

Top Incomes and National Savings*

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This Draft: 11 November 2007

Abstract

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 eleven 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 least at the top end of the distribution) is not a major driver of national savings rates.

Keywords: national savings; inequality; top incomes; panel data
JEL classification: D30, E21, O50

* We are grateful to Steve Dowrick, Tim Hatton, Gweneth Leigh, Patrice Yee Chong San, Luis Servén, Jonathan Skinner, Alan Taylor, and Elena Varganova for valuable comments and suggestions on earlier drafts; and to Tim Callen and Alan Taylor for sharing their data on historical 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) suggests 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 of the rich is relatively lower than of the poor, and higher inequality means less investment by the poor.

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) finds a positive relationship between inequality (the shares of the top 5 and 10, the share of the bottom 40 percent, and the Gini

coefficient) and gross domestic savings. Similarly, Hong (1995) finds a positive relationship between inequality (the share of the richest 20 percent) on saving rates in a cross-country sample of 64 developing and developed countries using 1960–1985 averages for each country.

However, studies using panel data have tended not to find a relationship between savings and inequality. Using panel data from 11 developed and 25 developing countries for 1970- 1992, Edwards (1996) shows that inequality (defined as the ratio of income received by the bottom 40 percent over income received by the higher 10 percent) does not significantly affect private savings. Similarly, Schmidt-Hebbel and Servén (2000), using a panel of 19 developed and 33 developing countries, do not support the notion that the Gini coefficient has any effect on gross national savings. These results are 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 to 1987, Bunting (1991) finds 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 to 1989, Dynan et al. (2004) find a strong positive relationship between personal savings rates and lifetime income. However, Gustman and Steinmeier (1999) and Venti and Wise 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 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 UK, and the US. 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.

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 representative 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, Stinson and Welniak, 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 studies that have combined taxation statistics with external population and personal income control totals to estimate top income shares for 11 developed countries. Top income shares track other measures of inequality quite closely (for the period where both are available). For example, using data from the World Income Inequality Database (WIID), Leigh (2007) shows that top income shares are strongly correlated with estimates of the Gini coefficient, in both pooled OLS specifications, and with country and year fixed effects. Comparing top income shares with data from the Luxembourg Income Study (which estimates inequality measures based on post-tax, size-equivalized household incomes), Leigh (2007) finds that the income share of the richest 10 percent is positively correlated with the Gini coefficient, Atkinson index, and the 90/50 ratio. This remains true when country and year fixed effects are included in the

regression. To improve cross-country comparability Leigh (2007) makes a number of small adjustments to these series.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 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).

¹ The original sources are Alvaredo and Saez (2006); Atkinson (2007); Atkinson and Leigh (2007a); Dell (2007); Dell, Piketty and Saez (2007); Nolan (2007); Piketty (2007); Piketty and Saez (2006b); Roine and Waldenström (2006); Saez and Veall (2005); 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, and drop New Zealand because bond returns for New Zealand are not available in the Dimson database.

Several existing studies (see eg. 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 (1992). Over the period 1993 to 2002, we use savings data from the OECD Economic Outlook database (2006). Over the period 1986 to 1992, we have data from both sources, 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

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 eg. MacKellar and Reisen 1998).

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). And since the interest rate may affect the savings rate, we control for the real return on bonds in local currency, sourced from Dimson, Marsh, and Staunton (2002). Below, we also investigate the robustness of our results by adding additional controls beyond these. The Data Appendix contains more detail on the derivation of our variables and their sources.

To give some sense of the patterns in our data, Figures 1 and 2 plot the income share of the richest ten percent against gross savings. It is difficult to discern any systematic patterns across the countries in our sample. In France, Ireland, Spain, Sweden, and Switzerland, inequality and savings appear to move together; while in Germany, the Netherlands, the UK, and the US, they seem to be negatively correlated.

