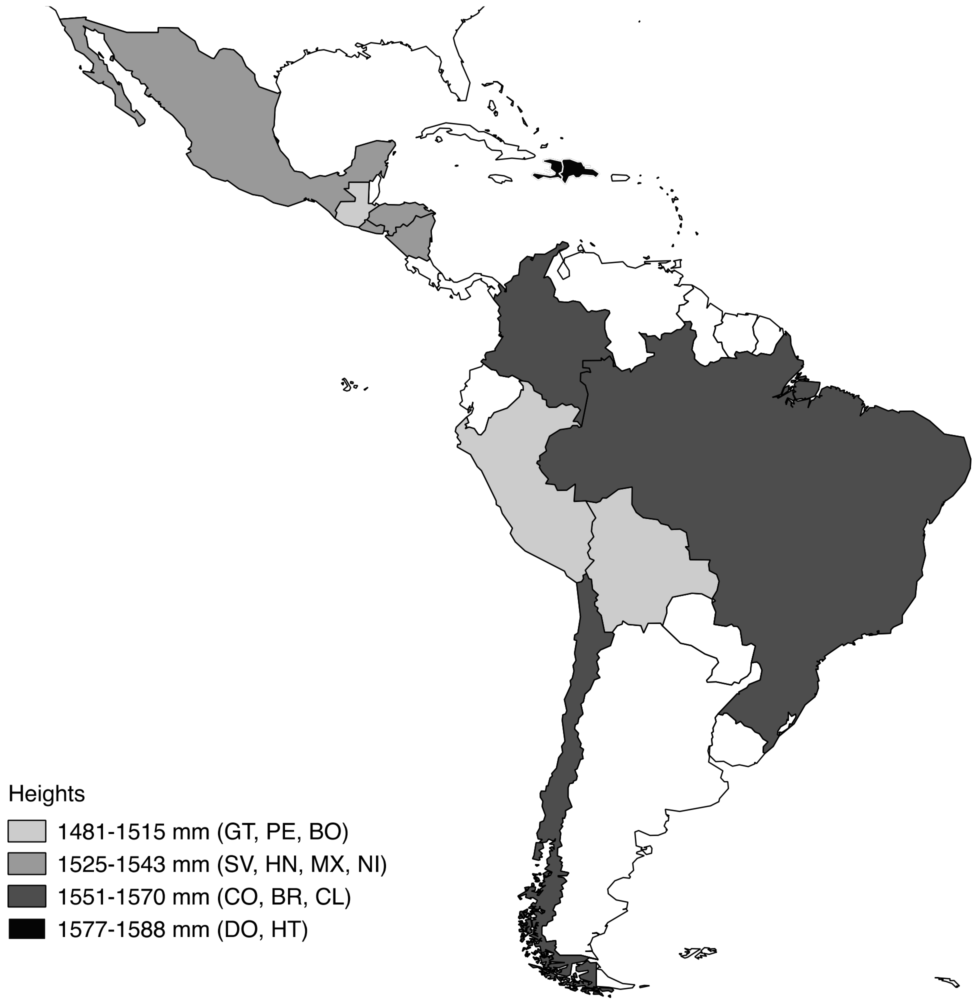


Table 2: Latin American Height Gains in Comparative Perspective

Region	Total gain in height
Twelve Latin American Countries, 1950-1994	**2.6 cm**
World, 1951-1996	1.0 cm
Twelve Latin American Countries, 1950-1979	**1.8 cm**
High income West, 1950-1979	2.4 cm
—Southern Europe, 1950-1979	5.3 cm
—United States, 1950-1979	0.9 cm
Africa, 1950-1979	0.2 cm
Central Asia, 1950-1979	1.5 cm
Indian subcontinent, 1950-1979	1.0 cm

Notes and sources: The Latin American figures are derived from Table 1; worldwide figures from Bentham, Di Cesare et al. (2016); High Income West, Bozzoli, Deaton and Quintana-Domeque (2009); US, Komlos and Lauderdale (2007); Deaton (2007) for all the rest. The averages are not weighted by population.

