Exploring the distribution of income in Brazil, 1839-1939 *

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Simposio 11
"Crecimiento económico y distribución del ingreso y la riqueza en AL, siglos XIX y XX"

1er Congreso Latinoamericano de Historia Económica (CLADHE I)
Montevideo, 5-7 de diciembre 2007

Abstract
The paper makes an attempt to measure income inequality in Brazil between 1839 and 1939. Based on Census data on the occupational structure of the population in 1872 and 1920, different sources are used in order to assign income to different occupational groups and construct two benchmarks. Using available time series for income of a limited amount of occupational groups, an attempt is done to estimate the evolution of income inequality from 1839-1898. An alternative scenario is constructed giving place to structural change between 1872 and 1939.
Our benchmark estimates show Gini-coefficients which we consider lower than what could be expected. In spite of it, inequality in Brazil was by 1870 rather high. Nevertheless, the trend between 1839 and 1898 was one of declining inequality. For the second half of this century, for which we have acceptable GDP estimates, decreasing inequality goes hand in hand with economic retardation. This economic retardation affected mainly the income of the privileged sectors of a highly un-skilled society.

Keywords: income distribution, economic growth, economic structure, skill

* We are grateful to Zephyr Frank and Leonardo Monasterio for generous contributions with data on urban rents and voters, respectively, as well as to Javier Rodríguez Weber for excellent research assistance.

1. Introduction

The relation between economic growth and income distribution has returned to the research agenda of economists and economic historians in the last decade. This was probably the result of the fact that economic growth was not always followed by diminishing inequality and that economic growth was itself not as pervasive as it could be expected.

The Kuznets curve attracted the interest of many, as it could be a good explanation for why equality trends were that delayed. First, growth should be followed by increasing inequality; then, when some threshold was surpassed, inequality should start to decline. The other related and key question was 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 it uses to happen in the history of (economic) thought, ideas advance in circles, and the causality between income distribution and growth changed again: inequality became more a point of departure than an outcome of growth. The question became to be whether an unfair distribution of wealth and income was a restriction to economic growth. If that was the case, countries with originally high inequality should grow less than others, thus limiting the preconditions for a fast reduction of inequality, both within and between countries.

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

Much evidence points to the fact that income distribution in Latin America went through significant changes, especially when facing the first globalisation boom and the later inward-looking growth: O'Rourke & Williamson (1999); Williamson (1999); Bértola (2005); Bértola & Williamson (2006). However, the sources of information are really scarce and there exist only a few antecedents of studies on income distribution on a quantitative basis for the countries of Latin America. Thus, our research tries to fill that gap with estimates for a group of Latin American countries since the 1870s: Argentina, Brasil, Chile, México and Uruguay.

In this paper we present some results on the Brazilian case. The paper is empirical to a high extent. It aims to share with the readers the first results of some empirical estimates of Brazilian income distribution around the years of 1872 and 1920 and the construction of some time series. The main purpose by now is to provoke criticisms and encourage recommendations of new data sources and methodological procedures.

Changes in income distribution are the result of many simultaneous and contradictory forces. For instance, changes in the productive structure by sectors, changes in skill and productivity, regional disparities. We will not be able to capture them all for the moment.

In spite of that, the results are so far encouraging and interesting. We have not been able to discuss the relation between income inequality and the potential for economic growth. However, the Brazilian case may be taken as an example of the impossibility to generalize the case of the European countries and the USA, which were stylized by Kuznets as the inverted "u" curve. Brazil shows relatively high inequality by the early 19th

Century and a pattern of slow growth and even retardation towards the end of the Century. A paradoxical case is shown here: a decadent, agrarian, low-skilled slave society with traditional manufacturing and services, show a downward trend in income inequality, due to the decreasing income of the elites linked to the slave-economy. By the turn of the Century, a period of economic growth with increasing inequality seems to have taken place. Brazil went through a fast economic growth during most part of the 20th Century and succeeded in reducing the per capita GDP gap with world leaders. However, the gap remains too wide and inequality among the highest in the world, why it makes not sense talking about a success story. The Brazilian case is better suited for an approach that emphasizes the role of wealth and income distribution, as constraints to economic growth, in line with a deep-rooted tradition of Latin American studies and in line with more recent contributions as those of Engerman & Sokoloff (1997), Acemoglu, Johnson & Robinson (2005), World Bank (2004).

In Section 2 we present basic data on Brazilian national, regional and sectoral income 1850-1940. Section 3 presents a picture of income distribution in 1872, based on the occupational structure of the population according to Census data, and a wide variety of income sources. Section 4 presents an estimate of income inequality for 1839-1898, based on a fixed 1872-year occupational structure and using a data base for wages and other forms of income mainly of the state of Rio de Janeiro. It also discusses the possible impact of structural change on income distribution 1872-1939. Section 5 presents a preliminary estimate of inequality in the year 1920. We finally conclude with our main findings and the agenda for future research.

2. Brazilian domestic and regional income, 1850-1930

According to Census data the Brazilian population slightly surpassed the amount of 10 million inhabitants by 1872. Population grew four-fold from that time to 1940.

Following Goldsmith's figures (Table 4), it's possible to notice the significant changes occurred in the regional composition of per capita income in Brazil, 1870-1940.

By 1872, the bulk of the population was concentrated in the poor North-East and the relatively rich Centre and South-East (CSE), around the triangle composed by the cities of Río de Janeiro, Sao Paulo and Bello Horizonte. The only significant shift was the 7 percentage-points increase of the South, at the expense of a less dynamic North-East.

The picture is clearly different when we consider the regional distribution of income: the Centre, South-East and South concentrated ¾ of total GDP by 1872, and this percentage tended to increase due to the expansion of the South during the first decades of the 20th Century. The South increased from a marginal position to 15% of national income. Regional per capita income thus showed great differences: by 1872 the CSE regions had an average income of almost four times all the others. By 1900 these differences had increased, with the exception of the scarcely populated North, which experienced an ephemeral growth momentum. On the contrary, in 1900-1940 regional differences decreased, being the exception, once again, the declining North.

The Centre-South-East and South regions showed important differences between them. The great expansion of San Paulo in the early 20th Century is well known: in 1900, this state concentrated 31 and 11 % of total exports and imports, respectively; but in 1925 these figures increased to 55 and 38% (Cano, 1983: Table 33). According to Goldsmith, the state of San Paulo produced 3.2% of added value in 1872, but 31% in 1939. In the same period, the state of Rio de Janeiro reduced its share from 68 to 21% (Goldsmith, 1983, Table I.8).

Brazilian per capita GDP grew relatively fast between the mid-1850s and 1870 according to Goldsmith; Maddison shows a picture of stagnation. For 1870-1940, Goldsmith's figures show a 0.9% annual per capita income growth. These figures are rather similar to those of Maddison (Table 3). Nevertheless, both estimates differ significantly with respect to what happened between those two years: while Maddison

shows a stable growth rate of GDP of 1.8% a year in the 19th Century, Goldsmith shows a lower GDP growth rate of 1.2% a year in 1872-1900. As population figures are similar, Goldsmith concludes that per capita GDP growth decreased at a yearly rate of 0.9% a year during these three decades, while Maddison's retardation was lower: -0.2% a year. On the contrary, it's obvious that Goldsmith gets a faster growth rate in 1900-1940 than Maddison.

Brazilian economic performance in the first part of the 19th Century has been object of some revisions, which pointed towards a higher economic dynamism (Frank 2006) than the one traditionally assumed. Following Goldsmith, this feature may be extended to the 1860s. Nevertheless, the last decades of the 19th Century are featured by a weak economic performance.

By 1870, when the expansive cycle reached its peak, Brazilian per capita GDP was, according to Maddison (Table 5), somewhat lower than world average, about ¼ of world leaders, about ½ of Argentina, about ¾ of Portugal, about 1½ of China, India and the African average. Thus, Brazil was very far from the high-income group, but also somewhat distant from the less developed regions of the world.

Table 1. Population, GDP and per capita GDP of Brazil 1872-1940 according to Goldsmith

	North	North-East	South-East +Centre	South	Total
	Population (1000)				
1872	346	4746	4339	742	10162
1900	719	6958	8451	1852	17980
1940	1485	14434	19630	5732	41240
	GDP at current prices (1000 mil-reis)				
1872	16940	296450	860310	36300	1210000
1900	246240	615600	3570480	127680	4560000
1940	1386320	8904440	34817960	8157960	53320000
	Per capita GDP at current prices (mil-reis)				
1872	49	62	198	49	119
1900	342	88	423	69	254
1940	934	617	1774	1423	1293

Own estimates based on Goldsmith, R.W. (1986)

Table 2. Population and GDP shares by region and regional relative per capita GDP, Brazil 1872-1940

	North	North-East	South-East +Centre	South	Total
	Population (%)				
1872	3	47	43	7	100
1900	4	39	47	10	100
1940	4	35	48	14	100
	GDP (%)				
1872	1	25	71	3	100
1900	5	14	78	3	100
1940	3	17	65	15	100
	Relative per capita GDP (%)				
1872	41	52	167	41	100
1900	135	35	167	27	100
1940	72	48	137	110	100

Own estimates based on Goldsmith, R.W. (1986)

Table 3. Population, real GDP and real per capita GDP of Brazil 1820-1940 according to Maddison (1990 Gheary-Khamis dollars)

