The biological standard of living in La Paz (Bolivia), 1880s-1920s: persistent stagnation and inequality

Boris Branisac (Universidad Católica Boliviana San Pablo, La Paz, Bolivia), Jose Peres-Cajías (Departament d'Història Economica, Institucions, Política i Economia Mund, Universitat de Barcelona), Nigel Caspab (Universidad Mayor de San Andrés and INESAD, Bolivia)

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Abstract: Based on almost 5.000 direct observations on National Identification Cards, this paper offers the first estimation of the evolution of average heights in the city of La Paz (Bolivia) for the decades 1880s–1920s. The analysis focuses on men of middle and upper classes aged 19–50 years old. Despite the city's growing economic importance and modernization, average heights remained stagnant around 163 cm. It also stands out that whereas average height differences between professional and ethnic groups remained significant and persistent throughout time, average heights remained stagnant in all groups. Three main reasons are provided to explain these inequalities between groups and stagnation across groups: scarce improvements in agricultural production, increasing wage inequalities and the persistence of a bad disease environment.

Keywords: Anthropometric history; Heights; Welfare; Inequality; First Globalization

1. Introduction

The Bolivian economy is frequently identified as a perfect example of a "reversal of fortune": it was among the most dynamic spaces in the Americas during colonial times and today is among the poorer economies in the region (Acemoglu, Johnson, & Robinson, 2002). No official data is available for Bolivian GDP prior to 1950. Using their own estimation of the Bolivian GDP and GDP per capita for the period 1846-1950, Herranz-Loncán & Peres-Cajías (2016) suggested that the divergence of the Bolivian economy (both to developed and neighboring countries) is driven by the low dynamism of the economy during the 19th century and two devastating crises that took place during the second half of the 20th century. Furthermore, they claim that divergence stopped, and even

some convergence to developed and neighboring economies was observed, during the first half of the 20th century.

Nevertheless, there is still only scarce quantitative evidence of how the economy's stagnation and subsequent recovery at the onset of the 20th century affected Bolivians' welfare.[1] This paper aims to fill this gap by providing an estimation of the average height of adult men (19-50 years) registered in the city of La Paz and who were born in the decades from the 1880s to the 1920s. Given the relevance of mining exports in Bolivia, it could be argued that economic growth was based on an enclave that hardly could affect overall urban wellbeing. However, one should be cautious before assuming that any export-led growth process in Latin America ended in mere enclaves (Kuntz-Ficker, 2017). Furthermore, our paper focuses on La Paz, which was the most dynamic region in Bolivia since the early 20th century, reflected by significant population and urbanization growth rates and a timid but continuous diversification of the economy towards manufactures and services. So, if a hypothetical trickle-down effect may have happened in Bolivia in the period we study, the place to look for evidence is La Paz.

In addition, the paper contributes to the growing literature on historical anthropometrics in Latin America since Bolivia is among the under-researched countries in the region (Martínez-Carrión & Salvatore, 2019). Our work is based on almost 5,000 records on National Identification Cards and, to the best of our knowledge, is the first direct estimation of men's average height in urban Bolivia during this period.[2] As suggested by the political and social implications involved in the ID Law of 1927, the statistical analysis we carried out confirms that our sample is not representative of the entire population but rather of the middle and upper classes of La Paz.

Our work stresses the stagnation of average height of men around 163 cm during the period under scrutiny. Despite differences in sample sizes, our results do not differ much to those found for rural Aymara and Quechua men in 1903 (average height around 160

[1] The main exception is the reconstruction of real wages in the city of Cochabamba from the 1820s to the 1920s (Henriques, 2015).

[2] Drawing from different sources with very heterogeneous sample sizes (from 1 to 700), Laure (1991) provides estimations (both for men and women) for different Bolivian indigenous groups (Aymaras, Quechuas, Guaranies and Amazonian) in rural areas from the 1820s to the 1980s. Godoy et al. (2006) offer an estimation of adults average height (both men and women) for the Tsimanes, a Bolivian indigenous group located in the Amazonian, from 1920 to 1980. Based on Demographic and Health Surveys (DHS), Challú & Silva-Castañeda (2016) offer data on the evolution of women average height from 1945 to 1990. There is also an indirect estimation of Bolivian men and women average heights from the late 19th century onwards (NCD Risk Factor Collaboration, 2016).

cm) (Laure, 1991). Likewise, even taking into account differences in the ecological context, our results are in line with those found for the Tsimanes men in the Amazonian in the first half of the 20th century (average height around 163 cm) (Godoy et al., 2006). Our findings are also coincident with the story of average height stagnation highlighted in these works.

In this regard, our results resemble other Latin American cases where an export boom and the expansion of the economy did not necessarily translate into better biological standards of living (Baten & Carson, 2010; Llorca-Jaña, Navarrete-Montalvo, Araya-Valenzuela, & Droller, 2018; López-Alonso, 2012; Salvatore, 2007; Twrdek & Manzel, 2010). The lack of a universal positive correlation between economic growth and average heights is a puzzle (Baten, 2017; Bodenhorn, Guinnane, & Mroz, 2017; Deaton, 2007; Komlos, 2019). One of the suggested explanations for this puzzle is inequality. In the case of the first Latin American export era (1850-1929), it could be argued that the extra revenue generated by higher exports and higher growth was captured by the elites and there was not a trickle-down effect which would have generated improvements in the living standards of the population.

In this context, whereas our sample focuses in the upper and middle classes of La Paz, we are still able to show enduring differences between social groups. On average, indigenous men were 3 cm shorter than non-indigenous, illiteracy was associated with a 3 cm penalty in heights and manual unskilled workers were approximately 2 cm and 4 cm shorter than non-manual unskilled and non-manual skilled workers, respectively. We show that these differences can be partially explained by the pressures on the less advantaged groups stemming from higher food prices and growing wage inequalities.

However, our results also show that average heights remained stagnant across the different occupational categories. Indeed, a particular lesson from our work stresses that the lack of a positive correlation between economic growth and biological wellbeing can take place even in the case of the elites. This result is similar to the Colombian sample of passport holders that spans from 1870 to 1919 (Meisel & Vega, 2007). Therefore, other factors beyond inequality could be also at play in the explanation of the "puzzle" in Latin America during the First Globalization. In this paper, we highlight the lack of improvements in general health conditions. Specifically, we stress the bad quality of water (despite the increase of municipal investment in water pipelines) and the lack of a suitable sewage system and proper public hospital until the early 1920s.

The paper proceeds as follows: Section 2 presents an overview of economic development in Bolivia and La Paz from Independence to the Great Depression. Section 3 presents our database and clarifies whom we are measuring. Section 4 presents and discusses our main results. Section 5 explores some explanations for the poor improvement of Bolivian biological standards of living. Finally, section 6 concludes.

2. The Economic development of Bolivia and La Paz: an overview

This section presents a brief overview of Bolivian economic development from Independence (1825) to the Great Depression in order to contextualize and better understand our results on the biological standards of living. To start with, given that during colonial times the economic dynamism of Bolivia's current territory was tied to mining production in Potosí (Assadourian, 1982; Menegus Bornemann, 1999), the crisis of the sector at the onset of the 19th century affected the overall economy (Tandeter, 1992). This economic downturn was reinforced by the contemporaneous crisis of textile production driven by illegal British imports (Huber Abendroth, 1994) and, thereafter, by the long and painful war of Independence (1809-1825).

This unfortunate starting point helps explain why Bolivia was among the last Latin American countries to overcome the direct and indirect costs of Independence. Indeed, despite some dynamism in copper or quinine exports (Barragán, Lema, Mendieta, & Peres-Cajías, 2015) and some increases in silver production during the 1830s (Platt, 1996), it was not until the early 1850s when silver production and aggregate exports started to grow steadily (Klein, 2011). Nevertheless, it remains unclear how the crisis in silver exports that started in the early 19th century and persisted until the mid-nineteenth century affected the wellbeing of the Bolivian population. For instance, recent research points to the existence of vibrant smuggling activities during the post-independence decades that benefited mining elites and subaltern agents such as indigenous traders (Langer, 2009).

