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The Distribution of Top Incomes in Five Anglo-Saxon Countries Over the Long Run*

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Taking five Anglo-Saxon countries that have relatively similar backgrounds and tax systems – Australia, Canada, New Zealand, the UK and the USA – we see that the shares of the very richest exhibit a strikingly similar pattern, falling in the three decades after World War II, before rising sharply from the mid-1970s onwards. The share of the top 1 per cent is highly correlated across Anglo-Saxon countries, more so than with the share of the next 4 per cent. Controlling for country and year fixed effects, we find that a reduction in the marginal tax rate on wage income is associated with an increase in the share of the top percentile group. Likewise, a fall in the marginal tax rate on investment income (based on a lagged moving average) is associated with a rise in the share of the top percentile group.

I Introduction

There has recently been a revival of interest in the study of the distribution of top incomes using income tax data, and these data provide long-run evidence about the top of the distribution for a sizeable number of countries (see Atkinson & Piketty, 2007, 2010). Such an *embarras de richesse* raises interesting questions as to how the findings should be analysed, and how we can use the data to draw conclusions about the underlying mechanisms. Most of the studies have focused on the national experience and the forces at work in the country in question. The national time series are individually of considerable interest, but we can also learn from cross-country comparisons about common factors. Moreover, the top income recipients in different countries inhabit the same world, and their experiences may well be interdependent. At the other extreme from purely national studies are those that pool all available countries in a single panel, without regard to the interdependences. With such a panel of country time series, we can explore common influences on the evolution of top shares and possible interdependencies. At the same time, the literature on cross-country growth regressions warns us of the pitfalls in merging data in this

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way, without regard to the specificities of both data and reality. Given the differences in systems of income taxation, and of income determination, across OECD (Organisation for Economic Co-operation and Development) countries, we cannot assume that the series are homogeneous.[1]

This article explores therefore an intermediate route. It is a comparative study of the levels of top income shares and their evolution over the twentieth century, but it is limited to a group of five Anglo-Saxon countries: Australia, Canada, New Zealand, UK and the USA. By selecting five countries with relatively similar backgrounds, we hope to eliminate some of the respects in which data are not comparable across countries and to hold constant some of the unobservable factors that might have long-run effects on the distribution of top incomes. Our five chosen countries are similar along several dimensions. Each was once under British rule, and each has a common law legal system. All suffered substantial losses in the two World Wars. English is the most commonly spoken language in each country, and migration and trade flows between them were high throughout the twentieth century. Analysing cross-country gross domestic product (GDP) growth correlations across the OECD, Otto *et al.* (2001) find that English-speaking countries tend to be more highly correlated with one another, which the authors posit may be due to five factors: trade, exchange rate deviations, legal origin, accounting standards and technology take-up.

Using data for these five Anglo-Saxon countries, we examine the degree of commonality of experience. The long run of years covered by the data allows us to explore changes over time in a way that is not possible with the income distribution datasets typically employed. Our data span more than 75 years, covering the Depression, the Second World War, the post-war Golden Age, the Oil Shocks and the information technology boom.

Section II of this article describes the underlying methodology in making cross-country comparisons of top income distributions, and the central issue of the comparability of income tax-based estimates across countries and across time. Unlike other social science disciplines, economists tend not to reflect on the issues raised by comparative analysis. These need to be borne in mind when considering the estimates for the five countries set out on a comparative basis in Section III. Section IV explores the impact of taxation on top income shares. The final section concludes.

II Challenge of Comparability

The basic sources for all five countries are the records of the personal income tax.[2] As has been documented in the national studies, the income tax has evolved over this period from a tax that was limited to a better-off minority to a mass tax. The income tax of today is very different in scope from that of the early 1900s. Over the period, too, there have been frequent changes in the form of income tax legislation. It was well put by the New Zealand Census and Statistics Department: 'Income-tax law is dynamic rather than static and there are few years in which amendments, some major and others minor, to the law have not affected the statistics' (1953, p. 4).

There are therefore good grounds to doubt the comparability across countries and across time of the estimates presented here. At the same time, there are at least three reasons why we feel that the estimates can be used to cast light on the evolution of top income shares in the five countries. First, by limiting attention to *five* countries, rather than the trying to tackle the whole OECD, we are able to keep in mind the specificities of country and period when considering the estimates. We are seeking in this way to blend quantitative and qualitative analysis. Second, as already emphasised, the five countries are chosen purposefully as those that enjoy a number of common features. None of the countries established separate taxation of earned income; there is no equivalent of the German Lohnsteuer or of the Nordic dual tax system. There is no quotient familial as in the French income tax. Third, we can attempt to allow for some of the most important differences. The move from a better-off tax to a mass tax can be taken into account by using external control totals for the total population and the total income. In Atkinson and Leigh (2010), we address several

[1] For an analysis that looks at the contemporaneous relationship between top incomes and top tax rates, see Roine *et al.* (2009). For recent reviews of the top incomes literature, see Leigh (2009), Atkinson *et al.* (2010, 2011).

[2] The tax year begins on January 1 in Canada and the USA, but on April 1 in New Zealand, April 6 in the UK, and July 1 in Australia. Throughout this article, any reference to a tax year should be taken to refer to the start of the tax year – for example, the 1980 Australian tax year is the tax year starting on 1 July 1980.

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issues affecting comparability, such as the appropriate age cutoff for the adult population, the treatment of countries that switch from joint to individual filing, the definition of total household income, the treatment of capital gains, and how to handle countries that move from tabulating taxable income to total income.

III A First Look at the Five Anglo-Saxon Countries

From the individual country studies, we know that the top income shares in Anglo-Saxon countries have followed a broad U-pattern over the twentieth century. How similar is in fact the pattern across the countries? Have the series moved in parallel in the North and South hemispheres? This section compares the findings for the share of top groups in the five countries, using results for Australia from Atkinson and Leigh (2007), for Canada from Saez and Veall (2005), for New Zealand from Atkinson and Leigh (2008), for the UK from Atkinson (2005, 2007) and for the USA from Piketty and Saez (2001, 2003). The figures for Australia, New Zealand and the UK have been adjusted in the way described in Atkinson and Leigh (2010, appendix A): the UK post-1990 series for individual incomes has been linked to the earlier series on a tax unit basis, the control totals for Australia, New Zealand and UK all relate to income including transfers, and deductions have been added back to give gross income. Construction of the series has also involved some interpolation and extrapolation as detailed in Atkinson and Leigh (2010, appendix A). We focus here on the shares of the top 0.1 per cent, the top 1 per cent and the top 5 per cent.

