INCOME DISTRIBUTION IN RURAL BUENOS AIRES, 1839-1867

Luis Bértola, Jorge Gelman y Daniel Santilli

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Abstract:

This paper presents an estimate of income distribution in the rural sector of the Buenos Aires province during the central decades of the 19th century, a period featured by important economic growth framed by the incorporation to the Atlantic economy. After presenting the results of previous attempts to measure wealth inequality and relative factor prices, the results of an estimate of total and functional income distribution based on the construction of social tables are presented. The results improve previous achievements and open the way for methodological discussions on how to approach inequality in pre-statistical societies. The main result is challenging: while, on the one hand, income distribution as measured by relative price movements deteriorate and wealth is increasingly concentrated, total inequality diminishes and the wage share increases, due to the important expansion of agrarian employment.

Resumen:

El trabajo presenta una estimación de la distribución del ingreso en el sector rural de la provincia de Buenos Aires en las décadas centrales del siglo XIX, una etapa de importante crecimiento económico en el marco de la incorporación en la económica atlántica. Luego de presentar los resultados de previas investigaciones sobre la distribución de la riqueza y la evolución de los precios relativos de factores, se presentan los resultados de la estimación de la distribución funcional y total del ingreso, a los que se arriba mediante la construcción de tablas sociales. Los resultados mejoran los anteriormente obtenidos, proponiendo una discusión metodológica relevante sobre la medición de la desigualdad en sociedades pre-estadísticas. El principal resultado es sugerente: mientras que, por un lado, se produce un deterioro en la distribución del ingreso en términos de precios relativos de los factores y una concentración de la riqueza, por otro lado, la desigualdad total tiende a caer y el peso relativo de la masa salarial a aumentar, debido a la fuerte expansión del empleo rural.

1.   Introduction

Latin America is a continent that has grown at average world growth rates over the last two centuries. In a context featured by increasing gaps between world leaders and poor regions, Latin America appears to be a region that could grow, but could never converge and join the group of world leaders; on the contrary, divergence with world leaders has been the dominating trend.

One of the factors that often appear in the explanations for the lack of Latin American economic dynamism are the well-known high inequality levels of the region. While for some scholars, high inequality is an early feature of the Latin American economies, for others, the pattern of high inequality was consolidated later on, either during the First Globalization boom or even during the process of industrialization that took place during the middle decades of the 20h century. According to these views, what is important to explain is not that Latin America showed high inequality levels, but why Latin America was not able to reduce inequality during the 20th century, as most developed countries did. Coatsworth (2008) went even further, stressing that, in the 19th century, increasing inequality was almost a pre-condition for economic growth.

Less disagreement exists on the fact that inequality grew almost everywhere in Latin America during the last decades of the 20th century, before the very recent reduction of inequality levels.

Latin America has always been a problematic concept. While many common features are recognizable among these economies, the existence of important variations and differing patterns of development, even within each country, especially the larger ones, can also be noticed. There is a long tradition in the creation of different typologies for the study of Latin American economies. One common feature in all the attempts is the one that distinguishes between the Indo-American, the Afro-American and the Euro-American economies (for a recent discussion see Bértola & Ocampo, 2013). These economies show important differences in terms of climate, natural resources, population density, ethnic composition of the population, and, what is clearly most important, in the type of social relations prevailing, in particular, in labor and land markets. While Indo-American societies had a combination of peasant communities and the extraction of surplus labor by the haciendas, and in Afro-American societies slave labor dominated until well into the 19th century, the Euro-American economies showed the early presence of wage labor and individual landownership, even if their weights differed between countries and over time. Thus, it is reasonable to assume that the patterns of wealth and income distribution may have varied significantly across these different groups, as well as the way in which the surplus was appropriated and used.

