# 5 Appendix (Not for Publication)

**Derivation of expression (3).** Expression (2) can be written:

$$\int_y^\infty g(z)dF(z) = 1 - F(y) - \left(\frac{T'(y)}{1-T'(y)}\right)\varepsilon y f(y). \tag{7}$$

Using the Leibniz rule, differentiating both sides with respect to $y$ yields

$$-g(y)f(y) = \frac{d}{dy}\left[1 - F(y) - \left(\frac{T'(y)}{1-T'(y)}\right)\varepsilon y f(y)\right], \tag{8}$$

and dividing by $f(y)$ provides (3).

**Comparison of income concentrations in Piketty and Saez (2007) and CBO data.** Table A1 compares the shares of market income excluding capital gains that each data source assigns to three groups—the 90-95th percent, the 95-99th percent, and the 99-100th percent of the population—at four points over the period.

| Comparison CBO and Piketty and Saez (2007) data | | | | | | |
|---|---|---|---|---|---|---|
| | 99-100 share | | 95-99 share | | 90-95 share | |
| Year | CBO | P&S | CBO | P&S | CBO | P&S |
| 1980 | 8.0 | 8.2 | 12.0 | 13.0 | 10.5 | 11.7 |
| 1990 | 11.7 | 13.0 | 12.5 | 14.1 | 10.7 | 11.8 |
| 2000 | 14.3 | 16.5 | 13.6 | 15.0 | 10.8 | 11.6 |
| 2010 | 14.0 | 17.5 | 14.1 | 16.3 | 11.2 | 12.6 |

**Table A1:** Comparison of income concentration in top quantiles according to CBO data and Piketty and Saez (2007).

As the table shows, these series track each other directionally, though the CBO data indicate a lower degree of income concentration at the very top over time. This difference may be due to factors discussed in Richard Burkhauser, Shuaizhang Feng, Stephen P. Jenkins, and Jeff Larrimore (2012), for example the focus on households in the CBO data rather than tax-paying units (also see related calculations in Hendren (2014)). To the extent that our use of CBO data thereby underestimates the incomes of higher earners, we will infer lower MSWWs on high earners for any given ETI, especially over time as inequality has risen.[31]

**Income distributions from CBO and Pareto-lognormal approximations** Figure A1 displays averages reported by CBO and our best-fit calibration over the range of years for which we have data. The Pareto-lognormal distributions somewhat underestimate incomes near the middle of the distribution, while overestimating incomes at the bottom. Outside of the top tail, an underestimate of income at a particular percentile is likely to bias upward MSWWs above that income relative to those below. Intuitively, underestimating income at a given percentile is equivalent to overestimating $F(y')$, where $y'$ is the estimated income level. Then raising the marginal tax rate at $y'$ will have smaller redistributive benefits than the calibration suggests, and thus a given tax rate must correspond to a greater commitment to redistribution than the calibration suggests. This effect is complicated by the dependence of the optimal tax rate on the density of earners at $y'$, so a directional claim cannot be made with certainty, but provided the latter effect is small, this reasoning suggests our MSWWs are likely to be biased down at low incomes, biased upward for middle incomes, and approximately correct at high incomes.

Our calibrations capture the well-known increase in concentration of income over this period, as we show in the online appendix through Lorenz curves for 1980, 1990, 2000, and 2010. Figure A2 plots the Lorenz curves for our calibrated distributions of market incomes across four decades. This progression demonstrates the well-documented concentration of income among high earners.

[31] Given the relatively low income at which the top marginal tax rate applies in the United States, we assign the same marginal tax rate to these households even if we somewhat understate their incomes.

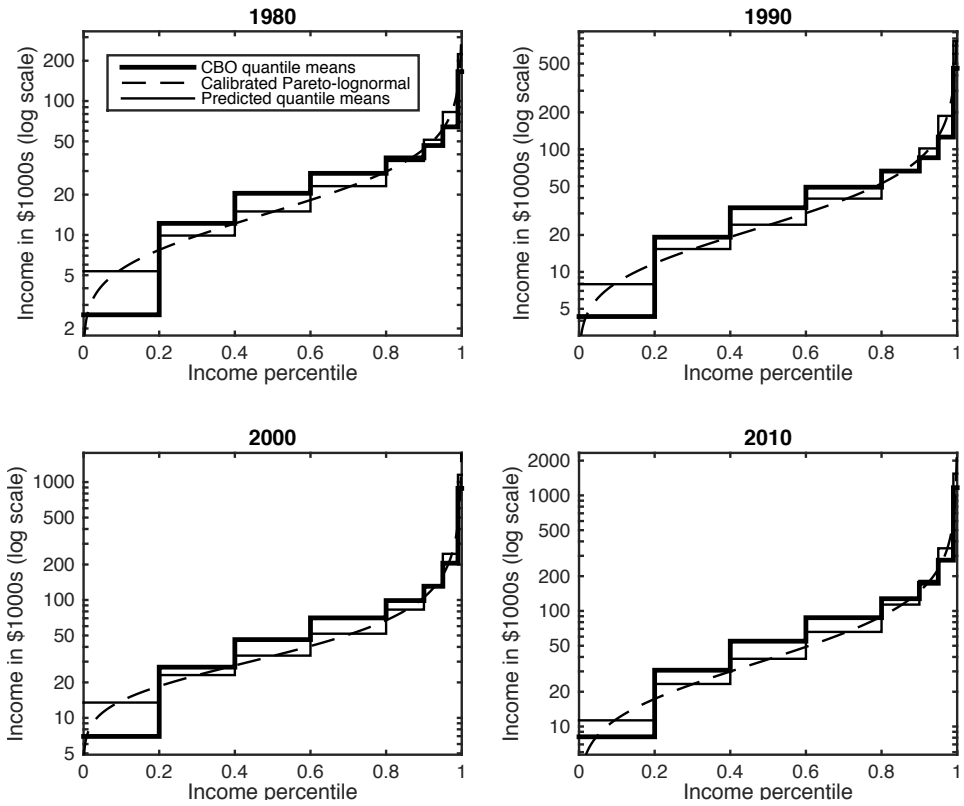


**Figure A1:** The reported and calibrated distribution of market income in the US for years 1980, 1990, 2000, and 2010. The bold lines represent the mean income within the quantiles reported in CBO data. The dashed line is the best-fit Pareto-lognormal distribution, selected by minimizing the sum of squared errors between the reported quantile means and those predicted by the calibrated distribution—denoted here by the thin solid line. (Income is reported in nominal terms.)

