Land-use and rural inequality profiles in the province of Barcelona in mid-nineteenth century

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*T*he long-term impact on income inequality of agricultural commercial specialization is still an open-ended discussion. Diverse economic models and approaches offer competing views, while historians increasingly stress the contingent nature of the paths followed in the various contexts. Applying common inequality indices like the Theil index along with new ones such as the inequality possible frontier (IPF) and Inequality Extraction Ratios (IER), this study examines how winegrowing specialization in Catalonia correlated with agricultural income distribution in the municipalities of the province of Barcelona during the mid-nineteenth century. This analysis examines a large dataset assembled from over 86,000 cadastral taxpayers in 292 municipalities and recorded in the Distribution of Personal Wealth in Real Estate Ownership of the province of Barcelona in 1852, combined with other population and land use data listed in the Estadística territorial de la provincia de Barcelona (Land Use Statistics of the Province of Barcelona), compiled in 1858. The results confirm that inequality in agricultural income distribution was lower in predominantly winegrowing municipalities than in timber and cereal-growing ones, despite the fact that commercial specialization and higher population densities could have extended the inequality possible frontier of those winegrowing areas in the mid-nineteenth century.*

Perfiles de la desigualdad rural y los usos del suelo en la provincia de Barcelona a mediados del siglo XIX

*E*l impacto sobre la desigualdad de ingresos de los procesos de especialización comercial agrícola es un tema de investigación abierto. Diversos enfoques y modelos económicos difieren, mientras los historiadores subrayan el carácter contingente de las trayectorias seguidas en distintos contextos. Vamos a estudiar cómo la especialización vitivinícola catalana se correlaciona con la distribución del ingreso agrario en los municipios de la provincia de Barcelona a mediados del siglo XIX, mediante indicadores de desigualdad habituales como el índice de Theil, junto con otros nuevos como la frontera de máxima desigualdad posible (IPF) y las tasas de extracción de la desigualdad (IER). Aplicamos este análisis a una base de datos con más de 86.000 contribuyentes de 292 municipios registrados en la* Distribución Personal de la Riqueza Territorial *en la provincia de Barcelona en 1852, combinados con datos de población y uso del suelo de la* Estadística territorial de la provincia de Barcelona, *de 1858. Los resultados confirman que la desigualdad en la distribución del ingreso agrario era menor en los municipios vitícolas que en los principalmente forestales o cerealícolas, aunque la especialización y mayor densidad de población de las zonas vitícolas podrían haber ampliado la frontera de máxima desigualdad a mediados del siglo XIX.*

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1. INTRODUCTION

What impact does agricultural commercial specialization entail on income inequality? There is no clear consensus in the literature to answer this question. To begin with, if market integration leads to a rise in total income and wealth in a region, this would also involve an upward shift of the maximum inequality possibility frontier, which in turn might lead to an increase in the actual extraction ratio taken by a small elite (Milanovic, 2011; Milanovic, Lindert & Williamson, 2011). Whether the latter happens or not depends on other factors at stake and, when considering them, diverse economic approaches and models differ (Williamson, 1991, 1999, 2009; O'Rourke & Williamson, 1999; Bourguignon & Morrisson, 2002; Lindert & Williamson, 2003; Piketty, Postel-Vinay & Rosenthal, 2006; Acemoglu & Robinson, 2006; Atkinson & Piketty, 2007; Hornborg, McNeill & Martínez Alier, 2007; Prados de la Escosura, 2008; Roine & Waldenström, 2009; Piketty, 2014). For example, the Stolper-Samuelson theorem states that under a Heckscher-Ohlin model of trade, a rise in the relative price of a good will lead to an increase in the return to the factor that is used most intensively in the production of the good traded, and to a fall in the return to the other factors less intensively used. Yet, this does not apply when a commercial specialisation sets in motion the advance of an agricultural frontier that extends the cropland area of the commodity being grown and sold abroad –at least as long as the frontier remains open (Greasley, Inwood & Singleton, 2007; Harley, 2007; Santiago-Caballero, 2011; Badia-Miró & Tello, 2014). These examples stress the importance of several contingent historical factors that frame how the disputed entitlement of natural resources affects who benefits from their use (Badia-Miró, Pinilla & Willebald, 2015).

The discussion above makes it very relevant to study how the agricultural specialization in brandies and wines that took place in Catalonia since the mid-17th century to the *Phylloxera* plague in the late 19th century affected income inequality (Vilar, 1962; Giralt, 1965; Valls-Junyent, 2004; Badia-Miró & Tello, 2014; Colomé *et al.*, 2016). Many historical monographs have pointed out that the spread of vineyards in this north-eastern corner of the Iberian Peninsula led to a less unequal rural society (Garrabou, Tello & Cussó, 2008; Garrabou *et al.*, 2009; Badia-Miró & Tello, 2014; Tello & Badia-Miró, 2015). Nevertheless, most available evidence comes from cadastral sources which, in most cases, did not make a clear distinction between landownership rents and the incomes obtained by winegrowers who were holders of tenancy contracts. This is an important shortcoming which may have led to overestimate the actual reduction in income inequality (Valls-Junyent, 1997; Colomé, 2013; López Estudillo, 2016). Using a large dataset assembled through an unexploited source on agricultural incomes recorded in the province of Barcelona in mid-19th century, we therefore test the hypothesis put forward by previ-

ous local case studies that the Catalan vineyard specialization led to a reduction of inequality in agrarian income distribution (Tello, Garrabou & Cussó, 2006; Colomé, Planas & Valls-Junyent, 2015).

According to the available case studies, there would have been two specific mechanisms at stake, one direct and another indirect. The direct mechanism was the leasing of small plots of land from well-off landowners to landless winegrowers through a traditional sharecropping contract called in Catalan *rabassa morta* (Badia-Miró *et al.*, 2010; Badia-Miró & Tello, 2014; Carmona & Simpson, 1999; Garrido, 2017a, 2017b, 2017c). The tenancy established by this peculiar long-lease emphyteutic contract lasted until the death of the vines planted by the tenant. Given that before the *Phylloxera* plague winegrowers used to bury strains of their old vines in order to keep them alive, the *rabassa* tenants tried to maintain their access to land almost permanently. The duration of the contract, together with the rent share taken by the landowner from the vintage harvested by the winegrower, gave rise to a long-lasting class conflict from the end of the 18th century until the Spanish Civil War in 1936-39 (Balcells, 1980; Valls-Junyent, 1997; Tello, 1997; Carmona & Simpson, 1999; Simpson, 2011; Colomé, 2013; Colomé *et al.*, 2016). Despite the conflicting social relationship between landowners and tenants, the fact that the *rabassa* tenancy system became so widespread might also be acknowledged as an achievement by the poorest sections of the Catalan rural society thanks to their bargaining power and collective action (Garrabou, Planas & Saguer, 2001a; Garrabou & Tello, 2002).

The second indirect mechanism through which vineyard specialization could have led to a reduction in landownership and agrarian income inequalities was the ability of many *rabassa* tenants to subsist from their vines, endure the pressure of the rent taken by the owner, and prosper enough to buy a small house, an adjoining garden and even a plot of their own. It is important to note that many of these landless tenants were immigrants initially coming from Southern France and the mountain villages of the Pyrenees (Nadal & Giralt, 1960). Some others, however, came from the non-inheriting progeny of the same class of well-off peasants who offered them *rabassa* tenancies. Furthermore, as non-heirs, they received a legitimate compensation from the first-born brother heir, which was paid either in cash or with a small plot of land. This second mechanism restrained landownership inequality, while the spread of *rabassa* tenancies only reduced the inequality of income distribution. Taken together, both mechanisms entailed an improvement of access to land and agrarian incomes that the *rabassa* tenants managed to achieve in winegrowing municipalities. These options were not so available to the poorest sectors of Catalan rural society in mainly cereal-growing, forest and livestock-grazing areas. In this sense, we may say that Catalan winegrowing tenants managed to harness the ongoing process of population growth, commercial specialization and agricultural intensification to carry out

a genuine process of socioeconomic empowerment (Badia-Miró & Tello, 2014; Tello & Badia-Miró, 2015).

