Centre for Global Economic History
RECONSTRUCTING THE HISTORY OF GLOBAL INEQUALITY

Universiteit Utrecht

CGEH Working Paper Series

Growth under extractive institutions? Latin American per capita GDP in colonial times

Leticia Arroyo Abad, Middlebury College

Jan Luiten van Zanden, Utrecht University

November 2014

Working paper no. 61

www.cgeh.nl/working-paper-series/

Growth under extractive institutions? Latin American per capita GDP in colonial times

Leticia Arroyo Abad, Middlebury College

Jan Luiten van Zanden, Utrecht University

Abstract: This paper presents new estimations of per capita GDP in colonial times for the two pillars of the Spanish empire: Mexico and Peru. We find dynamic economies as evidenced by increasing real wages, urbanization, and silver mining. Their growth trajectory is such that both regions reduced the gap with respect to Spain and even achieved parity. While experiencing swings in growth, the notable turning point is in 1780 as bottlenecks in production and later the independence wars reduced economic activity. To explain the long periods of growth between 1550 and 1780 we argue that these countries witnessed endogenous adaptations in institutions resulting in increased market orientation towards and a more balanced distribution of power between Spain and local elites. Our results question the notion that colonial institutions impoverished Latin America.

Keywords: GDP per capita, growth, Latin America.

JEL Codes: N16, N36.

Corresponding author: Leticia Arroyo Abad, Department of Economics, Middlebury College, e-mail: larroyoabad@middlebury.edu.

Acknowledgements: We would like to thank Richard Salvucci for his suggestions and Alejandra Irigoin for kindly sharing her data on silver remittances to Spain. Leticia Arroyo Abad acknowledges financial support by the National Science Foundation and the American Philosophical Society.

In the tales of underdevelopment, Latin America is a frequent character. Scores of articles and books are devoted to the problem of the Latin American economic lag. Given the rich endowments, why did the region fail to converge to the standards of living of the developed world? Comparisons to a variety of developed and developing countries abound, with the obligatory conclusion of the region's squandered opportunities to jump on the growth wagon. Explaining the economic gap between Latin America and the developed world has motivated a large share of the recent scholarship on the economic history of the region.[1]

Historical work on Latin America has often looked at the "path dependence" where the origin of the development path is traced back to the colonial period (Engerman and Sokolofff 1997, Acemoglu et al. 2001). As José Martí (1889) noted once: North America was born with a plough in its hand, Latin America with a hunting dog.[2] This literature focuses on political, economic, and social institutions, their persistence over time, and their influence on contemporary economic outcomes. Already in the 1960s and 1970s dependency theory developed a framework to analyse patterns of persistence. More recently, a number of studies link the colonial institutions to economic outcomes today. The message from this literature is clear, colonial institutions established in the 16th century are to blame for Latin America's relative poor economic performance (Acemoglu et al. 2001, Engerman and Sokoloff 1997, Dell 2012). Acemoglu and Robinson (2012: 18-19) summarize this view as follows: "After an initial phase of looting, and gold and silver lust, the Spanish created a web of institutions designed to exploit

[1] See Coatsworth and Summerhill (2010) for a historiography on this topic.
[2] Centro de Estudios Martinianos (2001, 135): "del arado nació la América del Norte, y la Española, del perro de presa".

the indigenous people. The full gamut of *encomienda, mita, repartimiento*, and *trajin* was designed to force indigenous people's living standards down to a subsistence level and thus extract all income in excess of this for Spaniards. This was achieved by expropriating their land, forcing them to work, offering low wages for labour services, imposing high taxes, and charging high prices for goods that were even voluntarily bought. Though these institutions generated a lot of wealth for the Spanish crown and made the conquistadores and their descendants very rich, they also turned Latin America into the most unequal continent in the world and sapped much of its economic potential."

In this paper we question this interpretation of the economic and institutional history of Spanish America between 1500 and 1800. Our starting point is a first systematic attempt to reconstruct the growth trajectory of this region during colonial times based on an earlier study quantifying the development of real wages in this period. The results are surprising: we show that there was much more economic growth between 1550 and 1780 than was previously assumed. Major indices of economic development such as the urbanization ratio, real wages of unskilled labourers, literacy and numeracy confirm this picture. These findings lead us to also question the static nature of institutions in Spanish America. We argue that the colonial period saw important changes in power balances within the Spanish empire, and that economic and socio-political changes affected the development of the so-called 'extractive institutions' that were put in place in the 16th century. These findings are in line with recent scholarship that challenges the view of Spain as a predatory state given the limited fiscal and monitoring capacity over the colonies (Grafe and Irigoin 2006, 2008, 2012). Via quantifying the size of remittances to the Spanish treasury in relation to GDP, and studying the

structure of the urban system, we also try to measure (the effects of) these institutional changes. Finally, we argue that these institutional developments help to explain the growth record of the region (Arroyo Abad 2013, Bulmer-Thomas 1994, Coatsworth 2005, González Dobado and Morrero 2011, Williamson 2010).

This paper fills the gap of the lack of macroeconomic indicators on the performance of the different parts of the Spanish empire. Historical national accounting in Latin America has particularly prospered in the last two decades with estimations going back to the 19th century for many countries and in a couple of cases, covering selected colonial periods.[3] Maddison (2001) pioneered the calculation of GDP per capita for the colonial period, but his estimates are rather crude. Prados de la Escosura (2009, 771) illustrates this point eloquently: "[…] levels of GDP per head in pre-1820 Latin America are just an unknown. Alas, John Coatsworth and Angus Maddison's figures, cited profusely […], are simply wild guesses." However, much scholarship on the Latin American growth performance has used this indicator despite its weaknesses.

In this paper we improve the existing colonial GDP per head estimations for Mexico and Peru. These areas were the two pillars of the Spanish empire with almost 60% of the population of Spanish Latin America by 1788 (Bulmer-Thomas 1994), and they were key producers of precious metals. For the purpose of this article, we define the Mexican economy as the central valley, the Yucatán area, and Northern Mexico –roughly the same area as contemporary Mexico. In the case of Peru, we consider Peru and Bolivia

[3] See the Global Prices and Income History Group website (http://gpih.ucdavis.edu) for details.

together as the functioning of the Potosí mines in Bolivia had deep effects on the entire region. In addition, from a political perspective, Bolivia was, until 1776, part of the viceroyalty of Peru. From a temporal perspective, we look at colonial times ending our estimations at 1820 when the processes of independence were already in place. By restricting our analysis to colonial times, we examine the degree and extent of economic divergence between the colonies and the motherland: Spain.

We apply the method developed by Malanima (2003), Alvarez-Nogal and Prados de la Escosura (2013), and Pfister (2011) to estimate the long-term evolution of GDP for Italy, Spain, and Germany respectively, to these two Latin American cases. This method makes use of earlier work on the development of wages and prices in these economies (Arroyo Abad et al. 2012) in combination with new estimates of the rate of urbanization and data on the evolution of the mining industry. We also take advantage of the recent work by Seminario de Marzi (2013) on Peruvian GDP from 1700 to the present. On this basis we are now able to chart the evolution of GDP per head of Mexico and Peru in much greater detail.[4]

Applying this indirect method (Section 1), we find that these colonial economies went through significant cycles of expansion and recessions. Moreover, the actual levels of GDP per capita were much higher than previously estimated. For the case of Mexico from mid-17th century onwards, the GDP per capita was, on average, as high as the Spanish level. While Peru's level was consistently lower than Spain's throughout the period, at its height, in the late 18th century, it reached up to 90% (Section 2). We explore the

[5] See the first results published as part of the Maddison project (Bolt and van Zanden 2013).

drivers of economic growth during colonial times including the development of mining (Section 3) and the expansion of the urban system (Section 4). These new estimations challenge the view of a lethargic economic performance of the region during colonial times, the evidence places these economies much closer to European development levels (Section 5).

Having more accurate figures on GDP per capita for the colonial period is key to answer when, how, and why Latin America fell behind. Our estimations suggest that while the region experienced economic growth, it was not sustainable. We look at the urban system, a major driver of economic growth, which was also sensitive to the ebb and flow of the mining sector. The growth experience of these colonies reflects the adaptation of different types of colonial institutions over time. The evidence suggests that the initial extractive institutions were not fixed but evolved and adapted to prevailing economic and political conditions.

1. Methodology

The work on historical national accounting of Latin America has expanded recently.[5] We found a surprising number of studies on national accounts, in a couple of cases the data available goes back to colonial times.[6] Of particular importance is the work by Seminario de Marzi (2013). In this working paper of nearly 300 pages, the author carefully estimates the Peruvian GDP since 1700s using the production approach.[7] These estimations are an extension of his previous published work on Peruvian GDP since 1896 (Seminario and

[5] See the first results published as part of the Maddison project (Bolt and van Zanden 2013).
[6] See Appendix A for a list of available GDP per capita estimations for Latin American countries.
[7] This working paper is expected to be published as a book soon.

Beltrán 1998). For the colonial period, the author divides the economy into four main sectors (agriculture, mining, construction and manufacturing, services and retail) and uses a variety of indicators to proxy for the evolution of these sectors. To date, Seminario de Marzi (2013)'s work is the most comprehensive attempt to estimate colonial GDP in Latin America.

We have used these new estimations in two ways. First, we are able to anchor our own estimates for the colonial period on more reliable 19th century figures (since we do not focus on making new estimates for that century). Second, as a robustness check, we can compare our more parsimonious colonial estimates with those available in Seminario de Marzi (2013).

To estimate the development of GDP per capita between 1500 and 1820 we used the indirect 'state of the art' approach developed for and applied to European countries for the same period. In the simplest form, this method allows for the indirect estimates of agricultural and non-agricultural outputs. The starting point is the agricultural output, which is identical to the demand for foodstuffs as inter-oceanic trade in these commodities was marginal (Borah 1954, Gallo and Newland 2004).[8] The per capita demand for foodstuffs is a function of real income and the relative price of foodstuffs to manufactured goods, assuming certain demand elasticities suggested by the international literature. The most important assumption is that real income is proxied by the real wage of an unskilled labourer, taken from previous work for these two economies (Arroyo Abad et al. 2012). There we demonstrated that the evolution of the real wages in Mexico and Peru reflected the general

[8] Trade in foodstuffs from New Mexico to Peru ended by 1560 as Peru's economy became more self-sufficient. Trade from Spain consisted mostly of manufactures (textiles, yarns, shoes, hats, furniture), luxury goods (rose water, scissors, necklaces, looking glasses), tools (knives, saddles, needles), religious objects, and books (Borah 1954).

increase and eventual decline of the scarcity of labour, the result of the massive depopulation following the Conquest during the 16th century, and the gradual recovery of population levels during the 18th century. Moreover, we cited anthropometric evidence that these trends in real wages in urban areas did reflect the standard of living of broad segments of the population. Overall we observe that the trends in real wages during colonial times are intertwined with population growth and labour institutions. The increase of standards of living was propelled by the dramatic decline in population following the Conquest despite the coercive labour institutions established by the Crown. As population recovered and these institutions faded away, real wages improved until the late 18th century. Until the end of the colonial rule, there is a trend reversal as supply-side bottlenecks pushed prices to higher levels.

Therefore we suggest that we can use this demand function to estimate per capita output of foodstuffs. We slightly deviate from the standard demand function in the sense that we do not assume an effect from the price level of agricultural commodities, as these prices already, to a large extent, determine the real wage level (nominal wages are relatively stable, and real wage fluctuations are driven by prices fluctuations). The assumption is that the demand for foodstuffs is basically driven by real income and the relative price of foodstuffs, and that fluctuations in agricultural prices may have had an impact in the short run. However, as we are interested in long-term changes we do not include them in the demand equation. We follow Allen (2000) and assume an income elasticity of demand of 0.5, and a cross-price elasticity of -0.1 (Allen 2000; for a discussion of these elasticities see Alvarez-Nogal and Prados de la Escosura 2013), but Alvarez-Nogal and Prados de la Escosura also demonstrate that the results are not very sensitive to variations in the

estimated coefficients. The agricultural sector was, by far, the largest in these colonial economies and represented the lion's share of the total output. We have assigned a share of 55% based on the existing literature on the topic (Salvucci and Salvucci 1987; estimates by Seminario de Marzi are slightly lower).

For Mexico between 1525 and 1570 we found real wages that were below the 'subsistence level' as reconstructed on the basis of the 'bare-bones basket' (Arroyo Abad et al. 2012). Applying a demand function as explained results in implausible levels of GDP per capita, much below 'subsistence' (defined by Maddison as 350-400 dollars of 1990). However, it is important to note that during part of this period, the Mexican population was actually declining mostly declining. We therefore assumed that the lower bound of the real wage was 1 (equal to subsistence), which (following the estimations explained here) results in a GDP per capita of about 370-380 dollars, nicely confirming Maddison's hypothesis about the minimum level of GDP.