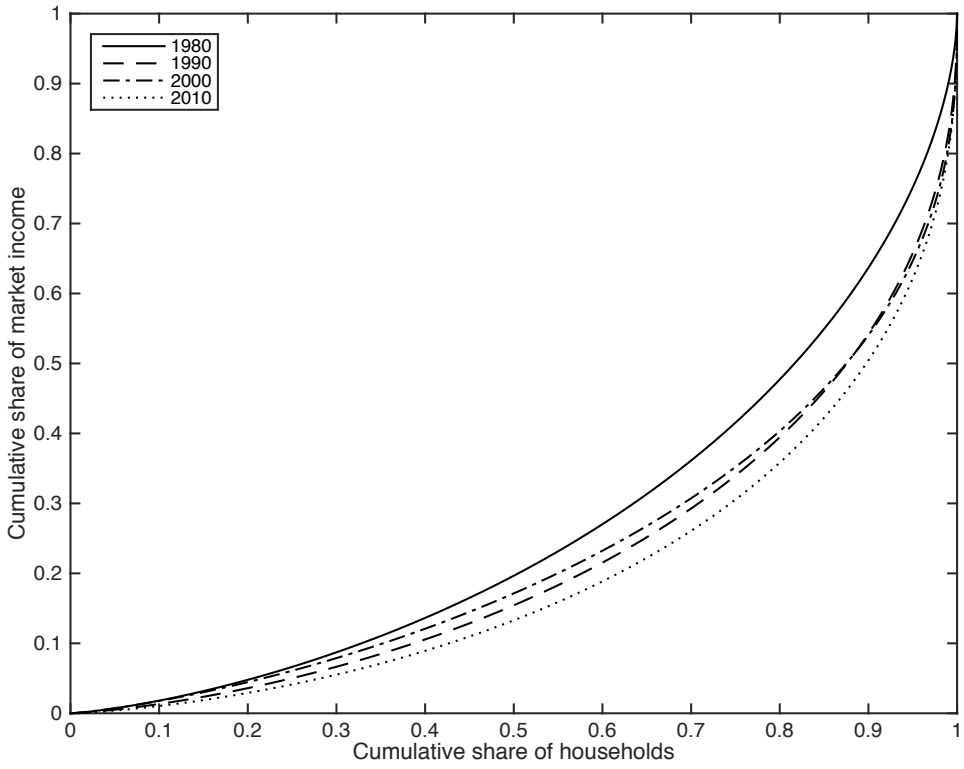


**Figure A2:** Lorenz curves for the calibrated distribution of market income in 1980, 1990, 2000, and 2010.

**Evolution of marginal tax rates** Figure A3 displays the evolution of marginal tax rates over this period.

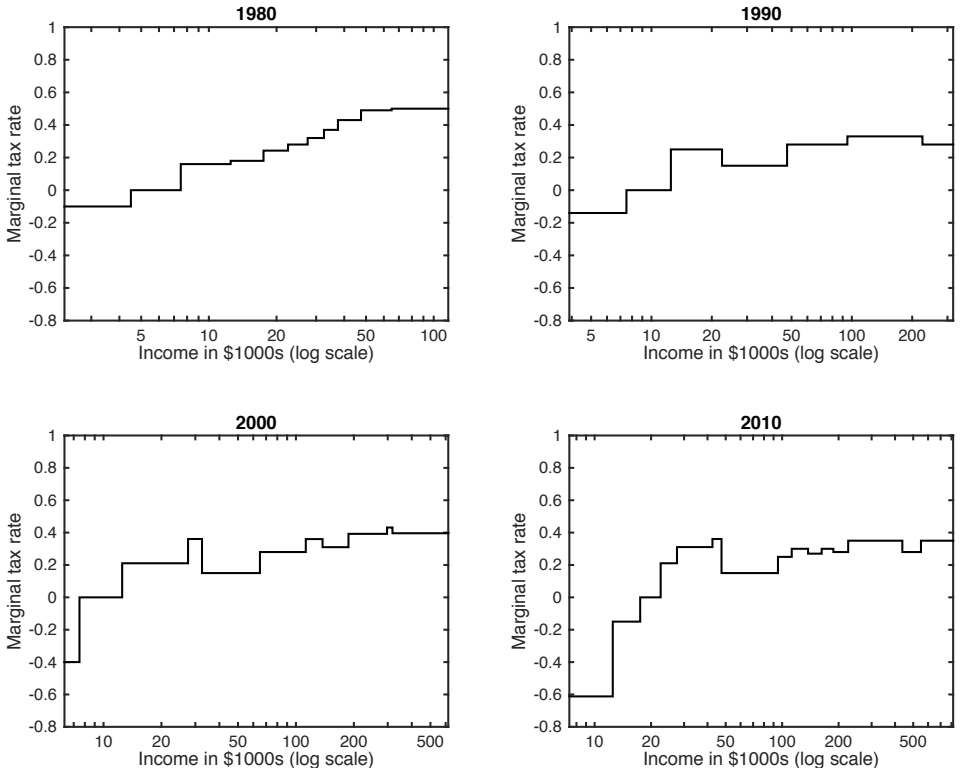


**Figure A3:** Marginal tax rate schedule as reported by NBER's TAXSIM for 1980, 1990, 2000, and 2010. Taxes on capital gains and at the state and local level are not included. Tax rates are computed for a family of two adults, filing jointly, with two dependents under age 17.

**Calculating MSWWs via numerical differentiation.** Figure A4 displays our calculated S weights and their smoothed version. This computation is sensitive to the assumed elasticity of taxable income—here we assume a value of 0.3. A technical complication is that discontinuities in the marginal tax rate schedule carry through to $\frac{\int_y^\infty g(z)dF(z)}{1-F(y)}$, generating points at which the schedule is not differentiable and the MSWWs are not defined. Since this feature is likely an artifact of the desire for a simple tax code, rather than a feature of underlying social preferences, we use a Gaussian kernel smoothing regression to smooth the schedule of S weights, rendering it differentiable, as shown in Figure A4. We use a bandwidth of 10% of the mean income in the 7th CBO bucket (the 95th to 99th percentile), which preserves the shape of the distribution while fully smoothing the kinks.

