The Australian National University

Centre for Economic Policy Research

DISCUSSION PAPER

The Distribution of Top Incomes in Five Anglo-Saxon Countries over the Twentieth Century

A B Atkinson and Andrew Leigh

DISCUSSION PAPER NO. 640

April 2010

ISSN: 1442-8636
ISBN: 978-1-921693- 21-2

A B Atkinson, Nuffield College, Oxford, United Kingdom. Email: tony.atkinson@nuffield.ox.ac.uk

Andrew Leigh, Economics Program, Research School of Social Sciences, ANU College of Business and Economics, The Australian National University, Australia. Email: andrew_leigh@ksg02.harvard.edu, http://andrewleigh.org

Acknowledgements:
We are grateful to Daniel Feenberg, Emmanuel Saez, Steven Stillman, and Michael Veall for assistance in compiling our Canadian and US tax rate series. We have received valuable comments and advice from Paul Flanagan, Bob Haveman, Adrian Pagan, Peter Stemp, and seminar participants at the Australian National University, Harvard University, Oxford University, the University of Melbourne, the Association for Public Policy and Management meetings, and the National Tax Association meetings. Elena Varganova provided outstanding research assistance. None of the above are responsible for the conclusions reached in the paper.

Abstract

Taxation data have been used to create long-run series for the distribution of top incomes in quite a number of countries. Most of these studies have focused on the national experience of individual countries, but we can also learn from cross-country comparisons. Comparative analysis is therefore the next stage in the research program. At the same time, we know from other fields that there are dangers in simply pooling all available time series, without regard to the specific nature of data and reality. In this paper, we therefore adopt an intermediate approach, taking five Anglo-Saxon countries that have relatively similar backgrounds and tax systems: Australia, Canada, New Zealand, the UK, and the US. The first part of the paper tackles the challenge of comparability of income-tax based estimates across countries and across time. The second part summarizes the evidence about top income shares. Across these five countries, 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 percent is highly correlated across Anglo-Saxon countries, more so than the share of the next 4 percent. The third part of the paper looks at the relationship between taxes and top income shares. 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.

JEL Codes: D31, H23, N30

Keywords: inequality, taxation, Australia, Canada, New Zealand, United Kingdom, United States

Introduction

There has recently been a revival of interest in the study of the distribution of top incomes using income tax data, beginning with the study by Piketty of the long-run distribution of top incomes in France (Piketty 2001, 2003). Following his lead, Atkinson (2005, 2007b) made estimates for the United Kingdom covering the twentieth century, and Piketty and Saez (2001, 2003) made estimates for the United States. Since then, the fruitfulness of income tax data in providing long-run evidence about the top of the distribution has led to estimates being constructed for a sizeable number of countries, including Argentina (Alvaredo, 2007), Australia (Atkinson and Leigh 2007), Canada (Saez and Veall, 2005), China (Piketty and Qian, 2006), Finland (Riihelä, Sullström and Tuomala, 2005), Germany (Dell, 2005, 2007), India (Banerjee and Piketty, 2005), Indonesia (Leigh and van der Eng, 2009), Ireland (Nolan, 2007), Japan (Moriguchi and Saez 2006), the Netherlands (Atkinson and Salverda, 2003), New Zealand (Atkinson and Leigh, 2008), Spain (Alvaredo and Saez, 2006), Sweden (Roine and Waldenström, 2006), and Switzerland (Dell 2005; Dell, Piketty and Saez 2007). The number is likely to increase, as data for further countries are exploited.

We have therefore information on top incomes covering more than 15 countries. 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 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 countries, we cannot assume that the series are homogeneous.[1]

This paper 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, United Kingdom and the United States. 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. Analyzing cross-country GDP growth correlations across the OECD, Otto, Voss and Willard (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. How similar are they? Are the countries of the Southern Hemisphere more alike?

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

Have they diverged or converged? 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 data sets 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 1 of the paper 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 2. Section 3 examines the extent to which top income shares are correlated across and within countries. Section 4 explores the impact of taxation on top income shares. The final section concludes.

1. The Challenge of Comparability

The basic sources for all five countries are the records of the personal income tax.[2] The oldest personal income tax is that of the United Kingdom (and Ireland). Originally introduced in 1799 as a war measure, Pitt's tax was abolished in 1802 with the Treaty of Amiens, to be reintroduced in a different form by Addington in 1803. The tax remained in existence until 1816, when it was again abolished. It was not until the Budget of 1842 under Peel that the tax was re-introduced to stay. The existence of the income tax does not mean that statistics exist on the distribution of income. It is true that for 1801 the UK income tax returns provide evidence on the distribution of total income (see Stamp, 1916), but the switch to a schedular system in 1803

[2] We use income tax data that relate to persons and not to limited companies, which limits the years covered: for example in the early Australian and New Zealand data persons and companies cannot be separated, so these series do not start in the first year of the personal income tax.

meant that no information was available about total income (the figures only covered incomes by schedules and could not be added together). It was only with the introduction of supertax in 1909 that the UK income tax data again yield direct information about the distribution of total income. The Inland Revenue later introduced special statistical exercises to assemble information on total income (the Surveys of Personal Income); these provide data for the more recent years, including micro-data in the past decade.

In the United States, the first personal income tax was introduced by Lincoln in 1862, to help fund the Civil War. It was repealed in 1872, reintroduced in 1894, declared unconstitutional by the Supreme Court in 1895, and finally reinstated in 1913, following the ratification of the 16th Amendment to the Constitution. The Internal Revenue Service has published tax return data since that date, and made micro-data files available since 1960 (see Piketty and Saez, 2003). In Canada, the federal individual income tax started in 1917. Income distribution statistics have been compiled since 1920, and micro-data files are available in Canada annually from 1982. In Australia, the federal income tax was first levied in 1914, with separate tabulations for individuals and corporations available from 1921 onwards. In New Zealand, income tax was initially imposed in 1892, and tabulations for individuals are again available from 1921 onwards.[3]

From this brief historical account, it is clear that the income tax developed independently in each case. The resulting statistics are not therefore necessarily comparable across the five countries. To this must be added the changes within countries over time. 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

[3] The tax year begins on January 1 in Canada and the US, but on April 1 in New Zealand, April 6 in the UK, and July 1 in Australia. Throughout this paper, 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 July 1, 1980.

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, 4). (Although they go on to reassure the reader that “while a comparison of the results for one particular year with those for another year may be uncertain without an examination of the law applying to those years, the broad picture presented by the tables is significant”.)

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. Secondly, as already emphasized, the five countries are chosen purposefully as those that enjoy a number of common features. While the income tax developed separately, the legislation was influenced by what was happening in the other Anglo-Saxon countries. 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. Thirdly, 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. The incomes of the top groups recorded in the tax returns can be set in the context of external information about the totals that allows for non-taxpayers and for differences in income definitions. This is explained in more detail below.

Control Totals for Population and Definition of the Tax Unit

The estimates of top income shares allow for the incomplete coverage of the population by the use of external control totals for the population derived from population censuses and population estimates for intermediate years. Using these totals, we can identify those taxpayers who make up, say, the top *x* percent. The calculation of the population control total depends of course on the definition of the tax unit. In Australia and Canada, the tax unit is the individual, and the totals are simply the number of adults.[4] In the other Anglo-Saxon countries, for certain periods, the tax unit has been wider; in particular, the "tax unit" combines the incomes of husbands and wives. In the United States, married women can file tax separate returns, but the number is "fairly small (about 1 percent of all returns in 1998)" (Piketty and Saez, 2001, 35).[5] Piketty and Saez therefore treat the data as relating to tax units, although they note that, before the Revenue Act of 1948, a larger number of married women with income in their own right filed separate tax returns (around 5 percent).[6] In the UK, the tax unit until 1990 was defined as a married couple living together, with dependent children (without independent income), or as a single adult, with dependent children, or as a child with independent income.[7] The same applied before 1953 in

[4] It should be noted that the studies for Australia, New Zealand, and the UK use persons aged 15 and over, while those for Canada and the US use persons aged 20 and over. If taking an age cut-off of 20 gives a control total for population that is on the low side, and hence gives a lower bound on the share of the top x percent, taking a cut-off of 15 will give a control total on the high side, and hence gives an upper bound. To give some sense of the magnitude of the effect, Atkinson and Leigh (2007) find for Australia that using persons aged 20 and over would reduce the top 1 percent share by approximately 0.5 percentage points, and the top 10 percent share by approximately 2 percentage points.

