DISCUSSION PAPER SERIES

DP11935

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ECONOMIC HISTORY and PUBLIC ECONOMICS

ISSN 0265-8003

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Discussion Paper DP11935
Published 24 March 2017
Submitted 24 March 2017

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JEL Classification: D31, H21, H24, H26, N40

Keywords: taxation, Income inequality, economic history

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Acknowledgements

Trends and gradients in top tax elasticities: Cross-country evidence, 1900–2014*

Enrico Rubolino† and Daniel Waldenström‡

15 March, 2017

Abstract

We compile data spanning the period 1900–2014 and up to 30 countries to study long-run patterns in the tax elasticity of top incomes. Our results show that top tax elasticities vary tremendously over time; they were medium-to-low before 1950, virtually zero during the postwar era up to 1980 and have thereafter increased to unprecedented levels. We document a strong income gradient in tax response within the top, underlining the importance to study even small top groups separately. Several mechanisms are investigated. Tax-driven income shifting between wage and capital income is important in the very top. Wars, financial crises, and country-specific effects and trends have bearing on top elasticities whereas standard macroeconomic factors and indicators of "real responses" do not.

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1 Introduction

How responsive are high-income earners to marginal income taxes? This question addresses key aspects of tax system design because top income earners usually pay a disproportionate share of all income taxes. At the same time, top earners have been found to be more sensitive to taxation than most other taxpayers in the population (see, e.g., Feenberg and Poterba, 1993; Feldstein, 1995; Slemrod, 1996; Gruber and Saez, 2002; Saez, 2004; Saez, Slemrod and Giertz, 2012; Piketty, Saez and Stantcheva, 2014; Rubolino and Waldenström, 2017; Saez, 2017). While there is relatively scarce evidence on this matter, several explanations have been proposed for the higher tax elasticities among top earners, some emphasizing the role of real, labor-supply related responses (e.g., Feldstein, 1995) while others highlight the role of tax avoidance activities (e.g., Auerbach, 1988; Slemrod, 1995; Goolsbee, 2000; Saez, 2017).

The purpose of this paper is to deepen the understanding of the structure and evolution of top income tax elasticities. We ask two main questions. First, is the tax elasticity of top incomes a constant parameter or varying over time and space? To answer this question, we have compiled a dataset containing tax rates, top income shares and control variables for up to 30 industrialized countries and a period of 115 years, 1900–2014. With these data we analyze the evolution of top elasticities across subperiods, countries, country groups, and income levels within the top of the distribution. To the best of our knowledge, such a close scrutiny of the historical and international trends of top tax elasticities has not been made before.[1]

The second question is: What accounts for trends and gradients in the top tax elasticity? Our data are not rich enough to allow for any conclusive analyses, but we offer different tests aimed to shed some light on this issue. We extend the baseline estimation by adding country and time effects, time trends and several economic and political control variables. Then we regress top wage income shares on the differential between marginal wage income and capital income taxes in order to study if top earners actively shift their income across tax bases in response to this differential. Lastly, we run GDP regressions on top income taxes as a simple test of trends in efficiency-related tax responses.

Our main finding is that the top tax elasticity varies tremendously over time, space and incomes. Among earners in the top 0.1 income percentile, the evidence indicates a marked J-shaped (or U-shaped) pattern over the past century, beginning with a medium elasticity in the decades before 1950 that dropped to zero in the postwar era up to 1980 after which it has increased to the highest levels seen so far. However, the story is completely different for earners in the lower half of the top decile whose tax elasticity has been very low and basically non-trending throughout the past century. The post-1980 surge is be particularly marked in

[1]Piketty, Saez and Stancheva (2014) examine elasticities in a cross-country panel since 1960, but they only do this for two distinct sub-periods and only for the top percentile versus the lower nine percentiles in the top income decile. Saez (2017) is one of few studies examining tax elasticities of smaller groups within the top percentile but only for one year and in one country (the U.S. in 2013). In addition, Roine, Vlachos and Waldenström (2009) and Atkinson and Leigh (2013) run multivariate cross-country panel regressions of top income shares on several variables.

Anglo-Saxon countries whereas other country groups exhibit less of a rise in recent years.

We also find a strong income gradient in the top tax elasticity. Almost nowhere in our data do the very top earners respond less to taxation than lower-earning groups. That said, the slope of this elasticity gradient varies over time, being steepest in the latest decades era, followed by the pre-World War II era while it was almost flat during the first postwar decades.

In a series of sensitivity checks, we rerun the analysis using different measures of top marginal tax rates (the statutory rate or fractile-specific rates), different sample sizes, top average tax rates, and alternative model specifications (instrumental variables or first-differences estimations). Our main results hold up well to all of these variants.

The mechanisms underlying the trends and gradient in the top tax elasticity are also studied. Tax avoidance behavior, in particular the opportunity to shift income across differently taxed labor and capital incomes, strongly influences the elasticity in the absolute income top but has less impact on incomes lower down in the top decile. By contrast, when examining "real responses", which we measure using different aggregate indicators of economic activity, we find small or no tax elasticities throughout. Similarly, including common macroeconomic or institutional controls does not affect the estimated top tax elasticities. Wars and financial crises play a role; wartime top percentile elasticities fall, but only in belligerent countries, while banking crises and currency crises have the opposite effect. However, the largest influence on tax elasticities comes from including country fixed effects and, quite importantly, country-specific trends. Their influence suggests that there are many common, and largely unobserved, factors shaping the behavioral responses to taxation among high-earning groups that we are still unable to fully identify.

We think that our empirical findings contribute to several literatures. The small, but growing literature on the optimal taxation of top incomes has so far paid little attention to evidence on long-term historical trends, and especially how these look across countries and country group (a notable exception being Piketty et al., 2014). There is also limited work on separating the analysis for different top groups; the top percentile has often come to represent the entire income top but our evidence shows that much of the top percentile elasticity is actually driven by the elasticity of the top 0.1 percentile, and the experience of the lower groups of the top decile, in turn, are completely different from this.

Our findings have also bearing on the economic historical literature about the evolution of economic policy, especially taxation, in the Western world. For example, in several studies of the political causes of income tax progressivity and the taxation of the rich, Scheve and Stasavage argue that geopolitical events, especially wars, set off policies that greatly affected the masses, e.g., mass mobilization, and this, in turn, created a pressure on the rich to contribute with their money (see Scheve and Stasavage, 2016, for a summary of this research). Our historical analysis shows that top earners became less responsive to top taxation during wartime, but only when their own countries took part in the wars and thus set off all the mobilization policies highlighted by Scheve and Stasavage.

The remainder of the paper is structured as follows. Section 2 presents the analytical framework for the derivation of the top tax elasticity and the empirical specification. Section 3 describes the income and tax data. Section 4 contains the main results and a sensitivity analysis and in section 5 we study potential underlying mechanisms. Section 6 concludes.

2 Analytical framework

Our analysis builds on the previous literature on optimal taxation among high-income earners (see, e.g., Gruber and Saez, 2002; Saez, 2004, and in particular Saez, Slemrod and Giertz, 2012). The starting point is a static labor supply model, where individuals maximize utility $u(c, l)$ for disposable income c (equal to consumption in a one-period model) and labor supply l usually measured by hours of work. Earnings are given by $w \times l$ where w is an exogenous wage rate. Workers face a budget constraint $c = w \times l \times (1 - \tau) + E$, where τ is the marginal tax rate and E is the virtual income.

It is well-known that top income earners may respond to taxation in other ways than just adjusting the hours of work, e.g., by working harder or by tax planning. Feldstein (1999) formulated this phenomenon by expressing that utility depends positively on disposable income but negatively on reported income z. Individuals then maximize a utility function $u(c, z)$ subject to a budget constraint of the form $c = (1 - \tau) \times z + E$. This individual maximization problem generates an individual "reported income" supply function $z(1 - \tau, E)$, where z depends on the net-of-marginal-tax rate $1 - \tau$ and virtual income E generated by the tax-transfer system. Assuming away income effects so that the income function z does not depend directly on E,[2] the elasticity of reported income with respect to the net-of-tax rate, ϵ, is defined as:

$$\epsilon = \frac{1 - \tau}{z} \frac{\partial z}{\partial (1 - \tau)}. \tag{1}$$

In a recent article, Piketty et al. (2014) extends the analysis of top income tax elasticities by proposing an optimal taxation model in which top incomes respond to marginal income taxes along three margins: 1) labor supply (real response), 2) tax avoidance, 3) compensation bargaining. These three responses sum up to the observed tax elasticity ϵ in equation (1).

The first of their specified channels represents the standard labor supply responses discussed above. The second channel captures all different kinds tax avoidance and income sheltering behavior aimed at minimizing tax payments. In the past literature, there are studies of examples of such response. For example, Slemrod (1996) showed that the surge in US top income shares after the tax reform of 1986 largely reflected tax avoidance rather than real responses when income earners shifted incomes from the more taxed corporate income to the less taxed

[2] Saez et al. (2012) suggest to assume away income effects in the absence of compelling evidence about significant income effects. Indeed, Gruber and Saez (2002) estimate negligible income effects of tax changes on reported income, implying that the compensated and uncompensated elasticities of taxable income are very similar.

personal income. Similarly, Auerbach (1988) argue that the timing of capital gains realizations are affected by tax changes, and Goolsbee (2000) offer several examples of how executives may choose the form of compensation such that taxes are avoided. A more recent example is Kleven and Schultz (2014) who study Denmark and show that where tax avoidance opportunities are limited by the tax system, the estimated elasticity is very low. The third channel reflects how high-paid employees, especially top executives, can bargain more aggressively for a pay increase if marginal taxes are lower, since they will now keep a larger fraction of it.

We empirical estimate the elasticity of reported top income shares with respect to the net-of-tax rate by fitting a log-linear cross-country panel regression,

$$\log y_{it}^s = e^s \log(1 - MTR_{it}) + \mu_i^s + \mu_i^s t^s + u_{it}^s, \tag{2}$$

where y_{it}^s is the share of total income earned by top fractile s in country i at time period t (usually a 5-year average). MTR_{it} is the marginal tax rate on personal income so that $(1 - MTR_{it})$ represents the retention rate. The e^s is our coefficient of interest, measuring the percentage variation in the top income share of fractile s as the retention rate changes by one percent. Country fixed effects μ_t account for permanent (including unobserved) differences in taxes and inequality across countries, while the country-specific time trend controls for non-tax-related factors. Finally, u_{it} is a Newey-West standard error term with eight-year lags.

There are potential endogeneity concerns with this specification. If the simultaneous causality mechanism is systematic within a country, i.e., if the way how levels of top income shares affect the statutory top marginal rate is always similar across time within a country, then these time invariant country characteristics are controlled for by the country fixed effects. The country fixed effects and country time trends address some of this problem, but reverse causality or omitted variables driving both top income shares and top tax rates could still generate a bias. To deal with such endogeneity problems, we run instrumental variable regressions following Gruber and Saez (2002). They proposed a method based on predicting the marginal tax rate that taxpayers would face if the income was unchanged from the previous year and then instrument the actual marginal tax rate associated with the realized income in the current period. Due to data limitations we can only calculate these tax rates for the period after 1980.

3 Data

3.1 Income data

Top income shares and average incomes for different top income fractiles come from the World Wealth and Income Database (WID). The concept of income is gross total income, which includes incomes from all sources (labor, including pensions, business, capital) before taxes and most transfers. Realized capital gains are not part of the main income definition, but we include them in robustness analyses. Income-earning units are usually tax households, which means adult single or married households. As discussed by Leigh (2009), Atkinson, Piketty and Saez (2011), and Roine and Waldenström (2015), these series stem from administrative tax sources and have been compiled using a common methodology for all countries, offering a high degree of comparability over time and space.

There are both strengths and weaknesses with these data. Their comparability across time, and also to some extent across countries, and their long historical grasp are the main reasons for why a study like the present one can be conducted. For our purposes, these reported top incomes are also close in nature to the taxable top incomes we would ideally want to use in estimating tax elasticities. The deviations are typically minor, where taxable incomes may be somewhat lower due to additional deductions that are not observed in our data. One of the more important problems with the top income data is that we only for a few countries access information about different income sources (labor, business and capital income) across different top income fractiles. While we can still do some analyses, this still limits our possibility to fully address the mechanisms behind tax responses, e.g., income-shifting across time or income sources.

3.2 Tax data

Our income tax data are collected from different sources and span the period 1900–2014 for up to 30 countries, which is the longest homogeneous historical cross-country database on top marginal taxes available.

The main measure of the top marginal income tax rate the statutory top marginal income tax rate, MTR^{top}, available over the entire time period. From Piketty et al. (2014) we collected data for 18 countries over the period 1960–2010. For the other countries and the period before 1960 we use data from a range of other sources (see Appendix table B1 for details). The MTR^{top} is the most commonly used measure of top marginal taxation in the previous literature. However, it is well known that the top statutory rate is a problematic proxy of top tax rates since it does not incorporate changes in income distribution or tax schedules, which makes it unclear how many top income earners who actually pay this top rate; in our dataset this share varies over time and across countries from virtually nobody to more than one third of the full tax population.[3]

For the period since 1981, we can also compute average marginal personal income tax rates corresponding to the average income level of each top income fractile s, MTR^s. We also compute a corresponding average tax rate, ATR^s. These rates are calculated for all top income fractiles and years in 15 countries using tax schedules in the OECD Tax Database (Tables I.1 to I.3) and incomes in the WID. The OECD Tax Database contains both central and sub-central government personal income tax schedules for wage income, plus the taxable income thresholds

[3]Scheve and Stasavage (2016) compare for a few countries the long-run correlation between the statutory top rate and an average rate which is close to MTR^s. They find a high correspondence and conclude that the MTR^{top} can be safely used for historical analyses.

at which these statutory rates apply.[4] These tax rates always account for standard deductions, tax credits, basic personal allowances, major national surtaxes, and other provisions in addition to statutory rates and thresholds at both central and sub-central government levels. However, even though we deem our calculations to be improvements, they are not perfect.[5]

A specific measurement problem with the historical tax data is the lack of information about income source-specific effective tax rates. This causes problem since capital and wage taxation sometimes differ, and many countries even apply differential tax rates to different forms of capital income (e.g., rents, dividends on listed vs. closely held firms, realized capital gains etc.). For this reason we have to leave out some observations when these can not be treated separately, e.g., in countries with dual tax systems where reported top incomes contain both labor and capital incomes. However, we do collect data on the statutory top corporate income tax rate and the top rate on wages, salaries and pensions. Such tax rates are retrieved from OECD Tax Database for the period 1981–2014 and from other different sources for the period before (see Appendix tables B1 and B2).

3.3 Control variables

We have collected information about economic and political factors which could account for some of the influences on top tax elasticities identified in the previous literature (Atkinson and Piketty, 2007; Roine et al., 2009; Doerrenberg and Peichl, 2014). These variables include GDP per capita, financial development (sum of bank deposits and stock market capitalization as share of GDP), globalization (2016 KOF index of globalization), trade union density as a percent of employees, technological progress (number of patents per capita), human capital (index based on years of schooling), and public spending.

4 The evolution of top income tax elasticities, 1900–2014

This section presents our main results regarding the evolution of income tax elasticities of top incomes, estimated on an unbalanced panel of 30 countries over the period 1900–2014. Results are reported for different top income fractiles and for different subperiods and also for different country groups. In a separate analysis, we estimate elasticities in the 1981–2014 period for

[4] The Database also provides standard tax allowances, tax credits, and surtax rates. The information is applicable to a single person without dependents. The threshold, tax allowance and tax credits amount are expressed in national currencies. Further explanatory notes may be found in the OECD Explanatory Annex: http://www.oecd.org/ctp/tax-policy/Personal-Income-Tax-rates-Explanatory-Annex-May-2016.pdf. See Appendix B for further details.

[5] Some smaller taxes and contributions are not included in the formula due to a lack of comparable information for all countries and time periods. Many of these taxes are so small that they would hardly have any bearing on the main analysis, but in some cases their omission is potentially important. For example, we were unable to consistently include social security contributions in the tax computations. Some of these contributions are part of insurance schemes, linked to benefits and should thus not be regarded as income taxes. Omitting them is therefore not problematic. However, other fees are pure taxes and should be part of the tax formula (see Bengtsson, Holmlund and Waldenström, 2016, for a discussion of the case of Sweden). Furthermore, deductions, allowances, and credits that vary by individuals characteristics are not included in the calculations.

which we access more detailed data on income tax rates allowing us to use vary the measurement of top marginal taxes as well as econometric specification.

4.1 Long-run elasticities

A first view of the long-run evolution of the top tax elasticity is provided by Figure 1. It presents cross-country estimates of the top income percentile elasticity measured within 20-year periods between 1900 and 2014, controlling for country fixed effects and country-specific time trends. A clear J-shaped pattern emerges over time. The elasticity was 0.11 in the pre-1920 period, and then fell, gradually, down to around 0.5 in the sixty years thereafter. Then, in the 1980s, the responsiveness increase drastically to 0.17 over the 1980s and 1990s and then further up to 0.33 in the 2000s and 2010s. If anything, this offers first-pass evidence against a temporal stability of top tax elasticities.

[Figure 1 about here]

Full results for the long-run tax elasticity estimations over the 1900–2014 period and subperiods are offered for all top income groups in Table 1. Results are based on equation (2) and presented for three specifications: a *baseline* which includes country fixed effects and country-specific time trends, a model including only country fixed effects and a model including no controls at all. The sample presented here is held constant and contains those ten countries which are observed over all years. The results for the full sample, which mainly adds observations in the latest period, are essentially the same and presented in the sensitivity analysis in section 4.4 below.

The top percentile (Top 1) has a long-run baseline elasticity of 0.26 and this is only marginally affected by removing country trends (0.23) or also the country fixed effects (0.16). The top decile (Top 10) has a lower elasticity, being 0.11 in our baseline model and the same or slightly lower in the alternative models. The top 0.1 group (Top 0.1) has a higher elasticity of 0.40 in the baseline, the same when only using fixed effects and 0.23 in the model without controls.

Looking at different subgroups within the top decile is a crucial part of the analysis, since we otherwise risk having most of the intertemporal variation being determined by the behavior of the highest-earning groups whose incomes are so large that they drive the entire top decile's income share. Columns 4 to 7 indicate a remarkable variation of responses within the top decile. In the bottom half of the top decile (Top 10-5), the baseline long-run elasticity is zero (0.01). The next four percentiles, which contain income-earners between the 95th and 99th income percentiles (Top 5-1), has a baseline long-run elasticity of 0.07, and is significantly different from zero in all specifications. When we look within the top income percentile, its bottom half (Top 1-0.5) has an elasticity of 0.12 that is significant, and the group with incomes between the 99.5th and 99.9th percentiles (Top 0.5-0.1) has an elasticity of 0.18.

[Table 1 about here]

How constant are the top elasticities over time? This question has been ignored in the previous income tax literature, with a rare exception being the study of Piketty et al. (2014) comparing elasticities in the 1960–1980 and 1981–2010 periods. We examine the variation in top tax elasticities over three main subperiods in the entire past century: 1900–1950, 1951–1980 and 1981–2014.[6] Results are presented in Figure 2 (and based on Table 1).

We observe a long J-shaped (or a "twisted" U-shaped) pattern in the top tax elasticities over the past century. In the early era before 1950, elasticities are medium to low, ranging from 0.15-0.20 in the top percentile to between zero and 0.07 in the bottom of the top decile. In the first decades of the postwar period, elasticities fell to virtually zero everywhere in the top decile. Not even the in the top 0.1 percentile we find estimate that are significantly different from zero, regardless of model specification. Finally, after 1980 elasticities have increased to historically high levels, but only in the very top. In the top 1 and 0.1 percentiles, we find elasticities around 0.3. In the rest of the top decile, estimates range from 0.08 in the next four percentiles and zero in the bottom half. Accounting for country-specific time trends appears to be crucial; with only country fixed effects or not controls, top percentile elasticities increase drastically, to 0.34–0.44 for the bottom groups in the top percentile up to 1.10–1.13 in the top 0.1 percentile. Thus, the overall J-shaped time pattern is particularly visible in the very top groups, whereas for the groups in the lower parts of the top decile this pattern is only seen in the models where we do not account for country-specific trends.

[Figure 2 about here]

4.2 Gradient in the top tax elasticity

Is the response to marginal income taxation the same for all top income earners? The results in Table 1 indicated that the answer to this question is "no". For almost all periods, tax elasticities are higher in the upper income levels. While this result is not entirely new, it has not been examined closely over such long time periods before. Furthermore, most previous studies have halted at comparing the top percentile with lower groups, but our analysis shows that this is not sufficient. We find that even within the top percentile there is considerable heterogeneity. To our knowledge, this attention to differences in tax responses within the top percentile has so far only been thoroughly addressed by Saez's (2004, 2017) studies of tax reforms in the US.

In Figure 2, we present the tax elasiticity gradient in the level of income, split between the same three sub-periods as above: pre-World War II, the early postwar era and the recent period. The figures confirms the considerable income gradient in the top tax elasticity, but above all that this gradient is not constant over time. We find that it is very pronounced in the most recent period, with a top 0.1 elasticity being more than four times that the elasticity in the Top 5-1 group and much more than that in the bottom half (where the elasticity is zero). Looking at the first postwar decades, we cannot find any evidence of a gradient; all top income earners

[6] We have also examined shorter time periods and they show similar levels and trends except for the post-1980 era where estimates become sensitive to period length.

responded more or less the same way to marginal income taxes, i.e., not at all. This result is also robust to different partitionings of the period. In the pre-Second World War era, finally, there was a clear gradient in the top tax elasticity, but not as steep as in the present period.