In any case, it is less debatable that, fueled by legislative changes, silver exports finally surpassed the levels achieved before the colonial crisis during the 1870s (Mitre, 1981). These changes in the political economy of exports went hand in hand with changes in land policy: after several decades of the so-called *reciprocal* pact between indigenous communities and the Bolivian government (Platt, 1982), the enactment of new measures

drove the expansion of *haciendas* at the expense of indigenous communities. The traumatic loss of the coastal province due to the War of the Pacific against Chile (1879) restricted the persistence of most previous political leaders, and allowed the economic elites that emerged since mid-century (and that lobbied for the kind of policies previously commented) to attain political hegemony. In this context, a more stable political scenario was achieved after the war.[3]

During the 1880s and early 1890s, silver exports continued growing, in part thanks to railways expansion (see below).[4] However, according to the Herranz-Loncán & Peres-Cajías (2016) estimates, the expansion of the mining sector was insufficient to affect the dynamism of the overall economy: the annual average growth rate of the Bolivian economy from 1846 to 1903 is estimated around 0.7%. This result is consistent with the low rates of population growth (0.3% yearly average between 1846 and 1900) and with the stagnation of urbanization, which was around 11% in 1846 and 10% in 1900 (Herranz-Loncán & Peres-Cajías, 2016).[5]

In contrast, from 1903 to 1929, Bolivian GDP per capita grew at an annual average rate of 2%, a process that is explained by changes in the Bolivian export sector. After the dramatic fall of international silver prices and the subsequent production crisis in the early 1890s, the concentration of the Bolivian export basket started to move from silver to tin and rubber (Peres-Cajías & Carreras-Marín, 2017). This last product, which was located in the Amazon basin, fueled economic dynamism beyond the traditional Bolivian export zone (Gamarra Téllez, 2007). However, the boom ended abruptly at the onset of the First World War as a consequence of rubber production increases in Asia. Meanwhile, the war effects on the international price of minerals allowed a great expansion of the value of tin exports from 1915 to 1918, which was followed by a considerable decrease during the

[3] For instance, the Constitution enacted in 1880 endured for more than fifty years. Likewise, government changes were achieved regularly and through constitutional channels.

[4] The expansion of exports during the 1880s may sound contradictory given the costs generated by the loss of the War of the Pacific (1879-1883). This loss converted Bolivia into a landlocked economy, which may have reduced the long-term growth potential of the economy. In the short term, it also increased the size and variations of trade costs. However, notice that state presence or that of Bolivian private investors in the coast was very restricted before the war. In this context, the dynamism of the economy (both before and after the war) was determined by private investment in silver mining that was located in the mountains range, far away from the war fields. Additionally, Bolivia withdrew after the Battle of Tacna in May 1880.

[5] These results are different to those of the National Census of 1900 (25%) since the authors define urban population as those living in a town/city with more than 2,000 inhabitants; the 1900 Census threshold is 200, an extreme low value (Oficina Nacional de Inmigración, 1904).

1919-1921 period. Beyond these oscillations, tin became the most important export product, accounting for at least two thirds of the value of total exports from 1918 onwards.

Railway expansions (Contreras, 2003) and changes in Bolivian trade policy (Peres-Cajías, 2017) were also critical to assure the steady growth of exports. Regarding the former, the first railway line was inaugurated in 1888 and connected the de facto Chilean port of Antofagasta to Uyuni (near the most important silver mine, Huanchaca); four years later, it was expanded to Oruro, the second most important mining center in Bolivia. During the first decade of the 20th century, the city of La Paz was connected to Peruvian ports (La Paz-Guaqui railway, 1905) and de facto Chilean ports (La Paz-Arica railway, 1913). Likewise, the first railway line was extended to Potosí (1912), Atocha (1913), Viacha (1913) and La Paz (1917).

This expansion of the railway system helps highlight that, beyond the impact on the competitiveness of mining exports, railways also prompted the integration of the most important Bolivian western cities, between them and to international markets (see Map 1).[6] This process reduced the price of imports in western cities, which in turn had negative effects on those local producers who previously supplied these markets (Peres-Cajías, 2017; Rodríguez Ostria, 1994). Given that Cochabamba became connected to Oruro in 1917, railway expansion was particularly harmful to producers located in the east of the country, specifically Santa Cruz (Sandoval et al., 2003). Thus, during the first half of the 20th century, most economic activity tended to be concentrated in the west of the country.[7]

Map 1. Current Administrative Map of Bolivia

[6] *Western Departments* refers to La Paz, Oruro and Potosi; their capital cities have the same name. The Department of Cochabamba is located in the center of the country. *Eastern Departments* refers to Santa Cruz, Beni and (since 1938) Pando; their capital cities are Santa Cruz de la Sierra, Trinidad and Cobija, respectively. The *southern Departments* are Chuquisaca and Tarija, whose capital cities are Sucre (which is also the country's capital) and Tarija.

[7] For instance, the ratio of Department population to total Bolivian population increased in La Paz and Oruro, remained constant in Potosí and reduced in Cochabamba, Chuquisaca, Tarija and Santa Cruz from 1900 to 1950. Furthermore, according to available estimates (Peres-Cajías, 2019), two thirds of the Bolivian GDP in 1950 (the first year when regional GDPs can be estimated) came from the Departments of La Paz (35%), Potosí (18%) and Cochabamba (14%). During this year, La Paz, Cochabamba and Potosí accounted for 24%, 16% and 14% of total agriculture production.

Sources: Central Intelligence Agency (https://www.cia.gov/library/).

Notwithstanding these negative consequences or the fact that the Bolivian export-led growth was among the less successful in Latin America (Kuntz, 2017), there is evidence of positive effects in Bolivian regional western economies. In the case of La Paz, this reflected by the creation of trade houses (i.e. Casa Grace, 1907) and banks (i.e. Banco Mercantil, 1905) and the beginning of industrial production (i.e. Cervecería Boliviana Nacional, 1877). Furthermore, the civil war (known as the Federal War, 1899) won by the *liberales* (located in the North of the country) over the *conservadores* (located in the South of the country) consolidated the city of La Paz as the only official Executive and Legislative seat. Given these externalities of tin exports and its political preeminence, La Paz consolidated as the most important Bolivian city: its population grew from 42,849 in 1846 to 52,697 in 1900 and 267,008 in 1950, which represented 26%, 29% and 38% of total Bolivian urban population, respectively (Peres-Cajías, 2019). Thus, while the yearly average growth rate of population was around 0.9% in Bolivia during the first half of the 20th century, it was around 3% in La Paz city. Based on this evidence it could be argued that economic growth in the city of La Paz was higher than the average growth rate at the country level, at least during the first half of the 20th century.

The urbanization of La Paz materialized in new and big houses owned by the emergent political elite, merchants and bankers. However, it was also accompanied by a modernization process that could favor the entire population (i.e. electricity since 1890). In the same vein, while the city became populated by relatively rich people, it never lost its indigenous heritage and, therefore, its *mestizo* nature (Cajías, Barragán, Cajías, & Medinaceli, 2007). In the next section, we seek to clarify how our database accounts for this social and ethnic diversity.

3. The data

The observations on heights come from National Identification Cards (ID) that were obtained at the Archivo de La Paz (ALP) and digitalized thereafter. The documents used correspond to the beginnings of the personal data bank produced by the Police Department in La Paz between the years 1929 and 1956. Bolivian IDs began to be used after the Law of December 10th, 1927,[8] which stated that the use of IDs was mandatory for all Bolivian inhabitants older than 21 years, with the exception of women,[9] low rank soldiers and extremely poor people (*pobres de solemnidad*). The law also fixed different prices for the ID procurement: 5 Bolivianos (Bs.) for professionals, industrial owners, public servants and particulars; Bs. 3 for the rest of inhabitants; Bs. 1 for indigenous people who lived beyond the urban periphery.

To better identify the composition of our sample, it is critical to understand the motivations of the Bolivian government to implement an ID card. For this, we have revised the discussions in Parliament before the promulgation of the law, the law itself and the complementary decrees which regulated its operation.[10] We have identified three main driving forces: a) in a context of mounting fiscal deficits and growing border tensions with Paraguay, it was highlighted as a type of direct tax whose revenues should be used for needs related to defense and infrastructure; b) it was identified as an effective tool to guarantee civil life and facilitate administrative procedures with the state; c) similarly to what was happening in Chile (1924) and Peru (1931), the ID was viewed as

[8] However, it was not until 1929 that effective registrations started, at least in La Paz city.
[9] Until the Chaco War (1932-1935), women who travelled outside the country had to ask for an ID in order to obtain their passports. The ID exception for women was abolished in practice during the 1940s.
[10] These are the Decrees 31/12/1927, 09/03/1928, 16/05/1928, 16/07/1928 and 20/08/1928.

the instrument that citizens should use to assure their participation (and to account for) in formal political contests.

In this context, considering that Bolivian political rights were not universal at that time,[11] arguably IDs were not required by all Bolivian citizens. Similarly, state enforcement towards the mandatory ID use should have had varied markedly throughout the country. Moreover, ID prices could be perceived as an abusive and even regressive tax: if the distribution of income was uneven (as it was), the share of total income devoted by *profesionales* (5Bs) to the ID procurement, was probably much lower than in the case of the rest of inhabitants (1-3 Bs). Indeed, some argued in the Congress (see *Redactor Cámara Diputados, año 1927*, pages 329-330) that Bs. 1 was expensive for Bolivian lower classes since it represented their daily wage. Curiously, Henriques' (2015) figure of construction daily wages in Cochabamba for the 1922-25 period is Bs. 1,47 and that of the daily price of a basic consumption basket is Bs. 1.08. Therefore, the procurement of an ID for a non-elite and non-indigenous Bolivian could represent three daily basic consumption baskets. All this suggests that ID use was restricted to the Bolivian well-off.

