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Income taxes and redistribution in the early twentieth century[1]

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Abstract

This paper studies the developments in the income taxes of Sweden, the United Kingdom, and the United States during the first half of the 20th century. We present the evolution of marginal and average effective tax rates over the whole income distribution and calculate the corresponding indices of progressivity and redistribution. Our results show that redistribution through income tax increased during the period, but with varying intensity and mechanisms. During World War I this was a joint effect of increases in the amount of revenue collected and progressivity, whereas in World War II revenue increased again but progressivity diminished.

Keywords: Taxation, Redistribution, Progressivity, Income tax, World Wars

JEL codes : H23, H24, N42, N44

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1. Introduction

Income taxes are a central feature of modern Western fiscal systems. They provide a significant share of public income, represent a strong instrument for income redistribution, and form the basis of a "fiscal contract." They became one of the core components of the fiscal toolkit that emerged from the early 20th century, at a time when progressive taxation was increasingly perceived as "fair" and "legitimate" (Scheve and Stasavage, 2016). Despite the changes in political attitudes towards progressive fiscal policy in recent decades (Steinmo, 2003), income taxation still heads up revenue collection in many advanced countries.

In this paper, we present and discuss the operation of personal income taxes in Sweden, the United Kingdom, and the United States during the first half of the 20th century. These three countries have had income taxes in place for a long time: the United Kingdom pioneered the implementation of a permanent tax on income in the mid-nineteenth century; Sweden was one of the early adopters in 1903, and the United States followed right before World War I. Something similar happened in France, a case which we have not estimated ourselves but with which we compare some of our results. While we do not claim that the experience of these four countries is representative of the history of Western income taxes, we choose them for their correspondence with different welfare state regimes (Esping-Andersen, 1990). Sweden has been portrayed by most of the literature as the prototype of the Scandinavian welfare state, with high social spending and low inequality; the two Anglosphere countries belong to the so-called "Liberal" group; and France, in the classic typology, illustrates the Continental welfare state.

During the first half of the 20th century, income taxes underwent deep regulatory changes in the context of war, political mobilization, and economic and administrative modernization. This was the period when income taxes developed some of the main features that characterize modern taxation, such as progressive schemes and, somewhat later, broad tax bases. A growing body of literature has described and analysed some of the major innovations implemented at that time, such as the boost in top marginal tax rates (Scheve and Stasavage, 2016), the expansion to low and middle incomes (Whiting, 1990; Steinmo, 2003), and the evolution of administrative procedures (Daunton, 2002; Mehrotra, 2013). However, our knowledge is still rather limited when it comes to the impact that these changes had on the distribution of the tax burden across social groups. How did they alter the income taxes paid by households at different points of the income distribution? What was the evolution of tax progressivity and redistribution, and how did these differ across countries?

We attempt to answer these questions using the historical tax statistics and the tax regulations in place at that time. We use the method of Blanchet et al. (2017) to disaggregate the grouped income tax statistics, which allows us to work with one million synthetic observations per country–year, representing the income distribution in a similar manner to what modern microdata would do. We then proceed to micro-simulate the tax payments by applying the corresponding family deductions and statutory tax rates (as well as other country-relevant regulations). Our estimates of tax payments and effective rates of taxation tally closely with the original evidence in grouped terms, while also providing much richer distributive information.

The paper shows that redistribution through income tax increased during the first half of the 20th century, but with varying intensity and mechanisms. During World War I, the joint effect of higher levels of progressivity and a larger amount of revenue collected in the United Kingdom and the United States increased the redistributive impact of the tax. By contrast, redistribution during World War II increased due to the expansion of the tax and *despite of* the reduction in the level of progressivity. Unlike what previous studies have suggested (e.g., Scheve and Stasavage, 2016), our results indicate that income tax progressivity diminished during the war (as the tax incorporated more low- and middle-income taxpayers. In the United States, for which we have yearly data from 1917 to 1946, both redistribution and progressivity diminished during the 1920s. The policies implemented in response to the Great Depression made up for part of this retrenchment and prepared the ground for the unprecedented spike in redistribution that took place during World War II. In fact, while the country began with the lowest level of income tax redistribution of the three, it experienced the highest growth rate throughout the period: more than twentyfold from 1917 to 1946.

Income tax in the United Kingdom, on the other hand, was always the most redistributive of the three, and after 1945 it was also the one that remained most progressive. Sweden, by contrast, had a systematically broader tax base than the two Anglosphere countries: it was already collecting income tax revenue from 20% of its population in the early 1910s, and from half in the early 1920s—and even more if we take into account the important local taxation system. This seems consistent with the literature's appreciations of the nexus between low progressivity and the attainment of redistribution via social spending (Lindert, 2004; Prasad and Deng, 2009).

The rest of this paper proceeds as follows. The next section introduces the previous literature on fiscal progressivity and redistribution during the early 20th century, while the third presents a brief overview of the history of income taxes in our countries of interest. The

fourth section discusses the methods and data, and the fifth one presents our results. The final section concludes.

2. Previous literature

Income taxes are among the most important features of modern fiscal systems. They not only account for a high share of public revenues today in many developed countries, but also play a fundamental role in redistribution. While most redistribution since the 1970s has been traceable to social spending, a not-inconsiderable proportion of it can be attributed to the direct effects of income taxes (Jesuit and Mahler, 2017; Guillaud et al., 2020).[4] Indeed, income tax is normally the only tax that makes a significant impact on inequality, as most other progressive taxes are too small to play much of a role. Moreover, they can also influence pre-tax income inequality through their effects on incentives for economic activity (Roine et al., 2009) and tax planning (Rubolino and Waldenström, 2020).

For many authors, the introduction of modern income taxes in the nineteenth and 20th centuries was related to representative government and suffrage extension, as part of a progressive program (Piketty, 2001; Acemoglu and Robinson, 2006; Mehrotra, 2013). But even though income tax came to be an important redistributive instrument in modern times, some have argued that it was not originally conceived as such. According to Mares and Queralt (2015), the introduction of income taxes in the nineteenth and early-20th centuries was often supported by conservative agrarian forces, as it allowed the tax burden to be shifted to the rising industrial sector. Similar insights have been recently provided by Beramendi et al. (2019) and Emmanegger et al. (2019), who emphasize the importance of inter-elite competition and industrialization in the process of implementing modern income taxation. In the same vein, Aidt and Jensen (2009) show evidence that, in Western countries, the extension of the franchise initially had a negative impact on the likelihood of income tax adoption, since those given the vote were potential taxpayers. It was only at higher levels that suffrage exerted a positive influence, when those who gained suffrage were not potential taxpayers due to their low incomes.

Alongside these institutional and structural factors, the early expansion of income taxes was often linked to revenue needs and war mobilization. Rodriguez (1981) held that progressive income taxation in Sweden was introduced and reinforced during both world wars

[4] Guillaud et al. (2020) actually conclude that redistribution by taxes was larger than by transfers in a sample of 22 OECD countries from 1999 to 2016, with the income tax being the only progressive tax in most cases. Their estimations, however, exclude the effect of pensions (which are normally very redistributive in rich countries).

in order to meet the demand for defense spending, similarly to what Witte (1985) posited for the United States. From a different angle, Scheve and Stasavage (2016) argued that increases in income and inheritance taxes were the result of social solidarity, as governments tried to compensate the working classes for their martial efforts by taxing the rich. Morgan and Prasad (2009) also acknowledged the role of World War I in the expansion of income taxes in France and the United States, but qualified this association by looking at patterns of industrialization and the growth of the state: while an advanced industrial economy and a small federal state favored a political coalition of farmers and labor in support of income taxes, it was the opposite situation that steered France towards indirect taxation. A related argument is put forward by Limberg (2022), who contended that banking crises facilitated the adoption of personal income taxes because of both the associated revenue needs and demands for fiscal fairness.

While the account of the history of income taxes is extensive, there is one crucial aspect that remains understudied: we hardly have any quantitative estimations of how tax payments were distributed during the first half of the 20th century. In their seminal book, Scheve and Stasavage (2016) analyse the evolution of income tax progressivity during the World Wars, but focusing mostly on the top statutory tax rates. As we show below, a more comprehensive account of the distribution of income tax payments across the income distribution is essential to grasp the actual redistributive effects of income taxation, and to further advance our understanding about the origins of modern fiscal and welfare states. This paper is dedicated to filling this gap.

Our study is part of a recent trend of revitalisation of the field of historical tax incidence. The empirical literature on the redistributive effects of income taxes, and general tax-and-transfer systems, has focused mostly on the decades after the 1970s, often due to the lack of available data for earlier periods (e.g., Piketty and Saez, 2007; Torregrosa-Hetland, 2015, 2021). One notable exception is Piketty (2001), who estimated the evolution of inequality and the incidence of income taxation on top incomes in France since the early 20th century. The field has received increased attention during the last decade, and some recent contributions within the Distributional National Accounts framework have made attempts to study the whole 20th century. Among them, Piketty et al. (2018) describe the evolution of inequality in the long term in the United States and the redistributive effects of taxes and transfers, while Bozio et al. (2020) do a similar exercise for France. These are general studies on the trends of inequality, which consequently put less of a focus on the income tax and do

not estimate its level of progressivity. We compare our results on top incomes to theirs at the end of the paper and in Appendix 6.

3. The history of income taxes in Sweden, the United Kingdom and the United States

The nineteenth century witnessed the early development of income tax, one of the most important fiscal instruments of the modern era. The first attempts to introduce a tax on earned income took place during the French Revolutionary Wars and the Napoleonic Wars amid the unprecedented mobilization of manpower and economic resources. The Austrian Empire, Belgium, Denmark, France, the Netherlands, Norway, and the United Kingdom all adopted some sort of modern income tax, albeit temporarily; at the end of the military conflicts, each of these countries reverted to their previous fiscal systems. It was not until 1842, under the leadership of the conservative Prime Minister Robert Peel, that a new tax on earned incomes was introduced in the United Kingdom. Despite being designed as a temporary tax, periodic renewals during subsequent decades made it a permanent feature of the modern British tax system (Daunton, 2007). The tax's progressivity was largely confined to the effects of exemption limits and abatements for the low and middle incomes up until 1909, when a complementary "supertax" on very wealthy taxpayers was introduced. During this same year, family deductions for taxpayers with children were also enacted. A couple of years earlier, in 1907, the tax also began to differentiate between so-called earned income (i.e., labour income) and unearned income (i.e., capital income), the latter being subject to higher marginal tax rates (HMSO, 1920).

The Swedish predecessor of modern income tax was implemented in 1903, as the central feature of a major tax reform. The minister of finance defended this new fiscal agenda on the grounds that "there can be no question that future revenue lays in the progressive income tax" (Steinmo, 1993, 64). This first Swedish income tax was only slightly progressive, with rates ranging from 1% to 5%, but it rapidly became an important source of revenue. The preceding system already included some taxes on labour and capital incomes—with a rate generally set at 1%—which were transformed into local revenues by a new reform in 1911. At the same time, the progressivity of the income tax was increased, notably by including an assessment of wealth in the tax base (Stenkula et al., 2014; Henrekson and Stenkula, 2015).

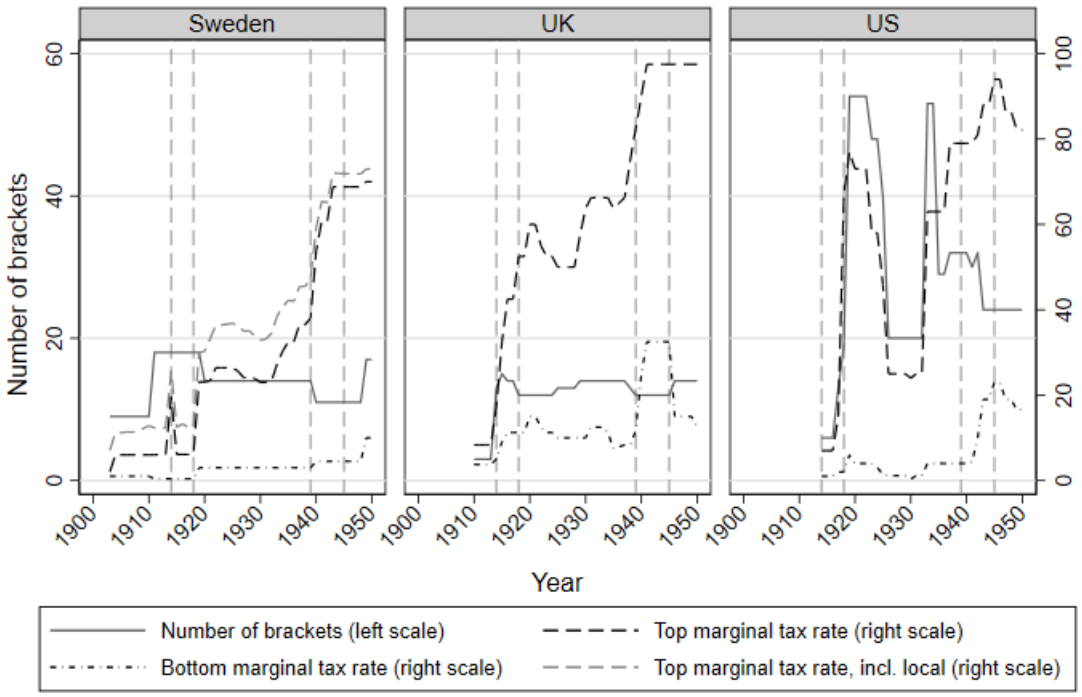
By contrast, the United States had to wait until 1913 to implement a long-lasting income tax, even if the country had flirted with this idea since the outbreak of the War of 1812. A temporary federal income tax came into force in 1861 during the Civil War, followed

by another attempt in 1894 amid a severe economic crisis. The latter came as a result of a quest for a fairer fiscal and social order by western and southern Populists, which eventually influenced the position of the Democratic Party in their favour (Brownlee, 2016). The subsequent Supreme Court ruling of unconstitutionality, though, delayed the enactment of this controversial tax for almost twenty more years. The current federal income tax was finally adopted just before the outbreak of World War I, when support for this measure had grown across the political spectrum and a constitutional amendment legalizing a federal income tax had been ratified by a majority of state legislatures (Brownlee, 2016; Mehrotra, 2013).