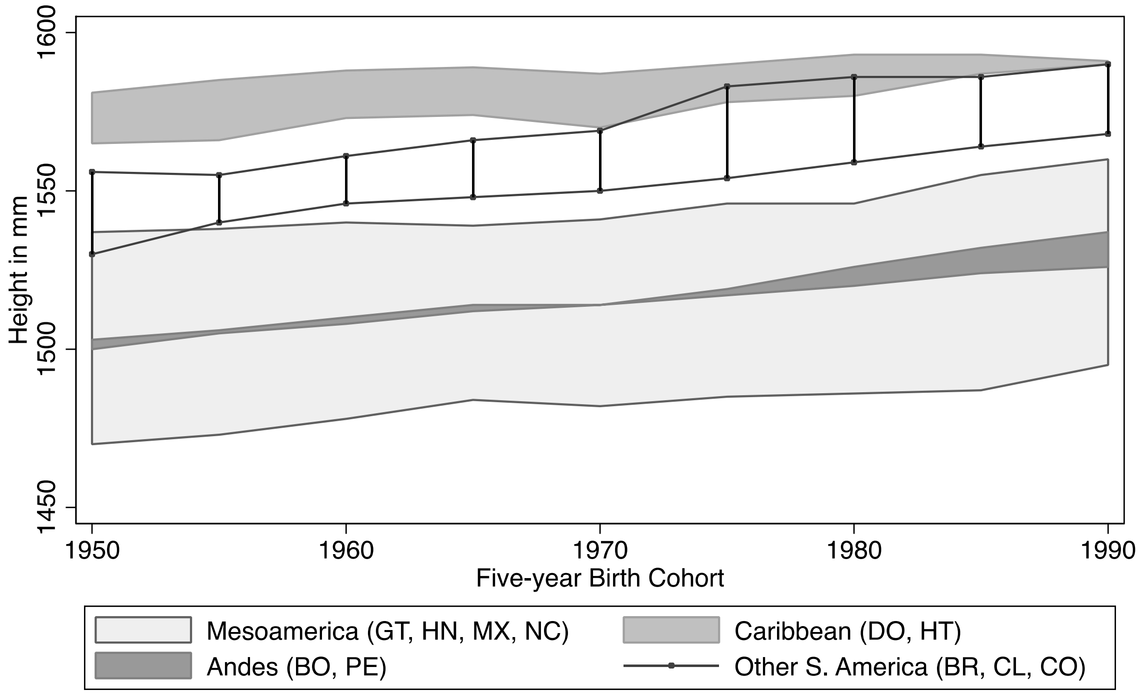
In terms of trends, one of the most remarkable findings is that in all countries heights progressed throughout the period, achieving a total average gain of 2.6 cm from the early 1950s to the early 1990s, as it is shown in Table 2. The pace of growth was below that of the high-income west, and certainly well below that of Southern Europe, whose human development indicators were not too far ahead of some Latin American countries in the years following the postwar (Gómez-Galvarriato and Silva-Castañeda, 2007). Still, heights certainly rose more than in the United States and other high-developing regions in which growth plateaued after substantial gains earlier in the century. The comparison also looks favorable in comparison to other developing regions of the world, and to the whole world on average.[6] The gains in female height connect well with the story of human development

[6] These comparisons are based on Bentham and Di Cesare (2016); Cole (2003); Deaton (2007); Hauspie et al. (1997)

in the region, which has expanded steadily, often surpassing other least developed areas of the world yet without catching up with the developed world (Prados 2007, 2015; Salehi-Isfahani 2013)

While all countries increased their heights, the increase was not the same across the board. At first sight, we can see an apparent regional pattern, in which South American countries typically achieved more progress than those in the north. Figure 2 indicates that growth in the Caribbean (the tallest region at the start of the period), was much less intense than in the rest of the countries— 18 mm from 1950-54 to 1990-94. By contrast, South American countries gained more than 33 mm in the same period. Brazil and Colombia led this group with a total increase of 38 mm. In Mesoamerica variation prevailed. Mexico gained 38 mm, but its southern Central American neighbors gained only 19 mm. These deviations from the regional pattern are not trivial: these countries with gains that surpassed their neighbors were those that also achieved a higher rate of economic growth in the region.