[Figure 3 about here]

4.3 Geographical differences: countries and regions

Countries and country-groups may differ in how their top income earners respond to taxation. In the previous top income literature, geographical and cultural similarities have been in especially post-1980 top income shares; in Anglo-Saxon countries they have surged while in Continental European countries they have remained almost constant and the Nordic countries seem to be a mix between the two others experiencing low but increasing top shares (see, e.g., Atkinson and Piketty, 2007; Roine and Waldenström, 2008, 2012). In their study of top income tax elasticities, Piketty et al. (2014) argue that differences in economic and political institutions across countries may be important for how taxpayers respond to income taxation, e.g., through the workings of specific tax laws allowing tax avoidance or social norms towards working.

Table 2 shows the country-specific elasticities for the top income percentile estimated using time series regressions, controlling for a linear time trend, over different periods since 1900. There is a considerable variation across countries, especially in the early period, but the pattern appears to be broadly consistent with the findings in Table 1. Before 1950, most countries for which we have data exhibit a non-negative elasticity, not above unity except in one case. Interestingly, the highest elasticities in this era are found in two Nordic countries, Norway (0.67) and Finland (0.53). Large negative coefficients are found in developing countries such as Indonesia (-1.03) and South Africa (-0.25). Looking at the early postwar period, a few countries have positive, significant elasticities such Sweden (0.57), Germany (0.49) and New Zealand (0.29). In most other cases, coefficients are insignificantly different from zero. Lastly, the post-1980 period is a period when most, but far from all, countries exhibit non-negative elasticities. The largest are found in Colombia (0.88), the US and Australia (both 0.74), the UK (0.58) and New Zealand (0.61). The Appendix (see table C5) shows similar country regressions for the Top 10-5 and Top 0.1 fractiles, and they broadly confirm the overall patterns presented in Table 1.

[Table 2 about here]

Turning to the country-group analysis, Figure 4 presents tax elasticities across top fractiles for five country groups: Anglo-Saxon countries (Australia, Canada, Ireland, New Zealand, the UK, and the US), Continental European countries (France, Germany, and the Netherlands), Nordic countries (Denmark, Finland, Norway, and Sweden), Southern European countries (Italy, Portugal, and Spain), and, finally, OECD countries where basically all countries in our historical dataset are included. Regressions are run for four different top fractiles, and they all include country fixed effects and country-specific trends (see Appendix table C6 for details). The result of this analysis is twofold. First, in most instances, trends in country-group elasticities do not differ much from the patterns reported above and they do not differ much from each other either. Second, there is one stark exception from this congruence: Anglo-Saxon top percentile elasticities in the post-1980 period. Looking at the top 0.1 percentile shows that the OECD as a whole has a 0.22 elasticity, with Nordic 0.22, Continental 0.24 and Southern Europe 0.37, the Anglo-Saxon group has an elasticity 0.92. We already saw this divergence in the country-specific results in Table 2.

[Figure 4 about here]

Summing up all the different long-run top tax elasticity estimations, we have made three striking, and partly new, observations about top income tax elasticities. First, we find evidence of a distinct *trend over time* in how responsive top incomes are to taxation. Specifically, elasticities were medium-high in the interwar era, low (or almost non-existent) during the first postwar decades, and then historically high in the era since 1981. Comparing country groups, this recent high responsiveness seems to mainly occur in Anglo-Saxon and Continental European countries while the Nordic countries have low top tax elasticities throughout the income top. Second, we establish a *tax elasticity gradient* in the level of income, with responsiveness being larger the higher up in the income distribution one gets. Differences are of an order of magnitude, at times being five-ten times larger in the top 0.1 percentile than in the lower half of the top decile. Over time, however, the slope of this gradient has changed, being almost flat in the early postwar era to very steep after 1980. Third, we find that top income earners in *Anglo-Saxon countries are much more tax responsive* than in other developed countries during the post-1980 era. Of course, these results are only first steps in analyzing the role of institutions for top tax elasticities and section 5 below presents further tests of the role of institutional factors.

4.4 Sensitivity analysis

We check the sensitivity of the estimated top tax elasticities in several dimensions. In this section focus lies on the measurement of top tax rates, the potential endogeneity of top taxation, and sample size restrictions. In the online appendix we also present results of other tests that cannot be presented here for spatial reasons.[7]

Table 3 presents estimated elasticities from baseline regressions over the most recent period, 1981–2014 for which the availability of more detailed tax data allows us to make these additional tests. In panel a, we see shows that when we use the fractile-specific top tax measure, MTR^s, instead of the statutory top rate, the income gradient in the top tax elasticity is present

[7] We run the analysis using first differences (over one and three years) instead of fixed effects to account for unobserved, constant characteristics. These results are generally consistent with our main analysis, with somewhat lower (higher) elasticities in the one-year (three-year) differences (see table C2). In addition, the appendix also contains more complete additional results in several dimensions discussed throughout the paper, e.g., using the full country sample rather than the sample of countries observed over the full period.

just like in our main analysis above. In the bottom half of the top decile, the tax elasticity is zero and then it increases the higher up the top decile one gets, reaching 0.45 in the top percentile and 0.68 in the top 0.1 percentile. Note that these last coefficients are clearly higher than the ones around 0.3 shown in Table 1. In panel b, we therefore examine whether this gap is due to the slightly different sample composition and size in the two cases and rerun the analysis using the MTR^{top} measure on the exact same sample. The coefficients are indeed close (we reject equality at all conventional significance levels) to the ones in panel a.

The endogeneity problem with our main analysis that we have mentioned in section 2, related to the concern that marginal tax rates may be mechanically related to income shocks that push income-earners in a different tax bracket while also changing income shares, is examine in panel c. That this problem may arise in regressions like ours was first pointed out by Gruber and Saez (2002) and we follow them and use an instrumental variable approach to predict the marginal tax rate that taxpayers would face if the income was unchanged from the previous year. Panel c presents 2SLS estimates that are very similar to the ordinary least-squares results in our main analysis for both coefficients and standard errors. In other words, our main specification results appear to be robust with respect to endogeneity bias arising from tax-rate determining income shocks.

In the final panel d, we examine if income earners respond differently to average tax rates (ATR^s) than to marginal tax rates. While standard tax theory predicts that people respond to marginal tax rates, the average tax rates may easier to observe and may thus influence behavior more than marginal tax rates do. However, although coefficients are indeed larger in this case, none of the differences is statistically significant at conventional levels.

[Table 3 about here]

5 What drives trends and gradients in top tax elasticities?

Our above analysis establishes a number of important facts about the structure and evolution of top tax elasticities in developed economies. But it is silent about what factors that may have caused it. In the present section, we make four distinct analyses aimed to shed light on the channels.

5.1 Macroeconomic outcomes and political institutions

Do macroeconomic factors and political institutions matter for how top income earners respond to the marginal income tax? *A priori*, the answer is not obvious, since even if these factors influence both taxation and top incomes this does not mean that they also influence how top earners respond to marginal taxation.

We approach this issue by including a number of macroeconomic and institutional variables, one at the time, in equation (2) to see if the baseline tax elasticity (which includes country fixed effect and country-specific trends) is affected. Table 4 presents the results for all top income fractiles studied over the 1981–2014 period in the same sample as in our main analysis (i.e., those countries that we observe for the entire historical period). Each row shows a new regression and only the tax elasticity is reported. Note that even if the t-tests concern difference from zero, the perhaps most relevant test is that between each row's elasticity and the baseline elasticity in the top. The results are strikingly consistent: none of the included additional variables move the estimated elasticity away from its level in the baseline specification. We first include GDP per capita in level and squared, without any effect in any of the fractiles. Trade union density dampens the elasticity somewhat, and when we run this regression over the full sample and thus also include countries only observed recent years, the tax elasticity of the top percentile drops by a third and has a p-value of about 1.65.

Adding globalization, measured by the KOF Index of Globalization (Dreher, 2006), or human capital, measured as educational attainment, has no impact on tax elasticities anywhere in the top income decile. This may be not be so surprising in the case of human capital, but more so in the case of openness. Standard trade models suggest that increasing factor flows make factor owners more responsive to taxation, and although this has been mostly applied to capital taxation some recent studies indicate similar effects on high-level wage earners (Kleven, Landais and Saez, 2013; Akcigit, Baslandze and Stantcheva, 2016). There may be many reasons for why we do not find any association, from the case where no link exists to a situation where the effect works either via other channels or over longer time windows. Including financial development suppresses the elasticity a bit, but the reduction is still not statistically significant. Interpreting such a small effect is therefore difficult, but it at least fits well with our other finding below that the tax elasticity increases during financial crises, i.e., contractions of the financial sector.

We also add two public policy variables, total tax revenues and central government spending as share of GDP, but none of them influences the estimated top tax elasticities.[8]

Altogether, we conclude that none of the macroeconomic or political variables that we included in our analysis have any significant bearing on the estimated top tax elasticities. However, given the substantial influence of country-specific fixed effects and time trends, clearly visible in Table 1, we cannot rule out that such institutional or real variables could indeed influence the tax responsiveness and that the quest for the appropriate variables therefore mus continue.

[Table 4 about here]

5.2 Wars and financial crises

History contains dramatic episodes of wars and financial crises that greatly affected the economic and political life of nations and their their citizens. In a series of studies, Ken Scheve

[8]We tried including measures of tax law institutions, the number of tax brackets and measures of the breadth of the income tax base, following the observations by Kopczuk (2005) of the potential influence by such tax institutions for the elasticity of taxable income, but this did not influence the tax elasticity.

and David Stasavage have convincingly shown that the rise of tax progressivity in the Western world is tied to wartime mass mobilization, whereby the bodily sacrifices of the masses forced politicians to make the rich sacrifice their money (see, e.g., Scheve and Stasavage, 2016). Other studies have shown how banking and financial crises affect the rich in various ways, often by imposing economic harm, at least momentarily (see, e.g., Roine et al., 2009).

We now examine whether the tax responsiveness of high-income earners changed during these times of turmoil. Specifically, we estimate tax elasticities during the two World Wars and controlling for if the countries were directly engaged in warfare or not (using classification schemes in Royal Institute of International Affairs, 1947). In addition, we also examine if top taxpayers changed their behavior during years of banking and or currency crises (using financial crises data of Bordo et al., 2001, and Laeven and Valencia, 2013).

Table 5 shows tax elasticity regressions for the top income percentile over the 1900–2014 period and how the elasticity changes when interacted with dummy variables for the incidence of World Wars, belligerence status during these wars, and banking crises, currency crises and twin crises (contemporaneous banking and currency crises). The results show that the top elasticity drops by one third, the baseline coefficient is 0.29 and the War dummy has a precisely estimated coefficient of –0.11. When separating countries that participated actively in the wars from those that did not, an interesting result appears: the negative War effect is entirely concentrated to top earners in countries at war whereas top earners in non-belligerent countries were not seemingly affected at all. One possible interpretation of this result is that not only did countries' wartime affairs boost top taxation (as Scheve and Stasavage find), but they also boosted the *willingness to contribute* among top earners in the belligerent countries. If correct, this suggests that the wartime spikes in fiscal redistribution was actually motivated from an economic efficiency perspective.

Banking and currency crises offer another set of exogenous shocks with potential influence on top earner tax responses. The results in Table 5 shows that banking crises are associated with higher responsiveness among top earners but that currency crises have the reverse, an equally large, association. Twin crises, i.e., when countries experience both a domestic banking crisis and a foreign exchange-related crisis, appear to almost double the top tax responsiveness, adding 0.21 to the baseline top tax elasticity of 0.25.

Summing up, we present new evidence suggesting robust links between top tax elasticities and geopolitical and economic shocks. The dampening effect of wars, but only in belligerent countries, has interesting resonance with the role of political context for fiscal policy-making. The role of financial crises is more complex, indicating that the nature of the crisis matters for how top earners respond to marginal taxation.

[Table 5 about here]

5.3 Income shifting and tax avoidance

Tax systems provide different degree of opportunities for top income earners to avoid taxation, e.g., by shifting incomes either across tax bases with different marginal tax rates or smooth incomes over time to avoid high progressive tax rates. Defining MTR^w as the top statutory tax rate on wage income and MTR^k as the top statutory tax rate on capital income, it follows that if $MTR^w \neq MTR^k$, taxpayers can minimize income taxes by shifting income from the more taxed to the less taxed base. Since, typically, capital is taxed at a lower rate than wage income, earners at the very top of the income distribution may potentially benefit more from such distortion, since they receive more income from capital.[9]

We can divide total income Y into two shares, Y^w is the share of wage income, and Y^k is the share of capital income. The tax system does not provide income-sheltering opportunities as long as each income share is correlated only to its own tax rate. In such case, regressing equations like

$$\text{log}Y_{it}^{s,w} = e_1^s \text{log}(1 - MTR_{it}^w) + e_2^s \text{log}(1 - MTR_{it}^k) + \mu_i^s + \mu_i^s t^s + u_{it}^s. \tag{3}$$

can be expect to have e_1 as the only statistically significant elasticity coefficient.[10] However, when allowing for income sheltering, then e_2 may also be non-zero. Furthemore, if income-shifting opportunities are available and practiced, then e_1 should have the *opposite sign* of the original e_1 without income shifting. In other words, if income-shifting is allowed, Y^w reacts negatively to a decrease in MTR^k, since it would be not optimal from a tax liability minimization problem.

Empirically, we measure MTR^k as the top statutory tax rate on corporate income and MTR^w as the top statutory tax rate on wage, earnings and pensions. We define Y^w as the share of income from earnings, salaries and pensions (as provided by WID) and all the other sources of income as Y^k. Only for some countries the WID split capital income in their different sources (dividends, rents, interests, etc.) However, for consistency reasons, we define Y^w as $100 - Y^w$, i.e. the share of income that does not originate from wage. Data availability allows to perform such test only for 10 countries (Australia, Canada, France, Italy, Japan, Korea, Netherlands, Spain, Taiwan, and US), a subset of the original dataset.

The results from this test of the presence of tax-driven income shifting among top wage income earners are presented in Table 6. They suggest that the very top of the distribution, the top 0.1 percentile, reacts quite strongly to differential taxation across income sources. The net of tax elasticity with respect to capital taxation is -0.41 with a standard error of 0.15. This

[9]According to the income decomposition provided by WID, on average (considering the data at hand) the bottom half of the top decile possess a share of income from capital around 15 percent of total income. On the other hand, capital share increases by more than four times (around 65 percent) for the top 0.1.

[10]We have thought about other specifications to identify the tax avoidance/income shifting responses, but given our data limitations we have been unable to formulate any variants that work both conceptually and empirically. Our trials included using both top wage and top capital income tax rates in the same regressions, regressing top total income shares or top total income levels on either wage or capital taxes.

implies that despite no direct link between wage incomes and capital taxes, a drop in marginal capital income taxation is associated with a large drop in wage income in the top 0.1 percentile. In the fractiles below the very top, however, we see less of a response of wage incomes to cuts in capital taxation. This most likely reflects that capital incomes are much less important lower down in the top decile; even if the wanted to, these taxpayers have no significant taxable capital income to shift over to.

[Table 6 about here]

5.4 Real responses

The standard labor supply model of taxation (see section 2) postulates that the elasticity of taxable income is a "real" response by which income earners adjust their hours worked or intensity in the work done. With such response, a high elasticity reflects the efficiency costs of taxation in contrast tax avoidance-related behavior that can be managed by improving the tax design or better monitoring. Our dataset is not ideal to separate between these two channels of top elasticities; we do not observe the real responses by top income group. However, we can match the top income tax data to various measures of aggregate real economic outcomes which reflect activity and efficiency dimensions of a labor supply model as previously also suggested by Piketty et al. (2014). If these measures give rise to similar tax elasticities as the top income shares, that would indicate that labor supply model-oriented explanations do indeed have bearing on the central findings of this study.

Table 7 presents five different "real responses" and their responses to top marginal taxation using the same baseline specification as in our main analysis above, including country fixed effects and country-specific time trends. First and foremost, we examine GDP per capita. Over the entire historical period since 1900, this variable is associated with a barely significant tax elasticity of 0.05, which is five times lower than the top percentile tax elasticity. In the different subperiods, GDP per capita is essentially zero in all cases. Second, real domestic absorption, defined as the sum of consumption and investment, is is only available in the postwar era. It has a small, positive but quite imprecisely estimated tax elasticity. Third, the aggregate number of hours worked has an elasticity just below zero in before 1980 and just above zero thereafter and is thus not indicating any pattern consistent with the labor supply model. The fourth indicator is the number of patents per capita, indicating innovation activity and therefore of interest. Its long-run top tax elasticity is 0.10, which is less than half the top percentile elasticity, but in the period before 1950 its elasticity is 0.15 and this is about the same as the top percentile elasticity. However, in the postwar era the patents elasticity is negative but insignificantly different from zero. Finally, we examine the tax elasticity of total tax revenues over GDP, a broad indicator or the capacity of the state to collect funds, but cannot find any significant associations for the postwar era when we have data.

Altogether, these tests reject the existence of large real responses to top marginal income taxation, both in the centurylong perspective and over shorter time periods. Some individual periods do indeed exhibit positive tax elasticities among these variables, but they are still considerably smaller than the top percentile income elasticities and also seldom consistent across eras.

[Table 7 about here]

6 Conclusions

The goal of this paper has been to explore and explain new facts about the evolution of top income tax elasticities over the past century, their variation across countries, and the extent to which they differ even within the very top of the income distribution. Several of these patterns have been studied before, but the scope of our newly compiled historical cross-country dataset and the close scrutiny of historical and international trends of top tax elasticities appears to be a unique contribution to the literature.

Our main finding is that top tax elasticities vary a lot, and that they do so in several dimensions. We document a J-shaped time trend in tax responses over the past century, most pronounced among the highest-earning groups while we cannot find any such trend in the lower half of the top income decile. Taxpayers in Anglo-Saxon countries account for a large part of this J-shape, especially regarding the increased elasticity in the most recent period, while Continental European and Nordic top income earners do not seem to have become more responsive to taxes in recent years. Several potential explanations to these patterns are examined, one of the most important being income shifting between high-taxed (labor income) and low-taxed (capital income) tax bases. Wars and financial crises also seem to affect top taxpayer behavior, but we could not find any marked tax responses in aggregate measures of productivity or economic efficiency, indicators of "real responses" to taxation.

We also find evidence of a considerable income gradient in the top tax elasticity, with a top 0.1 elasticity being more than four times that the elasticity in the Top 5-1 group and much more than that in the bottom half (where the elasticity is zero). This heterogeneous response to tax rate changes has implications for the empirical identification of tax elasticities. This identification usually relies on comparing differences in tax rate changes across taxpayers with different level of income (see Weber, 2014, for a discussion of difference-in-differences methodology in this literature). However, since the behavioral response to taxation varies with income, this kind of identification may be problematic and a single overall elasticity will not be applicable when considering the impact of tax rates changes that target only a specific fractile of the income distribution.

Needless to say, a paper with a scope such as ours leaves many stones unturned. We have already discussed the problematic aspects of using grouped income data, hiding both individual-level variation in tax responses and preventing us to freely choose concept of income across income sources. Extending the historical income distribution data by adding information about different income sources would be valuable. Collecting more data on historical tax institutions allowing for a further examination of their role for taxpayer behavior would also be welcome. We hope that our work will stimulate further research on such aspects since that would improve our understanding of the nature of tax responses among groups in the top of the income distribution.

References

Akcigit, U., S. Baslandze, S. Stantcheva (2016). "Taxation and the international mobility of inventors." The *American Economic Review* 106(10): 2930-2981.

Auerbach, A. J. (1988). "Capital gains taxation in the United States." *Brookings Papers on Economic Activity* 2: 595–631.

Alvaredo, F., A. B. Atkinson, T. Piketty, E. Saez, G. Zucman (2016). "The World Wealth and Income Database." http://www.wid.world, accessed on 04/02/2016.

Atkinson, A. B., A. Leigh (2013). "The distribution of top incomes in five Anglo-Saxon countries over the long run." *Economic Record* 89(S1): 31–47.

Atkinson, A. B., T. Piketty (eds.) (2007). *Top incomes in the United Kingdom over the Twentieth Century: A contrast between Continental European and English-Speaking Countries.* Oxford: Oxford University Press.

Atkinson, A. B., T. Piketty, E. Saez (2011). "Top incomes in the long run of history." *Journal of Economic Literature* 49: 3–71.

Bengtsson, N., B. Holmlund, D. Waldenström (2016). "Lifetime versus annual tax and transfer progressivity: Sweden, 1968–2009." *Scandinavian Journal of Economics* 118(4): 619–645.

Bordo, M., B. Eichengreen, D. Klingebiel, M. S. Martinez-Peria (2001). "Is the crisis problem growing more severe?" *Economic Policy* 16(32).

Doerrenberg, P., A. Peichl (2014). "The impact of redistributive policies on inequality in OECD countries." *Applied Economics* 46(17): 2066–2086.

Dreher, A. (2006). "Does globalization affect growth? Evidence from a new index of globalization." *Applied Economics* 38(10): 1091–1110.

