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## Top Incomes in the Long Run of History

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### Abstract:

A recent literature has constructed top income shares time series over the long-run for more than 20 countries using income tax statistics. Top incomes represent a small share of the population but a very significant share of total income and total taxes paid. Hence, aggregate economic growth per capita and Gini inequality indexes are sensitive to excluding or including top incomes. We discuss the estimation methods and issues that arise when constructing top income share series, including income definition and comparability over time and across countries, tax avoidance and tax evasion. We provide a summary of the key empirical findings. Most countries experience a dramatic drop in top income shares in the first part of the 20th century in general due to shocks to top capital incomes during the wars and depression shocks. Top income shares do not recover in the immediate post war decades. However, over the last 30 years, top income shares have increased substantially in English speaking countries and in India and China but not in continental European countries or Japan. This increase is due in part to an unprecedented surge in top wage incomes. As a result, wage income comprises a larger fraction of top incomes than in the past. Finally, we discuss the theoretical and empirical models that have been proposed to account for the facts and the main questions that remain open.

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## 1. INTRODUCTION

There has been a marked revival of interest in the study of the distribution of top incomes using income tax data. Beginning with the research by Piketty of the long-run distribution of top incomes in France (Piketty 2001, 2003), there has been a succession of studies constructing top income share time series over the long-run for more than 20 countries. In using data from the income tax records, these studies use similar sources and methods as the pioneering study for the United States by Kuznets (1953). Kuznets' estimates were not, however, systematically updated, and in more recent years household survey data have become the primary source for the empirical analysis of inequality.<sup>1</sup> The underlying income tax data continued to be available but remained in the shade for a long period. This relative neglect by economists adds to the interest of the findings of recent tax-based research.

The research surveyed here covers a wide variety of countries, and opens the door to the comparative study of top incomes using income tax data. In contrast to existing international databases, generally restricted to the post-1970 or post-1980 period, the top income data cover a much longer period, which is important because structural changes in income and wealth distributions often span several decades. In order to properly understand such changes, one needs to be able to put them into broader historical perspective. The new data provide estimates that cover much of the twentieth century and in some cases go back to the nineteenth century – a length of time series familiar to economic historians but unusual for most economists. Moreover, the tax data typically allow us to decompose income inequality into labor income and capital income components. Economic mechanisms can be very different for the distribution of labor income (demand and supply of skills, labor market institutions, etc.) and the distribution of capital income (capital accumulation, credit constraints, inheritance law and taxation, etc.), so that it is difficult to test these mechanisms using data on total incomes.

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<sup>1</sup> The Kuznets series itself remained very influential in the economic history literature on US inequality (see e.g., Williamson and Lindert, 1980 and Lindert 2000).

This paper surveys the methodology, main findings, and perspectives emerging from this collective research project on the dynamics of income distribution. Starting with Piketty (2001), those studies have been published separately as monographs or journal articles. Recently, those studies have been gathered in two edited volumes (Atkinson and Piketty 2007, 2010), which contain 22 country specific chapters along with a general summary chapter (Atkinson, Piketty, Saez, 2010), and a methodological chapter (Atkinson 2007) upon which this survey draws extensively.<sup>2</sup>

We focus on the data series produced in this project on the grounds that they are fairly homogenous across countries, annual, long-run, and broken down by income source for most countries. They cover 22 countries, including many European countries (France, Germany, Netherlands, Switzerland, UK, Ireland, Norway, Sweden, Finland, Portugal, Spain, Italy), Northern America (United States and Canada), Australia and New Zealand, one Latin American country (Argentina), and five Asian countries (Japan, India, China, Singapore, Indonesia). They cover periods that range from 15 years (China) and 30 years (Italy) to 120 years (Japan) and 132 years (Norway). Hence they offer a unique opportunity to better understand the dynamics of income and wealth distribution and the interplay between inequality and growth. The complete database is posted online in excel format in an electronic appendix to the paper as well as on our web-pages.

To be sure, our series also suffer from important limitations, and we devote considerable space to a discussion of these. First, the series measure only top income shares and hence are silent on how inequality evolves elsewhere in the distribution. Second, the series are largely concerned with gross incomes before tax. Thirdly, the definition of income and the unit of observation (the individual vs. the family) vary across countries making comparability of levels across countries more difficult. Even within a country, there are breaks in comparability that arise because of changes in tax legislation affecting the definition of income, although

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<sup>2</sup> The reader is also referred to the valuable survey by Leigh (2009). Shorter summaries have also been presented in Piketty (2005, 2007), Piketty and Saez (2006), and Saez (2006).

most studies try to correct for such changes to create homogenous series. Finally and perhaps most important, our series might be biased because of tax avoidance and tax evasion. Many of the studies spend considerable time exploring in detail how tax legislation changes can affect the series. The series created can therefore also be used to tackle the classical public economics issue of the response of reported income to changes in tax law.

We obtain three main empirical results. First, most countries experienced a sharp drop in top income shares in the first half of the 20<sup>th</sup> century. In these countries, the fall in top income shares is often concentrated around key episodes such as the World Wars or the Great Depression. In some countries however, especially those which stayed outside World War II, the fall is more gradual during the period. In all countries for which income composition data are available, in the first part of the century, top percentile incomes were overwhelmingly composed of capital income (as opposed to labor income). Therefore, the fall in the top percentile share is primarily a capital income phenomenon: top income shares fall because of a reduction in top wealth concentration. In contrast, upper income groups below the top percentile such as the next 4% or the second vingtile, which are comprised primarily of labor income, fall much less than the top percentile during the first half the 20<sup>th</sup> century.

By 1949, the dispersion in top percentile income shares across the countries studied had become small. In the second half of the twentieth century, top percentile shares experienced a U-shape pattern, with further declines during the immediate post-war decades followed by increases in recent decades. However, the degree of the U-shape varies dramatically across countries. In all the Western English speaking countries (in Europe, North America, and Australia and New Zealand), and in China and India, there was a substantial increase in top income shares in recent decades, with the United States leading the way both in terms of timing and magnitude of the increase. Southern European countries and Nordic countries in Europe also experience an increase in top percentile shares although less in magnitude than in English speaking countries. In contrast, Continental European countries (France, Germany, Netherlands, Switzerland) and

Japan experience a very flat U-shape with either no or modest increases in top income shares in recent decades.

Third, as was the case for the decline in the first half of the century, the increase in top income shares in recent decades has been quite concentrated with most of the gains accruing to the top percentile with much more modest gains (or even none at all) for the next 4% or the second vingtile. However, in most countries, a significant portion of the gains are due to an increase in top labor incomes, and especially wages and salaries. As a result, the fraction of labor income in the top percentile is much higher today in most countries than earlier in the 20<sup>th</sup> century.

The rest of this paper is organized as follows. In section 2, we provide motivation for the study of top incomes. In section 3, we present the methodology used to construct the database using tax statistics, and discuss in details the key issues and limitations. Section 4 presents a summary of the main descriptive findings. Section 5 discusses the theoretical and empirical models that have been proposed to account for the facts while Section 6 discusses how those models and explanations fit with the empirical findings. An electronic appendix gathers in excel format all the series discussed in the paper.

## **2. MOTIVATION**

The share of total income going to top income groups has risen dramatically in recent decades in the United States (US), and many other (but not all) countries. Taking the US case, we see from Figure 1 the changes since 1917 in the top decile (pre-tax) income share (from Piketty and Saez, 2003, series including capital gains updated to 2007). After a precipitous (10 percentage point) decline during World War II and stability in the post-war decades, the top decile share has surged (a rise of more than 10 percentage points) since the 1970s and reached almost 50% by 2007, the highest level on record. Figure 2 breaks down the top decile into the top percentile, the next 4% (top 5% excluding the top 1%), and the second vingtile (top 10% excluding the top 5%). It shows that most of the changes in the top decile are due to dramatic changes in the top percentile which rose from

8.9% in 1976 to 23.5% in 2007. As shown on Figure 3, the share of an even wealthier group - the top 0.1% - has more than quadrupled from 2.6% to 12.3% over this period. Figure 3 also displays the composition of top 0.1% incomes and shows that, although the levels of the top 0.1% income share is as high today as in the pre-Great Depression era, wages and salaries now form a much greater fraction of top incomes than in the past.

Why do these increases at the top matter? Several answers can be given. The most general is that people have a sense of fairness and care about the distribution of economic resources across individuals in society. As a result, all advanced economies have set in place redistributive policies such as taxation--and in particular progressive taxation, and transfer programs, which effectively redistribute a significant share of National Product across income groups. Importantly, different parts of the distribution are interdependent. Here we consider three more specific economic reasons why we should be interested in the top income groups: their impact on overall growth and resources, their impact on overall inequality, and their global significance.

### **Impact on overall growth and resources**

The textbook definition of income by economists refers to “command over resources”. Are however the rich sufficiently numerous and sufficiently in receipt of income that they make an appreciable difference to the overall control of resources? First, although the top 1% is by definition only a small share of the population, it does capture more than a fifth of total income--23.5% in the United States as of 2007. Second and even more important, the surge in top incomes over the last 30 years has a dramatic impact on measured economic growth. As shown in Table 1, US real income per family grew at a modest 1.2% annual rate from 1976 to 2007. However, when excluding the top 1%, the average real income of the bottom 99% grew at an annual rate of only 0.6% which implies that the top 1% captured 58% of real economic growth per family during that period (column 4 in Table 1). The effects of the top 1% on growth can be seen even more dramatically in two contrasting recent periods of economic expansion, 1993–2000

(Clinton administration expansion) and 2002-2007 (Bush administration expansion). Table 1 shows that, during both expansions, the real incomes of the top 1 percent grew extremely quickly at an annual rate over 10.1 and 10.3 percent respectively. However, while the bottom 99 percent of incomes grew at a solid pace of 2.7 percent per year from 1993–2000, these incomes grew only 1.3 percent per year from 2002–2007. Therefore, in the economic expansion of 2002-2007, the top 1 percent captured over two-thirds (65%) of income growth. Those results may help explain the gap between the economic experiences of the public and the solid macroeconomic growth posted by the U.S. economy from 2002 to the peak of 2007. Those results may also help explain why the dramatic growth in top incomes during the Clinton administration did not generate much public outcry while there has been an extraordinary level of attention to top incomes in the US press and in the public debate in recent years.

Such changes also matter in international comparisons. For example, average real incomes per family in the US grew by 32.2% from 1975 to 2006 while they grew only by 27.1% in France during the same period (Piketty 2001, and Landais 2007), showing that the macro-economic performance in the US was better than the French one during this period. Excluding the top percentile, average US real incomes grew only 17.9% during the period while average French real incomes – excluding the top percentile - still grew at much the same rate (26.4%) as for the whole French population. Therefore, the better macro-economic performance of the US versus France is reversed when excluding the top 1%.<sup>3</sup>

More concretely, we can ask whether increased taxes on the top income group would yield appreciable revenue that could be deployed to fund public goods or redistribution? This question is of particular interest in the current US policy debate where large government deficits will require raising tax revenue in coming years. The standard response by many economists in the past has been that “the game is not worth the candle”. Indeed, net of all federal taxes, in the US in 1976 the top percentile received only 5.8% of total pre-tax income, an amount

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<sup>3</sup> It is important to note that such international growth comparisons are sensitive to the exact choice of years compared, the price deflator used, the exact definition of income in each country, and hence are primarily illustrative.

equal to 24% of all federal taxes (individual, corporate, estate taxes and social security and health contributions) in that year. However, by 2007, net of all federal taxes, the top percentile received 17.3% of total pre-tax income, or about 74% of all federal taxes raised in 2007.<sup>4</sup> Therefore, it is clear that the surge in the top percentile share has greatly increased the “tax capacity” at the top of the income distribution. In budgetary terms, this cannot be ignored.<sup>5</sup>

### **Impact on Overall Inequality**

It might be thought that top shares have little impact on overall inequality. If we draw a Lorenz curve, defined as the share of total income accruing to those below percentile  $p$ , as  $p$  goes from 0 (bottom of the distribution) to 100 (top of the distribution), then the top 1% would scarcely be distinguishable on the horizontal axis from the vertical endpoint, and the top 0.1% even less so. The most commonly used summary measure of overall inequality, the Gini coefficient, is more sensitive to transfers at the centre of the distribution than at the tails. (The Gini coefficient is defined as twice the area between the Lorenz curve and the 45 degree line.)

But top shares can materially affect overall inequality, as may be seen from the following calculation. If we treat the very top group as infinitesimal in numbers, but with a finite share  $S^*$  of total income, then, graphically, the Lorenz curve reaches  $1-S^*$  just below  $p=100$ . As a result, the total Gini coefficient can be approximated by  $S^* + (1-S^*) G$ , where  $G$  is the Gini coefficient for the population excluding the top group (Atkinson 2007). This means that, if the Gini coefficient for the rest of the population is 40%, then a rise of 14 percentage points in the top share, as happened with the share of the top 1% in the US from 1976 to 2006, causes a rise of 8.4 percentage points in the overall Gini. This is larger than the official Gini increase from 39.8% to 47.0% over the 1976-2006 period based on

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<sup>4</sup> The 5.8% and 17.3% figures are based on average tax rates by income groups presented in Piketty and Saez (2006). We exclude the corporate tax and the employer portion of payroll taxes as the pre-tax income share series are based on market income after corporate taxes and employer payroll taxes. We have  $5.8\% = 8.8\% \cdot (1 - 0.262 - 0.016/2 - 0.068)$  and  $17.3\% = 23.5\% \cdot (1 - 0.225 - 0.03/2 - 0.022)$ . The percentage of all federal taxes is obtained using total federal average tax rates which are 24.7% and 23.7% in 1976 and 2007 from Piketty and Saez (2006).

<sup>5</sup> We discuss in Section 5 the important issue of the behavioral responses of top incomes to taxes.



US household income in the Current Population Survey (US Census Bureau, 2008, Table A3).<sup>6</sup>

### **Top Incomes in a Global Perspective**

The analysis so far has considered the role of top incomes in a purely national context, but it is evident that the rich, or at least the super-rich, are global players. What however is their quantitative significance on a world scale? Does it matter if the share of the top 1% in the US doubles? The top 1% in the US constitutes 1.5 million tax units. How do they fit into a world of some 6 billion people? According to the estimates of Bourguignon and Morrisson (2002), the world Gini coefficient went from 61% in 1910 to 64% in 1950 and then to 65.7% in 1992, as displayed in Figure 4 (full triangle series, right y-axis).<sup>7</sup> How did the evolution of top income shares in richer countries which fell during the first part of the 20<sup>th</sup> century and increased sharply in some countries in recent decades affect this picture?

To address this question, Atkinson (2007) defines the “globally rich” as those with more than 20 times the mean world income, which in 1992 meant above \$100,000. Atkinson uses the distribution of income among world citizens constructed by Bourguignon and Morrisson (2002) combined with a Pareto imputation for the top of the distribution<sup>8</sup> to estimate the number of “globally rich.” In 1992 there were an estimated 7.4 million people with incomes above this level, more than a third of them in the United States. They constituted 0.14% of the world population, but received 5.4% of total world income. As shown on Figure 4 (left y-axis), as a proportion of the world population the globally rich fell from 0.23% in 1910 to 0.1% in 1970, mirroring the decline in top income shares recorded in individual countries. Therefore, although overall inequality among world citizens increased, there was a compression at the top of the world distribution. But from 1970 we see a reversal, and a rise in the proportion of

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<sup>6</sup> The relation between top shares and overall inequality is explored further by Leigh (2007).

<sup>7</sup> As spelled out in Bourguignon and Morrison (2002), strong assumptions are required to obtain a worldwide Gini coefficient based on country level inequality statistics.

<sup>8</sup> The Pareto parameter is estimated using the ratio of the top 5% income share to the top decile income share (see equation (4) below), both being reported in Bourguignon and Morrisson (2002). Because those top income shares are often based on survey data (and not tax data), they likely underestimate the magnitude of the changes at the very top.

globally rich above the 1950 level. The number of globally rich doubled in the United States between 1970 and 1992, which accounts for half of the worldwide increase in the number of “globally rich” and hence makes a perceptible difference to the world distribution.

## **Summary**

There are a number of reasons for studying the development of top income shares. Understanding the extent of inequality at the top and the relative importance of different factors leading to increasing top shares is important in the design of public policy. Concern about the rise in top shares in a number of countries has led to proposals for higher top income tax rates; other countries are considering limits on remuneration and bonuses. The global distribution is coming under increasing scrutiny as globalization proceeds.

## **3. METHODOLOGY AND LIMITATIONS**

### **3.1 METHODOLOGY**

The value of the tax data lies in the fact that, early on, the tax authorities in most countries began to compile and publish tabulations based on the exhaustive set of income tax returns.<sup>9</sup> These tabulations generally report for a large number of income brackets the corresponding number of taxpayers, as well as their total income and tax liability. They are usually broken down by income source: capital income, wage income, business income, etc. Table 2A shows an example of such a table from the British super-tax data for fiscal year 1911-12. These data were used by Bowley (1914), but it was not until the pioneering contribution of Kuznets

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<sup>9</sup> The first income tax distribution published for the UK related to 1801 (see Stamp, 1916) but no further figures on total income are available for the nineteenth century on account of the move to a schedular system. The publication of regular UK distributional data only commenced with the introduction of supertax in 1909. Distributional data were however already by then being produced in certain parts of the British Empire. For example, in 1905, the State of Victoria (Australia) supplied a table of the distribution of income in 1903 in response to a request for information from the UK government (House of Commons, 1905, page 233).

(1953), that researchers began to combine the tax data with external estimates of the total population and the total income to estimate top income shares.<sup>10</sup>

The data in Table 2A illustrate the three methodological problems addressed in this section when estimating top income shares. The first is the need to relate the number of persons to a control total to define how many tax filers represent a given fractile such as the top percentile. In the case of the UK in 1911-12, only a very small fraction of the population is subject to the super-tax: less than 12,000 taxpayers out of total population of over 20 millions tax units, i.e. not much more than 0.05%. The second issue concerns the definition of income and the relation to an income control total used as the denominator in the top income share estimation. The third problem is that, for much of the period, the only data available are tabulated by ranges so that interpolation estimation is required. Micro data only exist in recent decades. Note also that the tabulated data vary considerably in the number of ranges, and the information provided for each range.

### **Pareto Interpolation**

The basic data are in the form of grouped tabulations, as in Table 2A, where the intervals do not in general coincide with the percentage groups of the population with which we are concerned (such as the top 1%). We have therefore to interpolate in order to arrive at values for summary statistics such as the shares of total income. Moreover, some authors have extrapolated upwards into the open upper interval, and downwards below the lowest range tabulated. The Pareto law for top incomes is given by the following (cumulative) distribution function  $F(y)$  for income  $y$ :

$$1-F(y) = (k/y)^\alpha \quad (k>0, \alpha>1), \quad (1)$$

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<sup>10</sup> Before Kuznets, US tax statistics had been used primarily to estimate Pareto parameters as this does not require estimating total population and total income controls (see below): see for example Crum (1935), Johnson (1935 and 1937), and Tucker (1938). The drawback is that Pareto parameters only capture dispersion of incomes in the top tail and – unlike top income shares – do not relate top incomes to average incomes.

where  $k$  and  $\alpha$  are given parameters,  $\alpha$  is called the Pareto parameter. The corresponding density function is given by  $f(y)=\alpha k^\alpha/y^{(1+\alpha)}$ . The key property of Pareto distributions is that the ratio of average income  $y^*(y)$  of individuals with income above  $y$  to  $y$  does not depend on the income threshold  $y$ :

$$y^*(y) = [ \int_{z>y} z f(z) dz ] / [ \int_{z>y} f(z) dz ] = [ \int_{z>y} dz/z^\alpha ] / [ \int_{z>y} dz/z^{(1+\alpha)} ] = \alpha y / (\alpha - 1)$$

$$i.e. \quad y^*(y)/y = \beta, \quad \text{with } \beta = \alpha / (\alpha - 1) \quad (2)$$

That is, if  $\beta=2$ , the average income of individuals with income above \$100 000 is \$200 000, and the average income of individuals with income above \$1 million is \$2 million. Intuitively, a higher  $\beta$  means a fatter upper tail of the distribution. From now on, we refer to  $\beta$  as the inverted Pareto coefficient. Throughout this paper, we choose to focus on the inverted Pareto coefficient  $\beta$  (which has more intuitive economic appeal) rather than the standard Pareto coefficient  $\alpha$ . Note that there exists a one-to-one, monotonically decreasing relationship between the  $\alpha$  and  $\beta$  coefficients, i.e.  $\beta=\alpha/(\alpha-1)$  and  $\alpha=\beta/(\beta-1)$  (see Table 2B).<sup>11</sup>

Vilfredo Pareto (1896, 1896-1897) in the 1890s using tax tabulations from Swiss cantons found that this law approximates remarkably well the top tails of the income or wealth distributions. Since Pareto, raw tabulations by brackets produced by tax administrations have often been used to estimate Pareto parameters.<sup>12</sup> A number of the top income studies conclude that the Pareto approximation works remarkably well today, in the sense that for a given country and a given year, the  $\beta$  coefficient is fairly invariant with  $y$ . However a key difference with the early Pareto literature, which was implicitly looking for some universal stability of income and wealth distributions, is that our much larger time span and geographical scope

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<sup>11</sup> Put differently,  $(\beta-1)$  is the inverse of  $(\alpha-1)$ . It should be noted that this is different from the inverse –Pareto coefficient used by Soltow (1969), although this too increases as the tail becomes fatter.

<sup>12</sup> There also exists a voluminous theoretical literature trying to explain why Pareto laws fit the top tails of income and wealth distributions. We survey some of these theoretical models in section 5 below. Pareto laws have also been applied in several areas outside income and wealth distribution (see e.g., Gabaix (2009) for a recent survey).

allows us document the fact that Pareto coefficients vary substantially over time and across countries.

From this viewpoint, one additional advantage of using the  $\beta$  coefficient is that a higher  $\beta$  coefficient generally means larger top income shares and higher income inequality (while the reverse is true with the more commonly used  $\alpha$  coefficient). For instance, in the United States, the  $\beta$  coefficient (estimated at the top percentile threshold and excluding capital gains) increased gradually from 1.69 in 1976 to 2.89 in 2007 as top percentile income share surged from 7.9% to 18.9%.<sup>13</sup> In a country like France, where the  $\beta$  coefficient has been stable around 1.65-1.75 since the 1970s, the top percentile income share has also been stable around 7.5%-8.5%, except at the very end of the period.<sup>14</sup> In practice, we shall see that  $\beta$  coefficients typically vary between 1.5 and 3: values around 1.5-1.8 indicate low inequality by historical standards (with top 1% income shares typically between 5% and 10%), while values around or above 2.5 indicate very high inequality (with top 1% income shares typically around 15%-20% or higher). In the case of the U.K. in 1911-12, a high inequality country, one can easily compute from Table 2A that the average income of taxpayers above £5,000 was £12,390, i.e. the  $\beta$  coefficient was equal to 2.48.<sup>15</sup>

In practice, it is possible to verify whether Pareto (or split histogram) interpolations are accurate when large micro tax return data with over-sampling at the top are available as is the case in the United States since 1960. Those direct comparisons show that errors due to interpolations are typically very small if the number of brackets is sufficiently large and if income amounts are also reported. In the end, the error due to Pareto interpolation is likely to be dwarfed by various

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<sup>13</sup> See Table A24 in the electronic appendix. When we include capital gains, the rise of the  $\beta$  coefficient is even more dramatic, from 1.82 in 1976 to 3.42 in 2007.

<sup>14</sup> See Table A24.

<sup>15</sup> The stability of  $\beta$  coefficients (for a given country and a given year) only holds for top incomes, typically within the top percentile. For incomes below the top percentile, the  $\beta$  coefficient takes much higher values (for very small incomes it goes to infinity). Within the top percentile, the  $\beta$  coefficient varies slightly, and falls for the very top incomes (at the level of the single richest taxpayer,  $\beta$  is by definition equal to 1), but generally not before the top 0.1% or top 0.01% threshold. In the example of Table 2, one can easily compute that the  $\beta$  coefficient gradually falls from 2.48 at the £5,000 threshold to 2.28 at the £10,000 threshold and 1.85 at the £100,000 threshold (with only 66 taxpayers left).

adjustments and imputations required for making series homogeneous, or errors in the estimation of the income control total (see below).