The adoption of these first income taxes was not trivial; the year after their enactment, the percentage of direct taxes vis-a-vis central government revenues increased by seven percentage points for the early adopters (Mares and Queralt, 2015). However, they were certainly minor in revenue terms by contemporary standards. At the end of the 19th century most states collected less than 10% of GDP from all their sources of revenue combined (Steinmo, 2003; Goenaga et al., 2018), and top marginal tax rates were also rather limited, not exceeding 10% (Scheve and Stasavage, 2016).

As mentioned earlier, the world wars fundamentally altered the tax systems of most Western countries, with measures including the expansion of the income tax, as well as the rise or implementation of other taxes such as excess profit taxes and estate taxes (Scheve and Stasavage, 2016). As a result, in both the United Kingdom and the United States the share of direct taxes increased significantly during the two conflicts (Daunton, 2002; Broadberry and Howlett, 2005; Rockoff, 2012; Brownlee, 2016). Figure 1 displays the evolution of some features of personal income taxes from ca. 1900 to 1950. The world wars pushed top marginal rates up to unprecedented levels, above 90% in the United Kingdom and the United States in the 1940s. Everywhere, the distance between top and bottom marginal tax rates grew, which signaled increased progressivity. At the same time, particularly during World War I, there was an increase in the number of tax brackets, most notably in the United States.

Figure 1. Marginal tax rates and number of brackets (1900-1950)



Sources: Sweden, Du Rietz et al. (2015); US, *Statistics of Income* (1945), and UK, Scheve and Stasavage (2016) and own calculations from *Reports of the Commissioners of Inland Revenue.*
Notes: Bottom marginal tax rates in the United Kingdom after 1920 reflect the tax rate relief established as a percentage of the standard tax rate. For instance, The Financial Act of 1931 modified the previous relief from five-ninths of the standard rate on the first £250 of taxable income to one-half of the standard rate on the first £175 (which was equivalent to 12.5%). Prior to the 1920 reform, the figure shows the lowest tax rate on earned income (the lowest rate on unearned income was higher).

Even in a non-belligerent country like Sweden, renewed military efforts required substantial state revenues, and income taxes rose significantly throughout the period. Temporary defence taxes were enacted during the world wars and were made permanent in their aftermath. Consequently, the marginal tax rate for low-income earners at the end of World War II had almost tripled from the pre-war levels, while the rates for high-income earners increased more than threefold in the same time span (Du Rietz et al., 2015). Marginal tax rates, however, did not soar as much as in belligerent countries.

It is noteworthy that while top marginal rates escalated in the United States during the wars, some deductions were also introduced. Several of the many deductions to the US income tax have been said to have especially benefitted the rich: this was the case of the deduction for charitable donations created in 1917 (Lindsey, 2003; Thorndike, 2013), the

exemption of interest income from Liberty Bonds (Kang and Rockoff, 2015), and the reduced rates applied to capital gains. Deductions through these mechanisms mitigated the impact of the rise in top marginal tax rates on high incomes, while the combination of very high marginal rates at the top and generous deductions was a vehicle for tax avoidance by the rich.

The Great Depression brought about another wave of fiscal reforms. After a period of retrenchment in the United States during the 1920s, the large deficits generated by Hoover's expansive policy in the aftermath of the 1929 stock market crash led to staggering income tax increases. Top marginal tax rates surged to levels similar to those seen in World War I (above 60%), while the number of tax brackets jumped (albeit temporarily) and bottom tax rates underwent a smaller increase. These reforms, however, could not fully compensate for the erosion of the tax base caused by the economic crisis, and income tax revenue as a share of total public revenue fell during the early 1930s (Brownlee, 2016; see also Figure 3 below). Top marginal tax rates were further increased in 1935 as part of Roosevelt's comprehensive tax reform, which left the top income tax rate above the levels reached during World War I. Despite the political tensions that these reforms precipitated, marginal tax rates did not recede before the outbreak of World War II.

The Great Depression also left an imprint on British fiscal policy. The Labour government increased top tax rates during three consecutive years, from 1929 to 1931. At the same time, the rise in the standard rate and a significant reduction in family deductions increased the tax burden on middle incomes (Daunton, 2002). This fiscal policy was stalled and partially reversed by the National Government, established in 1931, as part of a package of measures aimed at reducing fiscal pressure on middle incomes (e.g., cutting the bottom rates, as shown in Figure 1). Nevertheless, top marginal tax rates remained at very high levels until World War II.

In Sweden, the number of brackets was left unchanged during the 1930s, and so was the bottom marginal tax rate. Marginal rates at the top, however, escalated quite markedly. This was due to the introduction of an extra income tax in 1932 for incomes above 6,000 krs, as well as a general increase in tax rates in the middle of the decade. Standard income tax rates were also raised following the Great Depression by setting a higher multiplier, which the Parliament had the power to do annually in response to revenue needs (Du Rietz et al., 2015).

Exemption limits were also subject to profound changes during the first half of the 20th century, when they were reduced in the three countries amid wartime finance regulations: in the United States, the personal exemption for single persons stood at $3,000 in

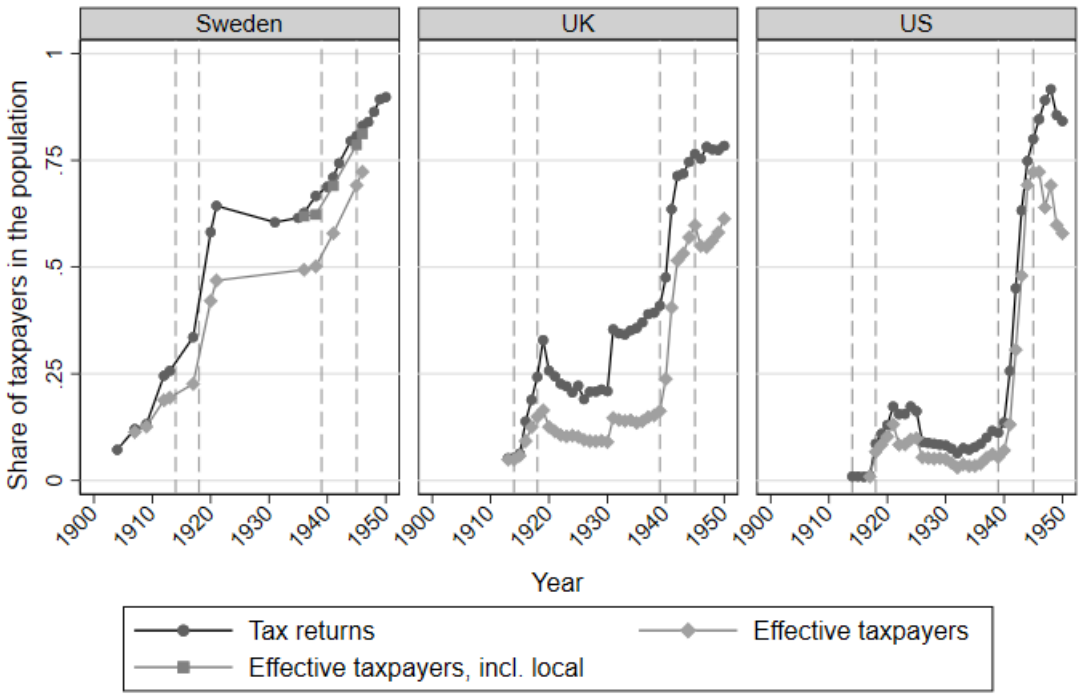
1914, and dropped to $1,000 in 1918.[5] In Sweden the threshold, which had been 1,000kr since 1904, was reduced to 800kr in 1912, while in the United Kingdom it went from £160 to £130 in 1915.[6] Similarly, during World War II the exemption for singles in the United States went from $1,000 in 1939 to $500 in 1943, while the threshold was reduced in the United Kingdom from £125 in 1939 to £110 in 1941 (in Sweden, by contrast, it was kept at 600kr). These reductions in the legislation of income taxes were reinforced by the effects of war inflation, resulting in much more intense decreases in the real value of the thresholds which were, in all countries, below the average per capita GDP by 1946 (The authors, 2022 forthcoming).

Because of this, the share of taxpayers in the population increased significantly during or in immediately after the world wars in our three countries (see Figure 2). Millions of citizens started paying income tax during the wars—sometimes even if their purchasing power had not increased accordingly (The authors, 2022 forthcoming). The number of tax returns in the United States soared from 358,000 in 1914 to 7.3 million in 1921, while it went from 742,000 in 1913 to over 2 million in 1921 in Sweden, and from 1.2 to 5.5 million in the United Kingdom during the same period. Although the 1920s was a period of retrenchment, particularly in the Anglosphere countries, the number of taxpayers did not return to pre-war levels. In the United Kingdom, the Great Depression ushered in a new expansion in the number of taxpayers through the aforementioned reduction in family deductions.

Even though the erosion of the exemption limits was less pronounced during World War II, the increase in the number of taxpayers was even more dramatic: almost 40 million households started paying income tax in the United States at some point between 1939 and 1945, and more than 10 million did so in the United Kingdom. As Steinmo put it, what was once a "class tax" had been transformed in a few years into a "mass tax" (Steinmo, 2003). The Anglosphere countries passed the threshold of 50% of their population during World War II, while in Sweden this milestone had already been reached in the 1920s; in the three countries, over 75% of the population was filing income tax returns by 1950.

[5] The deduction for spouses was also reduced during both world wars.
[6] In the United Kingdom this tax threshold (obligation to make a return) did not correspond to exempted income, but most of the income below the threshold was in fact exempted through personal deductions.

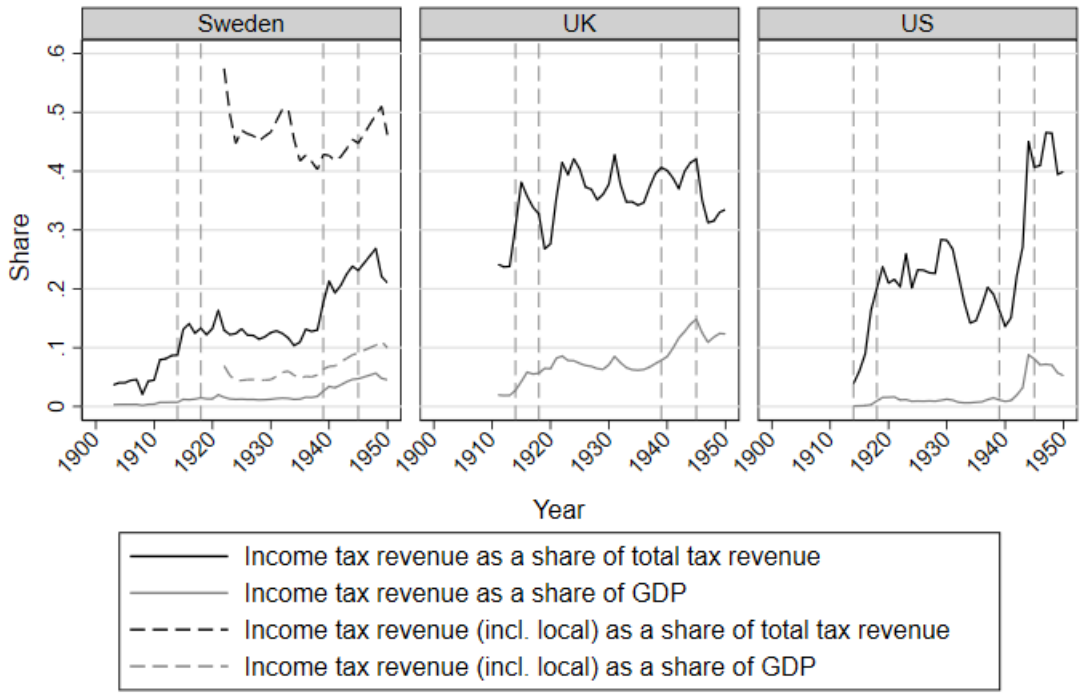
Figure 2. Share of tax returns and taxpayers in the population (1900–1950)



Sources: Sweden, World Wealth and Income Database, except for 1909 (Statistics Sweden, 1918), 1938 and 1942 (Quensel, 1944). US, *Statistics of Income* (1945). UK, *Reports of the Commissioners...* Total population (tax units) from World Wealth and Income Database.
Notes: effective taxpayers are defined as tax returns with positive tax due. In Sweden, the sources do not provide a series of effective taxpayers: the values shown are derived from our calculations. The series of total number of tax units from the World Wealth and Income Database are defined as adult population – married women, since joint filing was the norm in this period. In our further simulations for the US, we adjust for the number of married women who filed a separate return (see The authors, 2022), but we show here the original series for consistency between countries.