However, the fifteenth article of the Regulatory Decree of December 31st, 1927 suggests that IDs could be perceived as necessary also by middle urban classes whose economic activities were linked to the state or to international trade. This could be the case of lower range public servants such as drivers or cookers, or retailers.[12] Therefore, an anthropometric analysis based on IDs in Bolivia during this period can also get some information beyond the upper tail of the income distribution.

Coming back to the data used in this paper, we originally collected information from the identification cards of almost 7,000 men.[13] Thereafter, we decided to focus on men aged 19-50 years, assuming that no major changes in height occur between these years.[14] Thus, we discarded information from those who were born before the 1880s. Similarly,

[11] From 1839 to 1938, the right to vote was restricted to men, older than 21 years, literate and who possessed a property or a yearly rent higher than Bs. 200 (Barragán, 2006: 288-289).

[12] The article stated that the presentation of the ID was mandatory to: a) obtain the Bolivian citizenship; b) manage judicial, administrative and notarial issues; c) obtain the fiscal obligations contemplated in the national, departmental or municipal budget; d) start any request to the State's power (Executive, Legislative, Judiciary); e) do bank operations; f) obtain railways tickets; g) send and take merchandise transported by railways; h) to pay any custom duty; i) use post services; j) obtain passports; k) extend constitutional titles and permits to private companies.

[13] We focused on men because information on women was scarce.

[14] Notice, anyway, that there is no standard age range in studies focusing in Latin American heights (21-49, 16-39, 17-50, 20-50). See Llorca Jaña, Navarrete-Montalvo, Droller, & Araya-Valenzuela (2018).

given the lack of enough observations of men who were adults at the time of their registration during the 1930s, we also dropped those who were born after 1929. Then, we removed the observations that did not present information on occupations (47) and one clear outlier (218 cm), which generated a remaining sample of 5,890 observations. Among these, we identified rural laborers who accounted for 42%, 33%, 23%, 6% and 3% of the total observations per decade (1880, 1890, 1900, 1910 and 1920). Moreover, we verified that most of these rural laborers demanded their IDs in 1929. Bearing in mind these features, we noticed that changes in average heights could be driven by changes in the composition of the sample derived from selectivity and changes in the relative share of this group and not by changes in biological standards of living (for more information on selectivity issues, see the online appendix). Therefore, we removed rural laborers and obtained a final sample of 4,980 observations reflecting urban related occupations.

In spite of changes in the ID form composition and the used categories, we were able to systematically identify the following variables for the entire sample: year of registration, given names, first surname, second surname, year of birth, place of birth, measured height in cm, literacy level (literate or illiterate) and occupation.[15] We can use these variables to assess how fairly our sample reflects the diversity of the city of La Paz. On the one hand, the National Census of 1900 (the most reliable source of information) presents data on total population by cohorts and level of literacy for those older than 7 years. Using this information, we obtain a literacy rate for men of 39% in the city of La Paz. This is clearly lower than the literacy rates that we obtain in our sample for men older than 18 years: 50% (1880s), 59% (1890s), 71% (1900s), 88% (1910s) and 92% (1920s). However, the previous comparison can be misleading since the census data of 1900 is reflecting information about literacy of people born around 1820s to 1893. Therefore, if we accept that survivor selectivity does not play a critical role (Guntupalli & Baten, 2006) we can compare our data with literacy results of the 1976 Census, which reflects information of people born around 1880s-1960s. According to this source, literacy rates of men living in the city of La Paz and born during the 1880s-1920s period is quite similar to that of our sample: 38% (1880s), 62% (1890s), 70% (1900s), 79% (1910s) and 87% (1920s).

[15] Literacy was self-declared and proved by the ability to sign. The ID claimer also declared the highest level of schooling. We used both variables to confirm that those that declared being able to read and write did at least pass one year of school.

We also used information on occupational categories presented in the 1900 Census (which presents aggregated information on men and women) and that of the ID registers (which present information on men). Based on the HISCLASS classification and its use by Ayuda & Puche-Gil (2014), we constructed four main occupational groups. Group 1 corresponds to rural laborers (e.g. peasant, mule driver); Group 2 corresponds to manual laborers (e.g. construction worker, carpenter, laborer); Group 3 corresponds to non-manual unskilled (e.g. driver, cooker, retailer) and Group 4 corresponds to non-manual skilled (e.g. lawyer, engineer, technician). We evaluated the relative importance of each of these categories in the 1900 Census and in our first sample that considered rural laborers (Table 1). Clearly, rural laborers are underrepresented in our first database. However, given that we decided to eliminate this category from our final database, we also evaluate the relative importance of each occupational group without rural laborers (third and sixth row in Table 1). This comparison shows a more similar structure to that of the Census. Therefore, leaving aside rural laborers (whose probability of being illiterate was higher than in the remaining categories), our database would accurately reflect the occupational structure of those inhabitants who could be related to urban tasks. This shows that our database does not only consider the elites and incorporates information of urban *middle* classes.

Table 1. Occupational structure in La Paz city, 1880-1929

	Occupational Group					**Total**
	1. Rural Laborers	**2. Manual**	**3. Non-manual unskilled**	**4. Non manual skilled**	**Non identified**	
1900 Census (men and women)	19.074	11.829	11.385	7.090	2.867	52.245
Relative importance (%)	36,5	22,6	21,8	13,6	5,5	
Relative importance without rural laborers and non-identified (%)		**39,0**	**37,6**	**23,4**		
Our sample (men)	910	2.175	1.549	1.256		5.890
Relative importance (%)	15,4	36,9	31,1	25,2		
Relative importance without rural laborers (%)		**43,7**	**31,1**	**25,2**		

Sources: Authors' own calculation based in Censo 1900 and the heights database.

The identification of indigenous people is an alternative way to check that our database offers some information about the heterogeneous composition of La Paz. For this we decided not to use the *aspecto* (appearance) category since it involves a lot of ID

collectors' subjectivity and because it was not registered continuously.[16] In contrast, we used information on registered surnames. Since some surnames that were associated with indigenous people during colonial times are currently associated with the elites of La Paz or to *mestizo* people (e.g. the *Cusicanqui*, see Querejazu, 2011), we chose those surnames that fulfilled one of the two following conditions: *a)* they were associated with indigenous people during the discussions of the ID Law (see *Redactor de la Cámara de Diputados, año 1927*); *b)* they are unquestionably linked to indigenous origins nowadays. Hence, a man is considered indigenous if his first surname or second surname correspond to the list that is presented in the footnote.[17] Using this method, we identified 926 men as indigenous, which accounts for 19% of our final sample, which is non-negligible.[18]

A last point on the representativeness of our database is related to regional differences. Three different elements suggest that we should be cautious when extrapolating our results to overall Bolivian urban people: *a)* most men in our database were born in La Paz (75%, on average, in the Department of La Paz; among them, one third in the city of La Paz); *b)* the most populated regions of La Paz Department during the period under scrutiny are located in places that are between 3,000 and 4,200 meters above the sea level, which may have effects on the growth of children[19]; *c)* other Latin American experiences show that regional differences in height can be large (Llorca-Jaña, Navarrete-Montalvo, Araya-Valenzuela, et al., 2018; López-Alonso, 2012; Meisel & Vega, 2007).[20] In any case, while we are not sure that our results are representative of all urban Bolivia, we know that our sample deals with the middle and upper classes in the richest city of the country.

[16] The definition of *indigenous* in Bolivia is not straightforward (Albó, 2012; Barragàn, 2019; Lavaud & Lestage, 2009). Critical for our analysis, the variables "occupation" and "indigenous" do not show problems of multicollinearity.

[17] Specifically, we used the following surnames: Acarapi, Achu, Aduviri, Ajata, Alanoca, Apaza, Aruquipa, Condori, Calisaya, Catari, Chambi, Chipana, Choque, Colque, Condori, Huanca, Laime, Limachi, Mamani, Patzi, Poma, Quelca, Quispe, Ticona, Villca and Yujra. More information on these issues can be found here: https://www.familysearch.org/wiki/es/Pueblos_ind%C3%ADgenas_de_Bolivia and here, https://aymara.org/webarchives/www2004/biblio/apellidos.php. Both accessed on February, 15th 2019.

[18] Notice that indigenous were not only but mainly concentrated in occupational groups 2 and 3.

[19] For instance, Wehby, Castilla, & Lopez-Camelo (2010) show that increases in the altitude (from 5 to 3,600 meters) have persistent and significant effects on birth weight. Likewise, Baten & Blum (2014) find a small but statistically significant negative effect of altitude in their worldwide analysis of average heights.

[20] See the appendix to get information on average heights by department and birth decade. Despite differences in sample sizes, average height stagnation seems to prevail in all Bolivian departments. Regarding differences *between* departments, these can be driven by differences in the ecological context but also by differences in the composition of the sample (e.g. occupational categories). Thus, given that selectivity could play a role, these differences in average heights should be considered with caution.