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

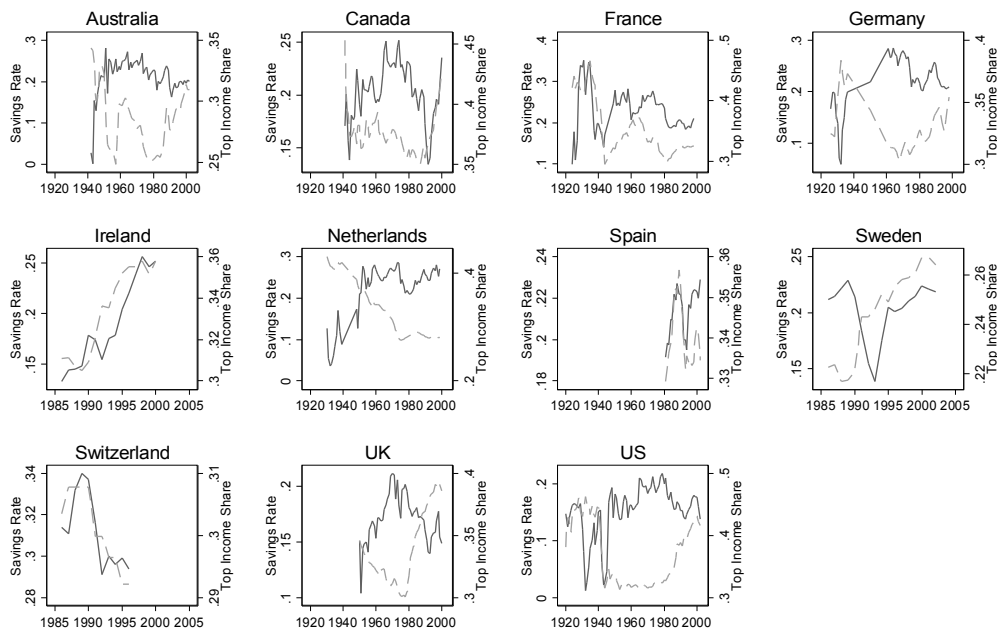
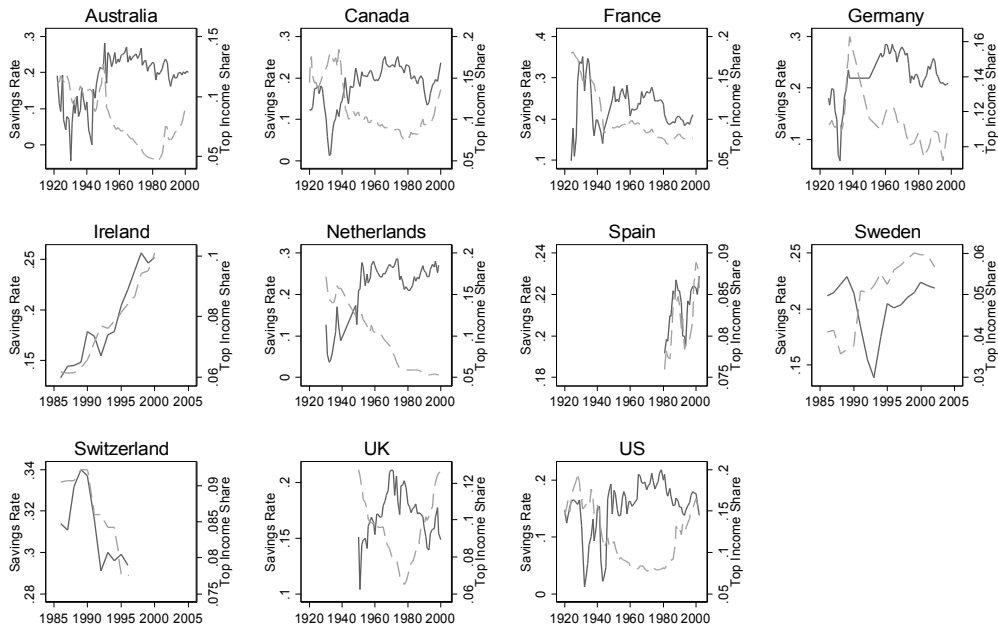
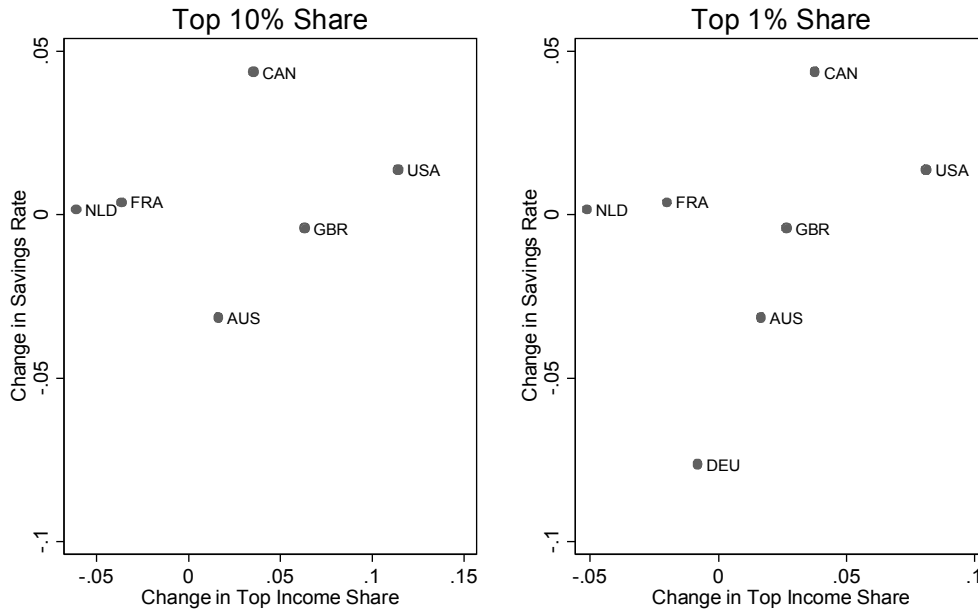