Feenberg, D. R., J. M. Poterba (1993). "Income inequality and the incomes of very high-income taxpayers: evidence from tax returns." in Poterba, J. M. (ed.), *Tax Policy and the Economy* 7: 145–177.

Feenstra, R. C., R. Inklaar, M. P. Timmer (2015). "The next generation of the Penn World Table." *The American Economic Review* 105(10): 3150–3182.

Feldstein, M. (1995). "The effect of marginal tax rates on taxable income: A panel study of the 1986 Tax Reform Act." *Journal of Political Economy* 103: 551–572.

Feldstein, M. (1999). "Tax avoidance and the deadweight loss of the income tax." *Review of Economics and Statistics* 81(4): 674–680.

Goolsbee, A. (2000). "What happens when you tax the rich? Evidence from executive compensation." *Journal of Political Economy* 108(2): 352–378.

Gruber, J., E. Saez (2002). "The elasticity of taxable income: evidence and implications."

Journal of Public Economics 84(1): 1–32.

Kopczuk, W. (2005). ”Tax bases, tax rates and the elasticity of reported income.” *Journal of Public Economics* 89(11): 2093–2119.

Kleven, H. J., C. Landais, E. Saez (2013). ”Taxation and international migration of superstars: Evidence from the European football market.” *The American Economic Review* 103(5): 1892–1924.

Kleven, H. J., E. A. Schultz (2014). ”Estimating taxable income responses using Danish tax reforms.” *American Economic Journal: Economic Policy* 6(4): 271–301.

Laeven, L., F. Valencia (2013). ”Systemic banking crises database.” *IMF Economic Review* 61(2): 225–270.

Leigh, A. (2009). “Top incomes.” in Salverda, W., B. Nolan, T. Smeeding (eds.), *The Oxford Handbook of Economic Inequality*. Oxford: Oxford University Press.

Piketty, T., Saez, E., Stantcheva, S. (2014). ”Optimal taxation of top labor incomes: a tale of three elasticites.” *American Economic Journal: Economic Policy* 6(1): 230–271.

Roine, J., J. Vlachos, D. Waldenström (2009). ”The long-run determinants of inequality: What can we learn from top income data?” *Journal of Public Economics* 93(7): 974–988.

Roine, J., D. Waldenström (2008). ”The evolution of top incomes in an egalitarian society: Sweden, 1903–2004.” *Journal of public economics* 92(1): 366–387.

Roine, J., D. Waldenström (2012). ”On the role of capital gains in Swedish income inequality.” *Review of Income and Wealth* 58(3): 569–587.

Roine, J., D. Waldenström (2015). ”Long-run trends in the distribution of income and wealth.” in Atkinson, A.B., F. Bourguignon (eds.), *Handbook of Income Distribution*, vol. 2A, Amsterdam: North-Holland.

Royal Institute of International Affairs (1947). *Chronology of the Second World War*. London.

Rubolino, E., D. Waldenström (2017). ”Tax progressivity and top income shares: Evidence from tax reforms.” Mimeo, Paris School of Economics.

Saez, E. (2004). ”Reported incomes and marginal tax rates, 1960-2000: evidence and policy implications.” *Tax Policy and the Economy* 18: 117–174.

Saez, E. (2017). ”Taxing the rich more: Preliminary evidence from the 2013 Tax Increase”, *Tax Policy and the Economy* 31, forthcoming.

Saez, E., J. Slemrod, S. H. Giertz (2012). ”The elasticity of taxable income with respect to marginal tax rates: A critical review.” *Journal of Economic Literature*: 3–50.

Scheve, K., D. Stasavage (2016). *Taxing the rich: A history of fiscal fairness in the United States and Europe*. Princeton, NJ: Princeton University Press.

Slemrod, J. (1995). ”Income creation or income shifting? Behavioral responses to the Tax Reform Act of 1986.” *American Economic Review* 85(2): 175–180.

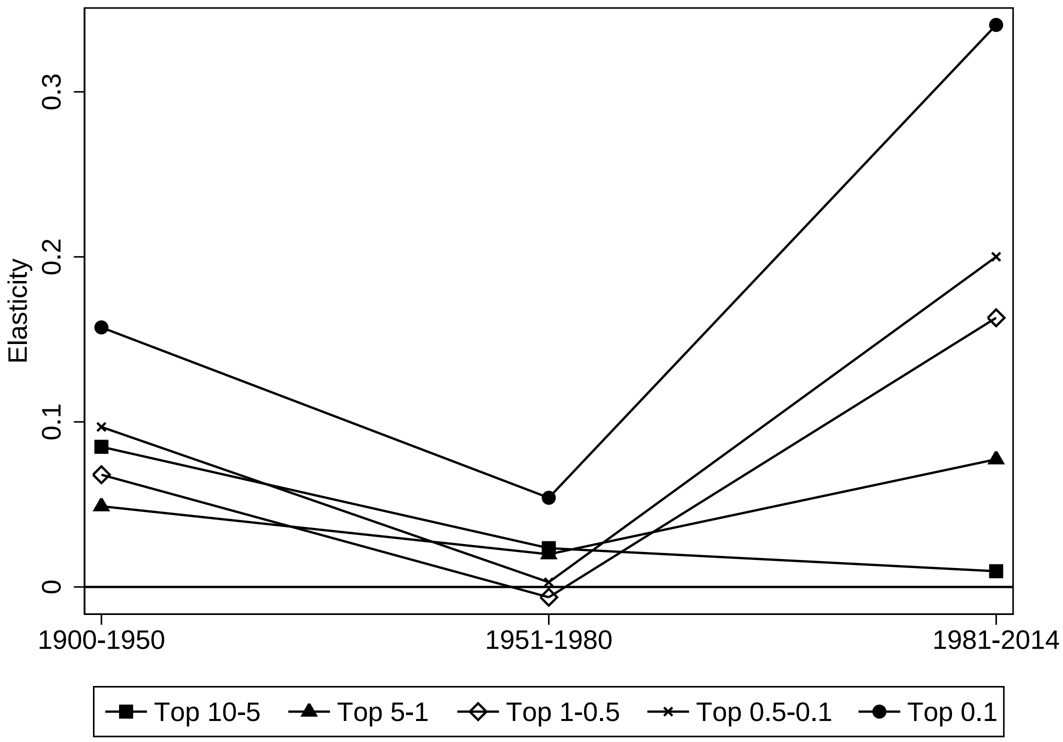
Slemrod, J. (1996). “High income families and the tax changes of the 1980s: the anatomy of behavioral response.” in Feldstein M. and J. Poterba (eds.), *Empirical Foundations of Household Taxation*. University of Chicago.

Weber, C. E. (2014). ”Toward obtaining a consistent estimate of the elasticity of taxable income using difference-in-differences.” *Journal of Public Economics* 117: 90–103.

Figure 1: Elasticity of top percentile over the long-run

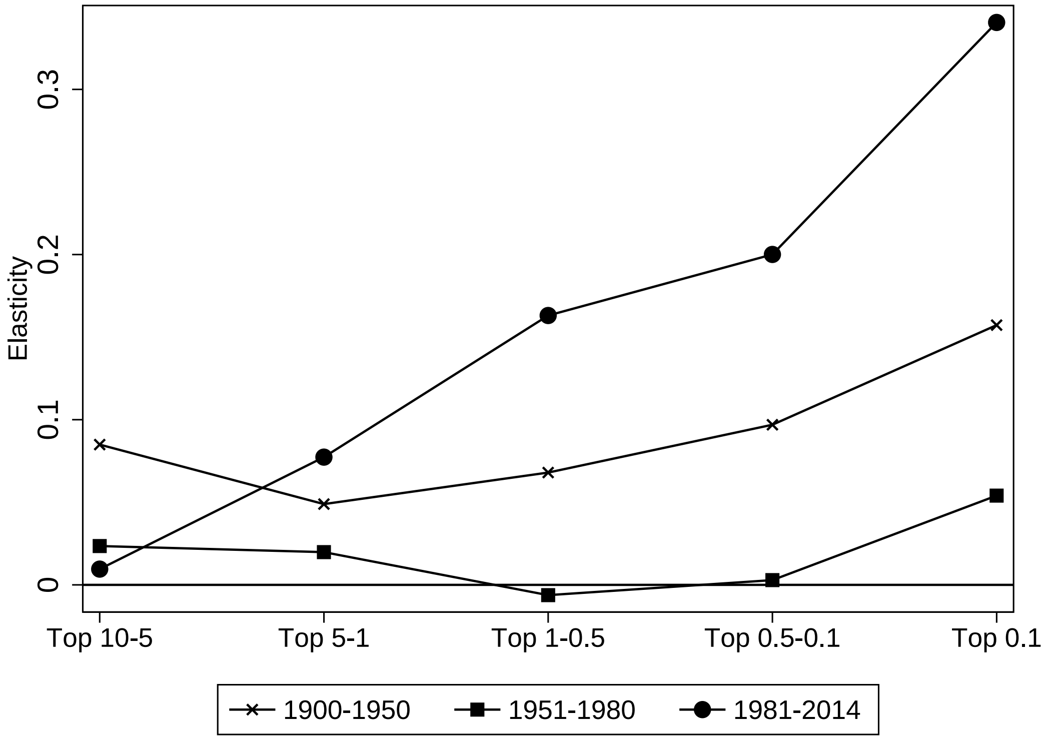
Note: This figure shows the elasticity of the top percentile over six different 20-years periods. It is the ϵ coefficient obtained regressing equation $log(top1_{it}) = \epsilon \times log(1 - MTR_{it}^{top}) + \mu_i + \mu_i t + u_{it}$. We control for both country fixed effects, μ_i, and country-specific time trend, $\mu_i t$. Coefficients and associated SEs are reported in Appendix table C6. The sample is composed of Australia, Canada, Denmark, France, Japan, New Zealand, Norway, Sweden, UK, and US. A replication of this figure using the full 30 countries sample is available in Appendix figure C1. Top percentile series are from WID, whereas tax rates' sources are listed in table B1.

Figure 2: Trends in top tax elasticities over the long-run



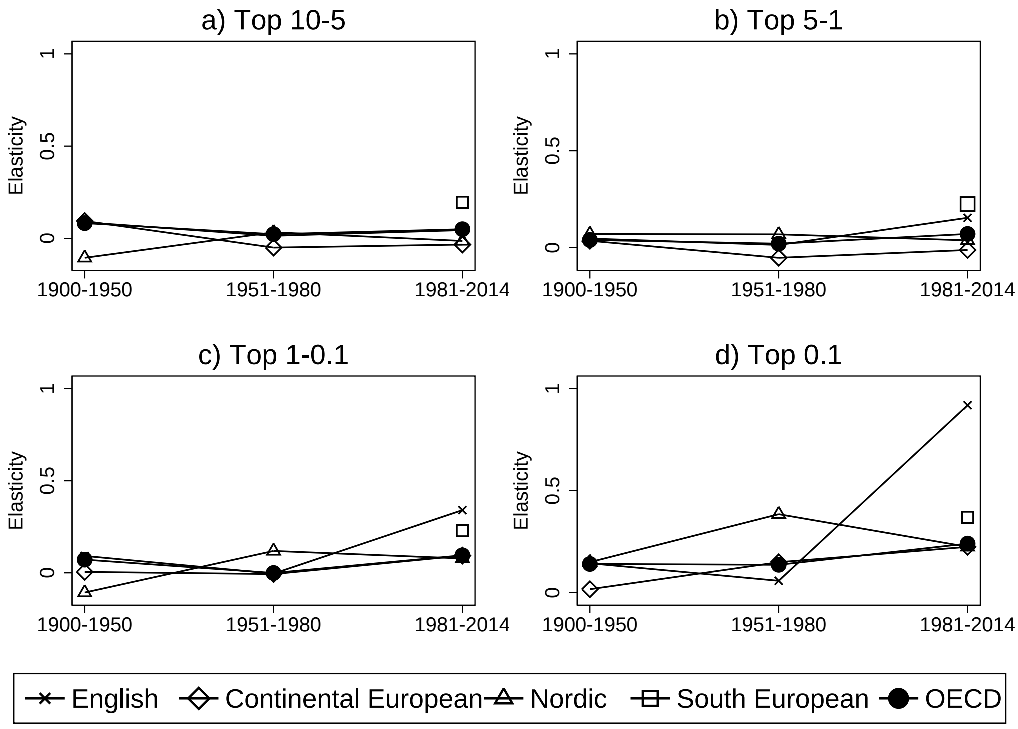
Note: This figure shows the elasticity of the Top 10-5, Top 5-1, Top 1-0.5, Top 0.5-0.1, and Top 0.1 over three different periods. It is the ϵ^s coefficient obtained regressing equation $log(y^s_{it}) = \epsilon^s \times log(1 - MTR^{top}_{it}) + \mu^s_i + \mu^s_i t^s + u^s_{it}$. We control for both country fixed effects, μ_i, and country-specific time trend, $\mu_i t$. Coefficients and associated SEs are from the baseline model reported in table 1, panel b) for 1900-1950 period, panel c) for 1951-1980 period, and panel d) for 1981-2014 period. The sample is composed of Australia, Canada, Denmark, France, Japan, New Zealand, Norway, Sweden, UK, and US. A replication of this figure using the full 30 countries sample is available in Appendix figure C2. Top income shares are from WID, whereas tax rates' sources are listed in table B1.

Figure 3: Gradients in top tax elasticities



Note: This figure illustrates the gradient in top tax elasticities over three different periods. Coefficients and associated SEs are from the baseline model reported in table 1, panel b) for 1900-1950 period, panel c) for 1951-1980 period, and panel d) for 1981-2014 period. The sample is composed of Australia, Canada, Denmark, France, Japan, New Zealand, Norway, Sweden, UK, and US. A replication of this figure using the full 30 countries sample is available in Appendix figure C3. Top income shares are from WID, whereas tax rates' sources are listed in table B1.

Figure 4: Country-group elasticity



Note: This figure shows the elasticity of the Top 10-5, Top 5-1, Top 1-0.1, and Top 0.1 over three different periods and for five different groups of countries: English (Australia, Canada, Ireland, New Zealand, UK, and US), Continental European (France, Germany, and Netherlands), Nordic (Denmark, Finland, Norway, and Sweden), South European (Italy, Portugal, and Spain), and OECD (all the previous plus Japan and Korea). Elasticities are computed controlling for both country fixed effects and country-specific time trend. Coefficients and associated SEs are reported in table C6. Top income shares are from WID, whereas tax rates' sources are listed in table B1.

Table 1: Long-term evidence on top tax elasticity

	Top 10	Top 1	Top 0.1	Top 10-5	Top 5-1	Top 1-0.5	Top 0.5-0.1
a) 1900-2014							
Baseline	0.11***	0.26***	0.40***	0.01	0.07***	0.12***	0.18***
	(0.01)	(0.03)	(0.06)	(0.02)	(0.01)	(0.02)	(0.03)
Country FE	0.10***	0.23***	0.38***	0.05***	0.06***	0.10***	0.14***
	(0.02)	(0.05)	(0.08)	(0.01)	(0.02)	(0.03)	(0.05)
No controls	0.06**	0.16***	0.23**	0.03	0.04*	0.06*	0.08
	(0.03)	(0.06)	(0.10)	(0.02)	(0.02)	(0.03)	(0.05)
Obs.	771	878	869	770	823	872	846
b) 1900-1950							
Baseline	0.08***	0.11***	0.16***	0.08***	0.05**	0.07***	0.10***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Country FE	0.12***	0.25***	0.34***	0.03	0.06**	0.12***	0.19***
	(0.02)	(0.04)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)
No controls	0.06***	0.16***	0.19***	0.01	0.01	0.07***	0.08***
	(0.02)	(0.04)	(0.06)	(0.02)	(0.02)	(0.02)	(0.03)
Obs.	172	272	304	172	226	272	277
c) 1951-1980							
Baseline	0.02	0.01	0.05	0.02	0.02	-0.01	0.01
	(0.01)	(0.02)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
Country FE	0.01	-0.09**	-0.12*	0.05***	0.03**	-0.06**	-0.10***
	(0.01)	(0.04)	(0.06)	(0.01)	(0.01)	(0.02)	(0.04)
No controls	0.01	-0.07*	-0.09	0.04*	0.03	-0.04*	-0.08**
	(0.02)	(0.04)	(0.06)	(0.02)	(0.02)	(0.02)	(0.04)
Obs.	286	293	289	286	285	293	290
d) 1981-2014							
Baseline	0.10***	0.29***	0.34***	0.01	0.08***	0.16***	0.20***
	(0.03)	(0.08)	(0.10)	(0.02)	(0.02)	(0.05)	(0.06)
Country FE	0.26***	0.64***	1.10***	0.07**	0.20***	0.34***	0.53***
	(0.04)	(0.10)	(0.18)	(0.03)	(0.02)	(0.07)	(0.10)
No controls	0.33***	0.69***	1.13***	0.16***	0.25***	0.44***	0.62***
	(0.07)	(0.12)	(0.20)	(0.05)	(0.06)	(0.09)	(0.12)
Obs.	313	313	276	312	312	307	279

Note: This table shows the elasticities of 7 top income groups over four different periods. Elasticities are obtained regressing equation $log(y^s_{it}) = \epsilon^s \times log(1 - MTR^{top}_{it}) + \mu^s_i + \mu^s_i t + u^s_{it}$. We control for both country fixed effects, μ_i, and country-specific time trend, $\mu_i t$. The sample is composed of Australia, Canada, Denmark, France, Japan, New Zealand, Norway, Sweden, UK, and US. A replication of this figure using the full 30 countries sample is available in Appendix table C1. Top income shares are from WID, whereas tax rates' sources are listed in table B1. Newey-West standard errors with 8 lags in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Country-specific elasticity of top percentile

Country	Coverage	Full period 1900-2014	Early era 1900-1950	Early postwar 1951-1980	Recent period 1981-2014
Argentina	1932-2004	-0.26 [29]	-0.17 [18]	- [3]	- [8]
Australia	1921-2010	0.12 [90]	0.05 [30]	-0.15* [30]	0.74*** [30]
Canada	1920-2010	0.14*** [90]	0.11*** [30]	0.01 [30]	0.18 [30]
China	1986-2003	n.v. [18]	-	-	n.v. [18]
Colombia	1993-2010	0.88*** [18]	-	-	0.88*** [18]
Denmark	1918-2010	0.4** [90]	0.01 [33]	-0.55 [27]	-0.2** [30]
Finland	1920-2009	0.78*** [90]	0.53*** [31]	0.17 [30]	-0.49 [29]
France	1919-2012	0.21*** [94]	0.03 [32]	-0.03 [30]	0.26*** [32]
Germany	1900-2008	0.20* [55]	0.04 [33]	0.49** [8]	0.18 [14]
India	1974-1999	-0.07 [22]	-	- [3]	1.21 [19]
Indonesia	1920-2004	1.37** [28]	-1.03*** [16]	-	0.90 [12]
Ireland	1975-2009	-0.13 [35]	-	- [6]	-0.32 [29]
Italy	1974-2009	0.16 [34]	-	n.v. [7]	0.19*** [27]
Japan	1900-2010	0.36*** [110]	0.47*** [50]	-0.32** [30]	-0.14* [30]
Korea	1979-2012	-0.21 [24]	-	n.v. [1]	-0.33 [23]
Malaysia	1974-2012	0.22* [18]		n.v. [1]	0.16 [17]
Mauritius	1952-2011	-0.54 [41]	-	n.v. [18]	-0.28*** [23]
Netherlands	1914-2012	0.16* [68]	-0.15** [29]	0.62 [13]	-0.03 [26]
New Zealand	1921-2012	0.46*** [85]	0.24*** [24]	0.29*** [29]	0.61*** [32]
Norway	1900-2011	0.58*** [72]	0.667*** [12]	0.07 [29]	0.23 [31]
Portugal	1976-2005	0.11 [24]	-	- [5]	0.40*** [19]
Singapore	1947-2012	0.36*** [59]	-	0.17** [28]	-0.31 [31]
South Africa	1914-2011	0.11 [72]	-0.25*** [32]	-0.14 [18]	-1.31 [22]
Spain	1981-2012	0.05 [32]	-	-	0.05 [32]
Sweden	1903-2013	0.56*** [82]	0.04 [19]	0.57*** [30]	0.09*** [33]
Switzerland	1960-2010	4.79** [33]	-	n.v. [10]	-1.01 [23]
Taiwan	1977-2013	-0.19 [37]	-	n.v. [4]	-0.14 [33]
UK	1918-2012	0.16* [63]	- [4]	-0.02*** [28]	0.58*** [31]
US	1913-2014	0.23*** [102]	0.13*** [38]	0.03 [30]	0.74*** [34]
Zimbabwe	1974-1984	- [8]	-	- [6]	n.v. [2]

Note: This table shows ϵ coefficients from time-series regressions of the form: $log(top1_t) = a_t + \epsilon \times log(1 - MTR_t^{top}) + \beta t + u_t$. The regressions are run over the whole time period and three sub-periods. When there is no variation in MTR^{top} or top percentile, we report "n.v.", that means no variation. Number of observations are reported in the square brackets. We exclude elasticities based on less than 10 observations. Top 1 percent is from WID. The sources for MTR^{top} are described in Appendix B, table B1. In table C5 we compute the country-specific elasticity for Top 10-5 (panel a) and Top 0.1 (panel b). *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Sensitivity analysis, 1981-2014

