

# **Income Distribution in Brazil, 1870-1920\***

**Luis Bértola**

Economic and Social History Programme, Faculty of Social Sciences, Universidad de la República, Uruguay ([lbertola@fcs.edu.uy](mailto:lbertola@fcs.edu.uy))

**Cecilia Castelnovo**

Economic and Social History Programme, Faculty of Social Sciences, Universidad de la República, Uruguay ([ccastelnovo@fcs.edu.uy](mailto:ccastelnovo@fcs.edu.uy))

**Henry Willebald**

Economic and Social History Programme, Department of Economic History and Institutions, Universidad Carlos III, Madrid ([hwilleba@clio.uc3m.es](mailto:hwilleba@clio.uc3m.es))

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## **Abstract**

In this paper we present some preliminary estimates of Brazilian income distribution around the years 1872 and 1920. The results show that income inequality in Brazil was already high by the 1870s and further increased during the First Globalization Boom. Our results are compatible with the so called Inequality Possibility Frontier, and seem to show that inequality is deeply rooted in Brazilian history. We present data at the province-state level, as well as at the regional level. Increasing inequality took place mainly within states, while inequality between states and regions did not increase. The picture is one of important shifts in the distribution of population and income in different regions of the country. The dynamics is better understood as an interaction between globalization, frontier expansion and different institutional environments and transformations, both in the core of the colonial and slave economy and in frontier regions.

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# Income Distribution in Brazil, 1870-1920

## 1. Introduction

The relationship between economic growth and income distribution has returned to the research agendas of economists and economic historians in the last decade. This was probably the result of the fact that economic growth has not always been followed by diminishing inequality. Furthermore, economic growth was itself has not been as pervasive as was expected.

The Kuznets curve attracted much interest because it provided a good explanation for why trends in equality could be delayed. According to this concept, growth should, at first, lead to increasing inequality; then, after some threshold is surpassed, inequality should start to decline. A related question is whether all countries should grow and whether the poorest should grow faster than the richest, in order not only to reach the trend of declining inequality in specific countries, but also to get inequality to decline worldwide.

As often happens in the history of (economic) thought, ideas advance in a circular fashion. The causality between income distribution and growth changed: inequality became a point of departure than an outcome of growth. The question came to be whether an unfair distribution of wealth and income is a restriction on economic growth. If that is the case, countries with very unequal income distributions should grow less than those with more equal income distributions, thus limiting the scope for a fast reduction in inequality, both within and between countries.

This is the framework for the present study. Our purpose is to come closer to a global history of inequality since 1870, i.e., to study inequality at a global level, considering it both within and between countries. Bourguignon and Morrison have already taken an important step in that direction with their work "Inequality among world citizens". One of the weaknesses of their study, specifically with the database they constructed, was the lack of information about the Third World. For example, the income distribution in Latin American countries was assumed to remain constant between 1820 and 1950. Thus, differences in income distribution were considered only as long as they were affected by average per capita income between countries.

The current debate regarding Latin America is centred on two alternative (but complementary) ideas. The first stresses the colonial roots of Latin American inequality. Unequal distribution of wealth, income and political power are seen as the basic determinant of a set of economic and political institutions that reinforces inequality and hampers growth (Engerman & Sokoloff 1997, Acemoglu, Johnson & Robinson 2005, World Bank 2004). Regardless of the original causes of inequality (resource endowments, colonial heritage or simply endogenous economic and political mechanisms), these views are in line with a deep-rooted tradition in Latin American studies.

However, there is much evidence that income distribution in Latin America went through significant changes, especially during the First Globalisation Boom, the later inward-looking growth and during the last decades of the 20<sup>th</sup> Century (O'Rourke & Williamson 1999, Williamson 2009, Bértola 2005, Bértola, Castelnovo, Rodríguez & Willebald 2009). The question remains whether high levels of inequality in Latin America are a long-lasting feature or whether they are the result of more modern incorporation into the world economy.

The sources of information are scarce and there are few quantitative studies on income distribution in Latin America. Thus, our research is an attempt to fill that gap, with estimates of changes in income distribution since the 1870s for a group of Latin American countries: Argentina, Brazil, Chile, México and Uruguay (see Bértola & Rodríguez 2009 and Bértola, Castelnovo, Rodríguez & Willebald 2009).

In this paper we present some preliminary results for Brazil. The paper is to a great extent empirical, aiming to show some estimates of Brazilian income distribution around the years 1872 and 1920. In Section 2 we present how we constructed these estimates of income inequality. Section 3 discusses our aggregate results and compares them with available GDP series. Section 4 presents the results at regional and provincial levels (states in 1920). Section 5 contains a brief discussion of changes in inequality between 1872 and 1920. Finally, some conclusions are presented.

## **2. How to estimate income distribution in Brazil, 1872 and 1920**

Our basic approach is to identify the occupational structure of the active population and then determine the income of each occupational group. In both steps we use data from the national population census.

*1872*

The Census Data of 1872 provides information on population by state, condition, gender and occupation. The total population of Brazil was estimated at 9.930.478 habitants, 4.172.114 of which did not declare any occupation. At that time there were 20 provinces, and 34 different occupations were registered.

Out of an estimated active population of more than 6 million people, about 1.5 million were slaves. Their income was determined according to reports on the cost of maintaining slaves. Detailed information on the activities in which slaves were involved is available. In cases where a particular activity required special skills, the income accorded to each slave involved was increased proportionally to the higher price fetched for slaves possessing special qualifications. The difference was about 25%. After consulting several sources for the cost of maintenance of slaves, we accepted Libby's estimates (Libby, 1984), which are similar to those of Carvalho de Mello (1978).

Obviously, there were differences among different slaves' "incomes", in relation to their gender, access to land, production for own consumption, etc. Similarly, the duration of a working day and alimentation could vary from place to place. In some cases, slaves were able to save money and buy their freedom. It seems realistic, however, to assume that differences among slaves did not significantly increase total inequality in Brazilian society in 1872.

About 5% of the active population consisted of civil servants. Our database includes official information regarding the income of each and every one of them. Complete registers of public employees were obtained from "Orçamento de Receita e Despesa do Imperio para Exercicio de 1871 -1872" and "Orçamento de Receita e Despesa do Imperio para Exercicio de 1872 -1873". This information was organized at the provincial level.

Our third important source of data is the list of voters at municipal level. The Brazilian electoral system was instituted in 1821, and by the 1870s was well developed. Voter participation in Brazilian elections reached levels similar to those in European countries today (Nunes 2003). Unfortunately, this kind of information is very limited. We have access to complete lists for the state of Rio Grande do Sul (RGS, more than 2000 cases) and processed information for San Pablo (SP) (Klein 1995) and Rio de Janeiro (RJ) (Nunes 2003). Although voters had to surpass a certain level of income in order to obtain the right to vote, this bar was set extremely low: 200 mil-réis (slaves' "income" was estimated to be 64 mil-réis). The register for Rio Grande do Sul, kindly provided by Leonardo Monasterio, includes more than 2,000 observations, each indicating the voter's occupation. The occupational categories in this register are compatible with the census arrangement of occupations and income.

The estimation was performed in three steps.

1. The income distribution for each occupational category in the province of Rio Grande do Sul was applied to similar occupational categories in other provinces.
2. A recent study by Eustaquio Reis provides estimates of the level of income per active population (Reis 2008). These different mean income levels were maintained for each profession in relation to Rio Grande do Sul, keeping the distribution pattern of each profession as in Rio Grande do Sul. The resulting average income per active population did not coincide with that of Reis, because these different income levels were applied only to some professions (not to slaves and not to civil servants). This was specially the case of provinces with high shares of slaves and high shares of civil servants, being the Province of Rio de Janeiro a typical case.
3. The difference between the estimated income of each province and the income expected according to Reis' relative estimates was assumed to be an excedent income appropriated by the elite. The income of the elite is usually a source of underestimation of total inequality. In order to assign this income share, the professional groups probably being part of the elite were selected: "advogados", "notaries y escriptores", "capitalistas y propietarios", "manufactureros y fabricantes", "comerciantes, guarda libros y cajeros", as well as high income civil servants in important positions, as presidents, commanders, etc. The estimated income loss was distributed among the richest 1% of the active population of the province that also was among these professional groups.