	1820	1850	1872	1880	1890	1900	1910	1920	1930	1940
Population (1000)	4507	7234	10167	11794	14199	17984	22216	27404	33568	41114
GDP (millions)	2912	4959	7327	8871	11267	12201	17078	26393	35187	51381
GDP per capita	646	686	721	752	794	678	769	963	1048	1250

Maddison, A., (2003)

Table 4. Growth Rates of population, real GDP and real per capita GDP of Brazil 1820-1940

	Goldsmith			Maddison		
	Population	GDP	Per Capita GDP	Population	GDP	Per Capita GDP
1820-1850				1.6	1.8	0.2
1850-1872	1.6	2.7	1.2	1.6	1.8	0.2
1872-1900	2,1	1,2	-0,9	2.1	1.8	-0.2
1900-1930	2.1	4.4	2.3	2.1	3.6	1.5
1900-1940	2,1	4,4	2,2	2.1	3.7	1.5
1872-1940	2.1	3.0	0.9	2.1	2.9	0.8

Table 5. Per Capita GDP 1870: (1990 International Geary-Khamis dollars)

Australia	3,273	**World Average**	**875**
United Kingdom	3,190	South Africa	858
United States	2,445	**Brazil**	**713**
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

3. Brazilian distribution of income, 1872

According to the 1872 Census (Appendix Table 1) about 6 million people had some profession and could thus be considered to be the active population. The difference between total "active" population and the grand total may be at a large extent explained by children (below 14 years old), housewives and retired people. It's highly possible that wage-earners without specific occupation constitute a share of this residual. Besides, child-work was very common already by those days. Thus, this figure of some 6 million people may be somewhat underestimated. In spite of that, and due to the fact that no clear assumptions may be done, we will work with the 6,065 million population in order to estimate income distribution in 1872.

A detailed presentation of our procedure in order to build the database, together with the table containing the different income categories, the number of people, the condition of this people (slave or free), the sectoral distribution (primary, secondary and tertiary), the skill composition (low, medium, high) and the gender composition are contained in an special file that may be obtained from the authors on request. Table 6 summarises our results.

A first consideration to be done has to do with total estimated income. While Raymond Goldsmith obtains a GDP of 1,200 million mil-réis, our estimate amounts to 1,887 millions. Methodological reasons may explain this difference. Goldsmith's estimates are based on four monetary aggregates at current prices (imports plus exports, wages, government expenditures and monetary stock). In our case, as we have assigned incomes to the whole "active population", it's possible that we have obtained an almost

exhaustive coverage. Given the different methodology, the differences may be reasonable. Further research will surely shed more light on this subject.

Table 6. Inequality measures, total and by Condition, Skill and Sector, 1872

	Pop. share	Income share	GE(0)	GE(1)	Gini	Mean (mil-réis)
Total	1.000	1.000	0.271	0.374	0.398	312
Condition						
Free	0.824	0.893	0.221	0.329	0.359	357
Slave	0.176	0.107	0.000	0.000	0.000	100
Within			0.182	0.310		
Between			0.088	0.064		
Skill						
low	0.830	0.617	0.119	0.116	0.269	232
medium	0.147	0.233	0.197	0.206	0.330	496
high	0.024	0.149	0.402	0.361	0.451	1960
Within			0.137	0.174		
Between			0.133	0.200		
Sector						
primary	0.589	0.523	0.231	0.329	0.362	277
secondary	0.144	0.198	0.276	0.409	0.375	429
tertiary	0.267	0.279	0.309	0.386	0.428	325
Within			0.258	0.361		
Between			0.012	0.013		

In spite of the efforts to collect income of different groups, the Gini coefficient obtained seems to be somewhat low. One could expect the Brazilian society to be more unequal than what a Gini of 0.398 is suggesting. There are at least three kinds of explanation for that:

1. The data available, as it still happens even nowadays, doesn't cover adequately the income of the wealthy classes. The sources used to estimate their income are based on the declaration of income of the citizens who want to be voters. These declarations may be partly underestimating the income of the richest. The income of the top income groups is a matter of increasing interest, as shown by the papers to be presented by Leigh & van der Eng and Roine and Waldenström in this same session. The declaration of income may partly be overestimating the income of the low and middle classes. Nevertheless, a lower income of the middle-income groups should probably reduce the Gini, instead of increasing it.
2. The second line of interpretation may be that inequality could really be low due to the predominance of low income groups. As it is commonly argued, agrarian societies at low levels of per capita income may show low inequality. If we look at Figure 1, were the Lorenz curve is reproduced, we can see the small differences in income which prevailed between at least the first five deciles. We don't believe this line of interpretation is right: i) most of the literature considers the Brazilian slave-society to be a very unequal one from the early colonial time; ii) as shown in Table 5, Brazil had already reached per capita income levels considerably above those of other less-developed regions; iii) if these low figures are correct, an important increase of the Gini must have taken place between the 1870s and the 1940s. As we cannot find a considerable increase in inequality in the late 19th Century (see next sections), all the increase should be delayed til the beginning of the 20th Century, something difficult to accept.

3. It's difficult to assign income to slaves. The income of slaves was estimated according to the cost of feeding slaves in mining companies in Minas Gerais (Libby), plus a similar amount in order to cover expenses for clothing and housing. This cost amounts to 100 mil-réis a year, but Libby argues that clothing was probably included in the alimentary budget. So we have probably overestimated their income. On the other side, slaves were already, by that time, working extra for additional monetary income, which we are not able to compute. On the other side, many slave-owners were not assigned any income representing additional "purchasing power" derived from services obtained from slave labour. 30-40 percent of all households owned slaves (Frank, 2005: 226).

Summing up, the downward bias of income inequality measures may be important. There are many ways in which future research may provide a higher Gini coefficient.

Table 6 also shows interesting results concerning between- and within-group inequality, according to different criteria:

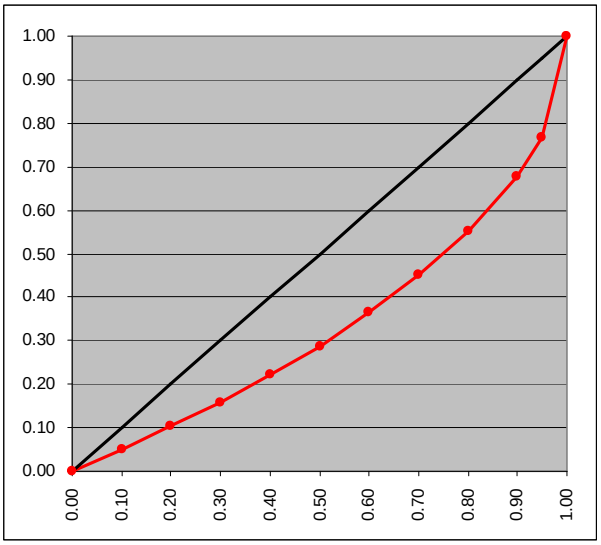
Condition. As all slaves were assigned the same income, no inequality was assumed to exist among them. Thus, all within-group inequality is concentrated among free people. Nevertheless, it is interesting to see that inequality among free people is higher than inequality between free and slave. Of course, no other than income considerations are made here. Hence, the low per capita income of wide sectors of the Brazilian society and the predominance of free labour pushes inequality down.

Skill. This information has to be taken with care. In many cases skill is easy to define according to the profession. In other cases, owners for instance, skill was simply assumed to increase with income. This assumption is controversial, but finds support in the data. For instance, among 3236 voters of the state of San Paulo, 38% were illiterate and their income was on average 27% of that of the literate voters (Klein, 1995). With this in mind, we can preliminarily conclude that the Brazilian society was overwhelmingly a low skilled society (83% of population according to our estimates; according to Census data 84% of the population was illiterate), while high-skilled people were no more than 2.4%. Inequality tends to increase within each skill group, as average income increases. Inequality between and within skill-groups is fairly distributed.

Sector. All inequality measures show that inequality is lower in the agrarian sector than elsewhere. Besides, this sector is about 60% of total population. This is in line with previous arguments about the correlation between low per capita income, low structural change (scarce industrialization) and low inequality, which, besides, resembles the starting point of the Kuznetsian inverted U-curve. On the contrary, different inequality measures show conflicting results regarding inequality in the secondary and tertiary sectors. The Gini and the GE(0) show the tertiary sector as the more unequal, while the GE (1) index shows the secondary sector as the more unequal.

In short. The picture we get is that of an agrarian society dominated by low-skilled people and a small high-skilled group, with rather low income on average, were the high-income group is still small and where the service sector concentrates most of the skilled people. Within the tertiary sector, the State and the armed forces constitute a part of the elite. This picture is still under construction.

Figure 1. The Lorenz Curve, Brazil 1872



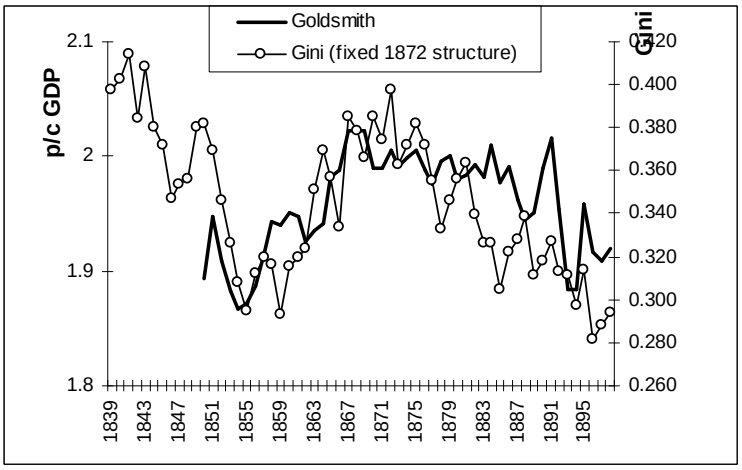
4. Brazilian Income Distribution 1839-1898: a fixed structure of a limited sample

In this section we try to approach income distribution in Brazil in 1839-1898 in a so far rather limited way, as we:

- depart from the structure of the active population by profession according to the 1872-year census; we have so long not been able to introduce any change in that occupational structure of population;
- use income data mainly for the city of Rio de Janeiro, based mainly on official information collected by Lobo (1978);
- most of the complementary information used is for the city of Rio de Janeiro or other regions of the "rich" central or South-Eastern region;
- data is only available for some income groups, why the structure differs somewhat from the total estimate for the year 1872.