[5] Separate assessment also existed in the UK, but married couples were treated in the statistics as a unit even where the wife elected for separate assessment (see for example, Inland Revenue, 1963, 81 and 1980, 6).

[6] This was particularly important in community property states, where all or part of a couple's income is legally regarded as divided equally between the spouses (Seltzer, 1968, 44).

[7] According to the Inland Revenue, "there are not many children below the age of 15 who fall into this category" (Inland Revenue, 1972, 1). For a small number of years, investment income of children was aggregated with that of their parents.

New Zealand. In these cases, an appropriate control total for tax units can be calculated by subtracting from the total individuals, as defined above, the number of married women.

The use of external control totals allows for the changing extent of income taxation, but does not avoid the fact that we have two countries where the unit is the individual, two where there was a change from tax units to individuals, and one where the basic unit is the tax unit, but there was a degree of separate filing before 1948. Unfortunately, we cannot predict even the direction of the difference between individual and tax unit-based estimates. Consideration of different assumptions about the joint distribution of income suggests that the use of an individual unit rather than a tax unit may lead to higher or lower top shares. As shown in Atkinson (2007a), where all rich people are either unmarried or have partners with zero income, and couples are weighted the same as individuals, the share rises on moving to independent assessment, since we have to include a larger number in order to arrive at a given percentage of the population. But if, at the other extreme, all rich tax units consist of couples with equal incomes, then the same amount (and share) of total income is received by a larger fraction of the population, so that the measured share falls. It is not therefore easy to forecast the direction of the difference, and it may well have changed over the century. This has to be borne in mind in interpreting the results.

On the other hand, we can learn from the cases where there was a change. In the case of the US, Piketty and Saez increase the recorded income shares by "about 2.5 percent" for the earlier period 1913-1947 when there was a degree of separate filing (Piketty and Saez, 2001, 35n).[8] When New Zealand moved from joint to individual filing in 1953, the top 5 percent, 1 percent and 0.1 percent shares increased by 21 percent, 25 percent and 27 percent respectively. Atkinson and Leigh (2008) therefore adjust New Zealand top income shares for 1952 and prior

[8] It should be noted that they use throughout a control total based on tax units, so that separate filing will definitely cause the top share to be understated.

years, on the assumption that the entire increase in top income shares from 1952 to 1953 was due to this switch. In the case of the United Kingdom, the introduction of independent taxation in 1990 was associated with a rise in the share of the top 0.1 percent of 20.7 percent, of the top 1 percent of 13.0 percent, and of the top 5 percent of 8.5 percent. Not all of this change can necessarily be attributed to the introduction of independent taxation, but in order to link the series we adjust the shares for 1990 and subsequent years by this percentage to put them on a tax unit basis.

This leaves us with “individual” series for Australia, Canada, and New Zealand, and “tax unit” series for the UK and the US. The experience of changes in the 1950s and 1980s suggests that the individual series may be expected to be higher.

Control Total for Income and the Definition of Income

In this section, we consider two related but different problems. The first is to take account of the fraction of people not filing tax returns, referred to as “non-filers”. As put by Saez and Veall (2005), “we need to estimate total income that would have been reported on tax returns, had everybody been required to file a tax return”. The second is that the definition of income in the income tax data may differ from our desired definition. In particular, the definitions may differ across countries.

In order to allow for non-filers in the US, Piketty and Saez (2001) used two methods. For the second half of the period (1944 to 1998), they extrapolate from the recorded incomes, imputing to non-filers a fixed fraction of filers’ average income (20 percent from 1946 to 1998). They note that the resulting total series is a broadly constant percentage (between 77 and 83 percent) of total personal income recorded in the national accounts if transfers are excluded. They therefore take as the control total a constant percentage (80 percent) of total personal income less transfers for the earlier period 1913-1943. (The implied estimate of the income of non-filers is then the difference between this control total and the total recorded in the tax returns.) In Canada, Saez and Veall use throughout (1920 to 2000) the constant percentage approach, applied to "total personal income less transfers", basing the percentage (80 percent) on the experience since the mid-1970s when they feel that filing was close to complete.

In the UK, in contrast, the total income of non-filers is constructed from estimates of the different elements of income missing from the tax returns. The resulting total declines from around 90 percent to around 75 percent of total personal income recorded in the national accounts. The fact that the constructed control totals are less than 100 percent of the national accounts totals for personal income reflects the differences in definition. To begin with, the national accounts totals for personal income include *non-household* elements, such as charities, life assurance funds and universities, and items not typically regarded as received by households, such as employer social security contributions. It is for this reason that, in the case of Australia and New Zealand, a specific control total for household income has been constructed from national accounts data.

Secondly, the national accounts include items of household income not included in the tax base. The New Zealand total is therefore reduced to 95 percent of the household income figure, and it is for this reason that the US and Canadian figures exclude transfers. This however raises an important question. Should the income definition follow the tax law, or should it follow a "preferred" definition of income? The latter preferred income concept may seek to approximate the Haig-Simons comprehensive definition, including such items as imputed rent, in kind employment benefits, capital gains and losses, and all transfer payments. For a single country study, it may be reasonable to take taxable income, as a concept well understood in that context. Alternatively, one may assume that all taxable incomes differ from the preferred definition by the same percentage, although this does not seem a particularly plausible assumption in the case of some of the items listed above. In a cross-country comparison, however, there seem good reasons for adopting a definition of income common across countries and that does not depend on the specificities of the tax law in each country.

The adoption of a common definition of income does however pose considerable problems, as illustrated here by reference to transfers, capital gains, the inter-relation with the corporate tax system, and tax deductions.

1. As noted above, in the US and Canada, the control totals take a percentage of personal income less transfers, on the grounds that the latter are either partially or totally exempt from tax. In the other three countries, the tax treatment of transfers has changed over time, with typically more transfers being brought into taxation over time, and in what follows we take throughout control totals including transfers for Australia, New Zealand and the UK.

2. The treatment of capital gains and losses differs across time and across countries. In the US, "the tax treatment of capital gains and losses has undergone several sweeping revisions since 1913" (Goode, 1964, 184). Capital gains have been regarded as within the purview of the income tax, but with different treatments regarding the deductibility of losses and the rates of taxation. Piketty and Saez (2003) present series for the US both excluding and including realized capital gains. In 1995, for instance, this adds some 4 percent to the total. The same is true for Canada. In the UK, the approach has been different, with certain gains brought under the regular income tax (and therefore included in the estimates), but other gains taxed, for parts of the period, under a separate Capital Gains Tax. The latter are not included. For Australia and New Zealand, series excluding capital gains are not readily available, so series for these countries include realized capital gains, to the extent that such gains were taxable. The series for Canada and the United States used here exclude capital gains.

3. The interpretation of the data depends not only on the *personal* tax law, but also on the taxation of *corporations*. One key feature is the extent to which there is an imputation system, under which part of any corporation tax paid is treated as a pre-payment of personal income tax. Payment of dividends can be made more attractive by the introduction of an imputation system, as in the UK in 1973, Australia in 1987 and New Zealand in 1989, in place of a "classical" system where dividends are subject to both corporation and personal income tax. Insofar as capital gains are missing from the

estimates but dividends are covered, a switch towards (away from) dividend payment will increase (reduce) the apparent shares. This needs to be taken into account when interpreting the results.

