Predistribution vs. Redistribution: Evidence from France and the U.S

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Keywords:
inequality, redistribution, predistribution, taxes, transfers

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Introduction

The issue of how to select the most adequate policies to reduce inequalities has attracted considerable interest, both in academia and in the public debate, in particular in light of the significant increase in inequality documented over the last decades in many countries. However, despite numerous research efforts, comparable long-term estimates of redistributive policies remain disappointingly scarce.

Public policies aiming to reduce inequalities can be classified into two categories. First, for a given level of pretax inequality, taxes, transfers and other public spending can reduce post-tax income inequality. This is what is usually called redistribution policies. The public economics literature has largely been influenced by an approach which treats pre-tax inequalities as given, and where the policy options for reducing inequalities largely rest on various combination of tax-and-transfers, with the constraints imposed by the behavioral responses to the tax and transfer system (e.g., this is the generic logic of optimal taxation literature).[1] However, public policies can also affect the pretax distribution of income, what has been called predistribution policies in political science (Hacker, 2011). For instance, the legal and social system contributes to determine the bargaining power of workers vis-à-vis firm owners and managers, via wage-setting rules, corporate laws, trade regimes or labor market regulations. Educational and health care policies impact the access to skills and jobs, and therefore the overall inequality of labor earnings. Taxation and transfers can also affect pre-tax income via behavioral responses of labor supply or different dynamics of capital accumulation. Although these channels are known to impact inequalities, the lack of adequate data series with sufficient historical and comparative breadth has limited the ability to evaluate the long-term impact of various public policy options on inequality.

This paper aims to quantify the amount of redistribution over time and across two countries, France and the U.S., and estimate the relative magnitudes of redistribution and changes in pretax income in accounting for the observed evolution of post-tax inequality. We define redistribution in a broad sense by all the government policies affecting pretax income to obtain a post-tax income, including the impact of taxation and public spending. More specifically, we include in the measure of redistribution the large share of public

[1] See Mirrlees (1976), Kaplow (2008), Piketty and Saez (2013) and Tanninen et al. (2019) for general surveys of this approach.

spending—health, education and collective public expenditures—that are not often included in redistributive analyses.

We make three main contributions. First, we develop a simple conceptual framework to clarify what we really can measure with redistribution, i.e., changes from pretax inequality to post-tax inequalities and what is the total effect of public policies on inequality. This framework highlights that the magnitude of redistribution is positively related to the level and progressivity of taxation and public spending, but also to the level of pretax income inequality. This provides a warning against hasty cross-country comparisons, as high-tax countries with low pretax income inequality can display similar levels of redistribution to low tax countries with high pretax income inequality. We also highlight that, in addition to a direct mechanical effect to reduce post-tax income inequality, taxation and public spending could affect post-tax inequalities indirectly: if policies reduce pretax income inequality, they will reduce post-tax inequalities and could be thus described as predistribution policies. But, this predistribution will lead also, perhaps counter-intuitively, to a decrease in observed redistribution. All things equal, policies that reduce pretax inequalities will lead to a reduction in the magnitude of mechanical redistribution. As a result, comparison across time and countries that disregard the potential effects of predistribution could lead to misleading conclusions in confusing direct mechanical redistribution effects with the total impact of policies on inequalities. While we stress our current lack of knowledge on the contribution of predistribution to the total reduction of inequality, we are able to measure the contribution of direct mechanical redistribution in explaining the changes over time and across countries of post-tax inequalities.

Our second contribution is to bring new data estimates on a century of post-tax inequality measures in France. We construct micro-files of the distribution of post-tax, post-transfer and post public spending income by combining national accounts, administrative tax data and household survey data in a comprehensive and consistent manner following DINA methodology. We develop a microsimulation model and use explicit tax incidence assumptions to impute all taxes, transfers and collective expenditures. The imputation of in-kind transfers and collective expenditures follows the best micro evidence to-date.[2] As a result, our French post-tax income series are annual, fully consistent with macroeconomic

[2]The imputation of in-kind transfers and collective expenditures is the most difficult part of this exercise. We present variants for imputing these public spending. We show that, if these variants have an effect on the magnitude of the reduction of inequality in France and in the U.S, they leave our conclusions unchanged.

aggregates and cover the entire income distribution, from bottom to top percentiles. We then update previous work on pretax inequalities in France by Garbinti et al. (2018), as well as pretax and post-tax inequality series in the U.S. from Piketty et al. (2018a).[3]

Third, we quantify the impact of redistribution on inequality dynamics. Our analysis relies on inequality indicators defined either as the ratio between average incomes of the top 10% and bottom 50% groups (ratio T10/B50) or as the ratio between average incomes of the top 10% and bottom 90% groups (ratio T10/B90). We use these indicators to assess the magnitude of inequality reduction implied by redistribution in France and the U.S. by sub-periods. This is done by computing the relative variation in our inequality indicators (ratio T10/B50 or ratio T10/B90) when going from pretax to post-tax income, thus obtaining measures of redistribution which can be compared to other changes in pre-tax inequalities that also affect post-tax inequalities.

Our analysis leads to three sets of results. First, we document that the reduction of inequality implied by redistribution is significant in both countries and increasing throughout the entire 20th century, even though not at the same pace and in the same period. As a case in point, redistribution measured by the T10/B90 ratio was similar in France and in the U.S. just before WWI (reducing pretax inequality by less than 10% in both countries), then increased sensibly in the U.S. after WWII while France kept a similar level of redistribution (-25% vs -12.5% for 1945-1955). From the mid-1970s onwards, redistribution increased in France, which cached-up with the U.S., and then both countries experienced increasing redistribution. At the end of the period (2010-2018), both France and the U.S. have reached similar levels of redistribution, with a slightly higher level in France (-33%) than in the U.S (-29%). Using the more precise indicator T10/B50, the level of redistribution is higher, but still remarkably close for both countries (-47% for the U.S. vs -51% for France).

Second, we decompose the evolution of post-tax income inequality between the variation in pre-tax income inequality and the change in redistribution. We show that the long-run decline in inequality in France over the 1900-2018 period (-64%) is due mostly to the fall in pretax inequality (-43%), and to a lesser extent to direct redistribution (-21%).

[3]Note that this comparison is made possible by the fact that both series are based on the very same methodology and are anchored to national accounts. See Alvaredo et al. (2020) for a complete presentation of the general methodology to construct pre-tax and post-tax distributional national accounts. See also Blanchet et al. (2019) for an attempt to present DINA estimates for European countries using machine learning and survey calibration.

Third, by comparing France with the U.S., we find that most of the post-tax inequality differences across the two countries can be attributed to changes in pre-tax inequalities. The pattern of U.S. inequality over the period from 1913 to 2018 is one of a significant decline in post-tax inequality (-37%) up to the 1980s, followed by a steep increase since then, to end slightly below the inequality level of 1913 (-15%). This evolution is the result of two opposing factors: rising pretax income inequality (+7%) and rising redistribution (-22%). These results show that if inequality has decreased much more in France than in the U.S. during the 1900-2018 period, this is not due to a relatively more important increase in redistribution by French tax and public spending. The major factor behind this differential trend comes from the differential evolution of pretax income inequality between the two countries. Pretax income inequality has decreased relatively more in France than in the U.S. over the 1900-1983 period and has increased relatively less since 1983. In other words, both changes in pretax inequality and redistribution have had a significant impact on the historical reduction of inequality, but the former is quantitatively about twice as large as the latter.

All together these results highlight that the focus on redistribution policies could miss a large part of the actual impact of public policies on the reduction of post-tax inequalities.

Related literature. Our paper builds upon a long tradition of research studying the historical evolution of income inequality. Following the pioneering work by Kuznets (1953) and Piketty (2001, 2003), a number of authors have used income tax data to construct long-run series of top income shares (see Atkinson and Piketty (2007, 2010) for a global perspective on top incomes). Several recent papers have attempted to combine the various available sources in a systematic manner in order to construct long-term income series of "distributional national accounts" (DINA) (see in particular Piketty et al. (2018a) for pre-tax and post-tax DINA in the U.S.; Garbinti et al. (2018) for pre-tax DINA in France). The present paper goes one step further by analyzing the respective role of redistribution and changes in pre-tax inequality in overall inequality dynamics.[4]

[4]We should also emphasize that the present research is part of a broader multi-country project, namely the WID.world project, with the aim of providing long-term homogeneous series of income and wealth consistent with national accounts in as many countries as possible in the coming years. See also Morgan (2017), Alvaredo et al. (2019), Novokmet et al. (2018) and Piketty et al. (2019) for recent work on pretax income inequality in Brazil, the Middle East, Russia and China, respectively. See Saez and Zucman (2016), Garbinti et al. (2021), Garbinti and Goupille-Lebret (2019), Martinez-Toledano (2017) for work on wealth inequality in the U.S., France and Spain.

Second, our paper relates to the large literature, initiated by Okner and Pechman (1974), that studies the progressivity and the tax burden of tax and transfer systems (for work related to France, see Bourguignon, 1998; Accardo et al., 2009; Landais et al., 2011; Chanchole and Lalanne, 2012; Eidelman et al., 2013; Bozio et al., 2020; Accardo et al., 2021).[5] Our key contribution to this literature is to construct long-term, annual series of pretax and post-tax income for France that provide a comprehensive view of how government redistribution affects inequality. Indeed, our French series cover the entire distribution, are fully consistent with national accounts, and consider all forms of taxes and government expenditure.

Third, our study complements the macro literature that analyzes the role of taxes and transfers on inequality dynamics (Kaymak and Poschke, 2016; Hubmer et al., 2017). The richness of our detailed micro series of pretax and post-tax income can offer a powerful guide to calibrate and quantify macroeconomic models and improve the ability of macroeconomic models to reproduce distributional dynamics over time (Ahn et al., 2018; Auray et al., 2022).

Fourth, our paper contributes to the broad literature on the determinants of pretax income inequality. This literature has typically discussed the relative role of education policies (Katz and Murphy, 1992; Chetty et al., 2017), minimum wage (Autor et al., 2016), compensation bargaining (Piketty et al., 2014), international trade and technological change (Autor et al., 2014; Acemoglu and Restrepo, 2020), as driving forces of increased inequality. Our results suggest that such "predistribution"—policies, rules and mechanisms impacting pretax income inequality—could matter much more than direct redistribution in explaining differences in overall inequality between the U.S., France and possibly other European countries. Generally speaking, our findings contribute to the expending policy debate on the notion of "predistribution" and call for a better comprehension of these mechanisms.[6]

[5] Bourguignon (1998), Accardo et al. (2009), Chanchole and Lalanne (2012), Eidelman et al. (2013), and Accardo et al. (2021) use microsimulation models and household surveys to estimate the progressivity of the tax and transfer system for one or two given years. Bozio et al. (2020) analyzes the impact of social security contributions on labor income inequality over the 1967-2015 period. The paper most directly related to ours is Landais et al. (2011), which combines tax data with national accounts to estimate tax rates by pretax income groups for a given year. See also Piketty and Saez (2007), Mirrlees et al. (2010), Sutherland and Figari (2013) with EUROMOD, Bengtsson et al. (2016), and OECD work by Zwijnenburg et al. (2017) for cross-country comparison exercises.

[6] The notion of "predistribution" has played an increasingly important role in policy debates since the 2000s, particularly in British policy debates (see e.g., O'Neill and Williamson, 2012; Thomas, 2017).

The rest of this paper is organized as follows. In section 1, we present our conceptual framework where we define inequality measures, and the measure of redistribution. In section 2, we describe our data sources and methodology to compute post-tax income series for France. In section 3, we present time series of post-tax inequalities in France, which we compare to the ones available for the U.S. We then present our main results regarding the overall magnitude of redistribution (section 4). In section 5, we discuss the possible interpretation of these results and offer some research perspectives.

1 Conceptual framework

In this section, we present the conceptual framework which will lead to the specific empirical estimates of income inequalities series and measures of redistribution, that we present in this paper. Our analysis is grounded on the income concepts developed by national accounts, as they allow comparison across time and countries (section 1.1). We then describe formally how variations in the level of inequality indicators can be ascribed to redistribution, or predistribution, and under which conditions these can be compared across time and countries (section 1.2).

1.1 Income definitions

In line with the DINA guidelines, we use three basic income concepts in our analysis: pretax income, post-tax disposable income and post-tax income. By definition, average income per adult is equal to average national income per adult for pretax and post-tax income.[7]

Pretax income inequality (I_{pre}). It is our benchmark concept to study the distribution of income. Pretax income is defined as the sum of all income flows going to labor and capital, after taking into account the operation of the pension and unemployment insurance systems, but before taking into account other taxes and transfers. That is, we deduct pension and unemployment contributions, and add pension and unemployment distributions. This concept should be benchmarked against the definition of factor income, which is equal to the sum of all income flows going to labor and capital, before considering the operation

[7]National income is defined as GDP minus capital depreciation plus net foreign income, following standard national accounts guidelines (SNA 2008).

of the pension and unemployment system. One problem of that measure is that retired individuals typically have very small factor income in countries using pay-as-you pension systems. As a result inequality of factor income tends to rise mechanically with the fraction of old-age individuals in the population, which biases comparisons over time and across countries.[8] Pretax income inequality will not be affected by ageing population nor by the design of the pension system. However, the limitation of the concept of pretax income is that it does not incorporate the redistribution carried out by the pension and UI systems over the life-cycle.[9]

Disposable income inequality (I_{disp}). It is defined as pretax income minus all forms of taxes plus all individualized monetary transfers. This income concept is the one used traditionally for measuring redistribution, as it is well defined in all institutional settings. The limitation of this concept is that it does not incorporate a large part of public spending, namely public services, whether in the form of in-kind transfers (e.g., education, health) or collective consumption expenditure (e.g., defense, police, justice).

Post-tax income inequality (I_{post}). Post-tax income is defined as the sum of all income flows going to labor and capital, after considering the operation of the pension and unemployment system, and also after taking into account all forms of taxes and transfers (monetary transfers, in-kind transfers, and collective consumption expenditure). In other words, post-tax income is defined as disposable income plus in-kind transfers and collective consumption expenditure.

1.2 Redistribution vs predistribution

Redistribution. In the literature, redistribution γ, i.e., the reduction in inequality due to a given tax and transfer system, is usually defined as $\gamma(I_{disp}, I_{pre}) = 1 - I_{disp}/I_{pre}$. If one defines T_t as the tax and monetary transfer system (with both level and progressivity), one can write γ as:

[8] Note that looking at the distribution of factor incomes among the working-age population can yield additional insights: it allows to better measure the distribution of labor costs paid by employers (see our companion paper Garbinti et al. (2018) for a presentation of factor income series).

[9] As a robustness check, we propose a variant of pretax and post-tax income inequalities taking fully into account this redistributive component for France (see Online Appendix Section C.6). However, we prefer to exclude the redistributive aspects of the pension and unemployment system in our baseline estimates to ensure a perfect comparability with the US data developed by Piketty et al. (2018a).

$$\gamma(T_t, I_{pre}) = 1 - \frac{I_{disp}(T_t, I_{pre})}{I_{pre}}.$$

The limitation of this measure of redistribution is that it fails to incorporate policies, like in-kind public spending, with a direct impact on post-tax inequalities. Our analysis follows the more ambitious objective to include such public spending, and therefore compares pretax inequalities to post-tax inequalities. Noting now T government tax and spending, i.e., the usual tax and monetary transfer system, to which we add public spending in kind, we can define redistribution γ as:

$$\gamma(T, I_{pre}) = 1 - \frac{I_{post}(T, I_{pre})}{I_{pre}}. \tag{1}$$

This way of writing the reduction in inequality when going from pretax to post-tax income allows to underline two mechanisms. First, there is a direct, or *mechanical*, positive effect of T on γ, which is rather intuitive: the higher the level and progressivity of tax and transfers T, the lower the level of post-tax inequality $I_{post}(T, I_{pre})$ and the higher the reduction in inequality. Second, there is a positive impact of the level of pretax inequality on redistribution γ as any reduction in inequality carried out by taxes and public spending is related to the level of pretax inequality.[10]

Predistribution. While informative, the approach described above does not account for the fact that tax and spending T could have also an *indirect* effect on the distribution of pretax income. For instance, behavioral responses to a high level of taxation could lead to decreasing the amount of taxable income; education policies could lead to higher skills at the bottom of the income distribution, and thus lower pretax inequality, etc. Consequently, the *observed* level of pretax income inequality encompasses both the *indirect* effect of T on pretax inequality and the level of inequality that would prevail in the absence of any

[10]An additional mechanism comes from the fact that the progressivity of taxes and transfers reduce more inequalities when the initial level of inequality is higher. For instance, it can be easily shown that the reduction in inequality due to a lump-sum transfer increases with the initial level of inequality. Let t (resp. b) be the average pretax income held by the top earners (resp. bottom earners) in a country. t/b is an indicator of pretax income inequality. If the government decides to add a lump-sum transfer a to each individual (funded on the discovering of a natural ressource), then the disposable income inequality is measured by $(t+a)/(b+a)$. The reduction in inequality γ due to this lump-sum transfer is such as $(t+a)/(b+a) = (1-\gamma) \times (t/b)$. So $\gamma = 1 - \frac{t+a}{t} \times \frac{b}{b+a} = 1 - \frac{1+\frac{a}{t}}{1+\frac{a}{b}}$. In this set-up, an increase in pretax income inequality can be either due to an increase in t or a decrease in b. γ turns out to be a decreasing function in t and an increasing function in b which means that when pretax income inequality increases, the measured reduction in inequality (γ) increases.

tax and transfer system I_0.

We can thus define *predistribution* α as the reduction in pretax income inequality compared to a counterfactual world without any tax and transfer system I_0:

$$\alpha(T, I_0) = 1 - \frac{I_{pre}}{I_0} \tag{2}$$

Ideally one would like to measure the total effect of government tax and spending on inequalities, i.e., how much counterfactual inequalities without any government interventions are reduced by all public policies. This measure, represented by the ratio of I_{post} to I_0 can be written as the product of redistribution and predistribution:

$$\frac{I_{post}}{I_0} = [1 - \gamma(T, I_{pre})] \cdot [1 - \alpha(T, I_0)] \tag{3}$$

The obvious problem is that I_0 is not observable, and therefore the level of predistribution is hard to assess.

Issues with cross-country comparisons. Acknowledging the potential impact of government tax and spending on pretax inequality leads to a serious concern about cross-country comparisons. If one wants to compare how a given tax and transfer system T_1 in one country reduces pretax income inequality compared to a system T_2 in another country, then the differences between T_1 and T_2 will not only affect post-tax income distribution through $\gamma(T, I_{pre})$ but also through its effect $\alpha(T, I_0)$ on pretax income. If T_1 induces more changes in pretax inequality than T_2 then $\alpha(T_1, I_0) > \alpha(T_2, I_0)$ and the direct comparison between $\gamma(T_1, I_{pre})$ and $\gamma(T_2, I_{pre})$ will not account for how each system reduces inequality.

Note also that the *predistribution* effect may also mechanically leads to misleading comparisons. For instance take two countries with similar levels of post-tax inequality I_{post}, I_0 and T. In a country A, an important part of T is used to finance public education, while it is not the case in a country B. Pretax income inequality is then likely to be lower in country A ($I^A_{pre} < I^B_{pre}$). Consequently, for similar level of post-tax income inequality, $\gamma^A = 1 - I_{post}/I^A_{pre} < \gamma^B = 1 - I_{post}/I^B_{pre}$ which could be interpreted as a lower redistribution in country A relative to B while this lower γ^A observed would only be the result of the *predistribution* effect of the public funding of education.

Overall, our framework makes clear that it should not be surprising to find countries

with high pretax inequality exhibiting higher redistribution than lower pretax inequality countries, even if the latter have higher tax and spending policies.

Issues with changes over time. A similar problem arises by comparing reduction in post-tax inequality over time within one single country. One could attribute lower levels of redistribution γ for a period of time when policies were mostly directed at reducing pretax inequalities. Again, as an example, a country A investing in education in period t leading to a reduction in pretax inequality in $t + 10$ without any change in the level of redistribution from pretax to post-tax inequalities would see its estimate of redistribution be reduced over the period, while the total effect of these policies on pretax inequalities leads to a reduction in post-tax inequalities.

Estimating redistribution and predistribution. In this paper, we aim to construct long series of pretax and post-tax inequalities for France, comparing them with the ones available for the U.S. The objective is to quantify redistribution γ and assess how much differences in post-tax inequalities can be attributed to redistribution vs changes in pre-tax inequalities. Let be clear from the onset that we will not be able to measure predistribution α, i.e., to estimate how much of the changes in pretax inequalities can be attributed to policies vs exogenous shocks. However, by establishing clearly the contribution of redistribution vs the potential role of predistribution, one provides a quantitative estimation of what we know about the level of redistribution and what we miss with potential impacts on pretax inequalities.

2 Data and methodology

In this section we describe the data sources and main steps of the methodology that we use in this paper in order to construct our post-tax income distribution series over the 1900–2018 period. Complete methodological details of our French specific data sources and computations are presented in the Online Appendix along with a wide set of tabulated series, data files and computer codes.[11]

[11] A longer and more complete discussion of the general methodological issues involved in creating DINA estimates (not specific to France) is presented in Alvaredo et al. (2020).

2.1 Data sources

In order to construct our series of pretax and post-tax income, we combine three main types of data: national accounts, tax data and household surveys. Details on each data source are given in the Online Appendix.

National accounts. We use the official national accounts established by the French national statistical office (INSEE) for the 1949-2018 period. For transfers, we rely on official statistics produced by Social Security agency (CNAF) and the ministry of Social Affairs (DREES) which report the number of beneficiaries and the aggregate amount of each transfer since 1946. For the 1900-1948 period, we use the historical series of national accounts reported in Piketty and Zucman (2014), which rely on the detailed series constructed by Villa (1994).

Tax data. Depending on the period covered the quality and details of the data vary. From 1988 onwards, we have access to large annual micro-files of income tax returns, produced by the French Ministry of Finance. These files include about 400,000 tax units per year, with large over-sampling at the top (they are exhaustive at the very top; since 2010 we also have access to exhaustive micro-files, including all tax units, i.e., approximately 37 million tax units). Between 1970 and 1988, we have access to micro-files only for a limited number of years (1970, 1975, 1979, and 1984) and these represent smaller sample (about 40,000 tax units per year). These micro-files allow us to estimate the distribution of fiscal income, i.e., income reported on income tax returns. In order to estimate the distribution of national income (pretax and post-tax), we need to combine income tax micro-files with other data sources, namely national accounts and household surveys, and to apply a number of imputation/simulation rules. While the micro-files are at the tax unit level, all our income series refer to the distribution of income among equal-split adults (i.e., the income of married couples is divided into two).[12]

Unfortunately, no income tax micro file is available in France before 1970, so we have to use income tax tabulations. Detailed income tax tabulations have been produced by the French Finance Ministry since the creation of income tax in France in 1914 (first

[12]Alternative series of pretax income at the tax-unit level (married couples and singles) as well as individualistic-adults series (i.e., labor income is allocated to each individual income earner within the couple) could be found in our companion paper Garbinti et al. (2018).

applied in 1915). These tabulations are available on an annual basis since 1915 (with no exception) and are based upon the universe of all tax units.[13] They report the number of taxpayers, total income and income taxes paid for a large number of income brackets. These tabulations were first used in a systematic manner by Piketty (2001, 2003) to estimate top shares of fiscal income and then by Garbinti et al. (2018) to estimate the complete distribution of fiscal and pretax income.

Household surveys. We exploit two household surveys produced by Insee to complete the distribution of income. First, we use the *enquête Patrimoine* (Wealth Survey) which details information on savings accounts and life insurance products, that are not available in income tax records. Second, we use the *enquête Logement* (Housing Survey) which offers information on owner-occupied housing assets.

2.2 Construction of post-tax income series

For the methodology detailing the construction of pretax and post-tax income series, we refer to the Appendix B and C for the period 1970-2018 and to Appendix D for 1900-1969. We present below the main approach and method for computing post-tax income series.

Micro-simulation of tax and transfers (1970–2018). In order to simulate the French tax and transfer system, we proceed as follows. First, we exploit the richness of the income tax micro-files to simulate very precisely all monetary transfers and taxes levied on income (progressive and flat income taxes, and social security contributions). In particular, we are able to consider all changes in tax schedules or specific tax deductions, exemptions and credits over time.

Second, when the appropriate tax base is not directly observable in income tax files—for instance for property tax, residence tax, and wealth tax—we use an estimate of wealth[14] and income as a proxy. Although imperfect, this methodology still allows us to simulate the different tax schemes and the specific exemptions.[15]

[13]We also rely on the estimates of the distribution of income for years 1900 and 1910 produced by the French Finance Ministry in the context of the parliamentary debates about the creation of an income tax (using data from various sources, including property taxes and inheritance taxes).

[14]See Garbinti et al. (2021) for details about the construction of our wealth series.

[15]We should also stress that we have used additional information from official reports to check and improve our simulations. For example, our simulations of wealth taxes are fully consistent with wealth tax tabulations, which report the number of taxpayers as well as average taxable wealth and tax paid by

Third, we must impute some taxes and transfers for which direct micro-simulation is not possible. For example, corporate taxes are assumed to be incident on capital income, i.e., allocated proportionally to dividends, life insurance income and interests. The incidence of corporate income tax (CIT) is probably one of the most contentious issue. Our assumption here implies less redistribution of CIT than traditional shareholder incidence, but more than estimates which attribute a significant share of CIT to labor income (e.g., Suárez Serrato and Zidar, 2016; Fuest et al., 2018).[16]

Estimation of tax and transfers before 1970. Before 1970, we rely on detailed income tax tabulations produced by the French Finance Ministry. We follow Garbinti et al. (2018) for estimates of pretax income, and we develop a simple procedure to estimate the distributions of disposable income. This procedure consists in computing correction factors (for each year and each percentile) to go from fiscal to disposable income, using all available information (see Appendix D for a complete description of the methodology).[17] Although this method should be seen as exploratory, we argue that it should reproduce accurately the long-run trend.[18]

Distribution of in-kind transfers and collective expenditure. Few studies provide detailed measures of the redistributive impact of non-monetary transfers, and even fewer offer estimates of changes over time.[19] As we know relatively little about who benefits from this government spending, we need to make some assumptions about their distribution. We are well aware that these assumptions could be improved with studies that could bring a more precise light over their true distributive effects.[20] Our baseline scenario (V1) assumes i) a lump-sum imputation of health care expenditures and public spending on

tax bracket. The number of beneficiaries of each monetary transfer is also consistent with the statistics provided by official reports (CNAF and DREES files).

[16]As a robustness check, we also consider alternative imputations for corporate retained earnings and corporate taxes and show that the resulting series are almost identical (see Appendix Section C.6).

[17]In particular, the correction factors incorporate the yearly evolution of the different taxes and transfers as reported in the National Accounts as well as the yearly distribution of income taxes paid by income group as reported in the income tax tabulations.

[18]In particular, we show in Appendix Figure E10 that disposable and pretax income shares are very close over the 1900-1969 denoting a small impact of taxes and monetary transfers on inequality. These results are in line with the estimates of pretax and disposable income shares over the 1970-1975 period where a microsimulation exercise is conducted on micro-files.

[19]For France we rely on the few studies done on health expenditures (e.g., Lardellier et al., 2011; Jusot et al., 2016) or education expenditures (Conseil de l'Emploi, des Revenus et de la Cohésion sociale, 2003).

[20]Nonetheless, including these public spending is a necessary step to compare countries with differential in-kind vs. monetary transfers: countries with higher level of in-kind transfers would appear artificially poorer if one used only a measure of disposable income.

education to individuals[21], and ii) a proportional imputation to post-tax disposable income for collective expenditures. A lump-sum imputation attributes the same average monetary value to each adult individual, and is therefore characteristics of a strong redistributive impact of these expenditures. A proportional imputation to post-tax disposable income is, on the contrary, neutral to the measurement of inequality. In order to assess the sensitivity of our results to the imputation of in-kind transfers and collective expenditure, we also present two alternative variants. We impute all these public spending either on a lump-sum basis (scenario V2)—the most redistributive assumption—or proportionally to post-tax disposable income (scenario V3). This last scenario has the advantage of being neutral and to be equal to disposable inequality measures, i.e., after tax and monetary transfers.