Because of all these changes, income tax revenue as a share of GDP (Figure 3, grey line) and as a share of total public revenue (dark line in Figure 3) increased substantially throughout the period, particularly during World War II. As has already been described elsewhere (e.g., Peacock and Wiseman, 1961; Rasler and Thompson, 1985; Sabaté, 2016), public revenues did not return to pre-war levels in the aftermath of the two conflicts. The evolution of the income tax followed a similar pattern: even if progressive taxation was soon attenuated in the postwar period, wartime reforms had expanded the scale and scope of the income tax irreversibly.

Figure 3. Income tax as a share of GDP and total tax revenue (1900–1950)



Sources: GDP from Williamson (2022) (UK), Johnston and Williamson (2022) (US), and Schön and Krantz (2015) (Sweden). Income tax revenue from Office of Management and budget, Historical tables (US), *Reports of the Commissioners…* (UK), *Taxeringen*…, Statistical Yearbooks and *Skattetaxeringarna* (Sweden). In Sweden, the series including the local tax has been estimated for this article. Total tax revenue from Office of Management and budget and Historical tables (US). Income tax revenue as a share of total central government revenue from Thomas and Dimsdale (2017) (UK). The Swedish total tax revenue data has been kindly provided by Magnus Henrekson and Mikael Stenkula.

Figure 3 also shows that a very sizable local income tax system existed in Sweden. When considering its revenue as well as that of the central tax, Sweden appears to be the country raising the highest share of total tax revenue through income tax, with values between 40 and 50% for most of the period shown. We will return to Swedish local income tax in Section 5.3.

4. Methods and data

This section describes the data and methods used to estimate the distribution of tax payments across different income levels in Sweden, the United Kingdom, and the United States over the

first half of the 20th century.[7] Departing from original tax statistics and the official regulations, we micro-simulate the tax dues paid by taxpayers at different points of the income distribution. With this information we estimate their effective tax rates and the corresponding indices of progressivity and redistribution.

First, we use the original tax statistics compiled by tax administrations and statistical agencies to gather information on the distributions of income, tax returns, and (when available) tax due. The most complete series exists for the United States, in which the data have been presented yearly since 1914 (although some information is not available for the years before 1917).[8] In Sweden and the United Kingdom data availability is more limited. In Sweden we are able to collect information for twelve years between 1907 and 1946, whereas in the United Kingdom we use the information compiled by the Commissioners of the Inland Revenue for 1911/12, 1919/20, 1938/39 and 1949/50.[9]

We face two difficulties when using these original tax statistics. On the one hand, the data are limited to tax units that filed income tax returns, so there is a lack of information on the number of people exempted and their income.[10] To fill this gap, we gathered additional data on total income and total tax units from various studies in the literature on top incomes (Piketty and Saez, 2003; Atkinson, 2007; Roine and Waldenström, 2008). The number and income of tax units who did not file a return was estimated as a residual.[11]

On the other hand, the aforementioned distributions of income are grouped by income levels that change across countries and over the years. Thus, to make calculations comparable and to illustrate the distribution of tax rates over the whole population, we need to disaggregate and create a synthetic sample of taxpayers from which we can later select the quantiles of interest. To do so, we follow the recent method and software developed by

[7] A more detailed account, with country-specific sources, adjustments and calculations, can be found in our methodological notes (The authors, 2022).

[8] Our account and the data we use for the United States only correspond to the federal income tax. Many states introduced additional personal income taxes during the twentieth century, and most did so prior to 1940. Two states actually had income taxes *before* the enactment of the federal tax: Wisconsin since 1911 and Mississippi since 1912 (Dincecco and Troiano, 2015; Penniman, 1980). We cannot, however, include these state taxes in our analysis because it would make the calculations too complex, given that each state had its own rules (tax base definition, allowances, rates, etc.).

[9] The data for the United Kingdom come from several Reports of the Commissioners of Inland Revenue for all benchmarks but 1911/12, for which we use the estimates provided by Scott and Walker (2020). There is also information available for 1937/38, when the Commissioners of Inland Revenue conducted a special investigation (recently complemented by Scott and Walker, 2020). However, we use the 1938/39 benchmark (which builds on the 1937/38 investigation) because the original distribution of income covers a larger share of tax units (see The authors, 2022).

[10] Tax units are defined as individuals or families that are considered one unit for the purpose of income tax, including those with incomes below the exemption limits.

[11] Note that the residual might also include income not reported by those who filed returns and it is therefore only an approximation of the revenues of the exempted population.

Blanchet et al. (2017), which disaggregates data from grouped statistics, such as cumulative income shares, and has been devised precisely for tax data. The procedure generates a synthetic sample consistent in mean and distribution with the original grouped information inputted (cumulative share of tax returns and total income for each income bracket, as well as the total average income), using the properties of the Pareto coefficients. The resulting samples contain 1 million equally weighted observations for each year: a number high enough to capture the variability present in the upper part of the income distribution. These synthetic samples are consistent with the original data in terms of number of units and average incomes in each bracket.[12]

Once the synthetic sample has been generated, we apply the regulations in force to simulate the operation of the tax.[13] Income in the original source follows the legal definition of the tax base, which normally corresponds to gross income (total amount originally received by the tax unit) excluding deductions for the associated costs (for instance, housing repairs). Our first step is to subtract the most important deductions from the tax base to obtain taxable income. Family deductions were the most significant ones in quantitative terms, and they were made for the individual taxpayer, as well as his spouse and children when present.[14] Since these depend on family circumstances, we generate eight taxpayer types within each observation: single people and couples, respectively, with zero, one, two, or three or more children, and we apply the corresponding deduction to their tax base.

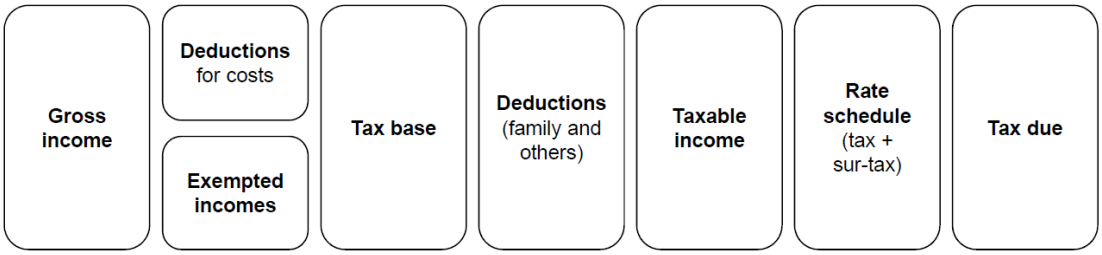
We also include other deductions of particular significance for each country: in the United States we take into account deductions for charitable donations, interest, and other assets; in the United Kingdom we factor in, among other categories, the so-called "earned income allowance", which allowed taxpayers to deduct a percentage of their earned income (amounting to about 20-30% of personal and family deductions during the 1930s and 1940s); finally, in Sweden we allow for the different family deductions for the cost of living (*ortsavdrag*, introduced in the 1920 tax reform), using the distribution of taxpayers into five different city groups according to their price levels.[15]

Once we have estimated the taxable income for each taxpayer type, we apply the statutory tax rates and obtain the corresponding tax due. After this, we calculate the average

[12] See comparative figures in The authors (2022).
[13] To our knowledge, this has been done very few times in previous studies. One notable precedent is Piketty (2001), who made similar calculations for France (with which we compare our results on top incomes in the last section).
[14] Indeed, income taxes were generally a family matter until well into the second half of the twentieth century (see more details on joint filing in The authors, 2022).
[15] Deductions in the United States are not simulated at the tax unit level but imputed using a regression model with the data grouped by income levels from Geloso et al. (2018). See The authors (2022).

tax due for each observation in our synthetic sample (one million, each representing the average income for its quantile) as a weighted average of the different family types (recall that there were eight taxpayer types, each representing a different family structure).[16] Figure 4 summarizes this procedure.

Figure 4. Estimating income tax payments



Source: authors' elaboration.

Finally, we find the effective income tax rate for each observation by dividing the tax due by its tax base. Even if we perform all calculations with the million observations, in the results section we focus on average effective tax rates by percentiles and permilles of the population. Percentiles are defined based on the most comprehensive definition of income that we can arrive at. Our average effective tax rates are calculated as simple averages; when calculated in grouped form (i.e., total tax due from taxpayers in each income bracket, divided by the total income of the same group), they are largely consistent with those provided or obtainable from the tax statistics (see The authors, 2022). The main differences are found within the upper part of the income distribution, where the groups in the original statistics are defined very narrowly (sometimes accounting for merely hundreds or even dozens of taxpayers). This tiny size renders the estimates less precise. The comparison, overall, suggests that our estimations are a reasonable depiction of the operation of the tax.

Effective tax rates are a good illustration of the distributive impacts of an income tax, as they show the percentage of income that was paid in taxes by families in different income levels. When effective tax rates increase in income, the tax is progressive. However, progressivity might be very strong at some segments of the income distribution and very weak, or non-existent, at others. Moreover, they tell us little about how redistributive the tax

[16] The information on the distribution by family types comes from the tax statistics themselves. In the case of Sweden, we also use the Census of 1945. The same family distributions (weights) are used over several years, since there is no yearly information available and the distribution of family types does not undergo abrupt changes; Piketty (2001) followed the same approach for France in 1915-44.

actually is. Thus, to obtain a more concise picture of the distributive impact of the tax, we also estimate synthetic indicators of progressivity and redistribution. In order to be consistent with modern practice using present-day income tax data, we follow the general framework in public economics, which is based on concentration curves (Kakwani, 1977; Lambert, 2001; Boadway and Keen, 2000). Progressivity and redistribution are two closely related concepts, but they are not interchangeable. A tax is *progressive* if the effective tax rates are increasing in income, which can also be expressed as tax payments being more concentrated than income. *Redistribution* refers to the effected change in inequality, which depends on progressivity but also on the size of taxation (e.g., a very concentrated tax might not reduce inequality much if it raises limited revenue). In this framework, we measure progressivity using the Kakwani index, which is obtained as the difference between the concentration of tax payments C_T and the Gini index of gross incomes G_Y:

$$K = C_T - G_Y \quad (1)$$

The index equals 0 when the tax is proportional (i.e., where tax payments are concentrated to the same extent as incomes), and obtains positive values when the tax is progressive.[17]

Redistribution is measured with the Reynolds-Smolensky index, which corresponds to the difference between the Gini indices of gross and net income (i.e., before and after tax):

$$RS = G_Y - G_{Y-T} \quad (2)$$

A tax is redistributive if RS > 0. For these calculations, we use the "progres" stata module developed by Peichl and van Kerm (2007).

The relationship between the two indices is given by the expression:

$$RS = [\frac{AETR}{(1-AETR)} K] - RR \quad (3)$$

where RR is the effect of re-ranking between tax units. Income tax redistribution is positively affected by progressivity (K) and the average effective rate on total income (AETR = total tax revenue / total tax base). The intuition behind this equation is straightforward. On the one hand, higher levels of progressivity reflect a skewed tax burden falling on the shoulders of upper income groups, which translates into a levelling of the income distribution. On the other hand, the average effective tax rate reflects the amount of revenue collected by the income tax: the higher the amount extracted from the economy, the greater the impact the tax will

[17] Because it takes the concentration of gross income into account, this measure of progressivity varies with inequality. A similarly concentrated tax (across the population) would be more concentrated (across income) if combined with a less unequal distribution of the tax base.

have on the distribution of income. All in all, redistribution might increase as a result of higher levels of progressivity, higher average effective tax rates, or both. We could even imagine a situation in which progressivity decreases and redistribution increases (we would just need the average effective tax rates to be on the rise enough so as to offset the first effect), or a parallel case in which redistribution comes with shrinking revenue collection (as long as progressivity increases). In the following sections, we will discuss not just the variation in total redistribution during the period, but also the relative importance of progressivity and amount of revenue in understanding its historical evolution.