	Top 10	Top 1	Top 0.1	Top 10-5	Top 5-1	Top 1-0.5	Top 0.5-0.1
a) Elasticity w.r.t. $1 - MTR^s$ (OLS)							
Elasticity	0.19***	0.45***	0.68***	0.02	0.15***	0.24***	0.34***
	(0.03)	(0.07)	(0.14)	(0.03)	(0.04)	(0.03)	(0.06)
Obs.	411	411	359	381	381	409	362
b) Elasticity w.r.t. $1 - MTR^{top}$ (OLS)							
Elasticity	0.18***	0.41***	0.52***	0.07	0.15***	0.25***	0.33***
	(0.04)	(0.07)	(0.11)	(0.05)	(0.04)	(0.05)	(0.06)
Obs.	411	411	359	381	381	409	362
c) Elasticity w.r.t. $1 - MTR^s$ (2SLS)							
Elasticity	0.22***	0.44***	0.64***	0.01	0.18***	0.31***	0.35***
	(0.03)	(0.07)	(0.12)	(0.03)	(0.03)	(0.04)	(0.06)
Obs.	395	395	343	365	365	393	345
d) Elasticity w.r.t. $1 - ATR^s$ (OLS)							
Elasticity	0.25***	0.62***	0.83***	-0.03	0.18***	0.36***	0.46***
	(0.06)	(0.10)	(0.18)	(0.04)	(0.06)	(0.07)	(0.08)
Obs.	411	411	359	381	381	409	362

Note: We perform four different sensitivity tests over the 1981-2014 period. In panel a) we use fractile-specific marginal tax rates (MTR^s). In panel b) we use the top statutory marginal tax rate on personal income MTR^{top} holding the sample constant. In panel c) we use the 2SLS method, where MTR^s are instrumented by the (Gruber and Saez, 2002) predicted marginal tax rate. In panel d) we use fractile-specific average tax rates (ATR^s). Fractile-specific tax rates are authors' computations from OECD Tax Database (see Appendix B2 for details). Top marginal tax rates' sources are specified in table B1. Top income shares are from WID. In each regression we control for country fixed effects and country-specific time trend. We use Newey-West standard errors with 8 lags. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Controlling for non-tax related factors

Controlling for...	Top 10	Top 1	Top 0.1	Top 10-5	Top 5-1	Top 1-0.5	Top 0.5-0.1
Baseline	0.10*** (0.03)	0.29*** (0.08)	0.34*** (0.10)	0.01 (0.02)	0.08*** (0.02)	0.16*** (0.05)	0.20*** (0.06)
GDP per-capita	0.08*** (0.03)	0.27*** (0.07)	0.32*** (0.11)	0.01 (0.02)	0.06** (0.02)	0.16*** (0.05)	0.17*** (0.06)
GDP per-capita and its square	0.08*** (0.03)	0.28*** (0.08)	0.25*** (0.11)	-0.02 (0.02)	0.05** (0.02)	0.17*** (0.05)	0.13*** (0.06)
Trade union density	0.08*** (0.02)	0.25*** (0.05)	0.33*** (0.10)	0.01 (0.02)	0.06*** (0.02)	0.15*** (0.04)	0.18*** (0.06)
Human capital	0.08*** (0.03)	0.26*** (0.07)	0.34*** (0.11)	-0.01 (0.02)	0.06*** (0.02)	0.13*** (0.05)	0.19*** (0.06)
Globalization	0.06*** (0.02)	0.22*** (0.06)	0.25** (0.09)	-0.01 (0.02)	0.05** (0.02)	0.14*** (0.04)	0.13*** (0.05)
Financial development	0.06*** (0.02)	0.20*** (0.06)	0.28*** (0.10)	0.01 (0.02)	0.04*** (0.02)	0.12*** (0.04)	0.14*** (0.12)
Tax Revenue	0.09*** (0.03)	0.27*** (0.07)	0.32*** (0.10)	0.01 (0.02)	0.08*** (0.02)	0.15*** (0.05)	0.19*** (0.07)
Public spending	0.06** (0.03)	0.25*** (0.07)	0.35*** (0.10)	-0.02 (0.02)	0.03 (0.02)	0.20*** (0.04)	0.14** (0.06)

Note: We start from the baseline regression $log(y^s_{it}) = \epsilon^s \times log(1 - MTR^{top}_{it}) + \mu^s_i + \mu^s_i t^s + u^s_{it}$ and then we add, one by one, several potential non-tax related components of top incomes' evolution to check whether e^s varies significantly. All the controls are log-transformed. The baseline model takes into account both country fixed effects and country-specific time trends. The model is estimated for 10 countries (Australia, Canada, Denmark, France, Japan, New Zealand, Norway, Sweden, UK, and US) over the 1981-2014 period. Newey-West standard errors with 8 lags in parenthesis. GDP per capita is from The Maddison-Project, trade union density as a share of employees and tax revenue as a share of GDP are from OECD, human capital (based on returns of education) is from the Penn World Table, version 9. Public spending (central government spending as a share of GDP) and financial development (sum of bank deposits and stock market capitalization as share of GDP) are from Roine et al. (2009). Globalization (2016 KOF index of globalization) is from Dreher (2006). Top income shares from WID. Data sources on top marginal tax rates are illustrated in table B1. In appendix table C7 we replicate this table using MTR^s. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: The role of wars and crises

Top 1

	(1)	(2)	(3)	(4)	(5)	(6)
e	0.25***	0.29***	0.37***	0.24***	0.25***	0.25***
	(0.03)	(0.03)	(0.07)	(0.03)	(0.03)	(0.03)
e*War		-0.11***	0.29			
		(0.03)	(0.18)			
e*War*Belligerent			-0.41**			
			(0.19)			
e*BC				0.14**	0.16**	0.10
				(0.07)	(0.07)	(0.08)
e*CC					-0.10***	-0.11***
					(0.03)	(0.04)
e*BC*CC						0.21**
						(0.09)

Note: The dummy "War" assumes value 1 for t = 1914-1918 and 1939-1945, 0 otherwise. The dummy "Belligerent" assumes value 1 if the country was involved in at least one war, 0 otherwise. The countries classification and date for WWII are the following: Argentina=1 (03/1945), Australia=1 (09/1939), Canada=1 (09/1939), China=1 (12/1941), Colombia=1 (11/1943), Denmark=0, Finland=1 (06/1941), France=1 (09/1939), Germany=1 (09/1939), India=1 (09/1939), Indonesia=0, Ireland=0, Italy=1 (01/1940), Japan=1 (07/1941), Korea=0, Mauritius=0, Malaysia=0, Netherlands=1 (05/1940), New Zealand=1 (09/1939), Norway=1 (04/1940), Portugal=0, Singapore=0, South Africa=1 (09/1939), Spain=0, Sweden=0, Switzerland=0, Taiwan=0, UK=1 (09/1939), US=1 (12/1941), Zimbabwe=0. We use the classification schemes of Royal Institute of International Affairs (1947). the The dummies "BC" and "CC" assume value 1 if a banking crisis or currency crisis respectively occurred at time t, 0 otherwise. Data on financial and currency crises are from Bordo et al., 2001, and Laeven and Valencia, 2013. Newey-West standard errors with 8 lags in parenthesis. Top 1 income share from WID. Sources on top marginal tax rates are illustrated in table B1. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Income share composition and tax rates

	Top $10-5^w$	Top $5-1^w$	Top $1-0.5^w$	Top $0.5-0.1^w$	Top 0.1^w
$(1-MTR^w)$	-0.07***	-0.03	0.05	0.06	0.07*
	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)
$(1-MTR^k)$	-0.08*	-0.03	0.17*	-0.01	-0.41***
	(0.04)	(0.07)	(0.10)	(0.13)	(0.15)
Obs.	262	263	264	264	343

Note: This table displays e_1^s and e_2^s coefficients from equation log$Y_{it}^{s,w} = e_1^s$log$(1-MTR_{it}^w)+ e_2^s$log$(1-MTR_{it}^k)+\mu_i^s+\mu_i^s t^s + u_{it}^s$, where Y^w represents the share of income from earnings, salaries and pensions (as provided by WID), and MTR^w and MTR^k are the tax rate on wage income (see table B1 for sources) and corporate income (see table B2 for sources), respectively. Data availability allows to perform such test only for 10 countries (Australia, Canada, France, Italy, Japan, Korea, Netherlands, Spain, Taiwan, and US). Newey-West standard errors with 8 lags in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Real responses to tax rate

	Top 1	GDP pc	CDA pc	Hours	Patents pc	Tax Revenue
i) 1900-2014						
Elasticity	0.26***	0.04	-0.08**	-0.01	0.16***	-0.01
	(0.03)	(0.03)	(0.04)	(0.01)	(0.04)	(0.03)
Obs.	878	864	592	615	825	469
ii) 1900-1950						
Elasticity	0.11***	-0.02			0.18***	
	(0.02)	(0.04)			(0.04)	
Obs.	272	272			272	
iii) 1951-1980						
Elasticity	0.01	0.01	0.04*	-0.02*	-0.02	-0.04
	(0.02)	(0.02)	(0.02)	(0.01)	(0.04)	(0.02)
Obs.	293	293	293	293	293	156
iv) 1981-2014						
Elasticity	0.29***	-0.03	-0.05	0.02**	-0.06	0.05
	(0.08)	(0.04)	(0.05)	(0.01)	(0.10)	(0.04)
Obs.	313	299	289	313	234	281

Note: This table computes the elasticity of various variables reflecting real responses with respect to the net-of-top marginal tax rate. We control for both country fixed effects and country-specific time trend in each regression. ”GDP pc”, ”CDA pc”, ”Hours”, ”Patents pc”, and ”Tax Revenue” indicate GDP per-capita (value of final goods and services produced within a country in a given year, divided by the average population for the same year), real domestic absorption (real consumption plus investment) at current PPPs (in mil. 2011 US dollars), average annual hours worked by persons engaged, number of registered patents per capita, and tax revenue as a share of GDP, respectively. Data is available over the 1900-2014 period for GDP; 1900-2006 for patents; 1950-2014 for real domestic absorption and average annual hours worked; 1965-2014 for tax revenue. Data source on GDP per-capita and population from Maddison (2013), real domestic absorption and average annual hours worked from Penn World Table (version 9), number of patents from Roine et al. (2009), tax revenue from OECD. The sample is composed of Australia, Canada, Denmark, France, Japan, New Zealand, Norway, Sweden, UK, and US. A replication of this figure using the full 30 countries sample is available in Appendix table C8. Newey-West standard errors with 8 lags in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Appendix A: Income data

Table A1: Key features in top income data

Country	Coverage	Tax unit, age-cut off	Income concept	Reference income basis	Capital gains included?
Argentina	1932-2004	Ind. 20+	GI	Nat. Acc.	No
Australia	1921-2010	Ind. 15+	GI	Nat. Acc.	Yes, where taxable
Canada	1920-2010	Ind. 20+	GI	Nat. Acc.	No (but reported after 1971)
China	1986-2003	Ind./Fam.	GI (including transfers)	Survey	No
Colombia	1993-2010	Ind. 20+	GI	Tax stat.	Yes
Denmark	1918-2010	Fam. 18+ - 1969; Ind. 15+ 1970-	GI, AI	Tax stat.	Yes
Finland	1920-2009	Ind. 16+	GI, AI	Tax stat.	No
France	1905-1912	Fam.	GI	Nat. Acc.	No
Germany	1900-2008	Fam. 21+	GI	Nat. Acc.	Yes, where taxable
India	1922-1999	Ind.	GI	Nat. Acc.	No
Indonesia	1920-2004	Households	NI (excluding farm income)	Nat. Acc. - 1939; Survey 1982-	No
Ireland	1964-2009	Fam. 18+	NI	Nat. Acc.	No
Italy	1974-2009	Ind. 20+	GI (excluding interest income)	Nat. Acc.	No (but reported after 1981)
Japan	1900-2010	Ind. 20+	GI	Nat. Acc.	No
Korea	1979-2012	Ind. 20 +	GI	Nat. Acc.	No
Malaysia	1947-2012	Ind. 15+	GI	Nat. Acc.	No
Mauritius	1933-2011	Fam. 15+	GI (with adjustments)	Nat. Acc.	No
Netherlands	1914-2012	Fam. 15+	GI	Survey	No
New Zealand	1921-2012	Fam. -1952; Ind. 1953- ; 15+	AI -1940; GI 1945-	Nat. Acc.	Yes, where taxable
Norway	1900-2011	Ind. 16+	GI	Nat. Acc.	Yes
Portugal	1936-2005	Fam. 20+	GI	Nat. Acc.	No
Singapore	1947-2012	Ind. 15+	GI	Nat. Acc.	No
South Africa	1913-2011	Fam. 15+ - 1989; Ind. 15+ 1990-	GI	Nat. Acc.	No (until 2002)
Spain	1981-2012	Ind. 20+	GI	Nat. Acc.	No
Sweden	1903-2013	Fam. -1950; Ind. 1951; 16+	GI	Nat. Acc. - 1950; Tax stat. 1951-	No

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Country	Coverage	Tax unit, age-cut off	Income concept	Reference income basis	Capital gains included?
Switzerland	1933-2010	Fam. 20+	GI	Nat. Acc.	No
Taiwan	1977-2013	Fam. 20+	GI	Nat. Acc.	No, but a very small fraction of capital gains (which represent approximately 0.04 percent of total income for the top 1) is included
UK	1913-2012	Fam. -1989; Ind. 1990-; 15+	GI	Nat. Acc. -1943; Tax stat. 1944-	Yes, where taxable
US	1913-2014	Fam. 20+	GI	Nat. Acc. -1943; Tax stat. 1944-	No
Zimbabwe	1945-1984	Ind.	GI	Nat. Acc.	No

Note: The source for each series is the World Wealth and Income Database (WID). See the WID and Akinson and Piketty (2007, 2010) for information about the country statistics. Tax units ”Fam.” and ”Ind.” stands for family and individual, respectively. ”GI” denotes total income from all sources (labor, capital, business) gross of all deductions, whereas ”NI” denotes income net of deductions. All incomes are market income (i.e. pre-tax and (most) transfers). ”Nat. Acc.” denotes that the reference income total is based on National Accounts data, typically some share of GDP or the sum of different aggregate income components, whereas ”Tax stat.” denotes that the reference total is derived form the sum of tax-assessed incomes plus some additional items (e.g. non-assessed income, imputed income from home ownership).
For Germany, series have the following breaks in coverage: from 1900 Prussia; from 1925, the Republic of Weimar; from 1935, Saarland is included; from 1950, the Federal Republic of Germany; from 1960, West Berlin and Saarland are included; from 1991, reunification.
For Korea, statistics are for all Korea (North and South combined) before liberation in 1945, and for South Korea after liberation.
For Malaysia, series until 1988 are Peninsular Malaysia; from 1989 Malaysia.

Appendix B: Tax data

Top marginal tax rate on personal and corporate income

Series on top marginal tax rate on personal income, MTR^{top}, and on corporate income, MTR^k, were built using raw data assembled from several sources.[11] Of these, five are the most used. First, the Comparative Income Taxation Database, compiled by Federica Genovese, Kenneth Scheve, and David Stasavage (2016), reports yearly data on the top marginal income tax rate for a legal individual. They provide historical data for 20 developed countries from 1800 (or independence) to 2010. In most cases, data are retrieved from government tax law, integrated with secondary sources which includes previous literature and institutional database (i.e. OECD, World Tax Database, etc.). We focus on the variable labeled ”Top rate in percent”, defined ”as the marginal tax rate of the direct tax that an independent government levies yearly on comprehensive and directly assessed forms of personal income for the highest income category.” (Codebook, pg. 2). The main advantage of this source is its long coverage. Moreover, if there are other taxes affecting income taxation, such as surcharges, the tax rate is a combined burden arising considering all these taxes taken together. However, a weakness of this data-set is that it only refers to the national (or federal) tax. Hence, we may have biased series for countries having local rates and sub-central tax policies that varies over time, affecting the overall marginal tax rate actually faced by top incomes[12]

Second, the OECD Tax Database provides comparative information on a range of tax statistics for the 34 OECD member countries. The data is derived from the Taxing Wages publication, which is updated annually and provides unique information on income tax paid by workers. We retrieve data on statutory central and sub-central government personal income tax rates. Data is available since 2000 in a complete and verified form, data for the 1981-1999 period is not always available for each year and has not been verified. The OECD Explanatory Annex (2014) extensively discusses the methodology elaborated to set out the marginal personal tax rate. The main weakness is that any income tax that might be due on non-wage income, as well as, all other kinds of taxes - e.g. net wealth tax, consumption tax, and corporate income tax - are not considered.

Third, the World Tax Indicator from Andrew Young School of Policy Studies (2010) compiled by Klara Sabirianova Peter, Steve Buttrick, and Denvil Duncan. This dataset makes use of tax anthologies published by international accounting firms such as Deloitte, Haskins and Sells, Coopers and Lybrand, and PricewaterhouseCoopers. In addition to those kind of source, they collect data from international organization publications and public policy center. They present data for 145 countries over 25 years (1981-2005). When used, we focus on the variable labeled ”toprate”, which represents the legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule.

[11] Our data are available online. We welcome input on any remaining typos to further improve data quality.

[12] However, our fractile-specific marginal tax rate series, MTR^s, consider both central and sub-central rates. Overall results are, however, robust to the use of series which include sub-central tax rates (see table 3).

Fourth, the dataset on top marginal tax rate compiled by Roine, Vlachos, and Waldenström (2009) for 25 countries over the period 1900-2006. Their variable called "margtax1" combines data on the statutory top marginal tax rates with some newly created series of marginal tax rates paid by those with incomes equal to five times GDP per capita, an income level approximately equal to the 99th income percentile. The reason for not only using statutory top rates is that these rates have been binding to quite varying degrees on top income across countries as well as within countries over time. These series were calculated combining data from national tax schedules and previous literature (Bach et al. [2005]; Rydqvist et al. [2007]; Roine and Waldenström [2009]).

Fifth, the recent work by Piketty, Saez, and Stantcheva (2014) present data on top tax rate for 18 OECD countries over the period 1960-2010. They include data on both central and local governments (when such local individual income taxes exist). Their primary source is the OECD annual "Taxing Wages", which covers data since 1980. For the period before, data are collected from the publication "Personal income tax systems for the period 1975-1983" (OECD, 1986). The remaining data is collected from previous literature.

Collecting clean and consistent panel data from such multiple references can be a difficult task, since it is required to reconcile contradictory information reported in various sources. The previous literature has not been exempt from those problems (see, for instance, the discussion in Peter et al. [2010, online appendix, section 1]). We discuss and devote special attention to three broad categories of data issues: definitional errors, country-specific issues, and editorial omissions and errors.

Definitional errors may occur when different numbers are quoted for the same tax rate due to differences in definition or reporting style. An example is the inclusion of sub-central taxes in one source, while another includes only central rates. Since we are interested in the effect of taxes on top income within-countries, we have to check that the definition of top tax rate is consistent for each country over time, whereas we can allow for different tax definition across countries. In other words, if series for one country includes sub-central taxes, whereas another excludes them, we would have consistent series as long as such series are consistent within each country over time. To guarantee consistency, we do not consider sub-central taxes when we do not have access to full information over the whole time period.

Country-specific issues typically arise because of differences between income year (year when income is earned) and fiscal year (year when income is taxed). This kind of issue exists only for the countries having a fiscal year different from the Gregorian calendar year. Such countries may have two tax schedules for a single calendar year, thus requiring us to align fiscal year with a certain income year. Specifically, we follow the conversion to calendar year suggested by Leigh (2007) for Australia, Ireland, New Zealand, and United Kingdom.

Finally, editorial errors or not verified sources (as, for instance, OECD data over the 1981-1999 period) are the last potential source of inconsistency. This issue includes a wide range of other potential shortcomings, such as tardy updating, missing data, breaks in publication series, and changing presentation formats. When such kinds of issues are found, we report them in the country-specific information below.

Tables B1 and B2 below provide country-specific information and sources on top marginal tax rate on personal and corporate income for each country in our data-set.

Table B1: Sources of the historical data on top marginal tax rate on personal income

Country	Coverage	Source	Information
Argentina	1932-2004	Roine et al. (2009)	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. Series are also available in Alvaredo (2010, Table 2 column 9). Argentine tax administration constitute the primary data source. The data cover the years 1932 to 1954, 1956, 1959, 1970 to 1973 and 1997 to 2004.
Australia	1909-2010	Roine et al. (2009) for 1909-1959; Piketty et al. (2014) for 1960-1981; OECD for 1982-2010.	Piketty et al. (2014) retrieve data from Atkinson and Leigh (2013). Since 1982 data are retrieved from the OECD Tax Database (Table I.1). To check the validity of these series, we check tax rates from the Australian Bureau of Statistics, http://www.abs.gov.au/. We include a surtax as a share of taxable income from 1983 to 1999 and from 2002 to 2010 fiscal years. We applied the maximum rate, retrieved from column 3 of table I.1 in OECD Tax Database. Since Australia has a non-calendar year, the rates shown are those in effect as of 1 July. We follow the conversion to calendar year as suggested by Leigh (2007).
Canada	1918-2010	Genovese et al. (2016).	In July 1917, the federal government imposed the first general tax on personal income. Tax Acts are the main source of data. Since 1981, Genovese et al. (2016) use statutory marginal tax rate reported in the OECD Tax Database (Table I.1), which is the same used here for other countries. See Genovese et al. (2016), Codebook, pg. 9-11 for more details.
China	1980-2003	Roine et al. (2009).	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. This was constant at 45 percent over this period.
Colombia	1993-2010	Andrew Young School of Public Policy (2010) for 1993-2005; Directorate of National Taxes and Customs (DIAN) for 2006-2010.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule.
Denmark	1918-2010	Atkinson and Søgaard (2016).	Atkinson and Søgaard (2016) series for Denmark refer as "equilibrium marginal tax rate". They were collected from the original laws at https://www.retsinformation.dk. It is the effective marginal tax rate taking into account the effect of the tax allowance under the assumption of a constant income level. Until 1987 the marginal tax rate applies to basically all income types. After this point capital income is taxed at a lower rate. Note that this rate does not include the local income tax rate. After the 1987 tax reform, while national rates have been significantly lowered, the municipal taxes have never gone below 25 percent. For consistency reason over time, we omit municipal taxes, even if they are available in the OECD Tax Database (Table I.2), which reports the marginal (flat) rates for Danish municipalities for the years since 1981.