Finally, in order to ensure that aggregate pretax and post-tax national incomes match exactly with aggregate national income, we follow Piketty et al. (2018a) and attribute 50% of government deficit (or surplus) in proportion to taxes and 50% in proportion to transfers and expenditures. This assumes that fiscal adjustment will be borne equally by taxes and spending. In practice, this makes very little difference (except in years with very large deficit or surplus).

3 A Century of Post-tax Income Inequalities

We start by comparing the long-run evolution of post-tax income inequality between France and the U.S., before comparing these trends to pretax income inequalities.

3.1 The long-run evolution of post-tax income inequality

We report on Figure 1 the evolution of post-tax income inequality in France and the United States over the 1900-2018 period, as measured by the shares of total post-tax income going to the top 10%, the middle 40%, and the bottom 50%. Post-tax income is defined as pretax income minus all taxes plus all monetary transfers, in-kind transfers, and collective expenditures. As a reminder our baseline scenario assumes a lump-sum imputation of health care expenditures and education spending to individuals, and a proportional imputation to post-tax disposable income for collective expenditures.

[21]For France which is characterized by a single-payer system where almost all health spending is paid for by the government, healthcare spending is attributed as a fix lump sum to all adults. For the U.S., healthcare spending is assigned on a lump sum basis to the beneficiaries.

For France, we observe a large decline of the top 10% post-tax income share (T10) from about 48% in 1900-1910 to 23% in 1983. This fall has been at the advantage of both the bottom 50% (B50), whose post-tax income share increased from 15% to 32%, and the middle 40% (M40), whose pretax income share increased from 36% to 44%. Since 1983, this trend halted, with a slight increase in the top 10% income share (+2 percentage points, from 23% in 1983 to 25% in 2018) and a corresponding erosion of the middle 40% income shares.

The comparison with post-tax series from the U.S. is interesting both for the similarities and divergence between the two countries.[22] First, the share of post-tax income of the top 10% (T10) is very similar in both countries from the start of the period until 1974-75, when a marked divergence starts to emerge. Whereas the share of T10 continues to fall in France, the U.S. experiments a steep rise in the share of post-tax income going to that group, from 27% in 1974 to 37% in 2018. These gains are made almost uniquely at the expense of the bottom 50% which experiences an increase in France and a marked decrease in the U.S. from 27% in 1974 to 22% in 2018. The middle group (M40) appears largely unaffected by these changes and represents in both countries a very similar share of post-tax income around 44%.

3.2 Post-tax vs pretax income inequality

Figure 2 compares the evolution of pretax and post-tax income inequality in France (Panel A) and in the U.S. (Panel B) over the 1900-2018 period. Two stylized facts are worth highlighting from these series.[23] First, the evolution of pretax and post-tax income inequality has been far from steady and differs strongly between the two countries. While pretax inequality has followed a U-shaped pattern in both countries, post-tax inequality is L-shaped in France and U-shaped in the U.S. The increasing progressivity of the French tax and transfer system has been able to counteract the gradual rise in pretax income inequality, leading to a relatively constant level of post-tax income inequality since the early 1980s. This contrast strongly with the U.S. case, where rising redistribution has not matched the dramatic increase in pre-tax inequality. Second, the difference between pretax

[22] U.S. post-tax income series are provided by Piketty et al. (2018a). The decomposition of the bottom 90% income share between the bottom 50% and the middle 40% shares is available for the U.S. only since 1962.

[23] Note that our stylized facts are robust to the use of alternative concepts of post-tax income (variants 2 and 3). See Appendix Figures E6 and E7.

and post-tax affects mostly the top 10% and bottom 50% income shares in both countries, leaving almost unchanged the middle 40% share. The difference in income shares of the middle group M40 is at most 2-3 p.p. in France, while it is around 1 p.p. in the U.S. By contrast T10 income share is reduced significantly by redistribution, for instance in 2018 from 34% to 25% in France and from 45% to 37% in the U.S., while B50 income share rises from 21% to 32% in France, respectively from 14% to 21% in the U.S.

Because pretax and post-tax DINA series are fully consistent with national income, they can be used to consistently compare income levels across countries. Figure 3 sets the macroeconomic comparison of income levels between France and the U.S. It presents the ratio of French national income per capita relative to the U.S. level from 1962 to 2018. This ratio rose from 60% in the early 1960s to 85% in 1982, then decreased to 70% at the end of the period. To understand this relative income performance, it has been usual to relate it to both productivity catch-up in the first half period, and to a relative decline in hours of work in France relative to the U.S. which has been well documented.[24]

What has not been yet documented is how the average national income trend can be split into distributional analysis. Figure 4 presents such decomposition between B50, M40 and T10 income groups, comparing relative level of pretax and post-tax income (in constant 2018 euros PPP) by income group between France and the U.S. This period is of particular interest as the level of inequality is similar between the two countries in the early 1960s and diverge dramatically since then. Table 1 provides absolute numbers for 1962 and 2018.[25]

In 1962, both countries depict the same level of pretax and post-tax income inequality. However, there are important cross-country differences due to the large gap in average national income between the two countries (15,000 euros vs. 24,000 euros). As a result, all French income groups earn approximately 60% of their U.S. counterpart in 1962. The recent period contrasts dramatically with the early 1960s. Post-tax income of the French bottom 50% group is now 5% higher than its U.S. counterpart (24,500 vs. 23,500 euros), reflecting a dramatic increase of the bottom 50% FR/U.S. ratio from 61% to 104% over the 1962-2018 period. In contrast, the middle 40% ratio increases only slightly to 72% (42,000 vs. 58,000 euros) and the top 10% ratio decreases to 47% (96,000 vs. 204,000 euros). Two

[24]See for instance Blundell and Laroque (2011, 2013) for an in-depth comparison of the UK, the US and France.

[25]The annual evolution of pretax and post-tax income between France and the U.S. over the 1962-2018 period is provided in Appendix Figure E1 (Panel A to C).

significant results emerge from this analysis. First, post-tax income of the French bottom 50% group was 60% lower than its U.S. counterpart in 1960, it is now 4% higher. Second, the ratios France/U.S. of pretax and post-tax income has remained very similar during the entire period, suggesting that redistribution has not been the main driver of these changes. In the next section, we look at the tools of redistribution used in the U.S. and France.

3.3 Anatomy of Redistribution in France vs the United States

Figure 5 presents the evolution of the structure of taxes and transfers for France and the U.S. over the 1900-2018 period. Taxes represented less than 10% of national income in the early 20th century and increased up to 25% in the early 1950s in both countries. Since the early 1950s, the total tax burden, excluding contributive Social Security contributions, has remained relatively constant in the U.S., hovering around 25%, while it continued to increase in France, reaching 40% in the mid-1990s.[26]

Change in the structure of taxation. From the start of our series, the structure of taxation appears markedly different in France and the U.S. In the early 20th century, indirect taxes represented in France 92% of total taxes, and capital taxes only 8%. By contrast, in the U.S., capital taxes represented 60% of the total, indirect taxes 26% and income taxes 12%. Over the 20th century, the French tax structure has been dramatically altered, with a decline of the share of indirect taxes in total taxes from 92% to 36% today. Capital taxes and progressive income taxes have significantly risen over this period, but the most striking increase has occurred for Social Security contributions (SSCs). Both contributive (pensions and UI) and non-contributive SSCs have been expanded after WWII but focusing on the non-contributive SSCs—the most similar to other form of taxation—, they reached 40% of the total taxes by the 1990s. This striking change reflects the rise of the French welfare state after 1945, largely influenced by a Bismarckian model whereby SSCs on earnings fund social benefits. From the 1990s onwards, non-contributive SSCs on labor earnings have been reduced, and replaced by flat-rate income taxes—taxing both labor and capital income as the same rate. In the U.S., the change in the tax structure has

[26]These figures exclude from the total tax burden contributive Social Security contributions (notably pension contributions) in line with the definition of pretax income. The total tax burden including these mandatory contributions is represented with a dotted line. France has also experienced an increase in these contributive SSCs post WWII, with a total tax burden reaching 55%, while the difference is more modest for the U.S. with total tax burden around 30%.

affected mostly capital taxes. These have declined from around 60% of total revenues to less than 20%. Indirect taxes have remained at approximately the same level throughout the century, and the most striking evolution has been the development of income taxation, which increased from a low level of 1% of national income in the 1910s to 11% today. To sump-up, although both countries have experienced significant changes in the structure of taxation over the 20th century, the differences between the two countries remain large. In France, indirect taxation and non-contributive SSCs represent together 60% of total taxes (75% over the 1900-1995 period), while in the U.S. progressive income tax and capital taxes together make the bulk of taxation, with 70% of the total taxes.

Tax progressivity. The structure of taxation provides some clues about the progressivity of the tax system, but comparisons are hazardous without detailed micro data and tax simulations. We can carry out robust analysis of the tax burden by income groups since the 1970s when we have access in both countries to administrative micro data.

Figure 6 provides a detailed picture of the evolution of tax progressivity in France and the U.S. by depicting the distribution of tax rates along the income distribution in 1970 and 2018. In France, the move towards more tax progressivity is clearly visible: in 1970, taxes rates increase slightly from 27% to 33% when we move from P10-P20 to P40-50, then remain stable until P99.5, before reaching 39% for P99.9-P100. By 2018, the average tax rates have shifted upward for the top 50% of the income distribution, with an almost linear increase from 27% for P10-P20 to 47% for P99-P99.9. At the very top of the income distribution (P99.9-P100), the increase is less pronounced, from 39% in 1970 to 45% in 2018, leading to a small regressivity in French tax rates. On the other hand, the tax increase is highest for the first half of the top 1% (P99-99.5), whose average tax burden jumped from 32% to 47%.

In the U.S., tax progressivity is much more important than in France in 1970. Average tax rates increased from 15% for P10-P20 to 54% for P99.9-P100. By 2016, the U.S. tax burden has shifted downwards, but not equally for all income groups. Two parts of the income distribution have experienced the most decline in tax rates: first, the middle of the income distribution, from P20 to P70, has seen a reduction of average tax rates of 3-4 percentage points[27]; second, the top 5 percent of the income distribution has seen its tax

[27]Note that we have classified EITC as a monetary transfer (see next section). Tax rates are therefore computed gross of EITC.

burden reduced by at least 3 percentage points, with the highest decline for the top 0.1%, where tax rates have declined from 54% in 1970 to 38% in 2018.[28]

Interestingly, French and U.S. tax rates at the very top have followed opposite trends. The tax rate faced by the French top 0.1% increased dramatically over the 1970-2018 period and is now equal to the level faced by the U.S. top 0.1% in 1970. In contrast, the tax rate faced by the U.S. top 0.1% has declined dramatically and converges toward the level faced by the French top 0.1% in 1970.

The role of monetary transfers for redistribution. We now look at the spending side of redistribution, by analyzing the role of transfers, in the evolution of redistribution in France and the U.S. We first look at the long-run change in the composition of transfers, distinguishing between monetary transfers, in-kind transfers (in particular education and health) and collective consumption goods (including police, public infrastructures, etc.).

Figure 5 present the evolution and composition of public spending—outside contributive social insurance—respectively in France and the U.S. In both countries, public spending has increased dramatically from the beginning of the 20th century to the mid-century. In France, public spending increased from 7% of national income in 1910 to approximately 34% in 2018.[29] Most of the increase is concentrated in the decade following WWII, with the creation of the French welfare state (public health care insurance, universal child benefits, etc.). Another expansion appears during the 1974-1984 period, notably with healthcare expenditures. Monetary transfers (including child benefits, means-tested benefits, or housing benefits) represent a small part of total spending, i.e., around 4% of national income. In the U.S., public transfers increased from 8% of national income in 1913 to 26% today. Most of the change happened in the aftermath of the Great Depression that led to the creation of the American welfare state, though the share of public spending continued to increase after WWII and during the 1960s. In comparison to France, monetary transfers and health care expenditure represent a much smaller part, despite a continuous increasing trend from the 1980s onwards—in part at the expense of collective expenditures (down from 14% of national income in the early 1980s to 11.5% in the late 2010s).

[28] As shown by Saez and Zucman (2019), the profile of taxation is regressive at the very top once we disentangle the top 0.1% between P99.9-P99.99 and P99.99-P100 in 2018. See also Saez and Zucman (2019) for a detailed analysis of the long-run changes in tax progressivity in the U.S. and the distributional effects of the recent reforms of the U.S. tax system.

[29] In line with the previous analysis of taxes, we exclude here spending on contributory pensions and unemployment insurance benefit.

Taking advantage of our administrative micro data, we now focus on the role played by monetary transfers since the 1970s. While they are a small part of total public transfers both in France and in the U.S., they have a strong impact on individuals' disposable income and are a crucial tool of any welfare state. In Figure 7, we present the average monetary transfers received by the different income groups previously defined, for France (panel A) and the U.S. (panel B). For France, the long-term evolution has been a reduction of universal (non means-tested) child benefits and related family transfers (e.g., benefits for non-working mothers) and a strong increase in means-tested benefits like income support and housing benefits.[30] This compositional change has impacted the distribution of monetary transfers (see Fig. 7.a), with a reduction of transfers received by the top 10% and the middle 40% and an increase for the bottom 50%—i.e., average transfers received by B50 increased from 2.7% to 6% of national income over the period 1970-2018.[31]

Figure 7.b presents similar estimation for the U.S. In the 1970s and 1980s, monetary transfers received by the top 10% and the middle 40% declined substantially to the benefit of the bottom 50%. In 2007-2010, in the aftermath of the Great Repression, monetary transfers increased markedly for the bottom 50% and middle 40%. After 2008, extraordinary government programs were implemented. Besides tax credits for low- and middle-income families, it consisted in an increase in funding and access to food assistance programs for low-income families, extension of unemployment benefits, and increases in amount of EITC (see Almeida (2020) for a detail of changes in redistribution).

Overall redistribution through monetary transfers has increased in both countries, but the size of these transfers, notably towards the bottom 50%, has been much more pronounced in France, compared to the U.S.

[30] Housing benefits have played a significant role in this increase in redistribution. Until the late 1970s, subsidized housing consisted mainly of government funded construction. But this policy did not target the poorest households (since many households managed to stay in the subsidized units after their income had become too high to allow them to stay). At the end of the 1970s, the government decided to change its housing policy towards housing benefits, instead of public housing projects. See Fack (2006) for a detailed discussion about changes in housing policies. Regarding means-tested benefits, disabled adults allowance increased in the 1970s, while the late 1980s saw the creation of a minimum income benefit (the Revenu minimum d'insertion, RMI) dedicated to the poorest households as an income support of last resort. This benefit was replaced in 2009 by the Revenu de solidarité active (RSA).

[31] In 1998, the top 10% income group in France experienced a significant drop in transfers received, corresponding to the introduction of means-testing in child benefits, a reform which was repealed the following year, but re-introduced in 2015.

4 Quantifying Redistribution

In this section we present the main results of the paper, i.e., a quantification of the amount of redistribution in France and the U.S. over the last century, and an estimation of the contribution of redistribution vs changes in pretax inequalities to explain changes in post-tax inequalities.

4.1 Measuring the extent of redistribution

Current level of redistribution (2010-2018). Following section 1 and equation (1), we compute the extent of redistribution γ, i.e., the difference between pretax and post-tax inequalities over pretax inequality. Table 2 presents key results for France and the U.S. in the recent period (2010-2018). Redistribution reduces the top 10% income shares by 25% in France against 19% in the U.S., while it increases the bottom 50% income share by 52%, compared to 53% in the U.S. In both countries the middle 40% share is only very modestly affected—even if it is noticeable that redistribution marginally benefits the middle 40% in the U.S., while it is negative in France.

One simple inequality indicator which can be used to assess the extent of redistribution is the ratio between the average income of the top 10% income group and the average income of the bottom 50% income group (T10/B50). In terms of pretax income, this ratio is equal to 8.0 in France, i.e., on average top 10% income earners make eight times more than bottom 50% income earners, compared to a ratio of 15.7 in the U.S. In terms of post-tax income, this ratio is reduced to 3.9 in France, i.e., a reduction of 51%, compared to 8.4 in the U.S., i.e., a reduction of 47%. In that sense, one can say that redistribution reduced pretax inequality by 51% in France against 47% in the U.S. over the 2010-2018 period.

We have also computed other inequality indexes—such as Gini and Theil indexes and Palma and P75/P25 ratios—to measure the change in inequalities over time and find similar results.[32] We prefer to highlight income ratios as inequality indicator for several reasons. First, they are intuitive and transparent statistics whose interpretation

[32]See Appendix Table E1. All the inequality indicators depict an increase in redistribution for France and the U.S. over the 1970-2018 period. Redistribution was relatively higher in the U.S. over the 1970-1979 period. Since 2010, both countries carry out similar level of redistribution whatever the inequality indicator used. If anything, the level of redistribution in France over the 2010-2018 period appears slightly higher than in the U.S. when using the Gini index and slightly lower when using the Theil index.

is straightforward. Second, they are not data-demanding and can therefore be used over historical data, which are usually not available at a very disaggregated level. Finally, they allow for a clearer decomposition of the role played by redistribution on inequality in the upper and lower segments of the distribution (while synthetic indexes like Gini and Theil tend to blur these distinctions). For instance, one can see that the 51% reduction in inequality in France comes primarily from the decline from bottom-end inequality. That is, top-end inequality (as measured by the ratio T10/M40) is reduced by 21% on average over the 2010-2018 period, while bottom-end inequality (as measured by the ratio M40/B50) is reduced by 38%. A very similar pattern is found for the U.S., where top-end inequality (ratio T10/M40) is reduced by 20%, while bottom-end inequality (M40/B50) is reduced by 33%.

How much does redistribution reduce inequality over time? We now turn to an analysis of long-term changes in redistribution between France and the U.S. Figure 8 presents the evolution of inequality ratios for pretax and post-tax income over the 1900-2018 period for the two countries. Panel A presents the evolution of the ratio T10/B50, which is available only from 1962 onwards for the U.S. In terms of pretax income, French top 10% income earners used to earn about 18 times more than bottom 50% income earners in 1900. The ratio T10/B50 has decreased almost continuously from 18.4 in 1900 to 6.1 in 1983, and increased since then to 8.0 in 2018.

The post-tax income ratio decreased dramatically during WWI, from 16.6 in 1910 to 9.3 in 1919, and then stabilizes around 10.5 over the 1920-1929 period. After 1929, post-tax income followed closely the pretax income ratio up to the mid-1970s, then decreased more rapidly than the pretax ratio over the 1974-1984 period, before stabilizing around 4. In the 1960s, inequality indicators were similar in the U.S. and in France, with ratios around 9 for pretax income and 7 for post-tax income, decreasing in both countries. From 1980 onwards, U.S. inequality indicators start increasing sensibly, along with measures of redistribution. France's path diverges here with a much less pronounced increase in pre-tax inequality, but with a similar increase in redistribution. At the end of the period, both countries reduce pretax inequalities by 50%—slightly more in France (51%) than in the U.S. (47%)—albeit with considerable difference in the level of pretax and post-tax inequalities.

To adopt a long-term perspective, panel B of Figure 8 presents the ratio T10/B90

which is available for both countries over the entire period of study.[33] During the 1925-1935 period, both France and the U.S. had T10/B90 post-tax ratios around 7, with similar redistribution levels (around 12% reduction). After WWII, both countries experienced a very steep drop in inequality, which was partly reversed in the U.S. despite increasing redistribution.

Figure 9 presents the annual evolution of our redistribution indicator γ, i.e., the percentage reduction from pretax to post-tax inequalities for T10/B50 (panel A) and T10/B90 (panel B). The T10/B50 indicator highlights the massive shock that WWI represents for France. During the war, and the following years, the very large health care spending and monetary transfers to veterans and widows, funded by debt and increased taxation have all contributed to that temporary spike in redistribution. From 1928 onwards, the extent of redistribution has been almost continuously increasing in France, most notably since 1973. The U.S. presents a similar picture of increasing redistribution, starting from very similar levels in both countries in the 1960s (around 25% reduction of pretax inequality), and reaching 45% of reduction at the end of the period in both countries. If one looks at the T10/B90 indicator (panel B), the shock represented by wars is evident in both countries—WWI for France and WWII for the U.S.—but contrary to France, the U.S. maintained after the war a high level of redistribution through the 1950s, 1960s and 1970s. With that indicator, the U.S. was the most redistributive country post WWII until the early 1980s, as France increased its level of redistribution steadily from 1973 onwards. Overall, the impact of redistribution on inequality has increased dramatically over time. Over the 1900-1914 period, redistribution played a modest role by reducing inequality between the top 10% and the bottom 90% income groups by 8-10% in France and in the U.S. In contrast, it reduced the same inequality indicator by 33% in France vs 29% in the U.S. over the 2010-2018 period. Interestingly, redistribution has increased first in the U.S., where higher level of redistribution is noticeable as soon as 1945, whereas France experienced a more continuous increase in redistribution, with a stronger trend from the mid-1970s onwards.

Panel A of Fig. 10 presents the same index of redistribution with the ratio T10/B90 comparing the benchmark estimate of post-tax income (V1) with the V3 variant where

[33]Note that the use of this alternative indicator is unlikely to affect our long-term trends and interpretations as the evolution of T10/B50 and T10/B90 are highly correlated. Using the average income of the bottom 90% group over the bottom 50% group will mechanically decrease the level and the changes in redistribution and inequality (see Table 3).

health care and education spending are allocated proportionally to disposable income. That latter measure is equivalent to disposable income, after taxes and monetary transfers. One can see with this figure that redistribution has been mostly in the form of taxes and monetary transfers in the U.S. up to the 1970s, at a time this form of monetary redistribution was still limited in France. Since the 1970s, both countries have experienced a form of convergence with a strong increase in monetary redistribution in France and an increase in health care spending in the U.S. Comparing estimates of post-tax income with disposable income highlights the importance of including non-monetary transfers in cross-country analysis of redistribution, and not focusing exclusively on the tax and benefit system. Panel B of Figure 10 presents another alternative assumption for collective expenditures (scenario V2, assuming lump-sum gains of all collective expenditures). The general pattern is very similar except that the level of redistribution is higher in both countries.

This long-term analysis has highlighted that the reduction of inequality implied by redistribution is significant in both countries and increasing throughout the entire 20th century, even though not at the same pace and in the same period. We now turn to an attempt to decompose changes in post-tax inequality to uncover what have been the main drivers of inequality over the last century.

4.2 The contribution of redistribution to changes in inequalities

In order to quantify the respective role of falling pretax income inequality and rising redistribution in the long-term decline of post-tax inequality in the U.S and in France, we rely on the following formula:

$$\frac{I_{t2}^{post}}{I_{t1}^{post}} = \frac{I_{t2}^{pre}}{I_{t1}^{pre}} \times \frac{\frac{I_{t2}^{Dis}}{I_{t2}^{pre}}}{\frac{I_{t1}^{Dis}}{I_{t1}^{pre}}} \times \frac{\frac{I_{t2}^{post}}{I_{t2}^{disp}}}{\frac{I_{t1}^{post}}{I_{t1}^{disp}}} \tag{4}$$

Where I^{pre}, I^{disp} and I^{post} are the inequality indicators (e.g., ratio T10/B50) computed using either the concept of pretax (pre), disposable (Dis) or post-tax (post) income, and $t1$ and $t2$ are the beginning and the end of the period considered. Equation (4) formalizes the decomposition of post-tax inequality into three terms: i) changes in pretax inequality, ii) changes in redistribution due to taxes and monetary transfers, and finally iii) changes in in-kind and collective expenditures.

Table 3 presents this decomposition for the T10/B50 indicator (panel A) and for the T10/B90 indicator (panel B) for both France and the U.S. For France, the overall decline in post-tax T10/B50 inequality over the 1900-2018 period (-75%) can be ascribed mostly to a decline in pre-tax inequality (-45%), and somewhat to tax and monetary transfers (-21%). Reduction of inequality from in-kind transfers or collective expenditures is comparatively small (in our baseline scenario -9%). The evidence is qualitatively similar using the indicator T10/B90 with respectively an overall decline in inequality of -64%, explained mostly by pretax inequality changes (-43%) and taxes and monetary transfers (-13%). For the U.S., the overall reduction in post-tax T10/B90 inequality over the 1913-2018 period (-15%) is the result of an increase in pretax inequality (+7%) corrected by an increasing redistribution from taxes and monetary transfers (-9%) and in-kind transfers and collective expenditures (-13%).

However, this long-term analysis masks two very different underlying dynamics. The decline in post-tax income inequality happens during the 1900-1983 period. It is mostly due to the fall in pretax income inequality (84% of the total decline for France, and 77% for the U.S.) and, to a lesser extent, to the rise in redistribution. In contrast, the 1983-2018 period is characterized by a moderate increase in post-tax income inequality in France (+10% in T10/B90). This stability is the result of two opposing forces: rising pretax income inequality (+26% in T10/B90) compensated largely by rising redistribution (-16%). For the same period, the contrast with the U.S. is startling. The overall increase in post-tax inequality (+35%) can be decomposed into an even higher increase in pretax inequality (+50%) only partially reduced by an increase in redistribution (-16%), even if that latter increase is of the same magnitude as the one observed in France. Note that the results are similar when using the indicator T10/B50.[34]

To sum up, these results show that if inequality has decreased much more in France than in the U.S. during the 1900-2018 period, this is not due to a relatively more important increase in redistribution by the French tax and transfer system. The major factor behind the differential trend in post-tax income inequality comes from the differential evolution of pretax income inequality between the two countries. Over the recent period, the rise in redistribution was similar in both countries. However, it was able to annihilate the slight

[34]As a sensitivity analysis, Appendix Table E2 depicts the same findings using the two other variants of post-tax income (V2 or V3). This is explained by the fact that the contribution of in-kind transfers and collective expenditures to the evolution of post-tax inequality remains small whatever the concept of post-tax income used.

rise in pretax inequality in France, but not in the U.S. where the increase in pretax income inequality has been much steeper.

Formula (4) can easily be extended to cross-country comparisons to assess the relative contribution of redistribution and differences in pretax income inequality to post tax income inequality. With two countries A and B:

$$\frac{I_B^{post}}{I_A^{post}} = \frac{I_B^{pre}}{I_A^{pre}} \times \frac{\frac{I_B^{post}}{I_B^{pre}}}{\frac{I_{t1}^{post}}{I_A^{pre}}} \tag{5}$$

Following equation (5), Figure 11 presents the relative contribution of pretax changes versus redistribution over the longer run, with the ratio T10/B50 since 1962 (panel A) and the ratio T10/B90 over the entire period (panel B). Since the mid-1960s, it is very clear that most of the differences in post-tax inequality between France and the U.S. should be accounted for by differences in pretax inequality. This has not always been the case, as for instance the higher level of redistribution in the U.S. in the 1940s and 1950s did play a significant role, but overall the contribution of pretax inequality in driving post-tax inequality is clearly the dominant force.

5 Discussion: from redistribution to predistribution?

To summarize our main results, pretax income inequality appears to be the main factor accounting for differential level and trend in inequality between France and the U.S. over the 20th century. Redistribution plays an important role today in reducing post-tax inequalities in both the U.S. and France, by 47% vs 51% using our benchmark measure of the ratio T10/B50. But this reduction of inequalities by direct redistribution has only contributed for a third of the total change in inequalities over the period.

Predistribution vs other pretax changes. In section 1, we have defined predistribution α as the impact of government interventions that lead to changes in pre-tax inequalities compared to a counterfactual case of no intervention. One immediate question is the share of pretax inequality changes one can attribute to taxation and public spending. One polar alternative would be to assume that all changes in pretax inequalities are

exogenous—this is the traditional approach in public economics, which focuses therefore only on redistribution—, and another polar alternative would assume that all changes to pretax inequalities are due to government interventions. Unfortunately, we are unable to identify the role played by predistribution to account for differential level and trend in pretax inequality between France and the U.S.