5. Results

This section displays the results of our micro-simulations. We first show the effective tax rates by income levels, and second the indices of progressivity and redistribution. In both cases, detailed annual analysis of the US data follows the general three-country comparison. Finally, Section 5.3 provides a robustness check on the inclusion of the Swedish local income tax.

5.1. Effective tax rates

Figure 5 depicts the estimated effective tax rates by income percentile, focusing on benchmark years before and after both world wars.[18] These rates show the percentage of income paid by tax units at different levels of income, in a comparable manner for the three countries. The results portray the general process of tax expansion during the two wars, with increases in the top effective tax rates and the incorporation of new taxpayers at the bottom of the income distribution.

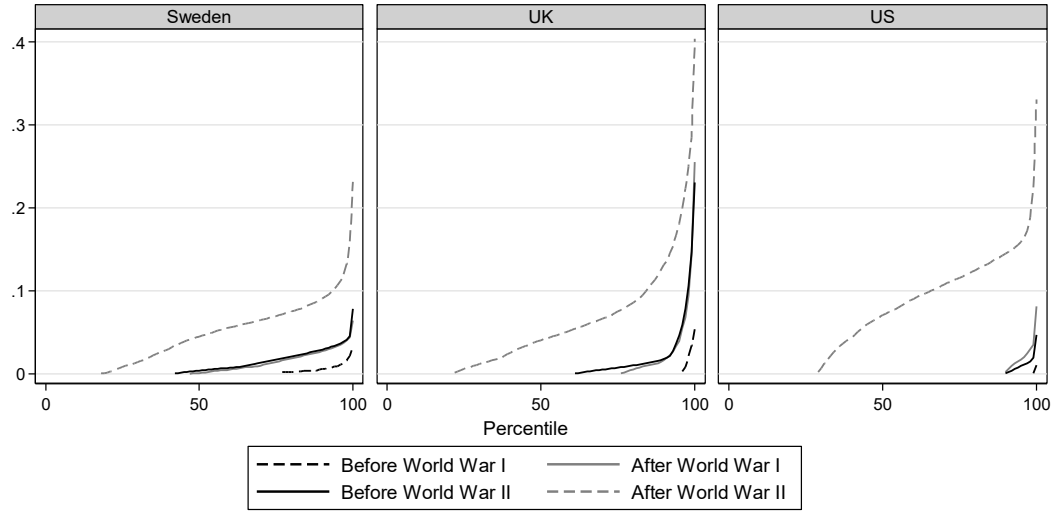
Indeed, effective tax rates were much higher at the end of the period than at the outset, particularly at the top of the income distribution. For example, in the United States the top effective tax rate increased from 1% in 1917 to 8.1% in 1919. The rate went down to 4.6% by 1939, but jumped again to 33% during World War II. A similar picture emerges in the United Kingdom, which was the country with the highest taxation of top incomes (reaching 40.3% for the top 1% at the end of the period).[19] Analogous trends are found in Sweden, albeit at lower levels: top effective tax rates reached 6.4% in 1921 and 23.2% in 1946. This was the

[18] In Appendix 1 we present the evolution of average marginal tax rates. These are systematically above the effective tax rates for two reasons: one, a mechanic effect (marginal tax rates are only applied to the last portion of income), and second, the operation of deductions (which create a wedge between the tax base and taxable income, to which marginal tax rates are applied). Interestingly, the differences between marginal and effective tax rates grew over time, as more complex tax structures were put in place.

[19] Our post-WWII estimate is more distant from the end of the war than in the other countries, which implies that it picks up the reduction of tax rates and other reforms implemented during the late 1940s.

lowest rate of the three countries, but it is affected by the fact that local taxes are not taken into account (see Section 5.3). By the mid-20th century, differences in terms of effective tax rates between the three countries were mostly found at the top.

Figure 5. Average effective tax rates by percentile of the income distribution



Source: own calculations with data from *Statistics of Income for 1945* (US)*, Taxeringen till inkomst…* and *Skattetaxeringarna* (Sweden); and Scott and Walker (2020) and *Reports of the Commissioners…* (UK).

Notes: "Before World War I" corresponds to 1912 in Sweden, 1911 in the UK, and 1917 in the US, and the "After World War I" to 1921, 1919 and 1919 respectively. Regarding World War II, the years used are 1938 in the UK and 1939 in the US; for after the war, 1946 in Sweden and the US, and 1949 in the UK. The choice is always based on data availability. Effective tax rates varied within each percentile and, in fact, in the lowest percentiles with a positive average effective tax rate many tax units were completely exempted. For instance, in Sweden after World War I (grey line in the leftmost box) the 52nd percentile was the lowest in which tax was paid (with an average effective tax rate of 0.006%). But at this level of income, only some single individuals without children were paying the tax.

All three countries also widened the tax base during the period by incorporating middle- and then low-income taxpayers into the tax scheme. In this respect, the contrast between the two sides of the Atlantic is very clear. In the United States the income tax remained largely restricted to the top decile of the income distribution until just before World War II (1939). In Sweden and the United Kingdom, on the other hand, the tax base expanded more dramatically

during World War I and the interwar period. In fact, the United States appears to be the only case in which the tax base did not increase during the interwar period and where tax rates decreased across the board. However, despite these disparities at the outset and during the interwar period, in all countries only the poorest fifth of the population did not pay income tax by the late 1940s; there was an unprecedented widening of the tax base in the United States during World War II.

Table 1. Tax base, tax due, and post-tax income in Sweden

Percentile	Tax base		Tax due		Post-tax income	
	$	%	$	%	$	%
Pre-WWI (1913)						
77	237.4	1.2	0.5	0.2	236.9	1.2
90	321.9	1.6	1.9	0.8	320.0	1.6
95	434.3	2.2	3.9	1.6	430.3	2.2
100	3831.6	19.4	171.0	69.3	3660.6	18.8
Post-WWI (1921)						
50	261.1	0.5	0.2	0.0	260.9	0.6
75	566.5	1.2	7.9	0.5	558.6	1.2
90	930.4	1.9	25.1	1.6	905.3	1.9
95	1229.4	2.5	41.0	2.6	1188.4	2.5
100	8356.1	17.1	790.9	50.6	7565.2	16.0
Pre-WWII (1938)						
50	270.4	0.6	1.0	0.1	269.4	0.6
75	558.3	1.2	9.4	0.6	549.0	1.2
90	937.4	2.0	27.2	1.7	910.2	2.0
95	1250.5	2.6	43.6	2.8	1207.0	2.6
100	6449.0	13.6	727.6	46.7	5766.5	12.5
Post-WWII (1946)						
25	282.0	0.3	2.2	0.0	280.0	0.3
50	688.1	0.7	30.8	0.3	657.3	0.8
75	1188.4	1.3	82.6	1.0	1105.8	1.3
90	1783.5	1.9	161.4	1.8	1622.0	1.9
95	2351.1	2.5	250.4	2.8	2100.7	2.5
100	9338.6	10.0	2553.7	29.0	6784.9	8.0

Source: own calculations using data from *Taxeringen till inkomst…* and *Skattetaxeringarna*. Dollar-krona exchange rates from Bohlin (2010).

Notes: The columns "$" show the average income and tax due in each percentile in current US dollars. The columns "%" show the percentage of each percentile over the total amount. The column "tax base" shows pre-tax income comparable to that of the other countries, and not the legal tax base, which in most of the period included wealth imputations and excluded local income taxes paid. The column "post-tax income" shows tax base minus tax due.

Tables 1 to 3 translate the previous tax rates into actual monetary units by showing the average pre-tax income, income tax due, and post-tax income for selected percentiles in each country. In line with the previous discussion, the United Kingdom after World War II shows the biggest difference between tax base and post-tax income, as the average taxpayer in the top percentile saw their tax base of £3,833 (equivalent to $14,144, as shown in Table 3) decline to £1,977 ($7,294) through the operation of the income tax. This was higher, both in absolute and in relative terms, than the reduction in income in any of the percentiles shown below. As a result, the British income tax in 1949 reduced the share of income in the hands of the top 1% from 11.4% in terms of tax base to 6.8% in post-tax income. The same pattern can be observed in the other two countries, albeit mitigated by less progressive schemes. In Sweden, for instance, the average taxpayer in the top percentile retained more than 73% of their pre-tax income (compared to 52% in the United Kingdom and 59% in the United States).

Table 2. Tax base, tax due, and post-tax income in the United Kingdom

Percentile	Tax base		Tax due		Post-tax income	
	$	%	$	%	$	%
Pre-WWI (1911)						
96	831.8	2.1	2.0	0.2	829.9	2.1
100	11787.0	29.4	742.0	86.4	11044.9	28.2
Post-WWI (1919)						
76	617.5	0.9	0.0	0.0	617.5	1.0
90	852.6	1.2	14.0	0.2	838.6	1.3
95	1194.2	1.7	47.4	0.8	1146.9	1.8
100	13545.1	19.6	4701.3	80.9	8843.8	14.0
Pre-WWII (1938)						
75	787.3	0.9	5.6	0.1	781.7	1.0
90	1245.3	1.5	21.5	0.3	1223.8	1.6
95	1801.3	2.1	83.2	1.3	1718.1	2.2
100	14196.6	16.8	4618.1	73.2	9578.4	12.2
Post-WWII (1949)						
25	553.7	0.4	3.1	0.0	550.6	0.5
50	945.5	0.8	38.1	0.2	907.4	0.8
75	1403.4	1.1	105.1	0.6	1298.3	1.2
90	2027.8	1.6	265.2	1.5	1762.6	1.6
95	2679.8	2.2	485.9	2.8	2193.9	2.1
100	14144.5	11.4	6850.9	39.4	7293.6	6.8

Source: own calculations using data from Scott and Walker (2020) and *Reports of the Commissioners…* Dollar-pound exchange rates from Officer (2022).

Notes: The columns "$" show the average income and tax due in each percentile in current US dollars. The columns "%" show the percentage of each percentile over the total amount. The column "post-tax income" shows tax base minus tax due.

While the income tax in the aftermath of World War II had the biggest impact on the income of the rich, the pre-World War II schemes placed a higher share of the income tax burden on these individuals. Take the US income tax in 1917: the top percentile bore almost 100% of the tax payments. However, the actual impact on their income was relatively mild, particularly in comparison with what was to come: the effective tax rate was around 1%, compared to 33.1% in 1946 (at a time when the income tax had reached the middle incomes, and hence the top percentile assumed only 33% of the tax payments).

Table 3. Tax base, tax due and post-tax income in the United States

Percentile	Tax base		Tax due		Post-tax income	
	$	%	$	%	$	%
WWII (1917)						
95	2776.8	2.9	0.0	0.0	2776.8	3.0
99	3173.9	3.3	0.2	0.0	3173.7	3.4
100	17249.7	18.2	566.8	100	16682.9	17.7
Post-WWI (1919)						
90	1198.1	0.9	2.0	0.1	1196.0	1.0
95	2605.4	2.0	44.0	1.3	2561.4	2.1
100	16911.3	13.2	2896.7	83.8	14014.6	11.3
Pre-WWII (1939)						
90	1034.8	1.0	0.2	0.0	1034.6	1.0
95	2381.4	2.4	22.0	1.2	2359.5	2.4
100	13396	13.2	1639.4	86.2	11756.6	11.8
Post-WWII (1946)						
29	552.7	0.3	0.4	0.0	552.3	0.3
50	1495.9	0.7	105.2	0.3	1390.7	0.8
75	2649.9	1.3	306.6	1.0	2343.3	1.3
90	3758.3	1.8	542.8	1.8	3215.5	1.8
95	4615.8	2.2	732.7	2.4	3883.2	2.2
100	24790.6	12.0	10105.0	33.0	14685.6	8.3

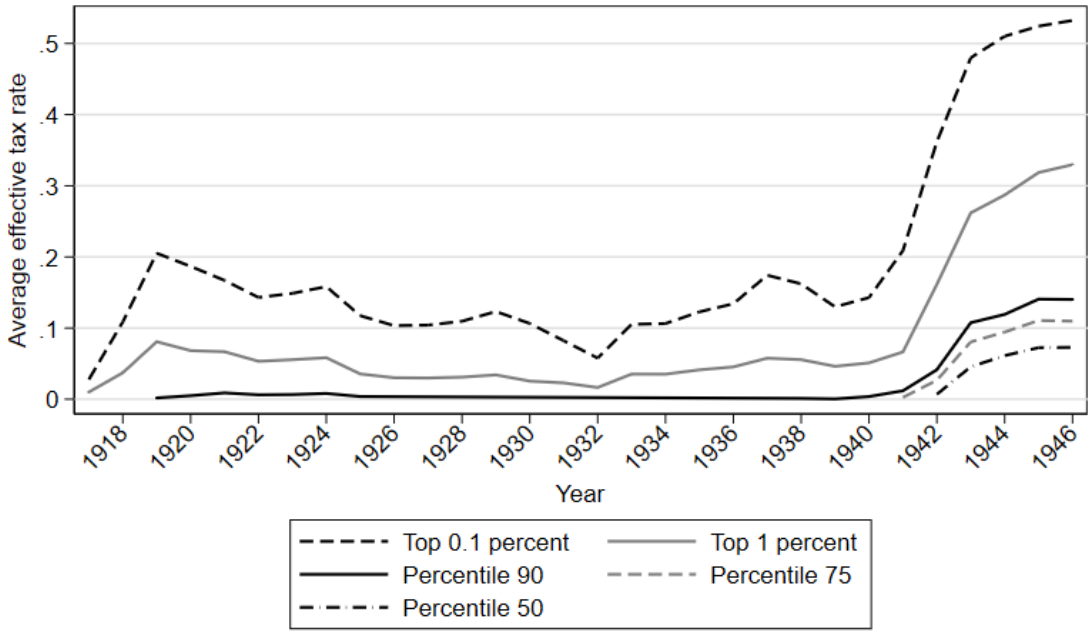
Source: own calculations with data from *Statistics of Income for 1945*.
Notes: same as Table 2.