For the estimation of non-agricultural output, the requirements are the sector distribution of GDP and the structure of the labour force over time, which are available for the benchmark year 1800 (Seminario de Marzi 2013 and Coatsworth 1978). As common practice in these studies, the urbanization rate proxies the evolution of the structure of the labour force, which can be reconstructed for both countries. For the total urban population, our starting point was E. Buringh's urban population dataset housed at the Centre of Global Economic History.[9] This database lists the most important urban centres for every country in the world in 50-year intervals. As most Latin American countries carried out national censuses by the end of the 19th

[9] For details on this dataset, check http://www.cgeh.nl/urbanisation-hub.

century, the estimates from that point onwards are fairly accurate. The challenge is to obtain estimates for the colonial period and the early Republican times. We employed a wide variety of sources ranging from regional studies to geographical dictionaries. Our aim was to be as comprehensive as possible; however, we should point out that for the early colonial times (ca. 1550s – 1650s), the figures are less reliable. While very accurate for total Spaniards they are quite vague for indians, mestizos, and other castes.[10]

To obtain urbanization rates, the second component needed is total population. Colonial population figures are still a highly contested area in the Latin American historiography. The study of the significant decline of the indigenous population after the encounter with the Europeans has attracted many scholars. They agree on a severe depopulation due to disease, violence, and social disruption; however, the degree of such decline is still unsettled. Known as the "war on numbers", the population estimations produced have a notable variance.[11] For the case of Mexico, the "High counters" or maximalist camp led by Cook and Simpson (1942) and Cook and Borah (1960, 1963), propose a high population level before the European encounter with a subsequent steep rate of depopulation in the order of 65% - 95% range. The "Low Counters" (or the minimalist camp) dispute this view that argues for depopulation rates as low as 22% (Rosenblat 1967).[12] While there is no unanimity on the extent of the decline, it appears that the consensus borders

[10] See Appendix B for a full description of the urban population sources consulted.
[11] See Denevan (1976), Sánchez-Albornoz (1984), and McCaa (1995), for a comprehensive account on the different estimates.
[12] The source of such remarkable difference is the role of the smallpox epidemics before 1540 (McCaa 1995).

on a depopulation rate of at least 50%. The trend reversal took place by mid-17th century (Sánchez-Albornoz 1984). With less dramatic impact of epidemics, the population of Mexico increased since then while the ethnic and racial composition changed. The indigenous population experienced lower growth rates while the mestizo segment was the most dynamic group.

For Mexico, we have followed an average of the population figures available for the 16th and 17th centuries and McCaa (2000)'s and INEGI (1991)'s figures for the rest of the period (see Table 1). In addition to the dispute of the depopulation rates, another challenge was finding total population figures after the initial demographic collapse. To arrive to our estimates we have consulted a number of works including Aguirre Beltran (1972), Whitmore (1992), and Denevan (1992). The core of the population estimates referred to Central Mexico, an area defined by Cook and Simpson (1942) and Cook and Borah (1974) that excluded the Yucatan region and North Mexico. This issue was addressed by adding the population of those regions from Cook and Borah (1974) and Gerhard (1982).[13]

[13] Cook and Borah (1971) provide estimates from early 16th century through late 18th century. From Gerhard (1979) we included estimates the population of North Mexico (Sinaloa y Sonora, Nueva Vizcaya, Baja California, Coahuila, Nuevo León y Nuevo Santander), we excluded areas that were transferred to US dominion after colonial times (i.e. Alta California, Nuevo Mexico, and Texas).

Table 1: Total population and urbanization rates in Mexico, Peru, and Spain

	1550	1600	1650	1700	1750	1800
Mexico						
Total population *(in millions)*	6.6	3.0	2.3	2.8	3.8	5.1
Urban population *(in thousands)*	116	194	220	338	435	744
Urbanization rate	1.8%	6.5%	9.8%	12.0%	11.5%	14.6%
Peru[14]						
Total population *(in millions)*	2.1	1.6	1.5	1.2	1.4	2.2
Urban population *(in thousands)*	63	193	212	237	212	271
Urbanization rate	3.0%	12.1%	14.1%	20.0%	15.9%	12.6%
Spain						
Total population *(in millions)*	5.4	6.9	7.2	7.5	9.3	11.9
Urban population* *(in thousands)*	604	972	900	833	1,256	2,210
Urbanization rate	11.2%	14.2%	12.5%	11.1%	13.5%	18.6%

(*) Adjusted urbanization rate – excludes "agro" towns.
Sources: Urban population: see appendix; Total population: Mexico: Acuña-Soto (2002), Aguirre-Beltrán (1946), Cook (1971), Cook and Simpson (1948), Denevan (1992), INEGI (1991), McCaa (2000); Peru: Cook (1981) and Seminario (2013); Spain: Alvarez-Nogal and Prados de la Escosura (2013).

For Peru, the demographic history is not as prolific as in the case of Mexico. Cook (1981) estimates a pre-Columbian population of 9 million, falling to 1.3 by 1570. The impact of lack of immunity to European diseases took a toll on the local population even before the Spaniards had set foot in Peru (Dobynns 1963). The demographic recovery took longer in Peru than in Mexico with an inflection point at the beginning of the 18th century following the epidemic of 1719 (Sánchez-Albornoz 1984). The mixing of the different groups of the population led to a continuous decrease of the share of the

[14] As noted earlier, these figures include Bolivia.

indigenous population: in 1650, 87.5% of total population was of indigenous origin while the share was only 46.2% by 1825 (Cook 1965). For total population figures we used Cook (1981) before 1700 and Seminario de Marzi (2011)'s estimates from 1700 onwards (see Table 1). For Bolivia, the estimates are generally incomplete in terms of the geographical and temporal scope. Throughout the colonial period, we only found figures for indigenous population in a few provinces including La Paz and La Plata (Kubler 1946, Sánchez-Albornoz 1978, Watchel 1971). To arrive to the total population, we used the overall evolution of the Peruvian relative composition of the population by type, i.e. casts, indigenous, and white (Gil de Taboada y Lemos 1846, Cook 1965). In addition, we assumed that the share of the provinces for which we had data remained constant over time based on the first Bolivian census.

For an important part of the non-agricultural sector, the mining industry, we have detailed and relatively reliable estimates of the evolution of output in both economies. It is known that the mining sector was a key sector in the colonial economy. Fiscal revenue and transatlantic trade, for example, depended on this sector (Brading 1971, Bakewell 1971, Fisher 1977, Stein and Stein 2000, Brown 2012). For the 1800 benchmarks we can estimate the relative participation of this sector in GDP: 8% in the case of Mexico, and 7% for Peru. As the mining industry had strong links with transport, trade, and government expenditure, we assume them to be as large as its direct contribution increasing the shares to 16% and 14% respectively.[15] These weights are in line with available estimations on the importance of this sector

[15] The rest of the non-agricultural sector was determined, as discussed earlier, by the evolution of the urban population.

on the overall economy. In the case of Mexico, Rosenzweig (1963) and Garavaglia (1983) claim that the share was 15% in 1800s while Salvucci and Salvucci (1987) state that the weight should be at least 10% in 1750.

The estimates of the output of the rest of the industrial and services sectors follow the standard practice based on the development of the urban population (Malanima 2003; Pfister 2011). Alvarez-Nogal and Prados de la Escosura (2013) adjust for agricultural labourers living in 'agro-towns', but the available estimates of the share of agricultural workers in the urban labour force suggest that this adjustment is not necessary for Latin America. In the big cities this share was tiny –0.8% in Lima in 1790, 0.01% in Mexico in the same year (Brading 1978). In smaller towns the share was a bit larger but not significant enough to justify adjustments.[16]

Summing up, our estimates of the evolution of GDP per capita are based on (1) agricultural output derived from the real wage estimates (about 55% of GDP), (2) the evolution of the urban sector (about 30%), and (3) the mining sector (15%).

Finally, the two series were linked to the benchmarks in 1800 in 1990 GK dollars and determined by backprojecting time series from the 1990 benchmark. The resulting estimate for Mexico is 813 dollars in 1800, whereas Peru's level is estimated at 665 dollars, a difference that is consistent with the existing literature. For example, Salvucci (2014) roughly estimates a gap of 36% between these two countries.

[16] For example Querétaro, Mexico in 1790: 5.4% (Wu 1984); Antequera (Oaxaca) Mexico in 1790: 3.7% (Chance and Taylor 1977). Chance and Taylor (1977) assert that agricultural workers lived in small rural towns.

2. Colonial economic growth: cycles and trends

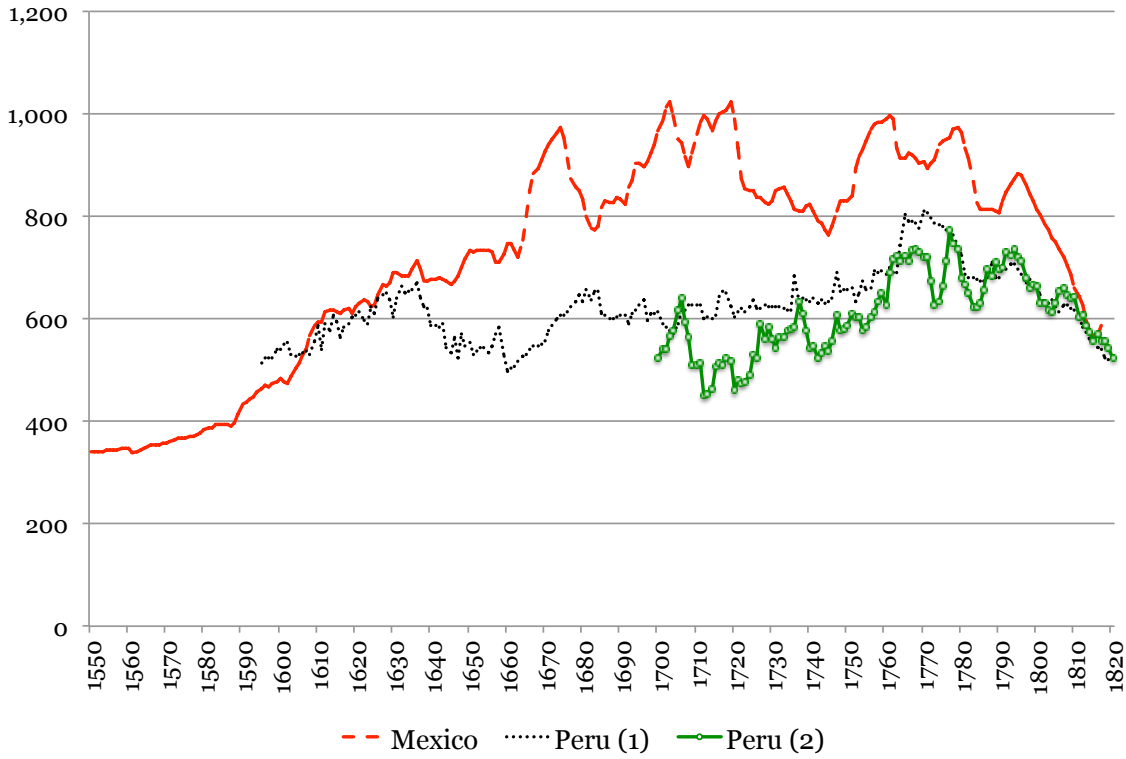
Figure 1 presents three series of GDP per capita: the Seminario de Marzi (2013)'s series for Peru going back to 1700, and our series for Peru (1590-1820), and Mexico (1525-1820). Compared to Seminario de Marzi (2013)'s figures, our estimations are strikingly similar: both show considerable growth in the 18th century, culminating in the 1770s, and a deep decline between the 1780s and 1810s.[17] The comparison confirms the validity of the relatively basic estimates as presented here: they reflect comparable trends.

An important feature is that both colonial economies went through a long cycle of expansion (at least in per capita terms), followed by a decline even before the wars of independence. In Mexico, per capita GDP increased more than 100% from the mid 16th century until the 1760s. The rise in Peru was less spectacular with a contraction in the late 17th century followed by an expansion in the second half of the 18th century.[18] In both economies, the 18th century ended by mid-century, with a sharp decline of between 40-50% between the 1760s and 1810s. This pattern is consistent with the research by TePaske (1986) for Mexico based on fiscal accounts. He claims that, in per capita terms, Mexico expanded during the 18th century but lost steam by 1790s.

[17] While the trends are similar, ours series are a tad more volatile. This is the result of Seminario de Marzi (2013)'s methodology as the series used to estimate the different sectors were smoothed through moving averages and Hodrick-Prescott filters.

