Tracing the reversal of fortune in the Americas. Bolivian GDP per capita since the mid-nineteenth century

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Abstract

In the centuries before the Spanish conquest, the Bolivian space was among the most highly urbanised and complex societies in the Americas. In contrast, in the early 21st century Bolivia is one of the poorest economies on the continent. According to Acemoglu, Johnson and Robinson (2002), this disparity between precolonial opulence and current poverty would make Bolivia a perfect example of "reversal of fortune" (RF). This hypothesis, however, has been criticised for oversimplifying long-term development processes by "compressing" history (Austin, 2008). In the case of Bolivia, a comprehensive description and explanation of the RF process would require a global approach to the entire postcolonial period, which has been prevented so far by the lack of quantitative information for the period before 1950. This paper aims to fill that gap by providing new income per capita estimates for Bolivia in 1890-1950 and a point guesstimate for the mid-nineteenth century. Our figures indicate that divergence has not been a persistent feature of Bolivian economic history. Instead, it was concentrated in the 19th century and the second half of the 20th century, and it was actually during the latter that the country joined the ranks of the poorest economies in Latin America. By contrast, during the first half of the 20th century, the country converged with both the industrialised and the richest Latin American economies. The Bolivian postcolonial era cannot therefore be described as one of sustained divergence. Instead, the Bolivian RF was largely the combined result of post-independence stagnation and the catastrophic crises of the late 20th century.

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1. Introduction

In the centuries before the Spanish conquest, the Bolivian space was among the most highly urbanised and, arguably, most complex and developed societies in the Americas. According to the estimates reported in Acemoglu, Johnson and Robinson (2002), the urbanisation rate in the Bolivian area ca. 1500 was, together with those in Mexico, Ecuador and Peru, the highest on the continent. The economic prominence of the Bolivian space was consolidated after the Spanish conquest due to silver discoveries, and the Bolivian city of Potosi became one of the most important economic centres in the Americas during the colonial era. For a long period of time, Potosi silver production was critical to the world economy (Pomeranz, 2000: 269-274), for regional economic integration (Assadourian, 1982) and to sustaining the Spanish administration (TePaske and Klein, 1982). Despite its gradual loss of position in favour of other areas of the Empire, Potosi remained an important economic centre until the collapse of the Spanish colonial power (Tandeter 1993; Grafe and Irigoin, 2006).[1] Not surprisingly, today, almost 500 years after their arrival in the region (1548), Spaniards still use the expression "*vale un Potosí*" (it is worth a "Potosi") as equivalent to "it is worth a fortune".

In stark contrast with its prosperity during precolonial and colonial times, in the early 21st century Bolivia is one of the poorest economies in the Americas. In 2013, according to the World Bank, its income per capita (PPP-adjusted) was the fourth lowest on the continent, just ahead of Haiti, Honduras and Nicaragua, and the country ranked 113th in the Human Development Index (UNDP). The HDI figure becomes substantially worse if it is corrected for inequality: Bolivia is a very unequal economy in one of the most unequal regions of the world (SEDLAC).

This contrast between precolonial and colonial opulence and current relative poverty would make Bolivia a perfect example of the so-called "reversal of fortune" (Acemoglu, Johnson and Robinson, 2002). According to this hypothesis, among the countries colonised by European powers since 1500, those that were relatively rich at the beginning of the colonial era are now relatively poor and vice versa. The reversal of

[1] The economic importance of Potosi was higher at the beginning of the colonial period (1570-1630) than thereafter (Bakewell, 1984; Tandeter, 1993). Recent works by Arroyo-Abad *et al*. (2012) and Allen *et al* (2011) show the relative decline of Potosi relative to other economies in the Americas and the world since the second half of the 17th Century.

fortune would be the result of an institutional reversal created by the colonisers, who were more prone to establish extractive institutions in rich areas, and institutions that encouraged investment in poor regions. After independence, the continuity in the rent-seeking and investment-discouraging character of the institutional framework in previously rich areas would have prevented them from taking advantage of opportunities to grow and industrialise, and would have condemned them to divergence. Although extractive institutions could generate some growth, this would be intrinsically limited and would last only so long before being destroyed by political instability (Acemoglu and Robinson, 2012).

Acemoglu, Johnson and Robinson (2002: 1266) explicitly mention Potosi among the examples of territories where Europeans established an institutional framework that would have hindered growth and investment in the long term. According to them, "(...) the area now corresponding to Bolivia was seven times more densely settled than the area corresponding to Argentina; so on the basis of [our] regression, we expect Argentina to be three times as rich as Bolivia, which is more or less the current gap in income between these countries" (ibid., p. 1248). Similarly, in their most recent book, *Why Nations Fail*, Acemoglu and Robinson (2012) state that Bolivia, due to its institutional setting, has always belonged to the poorest group of the Latin American economies, and consider the 1952 Bolivian Revolution as a typical example of political instability generated by long-term established extractive institutions.[2] In the same vein, Dell (2010) identifies a number of channels through which the negative effects of the mining *mita*, a forced labour system instituted by the Spaniards in Peru and Bolivia in 1573, have persisted over time and have affected the current development levels of the areas where it was established.

The "reversal of fortune" hypothesis, however, has been criticised for oversimplifying historical processes and "compressing" history. For instance, in the case of Sub-Saharan Africa, Austin (2008) stresses the difficulty of providing general explanations for a region with wide variations in economic growth experiences over time and across countries. Similarly, Frankema and Van Waijenburg (2012), in their reconstruction of the evolution of real wages in several British African colonies between 1880 and 1965,

[2] In *Why Nations Fail*, Acemoglu and Robinson (2012: 104) also provide a different, less optimistic, view of the Argentinean development process than in their previous works. In this new book they consider the country's economic dynamism before the 1920s as a typical example of unsustainable growth under extractive institutions.

have found some historical periods of both high economic dynamism and substantial intraregional variation. This indeed warns against the limitations of a historical analysis based on linking two distant "moments in time without reviewing possible changes during the centuries in between" (ibid.; p. 898).

In the case of Bolivia, the absence of information on economic growth before 1950 has so far prevented detailed analysis of variations in the country's long-term economic performance over time. It is true that the available official series of income per capita, which starts in 1950, clearly indicates that the second half of the 20th century was a period that saw Bolivia diverge from the world's core economies. More precisely, according to the New Maddison Project database, Bolivian pc GDP represented 20 percent of US pc GDP in 1950 and only 10 percent in 2010. However, it is interesting to observe that the Bolivian divergence was not sustained over time, but was associated with two specific economic catastrophes: i) the depression that followed the 1952 Revolution, and ii) the debt crisis and the structural adjustment programs of the 1980s.

Therefore, far from being a sustained process, Bolivian divergence during the second half of the 20th century seems to have been associated with certain conjunctures. The available research on the period before 1950 also seems to suggest an alternation of cycles of stagnation and economic dynamism. For instance, instability, de-urbanization, export stagnation and (since 1870) the decrease in silver prices and the Bolivian terms of trade would have reduced the country's potential for economic growth and convergence during the second half of the 19th century (Huber, 1991; Pacheco, 2011; Langer, 2004; Mitre, 1981; Klein 2011; Bértola, 2011). In contrast, the boom in rubber and, especially, tin exports since the early 20th century would have boosted a sustained growth process at least until the Great Depression of 1929 (Mitre, 1993; Bértola, 2011), a crisis which would have had a relatively mild impact in Bolivia, compared with other Latin American countries (Bértola, 2011: 262).

Unfortunately, so far the lack of information on crucial magnitudes of the Bolivian economy has prevented historians from testing any hypotheses on the country's relative performance since independence. Indeed, analyses of Bolivian long-term economic growth have suffered so far, either from being constrained to the second half of the 20th

century,[3] or from lacking a homogeneous indicator of economic performance for the whole postcolonial period.[4]

This paper aims to fill this gap by providing estimates of the Bolivian income per capita from the mid nineteenth century to 1950. More specifically, we present new yearly income per capita figures for 1890-1950 and a point guesstimate for the mid-nineteenth century. The new series may help to discover when Bolivia left its ancient colonial centrality and became a marginal space in the Americas, and to identify the main periods of Bolivian economic divergence after independence. The results of our estimation indicate that divergence, which originated before the mid-19th century, has not been a persistent feature of postcolonial Bolivian economic history. Instead, it seems to have been concentrated in the second half of the 19th century and the catastrophic episodes of the second half of the 20th century. It was only in this second period that the country joined the ranks of the poorest economies in Latin America. In contrast, during the first half of the 20th century, economic growth was not low by international standards, and Bolivia converged both with the core countries and with the richest economies in the region. It is therefore difficult to describe the postcolonial era in Bolivia as one of sustained divergence, but a much more complex process in which the country was unable to take advantage of available growth opportunities in certain crucial periods.

This is the first attempt to estimate the long term evolution of Bolivian pc GDP before 1950. There are, however, some antecedents for some specific periods or benchmark years. More precisely, Mendieta and Martín (2009) have estimated yearly GDP figures for 1929-1950 through a regression with three independent variables: exports, public expenditure and money supply (real M3). Morales and Pacheco (1999) report average GDP growth rates for some subperiods between 1900 and 1945, and yearly GDP figures for 1928-1936, although without giving information on their estimation methodology. Finally, Hofman (2001) provides GDP estimates for 1900, 1913 and 1929, also without indicating sources or estimation methods. The next section presents the sources and methods that we used to carry out our own estimation of the evolution of Bolivian GDP

[3] See, for instance, Mercado *et al.* (2005); Humérez *et al.* (2006); Grebe *et al.* (2012); Machicado *et al.* (2012); and Pereira *et al.* (2012).

[4] Some quantitative approaches to the evolution of some sectors or certain specific periods can be found, for instance, in Morales and Pacheco (1999); Mendieta and Martin (2009); Bértola (2011); Peres Cajias (2014); or Carreras-Marín, Badia-Miró and Peres-Cajías (2013).

between the mid nineteenth century and 1950, and compares it with these alternative estimates. Section 3 provides the sources and methods used to "guesstimate" the level of Bolivian GDP pc by 1846. On the basis of the new estimates, Section 4 analyzes Bolivian economic growth in detail and its long-term divergence from the core countries and the main economies of the region. Finally, Section 5 concludes.

2. Bolivian pc GDP between 1890 and 1950: sources and estimation methods

Our GDP series is based on the production approach. In order to provide a consistent link between our series and the current GDP figures, the starting point of the estimation is the value added of each Bolivian economic sector in 1950, taken from the official national accounts (Table 1). We have then estimated a series of real gross output for 1890-1950 for each of the sectors considered in that classification, which we have used to extend backwards each 1950 sectoral value added figure, under the assumption that, in each sector, gross output and value added evolved at the same pace. Finally, we have taken the sum of the resulting sectoral value added series as the yearly estimation of the Bolivian GDP.