### **Control Total for Population**

In some countries, such as Canada, New Zealand from 1963, or the United Kingdom from 1990, the tax unit is the individual. In that case, the natural control total is the adult population defined as all residents at or above a certain age cut-off, and the top percentile share will measure the share of total income accruing to the top percentile of adult individuals. In other countries, tax units are families. In the United Kingdom, for example, 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. The control total used by Atkinson (2005) for the UK population for this period is the total number of people aged 15 and over minus the number of married females. In the United States, married women can file tax separate returns, but the number is “fairly small (about 1% of all returns in 1998)” (Piketty and Saez, 2003). Piketty and Saez therefore treat the data as relating to families, and take as a control total the sum of married males and all non married individuals aged 20 and over.

What difference does it make to use the individual unit versus the family unit? If we treat all units as weighted equally (so couples do not count twice) and take total income, then the impact of moving from a couple-based to an individual-based system depends on the joint distribution of income. A useful special case is where the marginal distributions are such that the upper tail is Pareto in form. Suppose first that all rich people are either unmarried or have partners with zero income. The number of individuals with incomes in excess of \$Y is the same as the number of families and their total income is the same. The overall income control total is unchanged, but the total number of individuals exceeds the total number of tax units (by a factor written as  $(1+m)$ ). This means that to locate the top p%, we now need to go further down the distribution, and, given the Pareto assumption, the share rises by a factor  $(1+m)^{1-1/\alpha}$ . With  $\alpha = 2$  and  $m = 0.4$ , this

equals 1.18. On the other hand, if all rich tax units consist of couples with equal incomes, then the same amount (and share) of total income is received by  $2/(1+m)$  times the fraction of the population. In the case of the Pareto distribution, this means that the share of the top 1% is reduced by a factor  $(2/(1+m))^{1-1/\alpha}$ . With  $\alpha = 2$  and  $m = 0.4$ , this equals 1.2. We have therefore likely bounds on the effect of moving to an individual basis. If the share of the top 1% is 10%, then this could be increased to 11.8% or reduced to 8.3%. The location of the actual figure between these bounds depends on the joint distribution, and this may well have changed over the century.

Saez and Veall (2005) in the case of Canada can compute top wage income shares both on an individual and family base since 1982. They find that individual based top shares are slightly higher (by about 5%). Most importantly, the family based and individual based top shares track each other extremely closely. Similarly, Kopczuk, Saez, and Song (2009) compute individual based top wage income shares and show that they track also very closely the family based wage income shares estimated by Piketty and Saez (2003). This shows that changes in the correlation of earnings across spouses have played a negligible role in the surge in top wage income shares in North America. However, shifting from family to individual units does have an impact on the level of top income shares and creates a discontinuity in the series.<sup>16</sup>

### **Control Total for Income**

The aim is to relate the amounts recorded in the tax data (numerator of the top share) to a comparable control total for the full population (denominator of the top share). This is a matter that requires attention, since different methods are employed, which may affect comparability overtime and across countries. One approach starts from the income tax data and adds the income of those not covered (the “non-filers”). This approach is used for example for the UK (Atkinson

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<sup>16</sup> Most studies correct for such discontinuities by correcting series to eliminate the discontinuity. Absent overlapping data at both the family and individual levels, such a correction has to be based on strong assumptions (for example that the rate of growth in income shares around the discontinuity is equal to the average rate of growth the year before and the year after the discontinuity). We flag in Table 3 studies where no correction for such discontinuities are made.

2005), and the US (Piketty and Saez 2003) for the years since 1944. The approach in effect takes the definition of income embodied in the tax legislation, and the resulting estimates will change with variations in the tax law. For example, short-term capital gains have been included to varying degrees in taxable income in the UK. A second approach, pioneered by Kuznets (1953), starts from an external control total, typically derived from the national accounts. This approach is followed for example in France (Piketty 2001, 2003), or the US for the years prior to 1944. The approach seeks to adjust the tax data to the same basis, correcting for example for missing income and for differences in timing. In this case, the income of non-filers appears as a residual. This approach has a firmer conceptual base, but there are significant differences between income concepts used in national accounts and those used for income tax purposes.

The first approach estimates the total income that would have been reported if everybody had been required to file a tax return. Requirements to file a tax return vary across time and across countries. Typically most countries have moved from a situation at the beginning of the last century when a minority filed returns to a situation today where the great majority are covered. For example, in the US, “before 1944, because of large exemption levels, only a small fraction of individuals had to file tax returns” (Piketty and Saez, 2003, page 4). It should be noted that taxpayers might not need to make a tax return to appear in the statistics. Where there is tax collection at source, as with Pay-As-You-Earn (PAYE) in the UK, many people do not file a tax return, but are covered by the pay records of their employers. Estimates of the income of non-filers may be related to the average income of filers. For the US, Piketty and Saez (2003) for the period since 1944 impute to non-filers a fixed fraction equal to 20% of filers’ average income. In some cases, estimates of the income of non-filers already exist. Atkinson (2005) makes use of the work of the Central Statistical Office for the UK.

The second approach starts from the national accounts totals for personal income. In the case of the US, Piketty and Saez use for the period 1913-1943 a control total equal to 80% of (total personal income less transfers). In Canada, Saez and Veall (2005) use this approach for the entire period 1920-2000. How do



these national income based calculations relate to the totals in the tax data? In answering this question, it may be helpful to bear in mind the different stages set out schematically below:

Personal sector total income (PI)

*minus* Non-Household income (Non-profit institutions such as charities, life assurance funds)

*equals* Household sector total income

*minus* Items not included in tax base (e.g. employers' social security contributions and – in some countries – employees' social security contributions, imputed rent on owner-occupied houses, and non-taxable transfer payments)

*equals* Household Gross Income Returnable to Tax Authorities

*minus* Taxable income not declared by filers

*minus* Taxable Income of those not included in tax returns (“non-filers”)

*equals* Declared Taxable Income of Filers.

The use of national accounts totals may be seen as moving down from the top rather than moving up from the bottom by adding the estimated income of non-filers. The percentage formulae can be seen as correcting for the non-household elements and for the difference between returnable income and the national accounts definition. Some of the items, such as social security contributions, can be substantial. Piketty and Saez base their choice of percentage for the US on the experience for the period 1944-1998, when they applied estimates of the income of non-filers.

Given the increasing significance of some of the items (such as employers' contributions), and of the non-household institutions, such as pension funds, it is not evident that a constant percentage is appropriate. Since transfers were also smaller at the start of the twentieth century, total household returnable income was then closer to total personal income. Atkinson (2007) compares the two methods in the case of the United Kingdom. He shows that the total income estimated from

the first method by estimating the income of non-filers trends slightly downwards relative to personal income minus transfers from around 90% in the first part of the 20<sup>th</sup> century to around 85% in the last part of the century. Furthermore, there are substantial short term variations especially during world war episodes when the national accounts figures appear to be relatively higher by as much as 15-20%. Some countries do not have developed national accounts, especially in the earlier periods covered by tax statistics. In that case, the total income control is chosen as a fixed percentage of GDP, where the percentage is calibrated using later periods when National accounts are more developed.

Need for a control total for income is of course avoided if we examine the “shares within shares” which depend solely on population totals and the income distribution within the top, measured by the Pareto coefficient as shown in equation (4). This gives a measure of the degree of inequality among the top incomes that may be more robust but does not compare top incomes to the average as top income shares do.

### **Adjustments for Income Definition**

In a number of cases, the definition of income used to present the tabulations changes over time. To obtain homogeneous series, such changes need to be corrected for. The most common change in the presentation of tabulations is due to shifts from net income (income after deductions) to gross income (income before deductions). When composition information on the amount of deductions by income brackets is available, the series estimated can be corrected for such changes. If we assume that ranking of individuals by net income and gross income are approximately the same, the correction can be made by simply adding back average deductions bracket by bracket to go from net incomes to gross incomes. This assumption can be checked when micro-data is available as is the case in the United States since 1960 for example (Piketty and Saez, 2003).

It is also of interest to estimate both series including capital gains and series excluding capital gains (see below). This can also be done if data on amounts of capital gains are available by income brackets. Because capital gains

can be quite important at the top (see Figure 3), ranking of individuals might change significantly when including or excluding capital gains. The ideal is therefore to have access to micro-data to create tabulations both including and excluding capital gains. The micro-data can also be used to assess how ranking changes when excluding capital gains and hence develop simple rules of thumb to construct series excluding capital gains when starting with series including capital gains (or vice-versa). This is done in Piketty and Saez (2003) for the period before 1960, the first year when micro-data become available in the United States.

### **Other Studies**

As mentioned above, Kuznets (1953) first developed the methodology of combining national accounts with tax statistics to estimate top income shares. Before Kuznets, studies using tax statistics were limited to the estimation of Pareto parameters (starting with Pareto, 1897 and followed by numerous studies across many countries and time periods) or to situations where the coverage of tax statistics was substantial or could be supplemented with additional income data (as in Scandinavian countries, the Netherlands, the German states, or the United Kingdom as we mentioned above). Therefore, there exist a number of older studies in those countries computing top income shares from tax statistics. In general, those studies are limited to a few years. Those studies are surveyed in Lindert (2000) for the US and UK and Morrisson (2000) for Europe. They are also discussed in each modern study country by country. We mention the most important of those studies at the bottom of Table 3. The only country for which no modern study exists and older studies exist is Denmark. Those studies for Denmark show that top incomes shares fell substantially (as in other Nordic countries) in the first half of the 20<sup>th</sup> century till at least 1963 (Sorensen, 1993).

We also mention in Table 3 other important recent country specific contributions, including those by Merz, Hirschel, and Zwick (2005) and by Bach,

Corneo, and Steiner (2008) of Germany, by Gustafsson and Jansson (2007) of Sweden, and by Guilera (2008) of Portugal.<sup>17</sup>

Table 3 provides a synthetic summary of the key features of the estimates for all the studies to date.

**Table 3. Key features of estimates for each country**

	<b>France</b>	<b>UK</b>	<b>US</b>	<b>Canada</b>	<b>Australia</b>
<i>References</i>	Piketty (2001, 2003) Landais (2007)	Atkinson (2005, 2007b)	Piketty and Saez (2003)	Saez and Veall (2005)	Atkinson and Leigh (2007)
<i>Years covered</i>	1900-2006 1900-1910 aggregate, 1911-1914 missing) (92 years)	1908-2005. (1961 and 1980 missing).  (95 years)	1913-2007 (96 years)	1920-2000 (81 years)	1921-2002 (plus State of Victoria for 1912-1923). (82 years)
<i>Extent of coverage</i>	Initially under 5%.	Initially only top 0.05%.	Initially only around 1%.	Initially around 5%.	Initially around 10%.
<i>Unit of analysis</i>	Family.	Family to 1989; individual from 1990.	Family.	Individual.	Individual.
<i>Population definition</i>	Total number of families calculated from number of households and household composition data.	Aged 15 and over; before 1990 total number of tax units calculated from population aged 15 and over minus number of married women.	Total number of families calculated as married men plus non married men and women aged 20 and over.	Aged 20 and over.	Aged 15 and over.
<i>Method of calculating control totals for income</i>	From national accounts.	Addition of estimated income of non-filers.	From 1944, addition of income of non-filers = 20% average income; before 1944 80% (personal income –	80% (personal income – transfers) from national accounts.	Total income constructed from national accounts.

<sup>17</sup> This survey does not cover the estimates for former British colonial territories being prepared as part of a project being carried out by Atkinson (apart from Singapore, shown in Table 3). This project has assembled data for some 40 former colonies covering the periods before and after independence. Data for French colonies and Brazil are being examined by Facundo Alvaredo.

			transfers) from national accounts.		
<i>Income definition</i>	Gross income, net of employee social security contributions.	Prior to 1975 income net of certain deductions; from 1975 total income.	Gross income, adjusted for net income deductions.	Gross income, adjusted for the grossing up of dividend income.	Actual gross income; adjustment made to taxable income prior to 1957.
<i>Treatment of capital gains</i>	Capital gains excluded.	Included where taxable under income tax, prior to introduction of separate Capital Gains Tax.	Capital gains excluded in main series.	Capital gains excluded in main series.	Included where taxable under income tax.
<i>Breaks in series?</i>		Up to 1920 includes what is now Republic of Ireland; change in income definition in 1975; change to individual basis in 1990.			
<i>Method of interpolation</i>	Pareto	Mean split histogram Micro-tax data used from 1995	Pareto	Pareto	Mean split histogram
<i>Special features</i>	Share of employee contributions has grown. Interest income has been progressively eroded from the progressive income tax base.	Evidence from super-tax and surtax, and from income tax surveys.			
<i>Other References</i>		Bowley (1914, 1920), Procopovitch (1926) Royal Commission (1977)	Kuznets (1953), Poterba and Feenberg (1993)		

**Table 3. Key features of estimates for each country (continued 1)**

	<b>New Zealand</b>	<b>Germany</b>	<b>Netherlands</b>	<b>Switzerland</b>	<b>Ireland</b>
<i>References</i>	Atkinson and Leigh (2008)	Dell (2007 and 2008)	Salverda and Atkinson (2007),	Dell, Piketty, and Saez (2007)	Nolan (2007)

			Atkinson and Salverda (2005)		
<i>Years covered</i>	1921-2002 (1931, 1932, 1941-1944 missing). (79 years)	1891-1918 (annual), 1925-1938 (annual or biennial), 1950-1998 (triennial). (57 years)	1914-1999 (missing years in 1940s, 1950s, 1960s, 1970s and 1980s). (55 years)	1933-1995/96 (apart from 1933 based on income in 2 years). (31 years)	1922-2000 (1954-1963 missing). (68 years)
<i>Extent of coverage</i>	Initially less than 10%.		In 1914 covered 23%.	In 1933, 14% covered; increases to 33% in 1939 and over 50% from mid-1960s.	Varies; only top 0.1% for much of earlier period; top 0.1% missing in 1990s.
<i>Unit of analysis</i>	Family until 1952, then individual from 1953.	Family.	Family.	Family.	Family
<i>Population definition</i>	Aged 15 and over; before 1953 total number of tax units calculated from population aged 15 and over minus number of married women.	(From 1925) total number of family calculated from population aged 21 and over minus number of married couples.	Total number of families calculated from population aged 15 and over minus number of married women.	Total number of families calculated from population aged 20 and over minus number of married women.	Total number of families calculated from population aged 18 and over minus number of married women.
<i>Method of calculating control totals for income</i>	95% of total income constructed from national accounts.	90% of net primary income of households from national accounts minus employers' contributions.	Addition of estimated income of non-filers.	From 1971 20% average income imputed to non-filers; prior to 1971 total income defined as 75% net national income.	80% of (total personal income – state transfers – employers' contributions)
<i>Income definition</i>	Assessable income to 1940; total income from 1945.	After deduction of costs associated with specific income source.	Gross income.	Income before deductions.	Net; also gross from 1989.
<i>Treatment of capital gains</i>	Included where taxable.	Included where taxable.	Not included.	Excluded.	Not included.
<i>Breaks in series?</i>	Assessable income up to 1940; change	Changes in geographical boundaries.	Three different sources, with	None indicated.	Different sources: surtax

	to individual basis in 1953.		breaks in 1950 and 1977.		statistics and income tax enquiries.
<i>Method of interpolation</i>	Mean split histogram	Pareto	Mean split histogram	Pareto	Pareto
<i>Special features</i>		Need to combine <i>Lohnsteuer</i> and <i>Einkommensteuer</i> data.		Treatment of tax evasion through Swiss accounts.	
<i>Other References</i>		Procopovitch (1926), Mueller (1959), Hoffmann (1965), Mueller and Geisenberger (1972), Jeck (1968, 1970), Kraus (1981), Kaeble (1986), Dumke (1991), Merz, Hirschel, and Zwick (2005), and by Bach, Corneo, and Steiner (2008)	Hartog and Veenbergen (1978)		

**Table 3. Key features of estimates for each country (continued 2)**

	<b>India</b>	<b>China</b>	<b>Japan</b>	<b>Indonesia</b>	<b>Singapore</b>
<i>References</i>	Banerjee and Piketty (2005)	Piketty and Qian (2009)	Moriguchi and Saez (2008)	Leigh and van der Eng (2009)	Atkinson (2010)
<i>Years covered</i>	1922-1988 (71 years)	1986-2003 (18 years)	1886-2005 (119 years, 1946 missing)	1920-1939 1982-2004 (survey data) 1990-2003 (tax data) (34 years of tax data)	1947-2005 (57 years)
<i>Extent of coverage</i>	Initially under 1%.	Full urban population (household survey)	Initially only around 0.1%	Initially around 1%, Recent period 0.1%	Initially around 1%.
<i>Unit of analysis</i>	Individual	Both individual and household series	Individual	Households.	Tax unit, allowing separate election.
<i>Population definition</i>	40% of total population (corresponds roughly to all	Urban population included in the survey	Aged 20 and over	Total number of households from	Resident population aged 15 and over.

	adults with positive income)			population statistics.	
<i>Method of calculating control totals for income</i>	Equal to 70% of National Income from national accounts.	Based on the full population household survey	From National accounts: wages + personal capital income + unincorporated business income (excluding imputed rents)	1920-1939: from estimates of aggregate personal income 1982-2004: income from survey	Total income constructed from national accounts as 75% of Indigenous Gross National Income
<i>Income definition</i>	Gross income	Gross income (includes transfers)	Gross income (significant capital income base erosion after 1946)	Net income after personal allowances (farm income excluded)	Gross income
<i>Treatment of capital gains</i>	Capital gains excluded	Capital gains not measured in survey data and hence excluded	Capital gains excluded in main series.	Capital gains excluded	Capital gains excluded
<i>Breaks in series?</i>				No estimates from 1940 to 1981	
<i>Method of interpolation</i>	Pareto	Pareto	Pareto	Pareto	Mean split histogram
<i>Special features</i>		Urban Household surveys used (not tax statistics)	Pre-1946, income tax based on households but virtually all income earned by the head	1982-2004 estimates based on survey. Tax based estimates for 1990-2003 also available (but much lower)	
<i>Other References</i>					

**Table 3. Key features of estimates for each country (continued 3)**

	<b>Argentina</b>	<b>Sweden</b>	<b>Finland</b>	<b>Norway</b>
<i>References</i>	Alvaredo (2010)	Roine and Waldenstrom (2008)	Jantti, Riihela, Sullstrom, Tuomala (2010)	Aaberge and Atkinson (2010)
<i>Years covered</i>	1932-1973 (missing years). 1997-2004 (39 years)	1903-2006 (missing years) (75 years)	1920-2004 (85 years)	1875-2006 (missing years) (67 years)
<i>Extent of coverage</i>	Top 1%.	Top 10%	Top 5%	Top 10%
<i>Unit of</i>	Individual	Family initially, then	Family or individual	Family but



<i>analysis</i>		individual	(several periods)	separate taxation possible and becomes most prevalent
<i>Population definition</i>	Population aged 20 and over from National Census	Up to 1951: families (married couples + singles aged 16 and over) After 1951: individuals aged 16 and over	Adult population aged 16 and above	Adult population aged 16 and above
<i>Method of calculating control totals for income</i>	Total income constructed from national accounts initially as 60% of GDP	Up to 1942, 89% of personal sector income from National Account. After 1942, by adding income of non-filers	Total income constructed by adding income of non-filers	Total income constructed from national accounts initially as 72% of household income
<i>Income definition</i>	Gross income.	Gross income including transfers (series excluding transfers also estimated)	1920-1992: taxable income 1949-2003: Gross income (two overlapping series)	Gross income including transfers
<i>Treatment of capital gains</i>	Excluded	Both series including and excluding capital gains presented	Excluded	Included.
<i>Breaks in series?</i>		Gradual shift from family to individual taxation from 1952 to 1971	Changes from family to individual taxation. Overlapping series for taxable vs. gross income.	
<i>Method of interpolation</i>	Pareto	Pareto	Mean split histogram Survey data (linked to tax statistics) used for 1966-2004	Mean split histogram Micro-tax data used after 1966
<i>Special features</i>	Comparison to household surveys provided for recent period			top shares spike in 2005 because of dividend tax reform producing income shifting
<i>Other References</i>		Bentzel (1952) Kraus (1981) Gustafsson and Jansson (2007)	Hjerppe and Lefgren (1974)	

**Table 3. Key features of estimates for each country (continued 4)**

	<b>Spain</b>	<b>Portugal</b>	<b>Italy</b>
<i>References</i>	Alvaredo and Saez (2009)	Alvaredo (2009)	Alvaredo and Pisano (2010)
<i>Years covered</i>	1933-2005 (gap 1962-1980)	1936-2005 (1983-1988)	1974-2004 (29 years)

	except 1971) (49 years)	missing) (64 years)	
<i>Extent of coverage</i>	Top .01% initially Top 10% since 1981	Top 0.1% initially	Top 10%
<i>Unit of analysis</i>	Individual	Family	Individual
<i>Population definition</i>	Population aged 20 and over from National Census	Population aged 20 and over minus married women from census statistics	Population aged 20 and over from National Census
<i>Method of calculating control totals for income</i>	Total income constructed from national accounts initially as 66% of GDP and later refined	Total income constructed from national accounts initially as 66% of GDP and later refined	Total income constructed primarily from national accounts: wages, pensions, 50% of business income, and capital income from tax returns
<i>Income definition</i>	Gross income.	Gross income	Gross income but excluding interest income
<i>Treatment of capital gains</i>	Excluded (series with capital gains also estimated after 1981)	Excluded	Excluded
<i>Breaks in series?</i>	Significant change in income tax scope after 1978 Change from family to individual taxation in 1988 (corrected for)		
<i>Method of interpolation</i>	Pareto	Pareto	Pareto
<i>Special features</i>	Top wage income series also constructed after 1981	Top wage income series also constructed after 1964	
<i>Other References</i>		Guilera (2008)	

### 3.2 POSSIBLE LIMITATIONS

Top income share series are constructed using tax statistics. The use of tax data is often regarded by economists with considerable disbelief. In the UK, Richard Titmuss wrote in 1962 a book-length critique of the income tax-based statistics on

distribution, concluding, 'we are expecting too much from the crumbs that fall from the conventional tables' (1962: 191). More recently, compilers of databases on income inequality have tended to rely on household survey data, dismissing income tax data as unrepresentative.

These doubts are well justified for at least two reasons. The first is that tax data are collected as part of an administrative process, which is not tailored to our needs, so that the definition of income, of income unit, etc. are not necessarily those that we would have chosen. This causes particular difficulties for comparisons across countries, but also for time-series analysis where there have been substantial changes in the tax system, such as the moves to and from the joint taxation of couples. Secondly, it is obvious that those paying tax have a financial incentive to present their affairs in a way that reduces tax liabilities. There is tax avoidance and tax evasion. The rich, in particular, have a strong incentive to understate their taxable incomes. Those with wealth take steps to ensure that the return comes in the form of asset appreciation, typically taxed at lower rates or not at all. Those with high salaries seek to ensure that part of their remuneration comes in forms, such as fringe benefits or stock-options which receive favorable tax treatment. Both groups may make use of tax havens that allow income to be moved beyond the reach of the national tax net. Third, the tax data are in general silent about the industrial composition of top incomes which limits our ability to interpret and understand changes. It would be good for example to know more about the links between rising top income shares and Information and Communication Technologies (ICT), but this requires other data.

These shortcomings limit what can be said from tax data, but this does not mean that the data are worthless. Like all economic data they measure with error the 'true' variable in which we are interested. As with all data, there are potential sources of bias, but, as in other cases, we can say something about the possible direction and magnitude of the bias. Moreover, we can compensate for some of the shortcomings of the income tax data. It is true that income tax data cover only the taxpaying population, which, in the early years of income tax, was typically only a small fraction of the total population. As a result, tax data cannot be used to describe

the whole distribution, but we can estimate the upper part of the Lorenz curve, i.e., top income shares.