For women, income was determined to be 2/3 of similar male income. This was the average result obtained from many different sources of information. For women capitalists and owners, as well as for women slaves, income was determined to be the same as that of males in each group.

The database assigns income to about 5.6 million people, out of an active population slightly above 6 million.

The data was organized in different groups according to sector (primary, secondary, tertiary), condition (free-slave), gender, province and region.

Each region includes several provinces as follows (see Figure 1):

North: Amazonas, Pará

North-East: Alagoas, Maranhao, Pihahuy, Ceará, Rio Grande do Norte, Parahyba, Sergipe, Bahia, Pernambuco

Center-West: Mato Grosso, Goyáz

South:: Paraná, Santa Catarina, Rio Grande do Sul

South-East: Minas Geraes, Sao Paulo, Rio de Janeiro, Espíritu Santo

## **1920**

This estimate is also based on the population census. It assigns income to 8,5 million people out of an active population of 18 million. The main sources of data on income are as follows.

- A list of 32,000 civil servants (out of 186,000) with detailed information on income and occupation.
- A survey of wages in the secondary sector with the number of workers by 21 income intervals (8 male adult, 5 female adult, 4 male 14-20, 4 female 14-20), for 14 branches and 21 states. The survey covers about 1/5 of the total population registered by the census in these activities: 1.162.653 people.
- Information on average daily wages in the primary sector by 15 branches and 21 states.
- An estimate of landowners' income, according to census data on the size of farms and wage-ratios for 1920 and regional productivity differences for 1940.

- An estimate of industrial capitalists' incomes, using the industrial survey from 1920, and assuming the existence of one owner per enterprise.

**Figure 1. Brazil: regions and provinces-states.**



Source: own elaboration.

### 3. Aggregate Inequality and GDP levels and growth, 1870-1920

#### 3.1. Aggregate Inequality: a first glance

In 1872 and 1920, as shown in Table 1, Brazilian inequality levels were expectedly high. This is not a trivial result, as our earlier estimates showed unexpectedly low inequality levels in 1872 (Bértola, Castelnovo, Reis & Willebald, 2007).

Table 1: Aggregate inequality measures for Brazil, 1872 and 1920.

	p90/p10	p90/p50	p10/p50	p75/p25	GE(0)	GE(1)	Gini
1872	8,439	5,307	0,629	2,713	0,554	1,011	0,564
1920	9,529	5,028	0,528	2,371	0,662	0,977	0,616

Present results confirm the idea that Brazilian inequality was already high before the first great globalization boom took place, and that high inequality is of some kind of long run and structural character.

The previous statement does not preclude the existence of medium run changes and fluctuations in income inequality. With respect to the First Globalization Boom, it looks as if most indicators point to increasing inequality.

Before these results are discussed, we need to have an idea about aggregate and per capita GDP growth in Brazil during this time period.

#### 3.2. GDP levels and growth

##### *GDP growth*

The classic work by Celso Furtado (1963) was the reference to interpret Brazilian economic development during the 19<sup>th</sup> Century and the first decades of the 20<sup>th</sup> Century. According to him, in the second half of the 19<sup>th</sup> Century, GDP per capita grew at an annual rate next to 1.5 percent and maintained this dynamism up to the 1950s.

Leff (1982) questioned this interpretation and found that GDP per capita did not grow during the second half of the 19<sup>th</sup> Century because the economy was affected by adverse conditions such as uneven microeconomic responses, markets distortions and negative externalities.

However, both interpretations were speculative.

The works about Brazilian economic trajectory during the First Globalization most often referred to are Contador & Haddad (1975), Goldsmith (1986) and Maddison (1995, 2001). They have diverse methodological characteristics and show different long run trends.

Contador & Haddad (1975) present estimates for the period 1861-1970 according to the principal components method, a technique that uses the correlation of a group of variables with the evolution of the product to obtain the figures of the GDP.

The official Brazilian National Accounts, elaborated by the Instituto Brasileiro de Geografia e Estatística (IBGE) start in 1947. Haddad's series (1978, an actualization and upgrade of Contador & Haddad 1975) are extensively accepted for the first half of 20<sup>th</sup> Century (with some minor corrections like those presented in Haddad 1980) and the literature favourably evaluates these estimates.

Goldsmith (1986) presents data for 1850-1984 and, for the period covered by our work, the author applies two procedures. First, for 1850-1913, the GDP in current prices corresponds to a weighted average of four indexes –total wages, trade transactions (exports plus imports), government expenses of the Union and the money supply (M<sub>2</sub>). GDP in constant prices is obtained by deflating the above figures by a price index derived from the mean of four indexes of domestic prices (which includes interpolations for critical data).<sup>1</sup> Second, for 1913-1945, the variables in current prices are by linking the previously mentioned series with Haddad (1980) plus 5 per cent for depreciation. The data in constant prices corresponds to Haddad (1978)'s figures.

Finally, Maddison (1995, 2001) presents estimates of Brazilian GDP (total and per capita) that are widely utilized in international studies and convergence analysis. Maddison's source for the estimates from 1850-1900 is Goldsmith (1986). For later years the author incorporates his own estimates based in previous studies.<sup>2</sup>

There is no consensus about the best GDP estimates, but in general, scholars prefer Goldsmith's estimation for two reasons. First of all, Goldsmith's study improves the historical perspective and the quantity of data because it covers a longer time period. Second, the estimation incorporates more abundant information and, for a rigorous technical work, the results would be superior. The lesser variability of his data would confirm this perception (Goldsmith, 1986:25).

Maddison's estimates are commonly applied in the study of international distribution of income and convergence/divergence analysis. Considering that the data covers a similar period that of the Goldsmith study (even with earlier years), it is interesting to compare both series. Figure 2 presents the indexes of GDP per capita (1910=100) for 1850-1930.<sup>3</sup>

The discrepancies between the two series for the 19<sup>th</sup> Century are evident. Maddison's assumption of homogenous growth during several decades renders his figures for GDP from 1850 to 1890 less credible. Goldsmith's estimates show an increasing trajectory until 1870 and then a moderately decreasing trend later. This issue is very important from the point of view of international comparisons.

If we look at the evolution of the Brazilian economy using Maddison's data, it appears that Brazil started to overcome its delayed development with the boom in the

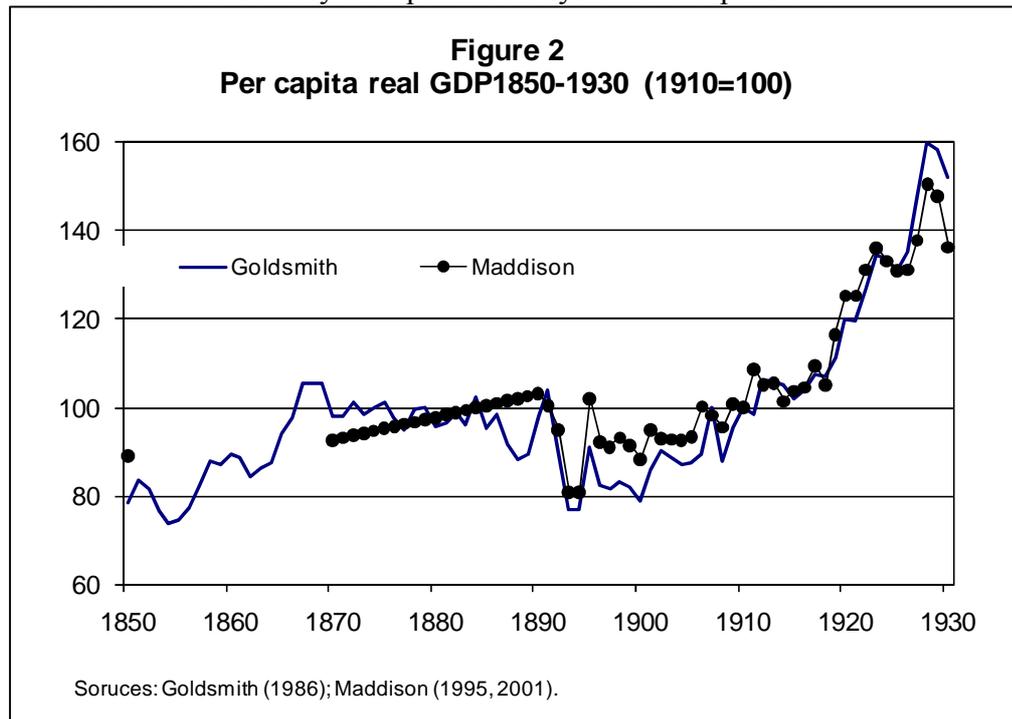
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<sup>1</sup> Goldsmith (1986): 31 quotes: Buescu (1973), Lobo (1975), Onody (1960) and Randall (1977).