Table 1. Sectoral composition of the Bolivian GDP (1950)

Agrarian Sector	31.21
Mining and petroleum industry	15.48
Mining	*14.94*
Petroleum industry	*0.54*
Manufacturing industry	14.08
Urban industry	*13.12*
Rural artisan production	*0.96*
Utilities	1.39
Construction	2.36
Services	35.48
Government	*5.36*
Transport	*6.67*
Trade	*11.32*
Housing rents	*4.93*
Financial and other services	*7.20*
TOTAL	100

Source: Sector percentages (in 1958 prices, the earliest available) have been taken from the ECLAC webpage, and the importance of the subsectors within each main sector comes from CEPAL (1958).
Notes: We have introduced two modifications into the original ECLAC data. First, we have corrected the sectoral percentages to account for the fact that financial services were not included in the ECLAC database before 1962 (the series included instead a non-classified "statistical difference" up to that year, which we have taken as a basis for our estimation of the weight of the financial sector). Second, we have

corrected the percentage of construction to account for the fact that the 1950 figure was a clear outlier; we have instead taken the average percentage for 1950-1955 and have recalculated the relative importance of the remaining sectors accordingly.

The quality of our results is affected by the absence of information for some sectors, which is especially serious in the case of agriculture, the manufacturing industry before 1925, and domestic trade services, and may have introduced biases of unknown direction in the level, fluctuations and composition of the series. In addition, our estimation also suffers from the lack of information on the evolution of prices and productivity in each sector, which has forced us to introduce a number of simplifying assumptions in the estimation. However, the importance of this problem is reduced by the low technological dynamism of an exceedingly large share of the Bolivian economy during the period under study; on the other hand, throughout the text we provide the results of some sensitivity tests that suggest that the main conclusions of our research are not affected by the assumptions that underlie the estimation. Nevertheless, due to the gradual reduction in the amount and quality of the available empirical information as the series go back into the past, it is necessary to allow for relatively large error margins in the case of the earliest observations.

Population

The available information on the historical evolution of the Bolivian population is very scarce. For the 19th century there is no official census, however, there are published estimates for different benchmark years (1825, 1831, 1835, 1846, 1854, 1865 and 1882). These seem to have been obtained with different methodologies and are mutually inconsistent, involving huge and unlikely demographic changes in different directions over short periods of time (Barragán, 2002; Urquiola, 1999: 216). In the case of the first half of the 20th century, apart from a few incomplete estimates for some intermediate years which do not cover the entire national territory, there are only two national censuses available, which were carried out in 1900 and 1950. The estimates for the 19th century, together with the national census totals, are reproduced in Table 2.[5]

[5] We have excluded from the 1900 figure the population from the former Bolivian coastal areas (*Litoral)*, which were still included in the census despite having being lost in the Pacific War.

Table 2. Available estimates of Bolivian population (1825-1950)

Year	Population
1825	1,100,000
1831	1,088,768
1835	1,060,777
1846	1,373,896
1854	2,326,126
1865	1,813,233
1882	1,172,156
1900	1,766,451
1950	2,704,165

Source: Barragán (2002) and National Censuses of 1900 and 1950.

Our estimation of the Bolivian population since the late nineteenth century is based on a geometric interpolation between the three national estimates that we consider the most reliable among those available: the 1900 and 1950 national censuses and the 1846 figure. The latter comes from Dalence (1851), and is usually preferred in Bolivian historiography, because it was elaborated in the context of an exhaustive and detailed survey of the Bolivian economy. The main shortcoming of the 1846 estimation is uncertainty on the size of the so-called "infidel" tribal population, which seems to account for those indigenous communities that were not yet fully integrated in the Bolivian state institutional structure. These communities, which the 1900 and 1950 National Census estimated at 91,000 and 87,000 individuals respectively,[6] were considered by Dalence in the mid 19th century to amount to approximately 760,000 people, i.e. 35.6 percent of the total Bolivian population. However, this figure (which is not included in the 1846 total population reported in Table 2) must be taken with certain caution, since it would involve a substantial net demographic decrease in the Bolivian population of more than 200,000 inhabitants throughout the second half of the 19th century, a period of demographic expansion in all Latin American countries (Yáñez et al., 2012). The 1950 national census also considers this figure unrealistic and suggests

[6] The 1900 national census distributed this population as follows: 27% in the Department of Tarija, 21% in the Department of Santa Cruz, 16% in the "Territorio de Colonias", 16% in the Department of La Paz and less than 10% each in the Departments of Beni, Cochabamba and Chuquisaca. The distribution of this population in 1950 was similar, and is consistent with the history of Bolivian State expansion (Barragán and Peres-Cajías, 2007), since the "infidel population" would be located mainly in the tropical lowlands and the Chaco, i.e. mostly in the northern and eastern areas of the country.

that the "infidel" population would have amounted instead to 100,000 individuals by the mid 19th century.[7]

Given that uncertainty, we have estimated two population series. One includes all individuals properly accounted for by the Bolivian State, and the other also includes the population of the "infidel" or "non-subjected" (as the 1900 Census calls them) communities. The former is the result of making a geometric interpolation between Dalence's figure for 1846 ("infidels" excluded) and the National Censuses of 1900 and 1950.[8] In the latter we add an almost stagnant series of "non-subjected" population that decreased monotonously from 100,000 individuals ca. 1854 to 91,000 in 1900 and 87,000 in 1950. In turn, we divide the first series between urban and rural population. We consider as urban the population living in cities with more than 2,000 inhabitants in each of the three benchmark years, and all the remaining population as rural. With this broad definition of cities, the Bolivian urbanisation rate is estimated to have increased from 11 percent in 1890 to 26 percent in 1950.[9]

[7] Neither migration nor the territorial loss associated with the Pacific War might explain a decrease of 200,000 people in the Bolivian population over the second half of the 19th century. The population of the areas that were lost to Chile in the early 1880s may be estimated at ca. 74,000; see Yáñez et al. (2012: 21). Likewise, net Bolivian migration might have involved even lower numbers. For instance, according to each country's official census, by 1895 the number of Bolivian-born citizens living in Chile and Argentina, which were probably the main destinations of Bolivian emigration, was 8,869 and 7,361 respectively, whereas the number of foreigners living in Bolivia in 1900 was 7,425. Therefore, the decrease in the Bolivian population between 1846 and 1900 that Dalence's estimate would involve might only be explained by a catastrophic decline of the "infidel" tribal population (by illness or displacement to neighbouring countries). While this possibility cannot be completely ruled out, given the absence of information here we have conservatively preferred to accept the 1950 Census suggestion and assume a stagnant evolution of this demographic group. Taking Dalence's figure, however, would not substantially alter the main feature of our GDP and per capita GDP series. The main change would obviously affect the 1846 estimates, which would be 18 and 19 percent lower, respectively, than in our series. This, however, would still be consistent with the sustained process of economic divergence of the Bolivian economy during the second half of the 19th century that is described below. Later on, the difference would become much lower, amounting to just 3 percent in 1890.

[8] In order to estimate this series, we have increased the 1950 Census figure by 0.7 percent, which is the estimated census omission for that year according to ECLAC; see Yañez et al. (2012: 11). For 1900, the Census estimates an omission of 5 percent, which is also incorporated in the calculation. Following Yañez et al. (2012), we also account in the series for the demographic effects of the Pacific War (1879) and the Chaco War (1932-1935).

[9] Maddison (2003) and Yáñez et al. (2012) provide alternative population series for Bolivia, which start, in the first case, in 1900, and, in the second, in 1826. Differences between those series and our own are not very large (always lower than 11 percent), with the exception of the last few years of the 19th century and the early 20th century in the case of Yáñez et al. (2012). The reason for that difference is twofold. First, Yáñez et al. (2012) assume a population figure for 1900 of 1,561,000, much lower than the total census estimate. This is apparently the result of the exclusion by those authors of the non-censed population, non-subjected communities and census omissions. Second, for 1882 they accept the figure reported in Table 2, which we consider a clear underestimate on the basis of the preceding and later figures. The result is that our estimate of the Bolivian population for 1890 is 20 percent larger than the figures provided by these authors.

Agrarian sector

The available information on the Bolivian agrarian sector before the mid 20th century is extremely scarce. The first Agrarian Census was carried out in 1950 (see CEPAL, 1958). Before that year, there are no reliable agricultural production data for the whole country in the official national statistics, and the 1900 national census, for instance, considered it impossible to provide even rough estimates of national agrarian production, due to the absence of statistical information (1900 National Census, p. LXVII). There is also an almost total absence of national production data in the historical literature (e.g. Larsson, 1988) and in international statistical publications,[10] with the only exception being a series of rubber exports (which would be barely equivalent to output, since practically the whole domestic production was exported) for 1890 onwards (Gamarra Téllez, 2007).[11]

Leaving rubber production aside, for the rest of the agrarian sector we have chosen an indirect estimation strategy. First, we estimated agrarian output in the mid 19th century on the basis of the information reported in Dalence (1851) and the assumption that the Bolivian import capacity at the time was relatively low and, therefore, domestic output should be enough to feed the Bolivian population.[12] Second, we linked the estimate for the mid 19th century with 1950 on the basis of the evolution of rural population.

[10] The League of Nations and UN yearbooks provide some data on agrarian production for Bolivia, but they are difficult to accept, showing huge changes between consecutive years and being inconsistent with the information reported in the Agrarian National Census of 1950.

[11] Bolivian foreign trade statistics might underestimate rubber production, since a lot of Bolivian rubber was moved to Brazil through the porous border line between both countries. Unfortunately, the importance of this smuggling activity is impossible to quantify.

[12] According to Dalence (1851), Bolivian food imports in 1846 were rather limited, consisting of just 100,000 *cargas* of potatoes and chuño, "a lot of" ají and "many" *arrobas* of rice. A low level of Bolivian import capacity in the mid 19th century would be consistent with the small size of the mining output and exports at the time. This might have been partially overcome, however, by the depreciation of the Argentinean peso relative to Bolivian silver and the resulting increase in Bolivian terms of trade with Argentina (Irigoin, 2009). Nevertheless, the impact of this process on Bolivian food import capacity would have been rather low, since legal imports from Argentina accounted for only 7% of total Bolivian imports at the time, and only 12% of these were compounded by food –most commonly cows (Dalence, 1851: 268-274). In addition, the value of the Bolivian currency in relation with the Argentinean peso was not stable over time and, given the persistent monetary heterogeneity in Argentina, probably not uniform across regions (see Irigoin, 2009: 563-568). Finally, if our assumption on the low level of Bolivian food imports is too low, this problem would involve an overestimation of the agrarian production in the mid 19th century, but this would be compensated for by the underestimation of the relative value of silver exports and production.

As has been indicated, our estimate of agrarian output for the mid 19th century is based on the information provided by Dalence (1851), who indicated the value of the agrarian gross production in Bolivia in 1846 and its composition, as well as an estimation of the amounts of different products which represented, overall, 96 percent of the total value of the sector. Dalence also provided a calculation of the nutritional needs of the Bolivian population in 1846 (excluding animal product consumption) and the resulting production surplus of vegetable foodstuffs. According to this author, each Bolivian individual would require 2 daily *libras* of food of vegetal origin. Since he estimated the available production to be as high as 3 *libras* per person, this (together with a small amount of food imports) would imply a huge yearly surplus of vegetable foodstuffs in the country (1.5 million *libras*).