Nevertheless, our framework allows a better understanding of the apparent puzzle that France and the U.S appear to perform rather similar level of redistribution γ while having very different public spending. First, the U.S. having higher pretax inequality, its redistribution level is mechanically higher. Second, and perhaps more importantly, the lower level of pretax inequality in France could be due, at least in part, to the policies implemented, and their predistribution effects. One immediate lesson from our paper is thus to warn against hasty cross-country comparisons in terms of redistribution. The amount of mechanical redistribution might not capture well the true impact of these policies on post-tax inequalities.

However, our findings clearly show that differences in post-tax income inequality between the two countries are explained by differences in pretax inequality rather than differences in redistribution. This implies that research and policy discussions should, in the future, focus on predistribution as much as on redistribution. In particular, a greater attention should be devoted to the study of the various policies and rules that can account for the fact that pretax inequality is so much larger in the U.S. than in France.

Which policies are likely to impact pretax changes? The set of policies that can affect the distribution of pretax income is potentially large. It includes the education system (particularly the inequality in education spending across social groups), labor market regulations (e.g., the level of the minimum wage and the various legal rules affecting the role of unions and the bargaining power of workers), and other policies affecting the distribution of primary assets and capabilities (including the health care system, the inequality of wealth and inheritance, etc.). The tax system has also an influence on pre-tax income: first, because taxation can lead to behavioral responses affecting labor and capital income, and second because progressive taxation of income and wealth can also affect the formation of top end compensation packages and wealth inequality (see e.g., Piketty et al., 2014; Piketty, 2014; Piketty et al., 2018b).

As a consequence, an inadequate take-away from our results would be that the non-

monetary transfers (e.g., education spending, public goods) have only a very small impact on the evolution of inequality within country or on the differences in inequality across countries. We believe, on the contrary, that our analyses highlight that a large set of policies can have an impact on pre-tax inequality (within country and over time) that would not be captured with the usual concept of redistribution because this analytical tool can only capture direct redistribution from a given pre-tax income inequality. In capturing redistribution, it misses "predistribution".

Conclusion

In this paper, we have presented post-tax Distributional National Accounts (DINA) for France. That is, we have combined national accounts, tax and survey in a comprehensive and consistent manner to build homogenous annual series on the post-tax, post-transfer distribution of national income by percentiles over the 1900–2018 period, with detailed breakdown by age, tax and transfer categories over the 1970–2018 period.

Our main conclusion is that changes in pretax inequality levels seem to play the central role in explaining the long-term evolution of the distribution of post-tax income in France. The same conclusion also applies if one attempts to account for the difference in inequality levels between France and the United States. These findings suggest that policy discussions on inequality should in the future pay more attention to policies affecting pretax inequality and should not focus exclusively on "redistribution" (i.e., redistributive taxes and transfers, for a given level of pretax inequality).

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Table 1 – Average real income by income group, France vs. U.S., 1962–2018

	1962			2018		
	Pretax	Post-tax	$\frac{Post-tax}{Pretax}$	Pretax	Post-tax	$\frac{Post-tax}{Pretax}$
Panel A: France						
Full Population	14 730 €			38 548 €		
Bottom 50%	5 386 €	7 014 €	130%	16 038 €	24 486 €	153%
Middle 40%	16 761 €	16 242 €	97%	44 132 €	41 783 €	95%
Top 10%	53 326 €	47 266 €	89%	128 762 €	95 916 €	74%
Panel B: United States						
Full Population	24 152 €			55 301 €		
Bottom 50%	9 813 €	11 406 €	116%	15 735	23 459	149%
Middle 40%	26 768 €	27 525 €	103%	56 466	58 032	103%
Top 10%	85 373 €	74 392 €	87%	248 472	204 273	82%
Panel C: Ratio France/US						
Full Population	61%			70%		
Bottom 50%	55%	61%		102%	104%	
Middle 40%	63%	59%		78%	72%	
Top 10%	62%	64%		52%	47%	

NOTES: The unit is the adult individual (20-year-old and over; income of married couples is splitted into two). Income corresponds to national income expressed in euros 2018 (PPP for the US). Fractiles are defined relative to the total number of adult individuals in the population.

Table 2 – How much does redistribution reduce inequality, France vs. US, 2010–2018 ?

	France			United States		
	Pretax	Post-tax	γ	Pretax	Post-tax	γ
Income shares (averages 2010–2018)						
Top 10%	33%	25%	25%	44%	36%	19%
Middle 40%	46%	44%	5%	41%	42%	-2%
Bottom 50%	21%	32%	-52%	14%	22%	-53%
Inequality indicators (ratios between average incomes)						
Total inequality (T10/B50)	8.0	3.9	51%	15.7	8.4	47%
Upper inequality (T10/M40)	2.9	2.3	21%	4.3	3.4	20%
Lower inequality (M40/B50)	2.8	1.7	38%	3.7	2.4	33%
Simplified Total inequality (T10/B90)	4.5	3.0	33%	7.2	5.1	29%

NOTE: The level of redistribution γ is defined as $1 - \frac{I_{post}}{I_{pre}}$. A positive number should be interpreted as a positive level of redistribution. For instance, total inequality, as measured by the ratio between the average incomes of the top 10% and the bottom 50%, drops from 8.0 in pretax income to 3.9 in post-tax income in France on average over the 2010-2018 period. This translates into a measure of our redistribution indicator γ of 51%, i.e., a reduction of 51% of the T10/B50 inequality indicator.

Table 3 – Decomposition of the evolution of post-tax income inequality: France vs. U.S.

	France			United States		
	1900–2018	1900–1983	1983–2018	1913–2018	1913–1983	1983–2018
Panel A: T10/B50 inequality indicator						
Changes in post-tax income inequality	-75%	-76%	4%			42%
Due to changes in pretax inequality	-45%	-59%	29%			66%
Due to changes in taxes and cash transfers	-21%	-11%	-20%			-10%
Due to changes in in-kind and collective expenditures (relative to disposable income)	-9%	-6,8%	-4%			-14%
Panel B: T10/B90 inequality indicator						
Changes in post-tax income inequality	-64%	-67%	10%	-15%	-37%	35%
Due to changes in pretax inequality	-43%	-56%	26%	7%	-29%	50%
Due to changes in taxes and cash transfers	-13%	-5%	-12%	-9%	-3%	-7%
Due to changes in in-kind and collective expenditures (relative to disposable income)	-8%	-6%	-4%	-13%	-5%	-9%

NOTES: Post-tax inequality relies on the benchmark scenario (scenario V1) which allocates health-care expenditures and education spending on a lump-sum basis, and collective expenditures proportionally to post-tax disposable income.

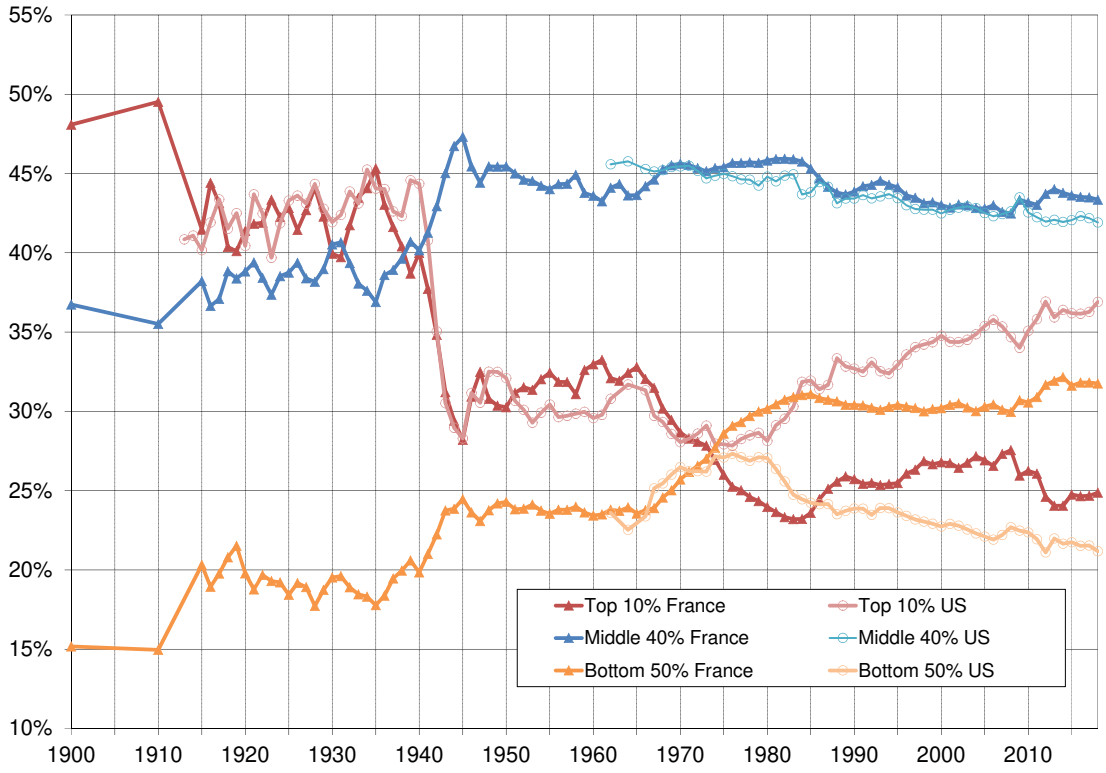
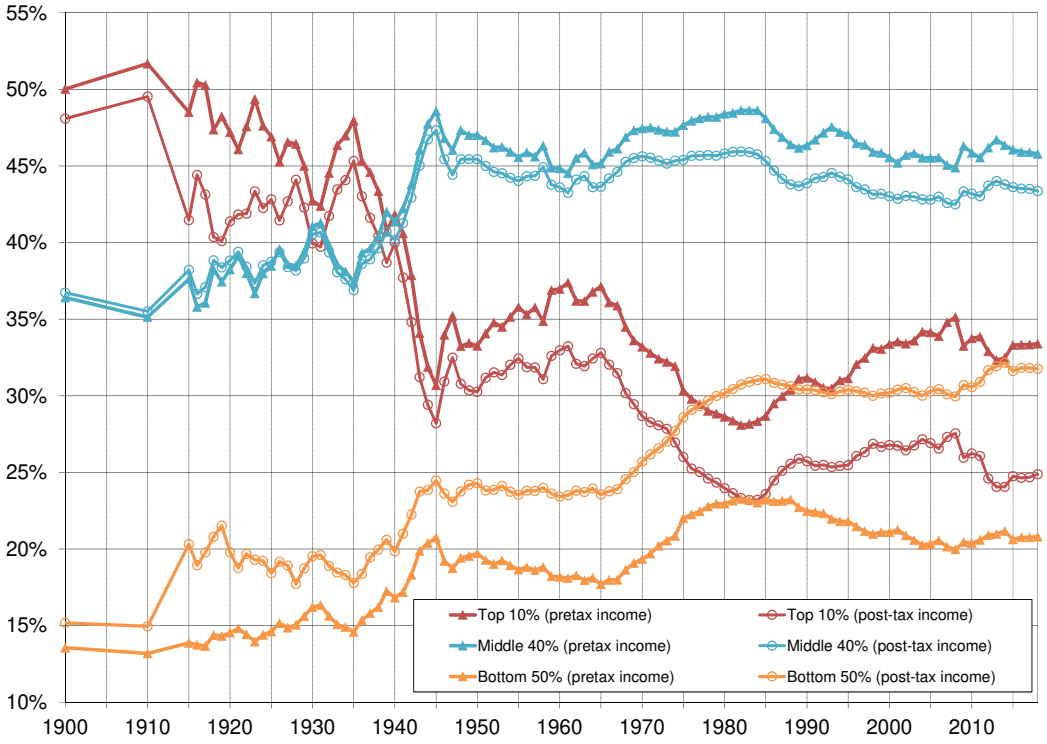


Figure 1 – Post-tax Income Inequality: France vs. the U.S., 1900–2018

NOTES: Distribution of post-tax income among equal-split adults (income of married couples divided by two). For the U.S: authors' computations using the data from Piketty et al. (2018a).

(a) France 1900–2018



(b) United States (1913–2018)

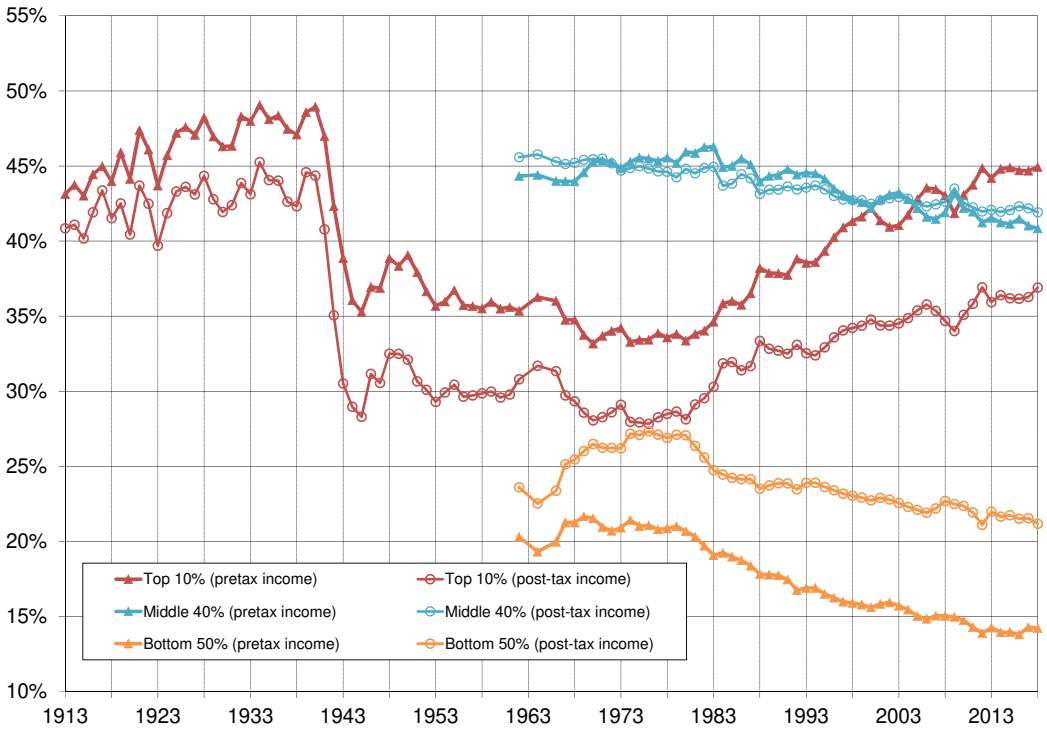


Figure 2 – Pretax vs Post-Tax Income Inequality

NOTES: Distributions of pretax national income and post-tax income among equal-split adults (income of married couples divided by two). For the U.S: authors' computations using the data from Piketty et al. (2018a).

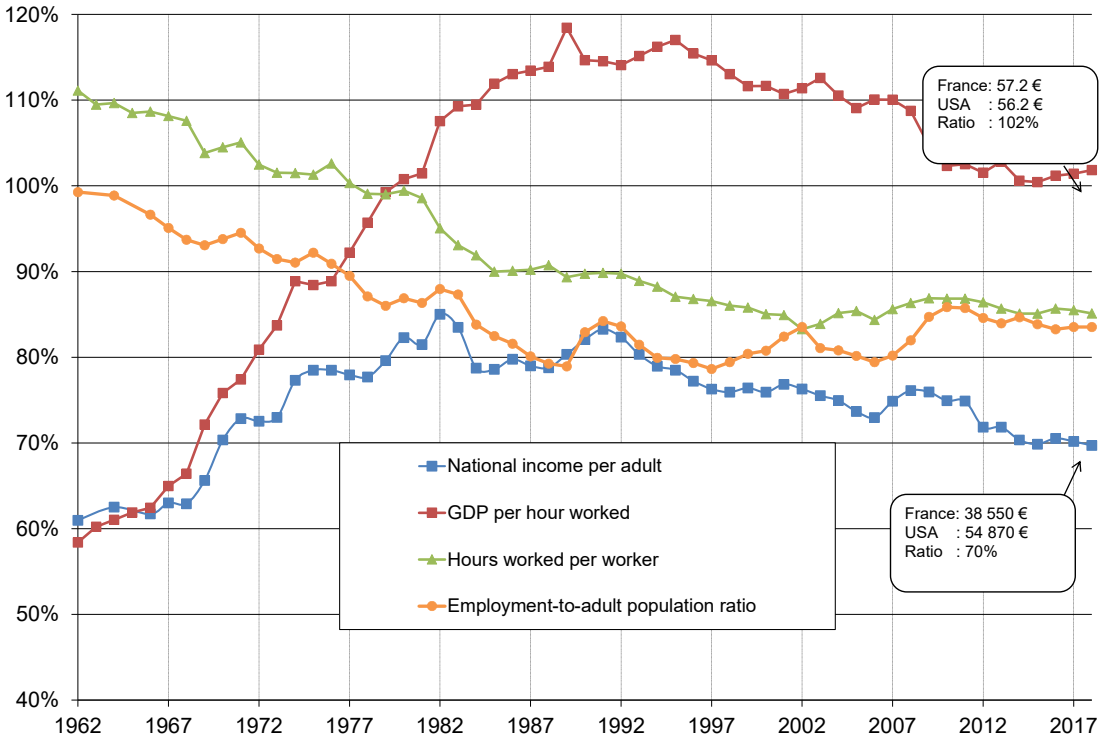


Figure 3 – Average income and productivity: ratio France/USA, 1962-2018

NOTES: Ratios France/USA for GDP per hour of work (OECD series) and per adult national income (WID.world). Both series are expressed in PPP 2018 Euros.

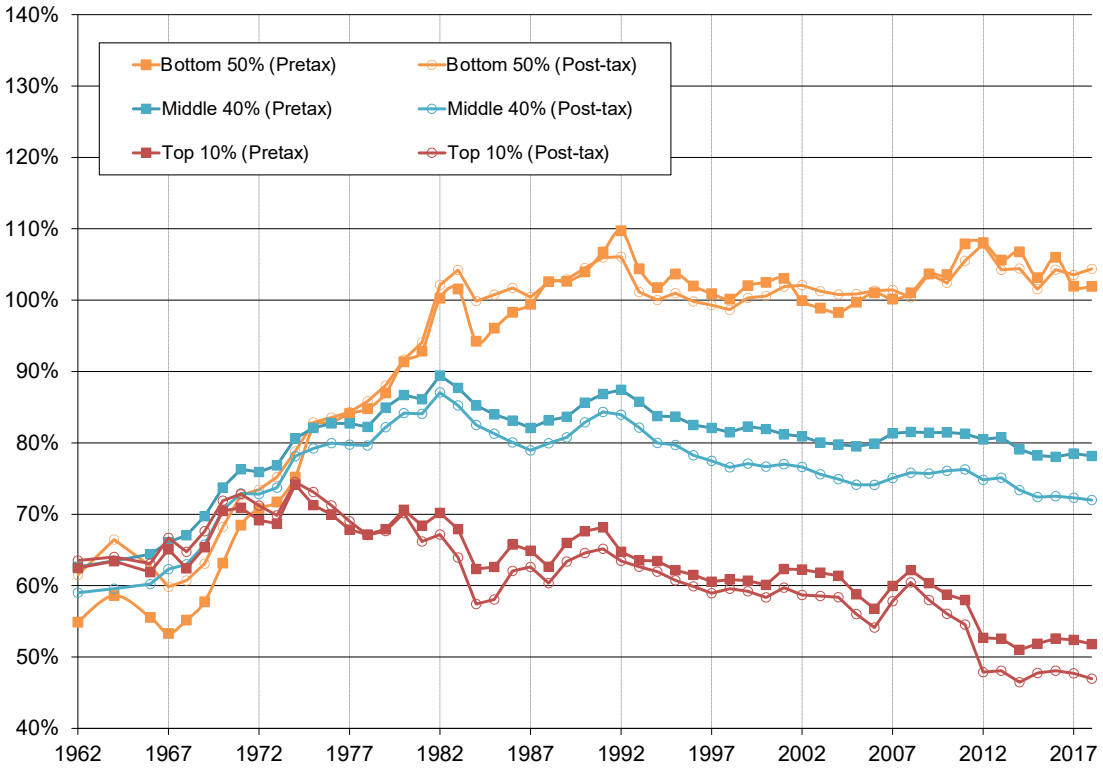
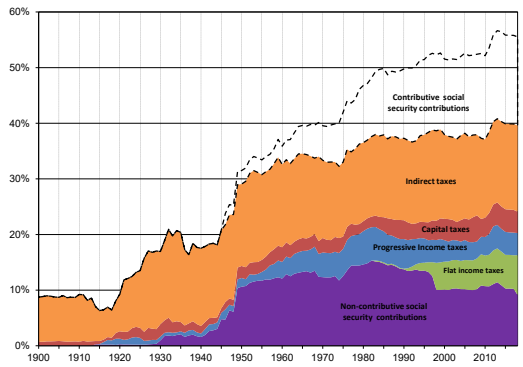


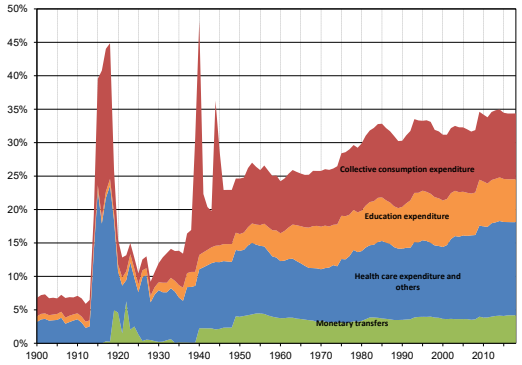
Figure 4 – Average real income by income group: ratio France/U.S.

NOTES: Ratios France/USA for pretax and post-tax income. Distributions of pretax national income and post-tax income among equal-split adults (income of married couples divided by two). For the U.S: authors' computations using the data from Piketty et al. (2018a).

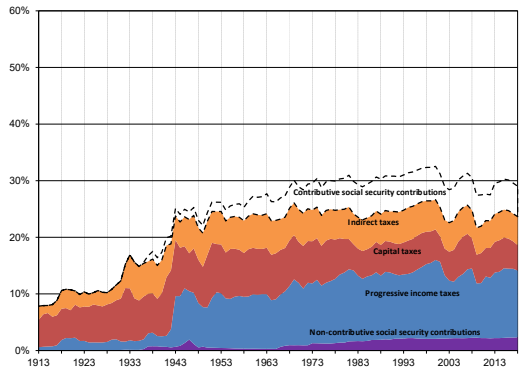
(a) Taxation (France, 1900–2018)



(b) Transfers (France, 1900–2018)



(c) Taxation (United States, 1913–2018)



(d) Transfers (United States, 1913–2018)

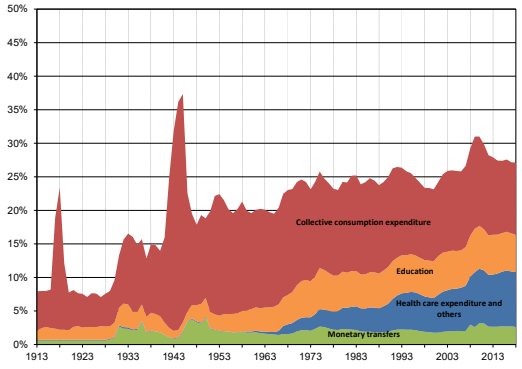


Figure 5 – Structure of taxes and transfers (percentage of national income)

NOTES: Decomposition of taxes and transfers, divided by national income. Data for the U.S are from Piketty et al. (2018a).

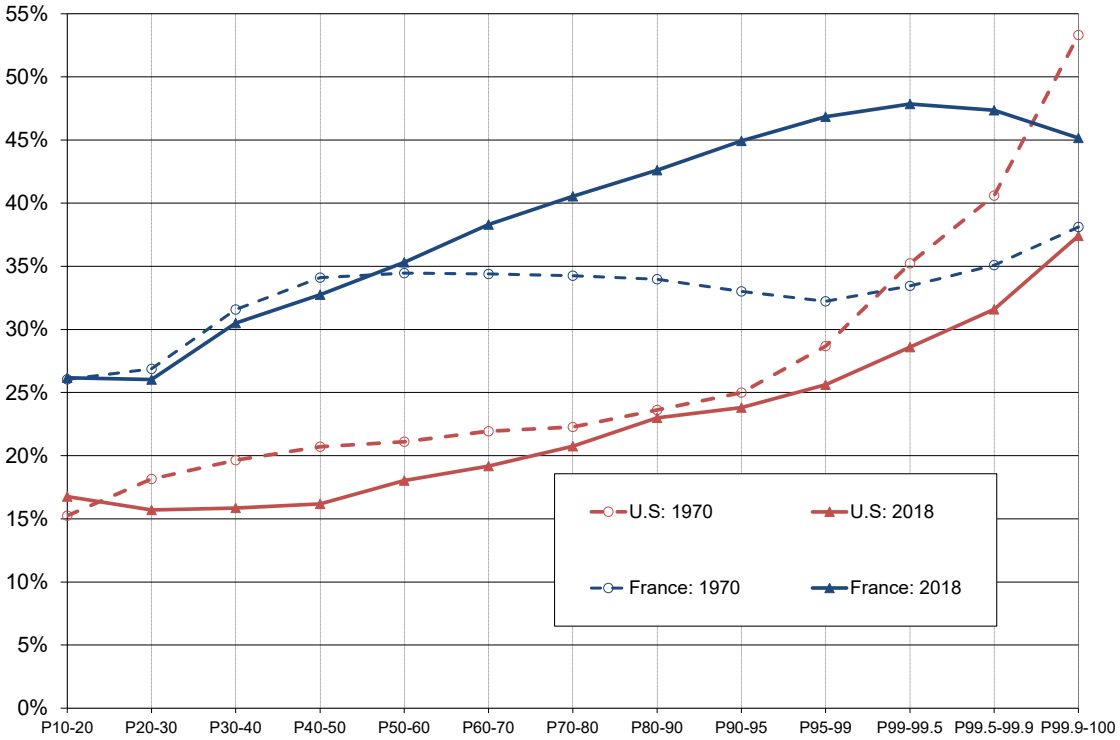
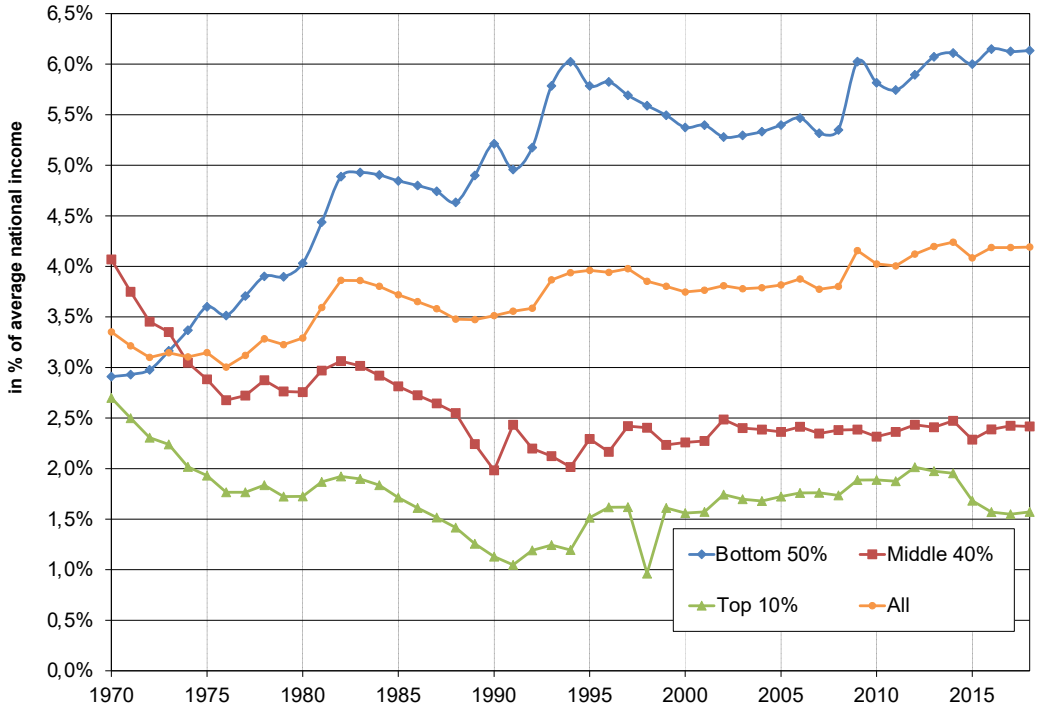


Figure 6 – Taxes paid by pre-tax income group, 1970 vs 2018

NOTES: Average tax rates by pretax income group of equal-split adults for France and the U.S. Total taxes exclude contributive social contributions. For the U.S: authors' computations using the data from Piketty et al. (2018a).