But why not use household surveys, which cover the whole (non-institutional) population? Why use income tax data? There are two main answers. The first is that household surveys themselves are not without shortcomings. These include sampling error, which may be sizeable with the typical sample sizes for surveys, whereas tax data drawn from administrative records are based on very much larger samples. Indeed, in some cases the tax statistics relate to the whole universe of taxpayers. Household surveys suffer from differential non-response and incomplete response (these two being the survey counterpart of tax evasion), as well as measurement error. Such problems particularly affect the top income ranges, as is recognized in studies that combine household survey data with information on upper income ranges from tax sources (see, for example, in the UK, Brewer et al. 2008). Indeed, most surveys impose top coding to limit the effects of measurement error on aggregates, which severely limit the analysis of top incomes using survey data. The second answer is that household surveys are a fairly recent innovation. Household surveys only became regular in most countries in the 1970s or later, and in a number of cases they are held at intervals rather than annually. The beauty of income tax evidence is that it is available for long runs of years, typically on an annual basis, and that it is available for wide variety of countries.

### **Comparison with household survey data: US case study**

The important recent study by Burkhauser et al. (2009) tries to reconcile the Piketty and Saez (2003) top income share series, estimated with tax statistics, with top income shares measured using CPS data but following the same methodology as in Piketty and Saez (2003) in terms of income definition and family unit.<sup>18</sup> Burkhauser et al. (2009) find that their CPS based top income share series match the Piketty and Saez (2003) series very closely for the second vingtile and the next

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<sup>18</sup> Wolff and Zacharias (2009) and Kennickell (2009) also compute top income shares using the Survey of Consumer Finances, which is not top coded and over-samples the rich. Wolff and Zacharias (2009) in particular use wealth data to estimate more comprehensive measures of capital income that cannot be observed in tax data. The trend of their estimated series is in line with the tax based estimates of Piketty and Saez (2003).

4% (i.e., the top decile excluding the top percentile). As depicted on Figure 5A, the top 1% share measured by the CPS also appears to follow the same qualitative trend as the top 1% share from tax data. However there are important quantitative differences that remain, especially comparing the CPS series with the tax series including realized capital gains (which are not measured in the CPS questionnaire). Four points are worth noting.

First, the top 1% share measured by the CPS is consistently lower than the top 1% income share measured with tax data. This is due to the fact that (a) the CPS does not record important income sources at the top (such as realized capital gains or stock option gains), (b) CPS incomes are by design recorded with top code,<sup>19</sup> (c) there might be under-reporting of incomes at the top in the CPS (i.e. some top income individuals might decide to under report their true income, even in the absence of uncertainty about the income concept).

Second, the CPS top 1% income share increased less than the tax based top 1% income shares from 1976 to 2006. The increase is 6.9 points in the CPS, while it is 14.0 points in the tax data including capital gains and 10.1 points in the tax data excluding capital gains.

Third, almost half of the increase in the CPS top 1% share is due to a large 3.4 percentage point jump from 1992 to 1993 which is due entirely to changes in measurement methodology (in particular, a substantial increase in the internal top code).<sup>20</sup> Therefore, erasing this jump and doing a proportional adjustment in pre-1993 series, the actual increase in the CPS top 1% share would be only 4.1 points (Table 4, Panel A).

Fourth, there is a concern that tax based top income shares also exaggerate the increase because of income shifting toward the individual tax base following the tax rate reductions on the 1980s. Indeed, the series excluding capital gains does display a large 4.0 point upward jump from 1986 to 1988. As is well

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<sup>19</sup> Burkhauser et al. (2009) use the internal CPS. The internal CPS is further top coded for confidentiality reasons before being publicly disclosed. However, even the internal CPS remains top coded by design. Such top codes are necessary in survey data to avoid having a handful of reporting errors having significant effects on aggregate statistics.

<sup>20</sup> Burkhauser et al. (2009) correct for such top coding issues using a parametric imputation fitted on the full distribution.

known (Feenberg and Poterba, 1993, Saez, 2004), almost one-half of this jump is due to a shift from corporate income toward individual business income due to the Tax Reform Act of 1986.<sup>21</sup> However, corporate retained earnings translate into capital gains that are eventually realized and reported on individual tax returns. Therefore, in the medium run, this shift will be matched by an equivalent reduction in capital gains. Indeed, the top 1% income share series including capital gains display no notable discontinuity around the TRA 1986 episode (the CPS top income shares increase as fast as the tax return based top income share including capital gains in the medium run from 1985 to 1990).<sup>22</sup>

Therefore, from 1976 to 2006 and erasing the 1992-1993 measurement discontinuity in the CPS, the CPS top 1% share effectively misses 10.4 points of the surge of the top 1% income share relative to income tax data including realized capital gains (the most economically meaningful series to capture total real top incomes). As we show on Figure 5B and Table 4 (Panel B), this has a substantial impact on the official CPS Gini coefficient series over the 1976 to 2006 period. Three points are worth noting on Figure 5B.

First, as mentioned above, the official CPS Gini increased from 39.8% in 1976 to 47.0% in 2006 and this increase includes a 2 percentage jump from 1992 to 1993 due to the measurement change discussed above, so that the real increase in the Gini is only 5.3 points over the period (Table 4). Second, when excluding the top 1%, the Gini for the bottom 99% households displays no discontinuity at all from 1992 to 1993 which shows that the discontinuity is entirely due to measurement changes within the top 1%.<sup>23</sup> The Gini for the bottom 99%

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<sup>21</sup> TRA 1986 made it more advantageous for closely held businesses to shift from corporate to pass-through entities taxed solely at the individual level. Furthermore, those firms that remain corporate have an incentive to shift more of their taxable income to the personal tax base. This can be done in many ways, e.g. higher royalty payments, payments for rent, higher interest payments, as well as higher wage payments to entrepreneurs (Gordon and Slemrod, 2000).

<sup>22</sup> The top income share including capital gains is abnormally high in 1986 because of very large capital gain realizations in that year to avoid the higher capital gain tax rates after TRA 1986, a well established finding clearly visible on Figure 3.

<sup>23</sup> We have estimated the Gini for the bottom 99% using the Atkinson (2007) formula  $G=(1-S)G_0+S$  from Atkinson (2007) where  $G$  is the Gini for the full population (Official CPS series),  $G_0$  the Gini for the bottom 99%, and  $S$  is the top 1% income share estimated by Burkhauser et al. (2009). This method is not perfect because the official CPS Gini is based on households and income including

increases only by 3.2 points from 1976 to 2006. Third, when correcting the Gini coefficient using the differential in top 1% shares between the tax data (either including or excluding capital gains) and Burkhauser et al. (2009), the Gini coefficient increases by 10.8 and 8.8 points respectively over the 1976-2006 period. Using our preferred series including capital gains, the increase in the Gini is 10.8 points, i.e., more than twice as large as the 5.3 point recorded in the Gini (after correcting the 1992-1993 discontinuity) and more than three times as large as the 3.2 point increase in the Gini for the bottom 99%. In other words, the top percentile plays a major role in the increase in the Gini over the last three decades and CPS data which do not measure top incomes fail to capture about half of this increase in overall inequality.

### **The Definition of Income**

Taxes affect the *substance* of the income distribution, and we return to this in section 4, but they also affect the *form* of the income distribution statistics. In all cases, the estimates follow the tax law, rather than a ‘preferred’ definition of income, such as the Haig–Simons comprehensive definition, which includes such items as imputed rent, fringe employment benefits, or accruing capital gains and losses. In principle, transfers from the government should not be included in pre-fisc incomes as they are part of the government redistributive schemes which tax pre-fisc incomes and provide transfers. In practice, the largest cash transfer payments are public pensions which are often related to social security contributions during the work life and hence can be considered as deferred earnings. Means-tested transfer programs are in general non-taxable and excluded from the estimates presented. Estimating top post-fisc income shares based on incomes after taxes and transfers is also of great interest to measure the direct redistributive effects of taxes and transfer policies.<sup>24</sup> Some studies, such as Atkinson (2005) for the United Kingdom, Piketty (2001) for France, and Piketty and

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cash transfers while Burkhauser et al. top 1% income share is based on families and excludes cash transfers.

<sup>24</sup> Taxes and transfers might also have indirect redistributive effects through behavioral responses. For example, high income earners might work less and hence earn less if taxes increase. We come back to this important point in Section 5.

Saez (2007) for the United States since 1960 have also estimated post-fisc top income shares.

For a single country study, it may be reasonable to assume that income is a concept well understood in that context. Alternatively, one may assume that all taxable incomes differ from the preferred definition by the same percentage. Neither of these assumptions, however, seems particularly satisfactory, and use of taxable income may well affect the conclusions drawn about changes over time. When we come to a cross-country comparison, there seems an even stronger case for adopting a definition of income that is common across countries and that does not depend on the specificities of the tax law in each country. Approaching a common definition of income does however pose considerable problems, as illustrated by the treatment of transfers (which have grown very considerably in importance over the century), by capital gains, by the interrelation with the corporate tax system, and by tax deductions. The studies for the USA and Canada subtract social security transfers on the grounds that they are either partially or totally exempt from tax. In other countries, such as Australia, New Zealand, Norway, and the UK, the tax treatment of transfers differs, with typically more transfers being brought into taxation over time.

Perhaps the most important aspect that affects the comparability of series over time within each country has been the erosion of capital income from the progressive income tax base. Early progressive income tax systems included a much larger fraction of capital income than most present progressive income tax systems. Indeed, over time, many sources of capital income, such as interest income, or returns on pension funds, have been either taxed separately at flat rates or fully exempted, and hence have disappeared from the tax base. Some early income tax systems (such as France from 1914 to 1964) also included imputed rents of homeowners in the tax base, but today imputed rents are typically excluded. As a result of this imputed rent exclusion and the development of numerous other forms of legally tax-exempt capital income, the share of capital income that is reportable on income tax returns, and hence included in the series presented, has significantly decreased over time. To the extent that such excluded



capital income accrues disproportionately to top income groups, this will lead to an underestimation of top income shares. Ideally, one would want to impute excluded capital income back to each income group. Because of lack of data, such an imputation is very difficult to fully carry out.<sup>25</sup> Some of the studies discuss whether the exclusion of capital income affects the series. For example, Moriguchi and Saez (2008), in the case of Japan, use survey data to estimate how interest income—today almost completely excluded from the comprehensive income tax base in Japan—is distributed across income groups. In the case of France, Piketty (2001, 2003) has shown that the long-run decline of top income shares was robust, in the sense that even an upper bound imputation of today’s tax-exempt capital incomes to today’s reported top incomes would be largely insufficient to undo the observed fall. In the estimates of top shares for Norway (Aaberge and Atkinson, 2010) a calculation has been made of income including the “full” return to stocks, but no systematic attempt has been made to impute full capital income on a comparable basis over time and across countries. We view this as one of the main shortcomings—probably the main shortcoming—of our data set. As we shall see in sections below, this limits the extent to which one can use our data set to rigorously test the theoretical economic mechanisms at play.

The treatment of capital gains and losses also differs across time and across countries. For a number of countries, series both including and excluding capital gains have been produced (see Table 3). As shown in Figure 6, the effects of the inclusion of capital gains on the share of the top percentile is often substantial. In the case of Sweden, Roine and Waldenström (2008) note that ‘over the past two decades the general picture turns out to depend crucially on how income from capital gains is treated. If we include capital gains, Swedish income inequality has increased quite substantially; when excluding them, top income shares have increased much less.’ In all cases, only realized capital gains are included, if at all, in tax statistics and no information on accruing capital gains is

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<sup>25</sup> Wolff and Zacharias (2009) use the Survey of Consumer Finance and combine income and wealth data to estimate broader measures of capital income since 1982.

available. Some accrued capital gains are never realized, for example, when there are step-up of basis provisions at time of death as in the United States.<sup>26</sup>

Finally, although the distinction between capital and labor income is clear conceptually, it is often partly blurred in the compositional tax statistics. For example, realized capital gains of business owners often correspond to the sale of accumulated earnings of entrepreneurs in their firm, rather than return on capital. Stock-option compensation sometimes appears as wage income but sometimes as capital income in tax statistics depending on the tax law.

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.) The aim is in general to measure gross income before deductions, but this is not always possible. The French estimates show income after deducting employee social security contributions. In a number of countries, the earlier income tax distributions refer to income after these deductions, but the later distributions refer to gross income. In the USA, 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 1913–43 to create homogeneous series. Private pension provisions are also sometimes used as a pay deferral vehicle to smooth taxable income and reduce the burden of progressive taxation. Such tax avoidance behavior may also lessen measured cross-sectional income concentration.

The areas highlighted above—transfers, tax-exempt capital income, capital gains, and deductions—may all give rise to cross-country differences and to lack of comparability over time in the income tax data. Any user needs to take them

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<sup>26</sup> Using the Survey of Consumer Finances, Poterba and Weisbenner (2001) estimate that, in 1998, capital gains unrealized at time of death were \$42.8bn (Table 10-8, p. 440), i.e., slightly less than 10% of the \$440bn of net realized capital gains reported on individual tax returns in 1998 (Piketty and Saez, 2003).

into account. We have tried to flag those items for each study in Table 3. The same applies to tax evasion, to which we devote the next sub-section.

### **Tax Avoidance and Tax Evasion**

As highlighted above, the standard objection to the use of income tax data to study the distribution of income is that tax returns are largely works of fiction, as taxpayers seek to avoid and evade being taxed. The under-reporting of income can affect cross-country comparisons where there are differences in prevalence of evasion and can affect measurement of trends where the extent of evasion has changed over time.

It is not a coincidence that the development of income taxation follows a very similar path across the countries studied. All countries start with progressive taxes on comprehensive income using high exemption levels which limits the tax to only a small group at the top of the distribution. Indeed, at an early stage of industrial development, when a substantial fraction of economic activity takes place in small informal businesses, it is just not possible for the government to enforce a comprehensive income tax on a wide share of the population.<sup>27</sup> However, even in early stages of economic development, Alvaredo and Saez (2009) note ‘the incomes of high income individuals are identifiable because they derive their incomes from large and modern businesses or financial institutions with verifiable accounts, or from highly paid (and verifiable) salaried positions, or property income from publicly known assets (such as large land estates with regular rental income)’.<sup>28</sup> Therefore, it is conceivable that the early progressive income taxes, upon which statistics those studies are based, captured reasonably well most components of top incomes. If tax avoidance and evasion has increased since then, the degree of equalization may be over-stated.

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<sup>27</sup> Even today in the most advanced economies, small informal businesses may escape the individual income taxes.

<sup>28</sup> Indeed, before comprehensive taxation starts, most countries had already adopted schedular separate taxes on specific income sources such as wages and salaries, profits from large businesses, rental income from large estates. Such schedular taxes emerge when economic development makes enforcement feasible.

Williamson and Lindert (1980) confront the issue directly for the data for the United States. They ask whether “superior tax avoidance” can have accounted for the income leveling over the period 1929-1951 found by Kuznets (1953). As they note, the argument of spurious leveling depends on a double differential: that tax avoidance/evasion has increased, and that it has increased faster for the top incomes. On the basis of comparisons of reported income totals with national accounts data, they conclude that “even under a strong assumption about changes in the pattern of lying, most of the leveling remains unobscured” (1980, page 88).

The extent of contemporary tax evasion is considered specifically in a number of studies. In the case of Sweden, Roine and Waldenström (2008) conclude that overall evasion is modest (around 5 per cent of all incomes) and that there is no reason to believe that under-reporting has changed dramatically over time. A speculative reason for this may be that while the incentives to under-report have increased as tax rates have gone up over time the administrative control over tax compliance has also been improved. The Nordic countries may well be different. In the case of Italy, Alvaredo and Pisano (2010) note the widespread view of tax evasion being much higher than in other OECD countries. Audits and subsequent scandals involving show-business people, well-known fashion designers, and sport stars help support this idea among the general public, even when they also provide evidence about the fact that top income earners are very visible for the tax administration. The evidence for Italy does indeed suggest that evasion is important among small businesses and the self-employed (traditionally numerous in Italy), for whom there is no double reporting, but that for wages, salaries, and pensions at the *top of the distribution* there is little room for evading those income components that must be reported independently by employers or the paying authorities. They conclude that the evasion from self-employment and small business income is unlikely to account for the gap in top incomes between Italy and Anglo-Saxon countries.

Another source of evidence is provided by tax amnesties, and Alvaredo (2010) discusses the results for Argentina. Information from the 1962 tax amnesty (which attempted to uncover all income that had been evaded by taxpayers between 1956 and 1961) suggested under-reporting of between 27 and 40 per cent. However, it varied with income. Evasion shows a lower impact at the bottom (where income from wage source dominates) and at the top of the tax scale (where inspections from the tax administration agency might be more frequent and enforcement through other taxes higher). The evidence may be indirect. In the case of India, Banerjee and Piketty (2005) note the innovations in tax collection that may have affected the prevalence of filing. They investigate the impact by considering the evolution of wage income, where taxes are typically deducted at source, so that no change would be observed if all that was happening was improved collection. They conclude that there was a 'real' increase in top incomes. As in other studies (such as that for Australia in Atkinson and Leigh, 2007), this is corroborated by independent evidence about what happened to top salaries.

It is important to remember that, while taxpayers may have a strong incentive to evade, the taxing authorities have a strong incentive to enforce collection. This takes the form of both sticks and carrots. For example, the Inland Revenue Authority of Singapore devotes considerable resources to enforcing tax collection, but also provides positive encouragement to tax compliance through emphasizing the role of taxes in financing key government services such as schools. The resources allocated to tax administration have been substantial: for example, in Spain in the pre-1960 period the administration was able to audit a very significant fraction (10–20 per cent) of individual tax returns. The tax authorities may also be expected to target their enforcement activities on those with higher potential liabilities. The scope for evasion may therefore be less for the very top incomes than for those close to the tax threshold, as Leigh and van Eng (2009) note to be the case in Indonesia.

One important route to avoiding personal income tax is for income to be sheltered in companies. The extent to which this is possible depends on the *personal* tax law and 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 (as discussed above) but dividends are covered, a switch towards (away from) dividend payment will increase (reduce) the apparent top income shares. This needs to be taken into account when interpreting the results. That is why estimating series including realized capital gains is valuable in order to assess the contribution of retained profits of corporations on top individual incomes. When realized capital gains are untaxed and hence not observed, it is important to assess the effects of attributing retained profits to top incomes. For example, in the UK, Atkinson (2005) examined the consequences of the large increase after the Second World War in the proportion of profits retained by companies. The attribution of the retained profits to top income groups would have reduced the magnitude of the fall in the share of the top 1 per cent between 1937 and 1957 but still left a very considerable reduction.

The reported shares of top incomes can also be affected by shifts between incorporated and non-incorporated activities. This has been modeled by Gordon and Slemrod (2000) and others. As discussed above, the US 1986 tax reform lowered the top individual tax rate below the corporate tax rate, inducing shifts of business income from the corporate tax base to the individual tax base. This can be visible as a surge of business income from 1986 to 1988 in top incomes as depicted on Figure 3. Eventually however, retained profits of corporations are received by individuals either as dividends or realized capital gains so that income including capital gains should not be affected by such shifts between the corporate and individual sector in the long-run.

The potential impact is particularly marked in the case of the dual income tax introduced in Nordic countries. The tax reform in Finland in 1993 combined progressive taxation of earned income with a flat rate of tax on capital income and

corporate profits, with a full imputation system applied to the taxation of distributed profits. Under the dual income tax, capital income is taxed at a lower rate than the top marginal tax rate on labor income. As discussed in the case of Finland by Jantti et al. (2010), the 1993 tax reform led to an increasing trend of the share of capital income (dividends) and declining share of entrepreneurial income. This can be interpreted as an indication of a tax-induced shift in organizational form and the choice of tax regime. Alvaredo and Saez (2009) provide a model of the incentive to adopt a (wealth tax) exempt organizational form and examine the effect of the wealth tax reform undertaken in Spain in 1994. Their empirical estimates suggest that there is a very large shifting effect: the fraction of businesses benefiting from the exemption jumps from one-third to about two-thirds for the top 1 per cent.

Note also that changes in tax laws can also produce significant intertemporal shifting of income, which can create spikes in top income shares. For example, the 1986 tax reform in the US actually increased the tax rate on realized capital gains in 1987, leading to a surge in realizations in 1986 before the tax increase started, making top income shares spike in that year, as can clearly be seen on Figure 3. More recently, Norway increased the tax on dividends in 2006 leading to a one time spike in dividend distributions in year 2005 to take advantage of the lower rates and leading to a 50% increase in the top 1% share in 2005, followed by a 50% drop in 2006 (see Figure 7C below).

Recent high-profile cases have drawn attention to tax avoidance by relocation or tax evasion by sending money abroad.. In their study of Switzerland, Dell, Piketty, and Saez (2007) investigated the issue of tax evasion by foreigners relocating to that country or through Swiss bank accounts. They found that the fraction of taxpayers in Switzerland with income abroad or non-resident taxpayers had increased in recent years but remains below 20 per cent even at the very top of the Swiss distribution, suggesting that the migration to Switzerland of the very wealthy is a limited phenomenon. They similarly conclude that the amount of capital income earned through Swiss accounts and not reported is small in relation to the total incomes of top income recipients in other countries. In the case of Sweden, Roine and Waldenström (2008) make ingenious estimates of 'capital

flight' since the early 1980s using unexplained residual capital flows ('net errors and omissions') published in official balance of payments statistics. To get a sense of the order of magnitude by which this 'missing wealth' would change top income shares in Sweden, they add all of the returns from this capital first to the incomes of the top decile and then to the top percentile. For the years before 1990, there is no effect on top income shares by adding income from offshore capital holdings since they are simply too small. However, after 1990, and especially after 1995, when adding all of them to the top decile, income shares increase moderately (by approximately 3 per cent). When instead adding everything to the incomes of the top percentile, the income shares increase by about 25 per cent which is equivalent to an increased share from about 5.7 to 7.0 per cent. While this is a notable change, it does not raise Swedish top income shares above those in France (about 7.7 per cent in 1998), the UK (12.5 per cent in 1998), or the USA (15.3 per cent in 1998).

To sum up, the different pieces of evidence indicate that tax evasion and tax avoidance need to be taken seriously and can quantitatively affect the conclusions drawn. They need to be borne in mind when considering the results, but they are not so large as to mean that the tax data should be rejected out of hand. Our view is that legally tax-exempt capital income poses more serious problems than tax evasion and tax avoidance per se.

### **Income Mobility**

A classical objection to inequality measures based on annual cross sectional income is that individuals move up or down the distribution of income overtime. If individuals can use credit markets to smooth fluctuations in income, then annual income might not be a good measure of economic welfare. Therefore, analyzing income mobility is valuable although it requires access to panel data. Saez and Veall (2005) and Kopczuk, Saez, and Song (2009) have analyzed jointly inequality and mobility for at the top of the individual wage earnings distributions in Canada and the United States. They found that mobility, measured as the probability to drop out of the top percentile from one year to the next, has been remarkably



stable over the last decades even though top wage earnings shares surged in both countries. As a result, increased mobility did not mitigate increases in annual top earnings shares. It would be valuable to extend such mobility analyzes at the top of the distribution to other countries and to total income (instead of just wage earnings).

#### **4 A SUMMARY OF THE MAIN FINDINGS**

We depict in Figure 7 the annual top 1% share of total gross income series for 22 individual countries grouped in four panels as follows: A. Western English speaking countries (US, Canada, UK, Ireland, Australia, New Zealand), B. Continental Central European countries (France, Germany, Netherlands, Switzerland) and Japan, C. Nordic European countries (Norway, Sweden, Finland) and Southern European countries (Portugal, Spain, Italy), D. Developing countries (China, India, Singapore, Indonesia, Argentina). As we shall see, the grouping is made not only on cultural or geographical proximity, but also on proximity of the historical evolution of top income shares. In all cases, we have used series excluding realized capital gains (as only a subset of countries present series including capital gains, and in those cases, series excluding capital gains have also been produced). We have used the same y-axis scale in all four panels to facilitate comparisons across panels. Western English Speaking countries in Panel A display a clear U-shape over the century. Continental central European countries and Japan in Panel B display an L-shape over the century. Nordic and Southern European countries display a pattern in between a U and a L shape in Panel C as the drop in the early part of the period is much more pronounced than the rebound in the late part of period. Finally, developing countries in Panel D also display a U/L shape pattern although there is substantial heterogeneity in this group.