This, however, is difficult to reconcile with the nutritional content of the Bolivian agricultural production that he reported in his book. Indeed, in order to meet a nutrient availability of 1,940 calories per male adult-equivalent per day,[13] and taking into account the production of meat and the food imports reported by Dalence, it would be necessary to increase the author's output estimate of each (vegetal) product by 89 percent. This is what we did to estimate the value of agricultural production in 1846, under the assumption that Dalence's figures were affected by a significant downward bias (maybe due to the inability to account for self-consumption; see Langer, 2004).[14] As a result of this assumption, we obtain an estimate of the Bolivian agrarian output in 1846 that is substantially higher than the value proposed by Dalence, but which is consistent with the nutritional needs of the Bolivian population and whose *composition*, in the case of agricultural products, is the same as in this author's report. The calculations may be seen in detail in Appendix A.

[13] This is the nutrient availability level used by Arroyo-Abad et al. (2012: 153) in their bare-bones basket for Latin America during the colonial era. Although this amount is rather low in comparative terms, we have preferred to use it here in order to account for the possibility that Dalence underestimated the level of food imports (see above, footnote 7). We have excluded the "non-subjected" population from the calculation of the nutritional needs of the Bolivian society because we estimate the subsistence production of this population separately from the rest (see below).

[14] We assume that Dalence's underestimation mainly affected agricultural produce, rather than livestock. This is based on the fact that Dalence's estimation of meat consumption per person was very similar to that provided by the 1950 Agrarian Census, which was around 23 kilograms per year (CEPAL, 1958: 268). If Dalence's figures for the whole agrarian sector were accepted, this would represent almost 20 percent of the total nutritional intake of the population of the country. This percentage is too high to be likely; for example, meat has been estimated as representing 12 percent of the total nutritional ingest in colonial times in Mexico, Peru, Bolivia and Colombia by Arroyo-Abad et al. (2012: 153).

In order to compare that estimate with the sector's output in 1950, we have taken a sub-group of goods for which price and quantity data were available for both 1846 and 1950, and which represented 82 percent of the total gross production in 1846 and 74 percent in 1950. We expressed the production of those goods in those two years in 1950 prices, and in each case added up the total value of the products for which unit prices and quantities were not available for both years (with the exception of rubber, see below). Finally, we have increased gross production in each year by 11 percent to account for forestry production.[15] According to these calculations, the gross output of the agrarian sector in 1950 was approximately twice as high as in 1846. This difference has been used to construct an index of output volume that, due to the lack of additional information, is assumed to have grown in line with rural population. Finally, we have increased that index by the value added of rubber (at 1950 prices), under the assumption that all rubber production was exported,[16] and by an additional amount to account for the food production of the "non-subjected" population.[17]

Although the paucity of empirical information on the sector prevents us from drawing any detailed conclusions on the evolution of the output series, our estimates indicate that the agrarian value-added per rural inhabitant would have increased by just 24% in a century. This extremely low progress is consistent with the very low levels of Bolivian agrarian productivity in the mid 20th century (CEPAL, 1958: 54) and, together with the gradual increase in urbanisation, it would help to explain the substantial growth in Bolivian food imports that took place since the 1920s.

Mining and petroleum industries

Unlike population or agriculture, the available information on output and prices of extractive industries (mining and the oil industry) is abundant and allows reconstructing the evolution of the production of silver, tin, copper, gold, antimony, lead, tungsten,

[15] This was the percentage in 1950 (CEPAL, 1958); Dalence (1851) does not present data for this sector for 1846.

[16] Rubber exports were negligible until 1890, when they started growing at a very quick pace. In the 25 years before 1915 they amounted, on average, to around 20% of total Bolivian exports. After 1915, due to Asian competition, and with the exception of the Second World War years, rubber exports became marginal. Export data come from Gamarra (2007) for 1890-1926 and from the official trade statistics afterwards. The relative price of rubber in 1950 has been taken from the Christopher Blattman database: http://chrisblattman.com.

[17] Under the oversimplifying assumption that these communities lived at subsistence level and all their economic activity was food production, we assume their per capita agrarian (and total) GDP to be 300 Geary-Khamis dollars of 1990. This is the subsistence minimum assumed by Milanovic et al. (2010: 262).

zinc and petroleum and its derivatives. Since, in most cases, all output was exported, we have often assumed exported quantities to be representative of production.[18]

Our series on silver production is based, up to 1907, on Klein's (2011: 304) decennial estimates, which have been annualized on the basis of Haber and Menaldo's (2011) database.[19] After 1907, we use silver exports figures, taken from the official trade statistics. When these were not available, we used Haber and Menaldo's (2011) data. The tin output index is based on export data taken from Haber and Menaldo (2011) up to 1903, Peñaloza Cordero (1985) for 1904-1924, and CEPAL (1958) for 1925-1950. Silver and tin were the two main minerals produced in Bolivia, and accounted for more than three quarters of total mining production in the century before 1950. We also estimated the evolution of the output of six other minerals of lower importance: copper (from Haber and Menaldo, 2011), gold (from the official trade statistics), and antimony, lead, tungsten and zinc (from the official trade statistics for 1908-1930 and Haber and Menaldo, 2011, for 1931-1950).[20]

We aggregated the resulting eight production indices by using the structure of prices in 1846, 1908, 1925 and 1950, obtained from information in Haber and Menaldo (2011) and Blattman's database. Finally, we have calculated a single series through weighted averages of each pair of aggregate indices, in which the relative weight of each series depends on the distance to the year of the price structure of that series. We have then used the resulting average volume series as representative of the evolution of mining value added (assuming therefore a constant ratio between value added and gross production).

In the case of the petroleum industry, the value added series is based on two volume indices, raw and refined oil production, that start in 1925 (when this industry was established in Bolivia) and are taken from CEPAL (1958: 193). Once more, due to the scarcity of information, we have assumed a constant ratio between oil value added and gross production between 1925 and 1950, which is 75 percent higher for refined oil than for raw oil.

[18] On this assumption, see Gómez (1978) and Mitre (1986, 1993).

[19] For this section, we rely on the complete mining production data estimated by Haber and Menaldo, which were kindly provided to us by the authors.

[20] We assume that the relative importance of the production of the last four minerals was negligible before 1908.

Manufactures

Following ECLAC, we divide the manufacturing sector into four subsectors: registered industry, non-registered industry, urban artisan production and rural artisan production. Together with the importance of each of those subsectors in the total manufacturing value added in 1950,[21] CEPAL (1958) also provides a series of gross production of the registered industry and some of its main branches for 1938-50. We have assumed that the non-registered industry and urban artisan production grew at the same pace as registered industry during those years, and have extended backward the sum of the output of those three subsectors until 1925 on the basis of a series of volume of imports of raw materials (CEPAL, 1958: 54).[22] Assuming a constant ratio between manufacturing gross production and value added, this series has been used as representative of the evolution of the value added of Bolivian manufacture (always excluding rural artisan production) between 1925 and 1950.

Unfortunately, there is no systematic information on the evolution of the manufacturing sector before 1925, and we can only make a very rough guesstimate on the basis of Dalence's (1851) description of Bolivian industry in 1846. With this information, and under the assumption that in 1846 the value added in manufacturing was ca. 50 percent of gross production (as in 1950), we can estimate the value added of urban industry in 1846 as approximately 26 percent of its level in 1925, and link those two benchmark years according to the evolution of urban population.[23] The growth of the resulting series is very low until the 1920s, which is consistent with the extremely slow Bolivian industrialisation process before that decade (Rodriguez, 1999) and the delay in the arrival of modern industrial companies to the country (Tafunell and Carreras, 2008: Table 8). It is also consistent with the assessment of the sector included in the 1900 National Census, according to which the Bolivian industrial sector was composed almost entirely of artisans, among which 95 percent were textile producers. In addition, on the textile industry, the 1900 Census stated that it was: "(...) still in an embryonic

[21] Registered industry: 33.5%; non-registered industry: 29.3%; urban artisan production: 30.4%; and rural artisan production: 6.8%.

[22] For each year we have taken the average of the imports of that year and the previous one, in order to account for the time lag between the purchase of the raw materials and the commercialization of the industrial product.

[23] A similar procedure is followed in Alvarez-Nogal and Prados de la Escosura (2007) for the early modern Spanish economy.

state. There is no information about any factory or establishment with the features of a stable and improved company. The only factory of this nature in Bolivia is one established in the city of La Paz" (1900 National Census, p. LXVII- our translation).

In the case of rural artisan production, and given the total absence of information, we have assumed that the value added of the subsector grew at the same pace as rural population between 1890 and 1950.

Utilities

Due to the absence of information on water distribution services, our estimation of the evolution of the value added of the utilities sector is only based on the production of electricity.[24] The origin of this activity in Bolivia can be traced back to at least 1888, when the first electrical plant was established in La Paz (Lázaro, 2010: 39). For 1890-1930, we assume that electric power capacity grew in line with the imports of electric material, which are available in Tafunell (2011).[25] After 1930, CEPAL (1958: 171-179) provides the total amount of electricity production in Bolivia for several benchmark years (1938, 1947 and 1952) and the yearly output of the main producers since 1945. This data allow the estimation of a yearly series of electricity production between 1938 and 1950, using industrial output to calculate the yearly changes between 1938 and 1945. Finally, we link the 1930 and 1938 estimates by using the increase in Bolivian electricity production between 1929 and 1937, provided by ONU (1952), and the yearly fluctuations of industrial production.

Construction

The value added of the Bolivian construction sector in the mid 20th century has been projected backwards on the basis of different indicators. For 1928-1950 we have taken the geometric average of two variables: apparent consumption of cement and imports of construction materials. The former has been estimated, for 1938-1950, on the basis of domestic production (taken from CEPAL, 1958: 161), under the assumption (also suggested by CEPAL, 1958) that it completely replaced imports during those years. For 1928-1938, we have carried out a geometric interpolation between cement imports in

[24] We do not consider gas production and distribution because this sector was negligible in Bolivia before 1950.
[25] We assume that power capacity was the same in 1890 and 1891.

1927 (when domestic production was almost inexistent; see Tafunell, 2006: 15) and domestic production in 1938. Imports of construction material since 1928 have also been taken from CEPAL (1958:54). For 1912-1927, we have assumed that the value added in the sector grew in line with the imports of construction materials (cement included), which have been taken from the official trade statistics. Finally, for 1890-1912 we have used the geometric average of urban population and an index of railway construction, which has been estimated by distributing the railway mileage that was open each year (Sanz Fernández, 1998) over the five previous years. The resulting value added series follows a very similar trend to the estimated urban population during the period.

Government services

The value added of government services has been assumed to grow in line with government expenditure expressed in real terms. Data on government expenditure comes from Gamarra (2007: 142) for 1890-99, and from our own estimation based on official fiscal statistics for 1900-1950 (see Peres-Cajías, 2014). In order to express those figures in real terms, we have used, for 1931-1950, the CPI estimated by Gómez (1978). Before 1931, given the absence of information on price changes, we have assumed that the PPP hypothesis holds. Therefore, we have estimated annual increases in Bolivian domestic prices as the product of changes in the British CPI (taken from Clark, 2013) and variations in the Bolivian peso/sterling pound exchange rate (taken from Gamarra, 2007: 142).[26] The resulting "pseudo-CPI" series has been smoothed by calculating a three year moving average, in order to eliminate the effect of sudden and transient short-term movements in the exchange rate.

Transport services

The value added of transport services has been estimated on the basis of information on two sub-sectors: railways and roads.[27] First, we have distributed the value added of the transport sector in 1950 between those two subsectors according to their respective

[26] The validity of the methodology described in the text has been tested by comparing the Chilean and Peruvian available CPI for the early 20th century (taken from Braun et al., 2000; and Portocarrero et al., 1992) with an alternative CPI for those countries, estimated as is indicated in the text. Both series are very similar in the two cases.