The case of the Province of Buenos Aires is a good example of a Euro-American economy. At the end of the colonial period, Buenos Aires city was still demographically bigger than its countryside, and continued to be a trading post between the Atlantic economy and the inland cities, especially important for the exchange of "Castile goods" and African slaves for Andean silver. The rural area was only partially linked to cattle export markets and remained essentially a food and cattle supplying hinterland for the

city and other internal markets (e.g. mules for the Andean markets). After the revolution of 1810, this circuit changed radically: the inland connections once so profitable for Buenos Aires merchants were then disrupted and new opportunities opened up for cattle export as the industrial revolution in the North Atlantic altered the terms of trade (Newland, 1998). Moreover, the advance in maritime navigation and commercial liberalization had a huge positive impact on the costs of the Atlantic exchange (O'Rourke & Williamson, 2006). Thus, Buenos Aires started the so-called "expansión ganadera" (cattle expansion) marked by the expansion of the frontier and increasing population. Land availability was decisive in the face of the high cost of capital and labor, a characteristic of this region that had only been strengthened by the wars that followed the 1810 revolution (Halperín Donghi, 1969).

The expansion of the frontier was not linear. It was very important between the 1820s and 1840s, when it tripled land availability in a few years. It retreated after Governor Rosas' fall in 1852, when the treaties with some indigenous groups were broken. The frontier expanded again in the 1860s and 70s, recovering previously gained land, while economic growth continued and the population increased very fast. The military campaign of 1879 led to a definitive control of the remaining territories previously controlled by the indigenous population. The frontier was thus significantly expanded again, but population continued to grow at even higher rates.

Frontier expansion went hand in hand with important productive changes. While up to the 1840s extensive bovine cattle breeding was dominant, after that sheep breeding for the production of leather and wool became more and more important. This process was stimulated by relative price movements, and by the opportunities for a more intensive use of land, a factor that was becoming less and less abundant.

For the period under consideration here, the basic data is presented in Table 1.

Table 1 – Population, territory and exports. Buenos Aires, 1815-1869

	1815	1838	1855	1869
Population				
City	49,737	65,344	91,548	177,787
Rural area	42,557	84,685	183,681	317,320
Total	92,294	150,029	275,229	495,107
Rural area (in Km^2)	43,670	130,254	99,622	139,622
Rural population/per Km^2 of rural area	0,97	0,65	1,84	2,27
Total exports value (in pesos fuertes) (*)	1,654,911	3,420,842	6,474,435	32,450,000

Sources: Population: 1815, Moreno and Mateo (1997); 1838, AGN (sala X-25-6-2); 1855 and 1869, Census of 1869 (INDEC 2003). Rural area: Census of 1869 (INDEC 2003). Exports: Rosal and Schmit (2004). (*): the year 1815 was replaced for 1814; 1838 for 1834, and 1855 for 1844; 1869, Barsky & Djenderdjian (2003).

These changing scenarios may produce quite different outcomes in terms of distribution. In any case, it is important to keep in mind that inequality trends and inequality levels are important for us, not only in terms of any concept of justice, but also in terms of their dynamic impacts on growth and development. The classical question is how large the economic surplus was, who appropriated it, and how it was used.

The most recent antecedents with respect to inequality measures in the Province of Buenos Aires are those of Gelman and Santilli. In several works, these authors estimated the distribution of land property, based on tax censuses for three years: 1839, 1855 and 1867.

Table 2 – Population, Property and Wealth Inequality in Buenos Aires

	1839	1855	1867	Growth rate		
				1839-55	1855-67	1839-67
Landowners	4,490	6,969	9,748	2.8	2.8	2.8
Population (1)	85,285	174,495	312,434	4.6	4.0	4.3
Capital (in $f)	4,711,662	12,827,228	56,291,645	6.5	13.1	9.3
Capital per landowner	1.049	1.841	5.775	3.6	10.0	6.3
Median	405	751	2,005	3.9	8.5	5.9
20/20	53.6	36.6	35.2			
Richest 20%	69.7%	69.6%	72.0%	0.0	0.3	0.1
Poorest 20%	1.3%	1.9%	2.0%	2.4	0.6	1.6
Gini among landowners	0.668	0.659	0.675			
Gini in total UC	0.888	0.915	0.969			

(1) Census years are 1838, 1854 and 1869
Source: Gelman and Santilli (2011)
$f= *pesos fuertes*, peso of silver, old colonial currency, replaced in Buenos Aires by paper money

Table 2 summarizes the available data for rural property. It shows a remarkable increase in total and per landowner real estate value, measured in *pesos fuertes*. In spite of this, the Gini-coefficient of wealth distribution among landowners does not increase. However, as the total amount of Census Units increases more than the number of landowners (4.3%, resp. 2.8% a year), total inequality between Census Units does increase to very high levels. In other words, considering wealth distribution, there was growing inequality, not because a redistribution of wealth between landowners, but due to the concentration of land in the hands of a smaller group of the total population. Even if the data only shows the distribution of land, and not that of total rural assets, the growing relative price of land makes landownership a good proxy for total wealth inequality.