Figure 2: Savings (left axis, solid line) and the Top 1% Share (right axis, dashed line)



Another way to analyze the data is to look at the relationship between changes in inequality and the change in savings, over the period from about 1960 to about 2000. Figure 3 shows this relationship. For both the top 10 percent and the top 1 percent, the correlation is positive, though not statistically significant. Naturally, empirical analysis needs to take account of the potential for reverse causation, as well as controlling for other factors that might affect both inequality and savings. It is to this that we now turn.

Figure 3: Changes in Top Incomes and Changes in Savings Rates
From circa 1960 to circa 2000



3. Empirical Findings

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

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

where S_{it} refers to gross national savings ratio 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 (in the five year lag specification, we only use data every five years, and similarly for the ten year lag specification). In addition, 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 to 0.6 percentage point drop in the savings rate.

The other two panels of Table 1 show results with country and year fixed effects. 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 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.

Table 1: Results – 1921-2002						
	[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]
Interest rate controls	No	No	No	No	No	No
Country & year FE	No	No	No	No	No	No
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]
Interest rate controls	No	No	No	No	No	No
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
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]
Interest rate controls	Yes	Yes	Yes	Yes	Yes	Yes
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	501	547	94	104	46	51
R-squared	0.7	0.71	0.74	0.72	0.81	0.82

Note: Standard errors, clustered at the country level, in brackets. All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate control is the rate of return on bonds in local currency, in both the current period and the lagged period.

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 (eg. world economic cycles) tended to be common to all countries, and will therefore be largely captured by year fixed effects.

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.

Table 2: Results – 1960-2002

	[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]
Interest rate controls	No	No	No	No	No	No
Country & year FE	No	No	No	No	No	No
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]
Interest rate controls	No	No	No	No	No	No
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
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]
Interest rate controls	Yes	Yes	Yes	Yes	Yes	Yes
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	352	354	70	71	38	39
R-squared	0.85	0.85	0.85	0.85	0.84	0.84

Note: Standard errors, clustered at the country level, in brackets. All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate control is the rate of return on bonds in local currency, in both the current period and the lagged period.