Let us summarize first the evidence in the middle of the twentieth century. The first columns in Table 5 show the position in 1949 (1950).<sup>29</sup> We take this year as one for which we have estimates for all except four of the twenty-two countries, and as one when most countries had begun to return to normality after the Second World War (for Germany and the Netherlands we take 1950). Moreover, it was before the 1950–1 commodity price boom that affected top shares in Australia, New Zealand, and Singapore.

If we start with the top 1 per cent—the group on which attention is commonly focused and which is depicted on Figure 7—then we can see from Table 5 that the shares of total gross income are strikingly similar when we take account of the possible margins of error. There are 18 countries for which we have estimates. If we take 10 per cent as the central value (the median is in fact around 10.8), then 12 of the 18 lie within the range 8 to 12 per cent (i.e. with an error margin of  $\pm 20$  per cent). In countries as diverse as India, Norway, France, New Zealand, and the USA, the top 1 per cent had on average between 8 to 12 times average income. Three countries were only just below 8 per cent: Japan, Finland, and Sweden. The countries above the range were Ireland, Argentina, and (colonial) Indonesia. The top 1 per cent is of course just one point on the distribution. If we look at the top 0.1 per cent, shown in Table 5 for 18 countries (Portugal replacing Finland), then we find that again 12 lie within a ( $\pm 20$  per cent) range around 3.25 per cent from 2.6 to 3.9 per cent. Leaving out the three outliers at each end, the top 0.1 per cent had between 26 and 39 times the average income.

We also report in Table 5 the inverse Pareto–Lorenz coefficients  $\beta$  associated to the upper tail of the observed distribution in the various countries in 1949 and 2005. Recall from equation (2) that  $\beta$  measures the average income of people above  $y$ , relative to  $y$  and provides a direct intuitive measure of the fatness of the upper tail of the distribution. Coming back to 1949, we find that 10 of the 20 countries for which  $\beta$  coefficient values are shown in Table 5 lie between 1.88 and

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<sup>29</sup> In the case of New Zealand, we have used the estimates of Atkinson and Leigh (2008: table 1) that adjust for the change in the tax unit in 1953. For Indonesia we have taken the 1939 estimate and for Ireland that for 1943.

2.00 in 1949. Countries as different as Spain, Norway, the USA, and (colonial) Singapore had Pareto coefficients that differed only in the second decimal place. As of 1949, the only countries with  $\beta$  coefficients above 2.5 were Argentina and India.

1949 is of interest not just for being mid-century, but also because later years did not exhibit the degree of similarity described above. The right-hand part of Table 5 assembles estimates for 2005 (or a close year). The central value for the share of the top 1 per cent is not too different from that in 1949: 9 per cent. But we now find more dispersion. For the top 1 per cent, 9 out of 21 countries lie outside the range of  $\pm 20$  per cent. Leaving out the two outliers at each end, the top 0.1 per cent had between 13 and 56 times the average income (in 1949 these figures had been 20 and 52). In terms of the  $\beta$  coefficients only 4 of the 22 countries had values between 1.88 and 2.00. Of the countries present in 1949, five now have values of  $\beta$  in excess of 2.5.

### **Before 1949**

Before examining the recent period in detail, we look at the first half of the century (and back into the nineteenth century). What happened before 1949 is relevant for several reasons. The behavior of the income distribution in today's rich countries may provide a guide as to what can be expected in today's fast-growing economies. We can learn from nineteenth-century data, such as those for Norway or Japan, that cover the period of industrialization. Events in today's world economy may resemble those in the past. If we are concerned as to the distributional impact of recession, then there may be lessons to be learned from the 1930s.

The data assembled here provide evidence about the inter-war period for 19 of the 22 countries; and for 5 of the countries we have more than one observation before the First World War. In Table 7 we have assembled the changes in the shares of the top 1 per cent and top 0.1 per cent for certain key periods, such as the world wars, and the crash of 1929–32, as well as for the whole period up to 1949.

The first striking conclusion is that the top shares in 1949 were much lower than thirty years earlier (1919) in the great majority of countries. Of the 18 countries for which we can make the comparison with 1919 (or in some cases with the early 1920s), no fewer than 13 showed a strong decline in top income shares. In only 1 case (Indonesia) was there an increase in the top shares. In half of the countries, the fall caused the shares to be at least halved between 1919 and 1949. For countries where one can compare 1949 with 1913–14, the fall generally seems at least as large.

What happened before 1914? In five cases, shown in italics, we have data for a number of years before the First World War.<sup>30</sup> Naturally the evidence has to be treated with caution and has evident limitations: for example, the German figures relate only to Prussia. But it is interesting that in the two Nordic countries (Sweden and Norway) the top shares seems to have fallen somewhat at the very beginning of the twentieth century, a period when they might have been in the upward part of the Kuznets inverted-U. As is noted in Aaberge and Atkinson (2010) for Norway and Roine and Waldenström (2008) for Sweden, at that time Norway and Sweden were largely agrarian economies. In neither Japan nor the UK is there evidence of a trend in top shares. In order to explore the pre-1914 period further, data apart from the income tax records needs to be applied. Using a variety of sources including wealth data, Lindert concludes that in the United States “we know that income inequality must have risen sometime between 1774 and any of these three competing peak-inequality dates: 1860, 1913 and 1929. ... Beyond this, the evidence on the rise of unequal America is only suggestive and incomplete” (2000, page 192). Using large samples of Parisian and national estate tax returns over the 1807–1994 period, Piketty, Postel-Vinay, and Rosenthal (2006) have found

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<sup>30</sup> We are referring here to the evidence from the studies reviewed in this article. There are other sources that have used income tax data for the nineteenth century. We have earlier cited the distribution published by Stamp (1916) for 1801 in the United Kingdom. The income tax systems in Germany provide evidence going back to the middle of the nineteenth century. Hoffmann (1965, Table 123) gave estimates of the Pareto coefficient for Prussia and a number of other German states going back, in the earliest case, to 1847 (on the German income tax data, see Grant, 2005, and Dell, 2008). The data from the US Civil War income tax, and the abortive 1894 income tax, were used by Soltow (1969). In the Civil War period, he finds “remarkable stability” in the Pareto coefficient (the implied inverted Pareto coefficient is 3.33).

that wealth concentration rose continuously during the 1807–1914 period (with an acceleration of the trend in the last three to four decades prior to 1914), and that the downturn did not start until the First World War. Due to the lack of similar wealth series for other countries, it is difficult to know whether this is a general pattern.

### **The Post-War Picture**

Returning to more recent times, we can see that there was considerable diversity of experience over the period from 1949 to the beginning of the twenty-first century. If we ask in how many cases the share of the top 1 per cent rose or fell by more than 2 percentage points between 1949 and 2005 (bearing in mind that two-thirds were in the range 8 to 12 per cent in 1949), then we find the 17 countries more or less evenly divided: 6 had a fall of 2 points or more, 5 had a rise of 2 points or more, and 6 had a smaller or no change. If we ask in how many cases the inverted-Pareto–Lorenz  $\beta$  coefficient changed by more than 0.1, then this was true of 15 out of 20 countries in Table 5, with 12 showing a rise (a move to greater concentration). Examination of the annual top 1% share data for individual countries is depicted on Figures 7A-D confirms that during the 50+ years since 1949 individual countries followed different time paths.

Can we nonetheless draw any common conclusions? Is it for example the case that all were following a U-shape, and that the differences when comparing 2005 and 1949 arise simply because some countries are further advanced? Is the USA leading the way, with other countries lagging? In Table 7, we summarize the time paths from 1949 to 2005 for the sixteen countries for which we have fairly complete data over this period for the share of the top 1 per cent and top 0.1 per cent. In focusing on change, we are not interested in small differences after the decimal points. The criterion applied in the case of the share of the top 1 per cent is that used above: a change of 2 percentage points or more. For the share of the top 0.1 per cent, we apply a criterion of 0.65 percentage points (i.e. scaled by 3.25/10). In applying this, we consider only *sustained* changes. This means that we do not recognize changes due to tax reforms that distort the figures, as in the

case of Norway (Aarberge and Atkinson, 2010) or New Zealand (Atkinson and Leigh, 2008), those due to the commodity price boom of the early 1950s, as for Australia, New Zealand, and Singapore, or other changes that are not maintained for several years.

Applying this criterion, there is just one case—Finland—where there is a pattern of rise/fall/rise. The share of the top 1 per cent in Finland rose from below 8 per cent in 1949 (it has been lower before then) to around 10 per cent in the early 1960s. Of the remaining 15 countries, one can distinguish a group of 6 ‘flat’ countries (France, Germany, Switzerland, the Netherlands, Japan, Singapore), and a group of 9 ‘U-shaped’ countries (UK, USA, Canada, Australia, New Zealand, India, Argentina, Sweden, Norway).

The ten countries belonging to the second group appear to fit, to varying degrees, the U-shape hypothesis that top shares have first fallen and then risen over the post-war period. In most countries, the initial fall was of limited size. As may be seen from Table 7, the initial falls in top shares were less marked in the USA, Canada, and New Zealand than in the UK, Australia, and India. The share of the top 1 per cent was much the same in the USA and UK in 1949 but in the UK the share then halved over the next quarter century, whereas in the USA it fell by only a little over a quarter.

The frontier between the U-shaped countries and the flat countries is somewhat arbitrary and should not be overstressed. In France, after an initial reduction in concentration, the top 1% income share has begun to rise since the late 1990s (Figure 7B). In Japan and Singapore, the rebound in recent years is even more pronounced (Figures 7B and 7D). The only three countries with no sign of a rise in income concentration during the most recent period, namely Switzerland, Germany, and the Netherlands, are countries where our series stop in the late 1990s. There exists some reasonable presumption that when data become available for the 2000s, these countries might also display an upward trend. Finally, note that Switzerland and especially Germany have always been characterized by significantly larger concentration at the top than other continental European countries. This is also apparent in the observed patterns of Pareto  $\beta$

coefficients, which more generally depict the same contrast between L-shaped and U-shaped countries as top income shares (see Figures 8A and 8B).

What about countries for which we have only a shorter time series? The time series for China is indeed short, but there too the top of the distribution is heading for greater concentration. For instance, the top 1% income share in China have gradually risen from 2.6% in 1986 to 5.9% in 2003 (Figure 7D). This is still a very low top 1% share by international and historical standards, but the trend is strong (and the levels are probably underestimated due to the fact that China's estimates are based on survey data and not tax data, see Piketty and Qian 2009). China has a way to go, but the degree of concentration is heading in the direction of the values in OECD countries. Regarding the other countries with limited time coverage (Spain, Portugal, and Italy), one also observes a significant rise in income concentration during the most recent period.

### **Are Top Incomes Different?**

In Table 8 we assemble the findings for the 'next 4 per cent' (those in the second to fifth percentile groups) and the 'second vingtile group' (those in the sixth to tenth percentile groups). The values are shown for three of the dates we have highlighted: around 1919 (or at the eve of the First World War, when available), 1949, and 2005. We have added, in the final column, text comments about these groups. In three cases, the data do not allow us to estimate shares below that of the top 1 per cent, so that there are 19 countries shown.

In many cases—15 out of 19—the top 1 per cent *are* different, in the sense that the changes in income concentration have particularly affected this group. For some countries, the 'next 4 per cent' exhibit some of the same features as the top 1 per cent (as in the UK in recent decades), so that it would be fairer to talk of concentration among the top 5 per cent, but typically the second vingtile group does not share the same experience. In other cases, like China, it is a matter of degree. But this is not universal, and in Table 7 we have shown in italics the four cases (Germany, Japan, Singapore, and Portugal) where there have been changes in the next 4 per cent and below.

Being in the top 1 per cent does not necessarily imply being rich, and there are also marked differences within this group. The very rich are different from the rich. We have earlier considered the top 0.1 per cent (in Table 5), and a number of the studies examine the top 0.01 per cent. Banerjee and Piketty (2005) show that in India in the 1990s it was only the top 0.1 per cent who enjoyed a growth rate of income faster than that of GDP per capita, in contrast to the situation in the 1980s when there was faster growth for the whole top percentile.

### **Composition of Top Incomes**

In France, Piketty (2003) found that the top capital incomes had not been able to recover from a succession of adverse shocks over the period 1914 to 1945; progressive income and inheritance taxation seem to have prevented the re-establishment of large fortunes. In the United States, Piketty and Saez (2003) argued that a substantial fraction of the rise in top incomes was due to a surge in top wage incomes.<sup>31</sup> Evidence from more recent years displayed on Figure 3 shows that top capital incomes have also increased significantly so that the initial conclusion of Piketty and Saez (2003) ‘top executives (the “working rich”) replaced top capital owners (the “rentiers”) at the top of the income hierarchy during the twentieth century’ based on data up to 1998 needs to be qualified. Wolff and Zacharias (2009), using the Survey of Consumer Finances, also form the view that the initial conclusion of Piketty and Saez (2003) was too strong. As they rightly point out, what happened is not so much that the “working rich” have replaced “coupon-clipping rentiers” at the top of the economic ladder, but rather that “the two groups now appear to *co-habitate* the top end of the income distribution” (2009, page 108, their italics). Their study demonstrates the importance of using a broader measure of the income from wealth.

Data on the composition of top incomes are only available for around half of the countries studied here, but a number record the decline of capital incomes and the rise of top earnings. The Japanese data show that ‘the dramatic fall in income

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<sup>31</sup> Analyzing US estate tax data up to 2000, Kopczuk and Saez (2004) show that top wealth shares have increased much less than top income shares. Kennickell (2009) obtains similar results using the Survey of Consumer Finances from 1989 to 2007.



concentration at the top was primarily due to the collapse of capital income during the Second World War' (Moriguchi and Saez, 2008). In the Netherlands, 'capital and wage incomes have traded places within the top shares [although] the increased role of the latter has not been able to prevent the decline or the stability of the top shares' (Salverda and Atkinson, 2007). In Canada, 'the income composition pattern has changed significantly from 1946 to 2000. . . . the share of wage income has increased for all groups, and this increase is larger at the very top. . . . The share of capital income [excluding capital gains] has fallen very significantly for the very top groups' (Saez and Veall, 2005). The Italian data (Alvaredo, 2010) only start in 1974 and the rise in top shares is modest: the share of the top 1 per cent rose from around 7 per cent in the mid 1970s to around 9 per cent in 2004. But the Italian data show a rise in the role of wage income in the very top groups. In 1976, wage earnings accounted for less than 10 per cent of the income of the top 0.01 per cent, but by 2004 this had increased to over 20 per cent. In Spain, a similar calculation (from figures that omit capital gains) shows that in 1981, earnings accounted for less than 20 per cent of the income of the top 0.01 per cent, but by 2004 this had increased to 40 per cent.

At the same time, the picture is not totally uniform. A major difference between the Nordic countries and the USA is the continuing importance in the former of capital income. In Sweden, Roine and Waldenström (2008) find that 'between 1945 and 1978 the wage share at all levels of top incomes became more important . . . But in 2004 the pattern is back to that of 1945 in terms of the importance of capital, in particular when we include realized capital gains'. The conclusions reached regarding Finland stress that 'the main factor that has driven up the top 1 per cent income share in Finland after the mid 1990s is an unprecedented increase in the fraction of capital income' (Jantti et al. 2010). This may reflect differences in reporting behavior following tax reforms, but it is not totally a difference between Nordic countries and the Anglo-Saxons. In Australia, Atkinson and Leigh (2007) found that 'the proportion of salary and wage income for top income groups in 2000 was quite similar to the proportion in 1980'. In the UK, it is true that the major themes have been the fall in capital incomes over the first three-quarters of the twentieth

century and the subsequent rise in top earnings, but minor themes have been an earlier fall on the share of top earners and a partial restoration of capital incomes since 1979.

## **5 SEEKING POSSIBLE EXPLANATIONS: THEORETICAL MODELS AND EMPIRICAL SPECIFICATIONS**

From the data on the changes in the upper part of the income distribution assembled for these 22 countries, certain possible explanations stand out. We have drawn attention to the falls in top income shares in countries fighting in the First and Second World Wars (and that some, but not all, non-combatant countries, were less strongly hit, or even saw an increase in top shares). According to Moriguchi and Saez (2008), ‘the defining event for the evolution of income concentration in Japan was a historical accident, namely the Second World War’ (see Figure 7B). Less momentous, but still distinctive, was the commodity price boom of 1950, which saw a rise in top shares in Australia, New Zealand, and Singapore (See Figures 7A,D). In these cases, a single event is sufficiently large for us to be content with a single variable analysis. Moreover, there is unlikely to be reverse causality, with the fall or rise in shares causing the wars or the commodity boom.

In general, however, explanations are likely to be multivariate, and we are confronted with the task of seeking to separate different influences. Piketty (2007) suggested that the database could be exploited as a cross-country panel, and this approach has been adopted by Roine, Vlachos, and Waldenström (2009) and Atkinson and Leigh (2007b). The former authors find, for example, that growth in GDP per head is associated with increases in top income shares and that financial development is pro-rich in the early stages of a country’s development. Financial development could well induce activity to shift from the informal to the formal economy, revealing incomes at least for the high skilled rather than inducing a jump in real incomes at the top of the distribution.

Multivariate statistical analysis may help us disentangle some of the factors at work. In particular, a number of the studies, following Piketty (2001, 2003),

highlight the role of progressive income taxation. But how can we be sure that there is a causal path from progressive taxation to reduced top income shares? In the UK, high top rates of income tax were first introduced during the First World War. Could these tax rates, and the reduction in top shares, not be seen as both *resulting* from third factors associated with the war and its aftermath, such as the loss of overseas income? Statistical analysis seeks to separate out the independent variation in different variables. For example, the UK was a combatant in the First World War but not the Netherlands. It may therefore be informative to compare the two countries, both of which had progressive income taxes. At the same time, there are possible third factors. Both the UK and the Netherlands faced similar global economic conditions that may have independently affected top shares. In the same way, policies other than progressive taxation may matter. First World War tax increases in the UK had been initiated by Liberal governments which pursued other redistributive policies apart from income taxation such as measures to prevent profiteering in the First World War. In the recent period, the tax cuts of the 1980s in the US and UK took place under Reagan and Thatcher who also pushed for liberalization of capital markets and privatization, both of which could have increased top income shares. There is also the possibility of reverse causality. The increases in top incomes as a result of changed executive remuneration policies may have increased political pressure for cutting top taxes. We need therefore a simultaneous, as well as multivariate, model.

Statistical analysis can help us identify independent variation, but it rarely proves fully conclusive. The conclusions that we draw inevitably involve elements of judgement. Judgement may be influenced by historical narrative. Piketty reached his conclusion regarding the role of progressive income taxation in France after an extensive discussion of the economic history of France over the twentieth century. While it would be reinforced by regression analysis in which the relevant tax rate variable had a highly (statistically) significant coefficient of a plausible magnitude, the conclusion was based on a reading of the events of the period. In the same way, the individual studies reviewed here provide each a historical narrative that in itself is part of the evidence. A number of studies, such as that on

Japan, contain evidence from a range of sources: income tax data, wealth data, estate data, and wage data. Combining these disparate sets of information is not a purely mechanical operation, and these narratives are of course subjective, reflecting the standpoints of the authors. Again they cannot be definitive. But equally they cannot be dismissed out of hand, and they play a significant role in our summary of major mechanisms in the next section.

A second set of considerations that led to the judgment concerning the importance of progressive taxation in France was based on economic theory, notably simulation models of capital accumulation. This brings us to the question as to how closely theoretical models of income distribution are linked to empirical tests of different explanations. In the income inequality literature, this link has typically been rather loose (see Atkinson and Brandolini 2006 for a survey). Theoretical models are invoked, but to produce a list of explanatory variables rather than to generate an estimating equation. The functional form is not specified, so that it is not clear how the explanatory variables should enter the estimating equation or what should be the form of the variable to be explained.

### **Modeling Capital Incomes**

One example of a clear link between theory and empirical specification is the most popular model in the income distribution literature: the Kuznets inverse-U curve. Recall that this curve is based on the structural change that takes place in an economy as it is transformed from largely agricultural (traditional) to industrial (modern). This model has however little to offer in the present context. As witnessed by the U-shape patterns for top income shares depicted on Figure 7, the inverse-U has little purchase in explaining top income shares. As far as top income shares are concerned, the basic problem with the Kuznets inverse-U model is that it focuses essentially on labor income, whereas it is clear that we need to consider both labor and capital income, and their changing roles. Indeed it is with capital incomes that we start, since historically they accounted for the bulk of top incomes.

It is often overlooked that in his Presidential Address, Kuznets (1955) evokes *two* 'groups of forces in the long-term operation of developed countries [that] make for *widening* inequality in the distribution of income' (p. 7). In addition to the structural change explanation, he also highlighted the concentration of savings in the upper income brackets and the cumulative effect on asset holding. Subsequently, Meade (1964) developed a theory of individual wealth holding, allowing for accumulation and transmission of wealth via inheritance. Stiglitz (1969) went on to show, in a general equilibrium setting, that with equal division of estates at death, a linear savings process, and persistent differences in earnings across generations, in the long run the steady-state distribution of wealth simply mirrors the distribution of earnings. To explain the extent of inequality we must appeal to explanations of the distribution of earnings. Alternative assumptions about bequests can however generate long-run equilibria where there is inequality of wealth even where earnings are equal. Stiglitz shows how the operation of primogeniture (leaving all wealth to one child) can lead in equilibrium to a stable distribution with a Pareto upper tail, with the Pareto coefficient

$$\alpha = \log[1+n] / \log[1+sr(1-t)] \quad (5)$$

where  $sr(1-t)$  is the rate of accumulation out of wealth,  $s$  being the savings rate,  $r$  being the rate of return,  $t$  the tax rate, and  $n$  is the rate of population growth (Atkinson and Harrison 1978: 213). For stability, the population growth rate has to exceed the rate of accumulation by the wealthy, so it follows that  $\alpha$  is greater than 1. The faster the rate of accumulation, the closer  $\alpha$  is to 1. Equation (5) provides an answer to the question as to how we should specify the empirical model. Approximating  $\log(1+x)$  by  $x$ , we should regress  $1/\alpha$  (or  $\beta$ ) on  $sr(1-t)/n$ . This provides a natural way of testing the impact of progressive income taxation.

However, this is deceptive, since it assumes (a) that the parameters are constant over time, and (b) that the primogeniture assumption is remotely plausible. The first of these concerns might be met by using a moving average of past tax rates. In countries such as the UK where the top tax rate was cut from 98 per cent to 40 per cent in the first half of the 1980s, there would then be a continuing rise in top income shares until the new equilibrium was approached.

The assumption about the division of estates is not plausible. Primogeniture may have applied in aristocratic England, but it was not legally permissible in most European countries (and, after 1947, Japan) and it never became widely established in the United States. On the other hand, the model can be re-interpreted in a more realistic manner. Suppose that only a fraction  $p$  of individuals are altruistic toward their children, while the others are selfish (leaving nothing), then if altruism is uncorrelated across generations the model is formally extremely close to the Stiglitz model as having an altruistic parent is equivalent to being the older sibling, and an equation similar to (5) will hold in equilibrium. More recently, Benhabib and Bisin (2007) have proposed a model with idiosyncratic rate of return on wealth across individuals and generations in an infinite horizon model. Such a model also generates a Pareto distribution for wealth which depends both on the capital income and estate tax rates.

The models of top incomes described above relate to capital income; we need now to consider possible explanations in terms of earned incomes.

