Income Inequality across the French Departments over the Last 100 Years

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Abstract – This paper analyses the change in spatial income inequality across the departments (the French *Départements*) of metropolitan France since 1922. Its most significant contribution is the reconstruction of average fiscal income per department, before and after the payment of income tax, based on an unprecedented use of archives from the Ministry of Finance. We highlight the following stylised facts: *(i)* a very significant reduction in interdepartmental average fiscal income inequality over the last century, with two periods of continuous decline, between 1922 and 1939 and from 1948 onwards; *(ii)* a significant contribution, albeit varying over time, of income tax to the reduction in inter-departmental inequality; *(iii)* an improvement in the situation in all departments lying along a line running from Calvados to Gard since 1948.

JEL Classification: N34, N94
Keywords: spatial inequality, French departments, fiscal income, income tax

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We would like to thank two anonymous contributors and Thomas Piketty for their constructive comments. We are solely responsible for any errors or omissions.
Received in April 2020, accepted in February 2021. Translated from 'Les inégalités de revenu entre les départements français depuis cent ans'.
The opinions and analyses presented in this article are those of the author(s) and do not necessarily reflect their institutions' or Insee's views.

Citation: Bonnet, F., d'Albis, H. & Sotura, A. (2021). Income Inequality across the French Departments over the Last 100 Years. *Economie et Statistique / Economics and Statistics*, 526-527, 49–69. doi: 10.24187/ecostat.2021.526d.2052

The election results and recent social movements in several developed countries have sparked growing interest in the question of spatial inequality. What is sometimes termed the "regional split" refers to a process of divergence between the metropolitan areas making an ever greater contribution to the generation of wealth and the rest of the national territory. Deinstrustrialisation and the emergence of a service and knowledge economy contribute to polarising business activity in some regions. The aim of this paper is to provide a historical perspective on this development, using a new reconstruction of interdepartmental income inequality since 1922.

The departmental level (the French *Départements* level) is useful and relevant. Useful because the departments' areas have been relatively stable since their creation in 1789, which makes it easier to conduct a historical comparison of departmental data. Relevant because this is the level at which certain regional development policies in the health, social, education and planning sectors are deployed. It is also relevant because people are attached to this level, as illustrated by various anecdotes: strong opposition to the plan to remove the department number from vehicle registration plates in 2008, strong proportion of *gilet jaunes* Facebook groups that include a reference to the department (20% according to Boyer *et al.*, 2019), etc. Historical reconstructions of income at smaller scales, such as commune or canton, are possible, but these come up against difficult issues surrounding the spatial development of these units, which was very significant over the 20th century, and the disconnection between the places where the people live and where they work.

In this paper, we document the development in interdepartmental income inequality before and after payment of income tax. Our first contribution is to have reconstructed average income for each of the 90 French departments (excluding overseas departments and the new departments formed from the splits that took place in the 1960s and 1970s). We have based our work on a new database of average tax income in each department of metropolitan France since 1922, developed from the digitisation of the archives of the Ministry of Finance. These fiscal data on income tax, combined with Bonnet & Sotura's (2021) database on the income distribution of each department and Bonnet's (2020) database on the population of each department broken down by age, allow us to measure average standards of living in each department in a new and more direct way. Based on the average tax income per department calculated using a regression before and after payment of income tax for each year since 1922, we develop indicators of inequality across departments that allow us to analyse the change in inequality over the last century.

The study of spatial inequality in France is, of course, not new; however, to date, historians and researchers in social science have only had indirect and piecemeal measures of long-term local standards of living. Several works (Combes *et al.*, 2011; Bazot, 2014) have since then taken departmental reconstructions of the value added per inhabitant as a basis. The latter allows us to study the change in location of productive activities and spatial differences in productivity, yet it still runs the risk of providing a biased measure of inequality in terms of standards of living due to the monetary transfers that take place between regions. Furthermore, other works complement these by looking into income dynamics across broader regional areas (see, for example, Behaghel, 2008).

Based on our data, we can see, on the whole, a very significant reduction in average tax income inequality, specifically over the periods 1922-1939 and 1948-2015. The period from 1922 to 1948 is characterised by a fall in relative income in the departments in the north-east arc around Paris and in the majority of the departments along the Atlantic coast, the Loire Valley and, to a lesser extent, Île-de-France. The reduction in inequality since 1948 can be likened to a phenomenon of convergence between the majority of departments. However, the departments of the three large metropolitan areas of Paris, Lyon and Marseille have experienced a deterioration in their relative situation. This trend is particularly noteworthy given the known phenomenon of productivity growth in large metropolitan areas and highlights the disconnection between a department's value added per inhabitant and its average income. Since the 1990s, income inequality between the departments has fallen considerably less sharply, in line with the global trend in income inequality (Blasco & Picard, 2019).

We can also observe that income tax significantly reduced interdepartmental inequality over three distinct periods: up to the start of the 1950s, the reduction was small; it then increased progressively up to the end of the 1980s, reaching its maximum level in 1989, when the national tax rate was at its highest; since then, the reduction has been much smaller. Finally, in terms of spatial income distribution in France, the very strong concentration trend seen in the 1940s

and 1950s was erased over the following two decades. However, since the end of the 1970s, income concentration has remained unchanged. But even here, this trend is in contrast with that of the increased spatial concentration of value added over the course of the last few decades (see Sanchis *et al*., 2015).

This paper falls within two fields of economic literature. Firstly, that of income inequality, in which we find Piketty's seminal paper (2001) on high incomes in France, followed by numerous works studying income inequality in other countries, such as Atkinson (2005) for the United Kingdom, Atkinson & Salverda (2005) for the Netherlands, Alvaredo (2009) for Portugal, or more recently Garbinti *et al*. (2018) for France. We are therefore expanding this literature to include local trends, which provide a greater understanding of the national dynamic due to their diversity. Our article also falls within the literature on regional convergence and divergence processes. Based on an analysis of regional income for a series of countries, including France, Williamson (1965) showed that the spatial trend in inequality followed a bell curve until the middle of the 20th century. During a country's initial development phases, regional differences increase because the most advanced regions benefit the most from development: they become relatively more productive and a growing proportion of production concentrates here. Following this, during the second phase, production factor mobility and decreasing returns create a process of convergence. A bell curve mapping spatial concentration is also found in the new economic geography literature started by Krugman (1991). The empirical literature that followed (Felice & Vecchi, 2015, on Italy between 1860 and 2010; Badia-Miro *et al.*, 2012, on Portugal between 1890 and 1980; Buyst, 2010, on Belgium between 1896 and 2000; Enflo & Rosés, 2015, on Sweden in the 20th century) confirmed this analysis using data on regional value added reconstructed using the method proposed by Geary & Stark (2002), i.e. based on national sectoral value added and regional employment by sector.

In the case of France, economists working on these issues used a different type of methodology to reconstruct the value added per department and only did this for a limited number of years. Toutain (1992-1993) reconstructed the departmental value added in 1860 and 1930 based on surveys on agriculture and industry, and census data. Combes *et al*. (2011) use Toutain's data (1992-1993) and those generated by INSEE for the 1980s and 2000s; Bazot (2014) reconstructed value added data every 10 years between 1840 and 1911 using Toutain's data (1992-1993) and trade tax data (a tax on non-agricultural businesses); Caruana-Galizia (2013) developed an econometric model based on the sectoral composition of the departments ; and lastly, Sanchis *et al.* (2015) supplement the data from Combes *et al.* (2011) with INSEE data for the 2000-2014 period. These authors note a strong departmental divergence in value added per inhabitant since the 2000s. This divergence is found in the literature on urban economics, which provides analyses of local job markets since the 1980s: Moretti (2012) and Diamond (2016) on metropolitan areas of the United States, and Lessmann (2014) and Lessmann & Seidel (2017) who found that inequality between regions increases gradually.

The rest of this paper is structured as follows: the first section provides details on the data, the methodological choices made to construct them, and the variables and indicators used; the second section is dedicated to the trends in interdepartmental inequality between 1922 and 2015.

1. Data, Methods and Variables

Here, we are interested in the changes in two variables within each department: average tax income and income after tax. Tax income is the total income declared by all households (whether taxable or not) within the department before any reduction to which they may be entitled are taken into account. We define the average tax income of the department as the ratio between that tax income and the department's adult population. We define the adult population as all people aged 20 or above, following Piketty (2001), so as to remain unaffected by changes in legislation on the age of legal majority. Income after tax is the difference between the tax income and the amount of income tax paid in each department. The two variables are measured for each department and each year between 1922 (first year for which we have fiscal data and population data for all metropolitan departments) and 2015.

The geographic scope of the study covers 90 French departments. In order to retain a stable geographic structure throughout the period, we made several methodological choices. Firstly, we kept the boundaries that were in place before the department reorganisations that took place in the 1960s and 1970s. In 1964, the decision was made to reorganise the Paris region and to split (from 1968) the Seine department into four departments (Hauts-de-Seine, Paris, Seine-Saint-Denis and Val-de-Marne) and the

Seine-et-Oise department into three (Essonne, Val-d'Oise and Yvelines).[1] In 1975, Corsica was split into two departments (Corse-du-Sud and Haute-Corse). From those dates onwards, we use the data on the newly created departments to reconstruct data for the populations of the initial departments. Secondly, overseas departments are not included in the analysis because the statistical series are only available for a period that is too recent. The list and map of the 90 departments studied are given in the Appendix (Figure A-I).

1.1. Database Construction

The construction of our database is based on: *(i)* the use of two recent departmental databases from which we have derived the average tax income for the years 1960-1969, 1986-1998 and 2001-2015; *(ii)* other departmental fiscal information collected for the years 1922-2015; and *(iii)* an estimation procedure allowing us to estimate the tax income for the years 1922-1959, 1970-1985 and 1999-2000. We will now explain this procedure.

Our first statistical source is the database built by Bonnet & Sotura (2021). Using administrative archives produced by the tax services, the authors estimated the distribution of tax income in each department and for each year of the following periods: 1960-1969, 1986-1998 and 2001-2015. We have used the total tax income (excluding capital gains) of each department. The second statistical source is the database built by Bonnet (2020), which provides an annual estimate of the population of each department broken down by age. Combining these two sources therefore gives us the average tax income for each department for the years 1960-1969, 1986-1998 and 2001-2015.

Furthermore, we also gathered new data for our estimation. These new data include the following variables for each of the 90 departments and all years from 1922 to 2015: the number of taxed households, total taxable income declared by those households and total income tax paid by those households.