[27] Due to its marginal importance during the period, air and river transport services have been ignored.

revenues in 1951, as estimated by CEPAL (1958).[28] Railway value added has then been projected backwards until 1930 on the basis of the evolution of railway ton-kms and passenger-kms (taken from www.docutren.com), weighted according to their respective unit transport prices in 1955 (estimated from price information in CEPAL, 1958: 226-227). Before 1930, we have assumed that the value added of railway transport grew in line with mining exports, corrected for the evolution of the railway mileage in operation.[29]

The value added of road transport has been projected backward, for 1926-1950, according to the evolution of gasoline consumption. This is available in CEPAL (1958: 199) for 1938-50 and has been extended backward to 1926 using information on gasoline imports (taken from the official trade statistics)[30] and gasoline production, which started in 1931 (also taken from CEPAL, 1958: 197). Before 1926 gasoline consumption was very low, reflecting the fact that the presence of trucks was rather limited at the time and road transport was still largely dependent on animal power. Therefore, for 1890-1926 we have used the sum of (deflated) imports and exports to approach the evolution of the value added of road transport.[31]

Banking services

The estimated value added of the services of the financial sector in 1950 has been projected backwards on the basis of a deflated series of bank deposits. This series is available since 1869, when the first Bolivian Bank ("Banco Boliviano") was established. Information on deposits has been taken from the *Extracto Estadístico de Bolivia* (1935) for 1890-1935 and from Gómez (1978: 199-200) for 1936-1950.

[28] According to CEPAL (1958), by 1951 railway revenues were 57% of road transport revenues. There is, however, a high margin of error in the latter, due to the low quality of the available information.

[29] We have increased the available railway mileage data (www.docutren.com) with an estimate of the tramway mileage in operation, calculated from information in Bolivia, República de (1911: 72-73), Alarcón (1925) and http://www.tramz.com/bo/bos.html.

[30] For 1933-37 it is impossible to obtain data on gasoline imports from the trade statistics, and we have estimated it from information on total fuel imports, taken from CEPAL (1958: 54).

[31] Imports and exports are available in real terms since 1925 in CEPAL (1958: 54). Before 1925 we used our estimated CPI to deflate imports and used our volume index of mining output (see above) as indicator of the evolution of exports in real terms.

Other services

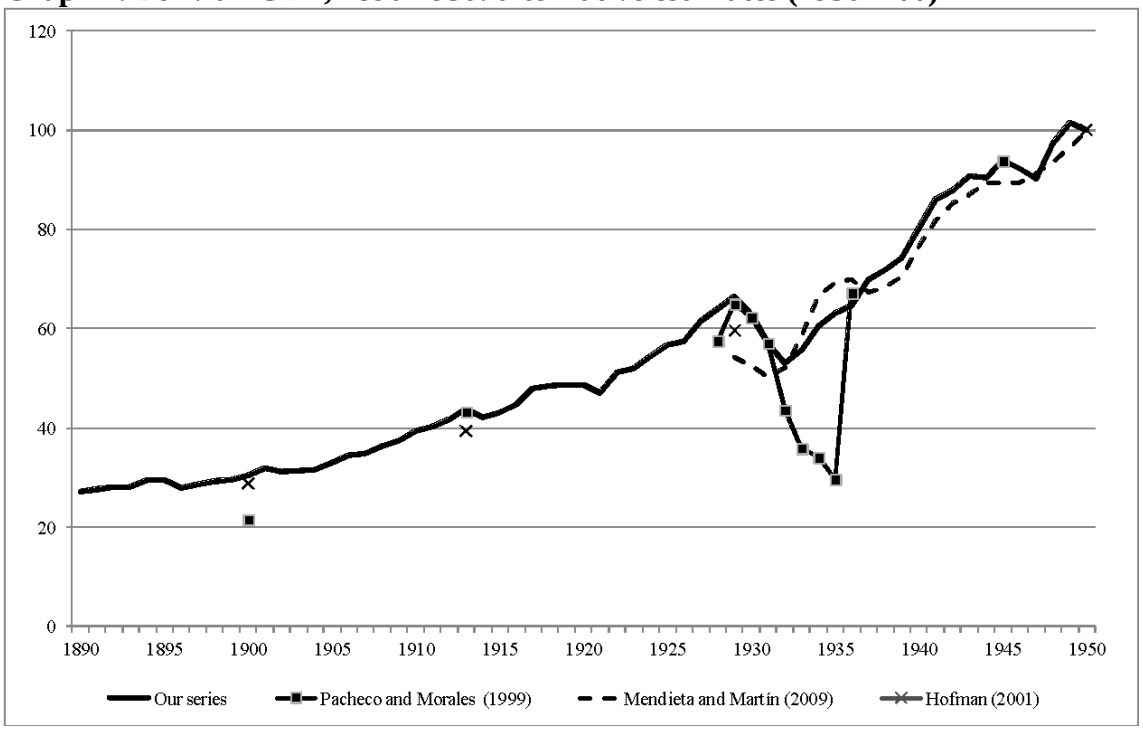
Information on other services is virtually inexistent. We used indirect indicators to project their value added backwards from 1950. In the case of trade services, as has been done by other authors (see e.g. Prados de la Escosura, 2003), we assumed that their value added grew in line with the evolution of the commercialised physical product, which is estimated as the sum of: i) a percentage of agrarian output equivalent to the relative importance of urban population on total population; ii) the overall production of the extractive and manufacturing industries; iii) total imports. We used two-year moving averages to account for stocks. Finally, we assumed that housing rents and other services evolved as urban population, allowing, in the case of housing rents, for a 0.5% annual increase in quality (see also Prados de la Escosura, 2003).

Graph 1 present our series for 1890-1950 and compares it with the alternative available estimates. The long term trend of our series is very similar to the others, with the exception of Morales and Pacheco's (1999) figure for 1900.[32] The main deviations are observed in the short-run fluctuations and, more specifically, in the Great Depression. According to Morales and Pacheco (1999), Bolivian GDP fell by more than 50 percent between 1929 and 1935, and fully recovered in 1936, whereas our estimates would indicate a much milder crisis (a 20% fall between 1929 and 1932), but also a much more gradual process of recovery to 1929 GDP levels.[33] Differences with Mendieta and Martín's estimates are much smaller, although they consider the consequences of the Great Depression to have been even less serious (just a 7% fall between 1929 and 1931) and the growth of the early 1930s much more intense than in our series. A possible explanation for that difference is the influence on their estimation of the evolution of M3 and public expenditure, which grew at high rates between 1933 and 1935 due to the financial costs of the Chaco War.

[32] Apparently (although they do not indicate it explicitly), Morales and Pacheco (1999) assumed that Bolivian GDP and exports grew at the same pace between 1900 and 1929. This may partially explain the deviation between their series and our own figures on 1900, since we estimate the ratio exports/GDP to have grown substantially between 1900 and 1913.

[33] Due to the lack of information on Morales and Pacheco's estimation methodology, it is not possible to know the reasons for that difference, which might be associated to the high weight of certain variables (such as public revenues) in these authors' calculations. On the relatively low impact of the Great Depression in Bolivia, see Bértola (2011: 262).

Graph 1. Bolivian GDP, 1890-1950: alternative estimates (1950=100)



Sources: Pacheco and Morales (1999), Hofman (2001), Mendieta and Martín (2009) and our own estimates.

Note: Mendieta and Martín's specific figures are not published in Mendieta and Martín (2009), but were kindly provided to us by Pablo Mendieta.

3. Bolivian income per capita ca. 1846: a guesstimate

As has been shown in the previous section, the available statistical information on the Bolivian economy becomes increasingly scarce as one goes back in time. As a consequence, the margin of error in our series is higher for earlier periods, up to the point, around 1890, in which the scarcity of data has prevented us from extending our estimation to previous years. Although we have some evidence on the long term trends of some of the GDP components, it is impossible to capture differences in growth rates among periods or to describe the successive growth cycles of the country. For instance, the lack of information makes it impossible to account for the effects of the growth of Bolivian coastal areas (the current Chilean region of Antofagasta) since the late 1850s

(Klein, 2011: 123, 140-143), or the consequences of their loss to Chile in 1879, in the course of the Pacific War.[34]

However, in order to have a preliminary picture of the long term process of Bolivian economic growth in the first few decades after independence, in this section we suggest a very rough guesstimate of the level of its income per capita by 1846. This is mainly based on the aforementioned description of the Bolivian economy by Dalence (1851), which allows comparing the situation of the main sectors of the economy in the mid 19th century with their level of development by 1890. Dalence's description has already been used in the previous section to capture the long term trends of those series, such as population, agrarian production, or manufactures before 1925, for which information is scarcer for the late 19th and early 20th century.

Our guesstimate of Bolivian income per capita in 1846 follows, as far as possible, the same sectoral division as the series described in the previous section. As has been indicated there, we have estimated the value added of the agrarian sector in 1846 on the basis of the nutritional needs of the Bolivian population. We assume that animal products were correctly assessed by Dalence (1851) but that, in the case of agricultural products, his estimates correctly reflected the composition of output, but not its level. The result of these assumptions is an agrarian output figure in 1846 that amounted to 80 percent of the production of the sector in 1890. We have increased that amount by an estimate of the food production of the "non-subjected" population.[35]

Mining output in 1846 is estimated on the basis of the decennial data of silver production provided by Klein (2011: 304) for the period 1840-1909 and the yearly fluctuations in the production of silver in Potosi, as presented by Mitre (1986). For the volume of tin, copper and gold produced in 1846, we used Dalence's data on their value in 1846 and information on the relative prices of these minerals coming from Haber and Menaldo (2011) and Blattman's database. The resulting amounts would represent 17% of the production of this sector in 1890.

[34] Before the 1850s, the Bolivian coast was a marginal space from an economic point of view. For example, population in that region was equivalent to 0.3% of the total Bolivian population in 1846. However, this space became increasingly important between the late 1850s and its conquest by Chile in the Pacific War, thanks to guano, saltpetre and silver export booms.

[35] On these calculations see the previous section and the Appendix.

Manufacturing value added is also estimated on the basis of Dalence's information, as previously described. For government services, we use the data of government expenditure in 1846-72 that were published by Huber Abendroth (1991). And, finally, estimates for other sectors (rural artisan production, construction, transport, trade, housing rents and other services) are based on the evolution of the same indirect indicators that have been used to estimate the series for 1890-1950.[36]

The result of those calculations is a GDP "guesstimate" for 1846 which amounts to 76 percent of the 1890 GDP. In per capita terms, it would represent 87 percent of the Bolivian pc GDP in 1890, which is a first indication of the extremely low growth rate of the Bolivian economy during most of the second half of the 19th century. It is important to stress, however, that this figure constitutes a very preliminary approach with a very high margin of error. Changes in the basic assumptions would involve some variations in the estimate, although not large enough to allow rejecting the hypothesis of a virtually stagnant economy between 1850 and 1890. For instance, if the pc GDP of the "non-subjected" population were assumed to be 200 Geary-Khamis dollars (instead of 300), the resulting pc GDP in 1846 would be 1 percent lower than our estimate, and if we assumed that industrial output was twice as large as indicated by Dalence (as we do in the case of agricultural products), the increase in the 1846 GDP pc would be just 6 percent, and these differences would diminish over time.