4. The evolution of heights in La Paz, 1880s-1920s

This section presents the main results of the article. To start with, Table 2 shows the descriptive statistics of the most important variables considered in the research. As previously noted, we considered those who were born between 1880 and 1929. The average of this variable is 1911 and, importantly to the analysis, its distribution suggests little evidence of age-heaping. Likewise, the average age of the sample is 28 years old and the standard deviation is 8. Measured height is reported in cm and varies from 128 to 194, the simple average being 162.8 cm, a figure that remains fairly stable throughout the different analysis we carried out (see below). Figures A1 and A2 show that this variable appears to be normally distributed, either considering the whole sample or splitting it in birth decades. The splitting of the sample according to birth decades is customary in the literature (Ayuda & Puche-Gil, 2014). We constructed a dummy variable for those who possessed an indigenous surname (dummy variable equal to 1) and those who did not (dummy variable equal to 0); as previously noted, indigenous men represent 19% of the sample. Another dummy variable is related with those adults who were able to read and write (dummy equal to 1) or not (dummy equal to 0) at the time of their ID registration; the average value of 0,9 shows that most adults in our sample were literate. Lastly, we constructed four different occupational groups but, as previously explained, did not use rural laborers in the analysis.

Table 2. Descriptive statistics

Variable	N	Mean	Std. Deviation	Min	Max
Year of birth	4980	1911,76	10,95	1880	1929
Age	4980	28,41	7,82	19	50
Height	4980	162,82	6,29	128	194
Indigenous	4980	0,19	0,39	0	1
Literacy	4964	0,90	0,30	0	1
Manual	4980	0,44	0,50	0	1
Non-manual unskilled	4980	0,31	0,46	0	1
Non-manual skilled	4980	0,25	0,43	0	1

Sources: Authors' own calculation based in the heights database.

Table 3 shows the average height by decade and the different dummies we considered in the analysis.[21] Regarding the former, the average height is quite stable around 162,8 cm.[22] In this context, whereas a small increase (lower than 0,5 cm) can be appreciated between the two initial decades and the remaining three, Figure A3 suggests that these differences are not statistically significant. Indeed, when comparing heights between the different decades, we were not able to reject the null hypothesis of the same mean and median.[23]

Table 3. Average height (cm) by birth decade and other characteristics, 1880s-1920s

Variable	N	Average Height	Std. Deviation	Min	Max
1880	230	162.43	6.52	148	186
1890	465	162.65	6.67	136	187
1900	1,186	162.85	6.24	141	185
1910	1,713	162.83	6.14	128	184
1920	1,386	162.89	6.34	134	194
Indigenous	926	160.36	5.28	128	180
Non indigenous	4,054	163.38	6.36	134	194
Literate	4,466	163.15	6.27	136	194
Illiterate	498	159.83	5.65	128	180
Manual	2,175	161.10	5.58	134	185
Non-manual unskilled	1,549	162.87	6.33	128	182
Non-manual skilled	1,256	165.71	6.32	141	194

Sources: Authors' own calculation based in the heights database.

As for the dummy variables capturing characteristics of the sample, it stands out that non-indigenous men were, on average, 3 cm taller than indigenous. These differences are also appreciated between literate and illiterate men, the former having an average height 3 cm higher than the latter. In the case of the occupational categories, non-manual unskilled workers present an average height approximately 2 cm higher than that of manual workers. Likewise, adults who worked in non-manual skilled activities were, on

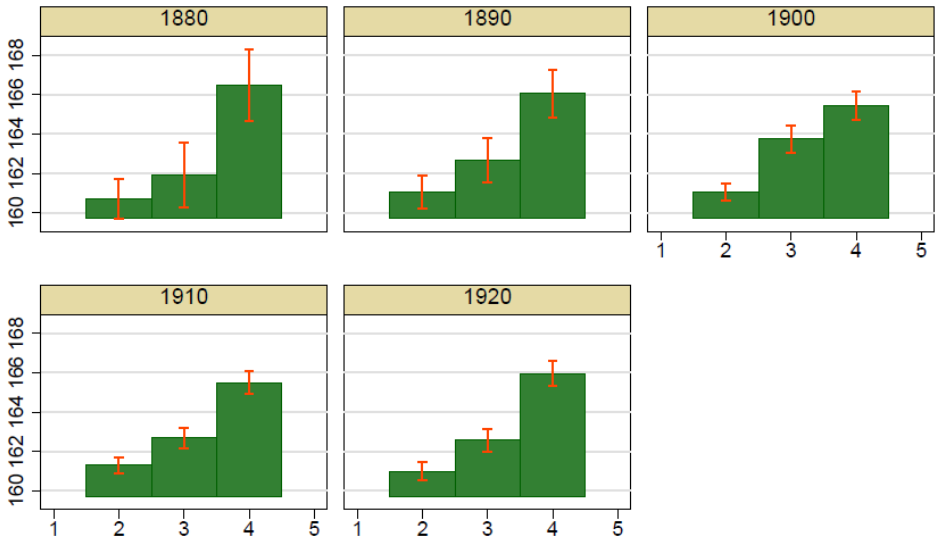
[21] The number of observations for the 1880 and 1890 decades is relatively small. This could be explained by the fact that Bolivian IDs were first registered just in 1929. We conducted extensive research at the Police archives held at the ALP and were not able to find more observations for these decades.

[22] The standard deviation is also very stable and is in line with previous research on Latin American average heights (see, for instance, Llorca-Jaña, Navarrete-Montalvo, Araya-Valenzuela, et al. (2018); Meisel & Vega (2007).

[23] Using the different decades as groups, we performed a two-group mean comparison test (t-test) and a nonparametric k-sample test on the equality of medians. This argument should be also considered when analyzing the slight increase in the average height of people born in the Department of La Paz (see the appendix).

average, 4.6 and 3 cm taller than those who worked on manual and non-manual unskilled activities, respectively. Figure 1 suggests that these differences were persistent and statistically significant throughout time. Here, we also run tests of mean and median differences in heights by category and decade and we could reject the null hypothesis of no difference with just one exception: manual workers and non-manual unskilled in the 1880 decade. Strikingly, the graph also stresses that heights of the different groups remained fairly stable through time.

Figure 1. Average height by occupational group and 95% interval of confidence (cm), 1880s-1920s



Sources: Authors' own calculation based in the heights database.
Notes: As described in the text, Group 2 corresponds to manual workers, Group 3 to non-manual unskilled workers, and Group 4 to non-manual skilled workers.

We executed different econometric exercises in order to prove the stagnation of average heights by decade as well as the differences between the groups considered. Table 4 shows the regression results for the entire sample and Table 5 shows the results before and after 1900 under the assumption that some differences could happen once La Paz achieved political hegemony. We are reporting here the OLS results with robust standard errors (White, 1980). As a robustness check, we have run regressions with other techniques to confirm that the results are not driven by outliers: we performed quantile regressions at the median (Koenker & Bassett, 1978) and robust regressions as described by Rousseeuw & Leroy (1987). We also performed the OLS regressions using bootstrapped standard errors, using 200 replications, which are generally adequate for

estimates of standard error (Mooney & Duval, 1993). The results are comparable to those presented here.[24]

As can be seen in Table 4, we are not able to identify a significant trend in heights. The different birth decade dummies are non-significant in Tables 4 and 5, with the only exception of 1920 in the third specification in Table 4. Notice, however, that the coefficient value is below 1 cm. In the same vein, with the exception of specifications 3 and 4 in Table 5, there is a significant height penalty on indigenous which ranges from 1.5 cm to 3 cm. Literacy is persistently associated with higher heights in Tables 4 and 5. In the case of the last specification in both tables, which is our favorite since it includes all the dummies and has a higher adjusted R^2, literate men tend to be 1.5-2 cm taller than illiterate men. Looking at the same specification, non-manual skilled workers are 4 cm taller than manual workers; the difference between non-manual unskilled and manual is around 1.5 cm.

Table 4. Regression results, overall sample

	1880-1920				
	1	**2**	**3**	**4**	**5**
Cons.	146.8***	162.43***	162.73***	160.76***	159.88***
	15,78	0,43	0,43	0,48	0,46
Year of birth	0,01				
	0,01				
1890 Decade		0,21	0,26	0,20	0,25
		0,53	0,52	0,52	0,50
1900 Decade		0,41	0,56	0,40	0,44
		0,47	0,46	0,46	0,44
1910 Decade		0,40	0,71	0,43	0,28
		0,45	0,45	0,45	0,43
1920 Decade		0,45	0.94**	0,60	0,34
		0,46	0,46	0,46	0,44
Indigenous			-3.09***	-2.55***	-1.58***
			0,20	0,21	0,22

[24] The results also hold when we restrict the analysis to people born in the Department of La Paz. All these results are available upon request.