We digitised the statistical tables contained in the archives of the Ministry of Finance held at the Savigny-le-Temple site. For the period from 1922 to 1974, we digitised the tables from the *Renseignements Statistiques Relatifs aux Impôts Directs* (RSRID, a set of volumes from between 1930 and 1975 on direct taxes). For 1975 and the period from 1978 to 2000, we digitised the tables from the *Annuaire Statistique de la Direction Générale des Impôts* (ASDGI, statistical yearbook of the Directorate-General for Taxes, volumes for 1976 and 1979-2002). We also retrieved data from the tax tabulations digitised by Bonnet & Sotura (2021). The data on taxable income are not available for the years 1978-1985 and the data on the number of taxed households are unavailable for the years 1986-1989. For all years from 2003 onwards, we used the ASDGIs available online on the website of the Directorate-General for Public Finance (volumes for 2004 and subsequent years).

In addition to the missing years, several other years pose problems. Between 1939 and 1945, there are no data for the three occupied departments (Bas-Rhin, Haut-Rhin and Moselle). The data have been imputed as follows: for each of the three departments and each of the three relevant variables, we calculated the ratio between the variable for the department and the variable for Vosges in 1938 and 1946 and interpolated in a linear fashion. In 1954, the data in the RSRIDs are not very credible because the taxes collected were ridiculously low, which is possibly due to a deliberate undervaluation in response to fiscal protest at the time.

The relevant year is the income year (and not the year in which the data was collected). Note that these variables only relate to the income of taxed households and do not therefore give the department's total tax income. Indeed, since the creation of the income tax at the start of the 20th century, only a portion of households has been taxable. According to Piketty (2001), the proportion of taxed households was around 10-15% between the two world wars, and only reached around 50-60% in the 1960s-1970s. Above all, up to 1986, only taxed households filled out an income tax return; therefore, we only have fiscal information for these taxed households for the years prior to 1986. The aim of our methodology is therefore to enable us to estimate average tax income, by department, of all taxed and non-taxed households.

1.2. Calculation of Average Tax Income

The average tax income values for the years 1960-1969, 1986-1998 and 2001-2015 have been obtained using two simple econometric models. The explained variable, y_{it}, is the average tax income of department i in year t relative to the average tax income calculated based on all 90 departments in year t. The series of numerator

1. The area following the split did not fully match the area before the split (some communes changed department) but the percentage of the population that moved as a result of the reorganisation is minimal. Furthermore, we have drawn up a robustness analysis that includes the seven departments of the Paris region.

values comes from Bonnet & Sotura (2021) while the denominator series has been developed on the basis of data from Garbinti *et al*. (2019).[2] We regress the average tax income of a department on the fiscal variables collected and demographic variables that enable us to take into account the trend in income (and in tax paid) over the life cycle.

To determine the average tax income for the periods 1922-1959 and 1970-1975, the estimated model is written as follows:

$$y_{it} = \sum_{a=1}^{7} \alpha_a p_{ait} + \beta r_{it} + \gamma r_{it} \times s_t + \delta_i + \theta + \varepsilon_{it} \qquad (1)$$

where p_{ait} represents the share of age category a in the population of department i (the seven age categories taken into consideration are: 0-19, 20-29, 30-39, 40-59, 60-64, 65-79, 80+) relative to the share of age category a in the population of the 90 departments; r_{it} is the average tax income of the taxed households of department i relative to the average tax income of taxed households in all 90 departments; s_t is, for all departments, the ratio between the total income declared by taxed households and tax income; δ_i is a fixed departmental effect; θ is a constant; and ε_{it} is an error term. We interact r_{it} with s_t to take account of the fact that the share of the tax income subject to income tax changes over time and that it is likely to affect the value of coefficient β. Model (1) is estimated for different periods depending on the year for which we want to determine the tax income. For example, the estimation of income for the period 1922-1944 is based on an equation estimated with values observed over the period 1960-1969, while income for 1945-1959 and 1970-1975 is estimated using the values for 1960-1969 and 1986-1998.

To determine the average tax income for the periods 1978-1985 and 1999-2000, for which the data on taxable income of taxed households are available, the estimated model is written as follows:

$$y_{it} = \sum_{a=1}^{7} \alpha_a p_{ait} + \beta t_{it} + \gamma tu_{it} + \delta_i + \theta + \varepsilon_{it} \qquad (2)$$

where t_{it} represents the average amount of tax of department i relative to the average amount of tax for all 90 departments and tu_{it} is the number of taxed households per adult in department i relative to the number of taxed households per adult in all 90 departments. Model (2) is estimated based on the values for 1960-1969 and 1986-1998 to predict the missing income for years 1978 to 1985 and on the values for 1986-1998 to predict the income for 1999 and 2000. The data from Bonnet & Sotura (2021) for 2001-2015 are not used to predict the preceding years due to a break in the data caused by a change in legislation on tax declaration in the year in which marital status changes.

In total, four estimations were made: for each, the model almost exactly estimates the ratio between the tax income of a department and the income of the 90 departments, as shown by the R^2 of the estimates (Table 1; see also Appendix, Table A-1 for the detailed results). Here, we can see, in particular, that the absence of fixed effects in the regressions only marginally changes the predictive power of the models.

Three years have not been predicted using the models, due to the lack of reliable information in the archives of the Ministry of Finance: 1954, 1976 and 1977. Here, we therefore used a linear interpolation of the ratio between the average tax income of each department and the average tax income of the 90 departments, before uniformly readjusting the variable obtained for the numerator in order to ensure that the total obtained for the 90 departments corresponded to the values given in Garbinti *et al*. (2019). Table 2 shows the source of our valuation of the tax income of the 90 departments under consideration for each year of the reference period.

1.3. Variables and Indicators

We use several inequality indicators. We start with the Gini indicator, which has the advantage of taking into consideration the entire income distribution and of being independent of the average. It allows us to understand whether there has been any convergence of income between the departments; this 'sigma convergence' is more robust than an analysis that regresses growth rates on the initial conditions. In addition to this, we also analyse the distribution of the average tax income of the 90 departments. We assess the share

2. *We have not used the same variable as Garbinti* et al. *(2019) because they include overseas departments. Hence we keep the geographical scope constant.*

Table 1 – **Specifications of the estimations**

Estimation	#1	#2	#3	#4
Data	1960-69	1960-69; 1986-98	1960-69; 1986-98	1986-98
Model	(1)	(1)	(2)	(2)
R^2	0.993	0.989	0.984	0.993

Table 2 – **Estimation or source used by period**

Years	
1922-44	Forecast based on estimate #1
1945-53	Forecast based on estimate #2
1954	Interpolation
1955-59	Forecast based on estimate #2
1960-69	Bonnet & Sotura (2021)
1970-75	Forecast based on estimate #2
1976-77	Interpolation
1978-85	Forecast based on estimate #3
1986-98	Bonnet & Sotura (2021)
1999-2000	Forecast based on estimate #4
2001-15	Bonnet & Sotura (2021)

of certain 'quantiles' of departments in the total average tax income of the 90 departments, such as that of the nine wealthiest departments (for which the average tax income is the highest) or the 18 least wealthy departments (for which the average tax income is the lowest). By considering the average income of the departments and not their total income, we do not need to weight the departments based on population when comparing them against each other. The analysis of the change in the share of various quantiles allows us to assess the distortion of the distribution.

We also relate our income variables to the surface area (in km^2) of each department to assess a sort of "regional performance". The differences between the departments in terms of this performance are likely to reflect inequality in the concentration of business activity. Indeed, income relative to surface area is the same as the product of average income and density. While these two terms have a positive correlation, we expect income inequality per km^2 to be greater than that of average income.

Furthermore, where our inequality indicators aggregate average income, they are not weighted. This allows us to focus on the differences between the relevant entities, which, for this work, are the departments. Furthermore, this also means that we do not need to implicitly assume that income is equally distributed within the department, an assumption which would be very far from reality (see Bonnet & Sotura, 2021). However, by not weighting, our results are more susceptible to geographical division. Therefore, the Appendix also contains our indicators with the income weighted by the adult population of each department. Our qualitative results are not affected by that hypothesis. In the case of income relative to department surface area, our observations are weighted by surface area (which is, of course, fixed in time) in order to look at the trend in income concentration gaps in metropolitan France.

However, the Gini or interdecile indicators are not affected by any spatial permutation of the departments and do not take their spatial proximity into account. To overcome this restriction, we also show our variables on maps of France. The departmental income is therefore given relative to the average income for all the departments.

2. Results

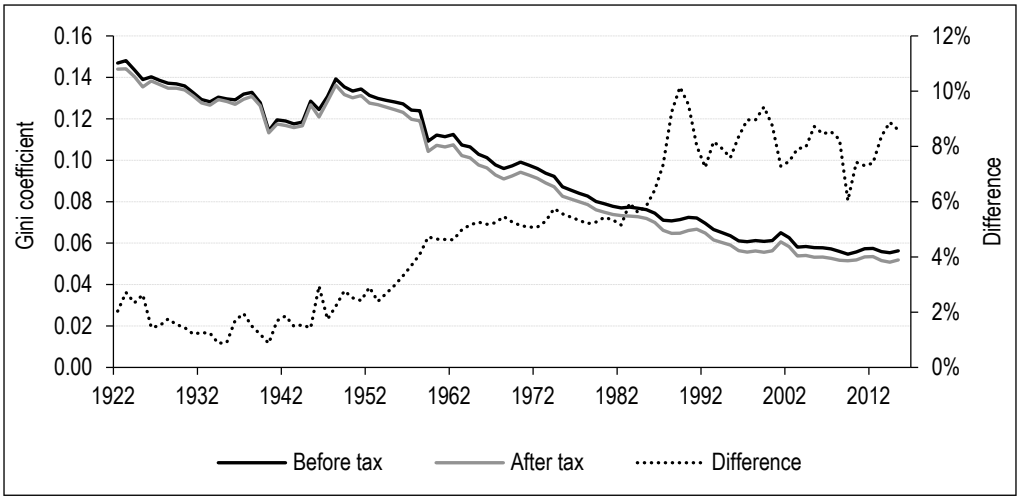
We will now detail the changes observed over the last century, firstly the trend in inequality by presenting aggregated indicators at national level, then the trends in dynamics by department, shown using maps.

2.1. Change in Inequality

Figure I shows the trend in interdepartmental average tax income inequality. The change over the last century is clearly downward. The Gini indicator was above 0.14 at the start of the period and is now below 0.06. We can see two periods of almost continuous decline: from 1922 to 1939 and from 1948 to 2015. Between 1948 and 1990, the decline was almost linear and the indicator fell, on average, by 1.4% per year. The decline is less rapid after, averaging -0.3% per year since 2000.