As indicated in the previous section, the assumption which likely has a higher potential impact on the estimates is our acceptance of the 1950 Census suggestion that the size of the "non-subjected" communities in 1846 was 100,000, i.e. very similar to their size in 1900 and 1950. If we accepted Dalence's data of 760,000 people instead, this would imply an 18 percent reduction of our pc GDP estimate for 1846 (see above), and an increase in the yearly growth rate of income per capita between 1846 and 1890, from 0.33 to 0.70 percent. This higher growth rate would be the result of the demographic shrinking of the "infidel" tribal population that is associated with use of Dalence's figure, and it would still be consistent with the sustained divergence of the Bolivian economy during the second half of the 19th century. In summary, our estimate for 1846 should be considered as an upper bound of the real value of pc GDP, and the size of its bias would depend on the actual size of the "infidel" tribal population.

[36] Imports, exports and rural and urban population for 1846 have also been taken from Dalence (1851).

On the other hand, as indicated in the previous section, one of the main shortcomings of this estimation is the absence of long-term information on prices and productivity differences among sectors, and the need to rely on the 1950 value added composition for the weighting structure of the estimation.[37] In the Bolivian case, however, the importance of this problem would be reduced by the small importance of the manufacturing sector. For instance, if sectoral differences in Bolivian prices were assumed to have evolved as in Spain, where the increase in agrarian prices between 1850 and 1950 was almost twice as large as in the rest of the sectors (Prados de la Escosura, 2003) this would mean that the Bolivian pc GDP during the second half of the 19th century would have been approximately 25 percent higher than our estimates. We consider this, however, as a higher bound of the bias associated with this problem, since the technological dynamism of Bolivian industry was substantially lower in comparison with Spain. A more precise estimation of the size of this bias, however, needs to wait for detailed studies into the history of Bolivian prices, something that is beyond the scope of this research.[38]

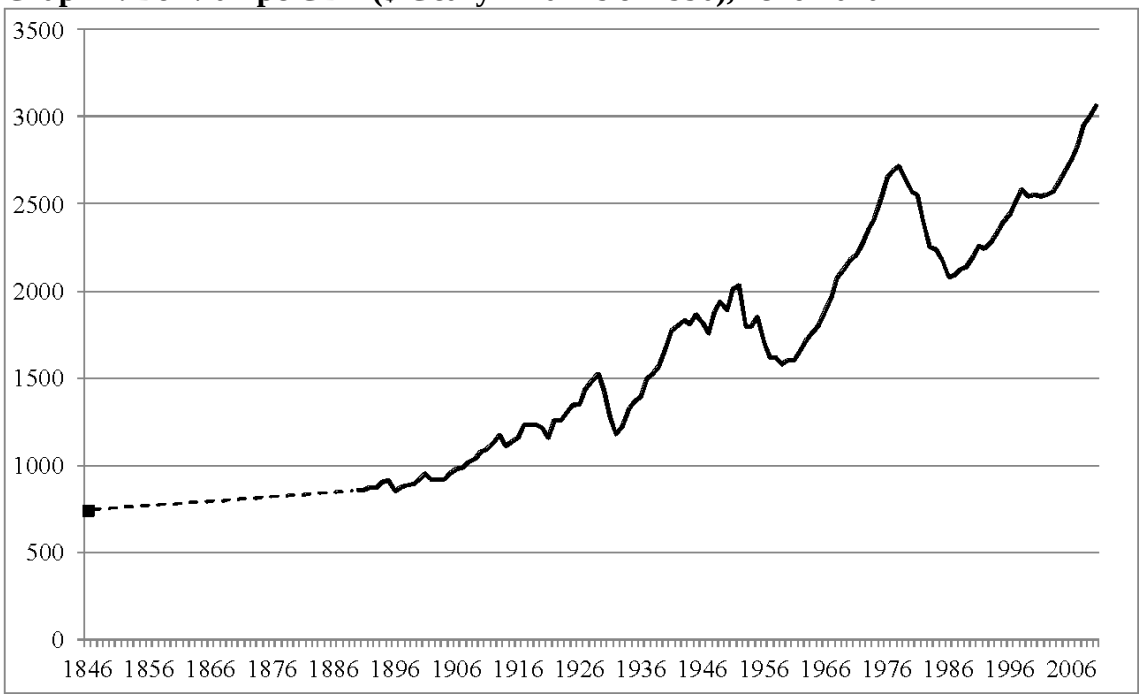
4. The Bolivian economy in the long term: growth and divergence since the mid 19th century

Graph 2 and Table 3 summarise the evolution of the Bolivian economy between the mid 19th and the early 21st century. Graph 2 presents per capita GDP from 1846 up to the present, and Table 3 provides information on GDP sectoral composition. Table A2 of Appendix B provides the complete yearly income per capita series.

[37] See Henriques (2012) for a first approach to price movements of specific products in Bolivia in the early 19th century.

[38] On the other hand, in an international comparison of Bolivia with higher-growing economies this problem would be partially compensated for by the bias in the opposite direction which is associated with the use (as is customary in this literature) of the 1990 PPP ratios that underlie the Maddison's Project database.

Graph 2. Bolivian pc GDP ($ Geary-Khamis of 1990), 1846-2010



Source: New Maddison Project database and, before 1950, our own figures.

Table 3. Sectoral composition of the Bolivian GDP, 1846-2008

	Agrarian sector	Mining and petroleum industries	Manufactures	Utilities and construction	Services
1846	73	1	8	1	16
1890-1899	69	6	7	1	17
1900-1909	65	8	7	1	19
1910-1919	56	12	8	2	23
1920-1929	48	16	9	2	25
1930-1939	45	14	8	3	30
1940-1950	34	18	12	3	33
1950-1960	28	15	13	4	40
1960-1970	26	11	14	6	43
1970-1980	18	19	15	6	43
1980-1990	21	14	13	4	48
1990-2000	16	7	17	6	54
2000-2008	14	11	14	6	55

Sources: Own estimations (see text) and, since 1950, ECLAC database.
Notes: Some rows do not add up to 100 due to rounding. After 1950, we have used the "subtotal" provided by ECLAC and have distributed the statistical discrepancies among all sectors, in proportion to their size.

Graph 2 and Table 3 show the gradual process of economic growth and structural transformation undertaken by the Bolivian economy from the first decades after independence onward. Income per capita in the early 21st century is 4 times higher than it was around 1850. Likewise, the agrarian sector, which accounted for three quarters of GDP in the mid 19th century, has experienced a sustained decrease in relative terms, and has been replaced by services since the 1950s as the main economic sector. Mining, manufacturing, utilities and construction also increased their importance from the mid 19th century onwards, although the GDP percentages they accounted for reached their maximums in the mid-20th century and stagnated thereafter. As a consequence, the industrial share of the Bolivian GDP is still among the lowest in the region today.

Graph 2 confirms some of the ideas advanced by previous research on the long term evolution of the Bolivian economy. Firstly, Bolivian economic growth was extremely slow until the first years of the 20th century. According to our estimates, between 1846 and 1903 Bolivian GDP grew at an annual average rate of just 0.68 percent. In per capita terms, the yearly growth rate was even lower (0.37 percent). In other words, Bolivia seems to have largely missed the initial growth opportunities opened by the first globalisation to the Latin American economies. Growth only accelerated from 1903 onwards, thanks to the expansion of rubber and, especially, tin exports. As a consequence of that export boom, the annual average rate of economic growth reached a level of 2.67 percent in the case of GDP and 1.73 in the case of GDP capita between 1903 and 1929.

The Great Depression put an end to this expansion, largely due to the huge and sudden reduction of mineral exports. In the case of tin, for instance, export volume decreased by almost 70 percent between 1929 and 1932, while at the same time international prices went down by almost 50 percent. However, the Bolivian economy achieved positive growth rates again in 1933 thanks to the renewed dynamism of tin exports, the increase in government expenditures (especially since the start of the Chaco War against Paraguay in 1932) and the expansion of the industrial sector. In addition, the effects of the Great Depression may be assumed to have been relatively limited (and highly concentrated in the Western Departments, which specialized in mineral exports), because by 1940 more than two-thirds of Bolivians were still primarily outside the market economy (Klein, 2011: 177).

Thereafter, the succession of two extremely destructive crises explains the slow progress of the Bolivian economy during the second half of the 20th century. The first followed the National Revolution of 1952, which provoked a serious economic downturn, largely associated with the indirect costs of the reorganization of the economy and inability to correct macroeconomic imbalances that had been generated by non-orthodox trade policies (Klein, 2011, pp. 213-222). Indeed, the Revolution brought about the consolidation of the State as a central economic agent, and involved an increase in government expenditure from 10-15 percent to 30-35 percent of the GDP (Peres Cajías, 2014). The growth in the size of the public sector was justified by new political leaders as an instrument to achieve higher levels of both equity (e.g. through land reform) and efficiency (for instance, by using public resources to further integrate the Eastern areas of the country in the domestic economy). The resources necessary to implement the new policies, however, could only be obtained in the short term from the main mining groups, which were nationalized and taxed through a multiple exchange rate system. The outcome of this process was a public mining corporation that suffered constant losses. These were financed by the government with monetary expansion, which in turn provoked sustained inflation. The combination of currency overvaluation (due to the multiple exchange rate regime), monetary expansion, and the conflict and destruction associated with the first stages of land reform, provoked a downturn in most economic sectors and a significant decrease in aggregate production. Macroeconomic stability only returned in the late 1950s, thanks to the application of a "shock therapy" policy under the auspices of the US Government and the IMF. However, the 1952 levels of GDP and GDP per capita would not be recovered until 1962 and 1967 respectively.

Between the end of the 1950s and 1978, economic growth resumed, bringing about some diversification through the consolidation of the oil industry and agrarian production in the Eastern lowlands. However, this new growth episode was still largely associated with the country's traditional growth engine, i.e. natural resource exports. Similarly, government resources also remained largely dependent on foreign trade taxes (Peres Cajías, 2014). In this context, the external debt crisis of the 1980s represented a new economic catastrophe for the Bolivian economy. The decrease in international prices of mineral product and constraints on international credit forced the government, once more, to appeal to expansionary monetary policies (Morales and Sachs, 1990), which had to be further extended to meet public workers' demand for wage increases.

This process ended up giving way to hyperinflation, which lasted until September 1985. Hyperinflation and foreign payment controls accelerated the crisis in the mining sector and encouraged corruption and smuggling. In the case of industry, the reduction in import capacity and the depression in internal demand also provoked a serious production crisis and, finally, the agricultural sector of the Western areas was affected at the same time by a series of destructive droughts (Luna, 1995).

