the review of income and wealth

Review of Income and Wealth
Series 55, Number 1, March 2009

TOP INCOMES AND NATIONAL SAVINGS

by Andrew Leigh* and Alberto Posso

Australian National University

The relationship between income inequality and national savings is theoretically ambiguous, and past empirical studies have delivered mixed results. We revisit the question using a newly available source of data on inequality: the income share of the richest 10 percent and the richest 1 percent. Combining this with historical data on national savings rates, we are able to investigate the relationship for 11 developed countries over the period 1921–2002. We find no consistent relationship between lagged top income shares and current savings rates, and our standard errors are small enough that we are able to reject more than modest effects in either direction. We view this as suggesting that inequality at the top end of the distribution is not a major driver of national savings rates.

1. Introduction

The effect of economic inequality on the savings rate is an issue that has interested economists for at least half a century. Yet theory and empirics have produced mixed predictions and results. Some have argued that inequality should boost savings. According to Kaldor (1957), inequality should have a positive effect on savings if the rich have a higher marginal propensity to save than the poor. Similarly, Friedman (1957) suggested that those with higher current income save more than their lower income counterparts in order to compensate for lower income in the future. Under this framework, short-run fluctuations in inequality should also lead to higher savings.

Conversely, Alesina and Rodrik (1996) have shown that if higher inequality leads to higher taxation (for redistributive purposes), then inequality will lower aggregate savings. In Alesina and Rodrik (1994), they have also demonstrated that if inequality is associated with socio-political instability, it is likely to reduce investment confidence, and therefore lower the savings rate. Similarly, Aghion *et al.* (1999) have shown that in the presence of capital-market imperfections and decreasing returns to individual investments, greater inequality results in lower aggregate savings and investment. This is because the marginal productivity of investment by the rich is relatively lower than investment by the poor, and higher inequality means less investment by the poor. A posited link between inequality and savings has been suggested as one channel through which inequality might affect growth (see, e.g. Voitchovsky, 2009).

Note: We are grateful to Steve Dowrick, Tim Hatton, Gweneth Leigh, Patrice Yee Chong San, Susanne Schmidt, Luis Servén, Jonathan Skinner, Alan Taylor, Elena Varganova, two anonymous referees, and associate managing editor Marcel Timmer for valuable comments and suggestions on earlier drafts; and to Tim Callen and Alan Taylor for sharing their data on historical savings rates.

*Correspondence to: Andrew Leigh, Economics Program, Research School of Social Sciences, Australian National University, ACT 0200, Australia (andrew.leigh@anu.edu.au).

© 2009 The Authors
Journal compilation © 2009 International Association for Research in Income and Wealth Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main St, Malden, MA, 02148, USA.

Two studies which focus on the cross-country relationship between inequality and savings have found that the two variables are positively related. Using data for 49 developing countries in the 1970s and 1980s, Cook (1995) found a positive relationship between inequality (measured as the top 5 percent share, the top 10 percent share, the bottom 40 percent share, or the Gini coefficient) and gross domestic savings. Similarly, Hong (1995) found a positive relationship between the top 20 percent share and saving rates in a cross-country sample of 64 developing and developed countries, using 1960–85 averages for each country.

However, studies using panel data have tended not to find a relationship between savings and inequality. Using panel data for 11 developed and 25 developing countries from 1970–92, Edwards (1996) showed that inequality (defined as the ratio of income received by the bottom 40 percent over income received by the top 10 percent) is not significantly related to private savings. Similarly, Schmidt-Hebbel and Servén (2000), using a panel of 19 developed and 33 developing countries, did not find support for the notion that the Gini coefficient has any effect on gross national savings. Their results were robust to various specifications, including a fixed effects model for 27 countries during this period.

A closely related literature compares individuals within the United States, seeking to determine whether people with higher lifetime incomes have higher savings rates. This has direct implications for our research. If the rich save more than the poor, then a mean-preserving transfer from poor to rich would raise aggregate savings rates. However, research on this topic has not always arrived at the same conclusion. Using interview and survey data for the United States covering the period 1960–87, Bunting (1991) found evidence of a positive effect of household income inequality on savings. Similarly, using two-stage panel data techniques for the United States covering the years 1983–89, Dynan *et al.* (2004) found a strong positive relationship between personal savings rates and lifetime income. However, Gustman and Steinmeier (1999) and Venti and Wise (2001) used survey data on individuals approximating retirement age in the United States and found no correlation between wealth and savings.

The empirical literature does not show a clear picture of the relationship between savings and inequality. These conflicting results are partly explained by different functional forms, data coverage, and time periods. Another factor in cross-national regressions is the quality of the income distribution data, which is often drawn from sources that are not directly comparable.

To address these limitations, we present new empirical evidence on the relationship between top-end inequality and the savings rate, using as our measure of inequality top incomes data for 11 developed nations: Australia, Canada, France, Germany, Ireland, the Netherlands, Spain, Sweden, Switzerland, the U.K., and the U.S. To preview the results, we find no statistically significant impact of top incomes on savings. Our results are also economically insignificant; allowing us to reject large impacts of top incomes on the aggregate savings rate.

The remainder of this paper is structured as follows. Section 2 examines the data employed. Section 3 presents the statistical model and results. Section 4 presents several robustness checks, and the final section concludes.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

2. Data

Most existing studies of the relationship between savings and inequality have used income distribution data from the Deininger and Squire database (Deininger and Squire, 1996). However, as Atkinson and Brandolini (2001) have shown, results based on this dataset can be fragile since it combines inequality measures that differ in the choice of reference group (individual, family, or household), in the type of inequality being measured (income or expenditure), and in the adjustments that are made for family size and the impact of income taxation. An alternative is to rely upon a smaller but more comparable inequality dataset, such as the Luxembourg Income Study. However, the relatively small number of observations in this dataset significantly reduces the precision with which one is able to estimate within-country changes. Moreover, even using surveys that are relatively comparable, one is left with the problem that survey data tends to undersample high earners (Moore *et al.*, 2000). If what matters for savings is income inequality at the very top of the distribution, then survey data may not fully capture the variation across countries and over time.