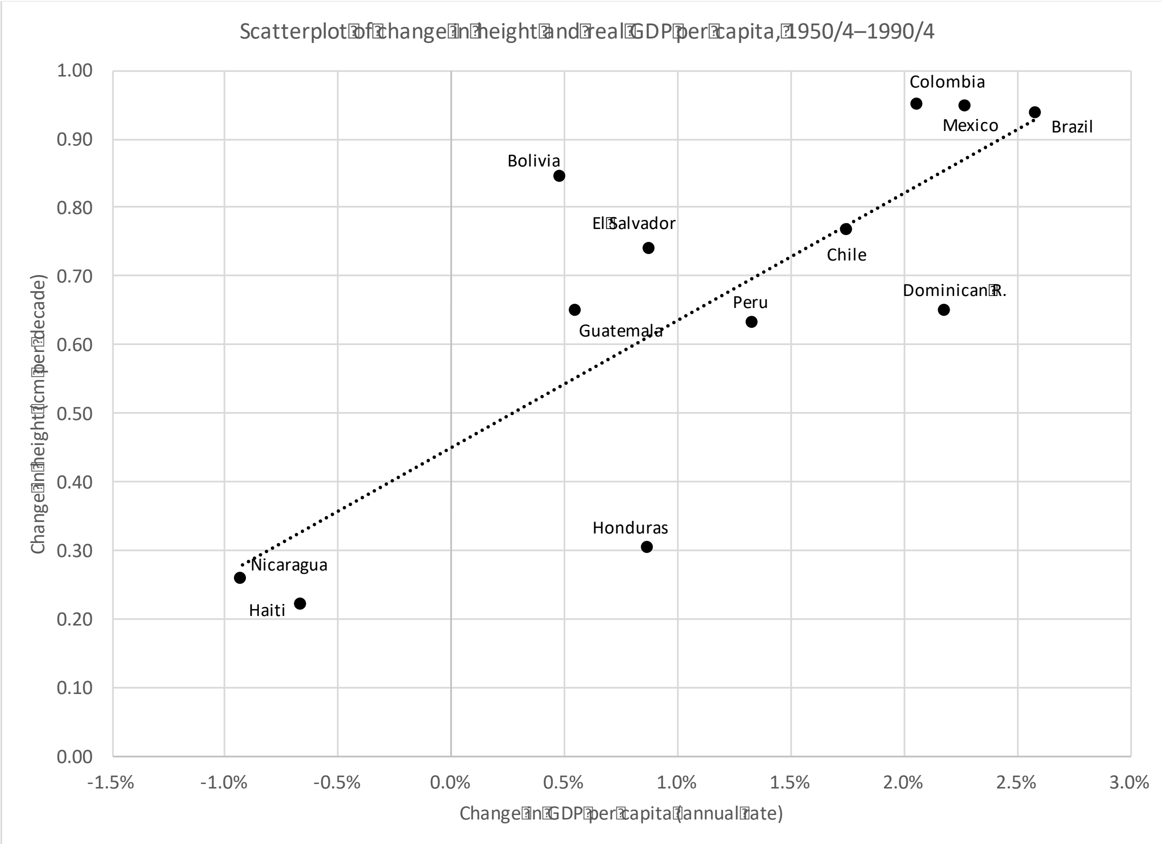
Figure 2: Height Range by Subregion



Notes: Each area shows the minimum and maximum height of each subregion.

Source: Table 1

Figure 3: Increase in height and economic growth, 1950/4-1990/4



Note: Due to lack of height data before 1955, El Salvador's rates are estimated for the 1955/9 and 1990/4 period.

We explore the correlation of height gains and economic growth in Figure 3, which plots the overall increase in heights (measured in centimeters per decade in the vertical axis), and the average annual rate of economic growth in the similar period. This is a simple approach that helps identify a relationship in the trends of the two variables regardless of their mean level. The two variables are solidly correlated. The R squared verifies this visual inspection: growth in real income explains 63 percent of the total increase in height. Haiti and Nicaragua stand on the one end with the negative rates of economic growth and the smallest improvement in height (less than 0.3 cm per decade). On the other end, Brazil, Colombia and Mexico have the largest increase in heights (almost 1 cm per decade) and more than a 2-percent annual growth of their economies.[7] Overall, the Latin American countries that underwent a process of industrialization and modernization of their economies were the ones that experienced more gains in height.