(i) Ranking of the Five Countries

We begin with the shares of the top 0.1 per cent and top 1 per cent, plotted in Figures 1 and 2, respectively. A reader from Mars would doubtless be struck by the similarity of the top income shares in the five countries and by the commonality of the U-shaped time path. In the 1960s, the

FIGURE 1
Share of Top 0.1 per cent

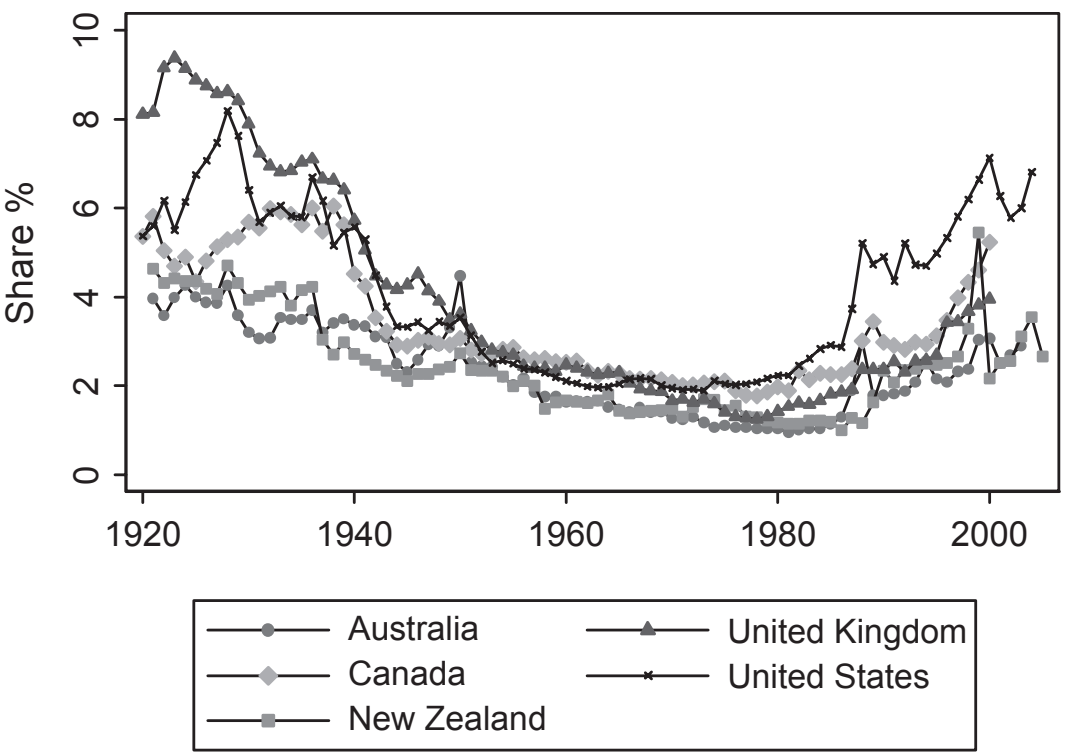

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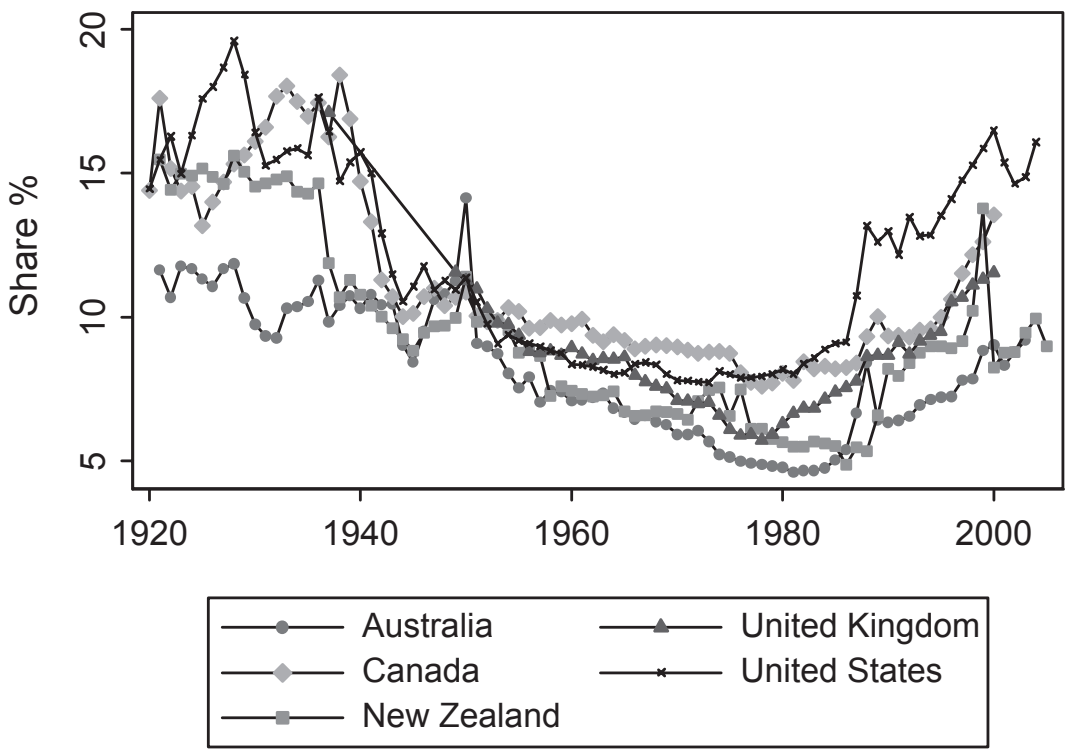
FIGURE 2
Share of Top 1 per cent



shares of the top 0.1 per cent were all around 1.5 to 2 per cent, and the shares of the top 1 per cent were between 7 and 10 per cent. In broad terms, the shares had been more than halved since the 1920s. After the 1970s, they recovered much of the ground that had been lost.

The shares of the very rich are highly correlated across countries. For the top 0.1 per cent, the correlations range from 0.814 to 0.918; the highest country-pair correlations are Australia–UK and New Zealand–UK, while the lowest are Australia–USA and New Zealand–USA. For the top 1 per cent, the correlations range from 0.713 to 0.906, with a mean of 0.832. In contrast, the cross-country correlations for the share of the next 4 per cent (i.e. the share of those in the top 5 per cent who are not in the top 1 per cent) are much lower and sometimes negative, with a mean of 0.167. This indicates that the rich are more globally integrated than the well-off. Indeed, the cross-country correlations of top shares are typically higher than those between the top shares and those in the same country but in the next income group down. The mean correlation among the top 1 per cent in different countries (0.832) is larger than the mean within-country correlation between this group and the next 4 per cent (0.536). For example, the share of the top percentile group in Australia is more correlated with the top percentile group share in the UK (0.888) than with the share of the next 4 per cent in Australia (0.125).

There are however differences between countries that become clearer on closer inspection. Over the period 1921–2000, the mean share of the top 0.1 per cent over the period as a whole is 2.4 per cent in New Zealand, 2.3 per cent in Australia, 3.4 per cent in Canada, 3.9 per cent in the UK and 4.0 per cent in the USA. The mean shares of the top 1 per cent are 8.1 per cent in Australia and 9.4 per cent in New Zealand, compared with 11.2 per cent in Canada and 11.8 per cent in the USA (the UK figures for the top 1 per cent do not span the whole period). This indicates a systematic difference between the Northern and Southern