(a) France



(b) United States

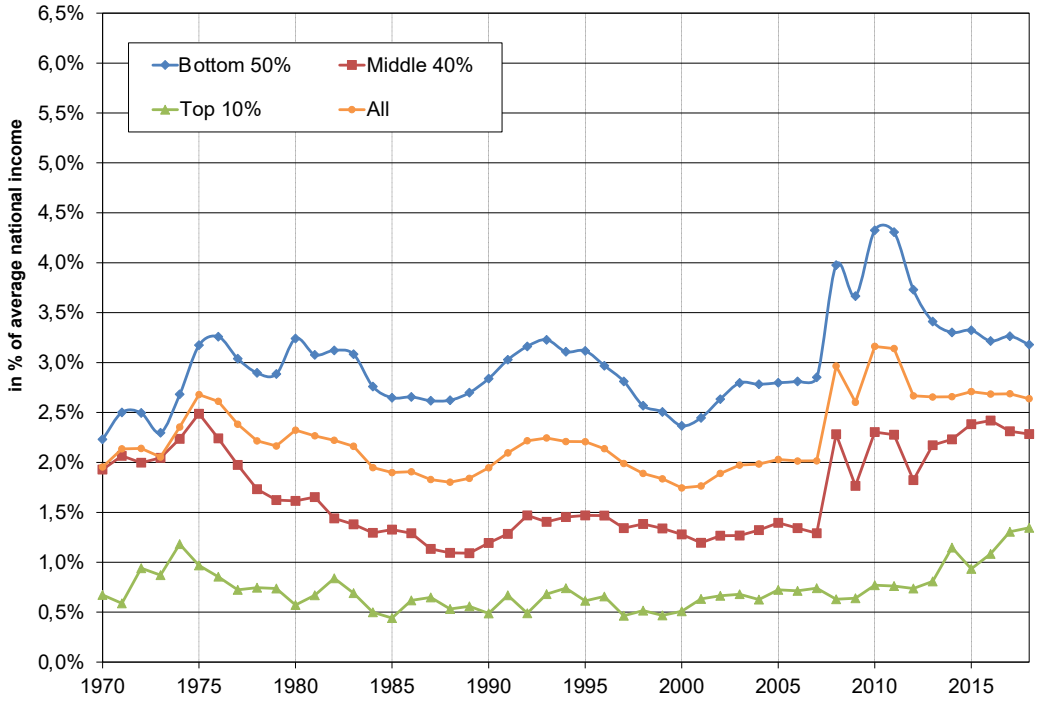
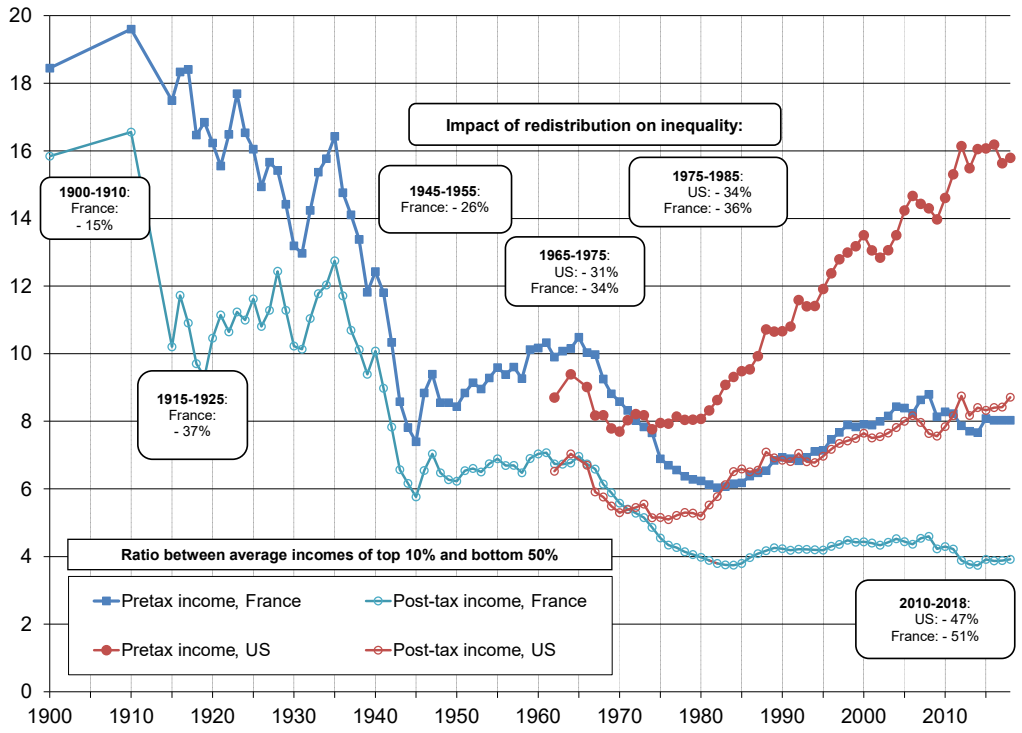


Figure 7 – Average monetary tranfers received by post-tax income group

NOTES: Average monetary tranfers received by post-tax income group. Monetary transfers include housing, family and social benefits. For the U.S: authors' computations using the data from Piketty et al. (2018a).

(a) Ratio T10/B50



(b) Ratio T10/B90

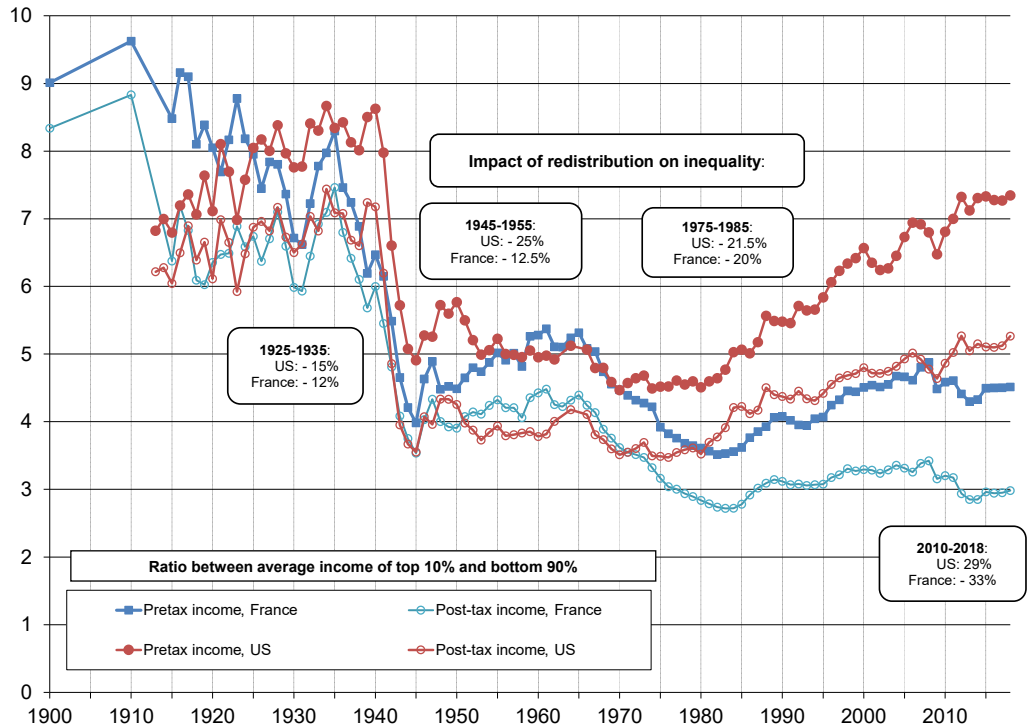
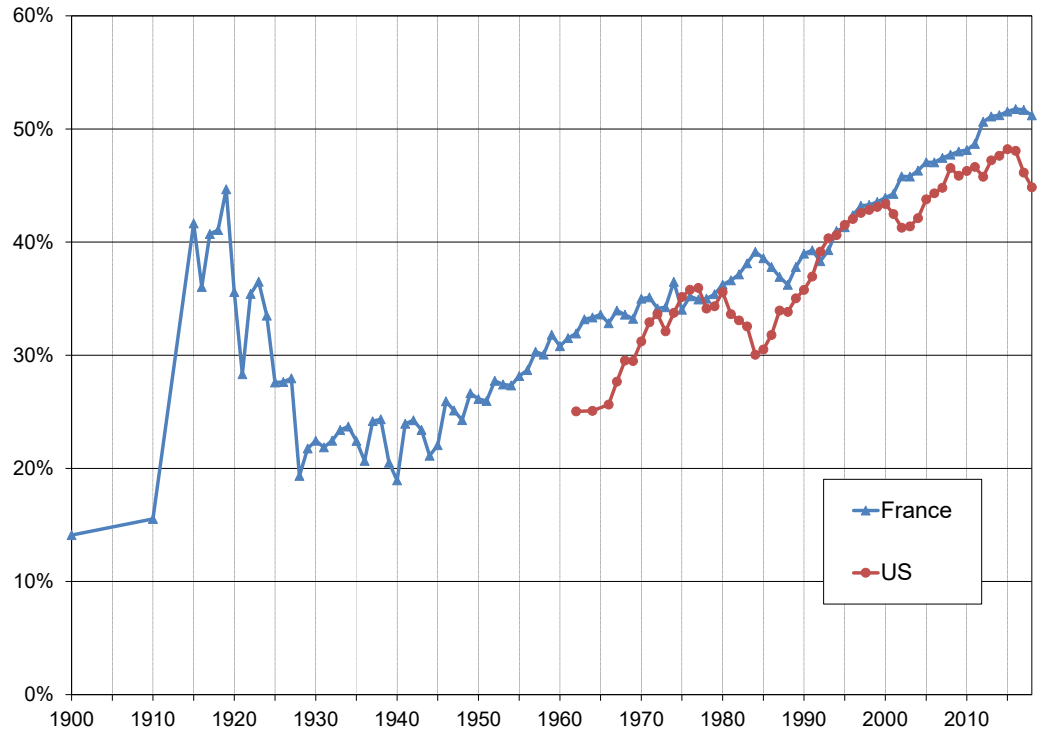


Figure 8 – Inequality and Redistribution: France vs. U.S.

NOTES: Ratios of pre and post-tax average incomes between top and bottom groups. For the U.S: authors' computations using the data from Piketty et al. (2018a).

(a) Redistribution γ for T10/B50



(b) Redistribution γ for T10/B90

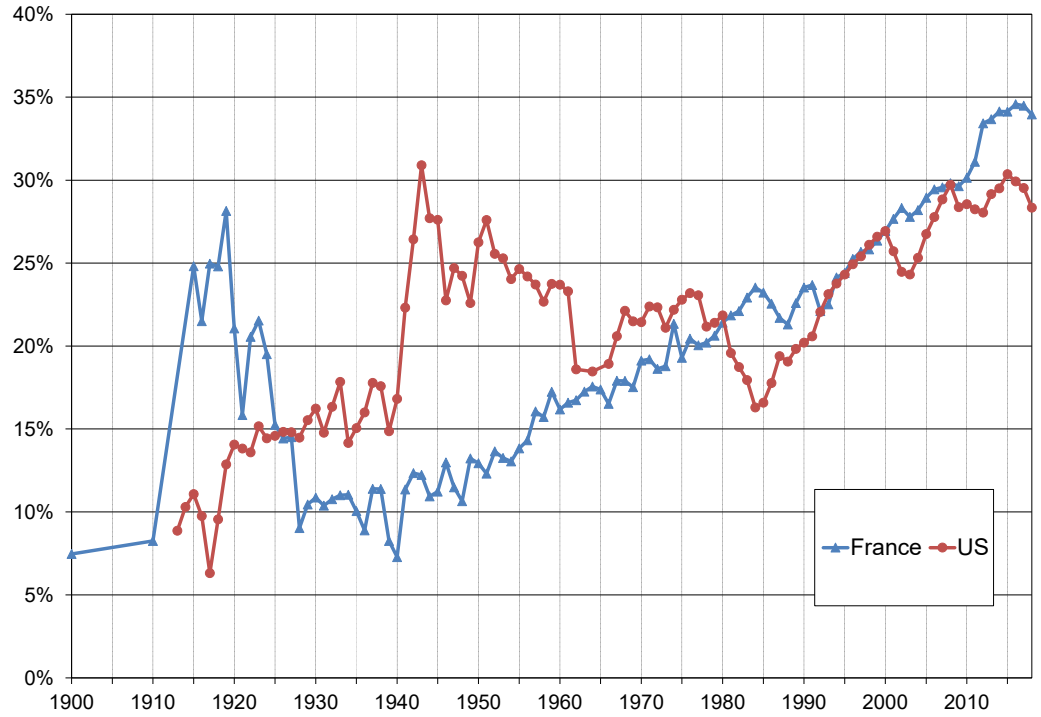
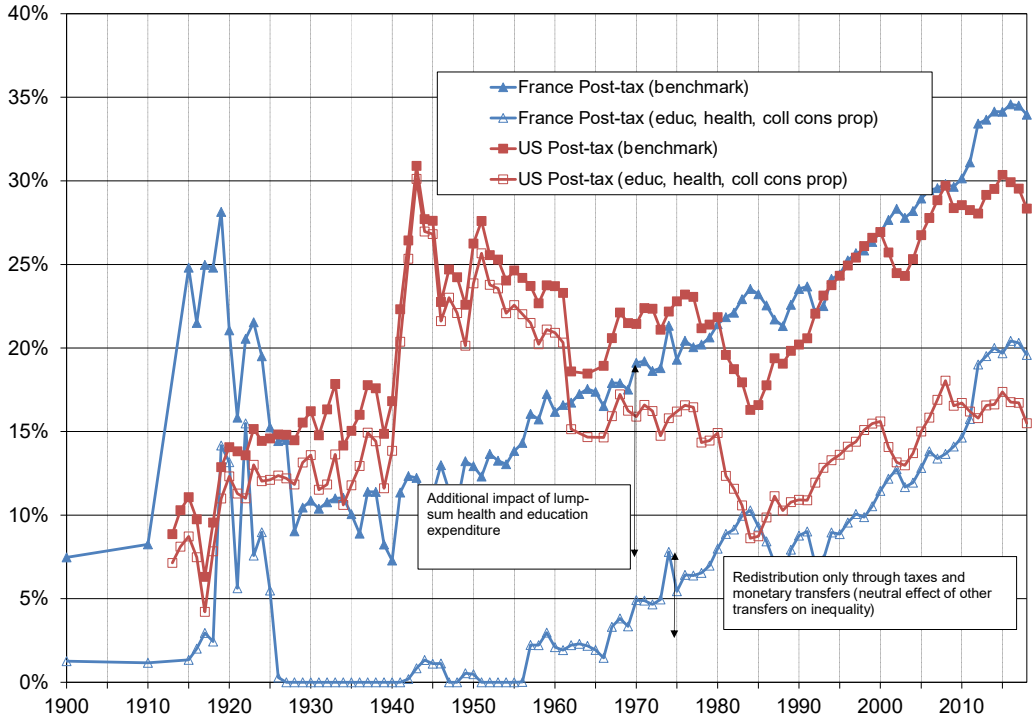


Figure 9 – Extent of Redistribution: France vs United States, 1900–2018

NOTES: Decrease from pretax to post-tax inequality (γ). For the U.S: authors' computations using the data from Piketty et al. (2018a).

(a) Ratio T10/B90, Post-Tax V1 vs V3



(b) Ratio T10/B90, Post-Tax V1 vs V2

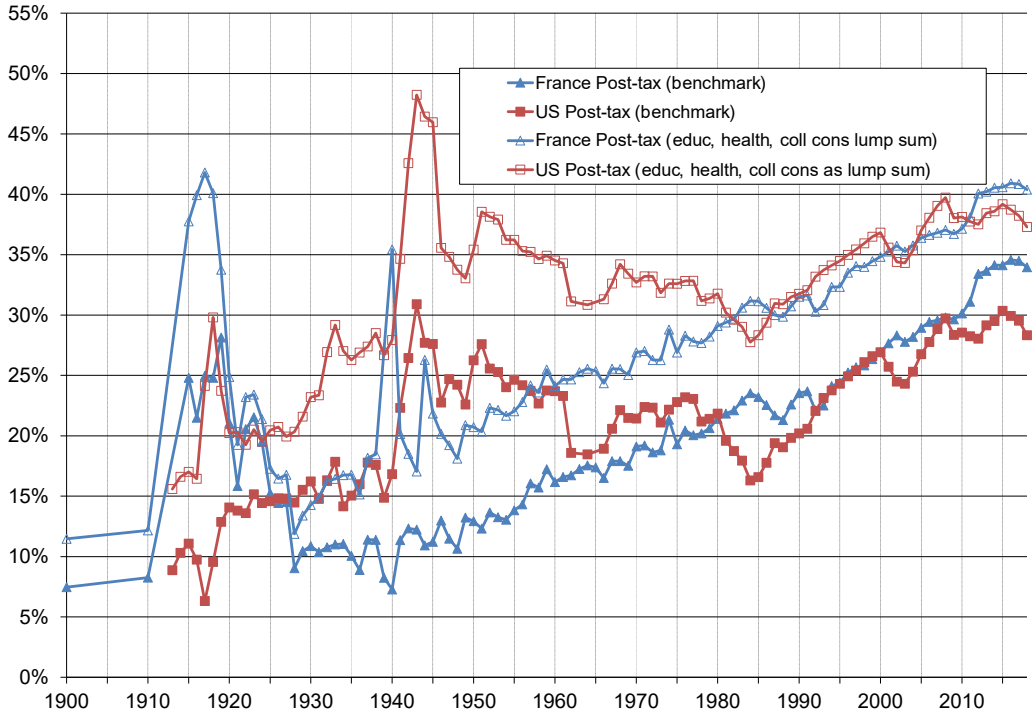
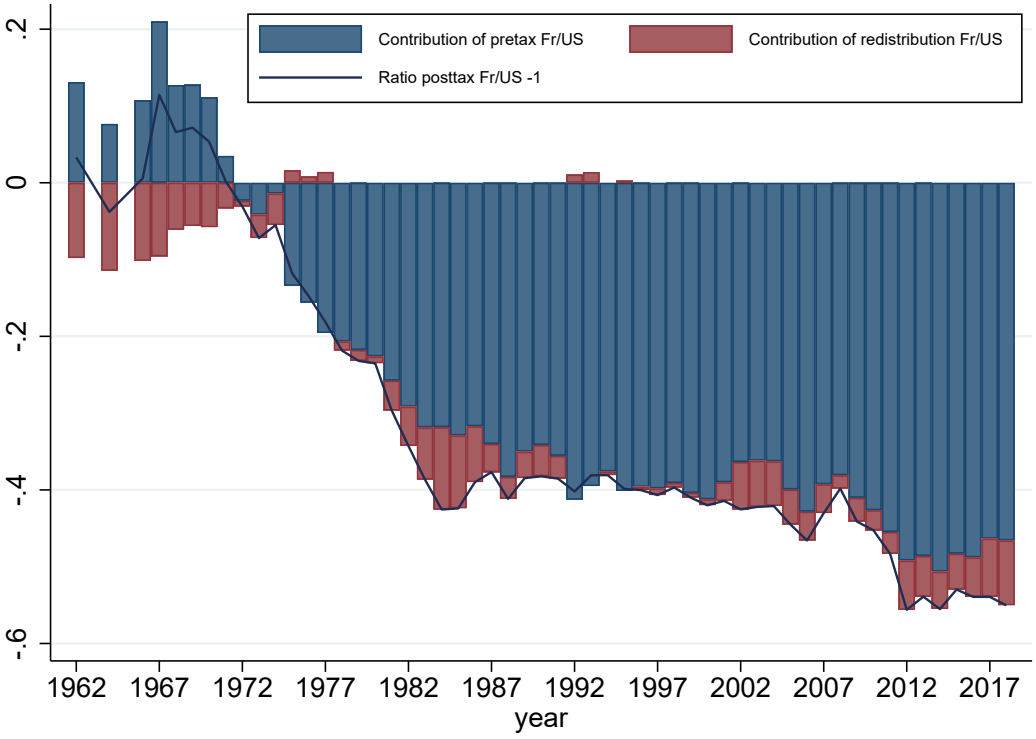


Figure 10 – Variants of redistribution measures

NOTES: Ratios of pre and post-tax average incomes between top and bottom groups. Our baseline scenario (V1) assumes i) a lump-sum imputation of health care expenditures and public spending on education to individuals, and ii) a proportional imputation to post-tax disposable income for collective expenditures. In our two variant scenarios, we impute all these public spending either on a lump-sum basis (scenario V2), or proportionally to post-tax disposable income (scenario V3). For the U.S: authors' computations using the data from Piketty et al. (2018a).

(a) Ratio T10/B50



(b) Ratio T10/B90

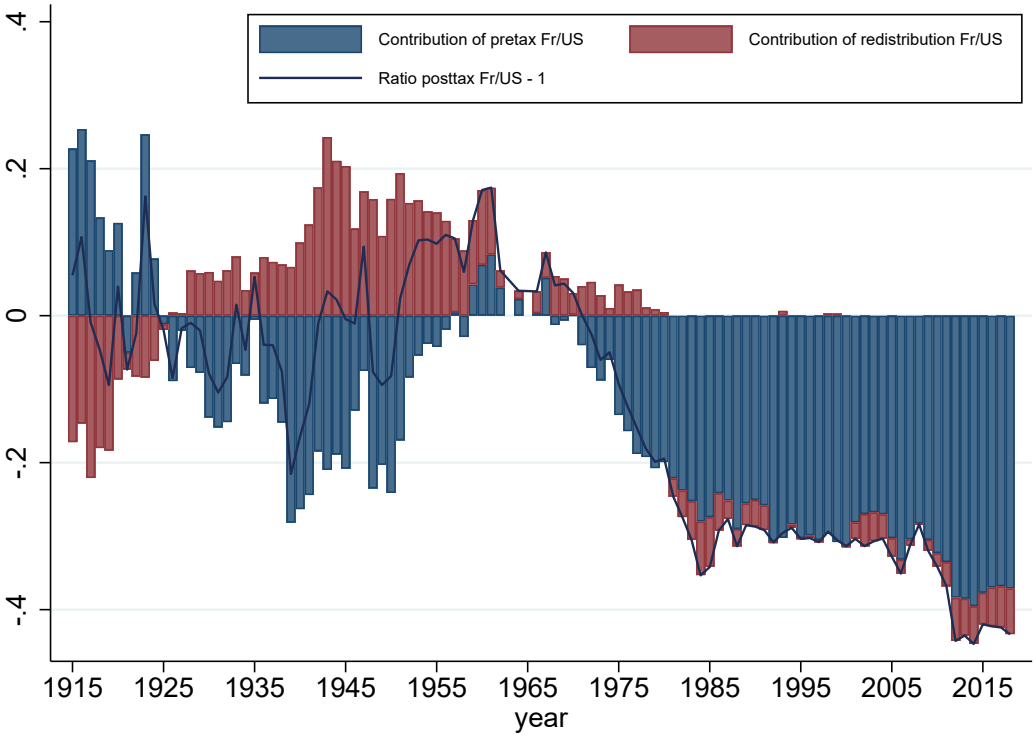


Figure 11 – Contribution of redistribution vs pretax changes to FR-US inequality ratio

NOTES: The black line show the ratio of the French vs US post-tax inequality measure. Bars in blue represent the contribution of changes in pretax inequality in explaining the FR/US ratio, while bars in red represent the contribution of changes in redistribution to that ratio. For the U.S: authors' computations using the data from Piketty et al. (2018a).

(For Online Publication)

Appendix to

Predistribution vs. Redistribution: Evidence from France and the U.S.

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This Appendix has three main purposes: to provide all relevant details on the data sources and methods we use in this research, to provide complete data series on income inequality dynamics as well as taxes and transfers, and third it presents also additional figures and tables not included in the main paper.

List of Appendices

The Appendix is organized as follows. In Appendix A, we present long-term series on income and wealth derived from national accounts. All data files, computer codes, additional series and robustness checks regarding the estimation of the distribution of pretax and postax income over the 1970-2018 period are presented in Appendix Band C. It also includes additional Tables and Figures related to income inequality as well as taxes and transfers. Appendix D present the data and methodology used to estimate the historical series of income inequality over the 1900-1969 period as well as our unified series of DINA income distributions since 1900.

This Appendix is supported by several series of Excel and PDF files as well as computer codes that contain and present our complete income inequality series. The directory `BGGGP2018POSTTAX.zip` is organized as follows. For each section of the Appendix, there is a folder called `BGGGP2018POSTTAXAppendixX` (with X=A,...,D). Each of these folders contains all the relevant materials (Excel files, computer codes, etc.) as well as a ReadMe file presenting these elements. The Excel files are called `BGGGP2018POSTTAXAppendixX.xlsx` and contain all tables and figures relatives to the section and excluded from the main text for the sake of conciseness. These Excel files can be supplemented by a DataFiles folder including all computer codes and raw data used to produce the income inequality series.

A National income and wealth accounts

The xls file in Appendix A includes tables on the long-term structure of aggregate income and wealth derived from the French national accounts.

Each year, the French national statistical institute (Insee, Institut national de la statistique et des études économiques) publishes retropolated national accounts in a comprehensive, consistent and homogenous manner. For this paper, we have used the most recent edition of the national accounts, i.e the 2016 edition, which follows the 2008 SNA and have 2010 base year. The French national accounts provide a full description of income accounts by sector starting in 1949. Wealth accounts by sector are also constructed starting in end 1969. For the earlier periods, we use the historical series provided by Piketty and Zucman (2014).

Our wealth and income series are updated and refined versions of national account series released by Piketty and Zucman (2014) and Garbinti et al. (2018). Compared to the previous series, our national account series are extended up to 2018 and include new tables on disposable income, post-tax national income as well as a complete breakdown of taxes and public spending.

Table A0 presents various long-term series of aggregate national income and personal wealth from 1700 to 2018. The series are depicted either in current or in constant 2016 euros using the GDP deflator index. We also provide per capita or per adult series.

A.1 National income circuit from the production to the distribution of factor income

Table A1 provides the decomposition of the long-term series of national income from 1896 to 2018. National income (Y_t) is obtained by subtracting the capital depreciation (KD_t) and adding the net foreign factor income (FY_t) to the gross domestic product (GDP_t) such as: $Y_t = GDP_t - KD_t + FY_t$.

Tables A2 to A12 provide an overview of the national income circuit from the production to the distribution of primary income since 1896. They show also the transition from national income to pre-tax factor income and pre-tax national income. By definition, the national income is equal to either the sum of the net value-added of all institutional sectors or the sum of primary income received by each sector. In the national accounts, six institutional sectors are defined: non-financial corporations, financial corporations, general government, non-profit institutions serving households (hereafter NPSIH), households and rest of the world sectors. In contrast with national accounts, we define six alternative sectors (hereafter production sectors): housing sector, non-corporate sector, corporate sector, government and NPSIH sector, foreign sector and production taxes sector (see details below).