The growing proportion of landless population could be expected to lead to a growing income inequality, not only because the worsened distribution of wealth, but also because of the impact of increasing labor supplies on relative prices.

Gelman & Santilli (2015) made a first attempt at measuring functional income distribution between 1770 and 1880 using the relation between wage and land price indices as a proxy. They also took into consideration the price of cattle, as a proxy for the income of landowners, as land, so abundant at the beginning of the period, may not have properly reflected the wealth of capital owners. This approach may give interesting results on a particular aspect of distribution. Gelman and Santilli concluded that in 1810-

1880, land prices grew far more than wages, excepting for the period 1830-1850, during which both increased at similar rates. Similar trends, even if less pronounced, were found in the cattle/wage ratio. Graph 1 shows their results.

Graph 1. Relative factor prices, 1770-1854 (1770=100)
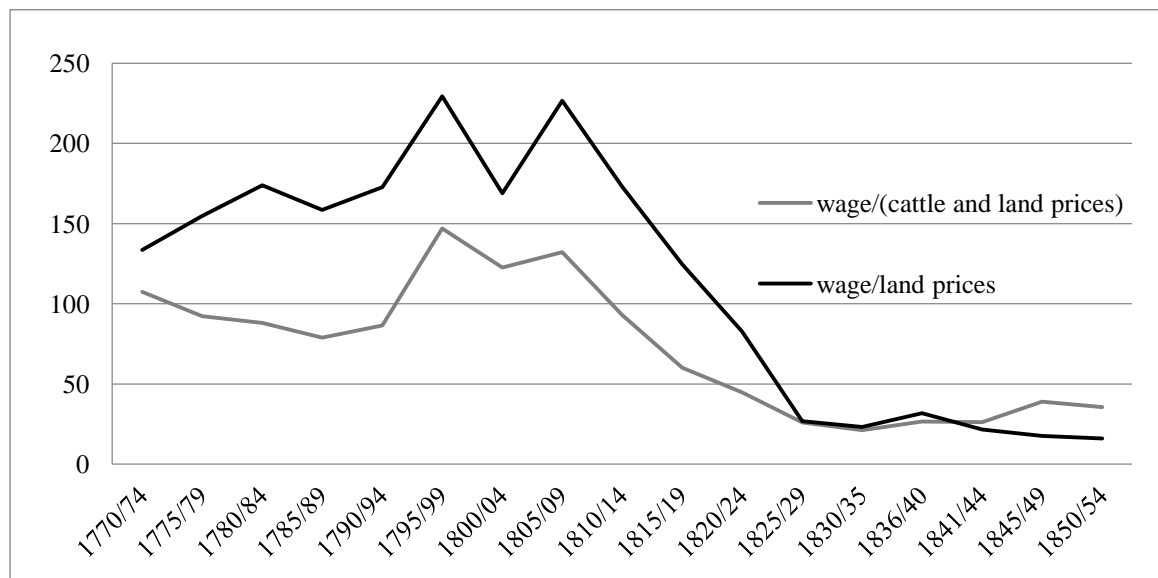
Source: Gelman and Santilli (2015)

Nevertheless, this approach faces several problems, already mentioned in the literature (see, for instance, Bértola et. al 2010). i) These ratios are not able to show absolute values and cannot compare absolute levels of income and distribution. For instance, if we have rural and urban wages and we have nothing but the index, an increase in the urban/rural ratio may mean an increase or a decrease in inequality. ii) The ratios between two prices do not tell us anything about how the quantities of the two factors are combined, and, thus, how the total income is distributed among groups. For instance, if land prices grow more than wages, but land is constant and labor increases significantly, total income may move in favor of labor. The distributive outcome is dubious. iii) There are problems in the comparison of wages, which are the real income of workers, with land prices. Land prices are not necessarily proportional to the income of landowners and cattle-ranchers.

This paper constitutes an attempt to measure the functional distribution of income as well as total income distribution, based on the construction of social tables. In section 2 we will present the methodology and sources. In section 3 we present and discuss the results. We conclude in section 4.