The most apparent feature of agrarian settlement in most of the province was a network of scattered poly-cultural farms called *masies* in Catalan, structured into compact land units around an isolated rural dwelling. Thanks to the late medieval peasant struggles held in Catalonia before and after the Black Death, the well-off landowners who lived in these *masies* gradually gained control of the rights of access to cropped and uncultivated land over a complex and conflictive transition from feudalism to agrarian capitalism (Garrabou, Tello & Cussó, 2008; Congost, 2015). From the 17th century onwards, population growth was fostered by increasing French immigrants and higher fertility. The owners of the scattered farms saw these immigrants, and the disinherited descendants of the old local families, as a new and frightening landless class that tried to settle down in the villages or towns between their networks of *masies*.

However, landowners soon discovered new opportunities to take advantage of the lack of land and labour availability of this landless class, and of the high relative prices of brandy or wine at that time, by expanding the inner winegrowing frontier and leasing to them some marginal lands to plant vineyards (Colomé *et al.*, 2013). Many landless families became winegrowers through the emphyteutic *rabassa* contract, and a new social geography appeared when a patchwork of small vineyard plots arose among the interstices of the old polycultural *masies* (Marull *et al.*, 2010; Olarieta, Rodríguez Valle & Tello, 2008; Tello, Garrabou & Cussó, 2006). This poorest share of population used to live in the streets of small towns or villages. While the shape of the diverse compact fields of every *masia* tended to be higher and be located around a scattered farmhouse, the small plots of vineyards planted by the *rabassers* used to be orientated towards the old villages, or even to the new ones created by these winegrowers, following the existing ways and roads (Garrabou, Tello & Cussó, 2008; Colomé, Cucurella-Jorba & Valls-Junyent, 2010; Colomé & Valls-Junyent, 2012).

Some local case studies on these vine-growing municipalities have shown a decrease in the Gini coefficients of landownership distribution from the beginning of the 18th century up to the *Phylloxera* plague (Garrabou, Tello & Cussó, 2008; Garrabou *et al.*, 2009). Later, when every old vine had been ravaged during the 1880s, all the *rabassa* contracts came to an end, and many tenants were evicted or gave up winegrowing, landownership distribution became more unequal again. In other areas, however, vineyards were replanted; many *rabassa* tenancies persisted, and with them the conflicts about the rent shares and land entitlements lasted another half a century up to the Spanish Civil War and Franco's dictatorship (Badia-Miró *et al.*, 2010; Colomé, 2013; Colomé *et al.*, 2016). Anyway, could this pathway be generalized assuming that the reduction in inequality of the

rural Catalan society up to mid-19th century was a general trend triggered by the spread of vineyard specialization?

We can find in the existing literature on the Catalan vineyard specialization some trends which might have counterbalanced the factors listed above that favoured a less unequal rural society (Colomé *et al.*, 2013). First, commercial specialization could attract more immigrants to the municipalities where vineyards were spreading, and also foster population growth in them by increasing birth rates, thus growing the number of people who owned only very small plots or had no land of their own (Valls-Junyent, 1997; Colomé *et al.*, 2010). Secondly, the spread of vineyards also raised the total income and wealth of the whole rural community. As Milanovic, Lindert and Williamson (2011) have pointed out, a wealthier economy could also mean the possibility to increase the extraction ratio taken by a small elite. Thirdly, many historical examples do show that an increase in market integration and globalization have led to greater inequality and not the opposite (Hornborg, McNeill & Martínez Alier, 2007). Even adopting a standard Heckscher-Ohlin approach, this could be the expected outcome when land was still the most abundant factor endowment in a region joining a global market (Acemoglu, Robinson & Johnson, 2002; Acemoglu & Robinson, 2006).

2. INEQUALITY OF WHAT, AND AMONG WHOM?

Having these historical and theoretical considerations in mind, we cannot take for granted that the reduction of inequality in landownership or agrarian incomes was a general trend in the province of Barcelona, without carrying out a cross-section analysis encompassing a great deal of municipalities. To do this, we have employed as a main source the Distribution of Personal Wealth in Real Estate Ownership published in the Official Gazette of the Barcelona province in 1852. This very exceptional document lists for each of the municipalities the names of all owners of land, houses and livestock who were subject to payment of the cadastral tax, adding up the monetary evaluation of their taxable incomes and annual tax burden paid. Drawn from this source, we have been able to include in our database more than 86,000 taxpayers in 292 municipalities for which we also had data on the land use patterns, out of the 311 existing at present in the province. These real estate owners represented 12% of the total population, 24% of all males, and 41% of all male inhabitants older than 21 recorded in the provincial census of 1857. The second main source used in our database is a Land-Use Statistics of the Province of Barcelona compiled in 1858 by a Spanish topographer, Pedro Moreno Ramírez (2011[1858]), which lists the total agrarian area and the extent occupied for each agricultural, forest or pastureland use in each municipality. This information has been com-

bined with the 1857 population census, so as to construct a dataset to correlate the land use profiles and agrarian income inequality in 292 municipalities of the province of Barcelona in mid-19th century.

The Distribution of Personal Wealth in Real Estate Ownership of 1852 is a very exceptional source. According to the Royal Order issued by the then Managing Director of Taxes, Statistics and State Heritage, all Spanish provinces had to publish in their Official Gazettes the whole list of taxpayers with their names, the taxes they paid, and tax burden applied (Bravo, 1852). Such unusual transparency can only be understood in the context of the initial efforts to legitimate a modern land tax system to be developed by the Spanish liberal governments after the new Tax Act passed in 1845. Unfortunately, these efforts failed to achieve their ultimate goals for over a century. During the 19th century and the first third of the 20th century the Spanish liberal governments never ended the cadastral maps and enquiries needed to assess an income value for each land unit devoted to a specific crop, so as to apply a uniform tax burden to every taxpayer (Muro, Nadal & Urteaga, 1996).

Due to the Spanish long-lasting failure in completing a true cadastral survey, a temporary tax system called *amillaramientos* was established. Instead of following a bottom up process to comply with the most basic principle of tax equity, the system of *amillaramientos* ran top to bottom. Each year the provincial quotas were politically distributed in the Spanish Parliament, and then each provincial quota was politically shared out between municipalities by provincial governors. It was only at municipal level where the already given amount of taxes to be paid was distributed among taxpayers according to the estimated cadastral value of their property and derived income (Carrasco, 1867). The Distribution of Personal Wealth in Real Estate Ownership clearly demonstrated that the tax burden applied to different municipalities of the Barcelona province in 1852 varied a lot, from twelve up to more than twenty per cent of the local aggregated income. Although some historians have used some partial information taken from these provincial lists (Díez Espinosa, 1986; Segura, 1993; Díaz Marín, 2000; Calatayud, Millán & Romeo, 2000; Burgueño, 2007), this is the first time that a large dataset is created and fully analysed using the whole information they contain.