**Accounting for transfers and state and local taxes** As mentioned in the text, our measure of marginal tax rates excludes two important components of the overall tax burden. First, it does not include phase-outs of transfer programs such as SNAP (food stamps) and housing vouchers. The effect of such phase-outs are likely strongest at low incomes, whereas our focus is largely on policy toward high earners. Nevertheless, we explore the possible extent of rising transfers (and thus, rising implicit marginal tax rates from phase-outs) by imposing an alternative tax schedule for 2010. Specifically, for those with annual earnings below $30,000, we replace the marginal tax rate as reported by TAXSIM with a constant rate of 40%, intended to approximate the effect of incorporating phase-outs according to the Congressional Budget Office's 2012a report on marginal tax rate's among low and middle income households. The evolution of MSWWs under this alternative specification is displayed in Figure A5. As expected, this modification lowers MSWWs for low and middle incomes in 2010

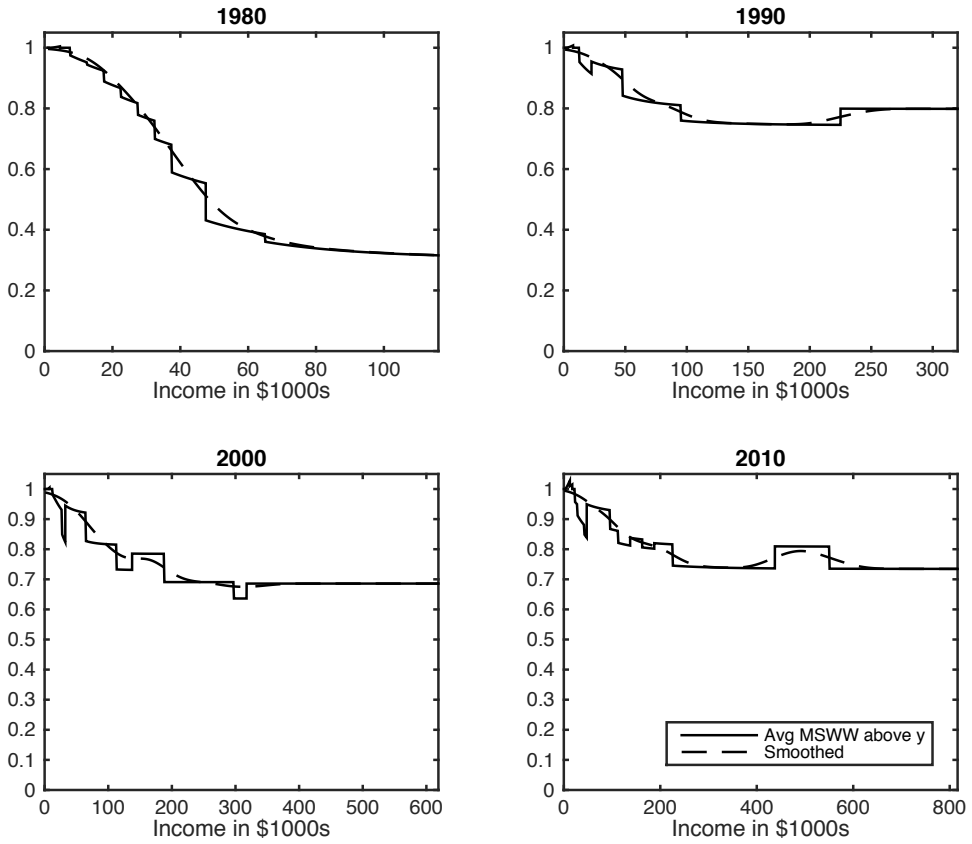


**Figure A4:** Average MSWWs above each income level, $\frac{\int_y^\infty g(z)dF(z)}{1-F(y)}$, in 1980, 1990, 2000, and 2010. Discontinuities are generated by kinks in the income tax schedule. Dashed lines are computed using Gaussian kernel smoothing regression with bandwidth equal to one tenth of the mean income in 95–99 percentile CBO bucket. Results are computed assuming an elasticity of taxable income of 0.3.

Another important component of the total tax burden ignored in our baseline analysis is state and local taxes. As pointed out in Hendren (2014), to the extent that these taxes represent implicit fees for local amenities, such as school quality, it is appropriate to exclude this component of the tax burden. Nevertheless, to explore the effect of state taxes, we add a flat 8% marginal tax rate at all levels of income. In practice, state taxes appear mildly regressive (Institute on Taxation and Economic Policy, 2013), making this a conservative assumption with respect to our main results.

The effect of this modification is displayed in Figure A6. The higher marginal tax rates serve to make the schedule of MSWWs (calculated assuming an ETI of 0.3) decline more sharply with income, but top MSWWs remain well above conventional values from 1990 through 2010.

**Computing the evolution of MSWWs due solely to tax changes.** The evolution of MSWWs displayed in Figure **??** is driven both by rising inequality in market incomes and changes to the progressivity of the tax code. To isolate the effect of policy changes alone, Figure A7 shows what this evolution would have looked like if market income inequality had not risen over time. This figure is constructed by scaling the market income distribution in 1980 by the change in average market incomes over time, so inequality (as measured by interquartile spreads or the Gini index) remains fixed. The schedule of MSWWs is plotted against the same vector of real disposable income as Figure **??** for comparability. As would be expected, MSWWs on high earners are somewhat lower when the effect of rising inequality is removed. Yet the qualitative resemblance between Figures **??** and A7 demonstrates the importance of tax reforms as the key driver of large changes to the implicit MSWWs—i.e., the large increase in the MSWWs on high earners from 1980 to 1990 is virtually identical in the two figures.