2.   Methods and sources

In an attempt to overcome the criticisms previously mentioned, many scholars have constructed so-called social tables, or dynamic social tables (Milanovic, Lindert, & Williamson, 2007; Bértola, 2005; Bértola et.al, 2010; Rodriguez Weber, 2014, and many others).

In what follows such an attempt is done for the years 1839, 1855 and 1867. The reasons for selecting the period are essentially related to the availability of data. For these years

we have both Census data and tax data. In the future, we aim to extend the period of analysis.

In any case, these three years are relevant: 1839 represents a year close to the climax of post-independence frontier expansion; 1855 is a year close to the bottom of the contractive cycle after Rosas' fall in 1852; 1867 is a year in which the occupied territory had slightly surpassed the levels of the 1830s. An important frontier expansion was to take place during the 1880s, in relation to the so-called *campaña del desierto.*

Categories

Our social tables are composed by the quantity and income of five different social groups or categories: *peones* (unskilled stable rural wage earners, UWE), *capataces* (stable employees with supervision responsibilities, SWE), temporary wage earners (often skilled wage earners working during short periods of time, TWE), and landowners (LO). Given the fact that owners of small farms often could not get the necessary basic income, and were forced to work as wage earners during short periods of time, this fifth group was identified and quantified. We call this group temporary landowners (TLO).

Functions

The five categories are limited to three in order to estimate the functional income distribution. UWE, SWE and TWE are added as wage incomes. The two other categories remain as they are, one representing capitalists and the other a mixed group.

Quantities

The number of wage earners for 1867 is obtained from the Population Census of 1869 (INDEC, 2003 and for 1855 from the provincial Census (Estado de Buenos Aires, 1854), while for 1839 it is calculated with data from the 1815 and the 1838 censuses, by GIHRR (2004).

The number of landowners is taken from data obtained to collect capital taxes (*Contribución Directa*) for the years 1839, 1855 y 1867 (AGN Sala III 33-4-7, AGN Sala III 33-5-14, AGN Sala III 33-8-28 al 32). This tax was instituted in 1821.

The number of temporary landowners (TLO), as mentioned, is obtained once the income of landowners is estimated. Temporary landowners are defined as those who receive from the land an income below that of supervision workers (SWE).

Income

The income of the different categories is obtained as follows:

Wages: When available, the average of the previous five years is used, otherwise, values of the current year are used, taken from Gelman and Santilli (2014).

Landowners:

The income of the landowners is obtained through several steps.

1. Total gross value of production of the agrarian sector is estimated on the basis of four products: cattle, wool, sheep leather and wheat (see Appendix 1).

2. Different non-wage costs for the production of these goods are estimated in order to obtain gross value added (see Appendix 1)

3. The total wage bill is deduced from gross value added to obtain the total income of landowners.

4. Total income of landowners is distributed among them according to the capital owned by each of them according to the tax data.

5. The income of those landowners that obtain an income from land property lower than that of the SWE, is completed up to this level, to create the group of TLO.

6. The amount of income used to complement the income of the TLO is reduced from that of the TWE.

Table 3 summarizes our basic data.

Table 3. Gross Agricultural Value of Production and Value

		1839	1855	1867
Gross Agricultural Value of Production				
Cattle		1798279	1271794	3248661
wool			7078579	19701120
leather			507870	2770470
wheat		559908	2367399	2361423
Total				
GAVP		**2358187**	**11225642**	**28081674**
Inputs				
Wool and leather			775913	2360030
Wheat		167972	710220	708427
Cattle		179828	127179	324866
Total inputs		**347800**	**1613311**	**3393323**
Gross Agricultural Value Added				
Total		**2010386**	**9612330**	**24688351**
Labor		**957261**	**3823000**	**16949175**
wages	UWE	57,91	84,19	130,83
	SWE	69,36	126,00	240,58
	TWE	104,05	200,34	300,00
numbers	UWE	11176	28089	77413
	SWE	2235	5618	15483
	TWE	1490	3745	10322
wage bill	UWE	647184	2364865	10127885
	SWE	155039	707839	3724786
	TWE	155039	750296	3096505
Property incomes		**1053125**	**5789330**	**7739176**
Income shares				
Wages		**0,476**	**0,398**	**0,687**
Property incomes		**0,524**	**0,602**	**0,313**
GAVA/worker		**134,9**	**256,7**	**239,2**

Source: Own estimates

Growth, social change and Inequality

Inequality is a complex concept. All inequality measures are quite limited in the sense that they reproduce particular features or focus on particular aspects of the distribution. That is why it is always necessary to combine different inequality measures to get a more precise idea about distribution.