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Country	Coverage	Source	Information
Finland	1917-2010	Genovese et al. (2016).	Series starts from 1917, which corresponds o Finland's independence and constitutes the initial year of the country's national income tax (even if since mid-1800s there was a tax of 1.5 percent on top incomes). Tax rates are collected from the applicable legislation published as *Suomen Asetuskokoelma* from 1917-1980, then named *Suomen Saadoskokoelma* since 1981. For the period 1981-2010, tax rates are checked from the OECD Tax Database (Table I.1). See Genovese et al. (2016), Codebook, pg. 13-15 for more details.
France	1919-2012	Roine et al. (2009) for 1919-2012 (updated).	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. For the period 1981-2012, tax rates are checked from the OECD Tax Database (Table I.1).
Germany	1900-2010	Piketty (2014) for 1900-1919; Genovese et al. (2016) for 1920-1945 and 1958-2010; Cosgrove (1996) for 1948-1957.	Piketty (2014, Chapter 14) includes general income tax supplements (i.e. surtaxes applying to all incomes above a certain level), but excludes all other taxes and social contributions. In 1946-1948 the top rate was set by the Allied Control Council. For the years 1958-1980, Genovese et al. (2016) use data from Hauser (1966, p. 147) and Corneo (2005, p. 161), who reports the rates for the period 1958-1974 and 1975-1980. Since 1981 data are retrieved from the OECD Tax Database (Table I.1). Legislative documents from 1949 onwards are available at the webpage of the *Bundesgesetzblatt*, http://www.bgbl.de/Xaver/start.xav?startbk=Bundesanzeiger BGBl. See Genovese et al. (2016), Codebook, pg. 17-18 for more details.
India	1974-2005	Roine et al. (2009) for 1974-2003; Andrew Young School of Policy Studies (2010) for 2004-2005.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. We exclude a surcharge on the basic income tax liability that was of 10 percent in 1979-1982, 5 percent in 1988-1989, 8 percent in 1990, and 12 percent in 1991-1996 for incomes exceeding a certain threshold, as reported in the World Tax Database.
Indonesia	1920-2004	Leigh and Van der Eng (2009).	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule.
Ireland	1922-2010	Genovese et al. (2010).	Tax rates were retrieved from the relevant Irish legislation, which was made available in the Library of the Office of the Revenue Commissioners, http://www.revenue.ie/. We checked the statutory values from Revenue Ireland with the OECD Tax Database (Table I.1). See Genovese et al. (2016), Codebook, pg. 19 for more details.
Italy	1900-2010	Genovese et al. (2010).	For the 1900-1923 period, the rate of the *Ricchezza Mobile tax* were used as the top rate of this series. The series for the top marginal income tax rate between 1923 and 1974 was obtained by researching Italian legislation and information published in the *Gazzetta Ufficiale*. It does not include the "imposta di famiglia" that existed until the 1971 reform, which consisted of progressive rates with a top rate of 8 percent. For more details about the sources and data construction, see Genovese et al. (2016), Codebook, pg. 20-22.

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Country	Coverage	Source	Information
Japan	1900-2010	Roine et al. (2009) for 1900-1959; Piketty et al. (2014) for 1960-2010.	Piketty et al. (2014) data are retrieved from Moriguchi and Saez (2008), who collected original tax laws and report the top rates for one couple with one income, including both central and sub-central tax rates. Local taxes were taken from the National Tax Administration data, as well as Moriguchi and Saez chapter on Japan in Atkinson and Piketty (2010). Local tax rates were assumed to be constant from 1960 to 1975 (due to lack of better information). The national tax legislation can be accessed from the National Diet Library's online database, at http://hourei.ndl.go.jp/. For the 1981-2010 period, tax rates are checked from the OECD Tax Database (Table I.1).
Korea	1979-2012	OECD.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. We consider taxation at both central and sub-central government levels. We follow OECD (see Explanatory Annex) to select the representative sub-central tax rate.
Malaysia	1974-2012	World Tax Database for 1974-1980; Andrew Young School of Policy Studies (2010) for 1981-2005; Inland Revenue Board of Malaysia for 2006-2012.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. This series includes a 5 percent excess profit tax for the years 1981 and 1982.
Mauritius	1950-2011	Atkinson (2011) for 1950-1969; Andrew Young School of Policy Studies (2010) for 1981-2005; Mauritius Revenue Authority for 2006-2011.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. The graduated income tax was introduced in 1950 replacing a Graduate Poll Tax that was in force since 1933.
Netherlands	1905-2012	Genovese et al. (2016).	Relevant legislation after 1945 can be retrieved at the Ministry of Finance website, http://www.rijksoverheid.nl/, or directly at the Government online archives, http://wetten.overheid.nl/zoeken/. Older laws are published in the *Staatsblad* (*van het Koninkrijk der Nederlanden*). For the 1981-2010 period, tax rates are checked from the OECD Tax Database (Table I.1). See Genovese et al. (2016), Codebook, pg. 24-26 for more details.
New Zealand	1911-2012	Roine et al. (2009) for 1911-2006; OECD for 2007-2012.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. Since New Zealand has a non-calendar year, the rates shown are those in effect as of 1 July. We follow the conversion to calendar year as suggested by Leigh (2007).
Norway	1900-2011	Genovese et al. (2016) for 1900-1959; Piketty et al. (2014) for 1960-1980; OECD for 1981-2011.	We consider taxation at both central and sub-central government levels. Piketty et al. (2014) data is based on income tax statistics published annually in Norway. We follow OECD (see Explanatory Annex) to select the representative sub-central tax rate. Although municipalities and regions are free to use reduced rates, in practice all use the maximum applicable rate - which is therefore also a representative rate. See Genovese et al. (2016), Codebook, pg. 27-29 for more details over the period 1900-1959.

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Country	Coverage	Source	Information
Portugal	1936-2010	Alvaredo (2009) for 1936-2005; OECD for 2006-2010.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. Since 1999 special reduced rates apply in the case of residents in the Azores Autonomous Region (where the national rates are multiplied by 0.8) and from 2001 to 2012 in the Madeira Autonomous Region.
Singapore	1952-2012	Atkinson (2010) for 1952-1980; Andrew Young School of Public Policy for 1981-2005; Inland Revenue Authority of Singapore for 2006-2012.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule.
South Africa	1913-2011	Alvaredo and Atkinson (2011).	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule.
Spain	1933-2012	Genovese et al. (2016) for 1933-1959; Piketty et al. (2014) for 1960-1980; OECD Tax Database for 1981-2012.	The first personal income tax (*Contribucion General sobre la Renta*) was established in all the territory of Spain in 1932 (Law of 20 December 1932). For the years from 1933 to 1960, Genovese et al. (2016) series relies on Alvaredo and Saez (2009), who report top statutory marginal income tax rates. See Genovese et al. (2016), Codebook, pg. 31-33 for more details. Piketty et al. (2014)'s souce is the chapter by Alvaredo and Saez on top income shares in Spain in Atkinson and Piketty (2010), appendix table 10.A.1. They use the maximum average tax rate of 50 percent(and then reduced to 44 percent) for the period 1960-1975. We use the OECD data (Table I.1) for the period between 1981 and 2010.
Sweden	1933-2013	Roine et al. (2009) for 1903-2006; OECD Tax Database for 2007-2013.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. We follow OECD (see Explanatory Annex) to select the representative sub-central tax rate, which is an average of municipal rates.
Switzerland	1960-2010	Piketty et al. (2014).	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. Piketty et al. (2014)'s data are obtained from Swiss annual income tax statistics.
Taiwan	1974-2013	World Tax Database for 1974-1980; Andrew Young School of Policy Studies (2010) for 1981-2005; Inland Revenue Authority of Taiwan for 2006-2013.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule.

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Country	Coverage	Source	Information
United Kingdom	1900-2012	Roine et al. (2009) for 1900-1959; Piketty et al. (2014) for 1960-1981; OECD for 1982-2012.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule. Piketty et al. (2014) use series constructed by Atkinson and Leigh (2013).
United States	1913-2014	Roine et al. (2009) for 1913-1959; Piketty et al. (2014) for 1960-1981; OECD for 1982-2014.	The top marginal tax rate includes general income tax supplements (i.e. surtaxes applying to all incomes above a certain level), but excludes all other taxes and social contributions (the uncapped rate of social security contributions on top earnings has been 2.5 percent since 1994 and was 0 percent before). Between 1971 and 1981, the top rate applying to earned income was lower than the top rate applying to ordinary unearned income (e.g. capital income). Also, between 1944 and 1963, there was a maximum top effective rate. The reduced rates applying to capital gains are excluded. We follow OECD (see Explanatory Annex) to select the representative sub-central tax rate. The representative sub-central state rate is a weighted average state personal income tax rate on wages. While most states impose scheduler rates, some do apply flat rates. Most states that impose personal income taxes allow personal allowances. The amount of those allowances varies. Seven states (and many localities) do not impose personal income tax while two states tax only dividends and interest income.
Zimbabwe	1977-2010	World Tax Database for 1977-1980; Andrew Young School of Policy Studies (2010) for 1981-2005; Zimbabwe Revenue Authority for 2006-2010.	Legally determined marginal tax rate applicable to the top bracket of the personal income tax schedule.

Note: Unless mentioned otherwise, data refer to the top marginal tax rate on earned income at the federal or national level. OECD source is the OECD Tax Database, Table I.7 dataset. This is the combined central government and sub-central government marginal personal income tax rate at the earnings threshold where the top statutory personal income tax rate first applies. It is calculated as the additional central and sub-central government personal income tax resulting from a unit increase in gross wage earnings. The combined rate takes account of the effects of tax credits and the deductibility of sub-central taxes in central government taxes. Our data are available online. We welcome input on any remaining typos to further improve data quality.

Table B2: Sources of the historical data on top marginal tax rate on corporate income

Country	Coverage	Source	Information
Argentina	1980-2004	World Tax Database for 1980-2002, Government of Argentina for 2003-2004.	This is the tax rate on net taxable business profits.
Australia	1956-2010	World Tax Database for 1956-1975, OECD for 1981-2010.	From 1956 to 1964, rates were applicable to non-private companies (resident). From 1965 to 1975, these rates were applicable to resident public companies. Private companies, co-operative, mutual life assurance companies, and certain other companies, were taxed at different tax rates. For example, the tax rate for private companies in 1973-74 was 45 percent. Private companies paid additional tax on the undistributed income (for example, 50 percent for financial year 1975-76). Note that Australia has a non-calendar tax year, the rates shown are those in effect as of 1 July. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1
Canada	1956-2010	World Tax Database for 1956-1980, OECD for 1981-2010.	From 1956 to 1978, these were flat tax rates. For 1980, this was just the basic tax rate (excluding surtaxes). The total rate included the basic rate, the provincial abatement rate, the net federal rate, and the ”typical” provincial rate. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1
China	1980-2003	World Tax Database.	From 1980 to 1982, this was the highest effective corporate income tax rate. The tax rate itself was progressive, varying from 5.75 percent to 34.5 percent. In addition, a surtax at a rate which varied between 10 percent and 100 percent was chargeable.
Colombia	1993-2010	World Tax Database for 1993-2002, KPMG (2016b) for 2006-2010.	Legally determined top tax rate on corporate income.
Denmark	1962-2010	World Tax Database for 1962-1977, OECD for 1981-2010.	From 1962 to 1973, this was a flat tax rate charged on net profits. There was an additional 20 percent surcharge on the basic tax liability for the fiscal year 1965-66. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.

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Country	Coverage	Source	Information
Finland	1959-2010	World Tax Database for 1959-1973, OECD for 1981-2010.	From 1959 to 1973, these were the state income tax rates that were charged on the profits of companies and co-operative societies. Distributed profits for 1965 and 1966 were charged at 42 percent. From 1968-1970, additional income tax on resident companies was imposed on taxable income. For example, the rate of this tax for 1970 was 4 percent. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
France	1956-2010	World Tax Database for 1956-1978, OECD for 1981-2010.	From 1956-1978, these were flat tax rates levied on net profits. In 1973, the tax rate does not include the surcharge of 18 percent that was levied on the basic tax liability. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
Germany	1957-2010	World Tax Database for 1957-1980, OECD for 1981-2010.	From 1957 to 1979, these rates were charged on the net profits of companies. The rates applied to the undistributed profits. Distributed profits were charged at different rate (for example, 15 percent from 1958 through 1973). Public credit institutes, mortgage banks and certain other banks were also charged at lower rates. Since 1981, the rates include the regional trade tax (Gewerbesteuer) and the surcharge. These rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
India	1956-2002	World Tax Database.	In 1956, the statutory rate was given in annas per rupee. This tax rate does not include the 5 percent surcharge on the basic income tax liability. A super-tax of 6 annas, 9 pies per rupee was also levied as an "additional duty of income tax." (12 pies=1anna, 16 annas=1 rupee). From 1957 o 1965, this was a flat tax rate applied on total income. In 1958 and 1959, this tax rate does not include the 5 percent surcharge on the basic income tax liability. Super-tax of 50 percent was also levied as an "additional duty of income tax." From 1960 to 1964, the tax rate does not include the 5 percent surcharge on the basic income tax liability. Super-tax of 55 percent was also levied as an "additional duty of income tax." This rate was effectively reduced by marginal rate allowances and various rebates. From 1964 to 1980, there was also a companies (profits) surtax applied on net chargeable profits. For example, the rate for the companies (profit) surtax for fiscal years 1966-67 through 1968-69 was 35 percent. From 1966 to 1980, these tax rates were levied on total income and were applicable to public companies. The rates do not include the surcharge that was levied on the basic tax liability. For example, the surcharge was 5 percent prior to 1980-81 and 7.5 percent for the tax year 1980-81. From 1981 to 1989, this was the tax rate on a widely held Indian company with taxable income in excess of Rs. 100,000.

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Country	Coverage	Source	Information
Indonesia	1979-2002	World Tax Database.	Legally determined top tax rate on corporate income.
Ireland	1955-2010	World Tax Database for 1955-1980, OECD for 1981-2010.	From 1955 to 1975, this was a flat tax rate converted into percentage. The statutory rates were given in shillings and pence per pound (until 1970). In addition, companies were liable for corporation profits tax levied on profits. For example, the corporation profits tax rate was 23 percent for profits over 2,500 pounds for the years 1966 through 1975. In 1976, this was a flat rate levied on the profits of companies. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
Italy	1960-2010	World Tax Database for 1960-1980, OECD for 1981-2010	From 1960 to 1973, these were flat tax rates for the company tax levied on net profits. In addition, companies were liable to schedular taxes charged on the different categories of income: (1) land tax; (2) agricultural income tax; (3) buildings tax; (4) movable wealth tax. From 1974 to 1977, These were flat tax rates. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1. The statutory combined corporate income tax rate includes the 4.25 percent regional business tax (Imposta Regionale sulle Attività Produttive; IRAP), which is a broader-based tax compared to CIT. See explanatory notes for more details.
Japan	1950-2010	World Tax Database for 1950-1980, OECD for 1981-2010.	The marginal tax rate will differ across firms based on annual income and capital asset holdings (i.e. not all firms will pay the top marginal tax rate). Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
Korea	1980-2012	World Tax Database for 1980-2002, KPMG (2016b) for 2006-2012.	Legally determined top tax rate on corporate income. Since 1980 to 1983, this was the tax rate on non-listed companies.
Malaysia	1955-2012	World Tax Database for 1955-2002, KPMG (2016b) for 2006-2012.	Legally determined top tax rate on corporate income. From 1955 to 1977, these were flat tax rates levied on the chargeable income. ”Chargeable income” was the assessable income, as reduced where appropriate by admissible allowances.
Mauritius	1956-2011	World Tax Database for 1956-2002, KPMG (2016b) for 2006-2011.	From 1956 to 1978, this rate was applied on ”chargeable income.” ”Chargeable income” was the taxpayer’s aggregate income, other than exempt income, less admissible deductions and set-off for losses. From 1967 to 1969, these rates do not include the 5 percent surtax that was imposed on chargeable income. In 1978, this was the rate for public companies. Private companies were taxed at 60 percent.

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Country	Coverage	Source	Information
Netherlands	1957-2010	World Tax Database for 1957-1980, OECD for 1981-2010.	From 1957 to 1979, these were flat tax rates levied on profits, subject to reduction where profits did not exceed a certain limit (50,000 guilders for 1973). In 1966, where profits were more than 100,000 fl., there was also a 47 percent tax on the entire profit. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
New Zealand	1956-2012	World Tax Database for 1956-1980, OECD for 1981-2012.	From 1956 to 1957, the rates were applicable to income over 6300 pounds. The tax increased by 1/150 d. for every pound up to a maximum of 8s. 8d. (pound = 20s., 1s. = 12 d.). From 1958 to 1961, the rates were applicable to income over 6300 pounds. The tax increased by 1/150 d. for every pound up to a maximum of 8s. 6d. (pound = 20s., 1s. = 12 d.). From 1962 to 1963, the rates were applicable to income over 3600 pounds. The tax increased by 1/150 d. for every pound up to a maximum of 8s. 8d. (pound = 20s., 1s. = 12 d.). From 1973 to 1979, the rates were applicable to resident companies and public authorities. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1. New Zealand has a non-calendar tax year, the rates shown are those in effect as of 1 April.
Norway	1957-2011	World Tax Database for 1957-1980, OECD for 1981-2011.	From 1957 to 1979, these were flat rates of the State Income Tax applied to net profits of companies. Building societies, savings banks and mutual insurance companies were taxed at different rates. Companies were also charged a Communal Income Tax. For example, the rate for the Communal Income Tax for 1970 to 1973 was 17-20 percent. In 1980, state tax was 27.8 percent and municipal (ordinary) rate was 21 percent. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1. New Zealand has a non-calendar tax year, the rates shown are those in effect as of 1 April.

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Country	Coverage	Source	Information
Portugal	1964-2010	World Tax Database for 1964-1980, OECD for 1981-2010.	From 1964 to 1978, these were the top tax rates for the Complementary Tax, which was a progressive surtax on total income from all sources. In addition, there were also schedular taxes charged on the different categories of income: (1) Property Tax and Tax on Agriculture; (2) Industrial Tax; (3) Tax on Income from Capital. In 1969, this rate does not include the surcharge imposed on the tax liability of the Complementary Tax (subject to marginal relief). The top marginal rate of the surcharge was 25 percent. In 1974-1975, in addition to these rates, profits of associations arising from the operation in Portugal of public concessions, industrial monopolies or other specially privileged commercial activities were subject to a Defense tax at a flat rate of 10 percent. In 1980, we only select the basic tax rate. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1. New Zealand has a non-calendar tax year, the rates shown are those in effect as of 1 April.
Singapore	1955-2013	World Tax Database for 1955-2002, KPMG (2016b) for 2006-2013.	Legally determined top tax rate on corporate income. From 1955 to 1979, these were flat tax rates levied on income after applicable deductions.
South Africa	1955-2011	World Tax Database for 1955-2002, KPMG (2016b) for 2006-2011.	Legally determined top tax rate on corporate income. From 1955 to 1977, these were tax rates for non-mining income. Mining income was charged at different tax rates. For example, the tax rate for mining income from diamonds was 45 percent for fiscal year 1960-61.
Spain	1965-2010	World Tax Database for 1965-1980, OECD for 1981-2010.	From 1965 to 1978, this was a general flat rate for the company tax that was charged on total income. Lower flat rates applied to certain partnerships (rate 25 percent for 1973-74) and certain savings banks (rate 16 percent for 1973-74). Companies were also subject to three schedular taxes : (1) agricultural land tax; (2) industrial tax; (3) tax on income from personal work. The schedular taxes were paid on account of company tax and were credited against that tax, but any excess could not be refunded. In 1968, a special temporary tax was charged on the profits of companies. The rate was 10 percent. From 1975 to 1978, this rate was applicable to joint-stock companies. The rate for other companies was 32 percent. In 1979, this was a flat tax rate levied on total income. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.

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Country	Coverage	Source	Information
Sweden	1958-2013	World Tax Database from 1958 to 1980, OECD from 1981 to 2013.	From 1958 to 1973, these were flat tax rates. They were not applicable to economic societies, savings and mortgage banks, life insurance offices, and non-profit organizations, which were taxed at different tax rates. Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
Switzerland	1981-2010	OECD.	
Taiwan	1980-2013	World Tax Database for 1980-2002, KPMG (2006b) for 2006-2013.	Legally determined top tax rate on corporate income.
UK	1978-2012	World Tax Database for 1978-1980, OECD for 1981-2012.	Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
US	1913-2014	World Tax Database for 1913-1980, OECD for 1981-2014.	Since 1981, these rates correspond to the combined corporate income tax rate, which shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate, as provided by the OECD Tax Database, table II.1.
Zimbabwe	2006-2010	KPMG (2016b).	Legally determined top tax rate on corporate income.