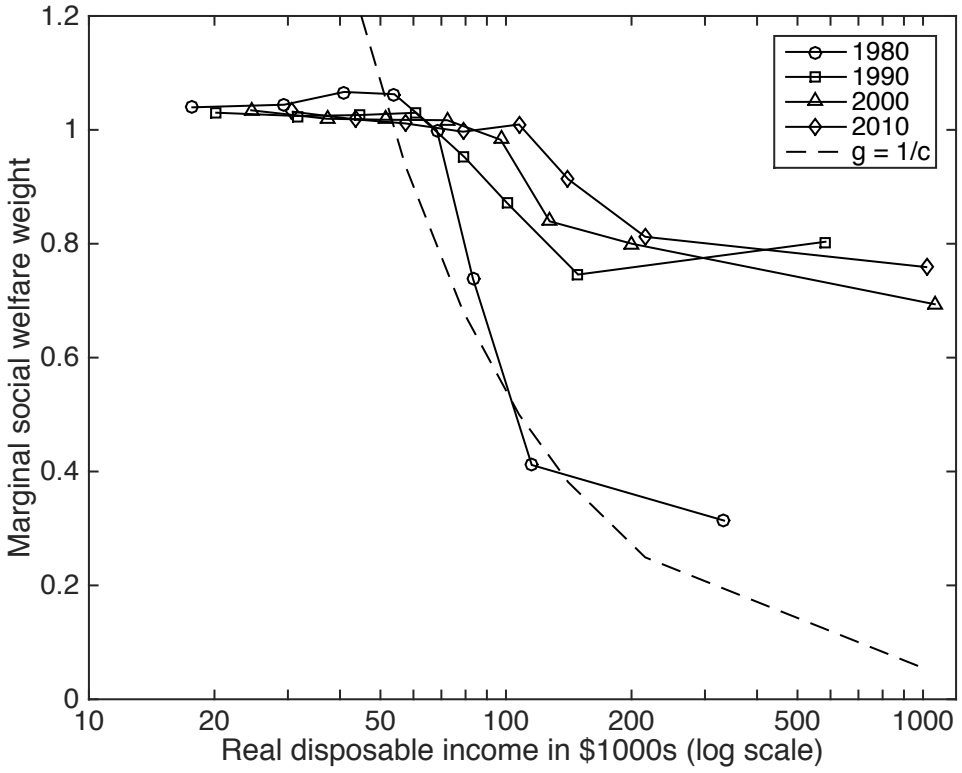


**Figure A5:** Average MSWWs, plotted against disposable income in 1980, 1990, 2000, and 2010. The 2010 marginal tax rates are set to 40% for those earning less than $30,000 annually, to approximate the effect of implicit marginal tax rates due to transfer phase-outs during that year.

**Beliefs in complementarities across skill levels** "Trickle-down economics" was the pejorative term applied in the 1980s to the idea that stimulating economic activity by high-earners would benefit low-earners, as well. Stiglitz (1982) is the best-known formalization of the idea in the optimal tax literature, and Rothschild and Scheuer (2013) recently expanded on his work. The basic idea of these analyses is that workers of different skill levels are complementary in production, so that an increase in effort by high-wage earners will raise the marginal productivities, and thus wages, of low-wage earners. That general-equilibrium dynamic is absent from our analysis thus far, and it may provide an alternative explanation of our findings. That is, if Americans strongly believed in the idea of trickle down economics, they would have voted for policies much as if their perceptions of the distortionary costs of taxation were higher than conventionally assumed.

We can again look to the GSS for some (limited) evidence on this question. The GSS asked respondents in 1987 and 1996 whether they strongly agreed (5), agreed, felt neither way, disagreed, or strongly disagreed (1) with the statement: "Allowing business to make good profits is the best way to improve everyone's standard of living." The mean responses in 1987 and 1996 were 2.73 to 2.66. Though of course only suggestive, these results suggest only a moderate, and stable, belief in complementarities of the sort at work in Stiglitz (1982) over this period.

**The extent of preference heterogeneity** One aspect of true preferences for redistribution involves the extent of heterogeneous preferences. Fleurbaey and Maniquet (2006) have developed in detail a distinction between dimensions of heterogeneity across individuals that likely merit redistribution, such as innate ability, and that likely do not, such as preferences for consumption relative to leisure. Lockwood and Weinzierl (2015), show that if such preferences vary across the population, optimal taxes will generally be less redistributive than in the conventional Mirrlees model. That paper also presents suggestive cross-sectional evidence that countries with greater preference heterogeneity (as reported in survey evidence) have less

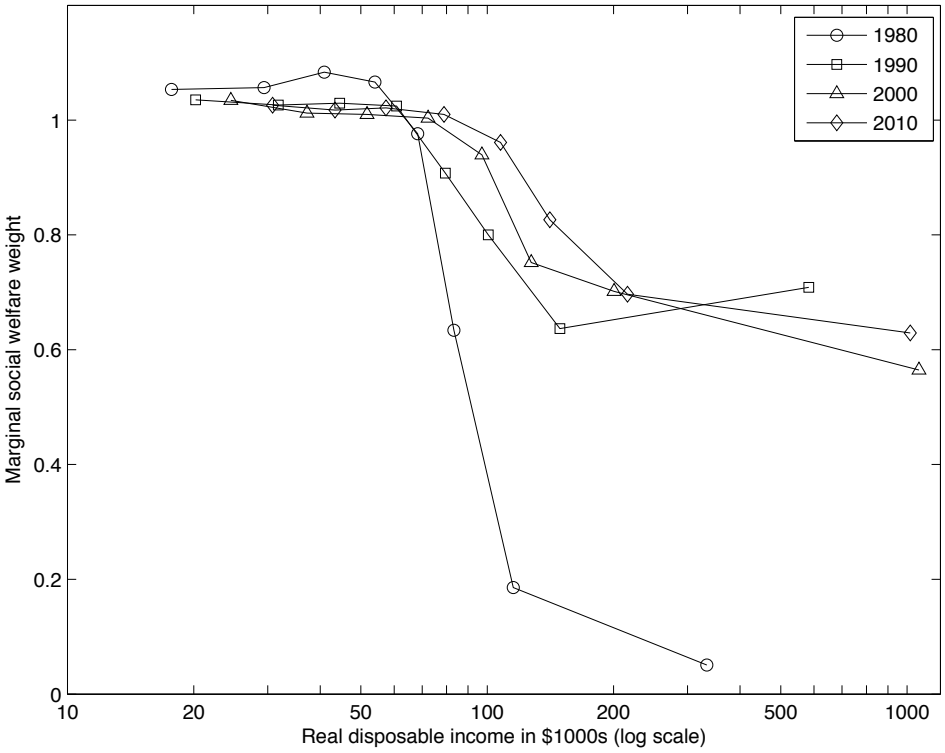


**Figure A6:** Average MSWWs, plotted against disposable income in 1980, 1990, 2000, and 2010, with an additional 8 percentage points added to the marginal tax rate at each income level to approximate state and local taxes.

progressive tax codes. Increasing preference heterogeneity could therefore explain the trend toward less redistributive tax policy in the United States over this period.

