Preliminary Draft: Comments Welcome

U.S. Inequality, Fiscal Progressivity, and Work Disincentives

An Intragenerational Accounting

by

Alan J. Auerbach
University of California, Berkeley

Laurence J. Kotlikoff
Boston University and The Fiscal Analysis Center

Darryl Koehler
Economic Security Planning, Inc. and The Fiscal Analysis Center

January 2016

We thank the National Center for Policy Analysis for research support from December 1, 2013 through November 1, 2014, the Searle Family Trust for their support in 2015, the Sloan Foundation, the Robert D. Burch Center for Tax Policy and Public Finance at the University of California, Berkeley, and Boston University for research support. We thank Emmanuel Saez and other participants at the October 2015 Boskin Fest for very helpful comments.

Abstract

This study combines the 2013 Federal Reserve Survey of Consumer Finances data and the Fiscal Analyzer, a highly detailed life-cycle consumption-smoothing program, to a) measure ultimate economic inequality – inequality in lifetime spending power – within cohorts, b) assess fiscal progressivity within cohorts, c) calculate marginal remaining lifetime net tax rates, taking into account all major federal and state tax and transfer policies, d) evaluate the ability of current income to correctly classify households as rich, middle class, and poor, e) determine whether current-year average net tax rates accurately capture actual fiscal progressivity, and f) determine whether current-year marginal tax rates on labor supply accurately capture actual remaining lifetime marginal net tax rates.

We find far less inequality in spending power than in wealth or labor earnings due to the fiscal system's high degree of progressivity. But U.S. fiscal redistribution generally comes with very high work disincentives for households of all ages, regardless of income class. There is, however, substantial dispersion in marginal net tax rates, which seems hard to reconcile with standard norms of optimal taxation. We also find that current income is a very poor proxy for remaining lifetime resources and that current-year net tax rates can provide a highly distorted picture of true fiscal progressivity and work disincentives.

1. Introduction

Inequality is a topic of intense national and international interest thanks to the growing dispersion of income and wealth around the world. Yellen (2014) reports that average real income of the top 5 percent of U.S. households ranked by income grew by 38 percent between 1989 and 2013. In contrast, the average real income of the lowest 95 percent grew by 10 percent. Over the same period, the share of total U.S. net tangible wealth (net financial and real assets) owned by the wealthiest 5 percent of Americans, regardless of age, grew from 54 percent to 63 percent. Today, the 50 percent poorest Americans, ranked on the basis of their wealth, own a mere 1 percent of total net wealth.[1]

As documented by Kopczuk, Saez, and Song (2010), wage inequality, while less pronounced than income or wealth inequality, is also significant and growing. Studies by Goldin and Katz (2008) and Acemoglu and Autor (2011) show a steady, dramatic 75 percent increase in the college/high school wage premium over the last three decades, with typical college graduates now earning twice the wage of high school graduates.[2]

These studies are important and interesting but, for understanding inequality, they all fail an important test: none measures inequality in living standards, which should be the ultimate concern when assessing economic fairness. A sufficiently progressive fiscal system can transform the most unequal distribution of *resources* into a much more equal *spending* distribution. Furthermore, if the fiscal system's progressivity increases over time, it can offset rising inequality in net wealth and labor earnings. By spending, we mean the

[1] Yellen (2014) also documents changes in wealth inequality. Note that this ranks all households by wealth rather than remaining lifetime resources. In our 2013 SCF data, the poorest 40 percent of households ages 20 to 79, ranked in terms of lifetime resources, account for almost 10 percent of total net wealth.

[2] See, in particular, Figure 1 in Acemoglu and Autor (2011).

present value of a household's remaining expected future lifetime expenditures, including imputed rent on owned homes and its expected future bequests, where "expected" refers to consideration of all household survival paths and their corresponding probabilities.