The period covering World War II and the few years that followed was more turbulent. It begins with a sharp drop, linked to the disorganisation of the urban departments and the increase in the relative weight of agriculture in the French economy during the war. This drop is offset by a very steep rise in inequality between 1944 and 1948, returning to levels seen in the mid-1920s. The wartime years caused significant population movements between departments along the Eastern border and the rest of France (Bonnet, 2021), which also led to a significant spatial redistribution of income. During the war,

Figure I – **Gini coefficient for average tax income before and after income tax, 90 departments, 1922-2015**



Notes: Gini coefficients are computed for average tax income per adult in the departments of metropolitan France before and after income tax, respectively. There is no weighting.
Reading note: In 1922, the Gini coefficient for the average tax income before income tax was 0.147.
Sources: Tax archives and calculations by the authors.

statistical data on both income and population were a lot more fragile. For this reason, our analyses focus on the periods 1922-1939 and 1948-2015.

Figure I also shows the change in inequality in tax income after income tax. Income tax significantly reduces interdepartmental inequality, but the magnitude of that reduction varies considerably over the period in question. We can distinguish three distinct periods. Until the start of the 1950s, the reduction in interdepartmental inequality resulting from the income tax was small, always below 3% of initial inequality. The reduction gradually increased until the end of the 1980s. It reaches its peak in 1989 (see Appendix, Figure A-II). Since 1989, the fall in interdepartmental inequality brought about by this tax fluctuates between 6 and 9%.

The change in interdepartmental income inequality is very different from that seen in other works, for example Combes *et al.* (2011) and Sanchis *et al*. (2015), for economic activity indicators such as value added measured at departmental level. Table 3 shows, for three key years, the Gini coefficient of average tax income after payment of income tax as shown in Figure I and the Gini coefficient of average departmental value added calculated based on data from Combes *et al*. (2011) and INSEE for our classification of departments and, for reasons of robustness, for that used by Combes *et al*. (2011).[3] Table 3 shows that the Gini coefficient of value added follows a U-shape trend: the stability of the last two decades of the 20th century was followed by an increase in equality from 2000 onwards. From this, we can infer that all the social and fiscal transfers, which represent a large proportion of tax income, make a significant contribution to reducing the inequality caused by the concentration of economic activities. Today, the Gini index is two times lower for income than for value added.

The trend shown by the Gini indicator can be supplemented by indicators specific to certain

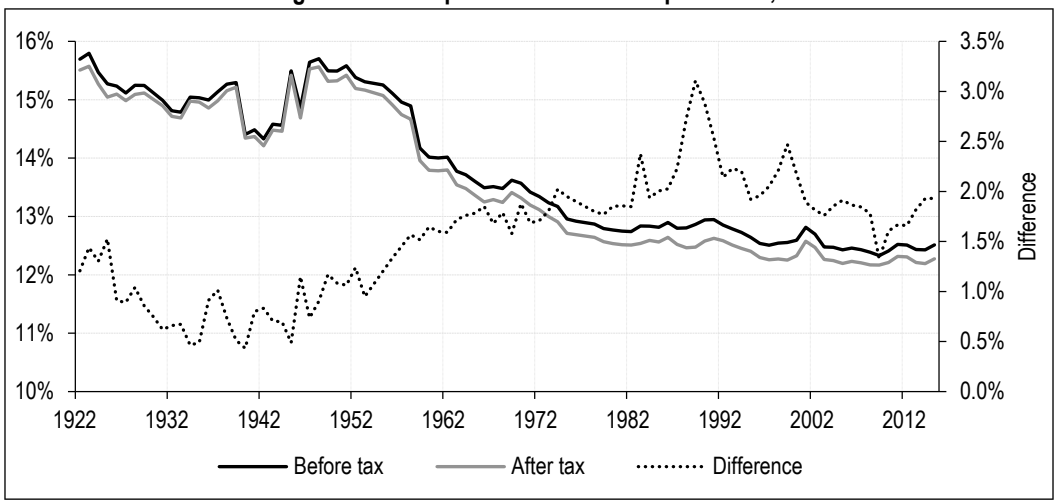
3. Combes et al. *(2011) only have aggregated values for the departments of Meurthe-et-Moselle, Moselle, Haut-Rhin and Territoire de Belfort, and have no values for Corsica in 1930 and 1982. To keep our classification, we did some imputations using the distribution formula that was predominant in the year 2000.*

Table 3 – **Gini indicators, 90 departments**

	1930	1980	2000	2014
Income after income tax	0.140	0.075	0.061	0.052
Value added				
Our classification	0.121	0.103	0.097	0.111
Combes *et al.* (2011) classification	0.118	0.104	0.098	0.113

Notes: The table shows the Gini coefficient of departmental average tax income per adult after payment of income tax as shown in Figure I and the Gini coefficient of average departmental value added calculated based on data from Combes *et al.* (2011) and INSEE. We give two value added Gini calculations: one is calculated using our classification of the departments (90 departments); the other using the classification used by Combes *et al.* (2011). There is no weighting.
Reading note: In 1930, the Gini of the average tax income of the departments before income tax was 0.140.
Sources: Tax archives, Combes *et al.* (2011), INSEE and calculations by the authors.

Figure II – **Share of the nine wealthiest departments in the average tax income per adult of the 90 departments, 1922-2015**

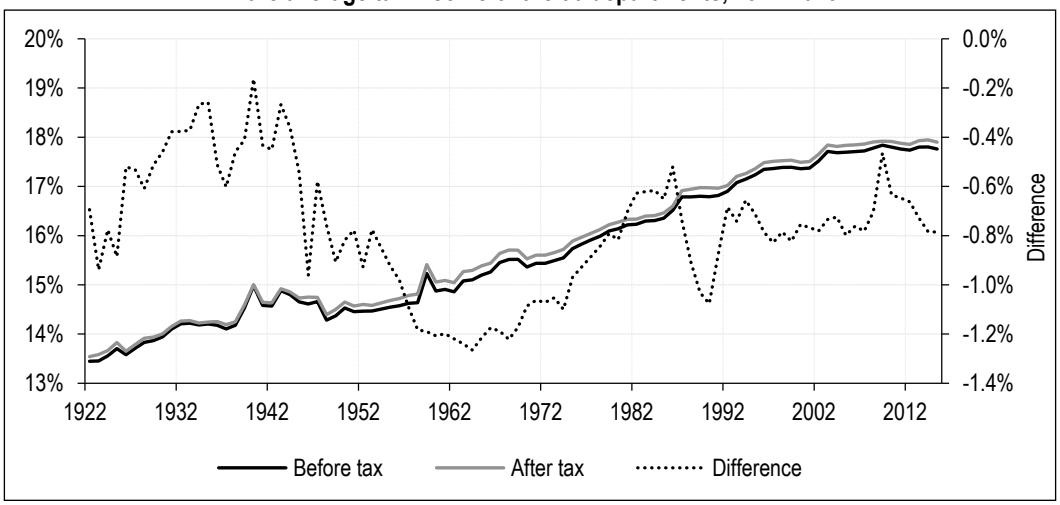


Notes: The share of the 9 wealthiest departments in terms of average tax income (P90-P100) is calculated based on tax income per adult before and after income tax, respectively. There is no weighting.
Reading note: In 1922, the share of tax income before income tax held by the 9 wealthiest departments in the total tax income of the 90 departments was 15.7%.
Sources: See Table 3.

parts of the distribution. Figure II shows the change in the share of average income held by the nine wealthiest departments in the total average income of the 90 departments. The time profile of the indicator is quite similar to that of the Gini indicator; however, we can see a sharp slowdown in the reduction from the 1970s onwards and a stabilisation of inequality from 2007. The role of income tax also changed over the period. Between 1954 and 1998, it increasingly reduced the share of income in the national income of the departments belonging to the upper income decile, with a maximum of 3.2% in 1989. Since then, the effect of income tax has fallen considerably, returning in 2015 to levels seen at the end of the 1970s (i.e. 1.9%).

Conversely, the least wealthy departments (which are not necessarily the same every year) underwent a significant catching-up process. Figure III shows that the share of average income held by the 18 least wealthy departments has continuously increased since the end of World War II. This increase seems to have levelled at 18% since the start of the 21st century. As is the case for the nine wealthiest departments, the level of inequality stabilised at the end of this period (from 2003 onwards). Likewise, after following an upward trend, the contribution of income tax

Figure III – **Share of income of the 18 least wealthy departments in the average tax income of the 90 departments, 1922-2015**



Notes: The share of the 18 least wealthy departments in terms of average tax income (P0-P20) is calculated based on tax income per adult before and after income tax, respectively. There is no weighting.
Reading note: In 1922, the share of average income before income tax held by the 18 least wealthy departments was 13.4%.
Sources: See Table 3.

to the increase in the share of the 18 least wealthy departments has fluctuated around -0.8% since the end of the 1970s.[4]

In total, Figures II and III show a situation that is far less unequal today than it was in the past. We can see that the wealthiest 10% of departments now hold 12.5% of total average income compared with 15.5% a hundred years ago; at the other end of the scale, the least wealthy 20% of departments hold almost 18% of the total compared with 14% a century ago. In other words, nowadays, the wealthiest 10% of departments have 25.5% more than the income they would have had if the distribution was equal, while the least wealthy 20% receive 11.3% less than they would in a context of equality. After payment of income tax, these percentages fall to 23.1% and 10.6%, respectively.

The changes over time shown in Figures I, II and III are partly based on estimations (cf. Table 2). As the evaluations are necessarily less accurate for the periods for which average income is evaluated using estimated coefficients, we have calculated 95% confidence intervals for the years in question and for the three distributions (indicator of income inequality before and after income tax and the gap between the two).[5] This calculation allows us to confirm that possible measurement errors would not change the trend described (see Appendix, Figures A-III, A-IV and A-V).

It is also important to note that the lack of weighting of the departments in the calculation of inequality indicators is of no consequence here. Weighting the departments by adult population gives a similar change over time in the Gini coefficients and shares of the various quantiles to that obtained using non-weighted indicators (see Appendix, Figures A-VI, A-VII and A-VIII). The weighting used, however, does not account for infra-departmental inequality, which has certainly changed over the period.