Figure A8 plots survey responses pertaining to the relative preference for labor and leisure over time. We are most interested in changes to preference *heterogeneity*, and therefore the figure also plots the standard deviation of responses over time.

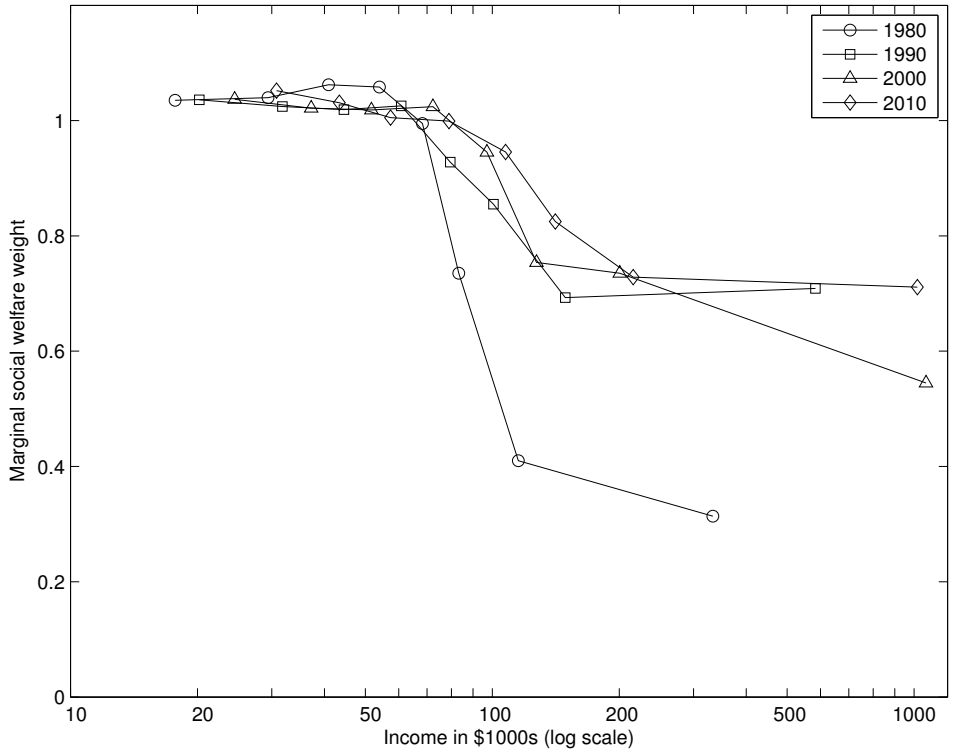


**Figure A7:** The evolution of MSWWs due to tax changes. This figure is identical to Figure **??**, except the inequality of market income is held constant over time.

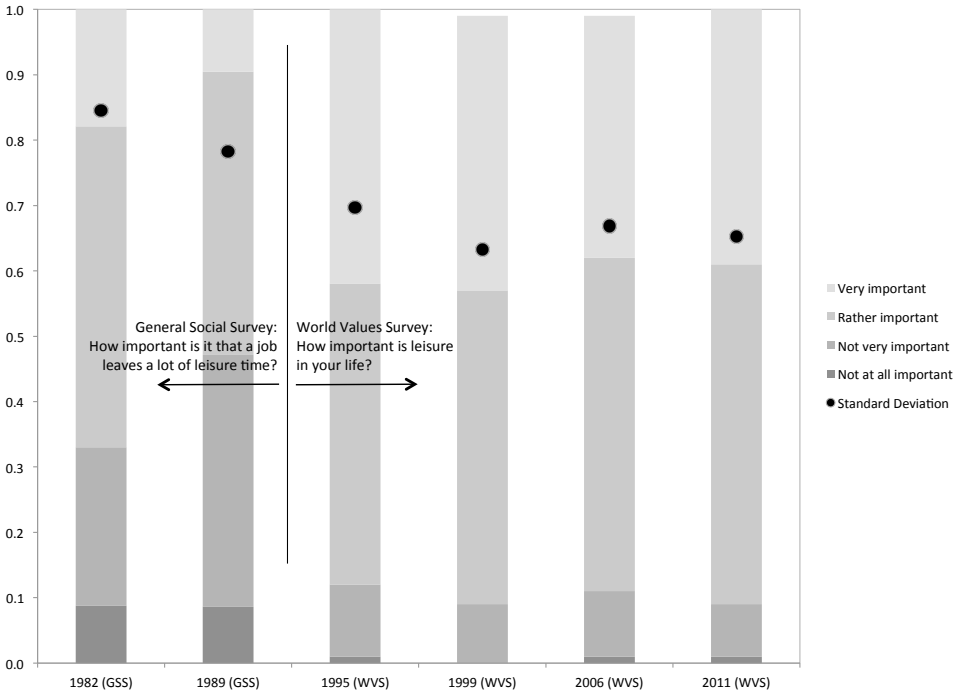


**Figure A8:** Responses to questions on the General Social Survey and the World Values Survey about preferences for leisure relative to consumption. Black dots plot the standard deviation of responses over time.

The evidence is hardly conclusive, and involves splicing together data from multiple surveys, but there appears to be little support for the hypothesis that preference heterogeneity rose substantially over time. On the contrary, the standard deviation of responses appears to decrease slightly over time.

**Extending the analysis to the early 20th century** Figure A9 shows the evolution of high-income MSWWs $g_t^*$ for each year of the 1979-2010 period and three fixed ETI values at or above the conventional range of empirical estimates.


