A TROPICAL SUCCESS STORY: A CENTURY OF IMPROVEMENTS IN THE BIOLOGICAL STANDARD OF LIVING, COLOMBIA 1910-2002 *

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I. Introduction

Since the late 1970's there has been a growing interest among economic historians in the study of the behavior of height over time, as an alternative method for measuring the standard of living.[1] Adult height reflects the net nutritional status of a person during the years of physical growth, which is influenced by food intake, health, and work effort.[2] Thus it provides a measure of the biological standard of living, one of the dimensions of the overall standard of living.

This paper studies the behavior in the height of Colombian women and men born since 1910 to 1984. For Colombians born in 1984 the adult height was recorded in 2002, when they received their citizenship card. Thus, the height data discussed in this paper reflect the behavior from 1910 to 2002 of the determinants of height. The information that is used comes from the citizenship card (*cédula de ciudadanía).* With 8.454.348 observations, this is one of the largest databases, relative to the population of the country, found in the literature of anthropometric history to date.

In economic terms Colombia was a success story during the twentieth century. The rate of growth of per capita GDP from 1905 to 2000 was 2.3%, one of the highest in Latin America[3]. This economic success was reflected in several dimensions of the standard of living, one of which is the height of its population. Colombian men born in 1984 were 7.9 cm. taller than those born in 1910, while in the case of women the increase was of 8.8 cm., an enormous improvement in physical well being which was achieved in only three generations.

This paper is divided in three main sections. First, the characteristics of the database are discussed. Then the national evolution of height for Colombians born in the period 1910-1984 is presented. Next, the behavior in the average height of the departments, the

[1] The research of Robert Fogel and his collaborators in the 1970's contributed to the increasing interest in anthropometrics on the part of economic historians. See John Komlos, Nutrition and Economic Development in the Eighteenth-Century Habsburg Monarchy. An Anthropometric History, Princeton University Press, USA, 1989, p. 25.

[2] See Richard Steckel, "Stature and the Standard of Living", Journal of Economic Literature, Vol. XXXIII, December, 1995. The first three years of life are the most important for a person's final height, although growth continues until around 18 years of age. See James M. Tanner, "Growth in Height as a Mirror of the Standard of Living", in John Komlos editor, Stature, Living Standards and Economic Development: Essays in Anthropometric History, West View, USA, 1994.

[3] GRECO, El Crecimiento económico colombiano en el siglo XX, Banco de la República, Fondo de Cultura Económica, Bogotá, 2002, p. 3.

main sub-national territorial units, is compared and a convergence analysis is performed for the period as a whole. Finally, some conclusions are drawn in the last section.

II. Data and Previous Studies

The first systematic treatment of the long run behavior of average height in a Latin America country was published in 1991 in Colombia.[4] The authors, Antonio Ordoñez and Doris Polania, used a sample of 14.103 observations for the period 1900-1972, obtained from the national citizenship card files (5.839 women and 8.264 men). That study concluded that there was a secular trend of increasing average height both for men and women. For men there was a gain of 7.0 cm. and for women 8.7 cm. However, Ordoñez and Polania did not try to relate the evolution of height with other social and economic variables, limiting themselves to a descriptive presentation of the data.

The height data used in this study comes from the citizenship card (*cédula de ciudadanía),* the same source that had been used by Ordoñez and Polania*.* However, unlike them we do not use a sample but the totality of the database available from the electoral authority of Colombia, the Registraduria Nacional del Estado Civil.

The existence of continuous information on the height of Colombians during the twentieth century is perhaps not accidental. The citizenship card originated in the need to have a document to identify voters. Colombia has one of the longest traditions of democratic elections in Latin America and has never had long periods of authoritarian governments.[5]

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[4] Antonio Ordoñez Plaja y Doris Polania, "Cambios de estatura en Colombia durante el presente siglo", Coyuntura Social, No. 6, junio de 1992. For Mexico there is an anthropometric study for the period 1870-1950 which uses data from military recruitment and passport records, Moramay Lopez-Alonso and Raúl Porras Condey, "The Ups and Downs of Mexican Economic Growth: The Biological Standard of Living and Inequality, 1870-1950", Journal of Economics and Human Biology ,Vol. 1, No. 2, 2003. Those authors found that Mexicans born in 1950 were not taller than those born in 1870.

[5] Over the last few years the electoral history of Colombia since independence has attracted the attention of several historians: David Bushnell: "Voter Participation in the Colombian Election of 1856", Hispanic American Historical Review, Vol. 51, 1971, "Las elecciones presidenciales, 1863-1883", Revista de la Universidad Nacional, Medellín, No. 18, 1984, "La elecciones en Colombia: Siglo XIX", Credencial Historia , Bogota, 1994; Malcom Deas, "El papel de la Iglesia, el ejército y la policía en las elecciones colombianas entre 1850 y 1930", Boletín cultural y bibliográfico , Biblioteca Luis Angel Arango, Vol. XXXIX, No. 60, 2002; Eduardo Posada Carbó, "Elections and Civil Wars in 19th Century Colombia: The 1875 Presidential Campaign", Journal of Latin American Studies , Vol. 26, 1994, "Los límites del poder: Elecciones bajo la hegemonía conservadora, 1886-1930", Boletín Cultural y bibliográfico , Biblioteca Luis Angel Arango, Vol. XXXIX, No. 60, 2002.

The first law to establish a voter identification document, although very deficient, was issued in 1853 by President Jose Maria Obando.[6] It was only until 1934 that a citizenship card (*cédula de ciudadanía)* was established for Colombian men over 21 years of age. The information included in that document recorded such physical characteristics as the color of skin, hair, and eyes, as well as height. Due to numerous problems with the quality of the records of the initial citizenship document, in 1952 a new one was issued. That new document included a picture of the citizen, his fingerprint, height, skin color, date of birth and place of birth. For women the citizenship document was first issued in 1956. In 1954 women had been granted the right to vote, although it was only until December of 1957 that they participated in an election.[7]

Through the years this last document has had a few minor changes concerning the information it includes and its presentation.[8] The database used in the present study corresponds to the records of this second citizenship card, which was first issued in 1952.

Table 1. Number of Observations on the Height of Colombians

Census year	Total population of Colombia	Number of births **	Number of observations on height	Observations as a percentage of those born in that year
1938	9.072.894	388.592	14.836	3,82%
1951	12.411.101	547.330	27.939	5,10%
1964	17.484.510	795.021	66.808	8,40%
1973	20.666.920	848.790	158.893	18,72%
1980*	24.225.517	790.721	750.225	94,88%
1984	27.853.436	909.136	211.850	23,30%

* Estimated population.

** Estimated by the authors

Table 1 shows the observations in the database and what percentage of those born in a specific year they represent. This percentage increases from 3.7 % in 1938 to 94.88% in

[6] Registraduría Nacional del Estado Civil, Historia electoral colombiana, Bogotá, 1988, p. 35.

[7] Ibid, p. 51.

[8] In 1975, when Colombians over eighteen years were granted the right to vote, the citizenship card began to be issued at that age. Since some people grow in height past their eighteenth birthday, especially in the early stages of development, this could introduce a structural break in the height series. For this reason a simple test proposed by Ben-David and D. Papell was performed, but no structural break in the series was found, either for men or women, D. Ben-David and D. Papell, "Slowdowns and Meltdowns: Postwar Growth Evidence from 74 Countries", NBER, WP 6266, 1997.

1980. Thus, the results obtained in this paper are highly representative of what happened for the overall Colombian population.[9] An important aspect of this database is that it also includes information for women, which is normally absent from military records, for example. Additionally, it allows for analysis at the regional level (and thus of racial characteristics) and even for the main cities and towns. Finally, it extends for almost a century of Colombian history, since it begins with those born in 1910 and extends to those born in 1984, and who achieved their adult height around 2002.

The quality of this data was further corroborated when a Kolmogorov-Smirnov normality test was performed for the observations of one year in every decade. In every case at the 10% level of significance the null hypothesis of normality was accepted.[10]

III. Growing Taller: Continuous Increases in Height

The average height of Colombians increased throughout the twentieth century in every decade, and for all sexes, regions, and social classes. This growth was neither hampered by the cycles of political and criminal violence, nor by those of concentration of personal income that occurred in several periods of that century.