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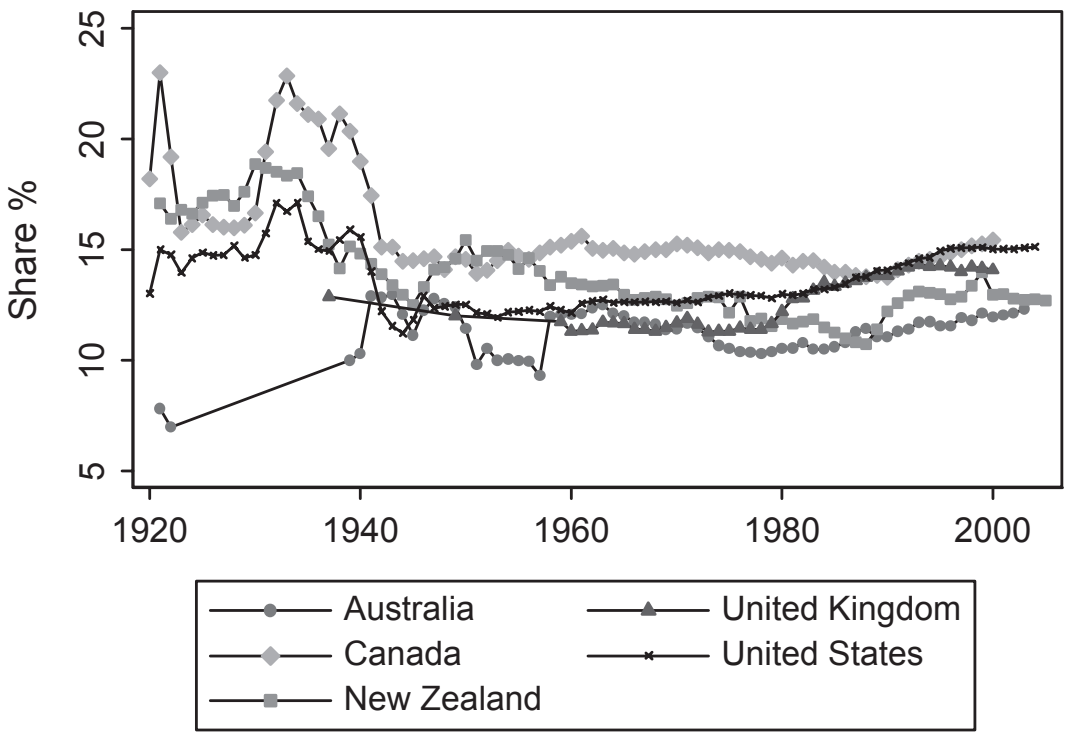
FIGURE 3
Share of 'Next' 4 per cent



hemispheres of the Anglo-Saxon world. The series in Figures 1 and 2 bear out the reputation of Australia and New Zealand for having a less unequal distribution: the shares of the top 1 per cent were lower at the outset, and they continued, despite the sharp rise in the late 1980s in New Zealand, to have smaller shares than Canada, the UK and the USA. It seems unlikely that the comparison of Northern and Southern hemispheres is affected by the difference in the tax unit, as both the Australian and Canadian data relate to individuals throughout the period in question. As a measure of the sensitivity of the estimates to the choice of income control totals, we may note that if the totals in Australia and New Zealand were reduced to 90 per cent of the constructed total, then the top 0.1 per cent shares in New Zealand would be raised from 2.4 to 2.7 per cent, and from 2.3 to 2.6 per cent in Australia, bringing them closer to, but still below, the North American shares. This ranking in terms of top income shares does not, of course, necessarily carry over to the distribution as a whole. Circa-2000 figures for the overall income distribution from the Luxembourg Income Study (LIS) show the following ranking in order of increasing overall inequality: Canada, Australia, UK and USA (New Zealand is not included).[3] While it should be noted that the income concept in the LIS is different, being the individual distribution of disposable household income per equivalent adult, this underlines the fact that the top may look different from the rest of the distribution.

Figure 3 allows us to see the differences for the group just below the top 1 per cent, described as

[3] Luxembourg Income Study, 'Income Inequality Measures', http://www.lisproject.org, checked on 10 May 2007. Figures are for Australia in 2001, Canada in 2000, the UK in 1999 and the USA in 2000. The ranking remains the same regardless of whether one compares on the basis of the Gini Coefficient, the equally distributed equivalent income measure ($\varepsilon = 0.5$ or $\varepsilon = 1.0$) or the 90/10 ratio.

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the 'next' 4 per cent. Over the period 1921–2000, Canada now appears to have the largest share: mean value of 15.8 per cent, compared with 13.6 per cent for the USA, and 14.0 per cent for New Zealand (the next 4 per cent share is not available for Australia and the UK in most of the interwar period). It is possible that these differences are due to the use of the individual as the unit in Canada and, since 1953, in New Zealand. The spouses of those in the top 1 per cent may be found in the next 4 per cent. As far as the changes over time are concerned, the U-shaped pattern is much less evident. For the three countries for which we have evidence (Canada, New Zealand and the USA), the shares cycled in the interwar period. The post-war period saw little clear direction of movement.

(ii) Changes over Time

The country rankings at the top of the distribution have not remained completely unchanged over the 80-year period. Figure 4 compares for the five countries the shares of the top 0.1 per cent, top 1 per cent, and top 5 per cent at a selection of dates: around 1920 (1921 for Australia and New Zealand; 1919 for the UK), 1938 (1937 for the UK, 1939 for Australia), 1949, 1980 and 2000 (as explained in Atkinson and Leigh (2008), the figures for 1998–2000 in New Zealand are affected by anticipation of tax changes, and we have therefore taken 2001).

The share of the top 1 per cent is largest initially in the UK, which was displaced from this position by Canada in 1938, but had regained the lead by 1949. During this period, the share of the top 1 per cent was greater in the UK than in the USA. The relative positions of the UK and North America, however, then changed. The post-World War II period saw the share halved in the UK, whereas the share fell much less in the USA and in Canada, which had together taken the lead by 1980, a position that they retained in 2000. The near doubling of the UK share from 1980 to 2000 was more than matched by the USA.

Even where the rankings have been preserved, the top income shares have not moved in parallel. Figure 5 shows this in two ways for the share of the top 0.1 per cent. First, the shares for each country are expressed relative to the contemporary average for the five countries: that is, taking out the common movement over time. Australia and New Zealand are quite consistently below the