Unfortunately, this exceptional source also entails a very important ambiguity in the economic data provided. The primary information contained in the local *amillaramientos* referred to the surfaces of land owned by each taxpayer, together with their houses and livestock. Clearly, this was information on the distribution of agrarian wealth. Owing to other contemporary sources (Peña, 1852; Carrasco, 1867) we know the specific methods that had to be used by the Finance officials to estimate in money terms an average yearly

income from the cadastral information on personal properties recorded in physical units. However, only these final cadastral estimates of annual incomes were published in the Distribution of Personal Wealth in Real Estate Ownership of 1852. This is understandable, considering the aim to assess the tax burden variation among different taxpayers and municipalities of the same province. But it requires us to deal with the resulting ambiguity: Are we calculating inequalities of wealth or income? It is well known that inequality of wealth is always greater than income inequality (Van Zanden, 1995). While people should at least be able to survive with the latter, real estate property was the result of a long-lasting accumulation that could only be carried out by those having higher incomes (Shenk *et al.*, 2010).

Since only the cadastral estimated revenues from land, houses and livestock were included, we cannot take this income information as if it had recorded all sorts of agrarian earnings. In addition, this information on rural earnings was given by means of an estimated average income that any landowner or tenant could obtain yearly from their properties, according to the standardized procedures applied by the cadastral officials. Surprisingly enough, the Gini coefficients obtained from this indirect data on personal agrarian incomes are rather similar to the ones directly calculated from the distribution of landownership measured in surface units from the local *amillaramientos*. This coincidence might have something to do with the existence of proportionality between the distributions of wealth and rents paid for housing (Peña, 1852), in the same vein as some economists of the time had alleged in order to propose using the data on rental housing as an easy proxy for personal income (San Julián, 2011).

In any case, the way of accounting the estimated agrarian incomes and wealth introduces and important bias in our dataset. A relevant share of all taxpayers included in the lists had only a very poor house of their own. Their recorded incomes were the implicit rent that could have been obtained by leasing these poor houses in the market, after having deduced a quarter of the rent as repair costs. Some others could also be sharecroppers, either as *rabassa* winegrowing tenants living in a village or as sharecropping families who, according to another typical Catalan contract called *masoveria*, had to live in the farmhouse where they worked for the owner of the *mas*. In this case, the cadastral valuation had to include the sharecropper's net income, obtained by deducting from their annual earnings the rent paid to the landowner (Peña, 1852). It is far from certain, however, that this rule had been always followed in the local cadastral registers *(amillaramientos)* from where our data comes from.

The Distribution of Personal Wealth in Real Estate Ownership of 1852 includes a great deal of very poor taxpayers with only rather incomplete incomes, because they were be-

low the lowest male agricultural wage at the time and no one could have survived with such a low yearly earning. According to the available series of Catalan agricultural wages for unskilled tasks, like digging, during the five years between 1850 and 1854 an agricultural labourer who worked 260 days a year would earn an income of some 1,720 Spanish *reales* in the province of Barcelona (Garrabou & Tello, 2002). The urban planner Ildefons Cerdà calculated the prevailing family budgets in Barcelona at the time in around 6,622 *reales* for a full working-class family (Cerdà, 1867). This means that at least three to four male adult unskilled wages like the ones considered would have had to be added up in order to achieve the minimum standard of living calculated by Cerdà. The cost of living was cheaper outside Barcelona, but this data reveals that between 1,500 to 2,000 *reales* could be considered a minimum income to survive at the time. However, the list of taxpayers of 1852 included a lot of people below that level (see Table A1 in the Annex). An astonishing 84-87% appeared in the document with a cadastral attributed income under the abovementioned poverty line of 1,500-2,000 *reales* a year.

Although this 87% of people who had such a small property worth less than 2,000 *reales* a year only owned 27% of all income recorded, they actually paid 30% of all cadastral taxes collected in the province. If we set aside the outlier case of Barcelona city, in most rural municipalities the proportion of taxes paid by taxpayers with an attributed income lower than 2,000 *reales* ranged from 32 to 50%. Even assuming that such poor taxpayers had endured exactly the same tax rate as the very rich, the prevailing tax system would have been very regressive. Our data show that they always bore an even higher tax burden (see Table A2 in the Annex). This clearly explains why the wealthy rural elites were so interested in including such a great amount of poor people in the taxpayers' list. In this way, the Spanish Treasure could raise a lot by extracting a bit from many taxpayers who only earned very little. Insofar as the tax quotas of each province and municipality came as given by previous political decisions taken top-down from the parliament and provincial governors, the relevant share paid by the poorest contributors became tax cuts for the local wealthy landowners.

While the vast majority of poor taxpayers were only attributed with cadastral earnings ranging from several tens to some hundreds of *reales*, and paid taxes for a few tens to less than a real per year, the small group of the richest taxpayers owned rural properties worth tens of thousands *reales*, and paid taxes for several thousand *reales* a year. In an electoral system based on the taxes paid, only major taxpayers were entitled to vote. We wonder whether the Spanish tax system described above might have something to do with the granting of voting rights to the entire adult male population as early as 1890; and also, consequently, with the immediate corruption of this general male suffrage by the so called Spanish *caciquismo* (Moreno Luzón, 2007). The anomalous tax system based on a po-

litical top-down allocation of cadastral quotas established, in fact, a perverse rule of the game encouraging the creation of vertical lobbies to get the minimum local tax share to be paid to the Treasure, and receive the maximum public expenditure in each province and municipality (Curto-Grau, Herranz-Loncán & Solé-Ollé, 2012).

In any case, the inclusion of so many people owning only a house, and perhaps a vegetable garden, together with landless tenants with very low yearly earnings, clearly biases our dataset. However, their presence also provides valuable information. We will later explain the adjustments we made to deal with these ambiguities in order to try to account for inequality in this agrarian income distribution. Before resuming with our analysis, we must finally refer to another concern raised by this kind of historical source. What credibility can we give to the information it contains, given the tax purpose of the document? Our research team has worked for many years using the private accounting records of the patrimony of the Marquis of Sentmenat, one of the richest Catalan landowners of the time. From his private records, we know that during the five years between 1850 and 1854 the Marquis earned in the two municipalities of Sentmenat and Palau-solità i Plegamans an actual average income of 12,047 and 15,983 *reales* a year respectively (Garrabou, Planas & Saguer, 2001b). The Distribution of Personal Wealth in Real Estate Ownership of 1852 attributed to the Marquis of Sentmenat a yearly cadastral income of 11,607 and 15,323 *reales* in the same municipalities: this means a downward deviation of only 3.9%. The comparison increased our trust in the accuracy of the information provided by this source.

3. SEARCHING FOR INEQUALITY PATTERNS

After mapping inequality indices, and unlike what happens with land-use spatial patterns (Garrabou *et al.*, 2009: 156), no apparent coincidence seems to appear in the spatial distribution of the prevailing inequality of agrarian incomes earned from real estate ownership. Often, the differences between neighbouring municipalities located in the same zone of land-use specialization were as pronounced as the ones observed among the major boundaries between land use areas of winegrowing, cereal-cropping, and woodland (see Figure 1).