Table 2. Average Height of Colombians by Date of Birth

Date of birth	Average Male Height	Average Female Height	Increase in Height for Men (%)	Increase in Height for Women (%)	CMS increased (Men)	CMS increased (Women)	Number of observations (Men)	Number of observations (Women)	TOTAL NUMBER OF OBSERVATIONS
1910-1914	163,48	150,78					1.751	2.197	3.948
1915-1919	163,61	151,49	0,0791%	0,4707%	0,13	0,71	4.582	4.993	9.575
1920-1924	164,16	152,38	0,3372%	0,5890%	0,55	0,89	9.086	9.779	18.865
1925-1929	164,70	153,06	0,3276%	0,4409%	0,54	0,67	15.659	16.299	31.958
1930-1934	165,17	153,48	0,2885%	0,2748%	0,48	0,42	22.219	24.619	46.838
1935-1939	165,76	154,21	0,3543%	0,4798%	0,59	0,74	34.637	33.820	68.457
1940-1944	166,26	154,69	0,3021%	0,3118%	0,50	0,48	40.186	45.623	85.809
1945-1949	167,10	155,59	0,5075%	0,5822%	0,84	0,90	53.164	60.723	113.887
1950-1954	167,84	156,40	0,4435%	0,5156%	0,74	0,80	73.835	80.863	154.698
1955-1959	168,07	156,81	0,1330%	0,2632%	0,22	0,41	101.613	111.278	212.891
1960-1964	168,47	157,17	0,2417%	0,2274%	0,41	0,36	142.054	157.950	300.004
1965-1969	169,00	157,34	0,3161%	0,1129%	0,53	0,18	177.464	221.024	398.488
1970-1974	168,91	157,21	-0,0558%	-0,0842%	-0,09	-0,13	298.908	426.660	725.568
1975-1979	169,66	157,81	0,4426%	0,3784%	0,75	0,59	1.639.499	1.646.878	3.286.377
1980-1984	170,64	158,65	0,5809%	0,5325%	0,99	0,84	1.528.875	1.468.110	2.996.985
TOTAL			4,3832%	5,2149%	7,17	7,86	4.143.532	4.310.816	8.454.348

[9] Height studies often run into difficulties created by deficient samples. For example, as a result of minimum height requirements such as those used in the military, truncation of the data is very common. Also, some samples may present regional or socio-economic status biases, which lead to results that may not be representative of the total population. See John Komlos, "How to (and how not to) Analyze Deficient Height Samples", (mimeo).

[10] The test was performed for the years 1910, 1920, 1930, 1940, 1950,1960,1970,1980, and 1984.

On average, male Colombians that were born between 1910 and 1914 grew to an adult height of 163.48 cm. In contrast, those born in the 1980-1984 period achieved an average height of 170.64 cm., an increase of 7.17 cm., which corresponds to a 4.4% growth in stature. In the same period women increased their height from 150.78 to 158.65 cm. That is an increase of 7.86 cm. or 5.2% above the initial height. In both cases, the data show an increase of about one centimeter per decade, a remarkable achievement by international standards.[11]

As shown in Table 2, 1970-1974 was the only five-year period between 1910 and 1984, for which the average height of Colombians born at that time fell. For men the reduction was -0.056% and for women, -0.084%. Though relatively small, this setback is somewhat puzzling since during those years per capita and agricultural GDP increased. For example, in the five years from 1970 to 1974 the average growth rate of agricultural GDP was 5.4%. Additionally, during the 1970's personal income distribution was improving. The available estimates of the Gini coefficient show that it fell from 0.53 in 1971 to 0.48 in 1978.[12]

Two interrelated economic events seem to explain the 1970-1974 reduction in average height. First, beginning in the 1970's the relative price of food began a long period of increase which lasted until the end of the 1980's. Thus the relative prices of food increased 71.1% with respect to the overall price index. Although the drop in average height occurred only for those born in 1970-1974 and the relative price increase extended over two decades, it has to be kept in mind that those persons born in that five-year period grew up during 1970's and 1980's.

An additional factor which could explain the reduction in height was pointed out by Miguel Urrutia, who has done some of the most important research on income distribution in Colombia. Urrutia argues that when inflation accelerated in the early

[11] Between the end of the nineteenth century and the beginning of the World War II, one of the fastest growing economies in the world was that of Japan. From 1892 to 1938 the average height among recruits increased from 156.1 cm. to 160.3 cm., an average of 0.91 cm. per decade. See Gail Honda, "Differential Structure, Differential Health: Industrialization in Japan, 1868-1940", in Richard H. Steckel and Roderick Floud, editors, Health and Welfare during Industrialization, NBER, University of Chicago Press, USA, 1997, p. 267.

[12] Juan Luis Londoño, Distribución del ingreso y desarrollo económico, Colombia en el siglo XX, Tercer Mundo Editores, Bogotá, 1995, p. 4.

1970's the real income of urban laborers in the formal sector lagged behind.[13] The reason was that at the time labor unions bargained for salary increases for a two-year time period.[14] This situation changed around 1975, when salary increases began to be made on an annual basis.

What are the main reasons behind the almost continuous increases in the height of Colombians from 1910 to 1984? The results of research in the field of anthropometric history identify at least four main factors for the rise of average height in a population over time: reduction in work stress, advances in overall health conditions, changes in the racial composition, and improvements in nutrition.[15] Among these possible influences on stature only the changes in racial composition do not seem to play a role in the Colombian case, since during the twentieth century the country experienced a negligible amount of foreign immigration.

At the beginning of the twentieth century Colombia was predominantly an agricultural country with most of its population working in physically demanding jobs in that sector. A majority of the children were also involved in the labor force. For example, in a population census carried out in the late nineteenth century most of the children who were older than eight years were part of the labor force.[16] Additionally, with economic development there was an increase in the number of jobs in the industrial and service sector, where jobs were often less physically demanding. Also, there was a significant reduction in child labor which was aided by the expansion of education and by legislation directed at prohibiting work deemed detrimental to the health of children.[17]

Throughout the twentieth century there was a continuous reduction in the mortality rate in Colombia.[18] One of the main reasons for that reduction was the improvement in

[13] Miguel Urrutia, Los de arriba y los de abajo, La distribución del ingreso en Colombia en las últimas décadas, CEREC, Bogotá, 1984, p. 180-181.

[14] The estimates of a modified version of Okun's Index, which also includes deviations in the rate of growth of GDP, by Jose Ignacio Lopez for the Colombian presidents since 1958 show that it was the administration of Misael Pastrana (1970-1974), which obtained the worst results according to this index. See José Ignacio Lopez, "Calificando a los presidentes: Una aplicación para Colombia del índice de Okun", Carta financiera, No. 125, diciembre, 2003, p. 17.

[15] See Chapter I, "The Theory of Anthropometric History" in John Komlos, Op.Cit.

[16] Cecilia Muñoz Vila, "The Working Child In Colombia Since 1880", Child Labor in Historical Perspective, 1800-1985 , UNICEF, Italy, 1996, p. 91.

[17] Ibid, p. 100.

[18] Carmen Elisa Florez, Las transformaciones sociodemográficas en Colombia durante el siglo XX, Tercer Mundo Editores, Bogotá, 2000, p. 9-15.

overall health conditions as a result of advances in personal hygiene, public sanitation and medical science. Especially important was the control or elimination of many tropical diseases. For example, the last reported urban epidemic of yellow fever occurred in 1929 in Socorro, Santander.[19] Public campaigns to eradicate this disease, which were undertaken since the early 1920's, with the aid of the Rockefeller Foundation, were responsible for this result. Additionally, since 1937 vaccination against yellow fever was undertaken by the government. These improvements in disease prevention must have contributed to the observed gains in the average height of Colombians.

The diet of Colombian laborers at the beginning of the twentieth was completely inadequate: it was deficient in calorie and protein intake, and lacked essential nutrients. In 1893, Manuel Cotes, a physician, studied in great detail total food consumption by rural laborers around Bogotá, where the best agricultural lands in Colombia are located.[20] The daily diet was composed of 3.500 grams of *chicha* (a fermented maize drink), 600 grams of *mazamorra* (maize porridge), 360 grams of bread, and 40 grams of chocolate.