<sup>2</sup> Maddison, A. and Associates (1992): *The Political Economy of Poverty, Equity and Growth: Brazil and Mexico*. Oxford University Press, New York.

<sup>3</sup> Goldsmith's series are expressed in 1910 prices and Maddison's estimates in 1990 prices (international dollar, Geary-Khamis).

international demand for its commodities. However, the history of stagnation that Goldsmith proposes shows the reality of a poor economy, with low dynamism, that had to wait until the turn of the Century to experience a systematic expansion.



The crisis of the 1890s was deeper and shorter for Goldsmith than does Maddison. In the first case, the fall was 26 per cent and incorporated decreasing movements in 1892 and 1893, stabilizing in 1894. In the second case, the fall was 22 per cent, but the contraction lasted for the period 1891-1894. For Maddison, the recovery was greater, with GDP remaining above Goldsmith's estimates until the end of the first decade of the 20<sup>th</sup> Century. From 1910 on, the movements in the two series are closer; the lineal coefficient is 0.6 in the period 1870-1899 and 0.98 from 1900 to 1930.

In short, there is a strong consensus for the estimates of GDP during the 20<sup>th</sup> Century, the evolution and levels of GDP estimates are not under strong discussion. Scholars prefer the series of Haddad's (1980) series for the period 1900-1947 and the IBGE data afterwards. However, for 19<sup>th</sup> Century the discussion is open. Considering the quality of the construction method and their historical consistency, we prefer Goldsmith's estimates.

#### *Our income estimates*

Our inequality estimates provide a sub-product in the form of a measure of total income, which can be compared with total gross domestic product (see Table 2).

Table 2: Estimated income compared, total and per capita: 1872, 1900, 1920.

<b>Current</b>								Population
GDP (1000000 mil-reis)			Per capita GDP (mil-reis)					millions
Goldsmith	Reis	Own	Goldsmith	Reis	Own			
1872	1210	613	1205	119	60	118		10,167
1900	4560			374				12,201
1920	14900		22778	544		831		27,404
<b>Constant</b>								
GDP (1000, 1910 mil-reis*)			Per capita GDP (1910 mil-reis, excepting for Maddison)			Maddison (1990 PPP\$)		
Goldsmith	Reis	Own	Goldsmith	Reis	Own			
1872	2670	1352	2658	263	133	261		713
1900	5791			475				678
1920	8556		13080	312		477		963
<b>Growth rates</b>								
GDP			Per capita GDP			Population		
Goldsmith	Maddison	Own	Goldsmith	Maddison	Own			
1872-1900	1,2	1,8		-0,9	-0,2			2,1
1900-1920	4,3	3,9		2,2	1,8			2,1
1872-1920	2,5	2,7	3,4	0,4	0,6	1,3		2,1

\*Price indices taken from Goldsmith (1986)

Sources: Goldsmith (1986), Maddison (2003), Reis (2009).

Our GDP estimate for 1872 is surprisingly close to Goldsmith's figure. We do not think we have to overreact to this result, as the methods of estimation used were quite different and we were searching for different aspects of economic activity. As compared to Reis, it is striking that our figure for total income is double his estimate, given the fact that we used his data for part of the analysis. Nevertheless, our results are defensible, as his GDP estimates were based on in average low incomes of municipality workers. While regional disparities may correctly reflect relative productivity across provinces, average income might not necessarily do.

On the other hand, our 1920 estimate looks too high compared to Goldsmith's. This may be a consequence of several factors: on average too high income levels of the recorded incomes, an under-representation of low-income sectors both in the recorded incomes and when scaling up the surveyed population, as well as an underestimation of total income by Goldsmith due to him not assigning income to non-monetary production as we do. If this was the case, a possible outcome is that inequality in 1920 is under-reported. In any case, a difference of 50% in per capita income estimates is too high to be happy with. While Maddison and Goldsmith report rates of per capita growth in income between 1872 and 1920 of 0.4 and 0.6, respectively, we get a much higher rate of 1.3. More research is needed to resolve this inconsistency. We accept Goldsmith's estimates for the moment.

### 3.3. Inequality, subsistence and GDP: inconsistencies in levels and growth rates

Lindert, Milanovic and Williamson (2007) argue that the level of possible inequality, the *inequality possibility frontier (IPF)*, depends on the level of per capita income, the subsistence level for the majority of the population and the size of the elite that can appropriate the eventual surplus. They present a final equation as follows:

$$G^* = ((\alpha - 1) / \alpha) (1 - \varepsilon),$$

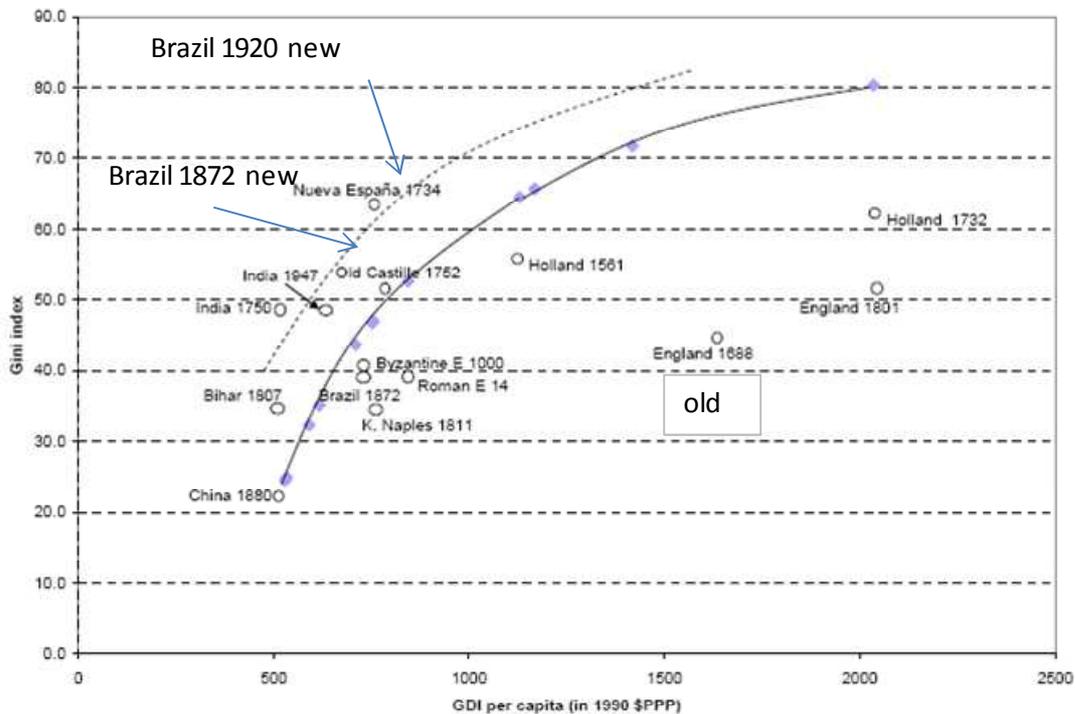
where  $G^*$  is the IPF for a certain level of per capita income,  $\varepsilon$  is the proportion of people belonging to a very small upper class and  $\alpha$  is the relation between average income and the subsistence income. In other words, an economy at very low levels of development,

where average income is not much higher than subsistence level, does not produce a surplus large enough to allow for high inequality levels.

On the other hand, the relation between the real and potential inequality can be regarded as an extraction rate, an indication of an institutional setting that is more or less favourable to the elite.

The authors present a theoretical IPF-curve (Figure 3), assuming that the elite is 0.1% of the population and that subsistence income is 300 or 400 1990 international purchasing power parity dollars (the latter figure is used by Maddison as an historical benchmark; the former is used as an “Asian” alternative).

**Figure 3**  
**Ancient Inequalities: Estimated Gini Coefficients,**  
**and Two Inequality Possibility Frontiers**



**Note:** The solid line IPF is constructed on the assumption that  $s = \$PPP400$ ; the broken-line IPF is constructed on the assumption that  $s = \$PPP 300$ . Estimated Ginis are Ginis2 unless only Gini1 is available.