[18] The timeframes are different, as we do not have estimates of real wages for mid-16th century Peru.

Figure 1: GDP per capita, Mexico and Peru in 1990 Geary-Khamis dollars

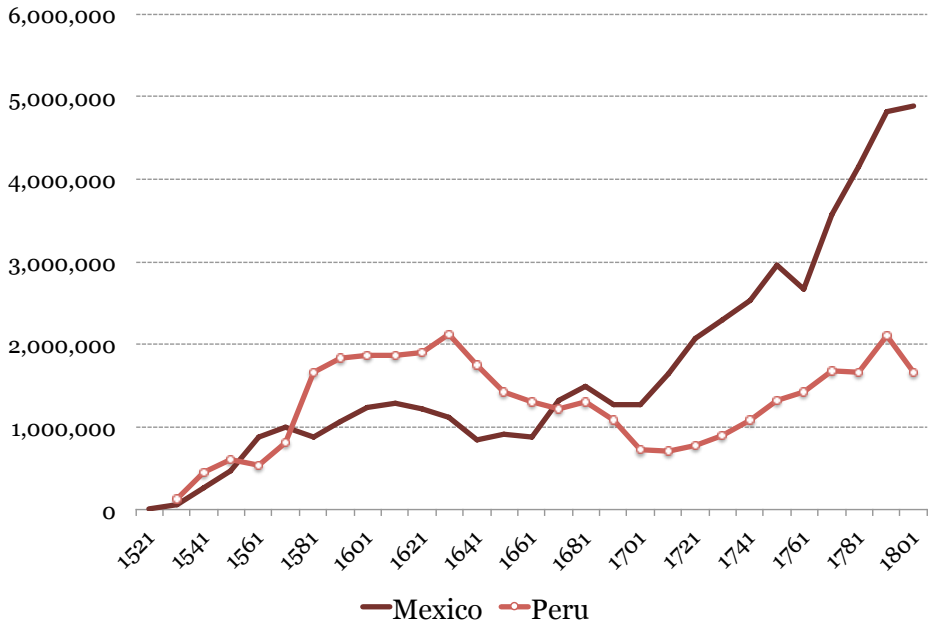


Sources: Mexico and Peru (1): see text; Peru (2): Seminario de Marzi (2013).

The growth of the economy failed to keep up with population growth towards the end of the 18th century (TePaske 1986). Eighteenth-century Peru did not experience much growth until the last quarter. One of the economic engines, silver mining only increased production in non-Potosí mines in 1770s, a change that may have reinvigorated the rest of the economy. This recovery was short-lived: mining, trade, and tribute revenue declined in 1790s onwards (TePaske 1986). These cycles of expansion and decline are consistent with the broad brushstrokes in the few comparative studies available. The volume edited by Jacobsen and Puhle (1986) conclude that in terms of periodization, both economies stumbled from 1790s onwards. Morever, the divergence between Mexico and Peru widened in the late 17th century until

mid-18th century when Peru regained economic dynamism. For the intervening decades, from 1730s to 1790s, the evidence is non conclusive in terms of the overall comparative performance.

Figure 2: Silver production by decade, in kilograms



Source: Brown and TePaske (2010)

Three developments drive the remarkable growth 'spurt' between 1550 and 1750. First, the urbanization ratio more than doubled in this period: it increased from 2% to 12% in Mexico and from 3% to 16% in Peru. Second, real wages went up as well. In Mexico the level rose from below subsistence in the middle decades of the 16th century to 2.5 to 3 times subsistence in the 1750s while in Peru from barely subsistence around 1600 to twice that level in the 1770s. Both the rise of urbanization and the increase in real wages were more or less continuous between 1550 and 1750. Third, the output of silver mining fluctuated much more violently, as Figure 2 demonstrates. In both regions there was a strong rise in silver mining during the 16th century, followed by

decline between the 1620s and 1690s. The 18th century saw a remarkable recovery, again in both regions, resulting in the final decades higher per capita output levels than during the best years of the 16th and early 17th century.

The same three factors influence the dramatic decline between the 1780s and 1820s: real wages decreased (by 50-60% in both regions), urbanization ratios declined, or at best stabilized, and, most dramatically, silver mining plummeted in this relatively brief period. The result is a dramatic decline of GDP per capita.

The three long-term trends driving the big cycle in GDP per capita, real wages, urbanization, and silver mining, were interconnected. High real wages and increased silver output must have stimulated urban growth, for example. That these three factors show the same or very similar long-term trends reinforces our results that per capita GDP underwent long cycles of growth and (sudden) decline, which is clear for Mexico. In the case of Peru, we observe two cycles, one during the 16th and early 17th centuries, and one during the 18th and early 19th centuries. From our estimations, we find volatile economic growth: large fluctuations seemed to be normal, in spite of the fact that many estimates are intrapolated (such as the data on population and urbanization), or that we use seven-years moving averages of the real wage estimates in the demand function with interpolation in the wage data. This volatility is present in other economic activity indicators such as the tithes.[19] For the case of Peru, the evolution of tithes per capita also showed sizable swings throughout the period (Newland and Coatsworth 2000).

[19] In theory, tithes reflect rural economic activity; however, this indicator is imperfect as it did not cover all agricultural production and in some cases the production was estimated ex ante. For a comprehensive critique on tithes, see Silva Riquer (1998). From a long-term perspective, this indicator is two times more volatile than GDP per capita.

Another noteworthy result is the 'Little Divergence' of Mexico in the 17th century. In the late 16th century Mexico and Peru were at a roughly similar level of real GDP per capita, but after 1630 Mexico's performance left Peru behind. Real wages were higher there (Arroyo Abad et al. 2012), but rates of urbanization were similar. The Mexican divergence is consistent with the qualitative literature: in the 18th century Mexico was considered to be the richest colony in the Spanish empire contributing 50% of Spain's revenue (Klein 1998). Before the mid-17th century, this position was claimed by Peru, which contributed most to the colonial treasury, but after 1660s Mexico took over this role. The Mexican economy also became more advanced than the Peruvian one: markets and free labour were more developed in Mexico than in the south (Salvucci 2014).

Overall, this method may over- or underestimate the actual total output. There were costs associated to being a colony. One of the costs was the transfers to the Spanish government, taking those into account, the impact was, on average, 0.9% and 0.13% of GDP.[20] However, recent research has unveiled the importance of inter-colonial transfers (ICTs). Acting in a decentralized manner, the local governments had power over the allocation and distribution of expenditures. ICTs between different fiscal units, known as *cajas*, were a widespread practice throughout colonial rule. For some districts, it was the most important source of revenue (Grafe and Irigoin 2006, 2012). Thus, to arrive to a more accurate estimation of GDP, it is imperative to take into account these ICTs in addition to the remittances to the Spanish government.

[20] This estimation is based on data kindly provided by Alejandra Irigoin for 1695, 1730-33, 1785-89, and 1796-1800.

Estimates on the size of these transfers are only available for the late 18th century from Grafe and Irigoin (2012). Combing over the fiscal accounts of all the colonial units, the authors discovered the importance of these ICTs. In particular, Mexico, given its size and position in the empire, was the main source of cross-colony subsidies (Grafe and Irigoin 2012). These figures together with the transfers to the Spanish government allow us to adjust GDP to represent the actual output that remained in Mexico and Peru. For this period, the ratio between the GDP per capita net of transfers and the one presented earlier is on average 95.8% and 99.7% in Mexico and Peru respectively. [21] Compared to other imperial endeavours, the burden of the empire was not as onerous, for example Java's net transfer to the Netherlands was 4% to 8% throughout the 19th century (Van Zanden and Marks 2012).[22]

3. Mining as a colonial growth driver

Colonial growth followed the swings of the principal economic activity: mining. The private exploitation of silver and gold in the New World quickly became an important source of fiscal revenue for the empire. The transfer of technology, state policies for labour provision to the mines, and inputs availability translated into increased production. For example, a few decades after the European arrival to Peru, production of silver in Potosí increased from 5 million *marcos* between 1551 to 1575 to 18 million *marcos* between 1576 to 1600 (Assadourian 1992).

[21] Note that the figures are only available for the late 18th century. Given the trend in silver exploitation during colonial times, it is expected that the ICTs were more significant in Peru's fiscal accounts in earlier periods such as the late 17th century.
[22] The profits from imperial endeavours were around 1% of GNP for Western Europe by 1800 (O'Brien 1982).

The evolution of silver production in colonial Latin America presented cycles that reflected the mining challenges faced due to the particular topography and the technology available. These cycles do not coincide in the two main silver production regions: Mexico and Peru. The silver mines in Upper Peru led the first American silver boom from 1570s to 1630s; however, Mexico became the main supplier of silver in the 18th century.[23]

In Mexico, the four main silver production locations were Durango, Guanajuato, San Luis Potosí, and Zacatecas.[24] Bakewell (1981) notes three periods in silver production in New Spain. The first one, during the 17th century is characterized by stagnation. Output fell by 25% in 1670s compared to 1610s and ended the century with approximately the same levels as it started. The lackluster performance of the sector had little to do with labour availability but instead is explained by scarcity of mercury –needed for amalgamation- and more strict royal credit policies.

The following period, the first half of the 18th century, experienced substantial growth as production doubled as mercury provision needed for the amalgamation process increased and the adoption of a new refining process.[25] The combination of readily available inputs and low cost mining techniques propelled the expansion observed in this period. In the last period, the second half of the 18th century, production doubled again partly driven by the Bourbon reforms, (see Figure 2) (Bakewell 1971, 1981). The expansion of the mining sector during this last period generated economic growth in Mexico

[23] Upper Peru supplied 65% of all silver to Spain during the first boom and Mexico 67% during the 18th century (Brading 1972).
[24] The secondary sites were Sombrerete, Chihuahua, Bolaños, and Rosario whose production was sporadic throughout colonial times (Bakewell 1981).
[25] Melting, as a new refining technique, did not require high-grade silver and miners used gunpowder to obtain more silver from existing mines (Bakewell 1981).

through the creation of linkages to other sectors such as agriculture, manufacturing, finance, and transportation. The success in mining helped developed the market-oriented economy and fostered market integration (Klein 1985, Ponzio 2005, Dobado and Marrero 2011).

In the viceroyalty of Peru, Huancavelica and Potosí became the pillars of mining during the 16th century with the guidance of viceroy Toledo with more availability of labour and mercury. He established the infamous *mita* – compulsory draft labour to the mines-, founded a mint in Potosí, and opened Huancavelica for mercury production. Within a few decades the production of silver in Potosí skyrocketed reaching 50% of all silver shipped to Spain by 1570. This impressive performance was not everlasting: by mid-17th century production fell as the result of insufficient mercury supplied, exhaustion of the high-grade ore, and shortage of coerced labour (Brading 1970, Brading and Cross 1972).

The slump in the mining sector in the first quarter of the 18th century had repercussions in the rest of the economy. Silver remittances to Spain allowed for influx of European goods to Peru resulting in a decline in activity in transatlantic trade. Moreover, the impact on the fiscal accounts was clear, low silver production meant low revenue. In real terms, total revenue in the early 1740s was, on average, 55% of the previous decade.[26] Production recovered in the 1730s as the Crown reduced the tax on silver mining from 1/5 to 1/10, equalizing it to the tax incidence on agriculture (see Figure 2). Population growth alleviated the labour supply problem in the form of a larger share of free labour and new techniques including the use of gunpowder

[26] Figures exclude miscellanea taxes and intercolonial transfers. Klein (1998)'s fiscal data was deflated using the cost of barebones basket from Arroyo Abad et al. (2012).

decreased the operating costs. With the creation of the viceroyalty of the Río de la Plata, Potosí ceased to be part of the viceroyalty of Peru. As a result, this recovery was produced by other mining sectors: Cerro de Pasco, Hualgayoc, and Huarochirí (Fisher 1977).

This bonanza was interrupted by the wars of independence. Shortage of labour once again resurfaced but caused by the mobilization of men for battle. The war also crowded out the mining sector in terms of inputs: gunpowder and mules. As in Mexico, the development of the mining sector created links with the rest of the economy in terms of inputs directly needed for production (such as salt and mercury) and agricultural products. It was also an urbanization magnet as exemplified by the largest city in the Western Hemisphere: Potosí. The urbanization wave also promoted trade and specialization (Contreras Carranza 2010).