FIGURE 4
Shares of Top Income Groups in Five Anglo-Saxon Countries

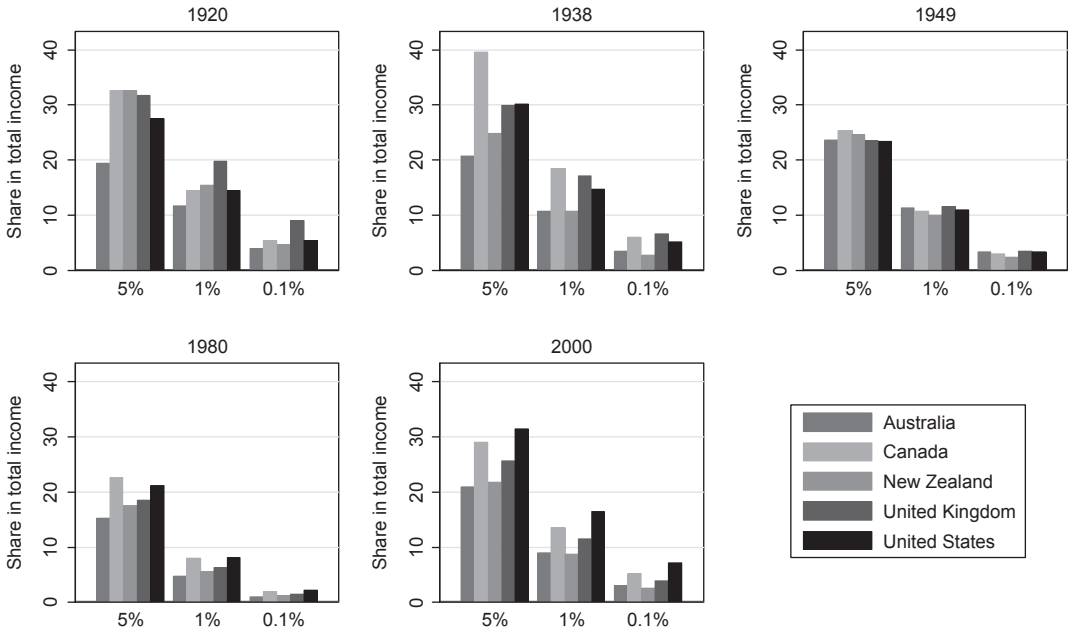

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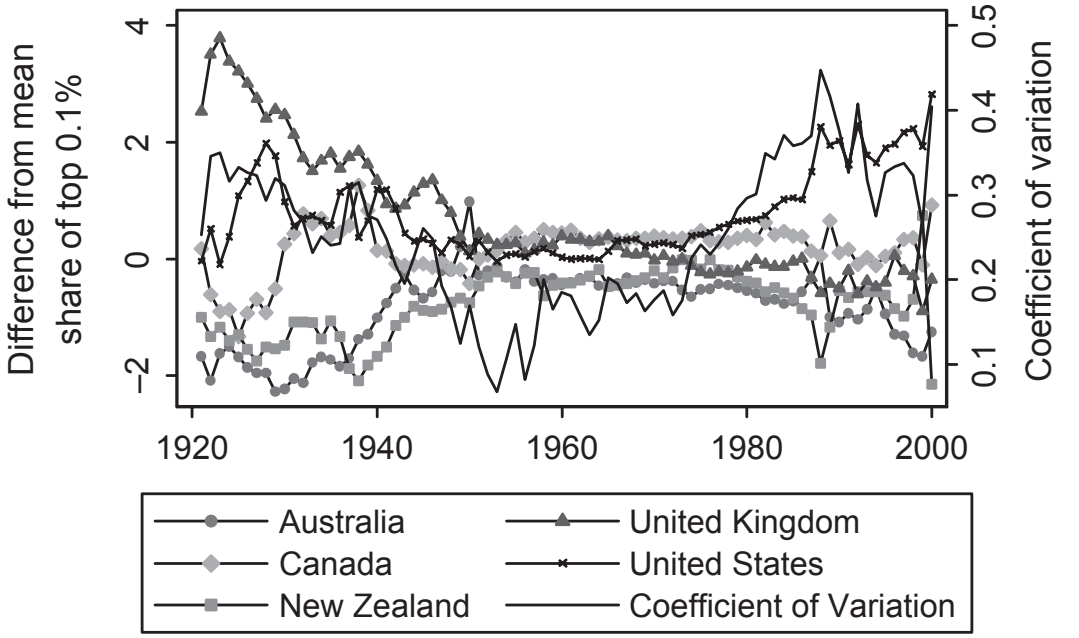
FIGURE 5
Cross-Country Variation in the Top 0.1 per cent Share



mean. The UK stands out in the early part of the period, whereas the USA stands out in the latter period. Moreover, the countries tend first to move together and then to diverge. This is shown by the heavy line without markers, which is the instantaneous coefficient of variation for the five countries. In 1921, the shares of the top 0.1 per cent varied between 4.0 and 9.1 per cent; by 1953, which saw the lowest value for the coefficient of variation, they varied between 2.3 and 2.8 per cent. The convergence had not, however, been uniform and seems largely to have taken place after the Second World War. The coefficient of variation halved between the late-1940s and the mid-1950s. In this context, we should note that top incomes in Australia and New Zealand were affected by the commodity price boom, although this would not explain a continuing reduction in the dispersion. The coefficient of variation remained below 0.2 until the early-1970s, when it rose steeply. By the 1990s, it was higher than in 1921.

(iii) Shape at the Top

We now focus on what has been happening *within* the top income group. We do so for two reasons. First, we have seen that many of the problems of comparability arise from the income control totals. By considering the share of the top 0.1 per cent within the top 1 per cent, we do not need to rely on the income control totals. Second, the shares within shares allow us to examine the changing *shape* of the distribution, independently of what is happening to the rest of the distribution. Figure 6 shows the evolution over the period 1921 (1949 in the UK) to 2000 of the share of the top 0.1 per cent within the top 1 per cent. In 1921, for example, the share of the top 0.1 per cent in the USA was 5.6 per cent, and the share of the top 1 per cent was 15.47 per cent, so the within share figure is 36.2 per cent. The figure confirms the overall U-shaped development and our earlier conclusions regarding country differences and trends. It indicates that the findings are not unduly reliant on the choice of income control totals.

The shares within shares are shown in more detail in Figure 7 in the form of Pareto–Lorenz coefficients, using the fact that with the Pareto distribution the within-group share of the top 1 per cent within the top 10 per cent, denoted by S_1/S_{10}, is given by $(0.1)^{(1 - 1/\alpha)}$. Easton (1983) notes that the list of available Pareto coefficients

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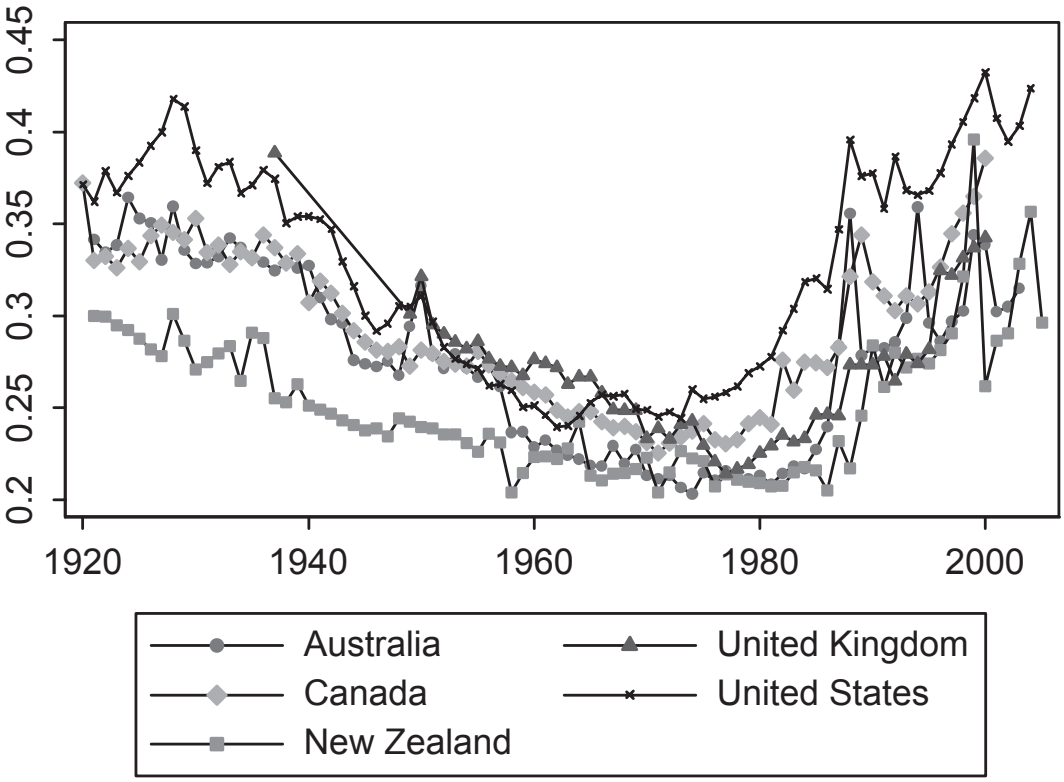
FIGURE 6
Share of Top 0.1 per cent Within Top 1 per cent



given by Clark (1951) showed a range from 1.13 in Germany in 1926 and India to 2.44 for the Prairie Provinces of Canada. Here, we start from a range from 1.8 (USA) to 2.1 (New Zealand). By 1970, they had risen to a range from 2.5 to 3.0. Then, we see the fall, returning to values below 2.2 in all five Anglo-Saxon countries. (As noted earlier, the figures for 1998–2000 in New Zealand are affected by anticipation of tax changes.)