Old: Bértola, Castelnovo, Reis & Willebald (2007)

Source: Lindert, Milanovic, Williamson (2007), and own estimates for Brazil.

How do our results fit in to this approach?

First let's remember that although Brazil was a poor and unequal country in 1872, if we follow Maddison's international ranking, it was not a non-developed nation. Brazilian per capita GDP was, according to Maddison (Table 3), somewhat lower than the world average: about 1/4 that of world leaders, about 1/2 that of Argentina and about 3/4 that of Portugal. However, it was almost 50% higher than that of China, India and the African average. Thus, Brazil was very far from the high-income group, but also somewhat distant from less developed regions of the world.

**Table 3. Per Capita GDP 1870: (1990 International Geary-Khamis dollars)**

World			
Australia	3,273	<b>Average</b>	<b>875</b>
United Kingdom	3,19	South Africa	858
United States	2,445	<b>Brazil</b>	<b>713</b>
France	1,876	Mexico	674
Germany	1,839	India	533
Canada	1,695	China	530
Argentina	1,311	Total Africa	500
Spain	1,207	Ghana	439
Portugal	975		

Source: Maddison 2003

Following the LMW proposition, we find two contradictory results.

- 1) Accepting the 1990 PPP \$400 subsistence limit (Table 4, Panel A), Brazil lies well above the IPF according to its per capita GDP (see Figure 3). Using this limit, the 1872 extraction rate was over unity; in 1920 it was close to unity; not a reasonable result. Reducing the subsistence level to 1990 PPP \$300 is not of much help. Using this limit, in 1872 the extraction rate was almost unity, hardly an acceptable result, even in a slave society (Table 4, Panel B).
- 2) Even the 1990 PPP \$300 is a problem. If Brazil had a per capita GDP of 1990 PPP \$721, as Maddison estimates, and the Gini is 0.56, a lognormal distribution casts the strange result that the average income of the first decile is only 1990 PPP \$61. For subsistence income to be 1990 PPP \$300, the Gini has to be 0.26, a record for Scandinavia or Asia, but not possible for a slave society. It is probably more adequate to make a Pareto transformation of the Gini-coefficient into deciles. The result would be that the lowest decile earned 1990 PPP \$206 in 1872, still well below Maddison's assumptions. We have to move to the 5<sup>th</sup> and 6<sup>th</sup> deciles in order to find subsistence-level incomes in the first case and to the 6<sup>th</sup> and 7<sup>th</sup> in the second.
- 3) In Table 4, Panel C, we use the income of the logtransformed lowest decile as the subsistence level income. The result is now more acceptable. The extraction rate of the richest 0.1% of the population is over 60%. This looks reasonable, but higher figures could also be expected. In Panel D we introduce the Pareto transformed value, and the result now looks more acceptable: the extraction rate is about 80%.
- 4) Why should we cross the river in search of water? Let us estimate the IPF using our own current price estimates of subsistence and mean income of the active population, as in Table 4, Panel E. The extraction rate now looks rather reasonable: 83% and 76% in 1872 and 1920, respectively, and quite similar to those shown in Panel D.

We can then conclude that our inequality estimates are compatible with our estimates for mean income, subsistence income and a reasonable extraction rate of the produced surplus in a slave and a post-slave society. Another conclusion is that Maddison's PPP estimates are faulty: either the GDP series or the PPP estimates are wrong!

Table 4: Estimated Gini-coefficients and the Inequality Possibility Frontier for Brazil, 1870 and 1920.

Panel A: elite as 0,1% of the population and subsistence income at 400PPP\$.

	%G-real/IPF	G-real	IPF	% élite	mean 1990PPP\$	Maddison 1990PPP\$
			$\alpha$	$\epsilon$	$\mu$	$s$
1872	1,27	0,56	0,44	1,80	0,1%	721
1920	1,05	0,62	0,58	2,41	0,1%	963

Panel B: elite as 0,1% of the population and subsistence income at 300PPP\$.

	%G-real/IPF	G-real	IPF	% élite	mean 1990PPP\$	Maddison 1990PPP\$
			$\alpha$	$\epsilon$	$\mu$	$s$
1872	0,97	0,56	0,58	2,40	0,1%	721
1920	0,90	0,62	0,69	3,21	0,1%	963

Panel C: own subsistence levels estimates (average of the lowest decile, lognormal transformation).

	%G-real/IPF	G-real	IPF	% élite	mean 1990PPP\$	Own estimates 1990PPP\$
			$\alpha$	$\epsilon$	$\mu$	$s$
1872	0,62	0,56	0,91	11,82	0,1%	721
1920	0,66	0,62	0,94	16,65	0,1%	963

Panel D: own subsistence levels estimates (average of the lowest decile, Pareto transformation).

	%G-real/IPF	G-real	IPF	% élite	mean 1990PPP\$	Own estimates 1990PPP\$
			$\alpha$	$\epsilon$	$\mu$	$s$
1872	0,79	0,56	0,71	3,50	0,1%	721
1920	0,82	0,62	0,75	4,05	0,1%	963

Panel E: own estimates at current prices of subsistence and mean income.

	%G-real/IPF	G-real	IPF	% élite	mean* current values, domestic currency	subsistence real** $s$
			$\alpha$	$\epsilon$	$\mu$	$s$
1872	0,83	0,56	0,68	3,09	0,1%	198
1920	0,76	0,62	0,81	5,42	0,1%	2649

\*mean income of active population

\*\*income of the lowest decile of the active population

With respect to PPP, we can provide a preliminary alternative estimate. Using PPP exchange rates between UK and Brazil ca: 1905 (Bértola, Camou & Porcile, 1998) we obtain that Brazilian per capita income is not 4.5 times lower than in the UK, as Maddison claims, but only 2.1 times lower. At the same time, and expressing Brazilian income in Maddison's terms, the 1872 average income is raised from 1990 PPP \$751 to \$890. More work has to be done to obtain adequate PPP estimates for the period under consideration.

### 3.4. Growth and inequality trends 1872-1920

Goldsmith, Contador & Haddad, and Maddison agree that the Brazilian economy went through a period of retardation in per capita GDP growth during the last decades of the 19<sup>th</sup> Century. Under such circumstances, we cannot expect drastic changes in the distribution of income. Even more, in previous versions of our work we reported a decreasing trend in income inequality based on very preliminary data for the Province of Rio de Janeiro (we will come back to this point in the coming section). We are not in a position to make any statement on trends in inequality from 1870-1900 at a national level.

Similarly, Goldsmith, Haddad and Maddison, all agree that during the first decade of the 20<sup>th</sup> Century the Brazilian economy recovered from negative trend of the late 19<sup>th</sup> Century, surpassing the 1870 per capita GDP levels at some point during the 1920s.

When we consider the aggregate inequality increases shown in Table 1, we are tempted to believe that inequality increased during the first decades of the 20<sup>th</sup> Century.

Another possibility is that total inequality actually went down when per capita GDP levels were reduced.

If we take a closer look at the inequality measures, we find four indicators pointing to increased inequality, while another three show something different.

Both ratios based on the income level of the 10<sup>th</sup> percentile show that its position was worsening. The Gini-coefficient, known for being representative of the middle part of the distribution, as well as the General Entropy index (0) -that weights every person equally instead of according to their income (as in GE(1)-, also show increased inequality. Nevertheless, all the indices where the middle-upper deciles are compared to the medium and medium-low levels, show decreasing inequality. That points to a possible polarization, in which medium-high sectors are losing ground, as well as the very poor ones, in favour of a lower-middle class and the elite.

In very broad terms, these changes in inequality can be associated to two different trends in the economy. The first was probably most influential during the last decades of the 19<sup>th</sup> Century. During the crisis of the slave society and the Empire, the imperial middle classes were probably damaged. At the same time, the abolition of slavery in a time of economic stagnation, created a very large low-income labour force. The second trend was probably more ubiquitous during the first decades of the 20<sup>th</sup> Century in most regions, but could have started earlier around the State of Sao Paulo. It involved the growth of new sectors and industries and the creation of an urban working class and new middle classes at different levels. Of course new industrial, commercial and agricultural elites were reinforced during a period of relatively high growth.