We therefore opt to use data on the share of national income held by top groups—specifically the richest 10 percent and the richest 1 percent. Our data are drawn from 11 studies that have estimated top income shares by combining taxation statistics with external control totals for the total population and personal income. Leigh (2007) makes some minor adjustments to improve the comparability of these series: averaging across years where the tax year does not correspond to the calendar year, adjusting for series breaks, and linearly interpolating breaks of four years or less. We use this dataset in our analysis.[1]

Naturally, the top incomes series are still not perfectly comparable. One problem is that the income unit differs, since married couples file taxes jointly in some countries and separately in others. Complicating matters still further, two countries in our sample (Sweden and the United Kingdom) switched from joint to individual filing. This did not appear to have a substantial impact on the Swedish series, but the United Kingdom series is adjusted to account for this switch. Another issue is the treatment of capital gains. Where possible, our series exclude capital gains, on the basis that the timing of capital gains realizations is largely discretionary. However, it was not possible to fully separate capital gains for Australia and the United Kingdom. Partly for these reasons, all of our regressions include country fixed effects.

Our adjusted top incomes data cover the period 1921–2002. Although there are some gaps, the final sample (i.e. the number of country-year observations on inequality and savings) is extremely large. For example, when we estimate our regressions using annual data, we have 547 observations on the top 1 percent, and 501 observations on the top 10 percent. Compared with previous studies on

[1]The original sources are Alvaredo and Saez (2006); Atkinson (2007); Atkinson and Leigh (2007); Dell (2007); Dell *et al.* (2007); Nolan (2007); Piketty (2007); Piketty and Saez (2006b); Roine and Waldenström (2006); Saez and Veall (2005); and Salverda and Atkinson (2007). Leigh (2007) also uses data for Japan and New Zealand. We exclude Japan, since data are not available for the top 10 percent. An important control variable for our purposes is the interest rate. Because the dataset from which we source historical financial returns does not include New Zealand, we drop that country from our analysis as well.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

inequality and savings, this gives us significantly more degrees of freedom. For instance, our sample size is approximately twice as large as the sample used by Schmidt-Hebbel and Servén (2000).

Several existing studies (see, e.g. Edwards, 1996) have noted that since most theories about savings and inequality relate to household behavior, an ideal measure of savings would be based on household surveys. However, due to data limitations, such measures are available only for a few countries, and over a short time span.[2] We opt instead to focus on the aggregate savings rate, incorporating private and government savings. This accords with most previous studies in the cross-country literature, which have used national savings. In addition, as Alesina and Rodrik (1994) point out, the aggregate savings rate is plausibly of greater policy interest, since it is a measure of the total amount of savings available in the economy.[3] However, we also investigate the robustness of our results to using household savings as the dependent variable.

Our savings data are drawn from two sources. Over the period 1921 to 1992, we are fortunate to be able to rely upon an extensive dataset of savings rates compiled by Taylor (2002). Until 1959, Taylor's savings rate is calculated via the current account identity, as the investment rate plus the ratio of the current account to GDP. From 1960 onwards, Taylor's estimates are taken from World Bank (1994). Over the period 1993 to 2002, we use savings data from the OECD Economic Outlook database (OECD, 2006). Over the period 1986 to 1992, we have data from Taylor (2002) and the OECD (2006), and do not observe any systematic divergence. (Overall, the mean absolute difference between the two sources is just 1 percentage point.)

In our preferred specifications, we include three controls. Since the level of income may affect the savings rate, we control for log GDP per capita in real Geary-Khamis dollars, sourced from Maddison (2003, 2007). Given that individuals' savings patterns tend to change across the lifecycle, we control for the dependency ratio, being the ratio of the population aged under 15 and over 64 to the rest of the population (see Deaton, 1992, for a discussion of the relationship between the age structure and the savings rate). Also, since the interest rate may affect the savings rate, we control for the real return on bonds in local currency, sourced from Dimson *et al.* (2002). Below, we also investigate the robustness of our results to adding further controls. The Data Appendix contains summary statistics, as well as more detail on the derivation of our variables and their sources.

To give some sense of the patterns in the data, Figure 1 plots the income share of the richest 10 percent against gross savings, while Figure 2 plots the income share of the top 1 percent against gross savings. In the top incomes series, two patterns are readily discernable. In the five English-speaking countries for which we have data back to World War I, top incomes followed a U-shaped pattern over

[2]Measures of savings based on household surveys, such as the United States Survey of Consumer Finances, are extremely complicated to administer (not least because they require oversampling the rich), and are therefore only available for a small number of years.

[3]Another complication is that, as Schmidt-Hebbel and Servén (2000) point out, it is preferable to calculate the savings rate as a ratio of GNP rather than GDP, since GDP excludes net income from abroad (and is therefore closer to the income concept relevant for agents' consumption and saving decisions). Unfortunately, both our data sources use GDP as the denominator. In practice, the GDP-GNP gap for most developed nations is quite small (see, e.g. MacKellar and Reisen, 1998).