4. Income tax systems differ in the extent of their provisions allowing the deduction of such items as interest paid, depreciation, pension contributions, alimony payments, and charitable contributions. Income from which these deductions have been subtracted is often referred to as "net income". (We are not referring here to personal exemptions.) In all five countries, the earlier income tax distributions refer to income after these deductions, but the later distributions refer to gross income. In the US, the income tax returns prior to 1944 showed the distribution by net income, after deductions. Piketty and Saez (2003) apply adjustment factors to the threshold levels and mean incomes for the years 1913-1943 (see Piketty and Saez, 2001, page 40). As they note, strictly the distribution needs to be re-ranked, but they conclude from examination of the micro-data for 1966-1995 that this re-ranking has small effects. In Canada, the tax returns for 1920 to 1945 relate to net income. Deductions were smaller, and Saez and Veall (2005) make no adjustment prior to 1929 and for 1929 to 1945 increase all amounts by 2 percent. In New Zealand, tax data from 1921-40 are tabulated by assessable income, so Atkinson and Leigh (2008) adjust them to make them comparable with the estimates based on total income in subsequent years. Similarly, in Australia, estimates for 1921-44 are based on taxable rather than total income by ranges of taxable income, while the estimates from 1947-57 are based on the distribution of taxable income by ranges of actual income. Using estimates from overlapping years, Atkinson and Leigh (2007) make adjustments to account for these changes. For the UK, there is one overlap year (1975), used to make the adjustment. It should be noted that the scale of the adjustments varies considerably across countries: for the share of the top 1 percent, the adjustment is 0.8 percent for the UK, 3.4 percent for Australia, but 19.1 percent for New Zealand.

Even with the adjustments made, there remain significant differences across the five countries in the definition of income. We have noted a number of elements that need to be taken into account, and one advantage of our limited range of comparison is that, with 5 countries, the reader may be able to keep these in mind when considering the results. More generally, we may note that, taking a single year, in 2000, the totals used here (excluding capital gains where possible) were, as a percentage of UN SNA total for pre-tax household current receipts: Australia (83 percent), Canada (70 percent), New Zealand (90 percent), UK (67 percent) and US (64 percent). Expressed as percentage of the total minus current transfers, the US figure rises to 73 percent, but these figures suggest that the totals used for Australia and New Zealand may be higher than those used in the other Anglo-Saxon countries.

2. 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, 2007b), and for the US from Piketty and Saez (2003, 2004). The figures for Australia, New Zealand and the UK have been adjusted in the way described above: the UK series has been put fully on a tax unit basis, the control totals for Australia, New Zealand and UK all relate to income including transfers, deductions have been added back to give gross income. Construction of the series has also involved some interpolation and extrapolation as detailed in Appendix A. We focus here on the shares of the top 0.1 percent, the top 1 percent and the top 5 percent. The top 0.1 percent series is complete for all five countries from 1921-2000, the top 1 percent covers all countries for the same period except the UK, which begins as a continuous series in 1949 (although there is an observation for 1937), and the top 5 percent is complete for the same period except for Australia which begins in 1939 (there are observations for 1921-22 and the UK which begins in 1959 (there are observations for 1937 and 1949).

Ranking of the Five Countries

We begin with the shares of the top 0.1 percent and top 1 percent, plotted in Figure 1 and Figure 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 shares of the top 0.1 percent were all around 1.5 to 2 percent, and the shares of the top 1 percent were between 7 and 10 percent. 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.

There are however differences between countries and over time that become clearer on closer inspection. First, there are differences between the five countries. Over the period 1921-2000, the mean share of the top 0.1 percent over the period as a whole is 2.4 percent in New Zealand, 2.3 percent in Australia, 3.4 percent in Canada, 3.9 percent in the UK and 4.0 percent in the US. The mean shares of the top 1 percent are 8.1 percent in Australia and 9.4 percent in New Zealand, compared with 11.2 percent in Canada and 11.8 percent in the US (the UK figures for the top 1 percent do not span the whole period). This indicates a systematic difference between the Northern and Southern 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 percent 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 US. It seems unlikely that the comparison of Northern and Southern hemispheres is affected by the difference in the tax unit, as the Australian and Canadian data both 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 percent of the constructed total, then the top 0.1 percent shares in New Zealand would be raised from 2.4 to 2.7 percent, and from 2.3 to 2.6 percent 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. Recent figures for the overall income distribution from the Luxembourg Income Study show the following ranking in order of increasing overall inequality: Canada, Australia, UK and US (New Zealand is not included).[9] 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 percent, described as the "next" 4 percent: i.e. the share of those in the top 5 percent who are not in the top 1 percent. Over the period 1921-2000, Canada now appears to have the largest share: mean value of 15.8 percent, compared with 13.6 percent for the US, and 14.0 percent for New Zealand (the next 4 percent 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 percent may be found in the next 4 percent. 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 US), the shares cycled in the interwar period. The post war period saw little clear direction of movement. As had been noted in the case of the UK by Brittain (1960), redistribution was highly localized. In recent decades there has been some rise, but it is much less marked than for the top 1 percent. In what follows, we consider these groups separately.

[9] Luxembourg Income Study, "Income Inequality Measures", www.lisproject.org, checked on 10 May 2007. Figures are for Australia in 2001, Canada in 2000, the UK in 1999 and the US 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 (epsilon=0.5 or epsilon=1.0), or the 90/10 ratio.

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 percent, top 1 percent and top 5 percent 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 percent 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 percent was greater in the UK than in the US. 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 US 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 US.

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 percent. First, the shares for each country are expressed relative to the contemporary average for the five countries: i.e. taking out the common movement over time. Australia and New Zealand are quite consistently below the mean. The UK stands out in the early part of the period, whereas the US 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 percent varied between 4.0 and 9.1 percent; by 1953, which saw the lowest value for the coefficient of variation, they varied between 2.3 and

2.8 percent. 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.

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 percent within the top 1 percent, we do not need to rely on the income control totals. Secondly, 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 percent within the top 1 percent. In 1921, for example, the share of the top 0.1 percent in the US was 5.6 percent and the share of the top 1 percent was 15.47 percent, so the within share figure is 36.2 percent. 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 percent within the top 10 percent, denoted by S_1/S_{10} is given by $(0.1)^{(1-1/\alpha)}$. Easton (1983) notes that the list of available Pareto coefficients 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 (US) 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.)

3. Correlations Across and Within Countries

Our examination in the previous section of the top income series for the five countries suggests that they provide a reasonably solid basis for further statistical analysis. They do indeed suggest a number of interesting avenues to explore. We begin by looking at the extent to which top income shares are correlated across countries. If top income shares are affected by global economic shocks, or policy changes that are adopted contemporaneously by different countries, we might expect the cross-country correlations to be positive. Alternatively, if top income groups are highly mobile, their shares might be negatively correlated across countries. A third possibility is that top income shares are primarily driven by autochthonous factors, and therefore uncorrelated across countries.

Tables 1 and 2 show the extent to which the shares of the top 0.1 percent (referred to as the "very rich") and the top percentile group (referred to as the "rich") are correlated across countries. Since the tax year does not start in the same month in all countries, we standardize all share data to calendar year basis before carrying out cross-country comparisons. For the very rich, 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-US and New Zealand-US. For the rich, the correlations range from 0.713 to 0.906, and the highest country-pair correlations are Canada-UK and Canada-New Zealand, and the lowest are UK-US and Australia-US. All correlations in Tables 1 and 2 are statistically significant at the 1 percent level. While one might have expected geography to be very important, the correlations for the country-pairs that are located closest to one another (Australia-New Zealand and Canada-US) are neither particularly high nor low. There is some tendency for the correlations with the UK to be higher, perhaps due to the importance of the London financial market for much of the twentieth century.

Table 3 shows the cross-country correlations for the share of the next 4 percent (referred to as the "well-off"). Only six of the ten correlations are significant at the 10 percent level or better, and the estimates range from -0.562 to 0.888, with a mean of 0.167. The highest correlation in Table 3 is between the well-off group in the UK and the US. Comparing the results in Tables 1, 2 and 3, the mean cross-country correlation of the top 0.1 percent and the top percentile group is substantially larger than the mean cross-country correlation of the next 4 percent, indicating that the rich and the very rich are more globally integrated than the well-off.

Within countries, Table 4 shows substantial difference in the correlations between top income shares of the top 1 percent and of the next 4 percent. The share of the rich and the well-off tend to move in tandem in all five countries, with the strongest relationship found in New Zealand, and the weakest in Australia. It is also instructive to compare the mean correlations in Tables 2 and 4. The mean correlation among the rich in different countries (0.832) is larger than the mean within-country correlation between the rich and the well-off (0.536). For example, the share of the top percentile group in the US is more correlated with the top percentile group share in Canada (0.846) than with the share of the next 4 percent in the US (0.757).