Literate				2.33***	1.59***
				0,29	0,29
Non-manual unskilled					1.56***
					0,20
Non-manual skilled					3.95***
					0,23
N	4.980	4.980	4.980	4.964	4.964
Adj. R^2	0,00	0,00	0,04	0,05	0,10

Sources: Authors' own calculation based in the heights database.
Notes: OLS regressions with robust standard errors. The Standard Error is presented below the coefficients value. ***p<0.01; **p<0.05; *p<0.1.

Table 5. Regression results, 1880-1890 and 1900-1920 decades

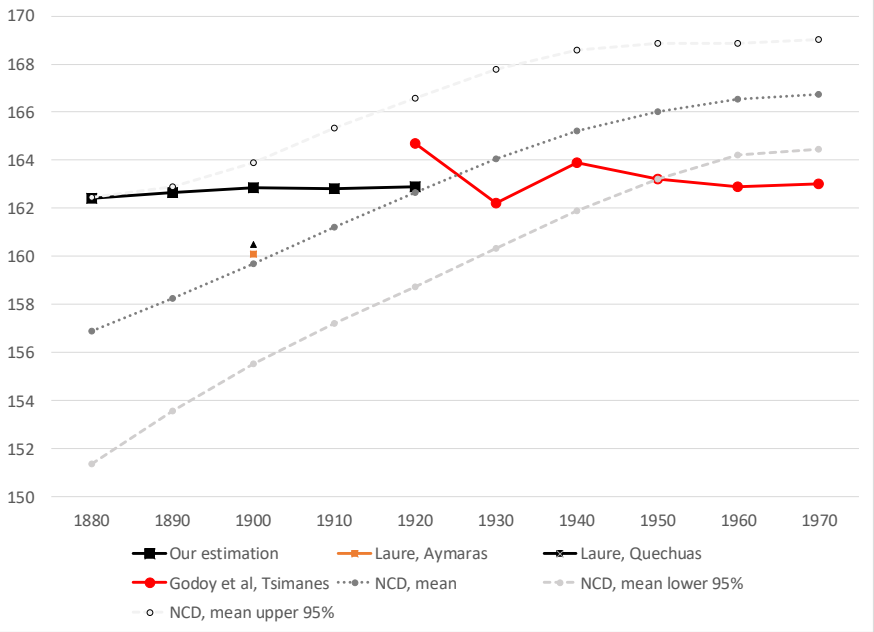
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Cons.	162.43***	162.73***	159.98***	159.26***	162.85***	163.29***	161.3***	160.46***
	0,43	0,44	0,71	0,72	0,18	0,18	0,33	0,33
1890 Decade	0,21	0,26	0,15	0,23				
	0,53	0,52	0,52	0,50				
1910 Decade					-0.01	0,14	0,03	-0,16
					0,23	0,23	0,23	0,22
1920 Decade					0,04	0,37	0,21	-0,08
					0,25	0,25	0,25	0,24
Indigenous		-3.09***	-1.33	-0,81		-3.09***	-2.65***	-1.67***
		0,74	0,84	0,84		0,21	0,22	0,22
Literate			3.14***	2.12***			2.2***	1.47***
			0,68	0,70			0,31	0,32
Non-manual unskilled				1.36**				1.58***
				0,56				0,21
Non-manual skilled				4.68***				3.83***
				0,62				0,24
N	695	695	694	694	4.285	4.285	4.270	4.270

Adj. R^2	0,00	0,02	0,04	0,12	0,00	0,04	0,05	0,10

Sources: Authors' own calculation based in the heights database.
Notes: OLS regressions with robust standard errors. The Standard Error is presented below the coefficients value. ***p<0.01; **p<0.05; *p<0.1.

The previous analysis confirms the stagnation of Bolivian male urban adults' average height around 163 cm in the 1880s-1920s decades. In Figure 2, we compare our estimation with the available evidence on average heights for Bolivians living in rural areas or obtained through indirect mechanisms. It is noteworthy that our estimation does not vary greatly to those obtained for Bolivians living in rural areas, either in the west (Aymaras), center (Quechuas) or north (Tsimanes) of the country. Likewise, our estimation lies within the credible intervals of the indirect estimation of male average height generated by the NCD Risk Factor Collaboration group (2016): it is closer to the upper limit at the beginning of the period, approaching the mean value thereafter. However, in contrast to this estimation, ours does not suggest an increasing trend.[25]

Figure 2. Different estimations of Average male heights in Bolivia (cm), 1880s-1970s

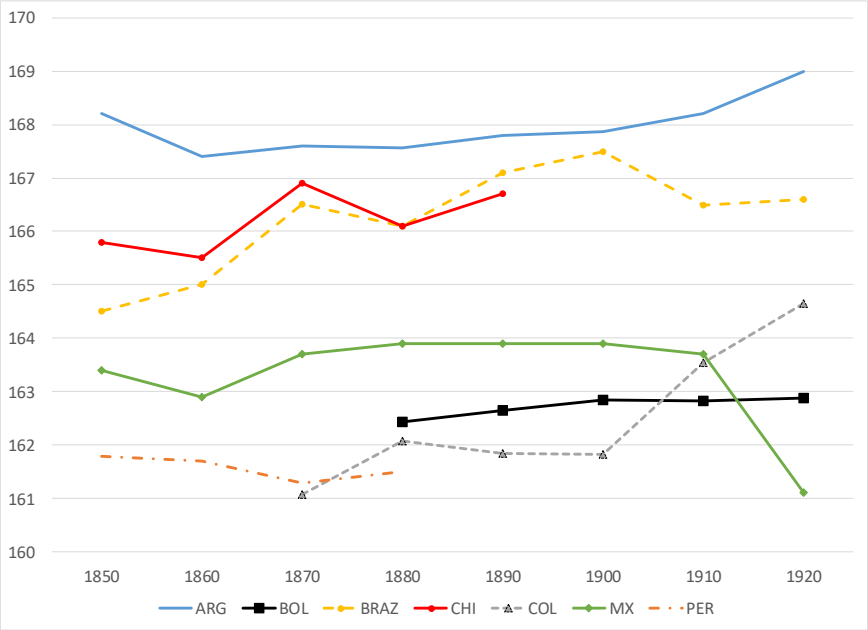


Sources: Godoy et al. (2006); Laure (1991); NCD Risk Factor Collaboration (2016).
Notes: Data on the Tsimanes refers to "Participant certain of age; physical stature corrected for age-related shrinkage".

[25] The estimation by the NCD Risk Factor Collaboration group (2016) uses a Bayesian model with a hierarchical structure. In the model, estimates of mean height for each country and year are informed by its own data, if available, and by data from other years in the same country and in other countries, especially those in the same region with data for similar time periods. As the availability of data for Bolivia is very scarce, the estimates for this country are relatively imprecise and the reported 95% credible intervals are quite large. Moreover, the NCD Risk Data is mostly based on post 1970s evidence, which implies that heights of early birth decades have to be adjusted by shrinking. Their shrinking adjustment is debatable.

It is also interesting to compare our estimation with the available evidence on other Latin American countries, which refers to men that are representative of the entire country (Figure 3). The comparison covers the broad first export era in the region after Independence (1850s to the Great Depression). It shows that urban Bolivian men were among the smallest in the region: average heights were clearly lower than those in Argentina, Brazil and Chile, lower than in Mexico and somehow similar to those in Colombia and Peru.[26] Furthermore, Bolivia mimics the stagnation of average heights in most countries in the region (Brazil and, since 1900, Colombia are the exceptions) and the weak relationship between the considerable expansion of exports and changes in the biological standards of living.

Figure 3. Men Average Heights in Latin America (cm), 1850s-1920s



Sources: Data obtained from Clio Infra, Baten & Blum (2014) and Llorca-Jaña et al. (2018).

5. Understanding inequality and stagnation

An explanation of the lack of correspondence between economic growth and changes in biological standards of living in Bolivia during the 1880-1920 decades, should identify explanations that account for: *a)* the persistence of significant inequalities within the upper and middle classes; *b)* the lack of significant improvements in average heights of

[26] However, given that our sample focuses on Bolivian middle and upper classes, it could be expected that Bolivian average height was even lower.

any social group. For this, it is illustrative to review some of the explanations proposed in the literature focused on Latin America during the 1880s-1920s decades. For instance, Meisel & Vega (2007) stress the following factors that may affect the rise of average heights in the case of Colombia: a reduction in the work stress, changes in the ethnic composition, improvements in nutrition and advances in overall health conditions. In the case of Peru, the lack of correspondence between changes in the aggregate economy and human welfare is attributed to inequality: it is argued that the considerable increase in guano exports (1850s-1870s) disproportionally benefited a white elite and that the export boom was accompanied by rising prices that were not followed by wage increases, which affected the living conditions of the poor (Twrdek & Manzel, 2010). Inequality is also stressed in the Chilean (Llorca-Jaña, Navarrete-Montalvo, Araya-Valenzuela, et al., 2018) and Mexican (López-Alonso, 2012) cases, but in a broader relationship with public policies and their effects on the evolution of health conditions.