The question is an even more complex one when we study a period of very fast growth and deep structural change.

In what follows we will present different results of our estimates and we will attempt to interpret these results.

Growth and structural change

Measured in 1855 *pesos Fuertes*, agricultural production grew by a factor of 14 between 1839 and 1867. Cattle were the most important good in 1838. Up to 1855, total production increased five-fold, but the driving force since the late 1840s was sheep breeding: wool and sheep leather made up 2/3 of output by 1855, increasing to 70% in 1867. Sheep breeding was a much more labor and capital intensive activity than cattle. It demanded more labor and was suitable for production in a less extensive way and in relatively smaller estates. This change was also fueled by falling cattle prices. Land use was all in all more efficient, even in the case of cattle, which nevertheless remained extensive in nature. Cattle breeding moved to the lands close the frontier.

Changes in the social structure

Following the changes in the productive structure, the social structure changed significantly during these 30 years. We have already seen in Table 1 that the rural area showed a cycle with bottom values in the 1850s, but without any significant increase between 1838 and 1869. The huge expansion had taken place in the 1820s and 1830s. However, the rural society increased its population at a rate of 4.4% a year. The number of wage earners increased seven-fold, while the number of landowners only doubled. As shown in Table 4, wage earners went up from 76% of our income-earners in 1839, to 91% in 1867.

Changes in inequality

Inequality changes were really contradictory. The process was clearly one of polarization, in the sense that the average income of landowners increased in relation to the mean and in relation to that of the other social categories. As shown in Table 4, the relative mean income of landowners increased steadily and went up from 3.5 to 5.7 times the population mean.

However, both the Gini-coefficient and the Bourguignon and Theil indices, show decreasing trends between 1839 and 1867. This is because the base of the social pyramid was clearly widened and inequality among wage earners was very low. As one can see in

Table 5, the decomposition of the inequality indices shows that inequality within the groups makes a much smaller contribution to total inequality than inequality between groups. The moderate increasing inequality among landowners is not enough to counteract this general trend.

In short, what we can see is a contradictory movement in inequality: a general decline of the general indices, but an increase in polarization between wage earners and landowners. In other words: class inequality was increased (landowners vis-á-vis workers), but general inequality did not because of the increasing weight of wage earners.

Table 4. Income shares and relative income by categories and functions, 1839, 1855 and 1867

	1839				1855			1867		
	Population Share	Income share	Relative mean	Population Share	Income share	Relative mean		Population Share	Income share	Relative mean
Unskilled wage-earners	0,598	0,322	0,538	0,637	0,246	0,386		0,694	0,410	0,591
Supersvisors	0,120	0,077	0,645	0,127	0,074	0,578		0,139	0,151	1,087
Temporary wage-earner	0,043	0,041	0,967	0,077	0,071	0,919		0,080	0,108	1,355
Temprary land-owners	0,099	0,064	0,645	0,039	0,023	0,578		0,036	0,039	1,087
Land-owners	0,141	0,496	3,524	0,119	0,587	4,930		0,051	0,292	5,689
All wage-earners	0,760	0,440	0,579	0,842	0,390	0,464		0,913	0,669	0,733

Source: Own estimates

The second trend, increasing inequality through polarization, is what is expected to happen according to conventional theory. In a process of market integration, the abundant factor, land, will increase its price in relation to the scarce one, labor. The rental-wage ratio will be expected to increase[1]. However, the outcome in total inequality, as captured by the different indices, will also be affected by many other forces, factor supplies among them. If, for example, land supply grows faster than labor supply, i.e., the land-labor ratio increases, then the opposite trend can be expected. Likewise, if the supply of labor increases significantly, the widened base of the pyramid may produce a fall in total inequality, as in our case.