The incidence of the three crises of the 20th century was so serious that we can characterise the period from 1929 to 2000, in economic terms, as a succession of "lost decades", due to the extremely long period required for the Bolivian economy to recover the previous maximum levels of its income per capita: 9 years in the case of the Great Depression, 17 years after the 1952 Revolution, and 28 years after the 1978 shock. The recovery from the last two crises was especially difficult because they were contemporaneous with the country's demographic transition.[39]

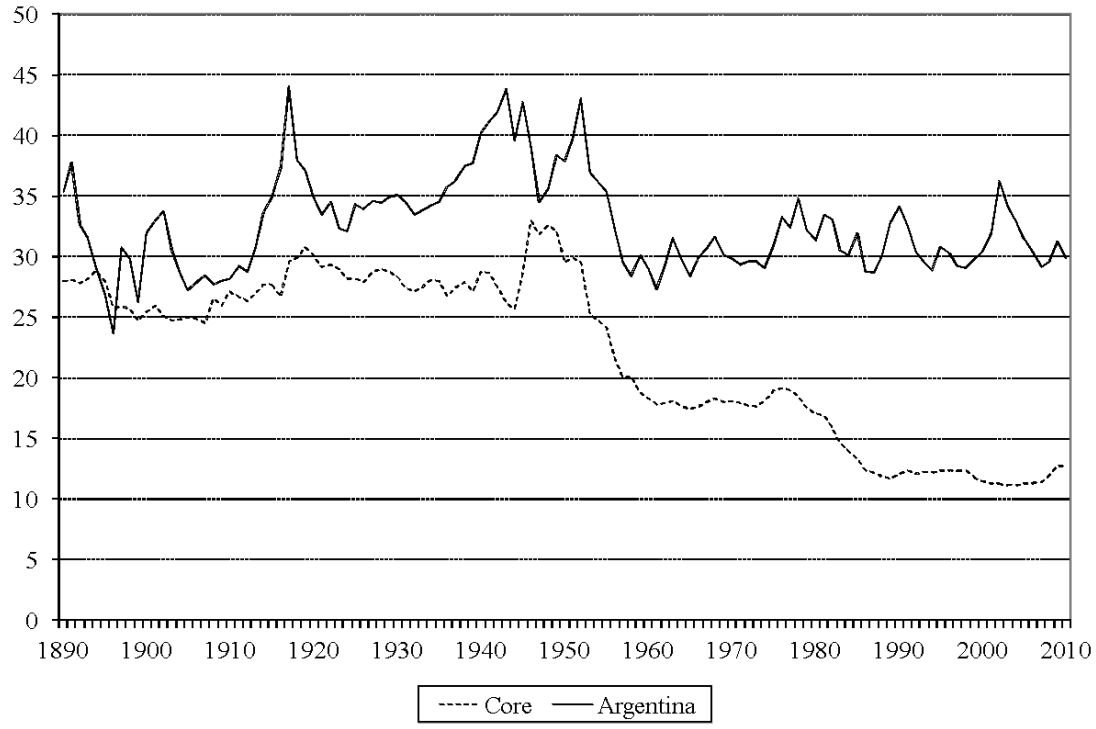
On the other hand, the new series would be consistent, at least until 1950, with the characterisation of Bolivian long-term economic growth as an inequality-enhancing process. This conclusion is a necessary implication of the low levels of agrarian labour productivity that characterized the country from the first decades following independence up until 1950. According to our estimates, in 1950 the ratio between agrarian production and rural population (which may be taken as a very rough approach to the productivity of agrarian workers) was only 23% higher than in 1846. In other words, whereas the average income per capita grew at a yearly rate of 0.9 percent between those two dates, the average income of agrarian workers, who were the poorest part of society and still amounted to two thirds of the population by 1950, would have grown at a yearly rate of 0.2 percent. Unlike other Latin American economies, in which the increase in inequality during the First Globalisation might be explained by the effect of international relations on factor prices (O'Rourke and Williamson, 1999; Frankema, 2009), in Bolivia it was largely the result of the stagnation and relative isolation of the traditional rural economies, which remained largely unaffected by the globalisation shock. In this regard, the benefits of economic growth would have been concentrated in

[39] As a consequence of a steady reduction in mortality rates and the stagnation of birth rates –which were, according to CELADE's estimates, around 45 per 1,000- the annual average growth rate of the Bolivian population was around 2% from the early 1950s to the late 1960s, and increased up to 2.3% per year from the late 1960s to the early 1990s. It was not until the first years of the 21st century that the Bolivian population started growing at annual rates below 2%.

mining producers, spreading only gradually to some sectors of the (relatively small) urban economy.[40]

In order to approach Bolivian economic performance from a comparative perspective, Graphs 3 and 4 compare the long-term evolution of the Bolivian GDP per capita with the average of four industrialised countries, and three large Latin American economies (Argentina, Mexico and Peru) since 1890.

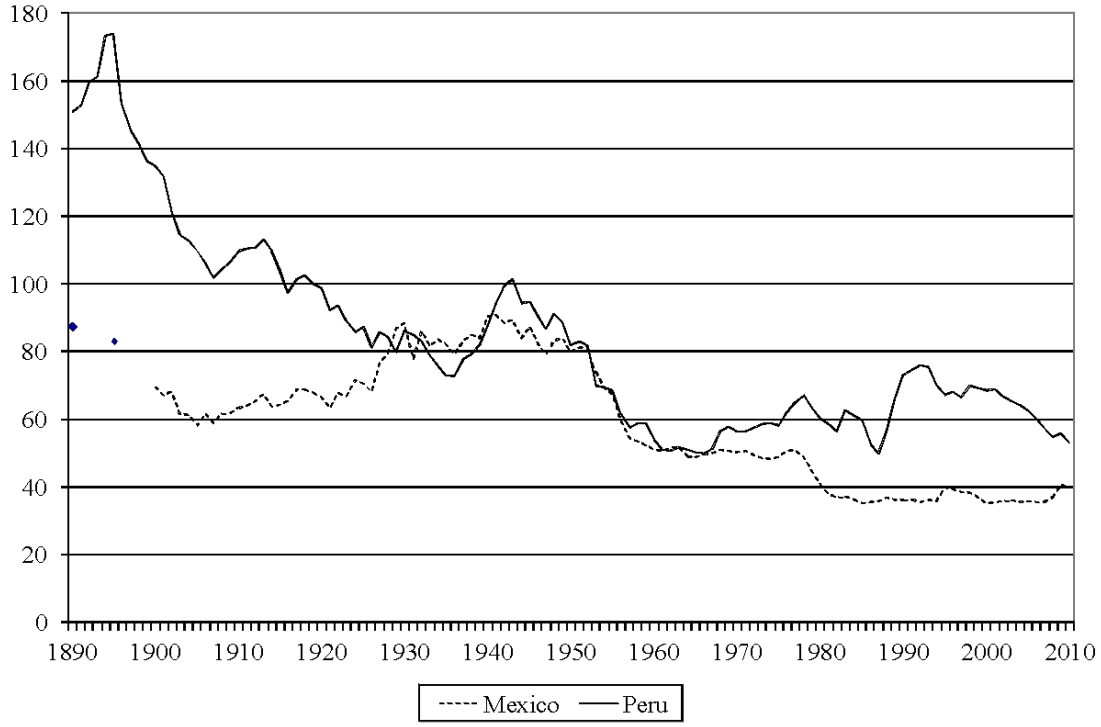
Graph 3. Bolivian pc GDP as a percentage of the average of four industrialised countries and Argentina (1890-2010) (%)



Sources: New Maddison Project database, Johnston and Williamson (2013) and our own figures.
Notes: "Core" is the unweighted average of the US, UK, French and German pc GDPs.

[40] In addition, inequality in the agrarian sector would also have increased over time, due to the expansion of big properties at the expense of land under indigenous communities' control; see Gotkowitz (2007) and Platt (1982).

Graph 4. Bolivian pc GDP as a percentage of the Mexican and Peruvian ones (1890-2010) (%)



Sources: New Maddison Project database and our own figures.

Graph 3 and 4 clearly show that the gap between Bolivia and the core countries or Argentina was very large in 1890. By contrast, differences with Mexico were much lower in the late 19th and early 20th centuries and Bolivia might have had a higher income per capita than Peru until the first years of the 20th century.[41] On the other hand, from 1890 onwards the comparative evolution of the Bolivian economy cannot be characterised at all as a process of sustained divergence. Indeed, the divergence of the Bolivian economy was a phenomenon of the second half of the 20th century and, more specifically, it was the result of the catastrophic economic crises of the Bolivian economy in the 1950s and (to a lesser extent) the 1980s. In fact, up to 1950 Bolivia managed to grow at rates similar to all the other countries represented in the graphs, and even to converge with them at certain specific conjunctures. Indeed, by 1950 Bolivian income per capita represented a slightly higher percentage of the income per capita of the core countries, Argentina and Mexico than in 1890.

[41] However, the comparison of Bolivia with Peru and Mexico is affected by the large error margins of the GDP figures for the three countries before the Interwar period. More specifically, the earliest Peruvian estimates (557 Geary-Khamis dollars of 1990 in 1896 and twice this level 15 years later) seem rather dubious.

In fact, in the case of Argentina, Graph 3 shows that the relative distance between both countries has remained virtually constant after the crisis that followed the 1952 National Revolution. As a consequence, if the whole 20th century is taken together, it is not possible to detect any divergence process between the Bolivian and the Argentinean economies. Instead, their long-term growth rates seem to have been virtually identical. This evolution would not be consistent with the predictions of the "reversal of fortune" hypothesis as is presented in Acemoglu, Johnson and Robinson (2002), which present Argentina, compared with Bolivia, as a country benefiting from the institutional effects of a low demographic and urbanisation density at the beginning of the colonial period.[42]

On the other hand, although the first half of the 20th century was a period of slight convergence of the Bolivian economy, it is undeniable that, at the end of the 19th century its income per capita was already significantly behind, not only the industrialised economies, but also the richest Latin American countries, being approximately 35 percent of the income per capita of Argentina. Our rough pc GDP guesstimate for 1846 allows us to roughly identify the period in which that distance arose, by comparing it with the available income per capita figure for the mid 19th century. Table 4 presents the results of that comparison.

[42] By contrast, it would instead be in line with the description of the Argentinean economy as constrained (like Bolivia) by the presence of extractive institutions (Acemoglu and Robinson, 2012) or as affected by a negative "institutional reversal" in the early 20th century (Araoz, 2011; Prados de la Escosura and Sanz, 2009).

Table 4. Bolivian pc GDP as a percentage of other Latin American economies and the US (%) (1850-2008)

	ca. 1850	1890	1950	2010
Argentina	60	35	38	30
Brazil	109	108	113	45
Chile	82	43	51	22
Colombia	152	119	88	43
Cuba	97	57	92	78*
Mexico	114	88	80	40
Uruguay	51	40	41	27
Venezuela	102	99	25	31
US	40	25	20	10

Sources: New Maddison Project database and our own figures.
Note: (*) In 2008.

As may be seen in the table, in the mid-19th century Bolivian pc GDP was already clearly below the level of income per capita of Argentina, Chile, Uruguay and the US, i.e. those American economies which, according to the reversal of fortune hypothesis, enjoyed a higher growth potential when they started their history as independent republics. In other words, the gap between Bolivia and those economies can be traced back at least to the first decades after independence. By contrast, by 1850 Bolivia was not significantly poorer than most economies in the region, and it might actually have been much richer than countries like Colombia and Venezuela.