The United States was the country that restricted the payment of the income tax to higher incomes for the longest period (on the eve of World War II, 86% of income tax was still paid by the very rich). In Sweden, by contrast, the top 1% bore no more than 69% of tax payments already in 1913, a trend that only sharpened in the following decades. The United Kingdom was in the middle of these two extremes: while the top percentile paid 86% of total income tax due in 1911, World War I and the Great Depression brought this figure down to 81% and

73% respectively. The reduction of family deductions implemented in 1931 was particularly relevant to this outcome, since it expanded the tax to middle incomes (even though the share of the tax in the lowest percentiles was very small).

As mentioned above, the US sources provide us with enough information to estimate yearly effective tax rates since 1917. Figure 6 displays the rates for some selected percentiles of the income distribution over the whole period. The effective tax rate at the top 1% of tax units first peaked in 1919 (8.1%), after which it declined for more than a decade. The fiscal reforms implemented by Hoover's and Roosevelt's administrations in response to the Great Depression saw the tax rate rise again, to 5.8%, in 1937, before soaring to over 30% in the mid-1940s. The trajectory of the top permille (top 0.1%) runs parallel to that of the top percentile, but at higher levels (20.5% in 1919, 17.4% in 1937, and 53.2% in 1946).

Figure 6. Average effective tax rates in the United States (1917–46)



Source: own calculations using data from *Statistics of Income for 1945* (data are shown in Appendix 4, Table A4).

Percentile 90, on the other hand, was essentially untouched by the income tax from the Republican reforms of 1924 and 1926 (effective in the tax years 1925 and 1926 in the figure). Treasury secretary Andrew Mellon's 1926 reform increased family deductions and reduced the number of tax brackets (from 40 to 20 in the surtax), bringing the top marginal tax rate down to 25%. It was only during World War II that the increases in taxation at this and lower levels became visible.

5.2. Indices of progressivity and redistribution

The increasing complexity and high tax rates of the first half of the 20th century suggest the income tax had strongly progressive and redistributive effects. However, during the construction of the post-war welfare states, low- and middle-income families were also incorporated into the tax net. What were the final effects on progressivity and redistribution of all these dynamics? Table 4 presents the Kakwani and Reynolds-Smolensky indices for the years before and after the wars, together with the corresponding average effective tax rates for all taxpayers (which give the "size" effect).

World War I was clearly associated with rising levels of progressivity in the United Kingdom and the United States, due to the increase in effective tax rates at the top as well as a relatively modest downward expansion of the tax. As we saw in the previous section, this was particularly true in the latter case, where the income tax barely affected the richest 10% of the population by 1919—consistently, the United States shows the highest levels of progressivity of all the interwar estimates. Conversely, and unlike what others have previously suggested (see, for instance, Scheve and Stasavage, 2016), progressivity decreased during World War II owing to the record-breaking incorporation of low- and middle-income taxpayers in the two Anglosphere countries (especially the United States).[20] Even though top effective tax rates climbed to their historical peaks in the 1940s, the downward extension prevailed in determining the overall effect of the war. As a result, both the United Kingdom and the United States witnessed their highest levels of income tax progressivity right after World War I (with the United States reaching the highest progressivity levels of all our estimate points).

By contrast, progressivity diminished in Sweden between 1913 and 1921 due to the combination of a relatively comprehensive income tax (including almost half of the population within its reach) and lower rates at the top.[21] The situation on the cusp of World War II was strikingly similar to that of 1921, but by 1946 the Swedish income tax had attained the lowest level of progressivity in our benchmarks (and of all our estimates for the three countries, even if it was close to the United States that same year). This is consistent with the findings of previous comparative studies on later periods (Steinmo, 1993; Prasad and Deng, 2009).

[20] Kakwani index values slightly above twenty are quite normal nowadays. In Wagstaff et al. (1999), the values for our countries lay at 8.91 for Sweden (1990), 22.78 for the United Kingdom (1993), and 23.71 for the United States (1987).

[21] It should be noted that additional income taxes enacted during WWI were no longer in effect in 1921, so these estimates do not represent the maximum progressivity reached during the conflict.

Table 4. Progressivity and redistribution indices

	Progressivity	Redistribution	Average effective tax rate	Taxpayers as % of total tax units
Sweden				
Pre-WWI (1913)	39.58	0.50	1.25	19.4
Post-WWI (1921)	32.92	1.09	3.20	46.9
Pre-WWII (1938)	35.29	1.19	3.28	50.2
Post-WWII (1946)	25.23	2.63	9.42	72.3
United Kingdom				
Pre-WWI (1911)	31.40	0.69	2.14	4.7
Post-WWI (1919)	55.67	5.11	8.40	16.4
Pre-WWII (1938)	53.01	4.28	7.47	15.2
Post-WWII (1949)	39.55	6.43	13.99	58.1
United States				
Pre-WWI (1917)	33.30	0.20	0.60	0.9
Post-WWI (1919)	69.37	1.93	2.71	8.4
Pre-WWII (1939)	61.91	1.19	1.88	5.5
Post-WWII (1946)	27.07	4.70	14.81	72.3

Source: authors' calculations.

Notes: the column "Taxpayers as % of total tax units" shows the ratio of effective taxpayers (i.e., with a positive tax due) to total tax units directly provided by the original sources, except in Sweden, and the United Kingdom in 1911, when we estimate it based on our own synthetic series, since the original sources do not provide this information. The ratios based on our own estimates are in most cases largely consistent with those of the original sources.

Redistribution followed a related but distinctive path; it increased during both wars in all three countries, reaching the highest levels at the end of the period. It therefore grew not only grew when progressivity was on the rise (World War I in the United Kingdom and the United States), but also while it stagnated (World War II in the same countries, and the two wartimes in Sweden). As mentioned in Section 4, redistribution depends not just on the progressivity of the tax system, but also on the amount of revenue that it collects. A very progressive system that affects a tiny percentage of the population and leaves most of the total income untouched will barely affect the level of inequality. The decreasing levels of income tax progressivity during World War II in both Anglosphere countries occurred alongside a marked expansion in revenue collection (average effective tax rates increased more than two-fold and nine-fold in the United Kingdom and the United States, respectively). Crucially, the system became *less* progressive, but it still remained progressive overall. Hence, it was the expansion of the tax, rather the growth in progressivity, that drove redistribution during World War II.

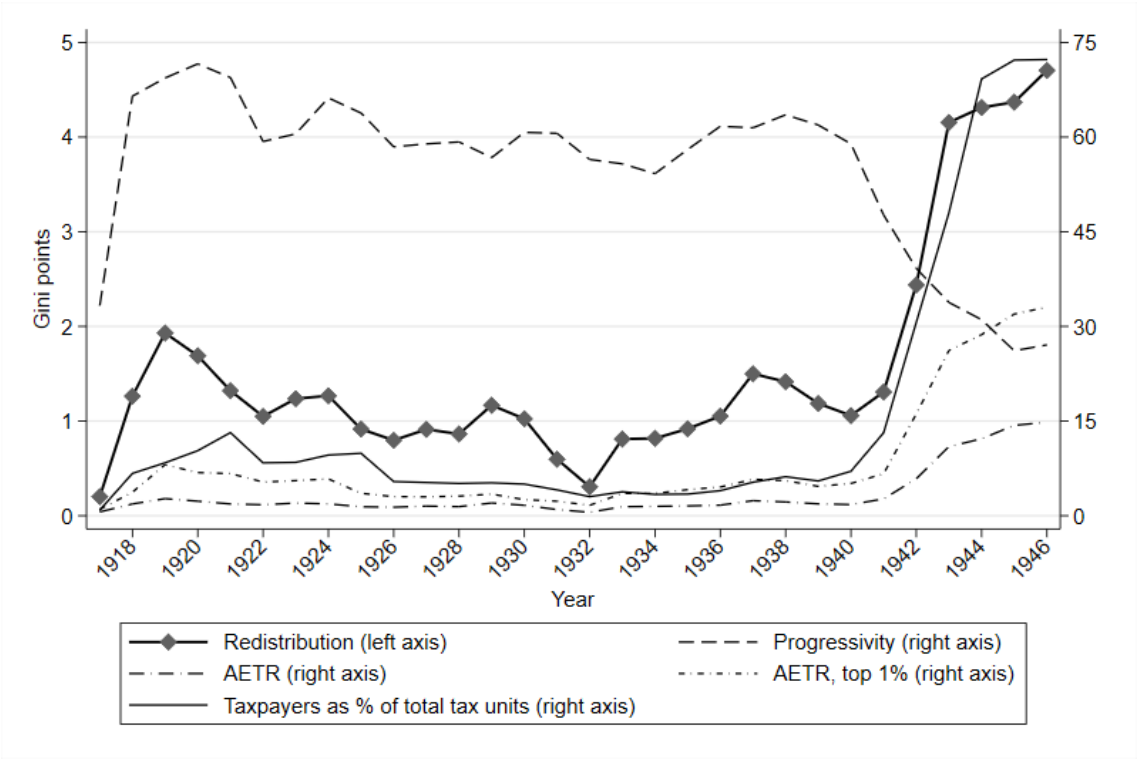
By contrast, the redistributive effect of World War I in the United Kingdom and the United States can be traced back to the joint effect of increases in the progressivity of the tax scheme and the amount of revenue collected. The two countries also witnessed a reduction in both progressivity *and* redistribution during the interwar period, due to regulatory changes aimed at reducing the burden on the rich and the size of the tax. The British system, nevertheless, remained the most redistributive of all throughout the period (and the most progressive in the mid-20th century).[22]

Because the aforementioned indices of redistribution and progressivity, based on the Gini, are subject to some uncertainty during the early years (given the limited information available due to high tax thresholds), we provide two alternative estimations. In Appendix 2 we estimate the same indices under a minimum income cap on low incomes equal to twice the poverty line of $1.90 a day in 1990 (to avoid very low incomes at the bottom of the distribution). Secondly, we have also calculated the percentage reductions in the ratio of incomes between selected income groups as an alternative measure of redistribution (see Appendix 3). The results of these robustness tests show consistent trends with our baseline estimations.

Figure 7 presents the evolution of redistribution through income tax and its components in the United States for the entire period. The very high levels of progressivity introduced during World War I slowly waned during the following fifteen years, only to increase again (at slightly lower levels) due to the tax reforms on the rich implemented in response to the Great Depression. To a large extent, the evolution of progressivity mimics that of tax rates at the top until the outbreak of World War II. During the early 1940s, the unprecedented broadening of the tax to the middle incomes entailed a reduction in progressivity (despite the rise in top tax rates). Redistribution also followed a similar path to that of top tax rates, but in this case throughout the whole period. The reforms of World War II brought redistribution to the highest level of the series: the combination of a progressive tax scheme that encompassed more than half the population led to the reduction of inequality by nearly five Gini points in 1946.

[22] Importantly, the ranking of the countries in terms of redistribution attained through the income tax does not change if we use an index of relative redistribution, in which the reduction in inequality is expressed as a percentage of initial inequality. For the post-WWII benchmark, this relative redistribution is estimated as 15.05% in the United Kingdom, 9.79% in the United States, and 5.33% in Sweden.

Figure 7. Redistribution through the income tax in the United States, 1917-1946



Source: authors' calculations (data are shown in Appendix 4, Tables A4 and A5).
Notes: AETR = average effective tax rate. The estimations for 1917 are subject to particular uncertainty because of the low share of tax units subject to the tax. The line "taxpayers as % of total tax units" uses the series provided by the original sources.

The "mass tax" has undergone many significant reforms in the three countries since the mid-20th century. The 1980s came with a wave of base-broadening, deduction-restricting reforms, and in the late 20th and early 21st century tensions towards dualization increased (that is, the tendency to expand differential treatment to capital gains and capital income). As a result, the levels of redistribution attained after World War II is high in comparison with more recent standards. Around 1990, a study on redistribution through income tax in twelve OECD countries found that this tax reduced inequality by about 1.5 to 4.5 Gini points, with an average of 3.2 (Wagstaff et al., 1999). The values obtained for the countries covered here were 2.06 (Sweden, 1990), 3.52 (United Kingdom, 1993), and 3.76 (United States, 1987): notably below the levels achieved during and after World War II.[23]

[23] In Appendix 6 we compare our average effective tax rates on top incomes in the United States with those of Brownlee (2000) and Piketty et al. (2018). Long-term trends are similar among them, albeit our series are generally above Piketty et al.'s, particularly during World War II.