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

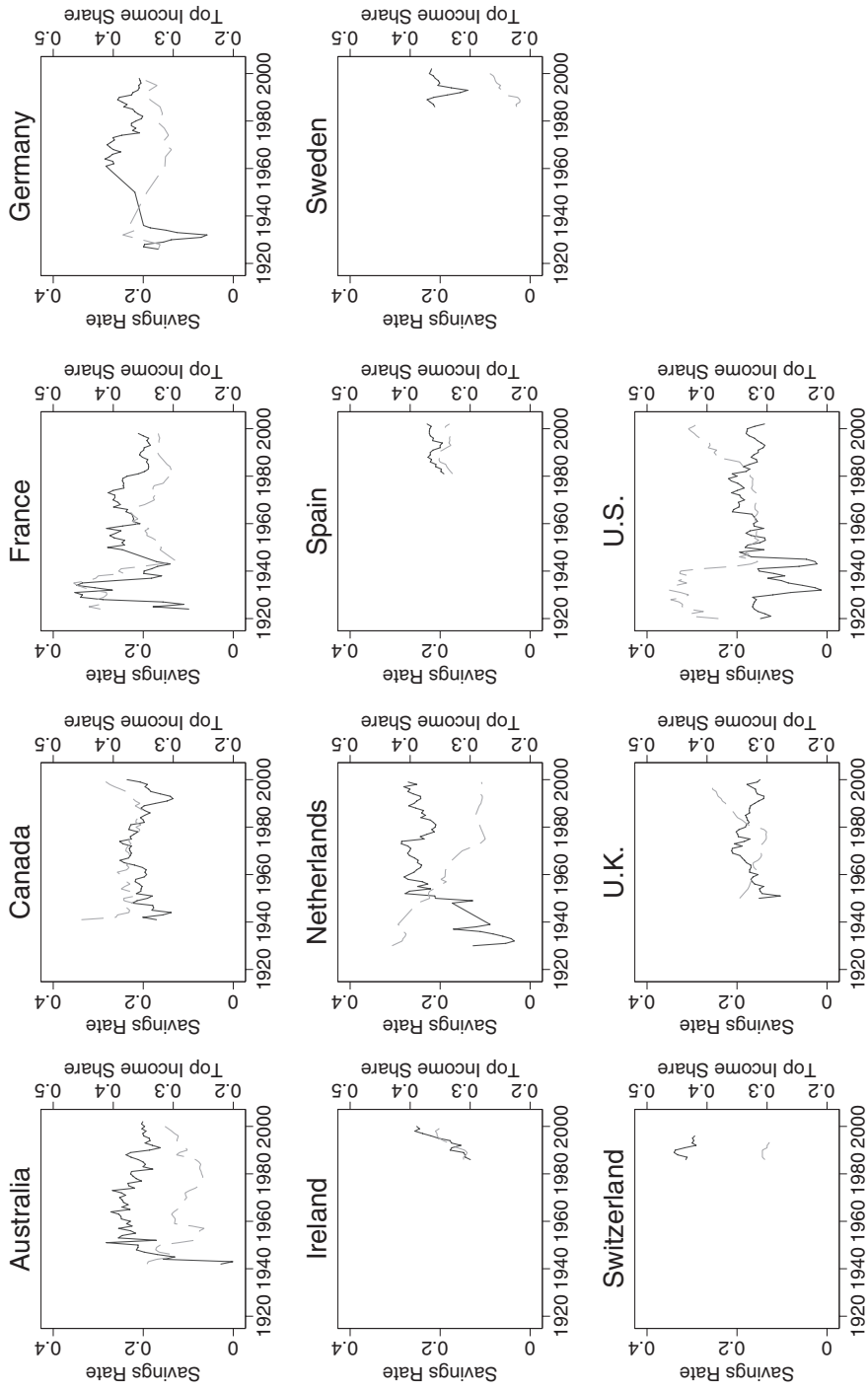

Figure 1. Savings (left axis, solid line) and the Top 10% Share (right axis, dashed line)

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

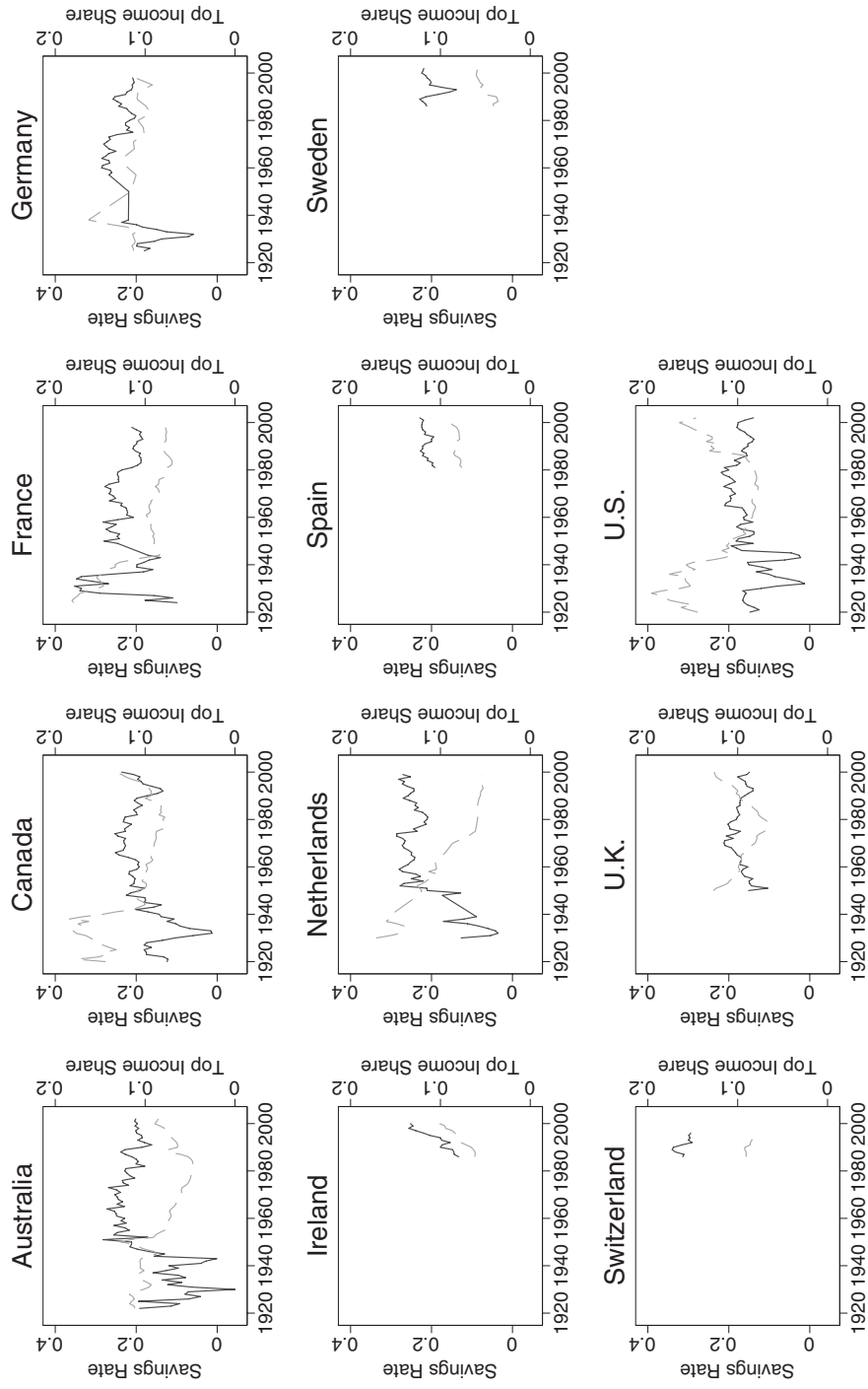

Figure 2. Savings (left axis, solid line) and the Top 1% Share (right axis, dashed line)

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

the twentieth century, whereas in continental European nations (except Switzerland), the two world wars coincided with sharp falls in top income shares.