The impact of mining trickled down to the colonial and the world economies.[27] While mining guided the exploration and settlement of Latin America, it also populated these paths. Voluntary and involuntary migration made the mining centres the most populated urban settlements in colonial Latin America. As an example, Potosí became the largest city in the Western Hemisphere. These settlements became magnets for commercial activity and were key in the formation of a complex circuit of trade within the colonies. The demand of these centres promoted the agricultural and commercial development of nearby areas. Cochabamba became the granary of Potosí while Zacatecas and Guanajuato stimulated the territories north of New Spain. However, the trade circuit expanded to farther away regions from mules from

[27] Scores of articles and books are available on the expansion of precious metals supply on Europe and the rest of the world.

Argentina to wine in Peru and Chile, the core and fringes of the Spanish empire became increasingly interconnected (Assadourian 1989, Johnson and Tandeter 1990, Assadourian 1992).

4. Urbanization as a source of economic growth

The rapid development of urban systems during the 16th and 17th centuries propelled economic growth. In general, urban centres generate demand for agricultural commodities and are evidence of the growing importance of non-agricultural activities.

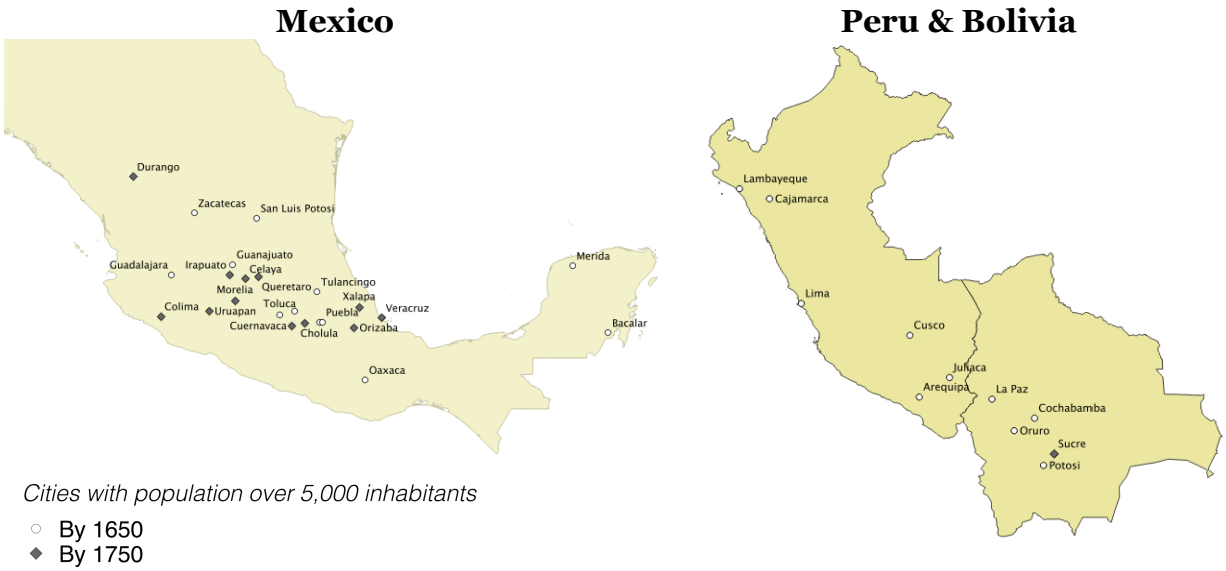
Urbanization in Latin America was an integral part of the imperial ambitions of the Spanish Crown. According to Morse "the city was the starting point for the occupation of the territory".[28] The first conquistadors, *encomenderos*, traders, and merchants stayed in urban centres. These nomadic conquistadors became sedentary colonizers by establishing settlements. These settlements obeyed different reasons and needs ranging from economic to military.[29]

The foundation of cities accelerated during the first decades after the conquest; however, this foundation frenzy died down by 1580 as the Spaniards reached the confines of the territory (see Figure 3). With the foundation of hundreds of cities, the Spaniards were "the most urban-minded

[28] Cited in Hardoy (1972), p. 78.
[29] From an economic perspective, some central bases were established near agricultural and mining locations such as Zacatecas in Mexico and Potosí in Bolivia. In the fringes of the empire such as Montevideo in Uruguay and Buenos Aires in Argentina, settlements were initially only fortresses to protect and to defend the colonial territory from competing empires. Other centers such as Lima in Peru and Veracruz in Mexico had multiple functions such as trade, defense, and administration. For further discussion see Centro de Estudios y Experimentación de Obras Públicas (1987) and Hardoy and Aranovic (1969).

of all colonizing peoples" (Soccolow and Johnson 1987, 28). The following century saw the expansion of these urban settlements propelled by the increased trade flows within the colonies and with Spain. This development also shaped the relative importance of these urban centres placing Mexico City and Lima as the domestic metropolises based on their economic relevance (Vives Azancot 1987).

Figure 3: Urbanization, main cities



Sources: see text.

The evolution of the size of these urban centres varied depending on conflict, epidemics, and regional economic development. In cities by mining centres, the recessionary cycles in mining translated into decline of trade, agricultural production, and public services (Esteva Fabegrat 1975, Soccolow and Johnson 1987). For example, Huánuco in Peru in mid 18th century was a ghost town according to the cosmographer Cosme Bueno. Migration from the countryside was also shaped by colonial ordinances and regulations. The

compulsory draft to the mines in Peru and Bolivia, the *mita*, triggered sizable migration towards urban centres as the indians looked to evade this service by moving from their original place of settlement. But the growth of cities was fuelled by the countryside as epidemics periodically ransacked the urban population. While the Spaniards founded many cities, the urban population concentrated in handful of centres, as shown in Figure 3, turning them into large cities even by international standards. The epitome of this move was Potosí, a city that reached 120,000 inhabitants at the height of silver production.

In the 18th century population growth gained steam as the last epidemic arrived in 1718 in Buenos Aires and expanded to reach Cuzco in 1720 killing 20,000 people (Pearce 2005). From that point onwards the region experienced a "demographic revolution" fuelled by better health conditions, immigration, and improved economic prospects (Morse 1974, Borah 1980).

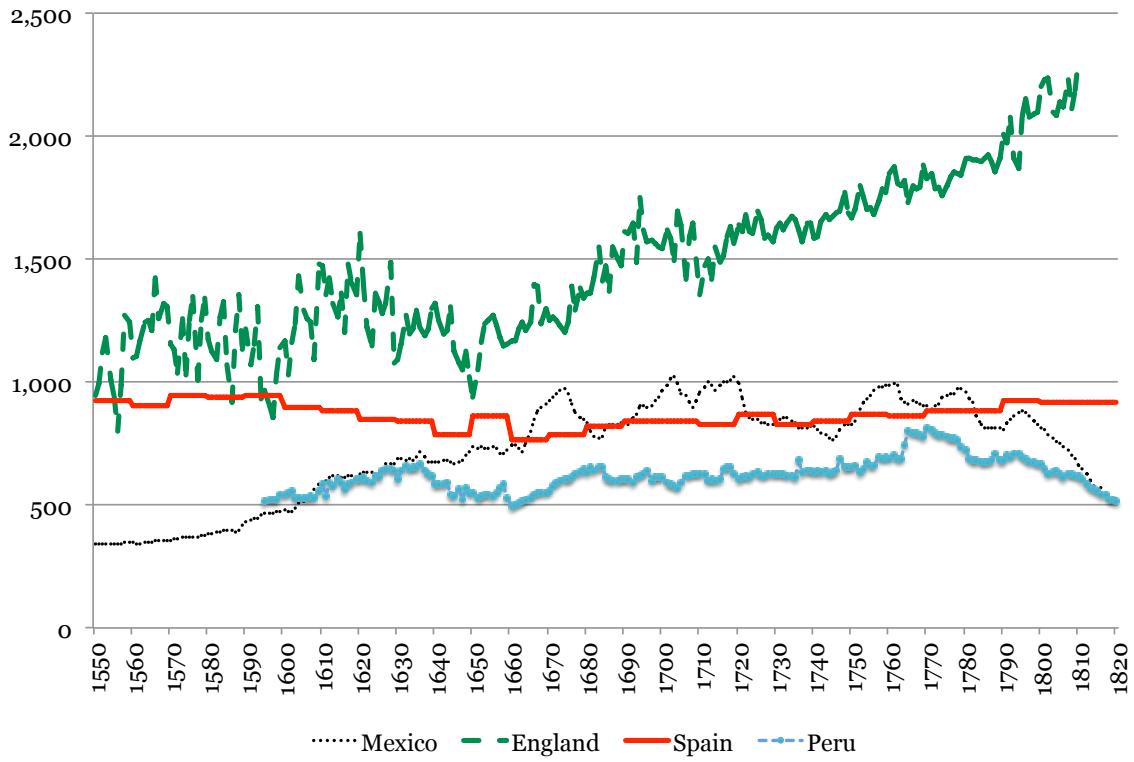
5. When did Latin America fall behind?

Our estimates indicate that the prevailing view of Latin America's sluggish growth during colonial times may need revision.[30] However, economic growth was not without obstacles. The interaction between the nature of the economic activities in Spanish America and the institutional framework delineate the growth experience during colonial times. Drawing from quantitative and qualitative evidence, we argue that the power of the institutional constraints to economic growth decreased over time allowing spurs of economic growth. Yet, institutional adjustment and adaptation were

[30] See for example Coatsworth (2003). In contrast, other authors have commented on the dynamism of 18th century Mexico, see Dobado and Marrero (2011).

not deep enough to create sustainable conditions for long-term economic growth.

Figure 4: GDP per capita, Mexico, Peru, Spain, and A, in 1990 Geary-Khamis dollars



Sources: Mexico and Peru: see text; England: Broadberry et al. (2011); Spain: Alvarez-Nogal and Prados de la Escosura (2013).

For certain, the colonial economies did not escape cycles of expansion and contraction. More importantly during the periods of rapid growth, the gap between the colonies and Spain was never again that narrow. Colonial Mexican GDP per capita was on average on par with Spanish one in good times while Peru's top performance reached 90% of Spanish per head output (see Figure 4).[31]

[31] To put in perspective, Peruvian GDP per capita in its next economic boom,– during guano times in the late 19th century, represented only 67% of Spanish per head output.

The new estimations place these economies at a much higher level of economic development than previously assumed. Compared to Maddison (2001)'s figures, our own estimation of Mexican GDP per capita is 70% higher for 1700. Coatsworth (2003), in turn, shows no GDP per capita growth between 1605 and 1800 with a level of $755 GK dollars, representing nearly a 20% gap with respect to our 1700 estimate.[32] However, the few indicators at hand indicate that these colonial economies experienced prosperity during colonial times.

The degree of urbanization, for example, surpassed the one enjoyed by Spain by the 18th century even though the colonial economies started at lower rates of urbanization. Around 1700s, the urbanization rate was 11.1% for Spain while in Mexico and Peru the figures reached 12% and 20% respectively.[33] This gap is reversed by 1800 as Spain becomes more urban with a rate 18.6%. Despite the Mexican urban gains, the urban concentration only reached 14.6% and in the case of Peru, urbanization lost ground bottoming out at 12.6%.[34]

Another telling aspect of the level of development is real wages. From the numerous historical studies on living standards of urban centres in the world we know that certain cities in Latin America had relatively high real wages by mid 17th century (see Table 2). While starting colonial life at or below subsistence level, real wages climbed attaining much higher levels than the

[32] Maddison (2001) does not present figures for Peru until 1900 and for Bolivia until 1945.
[33] The urban population corresponds to cities with at least 5,000 inhabitants. Figures from Spain do include workers involved in agricultural production; the unadjusted urbanization rate was 11.3% (Alvarez-Nogal and Prados de la Escosura 2013). For the sources of Latin American estimates, see the appendix.
[34] The main driver of such a drop is the significant decrease of urban population in Potosí (from a high 120,000 in the 17th century to 22,000 by 1800).

Madrid in the cases of Mexico City and Potosí. The Peruvian living standards had a more moderate trend even though they exceeded Madrid by mid-18th century.

Table 2: Real wages or Welfare ratios for Spain, Mexico, Bolivia, and Peru, in number of bare-bones baskets

	1550-99	1600-49	1650-99	1700-49	1750-99
Madrid	1.61	1.83	1.81	1.91	1.29
Mexico	0.74	1.64	2.57	2.66	2.35
Potosí				2.95	2.20
Arequipa & Cuzco	1.08*	1.19	1.03	1.18	1.64

(*) Only 1590 to 1599.
Sources: Latin America: Arroyo Abad et al. (2012), Spain: Allen (2001).

Our estimates suggest that the colonial economies were very dynamic at times while clearly facing growth challenges before the end of the colonial rule. It cannot be denied that growth was, to a large extent, based on the exploitation of mineral resources of the region – on silver and gold mining in particular. The waves of growth coincided with the waves of the mining industry, which had forward and backward linkages within these two economies.