4. The 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 labor 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 inter-war period causing voters to favor 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 US, 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 US (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 some of the key explanatory factors, and potential endogeneity are among the main econometric concerns.[10] 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, Gordon and Harrison (1989), who derive a model for the wealth share of the top 1 percent from the accumulation process of Meade (1964). Using a log-logistic transformation (log[S1/S99]), they transformed the top 1 percent share into an unbounded dependent variable,

[10] 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.

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.

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 US, 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 US over this forty-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 nonlinear 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 percent. We focus on the top 1 percent 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 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.

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 percent income are 16 percent in Australia in 1954, 45 percent in Canada in 1946, 25 percent in the UK in 1937, and 20 percent in the US in 1916. But in 2000, wages constitute a majority of top 1 percent 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 US, and around 55 percent in Australia (Atkinson and Leigh 2007, Fig 7; Saez and Veall, 2005, Fig 6; Atkinson 2007b, Fig 4.11; Piketty and Saez 2007, Table 5A.7).

One reason why income taxation might affect top income shares is through its immediate effect on work incentives. Analyzing US tax reforms in the 1980s, Gruber and Saez (2002) find that the 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.[11]

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

$$\partial \log S_1 = (\partial y_1/y_1) - (\partial y_{100}/y_{100}) = [-\eta_1(\partial \tau_1/(1-\tau_1))] - [-\eta_{100}(\partial \tau_{100}/(1-\tau_{100}))] \qquad (1)$$

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 percent, 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:

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

[11] 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 and Saez 2007, Tables 5A.0 and 5A.4)

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.[12]

Since the marginal tax rate on wage income paid by the top percentile group is endogenous to the income share of the top 1 percent, we instrument it using the top marginal tax rate.[13] Appendix B outlines the manner in which we have constructed our tax rate series. In the case of Canada, the UK, and the US, 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 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 percent of taxpayers. To take a particularly extreme example, the top marginal tax rate in Canada in 1920 was 72.5

[12] As noted above, the tax year starts in January in Canada and the US; 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 (eg. the 1990 time fixed effect is the 1990 tax year in the US and the 1990-91 tax year in Australia).

[13] Following the suggestion of Baum, Schaffer and Stillman (2003), we do not implement a degrees-of-freedom correction. We also partial-out exogenous regressors in calculating F-statistics.

percent, yet the median marginal tax rate for a taxpayer in the top percentile group was just 4.2 percent (Saez and 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, Duflo and Mullainathan (2004) point out, this is analogous to applying a Newey-West correction (Newey and West 1987) in a panel context, allowing for all lags to be potentially important. In Monte Carlo simulations using US state-year panels, Bertrand, Duflo and Mullainathan (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 Appendix B). These help account for the possibility is 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, since the dependent variable in both cases is the top 1 percent 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 5 shows the results from estimating equation (2). In all specifications, the coefficient on the top wage tax rate is statistically significant at the 5 percent 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 (ie. a 1 percentage point increase in the after-tax share) will lead to a 1.1-1.8 percent increase in the top percentile group share. Since 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 percent of personal income, so a 1.1 to 1.8 *percent* increase in the share of the top percentile group is equivalent to a 0.11 to 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 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 percent, or 0.12 percentage points. The 95 percent confidence interval on this estimate ranges from 0.6 to 1.8 percent (0.06 to 0.18 percentage points).

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 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):

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

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

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

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.

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

In what follows, we test this regression with two specifications – a lagged moving average of the marginal tax rate on investment income over a five-year and ten-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 percent share. We also cluster standard 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. Were we only to 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 6. 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 6 repeats this exercise, using a ten-year lagged moving average of the marginal tax rate on investment income. The results are similar to those using a five-year average, with the coefficients on the after-tax share ranging from 1.0 to 1.9. Again, the controls have the expected sign. Since 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 five years) is associated with a 1.5 percent (0.15 percentage point) rise in the income share of the top percentile group. Similarly, a 1 percent decrease in the median marginal tax rate paid by the top percentile group (averaged over the previous ten years) is associated with a 1.6 percent (0.16 percentage point) rise in the income share of the top percentile group.

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 7 (using a 5-year average of the tax rate on investment income) and Table 8 (using a 10-year average of the tax rate on investment income). In general, the investment tax rate coefficient tends to be larger and more statistically significant than the wage tax rate. The linear sum of the two coefficients is always positive and statistically significant at the 10 percent 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 to 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 percent.

Using our estimates of the elasticity of the top 1 percentile group share to the top marginal tax rate, we can estimate revenue hills for the Anglo-Saxon countries. In Figure 9, we show estimated revenue hills for two cases, in which the elasticity of the top percentile group share with respect to the after-tax share is 1.2, and in which the elasticity is 1.6. In our specification, the revenue-maximizing tax rate is simply the inverse of the elasticity (see Appendix C for proof). Thus if the elasticity is 1.2, the revenue-maximizing tax rate will be 83 percent (1/1.2), while if the elasticity is 1.6, the revenue-maximizing tax rate will be 63 percent (1/1.6). This suggests that in all five Anglo-Saxon countries, the tax rate paid by the top percentile group in the early-2000s was well below the revenue-maximizing point (ie. on the correct side of the Laffer Curve).[14] For example, our calculations suggest that with a top tax rate of 40 percent, governments forego between 9 and 19 percent of the maximum revenue they could potentially raise from the richest percentile group. However, it is important to note that this simple 'back of the envelope' calculation does not take account of other negative or positive impacts of top income shares on economic and political outcomes.

Potentially confounding factors

One potentially confounding factor when considering the effect of income taxes on top income shares is the impact of other taxes. Analyzing changes in overall tax progressivity in the US 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

[14] In 2000, the top marginal tax rate was 47 percent in Australia, 47.9 percent in Canada, 39 percent in New Zealand, 40 percent in the UK, and 39.6 percent in the US. These rates were the same for wage or investment income, and in all countries a taxpayer at the 99.5th percentile in 2000 paid the top marginal rate.

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 paper. Moreover, constructing more comprehensive 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 percent of their true incomes to the IRS, compared with an 86 percent 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.[15]

[15] 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).

5. Concluding Remarks

The shares of income accruing to the very top groups is 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 paper 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.

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Appendix A: Adjustments for Missing Data and for Tax Unit and Income Definitions

In making a comparison between five Anglo-Saxon countries, we have to take account of the fact that the series for the UK contains gaps and we have to make adjustments for changes in the tax unit.

For the UK, the estimates of Atkinson (2005a) for the shares of the top 5 percent and 1 percent in the UK cover 1918 and 1919, 1937, and do not start as an annual series until after the Second World War. The UK series covers therefore the full period for only the top 0.1 percent; the series for the top 1 percent and 5 percent only becomes continuous after 1949 and 1959, respectively. The following adjustments have been made:

a) The series have been interpolated linearly for three missing years: 1950 (top 1 percent only), 1960 (top 5 percent only), 1961 and 1980.

b) Where the top 0.1 percent lies in the open top interval, we have extrapolated assuming a Pareto distribution, using the relation between the starting level of income and the interval mean to calculate a value for the Pareto exponent, with this value using the cumulative distribution function to calculate the 0.1 percentile, and the mean income above this level then provides the desired income share. This has been used for a small number of years (1987 to 1992).

c) The statistics from 1975 relate to total income, and earlier figures are increased by a small amount: the share of the top 5 percent is increased by a factor of 1.0077, the share of the top 1 percent by a factor of 1.000797, and the share of the top 0.1 percent by a factor of 1.0097.

d) It is assumed that the whole of the percentage point increase in the top shares from 1989 to 1990 was attributable to the move from a tax unit to an independent basis, and this amount subtracted from the shares from 1990 onwards, to give a consistent tax unit series.