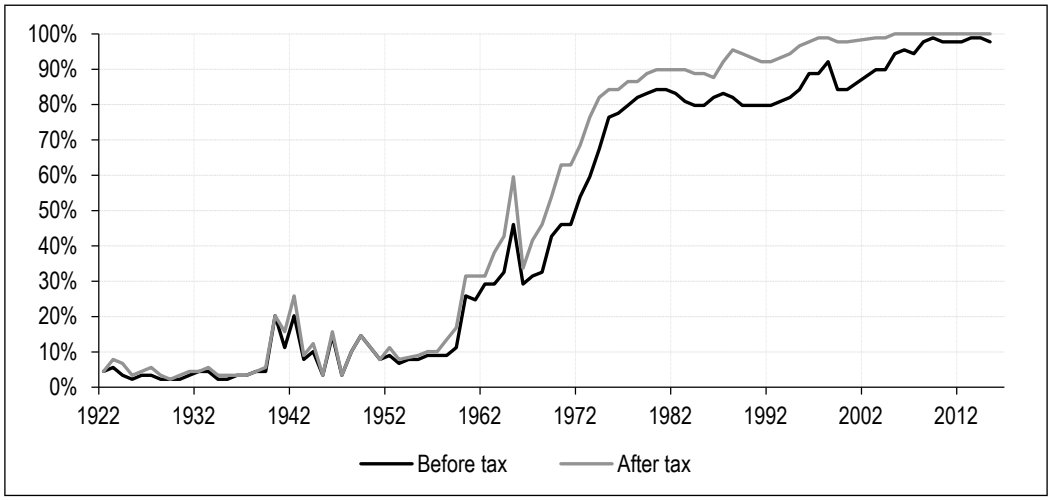
Likewise, whether or not the current departments of Île-de-France region are taken into account, which today accounts for around 30% of French GDP, barely changes the trend in the inequality dynamic, with the time profile of the Gini indicator remaining similar (see Appendix, Figure A-IX). Taking into consideration the seven departments of Île-de-France that resulted from the 1968 reorganisation likewise does not change the overall finding: the indicator calculated on the basis of the 95 departments fell sharply until the start of the 1980s and thereafter at a steadier rate, which is a dynamic similar to that found when looking at 90 departments (see Appendix, Figure A-X).

An alternative way of presenting the convergence of the departments is to measure their distance to the department with the highest income, which, at the end of the period in question, was the Seine department. For each year, we therefore

4. The tax increases the share of the 18 least wealthy departments, which contributes to reducing inequality. The contribution is nevertheless computed as in the other figures, which implies that a positive contribution is associated with a negative number.

5. The confidence intervals were calculated using a bootstrap method with 100 repetitions. At each repetition, the coefficients used to forecast tax income based on models 1 and 2 were taken at random following a normal distribution, the average and standard error of which are those taken from our regressions. We then repeated the procedure described in Section 1 in its entirety.

Figure IV – **Share of departments with average tax income above 60% of that of the Seine department, 1922-2015**



Reading note: In 1922, 4.5% of departments (i.e. 4 departments) had an average tax income per adult before income tax above 60% of that of the Seine department.
Sources: See Table 3.

calculate the share of departments for which average income was over 60% of that of the Seine department. Figure IV shows this trend. At the start of the 1950s, less than 10% of departments were above this threshold; since 2000, over 90% have crossed it. It we consider income after tax, 90% of departments had income above 60% of that of the Seine department from the start of the 1990s.

This trend can be explained by a fall in the relative income of the Seine department compared with the 89 other departments. In 1950, the average tax income of the department was 80% higher than the national average; by 2015, it was only 35% higher and only 27% higher payment of income tax. By way of comparison, the average value added in the Seine department was 114% higher than the average value added at national level in 2014.

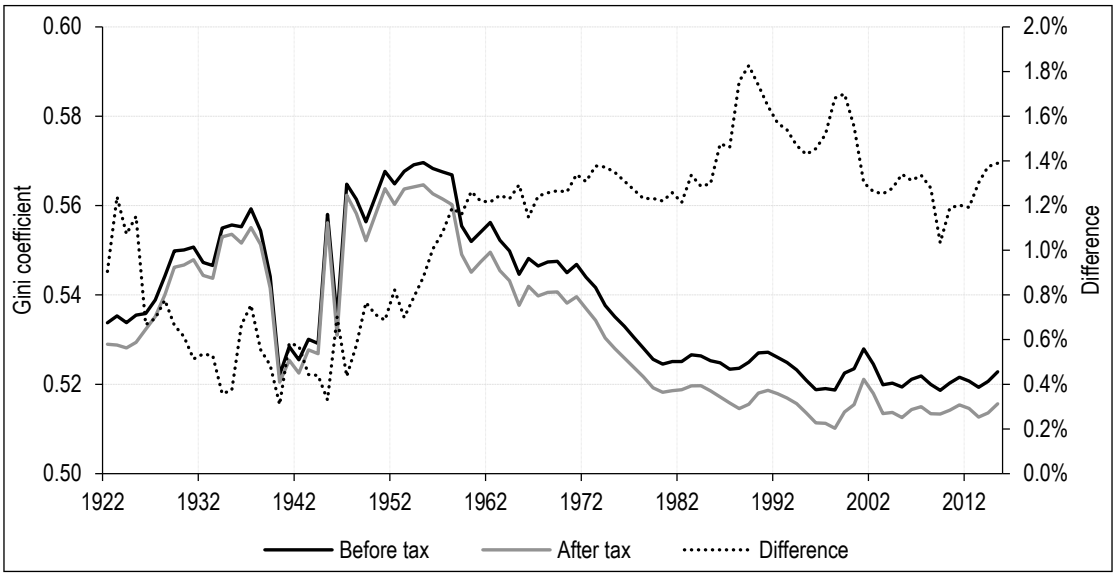
When the departmental income is related not to the number of people aged 20 and above but to the department's surface area, the measure of inequality accounts for the department's density (Figure V). With this approach, the inequality level firstly appears to be much higher, which is due to the fact that the French population has concentrated to a very significant extent over the last century (Bonnet, 2019). We also see an overall upward shift in inequality until the end of the 1950s, which was erased over the following two decades. Inequality has been unchanged since the end of the 1970s.

2.2. Heterogeneity of the Dynamics and Convergence

The above indicators aggregate the dynamics of the different departments and mask their own developments. To analyse the geographic dispersion of income in metropolitan France and its reconfiguration over the last 100 years, we have identified three key years (1922, 1948 and 2015) and represented for each one the ratio between tax income per adult in each department and the overall average tax income for all departments. In 1922 (Figure VI-A), we can see that the north of France was particularly wealthy: with the exception of Pas-de-Calais, all departments had an average tax income that was at least equal to the national average (100 or 110% of national income), with the Seine and Seine-et-Oise departments recording the highest level (125% of the national average). The neighbouring departments (Eure, Eure-et-Loir, Loiret, Meuse, Haute-Marne and Côte-d'Or) had an average tax income at around the national average (between 100 and 110%). To the south of this area, almost all the departments had an average tax income of less than 90% of the overall average tax income. The geographical areas with the lowest levels of income (average tax income of less than 75% of the national average) were in Brittany, the South West, the Alpes du Sud region and Corsica. In the south, the major exceptions to this trend were Rhône and Bouches-du-Rhône, which have large regional centres, and Alpes-Maritimes.

In 1948, the geography of income in France had not changed much (Figure VI-B). Overall, the

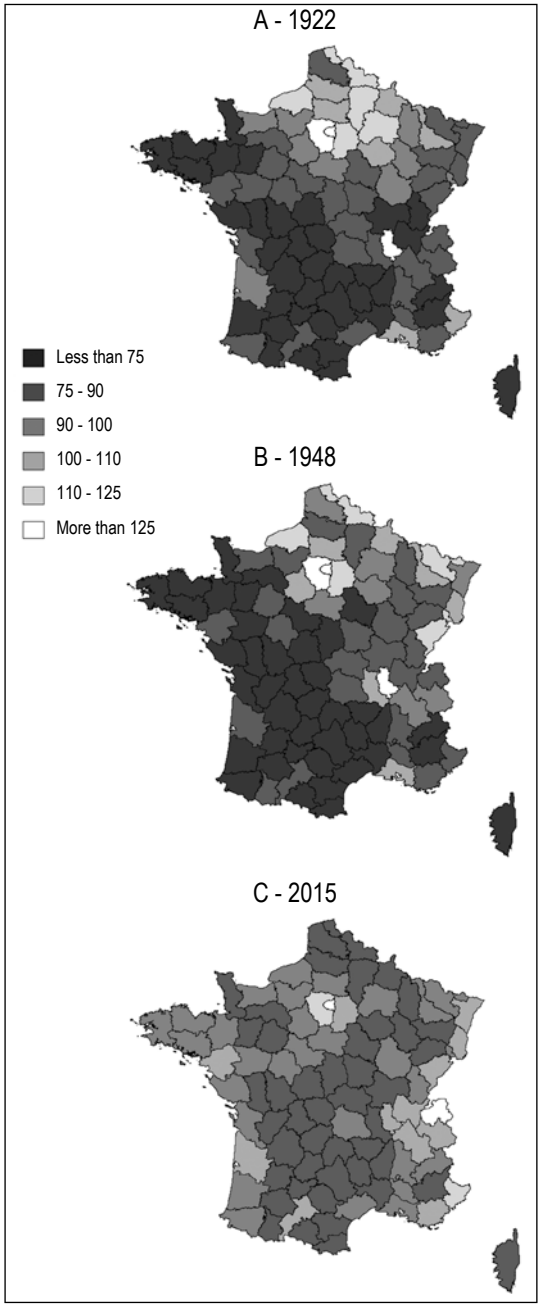
Figure V – **Gini coefficient of tax income per km² for 90 departments, 1922-2015**



Notes: The black and grey solid-line curves represent the Gini coefficient of departmental tax income per km² before and after income tax, respectively. There is no weighting.
Reading note: In 1922, the Gini coefficient of departmental tax income per km² before income tax was 0.534.
Sources: See Table 3.

departments with an average tax income above the national average were still those in the north of France. However, this area was much less homogenous than in 1922; departments such as Somme, Aisne, Marne and Aube had an average tax income below the national average, while departments bordering Switzerland, such as Doubs and Haut-Rhin, had an average tax income above the national average. In the south-west, almost all departments had an average tax income below the national average, with the vast homogenous area stretching from Brittany to the south of the Cevennes, lagging far behind in terms of income. Bouches-du-Rhône and Rhône remained the exceptions, and we also see the emergence of Loire, home to Saint-Etienne and its industries.