It is more difficult to discern long-run trends in the savings series, which are more volatile from year to year than the top incomes series. In most countries, savings rates rose slightly over the course of the twentieth century, but the increase was fairly small. Looking at the relationship between top incomes and savings, the associations do not seem to go in any consistent direction, with the data suggesting a positive relationship in France and Ireland, a negative relationship in the Netherlands and the United States, and no relationship in the other countries. Overall, there are no consistent associations between inequality and savings in Figures 1 and 2. However, inter-ocular impact tests do not account for potentially confounding variables such as income levels and age structures. We therefore turn to testing the relationship using multivariate regression.

3. Empirical Findings

The empirical model in this study involves estimating a savings equation which provides for capturing the impact of income inequality on household savings. This can be analyzed using the following equation:

$$S_{it} = \beta_1 \eta_{i,t-1} + \beta_2' Z_{it} + \beta_3' Z_{i,t-1} + \alpha_i + \lambda_t + \varepsilon_{it} \tag{1}$$

where S_{it} refers to the gross national savings rate of country i at time t, $\eta_{i,t-1}$ is inequality in the previous period, Z_{it} and $Z_{i,t-1}$ are vectors of time-varying country characteristics in the current and previous period, α_i is a country fixed effect, λ_t is a year fixed effect, and ε_{it} is a normally-distributed mean-zero error term.

Following Bertrand *et al.* (2004), standard errors are clustered by country. This allows for arbitrary error correlations among country-year observations within each country, which specifies standard errors that are asymptotically robust to serial correlation.

Our results focus on two measures of inequality: the income share of the richest 10 percent, and the income share of the richest 1 percent. To ensure that our results are capturing the effect of inequality on savings (rather than the reverse), we regress the current year's savings rate on the past inequality. We use three lags—one year, five years, and ten years. Following convention, the five-year lag specification only uses observations from years divisible by five; and the ten-year lag specification only uses observations from years divisible by ten (using all available observations makes little difference to the results). Since the interest rate may be endogenous with respect to the supply of savings, we show results both with and without an interest rate control.

We begin by showing results *without* country and year fixed effects. Although it is not our preferred specification, it is useful to see results without fixed effects, since some of the previous studies on this topic have used only cross-country variation. Panel A of Table 1 shows that, for the full sample (1921–2002), the results without fixed effects suggest a strong negative effect of past inequality on current savings rates: in this specification, a one percentage point increase in top income shares is associated with a 0.3–0.6 percentage point drop in the savings rate.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

TABLE 1

Inequality and Savings, 1921–2002 (dependent variable is the gross national savings rate)

	[1]	[2]	[3]	[4]	[5]	[6]
Lag:	T-1		T-5		T-10	
Measure:	Top 10%	Top 1%	Top 10%	Top 1%	Top 10%	Top 1%
Panel A: Without country and year fixed effects						
Inequality	–0.369*	–0.600**	–0.409	–0.543	–0.337**	–0.311
	[0.167]	[0.244]	[0.227]	[0.426]	[0.137]	[0.360]
Observations	501	547	94	104	46	51
R-squared	0.15	0.21	0.14	0.19	0.22	0.18
Panel B: With fixed effects, without interest rate controls						
Inequality	0.177	0.05	–0.061	0.159	0.009	0.27
	[0.177]	[0.257]	[0.110]	[0.359]	[0.331]	[0.552]
Observations	501	547	94	104	46	51
R-squared	0.7	0.71	0.73	0.71	0.78	0.81
Panel C: With fixed effects and interest rate controls						
Inequality	0.176	0.051	–0.07	0.15	–0.236	0.133
	[0.178]	[0.261]	[0.105]	[0.359]	[0.340]	[0.589]
Observations	501	547	94	104	46	51
R-squared	0.7	0.71	0.74	0.72	0.81	0.82

Notes: Standard errors, clustered at the country level, in brackets.

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

All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate controls are the rate of return on bonds in local currency, in both the current period and the lagged period.

The other two panels of Table 1 show results with country and year fixed effects. The rationale for country fixed effects is that they account for time-invariant country characteristics such as a country's relative size, its distance to major markets, and social norms about saving. Year fixed effects are intended to capture time shocks that are common to all countries, such as world wars, global economic cycles, and technological changes that affect cross-border capital flows in all developed nations.

Once country and year fixed effects are included, then either without the interest rate control (Panel B) or with the interest rate control (Panel C), our results show no significant effect of past inequality on the current savings rate. This is true regardless of whether we focus on the top 10 percent or the top 1 percent as our measure of inequality, and whether we use one-year, five-year, or ten-year lags. Clearly, the pooled OLS results are not robust to including fixed effects, thereby exploiting only differences in the rate of change in inequality across countries.

Although the specifications in Table 1 cover a long span of years, they have the disadvantage that the countries in our sample were subject to a number of major shocks over this period. The aftermath of World War I, the Great Depression, World War II, and the post-war rebuilding might all have affected both inequality and savings. We therefore restrict the specification to 1960 onwards, on the basis that macroeconomic conditions over this period were more stable, and those shocks that did occur (e.g. world economic cycles) tended to be common to all countries, and will therefore be largely captured by year fixed effects.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

TABLE 2

Inequality and Savings, 1960–2002 (dependent variable is the gross national savings rate)

	[1]	[2]	[3]	[4]	[5]	[6]
Lag:	T-1		T-5		T-10	
Measure:	Top 10%	Top 1%	Top 10%	Top 1%	Top 10%	Top 1%
Panel A: Without country and year fixed effects						
Inequality	–0.268*	–0.222	–0.235	–0.239	–0.171	–0.082
	[0.120]	[0.193]	[0.132]	[0.232]	[0.116]	[0.282]
Observations	352	354	70	71	38	39
R-squared	0.19	0.15	0.13	0.12	0.13	0.12
Panel B: With fixed effects, without interest rate controls						
Inequality	0.062	–0.129	–0.061	–0.266	0.028	0.035
	[0.141]	[0.202]	[0.158]	[0.261]	[0.306]	[0.504]
Observations	352	354	70	71	38	39
R-squared	0.84	0.85	0.84	0.85	0.84	0.84
Panel C: With fixed effects and interest rate controls						
Inequality	0.059	–0.127	–0.08	–0.237	–0.048	0.039
	[0.143]	[0.204]	[0.167]	[0.301]	[0.440]	[0.632]
Observations	352	354	70	71	38	39
R-squared	0.85	0.85	0.85	0.85	0.84	0.84

Notes: Standard errors, clustered at the country level, in brackets.

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

All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate controls are the rate of return on bonds in local currency, in both the current period and the lagged period.