There is widespread consensus that the independence wars shrank per capita output; however, our estimates reveal that the inflection point takes place a few decades earlier (Prados de la Escosura and Amaral 1993). This finding is consistent with existing literature on the appearance of bottlenecks and decline of productivity by mid-18th century (Jacobsen and Puhle 1986).

So far we have shown that the economies of Spanish Latin America were more dynamic than previously assumed, but how 'sustainable' was this growth?

The question we address is to what extent growth before 1800 enhanced the capacity for these economies to achieve 'sustained' economic growth via changes in the quality of the labour force and/or institutional change. We can resort to a handful of complementary indicators available for this period that can speak to the level of economic development in these economies.

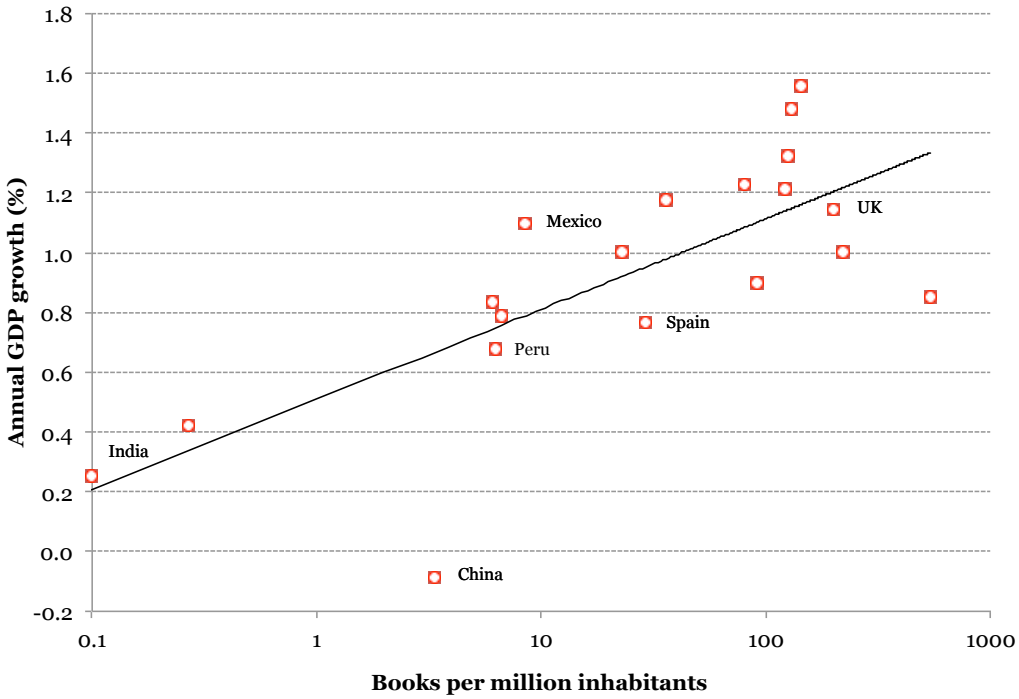
New growth theory stresses human capital formation as a main driver of endogenous growth processes. Our knowledge on educational attainment and provision in colonial Latin America is scarce. Education was a decentralized enterprise as private and religious schools provided schooling during these times. Primarily located in urban centres, the demand for schooling rose during the 18th century as evidenced by an increase in enrolment rates and new schools (Newland 1991).[35]

Recent work on the evolution of numeracy provides more support to the accumulation of human capital during colonial times. As a starting reference point, the pre-Columbian Incan society was characterized by modest economic development. Most of the population received limited education under Inca rule and overall human capital accumulation measured by numeracy was very low (Juit and Baten 2013). During colonial times, human capital accumulation increased significantly in Latin America. Starting from low levels, progress in terms of numeracy was such that by late 18th century, the region was converging to Western European levels: the gap between Argentina, Mexico, and Peru was reduced from 50% to 30% by 1780. These relative gains in numeracy were lost in the following decades leading to a

[35] The enrollment estimates available indicate that 37% and 50% of children in school age attended in Buenos Aires and San Juan de Puerto Rico respectively in the late 18th century. However, there are no widespread literacy estimations for Latin American countries until the 19th century (Newland 1991).

widening gap with respect to Western Europe (Manzel et al. 2012). Consistent with our findings in terms of GDP per capita performance, human capital accumulation stagnated from 1780 until the end of the wars of independence.

Figure 5: Book production and economic growth



Sources: Mexico: Chocano Mena (1997); Peru: Guibovich Perez (2001), rest of the world: Baten and Van Zanden (2008).

Book production and consumption can offer an alternative index of the development of human capital (Buringh and Van Zanden 2009). There is much information on the small-scale printing industry of the region, which was constrained by colonial regulation. Printing occurred in only four cities: Mexico City (from 1539 onwards), Lima (1584), Puebla (1640) and Guatemala City (1660). Moreover, print runs were small (about 500, whereas 1500 was normal in Spain) – demonstrating the relative small size of the market. But the industry gradually expanded: before 1700 about 3,400 titles were

published, of which 2,300 in Mexico and the remaining 1,100 in Lima; in the 18th century this increased to almost 5,500, of which nearly 4,000 in Mexico.

The per capita book production in the latter century was 6 titles per million inhabitants in Peru and 8.5 in Mexico, compared with 29 in Spain, 142 in the US, almost 200 in the UK, and 538 in the Netherlands. Baten and Van Zanden (2008) compared estimates of book production per capita in the 18th century – as a measure of the quality of human capital and the accumulation of knowledge – with the growth rates of GDP per capita during the 'Great Divergence' of the 19th century. They found a very strong correlation: countries with low levels of book production (China, India, Indonesia) grew very slowly or not at all, whereas the countries that topped the book-production league grew rapidly. We added two observations for Mexico and Peru to this picture (Figure 5), both colonies are in the intermediate range of both book production and economic growth, with values similar to those of Russia and Japan. It is also clear from this comparison that the growth experience of Mexico and Peru during the 19th century was neither exceptionally bad nor exceptionally good, in spite of the collapse of the colonial economy during the struggle for Independence and the 'lost decades' that followed. Mexico even did better than 'expected' on the basis of this relationship and grew in fact faster than, for example, Spain during these years.

5. Institutional change and economic growth

Sustainable economic growth depends on the existence of a growth-enhancing institutional framework. Many claim that the extractive nature of the colonial enterprise in Latin America gave rise to persisting institutions not

conducive to economic development (Acemoglu et al. 2001, Engerman and Sokoloff 1997). As a result of unequal access to and distribution of power, the region failed to achieve sustainable economic growth. Quantifying the degree of historical political inequality for international comparison is challenging; however, a look at the structure of the urban system serves as a useful proxy.

By international standards, Mexico and Peru were relatively highly urbanized countries with urbanization ratios comparable to those of Western Europe in the same period. The issue we want to address here is whether cities in Spanish America were typical 'consumer' or 'producer' cities, to borrow the terminology developed by Max Weber (1922, 1958). He contrasted the urban system of the Roman Empire, characterized by extremely large but 'predatory' cities such as Rome, with the much more balanced urban structure of the Middle Ages, with its many relatively small cities focused on manufacturing and international trade.

One way to operationalize this distinction is to look at the size of the largest city (usually the capital city) compared to the total urban population. A large 'primate city' effect – such as we find in Ancient Rome with its million inhabitants, or in the Arab world between 800 and 1800 with comparably large cities such as Baghdad, Cairo, and Istanbul (Bosker et al. 2012) – points to highly unequal political institutions. This is also confirmed by recent economic research: Ades and Glaeser (1995) and Davis and Henderson (2003) demonstrate that high levels of urban concentration are linked to a higher degree of political instability and lack of democracy: "Urban giants ultimately stem from the concentration of power in the hands of a small cadre of agents living in the capital. This power allows the leaders to extract wealth out of the hinterland and distribute it in the capital" (Ades and Glaeser, 1995: 224). A

balanced urban system, with a relatively small primate city, points to more equal distribution of political power (as found in Medieval Europe), where cities can only prosper if they develop a strong economic basis in manufacturing and international trade (Bosker et al. 2012).

The cities of Spanish America have enjoyed a rather bad press, however. They have been sketched as 'vehicles of conquest founded for the purpose of colonial exploitation' (Butterworth and Chance 1981, 10); such assessments are normal in the literature: "the hegemony of Mexico City reflects an urban system designed to expedite the flow of goods between the hinterlands and the capital and thence through Veracruz to Spain", is another example (Kemper and Royce 1979, 268). The data on the structure of the urban system suggest that these stereotypes were not incorrect: the share of the primate city in the total urban population was extremely high: 20-30% in the case of Mexico (where Mexico city continuously the largest city), 50-60% initially in Peru/Bolivia, when Potosí dominated the urban hierarchy, declining to 20-25% when Lima took over this role after 1650. In Spain the comparable share of the largest city (Granada at first, followed by Seville, after 1600 succeeded by Madrid) varied between 6% and 10%, which was more or less typical of Western Europe. In the Arab World, between 1500 and 1800 the primate city share fluctuated between 16% and 30% (Bosker et al. 2012).

From this perspective it appears that the unbalanced urban system reflected the set of extractive institutions introduced by the Spaniards. The urban system that emerged in North America was differently structured. There, larger towns emerged slowly and only towards the end of the colonial period (in 1700 the largest city was Boston with 'only' 7,000 inhabitants), reflecting the very different institutional settings of the two colonial empires

(see Elliott 2006 for a more detailed discussion of these contrasts). On the other hand, the pre-Columbian urban system was probably equally unbalanced as its colonial successor. The viceroyalty of Peru in 1530 had only one major city, Cuzco, which in 1550 still dominated the urban hierarchy (about 50% of the urban population at the time lived in the former capital city). Similarly, Mexico City, or rather Tenochtitlan, was a giant city that easily dwarfed the remaining (but also relatively impressive) cities in the heartland of the Aztec empire.[36] Both Tenochtitlan and Cuzco were typical consumer cities, centres of religion and administration (Katz 1978, Greenfield 1984).

The urban structure supports the view of a very extractive system at the start of the colonial period, followed by a gradual decline of the share of the primate city in total urbanization. This fits in the general picture of the Spanish American institutional makeup, it was far from constant over time. The institutions designed to exert control over the territories changed with the prevailing economic and political conditions. Moreover, the articulation of the Spanish institutions depended on the local elites, which often called royal mandates into question. Hence the unfavourable initial institutions did not remain uncontested throughout colonial rule. Fiscal, labour, and trade institutions both evolved and acquired flexibility, a reflection of the colonial elites influence on local affairs. The local elites were not just mere extensions of the metropolis; they were invested in the prosperity of the colonial economy.

The characterization of Spain as an absolutist ruler fades in light of the colonial fiscal management. The fiscal system was highly decentralized

[36] We estimate that about 50% of the urban population in that region lived in the capital.

allowing for negotiations and decisions at the local level. This surprising degree of autonomy was epitomized in the inter-colonial transfers. The interdependency of the fiscal units reveals the power of the local elites on resource allocation for the benefit of the colonial economy. These transfers facilitated trade within the empire by solving short-term capital shortages for merchants while enriching the local elites in the process. Such was the purview of the local elites that the expansion of the fiscal system into new territories in the 18th century (such as in northern Mexico) bore no direct cost to the Crown. This initiative was not altruistic, the local control of these new fiscal units translated into the development of the local economy. Moreover, the tax incidence on the key sector, mining, decreased over time in favour of taxes on trade and on consumption (Grafe and Irigoin 2006, 2012).