Figure VI – **Average tax income of each department as a percentage of the overall average tax income of the 90 departments**



Reading note: In 1922, the average tax income for Corsica was less than 75% of the average tax income of the 90 metropolitan departments.
Sources: See Table 3.

In 2015, we first see the disappearance of areas with relatively low income (Figure VI-C): no departments had an average tax income below 75% of the national average, which corroborates the decline in inequality documented above.[6] Furthermore, the departments with average tax income above the national average are no longer in the north of France, but close to the Swiss border, in the Parisian region and those in some regional centres such as Lyon, Nantes and Toulouse. We also note that the departments with average tax income between 75 and 90% of the national average lay along the diagonal line from the Spanish border to the Belgian border, with two branches in the north of the country and in Normandy. Although we are looking here at a measure of low income, these are also the departments that lie along the so-called "*diagonale du vide*" (a strip of French territory going in a diagonal from the north-east to the south-west, where population densities are lower than the rest of France). Conversely, the Atlantic coast has become a homogeneous zone with standards of living around the same level as the national average. The maps we have just examined clearly show this shift in the "low income diagonal", formerly extending from the north-west to the south-east but now stretching from the north-east to the south-west.

To show the heterogeneity of the dynamics, we have also classified the change in the average tax income of the departments relative to the national average into six categories, drawing from the literature on local population dynamics (see Oswalt & Rieniets, 2006):

- 'upward divergence' represents the departments in which average income was above the national average and where the gap has widened (for example, Alpes-Maritimes, where relative income grew from 100% in 1922 to 110% in 2015);

- 'emergence' represents those departments in which the average income was below the national average and has now exceeded this average (for example, Haute-Savoie, where the

6. This observation would not be called into question if we disaggregated the Seine department. For example, in 2015, the tax income per adult in Seine-Saint-Denis accounted for 84% of the average income.

relative average tax income grew from 76% in 1922 to 133% in 2015);[7]

- 'convergence from the top' represents those departments in which the average income was below the national average, has remained so, but where the gap has narrowed (for example, Oise, where the relative income was 110% in 1922 and was approaching 100% in 2015);

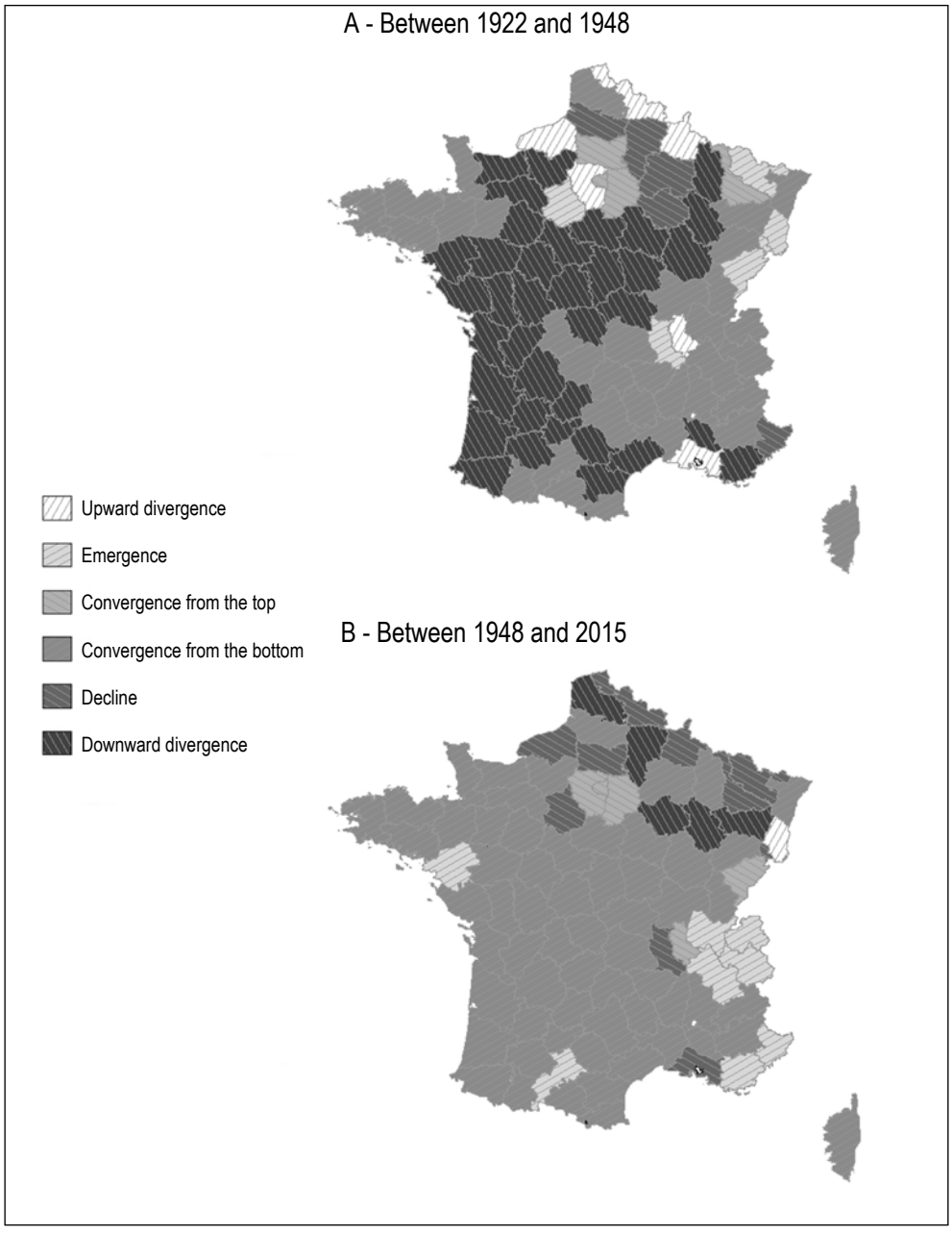
- 'convergence from the bottom' represents those departments in which the average income was above the national average (for example, Lozère, where the average tax income was 45% of the national average in 1922 and rose to 83% in 2015);

- 'decline' represents those departments in which the average income was above the national average but has fallen below (for example, Meurthe-et-Moselle, where the relative average income has fallen from 110% in 1922 to 90% in 2015);

- 'downward divergence' represents those departments in which average income was below the national average and where the gap has widened (for example, Haute-Marne, where

7. This is probably due to cross-border workers, the number of which has risen significantly over the last two decades (Debouzy & Simon, 2020).

Figure VII – **Categorisation of the departments by relative change**



Reading note: Between 1922 and 1948, Finistère underwent convergence from the bottom.
Sources: See Table 3.

relative income fell from 90% in 1922 to 83% in 2015).

The departments, as categorised above, are shown in Figure VII-A for the period 1922-1948 and VII-B for the period 1948-2015. The first period allows us to compare the departments over a quarter of a century from the post-WWI period to the post-WWII period. The majority of the departments along the Atlantic coast and the lower Loire Valley saw a downturn in their relative situation; the downturn was less pronounced but still present in Île-de-France, while a north-eastern arc of departments surrounding Paris underwent a decline.

Overall, the 90 departments studied underwent a continuous process of convergence between 1948 and 2015. The map here is radically different. All the departments on the line joining Calvados to Gard experienced an improvement in their relative situation. Along this "Caen-Nîmes" line, the departments of Toulouse and Nantes stand out in particular. Conversely, the departments of the three large metropolitan areas of Paris, Lyon and Marseille saw a deterioration in their relative situation, with a decline for Bouches-du-Rhône and convergence from the top for Seine and Rhône. For these latter two departments, this situation results rather from improvements in the departments situated to their east. Outside of the three large metropolitan areas, the departments that witnessed a deterioration were primarily situated to the north-east of a line from Calvados to Jura, with the notable exception of the departments in the Alsace region. These departments were once home to flourishing sectors and have since undergone a long decline.

* *
*

This article presents the change in interdepartmental inequality since 1922, based on a new database of average tax income in each department of metropolitan France, developed from the digitisation of the archives of the Ministry of Finance. The intention behind the article is to describe the situation, but the original database could be used for more causal approaches seeking, for example, to analyse the factors of regional development.

Our indicators of inequality between the departments have shown a very strong convergence of income over the period under consideration. This reduction in inequality has been particularly remarkable since 1948 and, even though there has been a slowdown in the rate of reduction since the 2000s, inequality reached its lowest level for a century in 2015. Today, all the departments of metropolitan France have an average tax income after income tax of above 60% of that of the Seine department. In 1950, only 10% were above this threshold. This interdepartmental convergence is similar to the process analysed by Bonnet & d'Albis (2020) for life expectancy but contrasts with the process described by Combes *et al.* (2011) for value added. This sheds light on the role played by public transfers in levelling standards of living, more than compensating for the divergent force resulting from the concentration of economic activities in certain areas of France, in particular the large metropolitan areas. The role of income tax is significant here. It considerably reduces inequality between regions: the nine wealthiest departments have an average tax income that is 25.5% higher than the national tax income per adult; this relative benefit falls to 23.1% after payment of income tax. However, income tax is only one of these public transfers, and would be interesting to assess the contribution of other transfers, such as that generated by the pension system. Indeed, it is likely that the gap between the very economically dynamic departments and those with a significant proportion of the population in retirement would narrow when we consider all income and not just employment income. Furthermore, the average tax income after income tax allows us to understand the effect of income tax on spatial inequality, but it would be useful to supplement this analysis by assessing the effect of other taxes paid by households, even if that effect is *a priori* weaker. The progressive nature of income tax at the individual level means that, overall, some departments are proportionally subject to higher taxation than others. This calculation method creates a type of spatial redistribution but, without information about how this tax is spent and allocated between the different departments, we cannot carry out an overall analysis of its redistributive effect.

Furthermore, the income convergence process has been of benefit to numerous departments, which have seen their relative situation improve, but the deterioration in the relative situation of other departments must not be ignored. Very simply, France is bisected by a diagonal line running from Calvados to Gard; since World War II, the "winners" have often been situated on the south-west side of this line, while the "losers" have been located on the north-east side. The decline experienced by some is likely to create a feeling of unhappiness among the

public and a rupture in national cohesion, despite income convergence.