In the 1930's the Colombian government undertook several studies on the living conditions of urban workers in the main cities of the country. According to these studies most of the income of the working class families was spent on food. In Medellín these expenditures represented 63.5% of the total budget, while in Bogotá it was 65.6%.[21] The results indicated that the main reason for the generalized malnutrition of the working class was its low income.[22]

In a study on the nutritional status of Colombian children done by FAO it was found that as recently as 1965 around 31.9 % were so malnourished that their achieved height was below their potential. However, there was a continuous improvement in nutrition that led to a drop in the number of children below their height potential, to 22.4% in 1977, 16.6% in 1986, 15.0% in 1995, and 13.5% in 2000.[23]

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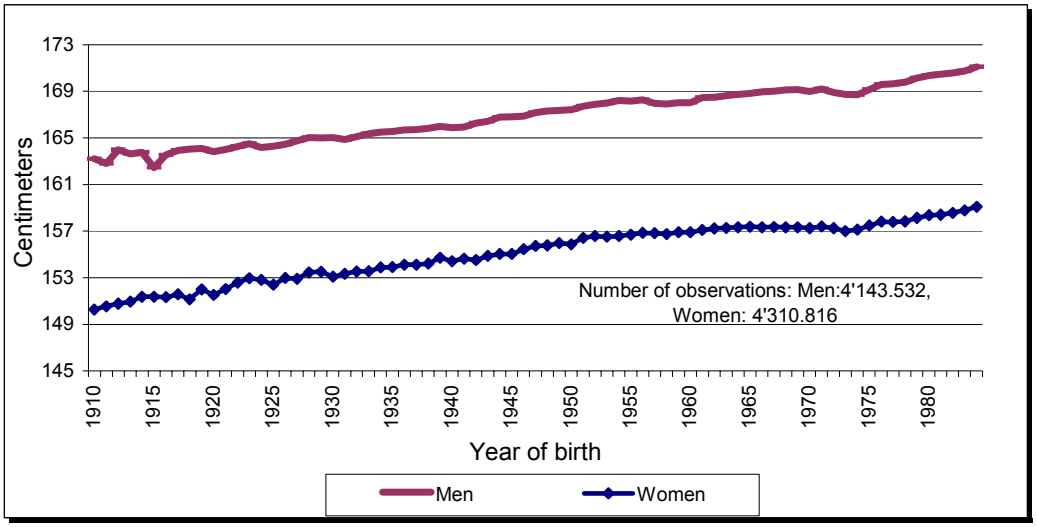
[19] Christopher Abel, Ensayos sobre historia de la salud en Colombia, 1920-1990, CEREC, Bogotá, 1996, p. 20.
[20] Manuel Cotes, Régimen alimenticio de la Sabana de Bogotá, Imprenta La Luz, Bogota, 1893, p. 30-33.
[21] Francisco Abrisqueta, "Las condiciones y el costo de vida de la clase obrera en Medellín", Anales de Economía y Estadística, Tomo III, Suplemento No. 6, octubre, 1940, p. 44.
[22] Ibid., p. 50.
[23] FAO, "Perfiles nutricionales por países: Colombia", Roma, junio, 2001, (mimeo), p. 17.

The improvements in the amount of food consumed by the Colombian population in the twentieth century were, to a large extent, a result of the increase in GDP per capita, which expanded at an average annual rate of 2.3% in the period 1905-2000, as has been mentioned.[24] Additionally, technological advances reduced the real price of key components of the diet. For example, beginning in the 1970's the poultry sector was industrialized and as a result the real price of chicken meat and eggs fell drastically, leading to an enormous increase in their consumption. While in 1950 Colombians ate an average of 2.7 kilograms per capita of chicken meat annually, by 1998 it had increased to 15.3 kilograms.[25]

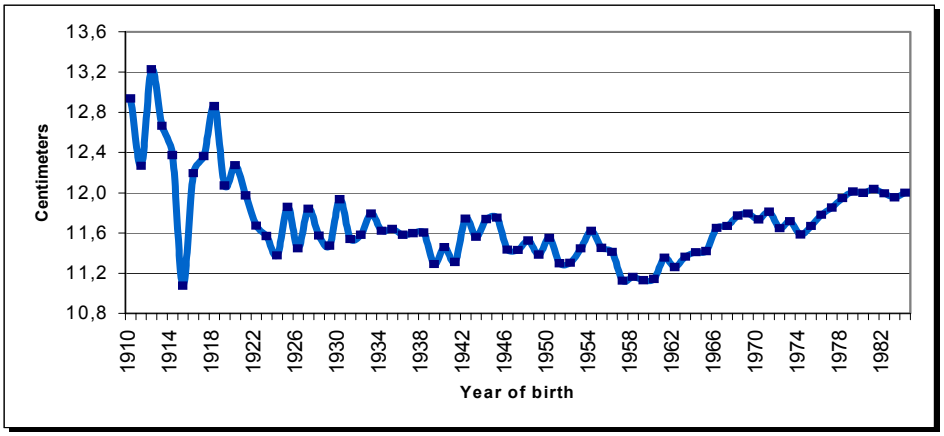
Graph 1. Average Height of Colombians, 1910 – 1984 (by year of birth)



As shown in Graph 1, with only minor fluctuations, there was a secular upward trend in the average height of successive generations of Colombians. This trend is observable for both men and women. The height of men was always above that of females by at least 11 centimeters. However, that differential went through very distinct cycles (see Graph 2).

[24] GRECO, Op.Cit.
[25] Luis Armando Galvis, "La demanda de carnes en Colombia: Un análisis econométrico", Documentos de trabajo sobre economía regional, Banco de La Republica, Cartagena, enero, 2000, p. 13.

Graph 2. Difference between the Average Height of Colombian Men and Women by the Date of Birth (in centimeters)

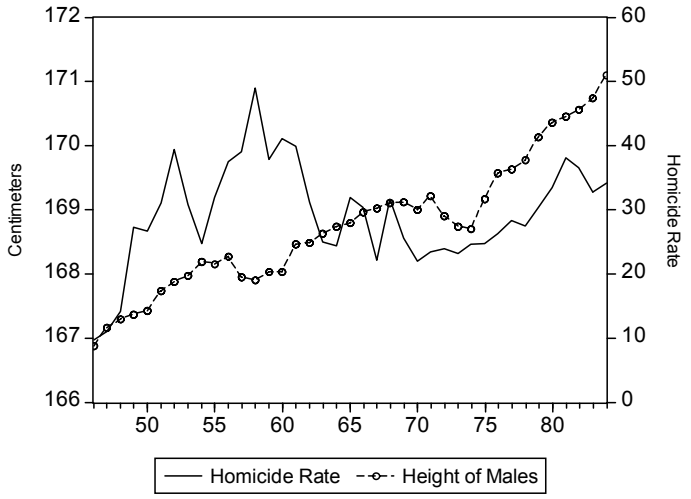


From 1910 to around 1960 the height of women converged towards that of men and the difference between them fell from more than 13 to 11 centimeters. This convergence could have been the result of the overall improvement of the status of women in Colombian society.

On the other hand, the divergence in the average height of men and women after about 1960 is puzzling since the improvement in the relative situation of women has continued after that date, as evidenced by their gains in education and access to the labor markets. Perhaps urbanization has favorably affected the relative work effort of men in comparison to what was prevalent when Colombia was a more rural society, and thus demanded more physical labor.

The upward trend in the height of Colombians throughout the twentieth century was only interrupted during two short periods of a few years, 1957-1960 and 1970-1975, when average height actually decreased. The possible causes for the behavior of height in the early 1970's have been mentioned. What happened in the late 1950's is more complex. This was a period in which an economic and a political crisis coincided. As shown in Graph 3, the increase in the rate of homicides in the late 1950's coincides with a reduction in the average adult height of men born between 1957 and 1960 (the same occurred with women).