Our database does not allow us to estimate structural change between different economic sectors, especially because of the 1872 data. Nevertheless, a much more important factor in explaining trends in inequality during the period is the disparate performance between different regions and provinces. This topic is tackled in the next section.

#### **4. The provincial and regional dimension: empirical results**

While aggregate results point to contradictory trends within a context probably characterized by moderate increases in inequality, a closer look at the regional and provincial levels shows the existence of more profound changes.

*1872*

Let's first take a look at the year 1872. Table 5 shows that we have three relatively rich regions in per capita income terms (North, South and South-East). Further we see that both population and income are concentrated in two of Brazil's five regions: the North-East and the South-East. However, average income in each region is quite different (0.7 and 1.2 of average national income, respectively): while the North-East is leading in population (almost half of the total), the South-East is leading in income (almost half of the total).

In terms of inequality (Table 6), the rich South-East is the more unequal region. It combines relatively high per capita income levels and a very high percentage of slave workers among its population. Despite this, within-region inequality adds ten times more to total inequality than between-region inequality: i.e., what matters more is the inequality within each region.

However, when discussing changes and trends, marginal movements are important. Moreover, the regions are not homogeneous themselves. When we consider inequality among the different provinces in 1872, we find that between-province inequality adds up to more than 20% of total inequality. If we consider the rich South-East region, we find that two populous provinces, Sao Paulo and Minas Gerais, have 75% of the region's population, but only half the region's income. Rio de Janeiro, on the other hand, with only a fourth of the regional population, captures half of its income.

Table 5. Brazilian population and income by region and province, 1872 and 1920.

state	1872				1920			
	Popn. share	Mean	Relative mean	Income share	Popn. share	Mean	Relative mean	Income share
<b>Center -West</b>	<b>2,6</b>	<b>128</b>	<b>0,65</b>	<b>1,7</b>	<b>2,6</b>	<b>3.178</b>	<b>1,20</b>	<b>3,1</b>
36 Goyaz	2,0	98	0,49	1,0	1,7	3.062	1,152	2,0
38 Mato Grosso	0,6	227	1,14	0,7	0,8	3.253	1,225	1,0
<b>North</b>	<b>3,3</b>	<b>291</b>	<b>1,46</b>	<b>4,9</b>	<b>5,3</b>	<b>2.085</b>	<b>0,79</b>	<b>4,2</b>
32 Amazonas	0,6	274	1,38	0,9	1,3	1.904	0,717	0,9
40 Pará	2,7	295	1,48	4,0	3,6	2.044	0,769	2,8
51 Territorio do Acre					0,4	2.717	1,023	0,4
<b>North-East</b>	<b>48,0</b>	<b>145</b>	<b>0,73</b>	<b>35,1</b>	<b>37,4</b>	<b>1.818</b>	<b>0,68</b>	<b>25,7</b>
31 Alagoas	3,3	140	0,70	2,3	3,2	1.837	0,691	2,2
33 Bahia	15,2	172	0,87	13,2	11,6	1.867	0,703	8,2
34 Ceará	7,6	113	0,57	4,3	4,2	1.622	0,610	2,6
37 Maranhao	4,0	143	0,72	2,9	3,1	1.782	0,671	2,1
41 Parahyba	4,3	103	0,52	2,2	3,0	1.562	0,588	1,7
43 Pernambuco	7,7	171	0,86	6,6	7,1	1.920	0,723	5,1
44 Piahuy	2,1	155	0,78	1,6	2,0	1.949	0,734	1,4
45 Río Gde do Norte	1,9	113	0,57	1,1	1,6	1.793	0,675	1,1
50 Sergipe	1,9	93	0,47	0,9	1,7	2.066	0,778	1,3
<b>South</b>	<b>8,1</b>	<b>290</b>	<b>1,46</b>	<b>11,8</b>	<b>11,2</b>	<b>3.824</b>	<b>1,44</b>	<b>16,2</b>
42 Paraná	1,2	169	0,85	1,0	2,3	3.933	1,480	3,4
46 Río Gde do Sul	5,2	348	1,75	9,1	6,6	3.980	1,498	9,8
48 Santa Catarina	1,7	200	1,01	1,7	2,4	3.319	1,249	3,0
<b>South-East</b>	<b>38,0</b>	<b>243</b>	<b>1,22</b>	<b>46,5</b>	<b>43,5</b>	<b>3.100</b>	<b>1,16</b>	<b>50,9</b>
35 Espiritu Santo	1,0	171	0,86	0,9	1,8	2.464	0,93	1,7
39 Minas Gerais	18,3	177	0,89	16,3	18,0	2.583	0,97	17,5
47 Río de Janeiro	7,9	572	2,88	22,7	9,0	3.790	1,43	12,8
49 Sao Paulo	10,8	122	0,62	6,7	14,7	3.432	1,29	18,9

### 1920

In 1920 we find three relatively rich regions (Table 5): South-East, the South and the Centre-West and two poor: the North and the North-East. The North and the Centre-West changed positions. The South and South-East represent 55% of population and 67% of income.

In terms of inequality (Table 6), we do not find important differences among the different regions: the contribution of between-region inequality to total is very low, about 6%. When we go on and consider inequalities between states, we did not find a similar increase like we did when we looked at the year 1872. Between-state inequality in 1920 is only about 8% of total inequality. One explanation for this may be that we are underestimating the income of the elite in some states. In any case, our results, at this point, tell us that between-region and within-state inequality are even less relevant in 1920 than in 1872.

### From 1872 to 1920

Let's enumerate the main changes between 1872 and 1920:

1. Per capita GDP increased by 18% (Goldsmith) to 35% (Maddison).
2. These figures imply that during this period Brazil fell significantly behind world leaders and its regional neighbours. In terms of between-country inequality, Brazil's laggardness made a great contribution to international inequality.
3. The distribution of population and income in the territory went through significant changes, favouring the Southern and the South-Eastern regions.
4. Nevertheless, the dispersion of average income among regions and states did not increase, no matter if we look at the regional or the provincial/state levels.
5. Particularly interesting is what happened within the South-Eastern region. It increased its weight more in terms of population than in terms of income. The most striking process is the decay of the position of the State of Río de Janeiro, in favour of both

San Paulo and Minas Geraes. Sao Paulo almost caught up with RJ's per capita income. The fall of Rio de Janeiro's position within this region parallels the fall of the North-East's position at the country-level, both in terms of population and income. This was the region with highest share of slaves in 1872 and was probably the most severely damaged by abolition. In 1855, it was established by law that all slaves aged 60 and older were free. In 1871 the "Lei do Ventre Livre" established that all the children born from that point on were free. Finally, abolition took place in 1888.