In the forty years before 1890, however, the Bolivian economy seems to have fallen behind most Latin American economies, with the exception of Brazil. This negative performance would have come to a halt in the late 19th or early 20th century, when the growth of the Bolivian economy was enough to keep or, in some cases, reduce distances between Bolivia and several other economies in the region. As a result, by 1950 Bolivia had similar pc GDP levels to Brazil, Mexico and Colombia (although it was still much poorer than the US and the Southern Cone countries). Divergence with most of the region, however, was clearly resumed (as has been shown above) from the 1950s

onwards, when Bolivia could not keep pace with those economies' dynamism. It was therefore only in the second half of the 20th century that Bolivia clearly joined the ranks of the poorest economies of Latin America. In other words, whereas Bolivia was already far behind from the Southern Cone countries by 1850, the current Bolivian poverty levels relative to countries such as Brazil, Colombia or Mexico are not a long-term historical phenomenon (as is suggested in Acemoglu and Robinson, 2012), but, to a large extent, the consequence of the shrinking of the economy after the 1952 revolution and the longer duration of the Bolivian "lost decade".[43]

5. Conclusions

The reversal of fortune hypothesis suggests that European colonisers were more prone to establish extractive institutions in rich areas (including present-day Bolivia), and institutions that encouraged investment in poor regions (like today's Argentina). After independence, the persistence in the rent-seeking and investment-discouraging character of the institutional framework in previously rich areas would have prevented them from taking advantage of the available opportunities to grow and industrialise and would have condemned them to sustained divergence (Acemoglu, Johnson and Robinson, 2002; Dell, 2010). In the case of postcolonial Bolivia, according to this hypothesis, in the long term we should therefore expect lower growth rates than in the highest income countries in the region.

The picture that arises from the new estimates, however, is much more complex. Firstly, most of the current distance between Bolivia and the US or the Southern Cone economies had already opened up by 1900, due to the country's disappointing performance during the early decades of the first globalisation period. By contrast, during the first half of the 20th century, Bolivia managed to converge with several industrialised economies and the Southern Cone countries, and to grow faster than most Latin American economies. In other words, as Austin (2008: 1013) reminds us in the case of Sub-Saharan Africa, the Bolivian growth record has not always been "tragic". It was only after 1950, and due to the succession of two economic catastrophes (the crisis

[43] The main exception to that common pattern was Venezuela, due to its specific growth trajectory, which can be explained by the evolution of the Venezuelan oil industry. In that case, Bolivian divergence was sustained until 1950 but did not continue thereafter.

that followed the 1952 Revolution and the external debt crisis of the 1980s), that Bolivian divergence was resumed and the country was clearly left behind economies like Brazil, Mexico or Peru, which had so far seen a similar level of development. To sum up, whereas the distance between Bolivia and Argentina, which were presented in Acemoglu, Johnson and Robinson (2002) as the typical example of the reversal of fortune hypothesis, was the outcome of the former's stagnation during the 19th century, the current position of the country in the Latin American ranking is largely the result of an extremely negative economic experience during the second half of the 20th century.

On the other hand, long-term Bolivian economic growth seems to have been closely associated with increasing inequality, due to the concentration of GDP gains in the hands of a small portion of the Bolivian population. Finding out to what extent the extractive character of Bolivian economic growth had an institutional origin would require further research. However, it seems to have been largely determined by the country's resource endowment, which conditioned the way in which Bolivia took part in the first globalization. In other words, it was the mining specialization of the Bolivian economy which kept a large share of the traditional rural economies unaltered by the evolution of the international economy.

Similarly, it is not clear to what extent Bolivian divergence can be attributed to its institutional specificity. As has been indicated, at least during the 20th century, Bolivian divergence was the result of three critical episodes. Two of them were international depressions, which can hardly be associated with any Bolivian particularity: and the higher incidence of the crisis of the 1980s in this country would be mainly associated to some exogenous factors, such as its delayed demographic transition or the succession a several bad agricultural years. The crisis of the 1950s, by contrast, was a purely Bolivian phenomenon but, interestingly enough, it was associated with the substitution of more inclusive institutions in place of the previous more extractive institutions. In other words, all these processes call for careful specific analyses and it is difficult to interpret them on the basis of unidimensional institutional explanations. As has been highlighted by Austin (2008) and Frankema and Van Waijenburg (2012) in the case of African economies, the Bolivian case also represents a clear warning against the risks of the "compression of history".

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References

Acemoglu, D., Johnson, J. and Robinson, J. (2002). "Reversal of Fortune: Geography and Institutions in the making of the Modern World income distribution". *Quarterly Journal of Economics*, 117 (4), pp. 1231-1294.

Acemoglu, D. and Robinson, J. (2012). *Why Nations Fail. The Origins of Power, Prosperity and Poverty*, London, Profile Books.

Alarcón, Ricardo (dir.) (1925). *Bolivia en el Primer Centenario de su Independencia*, s.l, s.e.

Allen, R. C. (2001). "The Great Divergence in European Wages and Prices from the Middle Ages to the First World War", *Explorations in Economic History*, 38, pp. 411-447.

Allen, R. C., Murphy, T. E. and Schneider, E. B. (2011). "The Colonial Origins of the Divergence in the Americas: A Labor Market Approach", Oxford Discussion paper nº. 559.

Álvarez-Nogal, C. and Prados de la Escosura, L. (2007). "The decline of Spain (1500-1850): conjectural estimates", *European Review of Economic History*, 11, pp. 319-366.

Araoz, F. (2011), "La calidad institucional en Argentina en el largo plazo", Universidad Carlos III de Madrid,, Working Papers in Economic History, WP 11-11.

Arroyo-Abad, L., Davies, E., and van Zanden, J. L. (2012). "Between conquest and independence: Real wages and demographic change in Spanish America, 1530–1820", *Explorations in Economic History*, 49 (2), pp.149–166.

Austin, G. (2008). "The 'Reversal of Fortune' and the Compression of history: Perspectives from African and Comparative Economic History", *Journal of International Development*, 20, pp. 996-1027.

Assadourian, C. S. (1982). *El Sistema de la Economía Colonial: El Mercado, Interior, Regiones y Espacio Económico*, Lima, Instituto de Estudios Peruanos.

Bakewell, P. (1984). *Miners of the Red Mountain: Indian labor in Potosi, 1545-1650*, Albuquerque, University of New Mexico Press.

Barragán, R. (2002). *El Estado Pactante. Gouvernement et Peuples. La Configuration de l'État et ses Frontieres, Bolivie (1825-1880)*, París, École des Hautes Études en Sciences Sociales, Phd dissertation.

Barragán, R. and Peres Cajías, J. A. (2007), "El armazón estatal y sus imaginarios. Historia del Estado", in PNUD, *Informe Nacional de Desarrollo Humano 2007. El Estado del Estado*, La Paz, pp.127-218.

Bértola, L. (2011). "Bolivia (Estado Plurinacional de), Chile y Perú desde la Independencia: Una historia de conflictos, transformaciones, inercias y desigualdad", in Bértola, L. and Gerchunoff, P. (comp), *Institucionalidad y desarrollo económico en América Latina*, Santiago, CEPAL-AECID, pp. 227-285.

Bolivia, República de (1911). *Memoria presentada a la Legislatura de 1911 por el Dr. Juan M. Saracho*, La Paz: Talleres Gráficos La Prensa.

Braun, J., Braun, M., Briones, I. and Díaz, J. (2000). *Economía Chilena 1810-1995. Estadísticas Históricas*, Santiago, Pontificia Universidad Católica de Chile, Documento de Trabajo 187.

Carreras-Marín, A.; Badia-Miró, M. and Peres Cajías, J.A. (2013), "Intraregional Trade in South America, 1912–1950: The Cases of Argentina, Bolivia, Brazil, Chile and Peru", *Economic History of Developing Regions*, 28 (2), pp. 1-26.

CEPAL (1958). *Análisis y proyecciones del desarrollo económico. IV. El desarrollo económico de Bolivia*, México, Naciones Unidas, Departamento de Asuntos Económicos y Sociales.

Clark, G. (2013). "What Were the British Earnings and Prices Then? (New Series)" MeasuringWorth, 2013, http://www.measuringworth.com/ukearncpi/

Dalence, J. M. (1851) [1975]. *Bosquejo estadístico de Bolivia*, La Paz, Universidad Mayor de San Andrés.

Dell, Melissa (2010), "The Persistent Effects of Peru's Mining Mita", *Econometrica*, 78 (6), pp. 1863-1903.

Frankema, E. (2009). *Has Latin America always been unequal?: A comparative study of asset and income inequality in the long twentieth century*, Leiden, Brill.

Frankema, E. and Van Waijenburg, M. (2012), "Structural Impediments to African Growth? New Evidence from Real Wages in British Africa, 1880-1965", *Journal of Economic History*, 72 (4), pp. 895-926.

Gamarra Téllez, M. P. (2007). *Amazonía Norte de Bolivia, economía gomera (1870-1940). Bases económicas de un poder regional. La casa Suárez*, La Paz, Colegio Nacional de Historiadores de Bolivia, CIMA, colección "Bolivia, Estudios en Ciencias Sociales", nº 5.

Gómez, W. (1978). *La minería en el desarrollo económico de Bolivia*, La Paz/Cochabamba, Los Amigos del Libro.

Gotkowitz, L. (2007). *A Revolution for Our Rights: Indigenous Struggles for Land and Justice in Bolivia, 1880-1952*, Durham and London, Duke University Press.

Grafe, R. and Irigoin, M. A. (2006). "The Spanish Empire and its Legacy: Fiscal Redistribution and Political Conflict in Colonial and Post-Colonial Spanish America", *Journal of Global History*, 1 (2), pp. 241-267.

Grebe, H., Medinaceli, M., Fernández, R. and, Hurtado, C. (2012). *Los ciclos recientes en la economía boliviana. Una interpretación del desempeño económico e institucional, 1989-2009*, La Paz, PIEB.

Grindle, M. and Domingo, P. (eds.) (2003). *Proclaiming revolution: Bolivia in comparative perspective*, London, Institute of Latin American Studies/Cambridge, Mass.: David Rockefeller Center for Latin American Studies, Harvard University.

Haber, S. and Menaldo, V. (2011). "Do Natural Resources Fuel Authoritarianism? A Reappraisal of the Resource Curse", *American Political Science Review*, 105 (1), pp. 1-26.

Henriques, R. (2012), "Series de precios de canastas básicas y niveles salariales nominales para la determinación de los niveles de vida y la desigualdad en la ciudad de Cochabamba, durante el primer siglo de la República de Bolivia, 1825-1925", III Latin American Economic History Conference, Bariloche (Argentina), 23-27 October.

Hofman, A. (2001). "Long run economic development in Latin America in a comparative perspective: Proximate and ultimate causes", ECLAC, Economic Development Section, Series "Macroeconomía del Desarrollo", nº 8.

Huber Abendroth, H. (1991). *Finanzas públicas y estructura social en Bolivia, 1825-1872*, Berlín, Universidad Libre de Berlín, Master's Dissertation.

Humérez, J. and Dorado, H. (2006). "Una aproximación de los determinantes del crecimiento económico en Bolivia, 1960-2004", *Análisis Económico UDAPE*, 21, pp. 1-39.

Irigoin, M. A. (2009) "Greshman on horseback: the monetary roots of Spanish American political fragmentation in the nineteenth century", *Economic History Review*, 62 (3), pp. 551-575.