Tables A2 and A3 present the decomposition of national income between these six alternative sectors. First, we regroup all production taxes net of subsidies received by the government (D2-D3) and the current surplus of the government (B2n) into the production taxes sector (Col 6). The net value-added of the remaining sectors is therefore net of production taxes. Second, the household sector is split into housing sector and non-

corporate sector. Housing sector (Col 1) corresponds to the net operating surplus of households (B2n). This surplus corresponds to all net rents from housing assets owned by the households (imputed and real ones) net of production taxes and capital depreciation. Non-corporate sector (Col 2) corresponds to mixed-income from self-employed (B3n) and non-corporate workers (compensations of employees paid by households). Third, we regroup non-financial and financial corporations into a unique corporate sector. The net value-added of corporate sector (net of production taxes) is reported on Col 3. It corresponds to the sum of the net operating surplus of non-financial and financial corporations (B2n) and wages and social contributions paid by the corporate sector (D1). Fourth, government and NPISH sector reported in Col 4 corresponds to compensations of employees paid by the government and the NPSIH sectors (D1). Fifth, we regroup into the foreign sector reported in Col 5 the sum of net foreign labor income and net foreign capital income received from the rest of the world.

Tables A4 to A9 show the transition from the production to the distribution of primary income for each sector.

In Table A4, the net-value added of the corporate sector is equal to the compensations of employees and the net operating surplus, which is split into the distributed profit, the corporate income taxes, the retained earnings and the other transfers.

In Table A5, the net-value added of the government and NPSIH is almost entirely equal to the compensation of employees. Indeed, the production value of the public administrations and NPISH are fixed, by convention, to their production cost. The net primary surplus of the government is then equal to the production taxes and the net capital received. Since 1983, the net capital income received by the government is slightly negative. It means that the French government pays more debt interests than it receives capital income from its investments in the economy.

In Table A6, the net-value added of the housing sector is equal to the sum of the imputed rents plus the real rents minus the mortgage interests paid by households. Note that the national accounts do not provide a decomposition of rental income into real rents and imputed rents, i.e. the rents that home owners would have received if they have rented their dwellings. Fortunately, the French ministry of housing computes detailed housing accounts breaking down total rents into real and imputed ones for each year since 1984. For each year since 1984, we then compute the ratio (imputed rents)/(total rents paid to household) that we applied to our series of rental income coming from the national accounts in order to estimate imputed rents. As the ratio is remarkably stable around 75% to 77% since 1984, we use the ratio observed in 1984 for the 1949-1983 period.

In Table A7, the net-value added of the non-corporate sector is equal to the sum of the compensations of employees (paid either by households or by non-corporate businesses) and mixed income self-employed. This mixed income is then split into a labor and a capital component using two alternative methods. In the first method, we assume that the non-corporate business sector has the same factor shares (labor vs capital) than the corporate sector. In the second method that we favor, we assume that labor income represents 70% of mixed income. As it turns out, both methods give estimates that are not significantly different.

A.2 From national income to pre-tax factor and pre-tax national income

Table A8 presents the net primary surplus of households (personal income) by type of income. This surplus is equal to all incomes (net of production taxes and capital depreciation) received by households from other production sectors. It is split into a labor component (compensation of employees and labor component of mixed income) and a capital component (capital component of mixed income, imputed and real rents net of mortgages, interests from debt assets and saving accounts, life insurance income, and dividends).

Table A9 breaks down the national income by total primary surplus of each sector. The national income is equal to the personal income of the households (labor and capital incomes described in Table A8), the net primary surplus of corporate sector (corporate taxed and non-distributed profits) and the primary surplus of the government and NPSIH (total product taxes received by the government, net operating surplus and net capital income).

Table A10 shows which components need to be added to go from the primary surplus of households to pre-tax factor income. Pre-tax factor income is equal to the sum of all pre-tax personal income flows accruing directly or indirectly to the individual owners of the production factors, labor and capital, before taking into account the operation of the tax transfer system and before taking into account the operation of the pension and unemployment system. In order to construct series of pre-tax factor income consistent with national income, one needs to add to the primary surplus of households, the primary surplus of corporations (undistributed profits and corporate income taxes), the net surplus and capital income received by the government and NPISH as well as production taxes.

Table A12 shows how to go from pre-tax factor income to pre-tax national income. Pre-tax national income (or more simply pre-tax income) is our benchmark concept to study the distribution of pre-tax income. Pre-tax national income is equal to the sum of all income flows going to labor and capital, after taking into account the operation of the pension system, but before taking into account other taxes and transfers. That is, we deduct pension and unemployment contributions (contributive social security contributions) and add pension and unemployment benefits. When the contributions do not match the benefits, we impute the deficit or the surplus. By definition, aggregate pre-tax national income and pre-tax factor income are both equal to national income. However, they differ in terms of income distribution as the elderly have no labor income in pre-tax factor income while they get pension benefits in pre-tax national income.

A.3 From pre-tax national income to disposable and post-tax national income

Table A13 shows how to go from pre-tax national income to disposable income and post-tax national income. Disposable income is obtained by deducting direct taxes, indirect taxes, and non-contributive social contributions from pre-tax national income and adding monetary transfers. Post-tax national income is then obtained by adding in-kind transfers,

collective consumption expenditure as well as surplus/deficit of public administration.

Tables A14, A15, A16 and A17 provide a breakdown of direct taxes, indirect taxes and public spending by detailed tax and transfer categories.

A.4 Wealth accounts

Table A20 presents the evolution of personal wealth, i.e., net wealth owned by households, broken down by asset class since 1970. The net personal wealth is defined as the sum of non-financial assets and financial assets, net of financial liabilities (debt), held by the household sector. We break down non-financial assets into housing assets and business assets. We include in housing assets the value of the building and the value of the land underlying the building. We include in business assets all non-financial assets held by households other than housing assets. We break down financial assets into four categories: deposits (including currency and saving accounts) ; bonds (including loans); equities (including investment funds shares); life insurance (including pension funds). We therefore have seven asset categories (housing assets, business assets, four financial asset categories, and debt), or actually eight categories when we break down housing into owner-occupied and tenant-occupied housing. In Table A21, we divide all the assets by national income in order to get wealth-income and assets-income ratio. Finally, Table A22 reports the decomposition of personal wealth by asset in percentage of total wealth.

B Construction of pretax DINA series, 1970-2018 period

We now present the data and the methodology used to estimate the distribution of pretax income over the 1970-2018 period. Our income distribution series are constructed using income concepts that are based upon national accounts categories.[A.1] By construction, average income per adult is equal to average national income per adult.[A.2]

This methodology has been developed in our companions papers (Garbinti et al., 2018, 2021) and has only slightly been improved in the current project. As compared to these works, we made the following improvements regarding the estimation of pre-tax income series. First, we extend the series over the 2015-2018 period. Second, we measure more accurately the concept of pretax income by improving the estimation of the different types of social security contributions as well as production taxes. In Garbinti et al. (2018), pretax income was obtained i) by deducing all social security contributions from factor income (and adding back pension and unemployment benefits), ii) by relying on crude incidence assumptions for the imputation of production taxes. In this paper, we take advantage of the development of a microsimulation model and new administrative data (CNAF and DREES Files) to estimate separately contributive and non-contributive social security contributions as well as the different types of production taxes at the individual level. We can therefore estimate more accurately the distribution of pretax income i) by deducting only the fraction of social security contributions devoted to the financing of the pension and unemployment systems and ii) by relying on more sophisticated simulations of production taxes (see Sections B.2 and B.4 for more details).

In order to estimate the distribution of pre-tax national income, we need to combine income tax micro-files with other data sources, namely national accounts and household surveys, and to apply a number of imputation rules that we describe below.

B.1 Fiscal income and micro-files of income tax returns

The estimation of the income distributions for the 1970-2018 period is based on micro-files of income tax returns. These micro-files have been produced by the French Finance Ministry since 1970 and fall into two categories: "Enquêtes Revenus Fiscaux" (Tax Income surveys, hereafter: ERF surveys) and "Échantillons Légers et Lourds" (hereafter: samples of income tax returns). We use the first series of ERF surveys produced jointly by Insee and the tax administration every 5 years from 1970 to 1990.[A.3] The surveys describe

[A.1] The reason for using national accounts concepts is that they are defined and estimated in the same manner in all countries and time periods, and aim to be independent from the fiscal legislation of the given country/year.

[A.2] National income is defined as GDP minus capital depreciation plus net foreign income, following standard national accounts guidelines (SNA 2008).

[A.3] The first series of ERF surveys was edited eight times since 1956 (1956, 1962, 1965, 1970, 1975, 1979, 1984 and 1990). The first ERF of 1956, 1962 and 1970 are not available anymore. The Tax Administration was responsible for filling the data related to tax income, while Insee was in charge of the statistical data processing. The updated version of these surveys are now called The Tax and Social Incomes Survey (ERFS). They are annual and match information from Labor Force surveys with income tax returns and social benefits perceived. See description of Tax Income Survey/ERF and Tax and Social Income

the socio-demographic structure of approximately 40,000 tax units along with all the information reported in their income tax returns (containing different sources of taxable income and income tax). In addition, we have access to large samples of income tax returns edited each year by the tax administration since 1988. These files include 40,000 tax units from 1988 to 1993 (Échantillon léger) and about 400,000-500,000 tax units per year since 1994 (Échantillon lourd). These micro-files are stratified by taxable income brackets with large oversampling at the top (they are exhaustive at the very top). Since 2010 we also have access to exhaustive micro-files, including all tax units, i.e. about 37 million tax units in 2010.

These micro-files allow us to estimate directly the distribution of fiscal income among tax units by income categories. In particular, fiscal labor income can be split into three components (wages; pension and unemployment benefits; and labor component of mixed income, which we assume for simplicity to be equal to 70% of total mixed income) and fiscal capital income into four components (tenant-occupied rental income; dividend; interests from debt assets; and capital component of mixed income, i.e. 30% of total mixed income).

The gap between fiscal income and national income can be decomposed into three components: tax-exempt labor income, tax-exempt capital income, and production taxes.

B.2 From fiscal labor income to pretax labor income

Tax-exempt labor income, which we define as the gap between national-accounts labor income and fiscal labor income, consists mainly of non-contributive social security contributions (SSCs)[A.4] and, to a lesser extent, of non-taxable compensation items such as health benefits and other in-kind benefits.

We apply the following methodology to estimate the distribution of pretax labor income from the distribution of fiscal labor income. First, we rely on a microsimulation model to simulate both contributive and non-contributive SSCs at the individual level in each year. In particular, we are able to capture the complexity of the different SSC schemes as well as reductions in employer SSCs (See Section C.3.2 for more details). Second, in the absence of specific information, we impute the rest of the non-taxable compensation items on a proportional basis to recover the distribution of pretax labor income.[A.5] The computation steps described here are performed in the `dorevtravcn.do` program.

Survey/ERFS on Insee website.

[A.4] Fiscal labor income is net of social security contributions. Non-contributive SSCs refers to contributions funding either health care spending or child benefits. They are called non-contributive because they fund benefits not directly related to the amount of contribution paid. In contrast, contributive SSCs open rights to unemployment and pension benefits depending on the amounts contributed. Note that contributive SSCs are excluded by definition from pretax income but included in factor income.

[A.5] More precisely, we upgrade all observed individual-level fiscal labor incomes by multiplying them by the aggregate ratio between national-accounts labor income and fiscal labor income. We do this separately for wages, pensions and unemployment benefits, and mixed income.

B.3 From fiscal capital income to pretax capital income

Tax-exempt capital income raises more complicated issues. Fiscal capital income differs from national capital income for three main reasons.

First, some capital income components are fully tax-exempt and therefore not reported in income tax returns. Tax-exempt capital income includes three main components: income going to tax-exempt life insurance assets[A.6] ; owner-occupied rental income; other tax-exempt interest income paid to deposits and saving accounts.

Second, some capital income components are included in the income tax returns, but their aggregate may differ from those reported in national accounts due to tax avoidance or tax evasion. For example, a significant part of dividends is missing in the tax data.[A.7]

Finally, corporate retained earnings and corporate taxes are not directly received or paid by individuals and are therefore excluded from income tax. Therefore, one needs to make implicit incidence assumptions on how to attribute them. As a result, these elements are either missing or under-reported in the income tax returns and need to be imputed.

It is worth stressing that all of these components have increased significantly in recent decades. In particular, life insurance assets did not play an important role until the 1970s, but gradually became a central component of household financial portfolios since the 1980s-1990s.[A.8] As a result, these elements are either missing or under-reported in the income tax returns and need to be imputed. The computation steps described here are performed in the `dorevcapwealthcn.do` program.

B.3.1 Survey based Imputations of fully tax-exempt capital income

Regarding owner-occupied housing, life insurance assets, deposits, and saving accounts, we use available wealth and housing surveys to impute these assets on the basis of labor income, financial income, and age.[A.9] We then attribute the corresponding asset income flows on the basis of average rates of return observed in national accounts for this asset class (See our companion paper Garbinti et al. (2021) for a detailed description of the methodology).

More specifically, the imputation procedure is the following. First, in the household surveys, we define groups according to three dimensions: age, financial income, and labor and replacement income.[A.10] Second, for each year, group and kind of asset to be imputed

[A.6] More precisely, this category regroups income attributed to life insurance and pension funds. Before 1998, life insurance income was entirely exempt from income tax. Since 1998, only capital income withdrawn from the account are taxed (see Goupille-Lebret and Infante (2018) for more details). As a result, total life insurance income reported in the tax data corresponds to less than 5% of its counterpart in national accounts.

[A.7] Individuals can legally avoid dividend tax using complex tax optimization strategies. Such schemes imply that dividends have to be distributed to and kept in holding companies. Dividend tax will eventually occur when the holding company distributes dividends to its shareholders.

[A.8] Imputed rent has also become gradually more important over time with the rise of home ownership. In addition, note that imputed rent was actually included in fiscal rental income (together with tenant-occupied rental income) until 1963 in France. Finally, corporate retained earnings and corporate taxes were relatively small until the mid-20th century and also increased significantly in recent decades.

[A.9] We also use the same methodology to impute rents paid by tenants, which will be used to compute residence tax (Section C.3.5) and housing benefits (Section C.4.2).

[A.10] For example, we define approximately 200 groups for the imputation of owner-occupied housing asset.

(owner-occupied housing, deposits, and life insurance), we compute both the proportion of households holding the asset considered (the extensive margin) and the share of total assets owned by the group (the intensive margin).[A.11] Third, in our income tax micro files, we define groups according to the same dimensions (age, financial income, and labor incomes). Then, within each of these groups, we randomly draw households that own the asset according to the corresponding extensive margin (i.e. computed for the asset, group and year considered). The intensive margin is then used to impute the amount of the asset held by asset holders within groups.[A.12]

More formally, the value of the asset j held by household i from group g at time t is derived from the survey-based imputation method as follows:

$$a_{ijgt} = h_{igjt} \cdot \frac{Sh_{jgt} \cdot A_{jt}}{\sum_k h_{kgjt}}$$

Where h_{igjt} is a dummy for being an asset holder and is computed using the extensive margin, $\sum_k h_{kgjt}$ is the number of households from group g that hold the asset j at time t, Sh_{jgt} is the share of total asset j owned by the group g, and A_{jt} is the aggregate stock of asset j at time t reported in the household balance sheet of national accounts.

This procedure can be seen as an hot deck procedure in two steps where the information is taken from external sources (housing and wealth surveys). It offers the advantage of respecting the initial distribution of asset holding (in the surveys) without creating outliers.

Finally, we attribute the corresponding asset income flows (owner-occupied rental income, interests from deposits and saving accounts, interests from life insurance assets) on the basis of average rates of return observed in national accounts for this asset class.

B.3.2 Reconciliation exercise for under-reported capital income

For capital income components reported in the income tax micro-files[A.13], we conduct the following reconciliation exercise. We adjust proportionally each of these capital income components to match their counterpart in national accounts (reported in the xls file

We first split the sample into 10 age groups (< 25; 25-30; 31-39; 40-49; 50-54; 55-60; 61-65; 66-70; 71-80; > 80). We then divide each age group into 4 percentile groups of financial income (P0-50; P50-90; P90-99; P99-100). Finally, we further split each of these 40 groups (10 age groups * 4 groups of financial income) into 5 percentile groups of labor and replacement income (P0-25, P25-50, P50-75, P75-90, P90-100).

[A.11] For owner-occupied housing, we also compute a debt to wealth ratio for each group, i.e. debt/gross value of the owner-occupied housing.

[A.12] Let us consider the following example. For year 2010, if 80% of the households in a group own a primary residence, the total gross value of the housing asset this group owns represents 0.5% of the total value reported in the survey and their mortgage represents 50% of the gross value of their housing asset, then the extensive margin is 80%, the intensive margin is 0.5% and the debt ratio is 50%. In the same group defined in the income tax returns, the asset-holders (who represent 80% of the considered group) will be supposed to hold 0.5% of the 4,484 billion euros that the gross owner-occupied housing asset represents in 2010 (as reported in the household balance sheets of French national accounts). If the group represents 100,000 tax units, it means that each of the 80,000 tax units who own this asset will hold 0.5%*4,484 billions/80,000, that is 280,000 euros of gross owner-occupied housing. The remaining 20,000 tax units of this group will not hold any housing assets. Finally, as the debt ratio is equal to 50% in our example, the mortgage associated to the housing asset will be equal to 140,000 euros.

[A.13] i.e., tenant-occupied rental income; dividends; interests from debt assets; and capital component of mixed income (i.e., 30% of total mixed income).

Appendix A, Table A8).[A.14] The assumption behind this simple adjustment is that tax evasion and tax avoidance behaviors do not vary along each income-specific distribution.[A.15] We also recover the distribution of each asset by capitalizing the corresponding capital income flows.[A.16]

B.3.3 Corporate retained earnings and corporate taxes

Regarding corporate retained earnings and corporate taxes, we impute them in proportion to dividends, life insurance income, and interests, i.e., total financial income excluding tax-exempt interest income paid to deposits and saving accounts.[A.17] More precisely, we impute to individuals the fraction that can be attributed to individuals, i.e., we subtract the fraction of domestic corporate capital income that can be attributed to the government.

We now present the main caveat of our imputation choice. If rich people are more likely to retain dividends in holding companies or more generally implement tax optimization or tax evasion strategies that reduce artificially their taxable dividends, our methodology will under-estimate the level of corporate retained earnings and corporate taxes accruing to the richest individuals and therefore under-estimate the level of income inequality. We argue, however, that this bias should mainly affect the level of inequality within the top 1% and, to a lesser extent, that within the top 10% because financial income is extremely concentrated at the top.[A.18] In other words, our methodology is likely to over-estimate the level of corporate earnings and corporate taxes accruing to the poorest individuals of the top 10% income group and under-estimate that of the very top incomes.

An alternative strategy used by Piketty, Saez and Zucman (2018) would be to impute corporate retained earnings in proportion to individual dividends or to use differential evasion rates in order to distribute relatively more retained earnings to the top 0.1% capital income earners. Such strategies could, however, be difficult to implement in the case of France for two reasons. First, there is a fuzzy frontier between interests and dividends in the tax data. Life insurance income and income from mutual funds are often a mix of both dividends and interests, and this decomposition is not available in income tax returns. Second, such strategies require to use differential evasion rates by income level, which are not available for France. As a robustness check, we impute corporate retained earnings and corporate taxes proportionally to equity assets and show that the resulting series are almost identical (see section C.6).

[A.14] That is, we multiply each individual capital income component reported in the micro-files by the corresponding national-income/fiscal-income ratio.

[A.15] Alstadsaeter et al. (2019) provide evidence that tax evasion rises sharply with wealth. Our assumption is therefore conservative, and our results should be seen as a lower bound of the true level of income concentration.

[A.16] See our companion paper Garbinti et al. (2021) for a detailed description of the methodology to estimate wealth inequality.

[A.17] In France, tax-exempt saving accounts (like livret A) are financial products that are regulated by the State and used to finance social projects.

[A.18] In 2014, the top 10% and the top 1% income groups earn 77% and 55% of total dividends, life insurance income and interests, respectively.

B.4 Production taxes

Taxes (less subsidies) on production (D2-D3) constitute the majority of the primary income of the government. One reason for including them in pretax income is that the frontier between production taxes and direct income and wealth taxes (D5) is somewhat arbitrary – so that it is unclear why we should deduct the former and not the latter. Thus, for the purpose of making comparisons over time and across countries, it makes more sense to look at the distribution of income before the deduction of any tax, be they production taxes or direct taxes. Production taxes also constitute an important source of revenue for governments: excluding them from analysis would bias the comparison of tax levels and progressivity among countries with different tax systems.

Note that Production taxes (in the SNA 2008 sense D2-D3) can be split into four categories: i) consumption taxes, which include value added taxes and several taxes on energy products, tobacco, alcohol beverages, among others (D21-D31); ii) taxes on wages (D291) ; iii) household property taxes (D292, households); iv) other net taxes on production, which include professional taxes and business property taxes (D292, corporate sector). These production taxes are already deducted before the value added is used to remunerate factors of production (unlike direct taxes) and are therefore excluded from fiscal income. Following the convention of national accounts, production taxes must be added to observed income levels in order to reach a consistent pretax income concept, rather than subtracted from it. This convention is somewhat at odds with intuition and with the practice of certain microsimulation studies. However, in practice, this is the only way of providing a treatment that is consistent with direct taxes (which are included within household primary income), and which avoids double-counting. If we were to remove taxes on products from household income, we would effectively be removing them twice. This is why we choose to distribute them as part of pretax income. There are several ways of doing so, and we choose to follow the DINA guidelines (Alvaredo et al., 2020) for comparability purposes.

We attribute to individuals these taxes using the following incidence assumptions and imputation rules. First, we assume that household property taxes only fall on housing assets and attribute them to individuals in proportion to their housing assets after taking into account time-varying specific tax exemptions (age, income, disability) and tax ceiling (see Section C.3.4). Second, we consider taxes on wages only fall on wages and impute them proportionally to social security contributions (see Section C.3.2). Finally, the incidence and imputation of consumption taxes raise more subtle implications. We follow the DINA guidelines (Alvaredo et al., 2020) by making a distinction between the distribution of consumption taxes in pretax income and their distribution when moving from pretax to post-tax income. To compute pretax income, we distribute consumption taxes to pretax labor income and pretax capital income on a proportional basis.[A.19] In contrast, we will

[A.19] As explained by Alvaredo et al. (2020) p.59, the rationale behind this choice is the following. "The VAT acts as the wedge between factor prices and market prices: therefore, its direct, mechanical effect is on prices. Factor price national income (national income excluding consumption taxes) can buy the full production at pretax prices (prices received by producers that do not include consumption taxes). Market price national income (national income including consumption taxes) can buy the entire production at post-tax prices (prices paid by consumers, which include consumption taxes). In national accounts, prices

remove the amount of consumption taxes effectively paid by each individual when we consider moving from pretax income to post-tax income (see Section C.3.5).

B.5 Other imputations to match national income

Finally, in order to ensure that aggregate pretax national income matches exactly with aggregate national income, we have to impute the i) surplus/deficit of the pension and unemployment system (around 4% for national income in 2018) and ii) an aggregate (close to 0 including the net operating surplus of the government (SNA S13B2n, close to 0)[A.20], the net capital income received by the government (SNA S13D4, -1,4% of NI in 2018), the share of corporate retained earnings and corporate taxes accruing to the government (+1,3% in 2018) and the net primary surplus of NPSIH (SNA S15B5n, close to 0)

Surplus of pension and unemployment systems

In our concept of pretax labor income, we deduct the contributive social contributions and include the pension and unemployment benefits. Therefore, our measure of redistribution excludes by definition the potential redistributive impact of the pension and unemployment system. Consistently with this framework, we attribute the deficit of the pension and unemployment system proportionally to labor and capital pretax incomes in order to neutralize the impact of this deficit on our measure of redistribution. Note that the French and US pension and unemployment systems do include a redistributive component, i.e., the share of unemployment and pension benefits received that is not linked to contributions made over lifetime. It represents around 16% of total pension and unemployment benefits in recent years for France (Cheloudko et al., 2020) and between 13% and 25% for the US (Liebman, 2001).[A.21] As a robustness check, we propose a variant of pretax and post-tax income inequalities taking fully into account this redistributive component for France and show that the resulting series are very close (see Section C.6). However, we prefer to exclude the redistributive aspects of the pension and unemployment system in our baseline

are always measured post-tax (i.e., including VATs, sales taxes, etc.) which is why standard national income includes consumption taxes. Factor price income cannot buy full production at post-tax prices precisely because consumption taxes create a wedge between pretax and post-tax prices. Therefore, for pretax national income, factor incomes should be inflated uniformly to line up with the national income aggregate. That way, they reflect the purchasing power of pretax income at the post-tax prices that exist in the economy. Because this is pretax (before any consumption decision is made), it makes the most sense to do a uniform rescaling, so as preserve the same distribution as factor income. In other words, going from factor price to market price national income is about changing the price index, and not about distributing taxes to individuals."

[A.20] Note that the net primary surplus of the government is different from the deficit/surplus of the government. The former refers to the SNA code S13B2n and is always very close to 0 by convention of national accounting. Because the output of the government sector is not sold at meaningful market prices, it is valued at cost (i.e., compensation of employees for labor, and consumption of fixed capital for capital). As a result, its net operating surplus is zero by construction. In practice, however, a small part of the government sector does operate as market enterprises and report some profits or losses that go into the net operating surplus. But this amount always remains small. In contrast, the surplus/deficit of the government refers to the difference between government income (all taxes + net capital income received) and spending (in-kind and monetary transfers as well as collective consumption expenditure) and will be taking into account to compute post-tax income (see Section C.5).

[A.21] Note that the methodology and the concept used to estimate these statistics are not harmonized between the French and the US case studies.

estimates to ensure a perfect comparability with the US data developed by Piketty et al. (2018a).[A.22]

Others

The very small remaining aggregate corresponding mainly to the net capital income received by the government and the share of corporate taxes and corporate retained earning accruing to the government is attributed as follow. 50% is attributed in proportion to taxes and 50% in proportion to transfers and expenditures. In effect, this is assuming that this aggregate will be borne equally by taxes and spending.

[A.22]To the best of our knowledge, there is no study that provides a consistent and harmonized measure of the redistributive impacts of the pension and unemployment benefits at a disaggregated level both in France and the U.S.

C Construction of post-tax DINA series, 1970-2018 period

We now present the different elements of the French tax and transfer system and how we simulate them using a microsimulation model and tax incidence assumptions to recover the distribution of disposable and post-tax income over the 1970-2018 period.

C.1 The French tax and transfer system in 2018.

The French tax system includes a large variety of taxes that we can regroup into five categories: indirect taxes, capital taxes, progressive income taxes, flat income taxes, and non-contributive social contributions. Indirect taxes make up about 15.5% of national income today. It includes consumption taxes (80% of total indirect taxes), professional taxes, and residence taxes. Capital taxes amount to about 4% of national income and consist of corporate taxes, wealth taxes, property taxes, and bequest and gift taxes. From 1991, France is characterized by the coexistence of two taxes on income: a progressive income tax—which is the historical income tax created in 1914—and a flat income tax called general social contribution.[A.23] In addition to these two income taxes, capital income is also subject to several other types of social contributions with flat tax rates.[A.24] We regroup the general social contribution and the other types of social charges under the general term of "Flat-rate income taxes" (7% of national income) and refers to the historical income tax as progressive income taxes (4% of national income). Finally, non-contributive social contributions include all SSCs that are not dedicated to the financing of the pension and unemployment systems as well as taxes on wages. Altogether, they make up to 9% of national income.