5.3. Local income taxation in Sweden

So far, for each of the three countries, our estimates have only taken account of the income taxes collected by the central state. This makes the series comparable from an administrative point of view. However, if we are interested in the effects of *modern income taxation*, regardless of the level of government in which they are collected, a more extensive approach might be advised.

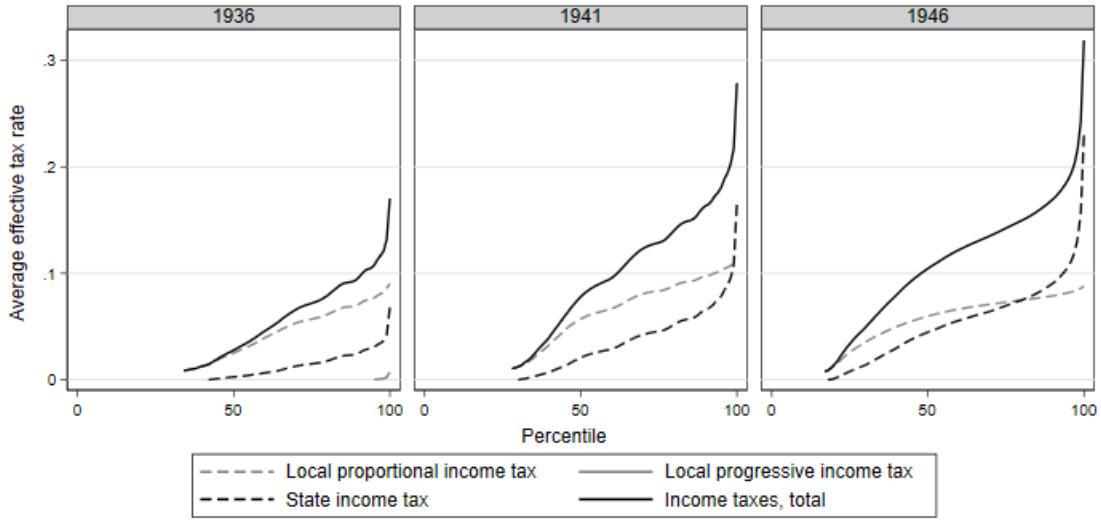
As we have noted, Sweden had (and has) an important system of local income taxation as well. Local income taxes had been applied since the 19th century, and were closely linked to the old system of income taxation (*bevillning*), which formed the basis of voting rights. When the modern state income tax was introduced in 1902, the old local taxes remained in place. The system's modernization, along similar lines as the central tax (i.e., involving self-declaration, joint consideration of all income, and assessment based on actual income and not imputed amounts), was discussed for a long time—and made difficult by their very role in demarcating the voting system, as well as by disputes around inequality between municipalities (Andersson, 1995; Dahlgren and Stadin, 1990). Modernization finally arrived with the reform of 1920 (*provisorium*), which was first applied in the tax year 1922 and further consolidated by a new reform in 1928.

In order to factor the effects of these local income taxes into our calculations, we present an additional estimation that includes both state and local income taxes from 1922 onwards. During most of the period explored here, local income taxation had a proportional and a progressive component. The former had a unique tax rate (although it had some progressive effects because of the tax deductions in place) and was the most important in terms of revenue. The progressive component affected only very high incomes and was intended to tackle inter-municipal inequalities. It was usually collected under central state income tax rules and was fully integrated into the state tax in 1939.

Unfortunately, our estimation of local income taxes is less accurate than is the case for state taxes, because the threshold for local income taxation was generally set at half the central tax level. Since our original income distribution statistics come from the central tax, the distribution of incomes below the state threshold is based entirely on the simulation à la Blanchet et al. (2017), and is therefore more uncertain (particularly in the early years of our period). In this paper, however, we aim only to show a first indication of how much the results change if we include local income taxation.

The results are shown in Figure 8 and Table 5. The total average effective tax rates increase significantly when including Sweden's important local income taxes. Tax payments can also be seen to start at lower percentiles.

Figure 8. Average effective tax rates in Sweden: state and local income taxation



Source: authors' calculations.

With respect to the cross-country comparison, the inclusion of local taxation makes Sweden the country with the least progressive income tax system during the entire period, mostly due to the proportional component of the local tax. However, the larger average effective tax rates also make it more redistributive than the United States until World War II.[24] Total income tax redistribution in Sweden seems to have slightly *increased* since the mid-20th century, if the 3.78 result for the general system in 1946 is compared with the 3.96 value estimated for 1990 by Wagstaff et al. (1999).

[24] Appendix 5 shows effective tax rates and indices of progressivity and redistribution for all the years available (both state and local income taxes).

Table 5. Progressivity and redistribution indices, including Swedish local income taxes

Year	Progressivity		Redistribution		Average effective tax rate	
	State	General	State	General	State	General
1936	29.90	22.35	0.88	2.28	2.85	9.27
1938	35.29	28.19	1.19	2.86	3.28	9.20
1941	25.75	18.94	1.99	3.53	7.19	15.70
1945	25.77	19.67	2.60	3.80	9.16	16.17
1946	25.22	19.06	2.63	3.77	9.42	16.51

Source: authors' calculations

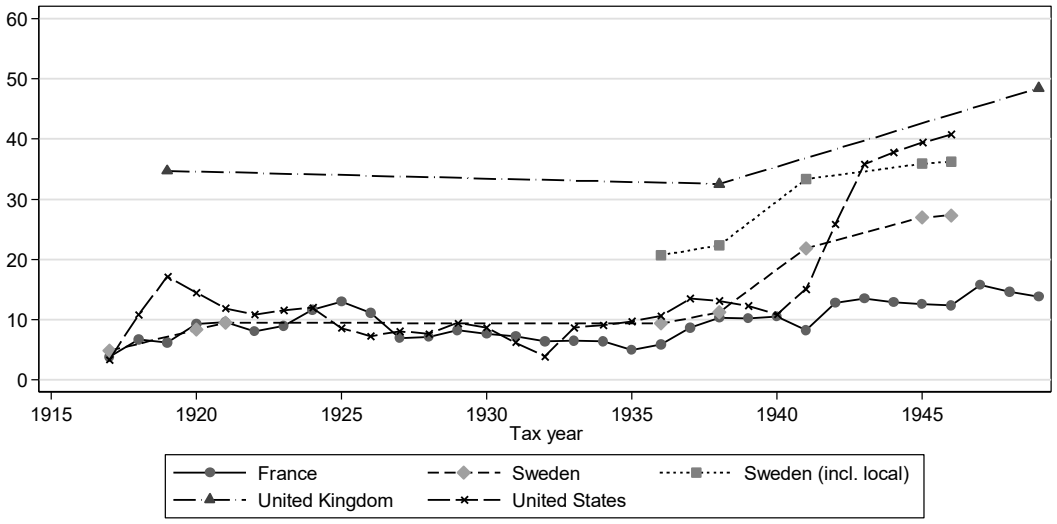
Notes: The category "General" includes state and local income taxes.

5.4. Comparison among three welfare state regimes

In this last section we compare the average effective tax rates on the top 1% of the income distribution in our three countries, as well as France. It is important to note that the average effective tax rates for percentiles that we use through the paper are calculated as a simple average of the rates for each observation in the group: i.e., they are intended to represent the experience of the average person in that group. French average effective tax rates, however, are calculated in an aggregate form, as: *(total tax paid by group) / total income of group*. This is equivalent to a weighted average of the observations in the group (weighting by income), and they are correspondingly higher. For the purpose of comparison, we have recalculated the average effective tax rates for our three countries in grouped form.

The historical evolution of the French top rate appears similar to that of Sweden and, to a lesser extent, the United States, until the eve of World War II. The rate remained close to 10% for most of the period, with limited changes during World War I and the Great Depression. The relatively low tax rates attained during the war, despite the compelling urgency to raise revenue, have been noted by previous research (Hautcoeur, 2005; Piketty, 2001). Tax rates in France diverged from those of Sweden and the United States in the 1940s, when the latter two countries increased their taxes to a larger extent than the French (the differential between France and the United States reached almost 30 percentage points by the end of World War II). This is consistent with Bozio et al. (2020), who argue that redistribution through income taxes was very limited in France in the period before 1970, and that general redistribution increased in the United States earlier than in France, to attain similar levels at present.

Figure 9. Average effective tax rates on the top 1% in four countries



Source: for France, Piketty (2001). For the rest, authors' calculations. The AETRs shown here are calculated in an aggregate form, as *(total tax paid by group) / total income of group*, for consistency with those of France.

The figure also shows that the United Kingdom stood out as being above the rest throughout the period. This is consistent with the outstanding levels of redistribution attained by the British income tax during the interwar years (recall that progressivity was higher in the United States until the 1940s, but this was the result of a smaller tax very much restricted to upper incomes). Once both state and local income taxes are taken into account, Sweden emerges as a middle-ground case between the United Kingdom on the one hand, and the United States and France on the other, at least during the second half of the 1930s.

6. Conclusions

The first half of the 20th century witnessed the emergence and consolidation of modern income taxes in many Western countries, particularly due to the impact of the world wars. In this paper we looked at the evolution of income tax progressivity and redistribution throughout the period in Sweden, the United Kingdom, and the United States. To do so, we presented new disaggregated estimates of income tax due and effective tax rates for several benchmarks based on country-specific historical tax statistics and tax regulations. We also compared our results with analogous data for France, which afforded us illustrative examples for each of the welfare state regimes identified by Esping-Andersen (1990).

Our results indicate that redistribution through income tax increased in the three countries during the interwar period, but the magnitude of the effect and the mechanisms at play differed between them. During World War I, higher levels of progressivity and a larger amount of revenue collected drove up the redistributive impact of the tax in the United Kingdom and the United States. By contrast, redistribution increased during World War II *despite* progressivity having diminished noticeably, mainly due to the expansion in the number of taxpayers. This result differs from the depiction in Scheve and Stasavage (2016) that progressivity increased during both world wars. Their analysis is based on top statutory marginal rates, which they consider a good indicator of the overall progressivity of the income tax. Our analysis shows that this might not be a good approximation for the World War II period.

In Sweden, redistribution also increased throughout these years, but progressivity diminished during both world wars. Unlike the two Anglosphere countries, Sweden's state income tax was quite early characterized by a broad base and comparatively moderate effective tax rates. When the local income tax is included in the simulation, Sweden is shown to have the least progressive income tax system over the entire period, but also to be more redistributive than the United States until World War II. These results are consistent with the findings of the earlier literature, according to which the most generous welfare states are related to relatively less progressive taxation (Steinmo, 1993; Lindert, 2004; Kato, 2004). Nevertheless, it remains to be seen whether this relationship holds when considering the whole tax system in the first half of the 20th century.

Finally, our study also illustrates, in a dynamic sense, the "political tradeoff" discussed by Guillaud et al. (2020) when referring to the total tax system: that high average tax rates are not often combined with very progressive tax systems.[25] According to our results, in the long term income taxes became less progressive as they grew bigger in size, which was driven by changes during World War II. However, in the comparison between our three countries, the same relation does not hold, given that the United Kingdom was found to have the most progressive and redistributive tax in the mid 20th century.

Our database of taxpayers and their corresponding tax variables (incomes, deductions, tax payments) paves the way for a range of analyses. First, in a related paper, we estimate how much the downward extension of these income taxes was due to inflation, and how this affected their progressivity and redistributive effects (The authors, forthcoming

[25] The same was found by Joumard et al. (2012) and Verbist and Figari (2014), referring to direct taxes and social contributions paid by households in rich countries in the early 21st century.

2022). Second, in a future study we will analyze the fiscal treatment of families in the different countries and their variation over time: were families favored in the income tax, even considering their higher needs? Finally, we intend to incorporate other taxes into the database, in order to establish the joint distributive effects of the tax systems in these countries, and how the war-financing needs were addressed in each case.