### **Modeling Top Earnings**

The dominant paradigm in labor economics explains rising wage dispersion in terms of skill-biased technical change. While we agree that this literature offers important insights about the premium to college education (see, for example, Acemoglu, 2001 and Katz and Autor 1999), we do not feel that it has a great deal to say about what is happening at the very top of the earnings distribution because dramatic changes have taken place within the top decile of the earnings distribution, i.e., within college educated workers. Empirically, labor economists have discussed the top decile as a proportion of the median, but we are interested in what happens to the top percentile and within the top percentile group. The skill-bias explanation has little to say directly about why the top percentile has increased relative to the top decile.

There are in fact a number of earlier theories that are directly relevant to top earnings. One such set of theories is those dealing with executive remuneration in a hierarchical structure. The model advanced by Simon (1957) and Lydall (1959)

generates an approximately Pareto tail to the earnings distribution, with a inverse Pareto exponent given by

$$\beta = \log[1 + \text{increment with promotion}] / \log[\text{span of managerial control}] \quad (6)$$

In this form, the model is purely mechanical, but it offers a vehicle by which we may introduce a number of explanatory variables, including technological change, taxation, and changes in the size distribution of firms and other organizations. Tournament theory (Lazear and Rosen 1981), for example, has provided an explanation of the size of the necessary increment. If one considers the position of people at a particular level in an organization, deciding whether or not to be a candidate for promotion to the next rank, then they are comparing the certainty of their present position with the risk of taking a new position in which they may fail, and lose their job. The higher-rank job also involves greater effort. In the very simplest case, the worker weighs the mean gain against the risk.

A second explanation of the rise in top earnings shares in a number of countries in the second half of the post-war period is provided by the 'superstar' theory of Rosen (1981). The expansion of scale associated with globalization and with increased communication opportunities has raised the rents of those with the very highest abilities. Where the 'reach' of the top performer is extended by technical changes such as those in Information and Communications Technologies (ICT), and by the removal of trade barriers, then the earnings gradient becomes steeper. Moreover, Frank and Cook (1995) and more recently Gordon and Dew-Becker (2008) argue that the winner-take-all pay-off structure has spread beyond fields like sport and entertainment: 'it is fair to say that virtually all top-decile earners in the United States are participants in labor markets in which rewards depend heavily on relative performance' (Frank 2000: 497). This could explain the rise in the  $\beta$  coefficient in the past quarter century. Indeed Rosen made precisely this prediction in 1981, referring back to Marshall's *Principles*, where Marshall identifies 'the development of new facilities for communication, by which men, who have once attained a commanding position, are enabled to apply

their constructive or speculative genius to undertakings vaster, and extending over a wider area, than ever before' (1920: 685). As captured in the title of the book by Frank and Cook (1995), it is a *Winner-Take-All Society*, and this suggests that it can usefully be modeled as an extreme value process. The distribution of earnings in this case is given by the maximum values generated by the results of many separate 'competitions'. If we limit attention to those values exceeding some specified threshold, then for a sufficiently high threshold the distribution function takes on the generalized Pareto form (Embrechts, Klüppelberg, and Mikosch 1997: 164 or Coles 2001: 75), which has a Pareto upper tail.

Finally, considerable attention has been devoted to the effects of marginal tax rates—and especially top marginal tax rate—on the earnings distribution. Higher top marginal tax rates can reduce top reported earnings through three main channels. First, top earners may work less and hence earn less—the classical supply side channel. Second, top earners may substitute taxable cash compensation with other forms of compensation such as non-taxable fringe benefits, deferred stock-option or pension compensation—the tax-shifting channel.<sup>32</sup> Third, because the marginal productivity of top earners, such as top executives, is not perfectly observed, top earners might be able to increase their pay by exerting effort to influence corporate boards. High top tax rates might discourage such efforts aimed at extracting higher compensation.<sup>33</sup>

The central concept capturing all those behavioral responses to taxation is the elasticity of reported earnings with respect to the net-of-tax rate (defined as one minus the marginal tax rate). There is a large literature (surveyed in Saez, Slemrod, and Giertz 2009) which attempts to estimate this elasticity. In general, the literature estimates this elasticity based on the sum of labor and capital income

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<sup>32</sup> The taxation of stock options varies substantially across countries. In the United States, profits from stock-option exercises are included in wages and salaries for tax purposes and hence captured in the estimates. In other countries, such as France, profits from stock options are taxed separately and hence are not included in the estimates.

<sup>33</sup> The welfare consequences of taxation differ widely across the three channels. The first channel creates pure tax distortions. In the second channel, the tax distortion is reduced by 'fiscal externalities' as tax shifting might generate deferred tax revenue as well. In the third channel, taxes can actually correct a negative externality if the contract between the executive and the board does not take into account the best interests of shareholders and other wage earners.



although, as we discussed above, the effects of tax rates on capital income might have a fairly long lag.

With a constant and uniform elasticity  $e$ , and a marginal tax rate  $t$ , by definition, reported earnings will be:  $z=z^0(1-t)^e$ , where  $z^0$  is reported income when the marginal tax rate is zero. Therefore, the top income share will be proportional to  $(1-t_T)^e$  where  $t_T$  is the top group marginal tax rate on earnings. Therefore, top income shares, combined with information on marginal tax rates by income groups, can be used to test this theory and estimate the elasticity  $e$  with a log-form regression specification of the form:

$$\log(\text{Top Income Share}) = \alpha + e \log(1-t_T) + \varepsilon,$$

As discussed below, Saez (2004) proposes such an exercise with US data from 1960 to 2000. Atkinson and Leigh (2007b) and Roine, Vlachos, and Waldenström (2009) combine data from several countries (and include several other variables) to test this relationship. In all those studies, top marginal tax rates do seem to negatively affect top income shares, although causality is difficult to establish. Another limiting factor to extend such an analysis is the absence of systematic series on marginal tax rates by income groups.<sup>34</sup>

### **Combining Capital and Earned Income**

In order to explain the shifting mix of capital and earned income, we need to bring the two income sources together in a single model. This crucially depends on their joint distribution. Are those with large capital incomes also those with high salaries, accumulating assets over their careers? Or are there, as assumed in classical distribution theories, separate classes of ‘workers’ and ‘capitalists’?

The latter case, with two distinct groups with high incomes, is the easier to handle. We can consider the upper tail of the income distribution being formed as a mixture of the two upper tails. Where however people receive both earned and capital income, we have to make assumptions about their correlation. Where they

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<sup>34</sup> Top marginal income tax rates may not approximate well effective marginal tax rates in upper income groups because of various exemptions, special provisions, the presence of other taxes such as social security contributions, or local income taxes. When top tax rates were extremely high, the fraction of taxpayers in the top bracket was often extremely small as well so that the marginal tax rate in the top 1% was substantially lower than the top marginal tax rate.

are independent, we have the convolution of the two distributions. However, this approach does not offer any obvious simple functional forms (since we are adding not multiplying the two components). Moreover, it seems more realistic to assume some positive degree of correlation. In the extreme case where people are ranked the same in the two distributions, we can form the combined distribution by inverting the cumulative distribution. In the case of a Pareto distribution, by inverting equation (1), we can express income  $y$  as  $y = [A/(1-F)]^{1/\alpha}$  where  $F$  is the percentile rank and  $\alpha$  the Pareto coefficient. Let us assume that both earned income and capital income are Pareto distributed with coefficients  $\alpha_l$ , and  $\alpha_k$  respectively, so that, if we add earned and capital income, we have total income as

$$[A/(1-F)]^{1/\alpha_l} + [B/(1-F)]^{1/\alpha_k} \quad (7)$$

Where  $\alpha_k < \alpha_l$ , the ratio of capital to earned income rises as we move up the distribution.

The different elements may be brought together in a simple decomposition. Taking for illustration the share of the top 1%, this can be broken down as follows:

$$\begin{aligned} & \text{Share of top 1\%} = \\ & \text{Proportion of earned income} \times \text{Share of top 1\% of earners} \\ & \times \text{Alignment coefficient for earnings} \\ & + \\ & \text{Proportion of capital income} \times \text{Share of top 1\% with capital income} \\ & \times \text{Alignment coefficient for capital income} \quad (8) \end{aligned}$$

The 'alignment coefficient' for earnings (capital income) is the share in earnings (capital income) of the top 1 per cent of income recipients divided by the share of top 1 per cent of earners (capital income recipients). Since the top 1 per cent of earners (capital income recipients) are not necessarily in the top 1 per cent of income recipients, the alignment coefficient is by definition less than or equal to 1. It is equal to 1 in the case discussed at the end of the previous paragraph, but in a class model where no workers are in the top 1 per cent the coefficient is zero. Evidence about the degree of alignment in the case of Sweden is provided by

Roine and Waldenstrom (2008), which show the distribution of wealth both ranked by wealth and by total income. They show that the share in total wealth of the top 1 per cent is some 5 to 10 percentage points lower when ranked by total income, but the two series move closely together over time.

The above examples give some idea of the strength of assumptions that is necessary to bridge the gap between theoretical models and empirical specification. For some readers the assumptions required may indeed be a bridge too far, and proof that we have simply to accept ad hoc specifications. Other readers however may see the formulation as solid ground in shifting sands, even if some way removed from where we would like to be. Our view is that micro-based models, in particular micro-based formulae for (inverse) Pareto coefficients, probably provide the most promising strategy to develop convincing empirical tests of the determinants and consequences of income and wealth concentration—probably more promising than standard cross-country regressions. However our data set, especially because of its lack of systematic decomposition between labor income and capital income components, and of systematic series on labor and capital tax rates, is unfortunately insufficient to do this in a fully satisfactory manner at this stage.

## **6 SEEKING POSSIBLE EXPLANATIONS: MAJOR THEMES**

In this section we consider some of the major explanatory factors suggested by the theoretical models described in the previous section and by the country accounts proposed in the individual country studies we have reviewed.

### **6.1 Politics and Political Economy**

The periods covered by our top income data have seen great changes in the political landscape. In 1900, all but 4 of the 22 countries analyzed were ruled by monarchies (the exceptions were Argentina, France, Switzerland, and the USA). Before the First World War, a quarter of the world's population lived as part of the British Empire. When the League of Nations was founded in 1920, there were just

forty-two member countries. Of the twenty-two countries studied, six have gained their independence since 1900. Many of the countries saw significant changes in their boundaries, such as the partition of India, and the division and reunification of Germany. Most of the countries were combatants in either the First or Second World Wars, and all were affected by these wars. The countries analyzed include four of the six that founded the European Union, and ten are current members of the EU.

The most momentous events were the world wars, and for most countries these were associated with falls in the top income shares. Starting with the Second World War, for fourteen countries we can observe the shares before and after entry into the war. Of these, one showed an increase: Argentina, where the top income shares were buoyed by expanded food exports to combatant countries (Alvaredo, 2010). The remaining thirteen all saw the top shares fall (for Germany no comparison is possible). The falls were again large: the share of the top 0.1 per cent fell by a third or more in France, the USA, Canada, the Netherlands, Japan, and Norway. For the First World War, we have fewer observations. The top shares rose in the Netherlands, which was a non-combatant, but they fell in all of the three combatants in Table 6 for whom data exist: Japan, the UK, and the USA. The fall in the USA is particularly striking, since it only entered the war in 1917, and in this case a major role is likely to have been played by the sharp economic downturns of 1918-1919 and 1920-1921, as well as the greater degree of progression of the income tax: the top marginal rate increased from 7 per cent in 1915 to 67 per cent by 1917 and was above 70 percent from 1918 to 1921.

What caused the falls in top shares during world wars? Two forces seem to have been in operation. The first, and probably much the most important, was the loss of capital income. Losses in capital income can arise through physical capital destruction directly due to the war and financial capital losses due to hyperinflation eroding the value of nominal bonds or direct redistribution due to confiscation or tax policies. There were, in some countries, losses due to the loss of territory, including the loss of colonies. For France, Piketty stresses that ‘the physical destructions induced by both World Wars were truly enormous in France. . . .

about one-third of the capital stock was destroyed during the First World War, and about two-thirds during the Second World War' (Volume I, p. 56). This was followed in 1945 by nationalization and a capital levy. The UK lost during the wars much of its capital income from abroad. In 1910 UK net property income from abroad represented 8 per cent of GNP; by 1920 it had fallen to 4.5 per cent; in 1938 it was close to 4 per cent, but by 1948 it had fallen to under 2 per cent (Feinstein 1972: table 1). In the case of Japan, Moriguchi and Saez attribute the precipitous fall in income concentration during the Second World War primarily to the collapse of capital income due to wartime regulations, inflation, and wartime destruction. They go on to argue that the change in the institutional structure under the Allied occupational reforms made the one-time income de-concentration difficult to reverse. The reductions in capital incomes also reflected the rise in corporate taxes during the wars and the restrictions on the payment of dividends.

The second mechanism by which world wars led to falls in top shares is via an equalization of earned incomes. In the USA, Goldin and Margo (1992) have applied the term 'the Great Compression' to the narrowing in the United States wage structure in the 1940s: 'when the United States emerged from war and depression, it had not only a considerably lower rate of unemployment, it also had a wage structure more egalitarian than at any time since' (1992: 2). The war economy imposed wage controls, under the National War Labor Board, as described by Piketty and Saez (2003). In Japan, the share in total wages of the top 5 per cent wage earners fell from 19 per cent in 1939 to 9 per cent in 1944 (Moriguchi and Saez, 2008).

Along with wars went changes in political regimes, either as a consequence or as a cause. The countries studied include five that were governed by dictatorships or military rule during the period covered by our data: Argentina, Germany, Indonesia, Portugal, and Spain. It is not possible in all cases to use the top income series to investigate their distributional impact, since the dictatorship coincided with the virtual absence of data (Argentina and Indonesia). But for some countries conclusions can be drawn. Of Germany, Dell writes: 'when the Nazis came to power in 1933, the top decile had been thoroughly equalized . . . The

effect of Nazi economic administration changed radically this outcome . . . In a period of time of only five years, the pre-First World War shares were nearly recovered' (Dell (2007), p. 374). In contrast, in the case of Spain, Alvaredo and Saez (2009) find that the top income shares fell during the first decade of the Franco dictatorship. They also conclude that the transition from dictatorship to democracy was not associated with a significant change in top shares. This latter finding in turn may be contrasted with that for Portugal, where Alvaredo (2010) finds a downward jump in top shares after 1970, and particularly 1974. He notes that this 'coincided with the final period of the dictatorship and could be attributed to the loss of the African colonies and to the leftward movement of the revolutionary government after 1974, when a process of nationalizations broke up the concentration of economic power in the hands of the financial-industrial groups'.

Within democracies, the top shares may be affected by changes over time in political partisanship. It is naturally tempting to relate the observed changes over time to political variables. For example, top income shares in the US and the UK start to increase during the Reagan and Thatcher administrations (Figure 7A). Scheve and Stasavage (2009) use a panel of top income data for thirteen countries, but cannot find any strong effect of partisanship. This will doubtless be further explored. Political variables may be more relevant to explaining differences across countries, reflecting political climate and traditions. As is noted by Roine and Waldenström (2009), a distinction is often drawn between liberal (Anglo-Saxon) welfare states, corporatist-conservative (continental European) welfare states, and social democratic (Scandinavian) welfare states. This makes it interesting to compare top income shares in Sweden and Norway with those in the USA/UK and in France and Germany as we did in the panels of Figure 7.

Finally, a major change in political regime is the end of colonial rule. The twenty-two countries include three for which we have data before and after independence. In the case of Indonesia, however, there is too large a gap in time to draw conclusions. In India, as with Indonesia, independence coincided with the end of the Second World War, so that it is hard to distinguish the effect of

independence per se. Only for Singapore do we have observations for a post-war colonial period. Here, as shown in Atkinson (2010), there is little evidence of a decisive break in the top income series with self-government.

## **6.2 Macroeconomics and Financial Crises**

Today there is much interest in looking back to the Great Depression. What were the distributional consequences of major recession? Was it bad for top income shares? Among the thirteen countries for which we have data, the period 1928–31(2) saw a rise in top shares in Canada (top 1 per cent), India, Indonesia, and Ireland, and no change in Finland and Germany. The remaining seven all saw top shares reduced. The top 0.1 per cent lost a fifth or more of their income share in Australia, France, the Netherlands, New Zealand, the UK, and the USA. In many countries, therefore, the depression reduced inequality at the top.

How far is this borne out by the historical accounts for individual countries? For the USA, Piketty and Saez (2003) find that the share of the top 0.01 per cent fell sharply from 1929 to 1932, in the sense that their average income went from 300 times the mean to 200 times. In the UK the same group saw their average income fall from 300 to 230 times. In the Netherlands, the top 0.05 per cent saw their share fall from 5.6 to 3.4 per cent. In contrast, the fall in Japan in top shares was much smaller. In the case of Sweden, Roine and Waldenström (2008) draw attention to the depression hitting Sweden later in 1931 (although they note that the depression of the 1920s was more severe), and in particular the dramatic collapse of the industrial empire controlled by the Swedish industrialist Ivar Kreuger in 1932. They show that between 1930 and 1935 there was a drop from 50 per cent to 43 per cent in the top percentile wealth share but an even larger drop in the wealth of the top one percent of income earners, from 38 per cent in 1930 to 26 per cent in 1934.

1929, like 2008, combined the onset of a wide recession with a financial crisis. What can we say about the latter from other episodes of financial crisis? In the case of Norway, there are grounds for believing that the Kristiania crash in 1899 led to a fall on top income shares (Aaberge and Atkinson, 2010). Much more

recently, however, the Norwegian banking crisis of 1988–92 does not appear to have led to a fall in top shares, although it may have postponed the increases associated with financial market liberalization. It is possible that today's financial crises are different from those in the past in their distributional consequences. In the case of Singapore, top income shares rose following the financial crisis of 1996–7, even if they have fallen back to some extent subsequently. In Indonesia (Leigh and van der Eng, 2008), there are some similarities.

Turning to the wider macroeconomic determinants of top shares, we saw in our discussion of the theoretical models that an important role is potentially played by the relative shares of earned and capital income. These are related to, but not identical to, factor shares in GNP. As is shown by Piketty for France, the capital share in household income follows a different path from the corporate share in value added. The same is demonstrated for the US by Piketty and Saez (2003). The two shares are not the same, since between households and the total economy stand various institutions, including the company sector (which retains profits), pension funds (which own shares), and the government (which levies taxes and receives profit income). The dividends paid to pension funds, for example, generate the income which is then paid to pensioners, in whose hands it is treated as deferred earnings, so that—in these statistics—it does not appear as unearned income. It is nonetheless interesting to examine the relation between factor shares and top incomes.

The separation of national and household income is one reason why the decline of top capital incomes may have taken place even if the factor share of capital has remained unchanged. This point is made forcefully for France by Piketty (2001, 2003). Profits may be retained within the company sector and rents may be accruing to owner-occupiers or public authorities rather than to private landlords. (These are, of course, a reminder of the incompleteness of the measure of income in the income tax data.) On the other hand, in some other countries there is a correlation. Roine and Waldenström (2008) plot for Sweden the changes in the capital share of value added and the evolution of the top 1 per cent income share. The series are strongly correlated over the whole period, but with a clear



difference between the first and second half of the century. Between 1907 and 1950 the correlation is 0.94, while it drops to 0.55 between 1951 and 2000. This indicates that, at least during the first fifty years, even short-term fluctuations of top incomes follow the fluctuations of the capital share of value added as a share of GDP. They also find a downward trend in the capital share of value added over the first eighty years.

### **6.3 Global Forces**

The top income data are particularly valuable for examining global forces, since our observations span a wide variety of periods, including the previous globalization of the nineteenth century and the protectionism of the inter-war years. Series covering twenty-two countries, with much of the data on a near-annual basis, allow us to explore the common economic influences on the evolution of top shares and possible interdependencies. Important among the common forces are the degree of integration of capital markets and the movements in major commodity prices.

One line of approach is to contrast the time variation of different income groups. A common feature to most of the studies has been the difference between the time paths of the very top groups and the paths followed by those just below the top. The top 1 per cent, and certainly the top 0.1 per cent, are different from the next 9 per cent (9.9 per cent). It is indeed interesting to ask whether the top 0.1 per cent are more like their counterparts in other countries than they are like the next 9.9 per cent in their own country. If we consider possible explanatory variables, then the most obvious candidates are the rate of return, movements in commodity prices (to which we have already made references), and, in recent years, the international market for managers and for superstars.

In addition to global correlations, there are other cross-country commonalities applying to pairs of countries or to subsets of the world economy. Saez and Veall (2005) use the top income share in the USA as an explanatory variable in a regression explaining the top income share in Canada. Leigh and van der Eng (2008) show the correlation between the top income share in Indonesia

and those in other countries. They conclude that the correlation is highest with another developing country—India—but note that the correlation with Argentina is negative. This appears a rich seam for future exploration.

#### **6.4 Progressive Taxation**

In the study of France that initiated the recent series of top income studies, Piketty (2001, 2003) highlighted the role of progressive income taxation: ‘how can one account for the fact that large fortunes never recovered from the 1914–45 shocks, while smaller fortunes did recover perfectly well? The most natural and plausible candidate for an explanation seems to be the creation and development of the progressive income tax’. It should be stressed here that this conclusion refers to the impact on the distribution of *gross* income: i.e. income before the deduction of income tax. (See Table 4.2 in Atkinson (2007b) for the UK for one of the few tables that relate to the distribution of income after tax.)

Evidence about the impact of taxation is discussed in many of the studies. In the case of Sweden, Roine and Waldenström (2008) conclude that ‘Progressive taxation hence seems to have been a major contributing factor in explaining the evolution of Swedish top incomes in the post-war period. However, given that much of the fall in top incomes happens before taxes reach extreme levels and largely as a result of decreasing income from wealth, an important effect of taxation in terms of top income shares has been to prevent the accumulation of new fortunes’ (p. 382). In the case of Finland, Jäntti, Riihelä, Sullström, and Tuomala conclude that the decline in income tax progressivity since the mid 1990s is a central factor explaining the increase of top income shares in Finland. In the case of Switzerland, a country that has never imposed very high rates of taxation, Dell, Piketty, and Saez (2007) conclude that the observed stability of top shares is consistent with the explanation of trends elsewhere in terms of tax effects.

Outside Europe, Moriguchi and Saez (2008) recall in the case of Japan ‘that the enormous fortunes that generated the high top 1 per cent income share in the pre-Second World War period had been accumulated at the time when progressive income tax hardly existed and capitalists could reinvest almost all of

their incomes for further capital accumulation' (p. 728). They go on to say that the fiscal environment faced by Japanese capitalists after the Second World War was vastly different: the top marginal tax rate for individual income tax stayed at 60–75 per cent from 1950 until the 1988 tax reform. Progressive taxation hindered the re-accumulation of large wealth, resulting in more equal distribution of capital income. This is the same mechanism that Piketty had earlier identified in France, and was highlighted in the case of the USA by Piketty and Saez (2003). Noting that 'it is difficult to prove in a rigorous way that the dynamic effects of progressive taxation on capital accumulation and pre-tax inequality have the right quantitative magnitude and account for the observed facts' (p. 23), they conclude that the interpretation seems reasonable on a priori grounds.

On the other hand, there are different findings in some countries. Saez and Veall (2005) devote a whole section of their study of Canada to the role of taxation and the consequences of the drop in marginal tax rates since the 1960s. They conclude that 'the concentration of the surge in the last decade and among only the very top income shares suggests that tax changes in Canada cannot be the sole cause' (p. 847). Their econometric analysis finds that 'Canadian top income changes are much more strongly associated with similar US changes than with Canadian tax developments'. The econometric research of Leigh and van der Eng (2009) for Indonesia does not find conclusive evidence of a link with marginal tax rates. Alvaredo (2009) notes that in Portugal the top tax rate has been constant at a new lower rate for a long period, during which top shares continued to rise. The same is true for the UK (Atkinson, 2007), where top shares rose steadily over the twenty years since the top rate of income tax was reduced to 40 per cent.