FIGURE 1

**Theil indices of inequality in the municipalities
of the province of Barcelona, 1852**
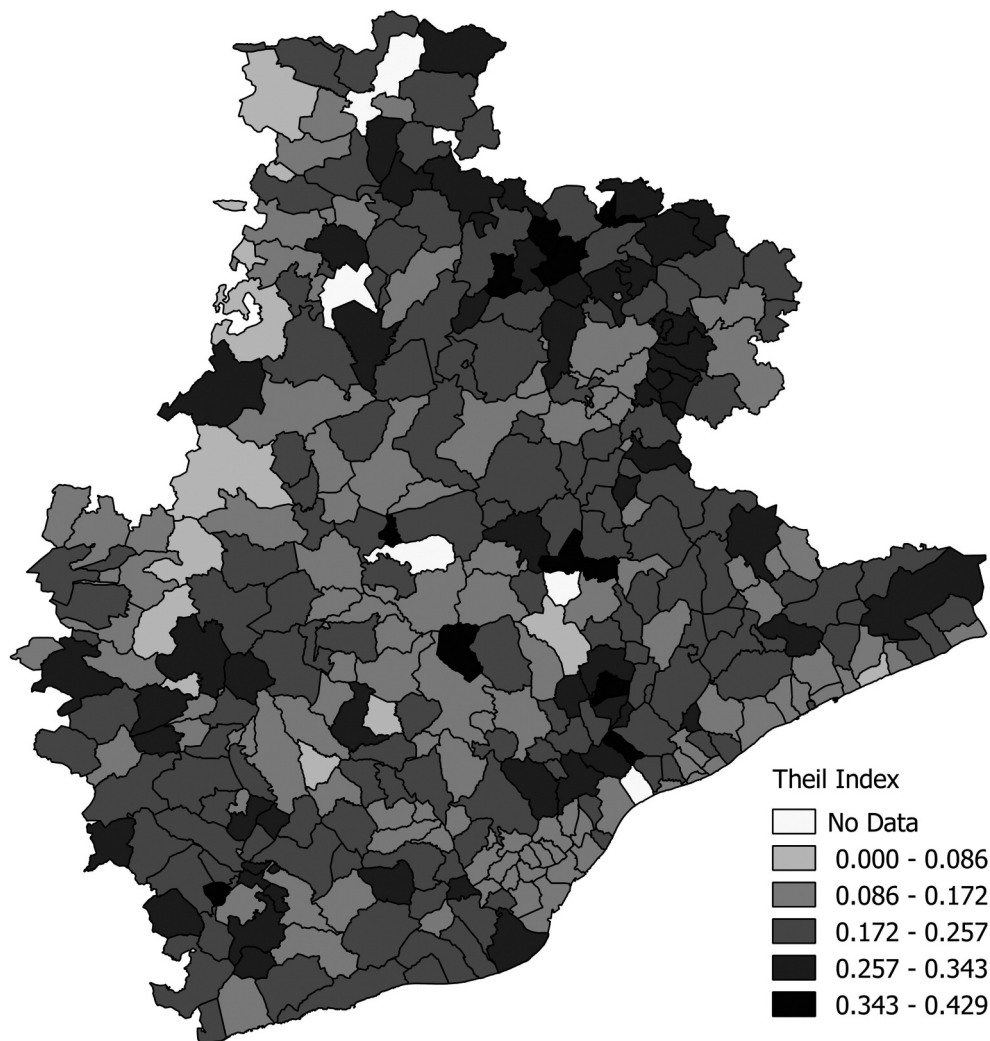
Theil Index

- ☐ No Data
- 0.000 - 0.086
- 0.086 - 0.172
- 0.172 - 0.257
- 0.257 - 0.343
- 0.343 - 0.429

Source: our own, from the Distribution of Personal Wealth in Real Estate Ownership of 1852 (Library of the Universitat de Barcelona, reference 146-1-II/13).

Theil indices have been obtained from the dataset of income cadastral values recorded for every taxpayer included in each municipality (see the methodological supplementary material) in the following way:

$$Theil_{i,Normalized} = \frac{Theil_i}{Theil_{i,Max}} = \frac{\dfrac{1}{N_i}\sum_j \dfrac{x_{i,j}}{\overline{x}_i}\ln(\dfrac{x_{i,j}}{\overline{x}_i})}{Ln(N_i)} \quad (1)$$

where N_i is the number of observations in each municipality i, $x_{i,j}$ each one of the individual observations of the annual incomes for every municipality, and $\overline{x}_i$ is the mean value of the distribution for each municipality. The Theil index shows less inequality as values tend to zero and more inequality as values tend to one. Theil values correct the potential bias attributable to the wide range of variation in the number of taxpayers and inhabitants in different municipalities. Table 1 shows the main statistics for the Theil index and other inequality indices.

TABLE 1

Main statistics for the various inequality index of the database on 1852 taxpayers in the municipalities of the province of Barcelona

	Theil	Mean log deviation	Gini
Number	292	292	292
Mean	0.202	1.016	0.668
Standard deviation	0.073	0.391	0.105
Median	0.201	0.958	0.682
Max	0.429	2.566	0.873
Min	0.018	0.071	0.193

Source: our own, from the Distribution of Personal Wealth in Real Estate Ownership of 1852 (Library of the Universitat de Barcelona, reference 146-1-II/13).

TABLE 2

Comparison between the main statistics of the database on the number of taxpayers in 1852 and of inhabitants in 1857 in the municipalities of the province of Barcelona

	Taxpayers in 1852	Inhabitants in 1857
Maximum	9,616	235,643
Minimum	17	211
Mean	297	2,396
Median	205	979

Source: our own, from the Distribution of Personal Wealth in Real Estate Ownership of 1852 (Library of the Universitat de Barcelona, reference 146-1-II/13) and population census of 1857 (available at http://www.ced.uab.es/index.php?newlang=eng).

The dispersion of Theil indices, and the existence of two peaks, lead us to seek for a few complementary explanations. As we have seen, our dataset is highly heterogeneous. For example, we find a maximum population of 235,643 inhabitants in the city of Barcelona, together with many municipalities having a minimum below 300 inhabitants. At the same time, some municipalities had an important percentage of taxpayers while in other cases the percentage was lower, thus indicating the necessity for a deeper statistical analysis (Table 2).

TABLE 3

**Main characteristics of the groups resulting from the cluster analysis
of the municipalities of the province of Barcelona, 1858**

Group	N	Density(inhab/km²)	Vineyard	Forestry	Cereal	Distance to BCN (hour)
1	15	Very high	Very high	Low	Low	Very near
2	30	Average	Very high	Low	Low	Near
3	5	Very high	High	Very Low	Very high	Very near
4	20	Average	Low	Low	Very high	Average
5	8	Very high	Average	Low	Very high	Near
6	20	Low	Very low	Very high	Low	Very far
7	51	Low	High	Average	Low	Near
8	37	Low	Low	High	Low	Near
9	14	Low	Very Low	High	High	Far
10	48	Very low	Very low	High	Low	Far
11	26	Average	Average	Average	High	Near
12	18	Low	Very high	Very low	High	Average
N	292	135.8	24.4%	52.2%	20.6%	12.0

Source: our own from Moreno Ramírez (2011[1858]).

In order to check the relationship between Theil inequality indices and the main land use patterns of the municipalities, we have repeated the analysis of the basic statistics splitting these municipalities considering groups based on statistically rigorous thresholds. The dataset has been split off according to similarity criteria considering cluster analysis from the percentage of winegrowing and cereal-cropping over total agricultural land, forest area over the total area of each municipality, the population density and the distance to Barcelona. To do that we carried out a non-hierarchical clustering with the number of groups obtained from a hierarchical clustering estimation[1]. The information of municipal land uses has been taken from the 1858 Land-Use Statistics of the Province of

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1. Considering Ward's linkage cluster analysis and assuming that we observe few changes when observing the Calinski-Harabasz pseudo-F coefficient after 12 groups.

Barcelona compiled by Pedro Moreno Ramírez (2011[1858]). The resulting categories were 12. Table 3 summarizes the main characteristics of each group.

Figure 2 shows the differences in inequality indices (means) by groups, and their standard deviations, ordering the groups from lowest to highest inequality.