Unfortunately, no data set reports such spending projections, and even measuring current-year spending is fraught with difficulties. However, there is an alternative and straightforward route to projecting what a household will spend. One can estimate remaining lifetime spending based on a) estimated lifetime resources – the household's current net wealth and its current and projected future labor earnings; b) the taxes it will pay and transfer payments it will receive, in present expected value; and c) assumed life-cycle consumption smoothing behavior subject to borrowing constraints.

We adopt this approach to assess U.S. inequality in remaining lifetime spending and also examine the degree to which U.S. federal and state fiscal policies reduce spending inequality. Specifically, we apply *The Fiscal Analyzer* to the 2013 Federal Reserve Survey of Consumer Finances (SCF).[3] The Fiscal Analyzer is a highly detailed life-cycle consumption-smoothing program that considers all possible household survival paths. It forms its consumption smoothing subject to borrowing constraints and smoothes a household's living standard not just over time along any given survival path, but also, based on its automatic life insurance purchases, across all survival paths. [4]

In forming its calculations, the Fiscal Analyzer incorporates economies in shared living and the relative cost of children. It also considers all major federal and state tax and

[3] When we began this project, the 2013 SCF was not yet released. Hence we used the 2010 SCF and switched to the 2013 SCF when it became available. The results from the 2010 SCF are remarkably similar to those we report here for the 2013 SCF.

[4] The life insurance purchased at each date by the program for its household heads (and spouses, if married or partnered) is subject to non-negativity constraints. Hence, the program does not assume households purchase annuities (sell life insurance) in order to achieve perfect across-state consumption smoothing.

transfer programs, including the federal personal income tax, the FICA payroll tax, state income taxes, state sales taxes, the federal corporate income tax, the federal estate tax, TANF welfare benefits, Food Stamps, Supplemental Security Income, Social Security retirement and auxiliary (spousal, divorced spousal, child, child-in-care spousal, child survivor, widow(er), divorced widow(er), mother (father), and divorced mother (father) benefits, Social Security disability benefits, Medicaid benefits, Medicare benefits, and Medicare Part B premiums. It treats consumption of Medicare and Medicaid benefits as non-fungible. All other welfare benefits, including Food Stamps, are treated as fully fungible sources of income.

In what follows, we use "present value" as shorthand for present *expected* value, where expectations reflect actuarial estimates of future mortality outcomes. Thus, the present value of spending is the sum, across all survivor paths *i*, of the product of a) the present value of annual spending along survivor path *i* and b) the probability of survivor path *i*.

The Fiscal Analyzer is comprehensive not only in its consideration of fiscal institutions, but also in its detail. For example, in handling the federal personal income tax, it follows the 1040 form on a virtually line-by-line basis taking into account personal exemptions, standard and itemized (including charitable deductions) deductions, the Earned Income Tax Credit, the Child Tax Credit, the Alternative Minimum Tax, preferential capital gains and dividend taxation, the tax treatment of contributions to and withdrawals from 401(k), standard IRA, Roth, and other retirement accounts, the taxation of Social Security benefits, and Medicare's high-income taxation of wages and asset income.

Social Security benefit calculation is another example of the program's precision. The Fiscal Analyzer includes the Early Retirement Benefit Reductions, the Delayed Retirement Credit, the Earnings Test, the Adjustment of the Reduction Factor, the Re-computation of Benefits, and the system's plethora of interconnected (across family members) eligibility conditions.

In addition to measuring spending inequality, comparing it to wealth inequality, and calculating average lifetime net tax rates, we also calculate marginal remaining lifetime net tax rates. Average lifetime net tax rates are measured as the present value of remaining lifetime net tax payments divided by remaining lifetime resources – the sum of net tangible wealth (including equity in homes and real estate) and human wealth – the present of future labor earnings from wages and self employment.

Marginal remaining lifetime net tax rates capture the present value of additional lifetime spending per dollar of additional current earnings. The calculation of these marginal rates takes into account that the extra earnings will, if the household is not borrowing constrained, lead to higher spending not just in the present, but also in the future. This reflects consumption smoothing. But it also means higher future assets and thus higher future asset income. This, in turn, can translate into higher future taxes and/or lower future benefits given the income and asset tests of the various benefit policies.