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 (a slightly broader measure of top income inequality), with annual data, and controlling for the return on bonds. 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 95 percent confidence interval on this estimate ranges from -0.22 to 0.57. Since the standard deviation of both the top 10 percent share and national savings is 5 percentage points, this implies 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. Given that the standard deviation of the savings rate is 5 percentage points, we can rule out anything other than small negative effects of inequality on savings, and our results would only be consistent with modest positive impacts.

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 found in Cook (1995), who found that a 1 percentage point increase in the income share of the richest ten 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 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

⁴ As a further robustness check, we re-estimated the regressions separately for English-speaking and non-English speaking countries, but did not find any consistent patterns.

quadratic in inequality causes the standard errors to increase substantially, and we can no longer reject economically meaningful effects of inequality on savings.

Table 3: Various Robustness Checks
Sample is 1960-2002

	[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%
<u>Panel A: Including a quadratic in inequality</u>						
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]
Interest rate controls	Yes	Yes	Yes	Yes	Yes	Yes
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	352	354	70	71	38	39
R-squared	0.85	0.85	0.85	0.86	0.84	0.85
<u>Panel B: Controlling for credit market depth</u>						
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]
Interest rate controls	Yes	Yes	Yes	Yes	Yes	Yes
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	352	354	70	71	38	39
R-squared	0.85	0.85	0.85	0.86	0.84	0.84
<u>Panel C: Controlling for public pension arrangements</u>						
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]
Interest rate controls	Yes	Yes	Yes	Yes	Yes	Yes
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	352	354	70	71	38	39
R-squared	0.86	0.86	0.87	0.87	0.88	0.86

Note: Standard errors, clustered at the country level, in brackets. All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate control is 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.

Next, 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 only because we only have data on both inequality and household savings 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 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 household savings rate by 0.126 percentage points (95% CI: -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 SD and +2/3 SD. This range encompasses economically meaningful impacts; but again, the results are not statistically significant.

Table 4: Robustness Check – Using Household Savings
Sample is 1975-2002

	[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 [0.141]	-0.002 [0.291]	0.04 [0.139]	0.044 [0.236]	0.196 [0.170]	0.279 [0.278]
Interest rate controls	No	No	No	No	No	No
Country & year FE	No	No	No	No	No	No
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 [0.318]	-0.178 [0.455]	0.022 [0.260]	-0.472 [0.541]	0.434 [0.574]	-0.279 [0.989]
Interest rate controls	No	No	No	No	No	No
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
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 [0.321]	-0.162 [0.467]	-0.138 [0.233]	-0.486 [0.521]	0.502 [0.691]	0.96 [1.715]
Interest rate controls	Yes	Yes	Yes	Yes	Yes	Yes
Country & year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	230	230	48	48	24	24
R-squared	0.74	0.74	0.83	0.84	0.90	0.89

Note: Standard errors, clustered at the country level, in brackets. All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate control is the rate of return on bonds in local currency, in both the current period and the lagged period.

Finally, to take into account the possibility that our results may be capturing something specific to top income inequality, we estimated the models using measures of inequality from the Luxembourg Income Study (LIS). The data in LIS are designed to be as comparable as possible, with all estimates based upon equalized post-tax household incomes. So far as we are aware, no previous study has used the LIS data to look at the relationship between

savings and inequality, so our results are novel to this extent. But our main focus is on whether the coefficient on inequality appears to be different when we use a measure of inequality at the top of the distribution (the 90/50 ratio) or a measure of inequality at the bottom of the distribution (the 50/10 ratio).