IV Impact of Taxation

What are the factors which may have affected top income shares? Piketty and Saez (2003) give a central role to taxation, executive compensation and shocks to capital returns. They note that while progressive taxation has only a level effect on labour income, it will have a cumulative, or dynamic, effect on capital income – since it reduces capital accumulation. As exogenous factors, Piketty and Saez pinpoint the Depression, the World Wars, and bouts of high inflation. The authors also argue that social norms were an important mediating factor – with norms in the interwar period causing voters to favour more redistributive policies, and norms in the 1980s and 1990s allowing executive compensation to rise unchecked. Saez and Veall (2005) compare top income shares in Canada and the USA, and posit three main factors affecting Canadian top incomes – the effect of wage controls imposed during World War II, the ability of the rich to move easily between Canada and the USA (which increased Canadian top incomes via a 'brain drain threat'), and changes in tax progressivity.

Despite a rich discussion of the explanatory variables, econometric analyses are relatively rare. This reflects the fact that much of the income distribution data is relatively new, as well as significant methodological issues. Breaks in the top incomes series, inadequate historical data for

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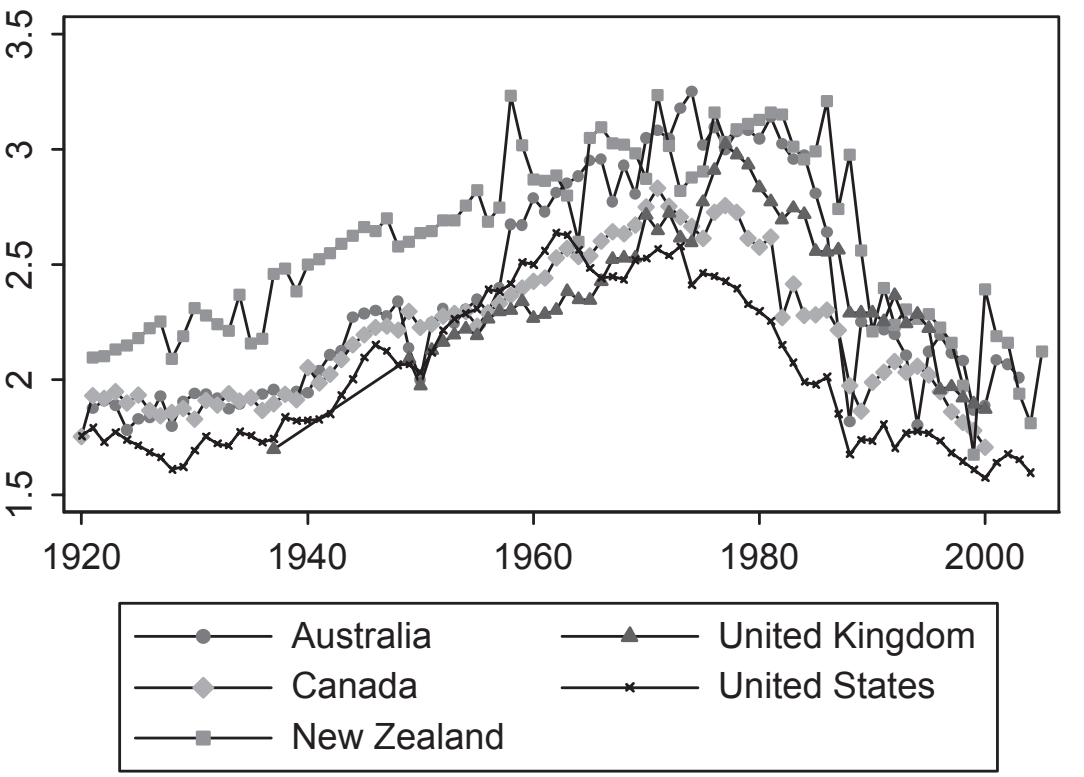
FIGURE 7
Pareto–Lorenz Coefficients S0.1/S1



some of the key explanatory factors, and potential endogeneity are among the main econometric concerns.[4] One major concern is the need for a theoretically justified specification for the equations to be estimated. In the parallel field of top wealth shares, one relevant study is Atkinson *et al.* (1989), who derive a model for the wealth share of the top 1 per cent from the accumulation process of Meade (1964). Using a log-logistic transformation (log(S1/S99)), they transformed the top 1 per cent share into an unbounded dependent variable and found that share prices had a significant positive impact on the share of the richest, while the value of owner-occupied housing and consumer durables had a significant negative impact.

[4] For example, the tax rate might be endogenous if rising incomes of the super-rich allowed them to exert more influence over the political system, and successfully campaign for a reduction in the top tax rate.

The closest study to our own is Saez (2004), written contemporaneously with the first version of this paper. Saez looks at whether changes in marginal tax rates over the period 1960–2000 can explain variation in top income shares in the USA and concludes that the effect holds only for the top percentile group, and cannot explain all of the change in top income shares in the USA over this 40-year period. Our study differs from that of Saez in that we are using a panel dataset, which provides a larger sample size, and allows us to control for non-linear time shocks (to the extent that these affect all countries simultaneously).

Our focus is the impact of taxation on the income share of the top 1 per cent. We focus on the top 1 per cent share for simplicity, and because it is the largest of the top income groups whose share we are able to consistently estimate for most of the twentieth century. As Figure 8 illustrates, there is a strong positive relationship in each of the five nations in our sample between

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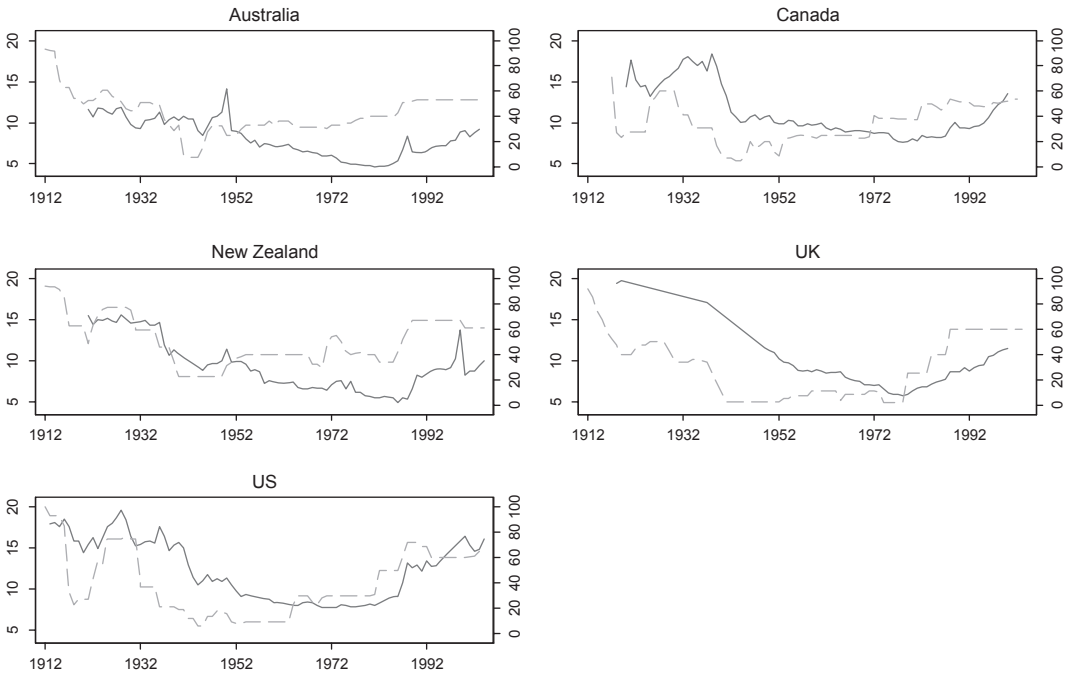
FIGURE 8
Share of the Top 1 per cent (solid line, left axis) and 1-Top Marginal Tax Rate (dashed line, right axis)