The results are presented in Appendix Table 2. Figure 2 plots de Gini obtained, together with the Goldsmith per capita income. Both curves seem to follow a similar trend, pointing to a dynamic of increasing inequality as the economy grows. In what follows, we will try to identify the underlying forces of this trend.

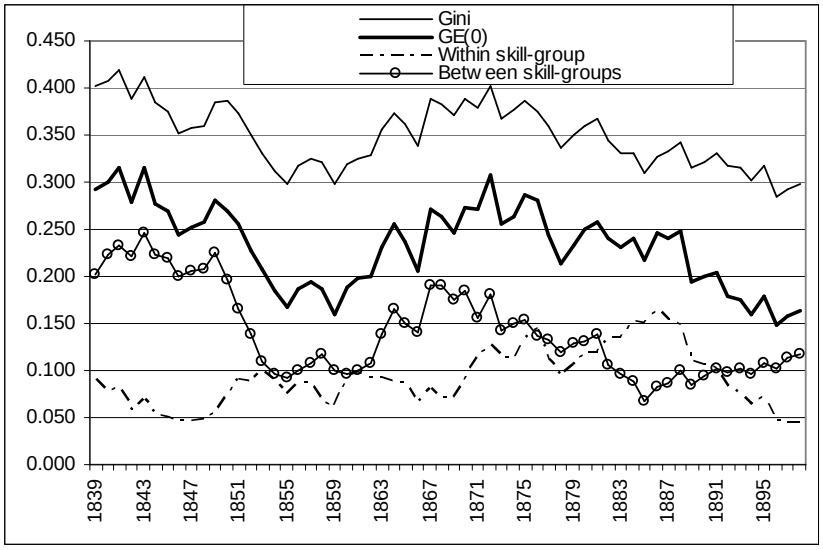
Figure 2. Per capita GDP (1910=log 100) and income distribution (Gini) within a fixed sample of the 1872 occupational structure, Brazil 1839-1898



Skill

Figure 3 shows inequality trends according to skill. Until the 1880s fluctuations in total inequality are mainly explained by differences between skill-groups. One possible explanation is that the income of the high-skilled group is the one that fluctuates more, while the low-income group's income remains near subsistence levels, thus fluctuating less. We have to keep in mind that we mainly register the income of the state of Rio de Janeiro, decadent since the 1870s. A possible explanation is that the income of the skilled population was highly sensitive to changes in aggregated per capita income. In the long-run, the declining inequality trend may be associated to the decadence of the traditional elite of a slave society. The new modern sectors around San Paulo still were relatively small in order to have a huge impact on the rest of the economy. Besides, our sample is not able to capture it. The income share of the high-skilled groups fell from 22% in the late 1860s to 15% in the 1890s (see Appendix Table 2). With respect to within-group inequality, it showed and increasing trend since the 1870s until the abolition of slavery. Since then, income differences among the unskilled population may have diminished.

Figure 3. Inequality in Brazil 1839-98: total, between- and within-group according to skill



Sectoral approach

Figure 4 shows sectoral inequality trends. As different from the skill approach, the sectoral approach shows, that income differences arise mainly from within the sectors, while between-sector inequality is relatively low. Figure 5 shows the Gini-coefficient by economic sector. The small secondary sector shows inequality levels similar to those of the primary sector. The service-sector is clearly the most unequal. It seems that the over-all inquality trend follows the trend of the tertiary sector. Thus, between-group inequality fluctuates in accordance to the fluctuations of that sector. The abolition of svalery had an important impact on the primary and secondary sectors. The 1890s constitute an odd period, featured by several significant institutional changes: the abolition of slavery in 1888, the definitive departure of Pedro II to France, the establishment of the so-called Old Republic (*República Velha*) and the starting point of a long-lasting inflationary process. In 1889-1899, the Domestic Price Index increased annually by 8.6%, while wages in Rio de Janeiro did it on average by 5.8%. In this context, the Brazilian economy was declining. In previous estimates inequality seemed to change the trend and started to grow. Nevertheless, our more accurate estimate of the income of the slaves and our estimates of their income since in the 1890s points now towards a continued decreasing inequality.

Figure 4. Inequality in Brazil 1839-98: total, between- and within-group according to sector

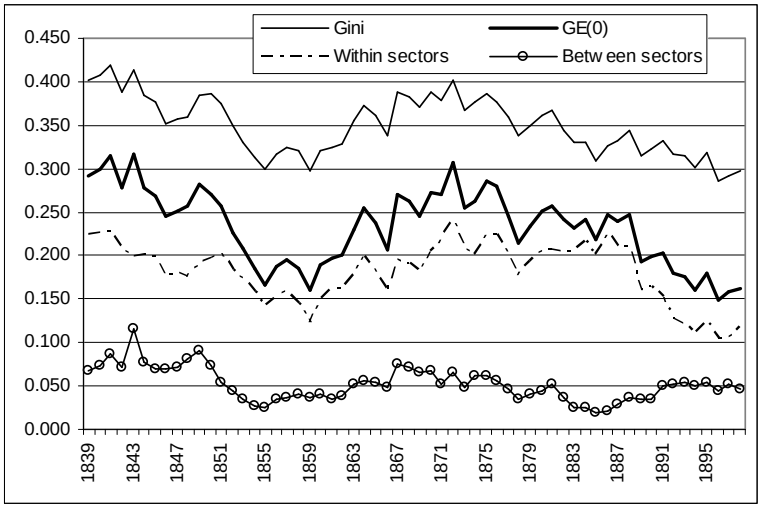
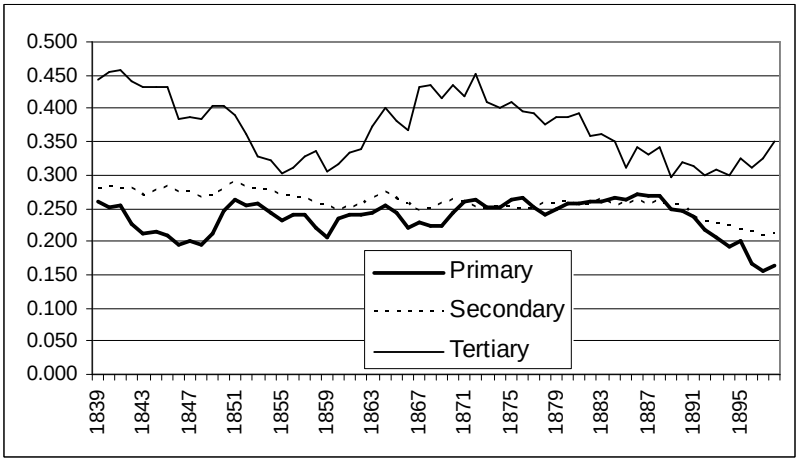


Figure 5. Gini-coefficient by economic sector, Brazil 1839-98



The previous estimate was not able to capture the changing productive structure of the Brazilian economy. As shown in Table 7, and according to Goldsmith, Brazil went through an important structural change. During the end of the 19th Century, in a context of falling per capita GDP, both agriculture and industry reduced their shares in GDP in favour of the tertiary sector. The changes were not dramatic. Indeed, when we introduce sectoral weights in order to estimate the Gini-coefficients, no important changes are obtained in relation to our original estimate (see Table 7).

Table 7. Income distribution in Brazil 1872-1939: sectoral weights according to Goldsmith; 1872 sectoral income distribution

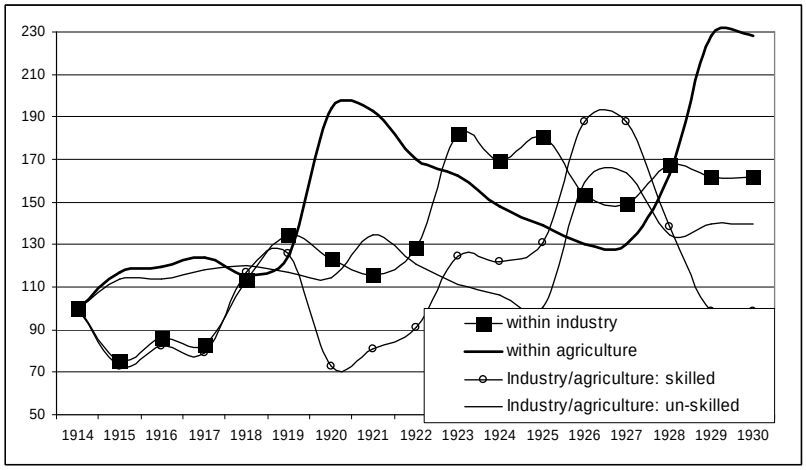
	Income share			Gini	
Year	Primary	Secondary	Tertiary	Fixed structure.	Changing structure
1872	0.523	0.198	0.279	0.402	0.402
1889	0.566	0.120	0.314	0.316	0.339
1900	0.492	0.149	0.359	0.298	0.305
1913	0.415	0.178	0.407		0.318
1920	0.413	0.201	0.386		0.314
1929	0.378	0.200	0.422		0.323
1939	0.327	0.247	0.426		0.327

During the first decades of the 20th Century, trends did change. Per capita GDP started to grow, as well as the share of the industrial sector. The tertiary sector continued growing. Agriculture was the only looser.