Graph 3. Height of Colombian Males and Homicide Rate per 100.000 Inhabitants



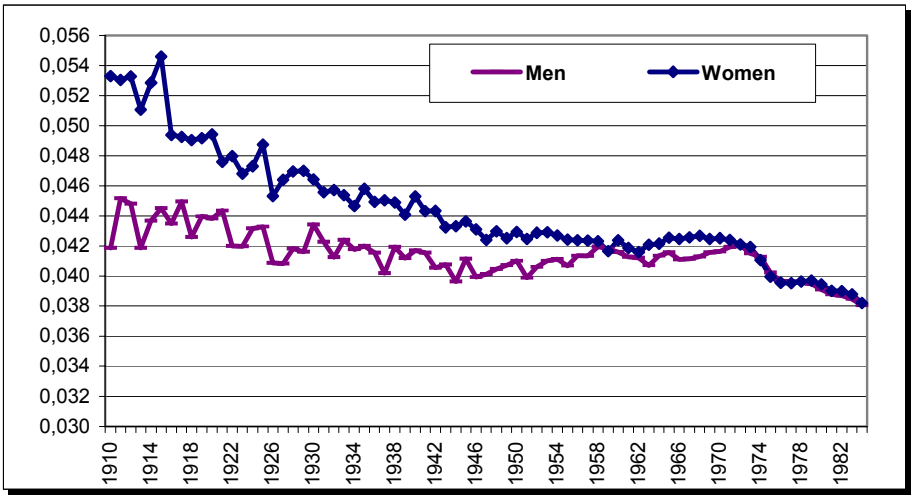
Between late 1953 and early 1957 the Colombian economy experienced a boom in the foreign sector due to the high prices of coffee, the main export at that time. However, in 1957 the real price of coffee fell in the international market. By 1960 the real price of Colombian coffee was 42% below its 1956 level.[26] There was a growing fiscal deficit and the exchange rate became overvalued. A sharp devaluation in 1957, plus a growing fiscal deficit, increased the level of inflation, from 8.4% in 1956 to 24.3% in 1957. As a result, rural wages in real terms dropped in 1957 and 1958.[27] Per capita GDP also fell, by -0.92 and -0.76 in 1957 and 1958, respectively.

During the late 1950's violence in Colombia rose to the highest level in the country's history up to that moment.[28] Since the late 1940's the intensity of political competition between the two traditional parties, Liberal and Conservative, led to increasing levels of violence.[29] The result was a breakdown of democracy and the military dictatorship of General Rojas Pinilla (1953-1957). On May 10, 1957, Rojas was overthrown. Democracy was reestablished in 1958 through a coalition of the two traditional parties. However, after 1958 violence continued at historically high levels until the early 1960's

[26] Alejandro López Mejia, "El Banco de la República y la política macroeconómica, 1955-1962", Banco de la República, Antecedentes, Evolución y Estructura, Banco de la República, Bogotá, 1990, p. 467.
[27] Juan Luis Londoño, Op. Cit., p. 225.
[28] In 1958 the number of homicides per 100.000 inhabitants rose to 49.
[29] See Alexander W. Wilde, "Conversations among Gentlemen: Oligarchical Democracy in Colombia", in Juan J. Linz and Alfred Stepan editors, The Breakdown of Democratic Regimes, Latin America, The Johns Hopkins University Press, USA, 1978.

as a result of rural banditry and the formation of guerrilla groups.[30] Since average height also fell in regions with very little political violence, such as the Caribbean Coast departments, most probably the reason for the reduction in average height during this period was the economic crisis prevailing at the time and not the political violence.

Graph 4. Coefficient of Variation for the Height of Colombians (by year of birth)



In sum, the average adult height of Colombians increased during successive generations throughout the twentieth century. Equally important, however, is that the dispersion in height fell significantly from 1910 to 1984. This reflects an improvement in the inter-personal distribution of biological welfare (see Graph 4).

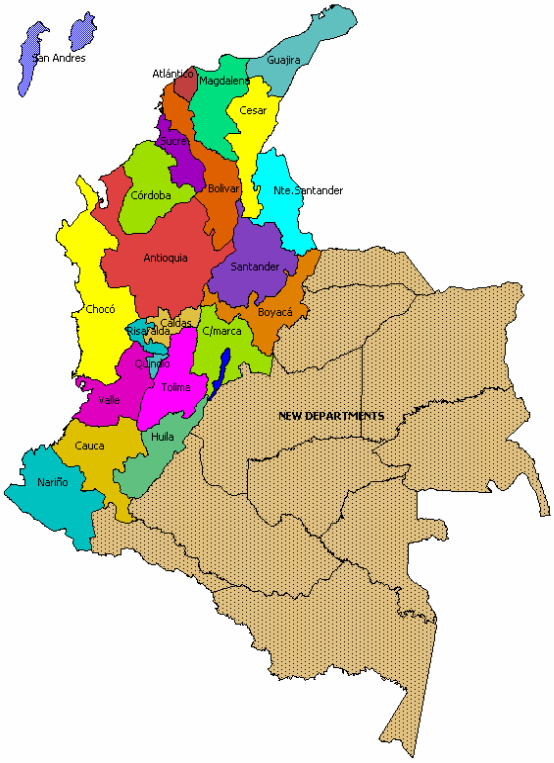
In the early 1910's the coefficient of variation for the height of Colombian women born at the time was 0.054; by the 1980's it was 0.038. For males, the coefficient of variation fell from 0.045 in the early 1910's to 0.038 in the early 1980's. However, in the case of males the coefficient of variation increased from the 1950's to the early 1970's. During this same period the coefficient of variation for women stagnated. As has been mentioned, this was also a period during which the distribution of income deteriorated.

[30] Norman Ofstein, "An Historical Review and Analysis of Colombian Guerrilla Movements", Documentos Cede, Universidad de los Andes, No. 21, agosto, 2003, p. 5.

IV. A Country of Many Regions and Sizes

Colombia is one of the most mountainous countries in the world. It is divided by the three mountain ranges in which the Andes opens itself in northern South America.[31] As a result there are clearly differentiated regions in terms of their culture, economic development, and even racial composition. Since 1886 the main internal political divisions have been the departments. Currently there are 32 departments. Bogotá, the capital, is a special territorial unit.[32]

Map 1. Colombian Departments

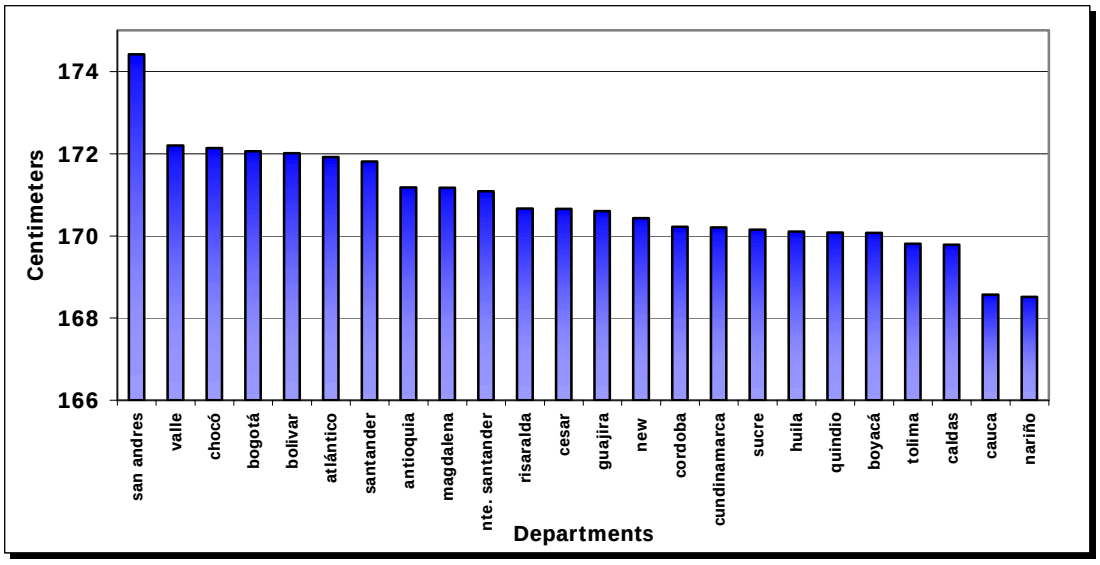


[31] In a study by the Interamerican Development Bank on the effects of geography on economic development a geographical fragmentation index, which varies between 1 and 0, was calculated for Latin America and the major regions of the world. Colombia and Ecuador, with an index above 0.8, had the highest fragmentation among Latin American countries and their index was above the one found for each of the major regions of the world. See John Luke, Alejandro Gaviria y Eduardo Lora, América Latina: Condenada por su geografía, Banco Interamericano de Desarrollo, Washington D.C., 2003, p. 6.