The institutions that ruled the labour market also experienced a series of adaptations throughout colonial rule. Coercive labour institutions became the badge of exploitation in Spanish Latin America in the literature; however, recent scholarship downplays the implied coercive strength throughout the long colonial period. To guarantee a steady labour force to the settlers, the Crown introduced and adapted a series of coercive labour practices such as the *mita*, the *encomienda*, and the *repartimiento*. The labour market outcomes then resulted from the interaction of the local implementation of pre-Columbian institutions with local conditions such as vertical social organization, neighbouring mineral wealth, depopulation, and access to land. The mining sector serves as an example of the development and transformation of the labour institutions. In the viceroyalty of Peru, the incidence of the compulsory draft labour for mining, the *mita*, fell significantly over time as remunerated labour gained ground. Depopulation

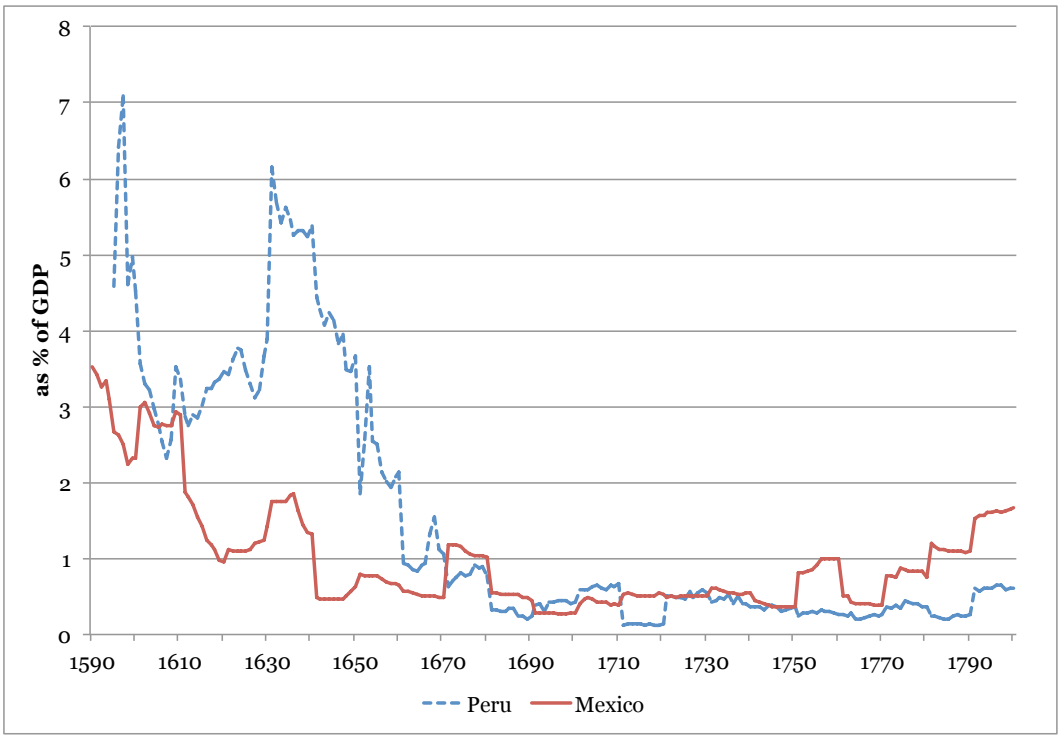
played a part; however, the indigenous communities sometimes opted out the obligation through cash payment. Emigrating from the original community was a common strategy to evade service as well. In Mexico, as early as the 16th century, the labour force in the mining sector was free and remunerated. Wage labour was even more prevalent in the agricultural sector where workers negotiated not only a monetary wage but also other benefits (Brading 1981, Langue 1991, Jacobsen 1993, Monteiro 2006, van Young 1971). These adaptations suggest that the Spanish innovation in their colonies was not coerced labour but the wage labour (Arroyo Abad et al. 2012).

A comparable account applies to trade. To fulfil the metropolis' mercantilistic ambitions, the trade system of choice aspired to trade balance surpluses under a heavily protected trade monopoly. One more time we observe adaptations to these initial institutions given the challenges faced throughout colonial rule. For starters, this strategy was successful as long as the trade between the colonies and Spain was complementary even though Spain had to increasingly rely on European goods to satiate the colonial demand. In addition, the development of a more complex urban system eroded Spain's comparative advantage. In the absence of a natural monopoly, Spain could not fully capture the colonial markets given that smuggling was rampant. With the Treaty of Utrecht in 1713, Spain was forced to give up the monopoly power allowing for more involvement of other European powers (Izard 1974, Márquez 2006).

This movement away from the more controlling and extractive practices is evident in the decline in the urban primacy effect and the silver exported to Spain. The system became less unbalanced suggesting less inegalitarian political power. A proxy of the changing power balance between

centre and periphery is the public revenue in silver and gold remitted to the Spanish treasury (see Figure 6). The ability of the Crown to secure inflow of precious metals from the colonies decreased: while the exports of silver to the Spanish government as a share of Mexican and Peruvian GDP were, on average, around 3.2% and 4% at the turn of the 17th century, they dropped to less than a percentage point or less in the 18th century.

Figure 6: Public revenues remitted to Spain



Sources: Public revenue from Peru and Mexico to Spain and the Philippines: Attman (1986), GDP: see text.

From a fiscal perspective, autonomy, defined as no subsidies received from or sent to Spain, became a reality in South America in the 18th century (Grafe and Irigoin 2012). As the colonial elites were becoming more powerful and more autonomous with respect to the colonial central power, the degree of exploitation declined. This evidence challenges the view of Spain as a predatory colonial power. As Grafe and Irigoin (2012) noted, Spain was a

stakeholder in the colonial enterprise more than absolutist ruler. Extraction from the colonies to the motherland was, in fact, low as the system of inter-colonial transfers that allowed for the functioning and expansion of the colonial economies was managed by local elites (Grafe and Irigoin 2008, 2012).

These institutional changes help to explain the growth trajectory we estimated. While the initial institutions portray a coercive system to guarantee labour for the formation of the colonial system while capturing the rents from the colonial activities, the Crown and the local elite adapted to the reigning conditions. Yet, the nature of economic growth was far from sustainable. The heavy reliance on the mining sector as an engine of growth was, perhaps, a vital factor in explaining the degree of sustainability of the colonial enterprise. This preferential treatment became even more evident in the late 18th century with the active favour of this sector. In both economies, silver production had reached capacity given the technology available and as a result the expansion was only possible with government subsidies and tax reductions (Carmagnani 1986). This allocation of resources towards mining with disregard of profitability crowded out investment in agriculture and manufacturing, especially in Mexico (Coatsworth 1986, Jacobsen and Puhle 1986).

6. Conclusions

In this paper we presented new estimates of economic growth in colonial Mexico and Peru, which showed substantial increase in real incomes between the middle of the 16th century and the 1780s. The main causes were increased scarcity of labour resulting in relatively high real wages, strong urbanization, and the rapid expansion of the mining sector. Around 1780 decline set in, as

the same three factors decreased. The phase of secular growth between 1550 and 1780, interrupted by periods of decline and stagnation, resulted in real incomes that almost matched and at times even slightly surpassed those of Spain.

How was growth possible in an economy characterized by 'extractive institutions'? Growth is partly explained by the Spanish and local elites changing the extractive institutions initially established. Labour institutions such as the *encomienda* and the *mita* were adapted to changing circumstances such as growing labour scarcity resulting in the adoption of more market-oriented institutions since the 16th century. Moreover, the balance of power between Spain and its colonies tilted as local elites were able to substantially lower the degree of colonial exploitation. The institutional adaptations from changing local conditions created a more favourable environment for growth, helping to explain the increase in the estimated income.

After 1780 the weaknesses of colonial growth became apparent and the economy started a contractionary phase. The bottlenecks in production and the wars of independence increasingly widened the gap with respect to Spain and the rest of Western Europe. Human capital formation displayed a similar trajectory with an upward trend (and perhaps even started to converge to Spanish levels) that was interrupted in the late 18th century resulting in a growing divergence. The growth trajectory places the two pillars of the Spanish empire much closer, in economic terms, to the motherland. As a result our findings challenge the notion that colonialism in Latin America impoverished the region.

References

Acemoglu, D. and J. Robinson, *Why Nations Fail*, New York: Crown Business, 2012.

Acemoglu, D., Johnson, S., and Robinson, J., "The colonial origins of comparative development: An empirical investigation," *American Economic Review*, 91(5) (2001): 1369–1401.

Acuña-Soto, Rodolfo, David W. Stahle, Malcolm K. Cleaveland, and Matthew D. Therrell, "Megadrought and Megadeath in 16th Century Mexico," *Emerging infectious diseases*, 8 (4), 2002, 360-62.

Adelman, Jeremy, *Colonial Legacies: The Problem of Persistence in Latin American History*, NewYork: Routledge, 1999.

Ades, Alberto and Edward L. Glaeser, "Trade and Circuses: Explaining Urban Giants", *Quarterly Journal of Economics* 110(1) (1995): 195-227.

Aguirre-Beltrán, Gonzalo, *La población negra de México*, Mexico, 1972.

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

Allen, R.C., Bassino, J., Ma, D., Moll-Murata, C., van Zanden, J.L., "Wages, prices, and living standards in China, 1738–1925: in comparison with Europe, Japan and India," *Economic History Review* 64 (1) (2011): 8–38.

Allen, Robert C. (2000), "Economic Structure and Agricultural Productivity in Europe, 1300-1800", *European Review of Economic History*, 4 (200): 1-25.

Álvarez-Nogal, C. and Prados de la Escosura, L., "The rise and fall of Spain (1270–1850)," *The Economic History Review*, 66 (1) (2013): 1–37.

Arroyo Abad, L. "Persistent Inequality? Trade, Factor Endowments, and Inequality in Republican Latin America", *Journal of Economic History*, 73 (1) (2013): 38-78.

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

Assadourian, Carlos Sempat. "The Colonial Economy: The Transfer of the European System of Production to New Spain and Peru," *Journal of Latin American Studies* 24 (1992): 55-68.

Assadourian, Carlos Sempat. *Modos de producción en América Latina*. Coyoaca□n: Siglo XXI Veintiuno Editores, 1989.

Attman, Artur, *American Bullion in the European World Trade*, Uppsala: Almqvist & Wiksell, 1986.

Bakewell, P. J. *Silver Mining and Society in Colonial Mexico: Zacatecas, 1546-1700*. Cambridge: University Press, 1971.

Bakewell, P.J. “La periodización de la producción minera en el Norte de la Nueva España durante la época colonial,” Coloquio sobre la historia del noroeste de México y suroeste de Estados Unidos, (1981) mimeo.

Baten, Joerg, and Jan Luiten Van Zanden. “Book production and the onset of modern economic growth,” *Journal of Economic Growth* 13(3) (2008): 217-235.

Bolt, J. and van Zanden, J. L. “The Maddison Project: collaborative research on historical national accounts,” *The Economic History Review* (2014).

Borah, Woodrow and Sherburne F. Cook, *The Aboriginal Population of Central Mexico on the Eve of the Spanish Conquest*, Berkeley: University of California Press, 1963.

Borah, Woodrow and Sherburne F. Cook, *The Indian Population of Central Mexico 1531-1610,* Berkeley: University of California Press, 1960.

Borah, Woodrow, "Latin American Cities in the Eighteenth Century: A Sketch", in *Urbanization in the Americas: the background in comparative perspective* edited by Woodrow Borah, Jorge Hardoy, and Gilbert Stelter, Ottawa: National Museum of Man, 1980.

Borah, Woodrow, *Early Colonial Trade and Navigation between Mexico and Peru*, Berkeley: University of California Press, 1954.

Bosker, Maarten, Eltjo Buringh, and Jan Luiten van Zanden. "From Baghdad to London: Unraveling Urban Development in Europe, the Middle East, and North Africa, 800–1800." *Review of Economics and Statistics* 95, no. 4 (2013): 1418-1437.

Brading, D. A. and Harry E. Cross, “Colonial Silver Mining: Mexico and Peru,” *The Hispanic American Historical Review* 52(4) (1972): 545-579.

Brading, D. A., “La ciudad en América Borbónica: elite y masas” in *Ensayos histórico-sociales sobre la urbanización de América Latina* ed. by J. Hardoy, R. Morse, and R. Schaedel, Buenos Aires: Editorial SIAP, 1978.

Brading, D. A., “Mexican Silver-Mining in the Eighteenth Century: The Revival of Zacatecas,” *The Hispanic American Historical Review*, 50(4) (1970): 665-681

Brading, D. A., *Miners and Merchants in Bourbon Mexico, 1763-1810*, Cambridge: Cambridge University Press, 1971.

Broadberry, Stephen, Bruce Campbell, Alex Klein, Mark Overton, and Bas van Leeuwen. “British Economic Growth, 1270-1870: An Output-Based Approach.” Studies in Economics 1203, Department of Economics, University of Kent, 2011.

Brown K. and J. TePaske, *A New World of Gold and Silver*, Leiden: Brill, 2010.

Brown, Kendall W., *A History of Mining in Latin America*, Alburquerque:

University of New Mexico, 2012.

Bulmer-Thomas, V., *An Economic History of Latin America since Independence*, Cambridge: Cambridge University Press, 1994.

Buringh, Eltjo, and Jan Luiten Van Zanden. "Charting the 'Rise of the West': Manuscripts and Printed Books in Europe, a long-term Perspective from the Sixth through Eighteenth Centuries," *The Journal of Economic History* 69(2) (2009): 409-445.

Butterworth, Douglas, and John K. Chance. *Latin American Urbanization*. Cambridge: Cambridge University Press, 1981.

Carmagnani, Marcello, "Comentarios" in Jacobsen, Nils, and Hans-Jürgen Puhle. *The Economies of Mexico and Peru During the Late Colonial Period, 1760-1810*. Berlin: Colloquium Verlag, 1986.