Our work can be extended in three directions. The first is to conduct an analysis in terms of purchasing power. However, this would require the calculation of long-term consumer price indexes at departmental level, which is not easy given information currently available. The second is to consider intra-departmental inequality and to break down the trend in national inequality into intra- and inter-departmental inequality. This would require the use of decomposable indicators. The third consists in comparing the change in regional inequality between countries. However, there are currently almost no databases equivalent to ours, with the exception of a database for the 51 US states, in which income since 1917 has been reconstructed by Franck (2015). Figure A-XI, in the Appendix, compares the change in our Gini coefficient for tax income with the one that we calculated based on data from Franck (2015). The reduction in inequality began much earlier in the United States, around 1933, but it ended in the mid-1990s, and has increased considerably since then. Inequality between the US states has now returned to the level of the beginning of the 1960s. Inequality in this country is also significantly higher as the Gini coefficient was 0.11 in 2014. It would be relevant and interesting to extend this comparison to other European countries. □

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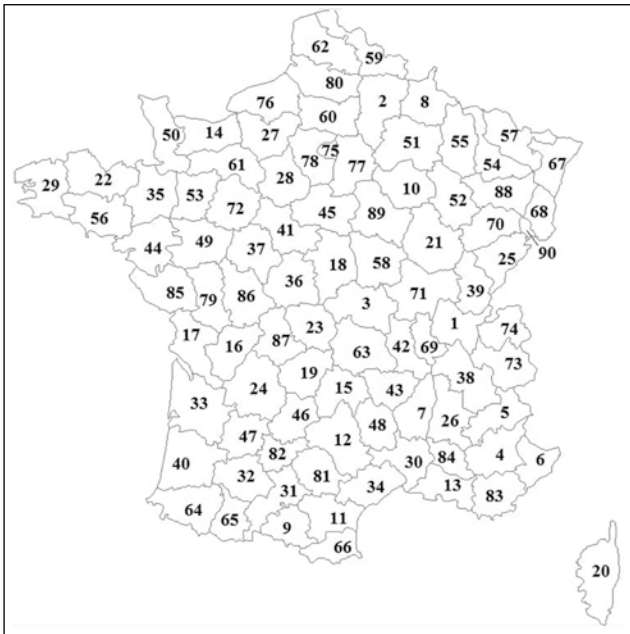
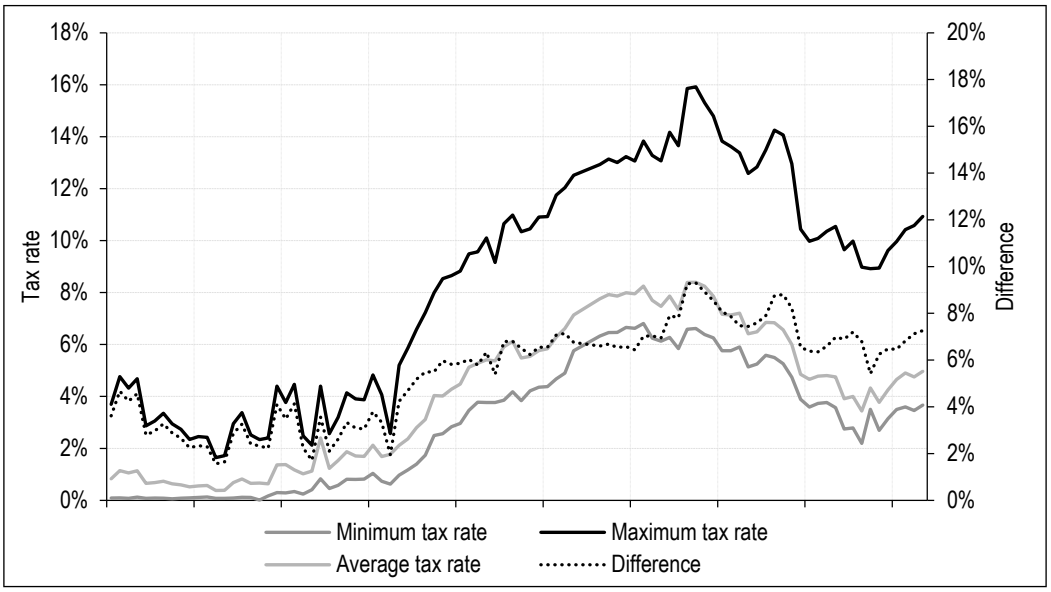
APPENDIX

Figure A-I – **Map and list of the 90 French departments studied in the article**



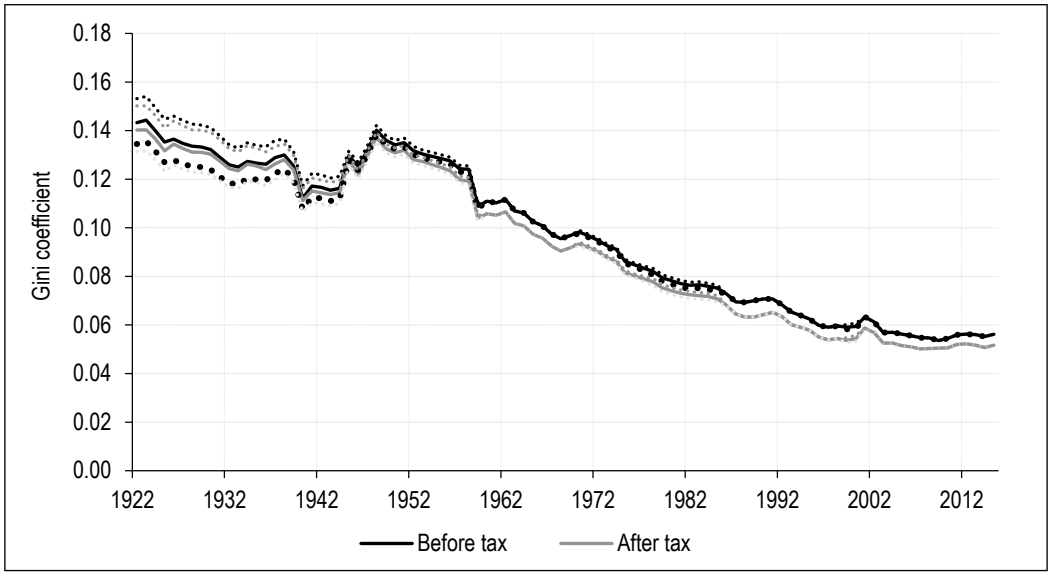
1 Ain	31 Garonne (Haute)	61 Orne
2 Aisne	32 Gers	62 Pas de Calais
3 Allier	33 Gironde	63 Puy de Dôme
4 Alpes (Basses)	34 Hérault	64 Pyrénées (Basses)
5 Alpes (Hautes)	35 Ille et Vilaine	65 Pyrénées (Hautes)
6 Alpes Maritimes	36 Indre	66 Pyrénées Orientales
7 Ardèche	37 Indre et Loire	67 Rhin (Bas)
8 Ardennes	38 Isère	68 Rhin (Haut)
9 Ariège	39 Jura	69 Rhône
10 Aube	40 Landes	70 Saône (Haute)
11 Aude	41 Loir et Cher	71 Saône et Loire
12 Aveyron	42 Loire	72 Sarthe
13 Bouches du Rhône	43 Loire (Haute)	73 Savoie
14 Calvados	44 Loire Inférieure	74 Savoie (Haute)
15 Cantal	45 Loiret	75 Paris
16 Charente	46 Lot	76 Seine Inférieure
17 Charente Maritime	47 Lot et Garonne	77 Seine et Marne
18 Cher	48 Lozère	78 Seine et Oise
19 Corrèze	49 Maine et Loire	79 Sèvres (Deux)
20 Corse	50 Manche	80 Somme
21 Côte d'Or	51 Marne	81 Tarn
22 Côtes du Nord	52 Marne (Haute)	82 Tarn et Garonne
23 Creuse	53 Mayenne	83 Var
24 Dordogne	54 Meurthe et Moselle	84 Vaucluse
25 Doubs	55 Meuse	85 Vendée
26 Drôme	56 Morbihan	86 Vienne
27 Eure	57 Moselle	87 Vienne (Haute)
28 Eure et Loir	58 Nièvre	88 Vosges
29 Finistère	59 Nord	89 Yonne
30 Gard	60 Oise	90 Territoire de Belfort

Figure A-II – **Average, maximum and minimum tax rate, 1922-2015**



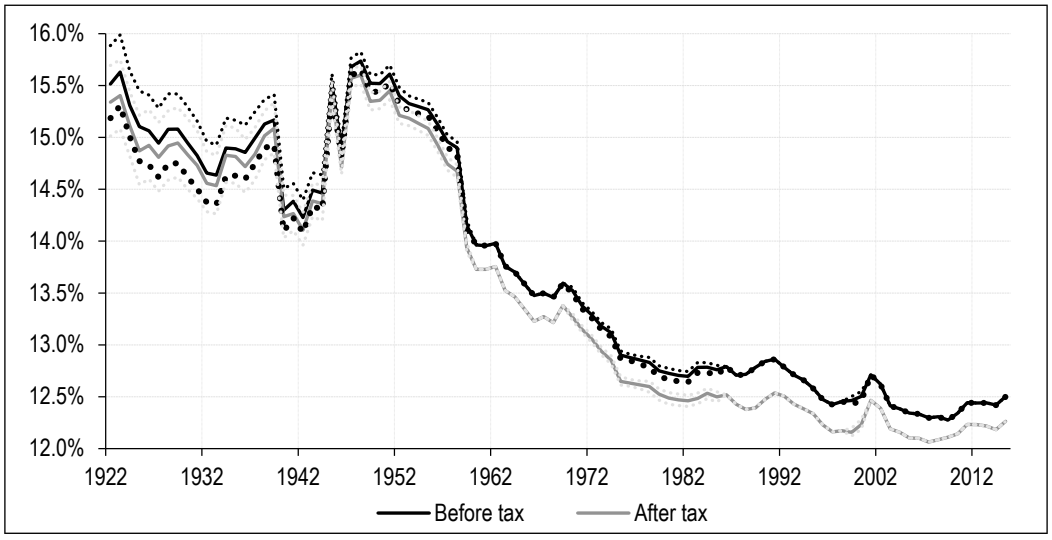
Notes: The tax rate of the department is itself an average rate over all taxpayers. There is no weighting of the departments.
Reading note: In 1922, the maximum departmental income tax rate was 3.7%. The gap between the maximum and minimum rates was 3.6 percentage points in 1922.
Sources: See Table 3.