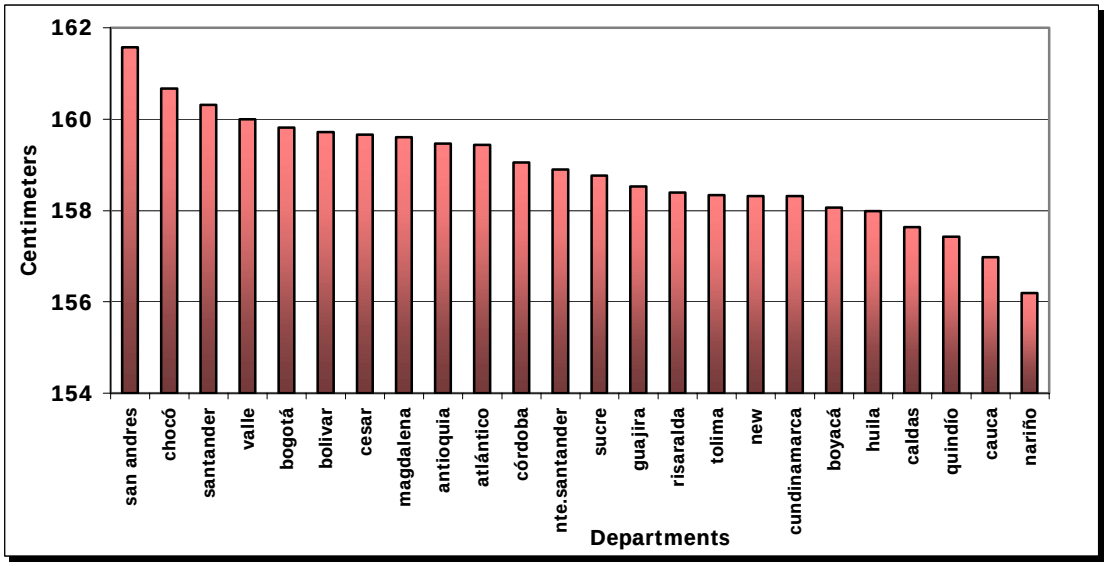
[32] In this paper all of the departments created in 1991 have been aggregated, because they are sparsely populated and there is no disaggregated GDP data for them. Also the special of district of Bogotá is included. Thus, 24 territorial units are used in the analysis.

Increases in Height in the Regions

Graph 5. Average Height of Men Born in the Departments of Colombia in 1984



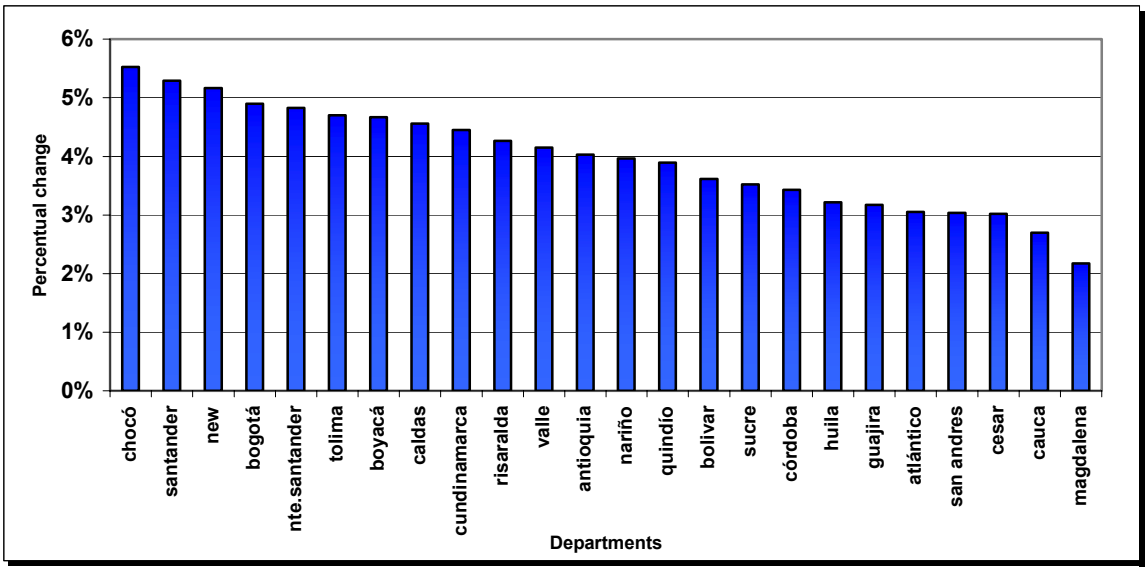
Graph 6. Average Height of Women Born in the Departments of Colombia in 1984



As a result of different levels of economic development, geographic endowment, and racial composition, the average height of the inhabitants of the Colombian departments differ significantly. In Graphs 5 and 6 the average height by department of birth is shown for those Colombians born in 1984. The tallest Colombians are the inhabitants of San Andres, both men and women. In 1984 the average height of Sanandresanas women was 162 cm. and that of men was 174 cm. The department of San Andres is composed

of several small islands in the Caribbean Sea, 180 kilometers off the coast of Nicaragua. Up to the early 1950's these islands were populated by an Afro-Caribbean, Protestant, and English-speaking population.[33] Thus, its ethnic characteristics were different in many ways from that of mainland Colombia. In contrast with Sanandresanos, the people of the department of Nariño, located in the southern border with Ecuador, were the shortest Colombians in 1984, with women having an average height of 156.2 cm. and men 168.5 cm.[34] Thus, there was a difference of six centimeters between the height of the inhabitants, both women and men, of these two departments.

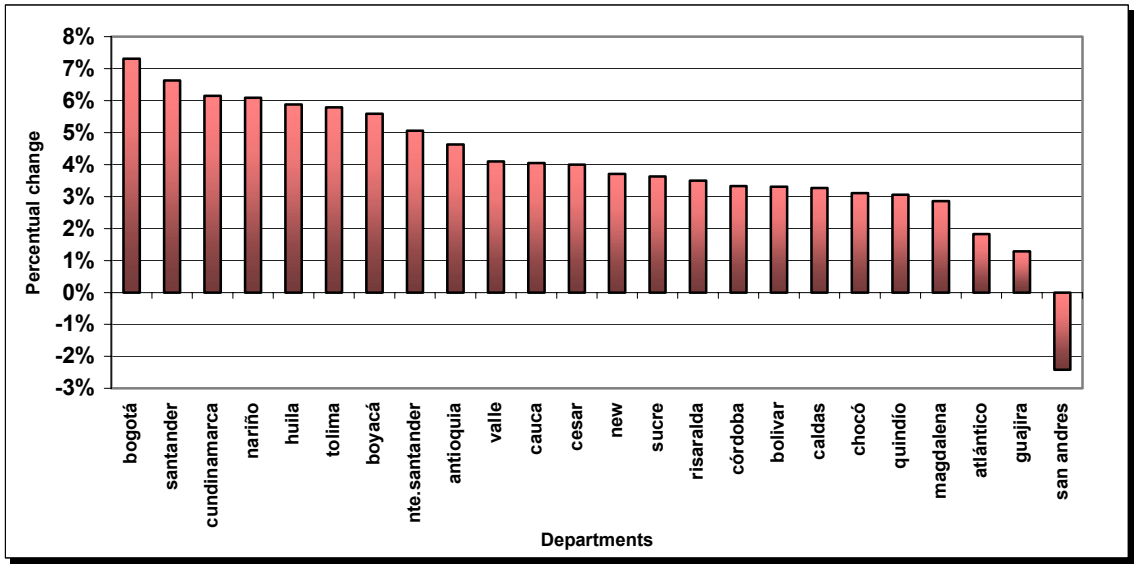
Graph 7. Increase in the Average Height of Men Born in the Departments of Colombia between 1910-1914 and 1980-1984 (%)



[33] Adolfo Meisel,"La continentalización de la Isla de San Andres: Panyas, raizales, y turismo, 1953-2003", Aguaita, Observatorio del Caribe, Cartagena, No. 9, diciembre, 2003, p. 8.