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[1] Such evidence is shown in Gelman & Santilli, (2015)

Table 5. Inequality measures, 1839, 1855 and 1867

		1839	1855	1867
d90/d/50		2,23	2,68	2,29
99/10		34,90	69,37	32,16
999/100		106,70	219,50	124,01
Gini total		0,421	0,561	0,356
Gini within land-owners		0,539	0,595	0,593
Bourguignon Index		0,291	0,544	0,208
Within categories		0,024	0,021	0,006
Between categories		0,267	0,524	0,202
Within functions		0,038	0,091	0,065
Between functions		0,253	0,453	0,144
Theil Index		0,360	0,589	0,268
Within categories		0,069	0,074	0,031
Between categories		0,290	0,515	0,237
Within functions		0,078	0,111	0,077
Between functions		0,282	0,478	0,191

Source: Own estimates

The polarization trend, however, is not noticed in the reported relation between deciles. The reason is that polarization is such, that wage earners are present even in the tenth decile. Following recent trends in income inequality studies, we can focus on top incomes. Table 6 reports these results. The polarization trend is clearly noticed here during the first period, but not in the second one, where we find a new reversal of inequality. The relative mean of the richest percentile goes back to its original values in 1867, but the income of the richest one per thousand, remains at levels much higher than those of 1839.

Table 6. Top incomes

	1839		1855		1867	
	share of income	relative mean	share of income	relative mean	share of income	relative mean
1%	0,188	18,8	0,268	26,8	0,190	19,0
1‰	0,058	57,4	0,085	84,7	0,074	73,3

Source: Own estimates

In Table 5 we also report top income in relation to the income of unskilled wage earners, the bottom 10%. We get a similar pattern: inequality first rises, but then diminishes. In the case of the top 1%, all gains were later lost, but in the case of the 1 o/oo, (Table 6)

they still remain above their 1839 relative levels. This confirms that the increasing inequality shown by the income of landowners in relation to the mean is due to the fact that the mean is diminishing because of the higher weight of wage earners, and not because of diminishing income differences.

Two trends, two stories

If we now try to sum up our information, it seems clear that we have two different periods, with different trends and underlying forces.

Between 1839 and 1855 the frontier retreated, mainly due to political instability after 1852 and the lack of security in the regions where land was disputed with the indigenous population. While the land area in use diminished quite severely after Rosas' fall, labor expanded significantly, mainly due to the productive changes introduced by sheep breeding. The value of production increased at high rates, especially in relation to the surface area in use. Even if wages increased noticeably during the period, landowner´s income increased even more. As a result, all the indices showed increasing inequality, even within the landowning class. Even if the share of wage earners in the total population increased, and in spite of increasing real wages (as proxied by the wage/agrarian price index), the wage share was reduced, because of the significant increase in production. The income share of the large landowners rose radically as well as their relative income. Thus, this is not only the typical case of market integration leading to the valorization of the abundant resource. It seems that the only explanation for this increasing inequality is the significant increase in land productivity (not only increasing prices), which is also expressed in the increasing relative value of land, as shown in Table 7.

Table 7. Relative prices of wages, agrarian products and land, 1839-1867 (1855=100)