Appendix B: Sources for income tax rates, rate of return and GDP

In the case of Australia, we are unaware of any previous attempt to create a series of top income taxation rates for the twentieth century, and therefore do so using figures from Commonwealth of Australia, *The Yearbook of Australia*, annual. However, because Australia witnessed a substantial shift in income taxation from the state to the federal level in 1941, ignoring state taxes would greatly understate the tax paid by high income earners prior to World War II. We therefore add federal and state taxes, on the assumption that taxpayers live in the largest state, New South Wales. As the Australian Yearbooks of the time noted, there was a good deal of commonality across state income tax regimes during this period (see eg. Australian Yearbook 1942-43, p. 931). NSW tax rates are found in New South Wales Government, *The Official Year Book of New South Wales*, annual. Using the same methodology as Atkinson and Leigh (2007), we estimate the earnings at the 99.5th percentile in each year, and calculate the marginal earned income tax rate and investment income tax rate at this point.

Top marginal income tax rates for Canada from 1920-2000 are drawn from Saez and Veall (2005, Table E1), who report the top marginal tax rate on any type of income. During the 1930s and 1940s, there was a different tax rate on investment income and unearned income (Perry 1955, 262; Revenue Canada 1946, 9-11). However, since all earned income above a certain threshold was classified as investment income, the top marginal rates for earned and investment income are the same over this period. From 1910-1919, top marginal tax rates are drawn from Canadian Tax Foundation (1957, Table 100, p.154). In our treatment of provincial income taxes in Canada, we follow Saez and Veall (2005). Since 1972, provinces have collected income taxes separately, and they assume that taxpayers live in the largest province, Ontario. From World War II to 1971, the provinces did not separately collect income taxes. For a few years prior to World War II, provincial income taxes were separately levied, and Saez and Veall omit these from their calculations. The median marginal tax rate paid by the top 1 percent group in Canada (ie. the rate paid by the taxpayer at the 99.5th percentile) is from Saez and Veall (2005, Table E1). In each year, the median taxpayer in the top 1 percent group is assumed to have the same marginal tax rate on earned and investment income, since total earnings at the 99.5th percentile are well in excess of the point above which additional earned income is treated as investment income.

For New Zealand, we obtain top marginal tax rates from New Zealand Government, *The New Zealand Official Yearbook*, annual. As with Australia, we are unaware of any previous attempt to create a series of top income taxation rates for New Zealand throughout the twentieth century. Since New Zealand is a unitary government, we do not have to deal with the issue of state taxes. We estimate the earnings at the 99.5th percentile in each year, and calculate the marginal earned income tax rate and investment income tax rate at this point.

The top marginal income tax rates on earned and investment income in the UK are from Inland Revenue *Annual Reports* and *Inland Revenue Statistics*, various years. Using the same methodology as in Atkinson (2005, 2007b), we estimate the earnings at the 99.5th percentile in each year, and calculate the marginal earned income tax rate and investment income tax rate at this point.

Top marginal income tax rates for the US are drawn from Internal Revenue Service, "US Individual Income Tax: Personal Exemptions and Lowest and Highest Bracket Tax Rates, and Tax Base for Regular Tax, Tax Years 1913-2006". SOI Bulletin Historical Table A. The median marginal tax rate paid by the top 1 percent group in the US is calculated by using the estimates of the earnings of the taxpayer at the 99.5th percentile, from updated tables for Piketty and Saez, Table A4 (downloaded from Saez's website on 10 May 2007). We use the NBER Taxsim program to calculate the median marginal tax rate for these taxpayers from 1960 onwards (see Feenberg and Coutts 1993). From 1930-59, we calculate marginal tax rates using a routine available in Stata. In each case, we assume that the taxpayer is married, filing jointly. Although Stata does not provide separate marginal tax rates for earned and investment income, the two types of income were taxed at the same rate throughout the period 1930-59. For the US, we are unaware of any attempt to compile state income tax rates prior to 1977. Were we to simply assume that individuals lived in the largest state, California, we would substantially overestimate the tax rates on the rich. For example, over the period 1977-2000, the population-weighted average top marginal state income tax rate in the US was around 5 percent, while the top marginal income tax rate in California was around 10 percent. We therefore do not take account of state income taxes in our US series.

Real rate of return and GDP

Real rate of return figures from the "Dimson-Marsh-Staunton Global/Returns Database", maintained by Ibbotson Associates (updated through December 2002). Since these data are proprietary, we do not reproduce them in the appendix tables to this paper. The series are described in more detail in Dimson, Marsh and Staunton (2002), which includes tables on a ten-year basis, and a graph of the annual data. This database does not include New Zealand. The Australian and UK figures are converted from calendar year basis to tax year basis. For each country, the rates of change are then converted into an index, which is set to 100 in 1900.

GDP is real GDP per capita (measured in 1990 International Geary-Khamis dollars), from Angus Maddison, *Historical Statistics for the World Economy: 1-2003 AD*. Downloaded from www.ggdc.net/Maddison/ on 10 May 2007.

Appendix C: Estimating the Revenue-Maximizing Tax Rate

In the paper, we estimate equations that take the form:

$$\log(S) = \beta(1-\tau) + K \quad \text{(A1)}$$

where S is the income share of the top percentile group, τ is the marginal tax rate paid by the top percentile group, and K is a vector of control variables and an error term.

Assuming the total income in the economy is \$1, we can write an equation for R, being the tax revenue paid by the top percentile group:

$$R = \tau \times S \times \$1 \quad \text{(A2)}$$

Substituting from equation (1):

$$R = \tau \times \exp[K+\beta(1-\tau)] \quad \text{(A3)}$$

To find the revenue-maximizing tax rate, we set the derivative equal to zero:

$$dR/d\tau = \exp[K+\beta(1-\tau)] - \tau\beta\times\exp[K+\beta(1-\tau)] = 0 \quad \text{(A4)}$$