Centro de Estudios Martinianos, *Obras Completas de José Martí*, Havana: Centro de Estudios Martinianos, 2001.

Centro de Estudios y Experimentación de Obras Públicas, *La ciudad iberoamericana*, Madrid: CEDEX, 1987.

Chance J. and W. Taylor, "Estate and Class in a Colonial City: Oaxaca in 1792," *Comparative Studies in Society and History* 19(4) (1977): 454-487.

Chocano Mena, Magdalena. "Colonial Printing and Metropolitan Books," *Colonial Latin American Historical Review* 6(1) (1997): 69-90.

Coatsworth, J. and William Summerhill, "The New Economic History of Latin America: Evolution and Recent Contributions," in *Handbook of Latin American History*, edited by Jose C. Moya, Oxford: Oxford University Press, 2010.

Coatsworth, J., "Structures, Endowments, and Institutions in the Economic History of Latin America." *Latin American Research Review* 40 (3) (2005): 3-39.

Coatsworth, John, "Mexico" in *The Oxford Encyclopedia of Economic History* edited by Joel Mokyr, New York: Oxford University Press, 2003, pp. 501-07

Coatsworth, John, "Obstacles to Economic Development in Nineteenth-Century Mexico", *American Historical Review*, 83(1) (1978): 80-100.

Coatsworth, John, "The Mexican Mining Industry in the 18th Century", in Jacobsen, Nils, and Hans-Jürgen Puhle. *The Economies of Mexico and Peru During the Late Colonial Period, 1760-1810*. Berlin: Colloquium Verlag, 1986.

Contreras Carranza, Carlos, *Compendio de Historia Económica del Perú, Economía del Período Colonial Tardío*, Lima: Banco Central de la Reserva del Perú, 2010.

Cook, Noble David, "La población indígena en el Perú colonial," *Anuario del Instituto de Investigaciones Históricas*, 8 (1965): 73-110.

Cook, Noble, *Demographic Collapse: Indian Peru*, Cambridge: Cambridge University Press, 1981.

Cook, Shelburne and Leslie Byrd Simpson, *The Population of Central Mexico in the 16th century*,New Haven: Yale U, 1948.

Cook, Shelburne and Woodrow Borah, *Essays in Population History*, Berkeley: University of California Press, 1974.

Davis, James C. and Henderson, J. Vernon. "Evidence on the political economy of the urbanization process," Journal of Urban Economics, Elsevier, vol. 53(1), (2003): 98-125.

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

Denevan, William M., *The Native Population of the Americas in 1492*, Madison: University of Wisconsin Press, 1976.

Díaz, J., R. Luders, and G. Wagner. "Economía Chilena 1810-2000. Producto Total y Sectorial. Una Nueva Mirada," *Documentos de Trabajo* 315 (2007), Instituto de Economia. Pontificia Universidad Católica de Chile.

Dobado González, R. and G. A. Marrero, "The role of the Spanish imperial state in the mining-led growth of Bourbon Mexico's economy," *Economic History Review*, 64(3) (2011): 855-884.

Dobynns, Henry, "An Outline of Andean Epidemic History," *Bulletin of the History of Medicine* 37(6) (1963).

Engerman, S., and K. Sokoloff. "Inequality, Institutions, and Differential Paths of Growth Among New World Economies." In *How Latin America Fell Behind* , edited by S. Haber, Stanford, CA: Stanford University Press, 1997, 260-304.

Esteva Fabregat, Claudio, 1975, "Población y mestizaje en las ciudades de Iberoamérica", in *Estudios sobre la ciudad iberoamericana*, ed. by Francisco Solano, Madrid: Artes Gráficas Benzal.

Ferreres, Orlando, et al. *Dos siglos de Economía argentina (1810-2004).* Buenos Aires: El Ateneo, 2005.

Fisher, John R., *Silver mines and silver miners in colonial Peru, 1776-1824.* Liverpool: Centre for Latin-American Studies, University of Liverpool, 1977.

Gallo, Andrés and Carlos Newland. "Globalización y convergencia de precios en el Imperio Español 1660–1810", *Revista de Historia Económica* 22(2) (2004): 573-596.

Garavaglia, Juan Carlos. *Mercado interno y economia colonial*. Mexico: Grijalbo, 1983.

Gerhard, Peter, *The North Frontier of New Spain*, Princeton: Princeton University Press, 1982.

Gerhard, Peter. *The North Frontier of New Spain*, Princeton: Princeton University Press, 1982.

Gil de Taboada y Lemos, Francisco, *Memoria de los Vireyes que han gobernado el Perú*, Lima: Libreria Central de Felipe Bailly, 1859, volume 6.

Gil de Taboada y Lemos, Francisco. *Memorias de los vireyes que han governado el Peré durante el tiempo del coloniaje español*, Lima: Librería Central de Felipe Bailly, 1846.

Grafe, Regina and Alejandra Irigoin, "A stakeholder empire: the political economy of Spanish imperial rule in America," *Economic History Review*, 65(2) (2012): 609-651.

Grafe, Regina and Irigoin, Alejandra, "The Spanish Empire and its legacy: fiscal redistribution and political conflict in colonial and post-colonial Spanish America," *Journal of Global History*, 1(02) (2006): 241-267,

Grafe, Regina and Irigoin, Alejandra. "Bargaining for absolutism: a Spanish path to nation-state and Empire Building." *Hispanic American Historical Review* 88, (2) (2008): 173-209.

GRECO, El desempeño macroeconómico colombiano, Series estadísticas (1905 - 1997), Banco de La República, Febrero de 1999.

Greenfield, Gerald Michael. *Latin American Urbanization Historical Profiles of Major Cities*. Westport, Conn: Greenwood Press, 1994.

Guibovich Perez, Pedro. "The Printing Press in Colonial Peru: Production Process and Literary Categories in Lima, 1584-1699", *Colonial Latin American Review*, 10(2) (2001): 167-188.

Hardoy, Jorge and Carmen Aranovic, "Urbanización en América Hispánia entre 1580 y 1630", *Boletín del Centro de Investigaciones Históricas y Estéticas*, (11) (1969): 9-89.

Hardoy, Jorge, *Las ciudades en América Latina*, Buenos Aires: Paidós, 1972.

INEGI, *Estadísticas Históricas de México*, México: INEGI, 1990, 2009.

Izard, Miguel, "Comercio libre, guerras colonialws y mercado americano", in *Agricultura, Comercio Colonial y Crecimiento Económico en la España Contemporánea*, Barcelona: Editorial Ariel, 1974.

Jacobsen, Nils, and Hans-Jurgen Puhle. *The Economies of Mexico and Peru During the Late Colonial Period, 1760-1810*. Berlin: Colloquium Verlag, 1986.

Jacobsen, Nils, *Mirages of Transition: The Peruvian Altiplano, 1780-1930*, Berkeley: University of California, 1993.

Johnson, Lyman L., and Enrique Tandeter. *Essays on the Price History of Eighteenth-Century Latin America*, Albuquerque: University of New Mexico Press, 1990.

Juif, Dácil-Tania and Joerg Baten, "On the human capital of Inca Indios before and after the Spanish Conquest. Was there a "Pre-Colonial Legacy"?", *Explorations in Economic History*, 50(2) (2013): 227-241.

Kalmanovitz, Salomón, El PIB de la Nueva Granada en 1800: Auge colonial, estancamiento republicano, *Revista de Economía Institucional* 8(15) (2006): 161-183.

Katz, Friedrich, “A Comparison of Some Aspects of the Evolution of Cuazco and Tenochtitlán” in Urbanization in the Americas from its Beginning to the Present ed. By Schaedel J. Hardoy, and N. Scott-Kinzer, The Hague: Mouton, 1978.

Kemper, Robert V. and Anya Peterson Royce, “Social Urbanization in Latin America”, *Urban Anthropology*, 8(3/4) (1979): 267-28

Klein, Herbert S., “Fiscalidad y Gastos de Gobierno: el virreinato del Perú 1680-1809,” Documento de Trabajo 66 IEP (1994).

Klein, Herbert S., “Las economías de la Nueva España, 1680-1809: un análisis a partir de las cajas reales”, *Historia Mexicana*, 34:4 (1985).

Klein, Herbert S., *The American Finances of the Spanish Empire, Royal Income and Expenditures in Colonial Mexico, Peru, and Bolivia, 1680-1809*, Alburquerque: University of New Mexico Press, 1998.

Kubler, George “The Quechua in the Colonial World”, in *Handbook of South American Indians* edited by J. Stewart, Washington DC: US Government Printing Office, 1946.

Langue, Frédérique, “Trabajadores y formas de trabajo en las minas zacatecanas del siglo XVIII”, *Historia Mexicana* 40(3) (1991):463-506.

Maddison, Angus. *The World Economy: A Millennial Perspective*. Paris, France: Development Centre of the Organisation for Economic Co-operation and Development, 2001.

Malanima, P. Measuring the Italian economy 1300–1861. *Rivista di Storia Economica* 19 (2003): 265–95.

Manzel, K., Baten, J. and Stolz, Y. “Convergence and divergence of numeracy: the development of age heaping in Latin America from the seventeenth to the twentieth century.” *The Economic History Review*, 65 (2012): 932–960.

Márquez, Graciela, “Commercial Monopolies and External Trade”, in *The Cambridge History of Latin America*, ed. by V. Bulmer-Thomas, J.H. Coatsworth, and R. Cortés Conde, Cambridge: Cambridge University Press, 2006.

McCaa, Robert. “The Peopling of Mexico from Origins to Revolution” in *A population history of North America*, ed. by Michael R. Haines, Richard H. Steckel. Cambridge, UK, 2000.

Monteiro, John, “Labor Systems” in *The Cambridge History of Latin America*, edited by V. Bulmer-Thomas, J.H. Coatsworth, and R. Cortés Conde, Cambridge: Cambridge University Press, 2006.

Morse, Richard, “Trends and Patterns of Latin American Urbanization, 1750-1920”, *Comparative Studies in Society and History*, 16(4) (1974): 416-447.

Newland, C. And J. Coatsworth, “Crecimiento económico en el espacio peruano, 1681-1800: una visión a partir de la agricultura”, *Revista de Historia Económica* 2 (2000): 377-393.

Newland, Carlos. “Spanish American Elementary Education Before Independence: Continuity and Change in a Colonial Environment.” *Itinerario* 15(2) (1991): 79-95.

O'Brien, Patrick. "European Economic Development: The Contribution of the Periphery” *The Economic History Review* 35(1) (1982): 1-18.

Pearce, Adrian, “El censo demográfico peruano de 1725-1740”, in *Más allá de la dominación y la resistencia, Estudios de historia peruana, siglos XVI-XX*, edited by P. Drinot and L. Garofalo, Lima: Instituto de Estudios Peruanos, 2005, pp. 136-180.

Pfister, U. “Economic growth in Germany, 1500–1850”, Paper presented at the Conference on Quantifying Long Run Economic Development, Venice, 22-24 March, 2011

Ponzio, Carlos Alejandro, “Globalisation and Economic Growth in the Third World: Some Evidence from Eighteenth-Century Mexico,” *Journal of Latin American Studies*, 37 (3) (2005): 437-467.

Prados de la Escosura, L., and S. Amaral. *La Independencia americana: consecuencias económicas*. Madrid: Alianza Editorial, 1993.

Prados de la Escosura, Leandro, “Review of Francis Fukuyama, *Falling Behind: explaining the development gap between Latin America and the United States*”, *Economic History Review*, 62 (3) (2009): pp. 770-772.

Rosenblat, Angel, *La población indígena y el mestizaje en América*, Buenos Aires: Editorial Nova, 1954.

Rosenzweig, Fernando, “La Economia Novo-Hispana al Comenzar del Siglo XIX”, *Ciencias Políticas y Sociales* 9 (1963).

Salvucci, Richard and Linda Salvucci, “Crecimiento económico y cambio en la productividad en México, 1750-1895”, *HISLA*, 10 (1987): 67-89.

Salvucci, Richard, “Capitalism and dependency in Latin America”, in *The Cambridge History of Capitalism*, 2014, 403-430.

Sánchez Albornoz, Nicolas, *Indios y tributos en el Alto Perú*, Lima: IEP, 1978.

Sánchez-Albornoz, Nicolás, “The population of colonial Latin America”, in *The Cambridge History of Latin America*, edited by Leslie Bethell, Cambridge: Cambridge University Press, 1984, 1-36.

Seminario de Marzi, L. B., “Las Cuentas Nacionales del Perú, 1700-2010”, Documento de discusión, Universidad del Pacífico DD/12/11 (2013).