FIGURE 2

Theil indices by groups of the database on the number of taxpayers according to cluster land-use groups in the municipalities of the province of Barcelona, 1852-58
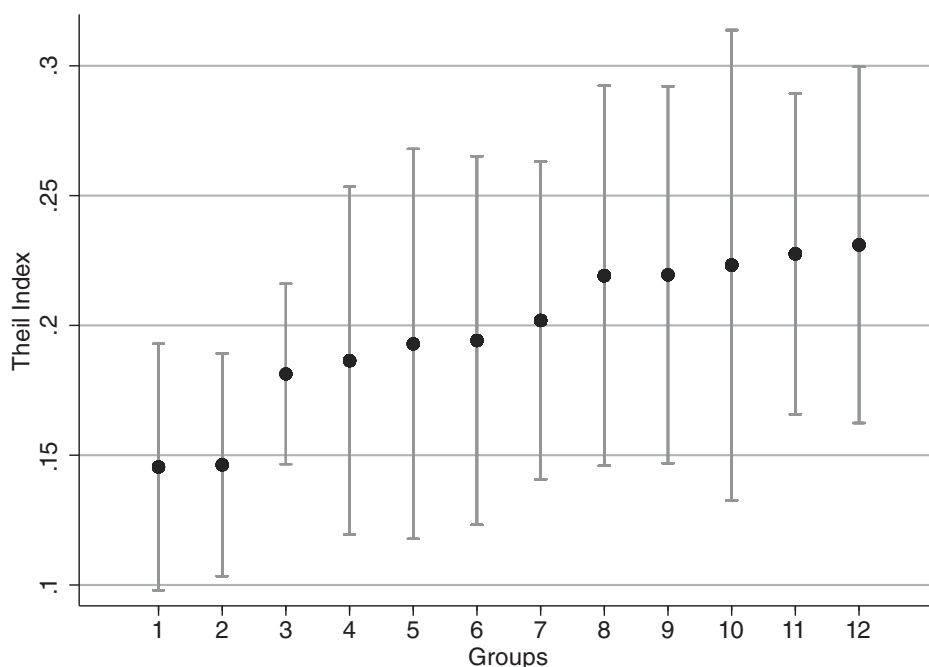
Source: our own, from the same historical sources referred in Figure 1 and Table 3.

According to Figure 2, the least unequal municipalities where those with a high share of vineyards, low share of forestry and cereal land, and close to Barcelona with either average population density (group 2) or high densities (group 1). Conversely, those more unequal municipalities had higher shares of cereal with low density (group 9 and 12), higher share of forestry with low density and low share of vineyards (group 8, 9 and 10), and high share of cereal land in municipalities close to Barcelona (group 11).

When comparing averages among groups we found the existence of statistical differences, specifically among group 1 and 2 in the one side and group 10, 11 and 12 on the

other side[2]. Furthermore, distances among mean and median warns us about the likely existence of non-normal distributions in the dataset. This first outcome leads us to ask about the underlying reasons for the complex spatial inequality pattern found in the province of Barcelona in mid-19th century, and the best statistical way to deal with this. Taking into account the characteristics of the available information, and the abovementioned biases existing in the dataset, we can outline a list of five likely factors that may have obscured these initial results:

a) There were no large areas of monoculture in the province of Barcelona. Almost all municipalities combined different proportions of all land uses. The very different size of municipalities, and the absence of large flat areas, involved the existence of many contrasting realities in the land uses prevailing within each place. In particular, the larger and more populous municipalities always combined cereal crops in the flattest lands with forest uses in the more slopping ones, and vineyards planted in intermediate slopes. Thus, we have never a "pure" winegrowing municipality clearly detached from other totally devoted to cereal or forest uses.

b) As explained, the database includes only taxpayers who had some real estate of their own. That means excluding some people deprived of property who, in many cases, obtained most or all of their incomes through wages earned by working in agriculture. At the same time, however, the database includes a large proportion of taxpayers only owing a poor house and a small vegetable garden, or having a sharecropping contract. If a significant number of adults deprived of property were unevenly distributed between municipalities with different land usages, this may introduce another bias in our database.

c) The simultaneous presence of wealthy landowners and well-off peasants along with a high proportion of landless residents who only held a poor house with garden, or could rely on sharecropping contracts, involves mixing very different realities in the same database. The resulting distribution seems to move in different orders of magnitude. As explained, this is largely the outcome of ambiguous data which is halfway between a distribution of land ownership and a distribution of agrarian income. To make it more coherent, either all types of income are included in the database or all attributed cadastral earnings should be converted into the original valuation of real estate property.

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2. An ANOVA test shows a F-statistics=4.20 and p=0.001<0.05 accepting the existence of differences among means.

d) The municipalities were not only very different in size, but also in population and wealth. As population density increased, so did the number of residents who made their living with activities that had little or nothing to do with land and livestock ownership. In this point, the contrast between rural towns, villages and the city matters. Barcelona becomes a special case that for our purpose has to be set aside as an outlier.

e) Inequality in the distribution of agrarian incomes within each municipality also depended on its level of wealth. Poorer areas could have lower inequality indices just because people had to achieve at least a subsistence minimum. However, the frontier of maximum inequality rose along with the wealth of a rural community. Consequently, the comparisons of inequality between municipalities should take into account their respective levels of the inequality possible frontier (IPF) and Inequality Extraction Ratio (IER).

In order to solve these difficulties, and improve our quantitative analysis, we will undertake in the next sections a deeper analysis of rural income inequality by including a level of subsistence income, using the frontier of maximum inequality linked to the wealth of each community (IPF), and comparing it with the inequality registered (IER).

4. A DEEPER ANALYSIS OF AGRARIAN INCOME INEQUALITY

Now we will try to deal with the double bias encountered, due to the fact that the original dataset only includes taxpayers, not the entire rural population who earned incomes from agrarian activities; and also, that many of these taxpayers appear with implausible incomes below the minimum subsistence level. The first bias reduces and the second one increases the inequality level, and without knowing their relative weight we cannot guess how they may skew the results obtained from this database. To correct the first bias, we have subtracted from the population figures in the census of 1857 the number of owners included in the lists of taxpayers of 1852, in order to then add to the original database the adult male population without any land, house or cattle of their own. They will be taken as a zero group in the valuation of property in each municipality. Afterwards, so as to turn the ambiguous dataset on personal wealth into a clearer distribution of agrarian incomes, we have added a minimum vital income of 1,500 *reales* a year –considered to be obtained from wages or earnings other than land, housing and livestock rents– to the earning valuation of property held by all inhabitants included in the new dataset. As explained, this flat vital income is obtained considering the unskilled daily wage of a Catalan labourer at the time multiplied by 260 working days a year (see the methodological supplementary material).

Unfortunately, these two changes will entail some disadvantages as well. The major drawback is that all inequality levels resulting from the new dataset are lower than the original ones, as expected. Taking this strong shift towards a more even distribution into account, from now on we can only consider significant the relative differences between the new Theil indices obtained in each municipality, not their absolute values. The key question is how different the new distributions are from the previous ones obtained with only taxpayers.