$$\beta\tau = 1 \quad \text{(A5)}$$

$$\tau = 1/\beta \quad \text{(A6)}$$

Figure 1: Share of Top 0.1%

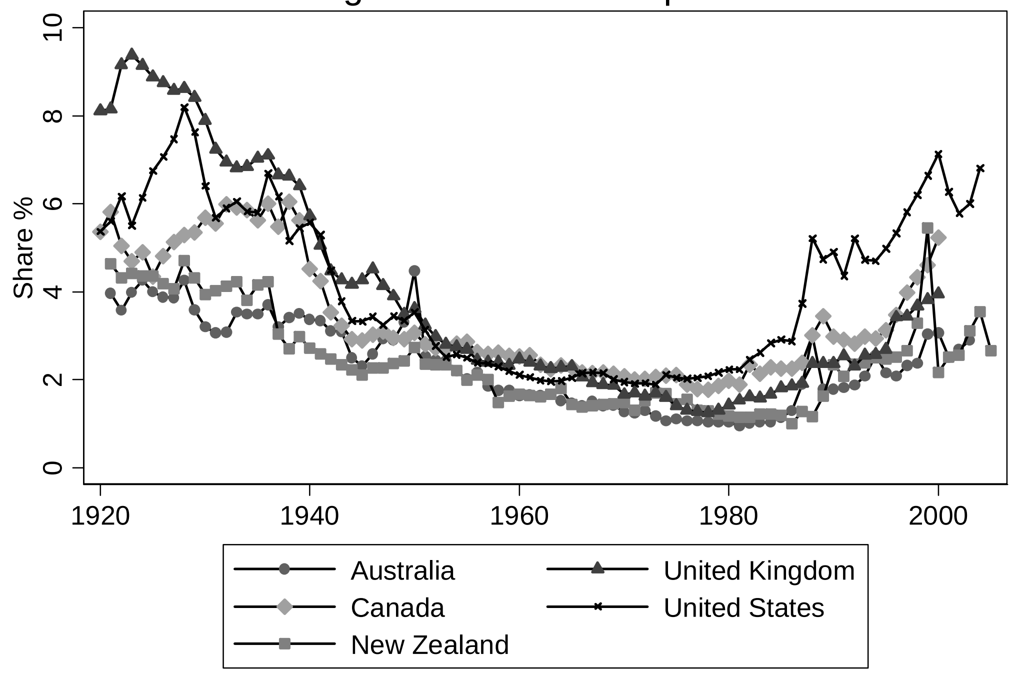

Figure 2: Share of Top 1%

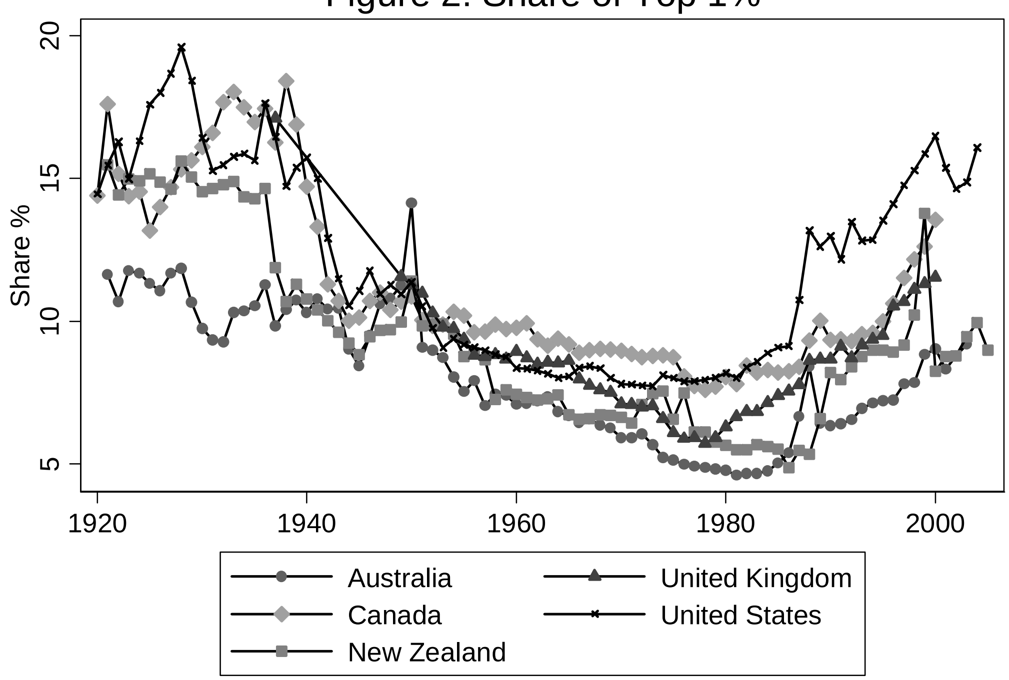

Figure 3: Share of 'Next' 4%

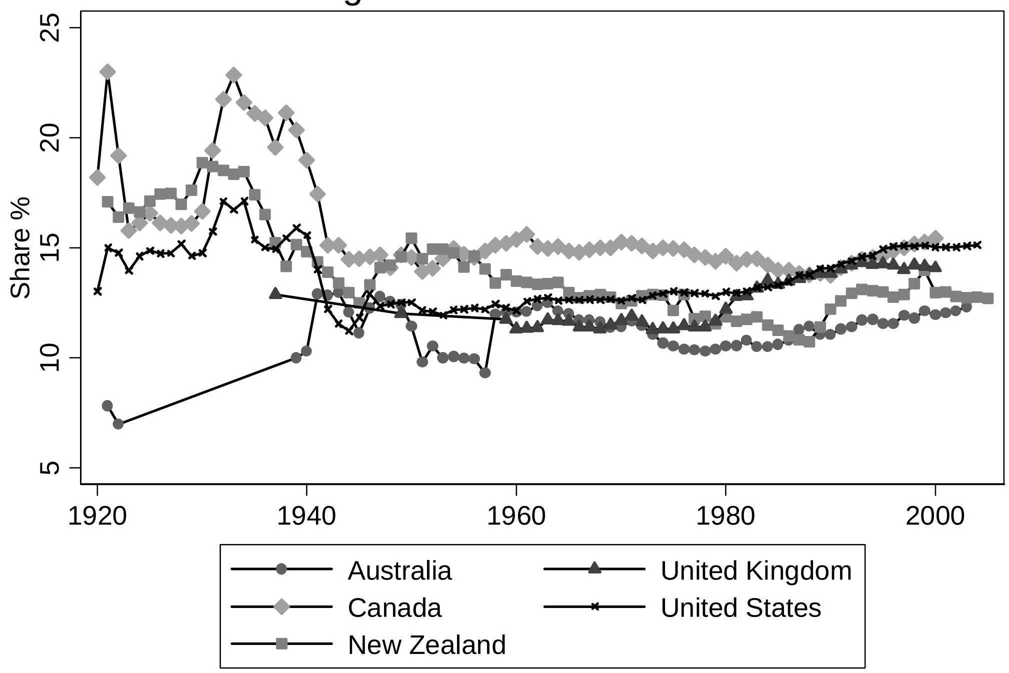

Figure 4: Shares of Top Income Groups in Five Anglo-Saxon Countries

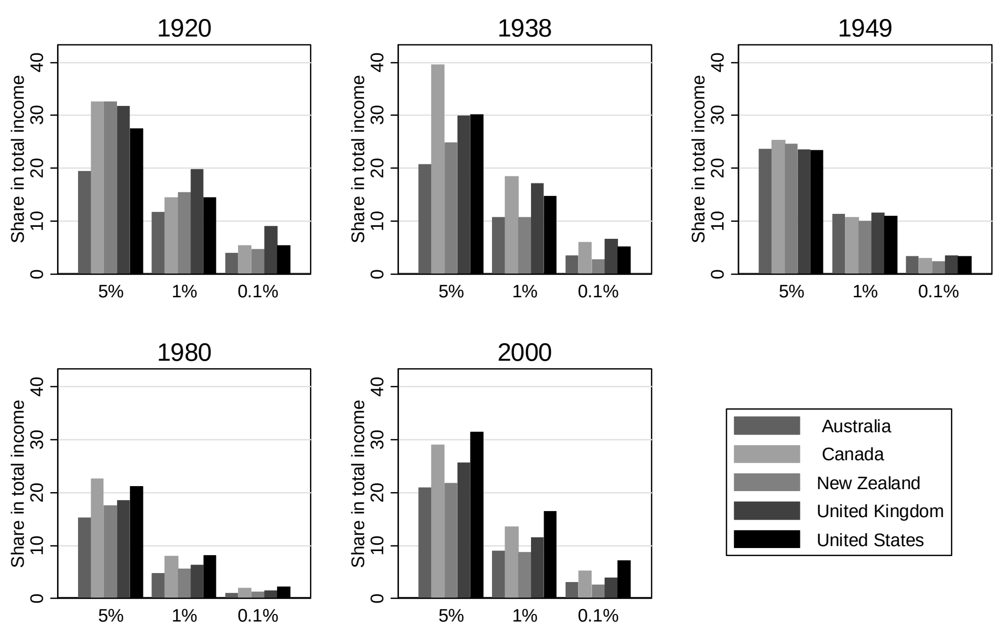