As these latter cases bring out, a key element in assessing the effect of taxation concerns the *timing* of the impact. Is the current income share a function of the current tax rate or of the past tax rates? The answer depends on the underlying behavioral model. The models used by Saez (2004) to examine the relation between marginal tax rates and reported incomes are based on current tax rates. On the other hand, models of wealth accumulation typically treat the *change* in wealth as a function of the current tax rate. In this case, the present top

income shares may reflect a weighted average of past tax rates. Piketty (2001, 2003) provides numerical simulations with a fixed saving rate model, which indicate that substantial capital taxes are a serious obstacle to the recovery of wealth holdings from negative shocks, and that the barriers would be further raised if the reduction in the rate of return were to reduce the propensity to save.

## **7 CONCLUSION**

In this paper we have argued that the study of top incomes is important from the standpoint of overall inequality and of the design of public policy. The tax data, on which the studies reviewed here are based, are subject to serious limitations, which we have examined at length. The data can however, in our judgment, be used for distributional analysis, and they are the only source covering such a long run of years. The data cover much of the twentieth century, including the Great Depression, the Golden Age, and the Roaring Nineties. In some cases, the data reach back before the First World War and into the nineteenth century. The estimates presented here are designed to be broadly comparable and provide evidence for more than 20 countries, containing more than half of the world's population.

It will be clear to the reader that much remains to be done. Major countries, such as Brazil and Russia, are still missing from the database; and Latin America is represented only by Argentina. Only a start has so far been made on testing different explanations and on evaluating the impact of policy. The results from income tax data need to be combined with those from other sources of evidence, such as the data on inherited wealth (Piketty, 2009), on long-run studies of company data (for example, Frydman and Saks, 2009, and Kaplan and Rauh, 2010) and of key sectors such as the financial industry (Philippon and Reshef, 2009). We hope however to have demonstrated the potential of the field and we hope that the data will provide a rich source for future researchers.

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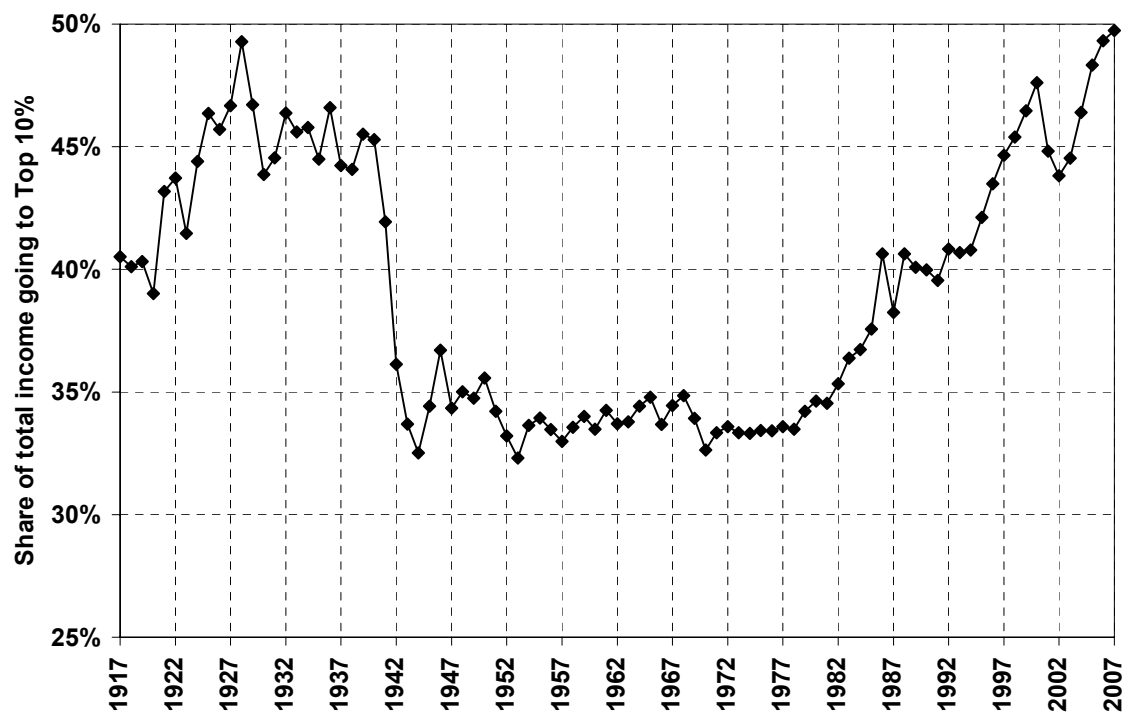
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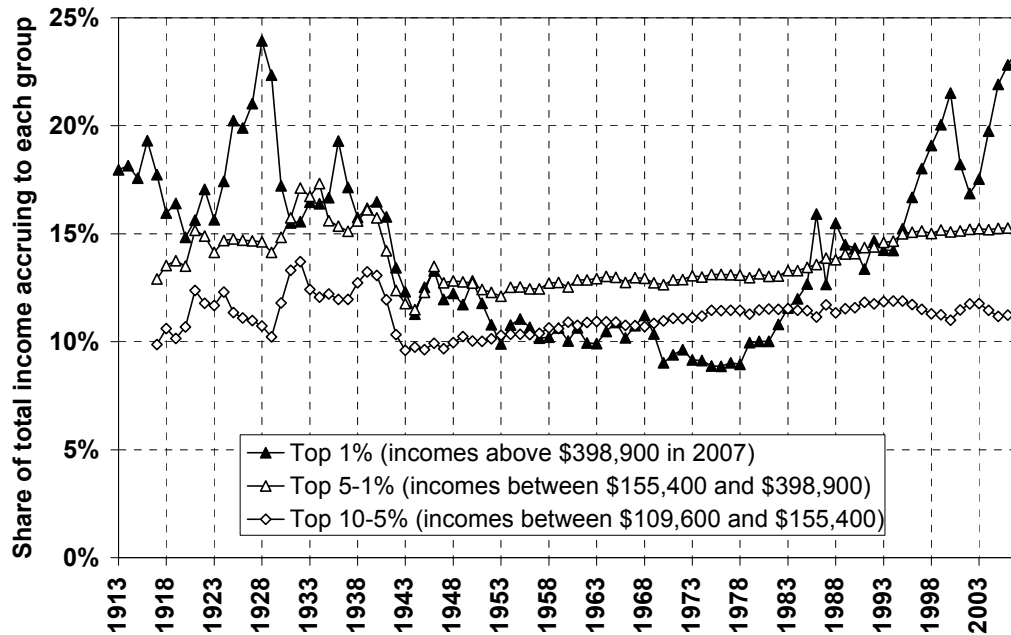
**FIGURE 1**

The Top Decile Income Share in the United States, 1917-2007

Source: Piketty and Saez (2003), series updated to 2007.

Income is defined as market income including realized capital gains (excludes government transfers).

In 2007, top decile includes all families with annual income above \$109,600.



**FIGURE 2**

**Decomposing the Top Decile US Income Share into 3 Groups, 1913-2007**

Source: Piketty and Saez (2003), series updated to 2007.

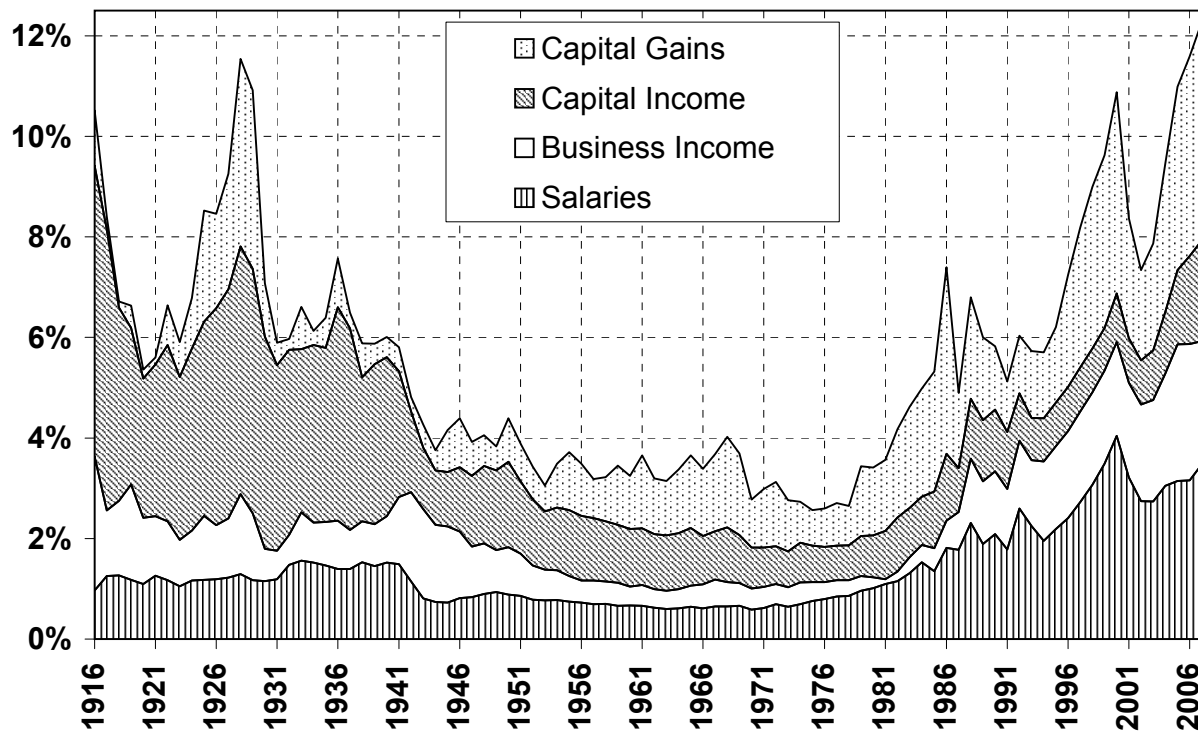
Income is defined as market income including capital gains (excludes all government transfers).

Top 1% denotes the top percentile (families with annual income above \$398,900 in 2007)

Top 5-1% denotes the next 4% (families with annual income between \$155,400 and \$398,900 in 2007)

Top 10-5% denotes the next 5% (bottom half of the top decile, families with annual income between \$109,600 and \$155,400 in 2007).





**FIGURE 3**  
The Top 0.1% Income Share and Composition, 1916-2007

Source: Piketty and Saez (2003), series updated to 2007.

The Figure displays the top 0.1% income share and its composition.

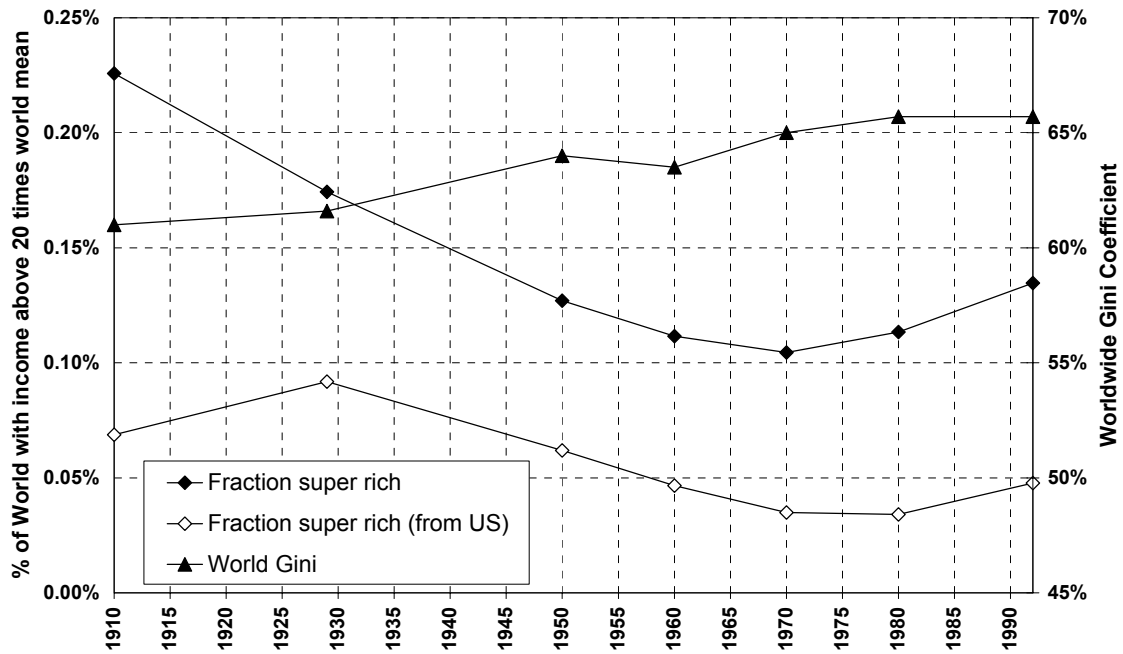
Income is defined as market income including capital gains (excludes all government transfers).

Salaries include wages and salaries, bonus, exercised stock-options, and pensions.

Business income includes profits from sole proprietorships, partnerships, and S-corporations.

Capital income includes interest income, dividends, rents, royalties, and fiduciary income.

Capital gains includes realized capital gains net of losses.



**FIGURE 4**

The Globally Super Rich and Worldwide Gini, 1910-1992

Sources: Fraction super rich series is defined as the fraction of citizens in the world with income above 20 times the world mean. Estimated by Atkinson (2007) using Bourguignon and Morrisson (2002) series.

Fraction super rich (from US) series is defined as the number of US citizens with income above 20 times the world mean divided by the world citizens. Estimated by Atkinson (2007) using Bourguignon and Morrisson (2002) series.

Worldwide Gini series is the Gini coefficient among world citizens estimated by Bourguignon and Morrisson (2002).

**Table 1. Top Percentile Share and Average Income Growth in the US**

	<b>Average Income Real Annual Growth</b>	<b>Top 1% Incomes Real Annual Growth</b>	<b>Bottom 99% Incomes Real Annual Growth</b>	<b>Fraction of total growth captured by top 1%</b>
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>
Period 1976-2007	1.2%	4.4%	0.6%	58%
Clinton Expansion 1993-2000	4.0%	10.3%	2.7%	45%
Bush Expansion 2002-2007	3.0%	10.1%	1.3%	65%

Computations based on family market income including realized capital gains (before individual taxes).

Incomes are deflated using the Consumer Price Index (and using the CPI-U-RS before 1992).

Column (4) reports the fraction of total real family income growth captured by the top 1%.

For example, from 2002 to 2007, average real family incomes grew by 3.0% annually but 65% of that growth accrued to the top 1% while only 35% of that growth accrued to the bottom 99% of US families.

Source: Piketty and Saez (2003), series updated to 2007 in August 2009 using final IRS tax statistics.

**Table 2A. Example of Income Tax Data: UK super-tax, 1911-12**

Income class		Number of persons	Total Income Assessed
At least	but less than		
£5,000	£10,000	7,767	£52,810,069
£10,000	£15,000	2,055	£24,765,153
£15,000	£20,000	798	£13,742,318
£20,000	£25,000	437	£9,653,890
£25,000	£35,000	387	£11,385,691
£35,000	£45,000	188	£7,464,861
£45,000	£55,000	106	£5,274,658
£55,000	£65,000	56	£3,295,110
£65,000	£75,000	37	£2,590,606
£75,000	£100,000	56	£4,929,787
£100,000	-	66	£12,183,724
Total		11,953	£148,095,867

Source: Annual Report of the Inland Revenue for the Year 1913-14: table 140, p. 155.

**Table 2B. Pareto-Lorenz  $\alpha$  coefficients vs. inverted-Pareto-Lorenz  $\beta$  coefficients**

$\alpha$	$\beta = \alpha/(\alpha-1)$	$\beta$	$\alpha = \beta/(\beta-1)$
1.10	11.00	1.50	3.00
1.30	4.33	1.60	2.67
1.50	3.00	1.70	2.43
1.70	2.43	1.80	2.25
1.90	2.11	1.90	2.11
2.00	2.00	2.00	2.00
2.10	1.91	2.10	1.91
2.30	1.77	2.20	1.83
2.50	1.67	2.30	1.77
3.00	1.50	2.40	1.71
4.00	1.33	2.50	1.67
5.00	1.25	3.00	1.50
10.00	1.11	3.50	1.40

Notes: (i) The " $\alpha$ " coefficient is the standard Pareto-Lorenz coefficient commonly used in power-law distribution formulas:  $1-F(y) = (A/y)^\alpha$  and  $f(y) = \alpha A^\alpha y^{1+\alpha}$  ( $A>0$ ,  $\alpha>1$ ,  $f(y)$  = density function,  $F(y)$  = distribution function,  $1-F(y)$  = proportion of population with income above  $y$ ). A higher coefficient  $\alpha$  means a faster convergence of the density towards zero, i.e. a less fat upper tail.

(ii) The " $\beta$ " coefficient is defined as the ratio  $y^*(y)/y$ , i.e. the ratio between the average income  $y^*(y)$  of individuals with income above threshold  $y$  and the threshold  $y$ . The characteristic property of power laws is that this ratio is a constant, i.e. does not depend on the threshold  $y$ . Simple computations show that  $\beta = y^*(y)/y = \alpha/(\alpha-1)$ , and conversely  $\alpha = \beta/(\beta-1)$ .

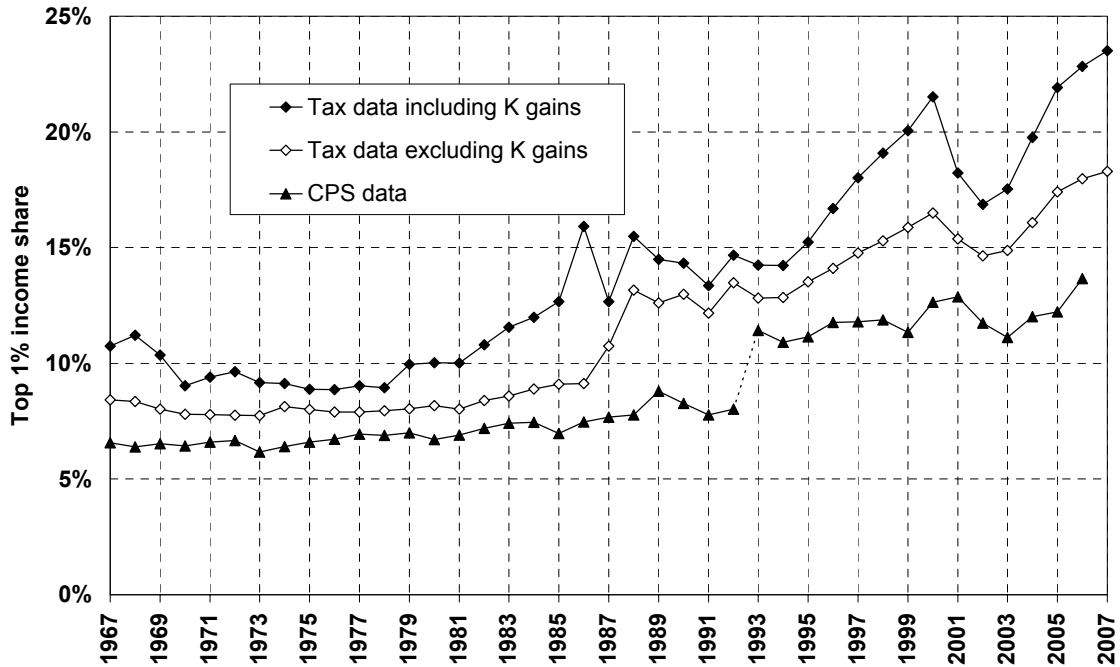
**Table 4. Inequality changes from 1976 to 2006, CPS vs. Tax Data Comparison**

	(1)	(2)	(3)	(4)
<b>A. Top percentile Income Shares</b>				
	<b>CPS data</b>		<b>Tax data excluding K gains</b>	<b>Tax data including K gains</b>
1976	6.7%		7.9%	8.9%
2006	13.7%		18.0%	22.8%
Raw point increase	6.9		10.1	14.0
Point increase (removing the '92-'93 CPS discontinuity)	4.1			
Point increase (removing the TRA'86 discontinuity)			7.0	
<b>B. Gini Coefficients</b>				
	<b>CPS data</b>	<b>CPS data (bottom 99%)</b>	<b>CPS (correcting top 1% with tax data excluding K gains)</b>	<b>CPS (correcting top 1% with tax data including K gains)</b>
1976	39.8%	35.5%	40.5%	41.1%
2006	47.0%	38.6%	49.3%	51.9%
Raw point increase	7.2	3.2	8.8	10.8
Point increase (removing the '92-'93 CPS discontinuity)	5.3	3.2		
Point increase (removing the TRA'86 discontinuity)			7.0	

Panel A presents top 1% income shares in 1976 and 2006 from CPS (estimated by Burkhauser et al. 2009 replicating the method of Piketty and Saez (2003) with CPS data) in col. (1), tax data excluding realized capital gains (from Piketty and Saez, 2003) in col. (3), tax data including realized capital gains (from Piketty and Saez, 2003) in col. (4). The next row shows the percentage increase from 1976 to 2006 for all three series. The CPS raw series displays a large discontinuity from 1992 to 1993 due to changes in measurement of top incomes (see Figure 4A). Therefore, we also present in the next row the percentage increase when eliminating this discontinuity (using a proportional adjustment to series before 1993 so that the top 1% share is constant from 1992 to 1993).

The tax data series excluding capital gains displays a significant increase from 1986 to 1988 due to the Tax Reform Act of 1986 (see Figure 4A graphs and notes). Therefore, we recompute the percentage increase in top shares removing this discontinuity in col. (4) by assuming that top 1% income shares based on tax data grew at the same rate as raw CPS top income shares from 1986 to 1988 (and using again a proportional adjustment in series before 1988). The tax data series including capital gains does not display a discontinuity around TRA 1986 (actually, CPS based top shares grow faster during the period 1985-1990 than tax based top shares including capital gains).

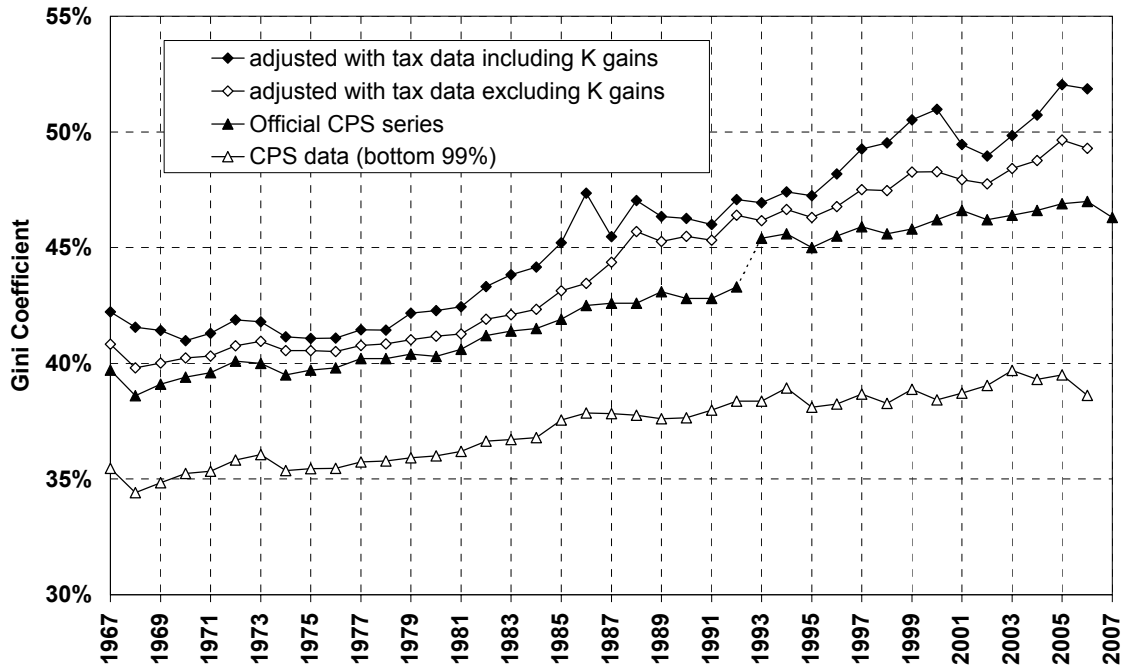
Panel B presents Gini Coefficients in 1976 and 2006 from CPS (from the official CPS series from the Census Bureau, see Figure 4B) in col. (1). Column (2) presents the Gini coefficients excluding the top 1% (as in Figure 4B). Columns (3) and (4) present the Gini coefficient adjusted for the difference in the top 1% share based on CPS data (Burkhauser et al. 2009) and the top 1% share based on tax data (excluding capital gains in col. (3) and including capital gains in col. (4)). The next row shows the percentage point increase from 1976 to 2006 in all four series. The CPS raw series displays a large discontinuity from 1992 to 1993 due to changes in measurement of top incomes (see Figure 4A). Therefore, we also present in the next row the percentage point increase when eliminating this discontinuity (using a proportional adjustment to series before 1993 so that the Gini series is constant from 1992 to 1993). The next row also presents the percentage point increase in the Gini coefficient when correcting the top 1% income share excluding capital gains for the increase from 1986 to 1988 (as done in Panel A).