Johnston, L. and Williamson, S. H. (2013). "What Was the U.S. GDP Then?" MeasuringWorth, 2013. http://www.measuringworth.org/usgdp/

Klein, H. S. (2011). *A Concise History of Bolivia*, Cambridge, Cambridge University Press.

Larsson, B. (1988). *Colonialism and Agrarian Transformation in Bolivia: Cochabamba, 1550-1900*, Princeton: Princeton University Press.

Langer, E. (2004). "Indian Trade and Ethnic Economies in the Andes, 1780-1880," *Estudios Interdisciplinarios de América Latina y el Caribe*, 15 (1), pp. 9-33.

Langer, E. (2009). "Bringing the Economic Back In: Andean Indians and the Construction of the Nation-State in Nineteenth-Century Bolivia", *Journal of Latin American Studies*, 41 (3), pp. 527-551.

Lázaro, G. (2010). *La energía eléctrica en la modernidad paceña. Represas de Milluni y Zongo, los tranvías y los inicios del teléfono*, La Paz: Honorable Consejo Municipal de La Paz.

Luna, J. (1995). "El sector productivo boliviano durante el período inflacionario", in J.A. Morales and G. La Torre (eds.). *Inflación, estabilización y crecimiento. La experiencia boliviana de 1982 a 1993*, La Paz, IISEC/UCB, pp. 143-243.

Machicado, C. G., Nina, O. and Jemio, L. C. (2012). *Factores que inciden en el crecimiento y desarrollo en Bolivia. Análisis nacional y regional, 1989-2009*, La Paz,

PIEB.

Maddison, A. (2003). *The World Economy. Historical Statistics*, Paris, OECD.

Mendieta, P. and Martín, D. (2009). "En busca de los determinantes del crecimiento económico boliviano", *Banco Central de Bolivia* (unpublished document).

Mercado, A.; Leitón, J. and, Chacón, M. (2005). "El crecimiento económico en Bolivia, 1952-2003", *IISEC working paper*, Nº1/05.

Milanovic, Branko; Lindert, Peter H. and Williamson, Jeffrey G. (2010), "Pre-Industrial Inequality", *Economic Journal*, 121, pp. 255-272.

Mitre, A. (1981), *Los patriarcas de la plata. Estructura socioeconómica de la minería boliviana en el siglo XIX*, Lima, Instituto de Estudios Peruanos.

Mitre, A. (1986). *El Monedero de los Andes*. La Paz, Hisbol

Mitre, A. (1993). *Bajo un cielo de estaño: fulgor y ocaso del metal en Bolivia*, La Paz, Asociación Nacional de Mineros Medianos.

Morales, J. A. and Pacheco, N. (1999). "El retorno de los liberales", in Campero Prudencio, F. (ed.), *Bolivia en el Siglo XX. La formación de la Bolivia contemporánea*, La Paz, Harvard Club de Bolivia, pp. 156-192.

Morales, J.A. and Sachs, J.D. (1990). "Bolivia's economic crisis", in *Country studies - Argentina, Bolivia, Brazil, Mexico*. Chicago, The University of Chicago Press, pp. 157-268.

ONU (1952). *World Energy Supplies in Selected Years, 1929-1952*, Nueva York, Naciones Unidas, Statistical Papers, series J, nº 1.

O'Rourke, K.H. and Williamson, J.G. (1999). *Globalization and History: The Evolution of a Nineteenth Century Atlantic Economy*, Cambridge (MA), The MIT Press.

Pacheco, N. (2011). "Bolivia y el Estado estacionario entre 1825 y comienzos de la década de 1860", Unpublished document.

Peñaloza Cordero, L. (1985). *Nueva Historia Económica de Bolivia. El estaño*, La Paz/Cochabamba, Los Amigos del Libro.

Pereira, R., Sherif, E. and, Salinas, V. (2012). *Finanzas Públicas. Comportamiento e impacto en el desarrollo nacional y regional, 1999-2010*, La Paz, PIEB.

Peres Cajías, J. A. (2014). "Bolivian Public Finances, 1882-2010. The Challenge to Make Social Spending Sustainable", *Revista de Historia Económica-Journal of Iberian and Latin American Economic History*, 32 (1), pp. 77-117.

Platt, T. (1982). *Estado boliviano y ayllu andino: tierra y tributo en el norte de Potosí*, Lima, Instituto de Estudios Peruanos.

Pomeranz, K. (2000). *The Great Divergence: Europe, China and the making of the modern world economy*, Princeton, Princeton University Press.

Portocarrero, F., Beltrán, A. and Romero, M. E. (1992). *Compendio Estadístico del Perú: 1900-1990*, Lima, Universidad del Pacífico.

Prados de la Escosura, L. (2003). *El progreso económico de España, 1850-2000*, Madrid, Fundación BBVA.

Prados de la Escosura, L. and Sanz-Villarroya, I.(2009), "Contract enforcement, capital accumulation, and Argentina's long-run decline", *Cliometrica*, 3 (1), pp. 1-26.

Rodriguez, G. (1999). "La Industria", in Campero Prudencio, F. (dir.), *Bolivia en el Siglo XX. La formación de la Bolivia contemporánea*, La Paz, Harvard Club de Bolivia.

Sanz Fernández, J. (coord.) (1998). *Historia de los ferrocarriles de Iberoamérica (1837-1995)*, Madrid, Ministerio de Fomento.

Simpson, J. (1989). "La producción agraria y el consumo español en el siglo XIX", *Revista de Historia Económica*, VII (2), pp. 355-388.

Tafunell, X. (2006). "En los orígenes de la ISI: la industria del cemento en Latinoamérica, 1900-1930". Unpublished paper.

Tafunell, X. (2011). "La revolución eléctrica en América Latina: una reconstrucción cuantitativa del proceso de electrificación hasta 1930", *Revista de Historia Económica-Journal of Iberian and Latin American Economic History*, 29 (3), pp. 327-359.

Tafunell, X. and Carreras, A. (2008). "La América Latina y El Caribe en 1913 y 1925. Enfoque desde las importaciones de bienes de capital", *El Trimestre Económico*, LXXV (3), pp. 715-753.

Tandeter, E. (1993), *Coercion and market: silver mining in colonial Potosí, 1692-1826*, Albuquerque, University of New Mexico Press.

TePaske, J. and Klein, H. (1982). *The Royal Treasuries of the Spanish American Empire*, Duke, Duke University Press.

Urquiola, M. (1999). "La distribución de la población en el siglo XX", in Campero Prudencio, F. (dir.), *Bolivia en el Siglo XX. La formación de la Bolivia contemporánea*, La Paz, Harvard Club de Bolivia, pp. 193-217.

Yañez, C., Rivero, R., Badia, M. and Carreras, A. (2012). "La población de los países latinoamericanos desde el siglo XIX hasta el 2008. Ensayo de historia cuantitativa", *Documentos de trabajo de la Asociación Española de Historia Económica*, Nº 1202.

Appendix A. Estimation of the nutrient content of the Bolivian agrarian production in 1846

As is indicated in the text, our estimation of Bolivian agrarian production in 1846 is based on the following assumptions: i) nutrient availability was 1,940 calories per male adult-equivalent per day; ii) animal products were correctly assessed by Dalence (1851); and iii) in the case of agricultural products, Dalence's estimates correctly reflect the composition of output, but not its level.

Table A1 indicates the indices of different products' nutrient content, which are the basis of our calculation and the percentage contribution of each product to the nutrition of the Bolivian population that results from Dalence's data, after our correction.

Table A1. Food production and nutrient content of the Bolivian agrarian output in 1846 according to Dalence (1851)

Product	Calories per kilogram	Percentage contribution to the nutrition of the Bolivian population
Wheat	3,420	18.50
Maize	3,180	48.94
Potatoes	700	5.70
Rice	3,420	0.46
Peas	2,790	2.07
Quinua	3,680	1.85
Ají	400	0.12
Chuño	3,230	7.41
Ocas	670	0.57
Chickpea	2,920	0.01
Cañagua	3,400	0.64
Pumpkin	260	0.28
Olives	1,060	0.00
Vegetables	233	0.19
Plantain	890	0.89
Nuts and coco	5,250	0.58
Grapes and sweet cane	1,780	1.11
Other fruits	430	1.14
Meat	2,482	9.52

Sources: Own elaboration based on Dalence (1851); the nutritional content has been obtained from Arroyo-Abad et al. (2012), Simpson (1989), Allen (2001), Allen et al. (2011) and the USDA National Nutrients Database.

Notes: i) Calories/person/day has been calculated in relation to the male-adult-equivalent population (see text); ii) the global calculation does not include imports.

In order to do the calculations, we have transformed the traditional weight units that were used by Dalence (*fanegas*, *cargas*, *arrobas* and *libras*) in kilograms. While Dalence does not offer a table with the equivalences, he presents the total weight in pounds (*libras*) of an aggregate of different products that were expressed in several units. The following equivalences would be consistent with that information: 1 *libra*, 0.46 kgr; 1 *arroba*, 25 *libras*; 1 *carga*, 100 *libras*; 1 *fanega*, 105 *libras*. These values, in addition, would be the only ones jointly consistent with the equivalences of these units in the Bolivian provinces, as reported in: http://sizes.com/units/[44]

On the other hand, we assume a nuclear family of a father, a mother and two children consumed the same quantity as three male adults (Allen et al., 2011). Considering this relationship and the population structure of 1900, which is offered by the 1900 National Census, the total population in 1846 has been converted into total adult population. We have also accounted for the food imports reported by Dalence (1851: 236): 100,000 *cargas* of potatoes and *chuño*, "a lot of" *ají* and many *arrobas* of rice, and we have assumed that *ají* and rice imports had the same weight as potatoes and *chuño* imports. We have finally added up the nutritional contributions made by milk and eggs (taken from Allen et al., 2011).

Appendix B.

Table A2. Bolivian pc GDP ($ Geary-Khamis of 1990), 1846-2010

Year	*pc GDP*	*Year*	*pc GDP*	*Year*	*pc GDP*
1846	743	1909	1036	1930	1431
		1910	1075	1931	1280
1890	854	1911	1094	1932	1179
1891	860	1912	1121	1933	1226
1892	872	1913	1168	1934	1317
1893	872	1914	1110	1935	1363
1894	907	1915	1128	1936	1399
1895	907	1916	1154	1937	1494
1896	848	1917	1228	1938	1525
1897	868	1918	1233	1939	1561
1898	887	1919	1227	1940	1673
1899	891	1920	1212	1941	1771
1900	917	1921	1160	1942	1794
1901	949	1922	1256	1943	1833
1902	917	1923	1260	1944	1812

[44] The *fanega* equivalence raises more doubts than the rest, because a value of 105 *libras* would be relatively low (although still possible) in the Bolivian context and, unfortunately, we have been unable to locate the "legal" Bolivian *fanega* of the mid 19th century, which is the specific *fanega* used by Dalence. However, the equivalence that we use is the only one that is consistent with the global amounts of production reported by Dalence. The only alternative to using a higher weight equivalence for the *fanega* would be to use a lower one for the *carga* and the *arroba*, but we are already applying the lowest possible weights for those two units.

1903	915	1924	1303	1945	1861
1904	916	1925	1345	1946	1814
1905	947	1926	1353	1947	1755
1906	980	1927	1436	1948	1874
1907	984	1928	1478	1949	1934
1908	1014	1929	1522	1950	1889

Source: see text.