In our case, changes in the ethnic composition is a poor explanatory variable given the persistence of the ethnic composition of the Bolivian population and the negligible importance of immigration, as can be proven in national censuses. Likewise, if changes in work stress were the explanatory variable, we should expect to find a positive trend in heights given the urbanization process that La Paz was living during the first half of the 20th century. In this context, while our results show persistent height premiums on the less physical demanded occupational groups, the height stagnation in each category is remarkable.

Regarding changes in nutrition, given the higher records of economic growth at the turn of the 20th century, the existence of a trickle-down process could be assumed. Nevertheless, our story may also fell in Komlos (2019: 42) description where, despite high records of economic growth, a break in the chain food may take place in contexts of acceleration of population growth and of urbanization. Therefore, rather than economic growth, what matters is rapid and constant improvements in agricultural productivity. It is hard to analyze this variable given the lack of enough evidence. Anyway, qualitative evidence or the global analysis of agriculture in Bolivia between 1846 and 1950 (Herranz-Loncán & Peres-Cajías, 2016) suggest the lack of significant changes in agriculture productivity. Moreover, considering the critical role of access to animal protein (Baten & Blum, 2012) it stands out a stagnation of cattle per capita in Bolivia throughout the 1880s-

1920s period (see data in Clio-Infra) as well as a reduction in meat per capita in the department of La Paz from around 20 kg/year (1846) to around 15 kg/year (1950).[27]

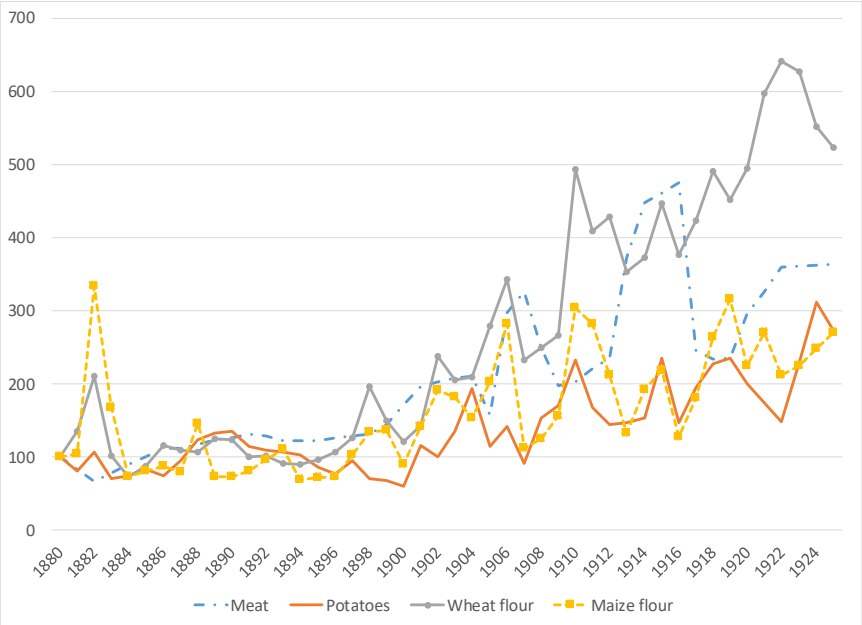
It is true that food restrictions in La Paz could be somehow lifted thanks to railways construction. Whereas this possibility should not be discarded, the population of La Paz could not necessarily fulfill this potential evenly. This idea can be indirectly analyzed by looking at the evolution of prices and real wages in the city of Cochabamba.[28] Indeed, prices of the most relevant products of the Bolivian diet were somehow stable during the last quarter of the 19th century but increased steadily since the beginning of the 20th century (Figure 4). The analysis of real wages shows that not all local consumers had the same ability to deal with this increase: real wages of the most important public servants in Cochabamba expanded at higher rates than the rest (Table 6).[29]

Figure 4. Evolution of prices of the main food items in the city of Cochabamba (1880=100), 1880-1925

[27] Our estimations of meat per capita by department considered different kinds of meat and used the equivalence ratios of animal endowments/meat production used in the censuses of 1846 and 1950. These estimations are available upon request.

[28] Given that there is little evidence of changes of dietary habits in Bolivia during the period under scrutiny, we can assume that diet relied on the same products identified for the mid-19th century: maize, wheat, potatoes/chuño and meat (see Appendix 1 in Herranz-Loncán & Peres-Cajías, 2016). Notice that it is not possible to analyze changes in the availability of these products in a national scale since there is very scarce data for agriculture production during this period (see the discussion in Herranz-Loncán & Peres-Cajías, 2016). Therefore, one should rely on prices. However, official data on prices in Bolivia was first collected in 1931. We could rely on import prices, but these were evaluated at official prices and not at market prices until 1919 (Peres-Cajías & Carreras-Marín, 2018). For instance, implicit import prices for wheat, rice or wheat flour are stagnant during the 1913-1918 period which is very unlikely given the evolution of prices in neighboring countries and the war-led global inflation. Therefore, given the lack of prices estimations for La Paz, we have to rely in the estimation made for Cochabamba (Henriques, 2015). The use of these prices as an approximation to prices in La Paz should be taken carefully since both cities were not necessarily integrated. This is particularly important for the 1888-1917 period, when railways construction was concentrated in the west of the country (see the discussion in Section 2). As for real wages, to the best of our knowledge, there is no available estimation of real wages during the period studied beyond the city of Cochabamba. So, once more, we rely on Henriques'(2015) estimates of public servant wages (notice that these were similar to public servant wages in La Paz).

[29] The *prefecto* is included in the "High" category; the Supreme Court Ministry, the Secretary of the Local Treasury and the main Judge are included in the "High-medium" category; physicians and university professors are in the third category (Medium); teachers are in the fourth category (Medium-low); cookers and drivers are in the last category (Low).



Sources: Authors own calculations based on (Henriques, 2015)

Table 6. Real wages of public servants in Cochabamba, 1882-1922

	Real Wages, Bs					Bs	
	High	**Medium-high**	**Medium**	**Medium-low**	**Low**	**Medium/ Low**	**Medium-low/ Low**
1882	666.6	279.4	68.3	29.6	6.9	9.9	4.3
1887	535.9	246.0	76.9	30.0	7.3	10.5	4.1
1892	520.5	234.0	77.5	29.8	8.6	9.0	3.5
1897	504.7	239.9	78.8	31.1	12.8	6.2	2.4
1902	750.9	248.8	58.9	26.7	9.7	6.0	2.7
1907	961.4	291.4	84.8	25.2	9.0	9.4	2.8
1912	1,189.0	414.7	84.2	27.8	9.1	9.2	3.0
1917	1,159.5	464.8	85.1	28.0	9.2	9.2	3.0
1922	1,180.8	544.3	91.0	27.8	9.6	9.5	2.9

Sources: Authors' own calculation based in Henriques (2015).

Moreover, notice that the third and fourth category in Henriques (2015) estimates correspond to occupations that are considered in our non-manual skilled laborers category; those introduced in Henriques' fifth category, are part of our non-manual unskilled laborers.[30] Interestingly, the ratio of real wages between the third and the fifth categories and that between the fourth and fifth category show a similar pattern: the ratio decreased during the last decades of the 19th century but increased again during the 20th

[30] Henriques (2015) introduces wages of physicians and university professors in the third category (Medium), those of teachers in the fourth category (Medium-low) and those of cookers and drivers in the last category (Low).

century. Furthermore, in 1897, when the lowest levels were achieved, university and schoolteachers earned 6.2 and 2.4 times more than cookers or drivers. This suggest that, beyond poor improvements in agriculture, significant differences in real wages would explain average heights stagnation and differences between the categories we studied.