[34] The inhabitants of Pasto, the capital of Nariño, have been the object of jokes by other Colombians similar to those common in England about the Irish and in the US about the Polish. Armando Montenegro suggests that the reason *pastusos* have been singled out for these type of jokes is that they have a very particular way of speaking and that the level of social and economic development of that region has lagged behind the rest of Colombia. An additional reason could be that they are the shortest Colombians. See Armando Montenegro, Una historia en contravia: Pasto y Colombia, El Malpensante, Bogota, 2002, p. 221.

Graph 8. Increase in the Average Height of Women Born in the Departments of Colombia between 1910-1914 and 1980-1984 (%)



Regional Differences in Height as a Result of Racial Composition and Per Capita GDP

Throughout the twentieth century the economic development of the Colombian departments has followed different paths because of differences in their relative export success and in their capacity for industrial growth. Thus, the evolution of the biological standard of living has not been the same for all of them. In terms of height Bogotá is a very successful case. For example, between 1910-1914 and 1980-1984 the average adult height of women born in Bogotá increased more than 7.0%, which was the largest gain for any territorial unit. In the case of men the increase was close to 5.0%.

The rapid economic growth of Bogotá in the last few decades has transformed it into Colombia's most important growth pole. From 1960 to 2001 its participation in total GDP increased from 14.0 to 22.0%. Currently, Bogotá is the territorial unit with the highest GDP per capita, if the new departments are not taken into consideration. It would seem that this economic prosperity is the main cause for the increase in height.

Bogotá has received a large influx of immigrants from other parts of Colombia. This could also have had a positive effect on average height, if the migrants came from regions where people were taller. However, the majority of immigrants (86%) came from

the departments of Cundinamarca, Boyacá, Tolima and Santander, which have a similar ethnic composition, so that there were no changes in the racial makeup of the city.[35]

The experience of San Andres in the period 1910-1984 is almost opposite to that of Bogotá. The annual growth rate in average height for Sanandresanos men was the lowest in the country, while that of Bogotanos was the highest, 0.021% and 0.082%, respectively. In the case of women something similar is observed, except that Sanandresanas had the only negative growth rate among the departments. The most likely explanation for the behavior of average height in San Andres is the change in the ethnic composition of the island that began in the 1950's, when it was declared a free port by the Colombian government. The possibility of buying duty free foreign goods attracted a large influx of tourists and of immigrants from continental Colombia to San Andres. By 1964 immigrants represented 50.6% of the local population. Currently the Afro-Caribbean English-speaking population, the so called *raizales,* constitutes a minority of San Andres's inhabitants. Most of these immigrants came from the continental Colombian departments of Atlántico and Bolivar, and their average height was below that of the *raizales.* Thus, the observed reduction in the average height of people born in the island in the last four decades does not imply that the average height of *raizales* has gone down.

Graphs 7 and 8 show that the departments of the Caribbean Coast (Córdoba, Sucre, Bolivar, Atlántico, Magdalena, Cesar, and Guajira) are among those that had the smallest gains in average adult height in the period 1910-1984. Perhaps it is not accidental that as a result of the consolidation of coffee exports and industrialization in other areas of the country, throughout most of the twentieth century the economy of the Caribbean region lagged behind that of the rest of the country and is currently the poorest of Colombia.[36]

However, at the beginning of the twentieth century the inhabitants of the Caribbean Coast were among the tallest in Colombia. The reason for this was the large percentage of the population of African ancestry, as well as the fact that the nutritional status was

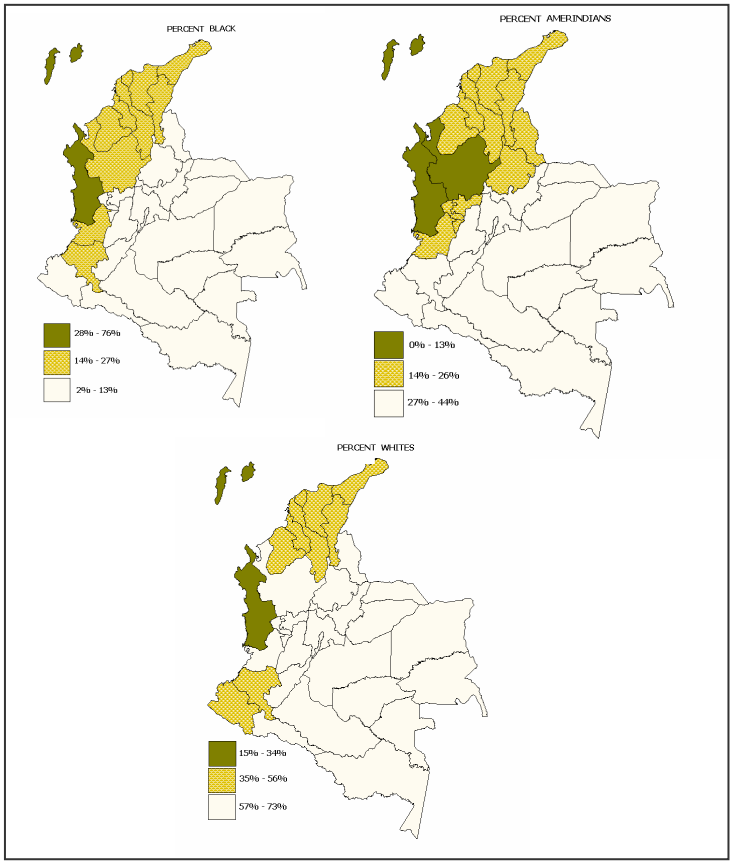
[35] DANE, XVI Censo Nacional de Población y V de Vivienda, Censo 1993, Bogotá, p. 105-107.

[36] See Adolfo Meisel, "Por qué perdió la Costa Caribe el siglo XX?", in Haroldo Calvo y Adolfo Meisel, editores, El rezago de la Costa Caribe colombiana , Banco de la República-Fundesarrollo-Universidad del Norte-Universidad Jorge Tadeo Lozano, Seccional del Caribe, Cartagena, 1999.

comparatively good, especially because of the consumption of meat and fish. The region was the main cattle producing area of the country and was scarcely populated, so meat consumption was among the highest in Colombia.[37] Additionally, the inhabitants of the Coast had access to fish from the sea and the numerous rivers and lakes of the region.

A cross-section statistical analysis of the determinants of average departmental height shows that the racial composition of the population and GDP per capita explain a large part of the differences in height observed among the departments. This analysis was done for 1980, since it was the year with the highest number of observations (more than 700.000). Maps 2 and 3 show respectively, the racial composition and the per capita GDP of the Colombian departments in 1980.

Map 2. Racial Composition of the Colombian Departments



Source: Yunis, Emilio. ¿Por qué somos así? ¿Qué pasó en Colombia? Análisis del mestizaje, Temis, Bogotá, 2003.

[37] Francisco Jose Vergara y Velasco, Nueva geografía de Colombia, Imprenta de Vapor, Bogota, 1901, Tomo I, p. 729.

In the case of women, the regression with average departmental height as a dependent variable, and the percentage in the population of blacks and per capita GDP as independent variables, in 1980, yields an adjusted R^2 of 0.43.[38] Both the percentage of blacks and GDP per capita are statistically significant at 1.0% level of confidence. However, these two variables do not influence the Colombian departments in the same way. For example, the department of Chocó has the lowest GDP per capita but it has the largest percentage of blacks in Colombia. As a result the women of Chocó have the second highest observed average adult height (see Graph 6). In contrast, the department of Cauca has a low participation of blacks in its population and is one of the least developed in the country. Thus, these two variables reinforce themselves and Cauca has the second lowest observed height for women (see Graph 6). For men, the regression using data for 1980 gives a similar result as for women (see Table 4).