FIGURE 3

Theil indices of the corrected sample from the original dataset, according to cluster land-use groups of the municipalities in the province of Barcelona, 1852-58
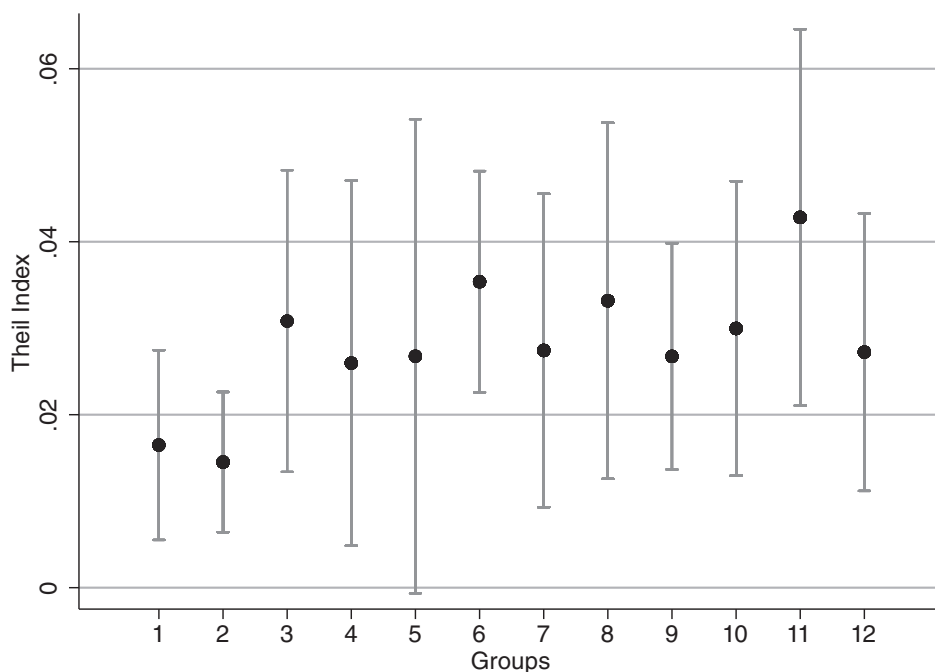
Source: our own, from the same historical sources referred in Figure 1 and Table 3.

In Figure 3 we see that group 1 and 2 remained as the least unequal municipalities. The correction increases inequality in group 6 (with high share of forest, low population density and far from Barcelona), reinforces inequality in group 11 (high share of cereal and close to Barcelona), and reduces inequality in other groups with a high share of vineyards: 1, 2 and 12 (the latter being the most unequal in the non-corrected sample). Differences on means by different groups remained statically significant. It is clear that the omission of non-taxpayers overestimated inequality levels in those municipalities with a high share

of vineyards, and underestimated inequality levels in those municipalities with a high share of forestland and low population densities.

5. ESTABLISHING THE INEQUALITY POSSIBILITY FRONTIER (IPF) AND INEQUALITY EXTRACTION RATIO (IER)

After having incorporated the previous corrections and caveats in the calculation of Theil indices, now we have to face the most difficult task. How the lack of a clear spatial pattern found when comparing the land-use maps with inequality of rural income distribution can be overcome? It seems as if there was a greater historical contingency in the geographical patterns of agrarian income inequality (Figure 1) than in the geographical distribution of prevailing land uses (Garrabou *et al.*, 2009: 156). This might be due to diverging local paths. While the landowners of a municipality could have decided to keep their forest and pasture lands exploited in a traditional manner, raising livestock and selling timber, firewood or charcoal, others might have chosen to establish a great deal of *rabassa* tenants in them who transformed the same sorts of land into vineyards. These different occasional decisions could have reinforced themselves over time in neighbouring areas, leading through path dependence and self-reinforcing trends to contrasting spatial realities juxtaposed into the same territory.

The main question that arises is whether we can find or not some key omitted variables which could capture and explain a great deal of this historical contingency. An important side of the question is that once the landowners of a place had decided to offer or not an opportunity to establish immigrants or disinherited people as winegrowing tenants in their lands, this would have entailed consequences for population sizes and levels of wealth in each community as well. If there was any relationship between the level of agrarian income inequality and the increase of wealth attained through a high investment in land improvement in a rural community, this could provide an interesting way to capture the disturbing degree of local contingency we found. This is why we decided to account for the inequality possibility frontier (thereinafter, IPF) that depends upon the level of economic development and agrarian wealth, as put forward by Milanovic, Lindert and Williamson (2011). When the wealth of a community increases so does the IPF, which may generate a greater distance between the vast majorities kept at subsistence level and a tiny elite able to concentrate the rest of income.

Therefore, we are going to use the IPF in order to calculate new inequality indices of personal agrarian income adjusted to different levels of rural wealth (see the methodological supplementary material). The first step is to work out the maximum values of in-

come inequality in each municipality. Following Milanovic, Lindert and Williamson (2011), the average income of the elite is:

$$Y\varepsilon_i = \frac{TI_i - (N_i - \varepsilon_i) * \mu_s}{\varepsilon_i} = \frac{1}{\varepsilon_i}[TI_i - (N_i - \varepsilon_i) * \mu_s] \qquad (2)$$

where $Y\varepsilon_i$ is the average income of the elite in a municipality i, TI_i is the total income in each municipality, μ_s is the subsistence income in each municipality, N_i is the total adult male population and ε_i is the number of persons that represents the elite also in this municipality.

To obtain the Theil index for the IPF (T*) of each municipality, we consider equation (1). The local population is divided into two groups, the first one with the subsistence income (μ_s) and the other with the income of the elite that obtains the rest of the surplus of the municipality, as shown in equation (3).

$$T_i^* = \frac{1}{N_i}\sum_j \frac{x_{i,j}}{\overline{x_i}}$$

$$= \frac{1}{N_i}\left[(N_i - \varepsilon_i)\frac{\mu_s}{\mu_i}ln\left(\frac{\mu_s}{\mu_i}\right) \right. \qquad (3)$$

$$\left. + \varepsilon_i \frac{\frac{1}{\varepsilon_i}[TI_i - (N_i - \varepsilon_i) * \mu_s]}{\mu_i}ln\left(\frac{\frac{1}{\varepsilon_i}[TI_i - (N_i - \varepsilon_i) * \mu_s]}{\mu_i}\right) \right]$$

Lastly, to make comparable this index with the rest of the values obtained for the entire dataset we have normalized equation (3) dividing by ln (N_i). From the calculus of the T* normalized we can obtain the inequality extraction ratio (IER thereinafter) for each municipality, considering:

$$IER_i = \frac{Theil_{Norm,i}}{T_{Norm,i}^*} \qquad (4)$$

IER indicates the percentage of the inequality that existed in each municipality respect to the IPF, which is the maximum potential of inequality possible with a defined value

for ε_i, assuming $\varepsilon = 1$ (the elite is formed by one person), N_i is the value of the adult male population of the municipality. When ER → 0 the value indicates that the level of inequality registered in the municipality was well below the potential frontier of maximum value of inequality. In the other extreme, when ER → 100% the level of inequality obtained is close to the level of maximum potential inequality. The results can be observed in Figure 4.