**FIGURE 5A**  
Comparing Top 1% Income Share from Tax and CPS data

Sources: Top 1% income share series based on tax data is from Piketty and Saez (2003), updated to 2007. Series excluding capital gains display a sharp increase from 1986 to 1988 due to the Tax Reform Act of 1986 which resulted (a) a shift from corporate income toward individual business income, (b) a surge in top wage incomes. Before TRA 1986, small corporations retained earnings and profits accrued to shareholders as capital gains eventually realized and reported on individual tax returns. Therefore, income including capital gains does not display a discontinuity around TRA 1986 (1986 is artificially high due to high capital gains realizations before capital gains tax rates when up in 1987).

Top 1%: CPS data series is from Burkhauser et al. (2009). Series display a 3.5 percentage point jump upward from 1992 to 1993 due entirely to changes in measurement and survey collection methods. Burkhauser et al. (2009) use CPS data to replicate Piketty and Saez (2003) using the same family unit definition and same income definition. CPS data do not include any information on capital gains.



**FIGURE 5B**  
CPS Gini Coefficients: correcting top 1% with tax data

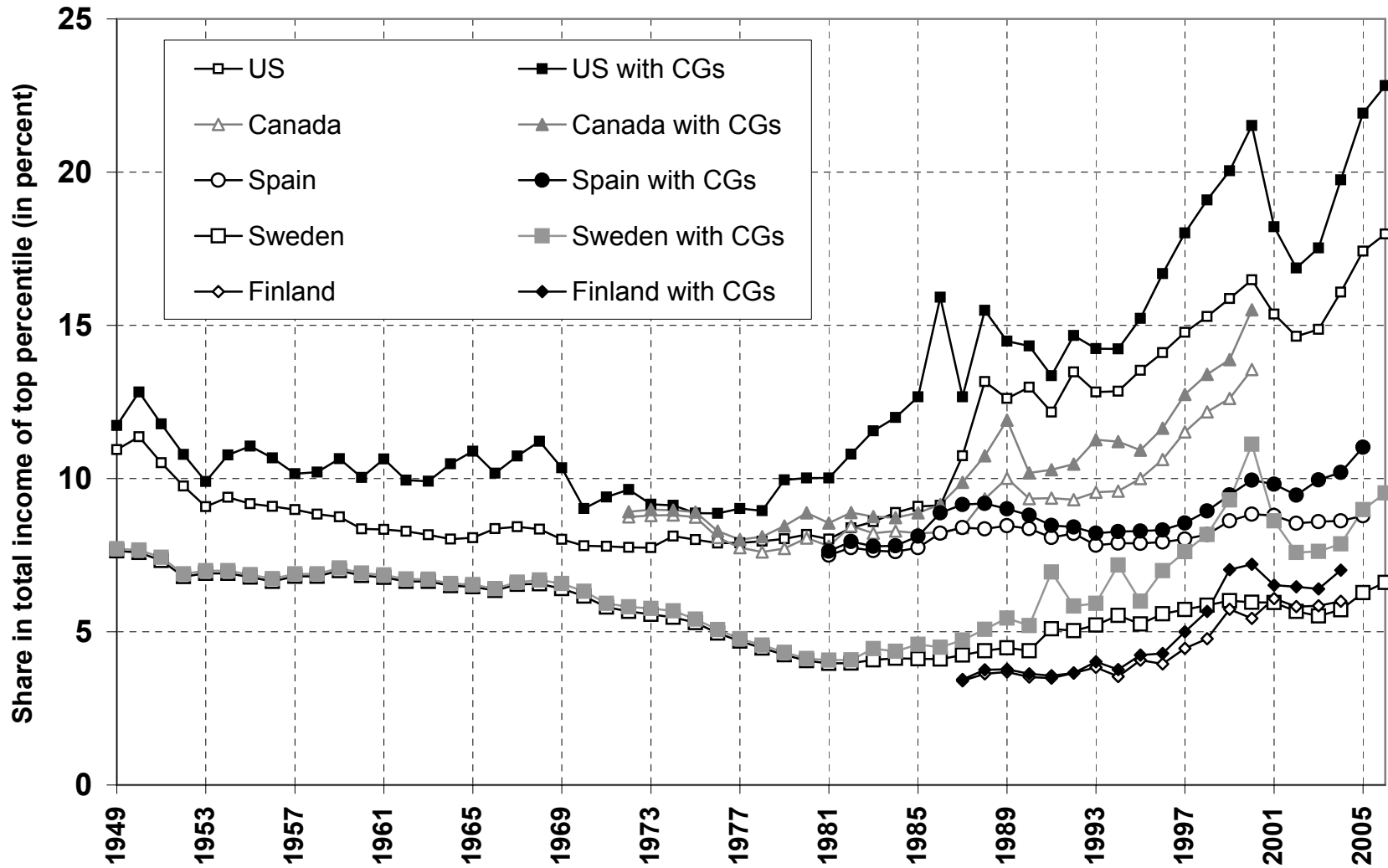
Official CPS data series is the official Gini coefficient estimated from CPS data by the Bureau of Census (Current Population Reports, Series P60-231). The unit of analysis is the household (not the family) and income includes cash transfers. The discontinuity from 1992 to 1993 is due to changes in measurement and survey collection methods.

CPS data (bottom 99%) series report the Gini coefficient based on CPS data but excluding the top 1%. We have computed those series using the formula  $G=(1-S)G_0+S$  from Atkinson (2007) where  $G$  is the Gini for the full population (Official CPS series),  $G_0$  the Gini for the bottom 99%, and  $S$  is the top 1% income share (from Burkhauser et al. 2009, depicted on Figure 4A). Note that the discontinuity from 1992 to 1993 vanishes entirely for the bottom 99% Gini demonstrating that the discontinuity in the Gini is entirely due to changes in the measurement and censoring of top incomes within the top 1%.

Adjusted tax data series adjusts the CPS Gini coefficient for the rise in the top percentile share in the tax data not captured by the CPS. Defining as  $D$  the difference in the top percentile shares from tax data (from Piketty and Saez, 2003) and the CPS data (from Burkhauser et al. 2009), the adjusted Gini is computed as  $(1-D)*G+D$  where  $G$  is the Official CPS Gini series (displayed in the graph). We have made those corrections both using the tax data series including capital gains and using tax data series excluding capital gains. Again, the fact that the discontinuity from 1992 to 1993 disappears in those corrected series confirms that the discontinuity in the official CPS Gini series is entirely due to changes in the measurement of top incomes within the top 1%.

The Gini correction using series including capital gains is the most meaningful economically because (a) realized capital gains are a significant source of income at the top (as many corporations retain substantial earnings or distribute profits using share repurchases instead of dividends), (b) top 1% income share series including capital gains are not affected as much by tax manipulation around TRA 1986 (as explained in the notes to Figure 4A).

Figure 6. Effect of capital gains on share of top percentile, 1949-2006





**Table 5. Comparative top income shares**

	Around 1949			Around 2005		
	share of top 1%	share of top 0.1%	$\beta$ coefficient	share of top 1%	share of top 0.1%	$\beta$ coefficient
Indonesia	19.87	7.03	2.22			
Argentina	19.34	7.87	2.56	16.75	7.02	2.65
Ireland	12.92	4.00	1.96	10.30		2.00
Netherlands	12.05	3.80	2.00	5.38	1.08	1.43
India	12.00	5.24	2.78	8.95	3.64	2.56
Germany	11.60	3.90	2.11	11.10	4.40	2.49
United Kingdom	11.47	3.45	1.92	14.25	5.19	2.28
Australia	11.26	3.31	1.88	8.79	2.68	1.94
United States	10.95	3.34	1.94	17.42	7.70	2.82
Canada	10.69	2.91	1.77	13.56	5.23	2.42
Singapore	10.38	3.24	1.98	13.28	4.29	2.04
New Zealand	9.98	2.42	1.63	8.76	2.51	1.84
Switzerland	9.88	3.23	2.06	7.76	2.67	2.16
France	9.01	2.61	1.86	8.73	2.48	1.83
Norway	8.88	2.74	1.96	11.82	5.59	3.08
Japan	7.89	1.82	1.57	9.20	2.40	1.71
Finland	7.71		1.63	7.08	2.65	2.34
Sweden	7.64	1.96	1.69	6.28	1.91	1.93
Spain			1.99	8.79	2.62	1.90
Portugal		3.57	1.94	9.13	2.26	1.65
Italy				9.03	2.55	1.82
China				5.87	1.20	1.45

Notes:(1) 1939 for Indonesia, 1943 for Ireland, 1950 for Germany and the Netherlands, 1954 for Spain

(2) 1995 for Switzerland, 1998 for Germany, 1999 for Netherlands, 1999-2000 for India 2000 for Canada and Ireland, 2002 for Australia, 2003 for Portugal 2004 for Argentina, Italy, Norway and Sweden

(3)  $\beta$  coefficients are calculated using share of top 0.1% in top 1% (see Tables 13A.23 and 13A.24), with the following exceptions:

- (i)  $\beta$  coefficient for Finland in 1949 calculated using share of top 1% in top 5%
- (ii)  $\beta$  coefficient for Spain in 1949 calculated using share of top 0.01% in top 0.05%
- (iii)  $\beta$  coefficient for Portugal in 1949 calculated using share of top 0.01% in top 0.1%
- (iv)  $\beta$  coefficient for Ireland in 2000 calculated using share of top 0.5% in top 1%

**Table 6. Summary of changes in shares of top 1 per cent and 0.1 per cent before 1949**

<i>Country</i>	<i>Share of top 1 per cent</i>	<i>Share of top 0.1 per cent</i>
France	1928-31: lose 2 points WW2: lose 4 points 1949 = half of 1914	1928-31: lose a fifth WW2: halved 1949 = a third of 1919
UK	- - - 1949 = half of 1914	WW1: lose a fifth 1928-31: lose a fifth WW2: lose 30 per cent 1949 = 40 per cent of 1919 <i>Pre-WW1: no obvious trend</i>
US	WW1: lose 3 points 1928-31: lose 4 points WW2: lose 3 points 1949 = 70 per cent of 1919	WW1: lose a third 1928-31: lose a third WW2: lose a third 1949 = half of 1919
Canada	1928-31: gain 1 point WW2: lose 6 points 1949 = $\frac{3}{4}$ of 1920	1928-31: no change WW2: halved 1949 = half of 1920
Australia	1928-31: lose 2½ points WW2: lose 1 point 1949 same as 1921	1928-31: lose a quarter WW2: lose a quarter 1949 = 85 per cent of 1921
New Zealand	1928-30: lose 1 point WW2: lose 2 points 1949 = $\frac{2}{3}$ of 1921	1928-30: lose a fifth WW2: lose a quarter 1949 = half of 1921
Germany	1928-32: no change 1933-38: gain 5 points 1950 = $\frac{2}{3}$ of 1938 <i>Prussia: 1914 unchanged relative to 1881 (Germany 1925 = 60% of Prussia 1914)</i>	1928-32: no change 1933-38: gain 3 points 1950 = half of 1938 <i>Prussia: 1914 unchanged relative to 1881 (Germany 1925 = half of Prussia 1914)</i>
Netherlands	WW1: gain 3 points 1928-32: lose 4 points WW2: lose 5 points 1950 = 60 per cent of 1914	WW1: gain a quarter 1928-32: lose a third WW2: lose a third 1950 = 45 per cent of 1914
Switzerland	WW2: lose 1 point 1949 is unchanged relative to 1933	WW2: lose a fifth 1949 is unchanged relative to 1933

Ireland		28-32: gain 40 per cent WW2: lose a fifth 1949 same as 1922
India	28-31: gain 2 points WW2: lose 5 points 1949 is unchanged relative to 1922	28-31: gain a fifth WW2: lose a quarter 1949 is unchanged relative to 1922
Japan	WW1: lose 3 points 28-31: lose 1 point WW2: lose 9 points 1949 = 40 per cent of 1914 <i>1914 is unchanged relative to 1886</i>	WW1: lose a tenth 28-31: lose a tenth WW2: lose two-thirds 1949 = quarter of 1914 <i>1914 is unchanged relative to 1886</i>
Indonesia	28-32: gain 5 points 1939 = 8 points higher than 1921	28-32: gain 15 per cent 1939 = quarter higher than 1921
Argentina	WW2: gain of 2 points 1949 is unchanged relative to 1932	WW2: gain of fifth 1949 is unchanged relative to 1932
Sweden	1949 is a third of 1912 <i>1912 = ¾ of 1903</i>	1949 is a fifth of 1912 <i>1912 unchanged relative to 1903</i>
Finland	28-30: no change WW2: loss of 5 points 1949 = half 1920	
Norway	WW2: lose 4 points 1949 = ¾ of 1913 <i>1913 = ⅔ of 1875</i>	WW2: lose 40 per cent
Spain		1949 = 60 per cent of 1933
Portugal		1949 = ¾ of 1936

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#### Notes

(1) WW1 denotes the First World War; WW2 denotes the Second World War

(2) "No change" means change less than 2 percentage points for top 1 per cent; less than 0.65 percentage point for top 0.1 per cent.

(2) Data coverage incomplete for part of the period for Argentina

**Table 7. Summary of changes in shares of top 1 per cent and 0.1 per cent between 1949 and 2005**

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Country	Share of top 1 per cent	Share of top 0.1 per cent
France	No change. Rose 1 point between 1998 and 2005.	Fell 1 point between 1949 and early 1980s. Rose 0.4 point between 1998 and 2005.
UK	Fell 6; rose 7½ points.	Fell 2; rose 3 points.
US	Fell 3; rose 10 points.	Fell 1; rose 6 points.
Canada	Fell 3; rose 6 points (up to 2000).	Fell 1; rose 3½ points (up to 2000).
Australia	Fell 7; rose 4 points.	Fell 2; rose 1½ points.
New Zealand	Fell 3; rose 4 points.	Fell 1; rose 1½ points.
Germany	No sustained change.	No sustained change.
Netherlands	Fell 6½ points (up to 1999).	Fell 3 points (up to 1999).
Switzerland	No sustained change.	No sustained change.
India	Fell 7½; rose 4½ points (up to 1999).	Fell 4; rose 2½ points (up to 1999).
Japan	No sustained change up to 1999; rose 1½ points between 1999 and 2005.	No sustained change up to 1999; rose ¾ point between 1999 and 2005.
Singapore	No sustained change from 1960 to 1998; rose 2 points between 1998 and 2005.	No sustained change from 1960 to 1990s; rose 2 points between 1990s and 2005.
Argentina	Fell 12; rose 4 points.	Fell 5½; rose 3 points.
Sweden	Fell 3½; rose 2 points.	Fell 1¼; rose 1¼ points.
Finland	Rose 2 points up to early 1960s; fell 6 points; rose 3½ points.	
Norway	Fell 4½; rose 8 points.	Fell 1¾; rose 4½ points.

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**Notes**

(1) "No change" means change less than 2 percentage points for top 1 per cent; less than 0.65 percentage point for top 0.1 per cent.

(2) Data coverage incomplete for part of the period for Argentina

**Table 8. Summary of changes in shares of top "next 4 per cent" and "second vintile"**

Country	"Next 4 per cent"		"Second vintile"		Text comments
France	1919	14.3	1919	8.4	"The secular decline of the top decile income share is almost entirely due to very high incomes" (Piketty, 2003).
	1949	12.7	1949	10.5	
	2005	13.0	2005	11.0	
UK	1919	11.9	1919	7.2	"This highlights the 'localised nature of redistribution'" (Atkinson 2007b, p. 96).
	1949	11.9	1949	8.9	
	1978	11.4	1978	10.7	
	2005	14.5	2005	11.2	
US	1919	13.5	1919	10.2	The next 4% and the second vintile "account for a relatively small fraction of the total fluctuation of the top decile income share" (Piketty and Saez, 2003).
	1949	12.5	1949	10.3	
	2005	15.2	2005	11.8	
Canada	1920	18.2			The "upturn during the last two decades is concentrated in the top percentile" (Saez and Veall, 2005).
	1949	14.7	1949	12.8	
	2000	15.4	2000	13.3	
Australia	1921	7.8			After 1958, "the downward trend continued for the next 4% but not for the second vintile" (Atkinson and Leigh 2007).
	1949	12.4	1949	9.1	
	2002	11.2	2002	10.4	
New Zealand	1921	14.1			After 1953, "the share of the [second] vintile was not much reduced" (Atkinson and Leigh, 2008).
	1949	12.3	1949	9.2	
	2005	12.7	2005	10.8	
Germany	1950	13.3	1950	9.5	"The bottom part of the top decile does not exhibit the same stability as the upper part. ... From the early 1960s ... the share of the bottom 9% of the top decile has been constantly growing" (Dell, 2007, p. 377).
	1998	13.1	1998	11.2	
Netherlands	1919	15.7	1919	10.1	"Most of the inter-war decline of the top 10% is restricted to the top 1%, while its post-war decline is broader and covers the upper vintile as a whole" (Salverda and Atkinson, 2007, p.
	1950	14.1	1950	10.6	
	1999	11.7	1999	11.0	
Switzerland	1949	12.3	1949	10.1	"The two bottom groups [the next 4% and the second vintile] are remarkably stable over the period" (Dell, Piketty, and Saez, 2007, p. 488).
	1995	11.5	1995	9.9	
Ireland (next 9%)	1943	30.3	-	-	"a much sharper rise [from 1990 to 2000] the higher one goes up the distribution" (Nolan 2007,p. 515).
	2000	25.8	-	-	
China					

	1986	7.2	1986	7.6	"the rise in income inequality was so much concentrated within top incomes in both countries [China and India]" (Piketty and Qian, 2009).
	2003	11.9	2003	10.2	
Japan	1919	9.6	-	-	"the income de-concentration phenomenon that took place during the Second World War was limited to within the top 1% ...[From 1992 to 2005 there has been] a sharp increase [in the share of the next 4%]" (Moriguchi and Saez, 2008).
	1949	13.8	-	-	
	2005	16.1	-	-	
Singapore	1974	12.3	1974	7.9	"Over a thirty year period there was broad stability of the very top income shares. At the same time there was some change lower down the distribution" (Atkinson, 2010).
	2005	14.6	2005	9.5	
Sweden	1919	14.9	1919	10.7	"Looking first at the decline over the first eighty years of the century, we see that virtually all of the fall in the top decile income share is due to a decrease in the very top of the distribution. The income share for the lower half of the top decile (P90–95) has been remarkably stable" (Roine and
	1949	12.3	1949	10.5	
	2005	11.1	2005	9.6	
Finland	1920	18.3	-	-	"Compared with top one per cent group, the income shares of percentile groups within the rest of the 10 per cent has risen relatively modestly over the last ten years".(Janti et al. 2010)
	1949	13.0	-	-	
	1992	12.1	-	-	
	1965	10.7	1965	9.8	
	2004	9.5	2004	8.7	
Norway	1913	12.4	1913	9.3	"Whereas the share of the top 1 per cent rose by some 7 percentage points between 1991 and 2004, the share of the next 4 per cent increased by only about 2 percentage points, and there was virtually no rise in the share of those in the [second quintile]" (Aaberge and Atkinson, 2010).
	1949	13.2	1949	11.9	
	2005	11.3	2005	9.4	
Spain	1981	13.6	1981	11.5	"the increase in income concentration which took place in Spain since 1981 has been a phenomenon concentrated within the top 1% of the distribution" (Alvaredo and Saez,
	2005	13.4	2005	11.0	
Portugal	1976	11.0	1976	8.8	"in Portugal, all groups within the top decile display important increases" (Alvaredo, 2009).
	2003	15.6	2003	11.7	
Italy	1974	12.4	1974	10.6	"the increase in income concentration which took place in Italy since the mid 1980s has been a phenomenon happening within the top 5% of the distribution" (Alvaredo and Pisano,
	2004	12.3	2004	10.3	

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Figure 7A. Top 1% share: English Speaking countries (U-shaped), 1910-2005