**Table 6. Brazilian inequality by region and province, 1872 and 1920.**

	1872			1920		
	GE(0)	GE(1)	Gini	GE(0)	GE(1)	Gini
<b>Center -West</b>	<b>0,627</b>	<b>0,751</b>	<b>0,597</b>	<b>0,701</b>	<b>1,067</b>	<b>0,624</b>
36 Goyaz	0,595	0,772	0,577	0,727	1,109	0,628
38 Mato Grosso	0,422	0,532	0,504	0,606	0,934	0,577
<b>North</b>	<b>0,346</b>	<b>0,523</b>	<b>0,443</b>	<b>0,516</b>	<b>0,808</b>	<b>0,545</b>
32 Amazonas	0,215	0,255	0,361	0,291	0,489	0,373
40 Pará	0,376	0,580	0,459	0,612	0,956	0,581
51 Territorio do Acre				0,212	0,364	0,262
<b>North-East</b>	<b>0,351</b>	<b>0,433</b>	<b>0,460</b>	<b>0,637</b>	<b>1,027</b>	<b>0,595</b>
31 Alagoas	0,281	0,364	0,410	0,636	1,027	0,588
33 Bahía	0,266	0,320	0,404	0,610	0,989	0,580
34 Ceará	0,404	0,508	0,485	0,784	1,197	0,644
37 Maranhao	0,336	0,422	0,445	0,632	1,024	0,586
41 Parahyba	0,386	0,508	0,473	0,580	1,034	0,549
43 Pernambuco	0,309	0,464	0,426	0,623	1,014	0,581
44 Piahuy	0,409	0,469	0,487	0,709	1,073	0,620
45 Río Gde do Norte	0,420	0,523	0,495	0,566	0,962	0,549
50 Sergipe	0,398	0,551	0,477	0,640	0,974	0,596
<b>South</b>	<b>0,418</b>	<b>0,521</b>	<b>0,495</b>	<b>0,627</b>	<b>0,958</b>	<b>0,595</b>
42 Paraná	0,292	0,450	0,410	0,528	0,871	0,533
46 Río Gde do Sul	0,419	0,498	0,483	0,634	0,930	0,593
48 Santa Catarina	0,301	0,414	0,423	0,694	1,134	0,614
<b>South-East</b>	<b>0,745</b>	<b>1,546</b>	<b>0,640</b>	<b>0,617</b>	<b>0,891</b>	<b>0,593</b>
35 Espiritu Santo	0,362	0,479	0,466	0,507	0,932	0,513
39 Minas Gerais	0,433	0,619	0,502	0,632	1,037	0,583
47 Río de Janeiro	1,207	2,142	0,759	0,681	0,804	0,609
49 Sao Paulo	0,338	0,519	0,437	0,540	0,786	0,551
<b>Total</b>	<b>0,554</b>	<b>1,011</b>	<b>0,564</b>	<b>0,662</b>	<b>0,977</b>	<b>0,616</b>
<b>Within-region</b>	<b>0,513</b>	<b>0,971</b>		<b>0,623</b>	<b>0,939</b>	
<b>Within-province (state)</b>	<b>0,429</b>	<b>0,864</b>		<b>0,617</b>	<b>0,932</b>	
<b>Between-region</b>	<b>0,041</b>	<b>0,040</b>		<b>0,039</b>	<b>0,038</b>	
<b>Between-province (stat)</b>	<b>0,125</b>	<b>0,147</b>		<b>0,047</b>	<b>0,046</b>	

6. The Gini-coefficient increased from a high 0.56 to an even higher 0.62.
7. The dispersion of the Gini-coefficients of the different regions and provinces (states) is reduced from 1872 to 1920, mainly because the Gini increases in most of the regions with lower inequality in the earlier year.

8. The weight of between-region, and between-state, inequality is thus reduced. However, between-region inequality is not reduced in absolute terms, while between-state inequality is reduced in both relative and in absolute terms. That seems to indicate that the different regions became more homogeneous. Particularly interesting is the contribution of the state of Rio de Janeiro (together with the Distrito Federal in 1920), where economic retardation seems to have been followed by decreasing inequality.

## 5. Some interpretations

A privileged line of interpretation of changes in inequality during the First Globalization Boom has been the Heckscher-Ohlin-Samuelson approach, as applied to Latin America mainly by Jeffrey Williamson (see especially Williamson 2009). The basic idea behind this approach is that the transport revolution changed relative factor endowments and initiated a process of adaptation of prices to the new equilibrium. The abundant factors in a region tended to increase their prices relative to other factors. In land-abundant regions the rental-wage ratio increased, as well as inequality.

“The inequality-globalization connection in the nineteenth century can be summarized this way: globalization seems to have had an inegalitarian effect in (initially) land-abundant countries, a force raising inequality by rewarding landowners more than workers; and globalization seems to have had an egalitarian effect in (initially) land-scarce countries, especially in those that stuck with free trade and resisted pleas for protection.” (Lindert & Williamson, 2001; 13).

This basic approach may be complemented and modified, providing different outcomes.

One obvious complement is that these forces may produce different impacts according to the specific settings of actors and institutions in a region. The impact of these trends may be quite different in family-based farmer economies with access to well developed free labour markets, than in, say, a slave economy like the Brazil in 1872, or hacienda-dominated Chile in the 19<sup>th</sup> Century. Trends in land-labour ratios do not say anything about absolute inequality levels and social features of different societies.

Also, we can examine whether we can approach globalization forces as a once for all change in factor endowments and a subsequent adjustment to this new equilibrium. The best way to approach this is as a process in which technological change and economic growth produce waves of productivity growth, in turn altering transport and commodity prices. Two different outcomes may be noticed. First, globalization makes new factors of production available, and the increased supply causes the relative factor price to fall. That makes these new regions competitive in distant markets. Later on, the expansion of demand for these new factors may raise their relative prices. However, this is one time change, but rather a process of continuously counteracting forces. So, the expected outcome has to do with what the frontier looks like: how fast productivity grows in maritime transport, channel building, railroad expansion, engineering infrastructure, other terrestrial communication, etc. Obviously, the cost of introducing new amounts of factors of production (land) also depends on institutional contexts: the strength of the state, the strength of the elites, the interaction between colonizers and native populations, property rights, access to labour, control of commercial networks, etc. This point was recently made by Harley (2007).

“Influenced by an older literature, I tend to think about nineteenth-century globalisation in terms of expansion of an Atlantic economy into frontier peripheries from its north-western Europe core rather than a ‘regime switch to openness’. Of course, both elements were present, but a major part of globalisation was the expansion of the core into newly settled peripheries rather than a change in trading relationships between established economies. A key feature of the peripheries, which the Williamson lens

leaves out of focus, was that they originally lay beyond the frontier of organised economic activity and globalisation was about their incorporation. (...) Globalisation is seen as the evolution of the relationship of the European core with an expanding periphery – usually but not always in the Americas. (...) Integration of a frontier into the Atlantic economy involved the discovery of export staples, a process of learning how best to exploit them and the mobilisation of capital and labour for their exploitation.” (Harley, 2007; 240-241)

Recently, Shanahan & Wilson, (2007; 14) studied how globalization, combined with the expansion of the frontier, produced very different outcomes in different regions of Australia. While Victoria showed the expected increase in the rental-wage ratio, the land-abundant South Australia shows a decrease in this ratio. Emery, Inwood & Thille (2007) report a similar variety of outcomes in two Canadian regions.

Besides the impact of frontier expansion in purely economic terms, the institutional settings involved are crucial for the distributive outcome. Again, the Australian case sheds light on that point.

“Despite their superficial similarities in one factor input (land), other factors such as labour and capital, as well as differences in policies and governance, could, and did, influence the measured level of inequality. In South Australia, government legislation and technological invention appear to have combined to decrease land prices and lower inequality for 20 out of 50 years. These findings are important. They suggest that in the Australian case at least policy differences did affect the returns to factors and measured inequality. Such variation was the result of relative resource abundance, which governments could influence through policies that opened up land or assisted (hindered) migration. Ultimately, long-run resource flows still produced outcomes that saw returns to relatively abundant factors improve relative to scarce.” (Sanahan & Wilson, 2007; 18).

The point of the decisive role of institutions has been a classical one. Let’s only mention Adelman’s comparison between Argentina and Canada and the recent contributions on New Zealand and Uruguay (Álvarez, Bértola, Porcile 2007). More recently, García and Robinson (2009) made a similar point:

“... most countries in the Americas had an open frontier, how that frontier land was allocated differed a lot... Our hypothesis suggests that if political institutions were bad at the time of frontier settlement, the existence of such frontier land might actually lead to worse development outcomes, probably because it provides a resource which non-democratic political elites can use to cement themselves in power” (García & Robinson, 2009:17-18).

Another concern with this approach is the strong assumptions underlying it. The two most mentioned in the literature are the assumption of constant returns to scale and that technology is ubiquitously available. What are the implications of those assumptions in this case?

- If we assume that the same technology is available everywhere, we assume that, once markets move towards equilibrium growth rates, factor prices will tend to converge.
- Furthermore, if technology is freely available, then no changes in productivity growth and per capita income may arise from that aspect. As an outcome, factor allocation is transformed into the key-explanation of economic performance. Productivity growth and its determinants almost disappear from the scene and from the core of the analysis.
- It does not consider that economies of scale are especially important in transport networks and in frontier expansion, a central aspect of this process.
- Different social institutional and organisational patterns have long-lasting impacts on productivity growth and technical change. Moreover, they have an impact on the way the fruits of technological change are distributed, both within and between countries and regions.

What about the Brazilian case?

Brazil seems to show high structural inequality. The fact that inequality grew during the First Globalization Boom should not blur this basic fact. High inequality is not merely a high Gini-coefficient, it is the expression of a whole set of social relations. Inequality may go through different trends, but it seems that in the case of Brazil (and in the case of Chile as well –see Bértola & Rodríguez 2009) high inequality is persistent.