The possible impact on income distribution of this structural change is also shown in Table 7. We obtain an increasing inequality trend since the end of the 19th Century. If that is true, it may be concluded that we still have a similar pattern as during the 19th Century, in which growth and inequality move in the same direction.

However, the assumption of constant sectoral inequality figures is hardly sustainable. While work on that period is in progress, Figure 6 gives a clue on intra-industrial, intra-agrarian and agri-industrial wage ratios. In all cases the trend points towards an increasing inequality between skill-groups and between manufactures and agriculture. In addition to the increasing inequality within the State of San Paulo, many sources point towards an increased regional differentiation of income. As a result of these different forces, a significant increase in income inequality is to be expected during the first decades of the 20th Century. In that confirms to be true, it should resemble the first phase of the Kuznetsian inverse u-curve.

Figure 6. Inequality smoothed trends among wage-earners in Sao Paulo, 1914-1930



Based on Cano, W. (1993), Table 51.

5. Brazilian Distribution of Income, 1920

The 1920 Census contains information about output value and quantity of different agricultural and industrial activities, and employment and wages for major professional occupations. Data on wages is restricted to manufacturing and agricultural occupations.

For the manufacturing sector, data was collected at the establishment level. Wage-earners are reported according to income range, gender and major industrial branches. For agriculture, wage data for 22 specific agricultural occupations was collected by municipal administrations. Only for unskilled labour (*trabalhadores da enxada*) the information distinguishes age and gender. Usually, the skill of workers in agriculture presents a minor range of variation than in manufacturing. For several occupations (transport, internal trade, private administration, liberal professions and servants) data from the city of Rio de Janeiro contained in Lobo (1979) was used. For civil servants we consider two categories -administration and security forces– at three different levels: federal, state and local.

Our procedure was similar as for the year 1872. As the Census data is worse than that of 1872 (the data is mainly aggregated around sectors of activity than around skill or income categories), we had lots of work to do in order to identify different income groups. We mobilised a wide variety of sources in order to identify different income groups within

every sector of activity. The detailed procedure can be obtained from the authors on request. The results are summarised in Table 8.

Table 8. Inequality measures, total and by Skill and Sector, 1920

	Pop. share	Income share	GE(0)	GE(1)	Gini
Total	1.000	1.000	0.166	0.234	0.311
Skill					
low	0.699	0.480	0.033	0.037	0.132
medium	0.242	0.336	0.059	0.067	0.171
high	0.059	0.184	0.228	0.304	0.367
Within			0.051	0.096	
Between			0.116	0.138	
Sector					
primary	0.385	0.365	0.049	0.047	0.161
secondary	0.071	0.120	0.142	0.130	0.284
tertiary	0.544	0.515	0.228	0.361	0.344
Within			0.153	0.219	
Between			0.013	0.015	

All in all, and due to similar arguments posed in relation to 1872, and exacerbated in this case due to the structure of the Census, the Gini obtained is clearly too low. One further explanation for that is that we have so long worked at an aggregated national level and have not been able to introduce regional differences. In spite of that, the total estimated income amounts to 89% of the one estimated by Goldsmith for 1920. There is too much work to do in order to get an acceptable figure.

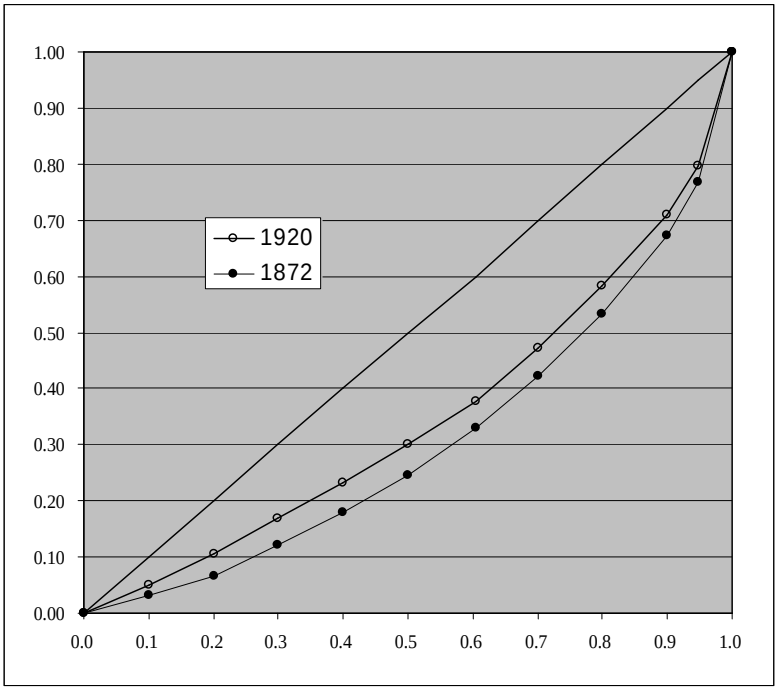
In spite of that, the results allow us to study some features of the income structure of the groups represented in the database.

In terms of skill, the population is still overwhelmingly un-skilled (70% according to our estimate and 76% illiterate according to the Census data). As in 1872, differences in income are mainly dependent on differences between skill-groups. Within-group inequality increases as average income grows.

The agrarian sector looks now less unequal than before. This probably reflects different coverage of the top incomes, but it also may be the result of the abolition of slavery. The sample covers the manufacturing sector badly, as it represents only 7% of the population and 12% of total income in our sample (but 20% according to Goldsmith). On the contrary, the tertiary sector is somewhat over-represented and shows the highest inequality figures. All in all, inequality, as different from skill, is higher within the sectors while inequality between sectors plays a minor role.

No clear conclusions can otherwise be drawn from this photograph unless more coverage is achieved. Figure 7 plots the Lorenz curve, compared to that of 1872. Differences between both arise in the three lower deciles (higher share in 1920) and on the two top ones (lower shares). We are not yet in a position to draw any clear conclusions about this comparison.

Figure 7. The Lorenz Curve, Brazil 1872 and 1920



6. Concluding remarks and research agenda

The paper advances some preliminary results of a research project, which is still going on. Exchange with colleagues is leading to new data sources on professions, regions and different periods, which already allow to us to improve the estimates shown in this paper.

So long we can report the following preliminary conclusions:

- A Gini coefficient of 0,4 in 1872 is already a high inequality figure for a country at low levels of per capita income, as that of Brazil by that time. Our guess is that further research may lead to an even higher value of the Gini.
- No huge between-sector inequality may be found. Inequality was mainly intra-sectoral. Thus, the Kuznetsian assumption of inequality being low in the agrarian sector at the outcome should be rejected. This may be a feature of a slave-society, as different from the development in Western Europe and the USA.
- The Brazilian society was a low-skilled one. Even within the low skilled sector, income inequality was important: between- and within-sector inequality was similar by 1872.
- A preliminary estimate of inequality trends, on the basis of a fixed 1872 occupational structure for 1839-1898 and with information of a sample for different occupations, shows important fluctuations, but a clear declining trend. Compared to per capita GDP data, a strong co-evolution may be noticed: when per capita income grows, so does inequality; and the other way round. The late 19th Centruy is featured by declining per capita GDP, giving the idea of a decadent traditional slave-society, in which the income of the elites and of the middle-income sectors were highly elastic to aggregate income.
- Given the fact that no huge differences in sectoral inequality were found, the exercise of re-weighting the different sectors according to sectoral GDP data, does not result in dramatic changes in inequality trends, compared to the results of our estimate with a fixed occupational structure.
- On the contrary, and for the period 1898-1939, by keeping sectoral Ginis unchanged and giving place to structural change, income inequality shows a slowly rising trend.

Complementary information for 1914-1930, however, points to the fact that inequality rose more intensively in the State of Sao Paulo: within industry, within agriculture, between agriculture and industry, and between skill-groups.

- As for the year 1920, and due to the quality of the Census data, the Gini obtained is quite low. The results show wealthier lower income-groups than in 1872 and less wealthy high-income groups. It's still a low-skilled society with a now lower inequality in the agrarian sector, than in the other two.

Our main tasks for future research are:

- To better explore sources for the 1872 and 1920 benchmarks with special consideration to regional variations (the North-East) and the top-income groups. Many sources are already identified. Another benchmark estimate for 1900 is also within reach.
- To construct benchmark-estimates for regional occupational structures between 1872 and 1940, as well as a benchmark estimate for 1820.
- To improve the income series with more fitted estimates, more occupations and to produce new estimates taking into account regional and structural (sectoral) change.

Once obtained these new estimates, we will come back to the substantial discussion about income inequality and growth. We will also be able to relate Brazilian income per capita and income distribution within a regional and international framework. Of special interest is to advance in similar studies, already on their way, for other Latin American countries.