Figure A-III – **Gini coefficient of the average tax income of 90 departments, 1922-2015 with 95% confidence intervals for the years in which income is estimated**



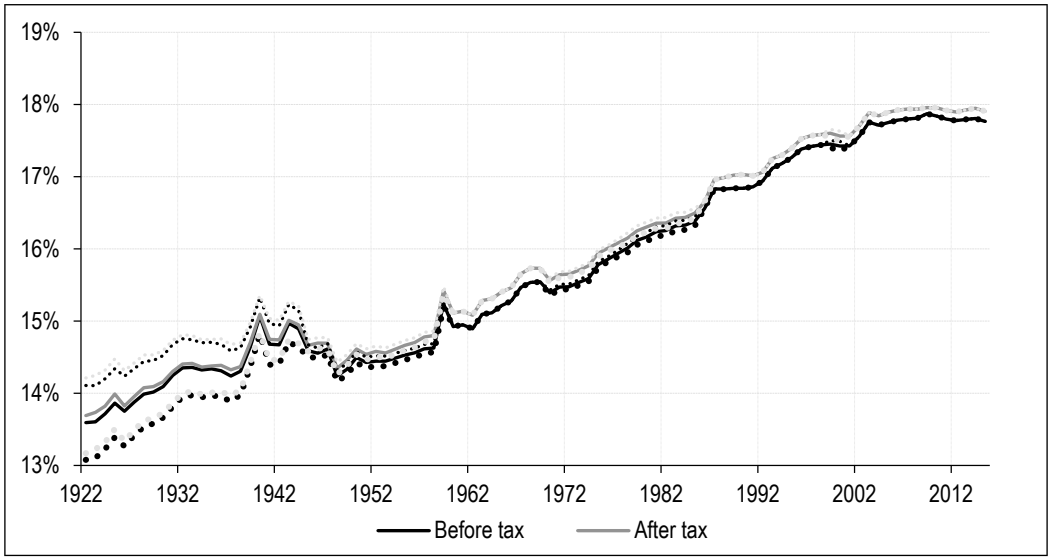
Notes: The black and grey solid-line curves represent the Gini coefficient of average tax income per adult in the departments of metropolitan France before and after income tax, respectively. The dotted curves represent the 95% confidence intervals obtained by bootstrapping (1,000 repetitions) for the periods in which tax income is estimated using models (1) and (2).
Reading note: In 1922, the Gini of the average tax income before income tax was 0.147, with a 95% confidence interval of between 0.134 and 0.153.
Sources: See Table 3.

Figure A-IV – **Proportion of the nine wealthiest departments in the average tax income of 90 departments, 1922-2015, with 95% confidence intervals for the years in which income is estimated**



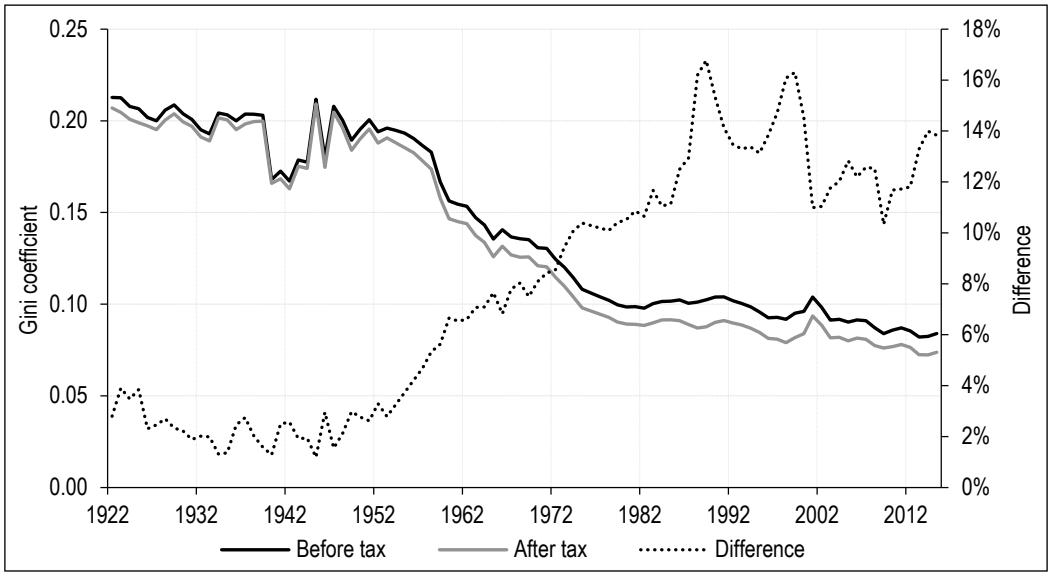
Notes: The black and grey solid-line curves represent the change in the share of average income per adult held by the nine wealthiest departments (P90-P100) in the total average income of the 90 departments before and after income tax, respectively. The dotted curves represent the 95% confidence intervals obtained by bootstrapping (1,000 repetitions) for the periods in which tax income is estimated using models (1) and (2).
Reading note: In 1922, the share of average tax income before income tax held by the nine wealthiest departments in the total average tax income of the 90 departments was 15.7%, with a 95% confidence interval of between 15.19% and 15.89%.
Sources: See Table 3.

Figure A-V – **Proportion of the 18 poorest departments in the average tax income of 90 departments, 1922-2015, with 95% confidence intervals for the years in which income is estimated**



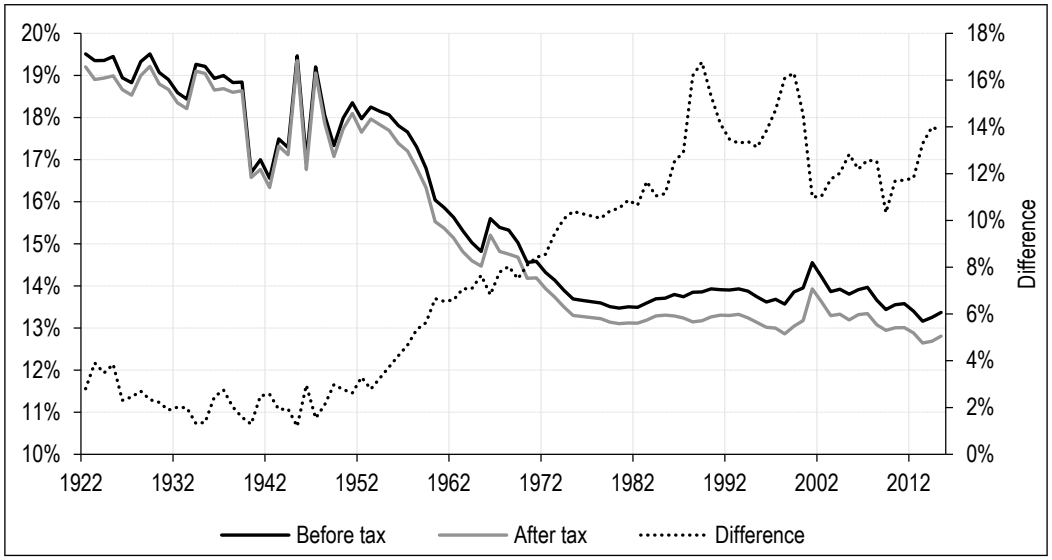
Notes: The black and grey solid-line curves represent the change in the share of average income per adult held by the 18 least wealthy departments (P0-P20) before and after income tax, respectively. There is no weighting. The black dotted curve represents the difference between the two curves. The dotted curves represent the 95% confidence intervals obtained by bootstrapping (1,000 repetitions) for the periods in which tax income is estimated using models (1) and (2).
Reading note: In 1922, the share of average income before income tax held by the 18 least wealthy departments was 13.4% with a 95% confidence interval of between 13.08% and 14.11%.
Sources: See Table 3.

Figure A-VI – **Gini coefficient of the average tax income of 90 departments weighted by their adult population, 1922-2015**



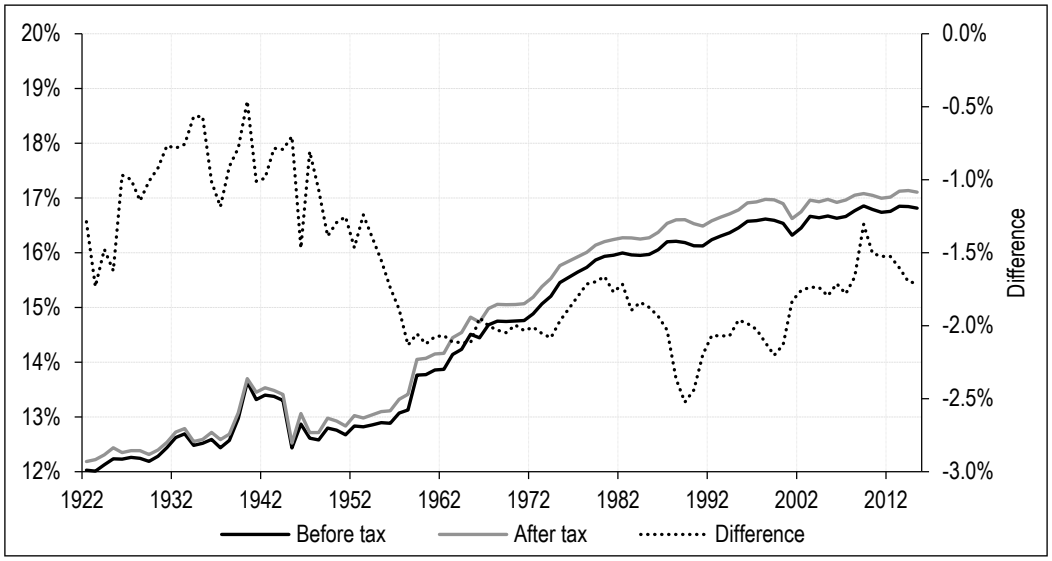
Notes: The black and grey solid-line curves represent the Gini coefficient of tax income, weighted by the adult population of each department, before and after income tax, respectively.
Reading note: In 1922, the Gini coefficient of departmental tax income before income tax, weighted by adult population, was 0.213.
Sources: See Table 3.