The results from the period from 1960 onwards are shown in Table 2. Again, we begin by showing a pooled OLS specification (Panel A), which shows a negative relationship between inequality and savings, though not as large as in the full sample, and generally not statistically significant. In Panels B and C, we add country and year fixed effects. The results are very similar to the results for the full sample, with none of the coefficients on the savings rate being statistically significant. This suggests that the results in Table 1 are not driven merely by the inclusion of data from the interwar and immediate post-World War II era.

For expositional simplicity, the coefficients on the time-varying country controls (national income, the dependency ratio, and the return on bonds) are not shown. In most cases, they are statistically insignificant. We also estimate the linear sum of the current and lagged controls (results not shown), which was negative and statistically insignificant in most specifications.

An important question about our results is whether they are insignificant because the estimated effect is close to zero, or merely because of measurement error. In more colloquial terms, one might ask: is our estimate zero, or *very* zero? A natural way to answer this question is to focus not only on our point estimates, but also on their associated standard errors. Our preferred estimates are those that use the top 10 percent share with annual data, and controlling for the return on bonds. (The top 10 percent share is our preferred estimate because it encompasses what we regard as "the rich" in a given society; by contrast, we think of the top 1 percent as "the elite".) Over the full sample (Table 1, Column 1, Panel C), the point estimate is 0.176, suggesting that a 1 percentage point increase in the share of the richest 10 percent would raise national savings by 0.18 percentage points. The

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

95 percent confidence interval on this estimate ranges from –0.22 to 0.57. Across the full sample, the standard deviation of the top 10 percent share is 5 percentage points. Our estimates therefore imply that a one standard deviation increase in the top 10 percent share (about the increase in the United States during the 1990s) would have increased national savings by a statistically insignificant 1 percentage point, with a 95 percent confidence interval from –1 percentage point to +3 percentage points. Across the full sample, the standard deviation of the savings rate is 6 percentage points. Our results are therefore consistent with no more than small negative effects or modest positive effects of inequality on savings.

If we perform the same exercise using the estimate from 1960 onwards, the results are quite similar. In Panel D, Column 1, the point estimate is 0.059, suggesting that a 1 percentage point increase in the share of the richest 10 percent would raise national savings by 0.06 percentage points. The 95 percent confidence interval on this estimate is from –0.26 to 0.38. This implies that a one standard deviation increase in the top 10 percent share would have increased national savings by a statistically insignificant 1 percentage point, with a 95 percent confidence interval from –1 percentage point to +2 percentage points. Again, this allows us to reject, at the 95 percent level of significance, economically large effects of top income inequality on savings rates. Overall, our results are consistent with the fixed effects framework in Schmidt-Hebbel and Servén (2000). Moreover, the results in Table 2 allow us to (just) rule out effects as large as those in Cook (1995), who found that a 1 percentage point increase in the income share of the richest 10 percent was associated with a 0.4 percentage points increase in the savings rate.

4. Robustness Checks

We perform a number of robustness checks, beginning in Table 3 with tests of functional form and additional covariates.[4] First, to account for the possibility that inequality may have a non-linear impact on savings, Panel A shows results including both the top income share and its square. Second, while the previous results control for the interest rate (in Panel C of Tables 1 and 2), it may also be the case that the degree of development of the local credit markets may affect savings patterns. In Panel B of Table 3, we therefore add a control for a proxy for credit market depth: the ratio of domestic credit to GDP. Third, while our main specifications control for the dependency ratio, it may also be the case that government pension schemes affect savings patterns. Panel C of Table 3 therefore controls for two variables relating to public pensions: the support ratio, and the effective contribution rates to public pension programs. These additional variables are defined in the Data Appendix. Note that in the case of both credit market depth and public pension programs, there is a possibility that these variables are themselves endogenous with respect to the savings rate, so these specifications are not

[4]In the late-twentieth and early-twenty-first centuries, the rise in top incomes was greater in English-speaking countries than in non-English-speaking countries (Piketty and Saez, 2006a; Atkinson and Piketty, 2007; Leigh, 2009). We therefore carried out a further robustness check, in which we re-estimated the regressions separately for English-speaking and non-English-speaking countries. We did not find a consistent relationship between savings and inequality in either subset of countries.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

TABLE 3

Inequality and Savings: Robustness Checks Sample is 1960–2002 (dependent variable is the gross national savings rate)

	[1]	[2]	[3]	[4]	[5]	[6]
Lag:	T-1		T-5		T-10	
Measure:	Top 10%	Top 1%	Top 10%	Top 1%	Top 10%	Top 1%
Panel A: Including a quadratic in inequality						
Inequality	0.079	–0.799	–1.155	–1.659	0.736	–2.782
	[0.737]	[0.759]	[0.739]	[1.093]	[4.815]	[4.205]
Inequality^2	–0.029	3.38	1.607	7.552	–1.192	15.338
	[0.976]	[3.269]	[1.096]	[4.884]	[6.857]	[20.045]
Observations	352	354	70	71	38	39
R-squared	0.85	0.85	0.85	0.86	0.84	0.85
Panel B: Controlling for credit market depth						
Inequality	0.047	–0.193	–0.093	–0.326	–0.09	–0.054
	[0.129]	[0.200]	[0.161]	[0.309]	[0.475]	[0.774]
Observations	352	354	70	71	38	39
R-squared	0.85	0.85	0.85	0.86	0.84	0.84
Panel C: Controlling for public pension arrangements						
Inequality	–0.034	–0.245	–0.112	–0.217	0.031	0.275
	[0.175]	[0.181]	[0.115]	[0.219]	[0.437]	[0.537]
Observations	352	354	70	71	38	39
R-squared	0.86	0.86	0.87	0.87	0.88	0.86

Notes: All specifications include country and year fixed effects, and interest rate controls.
Standard errors, clustered at the country level, in brackets.
*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.
All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate controls are the rate of return on bonds in local currency, in both the current period and the lagged period. Credit market depth is the ratio of domestic credit to GDP, in both the current period and the lagged period. Public pension arrangements are the support ratio, and the effective contribution rates to public pension programs, in both the current period and the lagged period.

our preferred estimates. For simplicity, the results in Table 3 are presented only for the years 1960–2002. All include country and year fixed effects, and a control for the interest rate.

None of the robustness checks in Table 3 appears to have a substantial impact on our main results, with the inequality coefficient (and its square, where applicable) being statistically insignificant in all specifications. Notably, the standard errors are also quite similar when domestic credit and public pension variables are added to the regression. However, adding a quadratic in inequality causes the standard errors to increase substantially, and we can no longer reject economically meaningful effects of inequality on savings.