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Appendix Table 1. Professions (in Portuguese) according to the 1872 Brazilian Census

			Libres			Esclavos			Total
			Homens	Mulheres	Sub-total	Homens	Mulheres	Sub-total	Suma
Religiosos	Seculares		2649	0	2649	0	0	0	2649
	Regulares	Homens	121	0	121	0	0	0	121
		Mulheres	0	295	295	0	0	0	295
Juristas	Juízes		813	0	813	0	0	0	813
	Advogados		2016	0	2016	0	0	0	2016
	Notários e Escrivães		1728	0	1728	0	0	0	1728
	Procuradores		1447	0	1447	0	0	0	1447
	Oficiais de Justiça		1760	0	1760	0	0	0	1760
Médicos			1948	0	1948	0	0	0	1948
Cirurgiões			238	0	238	0	0	0	238
Farmacêuticos			1712	1	1713	0	0	0	1713
Parteiros			75	1854	1929	0	8	8	1937
Professores e Homens de Letras			5,793	2393	8186	1	0	1	8187
Empregados Públicos			12651	3	12654	0	0	0	12654
Artistas			39650	3496	43146	1662	305	1967	45113
Militares			27230	0	27230	0	0	0	27230
Marítimos			21529	0	21529	2139	0	2139	23668
Pescadores			20451	49	20500	1387	0	1387	21887
Capitalistas e Proprietários			28,271	9220	37491	0	0	0	37491
Manufatureiros e Fabricantes			16,406	4778	21184	77	3	80	21264
Comerciantes, Guarda-Livros e Caixeiros			129,483	9373	138856	1	0	1	138857
Costureiras			204	459600	459804	1	49542	49543	509347
Operários	Canteiros, Calceteiros e Mineiros		9423	1466	10889	2412	322	2734	13623
	Em Metais		26713	1536	28249	3255	37	3292	31541
	Em Madeiras		49628	6	49634	8094	22	8116	57750
	Em tecidos		9631	117706	127337	1510	10082	11592	138929
	Em Edificações		22444	85	22529	5446	0	5446	27975
	Em Couros e Peles		7231	12	7243	796	3	799	8042
	Em Tinturaria		324	143	467	32	6	38	505
	De Vestuários		20275	328	20603	1952	76	2028	22631
	De Chapéus		1487	249	1736	175	50	225	1961
	De Calçado		23837	324	24161	2989	2	2991	27152
Lavradores			1619033	646768	2265801	373671	203910	577581	2843382
Criadores			91725	13163	104888	17	83	100	104988
Criados e Jornaleiros			359035	76708	435743	95449	45713	141162	576905
Serviço Doméstico			160727	903982	1064709	96092	186960	283052	1347761
Sem			1593699	1840003	3433702	206452	207609	414061	3847763
Soma no Censo			4311387	4093541	8404928	803610	704733	1508343	9913271
Soma con Profissão			2717688	2253538	4971226	597158	497124	1094282	6065508

Appendix Table 2. Income distribution in Brazil, 1839-1998 (fixed 1872-year occupational structure).

	Total			Condition														
				Free					Slave (free since 1889)					Within		Between	
Year	Gini	GE (0)	GE (1)	Gini	GE (0)	GE (1)	Pop share	Inc share	Gini	GE (0)	GE (1)	Pop share	Inc share	GE (0)	GE (1)	GE (0)	GE (1)
1839	0.401	0.292	0.431	0.363	0.248	0.390	0.819	0.941	0.000	0.000	0.000	0.181	0.059	0.203	0.367	0.089	0.065
1840	0.407	0.299	0.463	0.382	0.274	0.436	0.819	0.934	0.000	0.000	0.000	0.181	0.066	0.224	0.407	0.075	0.056
1841	0.419	0.315	0.480	0.395	0.290	0.451	0.819	0.935	0.000	0.000	0.000	0.181	0.065	0.237	0.422	0.078	0.058
1842	0.389	0.278	0.449	0.387	0.281	0.448	0.819	0.917	0.000	0.000	0.000	0.181	0.083	0.230	0.410	0.048	0.039
1843	0.412	0.316	0.488	0.424	0.331	0.495	0.819	0.913	0.000	0.000	0.000	0.181	0.087	0.271	0.452	0.045	0.036
1844	0.385	0.278	0.452	0.396	0.292	0.462	0.819	0.908	0.000	0.000	0.000	0.181	0.092	0.239	0.420	0.039	0.032
1845	0.376	0.269	0.447	0.391	0.287	0.462	0.819	0.904	0.000	0.000	0.000	0.181	0.096	0.235	0.418	0.035	0.029
1846	0.352	0.245	0.412	0.384	0.277	0.448	0.819	0.884	0.000	0.000	0.000	0.181	0.116	0.227	0.396	0.018	0.016
1847	0.358	0.252	0.423	0.388	0.282	0.455	0.819	0.888	0.000	0.000	0.000	0.181	0.112	0.231	0.404	0.021	0.018
1848	0.360	0.257	0.427	0.398	0.295	0.470	0.819	0.879	0.000	0.000	0.000	0.181	0.121	0.242	0.413	0.015	0.014
1849	0.384	0.281	0.461	0.404	0.303	0.480	0.819	0.903	0.000	0.000	0.000	0.181	0.097	0.248	0.433	0.033	0.028
1850	0.386	0.270	0.425	0.367	0.254	0.408	0.819	0.926	0.000	0.000	0.000	0.181	0.074	0.208	0.377	0.062	0.048
1851	0.374	0.257	0.383	0.329	0.208	0.340	0.819	0.939	0.000	0.000	0.000	0.181	0.061	0.170	0.320	0.086	0.063
1852	0.350	0.227	0.330	0.302	0.177	0.288	0.819	0.937	0.000	0.000	0.000	0.181	0.063	0.145	0.270	0.082	0.060
1853	0.330	0.209	0.287	0.270	0.144	0.235	0.819	0.941	0.000	0.000	0.000	0.181	0.059	0.118	0.221	0.090	0.065
1854	0.312	0.185	0.252	0.255	0.130	0.207	0.819	0.936	0.000	0.000	0.000	0.181	0.064	0.107	0.194	0.078	0.058
1855	0.299	0.167	0.238	0.251	0.127	0.204	0.819	0.927	0.000	0.000	0.000	0.181	0.073	0.104	0.189	0.063	0.049
1856	0.317	0.187	0.257	0.264	0.137	0.215	0.819	0.933	0.000	0.000	0.000	0.181	0.067	0.112	0.201	0.074	0.056