Table 3. Determinants of the Average Departmental Height of Colombian Women (1980)

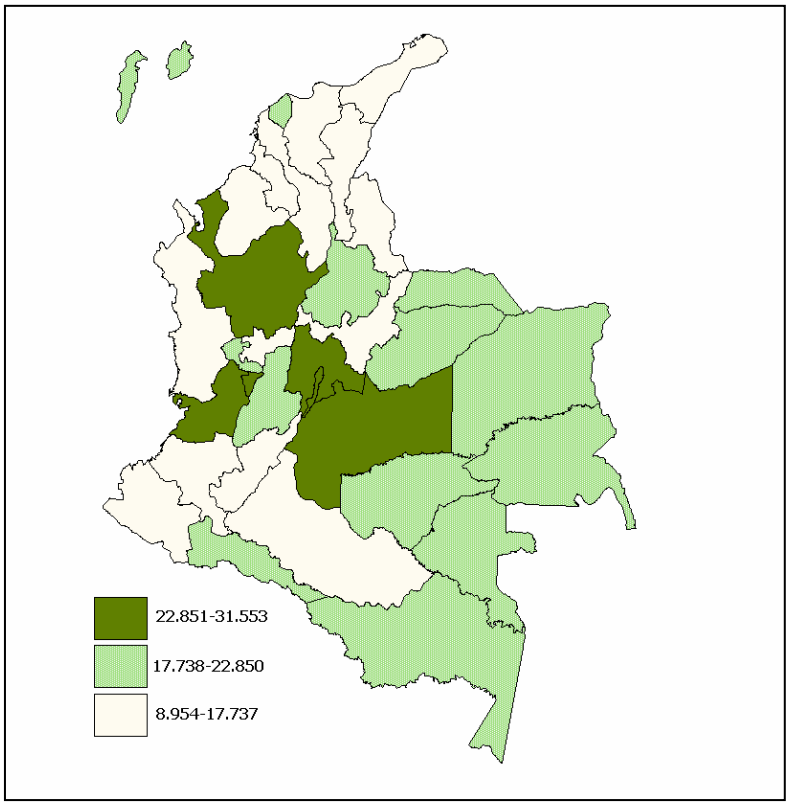
Dependent Variable: Average Departmental Height of Women in 1980				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Per Capita GDP 1980	2.38	0.74	3.23	0.0042
Percent Blacks	6.41	1.54	4.17	0.0005
Constant	133.85	7.34	18.24	0.0000
R-square	0.48	Adjusted R-square		0.43
# of observations	23			
F-Statistic	9.26	Prob. (F-Statistic)		0.001424

[38] The information on the racial composition of the departments was obtained from a study done by the Colombian geneticist Emilio Yunis. See Emilio Yunis, ¿Por qué somos así? ¿Qué pasó en Colombia? Análisis del mestizaje, Temis, Bogotá, 2003.

Table 4. Determinants of the Average Departmental Height of Colombian Men (1980)

Dependent Variable: Average Departmental Height of Men in 1980				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Per Capita GDP 1980	2.55	0.74	3.23	0.0013
Percent Blacks	3.91	1.54	4.17	0.0124
Constant	144.56	7.34	18.24	0.0000
R-square	0.42	Adjusted R-square		0.36
# of observations	23			
F-Statistic	7.23	Prob. (F-Statistic)		0.004344

Map 3. GDP Per Capita of the Colombian Departments in 1980 (pesos of 1975)



Source: DANE, Regional Accounts.

Additionally, a regression with the percentage of non-indigenous population (that is, blacks and whites) and GDP per capita as independent variables was estimated, also for 1980. In the case of men, the two independent variables were statistically significant at a 1.0% level of confidence and R^2 was 0.54. In the case of women, however, the GDP

variable was not significant. These results show that it is the percentage of native-Americans that determines a lower average height. It is significant that the two departments with the lowest observed average height, Cauca and Nariño, have the highest percentages of native-Americans among the departments, 39.0% and 44.2%, respectively.[39]

Convergence Analysis

Table 5. Estimates for β Convergence in the Average Height of Colombian Men and Women

Period: 1910 - 1984	Beta	Std. Error	t-Statistic	Prob.	R^2	Correlation coefficient
Men	0,00711	0,00085	8,33	0,0000	0,70	-0,92
Women	0,00887	0,00084	10,54	0,0000	0,82	-0,97

The analysis of how regional disparities in height evolved in Colombia during the twentieth century follows the methodology proposed by Robert J. Barro and Xavier Sala-i-Martin for the study of convergence in per capita GDP.[40] There is Beta (**β**) convergence when the unit that was farthest behind grows faster in the relevant variable. The estimates for **β** convergence are presented in Table 5. For men and women there was a process of departmental **β** convergence in height in the period 1910-1984. That is, those departments which were the tallest in 1910 grew more slowly than those that were the shortest. In Graph 9, it can be seen that the department with the lowest average height in 1910, Norte de Santander, was also the one that experienced the largest rate of growth of its average height in the period 1910-1984. In contrast, Magdalena, which had the tallest men in 1910, had the lowest rate of growth in the period 1910-1984.

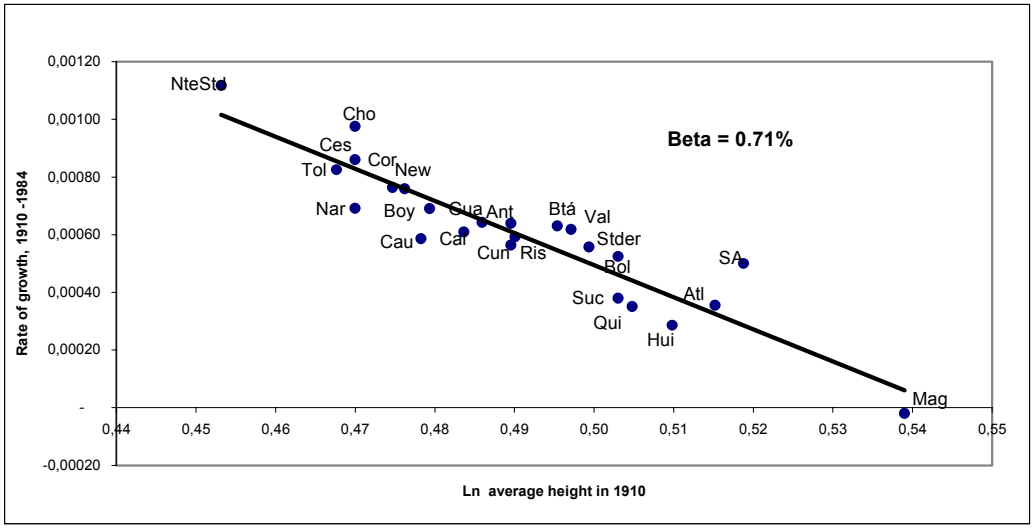
In the case of women, something similar occurs with respect to β convergence. The department with the shortest women in 1910, Nariño, experienced one of the largest

[39] Ibid., p.59

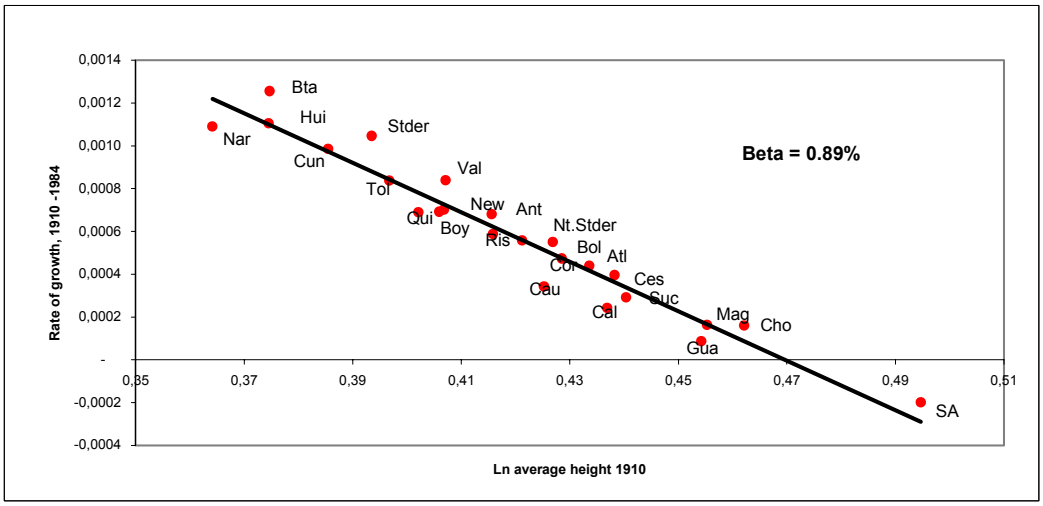
[40] Robert J. Barro and Xavier Sala-i-Martin, "Convergence across States and Regions", Brookings Papers on Economic Activity, Vol. 1, 1991, p. 108.

rates of growth of its average height in the period 1910-1984. In the opposite end, the women of San Andres, the tallest in 1910, grew the least between 1910 and 1984.