Since our primary specifications are based on national saving rates (which include government savings), it is possible that the null results are due to inequality having offsetting effects on household and government savings rates. For example, suppose that inequality has a first-order effect of increasing government savings, but no first-order impact on household savings. If the Ricardian equivalence theorem holds (Barro, 1974, 1989), then the rise in government savings will cause households to reduce private savings, leaving aggregate national savings unchanged.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

TABLE 4

Inequality and Household Savings, 1975–2002 (dependent variable is the household savings rate)

	[1]	[2]	[3]	[4]	[5]	[6]
Lag:	T-1		T-5		T-10	
Measure:	Top 10%	Top 1%	Top 10%	Top 1%	Top 10%	Top 1%
Panel A: Without country and year fixed effects						
Inequality	0.041	–0.002	0.04	0.044	0.196	0.279
	[0.141]	[0.291]	[0.139]	[0.236]	[0.170]	[0.278]
Observations	230	230	48	48	24	24
R-squared	0.46	0.46	0.59	0.59	0.67	0.66
Panel B: With fixed effects, without interest rate controls						
Inequality	–0.121	–0.178	0.022	–0.472	0.434	–0.279
	[0.318]	[0.455]	[0.260]	[0.541]	[0.574]	[0.989]
Observations	230	230	48	48	24	24
R-squared	0.74	0.74	0.79	0.80	0.88	0.87
Panel C: With fixed effects and interest rate controls						
Inequality	–0.126	–0.162	–0.138	–0.486	0.502	0.96
	[0.321]	[0.467]	[0.233]	[0.521]	[0.691]	[1.715]
Observations	230	230	48	48	24	24
R-squared	0.74	0.74	0.83	0.84	0.90	0.89

Notes: Standard errors, clustered at the country level, in brackets.

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

All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate controls are the rate of return on bonds in local currency, in both the current period and the lagged period.

Conversely, suppose that inequality has a first-order effect of increasing household savings (e.g. because the rich save more than the poor), but no first-order effect on government savings. Observing the growing disparity in retirement wealth, the government might choose to reduce government savings in order to increase expenditure on pensions for poor retirees (akin to the model in Alesina and Rodrik, 1996). In this second example, the fall in government savings would offset the rise in private savings, leaving national savings unchanged.

To address this problem, we look at the impact of top income shares on the household savings rate. Although data on household savings data are only available for the years 1975–2002, it is nonetheless instructive to see whether our results are robust to switching the dependent variable from the gross savings rate to the household savings rate over this period. This necessitates a substantial reduction in sample size, not merely because we have data on both inequality and household savings only for the period 1975–2002, but also because we are unable to obtain household savings data for Ireland. More detail on our household savings series is provided in the Data Appendix.

Table 4 shows this relationship, first without country and year fixed effects, then with fixed effects but no interest rate control, and then with both fixed effects and the interest rate control. Although the number of observations is substantially smaller, the results in Table 4 generally support the above conclusions using gross savings as the dependent variable. However, the 95 percent confidence interval is slightly larger. For example, according to Table 4, Column 1, Panel C, a 1 percentage point increase in the previous year's top 10 percent share lowers the

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

household savings rate by 0.126 percentage points (with a 95 percent confidence interval ranging from –0.851 to 0.599). Since the standard deviation of the top 10 percent share is 5 percentage points, and the standard deviation of the household savings rate is 4 percentage points, this suggests that a one standard deviation increase in the top 10 percent share would have an effect on the household savings rate of between −1 standard deviations and +2/3 standard deviations. This range encompasses economically meaningful impacts; but again, the results are not statistically significant. Given that the point estimates are close to zero, the estimates in Table 4 suggest that top income inequality does not affect household savings. These results also provide some reassurance that the absence of a relationship between inequality and national savings (Tables 1–3) is not merely due to offsetting shifts in household savings and government savings.

5. Conclusion

Using top incomes data, we revisit the impact of inequality on savings rates. By comparison with previous studies, our panel covers a small number of countries, but a long span of years. By including country fixed effects, we are able to account for the possibility that certain time-specific shocks affect both inequality and savings simultaneously. Without country and year fixed effects, we observe a negative correlation between past inequality and current savings rates. But in our (preferred) fixed effects specifications, we find no statistically significant effect of inequality on savings. Our results are not only statistically insignificant; they are also economically small, with standard errors in the fixed effects specifications that are tight enough to rule out more than modest impacts in either direction. The results are robust to the inclusion of a variety of controls, including GDP per capita, the dependency ratio, and proxies for the interest rate, credit market depth, and public pension arrangements.

However, we must be careful not to draw conclusions that go beyond the limits of our data. Since our primary specifications are based on national saving rates (which include government savings), it is possible that our null result is due to inequality having offsetting effects on household and government savings rates. To address this problem, we re-estimate our models using household savings data for recent decades. We find no statistically significant relationship between household savings and top incomes, though the standard errors on our household savings estimates are sufficiently large that we cannot entirely rule out such a relationship.

Data Appendix

Variables Used in Main Specifications

Top Incomes

Top incomes data are from Leigh (2007), who adjusts top incomes series from 13 different papers to produce a comparable dataset, estimated on a calendar-year basis. Note that in Australia, Canada, and Spain, the tax unit is the individual throughout the period of analysis, while in France, Ireland, the Netherlands,

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

Switzerland, and the United States, the tax unit is a married couple or single individuals throughout the analysis. Germany has a hybrid system, with most taxpayers filing as tax units, and the very rich filing as individuals. Sweden and the United Kingdom both switched from household to individual filing. Where this appears to have caused substantial breaks in continuity, Leigh (2007) adjusts the top incomes series to take account of the changes. We exclude Japan, since top 10 percent estimates are not available for that country; and New Zealand, since historical data on bond returns are unavailable.

Gross Savings

Our savings data are comprised of two data sources: Taylor (2002) and OECD (2006). From 1921 to 1992 we use savings data from Taylor (2002), who estimated savings rates over the period 1870–1992 for Argentina, Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the United States. We employ his data from 1921–92 for Australia, Canada, France, Germany, the Netherlands, Spain, Sweden, the United Kingdom, and the United States due to superior data availability. Taylor's data sources and definitions are as follows: from 1915 to 1959, the savings rate is calculated via the current account identity, as the investment rate plus the ratio of the current account to GDP. This data is taken by Taylor from Mitchell (1983, 1992), using his national income and overall current balance series at current prices. The overall current balance series are converted from U.S. dollars, using his exchange rate series as necessary. From 1960 to 1992, Taylor's estimates of GDP and gross domestic saving at current prices are taken from World Bank (1994).