FIGURE 4

Inequality Extration Ration (IER) according to cluster land-use groups, population densities and other features in the municipalities of the province of Barcelona, 1852-58
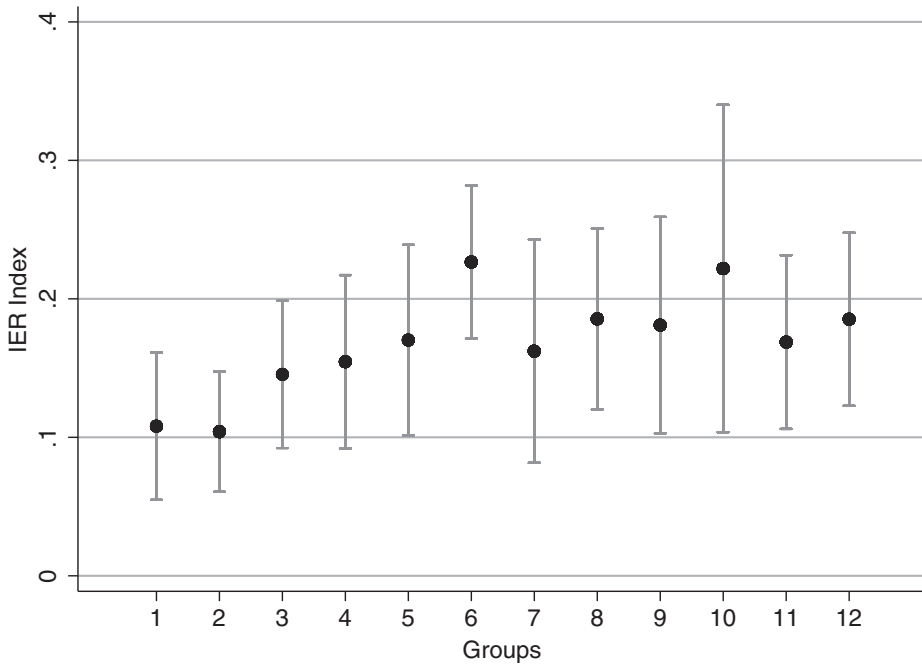
Theil$_{IPF}$ indices of each municipality have been calculated considering the elite = 1.
Source: our own, from the same historical sources referred in Figure 1 and Table 3.

Figure 4 and the summary of Table 4 confirm many of the previously reported results, adding at the same time a novel perspective. Winegrowing municipalities near to Barcelona (group 1 and 2) were further away from potential levels of inequality, while municipalities with mainly forestland, low population densities and far from Barcelona (group 6 and 10) were closer to their maximum IPF. Another interesting result is that IER figures for cereal crop municipalities near to Barcelona (group 11 and 12) now appear around the mean, whereas former Theil values had shown higher inequality (both for corrected and non-corrected estimations).

These changes in the ranks and levels of municipal inequality highlight the importance of introducing the corrections considered in the dataset so as to obtain more revealing results. As can be seen, the figures for the other groups remained stable with non-significant changes between IER and the former figures. ANOVA test confirms the existence of statistical differences between the means of the groups in both extremes, that is group 2 as being the least unequal municipalities and group 6 and 10 as being the most unequal municipalities (F=43.0).

TABLE 4
Extraction ratio (IER), Theil and Theil corrected with income of non-taxpayers, according to cluster land-use groups, population densities and other features in the municipalities of the province of Barcelona, 1852-58

	Absolute values			Mean = 100		
	Theil	Theil - corrected	IER	Theil	Theil - corrected	IER
1	0.15	0.02	0.11	72.2	57.9	62.4
2	0.15	0.01	0.10	72.6	51.0	60.1
3	0.18	0.03	0.15	89.9	108.2	84.0
4	0.19	0.03	0.15	92.5	91.1	89.3
5	0.19	0.03	0.17	95.7	93.9	98.3
6	0.19	0.04	0.23	96.3	124.2	130.8
7	0.20	0.03	0.16	100.2	96.3	93.7
8	0.22	0.03	0.19	108.7	116.4	107.1
9	0.22	0.03	0.18	108.9	93.8	104.5
10	0.22	0.03	0.22	110.7	105.2	128.1
11	0.23	0.04	0.17	112.9	150.2	97.5
12	0.23	0.03	0.19	114.6	95.6	107.0
Average	0.20	0.03	0.17			

Source: our own, from the same historical sources referred in Figure 1 and Table 2.

It is important to point out that this happens in spite of the fact of having previously included in our database a flat vital minimum income for all male adults, which inevitably entailed a compression of all Theil indices around very low absolute values of income inequality. The differences found become much more relevant when the abovementioned bias is taken into account, allowing us to confirm that the study of income inequality using the IER approach is able to reveal some important hidden dimensions of the question.

Table 4 summarizes the main results found with this statistical corrections and novel methodological approaches. They confirm that, before the *Phylloxera* plague, vineyard spe-

cialization was mainly performed in the province of Barcelona by poor landless peasants who sought to earn their living working as emphyteutic tenants on the thin and sloping soils leased to them by landowners. Nevertheless, this commercial specialization played a key role by linking the area with the emerging Atlantic economies, and gave way to an increase in population densities near the level of an urban-industrial society (Badia-Miró *et al.*, 2010; Badia-Miró & Tello, 2014). These figures also uphold our initial hypothesis that agrarian income inequality was kept lower in municipalities where vine-growing was carried out mixed with some degree of cereal cropping and forestry uses. This reduction in income inequality took place notwithstanding the land improvements made by these poor winegrowers, which increased the wealth of the whole rural community thus enhancing the frontier of a possible maximum inequality (IPF).

Indeed, the hard work of terracing poor sloping soils and planting vineyards was a huge investment in land improvement (Olarieta, Rodríguez & Tello, 2008) which increased the wealth of the entire rural community. How can this be reconciled with the fact that average income in winegrowing municipalities (group 1 and 2) appears to be the lowest in Table 5? The distinction between agricultural income averages per person or unit of land becomes a key issue here (see also Table 6 of the methodological supplementary material). As can be seen in Table 5, income per unit of land was higher in winegrowing municipalities than in forestry areas or cereal zones. Nevertheless, per capita averages were lower in the former than the latter.

Catalan vineyards were either spread over former forest and brushwood lands, or replaced poor intercropped cereal lands previously sown within sparse rows of vines and olive trees. The right columns in Table 5 clearly confirm that vineyard specialization enhanced the wealth of land –or the *landesque capital* in the term put forward by Amartya Sen (1959) and Håkkanson and Widgren (2014). However, left columns highlight that vineyards also required higher labour intensity, and this increased population densities even more. Therefore per capita levels of agricultural income and wealth became the lowest, besides being more evenly distributed.

This feature coincides with the estimates made in mid-18th century France by François Quesnay, who also attributed to the winegrowing peasant-owners the lowest non-wage agricultural income in his *Tableau Économique* and other writings (Milanovic, 2010). However, French winegrowers were mainly property-holders –exactly the same status that Catalan *rabassa* tenants aimed to earn some day through their collective struggle. Compared with their French counterparts, the Catalan winegrowing emphyteutic tenants could only be considered as would-be peasants. Nevertheless, their legal and actual status was also clearly stronger than many other tenants-at-will, or labour-tenants, that existed in sev-

eral regions of Europe at the time, such as the *statartorpare* in Sweden, *husmennene* in Norway, *husmaendene* in Denmark, or *heuerlinge* in Northwestern Germany (Morner, 1970). Unlike the German *heuerlinge*-system (Schlumbohm, 1996), for example, that left the disinherited layers of the rural society at the mercy of landowners' will, the Catalan *rabassa* winegrowers were entitled with a temporary ownership over the vines they had planted as long as they were kept alive (Giralt, 1965; Balcells, 1980; Carmona & Simpson, 1999; Simpson, 2011; Colomé, 2013; Colomé, Planas & Valls-Junyent, 2015; Garrido, 2017a, 2017b, 2017c).

TABLE 5

Average income per person and unit of agricultural land in Spanish *reales*, according to cluster land-use groups and population in the municipalities of the province of Barcelona, 1852–58

Group	N	Mean Income	Mean Income corrected	Income / ha	Income corrected / ha
1	15	857.7	1,916.7	819.9	3,483.4
2	30	631.9	1,933.9	163.1	849.6
3	5	1,010.8	2,172.7	333.0	1,064.1
4	20	991.0	1,985.3	333.0	1,789.2
5	8	1,363.9	1,945.9	632.4	3,065.8
6	20	1,984.6	2,033.5	43.2	175.3
7	51	1,009.3	2,038.0	87.9	362.8
8	37	1,214.8	2,080.9	50.4	191.2
9	14	1,111.1	2,026.4	64.6	269.0
10	48	1,441.0	1,996.0	43.6	213.3
11	26	1,078.8	2,370.4	203.5	613.6
12	18	869.4	1,987.6	192.4	897.8
Total	292	1,144.4	2,043.7	169.7	748.5

Source: our own, from the same historical sources referred in Figure 1 and Table 2.