**Figure A9:** Implied social welfare weight on the top 1% for a range of elasticities of taxable income.

We can extend the analysis in Figure A9 farther back in time. We use data from Piketty and Saez (2007) to calibrate the Pareto parameters at the top of the income distribution from 1916 to 2012. We then use the U.S. statutory marginal tax rate schedule (on earned income), the same set of ETI values from Figure A9, and the simplified formula for the top marginal tax rate from Saez (2001) to back out the implicit $g_t^*$ over this nearly 100-year period. Figure A10 shows the results.

As with the now-familiar figures from Thomas Piketty and Emmanuel Saez (2003) showing the U-shaped evolution of income inequality over this time period, Figure A10 demonstrates that the recent implicit values of $g_t^*$ are higher than any since the early 1930s.

The complementary analysis is in Figure A11, which shows the evolution of required ETIs for each year of the 1979–2010 period given four $g^*$ values (note that the smallest of these values is the "conventional" assumption).

Using the same approach as with the previous explanation, we can extend this analysis back over the last century. Figure A12 shows the results. As this figure makes clear, the perceived ETI implied by U.S. policy for the mid-20th century was extremely low for a wide range of high-earner MSWWs.

Examination of the reforms in 1964 provides a useful illustration of the ambiguity at the heart of this paper. The most important features of the 1964 reforms, for the purposes of this paper, were its substantial reductions in high-income marginal tax rates, for example from a top rate of 91 percent to a top rate of 70 percent on incomes over $200,000. President John F. Kennedy gave an argument for the 1964 reforms that stressed the distortionary costs of high marginal tax rates:

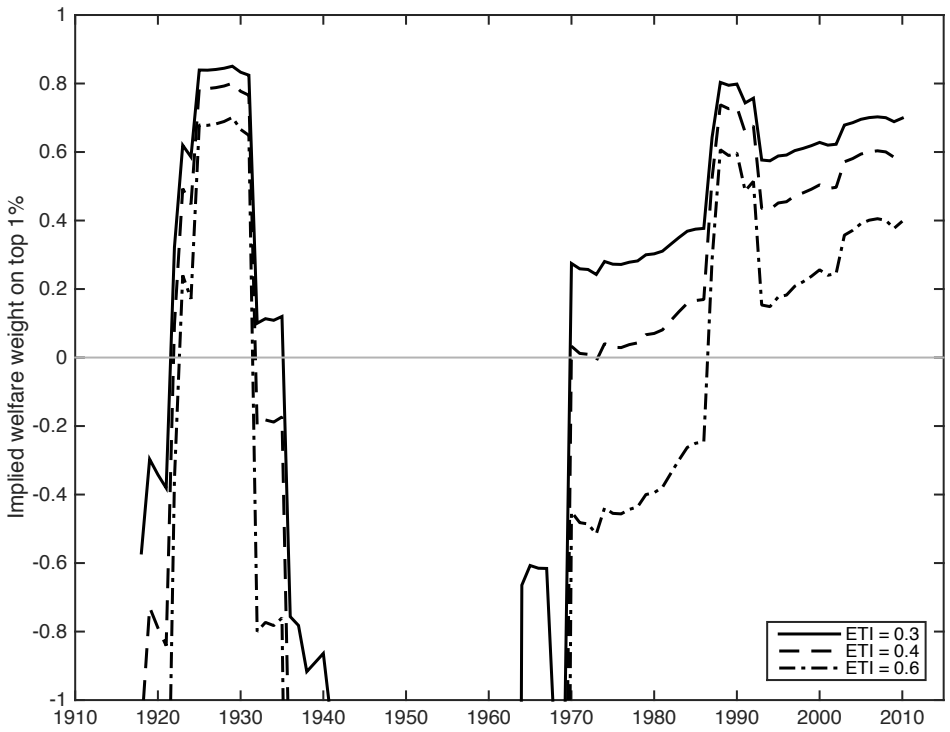


**Figure A10:** Implied social welfare weight on the top 1% for a range of elasticities of taxable income, for the full history of the US income tax. This figure is constructed using the highest marginal tax rate on wages and other earned income, as reported at `www.ctj.org/pdf/regcg.pdf`.

> "Our present tax system, developed as it was, in good part, during World War II to restrain growth, exerts too heavy a drag on growth in peace time; that it siphons out of the private economy too large a share of personal and business purchasing power; that it reduces the financial incentives for personal effort, investment, and risk-taking."

Kennedy's arguments are consistent with idea that the true ETI was too high for a top marginal tax rate of 91 percent to be optimal in peacetime, while during the war it had another—unconventional—justification. At nearly the same time, Ronald Reagan, soon to be the Governor of California and then President of the United States, gave a speech supporting Barry Goldwater, the Republican nominee for President in 1964. In it, he made a very different argument for a flatter marginal tax rate structure:

> "Have we the courage and the will to face up to the immorality and discrimination of the progressive tax, and demand a return to traditional proportionate taxation? Today in our country the tax collector's share is 37 cents of every dollar earned. Freedom has never been so fragile, so close to slipping from our grasp."

Reagan's arguments are consistent with the idea that the true welfare weights on those paying the top marginal tax rate were relatively too large for a 91 percent rate to be optimal.

**World Values Survey survey data about the perceived ETI.** Figure A13 shows the distribution of responses to this question, as well as the mean response, from 1990 through 2011.