Government spending can be decomposed into three distinct categories: monetary transfers, in-kind transfers, and collective consumption expenditure. Monetary transfers amount to about 4% of national income and include various types of housing benefits, family benefits, and social benefits.[A.25] In-kind transfers are all transfers that are not monetary (or quasi-monetary) and can be individualized. They correspond to individual goods and services produced directly or reimbursed by government. In-kind transfers make up to 20% of national income (including 12.5% for health and 6.5% for education expenditure). Collective consumption expenditure regroups all consumption services that benefit to the community in general and cannot be individualized (spending on defense,

[A.23] The historical income tax is called "Impôt sur le revenu" (IR) and the general social contribution is called "contribution sociale généralisée" (CSG).

[A.24] Note that since 2018, the two income taxes and the different social contributions have been merged into a unique 30% flat tax for capital income.

[A.25] The housing benefits regroup "Allocation de Logement Familiale" (ALF), "Allocation de Logement Personnalisée" (APL) and "Allocation de logement sociale" (ALS). The family benefits include "Allocation Familiale" (AF), "Complément Familial" (CF), "Allocation Pour Jeune Enfant" (APJE), "Prestation d'Accueil du Jeune Enfant" (PAJE), "Allocation de Rentrée Scolaire" (ARS), "Allocation d'Education de l'Enfant Handicapé" (AEEH) and "Allocation de Soutien Familial" (ASF). The social benefits regroup "Revenue de Solidarité Active" (RSA)/"Prime d'Activité" (PPA), "Allocation Adulte Handicapé" (AAH), and "Allocation de Solidarité aux Personnes Agées" (ASPA).

police, the justice system, public infrastructure, etc.). It amounts to 10% of national income.

The rest of the section goes over the details of the computation for the different taxes and transfers.

C.2 Microsimulation model.

In order to simulate the French tax and transfer system, we develop a microsimulation model. First, this model exploits the richness of the income tax micro-files to simulate very precisely all monetary transfers and taxes levied on income (progressive and flat income taxes, and social security contributions). In particular, we are able to consider all changes in tax schedules or specific tax deductions, exemptions and credits over time. We also use all socio-demographic variables reported in micro-files (number and age of dependents, marital status, disability status, etc.) in our simulation exercises. Second, when the appropriate tax base is not directly observed in our micro-files, we use our estimated variables of wealth[A.26] and income as a proxy. Wealth taxes, property taxes, and residence taxes are computed using our estimated values of taxable wealth, housing assets, and rents paid, respectively. Although imperfect, this methodology still allows us to simulate the different tax schemes and the specific exemptions, discounts and tax cap for low-income earners, disabled, widows or elderly. We should also stress that we have made every attempt to collect and use additional information from official reports to check and improve our simulations. [A.27] Third, we must impute the remaining taxes and transfers based on rules and tax incidence assumptions, e.g. corporate taxes or in-kind transfers and collective expenditure. We should stress that this work relies also on a collective and in-depth exercise of data collection regarding legislation parameters over the 1970-2018 period that we have made available at `https://www.ipp.eu/en/ipp-tax-and-benefit-tables/`.

C.3 Imputation of taxes

C.3.1 Progressive income taxes

The progressive income taxes correspond to the historical income tax implemented in France in 1914. The computation of the income tax is made in the Stata file *doirpp* and relies on the following steps:

1. Computation of the tax base: we reconstruct all the categorical income components of the tax base, taking into account the different rebates and deductions.

2. Application of the tax schedule: the gross income tax is computed using the tax schedule, which includes the rates and thresholds of the different tax brackets as well as some special rules on income rebates. We also take into account the family quotient ceiling rules (introduced in 1949) in the computation of the tax.

[A.26] See Section B.3 for details about the construction of our wealth series.

[A.27] For example, our simulations of wealth taxes are fully consistent with wealth tax tabulations, which report the number of taxpayers as well as average taxable wealth and tax paid by tax bracket. The number of beneficiaries of each monetary transfer is also consistent with the statistics provided by official reports (CNAF and DREES files).

3. Tax credits: after the application of the tax schedule, we subtract the tax credits to compute the tax due. Importantly, we are able to consider all changes in tax credits over time, using the administrative information on the credits' amount by household.

4. we take into account the *prélèvement forfaitaire libératoire* (up to its suppression in 2013), which offers taxpayers the possibility to choose between paying a flat tax on their capital incomes or including them into the standard progressive income tax schedule.[A.28]

Note that because our microsimulation exercice is based on the income tax microfiles, our estimates of income taxes are fully consistent with the tax data. The microsimulation exercice allows us to compute all intermediary concepts of income and taxes. These concepts are needed to impute other taxes and transfers[A.29] or to make some reclassification.[A.30]

C.3.2 Social Security Contributions

The French Social Security system is composed of a large number of different schemes, each financed through a specific Social Security contribution.[A.31] Social security contributions (SSC) are computed on gross wage, with different marginal payroll tax rates corresponding to different thresholds. These thresholds are expressed as a multiple of the reference threshold.[A.32] SSC can be disentangled between employee and employers SCC and by types of risk covered (old-age, unemployment, health care, etc). Among the different employee and employer SSC, we distinguish those that are really contributive, in the sense that they lead to future benefits (e.g., pensions and unemployment benefits), from those that are not contributive, in the sense that they fund benefits not directly related to the amount of contribution paid (e.g., health care and family benefits). The computation of the social security contributions is made in the Stata do file *dorevtravcn*.

Wage earners

To compute the different types of employee end employer social security contributions (unemployment, pensions and non-contributive) for wage earners, we proceed as follow.

First, we start from fiscal wages reported in the income tax microfiles and recover the concept of gross wage, which is the relevant tax base for SSC. Fiscal wage is equal to gross wage minus employee SSC minus the deductible fraction of the flat income tax CSG. We recover the concept of gross wage by adding back to fiscal wage the deductible fraction of CSG and by inverting the piecewise linear schedules for the different employee SSC.

[A.28] We also take into account the introduction of the flat tax (PFU) since 2018.

[A.29] Specific exemptions for flat income taxes and residential taxes are based on specific concepts of fiscal income (Revenu fiscal de Reference) or income taxes (income taxes before all tax credits or before refundable tax credits) depending on the year. Similarly, the concept of fiscal income used to compute the different monetary transfers varies by type of transfers and over time.

[A.30] For example, some in-work benefits are classified as tax credits (Prime pour l'emploi) and others as monetary transfers (prime d'activité). For consistency, we classify all in-work benefits as monetary transfers and adjust accordingly income taxes.

[A.31] See Bozio et al. (2020) for a complete description of SSC schemes in France.

[A.32] This reference threshold is referred to as the Social Security threshold (SST) (plafond de la Sécurite sociale or PSS, in French) and corresponds approximately to the mean gross wage.

Second, we apply the different piecewise linear schedules to compute the different types of employer and employee SSC (pension, unemployment, and non-contributive).[A.33] Finally, we take into account the succession of reduction schemes for low-incomes.[A.34] Starting in 1993, these SSC tax cuts are targeted toward employees paid around the minimum wage. Note that because these tax cuts have no tax-benefit linkage[A.35], we classify them as a reduction of non-contributive SSC.

Self-employed
For self-employed, we follow the same methodology as for wage-earners except that there is by definition no distinction between employee end employer SSC and there are no reduction in SSC.

C.3.3 Flat income taxes

In parallel to the historical progressive income tax, the French tax and transfer system also includes a variety of flat income taxes levied at source and called either social charges or social contributions (*prélèvements sociaux*). Although a significant proportion of these charges contribute to the funding of the social protection system, these charges are not a social security contribution, as they do not generate an entitlement to social security benefits. The CSG (*Contribution sociale généralisée*) – implemented since 1991 – and the CRDS (*Contribution au remboursement de la dette sociale*) – implemented since 1997 – are applied to all sources of income (labor, replacement, and capital income) with specific flat rates varying with the nature of the income. There is also a variety of small social charges specific to capital income that are known generically as other social contributions on capital income.

We compute CSG and CRDS as well as other social charges on capital income by applying the income-specific flat tax rates to the relevant tax bases.[A.36] Note that we also take into account the full or partial reduction of CSG and CRDS on pension and unemployment benefits for low income households. Finally, we have collected the aggregate revenues of each of these taxes using national accounts and official administrative reports and ensured that our simulations are fully consistent with these aggregates.

The computation of CSG and CRDS for labor and replacement income is done in the dofile *dorevtravcn*. The computations of all social charges on capital income is done in the dofile *dotaxcap*.

[A.33] Note that we have not tried to take into account SSC schedules specific to the public sector or some particular occupations. For simplicity, we apply the most common SSC schedule to all individuals, i.e the general SSC scheme for wage earners in the private sector.
[A.34] Exoneration famille, ristourne Juppé, allègements Aubry et Fillon, Credit d'Impot pour la Competitivite et l'Emploi (CICE).
[A.35] i.e., they do not reduce the expected benefits.
[A.36] For example, the tax base for wage is equal to gross wage multiplied by $(1-\tau)$, where τ is a small tax exemption that varies over time and with the level of gross wage. In 2018, τ is equal to 1.75% up to a threshold (158,928 euros, i.e. 4 times the reference threshold) and 0 above.

C.3.4 Capital taxes

Wealth taxes and tax shield

France has implemented an annual progressive wealth tax since 1982. This tax is paid by all resident tax units with net taxable wealth above a certain threshold (1,3 million euros since 2011). Since 1982, three successive versions of this tax have been implemented. A first wealth tax was introduced between 1982 and 1986 (*Impôt sur les Grandes Fortunes*). Then, a new wealth tax with a slightly less progressive tax schedule was reintroduced in 1989 under the name *Impôt de solidarité sur la fortune* (ISF). Since 2018, the ISF was replaced by the *Impôt sur la fortune immobilière* (IFI), transforming the ISF into a tax on housing assets only.

The computation of the wealth tax is done in the dofile *doisf* and involves to simulate the appropriate concept of taxable wealth and the corresponding amount of wealth taxes.

In order to compute taxable wealth, we proceed as follow. First, we rely on our imputed wealth variables[A.37] to compute a proxy for taxable wealth. This concept takes into account the full exemption of professional assets as well as the rebate for primary residence.[A.38] Second, we use this proxy for taxable wealth to rank individuals. Third, we use the detailed wealth tax tabulations by tax brackets provided by the tax administration and the properties of the Pareto distribution to simulate the distribution of taxable wealth and to match it to the distribution of our proxy for taxable wealth. This procedure allows us to match exactly the number of taxpayers and the amount of taxable wealth by tax brackets.

In order to compute the corresponding amount of wealth taxes, we proceed as follow. First, we apply the tax schedule to the taxable wealth and take into account the smoothing mechanism at the eligibility threshold as well as the reduction for dependant children. Second, we apply the general ceiling rules (*plafonnement des revenus*)[A.39] and the different majoration schemes[A.40] to obtain the net wealth taxes. Note that we have also used the wealth tax tabulations to check the consistency of our simulations.

Finally, we compute the tax shield (*bouclier fiscal*), implemented over the 2006-2011 period, that prevent taxes (wealth, income, property and residence taxes) to exceed 50% of taxpayer's income.

Property taxes

In France, the property tax is an annual tax imposed on the owner of a property, whether or not the property is actually occupied by them or rented out. Property tax is assessed on the notional rental value (valeur locative cadastrale) of residential premises resulting from valuations of developed land updated by the authorities. The amount of tax is calculated by multiplying the tax base by the rates voted by each municipalities. In 2018, property taxes amount to 1.1% of national income.

[A.37] See our companion paper Garbinti et al. (2021) for the description of the method used to estimate the distribution of wealth.

[A.38] Since 2018, we also take into account the full exemption of all financial assets.

[A.39] Since 1989, wealth taxes and income taxes can not exceed a fraction of fiscal income, e.g 75% since 2013.

[A.40] 8% of the IGF between 1984 and 1986; 10% of the ISF between 1995 and 1998.

We allocate the property tax proportionally to housing assets owned by individuals after taking into account potential exemptions, reductions, and tax cap which depend on socio-economic characteristics of the households (age, fiscal income, marital status, disabled, etc).[A.41]

Corporate income tax

Corporate taxes as well as retained earnings are assumed to be incident on capital income, i.e., allocated proportionally to dividends, life insurance income and interests. (See section B.3.3 for more details).

C.3.5 Indirect taxes

Residence tax

In France, the residence tax is an annual tax imposed on the occupier of a property in which they were resident on 1st January of each year, whatever their status (owner, tenant, free occupier). Residence tax is assessed on the notional rental value (valeur locative cadastrale) of residential premises resulting from valuations of developed land updated by the authorities. The amount of tax is calculated by multiplying the tax base by the rates voted by each municipalities. In 2018, residences taxes amount to 0.9% of national income.

We allocate the residence tax proportionally to the market rental value of the property occupied by tax units after taking into account potential exemptions and reductions, which depend on socio-economic characteristics of the households (age, fiscal income, marital status, etc).[A.42] In particular, we take into account the full exemption of the residence tax for widows, individuals aged over 60, low-income households and recipients of specific mean-tested benefits such as AAH (people with disability) and ASPA (elderly). We also compute partial tax exemption for low-income households as well as the recent reform implemented in 2018.

Consumption taxes

Consumption taxes correspond to the net taxes on product reported in the national account. Its main component is the value added tax (VAT) but this aggregate also includes a variety of smaller taxes such as the taxes on energy , alcoholic beverages, tobacco, insurance, etc.

Consistent with Piketty et al. (2018a), we assume that 70% of consumption taxes are paid by consumers and 30% are paid by factors of production (labor and capital).

We allocate the fraction of consumption taxes paid by factors of production (30% of the total) proportionally to pretax income.

For the fraction of consumption taxes paid by consumers, we propose an elaborated imputation methodology taking into account how households are differentially subject to these taxes depending on their family composition and level of disposable income. The imputation relies on the following steps.

[A.41] See the Stata code *dotaxcap* for more details.
[A.42] See the Stata code *dotaxcap* for more details.

1. We impute consumption using the profile of saving rates by disposable income computed by Garbinti and Lamarche (2014a,b) using the French Household Budget and Wealth Surveys.

2. We simulate consumption taxes using the different tax rates (in % of consumption) broken down by decile of disposable income and types of households computed by Dauvergne (2012) using the different waves of the French Household Budget Surveys.[A.43]

All these steps are performed at the end of the microsimulation model, in the `doprodtaxes.do` program, as we need disposable income as an input for the computation.

C.4 Imputation of monetary transfers

We simulate monetary transfers by applying the law parameters ruling their attribution using the information available in the microfiles. Of course, this task does not yield perfect simulation results since some information required for the application of the law is not always available in the data. We nonetheless find proxies for the unavailable variables and aim at obtaining total numbers of eligible individuals, total amounts, and averages of transfers consistent with the aggregated figures (provided by the *Caisse des allocations familiales*). We also check the consistency of the simulations by comparing the results to the information available in the ERFS surveys.[A.44]

C.4.1 Family benefits

Family benefits are granted to persons with custody of children up to the age of 20.[A.45] They include several benefits that are usually gathered in three broad categories: Childbirth and early childhood care benefits, basic benefits for maintenance, and benefits for special purposes.

Before turnings to these different benefits, note a special feature of the French system. All family benefits are computed as a percentage of a standardized amount (in French, the "*Base Mensuelle des Allocations Familiales*", monthly family benefit base, BMAF hereafter). This parameter is reevaluated every year by the government to take inflation into account. Figure E2 shows its evolution relative to the average national income per adult. As it turns out, this parameter decreases significantly over the period[A.46]

Note also that the concept of household's resources relevant for computing the eligibility and the amount of all these family benefits is similar and can be directly observed in our tax microfiles.

[A.43] More precisely, Dauvergne (2012) is able to compute the different consumption taxes by applying the precise tax rates to the different types of goods and services (following the detailed level of the Classification of Individual Consumption by Purpose - COICOP).

[A.44] Since 2006, the ERFS surveys match information from Labor Force surveys with income tax returns and social benefits perceived. See description of Tax Income Survey/ERF and Tax and Social Income Survey/ERFS on Insee website.

[A.45] With the exception of the "*Complement Familial*" for which the maximum age is 21.

[A.46] The drop in 1978-80 and the subsequent increase corresponds to a stagnation of the amount before the implementation of a catch-up policy.

The details of the computations can be found in our Stata code *dotransfers*. Hereafter we present the different components of the French system of family benefits and its chronology.

Childbirth and early childhood care benefits

Childbirth and early childhood care benefits aim to offset the costs of childcare or arrival of a child. Historically, the early childhood support policy can be divided into three main periods which each corresponds to distinct allowances ranging from non-means-tested benefits at the start of the period to those fully means-tested for the most recent period.

First, from the 1940s, early childhood benefits have existed in France, targeting all households with children without means test. For instance, the *"Allocation de Salaire Unique"* (Single salary allowance, ASU) was introduced in 1941 for couples with children without means test. As its name suggests, the only criterion was that only one of the parents had to work when the couple was claiming for this benefit. Prenatal and postnatal allowances (*"Allocations prénatales et postnatales"*) that were introduced in the early 70s in replacement of the previous benefits, were also childbirth and early childhood care benefits not means-tested.

Second, in 1985, new benefits were introduced some of which were means-tested. It is the case of the *"Allocation Pour Jeune Enfant"* (young child allowance, APJE), targeting parents of young children (below three years old) and replacing previous childbirth and early childhood care benefits[A.47]. From now on, part of the allowance depended on household resources. It comprised two parts.

- The "short" APJE which was attributed to newborns and that still did not depend on household's resources
- The "long" APJE which was granted to children from four months to three years old, and which was awarded subject to means-testing

The same year, the *"Allocation Parentale d'Education"* (parental leave allowance, APE) was also created. It aimed at providing financial support to parents of young children (below three years old) who were stopping or decreasing their professional activity to take care of their child. It complemented the APJE by taking into account the choice of the activity status of parents of young children. Beside the working status, the eligibility depended on the number of children.[A.48]

Finally, the *"Prestation d'Accueil du Jeune Enfant"* (early childhood benefit program, PAJE) replaces the previous childhood transfers starting in 2004 with a unified transfer which is now fully means-tested with a ceiling depending on the household composition.[A.49] This benefit is composed of the following four schemes:

[A.47] Initially named *"Allocation au Jeune Enfant"* in 1985 and renamed *"Allocation pour jeune enfant"* in 1987.

[A.48] Note that because we are not able to identify the precise working time of individual, we focus on individual who are completely out of the labor market.

[A.49] Note that the computation of this ceiling is similar to that of the threshold relevant for the computation of the APJE: only the underlying parameters are different.

- Birth and adoption grant (*Prime à la Naissance ou à l'Adoption*, PA): this means-tested bonus is distributed at the birth or the adoption of a child.
- Basic allowance (*Allocation de base*, AB): this means-tested transfer is attributed monthly to families with chilren under three years old.
- Supplement for free choice of working time (*Complément Libre Choix d'Activité*, CLCA): this scheme directly replaces the APE. Its computation follows the same logic as the APE.[A.50]
- Supplement for free choice of childcare (*Complément de Libre Choix du Mode de Garde*, CLCMG): the CLCMG supports households expenses for child care of children younger than six years old.[A.51]

Basic benefits for maintenance

Child benefit (*Allocations Familiales*, AF) The AF is a monthly family transfer attributed to all families with at least two children. The computation used not to depend on the family's ressources, but a modulation of the schedule was introduced in 2015, decreasing the amount received as resources increase.[A.52]

The pivotal variables for the computation of the AF relates to the family composition (number and age of children) and fiscal income, which are observed in the fiscal data.

Our computation follows the legislation. It has four main types of components: a base transfer, several majorations[A.53], a lump sum transfer[A.54], and a means-tested dimension[A.55].

Family income supplement (*Complément Familial*, CF) The CF aims at providing support to low-income or large families who are not eligible anymore to early childhood benefits. A first version of this transfer has been introduced in overseas departments in 1978. It was then attributed to children below three years old for families with more than three children. A reform extended this anecdotal transfer into a much larger one in 1986. Starting then, the transfer targets families with more than three children older than three years old[A.56].

[A.50] Since 2015, this benefit has been renamed "Shared child-rearing benefit" (*Prestation partagée d'éducation de l'enfant*, PreParE).

[A.51] We simulate separately this four components by applying the legislation specific to each of them, except for the CLCMG that we distribute equally to all children between zero and six years old living in a household where at least one parent is working since we cannot observe the necessary information to compute the CLCMG in the fiscal data.

[A.52] A means-tested dimension had also been implement for 1998 only.

[A.53] Majorations are attributed depending on the age of children, mainly to increase the amount when children reach a certain age. Our computation includes all these precise rules, that have been modified several times since the 70s (see the code for more details)

[A.54] The lump sum transfer, introduced in 2003, aims at decreasing the shock associated with the exit of older children to the AF scheme. Households previously eligible to the AF are entitled to a one year transfer for every child older than 20 years old, formerly eligible to the AF.

[A.55] first introduced in 1998 only, then repealed and finally reintroduced since 2015.

[A.56] Up to 18 years old before 2000, and up to 21 years old after.

In addition to the age requirement of the children, the eligibility of a family to the CF depends on family resources that have to be below a ceiling depending on the composition of the household.

Similar to the functioning of the AF, the amount of CF is expressed as a multiple of the MBAF. In practice, it is the sum of three components: the base amount[A.57], a majoration[A.58] and a phasing-out scheme for households whose resources are above the ceiling by an amount inferior to the base amount.

Family support allowance (*Allocation de Soutien Familial*, ASF) The ASF is a monthly benefit introduced in 1971 targeted toward supporting single parent's households (or children whose both parents are not in situation of taking care of them). The benefit is received by the remaining parent or the tutor. We best approximate this eligibility rule by attributing the ASF to single parent's households. There is no means test for this benefit.

Benefits for special purposes

Education allowance for a disabled child (Allocation d'éducation de l'enfant handicapé, (AEEH) The AEEH is a non-means tested benefit paid to the households who have a child under age 20 with a permanent disability. Before 2005, it was named "Allocation d'Education Spéciale" (Special Education Allowance), before being transformed into the AEEH. Beyond the basic allowance, there exist a supplement depending on the degree of the child's disability and a majoration for single parents family.

Our computation not only relies on the household composition but also on the number of disabled child. This latter information is reported accurately because it gives the right to an income tax reduction.[A.59]

Back-to-school allowance (*Allocation de Rentrée Scolaire*, ARS) The ARS is a yearly benefit introduced in 1974 aiming to support costs due to the start of the school year for parents of children between six and sixteen years old (increased to eighteen in 1990). This means-tested allowance depends on the age of the child in order to best reflect the household's actual expenses.

Eligibility depends on resources that have to be below a ceiling depending on the number of children. Before 1998, the eligibility condition was also conditioned on receiving another benefits. Because we compute all the relevant benefits (family or housing benefits, disability benefit) at the household level, we can implement this rule as well.[A.60]

[A.57] This amount was attributed to every eligible child before 1985, but was transformed into a single transfer by family in 1986.

[A.58] introduced in 2014 for households with resources lower than half the ceiling.

[A.59] Ideally we would also need information about the degree of disability of each concerned child. In the absence of this information, we assume that children are at the maximum degree.

[A.60] Accordingly, we compute the ARS only at the end of the `dotransfers.do` program, after having computed the other benefits.

C.4.2 Housing benefits

Housing benefits are means-tested benefits intended to cover part of the rent costs. The amount of housing benefit received depends on the difference between a measurement of the rental charges and a minimum participation depending in part on its resources.

These benefits bring together three non-cumulative benefits that are attributable in the following order of priority: *"Allocation de Logement Personnalisée"* (APL), *"Allocation de Logement Familiale"* (ALF) and *"Allocation de logement sociale"* (ALS). While these three benefits may differ in their award criteria, they have the same method of calculation.

In practice, The APL is the central pillar of the system, targeting all households leaving in contracted housing, i.e. subject of an agreement between the owner and the State concerning the rental conditions (maximum rent, tenant under a ressource ceiling, etc.). The ALF targets families with at least one child and young couples not eligible to the APL. Last, low-income households not eligible to the ALS and the APL can be eligible to the ALS. More details about the institutional settings can be found in (Fack, 2006) and IPP Report nÂ°35.

Our computation takes into account the subtleties of this system by applying the eligibility criteria and schedules. The computation of the housing benefits is per se quite complex, but turns out to be similar for the three housing benefits. It takes into account different parameters which vary according to the households' characteristics: household composition (single or couple, number of dependants)[A.61], ressources of the household and rent paid. Using these three main characteristics and the different time-varying legal parameters of the housing benefits system, we compute the different elements that are required to impute the housing benefits. Note that our imputations are fully consistent with aggregate numbers from administrative sources both in terms of number of recipients and distributed amount. The complete computations can be found in our Stata code *dotransfers*.

C.4.3 Social benefits

Social transfers are means-tested transfers. They bring together three different types of welfare benefits aiming at proving a decent livelihood.[A.62] The two first ones are intended for people of working age and the third one is intended for older individuals.

In-work Welfare benefit (*Revenu de Solidarité Active*, RSA) The RSA is an in-work welfare benefit that has been created in 2009 and replaces two previously existing welfare benefits: the *"Revenu Minimum d'Insertion"* (RMI) and the *"Allocation pour parent isolé"* (API). Its objective is to provide a minimum income to the unemployed and underemployed individuals[A.63] and to encourage them to find work. In particular, it aims

[A.61] Note that the definitions have changed over time. For instance, the number of children includes 18 and 19 years old starting in 1998 and is extended to those up to 20 years old in 2000.

[A.62] This is a right set out in the preamble to the French Constitution of 1946 and by the Council of Europe.

[A.63] As such, it is a bit abusive to call it an "in-work" benefit since there is a part of the RSA (*"RSA socle"*) which is intended for people who have no activity and who do not or no longer receive unemployment benefits.

at supplementing low-wage workers so that they do not earn less through employment than through unemployment. For the last years of our analysis, the RSA has been replaced (in 2016) by the *"Prime d'activité"* (PPA) with the aim at providing a simpler access to this benefit.[A.64]

To be eligible to this in-work welfare benefit, individuals must be above 25 years old. The amount received and the additional eligibility rules are based on the composition of the household (couple or single, number of children) and on its resources.

Disability pension (*Allocation Adulte Handicapé*, AAH) The AAH is a disability pension aiming at compensating persons with disabilities for the loss of income resulting from a reduction in their ability to work or earn a living. This social benefit has been created in 1972. The eligibility depends on the individuals' disability status and the households' resources that has to be lower than a ceiling depending on the household's composition.

Importantly for our computations, we are able to identify the disability status directly in the fiscal data.

Elderly Solidarity Allowance (*Allocation de Solidarité aux Personnes Agées*, ASPA) The ASPA is a welfare benefits intended for elderly individuals with no or low income. The first version of this non-contributory minimum pension has been introduced in 1941 for wage earners and extended to non-wage earner in 1956.[A.65] This means-tested benefit aims at increasing the resources of the claimants in order to bring him to a level depending in the household's composition (and resources).

In practice, the computation involves first computing the maximum transfer possible depending on the household composition (including majorations for spouses with no income and number of children) and, second, the resources are compared to a ceiling (still depending on the household composition) to determine both the eligibility and the received amount (reduced by the amount of the resources).

For all the social benefits, we use the individual characteristics directly observed in the microfiles and apply the eligible and computation rules, taking into account how they change over time. Note that, here again, our imputations are consistent with aggregate numbers from administrative sources both in terms of number of recipients and distributed amount. The different computations of these social benefits can be found in our Stata code *dotransfers*.

[A.64] By doing so, it merges the previous RSA with the *"Prime Pour l'Emploi"* that was a French tax credit aiming at reducing the impact of decreasing RSA for individuals who returned to work. Accordingly, the PPE is also part of the social benefits.

[A.65] In 2006, the ASPA replaces and simplifies the previous welfare benefit targeting elderly individuals, called *"Minimum Vieillesse"*.

C.4.4 Robustness: comparison with the Tax and Social Incomes Surveys (ERFS)

To assess the validity of our method of calculating monetary transfers, we compare the distribution of the imputed cash transfers to those observed in the Tax and Social Incomes Surveys (ERFS) along the income distribution. Interestingly, since 2006, the ERFS surveys have been matched with the social data that include the various benefits distributed, making them a valuable point of comparison.[A.66]

Figures E3 and E4 present the comparison of the ratio between transfers and disposable income along the income distribution as well as its decomposition by transfer categories: social, housing and family benefits. They show two important results.