During the 19th century many precarious *heuerling*-tenants emigrated from North-western Germany to the United States, while most Catalan *rabassa*-sharecroppers fiercely fought with the landowners to stay in the land and become wholly owners of it. In Albert Hirschman terms, the former had to take the "exit" option while the latter could raise their "voice" to organize collective action (Hirschman, 1970). By transforming into vineyards a previous landscape of brushwood, forest and poor cereal crops, these *rabassa* tenants not only opened a room for themselves among the Catalan rural communities. They also gained a place in society and a share of its income (Garrabou, Tello & Cussó, 2008; Garrabou *et al.*, 2009). By increasing population numbers and deepening the home market, this eventually helped to turn Catalonia into a late-modern industrious society

(Vries, 2010; Marfany, 2012) and an early-contemporary industrial economy (Valls-Junyent, 2004; Badia-Miró & Tello, 2014).

6. CONCLUSIONS

Despite the initial high degree of contingency found in the spatial location of Theil indices (Figure 1), and the lack of a simple correlation between inequality indices and other variables tested, we have found some relevant land-use patterns of inequality in personal agrarian wealth or income distribution in the municipalities of the Barcelona province in mid-19th century. These land-use profiles of agrarian income inequality have been confirmed and enhanced by correcting Theil indices of estimated income distribution for all the male adult population, and applying the inequality possible frontier (IPF) approach to compare the Inequality Extraction ratio (IER) with the maximum attainable one.

The corrected results confirm that agrarian income inequality was lower in winegrowing municipalities while, at the same time, underline the higher inequality of those mainly forestry municipalities that were on average already apparent before the correction of the sample and the introduction of the IER index. Those mainly forestry municipalities where the more unequal, and the highly populated winegrowing ones were the least in spite of attaining higher population densities, developing a commercial vineyard specialization, and increasing the total wealth above a subsistence line could have also meant an extended frontier (IPF) of possible inequality through a greater extraction ratio (IER) exerted by an agrarian elite. This outcome can be interpreted as a historical process of socioeconomic and political empowerment achieved by the Catalan rural class of winegrowing tenants thanks to the long-lasting social fight they waged from the 18th century up to the outbreak of Spanish Civil war in 1936 (Badia-Miró & Tello, 2014; Tello & Badia-Miró, 2015; Colomé *et al.*, 2016).

In this sense, the statistical cross-section analysis conducted with a remarkably large database of more than 86,000 recorded taxpayers in 292 municipalities has provided for the first time solid quantitative answers to a set of questions posed for a long time by Catalan rural historians. Our results also reinforce the ideas of those who argue that, beyond the undeniable impact of purely economic factors, the historical path followed by wealth and income distribution moves between greater degrees of freedom under a strong influence of many social, cultural and political forces (Atkinson & Piketty, 2007). As Paul Krugman (2009) or Joseph Stiglitz (2012) have pointed out, changes in social values, political regulations, institutions and politics matter (Garrabou, Ramon-Muñoz & Tello, 2015).

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ANNEX

TABLE A1

Number of taxpayers in the Distribution of Personal Wealth in Real Estate Ownership of 1852 in the province of Barcelona

Districts of the province of Barcelona	taxpayers				
	All	With less than 2,000 *reales*	%	With less than 1,500 *reales*	%
Barcelona	11,940	7,642	64.0	7,004	58.7
Arenys	6,774	6,161	91.0	5,980	88.3
Berga	3,657	2,970	81.2	2,820	77.1
Granollers	8,384	7,608	90.7	7,447	88.8
Igualada	9,852	9,055	91.9	8,785	89.2
Manresa	9,561	8,796	92.0	8,601	90.0
Mataró	5,326	4,748	89.1	4,576	85.9
Sant Feliu de Llobregat	8,673	8,021	92.5	7,834	90.3
Terrassa	8,276	7,659	92.5	7,491	90.5
Vic	7,356	6,430	87.4	6,242	84.9
Vilafranca del Penedès	6,500	5,676	87.3	5473	84.2
Province of Barcelona	86,299	74,766	86.6	72,253	83.7

Source: our own, from the Distribution of Personal Wealth in Real Estate Ownership of 1852 in the province of Barcelona (Library of the Universitat de Barcelona, reference 146-1-II/13).

TABLE A2

Taxes paid and tax burden of taxpayers above and below an attributed cadastral income of 2,000 *reales* a year in the province of Barcelona, according to the Distribution of Personal Wealth in Real Estate Ownership of 1852 (in *reales* a year or percentaje)

Districts of the province of Barcelona	Estimated cadastral income of all taxpayers	Taxpayers with more than 2,000 *reales*				
		Estimated cadastral income	% of all income attributed	Taxes paid	% of all taxes paid	% of tax burden
Barcelona	40,745,709	36,242,839	88.9	4,447,032	87.4	12.3
Arenys	5,918,547	3,362,731	56.8	513,458	55.6	15.3
Berga	5,061,354	3,708,250	73.3	541,062	68.5	14.6
Granollers	7,774,228	5,178,452	66.6	812,785	66.3	15.7
Igualada	6,778,104	3,579,993	52.8	629,203	50.2	17.6
Manresa	6,933,038	4,343,674	62.7	755,428	60.5	17.4
Mataró	5,076,673	2,980,214	58.7	472,361	57.0	15.8
Sant Feliu de Llobregat	6,555,209	3,710,259	56.6	606,685	55.1	16.4
Terrassa	6,571,379	3,781,913	57.6	580,909	57.3	15.4
Vic	6,994,514	5,110,590	73.1	1,039,174	72.2	20.3
Vilafranca del Penedès	7,038,780	4,895,405	69.5	890,345	68.2	18.2
Province of Barcelona	105,447,534	76,894,320	72.9	11,288,442	69.6	14.7

Districts of the province of Barcelona	Estimated cadastral income of all taxpayers	Taxpayers with less than 2,000 *reales*				
		Estimated cadastral income	% of all income attributed	Taxes paid	% of all taxes paid	% of tax burden
Barcelona	5,087,106	4,502,870	11.1	640,074	12.6	14.2
Arenys	923,500	2,555,816	43.2	410,042	44.4	16.0
Berga	790,410	1,353,104	26.7	249,348	31.5	18.4
Granollers	1,225,356	2,595,776	33.4	412,571	33.7	15.9
Igualada	1,252,699	3,198,111	47.2	623,496	49.8	19.5
Manresa	1,249,441	2,589,364	37.3	494,013	39.5	19.1
Mataró	829,013	2,096,459	41.3	356,653	43.0	17.0
Sant Feliu de Llobregat	1,100,946	2,844,950	43.4	494,261	44.9	17.4
Terrassa	1,013,776	2,789,466	42.4	432,866	42.7	15.5
Vic	1,439,601	1,883,924	26.9	400,427	27.8	21.3
Vilafranca del Penedès	1,304,541	2,143,375	30.5	414,196	31.8	19.3
Province of Barcelona	16,216,389	28,553,214	27.1	4,927,947	30.4	17.3

Source: our own, from the Distribution of Personal Wealth in Real Estate Ownership of 1852 in the province of Barcelona (Library of the Universitat de Barcelona, reference 146-1-II/13).