Our measurement of inequality as well as average and marginal net tax rates is cohort-specific (hence the title's reference to *intragenerational accounting*). It's also dynamic insofar as we consider remaining lifetime spending and net taxes. In contrast, the above-cited studies are static. They consider inequality in wealth, income, or earnings at a point in time and generally lump together households of all ages.

2. Basic Methodology

The Appendix details our treatment of the 2013 SCF data, the construction of The Fiscal Analyzer, and how we account for each of the survival paths household heads and their spouses/partners may experience. But the basics of our approach can be captured in three equations.

A. Framework

Equation (1) defines remaining lifetime resources, *R*, as

(1) $R = H + W$,

where *H*, human wealth, is the present value of lifetime earnings and *W* is private net wealth. The measure *R* constitutes the lifetime resources available before taxes are paid or transfer payments are received. Equation (2) defines remaining lifetime spending, *S*, as

(2) $S = R - T$,

where *T* stands for the present value of remaining lifetime net taxes (taxes paid less transfer payments received). Combining (1) and (2) yields

(3) $S = H + W - T$.

Again, while inequality in *R* and its two components, *W* and H, may be of independent interest and certainly has been the subject of considerable recent research, our focus is on ultimate inequality, i.e., inequality in *S*. Casual observation tells us that *S*, like *R*, is extremely unequally distributed in the United States. But even if significant inequality remains, a relevant question is the extent to which progressivity in the distribution of *T* mitigates inequality in the distribution of *S*.

Our study measures inequality in *S* on a cohort-specific basis and determines the degree to which inequality in *T* reduces inequality in *S*.[5] A second important question, but one reserved for future research, is the extent to which changes over time in progressivity in *T* have mitigated or exacerbated changes over time in inequality in S.

B. Fiscal Labeling Issues

As we have emphasized repeatedly in our own work (e.g., Kotlikoff, 1984 and 1988, Auerbach and Kotlikoff, 1987, Auerbach, Gokhale, and Kotlikoff, 1991, Kotlikoff, 2002, and Green and Kotlikoff, 2006), while measures such as consumption are well-defined, others, such as taxes and transfer payments, are not.[6] Forward-looking measures such as those considered here substantially lessen the problem; this was one of the important motivations for our previous work developing generational accounting. For example, a change simply in future labeling of social security transactions, from the taxes and transfers under a public system to saving and dissaving under a private system, would have no impact on average remaining lifetime tax rates, even though it would change annual flows of taxes and transfers. Still, some types of government policy interventions would affect our measures as well. For example, a policy equivalent to raising the minimum wage could be constructed using government taxes on employment and transfers to workers; our approach would not yield the same average tax rate calculations for these equivalent policies, because we take market wages as given.

---

[5] In doing so, we do not consider the extent to which changes in government policy through *T* have general equilibrium effects on the elements of *R*, as will be the case if government tax and transfer programs influence decisions to work and save. Thus, our estimates of the impact of government policy on progressivity are of a partial equilibrium nature, taking the underlying distribution of resources as given.

[6] Different, but equally valid fiscal labeling conventions will change *W* and *T* by equal absolute amounts. Hence, as described below, average net tax rates depend on the specific conventions used.

Therefore, we need to clarify the precise economic question our average net tax rates are answering. They are telling us the percentage change in the present value of remaining lifetime spending that would arise were taxes and transfer payments, *as currently labeled/defined by the U.S. government,* eliminated entirely.[7]

3. Preview of Findings

Our findings are striking. The distribution of remaining lifetime spending, while still highly unequal, is considerably more equal than either net wealth or current income. For example, the top 1 percent of 40-49 year olds ranked by resources account for 18.9 percent of total cohort net wealth and 13.4 percent of total cohort current income, but only 9.2 percent of total cohort remaining lifetime spending. As for the lowest-resource quintile, it has just 2.1 percent of the cohort's net wealth and 4.6 percent of its current income. But it has 6.9 percent of its total spending power. That spending, S, is much more equally distributed than is either wealth or current income is due to both the progressivity of the fiscal system as well as the fact that human wealth, H, which also determines spending, is more equally distributed than either net wealth or the asset-income component of current income.