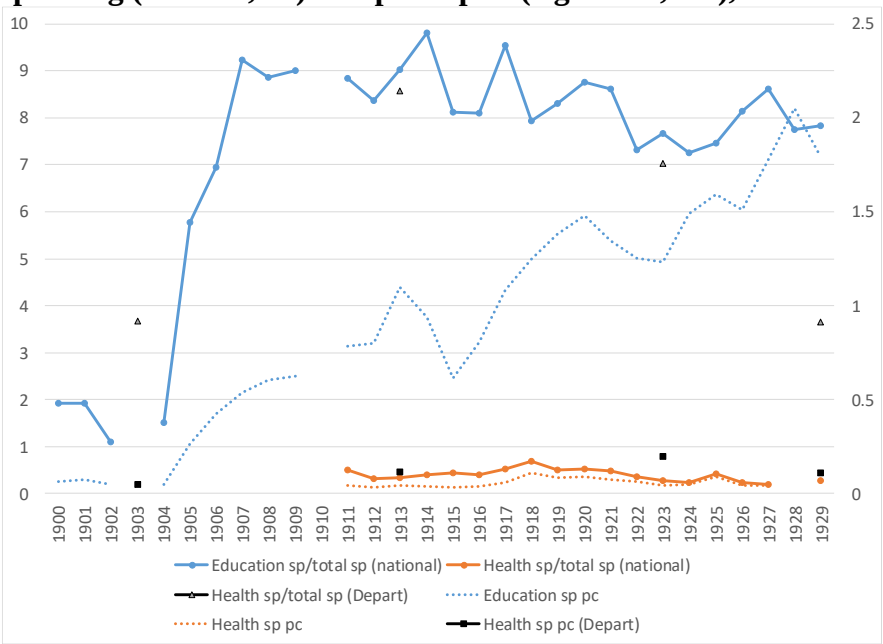
However, given that the average height of the well-off also remained stagnant, other variables should be considered. Particularly, when analyzing the evolution of general health conditions, it stands out that the meager improvement in public health provision may have particularly hit the poor, but also affected the well-off.[31] To better understand this fact it is necessary to revise the organization of the Bolivian health system throughout time. During the 19th century, health policies were a prerogative of municipalities, being the *Juntas de Sanidad* (1826-1830) and the *Protomedicato* (1830-1893) the national institutions entitled to give some coherence to these policies. Indeed, through its coordination with *Prefectos* (the heads of the Departmental Governments), these institutions regulated public health policies and hospitals, distributed smallpox vaccines and regulated medical professional services (Mendizábal, 2002). However, the *Protomedicato* did not function regularly (it was interrupted several years at the mid-19th century), had low enforcement power regarding the distribution of smallpox vaccines and was not managed by health specialists (Mendizábal, 2002: 87-98). This last feature was overcome with the instauration of the *Tribunales Médicos* (1893-1906), whose functions were the regulation of public health policies, the formation of medical specialists and that of medical examiners (Mendizábal, 2002: 101). In 1906, the *Dirección General de Salud* was created as the national entity in charge of public health policies. However, in contrast with other centralization efforts promoted by the *liberales* during the same period, health services received relatively few resources from national funds until 1938, when the *Ministerio de Salud* was created (Barragán & Peres-Cajías, 2007), and it just experienced a progressive incorporation of Departmental funds.

Despite the lack of quantitative evidence for the 19th century, Figure 5 illustrates how this organization of the public health system was reflected in public spending. To begin with, in contrast to education services whose relative importance in national expenses increased after the centralization process on the eve of the 20th century, the relative importance of health services remained below 1% of total national spending from 1900

[31]Indeed, according to Baten & Blum (2014) results, a bad disease environment may have a higher impact on average heights than the protein effect.

to 1929. Thus, while the national spending per capita on education increased from Bs. 0.06 in 1900 (before centralization) to Bs. 1.79, national health spending per capita remained around Bs.0.04 from 1911 (the first year when data is available) to 1929. Regarding Departmental funds, we only have scarce information and related to *budgeted* expenses. Using this information, we see that the relative importance of health spending increased during the first decade of the 20th century, but the per capita amounts did not surpass Bs. 0.20.

Figure 5. Public spending in Health and Education in Bolivia as a share of total spending (left axis, %) and per capita (right axis, Bs.), 1900-1929



Sources: Authors own calculations based on Barragán & Peres-Cajías (2007) and Peres-Cajías (2014).

It is also illustrative to analyze the evolution of health expenses in the fiscal accounts of the city of La Paz (Table 7). The limited quantitative evidence that we were able to reconstruct shows that its relative importance diminished from the last quarter of the 19th century to the first decade of the 20th century. Nevertheless, this fall was the result of the incorporation of other items which included some that affected the evolution of biological standards of living (see below). This explains why the fall in the relative importance of health expenses did not translate into a fall in the absolute amounts expended, which remained around Bs. 0.9 per capita throughout the period under scrutiny, a higher level than the average spent by national and departmental funds. Municipal expenses on health were destined to the Hospital Landaeta (for males, inaugurated in 1555), Hospital Loaiza

(for women, inaugurated in 1807) and the Hospital Lazareto (for infectious diseases). Furthermore, by issuing municipal debt, a modern hospital began to be built in 1913. The hospital opened in 1920 but did not operate fully until 1925 (Alarcón, 1925; Mendizábal, 2002).

Table 7. Public spending in health and water systems in La Paz city, 1883-1910

	1883	1884	1886	1888	1891	1897	1904	1906	1908	1910
Relative importance Health on total Expenses (%)	40.61	33.47	21.81	14.75	16.01	18.50	13.30	21.39	8.66	5.89
Per capita, Bs.	0.91	0.78	0.78	0.87	0.88	0.92	1.17	1.71	1.00	0.72
Relative importance Health and Water Services on total Expenses (%)	40.61	34.48	23.77	15.21	17.01	19.11	19.93	38.56	9.85	11.64
Per capita, Bs.	0.91	0.80	0.85	0.90	0.93	0.95	1.75	3.08	1.14	1.42

Sources: Authors' own calculation based in Municipal Yearbooks.

In Table 7, we also incorporated information on water services expenses since it may have also affected changes in health conditions and was one of the new expenses that was prioritized at the turn of the 20th century. This is reflected in a significant increase of the per capita amount spent on this item since 1904, which in turn is a consequence of the municipal efforts to develop two new systems of piped drinking water, one in Tembladerani (1903) and another one in Milluni (1908). External debt was also used in 1919 to finance the construction of a modern sewage system; this could be particularly beneficial for health conditions in the dry season, when home and industrial residues remained in the city because of the scarcity of water in the city's main river (Ingeniería Internacional, 1919, 1922).

One should be cautious in interpreting how these changes in health policies affected the disease environment during the 1880-1920 decades. Indeed, some of these changes took place in the 1920s –i.e. during the very last years of the period under study. Furthermore, the real impact of these changes is not obvious. For instance, whereas municipal yearbooks stressed that municipal hospitals operated fairly well, some secondary sources state the contrary (Zulawski, 2000). Likewise, despite the installation of new systems of piped drinking water, there is evidence on local medical journals

(Zulawski, 2000) and even in municipal legislation (see, for instance, *Ordenanza Municipal* 17/09/1917), that points to the poor quality of the city's drinking water and the lack of enough provision of water to the entire population. This is not irrelevant since municipal yearbooks show that one of the most important death causes in La Paz was related with gastrointestinal diseases throughout the period under study (see also Zulawski, 2000).

The late installation of both a modern hospital or a modern sewage system, and the bad quality of piped drinking water, affected all inhabitants in the city of La Paz. This could be one of the explanations to understand why even average heights of the non-manual skilled laborers remained stagnant during the 1880s-1920s decades. In spite of this "equalization", inequality still played a role. Indeed, given the decentralized nature of health policies, it could be expected that public intervention was rather limited in rural areas, therefore restricting improvements in the biological standards of living of the less advantaged groups. For instance, whereas the distribution of smallpox vaccines were a prerogative of the Bolivian Central government since the 19th century, vaccines were only distributed once an epidemic episode was identified (Zulawski, 2000). Not surprisingly, smallpox was one of the most important causes of death in the 1880s and the 1910s. Other common diseases in the Department of La Paz were related to bad hygienic conditions (whooping cough or typhoid) or the presence of highly infectious diseases that needed to be restrained with vaccines (measles) (see municipal yearbooks; also Grieshaber, 1980). This fact highlights another relevant feature: as rural-urban contact was particularly intense during this period (both landlords and land laborers travelled frequently between both places), the combination of lack of public support in rural areas and the relevance of highly infectious diseases could also affect the biological wellbeing of the well-off.[32]

6. Conclusions

[32]For the Indian case, Guntupalli &Baten (2006: 579) stress that "Especially in societies with a poorly, or modestly developed public health system, morbidity crises also affected the middle and upper strata, especially those who were in frequent contact with other people (such as traders)." Moreover, whereas we did not find any specific reference, railways construction may increase the potential of diseases diffusion (either from rural areas or foreign countries). Regarding the persistence of a bad disease environment consider Henriques (2015) figures that show clear improvements in life expectancy, mortality rates and infant mortality rates during the 1902-1917 period. However, figures are not so different to those for the 1850s. Moreover, improvements stopped during the 1917-1921 period and there is a clear downward trend during the 1921-1925 period, which is explained by a mortality crisis.