From 1993 to 2002, estimates of gross national savings as a percent of GDP are taken from Annex Table 24 of the OECD (2006). Gross national savings is defined by the OECD simply as gross national income less consumption (private and public).

Overall, the Taylor and OECD data sources are very close to one another. Over the years that we have data from both sources (1986–92), we estimated the mean absolute differences between the two. These differences ranged from 0.003 percentage points (the U.K.) to 0.01 percentage points (Germany) with an average of 0.0074 percentage points.

GDP

GDP is real GDP per capita (measured in 1990 International Geary-Khamis dollars), from Maddison (2003, 2007).

Interest Rate

We use the total return on bonds (%) in local currency, sourced from the "Dimson–Marsh–Staunton Global/Returns Database", maintained by Ibbotson Associates (updated to December 2002). The series are described in more detail in Dimson *et al.* (2002), which includes tables on a ten-year basis, and a graph of the annual data.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

Dependency Ratios

We follow the definition set by the United Nations Population Division (http://www.un.org/esa/population/unpop.htm) and define the total dependency ratio as the ratio of the sum of the population aged 0–14 and that aged 65+ to the population aged 15–64. These population figures are obtained from the Human Mortality Database, maintained by the University of California, Berkeley and the Max Planck Institute for Demographic Research. The data are available at http://www.mortality.org or http://www.humanmortality.de. The data were downloaded on August 29, 2007.

Treatment of Germany

All series for Germany are for West Germany for 1956–91, and for reunified Germany from 1992 onwards.

Variables Used in Robustness Checks

Credit Market Depth

Following Bailliu and Reisen (1997), we proxy credit market depth with a measure of domestic credit claims on the private sector as a proportion of GDP. Domestic credit data is taken from the International Financial Statistics, Line 32d (IMF, Various Years). For most countries in our sample, these data are available for the period 1950–2002. Where there are gaps in the data, we interpolate linearly. Where data are missing at the beginning or end of the sample, we use the earliest or latest observation, as applicable. GDP data are from OECD National Accounts.

Public Pension Arrangements

We control for two proxies for a country's public pension arrangements: the support ratio and effective contribution rates to public pension programs. These are taken from Disney (2006). Disney (2006) provides data for both variables for the years 1955, 1965, 1975, 1985, and 1995. We linearly interpolate between these years, and assume that the figures for 1950–54 are the same as for 1955, and the figures for 1996–2002 are the same as for 1995.

Household Savings Rates

For 1986–2002, these are taken from the OECD (2006), Annex Table 23, and represent the ratio of household savings to household disposable income. The OECD notes that most countries report household savings on a net basis (i.e. excluding consumption of fixed capital by households and unincorporated businesses). However, the data for Spain, Sweden, Switzerland, and the U.K. include savings by non-profit institutions (the OECD refers to these four countries' series as "gross savings"). The OECD does not report household savings data for Ireland.

From 1975 to 1985, we use data from the IMF's World Economic Outlook (WEO) database, as used in Callen and Thimann (1997), and kindly provided to us

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

by Tim Callen. This gives the ratio of household savings to GDP. Unfortunately, there appear to be a number of major discrepancies between the IMF and OECD series. Since the IMF series is expressed as a ratio of GDP, and the OECD series is expressed as a ratio of household disposable income (which is typically around two-thirds of GDP), the IMF household savings rate should be lower. However, for some countries, the IMF savings rate in 1985 is considerably *higher* than the OECD savings rate in 1986. For example, the 1985 and 1986 figures for Australia are 18.5 and 10.3 percent respectively, while the figures for France are 15.0 and 8.1 percent. It seems improbable that the savings rate in these two countries fell so substantially (particularly if the 1985 figure is adjusted upwards by a factor of 1.5). We therefore adopt a more conservative approach, and scale the 1975–85 figures so that the savings rates in 1985 and 1986 are the same. In effect, this allows us to exploit the changes from 1975 to 1985, but standardizes the levels to match the OECD series.

TABLE A1

Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Gross national savings rate	547	0.197	0.059	–0.044	0.352
Top 1% share	547	0.099	0.031	0.036	0.196
Top 10% share	501	0.338	0.049	0.217	0.466
Log real GDP per capita	547	9.276	0.523	7.792	10.259
Dependency ratio	547	0.538	0.061	0.426	0.713
Rate of return on bonds	547	0.038	0.114	–0.307	0.625
Credit market depth	434	0.701	0.326	0.282	1.793
Support ratio	434	2.540	0.305	1.980	3.200
Effective pension contribution rate	434	0.193	0.073	0.073	0.450
Household savings rate	230	0.098	0.040	–0.030	0.179

References

Aghion, P., E. Caroli, and C. Garcia-Peñalosa, "Inequality and Economic Growth: The Perspective of the New Growth Theories," *Journal of Economic Literature*, 37, 1615–60, 1999.

Alesina, A. and D. Rodrik, "Distributive Politics and Economic Growth," *Quarterly Journal of Economics*, 109, 465–90, 1994.

———, "Income Distribution, Political Instability, and Investment," *European Economic Review*, 40, 1203–28, 1996.

Alvaredo, F. and E. Saez, "Income and Wealth Concentration in Spain in a Historical and Fiscal Perspective," CEPR Discussion Paper No 5836, Centre for Economic Policy Research, London, 2006.

Atkinson, A. B., "Top Incomes in the United Kingdom over the Twentieth Century," in A. Atkinson and T. Piketty (eds), *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English Speaking Countries*, Oxford University Press, Oxford, 82–140, 2007.

Atkinson, A. and A. Brandolini, "Promise and Pitfalls in the Use of 'Secondary' Data-Sets: Income Inequality in OECD Countries as a Case Study," *Journal of Economic Literature*, 39, 771–99, 2001.

Atkinson, A. B. and A. Leigh, "The Distribution of Top Incomes in Australia," *Economic Record*, 83, 247–61, 2007.

Atkinson, A. and T. Piketty, *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English Speaking Countries*, Oxford University Press, Oxford, 2007.

Bailliu, J. and H. Reisen, "Do Funded Pensions Contribute to Higher Aggregate Savings? A Cross-Country Analysis," OECD Development Centre Working Papers 130, OECD Development Centre, Paris, 1997.