Our LIS data cover the period 1970-2002. To maintain comparability with the previous results, we restrict the sample to the 11 countries covered by this study. In order that we may estimate fixed effects models, we impute values for missing years, using inequality figures up to 3 years before or afterwards. Even so, we do not have sufficient country-year observations to estimate models with both fixed effects and ten year lags.

The LIS results are shown in Table 5. Without country and year fixed effects (Panel A), we find that both measures of inequality have a negative impact on the savings rate. This is consistent with our results for top income shares, though it is only statistically significant for the 50/10 ratio with a ten-year lag. Once country and year fixed effects are added to the regressions (Panel B), the coefficients become small and mostly insignificant. The same is true when controlling for the interest rate (Panel C). The exception is the coefficient on the 50/10 ratio with a one-year lag, which is significant at the 10 percent level. The coefficient on this estimate is 0.010 (regardless of whether we control for the interest rate). Since the standard deviation of the 50/10 ratio in this sample is 0.35, this suggests that a one standard deviation increase in the 50/10 ratio would lead to a 3.5 percentage point increase in the savings rate, or about two-thirds of a standard deviation increase in savings. Overall, we regard the results from Table 5 as suggesting that although the effects of bottom-end inequality on savings may be slightly stronger than the effect of top-end inequality on savings, neither effect is particularly strong.

Table 5: Robustness Check – Using LIS Inequality Data
Sample is 1970-2002

	[1]	[2]	[3]	[4]	[5]	[6]
Lag:	T-1		T-5		T-10	
Measure:	50/10	90/50	50/10	90/50	50/10	90/50
Panel A: Without country and year fixed effects						
Inequality	-0.037	-0.022	-0.042	-0.017	-0.105**	-0.066
	[0.021]	[0.025]	[0.024]	[0.019]	[0.041]	[0.101]
Interest rate controls	No	No	No	No	No	No
Country & year FE	No	No	No	No	No	No
Observations	235	235	40	40	18	18
R-squared	0.29	0.21	0.32	0.21	0.48	0.23
Panel B: With fixed effects, without interest rate controls						
Inequality	0.010*	0.003	0.002	-0.007		
	[0.005]	[0.007]	[0.012]	[0.008]		
Interest rate controls	No	No	No	No		
Country & year FE	Yes	Yes	Yes	Yes		
Observations	235	235	40	40		
R-squared	0.91	0.9	0.94	0.94		
Panel C: With fixed effects and interest rate controls						
Inequality	0.010*	0.003	0.007	-0.005		
	[0.005]	[0.006]	[0.018]	[0.010]		
Interest rate controls	Yes	Yes	Yes	Yes		
Country & year FE	Yes	Yes	Yes	Yes		
Observations	235	235	40	40		
R-squared	0.91	0.91	0.94	0.94		

Note: Standard errors, clustered at the country level, in brackets. Inequality is measured as the 50/10 or the 90/50 ratio. All specifications include controls for current and lagged real income per capita, and the current and lagged dependency ratio. Interest rate control is the rate of return on bonds in local currency, in both the current period and the lagged period.

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 savings rates (which include government savings rates), it is possible that our null result is due to inequality having offsetting effects on household and government savings rates. For example, if the government expected higher inequality to raise household savings, then when it observed a rise in inequality, it might reduce government savings to offset this change. As a partial test of this theory, we re-estimate our models using household savings data for recent decades. However, while we find no statistically significant relationship between household savings and top incomes, the standard errors on our household savings estimates are sufficiently large that we cannot entirely rule out this possibility.

The other concern is that inequality at the bottom of the distribution may matter for savings, but not inequality at the top of the distribution. Although top income shares are correlated with relative poverty rates, this correlation is weak. Therefore, if it were the case that top incomes had no impact on savings, and relative poverty had a small effect on savings rates, then we might not observe a significant relationship between savings rates and top incomes. We attempt to test this theory by using inequality data from the Luxembourg Income Study.