Seminario, Bruno and Arlette Beltrán. *Crecimiento económico en el Perú: 1896-1995*, Lima: Universidad del Pacífico, 1998.

Silva Riquer, J., “Los registros decimales en la historia agraria colonial”, *América Latina en la Historia Económica*, 10(5) (1998): 51-63.

Soccolow, Susan and Lyman Johnson, “Urbanization in Colonial Latin America”, *Journal of Urban History* 8(27) (1981): 27-59.

Stein, Stanley J. and Barbara Stein, *Silver, Trade, and War: Spain and America in the Making of Early Modern Europe*, Baltimore: Johns Hopkins University Press, 2000.

Tandeter, Enrique. *Coercion and Market: Silver Mining in Colonial Potosí, 1692-1826*. Albuquerque: University of New Mexico Press, 1993.

TePaske, John J., "General Tendencies and Secular Trends in the Economies of Mexico and Peru, 1750-1810: The View From the *Cajas* of Mexico and Lima," in *The Economies of Mexico and Peru During the Late Colonial Period, 1760-1810*, Berlin: Colloquim Verlag, 1986, 316-339.

Urrutia, M. y GRECO*, El crecimiento económico colombiano en el siglo XX*, Banco de la República y Fondo de Cultura Económica, 2002.

Van Young, E., 1981. *Hacienda and Market in Eighteenth Century Mexico*. University of California Press, Berkeley.

Van Zanden, J.L. and Daan Marks. *An Economic History of Indonesia*. New York: Routledge, 2012.

Vives Azancot, Pedro, "Iberoamérica y sus ciudades en los siglos XVII y XVIII", in *La ciudad iberoamericana* ed. by Centro de Estudios y Experimentación de Obras Públicas, Madrid: CEDEX, 1987.

Watchel, Nathan*, Los vencidos: Los indios del Perú frente a la conquista española (1530-1570)*, Madrid: Alianza Editorial, 1971.

Weber, Max, *Economy and Society*, Tubingen, 1922.

Weber, Max, *The Protestant Ethic and the Spirit of Capitalism*, New York: Scribner, 1958.

Whitmore, Thomas. *Disease and Death in Early Colonial Mexico: Simulating Amerindian Depopulation*. Boulder: Westview Press, 1992,

Williamson, Jeffrey G. Five centuries of Latin American income inequality. Revista de Historia Económica / Journal of Iberian and Latin American Economic History 28 (2010): 227-252.

Wu, Celia. The Population of the City of Queretaro in 1791, *Journal of Latin American Studies*, 16(2) (1984): 277-307.

Appendix A: New GDP estimations for Latin American countries

Table A1 presents the data available for selected Latin American countries in the Maddison project database as described in Bolt and van Zanden (2013) vis-à-vis new sources.

Table A1: GDP sources for selected Latin American countries

Country	Maddison project	New	Source
Argentina	1800, 1821, 1850, 1860, 1870, 1875-present	1810-present	Ferreres (2005)
Brazil	1800, 1821, 1850, 1860, 1870-present		
Chile	1800, 1821, 1850, 1860, 1870-present	1810-present	Diaz and Wagner (2010)
Colombia	1800, 1821, 1850, 1860, 1870-present	1761-1800, 1825, 1835, 1843, 1851, 1864, 1870, 1887, 1898, 1905-present	Kalmanovitz (2006), GRECO (1999), Urrutia and GRECO (2002)
Mexico	1800, 1821, 1850, 1860, 1870, 1890, 1895, 1900-present	1800, 1845, 1860, 1877, 1895-present	
Peru	1870-present	1700-present	Seminario de Marzi (2011)
Uruguay	1800, 1821, 1850, 1860, 1870-present		
Venezuela	1800, 1821, 1850, 1860, 1870-present	1830-present	De Corso (2013)

Appendix B: Notes on Latin American urbanization data

Reliable figures on urban population in colonial Latin America are hard to find. While the Spanish crown conducted population surveys every century or so, the interest gravitated towards assessing the size of the Indian population, especially the working age male segment, for tribute and service purposes. To be accurate, especially in the early colonial period, i.e. before 1700s, the statistics available for urban centres provide a good picture of the *Spanish* population. In particular, these accounts cite the number of "*vecinos*", the Spanish male head of households, with sporadic mention of the rest of the population in the area (generally classified as indians, mestizos, mulattoes, and black).

To quantify the size of cities during colonial times, a few different sources are available. Comprehensive studies on urban centres in the world such as Chandler and Fox (1974), Chandler (1987), Bairoch (1988), and Eggiman (1995) provide figures for selected cities in the region in 50-year intervals. According to their methodology, these works look at geographical dictionaries and historical accounts. However, Chandler and Fox (1974, 2) note that calculating population size is a puzzle and this exercise implies estimation methods to infer total population from imperfect data. In the absence of general population censuses, the data available only encompass a particular segment of the population (such as "*vecinos*" in Latin America) and multipliers are needed to estimate the total population. The results are rough figures of the main cities in the world. More recently, at the Center for Global History, E. Buringh has compiled a global dataset of urban settlement sizes from 1500 to 2000.

Using this dataset as a starting point, we consulted regional and national sources to supplement and corroborate the existing estimations. Overall, we have found that the figures from the late 19th century were quite accurate. This finding is not surprising, as most Latin American countries had, by then, carried out a national population census. For the earlier period, there are a few discrepancies. Our rule of thumb was to use the national or regional estimates whenever possible as we believe provide more reliable information. In general, the sources consulted included geographical dictionaries, urbanization and population studies, traveller's accounts, colonial censuses, and regional economic studies. To be transparent with our methodology, we looked at the earliest national census available (1790 for Mexico and 1876 for Peru) to check for estimated urbanization rates and main urban centres. Identifying the main urban centres from a postcolonial source may overlook the importance of certain cities during colonial times. To prevent this issue, we used Alcedo (1788)'s dictionary that listed and classified locations according to perceived size.[37] In the case of Mexico, the existing database was quite thorough in terms of the number of cities included; however, the extrapolation exercise was, at times, overestimating the degree of urbanization. For Peru, the opposite is true, the number of cities listed is fairly low giving as a result a low urbanization rate.

[37] The classification was city, town, and village.

Bolivia

Estimating the urbanization level of Bolivia was plagued by lack of data. Compared to Peru, Bolivia has received much less scholarly attention. Official statistics are also in short supply as the National Statistical Institute states "Bolivia is a country with scarce census tradition".[38] To obtain additional estimates, we used regional sources such as Cook (1981), Leonard (1948), and Urquidi (1971). In addition, we identified the main urban centres using the 1900 census that listed them by department and province. By 1900 only nine urban centres had a population over 5,000 people.

Mexico

Of the over 70 cities identified in Buringh's dataset, we were able to locate complementary sources for nearly 30 of them. The sources range from national censuses to regional and city studies. In particular, we were able to obtain official statistics for the late 18th century for the main Mexican cities as published by the INEGI in *Estadísticas Históricas de México* (EHM). In addition, this publication includes data for the main 25 cities in Mexico starting in 1790. We confirmed the relative importance of these cities using Secretaría de Gobernación (1993)'s work on population processes in Mexico.

For earlier periods, we used regional sources. In particular we are indebted to the work by Bakewell (1971), Brading (1971), Van Young (1981), Taylor (1984), Contreras et al. (1996), and Rabell Romero (2008) for urban population estimations for Zacatecas, Guanajuato, Guadalajara, Oaxaca, and Puebla. As we present estimations in 50-year intervals, most figures are interpolated.

Peru

Using the Clio database as starting point, we used the 1876 census to identify the main urban centres in Peru. According to this source, Peru had many urban settlements; however, most of them were fairly small as almost 85% had fewer than 1,000 inhabitants. The cities with population over 5,000 people were a handful, amounting to 19. To the original dataset, we added as many cities as possible provided we could find early population data to estimate the trajectory. As a result, we added Lambayeque, Moyobamba, and Chachapoyas.

For all cities, we tracked down different sources to obtain more accurate estimations on city size. For the early 16th century, we used Cook (1981)'s estimations for Cuzco, Chachapoyas, and Cajamarca. For Cajamarca, we estimated depopulation based on the rates available in the same source.[39] For the mid-late 18th century, Bueno (1951) provided information for various locations such as Chachapoyas. For a few locations, we were able to identify a key source, for example in the case of Trujillo, Coleman (1979) offers useful data on urban population. Not surprisingly, Lima's population estimations are more frequent, we used the compilation presented in Arbulu (2011) and complemented them with figures from Bowser (1977). As we present estimations in 50-year intervals, most figures are interpolated. For all cases,

[38] Instituto Nacional de Estadística, "Censos anteriores", url: http://www.inei.gob.pe/estadisticas/censos/, accessed on October 20th, 2013.
[39] It was estimated that the population loss was around -0.2% per year, much lower than other locations in Peru.

the 1850 population estimates were calculated using the 1876 census information.

Appendices - Bibliography

Arbulú, Javier Tantaleán, *El virrey Francisco de Toledo y su tiempo*, Lima: Fondo Editorial, 2011.

Bairoch, Paul, *Cities and Economic Development*, Chicago: University of Chicago Press, 1988.

Bakewell, Peter, *Silver Mining & Society in Colonial Mexico, Zacatecas 1546-1700*, Cambridge, Cambridge University Press,

Borah, Woodrow, "Latin American Cities in the Eighteenth Century: A Sketch", in *Urbanization in the Americas: the background in comparative perspective* edited by Woodrow Borah, Jorge Hardoy, and Gilbert Stelter, Ottawa: National Museum of Man, 1980.

Bowser, Frederick, *El esclavo africano en el Perú*, Mexico: Siglo XXI, 1977

Bueno, Cosme, *Geografía del Perú Virreinal (siglo XVIII)*, Lima: Azangaro, 1951.

Brading, D.A., *Miners and Merchants in Bourbon Mexico, 1763-1810*, Cambridge: Cambridge University Press, 1971

Buringh, Eltjo, Urbanisation Hub, The Clio-infra database on urban settlement sizes: 1500-2000, Center for Global Economic History, http://www.cgeh.nl/urbanisation-hub, accessed: September 2013.

Chandler, Tertius and Gerald Fox, *3000 Years of Urban Growth*, New York: Academic Press, 1974.

Chandler, Tertius, *Four Thousand Years of Urban Growth*, Lewiston: The Edwin Mellen Press, 1987.

Coleman, Katharine, "Provincial Urban Problems: Trujillo, Peru, 1600-1784", in *Social Fabric and Spatial Structure in Colonial Latin America*, edited by David J. Robinson, Ann Harbor: University Microfilms, 1979.

Contreras, Carlos, "Indios y blancos en la ciudad minera" in *Ciudades de los Andes: vision histórica y contemporánea*, edited by Eduardo Kingman Gances, Quito: Ciudad, 1992.

Cook, Noble David, *Demographic Collapse, Indian Peru, 1520-1620*, Cambridge: Cambridge University Press, 1981.

De Corso, Giuseppe. "El crecimiento económico de Venezuela, desde la oligarquía conservadora hasta la revolución bolivariana: 1830-2012, una vision cuantitativa." *Revista de Historia Económica*, 31(3) (2013): 321-357.

Dirección de Estadística, *Censo general de la República del Peru ´, formado en 1876*, Lima: Imprenta del Teatro, 1878.

Eggimann , Gilbert, *La population des villes des tiers mondes de 1500 à 1950*, Université de Genève, Centre d'histoire économique comparée, 1995.

INEGI, *Estadísticas Históricas de México*, México: INEGI, 2009.

Leonard, Olen E., "La Paz, Bolivia: Its Population and Growth", *American Sociological Review*, 13(4) (1948): 448-454.

Malanima, P. (2003). Measuring the Italian economy, 1300-1861. *Rivista di storia economica*, XIX.

Pfister, U. “Economic growth in Germany, 1500–1850”, Paper presented at the Conference on Quantifying Long Run Economic Development, Venice, 22-24 March, 2011

Rabell Romero, Cecilia, *Oaxaca en el siglo XVIII: población, familia y economía,* Mexico: UNAM, 2008.

Secretaría de Gobernación, *El poblamiento de México*, México: Consejo Nacional de de Población, 1993.

Taylor, William, "Town and Country in the Valley of Oaxaca, 1750-1812", in *Provinces of Early Mexico* edited by Ida Altman and James Lockhart, Los Angeles: UCLA Press, 1984.

Urquidi, Jose Macedonio, *El origen de la Noble Villa de Oropesa,* Cochabamba: Editorial Canelas, 1971.

Van Young, Eric, *Hacienda and Market in Eighteenth-Century Mexico*, Berkeley: U of California Press, 1981.