1857	0.324	0.195	0.267	0.272	0.144	0.224	0.819	0.935	0.000	0.000	0.000	0.181	0.065	0.118	0.210	0.077	0.057
1858	0.321	0.186	0.267	0.287	0.159	0.242	0.819	0.922	0.000	0.000	0.000	0.181	0.078	0.130	0.223	0.056	0.044
1859	0.297	0.160	0.228	0.269	0.140	0.209	0.819	0.915	0.000	0.000	0.000	0.181	0.085	0.114	0.191	0.046	0.037
1860	0.320	0.189	0.238	0.262	0.131	0.189	0.819	0.937	0.000	0.000	0.000	0.181	0.063	0.107	0.178	0.082	0.060
1861	0.324	0.198	0.247	0.262	0.132	0.193	0.819	0.941	0.000	0.000	0.000	0.181	0.059	0.108	0.182	0.090	0.065
1862	0.328	0.200	0.259	0.271	0.141	0.210	0.819	0.939	0.000	0.000	0.000	0.181	0.061	0.115	0.197	0.085	0.062
1863	0.355	0.230	0.312	0.305	0.176	0.265	0.819	0.939	0.000	0.000	0.000	0.181	0.061	0.144	0.249	0.086	0.063
1864	0.374	0.255	0.367	0.329	0.206	0.323	0.819	0.940	0.000	0.000	0.000	0.181	0.060	0.168	0.304	0.086	0.063
1865	0.361	0.237	0.335	0.317	0.191	0.294	0.819	0.936	0.000	0.000	0.000	0.181	0.064	0.157	0.275	0.080	0.059
1866	0.338	0.207	0.303	0.310	0.184	0.281	0.819	0.922	0.000	0.000	0.000	0.181	0.078	0.150	0.259	0.056	0.044
1867	0.389	0.271	0.384	0.357	0.238	0.350	0.819	0.934	0.000	0.000	0.000	0.181	0.066	0.195	0.327	0.076	0.057
1868	0.383	0.263	0.382	0.358	0.240	0.356	0.819	0.929	0.000	0.000	0.000	0.181	0.071	0.196	0.331	0.067	0.051
1869	0.370	0.246	0.359	0.345	0.224	0.335	0.819	0.927	0.000	0.000	0.000	0.181	0.073	0.183	0.311	0.063	0.049
1870	0.389	0.273	0.387	0.350	0.230	0.346	0.819	0.939	0.000	0.000	0.000	0.181	0.061	0.188	0.325	0.085	0.062
1871	0.379	0.271	0.348	0.315	0.189	0.283	0.819	0.952	0.000	0.000	0.000	0.181	0.048	0.155	0.269	0.116	0.079
1872	0.402	0.307	0.389	0.338	0.214	0.317	0.819	0.956	0.000	0.000	0.000	0.181	0.044	0.176	0.303	0.131	0.087
1873	0.367	0.256	0.321	0.302	0.174	0.255	0.819	0.951	0.000	0.000	0.000	0.181	0.049	0.142	0.243	0.114	0.078
1874	0.376	0.263	0.331	0.316	0.187	0.269	0.819	0.949	0.000	0.000	0.000	0.181	0.051	0.153	0.255	0.110	0.076
1875	0.386	0.286	0.347	0.316	0.188	0.272	0.819	0.957	0.000	0.000	0.000	0.181	0.043	0.154	0.260	0.133	0.087
1876	0.376	0.280	0.321	0.299	0.167	0.238	0.819	0.960	0.000	0.000	0.000	0.181	0.040	0.137	0.228	0.144	0.092
1877	0.359	0.245	0.303	0.294	0.164	0.239	0.819	0.950	0.000	0.000	0.000	0.181	0.050	0.134	0.227	0.111	0.077
1878	0.337	0.213	0.276	0.278	0.150	0.223	0.819	0.942	0.000	0.000	0.000	0.181	0.058	0.123	0.210	0.091	0.066
1879	0.351	0.233	0.295	0.287	0.158	0.235	0.819	0.947	0.000	0.000	0.000	0.181	0.053	0.130	0.222	0.103	0.073
1880	0.360	0.250	0.307	0.291	0.161	0.238	0.819	0.952	0.000	0.000	0.000	0.181	0.048	0.132	0.226	0.119	0.080
1881	0.368	0.258	0.318	0.300	0.171	0.250	0.819	0.952	0.000	0.000	0.000	0.181	0.048	0.140	0.238	0.118	0.080
1882	0.344	0.240	0.269	0.263	0.133	0.190	0.819	0.957	0.000	0.000	0.000	0.181	0.043	0.109	0.182	0.132	0.087
1883	0.330	0.231	0.258	0.246	0.120	0.179	0.819	0.957	0.000	0.000	0.000	0.181	0.043	0.099	0.171	0.132	0.087
1884	0.330	0.241	0.251	0.239	0.112	0.163	0.819	0.961	0.000	0.000	0.000	0.181	0.039	0.092	0.157	0.149	0.095
1885	0.309	0.218	0.220	0.213	0.091	0.133	0.819	0.960	0.000	0.000	0.000	0.181	0.040	0.075	0.127	0.144	0.092
1886	0.326	0.247	0.247	0.228	0.104	0.152	0.819	0.964	0.000	0.000	0.000	0.181	0.036	0.085	0.146	0.162	0.100
1887	0.332	0.240	0.253	0.241	0.113	0.166	0.819	0.961	0.000	0.000	0.000	0.181	0.039	0.092	0.159	0.148	0.094
1888	0.343	0.247	0.272	0.256	0.127	0.188	0.819	0.960	0.000	0.000	0.000	0.181	0.040	0.104	0.180	0.143	0.092
1889	0.316	0.194	0.235	0.245	0.117	0.175	0.819	0.945	0.000	0.000	0.000	0.181	0.055	0.096	0.165	0.098	0.070
1890	0.322	0.199	0.244	0.254	0.125	0.186	0.819	0.944	0.000	0.000	0.000	0.181	0.056	0.102	0.175	0.097	0.069
1891	0.332	0.203	0.251	0.271	0.139	0.198	0.819	0.941	0.000	0.000	0.000	0.181	0.059	0.114	0.186	0.090	0.065
1892	0.317	0.180	0.228	0.270	0.137	0.189	0.819	0.930	0.000	0.000	0.000	0.181	0.070	0.112	0.176	0.068	0.052
1893	0.315	0.176	0.224	0.276	0.141	0.191	0.819	0.925	0.000	0.000	0.000	0.181	0.075	0.116	0.177	0.060	0.047
1894	0.301	0.160	0.210	0.273	0.138	0.188	0.819	0.915	0.000	0.000	0.000	0.181	0.085	0.113	0.172	0.047	0.038
1895	0.318	0.179	0.231	0.283	0.148	0.201	0.819	0.923	0.000	0.000	0.000	0.181	0.077	0.121	0.186	0.057	0.045
1896	0.286	0.148	0.204	0.280	0.146	0.200	0.819	0.898	0.000	0.000	0.000	0.181	0.102	0.120	0.180	0.029	0.024
1897	0.292	0.158	0.220	0.296	0.163	0.222	0.819	0.893	0.000	0.000	0.000	0.181	0.107	0.133	0.198	0.025	0.021
1898	0.298	0.163	0.227	0.294	0.162	0.224	0.819	0.900	0.000	0.000	0.000	0.181	0.100	0.132	0.201	0.030	0.026