One big question is whether this social organization helps explain the pattern of slow growth during this period. The case of Río de Janeiro and the North-East, the core regions of the early colonial regime and of the slave society, may illustrate this idea. Figure 4 shows the existence of a negative correlation between the percentage of slaves in the active population in 1872 and the growth rate of GDP between 1872 and 1920. It is true that the province of Río de Janeiro looks like an outlier, but its weight is very high. Excluding Rio de Janeiro, the trend turns to be slightly positive.

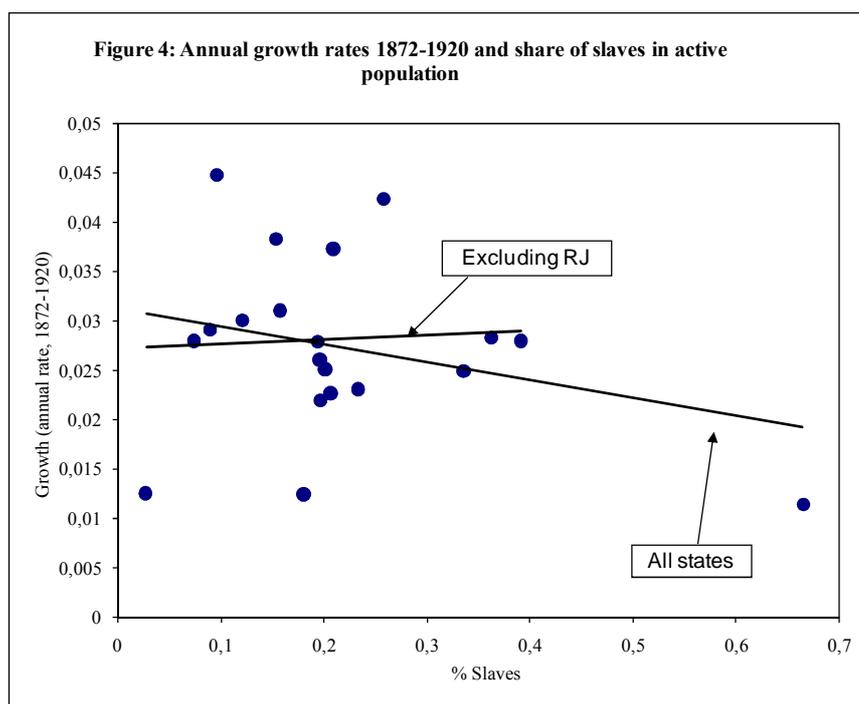


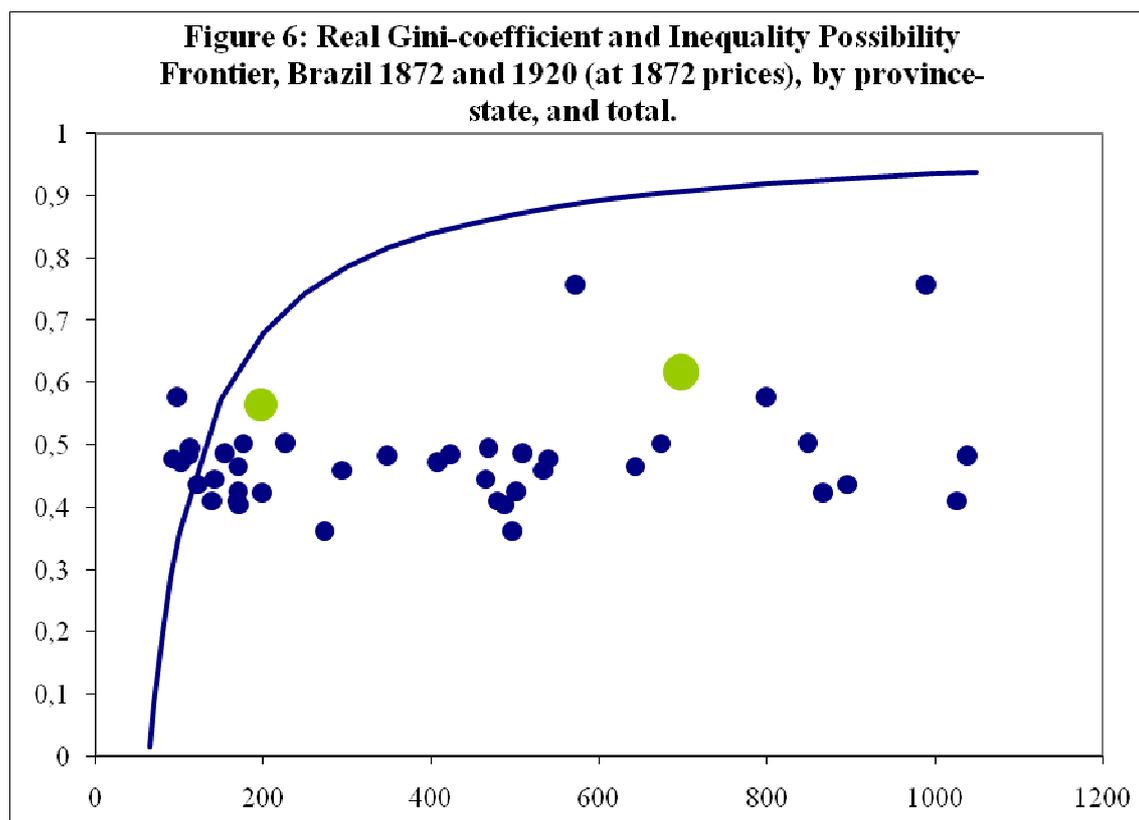
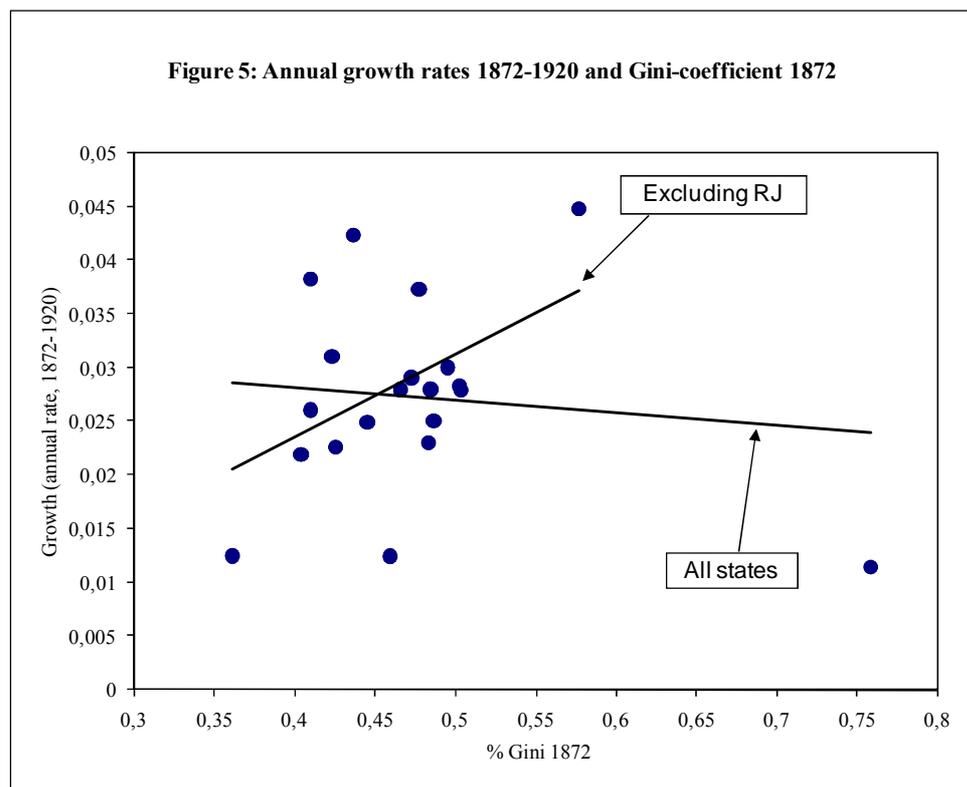
Figure 5 shows that there is no correlation between growth and inequality. Once again, Río de Janeiro is an outlier. Excluding it the correlation between inequality and growth is positive.

Classical economics sustained that capital formation necessary for growth implies an increase in inequality. The family of authors constituted by Kuznets, Lewis and Prebisch, from different points of view, considered that income growth at early stages might lead to increasing inequality, following a path similar to the LMW curve.