Within each cohort, those with the lowest resources face significantly negative average remaining lifetime net tax rates, and those with the highest resources face significantly positive average remaining lifetime net tax rates. Consider, again, the cohort aged 40 to 49. Each dollar of remaining pre-tax lifetime resources of those in the top 1 percent of the resource distribution is taxed, on average, at a 45.0 percent net rate. For

[7] This is just T/R, where T gives the change in spending and R measures the spending that would arise in the absence of fiscal policy, *as conventionally* defined. One could also measure T (again, the change in S arising from eliminating T) as a percentage of current S (i.e., of $R - T$). This would raise all measured net tax rates. This would not necessarily make the fiscal system appear more progressive unless, for example, one measures progressivity purely in terms of the average net tax rate levied on the top 1 percent.

those in the top quintile the average net tax rate is 32.5 percent. But for those in the bottom quintile, every dollar of pre-tax resources is matched by a 34.2 percent net subsidy. Or, take those aged 70-79 in the top 1 percent of their cohort's resource distribution. Their remaining lifetime net tax rate is 26.8 percent. In contrast, those in the lowest quintile face a negative average remaining net tax rate of nearly 700 percent!

Longevity plays a major role in determining fiscal progressivity. Average net tax rates of those in the poorest quintile in each cohort would be significantly lower were they to live as long as those in the top quintile and, thereby, collect far more benefits. Take the lowest quintile of the 20 year-olds, 40 year-olds, and 70 year-olds. These negative average net tax rates would fall to –22.1 percent, –47.4 percent, and –825.4 percent from their respective values of –15.4 percent, –34.2 percent, and –695.3 percent.

Our complicated system of separately designed taxes and transfers leads, however, to median marginal net tax rates that are remarkably high for households at all resource levels. Among the poorest fifth of the 30-39 year-old cohort the average remaining lifetime net tax rate is –16.8 percent, whereas their median lifetime marginal net tax rate is 45.0 percent. This is nearly as high as the 47.4 percent median marginal rate of those in the top fifth of the cohort's resource distribution.

There is also enormous variation across households with the same or similar resources in net marginal tax rates. Consider the third resource quintile of 50 to 59 year-olds. Their median remaining lifetime net tax rate is 44.2 percent. But the minimum marginal rate is –5.3 percent, and the maximum rate is 262.3 percent! Among the top 1 percent resource holders in this age group, the minimum marginal remaining lifetime net tax rate is just 35.4 percent, whereas the maximum rate is 78.8 percent.

Such extreme differences in marginal net tax rates facing households in similar economic circumstances seem very much at odds with optimal tax theory absent some compelling justification for imposing very different tax rates on individuals in similar economic circumstances. As distortions rise roughly with the square of the marginal tax rate, raising household A's marginal rate and lowering household B's from a position of equality will raise the total excess burden imposed on the two households without any apparent change in the progressivity of the distribution of resources.

A final key finding is that classifying the lifetime poor, middle class, and rich based on their current income is highly inaccurate. So too is using current-year average and marginal net tax rates as proxies for remaining lifetime average and marginal net tax rates. This finding should be of interest to policymakers as well as tax analysts who routinely assess fiscal progressivity based on such annual average tax rates and assess tax distortions using current-year marginal tax rates.

The paper proceeds in Section 4 with a brief motivation of cohort-specific analysis of progressivity, i.e., *intragenerational accounting*. We explain why such analysis should be forward looking rather than based on current-year figures, and how this remaining lifetime approach relates to the prior literature evaluating inequality and fiscal progressivity. Section 5 presents a discussion of our data and methodology. Section 6 lays out our main results, first for the 40-49 year-old cohort and then, in less detail, for other cohorts. Section 7 discusses the sensitivity of our results to particular assumptions. Finally, Section 8 concludes with a review of our key findings and their implications for the evaluation of potential tax reforms.