Appendix Table 2. (cont.).

	Sector																		
	Agriculture					Industry					Services					Within		Between	
Year	Gini	GE (0)	GE (1)	% Pop	% Inc	Gini	GE (0)	GE (1)	% Pop	% Inc	Gini	GE (0)	GE (1)	% Pop	% Inc	GE (0)	GE (1)	GE (0)	GE (1)
1839	0.259	0.152	0.269	0.630	0.474	0.279	0.216	0.228	0.068	0.172	0.443	0.376	0.518	0.301	0.354	0.224	0.350	0.068	0.081
1840	0.252	0.146	0.287	0.630	0.466	0.282	0.213	0.240	0.068	0.175	0.456	0.397	0.560	0.301	0.358	0.226	0.377	0.073	0.087
1841	0.253	0.148	0.293	0.630	0.456	0.281	0.215	0.220	0.068	0.193	0.457	0.398	0.563	0.301	0.350	0.228	0.373	0.087	0.106
1842	0.226	0.126	0.273	0.630	0.469	0.278	0.194	0.235	0.068	0.176	0.442	0.376	0.545	0.301	0.356	0.206	0.363	0.072	0.086
1843	0.212	0.120	0.268	0.630	0.439	0.268	0.191	0.179	0.068	0.230	0.433	0.367	0.538	0.301	0.331	0.199	0.337	0.117	0.151
1844	0.213	0.122	0.274	0.630	0.466	0.277	0.188	0.226	0.068	0.183	0.434	0.368	0.541	0.301	0.351	0.200	0.359	0.077	0.093
1845	0.210	0.121	0.277	0.630	0.472	0.282	0.189	0.246	0.068	0.173	0.431	0.366	0.540	0.301	0.354	0.200	0.365	0.069	0.082
1846	0.196	0.114	0.266	0.630	0.483	0.273	0.172	0.229	0.068	0.181	0.384	0.308	0.469	0.301	0.336	0.176	0.327	0.069	0.085
1847	0.200	0.117	0.274	0.630	0.479	0.273	0.175	0.228	0.068	0.186	0.388	0.311	0.475	0.301	0.335	0.179	0.333	0.072	0.090
1848	0.194	0.116	0.273	0.630	0.474	0.265	0.166	0.209	0.068	0.197	0.383	0.307	0.470	0.301	0.329	0.177	0.325	0.080	0.102
1849	0.212	0.127	0.298	0.630	0.465	0.269	0.186	0.214	0.068	0.207	0.404	0.326	0.496	0.301	0.329	0.191	0.345	0.090	0.116
1850	0.244	0.140	0.288	0.630	0.480	0.279	0.207	0.232	0.068	0.189	0.403	0.311	0.457	0.301	0.331	0.196	0.333	0.074	0.092
1851	0.263	0.157	0.275	0.630	0.500	0.288	0.222	0.256	0.068	0.164	0.391	0.296	0.413	0.301	0.335	0.203	0.318	0.053	0.064
1852	0.254	0.145	0.240	0.630	0.515	0.282	0.209	0.243	0.068	0.154	0.362	0.256	0.353	0.301	0.331	0.183	0.278	0.044	0.052
1853	0.256	0.150	0.222	0.630	0.533	0.280	0.207	0.239	0.068	0.144	0.328	0.219	0.290	0.301	0.323	0.175	0.246	0.034	0.041
1854	0.242	0.131	0.189	0.630	0.540	0.274	0.188	0.225	0.068	0.132	0.321	0.207	0.271	0.301	0.329	0.158	0.221	0.027	0.031
1855	0.231	0.118	0.181	0.630	0.545	0.272	0.179	0.224	0.068	0.132	0.301	0.181	0.246	0.301	0.323	0.141	0.207	0.026	0.030
1856	0.239	0.128	0.191	0.630	0.534	0.265	0.184	0.206	0.068	0.146	0.312	0.195	0.260	0.301	0.320	0.152	0.215	0.035	0.042
1857	0.240	0.129	0.192	0.630	0.528	0.264	0.185	0.203	0.068	0.147	0.328	0.214	0.283	0.301	0.326	0.158	0.223	0.036	0.043
1858	0.219	0.106	0.174	0.630	0.519	0.256	0.166	0.185	0.068	0.152	0.337	0.220	0.303	0.301	0.330	0.145	0.218	0.041	0.049
1859	0.205	0.092	0.148	0.630	0.529	0.251	0.152	0.169	0.068	0.147	0.306	0.184	0.252	0.301	0.324	0.124	0.185	0.036	0.043
1860	0.234	0.122	0.161	0.630	0.525	0.249	0.171	0.161	0.068	0.152	0.317	0.201	0.251	0.301	0.322	0.149	0.190	0.040	0.048
1861	0.241	0.131	0.170	0.630	0.526	0.251	0.176	0.172	0.068	0.144	0.334	0.223	0.276	0.301	0.330	0.162	0.205	0.036	0.042
1862	0.240	0.129	0.177	0.630	0.523	0.254	0.179	0.180	0.068	0.147	0.339	0.228	0.289	0.301	0.330	0.162	0.214	0.038	0.045
1863	0.244	0.134	0.200	0.630	0.503	0.264	0.191	0.187	0.068	0.163	0.372	0.269	0.353	0.301	0.335	0.179	0.249	0.052	0.062
1864	0.254	0.146	0.242	0.630	0.494	0.274	0.206	0.222	0.068	0.163	0.402	0.312	0.424	0.301	0.342	0.200	0.301	0.055	0.066
1865	0.244	0.134	0.216	0.630	0.499	0.261	0.193	0.198	0.068	0.166	0.381	0.281	0.381	0.301	0.335	0.182	0.268	0.055	0.066
1866	0.220	0.109	0.187	0.630	0.505	0.257	0.171	0.189	0.068	0.158	0.366	0.259	0.360	0.301	0.337	0.158	0.246	0.048	0.058
1867	0.230	0.118	0.193	0.630	0.466	0.246	0.180	0.161	0.068	0.181	0.433	0.360	0.492	0.301	0.353	0.195	0.293	0.076	0.091
1868	0.222	0.111	0.190	0.630	0.468	0.248	0.173	0.165	0.068	0.174	0.435	0.363	0.502	0.301	0.358	0.191	0.297	0.072	0.085
1869	0.223	0.111	0.193	0.630	0.479	0.258	0.176	0.175	0.068	0.171	0.414	0.329	0.456	0.301	0.350	0.181	0.282	0.065	0.078
1870	0.243	0.132	0.213	0.630	0.474	0.262	0.193	0.185	0.068	0.171	0.435	0.363	0.492	0.301	0.355	0.206	0.308	0.067	0.080
1871	0.259	0.158	0.210	0.630	0.491	0.259	0.204	0.188	0.068	0.155	0.419	0.348	0.438	0.301	0.354	0.218	0.287	0.053	0.061
1872	0.263	0.167	0.213	0.630	0.472	0.252	0.211	0.173	0.068	0.165	0.451	0.404	0.507	0.301	0.363	0.241	0.313	0.066	0.076
1873	0.252	0.150	0.187	0.630	0.497	0.250	0.192	0.171	0.068	0.149	0.409	0.332	0.415	0.301	0.354	0.208	0.266	0.048	0.055
1874	0.251	0.146	0.190	0.630	0.487	0.251	0.197	0.160	0.068	0.172	0.400	0.317	0.400	0.301	0.341	0.201	0.256	0.062	0.075
1875	0.264	0.169	0.207	0.630	0.485	0.251	0.211	0.167	0.068	0.171	0.410	0.341	0.416	0.301	0.344	0.224	0.272	0.062	0.075
1876	0.265	0.178	0.199	0.630	0.494	0.250	0.213	0.162	0.068	0.165	0.394	0.323	0.376	0.301	0.341	0.224	0.253	0.056	0.067
1877	0.251	0.147	0.182	0.630	0.502	0.248	0.189	0.167	0.068	0.150	0.394	0.309	0.382	0.301	0.348	0.199	0.250	0.046	0.054
1878	0.241	0.131	0.173	0.630	0.516	0.257	0.178	0.184	0.068	0.135	0.375	0.276	0.349	0.301	0.348	0.178	0.236	0.035	0.040
1879	0.249	0.143	0.184	0.630	0.509	0.257	0.187	0.181	0.068	0.142	0.386	0.296	0.370	0.301	0.349	0.192	0.248	0.041	0.046
1880	0.258	0.159	0.196	0.630	0.505	0.260	0.200	0.181	0.068	0.150	0.388	0.304	0.371	0.301	0.344	0.205	0.254	0.045	0.053
1881	0.257	0.157	0.197	0.630	0.498	0.255	0.200	0.174	0.068	0.158	0.394	0.311	0.384	0.301	0.343	0.206	0.258	0.051	0.061
1882	0.259	0.169	0.183	0.630	0.519	0.255	0.199	0.168	0.068	0.144	0.360	0.275	0.314	0.301	0.337	0.203	0.225	0.038	0.044
1883	0.261	0.173	0.185	0.630	0.534	0.262	0.196	0.196	0.068	0.120	0.360	0.278	0.315	0.301	0.347	0.206	0.231	0.024	0.027
1884	0.266	0.189	0.187	0.630	0.536	0.255	0.202	0.183	0.068	0.124	0.350	0.274	0.295	0.301	0.340	0.215	0.223	0.025	0.028
1885	0.264	0.187	0.182	0.630	0.553	0.257	0.197	0.187	0.068	0.118	0.310	0.227	0.232	0.301	0.329	0.200	0.199	0.018	0.021
1886	0.270	0.204	0.192	0.630	0.543	0.259	0.208	0.191	0.068	0.118	0.343	0.275	0.284	0.301	0.340	0.226	0.223	0.021	0.023
1887	0.269	0.192	0.198	0.630	0.536	0.257	0.210	0.185	0.068	0.136	0.330	0.250	0.267	0.301	0.328	0.210	0.219	0.030	0.035
1888	0.269	0.188	0.205	0.630	0.527	0.260	0.214	0.187	0.068	0.146	0.341	0.258	0.286	0.301	0.327	0.211	0.229	0.036	0.043
1889	0.248	0.143	0.179	0.630	0.538	0.254	0.185	0.177	0.068	0.147	0.297	0.187	0.224	0.301	0.315	0.159	0.193	0.034	0.042
1890	0.247	0.140	0.177	0.630	0.531	0.255	0.184	0.178	0.068	0.145	0.320	0.210	0.255	0.301	0.324	0.164	0.203	0.035	0.041
1891	0.238	0.128	0.165	0.630	0.517	0.238	0.177	0.148	0.068	0.170	0.312	0.198	0.244	0.301	0.313	0.152	0.187	0.051	0.064
1892	0.217	0.101	0.135	0.630	0.516	0.229	0.156	0.130	0.068	0.171	0.300	0.178	0.226	0.301	0.313	0.128	0.162	0.052	0.065
1893	0.205	0.089	0.119	0.630	0.511	0.226	0.147	0.120	0.068	0.172	0.308	0.185	0.236	0.301	0.317	0.122	0.156	0.054	0.068
1894	0.192	0.077	0.108	0.630	0.515	0.223	0.135	0.116	0.068	0.167	0.299	0.174	0.228	0.301	0.318	0.110	0.147	0.050	0.062
1895	0.202	0.086	0.116	0.630	0.507	0.219	0.142	0.117	0.068	0.170	0.324	0.203	0.264	0.301	0.324	0.125	0.164	0.054	0.067
1896	0.166	0.061	0.094	0.630	0.515	0.214	0.115	0.110	0.068	0.156	0.310	0.190	0.258	0.301	0.329	0.104	0.151	0.044	0.054
1897	0.155	0.056	0.087	0.630	0.504	0.208	0.110	0.101	0.068	0.164	0.324	0.211	0.291	0.301	0.333	0.106	0.157	0.052	0.063
1898	0.164	0.059	0.088	0.630	0.504	0.211	0.111	0.105	0.068	0.150	0.349	0.240	0.329	0.301	0.346	0.117	0.174	0.046	0.053

Appendix Table 2. (cont.).