Note: OECD source is the OECD Tax Database, Table II.1 dataset. This is the combined corporate income tax rate - shows the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate.

Fractile-specific marginal and average tax rate

The marginal tax rate (MTR) on personal income is computed taking into account of tax rates and surtaxes at both central and sub-central government levels. The MTR is computed for each fractile *s* of the income distribution, belonging to country *i* in year *t* over the 1981-2014 period.

The average tax rate (ATR) on personal income is computed for each fractile *s* of the income distribution taking into account standard deductions, basic personal allowances, tax credits, major national surtaxes, and other provisions in addition to statutory rates and thresholds at both central and sub-central government levels. The ATR is computed for for each fractile *s* of the income distribution , belonging to country *i* in year *t*, using the following general formula:

$$ATR^s_{i,t} = \frac{\{[C_{j,i,t} + S_{p,i,t} + \bar{Y}^s_{i,t}(\sigma^{TI,C}_{i,t} + \sigma^{TI,S}_{i,t} + \sigma^{E,C}_{i,t} + \sigma^{G,C}_{i,t}) - (K^w_{i,t} + K^{nw}_{i,t})](1 + \sigma^{N,C}_{i,t})\}}{\bar{Y}^s_{i,t}}, \quad (4)$$

where

$$C_{j,i,t} = \sum_{j=1}^{J} X_{1,i,t}\zeta_{1,i,t} + (X_{2,i,t} - X_{1,i,t})\zeta_{2,i,t} + \cdots + (X_{j,i,t} - X_{j-1,i,t})\zeta_{j,i,t} + \cdots + (\bar{Y}^s_{i,t} - X_{J,i,t})\zeta_{J,i,t} \quad (5)$$

is the share of taxes levied on central government level;

$$S_{p,i,t} = \sum_{p=1}^{P} \Phi_{1,i,t}\psi_{1,i,t} + (\Phi_{2,i,t} - \Phi_{1,i,t})\psi_{2,i,t} + \cdots + (\Phi_{p,i,t} - \Phi_{p-1,i,t})\psi_{p,i,t} + \cdots + (\bar{Y}^s_{i,t} - \Phi_{P,i,t})\psi_{P,i,t} \quad (6)$$

is the share of taxes levied on sub-central government level;
$X_{j,i,t}$ is the taxable income j-threshold at which the j-statutory rate applies at central government level; $\zeta_{j,i,t}$ is the j-statutory central government personal income tax rate; $\Phi_{p,i,t}$ is the taxable income threshold at which the p-statutory rate applies at sub-central government level; $\psi_{p,i,t}$ is the p-statutory sub-central government personal income tax rate; $\sigma^{TI,C}_{i,t}$ is the surtax as a share of taxable income levied on central government level; $\sigma^{TI,S}_{i,t}$ is the surtax as a share of taxable income levied on sub-central government level; $\sigma^{E,C}_{i,t}$ is the surtax as a share of gross earnings; $\sigma^{G,C}_{i,t}$ is the surtax as a share of central government tax measured gross of tax credit; $\sigma^{N,C}_{i,t}$ is the surtax as a share of central government tax measured net of tax credit; $K^w_{i,t}$ is the basic wastable tax credit; $K^{nw}_{i,t}$ is the basic non-wastable tax credit; $\bar{Y}^s_{i,t}$ is the average reported gross income by the share *s* of total income *Y*.

Australia

Marginal and average tax rates are computed from 1981 to 2010. Marginal tax rates include a surtax as a share of taxable income from 1983 to 1999 and from 2002-2010 fiscal year. We apply the same maximum rate (displayed in column 3 of OECD Tax Database, table I.1) to each fractile.

Average tax rates are constructed using the following formula:

$$ATR_t^s = \frac{C_{j,t} + (\bar{Y}_t^s \sigma_t^{TI,c})}{\bar{Y}_t^s}. \tag{7}$$

Note1: Australia has a non-calendar year, the rates and thresholds that OECD provides are those in effect as of 1 July.

Note2: OECD data mistakes. Since $X_{j,t}$ contained in $C_{j,t}$ in some years is likely to be affected by mistakes, the following corrections have been made to avoid a biased estimation due to several unrealistic taxable income thresholds:

- For t=1984, OECD provides:

$$\begin{aligned} C_{j,t} = {} & [(12500 - 4595) \times 0.2667] + [(19500 - 12500) \times 0.3] + [(28000 - 19500) \\ & \times 0.46] + [(\mathit{3500000} - 28000) \times 0.4733] + [(\mathit{3578800\text{-}3500000}) \\ & \times 0.553] + [(\bar{Y}_t^s - \mathit{3578800}) \times 0.6] \end{aligned}$$

  but equation (7) will read 35000 instead of *3500000*, and 35788 instead of *3578800*.

- For t=1985, OECD provides:

$$\begin{aligned} C_{j,t} = {} & [(12500 - 4595) \times 0.25] + [(19500 - 12500) \times 0.3] + [(28000 - 19500) \times 0.46] \\ & + [(\mathit{3500000} - 28000) \times 0.48] + [(\bar{Y}_t^s - \mathit{3500000}) \times 0.6] \end{aligned}$$

  but equation (7) will read 35000 instead of *3500000*.

- For t=1986, OECD provides:

$$\begin{aligned} C_{j,t} = {} & [(12500 - 4890) \times 0.2442] + [(12600 - 12500) \times 0.265] + [(19500 - 12600) \\ & \times 0.2942] + [(\mathit{2800000} - 19500) \times 0.4425] + [(\mathit{3500000\text{-}2800000}) \\ & \times 0.4683] + [(\bar{Y}^s t - \mathit{3500000}) \times 0.5708] \end{aligned}$$

  but equation (7) will read 28000 instead of *2800000*, and 35000 instead of *3500000*.

Those rates have been verified consulting the World Tax Database[13], which provides the bottom and the top tax bracket since 1979.

Canada

Marginal and average tax rates are computed from 1981 to 2010. Marginal tax rates include a surtax as a share of central government tax measured net of tax credit from 1985 to 2000. We apply the same maximum rate (displayed in column 3 of OECD Tax Database, table I.1) to each fractile. We also consider sub-central government tax rates including the amount of

[13]Link: https://www.bus.umich.edu/otpr/otpr/OTPRdataV3.asp for data on the top bracket and https://www.bus.umich.edu/otpr/otpr/OTPRdataV3.asp for data on the bottom bracket

tax paid at the state level through the progressive rate structure. We apply the representative sub-central rates from period 1981-1999 (as defined in column 3 of OECD Tax Database, table I.3, historical series). For the period starting from 2000, we access to better data and we can retrieve the actual top marginal tax rate faced by each fractile for a representative state. OECD uses Province of Ontario as representative.[14] Since both state and local taxation apply to a similarly defined tax base, the sub-central rates are aggregated to the central rates.

Average tax rates are constructed using the following formula:

$$ATR_t^s = \frac{[(C_{j,t} + S_{p,t} + \bar{Y}_t^s \sigma_t^{TI,S}) - K_t^w](1 + \sigma_t^{N,C})}{\bar{Y}_t^s} \tag{8}$$

Note1: the representative sub-central government tax rate ($\psi_{p,t}$) is for the Province of Ontario, where the largest city in Canada, Toronto, is located. It should be noted that various provinces provide tax relief to low-income earners in the form of targeted tax reductions and some provinces levy surtaxes, which primarily affect high-income earners. For the years from 1981 to 1999, OECD does not provide all the thresholds and the corresponding tax rated applied at state level, but only the minimum and maximum. Thus, the formula takes into account a representative sub-central rate equal to the sub-central rate used in OECD Taxing Wages. See the Explanatory Annex for further explanations.

Note2: for the years from 1981 to 1987 what OECD provides is a deduction from net income and not a tax credit. Therefore, the values provided by the OECD tables for such years are not computed as K_t^w.

Denmark

Marginal and average tax rates are computed from 1981 to 2010. Marginal tax rates include the representative sub-central government tax rate, which is an average of municipal and regional rates (displayed in column 3 of OECD Tax Database, table I.2). Since 2007 the regions no longer collects taxes, and the representative sub-central government tax rate is then an average of municipal rates. We also include a church tax of 0.7 percent to the MTR paid by each fractile.

Average tax rates are constructed using the following formula:

$$ATR_{s,t} = \frac{C_{j,t} + S_{p,t} + \bar{Y}_t^s(\sigma_t^{TI,C} + \sigma_t^{TI,S})}{\bar{Y}_{s,t}} \tag{9}$$

Note1: the representative sub-central government tax rate $\psi_{p,t}$ is an average of municipal and regional rates. Since 2007 the regions no longer collect taxes, and the representative sub-central government tax rate is then an average of the municipal levels. See the Explanatory Annex for further explanations.

Note2: in $\psi_{p,t}$ is included a church tax of 0.7 percent.

[14]See the Explanatory Annex for further details on the representative state.

France

Marginal and average tax rates are computed from 1981 to 2006. Marginal tax rates include a surtax rate applied to a base of 95 percent of gross earnings since 2000. We apply the same maximum rate (displayed in column 3 of OECD Tax Database, table I.1) to each fractile.

Average tax rates are constructed using the following formula:

$$ATR_t^s = \frac{C_{j,t} + (\bar{Y}_t^s \sigma_t^{E,C})}{\bar{Y}^s t} \tag{10}$$

Note: this does not take into account of the effects of the "prime pour l'emploi"(PPE). Furthermore, it does not include the basic deduction of 10 percent of taxable income (with a lower and upper limit) or the 20 percent supplementary deduction.

Ireland

Marginal and average tax rates are computed from 1981 to 2009. Average tax rates are computed using the following formula:

$$ATR_t^s = \frac{(C_{j,t} + \bar{Y}_t^s \sigma_t^{E,C}) - K_t^w}{\bar{Y}_t^s} \tag{11}$$

Note: OECD data mistake. Since $X_{j,t}$ contained in $C_{j,t}$ in some years is likely to be affected by mistakes, the following corrections have been made to avoid a biased estimation due to an unrealistic and very regressive tax schedule:

- For t=1981, OECD provides:

$$\begin{aligned} C_{j,t} = (1000 \times 0.25) + [(4500 - 1000) \times 0.35] + [(2000^i - 4500) \times 0.45] \\ +[(2000^{ii} - 2000^i) \times 0.55] + [(\bar{Y}_t^s - 2000^{ii}) \times 0.6] \end{aligned}$$

  but equation (11) will read 20000 instead of 2000^i, and 24000 instead of 2000^{ii}.

- For t=1982, OECD provides:

$$\begin{aligned} C_{j,t} = (1000 \times 0.25) + [(3000 - 1000) \times 0.35] + [(2000^i - 3000) \times 0.45] \\ +[(2000^{ii} - 2000^i) \times 0.55] + [(\bar{Y}_t^s - 2000^{ii}) \times 0.6] \end{aligned}$$

  but equation (11) will read 20000 instead of 2000^i, and 24000 instead of 2000^{ii}.

- For t=1983, OECD provides:

$$
\begin{aligned}
C_{j,t} &= (1000 \times 0.25) + [(3000 - 1000) \times 0.35] + [(2000^{i} - 3000) \times 0.45] \\
&+[(2000^{ii} - 2000^{i}) \times 0.55] + [(2000^{iii} - 2000^{ii}) \times 0.6] + [(\bar{Y}_t^s - 2000^{iii}) \times 0.65]
\end{aligned}
$$

but equation (11) will read 20000 instead of 2000^i, 24000 instead of 2000^{ii}, and 28000 instead of 2000^{iii}.

- For t=1984, OECD provides:

$$
\begin{aligned}
C_{j,t} = (4000 \times 0.35) + [(2000^{i} - 4000) \times 0.45] + [(2000^{ii} - 2000^{i}) \times 0.55] \\
+[(2000^{iii} - 2000^{ii}) \times 0.6] + [(\bar{Y}_t^s - 2000^{iii}) \times 0.65]
\end{aligned}
$$

but equation (11) will read 20000 instead of 2000^i, 24000 instead of 2000^{ii}, and 28000 instead of 2000^{iii}.

- For t=1985, OECD provides:

$$C_{j,t} = (4500 \times 0.35) + [(\mathit{2800} - 4500) \times 0.48] + [(\bar{Y}_t^s - \mathit{2800}) \times 0.6]$$

but equation (11) will read 28000 instead of *2800*.

- For t=1986 and 1987, OECD provides:

$$C_{j,t} = (4700 \times 0.35) + [(\mathit{2800} - 4700) \times 0.48] + [(\bar{Y}_t^s - \mathit{2800}) \times 0.58]$$

but equation (11) will read 28000 instead of *2800*.

- For t=1988, OECD provides:

$$C_{j,t} = (5700 \times 0.35) + [(\mathit{2900} - 5700) \times 0.48] + [(\bar{Y}_t^s - \mathit{2900}) \times 0.58]$$

but equation (11) will read 29000 instead of *2900*.

- For t=1989, OECD provides:

$$C_{j,t} = (6100 \times 0.32) + [(\mathit{3100} - 6100) \times 0.48] + [(\bar{Y}_t^s - \mathit{3100}) \times 0.56]$$

but equation (11) will read 31000 instead of *3100*.

- For t=1990, OECD provides:

$$C_{j,t} = (6500 \times 0.35) + [(\mathit{3100} - 6500) \times 0.48] + [(\bar{Y}_t^s - \mathit{3100}) \times 0.53]$$

but equation (11) will read 31000 instead of *3100*.

- For t=1991, OECD provides:

$$C_{j,t} = (6700 \times 0.29) + [(\mathit{3100} - 6700) \times 0.48] + [(\bar{Y}_t^s - \mathit{3100}) \times 0.52]$$

but equation (11) will read 31000 instead of *3100*.

Italy

Marginal and average tax rates are computed from 1981 to 2009.[15] Marginal tax rates include sub-central government tax rates. We apply the representative sub-central rates from period 1999-2009 (as defined in column 3 of OECD Tax Database, table I.2). The city of Rome, located in the region Lazio, is the representative sub-central government tax rates used by OECD. Therefore the combined top marginal rate includes both the regional surcharge tax levied in Lazio and the local surcharge tax levied in Rome. The regional surcharge tax was introduced in 1997, whereas the local surcharge tax was introduced in 1999.

Average tax rates are computed using the following formula:

$$ATR_t^s = \frac{(C_{j,t} + S_{p,t} + \bar{Y}_t^s \sigma_t^{TI,C}) - K_t^w}{\bar{Y}_t^s} \tag{12}$$

Note1: Since 2005, in accordance with how "solidarity levies" and surcharges are reported in other countries, the rate $\zeta_{J,t}$ is equal to 43 percent, given that it is included the "solidarity level" of 4 percent which is applicable for personal income in excess of 100000 euros. The top marginal tax rate, $\zeta_{J,t}$, as defined in the Italian Income Tax Act is 39 percent.

Note2: In 2003, the Financial Law introduced an allowance system for employees, self-employed and pensioners, varying with income. For employees the standard allowance for wage income ("no tax area") was 7500 euros for years from 2003 to 2006. In 2005 the Financial Law launched a new tax rates and income brackets, conversion of tax credits for family dependents into tax allowances, and abolition of tax credits for employees, self-employed and pensioners. In 2007 a new tax credits system has replaced the former system of tax allowances. To cover these reforms, equation (35) will consider $K_t^w = 0$ from 2003 to 2006 and $X_{1,t}$, the taxable income first-threshold at which the first statutory rate applies at central government level, will be equal to the statutory threshold less the standard allowance. Therefore, for t=2003 and 2004, $X_{1,t} = 15000 - 7500$, whereas for t=2005 and 2006, $X_{1,t} = 26000 - 7500$. See the Explanatory Annex for further details.

Note3: The city of Rome, located in the region Lazio, is the representative sub-central government tax rates, $\psi_{p,t}$. Therefore the combined top marginal rate includes both the regional surcharge tax levied in Lazio and the local surcharge tax levied in Rome. These surcharges are due only by taxpayers who actually pay the Personal Income Tax (IRPEF). The regional surcharge tax was introduced in 1997. The tax may be levied by each region on resident taxpayers'

[15] Data are missing for years 1996 and 1997 because of missing values on average reported income.

total taxable income at discretionary rate included in a given range. The local surcharge tax was introduced in 1999. The tax may be levied by each local government at an initial rate that cannot exceed 0.2 percent. If the tax is levied, the local government can increase the initial rate, on a yearly basis, up to a maximum of 0.5 percent. It should be noted that for the city of Rome, the local surcharge tax is levied at an increased rate of 0.9 percent (higher than the maximum rate), due to municipal budget deficit. See the Explanatory Annex for further details.

Japan

Marginal and average tax rates are computed from 2000 to 2010.[16] Marginal tax rates include sub-central government tax rates. We apply the representative sub-central rates (as defined in column 3 of OECD Tax Database, table I.2).

Average tax rates are computed using the following formula:

$$ATR_t^s = \frac{(C_{j,t} + S_{p,t} + \bar{Y}_t^s \sigma_t^{TI,C})}{\bar{Y}_t^s} \tag{13}$$

Note1: In ψ_p, t is also included a standard fixed (annual) per-capita amount of Prefectural inhabitants tax of JPY 1000, and a standard fixed (annual) per-capita amount of Municipal inhabitants tax of JPY 3000.

Note2: In $\sigma_t^{TI,C}$ is also included a lump sum tax levied on sub-central level.

Note3: $X_{1,t}$, the taxable income first-threshold, at which the first statutory rate applies at central government level, is equal to the statutory threshold less the basic fixed allowance.

Korea

Marginal and average tax rates are computed from 2000 to 2012. Marginal tax rates include sub-central government tax rates. These rates are surtax rates, expressed as a percentage of the central government tax rate. We apply a uniform sub-central government tax rate of 10 per cent as the representative rate (as defined in column 3 of OECD Tax Database, table I.2).

Average tax rates are computed using the following formula:

$$ATR_t^s = \frac{C_{j,t} + S_{p,t}}{\bar{Y}_t^s} \tag{14}$$

Note1: A uniform sub-central government tax rate of 10 per cent is used as a representative rate. The local government can adjust the rate between a lower limit of 5 per cent and an upper limit of 15 per cent. However, in practice all use the 10 per cent rate (OECD, Explanatory Annex).

Note2: We include a basic tax allowance that is a tax relief available to all taxpayers. Such

[16] From 1981 to 1999 OECD provides only the top marginal tax rate on central level and the representative marginal tax rate on sub-central level.

reliefs are universally/automatically available and are unrelated to expenditures incurred by the taxpayer. They are typically available as fixed amounts.

Note3: $S_{p,t}$ are surtax rates, expressed as a percentage of the central government tax rate. Local governments are free to set sub-central rates between 5 and 15 per cent, but in practice all use the 10 per cent rate. See the Explanatory Annex for further details.

Netherlands

Marginal and average tax rates are computed from 1981 to 1999.[17] Average tax rates are computed using the following formula:

$$ATR_t^s = \frac{C_{j,t}}{\bar{Y}_t^s} \tag{15}$$

Note: $X_{1,t}$, the taxable income first-threshold, at which the first statutory rate applies at central government level, is equal to the statutory threshold less the basic fixed allowance.

New Zealand

Marginal and average tax rates are computed from 1981 to 2012. Average tax rates are computed using the following formula:

$$ATR_{s,t} = \frac{C_{j,t} - K_t^w}{\bar{Y}_{s,t}} \tag{16}$$

Note: New Zealand has a non-calendar year, the rates and thresholds that OECD provides are those in effect as of 1 April.

Norway

Marginal and average tax rates are computed from 1981 to 2011. Since 1988, marginal tax rates include a surtax as a share of central government tax measured gross of tax credit (as provided in column 3 of OECD Tax Database, table I.1, historical series). Marginal rates also include the representative sub-central tax rates, as defined in column 3 of OECD Tax Database, table I.2. This rate is equal to the maximum applicable rate, since, although municipalities and regions are free to use reduced rates, in practice all use the maximum applicable rate (OECD, Explanatory Annex).

Average tax rate are computed using the following formula:

$$ATR_t^s = \frac{(C_{j,t} + S_{p,t} + \bar{Y}_t^s \sigma_t^{G,C}) - K_t^w}{\bar{Y}_t^s} \tag{17}$$

Note1: Personal income (i.e. ordinary income) is taxed with a 27 percent flat rate in most of

[17] Data on the tax sides are not available for years 1982,1983,1984,1986,1987, and 1988, thus there are no observations for these years.

the country. Ordinary income includes all income (e.g. from labour, capital and pensions) less allowances. The revenue from personal income tax on ordinary income is split between three levels of government: central, state and local. The split is decided upon by the Parliament as part of the National Budget. The central government tax rate between the personal allowance and the first threshold level, $X_{1,t}$, is, therefore, the central government revenue share of tax on ordinary income. For municipalities in the northernmost parts of Norway, a reduced flat rate of 23.5 percent applies. The reduction is in the central government part of the income tax revenue.