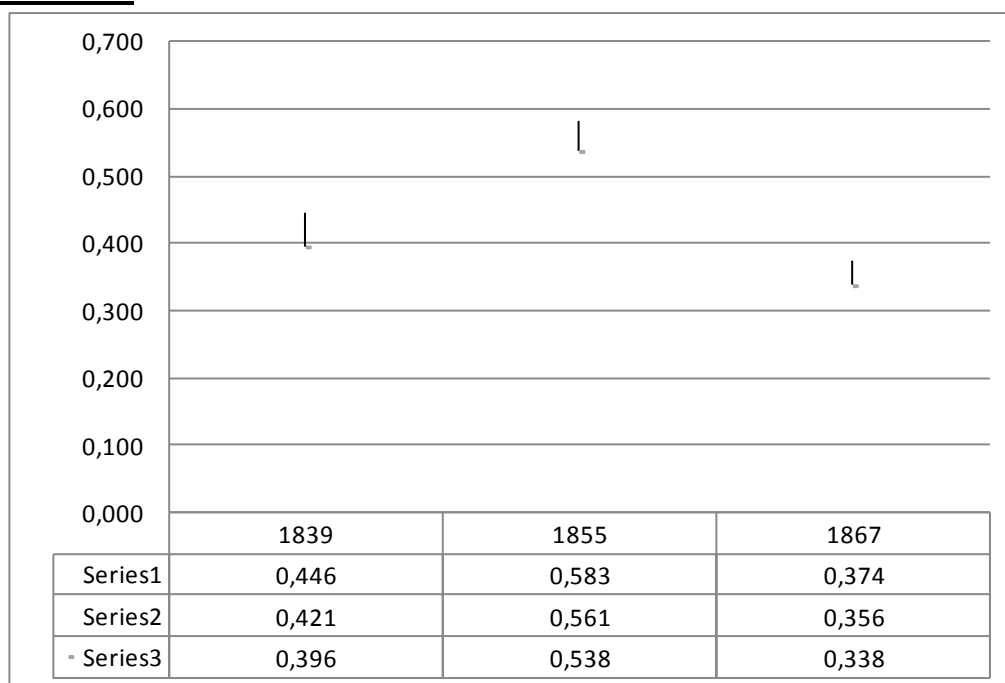|	1839	1855	1867
Gross Agrarian Value Added			
Current GAVP ($ Fuertes)	2358187	11225642	28081674
Real GAVP	1657676	11225642	22998608
Price indices			
Agrarian price index	142,26	100,00	122,10
Wage index	62,9	100,0	160,9
Land price index	10,5	100,0	129,5
Relative prices indices			
Wages/agrarian prices	44,2	100,0	131,7
Wages/land prices	600,8	100,0	124,2
Land prices/agrarian prices	7,4	100,0	106,1
Growth rates	**1839-55**	**1855-67**	**1839-67**
Gross Agrarian Value Added			
Current GAVP	10,2	7,9	9,3
Real GAVP	12,7	6,2	9,8
Price indices			
Agrarian price index	-2,2	1,7	-0,5
Wage index	2,9	4,0	3,4
Land price index	15,1	2,2	9,4
Relative prices indices			
Wages/agrarian prices	5,2	2,3	4,0
Wages/land prices	-10,6	1,8	-5,5
Land prices/agrarian prices	17,7	0,5	10,0

Source: Own estimates

The second period is quite different. Production continued to grow, even if more slowly (6.2 vs the previous 12,7% annual growth rate, as in Table 7), particularly if we consider that the frontier expanded again. With the structural change produced by sheep breeding having a less important impact, it seems that the earnings of landowners could not grow as much as during the previous period. Besides, the structure of production was now demanding more labor, and the base of the social structure widened at a faster rate. Moreover, wage increased both in relation to the prices of the agrarian production and land prices. This explains the reduction of total inequality. If wages had remained constant in terms of their purchasing power of agrarian products in 1839, the income of landowners would have increased 30% in 1867 and their share of total income would have increased from 30 to 40% that year.

While inequality among landowners did not increase, the income share and the relative mean income of the richest 1% of the income takers went back to the levels of 1839. Nevertheless, the very rich really were able to accumulate more wealth and income and

they could retain an important part of the share and relative income they had gained during the first period. These elites were so rich, that their income went, on average, up from three to four times the income of the richest 1%.

Finally, in order to get an idea about how sensible our estimates are with respect to our sources of information, we constructed two alternative scenarios for each of three years. The two alternative scenarios were: one in which wages were assumed to be 5% higher and agrarian prices 5% lower; and an opposite one, in which wages were 5% lower and agrarian prices higher. In this way we let change total value added (through higher or lower agrarian prices) and the wage bill, both impacting the income distribution in the same direction; either in favor of labor or in favor of landowners income. As shown in Graph 2, the new results fit the main trends found before, telling us that our results seem to be rather robust.

Graph 2. Gini-coefficients with +/- 5% variation in wages and agrarian prices, 1839, 1855 and 1867

	1839	1855	1867
Series1	0,446	0,583	0,374
Series2	0,421	0,561	0,356
Series3	0,396	0,538	0,338

Source: own estimates

3. Conclusions

This article estimates income distribution in rural Buenos Aires in the years 1839, 1855 and 1867. These three years are good benchmarks. After independence, the agrarian frontier expanded significantly. This expansion came to an end in the late 1830s and early 1840s. A reduction of the available land took place at the beginning of the 1850s, because of political and military instability in the Confederation. The frontier expanded again during the 1860s, recovering lost ground, yet without greatly surpassing the 1839 levels.