Side-by-side comparisons of neighboring countries with similar environmental and demographic characteristics also highlight the importance of economic growth. In the Island of Hispaniola, Haiti started out with a height advantage of one cm relative to Dominican Republic. Yet, by the 1990s, after negative economic growth rates and lagging in nutrition and life expectancy, Haitians gained almost no height. Dominican Republic caught up and even slightly surpassed Haiti in the late 1990s. The anthropometric trend conforms well to the significant gaps in development in the island, as well as with recent revisionism on Haitian history that points to the second half of the twentieth century as a moment of collapse in governance, state capacities and living standards (Diamond, 2005; Dubois, 2012).[8]

The Mesoamerican countries, including Mexico, Guatemala, El Salvador, Honduras and Nicaragua, also show some remarkable divergences in trends that are likely connected to their varying economic paths. On one end, Nicaragua started out with the tallest population in the 1950s. After four decades of negative economic growth, Nicaragua only increased female heights in 1 cm. Mexico, by contrast, was 1 cm behind Nicaragua in the early 1950s, but experienced one of the highest rates of height increase in the region along with a high (even if highly uneven over time) rate of economic growth. By the 1990s Mexican women were about 1 cm taller than Nicaraguans. Similarly, Mexicans became taller than Honduras and increased the gap with Guatemalans and Salvadorians, all populations that experienced slower rates of economic growth.[9]

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[7] These findings are much in agreement with Meisel and Vega's characterization of Colombia as "tropical success story." Monasterio et al,, and López-Alonso and Vélez-Grajales for Brazil and Mexico, respectively, highlight the importance of enduring inequalities in this period. Our findings do not contradict that idea; still, the trends in male heights presented in those studies align well with our results.

[8] See Chapter 11 in Diamond (2005). We drew information about the ancestry of the population from Putterman and Weil (2010); nutrition data, from the food balance sheets (1960 to the present) in FAOSTAT; health and economic indicators, from MOXLAD and CEPALSTAT. The databases are cited at the end of the text.

[9] On an insightful socioeconomic interpretation of Guatemala's anthropometric history, see Rios and Bogin (2010). Given that Guatemala's deficiency in proteins is particularly noticeable in milk protein consumption (4 daily grams compared to 7.2 grams in the other four Mesoamerican countries), it is likely that the low protein intake is related to a higher prevalence of lactose intolerance; see Baten and Blum (2014)

The effect of economic growth likely conflates the importance of the expanding state capacities, such as the improved provision of primary health services and other public services (McGuire, 2010). In fact, Latin America has shown significant progress in development indicators, even in spite of the prolonged economic crisis of the 1980s. The cases of Bolivia and Dominican Republic, two outliers in the regression of economic growth and height growth, illustrate the importance of looking more broadly at state capacities. Bolivian women gained more than 0.8 mm in height per decade, ranking fourth in our dataset. This growth outperforms the prediction based on economic growth. While Bolivia lags the region in its development indicators, it is a country that has made more progress than other countries in this region. One particular area of improvement is its rural maternal health plan, in which local infirmaries work in close contact with local communities. National histories of public health policies and nutrition likely hold important insights to understand the evolution of heights.[10] The opposite is the case of Dominican Republic, which underwent a rather successful transition toward neoliberal policies since the 1970s, but that has continued experiencing high income inequality and poor outcomes in non-economic indicators of human development.[11]

Conclusion

During the second half of the twentieth century, Latin America experienced sustained growth in average female heights. This growth was superior to what has been found for other developing regions but this Latin American pattern was far from being spectacular if we take into account what has been found for Southern Europe roughly in the same period. Still, our estimations show some interesting regional features that open important research questions.

First, what are the determinants of heights and what is driving its changes? Geography, the environment and genetics seem to play a factor in the levels of height average, whereas economic growth and more broadly human development seem influential in setting the pace of the increase in height. These hypotheses require a more sophisticated econometric approach to be confirmed. But the data we have compiled is useful to suggest these topics as part of a wider research agenda.

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[10] See Pacino (2015). It is important to highlight, however, that the impact of these policies evade measures of mortality, such as infant mortality or life expectancy. Changes in infant mortality are only correlated to short-term changes in height (from one five-year period to the next), but not so with long-term changes in height. A similar correlation of changes over the period similar to that presented in Figure 2 show R^2 close to 0.2.

[11] Although it does not cover more recent developments, Cassá (1986) provides an excellent overview of the gaps between economic and human development in Dominican Republic.

Second, is this data telling us something new about the history of Latin America in this period? The average heights trends of each country tend to be steady and independent of the evolution of economic performance over time or at their starting point. This is normal, partly, because average heights usually grow slowly, with strong dependencies between the height of one generation to the previous one (Cole 2003). But during this period in Latin America, the stability of these trajectories is worth mentioning since the trends in economic growth and variations in economic policy could not be more pronounced. Height gains did not pick up during the economic boom decades of the 1950s and 1960s, neither they relented during the deep and long crisis of the 1980s. It is true that more data would be useful to trace the evolution in the 1990s, but at this point all the evidence suggests that the 1980s were not a watershed in Latin American anthropometric history as it was in its economic history. GDP-driven narratives could then be complemented by the introduction of anthropometric data. This is quite a laborious agenda but it will certainly pay off with a deeper understanding of the drivers and dimensions of Latin American human development.