Note2: Although municipalities and regions are free to use reduced rates, in practice all use the maximum applicable rate, $\psi_{P,t}$, - which is therefore also a representative rate.

Portugal

Marginal and average tax rates are computed from 1981 to 2005.[18] Average tax rates are computed using the following formula:

$$ATR_t^s = \frac{C_{j,t} - K_t^w}{\bar{Y}_t^s} \tag{18}$$

Note1: As from 1999, special reduced rates apply in the case of residents in Azores Autonomous Region (where the national rates are multiplied by 0.8) and as from 2001 in the Madeira Autonomous Region.

Note2: $X_{1,t}$, the taxable income first-threshold, at which the first statutory rate applies at central government level, is equal to the statutory threshold less the basic fixed allowance.

Spain

Marginal and average tax rates are computed from 1981 to 2012. Marginal tax rates include sub-central personal income tax rates. Their progressive structure is provided in table I.3 of OECD Tax Database.

Average tax rates are computed using the following formula:

$$ATR_t^s = \frac{(C_{j,t} + S_{p,t}) - K_t^w}{\bar{Y}_t^s} \tag{19}$$

Note1: $X_{1,t}$, the taxable income first-threshold, at which the first statutory rate applies at central government level, is equal to the statutory threshold less the basic fixed allowance.

Note2: Until 2002, the Autonomous regions had the possibility of modifying their share in the income tax liability up to an amount of ± 20 percent by changing the regional tax schedule set up by central government, keeping a progressive tax structure. As of 2003, the ± 20 restriction was abolished and the Autonomous regions are liable to keep a progressive rate schedule with the same number of tax brackets as the central government.

Note3: For the years 1986 and 1987 OECD provides a structure of statutory central govern-

[18] Data on income side is missed from 1983 to 1988

ment personal income tax rates that are regressive at a certain point, i.e. $\zeta_{1,t} < \zeta_{2,t} < \cdots < \zeta_{j,t} > \zeta_{j+1,t} < \cdots < \zeta_{J,t}$. It has not been possible to verify whether the data was correct, therefore, since the regressivity is only at a very low level, modifications are not made.

Switzerland

Marginal and average tax rates are computed from 1981 to 2010.[19] Marginal tax rates include the representative sub-central personal income tax rates, which is that applied for the Cantonal of Zurich, and a lump sum tax (as provided in OECD Tax Database, table I.3).

Average tax rate are computed using the following formula:

$$ATR_t^s = \frac{C_{j,t} + S_{p,t} + \bar{Y}_t^s \sigma_t^{TI,S}}{\bar{Y}_t^s} \tag{20}$$

Note1: The representative sub-central personal income tax rates ($\psi_{p,t}$) is for the Cantonal of Zurich. The system of local taxation $S_{p,t}$ is a multiplier (1.19 for the commune of Zurich) that is applied on the progressive federal tax liability. The State tax system has the same features as the federal tax.

Note2: $\sigma_t^{TI,s}$ represents a lump-sum tax equals to 0.12.

Note3: $X_{1,t}$, the taxable income first-threshold, at which the first statutory rate applies at central government level, is equal to the statutory threshold less the basic fixed allowance.

United Kingdom

Marginal and average tax rates are computed from 1981 to 2012.[20] Average tax rates are computed using the following formula:

$$ATR_t^s = \frac{C_{j,t}}{\bar{Y}_t^s} \tag{21}$$

Note1: $X_{1,t}$, the taxable income first-threshold, at which the first statutory rate applies at central government level, is equal to the statutory threshold less the basic fixed allowance.

Note2: United Kingdom has a non-calendar year, the rates and thresholds that OECD provides are those in effect as of 5 April.

Note3: In 1989 the computation of income shares does not use anymore married couples and single adults as unit, but it has started to use all adults as unit.

United States

Marginal and average tax rates are computed from 1981 to 2014. Marginal tax rates include the representative sub-central tax rates, as defined in column 3 of OECD Tax Database, table

[19] Data is missing in years 1982, 1984, 1984, 1988, 1990, 1992, and 1994 because, in such period, data had been collected every two years.

[20] Data on income side is missing in year 2008.

I.2. The representative sub-central state rate is a weighted average state personal income tax rate.

Average tax rates are computing using the following formula:

$$ATR_t^s = \frac{(C_{j,t} + S_{p,t}) - K_t^{nw}}{\bar{Y}_t^s} \tag{22}$$

Note1: $X_{1,t}$, the taxable income first-threshold, at which the first statutory rate applies at central government level, is equal to the statutory threshold less the basic fixed allowance.

Note2: Since 2001, a 10 percent tax rate was added to the first 6000 dollars of taxable income.

Note3: The representative sub-central state rate, $\psi_{p,t}$, is a weighted average state marginal income tax rate on wages provided by the National Bureau of Economic Research (www.nber.org). Most states that impose personal income taxes allow personal allowances. The amount of those allowances varies. It should be noted that seven states (and many localities) do not impose personal income tax. Since 2000, the levels of sub-central taxation, $S_{p,t}$, applied are both at state and local degrees.

Appendix C: Alternative specifications and sensitivity analysis

In this section we perform a number of tests to check the sensitivity of our main findings to sample composition, alternative specifications, different tax rate measurements, and the inclusion of capital gains in income data. In what it follows we perform a series of replications of the main results. Overall, these results reported below confirm the validity of our results and the alternative specifications reinforce our main findings.

We test the sensitivity of the estimations to sample selection by replicating our main results using a different sample. Results displayed in figures 1-3 are obtained using data from a subsample composed of the 10 countries whose data is available for the whole 1900-2014 period.[21] In the figures below, we replicate those findings using the full sample composed of 30 countries. Figure C1 shows the elasticity of the top percentile. Figure C2 displays the long-run trend for various groups at the top of the income distribution. Finally, figure C3 reports the gradient over three different periods. The results of these three figures are very close to our main result shown in figures 1-3, suggesting that sample composition does not represent a serious issue for our main findings.

In the tables C1-**??** below, we run a series of robustness tests based on varying sample composition and/or econometric specification. Table C1 shows the elasticity using the full sample instead of the constant sample used in table 1. Comparing the elasticities reported in table 1 and table C1, we do not find any significant difference.

We replicate the main results shown in table 1 using the first difference estimator to capture short-term variation in the behavioral response to tax rate. In C2 we show e^s coefficients estimated from standard first difference regression of the following form:

$$\Delta log(y^s_{it}) = e^s \times \Delta log(1 - MTR^{top}_{it}) + \mu^s_i t^s + \mu^s_i + e^s_{it}, \qquad (23)$$

where $\Delta log(y^s_{it})$ and $\Delta log(1 - MTR^{top}_{it})$ are vectors of first-differenced top income shares and net-of-top marginal tax rate, respectively. We also include country fixed effects μ^s_i and country-specific time trend $\mu^s_i t^s$ as in our equation (2). In panel a) we use annual data, thus the results are based on a simple difference between year t and year $t - 1$. In panel b) we use 3-years average data. Results display the same pattern already illustrated in table 1. Unsurprisingly, the elasticities computed using 3-years average data have larger coefficients than annual differences, since the former includes also some medium-term effects of tax changes.

Capital gains represent a highly complicate income component to include in an individual's income (Roine and Waldenström, 2015) and we exclude them where possible (see table A1). Theoretically capital gains, both realized and unrealized, are undoubtedly a source of income in the classic Haig-Simons definition. However, since they become observable in tax returns data only when realized, it becomes difficult to allocate them properly in time. Exclusion and inclusion of capital gains can change the top income series, especially in the very top groups,

[21] They are Australia, Canada, Denmark, France, Japan, New Zealand, Norway, Sweden, the UK, and the US

since capital gains are a more important source of income for the very top. WID provides separate series for just a few countries.[22] We test the sensitivity of our results to the inclusion of capital gains in C3 using this sub-sample. Results show that the two elasticities are very close. Hence, the inclusion of capital gains appears to do not affect our results.

Table C4 and C6 are only illustrative and display the estimated coefficients and standard errors graphically shown in figures 1 and 4.

We compute the country-specific elasticity of the bottom half of the top decile (top 10-5) in the panel a of table C5 and of the top 0.1 in panel b. These results are an integration of table 2, where we illustrate the elasticity of the top percentile.

In table C7 we re-estimate the role of non-tax-related factors using MTR^s series instead of MTR^{top}. As already discussed in section 4.4, results do not appear to change significantly using MTR^s, but the coefficients are slightly larger when we use fractile-specific marginal tax rates.

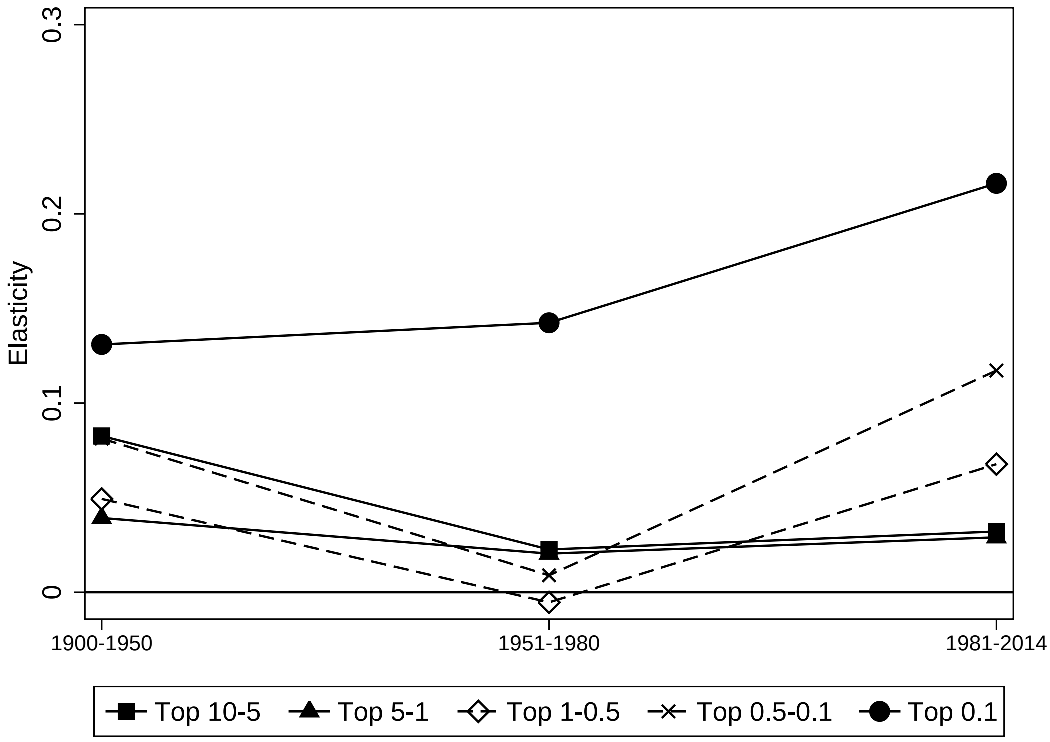
Finally, in table C8, we test real-responses to tax rate using the full sample. As in the case where the constant sample was used (see table 7), results indicate weak real-responses to tax rate.

[22]These countries are Canada (1982-2010), Germany (1950-2010), Japan (1947-2010), Spain (1981-2012), Sweden (1903-1913), and the US (1913-2014).

Figure C1: Elasticity of top percentile over the long-run, full sample

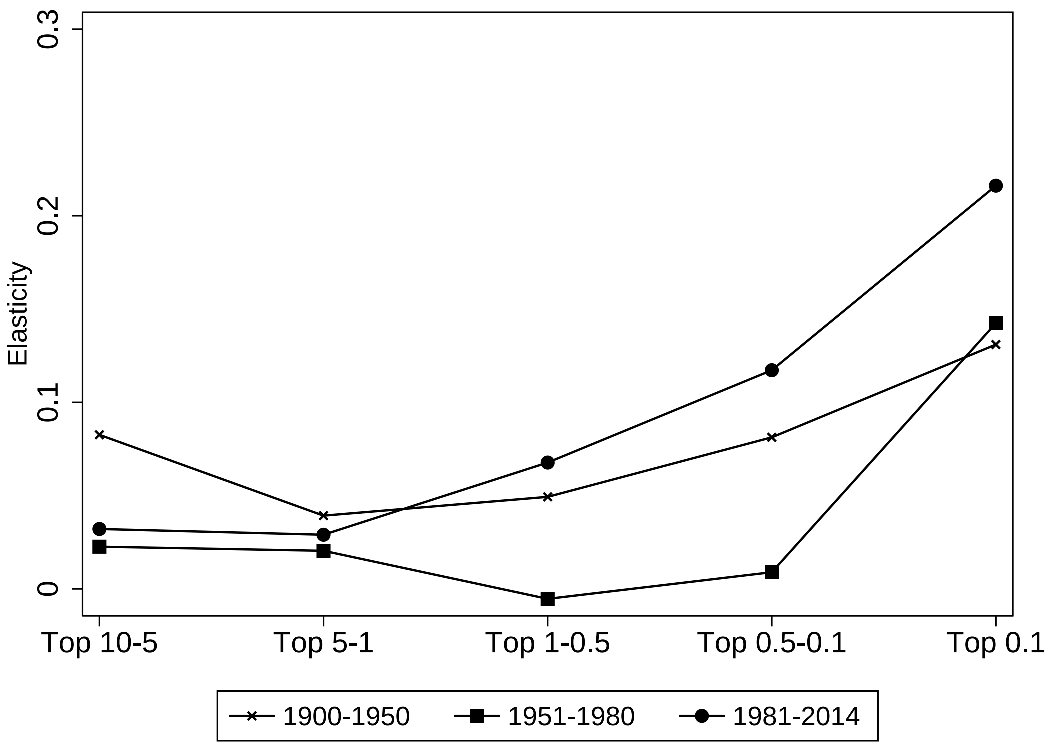
Note: This figure shows the elasticity of the top percentile over six different 20-years periods. It is the ϵ coefficient obtained regressing equation $log(top1_{it}) = \epsilon \times log(1 - MTR_{it}^{top}) + \mu_i + \mu_i t + u_{it}$. We control for both country fixed effects, μ_i, and country-specific time trend, $\mu_i t$. Top percentile series are from WID, whereas tax rates' sources are listed in table B1.

Figure C2: Trends in top tax elasticities over the long-run, full sample



Note: This figure shows the elasticity of the Top 10-5, Top 5-1, Top 1-0.5, Top 0.5-0.1, and Top 0.1 over three different periods. It is the ϵ^s coefficient obtained regressing equation $log(y^s_{it}) = \epsilon^s \times log(1 - MTR^{top}_{it}) + \mu^s_i + \mu^s_i t^s + u^s_{it}$. We control for both country fixed effects, μ_i, and country-specific time trend, $\mu_i t$. Coefficients and associated SEs are from the baseline model reported in table C1, panel b) for 1900-1950 period, panel c) for 1951-1980 period, and panel d) for 1981-2014 period. Top income shares are from WID, whereas tax rates' sources are listed in table B1.

Figure C3: Gradients in top tax elasticities over different eras, full sample



Note: This figure illustrates the gradient in top tax elasticities over three different periods. Coefficients and associated SEs are from the baseline model reported in table C1, panel b) for 1900-1950 period, panel c) for 1951-1980 period, and panel d) for 1981-2014 period. Top income shares are from WID, whereas tax rates' sources are listed in table B1.

Table C1: Long-term evidence on top tax elasticity, full sample

	Top 10	Top 1	Top 0.1	Top 10-5	Top 5-1	Top 1-0.5	Top 0.5-0.1
a) 1900-2014							
Baseline	0.10***	0.25***	0.39***	0.01	0.06***	0.10***	0.16***
	(0.01)	(0.03)	(0.05)	(0.01)	(0.01)	(0.02)	(0.02)
Country FE	0.13***	0.26***	0.42***	0.05***	0.08***	0.11***	0.15***
	(0.02)	(0.04)	(0.07)	(0.01)	(0.02)	(0.03)	(0.04)
No controls	0.07***	0.25***	0.37***	-0.02	0.03	0.10***	0.15***
	(0.03)	(0.05)	(0.09)	(0.02)	(0.02)	(0.03)	(0.05)
Obs.	1216	1623	1489	1171	1279	1431	1345
b) 1900-1950							
Baseline	0.07***	0.10***	0.13***	0.08***	0.04*	0.05**	0.08***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Country FE	0.11***	0.25***	0.33***	0.01	0.05**	0.11***	0.19***
	(0.02)	(0.04)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)
No controls	0.07***	0.21***	0.24***	-0.02	0.01	0.07***	0.13***
	(0.02)	(0.04)	(0.06)	(0.03)	(0.02)	(0.02)	(0.03)
Obs.	227	431	453	227	285	374	384
c) 1951-1980							
Baseline	0.02	0.02	0.14***	0.02	0.02	-0.01	0.01
	(0.01)	(0.02)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
Country FE	0.01	-0.08**	0.04	0.05***	0.03**	-0.06**	-0.09**
	(0.01)	(0.04)	(0.09)	(0.01)	(0.01)	(0.02)	(0.03)
No controls	0.02	0.09	0.16*	0.01	0.05	0.04	0.03
	(0.02)	(0.06)	(0.08)	(0.03)	(0.04)	(0.04)	(0.05)
Obs.	346	454	450	353	372	420	414
d) 1981-2014							
Baseline	0.05	0.16***	0.22***	0.03	0.03	0.07	0.12**
	(0.04)	(0.06)	(0.08)	(0.03)	(0.03)	(0.06)	(0.05)
Country FE	0.27***	0.62***	0.99***	0.12**	0.20***	0.31***	0.46***
	(0.04)	(0.08)	(0.11)	(0.05)	(0.05)	(0.06)	(0.07)
No controls	0.24***	0.68***	1.19***	0.01	0.14	0.37***	0.58***
	(0.06)	(0.10)	(0.14)	(0.07)	(0.09)	(0.09)	(0.09)
Obs.	643	738	586	591	622	637	547

Note: This table shows the elasticities of 7 top income groups over four different periods. Elasticities are obtained regressing equation $log(y_{it}^s) = \epsilon^s \times log(1 - MTR_{it}^{top}) + \mu_i^s + \mu_i^s t + u_{it}^s$. We control for both country fixed effects, μ_i, and country-specific time trend, $\mu_i t$. Top income shares are from WID, whereas tax rates' sources are listed in table B1. Newey-West standard errors with 8 lags in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table C2: Long-run elasticity using First Difference

a) Annual data

	Top 10	Top 1	Top 0.1	Top 10-5	Top 5-1	Top 1-0.5	Top 0.5-0.1
i) 1900-2014							
Elasticity	0.02*	0.02*	0.04**	0.01	0.01	0.01	0.02
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Obs.	735	840	833	734	782	832	807
ii) 1900-1950							
Elasticity	0.02	0.02	0.04**	0.03	-0.01	-0.01	0.01
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Obs.	144	242	278	144	194	242	249
iii) 1951-1980							
Elasticity	0.01	0.03	0.01	0.01	0.01	0.01	0.02
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
Obs.	280	287	282	280	278	277	283
iv) 1981-2014							
Elasticity	0.07**	0.23***	0.29**	-0.01	0.03	0.09***	0.14**
	(0.03)	(0.07)	(0.12)	(0.02)	(0.02)	(0.03)	(0.06)
Obs.	311	311	246	310	310	303	275

b) 3-years average data

	Top 10	Top 1	Top 0.1	Top 10-5	Top 5-1	Top 1-0.5	Top 0.5-0.1
i) 1900-2014							
Elasticity	0.05***	0.08***	0.12***	0.03	0.03	0.03	0.06**
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Obs.	260	294	289	260	276	292	281
ii) 1900-1950							
Elasticity	0.06*	0.07*	0.11***	0.05	0.04	0.03	0.05
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Obs.	55	87	97	55	71	87	87
iii) 1951-1980							
Elasticity	0.04***	0.06**	0.11***	0.02	0.03**	0.03	0.05**
	(0.01)	(0.03)	(0.04)	(0.01)	(0.01)	(0.02)	(0.03)
Obs.	98	100	100	98	98	100	100
iv) 1981-2014							
Elasticity	0.07**	0.23***	0.37**	-0.01	0.05*	0.16***	0.19**
	(0.03)	(0.07)	(0.16)	(0.03)	(0.03)	(0.04)	(0.09)
Obs.	107	107	92	107	107	105	94

Note: The table shows e^s coefficients obtained from regressions of the following kind: $\Delta log(y^s_{it}) = e^s \times \Delta log(1 - MTR^{top}_{it}) + \mu^s_i t^s + \mu^s_i + e^s_{it}$. In panel a) we use annual data, thus the results are based on a simple difference between year t and year $t-1$. In panel b) we use 3-years average data. The sample used is the same of table 1. For more information, see table 1.

Table C3: The role of capital gains

	Top 10	Top 1	Top 0.1	Top 10-5	Top 5-1	Top 1-0.5	Top 0.5-0.1
KG excluded	0.13***	0.27***	0.49***	0.04***	0.09***	0.11***	0.20***
	(0.02)	(0.04)	(0.07)	(0.01)	(0.02)	(0.03)	(0.04)
KG included	0.14***	0.29***	0.48***	0.04***	0.09***	0.13***	0.20***
	(0.02)	(0.05)	(0.08)	(0.01)	(0.02)	(0.04)	(0.04)
Obs.	327	332	333	327	327	332	333

Note: This table compares the elasticity estimated from income data excluding capital gains (first row) and including capital gains (second row). WID provides separate series for just a few countries (coverage in brackets): Canada (1982-2010), Germany (1950-2010), Japan (1947-2010), Spain (1981-2012), Sweden (1903-1913), US (1913-2014). Newey-West standard errors with 8 lags in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table C4: Figure 1 coefficients

	1900-1920	1921-1940	1941-1960	1961-1980	1981-2000	2001-2014
Baseline	0.11	0.04	0.04	0.02	0.17***	0.33
	(0.10)	(0.03)	(0.04)	(0.02)	(0.06)	(0.31)
Obs.	51	144	176	194	200	113

Note: See figure 1 for details.