4. Assessing Fiscal Progressivity

Our analysis measures fiscal progressivity on an expected lifetime basis, rather than on the annual basis that is more typical of existing studies.

A. The Need for a Dynamic Approach

Measuring current consumption is challenging and projecting future consumption is even more difficult. Consequently, most empirical studies of inequality simply ignore future consumption. Instead, they take current disposable income as a proxy for current consumption. They treat current disposable income as a valid measure of inequality and compare households, regardless of age, on the basis of this measure.

The problem with this practice is clarified by considering a world of identical individuals observed at different points in the life cycle. For simplicity, assume that these identical individuals work and pay taxes only when young and receive transfer payments only when old. Since everyone consumes exactly the same amount as everyone else as they progress through life, everyone enjoys the same lifetime living standard, i.e., there is no inequality across or within generations. But if one measures inequality based on current net income (income net of taxes and gross of transfer payments), the assessment can differ dramatically. Moreover, the tax and transfer system will be measured as progressive since it takes resources from those with currently high incomes – the young – and provides transfers to those with currently low incomes – the old.

Net wealth inequality across all households, regardless of age, is another popular measure of welfare differences. But this measure ignores the fact that the young may have little or no net wealth simply because they haven't yet had much time to save.

Taking a life-cycle perspective leads one to assess inequality based on lifetime utility or, in the case of older cohorts, remaining lifetime utility. This naturally leads to examining differences in remaining lifetime consumption, i.e., available resources *S*, on a cohort-by-cohort basis. This approach controls for differences arising from individuals being at different points in the life cycle.

As mentioned, we infer current and future consumption from each household's current and future resources. Specifically, we calculate the path of consumption that households would experience were they to smooth their consumption subject to annual borrowing constraints.

The precise nature of consumption smoothing depends on preferences. At present, we assume all households wish to maintain a stable living standard per household member through time, where living standard is defined as discretionary spending per effective adult with an adjustment for economies in shared living.[8] However, our methodology can accommodate any desired profile of relative consumption by age. We also assume that households know their future labor earnings and asset returns, a simplification that we hope to relax in future work.

B. Prior Studies of Fiscal Progressivity

Since the classic work of Pechman and Okner (1974), a standard approach to calculating the distributional effects of federal tax, or federal tax and transfer policy has been to classify individuals or households by before-tax income, possibly adjusting for family size, and then, using particular assumptions about tax *incidence* (who bears the ultimate burden

[8] The term "effective adult" refers to our assumption that children are less expensive than adults, specifically that they can enjoy the same living standard as adults with 30 percent less spent on them.

of any particular tax) assign taxes and transfers to different households in order to determine the progressivity of the fiscal system. The Pechman-Okner methodology has been retained, with refinements, notably in the continuing series of analyses by the Congressional Budget Office (CBO; most recently in CBO, 2014). Such studies generally find the U.S. fiscal system to be progressive, with the personal income tax (inclusive of such elements as the Earned Income Tax Credit) playing an important role.

But it has long been recognized that the annual snapshot approach to measuring progressivity (fiscal incidence) can deliver a distorted view. For example, Poterba (1989) contrasts the progressivity of excise taxes based on classifying households by annual income with the progressivity based on classifying households by annual consumption, which is a proxy for the level of the household's remaining lifetime resources. He shows that the first approach makes excise taxes look much more regressive than the second. Fullerton and Rogers (1993) build on Poterba's insight, considering the lifetime incidence of tax systems more generally. Altig et al. (2001) carry this approach further by performing such analysis within a general equilibrium model with rational, forward-looking households making lifetime planning decisions with respect to consumption and labor supply. These studies, however, consider simplified versions of the U.S. fiscal system, taking account of major programs but not all of the key elements that affect household burdens and incentives.