1 minus the top marginal tax rate (on any type of income) and the income share of the top percentile group. We consider two potential channels through which this effect might operate – an immediate effect of the marginal tax rate on wage incomes, and a lagged effect of the marginal tax rate on capital incomes.

(i) Marginal Tax Rates on Wage Income

For four of the five Anglo-Saxon countries (New Zealand is the exception), we have some information on the composition of income earned by the top percentile group. In each case, wages have grown larger, relative to investment income. In the first year available, wages were a minority of the income received by the top percentile group – the earliest numbers for the wage share of top 1 per cent income are 16 per cent in Australia in 1954, 45 per cent in Canada in 1946, 25 per cent in the UK in 1937 and 20 per cent in the USA in 1916. But in 2000, wages constitute a majority of top 1 per cent income in all four countries – approximately two-thirds of the income received by those in the top percentile group in Canada, the UK and the USA, and around 55 per cent in Australia (Saez & Veall, 2005, fig. 6; Atkinson, 2007, fig. 4.11; Atkinson & Leigh, 2007, fig. 7; Piketty & Saez, 2007, table 5A.7).

One reason why income taxation might affect top income shares is through its immediate effect on work incentives.[5] Analysing US tax reforms in the 1980s, Gruber and Saez (2002) find that the

[5] Piketty *et al.* (2011) explore three channels through which top tax rates might affect the pre-tax incomes of the top 1 per cent: economic activity (akin to what we describe as work incentives); tax avoidance; and a 'compensation bargaining channel', through which the very rich have a strong influence over their own pay. In the period since 1975, they observe that the elasticity of GDP growth with respect to the top marginal tax rate is small, and they therefore conclude that the compensation bargaining channel may be more important than the economic activity channel. (Incidentally, their optimal top tax rates range from 57 per cent to 83 per cent, while our revenue-maximising top tax rates range from 63 per cent to 83 per cent.)

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elasticity of taxable income with respect to the marginal tax rate is three times as high for those earning in excess of $100,000 than for the rest of the population.[6]

The relationship between the top percentile group share and the elasticity of before-tax income can be written as:

$$\begin{aligned}\partial \log S_1 &= (\partial y_1/y_1) - (\partial y_{100}/y_{100}) \\ &= [-\eta_1(\partial\tau_1/(1-\tau_1))] - [-\eta_{100}(\partial\tau_{100}/ \\ &\quad (1-\tau_{100}))]\end{aligned}$$

where y is before-tax income, η is the elasticity of taxable income with respect to the income tax rate, τ is the marginal tax rate on wage income paid by the top percentile group, and subscripts 1 and 100 denote the top 1 per cent and the entire population, respectively. If we assume that the population as a whole is largely unresponsive to the marginal tax rate on wage income paid by the top percentile group, then this suggests the following regression specification:

$$\log(S_1)_{jt} = \alpha + \beta(1-\tau_1)_{jt} + \gamma Z_{jt} + \delta_j + \lambda_t + \varepsilon_{jt} \quad (2)$$

where j and t index countries and years, respectively, S_1 is the share of the top percentile group, τ_1 is the median marginal tax rate on wage income paid by the top percentile group, Z is a vector of time-varying country characteristics, δ and λ are country and time fixed effects, respectively, and ε is a normally distributed error term.[7]

Since the marginal tax rate on wage income paid by the top percentile group is endogenous to the income share of the top 1 per cent, we instrument it using the top marginal tax rate.[8] Atkinson and Leigh (2010, appendix B) outline the manner in which we have constructed our tax rate series. In the case of Canada, the UK and the USA, our series expand on already published data. So far as we are aware, this is the first time such series have been created for Australia and New Zealand. This involved considerable archival research, which is detailed in Atkinson and Leigh (2010, appendix B). For the early part of the century, straightforward tax tables are not available, and we need to take account of the regular income tax, plus separate sur-taxes that applied to wage and investment income at various times. The process is particularly complicated in the case of Australia, since state governments levied most income taxes in the 1920s, while the federal government levies all income taxes in the modern era. We therefore calculate Australian marginal tax rates on the assumption that taxpayers live in the most populous state, New South Wales.

For the most recent years in our sample, the median marginal tax rate paid by the top percentile group is the same as the top tax rate. However, in the early years of our sample, the top marginal rate was well above the marginal rate paid by the top 1 per cent of taxpayers. To take a particularly extreme example, the top marginal tax rate in Canada in 1920 was 72.5 per cent, yet the median marginal tax rate for a taxpayer in the top percentile group was just 4.2 per cent (Saez & Veall, 2005, table E1).

To take account of the possibility of serial correlation, we cluster standard errors at the country level, effectively allowing for an arbitrary variance-covariance matrix within each country. As Bertrand *et al.* (2004) point out that this is analogous to applying a Newey–West correction (Newey & West, 1987) in a panel

[6] During the period covered by Gruber and Saez's study (1979–1990), an income of $100,000 approximately corresponds to the top percentile group (excluding capital gains, the cutoff for the 99th percentile rose from $69,532 to $152,862: Piketty & Saez, 2007, tables 5A.0 and 5A.4). Using data for New Zealand, Claus *et al.* (2012) similarly find that those with higher incomes are more responsive to income tax rates.

[7] As noted above, the tax year starts in January in Canada and the USA; April in New Zealand and the UK; and July in Australia. The time fixed effects therefore account for a common effect in the tax year that starts in a given calendar year (e.g. the 1990 time fixed effect is the 1990 tax year in the USA and the 1990–1991 tax year in Australia).

[8] Following the suggestion of Baum *et al.* (2003), we do not implement a degrees-of-freedom correction. We also partial-out exogenous regressors in calculating *F*-statistics. Although the *F*-statistic is below 10 in specifications that lack time-varying country controls, we have not satisfied ourselves that other instruments would meet the exclusion restriction. One can imagine credible stories under which the top tax rate is endogenous with respect to top income shares (e.g. more inequality might allow millionaires to influence tax policy in their favour).