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Appendix 1. Marginal income tax rates

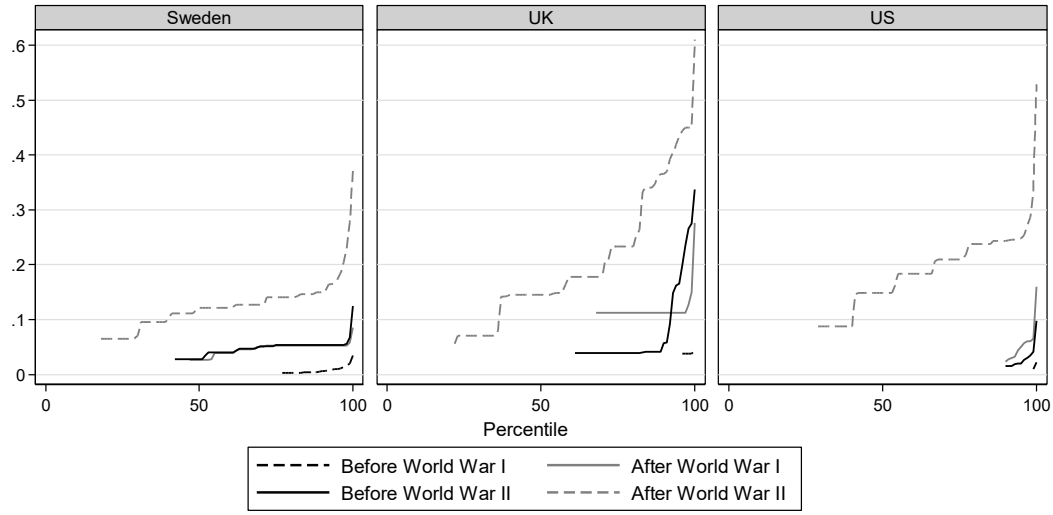
In this first appendix we show the evolution of average marginal income tax rates for our three countries before and after the world wars. Average marginal tax rates are above the average effective tax rates for two reasons. The first is a mechanical effect: since the marginal rate corresponding to a taxpayer only applies to the top portion of their income, the average effective rate will always be lower (as long as there is a progressive schedule in place). Secondly, allowances increase this distance by introducing a wedge between the tax base (the denominator in the effective tax rate) and taxable income (to which the statutory rates are applied). For this reason, effective tax rates are better estimates of the actual extent of the tax burden on high income individuals—or any income level, for this matter.

Nevertheless, top marginal tax rates matter in their own right. The literature has argued that they have significant incentive effects (on labour, wage bargaining, and capital accumulation), which could lead to a reduction in inequality *ex ante* (Piketty, 2001; Roine et al., 2009; Atkinson and Leigh, 2013; Piketty et al., 2014). Marginal tax rates apply to the final portion of taxpayers' income, and as such affect decisions at the margin— decisions to take on extra work or make a new investment—but also to report the additional income or try to hide it from the tax authorities. We thus turn now to describing the evolution of these rates during our period of study.

Figure A1 presents the average marginal tax rates by percentiles of the income distribution, focusing on the changes undergone during the world wars. In line with our previous discussion, World War I witnessed a massive expansion of top—and to a lesser extent bottom—tax rates. In the United States, the marginal tax rate imposed on the top 1% of the population increased from 2.2% in 1917 to 16% in 1919. The top marginal tax rates in Sweden were considerably below those of the Anglosphere countries (3.6% in 1912 and 8.5% in 1921), while the tax expanded considerably into lower income levels. A major reform in 1920 consolidated the "temporary" tax increases of the war period, instituting a system in which the majority of the taxpaying population were subject to the same marginal tax rate. In the United Kingdom, for its part, we observe the two effects: a widening of the tax base and a rise in top marginal tax rates. Interestingly, both the highest and the lowest average marginal tax rates by percentile of the income distribution in the United Kingdom during World War I were above those of the other two countries, even though the highest *statutory* marginal tax rates were found in the United States (65% of income in the Revenue Acts of 1918 in the United States compared to 52.5% in the United Kingdom that same year). This attests to the

highly skewed distribution of tax brackets in the latter case, with very high rates only affecting a tiny segment of the most affluent citizens.[26]

Figure A1. Average marginal tax rates by percentile of the income distribution



Source: authors' calculations using data from *Statistics of Income for 1945* (US)*, Taxeringen till inkomst… (*Sweden), and *Reports of the Commissioners....* (UK).
Notes: "Before World War I" corresponds to 1912 in Sweden, 1911 in the United Kingdom, and 1917 in the United States, and the "After World War I" to 1921, 1919 and 1919 respectively. Regarding World War II, the years used are 1938 in the United Kingdom and 1939 in the United States; for after the war, 1946 in Sweden and the United States, and 1949 in the United Kingdom. The choice is always due to data availability. In the United Kingdom, "earned" and "unearned" income were taxed at different tax rates from 1914 to 1919 (from 1920 onwards the same tax rates applied to both types of income, but "earned income" was entitled to special allowances); we only show rates for earned income here, while the rates for unearned income were significantly higher.

A similar situation was found during World War II. By the end of conflict, people in the top income percentile were experiencing marginal tax rates of 61% (United Kingdom, 1949), 52.9% (United States), and 38.1% (Sweden).[27] These rates were much higher than those of the

[26] This point was also made earlier by Roine et al. (2009), while noting that top rates over the twentieth century were applied to relatively larger groups of taxpayers in Scandinavia and the United Kingdom than in the United States or Japan.
[27] Our results are consistent with those of Rydqvist et al. (2008), who calculated series of marginal taxes on dividend income and capital gains for several countries, showing that they were significantly below the top statutory marginal rates. In Sweden, it was only around 1980 that the top percentile paid a marginal tax rate close to the statutory top rate (Roine and Waldenström, 2009).

beginning of the period, but clearly below the maximum statutory rates, which lay at 97.5% in the United Kingdom, 94% in the United States, and 68.75% in Sweden. The distance between top statutory and average marginal tax rates at the top 1% of the income distribution was particularly high in the United States, where the tax structure was extremely skewed (as described in the main text). For example, the top statutory rate in place in the United States in 1946 (94%) only affected those taxpayers with over $200,000 in taxable income, which meant approximately 1,400 people: that is, 0.003% of tax returns in that year! A more startling situation still can be found in 1937, when the tax schedule included 33 brackets, with a top marginal tax rate of 79% that affected people with income of over $5 million. This was so extreme a threshold that it became known as “the Rockefeller tax” (Thorndike, 2013).

There was also a clear distance between marginal and effective tax rates at all income levels, and for all countries and periods (as expected). For instance, the marginal tax rate estimated for the top percentile in the United States in 1946 was 52.9%: a difference of twenty points compared to the effective tax rate for this same year. In Sweden, while the marginal tax rate imposed upon the top percentile reached 8.5% in 1921, the average effective tax rate stood at 6.4%. By the end of World War II, the top 1% were subject to an average marginal rate of 38.1%, but the effective tax rate was 23.1%. This illustrates the need to go beyond marginal tax rates and to look at effective taxation to evaluate the progressivity of income taxes and their impact at the top of the distribution. The differences between marginal and effective tax rates grew over time, as more complex income tax structures were put in place. In the United States and Sweden, we can also see that these differences were clearly bigger at the very top of the income distribution (15–20 points versus between 5 and 10 in the 1940s), as a result of the multiplicity of brackets.

Appendix 2. Robustness of progressivity and redistribution estimations under a minimum income cap

The disaggregation procedure that we use to obtain the synthetic distribution of taxpayers relies on the information about incomes reported by those who filed a return. Therefore, the procedure is less accurate when the filing threshold was high and the percentage of population filing was low. We have performed some alternative estimations in order to show the extent to which the indices of progressivity and redistribution would vary if we put some restrictions on the values of incomes below the threshold.[28]

We have used three alternative caps on minimum incomes: a) the value of $300 a year in 1990; b) the poverty line of $1.90 a day in 1990; and c) double the previous amount, which sometimes means capping all incomes at just below the threshold. Option a) entails a very small correction of some unrealistically low incomes, while option c) probably entails too big a correction for the earliest years (it represents 35% of average incomes in Sweden in 1912, 21% in the United Kingdom in 1911, and 14% in the United States in 1917, while the corresponding figures for the later years are 17%, 15%, and 10% respectively).

If we impose a minimum cap on low incomes, the distribution automatically becomes less unequal, and the progressivity index therefore goes up (since it is calculated as a concentration of the tax minus Gini index of pre-tax incomes). The redistribution index is normally less affected because both the pre-tax and the post-tax Gini indices move in the same direction as a result of this adjustment. Because average incomes were higher in the United States, the correction is less intense there and the indices therefore change very little.

Table A1 shows the estimates under the most extreme cap, corresponding to option c). The results for the other caps are available upon request. Our conclusions from the main analysis still hold: income tax redistribution increased during the world wars in the three countries, as well as during the Great Depression in the United States (the only country for which we have data for this period). This growth in the redistributive impact of the tax was driven by increases in the level of progressivity during World War I in the United Kingdom and the United States (but not in Sweden), and by increases in revenue levels during World War II (in fact, progressivity diminished during World War II because of the downward expansion of the tax). Similarly, the United Kingdom remained the most redistributive

[28] In addition, in our methodological notes (The authors, 2022) we provide ranges of error calculated for our Ginis. High ranges of error at the beginning of the period imply some uncertainty in our index of progressivity (Kakwani) but less in the index of redistribution (Reynolds-Smolensky), because the latter is obtained as a difference of pre- and post-tax Gini, both of which have the same potential mismeasurement.

country throughout the period, while the United States retained some of the most progressive income tax schemes.

Table A2. Progressivity and redistribution under a minimum income cap

Sweden				
	Baseline		Minimum cap on low incomes	
	Progressivity	Redistribution	Progressivity	Redistribution
1912	36.11	0.44	44.50	0.51
1913	35.33	0.45	43.78	0.53
1917	26.77	0.51	41.95	0.70
1920	32.92	0.96	39.97	1.10
1921	27.38	1.02	30.92	1.12
1945	27.04	3.07	27.86	3.14
1946	26.58	3.08	26.82	3.10
United Kingdom				
	Baseline		Minimum cap on low incomes	
	Progressivity	Redistribution	Progressivity	Redistribution
1911	31.40	0.69	38.23	0.80
1919	55.67	5.11	56.16	5.13
1938	53.02	4.28	53.11	4.28
1949	39.55	6.43	39.78	6.46
United States				
	Baseline		Minimum cap on low incomes	
	Progressivity	Redistribution	Progressivity	Redistribution
1917	33.30	0.20	38.46	0.22
1919	69.37	1.93	69.37	1.93
1926	58.46	0.80	58.57	0.80
1937	61.48	1.50	61.51	1.50
1939	62.03	1.08	62.07	1.08
1946	27.94	4.70	27.94	4.70

Source: authors' calculations.

Notes: The columns "Minimum cap on low incomes" adjust our baseline estimates with a cap on low incomes on 3.80$ a day in 1990 (corresponding to option c in the text).

Appendix 3. Alternative indicators of redistribution

Even if the Reynolds-Smolensky index is the most-used indicator to measure redistribution, it can have some shortcomings, particularly for historical studies. In this appendix we add a different indicator that contributes to our previous results in two ways: 1) by bypassing the uncertainty about income levels *for some countries and years*, and 2) by providing a more straightforward quantification of reductions in inequality.

Table A2 shows the percentage reduction in income ratios, for some selected percentiles. This indicator is calculated as follows:

$$Percentage\ reduction\_xy\text{: } \frac{(R_G - R_P)}{(R_G)}$$

R_G being the ratio in gross incomes and R_P the ratio in post-tax incomes, defined as follows:

$$R_G = \frac{average\ gross\ income\ in\ group\ x}{average\ gross\ income\ in\ group\ y}$$

$$R_P = \frac{average\ posttax\ income\ in\ group\ x}{average\ posttax\ income\ in\ group\ y}$$

Groups are defined in quantile terms, but with different spans. We have used the following: T10 (*top 10%*: percentiles 91-100), M40 (*middle 40%*: percentiles 51-90), B50 (*bottom 50%:* percentiles 1-50), B90 (*bottom 90%:* percentiles 1-90) and T1 (*top 1%:* percentile 100). With these, we have calculated the reduction in the ratios T10B50, T10M40, M40B50, T10B90, and T1B50. The indicator T10B90 quantifies total redistribution between the top decile and the rest. T10B50, T10M40, and M40B50 capture redistribution between the top, middle, and bottom groups as conventionally defined. In this we follow Bozio et al. (2020) and related work at the World Inequality Lab. However, in many of the country–years that we analyze in this paper, a significant share of the tax units in the top decile did not pay any income taxes. Therefore, we add the indicator T1B50 to illustrate the reduction of inequality between the top 1% of the distribution and the bottom 50%.

The results tell the same story as those presented in the main text: redistribution increased during both wars in all countries and decreased with varying intensity in the 1920s. The trajectory of the T1B50 indicator in the United States aligns closely to that of the

Reynolds-Smolensky index shown in Figure 8. The income tax in the United Kingdom was always the most redistributive, reducing the ratio between the average incomes of the top 1% and the bottom 50% by 35% in 1919 and by 48% in 1949. During World War I, Sweden lagged some way behind (with a reduction near 5%, but which rose to 9.5% after the war in 1921), while the United States was closer (17% in 1919). Both Sweden and the United States grew more redistributive by the end of the period (28% reduction in Sweden and 39% in the United States).

Once again, including the effects of local income taxation increases the estimates of Swedish redistribution, but it does not affect the ranking of the countries. Total income tax redistribution in Sweden reduced the T1B50 ratio to 32% in 1945, up from 20% in 1936 (versus 28 and 9% respectively when considering only state income taxes).