Finally, besides economic growth, is there anything else driving these trajectories? The deviations from the general trend showed in figure 3, about relationship between changes in average heights and economic growth, might point, at least in some cases, at the relevance of elements affecting average heights that are not related to the process of economic growth. The countries in which height gains overperform the expected increase due to economic performance, such as the case of Bolivia, seem to be countries where the states have developed certain capacities or applied successful policies that might explain the relative success in terms of biological well-being. This calls for the continued study of individual cases and policies in the twnntieth century and for broadening the typical borders of anthropometric and economic history and include the construction of states capacities as a variable on its own right.

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Health Survey Microdata

All surveys labeled as DHS were obtained with special permission of the Demographic and Health Surveys Program, funded by USAid, http://dhsprogram.com. We only provide full title and original organization for the non-DHS surveys.

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Colombia

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Dominican Republic

- DHS 1991, 1996, 2013

El Salvador

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Haiti

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Mexico

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Nicaragua

- DHS 1998, 2001
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Peru

- DHS 1991, 1996, 2000, 2007, 2009, 2010, 2012

Appendix

Table A.1: Coverage and characteristics of health surveys

Survey	Birth cohorts	Frequency	Type of population surveyed
Bolivia			
DHS 1994	1950–1976	2,536	2
DHS 1998	1950-1980	4,337	2
DHS 2003	1953-1988	17,268	2
DHS 2008	1958-1993	16,492	2
Brazil			
BSNH 1989	1941-1970	12,700	1
DHS 1996	1952-1979	3,225	2
ENDEF 1977	1955-1959	9,662	1
PNDS 2006	1957-1992	15,391	3
POF 2008	1948-1994	54,889	1
Chile			
ENS 2003	1946-1985	1,328	1
ENS 2009	1950-1994	1,922	1
Colombia			
DHS 1995	1952-1979	3,734	2
DHS 2000	1957-1983	3,590	2
DHS 2005	1954-1989	34,901	2
DHS 2010	1960-1994	44,724	2
El Salvador			
ENESF 2008	1958-1993	9,672	3
RHS 2002-3	1958-1986	3,559	3
Guatemala			
ENSMI 2002	1952-1987	7,829	2
ENSMI 2008	1959-1994	16,447	2
DHS 1995	1949-1979	5,379	2
DHS 1999	1953-1981	2,459	2
Haiti			
DHS 1995	1949-1976	2,173	2
DHS 2000	1950-1985	9,997	2
DHS 2006	1956-1990	5,241	2
DHS 2012	1962-1997	9,400	2
Honduras			
DHS 2006	1956-1991	19,206	2
DHS 2012	1962-1997	22,363	2
ENESF 2001	1956-1984	3,926	3
ENCOVI 2004	1954-1989	4,954	1
Mexico			
ENSANUT 1999	1950-1984	15,922	3
ENSANUT 2006	1946-1990	20,364	1
ENSANUT 2012	1946-1996	21,531	1
MFS 2002	1941-1986	8,138	1

MFS 2005	1944-1989	8,622	1
MFS 2009	1948-1993	9,367	1
Nicaragua			
DHS 1998	1948-1983	13,091	2
DHS 2001	1951-1986	12,603	2
ENDESA 2006	1961-1997	21,056	3
ENDESA 2011	1961-1997	21,056	3
Peru			
DHS 1991	1946-1974	5,264	2
DHS 1996	1948-1980	10,962	2
DHS 2000	1950-1985	26,754	2
DHS 2007	1955-1993	26,617	2
DHS 2009	1959-1994	23,094	2
DHS 2010	1960-1995	22,443	2
DHS 2012	1962-1997	23,592	2
Dominican Republic			
DHS 1991	1946-1974	2,246	2
DHS 1996	1947-1981	7,905	2
DHS 2013	1963-1998	9,117	2

Note: Type 1 are health surveys that include all the population, of which we selected women age 15-59; types 2 are surveys of mothers in the 15-49 age range; type 3 are reproductive health surveys of women age 15-49. We eliminated cohorts with less than 30 cases.