First, our method leads to very similar results for individuals above the 20th percentile of the distribution. The total ratios as well as the ratios for the different benefits are very close if not identical in both sources.

Second, for the two first deciles, the share of imputed transfers is lower in the ERFS surveys than in our data. As it turns out, this difference is largely due to the much lower shares of housing and social benefits observed in the ERFS surveys. This last result does not come as a surprise but rather confirms our method. Indeed, the ERFS surveys do not include a significant share of the recipients of the housing and social benefits. By their sample design, these surveys exclude individuals from "non-ordinary households", a large portion of which being constituted by students' households and individuals in institutions (such as retirement homes), ie an important part of the low-income distribution. Consequently, the housing benefits and the old-age benefits are underestimated in the ERFS surveys. Table E3 confirms this point by comparing the aggregate values of the benefits observed in both sources with those in the administrative data.

C.5 From disposable to post-tax income

To compute post-tax income and comprehensively measure all government spending, we need to allocate in-kind transfers and collective consumption expenditure as well as the surplus/deficit of the government.

As we know relatively little about who benefits from this government spending, we need to make some assumptions about their distribution. We are well aware that these assumptions could be improved with studies that could bring a more precise light over their true distributive effects.[A.67]

In particular, few studies provide detailed measures of the redistributive impact of non-monetary transfers, and even fewer offer estimates of changes over time. Based on the few studies done on health expenditures (e.g., Lardellier et al., 2011; Jusot et al., 2016) or education expenditures (Conseil de l'Emploi, des Revenus et de la Cohésion sociale, 2003), we assumes a lump-sum imputation of health care expenditures and public spending on

[A.66] We rely on the public-use files ERFS that can be obtained from the `http://quetelet.progedo.fr/` data platform.

[A.67] Nonetheless, including these public spending is a necessary step to compare countries with differential in-kind vs. monetary transfers: countries with higher level of in-kind transfers would appear artificially poorer if one used only a measure of disposable income.

education to individuals.[A.68]

Given that we know relatively little about who benefits from collective consumption expenditure (defense, police, the justice system, infrastructure, etc.), we adopt a conservative approach by allocating it proportionally to post-tax disposable income. This seems like the most reasonable benchmark to start with as it has the advantage of being neutral, i.e. post-tax income inequality will not be affected by the allocation of collective consumption expenditure.

To sum up, our baseline scenario (V1) assumes i) a lump-sum imputation of health care expenditures and public spending on education to individuals[A.69], and ii) a proportional imputation to post-tax disposable income for collective expenditures. In order to assess the sensitivity of our results to the imputation of in-kind transfers and collective expenditure, we also present two alternative variants (see Figure10 in the main paper and the next section).

Finally, in order to ensure that aggregate post-tax national incomes match exactly with aggregate national income, we follow Piketty et al. (2018a) and attribute 50% of government deficit (or surplus) in proportion to taxes and 50% in proportion to transfers and expenditures. This assumes that fiscal adjustment will be borne equally by taxes and spending. In practice, this makes very little difference.

C.6 Robustness checks

This section presents five variants for pre-tax and post-tax inequalities to assess the sensitivity of our benchmark series.

Alternative imputations of public spending (V2 and V3)
Our baseline scenario (V1) assumes i) a lump-sum imputation of health care expenditures and public spending on education to individuals, and ii) a proportional imputation to post-tax disposable income for collective expenditures. In our two first variants, we impute all these public spending either on a lump-sum basis (scenario V2)—the most redistributive assumption—or proportionally to post-tax disposable income (scenario V3). This last scenario has the advantage of being neutral and to be equal to disposable inequality measures, i.e., after tax and monetary transfers.

Redistributive component of the pension and unemployment benefits (V4)
In our concept of pretax labor income, we deduct the contributive social contributions and include the pension and unemployment benefits. Therefore, our measure of redistribution excludes by definition the potential redistributive impact of the pension and unemployment

[A.68] Lardellier et al. (2011) use the microsimulation model OMAR developed by the statistical direction of the French government (DREES) and detailed administrative data on health expenditures to estimate the distribution of public spending on health by decile of disposable income (Figure IV page 63). Conseil de l'Emploi, des Revenus et de la Cohésion sociale (2003) (Table 6 page 41) provides a decomposition of public spending on education by decile of disposable income.

[A.69] For France which is characterized by a single-payer system where almost all health spending is paid for by the government, healthcare spending is attributed as a fix lump sum to all adults. For the U.S., healthcare spending is assigned on a lump sum basis to the beneficiaries.

system. Note that the French and US pension and unemployment systems do include a redistributive component, i.e., the share of unemployment and pension benefits received that is not linked to contributions made over lifetime. For France, it represents around 16% of total pension and unemployment benefits in recent years (Cheloudko et al., 2020) and decreases with the level of benefits received. For example, the redistributive component represents 49% of the pension benefits received in the first quartile, 27% for the second quartile, 13% for the third quartile and 10% for the last quartile (of pension benefits received). In the variant (V4), we compute alternative series of pretax and post-tax income inequalities taking fully into account this redistributive component. More precisely, we estimate the redistributive component of the pension and unemployment benefits and reclassify it as a monetary transfers (rather than pretax income).

Alternative imputation of consumption or corporate taxes (V5 and V6)
In the scenario V5, we assume that consumption taxes are fully paid by consumers, departing from the benchmark scenario where 30% of consumption taxes are paid by factors of production.

In the scenario V6, we follow Piketty et al. (2018a) by imputing corporate taxes and retained earnings proportionally to dividends/equity assets rather than dividends, life insurance income, and interests.

Sensitivity analysis
Figure E5 presents our redistribution mesure (γ) using T10/B90 (Panel A) or T10/B50 indicator (Panel B) for the different variants. Figures E6 to E8 depict the underlying pre-tax and/or post-tax income shares. The main message of this sensitivity analysis is that the alternative variants for corporate taxes, consumptions taxes or pension benefits has a small impact on the income shares and our measure of redistribution. In contrast, the allocation rules regarding in-kind transfers and collective expenditure have a significant impact on the measure of redistribution and post-tax income inequality. The comparison between our benchmark series and the scenario V3 – which is equivalent to disposable income – highlights the importance of including non-monetary transfers in cross-country analysis of redistribution, and not focusing exclusively on the tax and benefit system. Note that if these V2 and V3 variants have an effect on the magnitude of the reduction of inequality in France and in the U.S, they leave our conclusions about the relative role of redistribution and pretax inequality on post-tax inequality unchanged (See Section 4in the main paper).

D Construction of historical disposable and post-tax DINA series, 1900-1969 period

Appendix C presents the data and the methodology used to estimate historical pre-tax, disposable and post-tax DINA series over the 1900-1969 period. The stata code used to estimate the different historical series is dosharesFr19001969. The .xls file BGGGP2018PosttaxAppendixC includes all tables and figures related to the historical series of income inequality.

D.1 Income tax tabulations and fiscal income

Before 1970, no income tax micro file is available in France. We rely instead on detailed income tax tabulations produced by the French Finance Ministry since the creation of income tax in France in 1914 (first applied in 1915). These tabulation are available on an annual basis since 1914 (with no exception) and are based upon the universe of all tax units. We also use estimates of the distribution of income for years 1900 and 1910 that were produced by the French Finance Ministry in the context of the parliamentary debates about the creation of an income tax. This data reports the number of taxpayers, total income as well as income composition, and total income taxes for a large number of income brackets.

The income tax tabulations were first used in a systematic manner by Piketty (2001, 2003) to estimate top fiscal income shares. Garbinti et al. (2018) update and considerably refine these estimates. In particular, they produce annual series of fiscal income for the entire distribution either among tax units or equal-split individuals by applying the generalized, non-parametric Pareto interpolation techniques developed by Blanchet et al. (2021) to these tabulations.[A.70] Note that they also provide a systematic comparison between the distribution of fiscal income estimated via the micro-files and via the income tax tabulations over the 1970-2014 period and find that the two series are virtually identical.

D.2 From fiscal income to pretax income

In order to estimate the distribution of pretax national income from the distribution of fiscal income over the 1900-1969 period, we apply the simple procedure implemented by Garbinti et al. (2018). First, they compute the ratios between pretax income and fiscal income by percentile in 1970 – the first year where both pretax income and fiscal income series are available. Second, they start from the presumption that the induced corrections on percentile shares tends to rise over time. This assumption is motivated by the fact that at the beginning of the period, tax rates are relatively small, so that incentives for tax optimization are limited, and legal tax exemption regimes are rare.[A.71]. Third, they

[A.70] Piketty (2001, 2003) focused on the top decile among tax units and did not attempt to go below the 90th percentile or to correct for different tax unit sizes). See Appendix of Piketty (2001) and Appendix D of Garbinti et al. (2018) for a complete description of the methodology regarding the construction of historical series of fiscal income.

[A.71] This is confirmed by the detailed breakdowns by labor and capital incomes (which unfortunately are only available for a number of isolated years – rather than on an annual basis – prior to 1945)

assume that the ratios between pretax income and fiscal income by percentile level rise linearly from 1 in 1900, i.e. inequality in pre-tax national income is equal to inequality in fiscal income, to the ratios observed in 1970. Finally, they can recover the historical series of pretax income by applying these ratios to the historical series of fiscal-income.

While this approach is clearly an approximation, they argue that the impact on the long run patterns should be very limited. They show in Figure 8 that the shares of pre-tax income and fiscal income are almost identical over the 1970-1984. Indeed, this is only since the mid-1980s that a growing gap between the two series appears at the top of the distribution. As already discussed in Section B.3, this growing gap reflects the growing importance of missing capital income and retained earnings in fiscal income that are mainly concentrated at the top of the distribution.

D.3 From fiscal income to disposable income

Going from fiscal to disposable income requires to deduct bequest taxes and income taxes from fiscal income and add back monetary transfers.[A.72] Conceptually, the distribution of disposable income can be recovered from the distribution of fiscal income using the following equation:

$$Disp_{pt} = a_{pt} \cdot Fisc_{pt} \cdot \frac{Disp_t}{Fisc_t},$$

where $Fisc_{pt}$ and $Disp_{pt}$ are fiscal and disposable income accruing to percentile p at time t, $Disp_t/Fisc_t$ is the ratio between average disposable income and average fiscal income at time t, and a_{pt} are correction factors capturing the redistributive effects of monetary transfers, and bequest and income taxes by year and percentile.

Our objective is to estimate a_{pt} over the 1900-1969 period as $Fisc_{pt}$ is provided by Garbinti et al. (2018) and $Disp_t/Fisc_t$ can be computed using the National Accounts. Before World War I, we can assume that our correction factors a_{pt} are equal to 1. Indeed, income taxes and monetary transfers did not exist and the redistributive effects of bequest taxes were negligible as they represented less than 0.7% of national income and were based on small tax rates. Over the 1915-1969 period, one simple approach (referred to as the "simple method") would be to assume that correction factors rise linearly from 1915 to 1970. While this approach is clearly an approximation, it has the merit to capture the trend in redistribution induced by the progressive development of monetary transfers, and bequest and income taxes over the 1915-1969 period. One drawback of this simple approach is that it does not capture non-linear changes in redistribution over time.

To overcome this limitation, we go one step further and develop a more sophisticated interpolation procedure (our baseline method). This procedure consists in splitting the correction factors a_{pt} into three tax-specific correction factors (income taxes/bequest taxes/ monetary transfers) and use all available information to estimate their changes over time. In particular, the correction factors for income taxes are constructed using income taxes

[A.72] Note that fiscal income is already net of production taxes, corporate taxes and social security contributions. In addition, the tax system was much less complex over the 1900–1969 period as flat income taxes and wealth taxes did not exist.

paid each year by income group as reported in the tax tabulations. Correction factors for bequest taxes and monetary transfers take into account the yearly evolution of their macroeconomic aggregates as reported in the National Accounts.

In order to assess the robustness of our 1900-1969 series, Figure E9 reports the evolution of the bottom 50% (Panel A) and the top 10% (Panel B) shares for disposable income (simple or baseline method). It shows that disposable income shares derived from the simple and baseline methods are almost identical except during the 1919-1925 period where exceptional monetary transfers were implemented and could by definition not be taken into account by the linear interpolation implemented in the simple method. If we exclude the 1919-1925 period, the fact that the simple and baseline methods deliver consistent income shares reflects that the redistribution induced by taxes and monetary transfers is likely to follow a smooth and continuous trend over the 1900-1969 period. As shown in Figure E10, disposable and pretax income shares are very close over the 1900-1969 denoting a small impact of taxes and monetary transfers on inequality. Although our method should be seen as exploratory and incomplete, we argue that it should not under-estimate the level and evolution of disposable income inequality. Indeed, pretax and disposable income shares are also very similar over the 1970-1975 period where a microsimulation exercise is conducted on micro-files.

D.4 From disposable income to post-tax national income

To recover the different historical series of post-tax national income, we just need to add in-kind transfers and collective expenditure to disposable income depending on the imputation rules described in Section C.5.

E Additional Tables and Figures

Table E1 – Complementary indicators for redistribution: France vs. U.S, 1970-2018

Inequality indicators: Post tax/Pretax income					
France	1970-1979	1980-1989	1990-1999	2000-2009	2010-2018
Total inequality (T10/B50)	-35%	-37%	-41%	-46%	-51%
Total inequality (T10/B90)	-20%	-22%	-24%	-29%	-33%
Upper inequality (T10/M40)	-10%	-12%	-13%	-16%	-21%
Lower inequality (M40/B50)	-27%	-29%	-32%	-36%	-38%
Gini (Reynolds-Smolensky index)	-10%	-11%	-12%	-15%	-16%
Theil	-15%	-15%	-17%	-20%	-22%
p75/p25	-26%	-28%	-31%	-34%	-34%
Palma ratio (share T10/share B40)	-40%	-43%	-47%	-52%	-56%
U.S	1970-1979	1980-1989	1990-1999	2000-2009	2010-2016
Total inequality (T10/B50)	-34%	-33%	-41%	-44%	-47%
Total inequality (T10/B90)	-22%	-19%	-24%	-27%	-29%
Upper inequality (T10/M40)	-15%	-11%	-15%	-18%	-20%
Lower inequality (M40/B50)	-22%	-25%	-30%	-31%	-33%
Gini (Reynolds-Smolensky index)	-9%	-9%	-11%	-11%	-12%
Theil	-16%	-16%	-22%	-26%	-28%
p75/p25	-25%	-28%	-32%	-33%	-33%
Palma ratio (share T10/share B40)	-38%	-38%	-46%	-49%	-52%

NOTES: Total inequality between pretax and post-tax incomes, as measured by the ratio between the average incomes of the top 10% and the bottom 50%, drops by 35% in France and by 34% in the US on average over the 1970-1979 period.

Table E2 – Decomposition of the evolution of post-tax income inequality: France vs. U.S.

		V1: Benchmark			**V2: lumpsum method**			**V3: proportional method**			**V4**		
		1900-2018	1900-1983	1983-2018	1900-2018	1900-1983	1983-2018	1900-2018	1900-1983	1983-2018	1900-2018	1900-1983	1983-2018
	Panel A: T10/B50 indicator												
France	Changes in post-tax income inequality	-75%	-76%	4%	-77%	-78%	6%	-71%	-73%	9%	-74%	-75%	4%
	Due to pretax inequality	-45%	-59%	29%	-44%	-57%	29%	-48%	-62%	29%	-46%	-60%	28%
	Due to taxes and monetary transfers	-21%	-11%	-20%	-21%	-10%	-20%	-23%	-11%	-20%	-22%	-11%	-20%
	Due to in-kind and collective expenditures	-9%	-7%	-4%	-12%	-11%	-3%	0%	0%	0%	-6%	-3%	-4%
US	Changes in post-tax income inequality			42%			45%			60%			47%
	Due to pretax inequality			66%			67%			70%			67%
	Due to taxes and monetary transfers			-10%			-10%			-10%			-10%
	Due to in-kind and collective expenditures			-14%			-12%			0%			-11%
	Panel B: T10/B90 indicator												
France	Changes in post-tax income inequality	-64%	-67%	10%	-66%	-69%	10%	-59%	-64%	14%	-62%	-66%	10%
	Due to pretax inequality	-43%	-56%	26%	-42%	-55%	26%	-46%	-58%	26%	-44%	-57%	26%
	Due to taxes and monetary transfers	-13%	-5%	-12%	-13%	-5%	-12%	-14%	-6%	-12%	-13%	-6%	-12%
	Due to in-kind and collective expenditures	-8%	-6%	-4%	-12%	-9%	-4%	0%	0%	0%	-5%	-3%	-4%
US	Changes in post-tax income inequality	-15%	-37%	35%	-20%	-41%	36%	-3%	-33%	45%	-11%	-35%	37%
	Due to pretax inequality	7%	-29%	50%	7%	-27%	50%	7%	-30%	52%	7%	-29%	51%
	Due to taxes and monetary transfers	-9%	-3%	-7%	-9%	-4%	-7%	-9%	-3%	-7%	-9%	-3%	-7%
	Due to in-kind and collective expenditures	-13%	-5%	-9%	-17%	-10%	-8%	0%	0%	0%	-9%	-3%	-7%

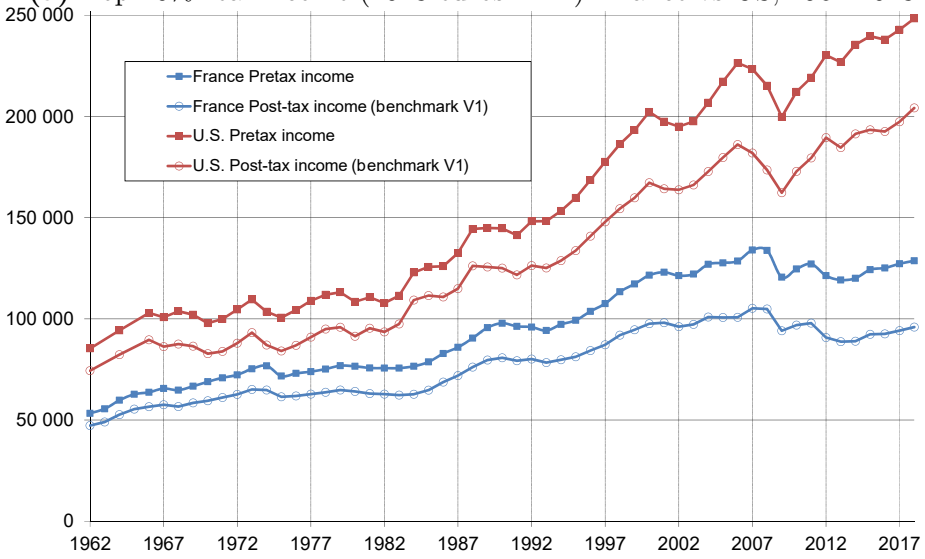
NOTES: .

Table E3 – Ratio of total observed transfers to administrative statistics (2017)

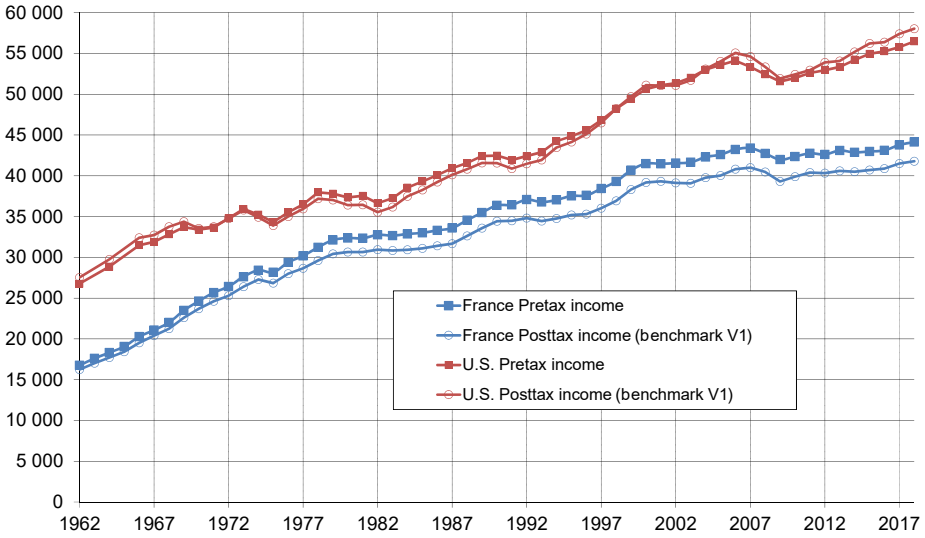
	DINA	ERFS Surveys	Total NA
Family benefits	**100%**	**79%**	**29.84**
Housing benefits	**100%**	**90%**	**18.16**
Social benefits	**100%**	**78%**	**28.41**
Disability pensions	100%	87%	9.1
Old-age benefits	100%	61%	3.26
In-work welfare beenfits	100%	76%	16.05

Source: authors' computations, ERFS surveys, administrative aggregated statistics from the CAF.
Notes: While the DINA estimates include 100% of family transfer by construction, the amount of social benefits observed in the Tax and Social Income Surveys (ERFS) corresponds to 79% of the administrative aggregated statistics. The Total NA corresponds to the national amount, in billion euros.

(a) Top 10% real income (2018 euros PPP): France vs US, 1962-2018



(b) Middle 40% real income (2018 euros PPP): France vs US, 1962-2018



(c) Bottom 50% real income (2018 euros PPP): France vs U.S., 1962-2018

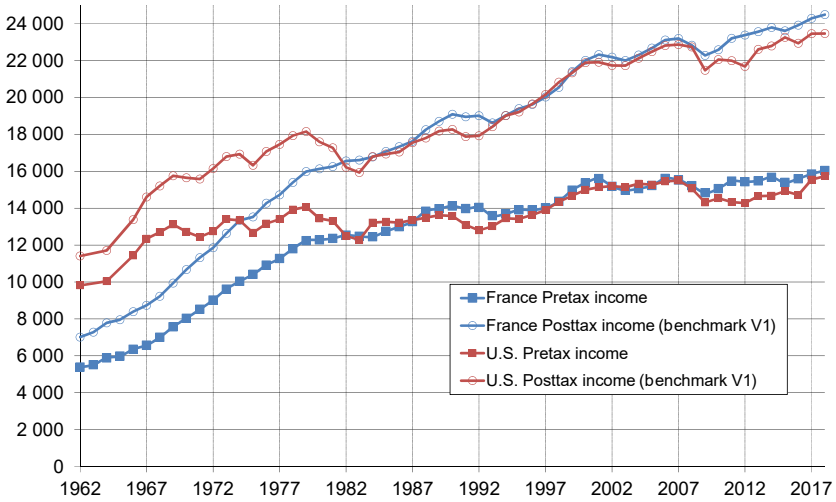


Figure E1 – Annual evolution of pretax and post-tax income between France and the U.S., 1962-2018

NOTES: Real incomes in 2018 € PPP. For the U.S: authors' computations using the data from Piketty et al. (2018a).

Figure E2 – Evolution of the monthly base amount of family transfers

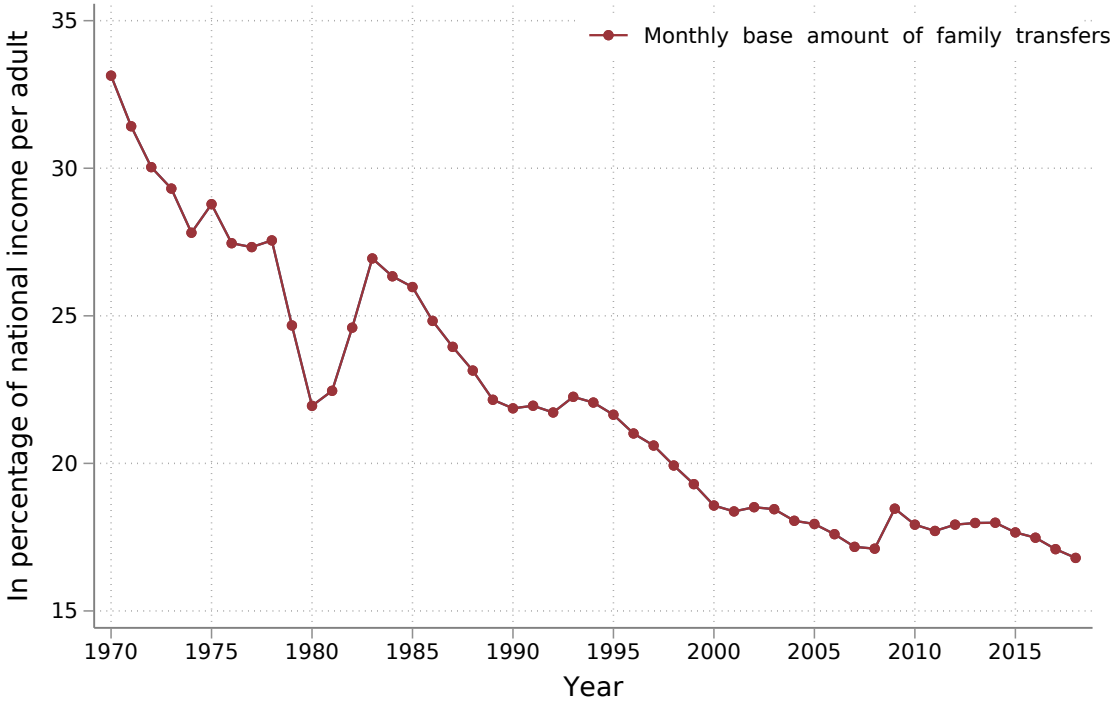
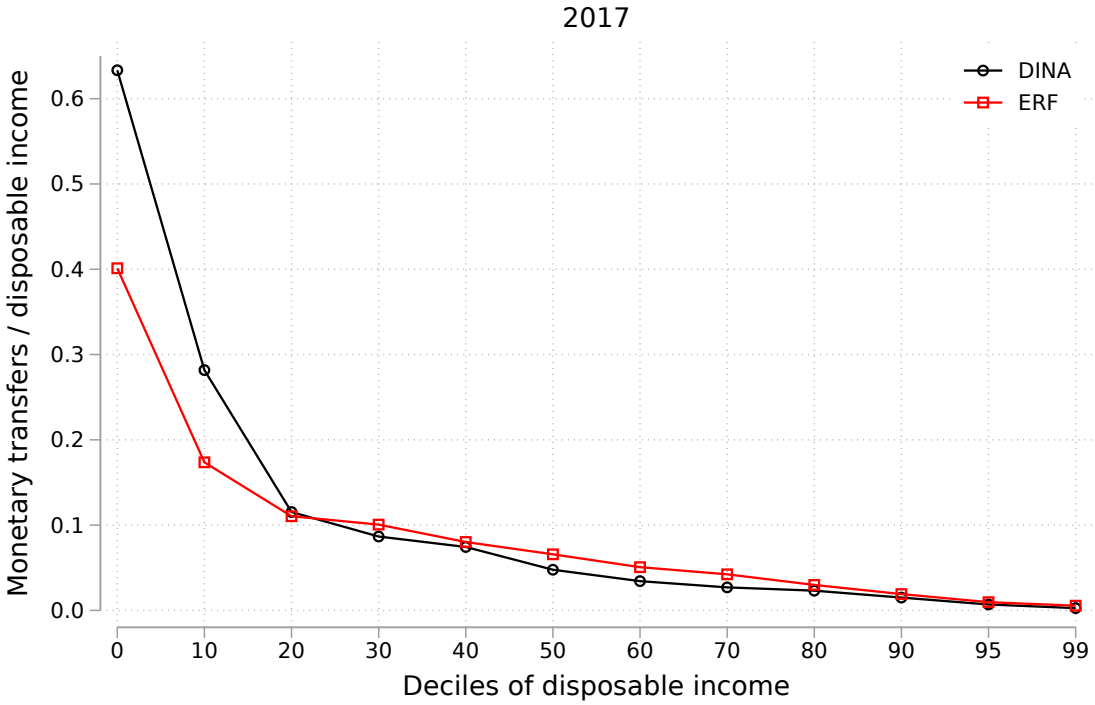
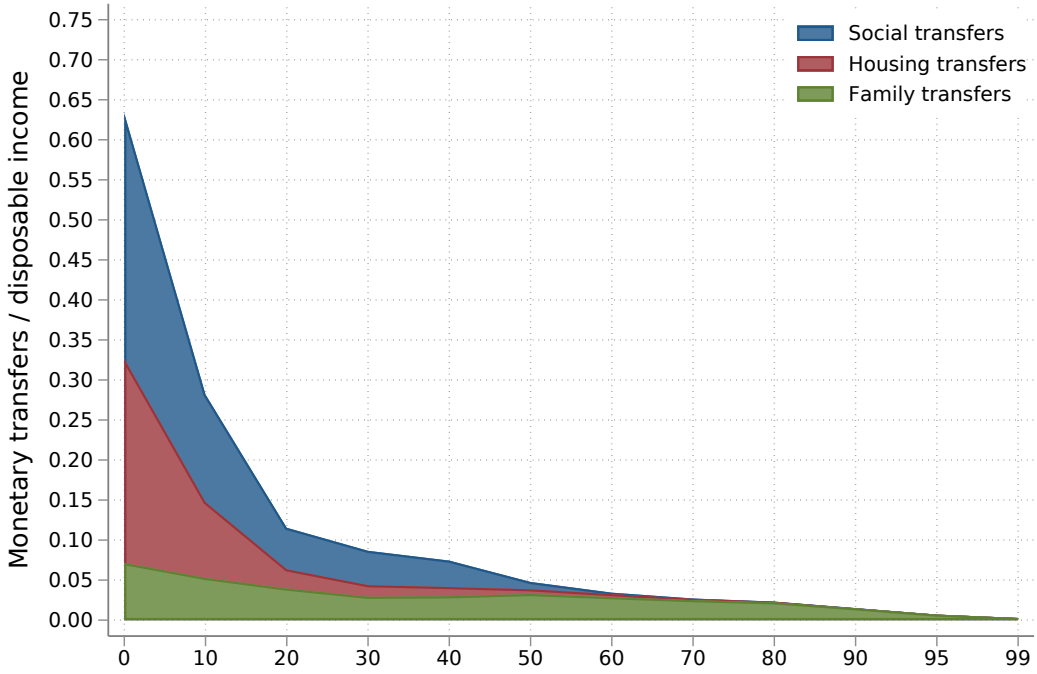