Table C5: Country-specific elasticity of Top 10-5 and Top 0.1

a) Top 10-5

Country	Coverage	Full period 1900-2014	Early era 1900-1950	Early postwar 1951-1980	Recent period 1981-2014
Argentina	1932-2004	-	-	-	-
Australia	1921-2010	-0.11* [70]	0.11 [10]	0.28 [30]	0.19*** [30]
Canada	1920-2010	0.01 [69]	- [9]	0.03 [30]	-0.09 [30]
China	1986-2003	n.v. [18]	-	-	n.v. [18]
Colombia	1993-2010	-	-	-	-
Denmark	1918-2010	-0.03 [90]	0.36*** [33]	-0.42 [28]	-0.07 [29]
Finland	1920-2009	-	-	-	-
France	1919-2012	0.03 [94]	0.11** [32]	-0.05 [30]	-0.03 [32]
Germany	1900-2008	-0.01 [47]	0.08 [26]	- [7]	0.13 [14]
India	1974-1999	-	-	-	-
Indonesia	1920-2004	-	-	-	-
Ireland	1975-2009	-	-	-	-
Italy	1974-2009	0.02 [34]	-	n.v. [7]	0.02 [27]
Japan	1900-2010	0.12*** [64]	- [4]	0.19*** [30]	-0.01 [30]
Korea	1979-2012	0.09 [24]	-	- [1]	0.09 [23]
Malaysia	1974-2012	0.46*** [16]	-	-	0.46*** [16]
Mauritius	1952-2011	-0.30*** [15]	-	-	-0.30*** [15]
Netherlands	1914-2012	0.05** [68]	0.06 [29]	-0.17*** [13]	-0.06* [26]
New Zealand	1921-2012	0.03 [81]	0.32** [20]	0.02 [29]	-0.02 [32]
Norway	1900-2011	-0.24*** [67]	- [7]	-0.05 [29]	-0.16** [31]
Portugal	1976-2005	0.22** [24]	-	- [5]	0.46*** [19]
Singapore	1947-2012	-0.14 [38]	-	- [7]	-0.13 [31]
South Africa	1914-2011	- [8]	-	- [8]	-
Spain	1981-2012	-0.12***	-	-	-0.12*** [32]
Sweden	1903-2013	-0.01 [82]	0.04 [19]	0.33*** [30]	0.01 [33]
Switzerland	1960-2010	-0.70 [33]	-	- [10]	0.06 [23]
Taiwan	1977-2013	0.11** [37]	-	- [4]	0.10** [33]
UK	1918-2012	0.01 [55]	- [4]	0.02 [20]	0.17*** [31]
US	1913-2014	0.06*** [98]	0.08*** [34]	-0.03*** [30]	-0.05* [34]
Zimbabwe	1974-1984	- [8]	-	- [6]	- [2]

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b) Top 0.1					
Country	Coverage	Full period 1900-2014	Early era 1900-1950	Early postwar 1951-1980	Recent period 1981-2014
Argentina	1932-2004	0.07 [29]	-0.10 [18]	-	- [8]
Australia	1921-2010	0.31*** [90]	0.10*** [30]	-0.15 [30]	1.55*** [30]
Canada	1920-2010	0.25** [90]	0.13*** [30]	0.07*** [30]	1.04** [30]
China	1986-2003	-	-	-	-
Colombia	1993-2010	1.65** [16]	-	-	1.65** [16]
Denmark	1918-2010	0.58** [87]	-0.51 [33]	-0.54 [24]	-0.69*** [30]
Finland	1920-2009	-	-	-	-
France	1919-2012	0.33*** [90]	0.04 [32]	0.01 [30]	0.57*** [28]
Germany	1900-2008	0.28*** [56]	0.08 [33]	- [9]	0.10 [14]
India	1974-1999	-0.06 [22]	-	- [3]	2.17** [19]
Indonesia	1920-2004	-0.44 [22]	-1.07** [20]	-	- [2]
Ireland	1975-2009	0.23** [26]	-	0.29 [16]	- [10]
Italy	1974-2009	-0.02 [34]	-	- [7]	0.05 [27]
Japan	1900-2010	0.56*** [110]	0.77*** [50]	-0.49*** [30]	-0.2 [30]
Korea	1979-2012	-0.38** [24]	-	- [1]	-0.48* [23]
Malaysia	1974-2012	- [8]	-	-	- [8]
Mauritius	1952-2011	0.23 [33]	- [1]	n.v. [19]	-0.07 [13]
Netherlands	1914-2012	-0.06 [51]	-0.20** [29]	- [9]	-0.24** [13]
New Zealand	1921-2012	0.23*** [61]	0.23** [24]	0.32*** [28]	- [9]
Norway	1900-2011	1.26*** [70]	- [10]	0.32*** [29]	0.63 [31]
Portugal	1976-2005	0.63*** [64]	0.18 [15]	0.56*** [30]	0.54*** [19]
Singapore	1947-2012	0.71*** [59]	-	0.44** [28]	-0.23 [31]
South Africa	1914-2011	0.23 [66]	-0.32*** [33]	-0.26** [13]	1.29 [17]
Spain	1981-2012	0.34** [32]	-	-	0.34** [32]
Sweden	1903-2013	1.03*** [82]	0.32 [19]	0.60*** [30]	0.20*** [33]
Switzerland	1960-2010	- [33]	-	- [10]	-0.95 [23]
Taiwan	1977-2013	-0.23 [37]	-	- [4]	-0.11 [33]
UK	1918-2012	0.26*** [87]	0.14*** [38]	-0.02 [28]	0.73*** [21]
US	1913-2014	0.41*** [102]	0.18*** [38]	0.08 [30]	1.20*** [34]
Zimbabwe	1974-1984	- [8]	-	- [6]	- [2]

Note: This table shows coefficients from time-series regressions of the form: $log(topincomeshare_t) = a_t + e \times log(1 - MTR_t^{top}) + \beta t + u_t$. The regressions are run over the whole time period and three sub-periods. When there is no variation in MTR^{top} or top percentile, we report "n.v.", that means no variation. Number of observations are reported in the square brackets. We exclude elasticities based on less than 10 observations. We use Newey-West standard errors with 8 years lag. Top income shares are from WID. The sources for MTR^{top} are described in Appendix B, table B1. *** p<0.01, ** p<0.05, * p<0.1.

Table C6: Figure 4 coefficients

Period	OECD	English	Continental European	South European	Nordic
			i) Top 10-5		
1900-1950	0.08***	0.09***	0.09***	-	-0.11
	(0.02)	(0.03)	(0.03)	-	(0.08)
Obs.	227	77	87	-	59
1951-1980	0.02	0.01	-0.05	-0.06	0.033
	(0.02)	(0.02)	(0.05)	(0.23)	(0.06)
Obs.	329	139	60	12	87
1981-2014	0.05*	0.04	-0.03	0.20*	-0.01
	(0.03)	(0.04)	(0.05)	(0.10)	(0.02)
Obs.	476	157	95	78	93
			ii) Top 5-1		
1900-1950	0.04*	0.05	0.04	-	0.07
	(0.02)	(0.03)	(0.03)	-	(0.15)
Obs.	281	106	87	-	64
1951-1980	0.02	0.01	-0.05	0.21	0.07
	(0.02)	(0.01)	(0.06)	(0.14)	(0.07)
Obs.	328	139	60	12	86
1981-2014	0.07**	0.15***	-0.01	0.22***	0.04**
	(0.03)	(0.04)	(0.06)	(0.08)	(0.02)
Obs.	476	157	95	78	93
			iii) Top 1-0.1		
1900-1950	0.07***	0.09***	0.01	-	-0.10
	(0.02)	(0.02)	(0.02)	-	(0.10)
Obs.	332	126	94	-	62
1951-1980	-0.01	-0.01	-0.01	0.51***	0.12
	(0.02)	(0.02)	(0.07)	(0.11)	(0.09)
Obs.	335	152	57	12	83
1981-2014	0.10***	0.34***	0.09	0.23***	0.08**
	(0.04)	(0.08)	(0.09)	(0.07)	(0.03)
Obs.	437	134	78	78	94
			iv) Top 0.1		
1900-1950	0.14***	0.14***	0.02	0.18	0.15
	(0.03)	(0.02)	(0.04)	(0.36)	(0.16)
Obs.	381	160	94	15	62
1951-1980	0.14***	0.06	0.15***	0.56***	0.38***
	(0.04)	(0.04)	(0.03)	(0.20)	(0.08)
Obs.	371	162	58	37	83
1981-2014	0.24***	0.92***	0.22	0.37***	0.22**
	(0.08)	(0.20)	(0.20)	(0.09)	(0.09)
Obs.	437	134	78	78	94

Note: See figure 4 for details.

Table C7: Controlling for non-tax related factors, using MTR^s

Controlling for...	Top 10	Top 1	Top 0.1	Top 10-5	Top 5-1	Top 1-0.5	Top 0.5-0.1
Baseline	0.16***	0.56***	0.96***	-0.01	0.09***	0.26***	0.44***
	(0.03)	(0.09)	(0.11)	(0.02)	(0.03)	(0.05)	(0.07)
GDP per-capita	0.15***	0.52***	0.87***	-0.01	0.08***	0.24***	0.36***
	(0.03)	(0.09)	(0.17)	(0.02)	(0.03)	(0.05)	(0.06)
GDP per-capita	0.15***	0.54***	0.86***	-0.02	0.07***	0.24***	0.34***
and its square	(0.04)	(0.09)	(0.18)	(0.02)	(0.03)	(0.05)	(0.06)
Trade union	0.12***	0.45***	0.89***	-0.02	0.06***	0.20***	0.39***
density	(0.03)	(0.09)	(0.20)	(0.02)	(0.02)	(0.04)	(0.08)
Human capital	0.15***	0.54***	0.96***	-0.02	0.08***	0.23***	0.43***
	(0.03)	(0.09)	(0.21)	(0.02)	(0.02)	(0.04)	(0.08)
Globalization	0.12***	0.46***	0.83***	-0.02	0.06**	0.20***	0.34***
	(0.03)	(0.08)	(0.19)	(0.02)	(0.02)	(0.04)	(0.07)
Financial	0.13***	0.47***	0.91***	-0.01	0.06***	0.20***	0.39***
development	(0.03)	(0.08)	(0.19)	(0.02)	(0.02)	(0.04)	(0.07)
Tax Revenue	0.16***	0.55***	1.00***	-0.01	0.09***	0.25***	0.47***
	(0.04)	(0.09)	(0.22)	(0.02)	(0.03)	(0.05)	(0.08)
Public spending	0.10***	0.36***	0.63***	-0.01	0.07**	0.19***	0.28***
	(0.03)	(0.07)	(0.11)	(0.02)	(0.03)	(0.05)	(0.06)

Note: We start from the baseline regression $log(y^s_{it}) = \epsilon^s \times log(1-MTR^s_{it}) + \mu^s_i + \mu^s_i t^s + u^s_{it}$ and then we add, one by one, several potential non-tax related components of top incomes' evolution to check whether e^s varies significantly. All the controls are log-transformed. The baseline model takes into account both country fixed effects and country-specific time trends. The model is estimated for 9 countries (Australia, Canada, Denmark, France, Japan, New Zealand, Norway, UK, and US) over the 1981-2014 period. Newey-West standard errors with 8 lags in parenthesis. GDP per capita is from The Maddison-Project, trade union density as a share of employees and tax revenue as a share of GDP are from OECD, human capital (based on returns of education) is from the Penn World Table, version 9. Public spending (central government spending as a share of GDP) and financial development (sum of bank deposits and stock market capitalization as share of GDP) are from Roine et al. (2009). Globalization (2016 KOF index of globalization) is from Dreher (2006). Top income shares from WID. Fractile-specific marginal tax rates are authors' computations from OECD Tax database (see Appendix B2 for details). *** p<0.01, ** p<0.05, * p<0.1.

Table C8: Real responses to tax rates, full sample

	Top 1	GDP pc	CDA pc	Hours	Patents pc	Tax Revenue
			i) 1900-2014			
Elasticity	0.25***	0.05*	-0.05	0.01	0.10**	-0.01
	(0.03)	(0.02)	(0.04)	(0.01)	(0.04)	(0.03)
Obs.	1623	1582	1131	1087	1169	824
			ii) 1900-1950			
Elasticity	0.10***	0.01			0.15***	
	(0.02)	(0.04)			(0.04)	
Obs.	431	422			365	
			iii) 1951-1980			
Elasticity	0.02	0.04	0.04*	-0.02*	-0.03	-0.03
	(0.02)	(0.03)	(0.02)	(0.01)	(0.04)	(0.03)
Obs.	454	453	429	405	372	211
			iv) 1981-2014			
Elasticity	0.16***	0.01	0.08	0.03***	-0.06	0.03
	(0.06)	(0.04)	(0.07)	(0.01)	(0.09)	(0.04)
Obs.	738	707	689	670	432	613

Note: This table computes the elasticity of various variables reflecting real responses with respect to the net-of-top marginal tax rate. We control for both country fixed effects and country-specific time trend in each regression. ”GDP pc”, ”CDA pc”, ”Hours”, ”Patents pc”, and ”Tax Revenue” indicate GDP per-capita (value of final goods and services produced within a country in a given year, divided by the average population for the same year), real domestic absorption (real consumption plus investment) at current PPPs (in mil. 2011 US dollars), average annual hours worked by persons engaged, number of registered patents per capita, and tax revenue as a share of GDP, respectively. Data is available over the 1900-2014 period for GDP; 1900-2006 for patents; 1950-2014 for real domestic absorption and average annual hours worked; 1965-2014 for tax revenue. Data source on GDP per-capita and population from Maddison (2013), real domestic absorption and average annual hours worked from Penn World Table (version 9), number of patents from Roine et al. (2009), tax revenue from OECD. Newey-West standard errors with 8 lags in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Appendix References

Alvaredo, F. (2009). ”Top incomes and earnings in Portugal 1936–2005”. *Explorations in economic history*, 46(4), 404-417.

Alvaredo, F. (2010). “The Rich in Argentina over the Twentieth Century: 1932–2004”. In: Atkinson, A.B., Piketty, T. (Eds.), *Top Incomes: A Global Perspective*, vol. 2. Oxford University Press, Oxford.

Alvaredo, F., Atkinson, A. B. (2011). “Colonial rule, apartheid and natural resources: top incomes in South Africa, 1903–2007.” CEPR Working Paper No. 8155, Center for Economic Policy Research, London.

Alvaredo, F., A. B. Atkinson, T. Piketty, E. Saez, G. Zucman (2016). ”The World Wealth and Income Database.” http://www.wid.world, accessed on 04/02/2016.

Alvaredo, F., Saez, E. (2009). ”Income and wealth concentration in Spain from a historical and fiscal perspective.” *Journal of the European Economic Association*, 7(5), 1140-1167.

Andrew Young School of Policy Studies. (2010). ”Andrew Young School World Tax Indicators (Volume 1).” [Data file, data description, and data appendix]. Retrieved from http://aysps.gsu.edu/isp/wti.html

Atkinson, A. B. (2010). ”Top incomes in a rapidly growing economy: Singapore.” in Atkinson, A. B. and Piketty, T. (eds.) *Top incomes over the Twentieth Century: A Global Perspective*. Oxford: Oxford University Press.

Atkinson, A. B. (2011). ”Income distribution and taxation in Mauritius: a seventy-five year history of top incomes.” Unpublished mimeo.

Atkinson, A. B., Leigh, A. (2013). ”The Distribution of Top Incomes in Five Anglo-Saxon Countries Over the Long Run.” *Economic Record*, 89(S1), 31-47.

Atkinson, A. B., Piketty, T. (Eds.) (2007). *Top incomes over the Twentieth Century: a contrast between European and English-Speaking countries*. Oxford University Press, Oxford.

Atkinson, A. B., Piketty, T. (Eds.) (2010). *Top incomes: a global perspective*. vol. 2. Oxford University Press, Oxford.

Atkinson, A. B., Søgaard, J. E. (2016). ”The long-run history of income inequality in Denmark.” *Scandinavian Journal of Economics*, 118: 264–291.

Australian Bureau of Statistics, http://www.abs.gov.au/.

Bach, S., Corneo, G., Steiner, V. (2005). “Top Incomes and Top Taxes in Germany”, mimeo, DIW Berlin.

Corneo, G. (2005). ”The rise and likely fall of the German income tax, 1958 - 2005.” *CESifo. Economic Studies* 51:159-186.

Cosgrove, M. H. (1996). *The Cost of Winning: Global Development Policies and Broken Social Contracts*. Transaction Publishers.

Genovese, F., Scheve, K., Stasavage, D. (2016). Comparative Income Taxation Database. [Computer file]. Stanford, CA: Stanford University Libraries. <http://data.stanford.edu/citd>.

Leigh, A. (2007). ”How closely do top income shares track other measures of inequality?” *The Economic Journal*, 117(524).

Government of Argentina, Buenos Aires, Administracion Federal de Ingresos Públicaos (AFIP)

(Federal Administration of Public Revenues).

Government of Colombia, Bogotà, Directorate of National Taxes and Customs (DIAN).

Government of Malaysia, Kuala Lumpur, Lembaga Hasil Dalam Negeri (Inland Revenue Board).

Government of Mauritius, Port Louis, Mauritius Revenue Authority.

Government of Singapore, Singapore, Inland Revenue Authority of Singapore (IRAS)

Government of Taiwan, Taipeh, Ministry of Finance, National Tax Administration

Government of Zimbabwe, Harare, Zimbabwe Revenue Authority.

Hauser, K. (1966). ”West Germany.” In *Foreign Tax Policies and Economic Growth*. National Bureau of Economic Research (NBER)/UMI.

KPMG (2016a). Individual income tax rates table. Available at: https://home.kpmg.com/xx/en/home/services/t tools-and-resources/tax-rates-online/individual-income-tax-rates-table.html

KPMG (2016b). Corporate tax rates table. Available at: https://home.kpmg.com/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html

Leigh, A., Van der Eng, P. (2009). ”Inequality in Indonesia: What can we learn from top incomes?” *Journal of Public Economics*, 93(1), 209-212.

Moriguchi, C., Saez, E. (2008). ”The Evolution of Income Concentration in Japan: 1886-2005.” *The Review of Economics and Statistics* 90(4):713-734.

OECD Statistics. http://stats.oecd.org

OECD. (annual). *Taxing wages*, OECD, Paris.

OECD. (1986). *Personal income tax systems*, OECD, Paris.

OECD. (2014). *Explanatory Annex. Part I. Taxation of wage income*. http://www.oecd.org/ctp/tax-policy/Personal-Income-Tax-rates- Explanatory-Annex-2014.pdf

OECD. (2016a). *Explanatory Annex. Part II. Taxation of corporate and capital income.* http://www.oecd.org/ct policy/Corporate-and-Capital-Income-Tax-Explanatory-Annex-May-2016.pdf

OECD. (2016b). *Explanatory Annex*: http://www.oecd.org/ctp/tax-policy/Personal-Income-Tax-rates-Explanatory-Annex-May-2016.pdf

Peter, K. S., Buttrick, P., Duncan, D. (2010). ”Global reform of personal income taxation, 1981-2005: Evidence from 189 countries.” *National Tax Journal*, 63 (3), 447 – 478.

Piketty, T. (2003). ”Income inequality in France, 1901–1998.” *Journal of political economy*, 111(5), 1004-1042.

Piketty, T. (2014). *Capital in the twenty-first century*. Harvard University Press.

Piketty, T., Saez, E., Stantcheva, S. (2014). ”Optimal taxation of top labor incomes: a tale of three elasticites.” *American economic journal*: economic policy, vol.6, n.1, p.230-271.

Rydqvist, K., Spizman, J., Strebulaev, I. (2007). “The Evolution of Aggregate Stock Ownership: A Unified Explanation”, mimeo, Binghampton University.

Roine, J., Vlachos, J., Waldenström, D. (2009). ”The long-run determinants of inequality: What can we learn from top income data?” *Journal of Public Economics*, 93(7), 974-988.

Roine, J., Waldenström D. (2009). “Top Incomes in Sweden over the twentieth century”, in A.B. Atkinson and T. Piketty (eds.) (2009), *Top Incomes: A Global Perspective*. Volume

II, Oxford: Oxford University Press.

Roine, J., D. Waldenström (2015). ”Long-run trends in the distribution of income and wealth.” in Atkinson, A.B., F. Bourguignon (eds.), *Handbook of Income Distribution*, vol. 2A, Amsterdam: North-Holland.

Scheve, K., Stasavage, D. (2016). *Taxing the Rich: A History of Fiscal Fairness in the United States and Europe*. Princeton and New York: Princeton University Press and Russell Sage Foundation.

World Tax Database, Office of Tax Policy and Research, University of Michigan.