Graph 9. Beta Convergence in the Average Height of Colombian Males



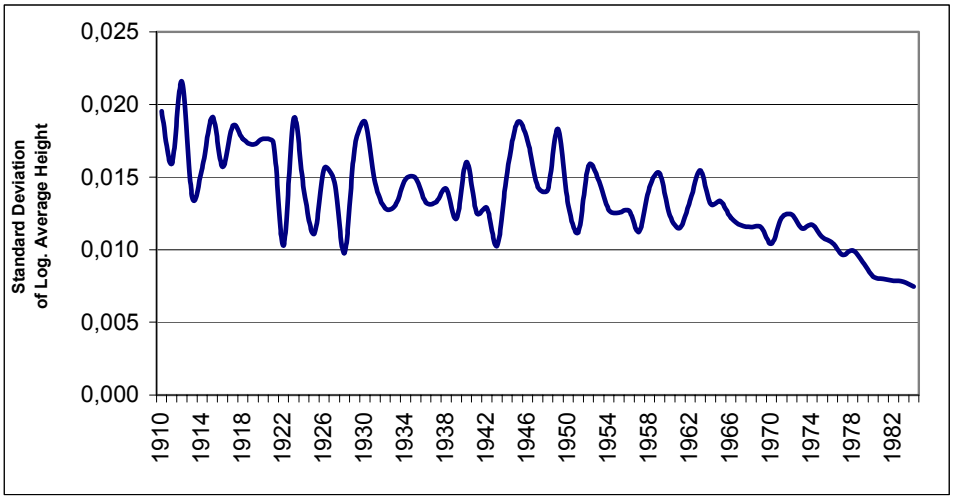
Graph 10. Beta Convergence in the Average Height of Colombian Females



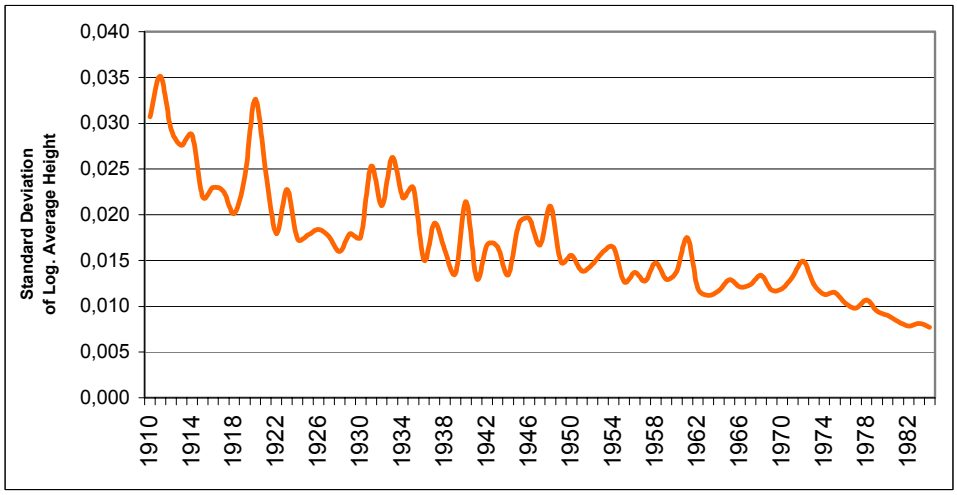
The presence of **β** convergence is a necessary but not a sufficient condition for the reduction in the dispersion of a variable. In the case of the average height of men and women in the Colombian departments in the period 1910-1984 there was also a process of reduction in the observed dispersion, Sigma convergence (**δ**). Graphs11 and 12 show the evolution of **δ** convergence, measured as the standard deviation of the logarithm of departmental height, for both men and women. In both cases there is a clear secular

trend towards a reduction of the dispersion of average height in all departments. In the case of men, **δ** drops from around 0.02 at the beginning of the period to 0.007 in the early 1980's, while for women the reduction in the same period is from 0.03 to 0.005.

Graph 11. Sigma Convergence in the Average Height of Colombian Males



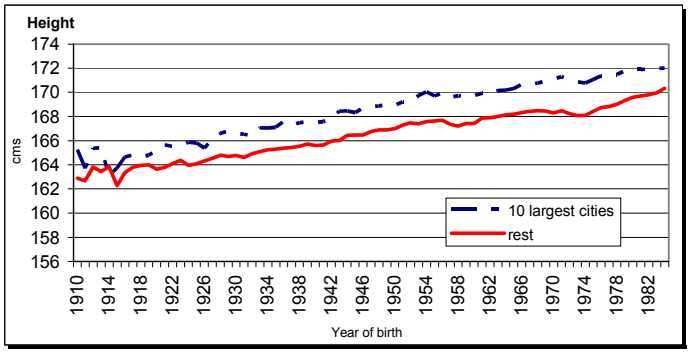
Graph 12. Sigma Convergence in the Average Height of Colombian Females



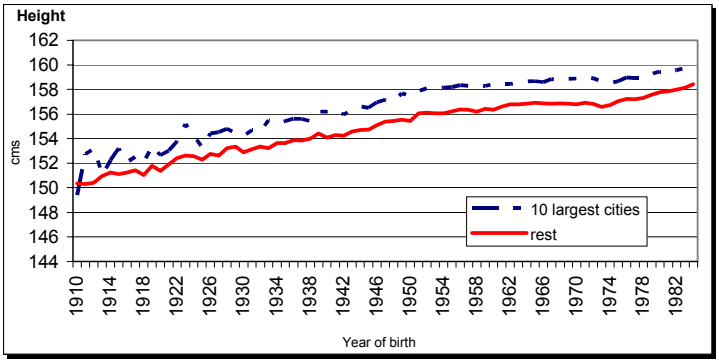
Capital Cities and the Rest of Colombia

Unlike what occurred during the process of industrialization and urbanization in some of the currently developed countries, where the height of rural inhabitants tended to be above that of urban dwellers, what has been observed in Colombia is the opposite.[41] Throughout the 1910-1984 period, the average height of those born in the ten largest Colombian cities, which currently represent 36% of the total population, has been around two centimeters above that of the rest of the country. This coincides with the dualism that prevails in the Colombian economy in which the cities are more prosperous and have a higher standard of living than rural areas, a situation that is common to many developing countries.

Graph 13. Average Height of Colombian Males Born in the Ten Largest Cities vs. Those Born in the Rest of Colombia



Graph 14. Average Height of Colombian Females Born in the Ten Largest Cities vs. Those Born in the Rest of Colombia



[41] In the case of England in the nineteenth century, men who grew up in urban areas were shorter than those born in rural areas. See R. Floud, K. Wachter, and A. Gregory, Height, Health and History: Nutritional Status in the United Kingdom, 1750-1980, Cambridge University Press, Great Britain, 1990.

V. Conclusions

The study of the evolution of the average height of Colombians in the period 1910-2002 reveals a remarkable achievement. On average, Colombian women born in 1984 achieved an adult stature that was 8.8 cm. above those born in 1910. In the case of men in this same period, the increase was 7.9 cm. These advances were present almost uninterruptedly through the twentieth century and throughout the country.

The evolution of the biological standard of living in Colombia was also a success story from the point of view of the reduction of inequalities that were present in 1910. There was a reduction in the dispersion of the height of Colombians, as measured by the standard deviation of the logarithm of this variable. Thus, in this dimension of the overall standard of living, Colombia became a more equal society.

There was also convergence in the average height of the inhabitants of the different departments of the country, as reflected in the presence of **β** and **δ** convergence.

Also there were no prolonged periods of reduction in average height. Although there were two short periods during which average national height fell, 1957-1960 and 1970-1974, there was an immediate return to the long run trend of increasing height.

The main reason for the increase in height was the continuous improvement in the nutrition of Colombians throughout the century due to sustained economic growth. Additionally, advances in health and reductions in work effort, for reasons such as the elimination of child labor, contributed to these gains.

The behavior of average height does not coincide with that of income distribution or the cycles of violence that the country experienced in the twentieth century.

An additional contribution of this paper, made possible by the size of the database, was establishing through regression analysis, that the racial composition of the population and GDP per capita have an influence on the average height of men and women born in the different departments of Colombia. Thus, it was possible to understand why some of the poorest departments also are among tallest.