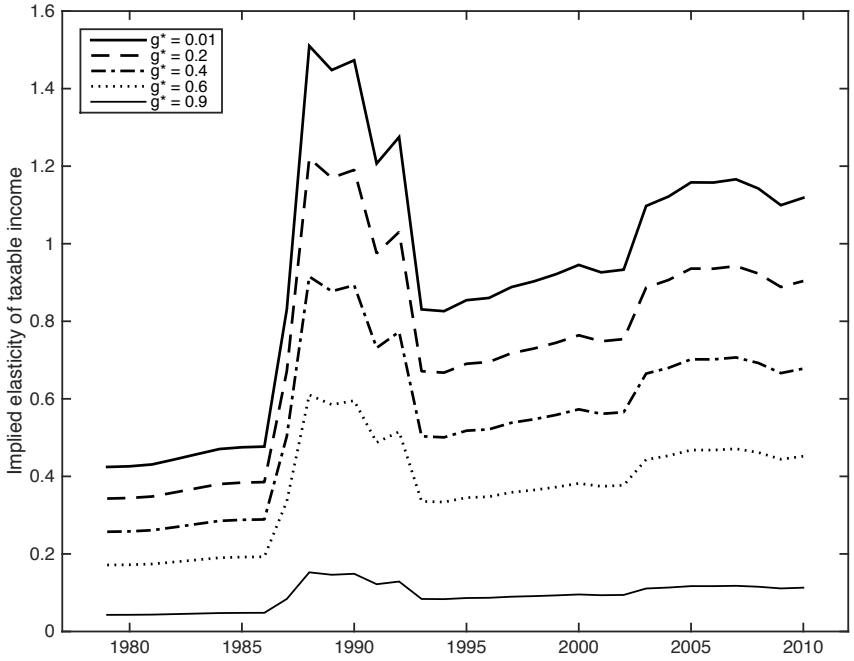


**Figure A11:** Implied elasticities of taxable income which would place a welfare weight on the top 1% of earners, denoted $g_t^*$, of 0.01 (the "conventional" case), 0.2, 0.4, 0.6, or 0.9.

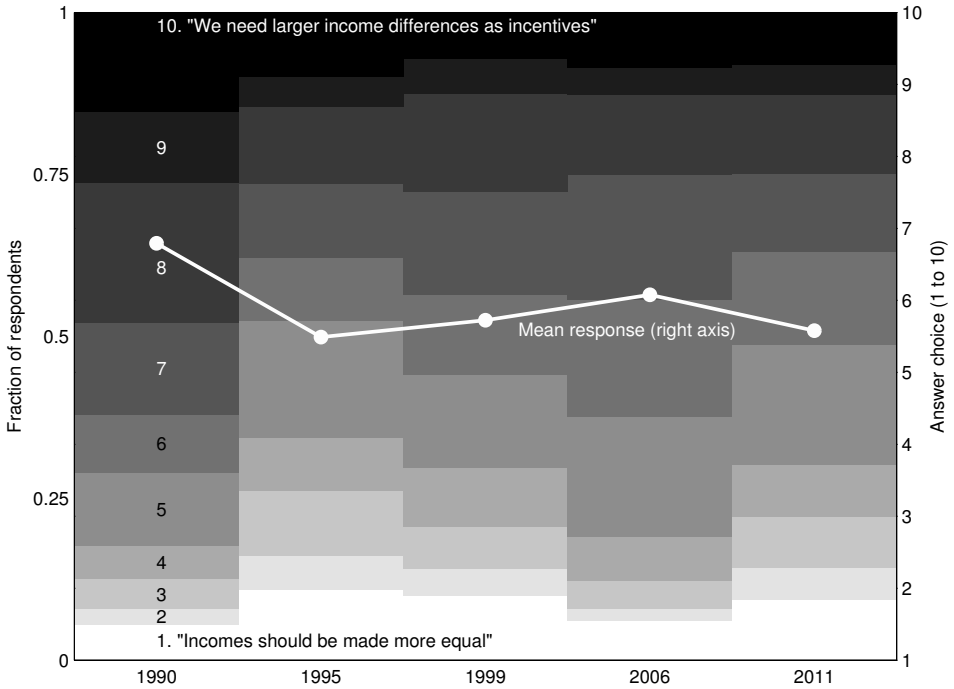


**Figure A13:** Responses to the World Values Survey question in which 1 is "Incomes should be made more equal" and 10 is "We need larger income differences as incentives." The solid line shows the mean answer in each year, as measured by the right axis.

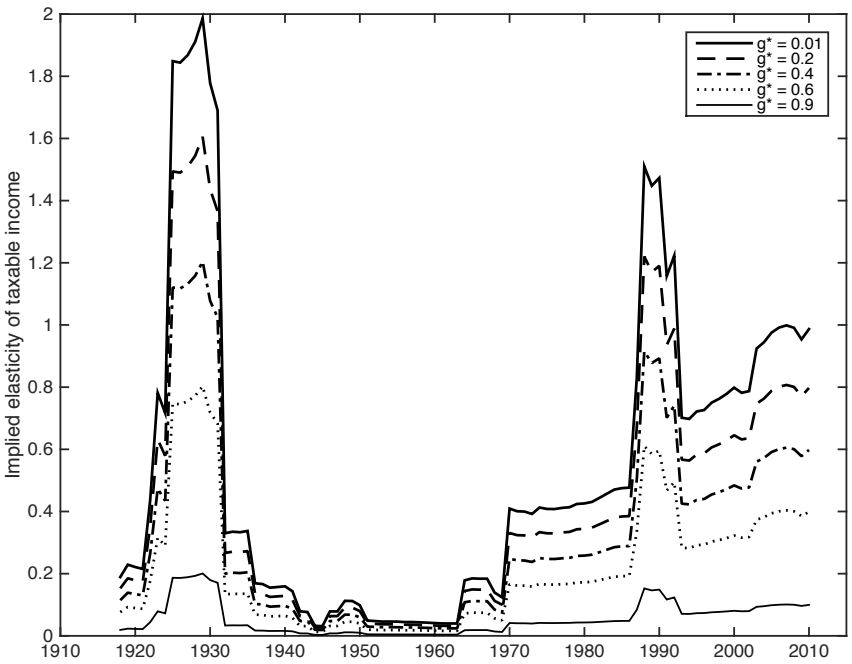


**Figure A12:** Implied elasticities of taxable income for various welfare weights on the top 1% for the history of US income tax. This figure is constructed using the highest marginal tax rate on wages and other earned income, as reported at `www.ctj.org/pdf/regcg.pdf`.

**Survey responses about political representation.** Figure A14 displays the share of respondents agreeing with two statements about political representation in the General Social Survey: "Public officials are interested in the problems of the average man" and "The average citizen has considerable influence on politics".