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TABLE 1
Top Income Shares and Wage Tax Rates: Dependent Variable is Log(Top 1 per cent Share)

	[1]	[2]	[3]	[4]
After-tax share	1.863**	1.206***	1.149***	1.232***
(instrumented)	[0.770]	[0.314]	[0.412]	[0.226]
Log real GDP		0.526***	0.204**	0.185
per capita		[0.190]	[0.092]	[0.138]
Return on bills				−0.11
				[0.152]
Return on bonds				0.182***
				[0.057]
Return on equities				−0.151***
				[0.034]
Country and year fixed effects	Yes	Yes	Yes	Yes
Observations	393	393	308	308
Countries	5	5	4	4
F-test on excluded instrument	7.42	48.72	62.96	56.60
P-value	0.052	0.002	0.004	0.005

Notes: After-tax share is one minus the marginal tax rate on wage income paid by a taxpayer at the 99.5th percentile. It is instrumented with one minus the top marginal wage tax rate. Return on bills, bonds and equities are a cumulative returns index, set to 1 in the year 1900. Standard errors, clustered at the country level, in brackets. *** and ** denote statistical significance at the 1 per cent and 5 per cent levels, respectively.

context, allowing for all lags to be potentially important. In Monte Carlo simulations using US state-year panels, Bertrand *et al.* (2004) find that this technique performs quite well in finite samples.

The time-varying country characteristics that are included in the regressions are the log of real GDP per capita, and an index of the cumulative return on equities, bills and bonds (more details on the construction of these variables is available in Atkinson & Leigh, 2010, appendix B). These help account for the possibility that prevailing economic conditions might be affecting both the tax rates and the share of the top percentile group. Unfortunately, the financial return variables are not available for New Zealand. We include the same set of time-varying controls in both the wage tax and investment tax regressions, as the dependent variable in both cases is the top 1 per cent share.

For both the wage and investment tax regressions, we present four specifications, all of which include country and year fixed effects. Column 1 has no additional time-varying controls; column 2 includes GDP; column 3 includes GDP, but drops New Zealand (for which the financial return variables are unavailable); and column 4 adds the financial return variables.

Table 1 shows the results from estimating Equation (2). In all specifications, the coefficient on the top wage tax rate is statistically significant at the 5 per cent level or better, with the point estimate ranging from 1.1 to 1.8. This suggests that a 1 percentage point cut in the marginal wage tax rate paid by the top percentile group (i.e. a 1 percentage point increase in the after-tax share) will lead to a 1.1–1.8 per cent increase in the top percentile group share. As the dependent variable is the log share of the top percentile group, we can convert this to a percentage point estimate. Across these five countries, the average share of the top percentile group is 10 per cent of personal income, so a 1.1–1.8 per cent increase in the share of the top percentile group is equivalent to a 0.11–0.18 *percentage point* increase in the share.

The other coefficients mostly have the expected sign. The top percentile group share is modestly pro-cyclical, positively correlated with the return on bonds (controlling for the return on bills and equities), and negatively correlated with the return on equities (controlling for the return on bills and bonds). However, while the coefficients on the financial return indicators are sometimes significant, including them has virtually no effect on the tax coefficient. Our preferred

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specification is therefore column 2, which controls for GDP, but not the other financial controls. The results of this specification imply that a 1 percentage point cut in the top marginal wage tax rate will increase the top percentile group share by 1.2 per cent, or 0.12 percentage points. The 95 per cent confidence interval on this estimate ranges from 0.6 to 1.8 per cent (0.06–0.18 percentage points).

(ii) Marginal Tax Rates on Investment Income

The other principal channel through which taxation might affect the share of the top percentile group is via its impact on accumulation. Assuming that the investment income of the top percentile group in period t ($y_{1,t}$) is a function of their amount invested the previous year ($I_{1,t-1}$), the rate of return on investment income ($r_{1,t}$), and the marginal tax rate paid by

TABLE 2
Top Income Shares and Investment Tax Rates: Dependent Variable is Log(Top 1 per cent Share)

	[1]	[2]	[3]	[4]
Panel A: 5-year moving average of tax rates				
After-tax share	1.984*	1.518**	1.279**	1.207***
(instrumented)	[1.077]	[0.619]	[0.579]	[0.418]
Log real GDP		0.529**	0.14	−0.094
per capita		[0.256]	[0.100]	[0.176]
Return on bills				−0.024
				[0.252]
Return on bonds				0.267**
				[0.105]
Return on equities				−0.168***
				[0.048]
Country and year fixed effects	Yes	Yes	Yes	Yes
Observations	381	381	300	300
Countries	5	5	4	4
F-test on excluded instrument	5.27	12.99	15.10	34.89
P-value	0.083	0.022	0.030	0.001
Panel B: 10-year moving average of tax rates				
After-tax share	1.961	1.605*	1.301**	1.029***
(instrumented)	[1.211]	[0.823]	[0.582]	[0.340]
Log real GDP per		0.418	0.014	−0.235
capita		[0.258]	[0.090]	[0.239]
Return on bills				−0.081
				[0.247]
Return on bonds				0.311***
				[0.079]
Return on equities				−0.122**
				[0.053]
Country and year fixed effects	Yes	Yes	Yes	Yes
Observations	362	362	286	286
Countries	5	5	4	4
F-test on excluded instrument	3.66	7.78	18.33	35.32
P-value	0.128	0.049	0.023	0.009

Notes: After-tax share is one minus the marginal tax rate on investment income paid by a taxpayer at the 99.5th percentile, averaged over a 5-year (10-year) period. It is instrumented with one minus the top marginal investment tax rate, also averaged over a 5-year (10-year) period. Return on bills, bonds and equities are a cumulative returns index, set to 1 in the year 1900. Standard errors, clustered at the country level, in brackets. ***, **, *Statistical significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively.

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the top percentile group $(1 - \tau_{1,t})$, we can write down an equation for the income of the top percentile group (now assumed to be investment income):

$$y_{1,t} = (1 - \tau_{1,t}) r_{1,t} I_{1,t-1} \quad (3)$$

Likewise, the investment income of the population as a whole will be

$$y_{100,t} = (1 - \tau_{100,t}) r_{100,t} I_{100,t-1} \quad (4)$$

Now, assuming that $I_{1,t-1}$ derives only from investment income over the previous N periods, and that τ_{100} remains unchanged (or equivalently, changes in the tax base are uncorrelated with changes in the rate paid by the top percentile group), then $\log(S_1)$ can be approximated by an equation in which the independent variable of interest is a simple moving average of the tax rate from period $t - N$ to period t.

$$\log(S_1)_{jt} = \alpha + \beta \left[\frac{1}{N+1} \sum_{i=0}^{N} (1 - \tau_{1,t-i}) \right]_{jt} + \gamma Z_{jt} + \delta_j + \lambda_t + \varepsilon_{jt} \quad (5)$$

In what follows, we test this regression with two specifications – a lagged moving average of the marginal tax rate on investment income over a 5-year and 10-year period. As in our results for wage income, we instrument the marginal tax rate on investment income at the 99.5th percentile with the top marginal tax rate, to address the possible endogeneity of the marginal rate to the top 1 per cent share. We also cluster standard

TABLE 3
Top Income Shares and Top Tax Rates – Current Wage Tax Rate and 10-Year MA of Investment Tax Rate: Dependent Variable is Log(Top 1 per cent Share)

	[1]	[2]	[3]	[4]
After-tax share	0.541	0.221	0.228	0.421***
on wage	[0.338]	[0.280]	[0.198]	[0.102]
Income (instrumented)				
After-tax share on investment	1.625	1.433	1.127**	0.745**
Income (instrumented)	[1.238]	[1.012]	[0.496]	[0.359]
Log real GDP per capita		0.459**	0.046	−0.129
		[0.226]	[0.072]	[0.235]
Return on bills				−0.091
				[0.222]
Return on bonds				0.272***
				[0.066]
Return on equities				−0.138***
				[0.050]
Country and year fixed effects	Yes	Yes	Yes	Yes
Observations	362	362	286	286
Countries	5	5	4	4
F-test on excluded instrument (wage income)	42.85	48.27	109.63	86.56
P-value	0.002	0.002	0.002	0.002
F-test on excluded instrument (investment income)	2.04	16.24	12.29	271.53
P-value	0.245	0.012	0.036	0.001
Linear sum of tax coefficients	2.167*	1.654**	1.354**	1.166***
	[1.250]	[0.752]	[0.596]	[0.286]

Notes: After-tax share is one minus the marginal tax rate on wage/investment income paid by a taxpayer at the 99.5th percentile. It is instrumented with one minus the top marginal wage/investment tax rate. Where applicable, both the endogenous and exogenous rates are averaged over a 5-year (10-year) period. Return on bills, bonds and equities are a cumulative returns index, set to 1 in the year 1900. Standard errors, clustered at the country level, in brackets. ***, **, *Statistical significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively.