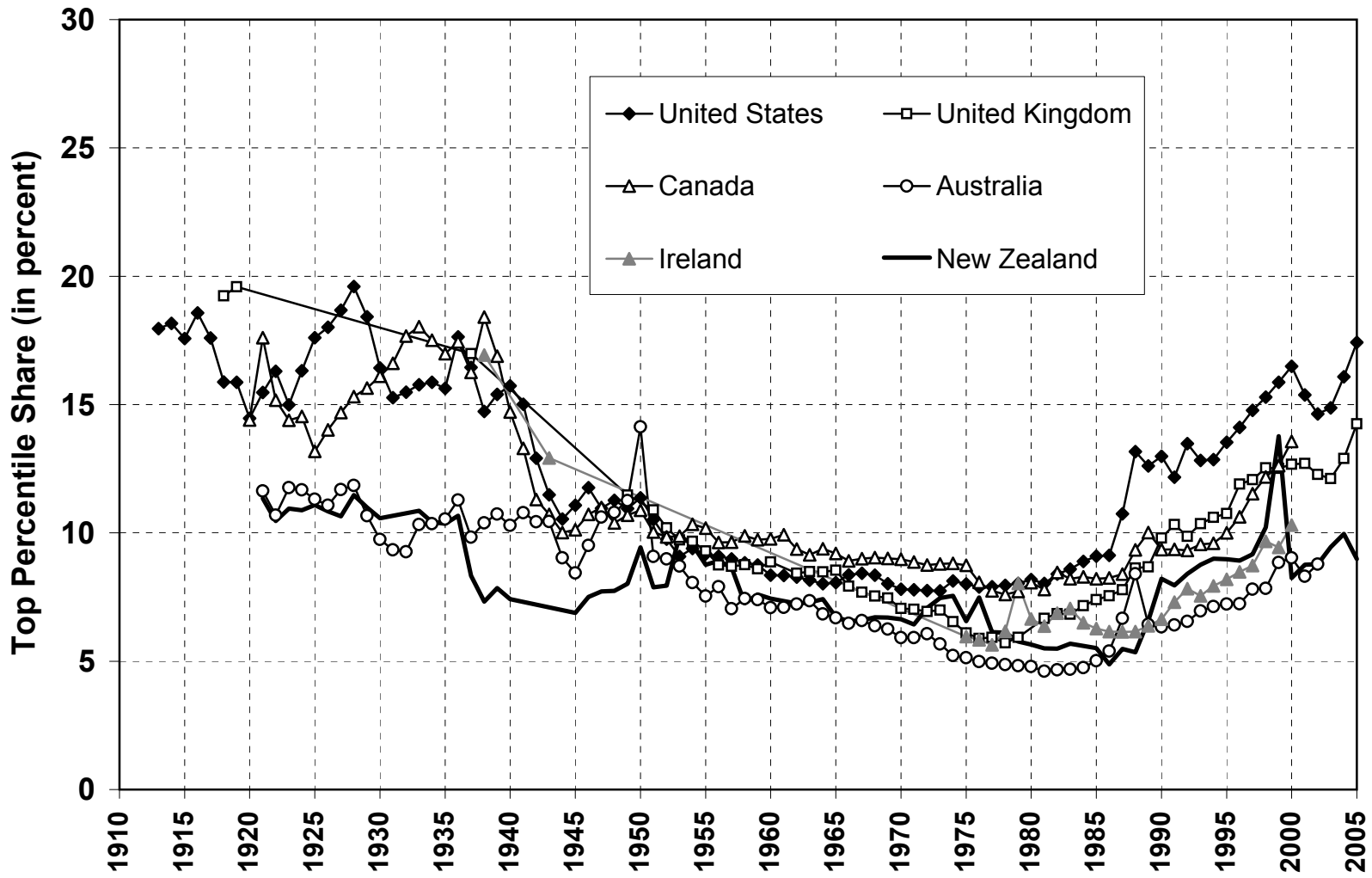


Figure 7B. Top 1% Share: Middle Europe and Japan (L-shaped), 1900-2005

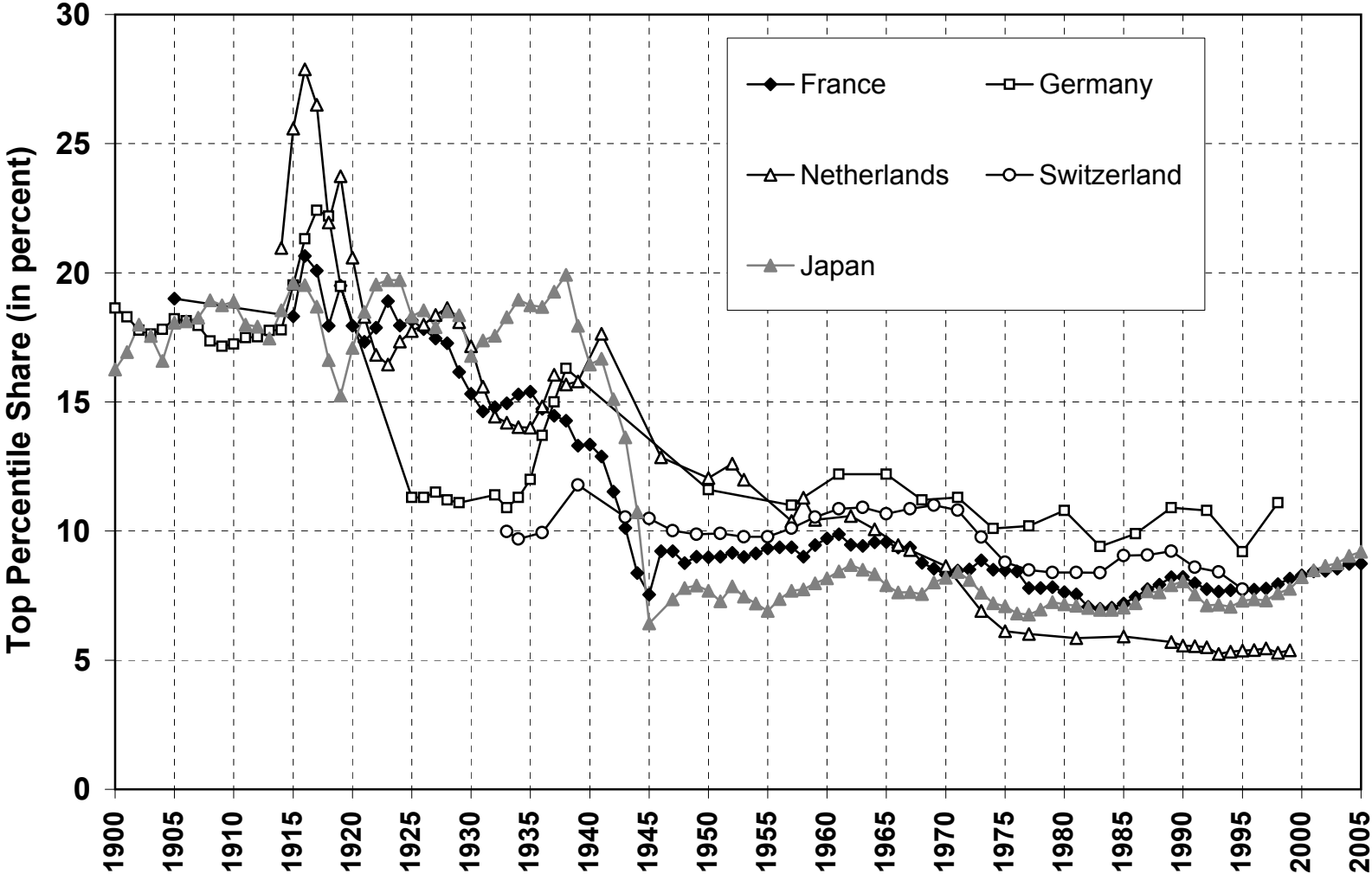




Figure 7C. Top 1% Share: Nordic and Southern Europe (U/L-shaped), 1900-2006

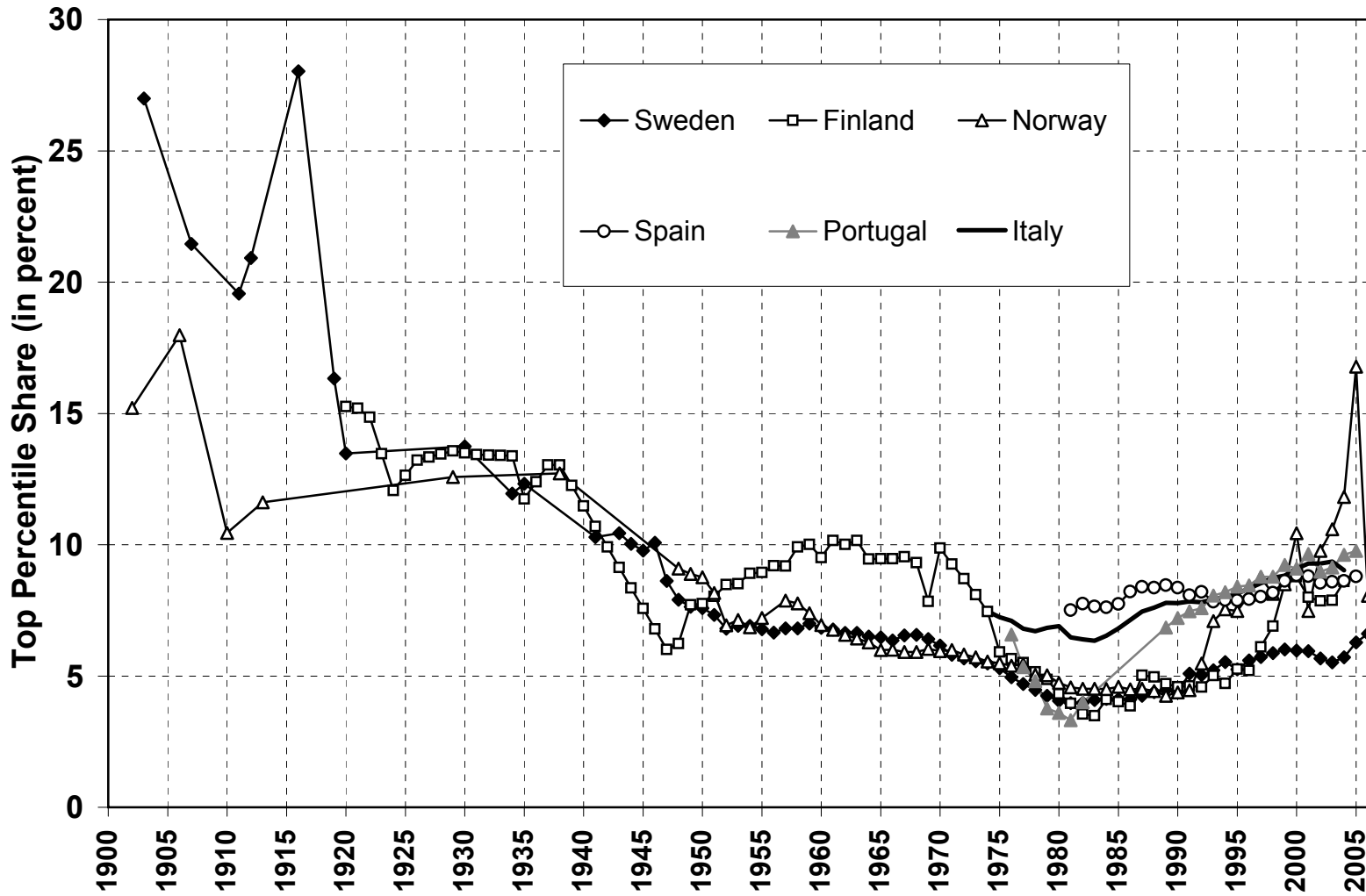


Figure 7D. Top 1% Share: Developing countries, 1920-2005

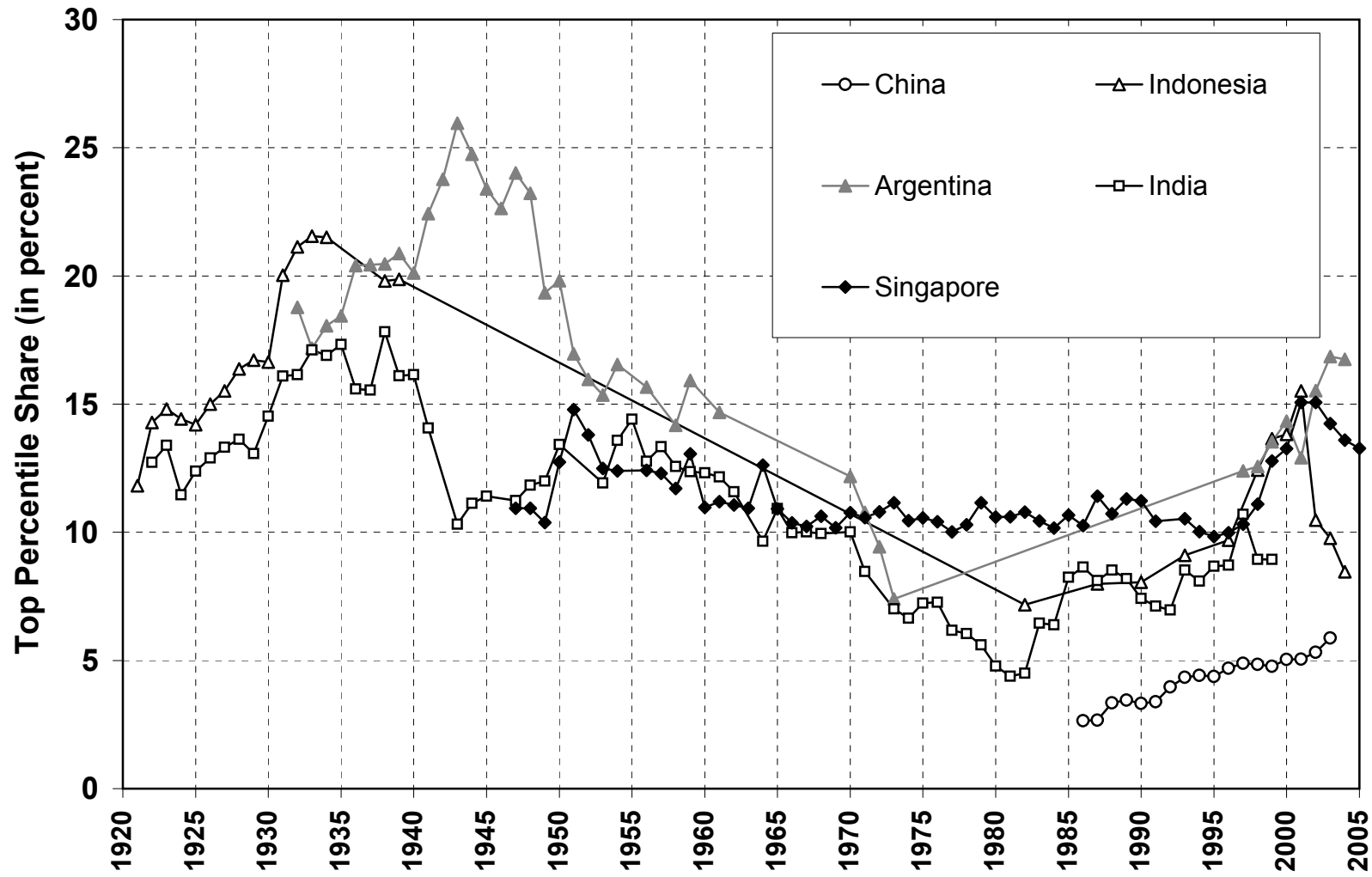


Figure 8A. Inverted-Pareto  $\beta$  coefficients: English-speaking countries, 1910-2005

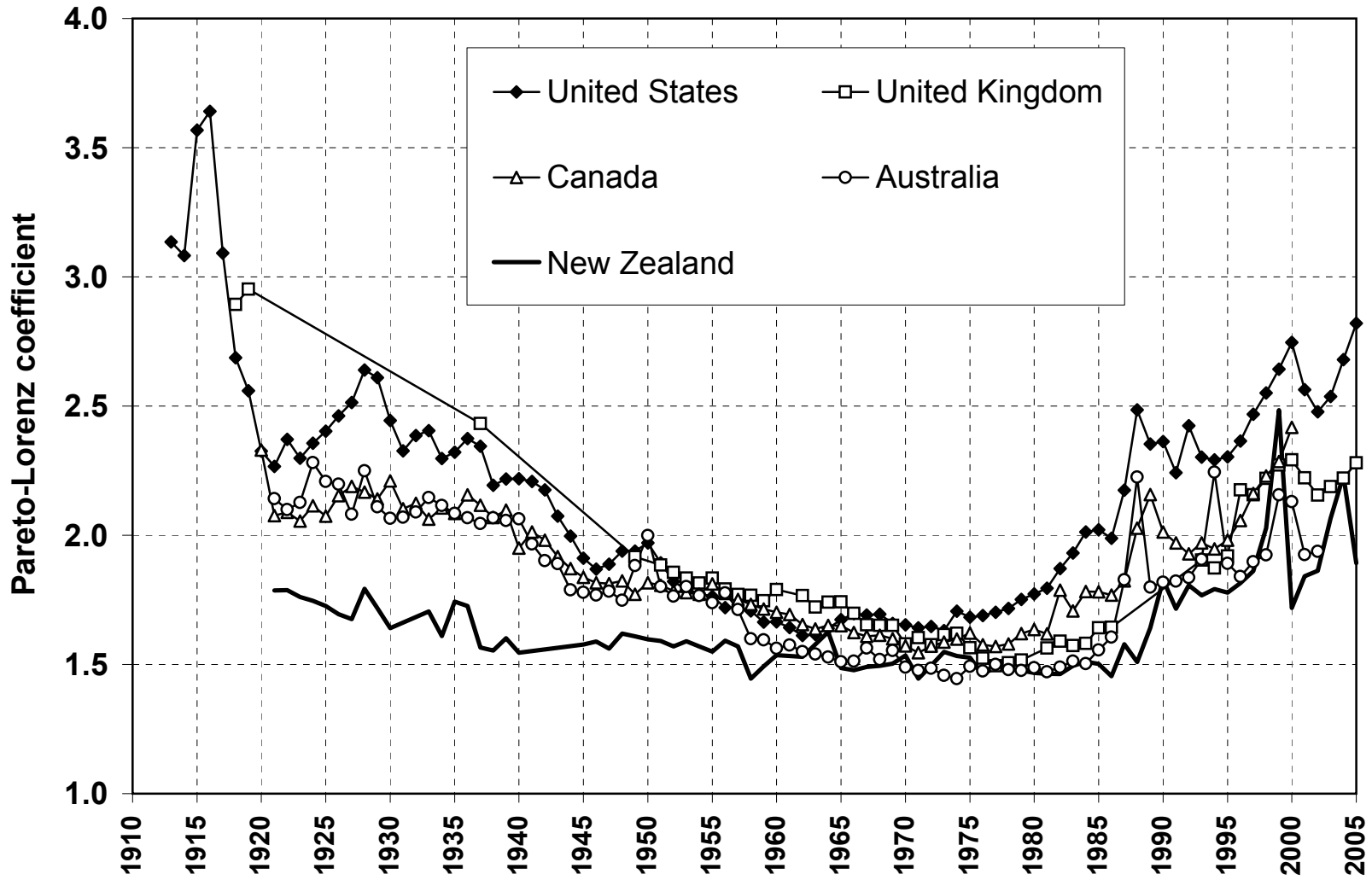


Figure 8B. Inverted-Pareto  $\beta$  coefficients, Middle Europe and Japan, 1900-2005

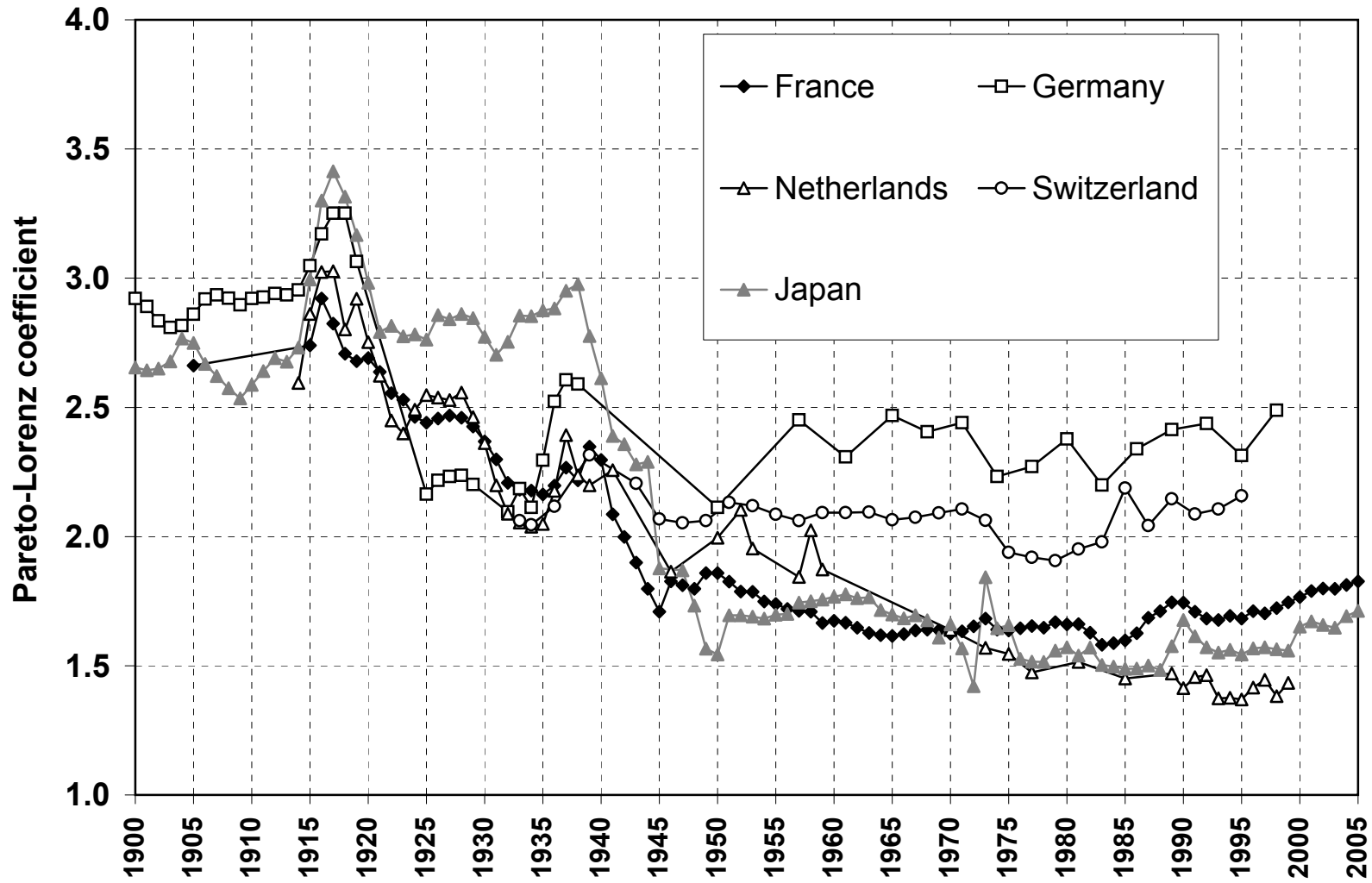


Figure 8C. Inverted-Pareto  $\beta$  coefficients, Nordic and Southern Europe, 1900-2006

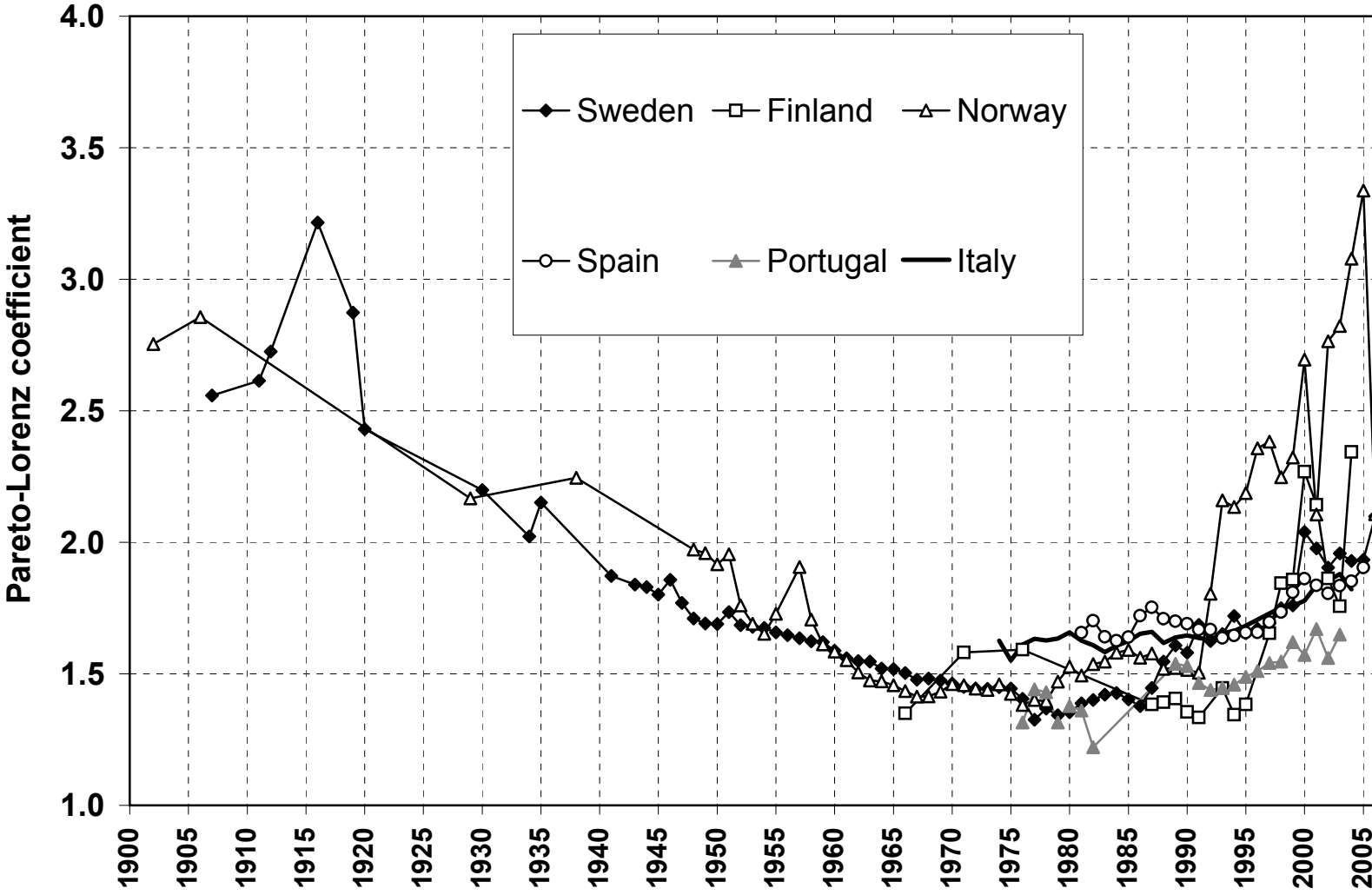


Figure 8D. Inverted-Pareto  $\beta$  coefficients, Developing Countries: 1920-2005