Barro, R., "Are Government Bonds Net Wealth?" *Journal of Political Economy*, 82, 1095-117, 1974.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

———, "The Ricardian Approach to Budget Deficits," *Journal of Economic Perspectives*, 3, 37–54, 1989.
Bertrand, M., E. Duflo, and S. Mullainathan, "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics*, 119, 249–75, 2004.
Bunting, D., "Savings and the Distribution of Income," *Journal of Post Keynesian Economics*, 14, 3–22, 1991.
Callen, T. and C. Thimann, "Empirical Determinants of Household Saving: Evidence from OECD Countries," IMF Working Paper 97–181, International Monetary Fund, Washington, DC, 1997.
Cook, C. J., "Savings Rates and Income Distribution: Further Evidence from LDCs," *Applied Economics*, 27, 71–82, 1995.
Deaton, A., *Understanding Consumption*, Oxford University Press, New York, NY, 1992.
Deininger, K. and L. Squire, "A New Data Set on Income Distribution," *World Bank Economic Review*, 10, 565–91, 1996.
Dell, F., "Top Incomes in Germany Throughout the Twentieth Century: 1891–1998," in A. Atkinson and T. Piketty (eds), *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English Speaking Countries*, Oxford University Press, Oxford, 365–425, 2007.
Dell, F., T. Piketty, and E. Saez, "Income and Wealth Concentration in Switzerland Over the 20th Century," in A. Atkinson and T. Piketty (eds), *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English Speaking Countries*, Oxford University Press, Oxford, 472–500, 2007.
Dimson, E., P. Marsh, and M. Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns*, Princeton University Press, Princeton, NJ, 2002.
Disney, R., "Household Saving Rates and the Design of Public Pension Programmes: Cross–Country Evidence," *National Institute Economic Review*, 198, 61–74, 2006.
Dynan, K. E., J. Skinner, and S. P. Zeldes, "Do the Rich Save More?" *Journal of Political Economy*, 112, 397–444, 2004.
Edwards, S., "Why are Latin America's Savings Rates So Low? An International Comparative Analysis," *Journal of Development Economics*, 51, 5–44, 1996.
Friedman, M., *A Theory of the Consumption Function*, Princeton University Press, Princeton, NJ, 1957.
Gustman, A. and T. Steinmeier, "Effects of Pensions on Savings: Analysis with Data from the Health and Retirement Study," *Carnegie-Rochester Conference Series on Public Policy* 50, 271–324, 1999.
Hong, K., "Income Distribution and Aggregate Saving," Unpublished Manuscript, Harvard University, Cambridge, MA, 1995.
IMF (International Monetary Fund), *International Financial Statistics*, IMF, Washington, DC, Various Years.
Kaldor, N., "A Model of Economic Growth," *Economic Journal*, 67, 591–624, 1957.
Leigh, A., "How Closely do Top Income Shares Track Other Measures of Inequality?" *Economic Journal*, 117, F619–33, 2007.
———, "Top Incomes," in W. Salverda, B. Nolan, and T. Smeeding (eds), *The Oxford Handbook of Economic Inequality*, Oxford University Press, Oxford, 2009 (forthcoming).
MacKellar, L. and H. Reisen, "A Simulation Model of Global Pension Investment," OECD Development Centre Working Papers 137, OECD Development Centre, Paris, 1998.
Maddison, A., *The World Economy: Historical Statistics*, OECD Development Centre, Paris, 2003.
———, "Historical Statistics for the World Economy: 1–2003 AD," Excel file, http://www.ggdc.net/maddison/ (accessed August 30, 2007).
Mitchell, B. R., *International Historical Statistics: The Americas and Australasia*, Gale Research, Detroit, 1983.
———, *International Historical Statistics: Europe, 1750–1988*, Stockton Press, New York, NY, 1992.
Moore, J. C., L. L. Stinson, and E. J. Welniak, "Income Measurement Error in Surveys: A Review," *Journal of Official Statistics*, 16, 331–62, 2000.
Nolan, B., "Long-Term Trends in Top Income Shares in Ireland," in A. Atkinson and T. Piketty (eds), *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English Speaking Countries*, Oxford University Press, Oxford, 501–30, 2007.
OECD, *OECD Economic Outlook*, OECD, Paris, 2006.
Piketty, T., "Income, Wage and Wealth Inequality in France, 1901–1998," in A. Atkinson and T. Piketty (eds), *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English Speaking Countries*, Oxford University Press, Oxford, 43–81, 2007.
Piketty, T. and E. Saez, "The Evolution of Top Incomes: A Historical and International Perspective," *American Economic Review*, 96, 200–5, 2006a.
———, "Income Inequality in the United States," Tables and Figures updated to 2004 in Excel format, http://emlab.berkeley.edu/users/saez/ (accessed December 6, 2006), 2006b.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009

Roine, J. and D. Waldenström, "Top Incomes in Sweden over the Twentieth Century," Research Institute of Industrial Economics, Working Paper 667, Stockholm, 2006.
Saez, E. and M. Veall, "The Evolution of High Incomes in Northern America: Lessons from Canadian Evidence," *American Economic Review*, 95, 831–49, 2005.
Salverda, W. and A. B. Atkinson, "Top Incomes in the Netherlands Over the Twentieth Century," in A. Atkinson and T. Piketty (eds), *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English Speaking Countries*, Oxford University Press, Oxford, 426–72, 2007.
Schmidt-Hebbel, K. and L. Servén, "Does Income Inequality Raise Aggregate Saving?" *Journal of Development Economics*, 61, 417–46, 2000.
Taylor, A., "A Century of Current Account Dynamics," *Journal of International Money and Finance*, 21, 725–48, 2002.
Venti, S. and D. Wise, "Choice, Chance, and Wealth Dispersion at Retirement," in S. Ogura, T. Tachibanaki, and D. Wise (eds), *Aging Issues in the United States and Japan*, University of Chicago Press, Chicago, IL, 25–64, 2001.
Voitchovsky, S., "Inequality and Economic Growth," in W. Salverda, B. Nolan and T. Smeeding (eds), *The Oxford Handbook of Economic Inequality*, Oxford University Press, Oxford, 2009 (forthcoming).
World Bank, *World Data 1994: World Bank Indicators on CD-ROM*, The World Bank, Washington, DC, 1994.

© 2009 The Authors
Journal compilation © International Association for Research in Income and Wealth 2009