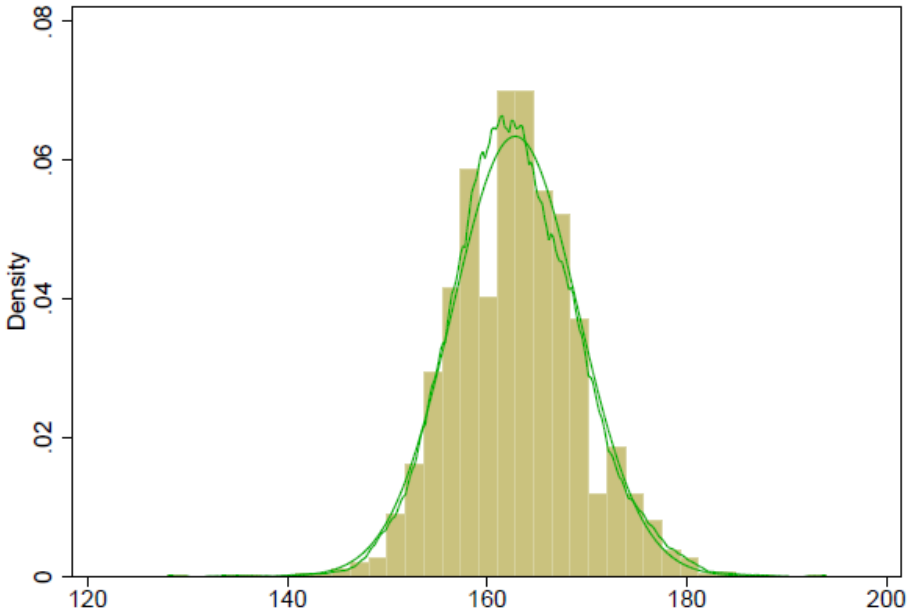
This paper is the first to use a relatively large and consistent dataset of male adults' heights to address the evolution of living standards in La Paz (Bolivia) between 1880 and 1929. As had been shown in some other studies focusing on Latin American economies, we document that average heights did not increase over these five decades. Our estimates suggest that the average height remained around 163 cm throughout the period.

Furthermore, we show that the differences in average height between social groups that we document in the first birth decade of our study, namely 1880, persist until the last birth decade, 1920, showing almost no sign of a reduction in inequalities. As in other case studies, we show that average height was largely a function of socioeconomic status, as measured by occupational level and of educational level, proxied by literacy. In addition to this, in Bolivia being indigenous was associated with a lower average height. Interestingly, the average height of indigenous men in our sample is around 160 cm, which is the level found by Laure (1991) for Aymara and Qhechuas in rural areas in 1903.

We argue that the stagnation of male urban Bolivian average heights during the 1880-1929 period can be explained by poor improvements in agricultural production and health conditions and by pressures on the less advantaged groups stemming from higher food prices and growing wage inequalities. Indeed, we confirm that only few resources were provided to public health in the period we study and were not enough to provide water of good quality to the entire population. Our conclusion on the effects of food prices and real wages is based on a recent analysis made for the city of Cochabamba. This highlights that more research is still needed on mortality, life expectancy, urban prices, dietary habits and inequality in different Bolivian cities.

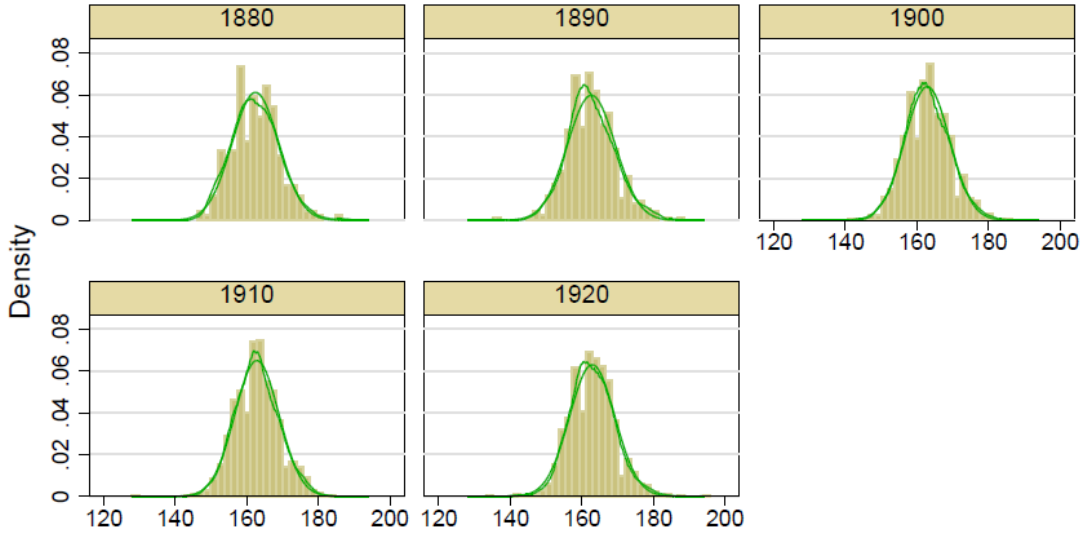
Appendix

Figure A1. Histogram and Distribution of Adult Male Height in Bolivia, 1880-1929



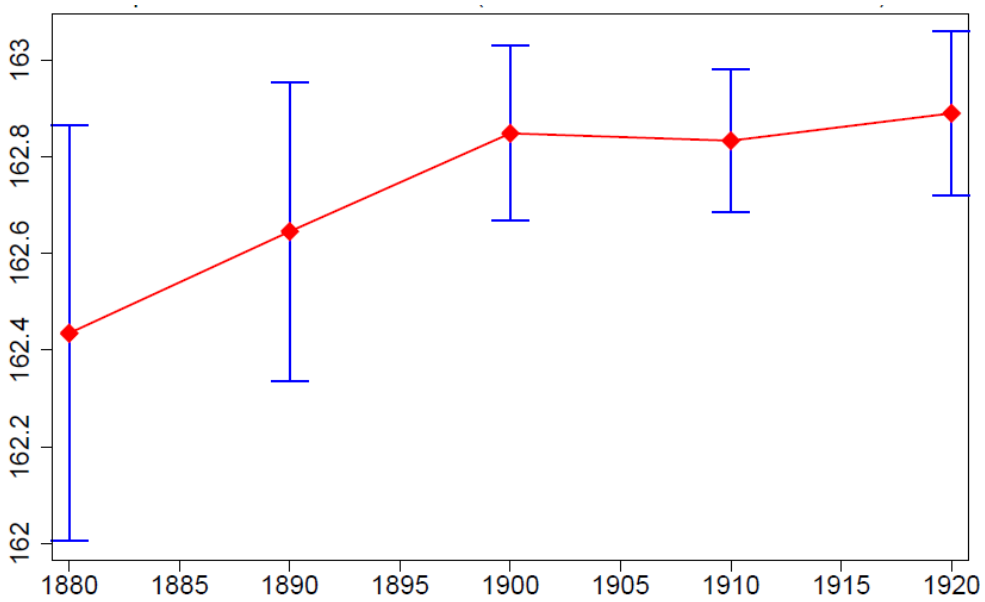
Sources: Authors' own calculation based in the heights database.

Figure A2. Histogram and Distribution of Adult Male Height in Bolivia, by decades



Sources: Authors' own calculation based in the heights database.

Figure A3. Average height by decade and 95% interval of confidence



Sources: Authors' own calculation based in the heights database.

Table A1. Average height by department and decade

Department where the person was born		Birth decade					Total sample	Relative importance, %
		1880	1890	1900	1910	1920		
La Paz	Mean	161.59	161.74	161.89	162.28	162.17	162.08	
	St. Dev	6.17	6.51	5.89	6.07	6.05	6.07	
	Obs.	188	337	895	1260	1084	3764	75.58
Oruro	Mean	158	164.55	164.56	161.95	163.3	163.09	
	St. Dev	10.44	6.57	6.32	5.09	6.79	6.15	
	Obs.	3	20	55	96	68	242	4.86
Potosi	Mean	160.2	161.81	163.62	163.38	164.71	163.59	
	St. Dev	3.34	6.54	5.47	6.13	6.75	6.19	
	Obs.	5	21	53	103	65	247	4.96
Chuquisaca	Mean	168.1	166.04	166.91	165.17	166.11	166.23	
	St. Dev	6.42	6.49	7.69	6.2	5.57	6.63	
	Obs.	10	25	46	40	27	148	2.97
Cochabamba	Mean	167.36	165.71	165.73	165.59	166.2	165.87	
	St. Dev	5.97	6.58	5.79	6.01	6.84	6.19	
	Obs.	22	49	98	140	80	389	7.81
Tarija	Mean		168	167.22	164.33	167.36	166.6	
	St. Dev		7.81	4.84	7.59	5.78	6.11	
	Obs.		3	9	9	14	35	0.70
Santa Cruz	Mean	171	167.33	168.95	166.22	167.68	167.47	
	St. Dev		3.93	6.6	5.57	6.21	5.93	
	Obs.	1	6	21	32	28	88	1.77
Beni	Mean	172	162	170.62	166.54	166.33	166.98	
	St. Dev		5.56	4.63	4.91	5.39	5.29	

	Obs.	1	3	8	22	15	49	0.98
Pando	Mean				170.5		170.5	
	St. Dev				9.19		9.19	
	Obs.				2		2	0.04
Litoral	Mean				160	173	164.33	
	St. Dev				14.14		12.5	
	Obs.				2	1	3	0.06
No data	Obs.						13	0.26
TOTAL							**4980**	**100**

Sources: Authors' own calculation based in the heights database.
Notes: Please consider footnotes 20 and 23 to analyze the table.

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