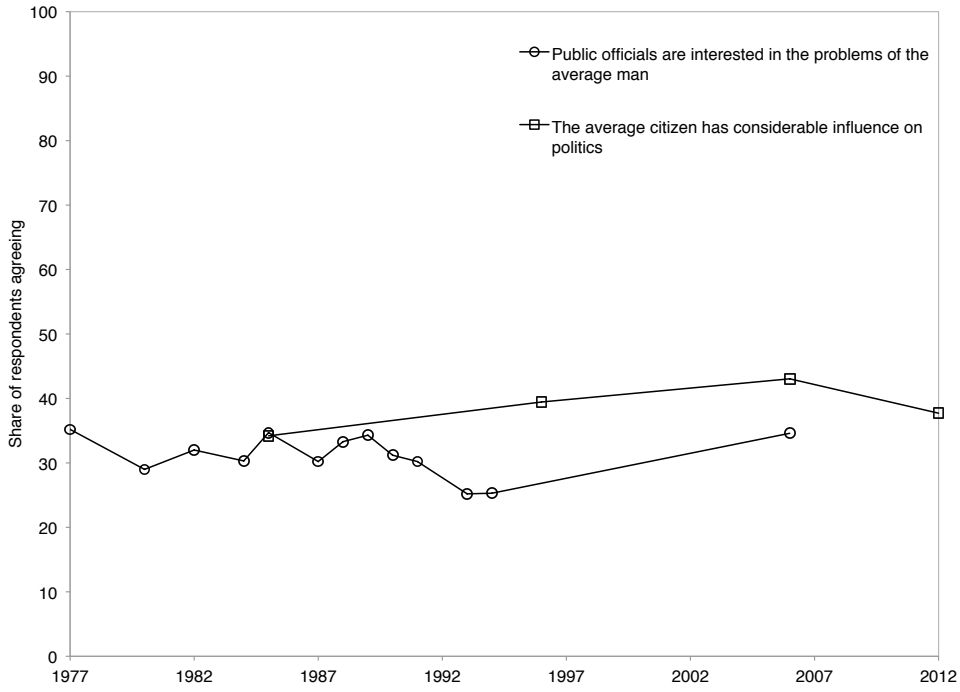


**Figure A14:** Share of respondents agreeing with two statements about about political representation on the General Social Survey over time.

**Illustration of income and tax distributions** Figure A15 displays the illustration of the income shares and tax burdens across quintiles of the income distribution, as shown to respondents in our MTurk survey described in Section 3.2.

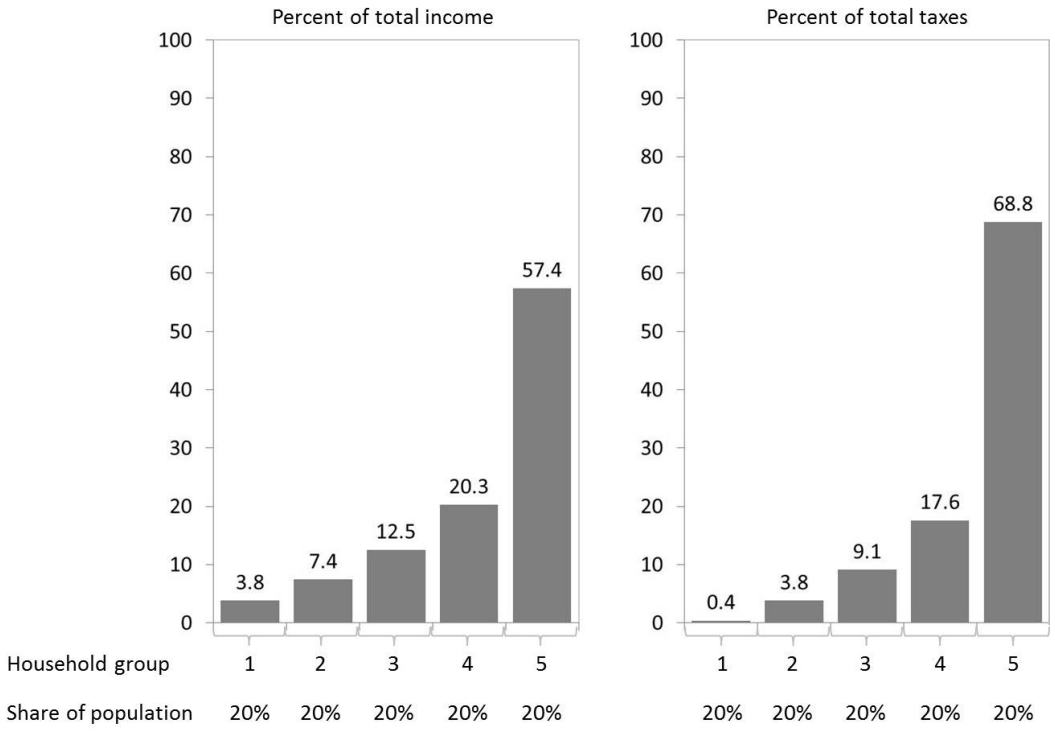


**Figure A15:** Distribution of market income from CBO (2013) by household income quintile (left panel) and distribution of federal tax payments from CBO (2013) by household income quintile (right panel).

**Raw and reweighted survey results** Figure A2 displays the raw response shares from our MTurk survey, as well as the reweighted shares, which are adjusted to mirror the distribution of self-reported political affiliations among Gallup respondents. Reweighting gives us a result for the "No information" treatment that is much more similar to Gallup's than our unadjusted results.

**Unadjusted data**

| | Upper-income households pay... | | | |
|---|---|---|---|---|
| Treatment | Too little | Fair share | Too much | Obs |
| No information | 80% | 16% | 4% | 51 |
| Income shares | 70% | 22% | 7% | 54 |
| Tax shares | 48% | 33% | 19% | 39 |
| Both income and tax shares | 54% | 33% | 13% | 52 |

**Adjusted data (scaled to match Gallup shares of political affiliation)**

| | Upper-income households pay... | | | |
|---|---|---|---|---|
| Treatment | Too little | Fair share | Too much | Obs |
| No information | 71% | 22% | 7% | 51 |
| Income shares | 59% | 29% | 12% | 54 |
| Tax shares | 34% | 40% | 26% | 39 |
| Both income and tax shares | 48% | 28% | 24% | 52 |
| **Gallup results** | 61% | 24% | 13% | 1,026 |

**Table A2:** Results by treatment, raw and adjusted for political composition.