Year	Skill																		
	Low					Middle					High					Within		Between	
	0.203	0.083	0.088	0.906	0.640	0.174	0.124	0.078	0.059	0.125	0.278	0.186	0.215	0.036	0.235	0.090	0.116	0.203	0.315
1839	0.189	0.070	0.079	0.906	0.624	0.171	0.115	0.075	0.059	0.126	0.283	0.190	0.220	0.036	0.250	0.077	0.113	0.223	0.350
1840	0.195	0.075	0.090	0.906	0.613	0.182	0.128	0.081	0.059	0.141	0.287	0.194	0.225	0.036	0.246	0.083	0.122	0.232	0.358
1841	0.161	0.050	0.063	0.906	0.625	0.166	0.095	0.066	0.059	0.126	0.284	0.184	0.222	0.036	0.249	0.058	0.103	0.221	0.347
1842	0.164	0.061	0.093	0.906	0.598	0.192	0.126	0.083	0.059	0.171	0.288	0.186	0.227	0.036	0.231	0.069	0.122	0.246	0.366
1843	0.149	0.046	0.061	0.906	0.622	0.167	0.092	0.065	0.059	0.132	0.292	0.191	0.232	0.036	0.246	0.054	0.104	0.224	0.348
1844	0.142	0.042	0.054	0.906	0.627	0.163	0.083	0.061	0.059	0.123	0.297	0.196	0.239	0.036	0.250	0.049	0.101	0.220	0.346
1845	0.125	0.036	0.049	0.906	0.641	0.158	0.072	0.055	0.059	0.130	0.334	0.228	0.290	0.036	0.229	0.045	0.105	0.199	0.306
1846	0.127	0.038	0.051	0.906	0.636	0.161	0.077	0.058	0.059	0.134	0.338	0.232	0.297	0.036	0.230	0.047	0.109	0.205	0.314
1847	0.125	0.040	0.056	0.906	0.631	0.159	0.076	0.057	0.059	0.143	0.340	0.234	0.301	0.036	0.226	0.049	0.112	0.208	0.315
1848	0.144	0.047	0.067	0.906	0.617	0.168	0.098	0.068	0.059	0.151	0.341	0.233	0.303	0.036	0.232	0.056	0.122	0.225	0.339
1849	0.182	0.064	0.076	0.906	0.642	0.171	0.111	0.073	0.059	0.136	0.340	0.233	0.303	0.036	0.222	0.073	0.126	0.197	0.299
1850	0.203	0.084	0.084	0.906	0.672	0.171	0.116	0.075	0.059	0.117	0.341	0.233	0.302	0.036	0.211	0.091	0.129	0.166	0.254
1851	0.200	0.081	0.079	0.906	0.698	0.169	0.107	0.071	0.059	0.111	0.343	0.238	0.305	0.036	0.191	0.089	0.122	0.138	0.208
1852	0.208	0.093	0.085	0.906	0.728	0.168	0.107	0.071	0.059	0.104	0.363	0.262	0.336	0.036	0.168	0.100	0.126	0.109	0.161
1853	0.200	0.082	0.076	0.906	0.743	0.164	0.093	0.065	0.059	0.095	0.326	0.223	0.280	0.036	0.162	0.088	0.108	0.097	0.144
1854	0.188	0.069	0.066	0.906	0.748	0.163	0.084	0.061	0.059	0.095	0.345	0.237	0.309	0.036	0.156	0.076	0.103	0.092	0.134
1855	0.198	0.079	0.076	0.906	0.735	0.167	0.100	0.068	0.059	0.107	0.340	0.232	0.304	0.036	0.158	0.086	0.111	0.101	0.146
1856	0.199	0.080	0.077	0.906	0.727	0.167	0.102	0.069	0.059	0.108	0.319	0.211	0.271	0.036	0.165	0.086	0.108	0.108	0.159
1857	0.181	0.062	0.065	0.906	0.716	0.164	0.091	0.064	0.059	0.112	0.293	0.191	0.234	0.036	0.172	0.068	0.094	0.118	0.174
1858	0.172	0.054	0.058	0.906	0.735	0.165	0.082	0.061	0.059	0.109	0.290	0.186	0.231	0.036	0.155	0.061	0.085	0.099	0.143
1859	0.205	0.088	0.084	0.906	0.736	0.174	0.112	0.074	0.059	0.115	0.264	0.157	0.204	0.036	0.149	0.092	0.101	0.097	0.137
1860	0.209	0.094	0.087	0.906	0.735	0.169	0.111	0.072	0.059	0.108	0.254	0.149	0.190	0.036	0.158	0.097	0.101	0.101	0.146
1861	0.205	0.088	0.083	0.906	0.727	0.169	0.109	0.072	0.059	0.110	0.267	0.160	0.206	0.036	0.164	0.092	0.102	0.108	0.158
1862	0.206	0.088	0.087	0.906	0.695	0.177	0.119	0.076	0.059	0.121	0.262	0.156	0.201	0.036	0.184	0.092	0.107	0.138	0.205
1863	0.202	0.083	0.083	0.906	0.672	0.174	0.118	0.076	0.059	0.119	0.291	0.188	0.233	0.036	0.209	0.089	0.114	0.166	0.253
1864	0.200	0.080	0.082	0.906	0.684	0.170	0.115	0.074	0.059	0.123	0.290	0.188	0.230	0.036	0.194	0.086	0.109	0.151	0.225
1865	0.179	0.060	0.065	0.906	0.695	0.164	0.094	0.065	0.059	0.116	0.279	0.181	0.216	0.036	0.189	0.066	0.093	0.140	0.210
1866	0.196	0.076	0.085	0.906	0.648	0.172	0.122	0.077	0.059	0.137	0.234	0.152	0.151	0.036	0.215	0.081	0.098	0.189	0.285
1867	0.186	0.066	0.075	0.906	0.648	0.172	0.112	0.074	0.059	0.131	0.231	0.149	0.148	0.036	0.221	0.072	0.091	0.191	0.290
1868	0.184	0.065	0.074	0.906	0.662	0.175	0.108	0.072	0.059	0.127	0.248	0.160	0.170	0.036	0.211	0.071	0.094	0.175	0.265
1869	0.202	0.083	0.087	0.906	0.653	0.177	0.122	0.078	0.059	0.127	0.245	0.160	0.166	0.036	0.220	0.088	0.103	0.185	0.284
1870	0.222	0.112	0.102	0.906	0.681	0.174	0.133	0.080	0.059	0.115	0.233	0.138	0.152	0.036	0.204	0.114	0.110	0.157	0.239
1871	0.230	0.125	0.113	0.906	0.658	0.177	0.150	0.086	0.059	0.124	0.217	0.132	0.130	0.036	0.218	0.126	0.113	0.180	0.276
1872	0.220	0.111	0.099	0.906	0.694	0.173	0.129	0.079	0.059	0.112	0.225	0.136	0.138	0.036	0.194	0.113	0.105	0.143	0.216
1873	0.222	0.110	0.106	0.906	0.683	0.182	0.142	0.084	0.059	0.130	0.234	0.140	0.151	0.036	0.187	0.113	0.111	0.150	0.220
1874	0.233	0.131	0.118	0.906	0.679	0.180	0.154	0.087	0.059	0.130	0.232	0.135	0.149	0.036	0.191	0.132	0.120	0.154	0.228
1875	0.238	0.144	0.123	0.906	0.695	0.182	0.159	0.089	0.059	0.126	0.215	0.112	0.133	0.036	0.179	0.143	0.120	0.137	0.200
1876	0.220	0.110	0.099	0.906	0.702	0.172	0.128	0.078	0.059	0.113	0.225	0.128	0.140	0.036	0.185	0.112	0.104	0.133	0.199
1877	0.207	0.092	0.084	0.906	0.719	0.167	0.104	0.070	0.059	0.100	0.234	0.133	0.153	0.036	0.181	0.094	0.095	0.120	0.181
1878	0.215	0.103	0.093	0.906	0.709	0.171	0.117	0.075	0.059	0.106	0.232	0.132	0.150	0.036	0.185	0.105	0.102	0.128	0.193
1879	0.224	0.118	0.104	0.906	0.705	0.178	0.133	0.081	0.059	0.112	0.239	0.139	0.160	0.036	0.183	0.120	0.112	0.131	0.195
1880	0.225	0.117	0.106	0.906	0.696	0.178	0.137	0.082	0.059	0.119	0.240	0.142	0.159	0.036	0.185	0.119	0.113	0.138	0.206
1881	0.232	0.135	0.112	0.906	0.730	0.181	0.139	0.083	0.059	0.108	0.239	0.140	0.158	0.036	0.161	0.136	0.116	0.105	0.153
1882	0.228	0.135	0.107	0.906	0.746	0.170	0.119	0.075	0.059	0.089	0.238	0.139	0.157	0.036	0.166	0.134	0.112	0.097	0.146
1883	0.236	0.153	0.117	0.906	0.751	0.174	0.134	0.081	0.059	0.093	0.240	0.142	0.160	0.036	0.156	0.151	0.120	0.089	0.131
1884	0.234	0.152	0.115	0.906	0.777	0.172	0.126	0.078	0.059	0.088	0.265	0.162	0.200	0.036	0.136	0.150	0.123	0.068	0.097
1885	0.240	0.167	0.123	0.906	0.761	0.174	0.137	0.082	0.059	0.088	0.245	0.148	0.166	0.036	0.151	0.165	0.126	0.082	0.121
1886	0.237	0.153	0.119	0.906	0.750	0.175	0.142	0.083	0.059	0.102	0.272	0.167	0.208	0.036	0.148	0.153	0.128	0.087	0.125
1887	0.236	0.147	0.118	0.906	0.736	0.177	0.145	0.085	0.059	0.109	0.275	0.167	0.214	0.036	0.156	0.148	0.129	0.099	0.143
1888	0.216	0.105	0.094	0.906	0.750	0.171	0.118	0.075	0.059	0.110	0.315	0.204	0.273	0.036	0.139	0.109	0.117	0.085	0.118
1889	0.214	0.102	0.092	0.906	0.741	0.171	0.116	0.075	0.059	0.108	0.285	0.175	0.227	0.036	0.150	0.105	0.110	0.094	0.134
1890	0.213	0.097	0.094	0.906	0.727	0.173	0.127	0.078	0.059	0.130	0.280	0.171	0.220	0.036	0.143	0.101	0.110	0.102	0.141
1891	0.197	0.077	0.081	0.906	0.732	0.171	0.113	0.074	0.059	0.132	0.254	0.151	0.187	0.036	0.136	0.082	0.094	0.098	0.133
1892	0.191	0.071	0.077	0.906	0.728	0.174	0.110	0.073	0.059	0.134	0.224	0.120	0.143	0.036	0.138	0.075	0.085	0.101	0.138
1893	0.177	0.059	0.067	0.906	0.733	0.170	0.097	0.067	0.059	0.130	0.223	0.120	0.142	0.036	0.137	0.063	0.077	0.097	0.133
1894	0.186	0.066	0.073	0.906	0.721	0.168	0.106	0.071	0.059	0.133	0.210	0.108	0.125	0.036	0.147	0.070	0.080	0.108	0.151
1895	0.150	0.042	0.049	0.906	0.729	0.159	0.076	0.057	0.059	0.121	0.202	0.102	0.116	0.036	0.149	0.046	0.060	0.102	0.144
1896	0.142	0.040	0.049	0.906	0.716	0.158	0.076	0.057	0.059	0.128	0.192	0.098	0.101	0.036	0.156	0.044	0.058	0.114	0.161
1897	0.149	0.041	0.048	0.906	0.715	0.159	0.075	0.057	0.059	0.117	0.190	0.096	0.091	0.036	0.167	0.045	0.056	0.118	0.171
1898	0.203	0.083	0.088	0.906	0.640	0.174	0.124	0.078	0.059	0.125	0.278	0.186	0.215	0.036	0.235	0.090	0.116	0.203	0.315