Across the contractive and expansive cycles, the number of wage earners increased at very high rates, increasing the number of employees per land unit.

Agrarian value added increased at very high rates, particularly up to the 1850s, mainly due to the important structural change produced by the introduction of sheep breeding for the production of leather and wool. Sheep breeding was much more labor-demanding than cattle breeding.

The distributional outcomes of this process are contradictory. Two trends can be found in the two different periods.

Up to 1855 inequality increased, mainly because of the huge increase in value added. In spite of improved real wages relative to agrarian prices, and in spite of the increasing amount of wage earners, profits skyrocketed thanks to the important increase in value added per worker. All inequality indices showed rising values, as well as the average income of landowners in relation to the measured population mean, and to wages. Income was particularly concentrated in the top 1% and the top 1 o/oo.

Between 1855 and 1867, two contradictory movements can be found. The Gini coefficient, as well as the Bourguignon and Theil indices, shows an important reduction to levels even lower than those of 1839. In contrast, the average income of landowners continued to grow in relation to the mean and to wages. In spite of the expansion of the frontier, wage earners grew at a much faster rate than the increases in land area in use. In addition, real wages in terms of agrarian prices continued to grow. While value added continued to grow fast, it did so at lower rates than in the previous period. Productivity per worker decreased somewhat. The landowners could thus appropriate a shrinking share of total income, but income was still growing fast and average income of landowners improved in relation to the average income of the increasing landless labor force. This is the main explanation for why land prices continued to rise.

In summary, the whole 1839-1867 period was one of very fast growth of agrarian value added, without any significant expansion of the frontier. Labor increased significantly in relation to land. Real wages grew faster than agrarian prices, but value added per worker rose significantly. While landowners captured a reduced share of total income, average income of landowners, as well as the value of land, increased in relation to wages. Nevertheless, total income inequality as measured by the Gini-coefficient and general entropy indices decreased.

Income inequality trends contrast with wealth inequality trends, as a smaller and smaller part of the population had access to land.

These results show the complexity of distributional issues and warn us about the use of simplified proxies to approach income inequality. The Inequality Possibility Frontier approach, for example, as developed by Milanovic, Lindert and Williamson, sustains that inequality cannot be high if per capita incomes are low. The whole approach is based on the use of the Gini-coefficient and the inequality indicator. As shown here, decreasing Gini-coefficients are compatible with increasing factor price inequality and increasing polarization.

Future research will try to expand the analysis to the very interesting period covering the rest of the century, in which an important expansion of the frontier took place, together with rising agrarian prices and continued immigration and population growth.

Appendix 1

Estimation of Gross Agrarian Value of Production

Bovine cattle ranching.

In order to estimate the annual cattle production, an extraction rate of 22% of the stock was assumed, following Gelman and Santilli (2006, p. 106). The stock of cattle was estimated as follows:

1839: 1839 *Contribución Directa*, (AGN Sala III 33-4-7).

1855 and 1867. As *Contribución Directa* did not include cattle, we followed the estimates of Chiaramonte (1986, p. 42) based in turn on Ortiz (1974), for 1855, and of Sábato (1989, pág. 36), for 1867. Other costs are estimated as being 10% of total value of production.

Cattle prices were taken for 1838 & 1855 from Gelman & Santilli (2015); 1867 from *Anales de la Sociedad Rural* (1867, p. 426).

Sheep ranching: wool and leather

This was a very small sector in 1839, which is why a separate estimate was not performed. The number of sheep was taken from Chiaramonte (1986, p.. 42). The production of wool and leather per sheep, as well of the respective prices, were taken from Sábato (1989, p. 151-3).

Wheat

For 1839 and 1867, we estimated the harvest departing from the estimates of per capita production by Djenderedjian (2008, p. 382). For 1855, *Registro Estadístico del Estado de Buenos Aires*, as in Gelman & Santilli(2011, p. 206-7).

Prices are taken from Gelman & Santilli (2014), excepting for 1867, taken from *Anales de la Sociedad Rural* (1867, p. 426). Following Djenderedjian (2008, p. 272), 10% of the harvest is kept as seed and other related costs amount to 20% of the value of the harvest.

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