Inequality in Brazil was already high at an early stage. Further development raised inequality but not considerably. Figure 6 presents the data for provinces and states in 1872 and 1920 (at 1872 prices), respectively. At relatively low levels of income, real inequality is almost non-elastic to income, while the IPF shows a sort of high income-elasticity.

One possible shortcoming of the data is the lack of regional prices in order to estimate regional cost of living. An alternative explanation has to explore the changes in the social structures linked to the growth process and their distributional implications.

As mentioned before, Río de Janeiro is an interesting case. In our previous attempt to estimate Brazilian inequality, we performed an exercise based on the changes in incomes of a fixed 1872 structure of different occupations of the Province of Río de Janeiro, based on data from Lobbo (1976). The interesting result, shown in Figure 7, is that inequality fell during the last decades of the 19<sup>th</sup> Century.



This may be the result of different forces. The abolition of slavery may have had a negative impact on economic activity and specially damaged the sources of income of slave-owners and the elites of the slave society. This is reflected in the relative decadence of the State of Río de Janeiro. However, this falling trend in income inequality may also reflect the general retardation of the Brazilian economy during the last decades of the 19<sup>th</sup>

Century. In that case, Río de Janeiro may not be an exception, but represent the whole country.

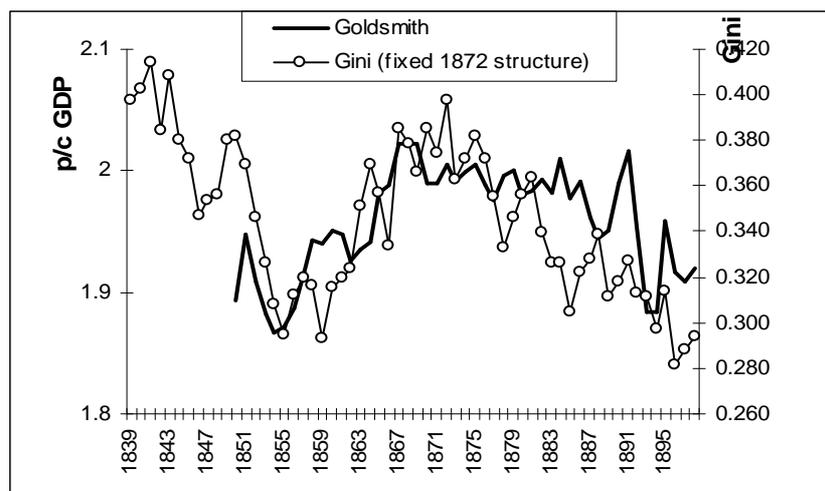
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**Figure 7. Brazilian real per capita GDP and income distribution (Gini) of a fixed 1872 occupational structure of Río de Janeiro, 1840-1898.**



## 6. Conclusions and research agenda

Between 1872 and 1920 the world economy grew at a fast pace with the industrialized economies performing very well. Some Latin American countries, like Argentina, Chile and Uruguay also did well, keeping pace with the most dynamic economies. Brazil did not. On the contrary, the Brazilian economy was stagnant until the turn of the century.

This process of divergence can hardly be explained in terms of factor allocation and relative factor price movements. A more profound analysis of social structures and economic, social and political institutions is needed. In other words, why, how and how much the industrialization process of core countries permeated to peripheral regions.

This is the central topic to explain.

In searching for different explanations, the study of inequality as a limit to growth has returned to the table. Did inequality hinder growth? What kind of inequality? What

are the causes of inequality? Was inequality an inevitable or even desirable outcome of modern growth, or was it a persistent feature of the Brazilian society.

This paper has tried to find some facts before announcing attractive theories. Unfortunately, our empirical contribution is still fragile. The construction of the data has been so labour demanding that our analytical strength is still to be demonstrated.

What we will now summarize are a few stylized facts and a short but attractive research agenda.

Our main findings are:

Brazilian inequality was high already by 1872. In spite of the existence of very important regional differences, within-region inequality was clearly dominant. Regional disparities were not negligible at all. Between-region inequality was important, and between-province inequality more so. An outstanding case is the province of Rio de Janeiro, with the highest per capita income and inequality levels, clearly above the rest.

By 1920 inequality had increased, mainly within each specific province (now state) and region. Between-region and between-state inequality did not add to total inequality as much as it did in 1872. Again, Rio de Janeiro was a special case, losing income and population shares and showing lower inequality levels. A similar pattern had occurred earlier in the North-East, the other centre of the colonial and slave society. The core of the Brazilian economy moved to the South-West from the coastal Mid-East.

The standard neoclassical approach has been very active, creative and a real leader in the interpretation of inequality trends during the First Globalization Boom. With this approach, changes in inequality are interpreted as the result of an intensive use of the abundant factors in a region, whose relative prices increase as the transportation revolution integrates the world economy.

While accepting that this mechanism may work, we have sustained that many other forces come into play as well. The transport revolution, a more comprehensive globalization process and the development of different institutional arrangements made the significant expansion of the frontier possible, provoking changes in factor endowments precisely in a direction contrary to the one predicted by the typical neoclassical interpretation. Thus, we expect to see a complex set of counteracting forces at not only the continental level, or between core and periphery (either poor or not), but also at the national, regional and provincial levels, between their corresponding centres and peripheries.

So far, we have considered the results of the action of pure market forces. But what about many other aspects of social organization, that we nowadays in a simplistic way call institutions? Can we expect similar processes of factor price convergence, when the frontier is extended on the basis of slave labour rather than in a farmer economy? Are the distributional consequences similar in regions facing the abolition of slavery than in regions dominated by free immigrants? Are the distributional consequences similar when the state develops a progressive land policy than when local elites are able to appropriate extended areas of land?

Nevertheless, not even the distributional outcomes of different institutional environments in the short-run are the decisive topic. What matters most is the relationship between these different institutional settings and distributional outcomes, and their effect on technical change and productivity growth. That topic has been completely off the agenda in favour of the study of factor price movements. This paper is no exception, since we haven't been able to do more than suggest some lines of research.

The March 2007 special number of the AEHR on factor price movements during the First Globalization Boom contains some articles with ideas similar to ours. Jeffrey Williamson, the leader of the leading paradigm, challenges the author of these papers: "However, a booming export price also induced land settlement, extended frontiers, and an upward drift in land-labour ratios. Further work by the authors of these AEHR papers might well try to assess these offsetting forces." (Williamson 2007: 206).

At the time he requests for more and better research, he seems to concede on some points.

“... globalisation did not precipitate an absolute factor price convergence within the periphery and between the poor periphery and the core. We need to understand the sources of productivity growth differentials to account for the latter...” (Williamson 2007: 206).

There is too much to be done. Our future research will try to tackle the following topics.

1. Our first task is to continue improving the 1920 database. We suspect our total income is overestimated when we expand some sectors surveyed to the total of the population.
2. A second line of research is to assess the importance of the expansion of the frontier. Both land/labour and rental/wage ratios are necessary at different levels: national, regional, provincial.
3. The selection of important case-studies is of special interest in order to compare the outcome of frontier expansion under different circumstances. Brazil is a continent-wide country. Nevertheless, comparisons with other Latin American countries may shed light on this. Similarly, the expansion of the frontier may have different impacts depending on the prevailing social structures and institutions in the local or regional core. The interaction between the expansion of Sao Paulo and Rio de Janeiro's relative decay, in a context of drastically changing social relations, is a topic of special interest. The main goal is to assess relations between patterns of frontier expansion and wealth and income distribution, and their impact on growth patterns of GDP and productivity.
4. The complex set linked to the Inequality Possibility Frontier deserves special attention: estimating adequate purchasing parity levels, assessing which is the real subsistence level income, and more detailed studies of the elite are necessary complements. Revision of GDP estimates deserves urgent attention, but was out of reach for our research team.
5. The commodity lottery has not been given special attention in this paper. However, some provinces, like Pará, went through drastic changes between expansive cycles and subsequent disasters, having a great impact on local as well as inter-province income levels. The study of movements in inequality in some special cases like those previously mentioned, may shed light on these special dynamics.

More homework can be added to this list. Considering that this paper is part of an attempt to incorporate several Latin American countries into a larger study, it seems like an ambitious list so far.

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