Figure A-VII – **Proportion of the 9 wealthiest departments in the average tax income of 90 departments weighted by their adult population, 1922-2015**



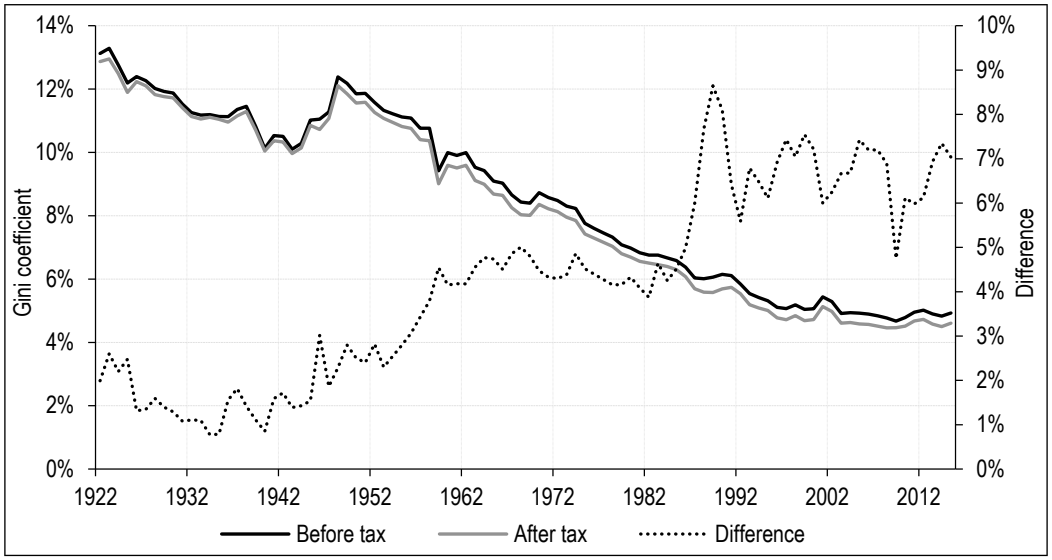
Notes: The black and grey solid-line curves represent the change in the share of average income per adult held by the nine wealthiest departments (P90-P100) in the total average income of the 90 departments before and after income tax, respectively, with the departments weighted by their adult population.
Reading note: In 1922, the share of average tax income before income tax, weighted by adult population, held by the nine wealthiest departments, was 19.5%.
Sources: See Table 3.

Figure A-VIII – **Proportion of the 18 poorest departments in the average tax income of 90 departments weighted by their adult population, 1922-2015**



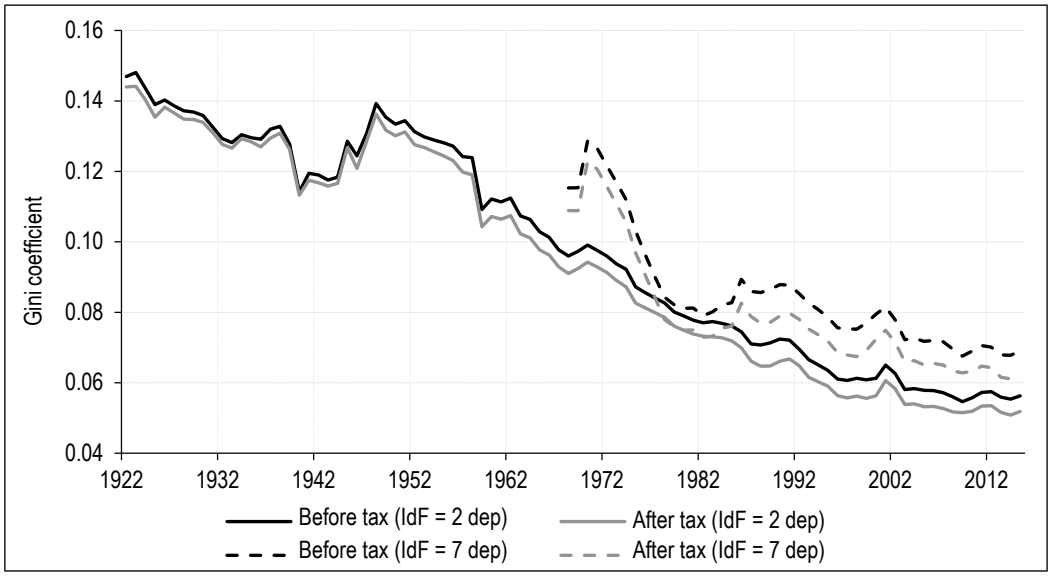
Notes: The black and grey solid-line curves represent the change in the share of average income held by the 18 least wealthy departments (P0-P20) before and after income tax, respectively, with the departments weighted by their adult population. There is no weighting. The black dotted curve represents the difference between the two curves.
Reading note: In 1922, the share of average income, weighted by adult population, held by the 18 least wealthy departments, before income tax, was 12.0%.
Sources: See Table 3.

Figure A-IX – **Gini coefficient of the average tax income of 87 departments excluding those in Île-de-France (Seine, Seine-et-Marne and Seine-et-Oise), 1922-2015**



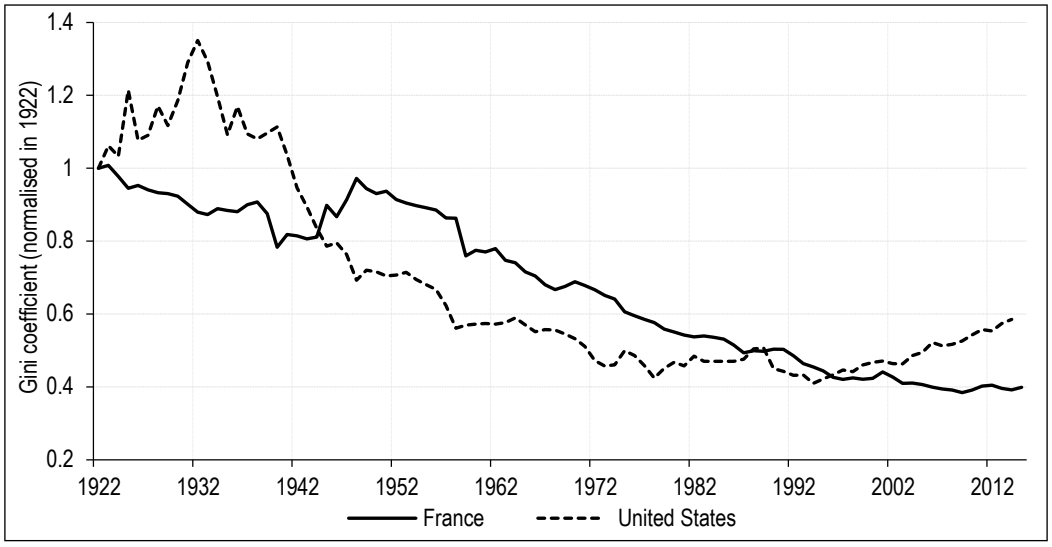
Notes: The black and grey solid-line curves represent the Gini coefficient of the average tax income of the 87 metropolitan departments, excluding those of Île-de-France (Seine, Seine-et-Marne and Seine-et-Oise) before and after income tax, respectively. The black dotted curve represents the difference between the two curves.
Reading note: In 1922, the Gini coefficient of the average tax income before income tax of the 87 metropolitan departments, excluding those of Île-de-France, was 0.131.
Sources: See Table 3.

Figure A-X – **Gini coefficient of the average tax income of 90 departments (1922-2015) and 95 departments (1968-2015) after the reorganisation of the Seine and Seine-et-Oise departments**



Notes: The black and grey solid-line curves represent the Gini coefficient before and after income tax, respectively, of the average tax income of the 90 metropolitan departments under the former system before the reorganisation of the Île-de-France departments. The dotted curves represent the Gini coefficient of the average tax income of the 95 metropolitan departments under the subsequent system following the reorganisation of the Île-de-France departments but before the reorganisation of Corsica.
Reading note: In 2015, the Gini coefficient of average tax income before income tax of the 90 departments was 0.56, while that of the 95 departments was 0.69.
Sources: See Table 3.

Figure A-XI – **Gini coefficient of the average tax income in France and United States (1922=1)**



Reading note: In 1922, the Gini coefficient of the average tax income before income tax of the departments of France was 0.14.
Sources: See Table 3 and Franck (2015).

Table A-1 – **Results of regressions for the four periods under consideration (least squares method)**
Explained variable: average tax income per adult of the departments

Estimation	#1		#2		#3		#4	
Data	1960-1969		1960-1969 ; 1986-1998		1960-1969 ; 1986-1998		1986-1998	
Model	(1)		(1)		(2)		(2)	
0-19 years	0.5391	0.927	-0.24	0.047	-0.355	0.123	-0.4756	-0.346
	(0.018)	(0.0125)	0	(0.1499)	0	(0.0044)	0	0
20-29 years	0.3178	0.237	-0.0779	-0.083	-0.0299	-0.041	-0.2925	-0.327
	(0.0005)	(0.0834)	0	0	(0.1471)	(0.0762)	0	0
30-39 years	0.6488	0.495	-0.0261	-0.008	0.0294	0.067	-0.1129	-0.522
	0	(0.0017)	(0.1452)	(0.7352)	(0.2423)	(0.0342)	(0.0231)	0
40-49 years	0.3593	0.25	-0.1759	-0.038	-0.1213	0.028	-0.1052	-0.22
	(0.0006)	(0.0592)	0	(0.0213)	0	(0.2227)	(0.0074)	0
50-64 years	0.5058	0.397	-0.1916	-0.055	-0.2093	-0.1	-0.2635	-0.285
	(0.0002)	(0.0477)	0	(0.0098)	0	(0.0008)	0	0
65-79 years	0.1103	0.242	-0.2062	-0.09	-0.1917	-0.031	-0.2606	-0.302
	(0.1778)	(0.083)	0	0	0	(0.2385)	0	0
80+	0.1596	0.093	0.0444	0.006	0.0851	0.023	-0.0188	-0.118
	0	(0.0092)	0	(0.3821)	0	(0.0085)	(0.5308)	0
Income per adult	0.3495	0.673	0.6001	0.777				
	0	0	0	0				
Share of income	-0.0329	-0.15	-0.2042	-0.313				
	(0.068)	0	0	0				
Share of taxes					0.2511	0.274	0.0893	0.2
					0	0	0	0
Taxable units					0.2268	0.341	0.2314	0.505
					0	0	0	0
Interaction	-2.0075	-2.237	1.3536	0.602	1.2908	0.311	2.1591	2.399
	(0.0068)	(0.053)	0	0	0	(0.031)	0	0
Fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
R^2	0.993	0.968	0.989	0.975	0.984	0.963	0.993	0.978

Notes: The table shows the regression results over four periods. The variable to be explained is the departmental average tax income per adult relative to the average tax per adult of the 90 departments. p-value in parentheses.
Reading note: For the period 1960-1969, an increase of one percentage point in the share of the 0-19 age range in the population of a department means a relative average tax income per adult of 0.5391 percentage points (for the specification without departmental fixed effect).
Sources: See Table 3.