Figure 5: Cross-Country Variation in the Top 0.1% Share

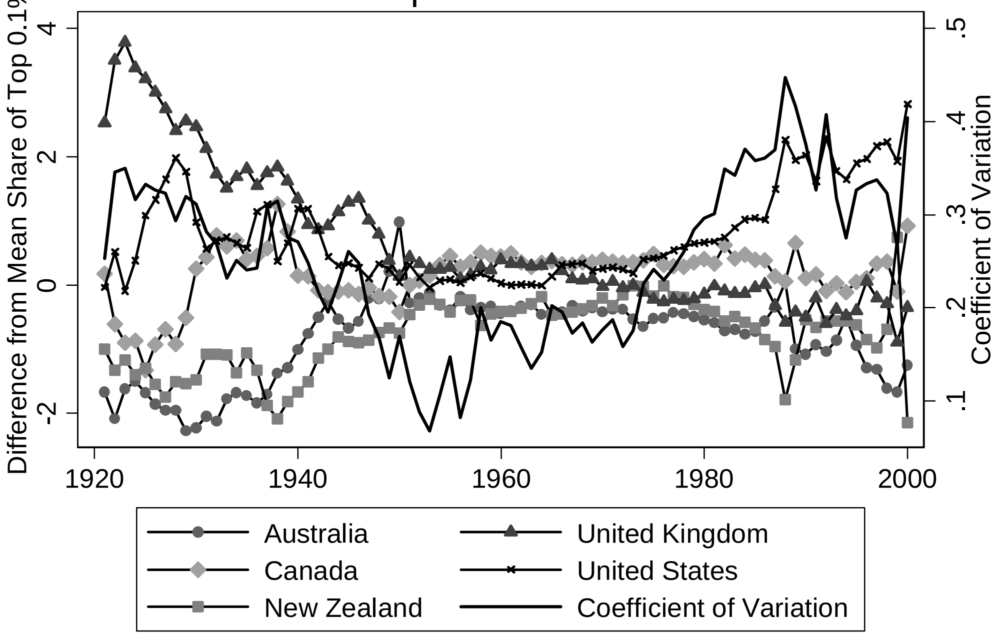

Figure 6: Share of Top 0.1% Within Top 1%

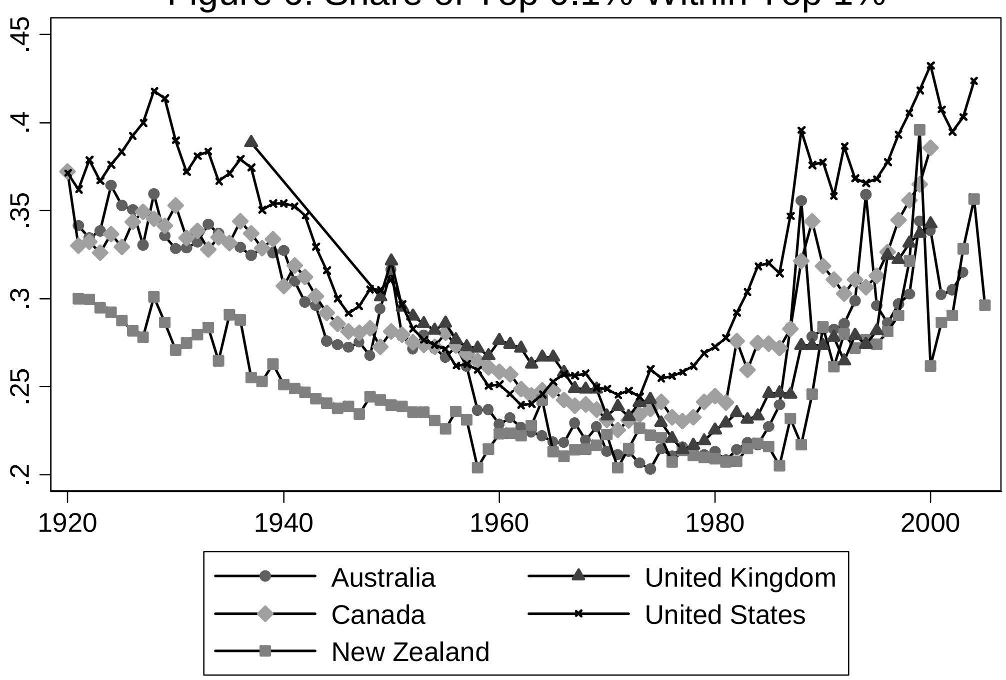

Figure 7: Pareto-Lorenz Coefficients S0.1/S1

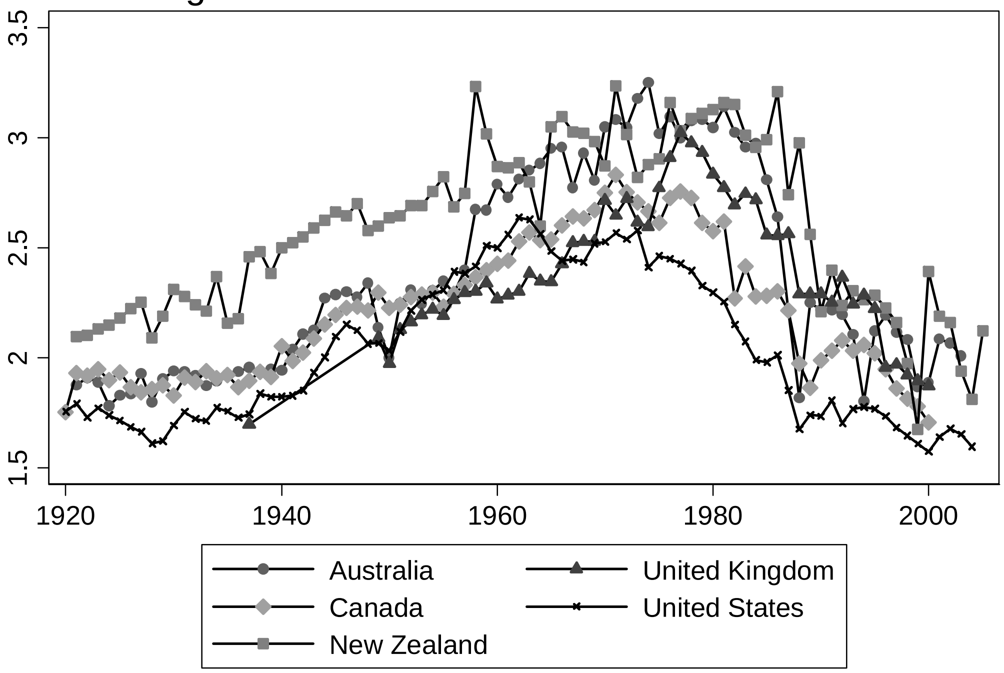

Figure 8: Share of the Top 1% (solid line, left axis)
& 1-Top Marginal Tax Rate (dashed line, right axis)