Figure E3 – Comparison DINA - ERFS surveys



Source: authors' computations, ERFS surveys

(a) DINA



(b) ERFS survey

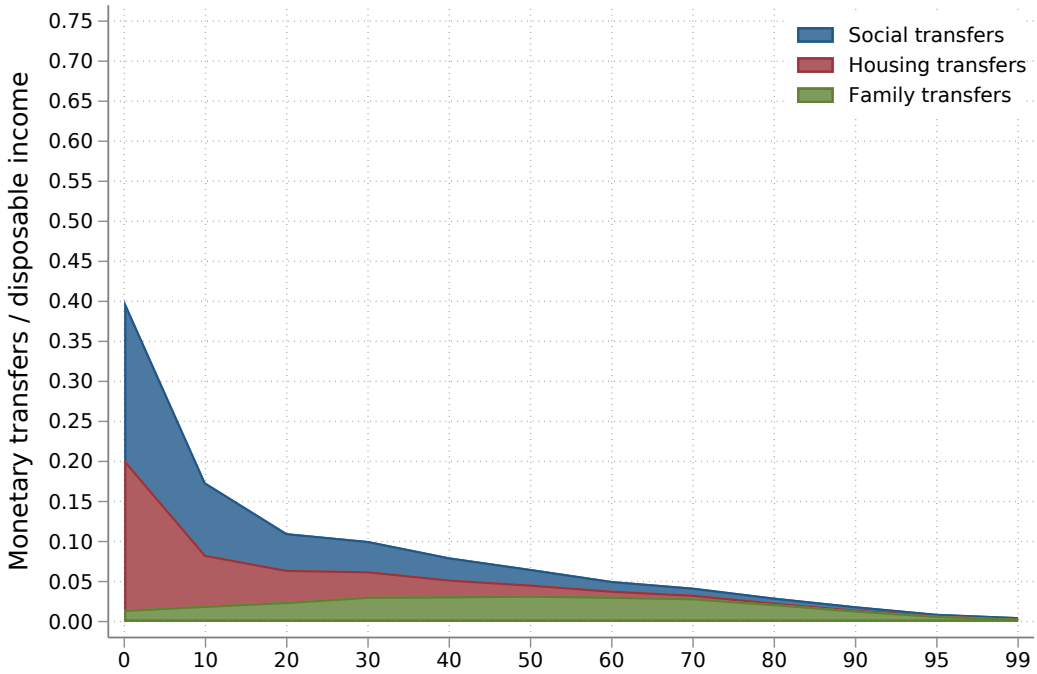
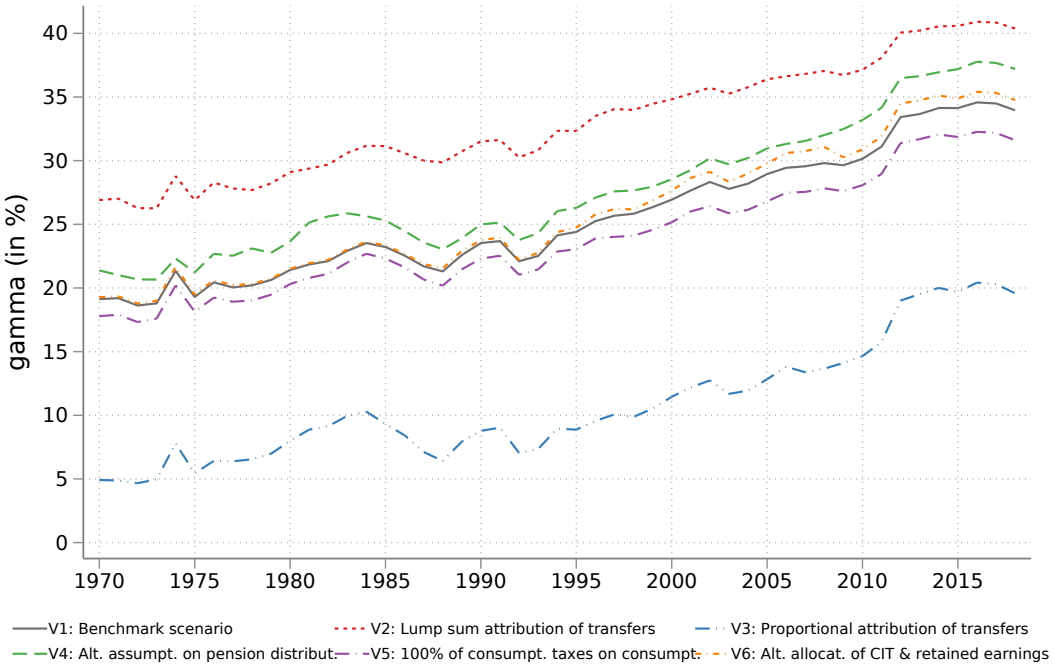


Figure E4 – Comparison DINA - ERFS surveys (2017)

NOTES: Decomposition of monetary transfers in % of disposable income by group of disposable income.

(a) Ratio T10/B90



(b) Ratio T10/B50

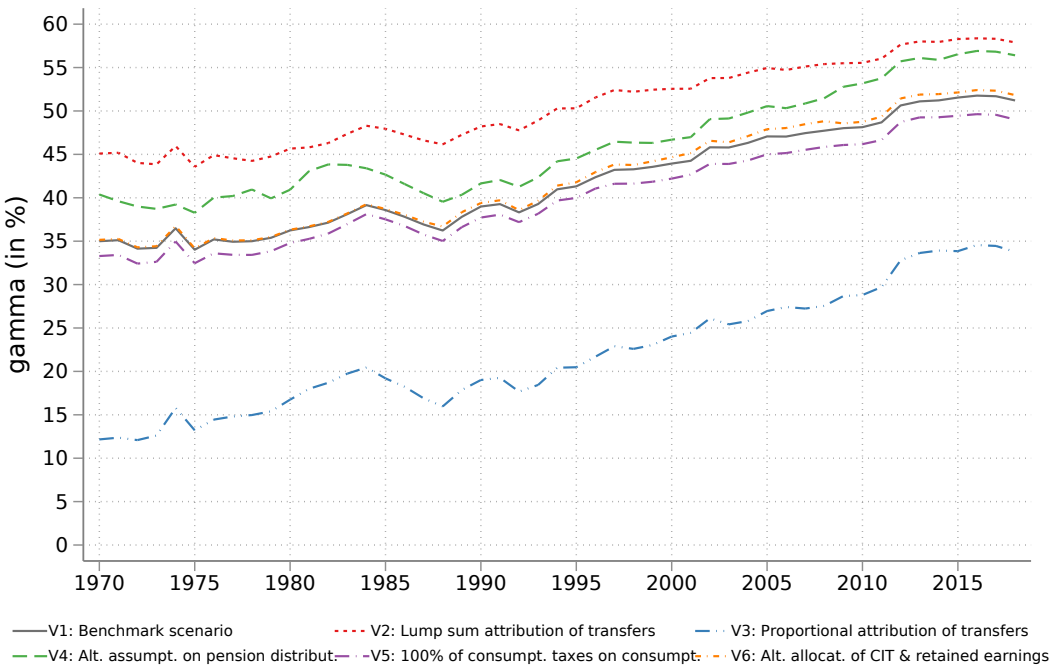


Figure E5 – Variants of Redistribution Measures

NOTES: Extent of redistribution (γ) by variant of pretax and post-tax income inequality.

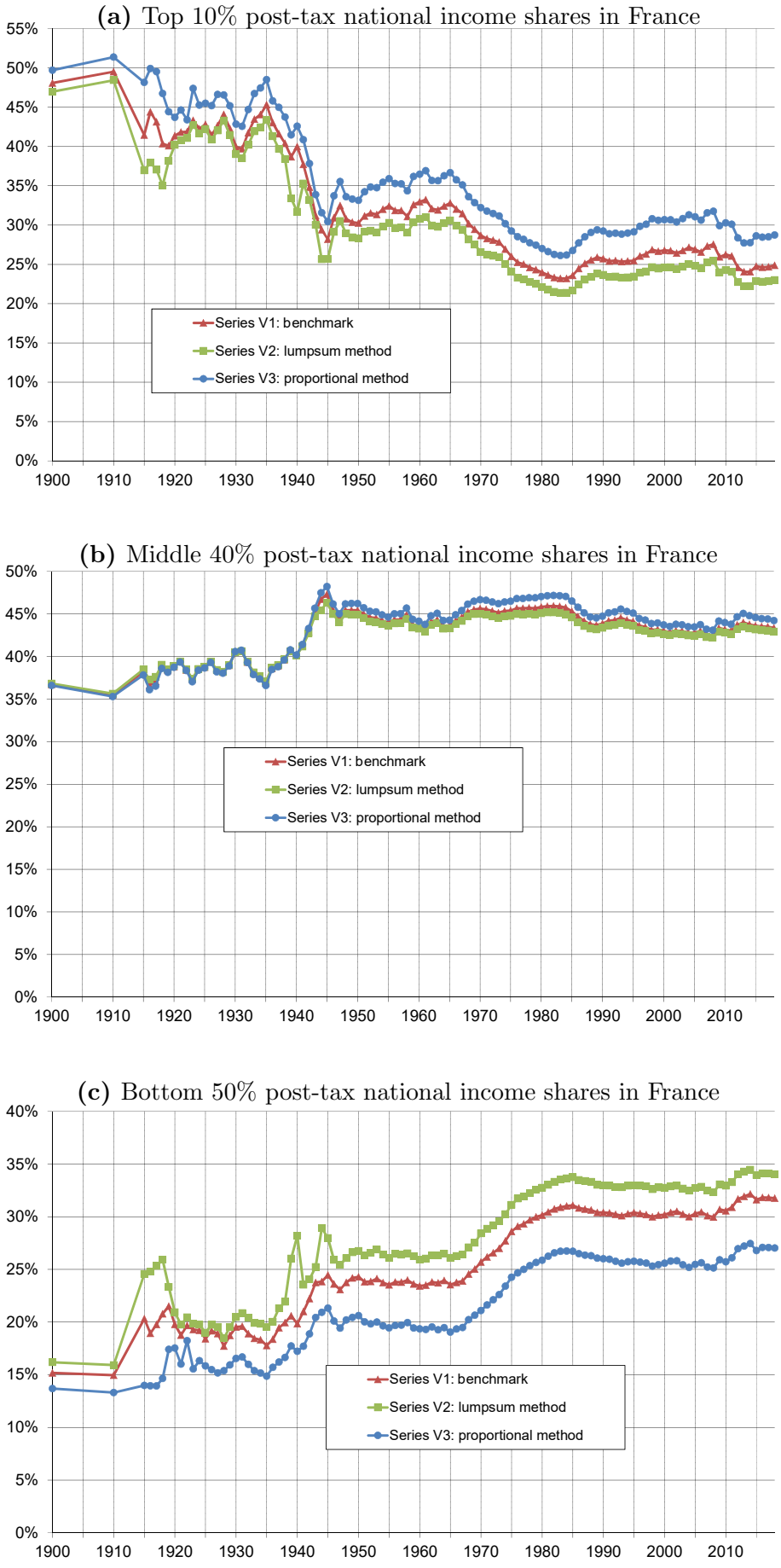
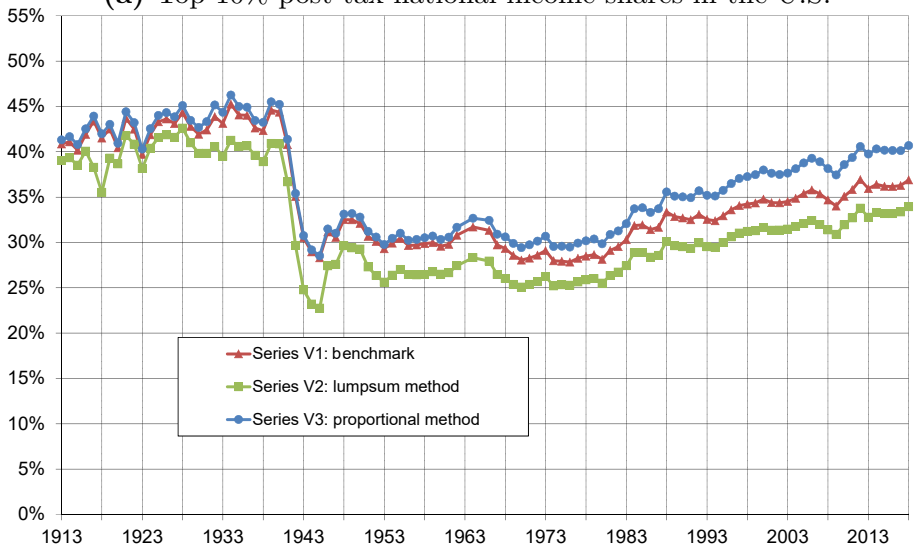


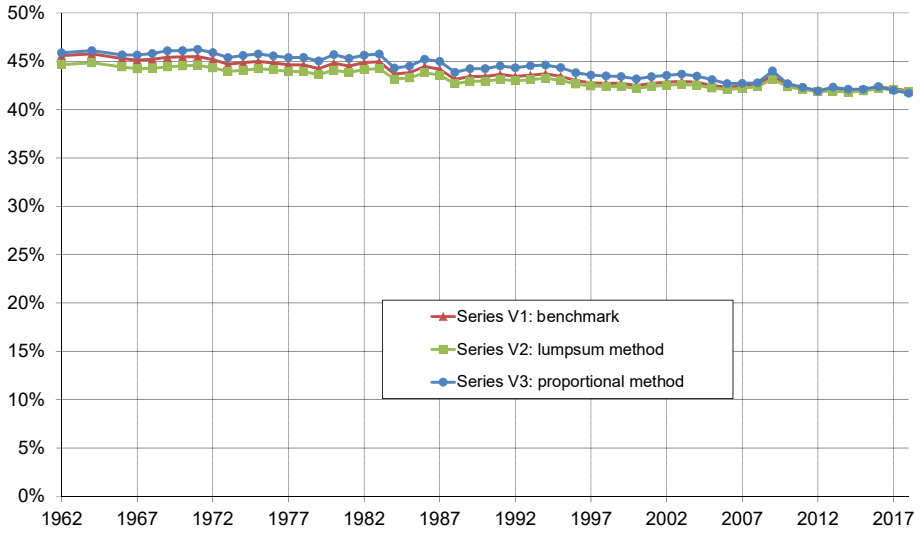
Figure E6 – Robustness checks to the use of alternative concepts of post-tax income

NOTES: Our baseline scenario (V1) assumes i) a lump-sum imputation of health care expenditures and public spending on education to individuals, and ii) a proportional imputation to post-tax disposable income for collective expenditures. In our two variants, we impute all these public spending either on a lump-sum basis (scenario V2) or proportionally to post-tax disposable income (scenario V3).

(a) Top 10% post-tax national income shares in the U.S.



(b) Middle 40% post-tax national income shares in the U.S.



(c) Bottom 50% post-tax national income shares in the U.S.

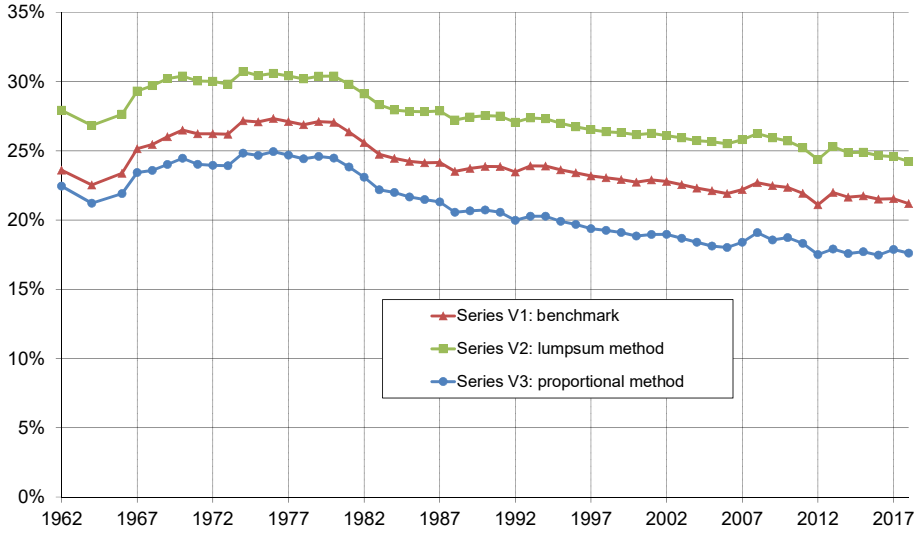
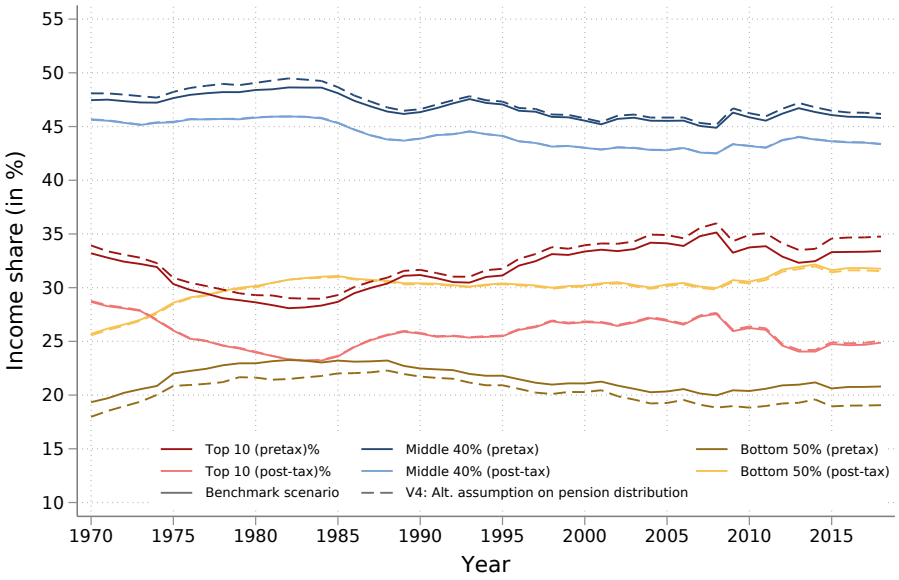


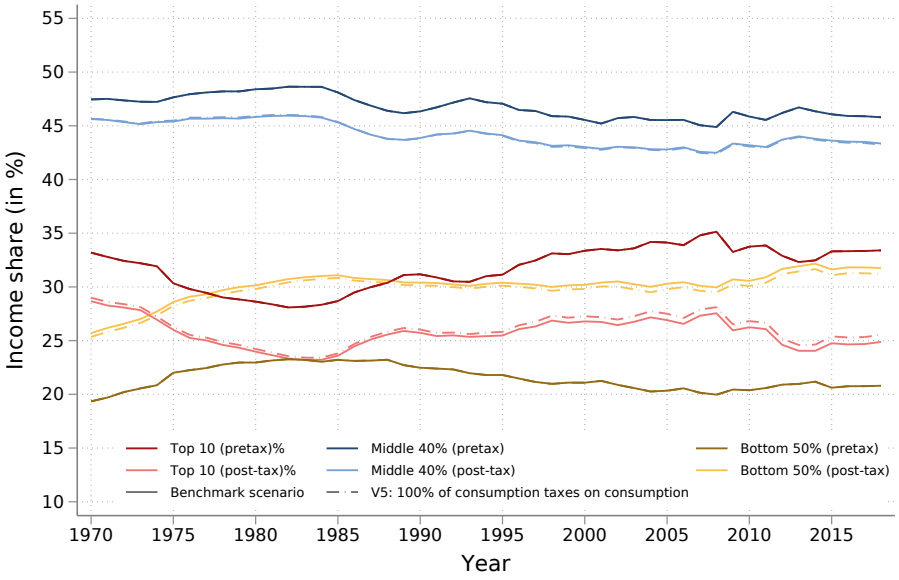
Figure E7 – Robustness checks to the use of alternative concepts of post-tax income for the U.S.

NOTES: See notes Figure E6. For the U.S: authors' computations using the data from Piketty et al. (2018a).

(a) V1 vs. V4



(b) V1 vs. V5



(c) V1 vs. V6

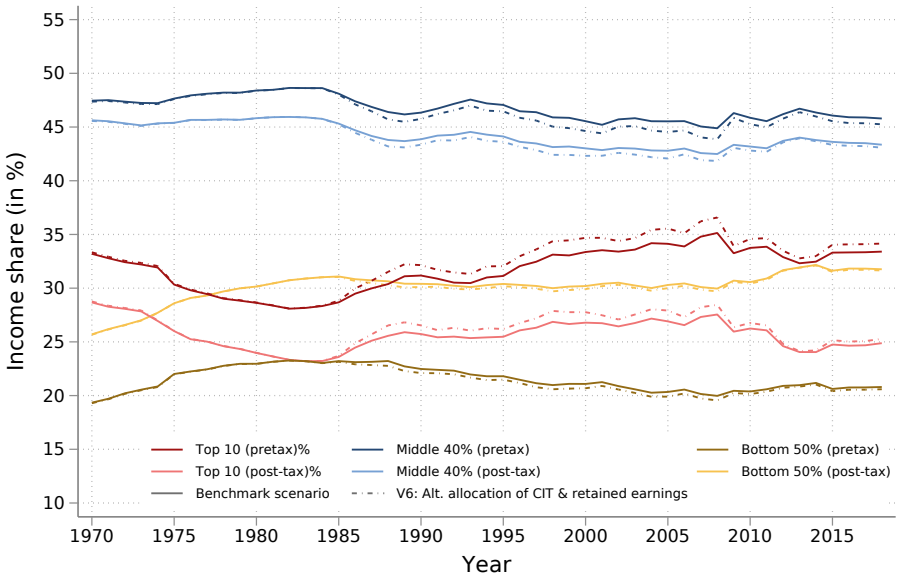


Figure E8 – Pretax vs. Post-Tax Income Inequality

NOTES: Distributions of pretax and post-tax income among equal-split adults (income of married couples divided by two).

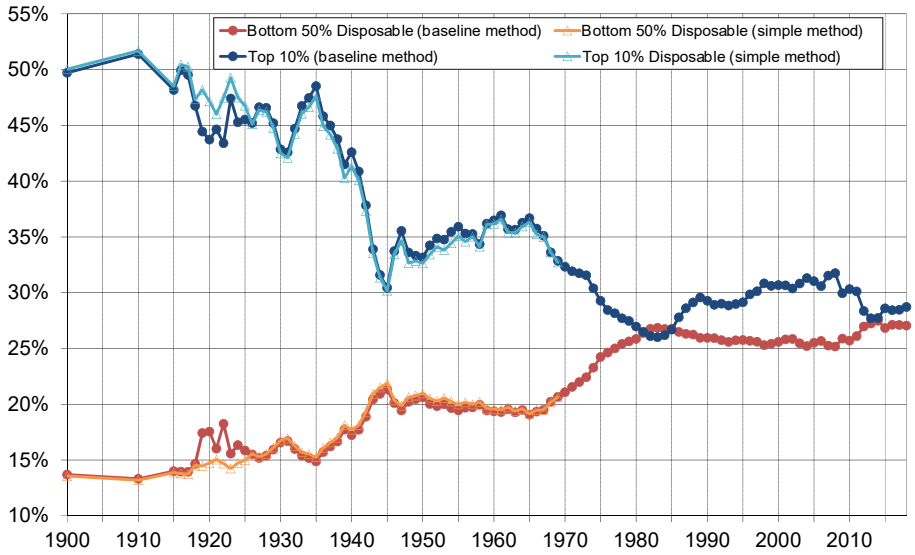


Figure E9 – Robustness checks on disposable income inequality

NOTES: Distributions of disposable income among equal-split adults (income of married couples divided by two).

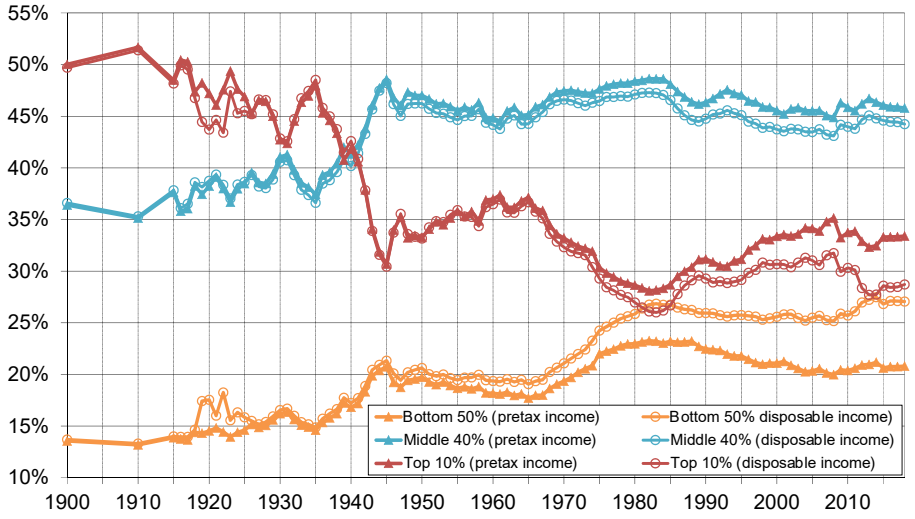


Figure E10 – Pretax vs. disposable income inequality in France

NOTES: Distributions of pretax and disposable income among equal-split adults (income of married couples divided by two).