Table A3. Percentage reduction in income ratios (from gross income to post-tax income)

Sweden, only state income taxes					
	T10B50	T10M40	M40B50	T10B90	T1B50
1907	1.1%	1.1%	0.0%	1.1%	1.9%
1909	1.1%	1.1%	0.0%	1.1%	1.9%
1912	2.7%	2.5%	0.1%	2.6%	4.4%
1913	2.7%	2.6%	0.1%	2.6%	4.5%
1917	3.3%	3.1%	0.3%	3.1%	4.8%
1920	5.2%	4.2%	1.1%	4.4%	8.3%
1921	5.9%	4.5%	1.5%	4.8%	9.5%
1936	5.2%	3.8%	1.5%	4.1%	9.3%
1938	6.2%	4.6%	1.7%	5.1%	11.2%
1941	11.9%	8.4%	3.8%	9.1%	21.2%
1945	14.3%	10.0%	4.8%	11.1%	25.6%
1946	14.3%	10.1%	4.7%	11.2%	25.6%
Sweden. including local income taxes					
	T10B50	T10M40	M40B50	T10B90	T1B50
1936	13.5%	7.9%	6.1%	9.2%	19.8%
1938	14.3%	8.7%	6.1%	10.3%	21.6%
1941	20.4%	12.0%	9.5%	13.9%	30.8%
1945	20.1%	12.4%	8.8%	14.4%	32.2%
1946	19.7%	12.3%	8.4%	14.4%	31.9%
United Kingdom					
	T10B50	T10M40	M40B50	T10B90	T1B50
1911	4.1%	4.1%	0.0%	4.1%	6.3%
1919	21.1%	20.8%	0.4%	20.9%	34.7%
1938	18.3%	17.7%	0.7%	17.9%	32.5%
1949	29.1%	24.4%	6.2%	26.0%	47.6%

United States					
	T10B50	T10M40	M40B50	T10B90	T1B50
1917	1.3%	1.3%	0.0%	1.3%	3.3%
1918	5.5%	5.5%	0.0%	5.5%	10.8%
1919	8.1%	8.1%	0.0%	8.1%	17.1%
1920	6.8%	6.7%	0.0%	6.8%	14.4%
1921	5.5%	5.3%	0.2%	5.4%	11.8%
1922	4.6%	4.6%	0.1%	4.6%	10.8%
1923	5.3%	5.2%	0.1%	5.2%	11.5%
1924	5.3%	5.2%	0.1%	5.3%	12.0%
1925	3.7%	3.7%	0.0%	3.7%	8.5%
1926	3.6%	3.6%	0.0%	3.6%	7.2%
1927	4.1%	4.1%	0.0%	4.1%	8.0%
1928	3.9%	3.9%	0.0%	3.9%	7.6%
1929	5.1%	5.1%	0.0%	5.1%	9.4%
1930	4.5%	4.5%	0.0%	4.5%	8.6%
1931	2.9%	2.9%	0.0%	2.9%	6.1%
1932	1.6%	1.6%	0.0%	1.6%	3.8%
1933	4.0%	4.0%	0.0%	4.0%	8.7%
1934	4.1%	4.1%	0.0%	4.1%	9.1%
1935	4.4%	4.4%	0.0%	4.4%	9.7%
1936	4.9%	4.9%	0.0%	4.9%	10.6%
1937	6.5%	6.5%	0.0%	6.5%	13.5%
1938	6.0%	6.0%	0.0%	6.0%	13.1%
1939	5.3%	5.3%	0.0%	5.3%	12.2%
1940	4.7%	4.6%	0.0%	4.7%	10.8%
1941	6.4%	5.9%	0.5%	6.1%	15.1%
1942	12.8%	10.6%	2.5%	11.2%	25.8%
1943	18.8%	14.4%	5.1%	16.0%	33.9%
1944	20.0%	14.7%	6.1%	16.5%	35.7%
1945	22.2%	14.7%	8.7%	16.8%	37.6%
1946	23.2%	16.0%	8.6%	18.0%	38.9%

Source: authors' calculations.

Notes: Columns with 0.0% indicate that the payment of taxes in the income group in the numerator was non-existent or so limited that inequality was left unaffected.

Appendix 4. Progressivity, redistribution and average effective tax rates in the United States (1917-1946)

This appendix presents the data used in Figures 7 (Table A4) and 8 (Table A5) for the United States from 1917 to 1946.

Table A4. Average effective tax rates in the United States (1917-46)

	Top 0.1 percent	Top 1 percent	Percentile 90	Percentile 75	Percentile 50
1917	2.8	1.0			
1918	10.9	3.7			
1919	20.5	8.1	0.2		
1920	18.7	6.8	0.5		
1921	16.7	6.7	0.9		
1922	14.3	5.3	0.6		
1923	14.9	5.6	0.7		
1924	15.8	5.8	0.8		
1925	11.7	3.6	0.4		
1926	10.3	3.0			
1927	10.4	3.0			
1928	11.0	3.1			
1929	12.3	3.4			
1930	10.6	2.5			
1931	8.2	2.3			
1932	5.8	1.6			
1933	10.5	3.5			
1934	10.6	3.5			
1935	12.3	4.1			
1936	13.4	4.5			
1937	17.4	5.8			
1938	16.2	5.6	0.1		
1939	13.0	4.6	0.0		
1940	14.3	5.1	0.4		
1941	20.9	6.6	1.2	0.3	
1942	36.2	16.1	4.1	2.7	0.7
1943	48.0	26.2	10.8	8.1	4.6
1944	51.0	28.7	11.9	9.4	6.1
1945	52.4	32.0	14.5	11.7	7.9
1946	53.2	33.1	14.4	11.6	8.0

Source: authors' calculations.

Table A5. Progressivity and redistribution indices in the United States (1917-46)

	Progressivity	Redistribution	Average effective tax rate	Taxpayers as % of total tax units
1917	33.3	0.2	0.6	0.9
1918	66.5	1.3	1.9	6.7
1919	69.4	1.9	2.7	8.4
1920	71.6	1.7	2.3	10.3
1921	69.4	1.3	1.9	13.2
1922	59.3	1.0	1.7	8.4
1923	60.5	1.2	2.0	8.5
1924	66.2	1.3	1.9	9.6
1925	63.8	0.9	1.4	9.9
1926	58.5	0.8	1.3	5.4
1927	58.9	0.9	1.5	5.3
1928	59.2	0.9	1.4	5.1
1929	56.8	1.2	2.0	5.2
1930	60.8	1.0	1.7	5.0
1931	60.6	0.6	1.0	4.1
1932	56.5	0.3	0.5	3.0
1933	55.8	0.8	1.4	3.8
1934	54.2	0.8	1.5	3.4
1935	58.0	0.9	1.6	3.4
1936	61.7	1.1	1.7	4.0
1937	61.5	1.5	2.4	5.3
1938	63.5	1.4	2.2	6.2
1939	61.9	1.2	1.9	5.5
1940	58.9	1.1	1.8	7.0
1941	47.7	1.3	2.7	13.1
1942	39.2	2.4	5.9	30.6
1943	33.8	4.2	10.9	48.0
1944	31.1	4.3	12.2	69.2
1945	26.1	4.4	14.3	72.2
1946	27.1	4.7	14.8	72.3

Source: authors' calculations.

Notes: see Figure 8.

Appendix 5. Progressivity, redistribution and average effective tax rates in Sweden (1907-1946)

This appendix presents all our results for average effective tax rates and indices of progressivity and redistribution for Sweden, including years which are not shown in the main text.

Table A6. Average effective tax rates in Sweden (1907-46)

Only state income taxes					
	Top 0.1 percent	Top 1 percent	Percentile 90	Percentile 75	Percentile 50
1907	2.6	1.2	0.0		
1909	2.5	1.2	0.0		
1912	5.4	3.2	0.6		
1913	5.5	3.3	0.6		
1917	5.7	3.6	0.6	0.3	
1920	9.8	5.7	2.2	1.0	
1921	10.8	6.4	2.7	1.4	0.1
1936	13.0	6.8	2.5	1.5	0.3
1938	14.5	7.9	2.9	1.7	0.4
1941	27.9	16.6	6.6	4.5	2.1
1945	36.1	22.4	8.7	6.6	3.9
1946	36.8	23.2	9.1	6.9	4.5
Including local income taxes					
	Top 0.1 percent	Top 1 percent	Percentile 90	Percentile 75	Percentile 50
1936	26.1	17.1	9.6	7.2	2.8
1938	27.2	17.6	9.6	7.0	3.0
1941	39.6	27.9	16.3	12.9	7.8
1945	45.2	31.3	16.6	13.8	9.6
1946	45.8	32.0	17.0	14.2	10.4

Source: authors' calculations.

Table A7. Progressivity and redistribution indices in Sweden (1907-46)

Only state income taxes				
	Progressivity	Redistribution	Average effective tax rate	Taxpayers as % of total tax units
1907	33.7	0.2	0.6	11.3
1909	38.7	0.2	0.5	12.6
1912	40.4	0.5	1.2	18.8
1913	39.6	0.5	1.3	19.4
1917	29.6	0.6	1.9	22.6

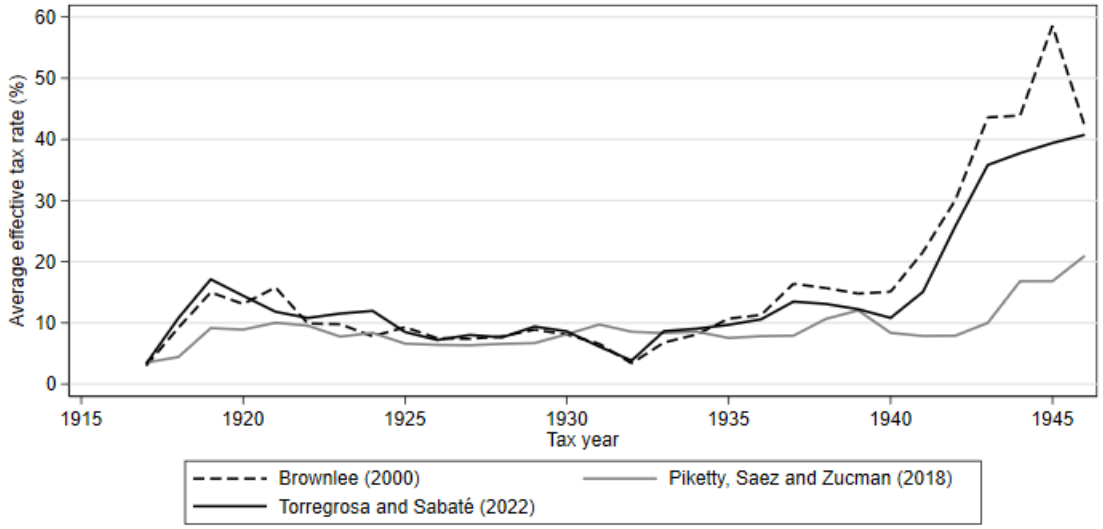
1920	33.7	1.0	2.8	42.1
1921	32.9	1.1	3.2	46.9
1936	29.9	0.9	2.9	49.4
1938	35.3	1.2	3.3	50.2
1941	25.8	2.0	7.2	57.9
1945	25.8	2.6	9.2	69.2
1946	25.2	2.6	9.4	72.3
Including local income taxes				
	Progressivity	Redistribution	Average effective tax rate	Taxpayers as % of total tax units
1936	22.4	2.3	9.3	61.9
1938	28.2	2.9	9.2	62.3
1941	18.9	3.5	15.7	69.0
1945	19.6	3.8	16.2	78.7
1946	19.1	3.8	16.5	81.2

Source: authors' calculations.

Appendix 6. Comparison of results with other studies on the United States

Previous estimations of effective tax rates exist for the case of the United States in Brownlee (2000) and Piketty, Saez and Zucman (2018). These do not always coincide in their specific definition. Brownlee provided effective tax rates for the top 1% of the population (households), using "taxable income" as a reference. Piketty, Saez and Zucman (2018) estimated effective rates for the entire distribution, using "pre-tax income" in the DINA-framework as a reference (i.e., adjusted to total national income— including the imputation of undistributed profits). On the other hand, the two estimates calculate the average effective tax rates in an aggregate form (as in the French case cited in the main text), whereas we calculate them as a simple average of the rates for each observation in the group. For the purpose of comparison, we have recalculated the AETRs in grouped form, and show them here together with those of Brownlee (2000) and Piketty, Saez and Zucman (2018). As can be seen in Figure A2, the trends are similar across the three estimates, except for the period after 1940. The differences thereafter can be attributed to the estimation of the reference income used as a denominator.

Figure A2. Average effective tax rates on the top one percent in the United States, according to different studies



Source: Brownlee (2000), Piketty, Saez and Zucman (2018), and author's calculations. We have used the 2022 version of the PSZ data, downloaded from http://gabriel-zucman.eu/usdina/.

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