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errors at the country level to take account of possible autocorrelation.

Because our focus is on the effect of past tax rates, the sample size is smaller in these specifications than in the wage tax rate specifications. Where we only use the top tax rate, it would be possible to estimate tax rates for the decade before our top income share series begin. However, we are using the top tax rate as an instrument for the tax rate at the 99.5th percentile, which we cannot calculate for years before the top income share series begin.

The results of this exercise are shown in Panel A of Table 2. With only country and year fixed effects, the coefficient on the lagged after-tax share is 1.9 (column 1). Controlling for log GDP per capita, it falls to 1.5 (column 2). Excluding New Zealand, the coefficient on the lagged after-tax share falls to 1.2 (column 3). In column 4, we then add the three financial market indicators, causing the after-tax share coefficient to fall very slightly again. Panel B of Table 2 repeats this exercise, using a 10-year lagged moving average of the marginal tax rate on investment income. The results are similar to those using a 5-year average, with the coefficients on the after-tax share ranging from 1.0 to 1.9. Again, the controls have the expected sign. As there is little change in the after-tax share coefficient between columns 3 and 4, our preferred specification is therefore column 2, which includes all five countries, and controls only for GDP per capita. The after-tax share coefficients on this specification suggest that a 1 percentage point decrease in the median marginal tax rate paid by the top percentile group (averaged over the previous 5 years) is associated with a 1.5 per cent (0.15 percentage point) rise in the income share of the top percentile group. Similarly, a 1 per cent decrease in the median marginal tax rate paid by the top percentile group (averaged over the previous 10 years) is associated with a 1.6 per cent (0.16 percentage point) rise in the income share of the top percentile group.

(iii) Combining Wage and Investment Tax Rates

To what extent are the effects of wage tax rates and investment tax rates cumulative? To test this, we model the top percentile group share as a function of both the current marginal tax rate on wage income and a lagged moving average of the marginal tax rate on investment income. The results of this specification are shown in Table 3, using a 10-year average of the tax rate on investment income (results are similar for a 5-year average: see Atkinson & Leigh, 2010). The investment tax rate coefficient tends to be larger than the wage tax rate. The linear sum of the two coefficients is always positive and statistically significant at the 10 per cent level or better. The coefficient on the sum ranges from 1.2 to 2.1, indicating that the cumulative impact (through the wage tax channel and the investment tax channel) is similar to the effect observed through either channel individually.

Using these figures, it is possible to do some rough calculations to estimate the contribution of cuts in top marginal tax rates to the rise in top income shares in Anglo-Saxon countries. Over the period 1970 to 2000, the top percentile group share in these five countries rose by 4.5 percentage points (or 46 log points). During the same period, the median after-tax share for those in the top percentile group rose by 15 percentage points for wage income, by 16 percentage points for investment income (lagged 5-year moving average), and by 12 percentage points for investment income (lagged 10-year moving average). With the coefficient on the after-tax share of around 1.2–1.6 (in our preferred estimates), this implies that reductions in tax rates can explain between one-third and one half of the rise in the income share of the richest 1 per cent.

(iv) Potentially Confounding Factors

One potentially confounding factor when considering the effect of income taxes on top income shares is the impact of other taxes. Analysing changes in overall tax progressivity in the USA since the 1960s, Piketty and Saez (2007) find a dramatic drop in progressivity, due primarily to a drop in corporate taxes and in estate and gift taxes, and only partially to changes in top marginal individual income tax rates. Similarly, looking at changes in top income shares before and after major changes in the US tax code that took effect in 1987, Slemrod (1996) finds that about one-third of the increase in top income shares was due to shifts from the corporate sector to the personal sector. In ignoring these other tax changes (and any *interaction* between the personal income tax rate and corporate tax rate), our approach will only capture part of the effect of taxation on top income shares. However, obtaining estimates of these taxes for our five countries over the full twentieth century is beyond the scope of this article. Moreover, constructing more compre-

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hensive measures of the tax burden over the full twentieth century would require us to make significant assumptions about income sources for the top percentile group. A key limitation is that we are relying for the most part on tabulations of taxpayers into income bands, taxpayer micro data being unavailable for most countries and years in our sample.

Another possibility is that the results observed above primarily reflect patterns of tax avoidance, rather than changes in real incomes. Since higher tax rates increase the marginal benefit to hiding a dollar of income, higher tax rates might simply cause reported incomes to decline, without affecting real incomes. Although it is impossible to properly estimate the magnitude of this effect, it may not be as significant as is commonly believed. Christian (1994) finds that US taxpayers with (auditor adjusted) earnings above $100,000 reported 97 per cent of their true incomes to the Internal Revenue Service (IRS), compared with an 86 per cent reporting rate for those with incomes under $25,000. Slemrod and Yitzhaki (2002) also suggest that non-compliance is much lower for wage incomes, as there is a greater chance that understatement of wage incomes will be detected. Given that the wage share in the top percentile group has steadily risen since World War II, this gives us more confidence that our effects are not merely reflecting changing patterns of tax avoidance.[9]

V Concluding Remarks

The shares of income accruing to the very top groups are of importance both because their share of the total is significant and on account of the economic power which it conveys. They are also a 'marker' of social and economic evolution. Tracing these shares over much of the twentieth century provides insights into the long-run development of societies and the impact of events such as the World Wars and the Great Depression. Looking across countries is informative for what it tells us about differences in institutions and policies. At the same time, it is helpful to hold constant as much as possible of the un-measurable cultural and social factors. For this reason, comparing the experience of Anglo-Saxon countries, with much shared history, is of particular interest.

In this article, we have charted the experience of five countries. In doing so, we have highlighted the problems of making such comparisons and the limitations of the estimates. These need to be borne in mind when considering the broad picture – of convergence up to 1965 followed by divergence – and when seeking to develop explanatory analysis. We find that top income shares are highly correlated across Anglo-Saxon countries. The share of the very rich appears to be extremely responsive to changes in marginal tax rates. Over the period 1970–2000, we estimate that reductions in tax rates can explain between one-third and one half of the rise in the income share of the richest percentile group.

[9] If one thought that either of these confounders (the impact of other taxes, or underreporting of taxable income) was primarily a feature of recent times, then one solution would be to estimate our regressions on pre-1960 data. When we do this, we obtain coefficients that are slightly larger than those reported for the full sample, and still statistically significant. For a more detailed discussion of the impact of tax underreporting on top income shares, see Leigh (2009).

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