Although our fixed effects specifications provide mixed results, it does not appear that either the 90/50 ratio (a measure of top end inequality) nor the 50/10 ratio (a measure of bottom-end inequality) have a strong effect on the savings rate. However, our results are not definitive on the relationship between relative poverty and savings; so our conclusions are probably better regarded as a test of hypotheses about the marginal propensity of the rich to save (eg. Kaldor 1957), than the political economy effects of inequality on savings (eg Alesina and Rodrik 1994, 1996).

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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 data set, 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, 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 all 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 Economic Outlook (2006). From 1921-92 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 1915-59, 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 1960-92, Taylor's estimates of GDP and gross domestic saving at current prices are taken from World Bank (1994).

From 1993-2002 estimates of Gross National Savings as a percent of GDP are taken from Annex Table 24 of the OECD Economic Outlook (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 (UK) 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 through December 2002). The series are described in more detail in Dimson, Marsh and Staunton (2002), which includes tables on a ten-year basis, and a graph of the annual data.

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. This is constructed from data from the Human Mortality Database, maintained by the University of California, Berkeley (USA) and Max Planck Institute for Demographic Research. The data are available at www.mortality.org or www.humanmortality.de. The data were downloaded on the 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 International Financial Statistics, Line 32d. For most countries in our sample, these data are available for the period 1950-2002. Where there are gaps in the data, we linearly interpolate. Where data are missing at the beginning or end of the sample, we use the earliest or latest observation, as applicable. GDP data is 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), who describes the variables as follows.

Support ratio: "ILO data on activity rates gives the ratio of actual workers aged 15–59 to people aged over 60. To convert this ratio into an effective support ratio, I make a couple of additional assumptions. First, I remove all workers aged under 20 and over 60, on the rounds that their contribution to total contribution revenue is likely to be low (low incomes and/or low hours). Secondly, it should not be assumed that all people over 60 receive a pension from the public programme ... most countries have a contribution requirement underpinning eligibility for benefits. As an approximation, I take all men as eligible for a pension, and the proportion of women eligible as equivalent to the highest rate of participation observed in each decade's cross-section of participation rates for women. So, for example, if the highest 5-year age band participation rate is 70 per cent, I assume that this percentage will receive a full pension. Since noncontributors are generally entitled to some benefits, especially widows (and widowers without their own pension rights), I use information on rights to survivors benefits (which varies across these countries from 0 per cent to 100 per cent of the original award) from the US Public Pension Administration's Survey of country pension programmes." (Disney 2006)

Effective contribution rates to public pensions: "These are the average expected gross public pension replacement rates ... They are stylised indicators of what a 55 year old at each date could expect, in terms of public pension benefits relative to earned income at retirement, if that individual started work at age 20 ... By interpolation (with adjustments where pension reforms seem to have had significant

impacts, as in the United Kingdom in the late 1970s) and by extrapolation to the mid-1950s, I have used these data to construct mid-decade estimates of expected replacement rates for a 55 year old in 1955, 1965, 1975, 1985 and 1995” (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 1955, and the figures for 1996-2002 are the same as 1995.

Household savings rates

For 1986-2002, these are taken from the OECD Economic Outlook (2006), Annex Table 23, and are the ratio of household savings to household disposable income. The OECD notes that most countries report household saving 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 UK include saving 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 1975-1985, we use data from the IMF’s World Economic Outlook (WEO) database, as used in Callen and Thimann (1997), and kindly provided to us 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% respectively, while the figures for France are 15.0% and 8.1%. 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 1975-1985 figures so that the savings rates in 1985 and 1986 are the same. In effect, this allows us to exploit the changes from 1975-1985, but standardizes the levels to match the OECD series.

LIS Inequality

We use the 50/10 and the 90/50 ratio from the Luxembourg Income Study, <http://www.lisproject.org/keyfigures.htm>, accessed on 22 June 2007. For more details on these measures, see the ‘Methods and Warnings’ page on the LIS website. We impute missing observations by using inequality data from the nearest year, up to three years away. For France in 1984, we use the budget estimate rather than the tax estimate.