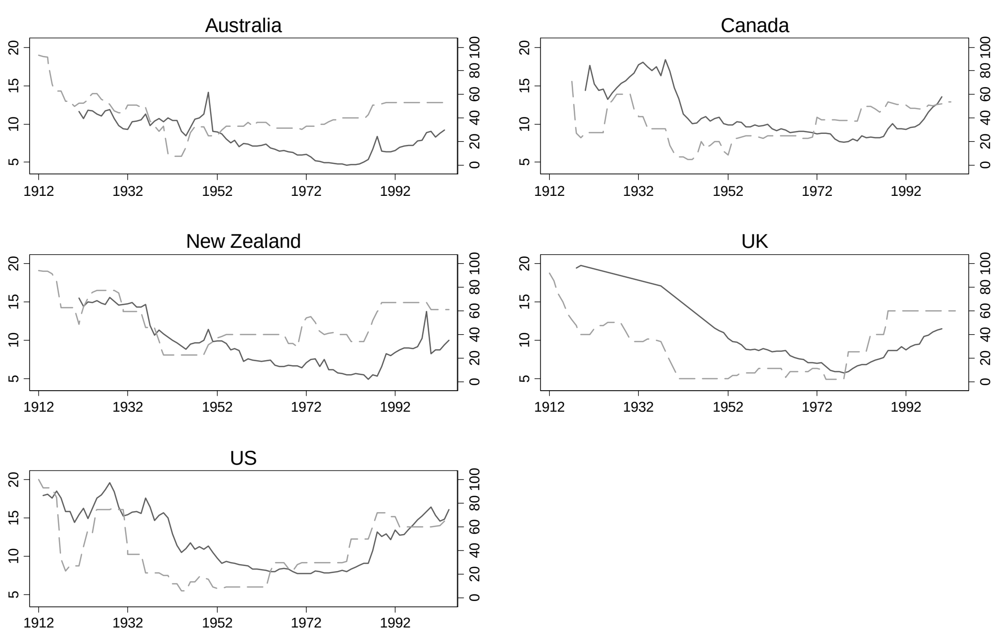

Figure 9: Simulated Revenue Hills

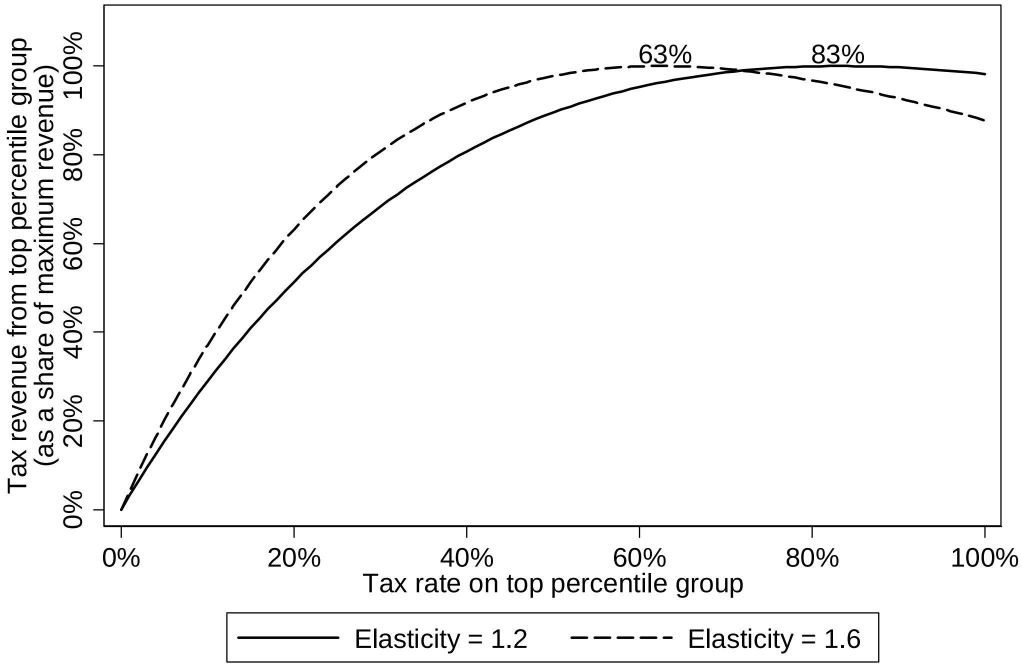

Table 1: Cross-Country Correlation of the Top 0.1% Share

	Australia	**Canada**	**NZ**	**UK**	**US**
Australia	1.000				
	82				
Canada	0.855	1.000			
	[0.001]				
	80	*81*			
NZ	0.879	0.887	1.000		
	[0.001]	[0.001]			
	82	*80*	*84*		
UK	0.906	0.909	0.918	1.000	
	[0.001]	[0.001]	[0.001]		
	79	*80*	*79*	*87*	
US	0.814	0.885	0.850	0.885	1.000
	[0.001]	[0.001]	[0.001]	[0.001]	
	82	*81*	*84*	*87*	*92*
			Mean=0.879		

Notes:

1. P-values in brackets. Number of observations in italics.
2. All share statistics converted to from tax year to calendar year basis. For Australia (where the financial year starts on 1 July), we combine pairs of tax years using weights of 1/2 and 1/2. For New Zealand (where the financial year starts on 1 April) and the UK (where the tax year starts on 6 April), we combine pairs of tax years using weights of 3/4 and 1/4.

Table 2: Cross-Country Correlation of the Top 1% Share

	Australia	**Canada**	**NZ**	**UK**	**US**
Australia	1.000				
	82				
Canada	0.784	1.000			
	[0.001]				
	80	*81*			
NZ	0.851	0.889	1.000		
	[0.001]	[0.001]			
	82	*80*	*84*		
UK	0.888	0.906	0.850	1.000	
	[0.001]	[0.001]	[0.001]		
	51	*51*	*51*	*52*	
US	0.760	0.846	0.832	0.713	1.000
	[0.001]	[0.001]	[0.001]	[0.001]	
	82	*81*	*84*	*52*	*92*
			Mean=0.832		

Notes:
1. P-values in brackets. Number of observations in italics.
2. All share statistics converted to from tax year to calendar year basis. For Australia (where the financial year starts on 1 July), we combine pairs of tax years using weights of 1/2 and 1/2. For New Zealand (where the financial year starts on 1 April) and the UK (where the tax year starts on 6 April), we combine pairs of tax years using weights of 3/4 and 1/4.

Table 3: Cross-Country Correlation of the Next 4% Share

	Australia	**Canada**	**NZ**	**UK**	**US**
Australia	1.0000				
	65				
Canada	-0.284	1.000			
	[0.024]				
	63	*81*			
NZ	-0.126	0.691	1.000		
	[0.314]	[0.001]			
	65	*80*	*84*		
UK	0.064	-0.562	-0.191	1.000	
	[0.689]	[0.001]	[0.232]		
	41	*41*	*41*	*42*	
US	0.007	0.689	0.499	0.888	1.000
	[0.954]	[0.001]	[0.001]	[0.001]	
	65	*81*	*84*	*42*	*88*
			Mean=0.167		

Notes:

1. P-values in brackets. Number of observations in italics.
2. All share statistics converted to from tax year to calendar year basis. For Australia (where the financial year starts on 1 July), we combine pairs of tax years using weights of 1/2 and 1/2. For New Zealand (where the financial year starts on 1 April) and the UK (where the tax year starts on 6 April), we combine pairs of tax years using weights of 3/4 and 1/4.

Table 4: Within-Country Correlation of the Top 1% Share and the Next 4% Share	
Australia	0.125
	[0.313]
	67
Canada	0.879
	[0.001]
	81
NZ	0.931
	[0.001]
	85
UK	0.158
	[0.291]
	46
US	0.757
	[0.001]
	88
Mean	**0.536**

Notes:
1. P-values in brackets. Number of observations in italics.
2. Share statistics are on a tax year basis.

Table 5: Top Income Shares and Wage Tax Rates
Dependent Variable is Log(Top 1% Share)

	[1]	[2]	[3]	[4]
After-tax share (instrumented)	1.863**	1.206***	1.149***	1.232***
	[0.770]	[0.314]	[0.412]	[0.226]
Log real GDP per capita		0.526***	0.204**	0.185
		[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
Years	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]

Note: After-tax share is one minus the marginal tax rate on wage income paid by a taxpayer at the 99.5^{th} 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%, 5% and 10% levels, respectively.

Table 6: Top Income Shares and Investment Tax Rates
Dependent Variable is Log(Top 1% Share)

	[1]	[2]	[3]	[4]
Panel A: 5 Year Moving Average of Tax Rates				
After-tax share (instrumented)	1.984*	1.518**	1.279**	1.207***
	[1.077]	[0.619]	[0.579]	[0.418]
Log real GDP per capita		0.529**	0.14	-0.094
		[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
Years	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 (instrumented)	1.961	1.605*	1.301**	1.029***
	[1.211]	[0.823]	[0.582]	[0.340]
Log real GDP per capita		0.418	0.014	-0.235
		[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
Years	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]

Note: After-tax share is one minus the marginal tax rate on investment income paid by a taxpayer at the 99.5^{th} 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. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 7: Top Income Shares and Top Tax Rates - Current Wage Tax Rate and 5 Year MA of Investment Tax Rate
Dependent Variable is Log(Top 1% Share)

	[1]	[2]	[3]	[4]
After-tax share on wage	0.165	-0.159	-0.12	0.067
income (instrumented)	[0.468]	[0.361]	[0.312]	[0.452]
After-tax share on investment	1.874*	1.642**	1.372**	1.159
income (instrumented)	[1.023]	[0.801]	[0.622]	[0.724]
Log real GDP per capita		0.508**	0.128	-0.081
		[0.240]	[0.080]	[0.246]
Return on bills				-0.026
				[0.258]
Return on bonds				0.262***
				[0.082]
Return on equities				-0.169***
				[0.052]
Country and year fixed effects	Yes	Yes	Yes	Yes
Years	381	381	300	300
Countries	5	5	4	4
F-test on excluded instrument				
(wage income)	17.80	33.76	49.69	39.12
[P-value]	[0.010]	[0.003]	[0.005]	[0.007]
F-test on excluded instrument				
(investment income)	2.66	11.60	19.69	60.55
[P-value]	[0.184]	[0.021]	[0.018]	[0.004]
Linear sum of tax coefficients	2.039*	1.483**	1.252**	1.226***
	[1.132]	[0.600]	[0.596]	[0.297]

Note: 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. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 8: 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% Share)

	[1]	[2]	[3]	[4]
After-tax share on wage	0.541	0.221	0.228	0.421***
income (instrumented)	[0.338]	[0.280]	[0.198]	[0.102]
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
Years	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]

Note: 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. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.