More recently, some analyses have considered the impacts of particular components of the fiscal system on progressivity, attempting to incorporate the full range of program details in their analysis. For example, Goda, Shoven, and Slavov (2011) estimate the progressivity of the U.S. Social Security system within particular age cohorts, taking

account of how the program works as well as the projected mortality of individuals in different lifetime income groups. Longevity is an important consideration, because Social Security is an annuity-based transfer program, with lifetime payments dependent on longevity. This is the type of analysis we perform here. But our actuarial analysis is of the entire U.S. fiscal system, rather than for a particular component of the system. While studying individual fiscal components is interesting in its own right, one cannot gain a picture of the fiscal system's overall effects from doing so.

5. Data and Methodology

As mentioned, our primary data come from the 2013 Survey of Consumer Finances (SCF). We also use all past waves of the Current Population Survey (CPS) to impute past Social Security covered earnings to our households as well as to project future covered earnings.

The SCF provides the value of *W*, the household's (i.e., household head's and spouse's, if married) tangible wealth. All inputs from the 2013 survey are transformed into 2015 dollars and all provisions of all fiscal systems are from 2015. The 2013 SCF has 6,015 families.[9] As Appendix B, which details our sample selection and coding decisions, makes clear, we attempted to include all observations in the SCF. This reflects our goal of obtaining a picture of spending inequality and fiscal progressivity that encompasses the entire country. Unfortunately, the SCF data set does not include state identifiers. We may, in future work, randomly assign households to different states, but in this study we assume that all SCF respondents reside in Ohio.

[9] Missing data are imputed randomly and presented in five different SCF data sets called implicates. We report results only for the first implicate. But we have run our analysis with the other implicates and found no significant differences in results. The time required to process all households in the SCF for one implicate is roughly 16 hours.

A key component of our calculations involving saving and wealth is the before-tax rate of return on household saving. For this, we use the average return on wealth for the period 1945-2013 based on data from the National Income and Product (NIPA) accounts and the Federal Reserve's Flow of Funds data. The numerator for each year equals the share of national income not going to wages and salaries (including the portion of proprietors' income we impute to labor). The denominator is aggregate wealth of the household sector plus financial wealth (negative if a net liability) of the federal, state and local government sectors. The resulting average real before-tax rate of return is 6.4 percent. To calculate nominal rates of return, we assume an inflation rate of 2 percent.

A. Projecting and Backcasting Labor Income

Our methodology requires, for each individual, a trajectory of labor earnings; past earnings are needed to calculate Social Security covered earnings, and future earnings are needed to calculate the value of human wealth, *H*, a component of remaining lifetime resources. We use the CPS to statistically match SCF households for this purpose. In particular, we define cells in each wave of the CPS by age, sex, and education,[10] and use successive waves to estimate annual earnings growth rates by age and year for individuals in each sex and education cell. These cell growth rates are used to "backcast" each individual's earnings history. We also project future earnings for each particular cell defined by age and demographic group, until age 67 (when we assume individuals claim retirement benefits) by using average historical growth rates by age, net of average overall earnings growth and plus an assumed future annual general real growth rate of 1 percent.

[10] In cases where cells have fewer than 25 observations, we merge cells for adjoining ages and assume that average growth rates for these merged cells hold for all included ages.

These past and future growth rate estimates are for cell aggregates and do not account for earnings heterogeneity within cells. To deal with such heterogeneity, we assume that observed individual deviations in earnings from cell means are partially permanent and partially transitory, based on an underlying earnings process in which the permanent component (relative to group trend growth) evolves as a random walk and the transitory component is serially uncorrelated. We also assume that such within-cell heterogeneity begins in the first year of labor force participation.

In particular, suppose that, at each age, for group *i*, earnings for each individual *j* evolve (relative to the change in the average for the group) according to a shock that includes a permanent component, *p*, and an *iid* temporary component, *e*. Then, at age *a* (normalized so that age 0 is the first year of labor force participation), the within-group variance will be $a\sigma_p^2 + \sigma_e^2$. Hence, our estimate of the fraction of the observed deviation of individual earnings from group earnings, $\left(y_{ij}^a - \bar{y}_i^a\right)$, that is permanent is $\frac{a\sigma_p^2}{a\sigma_p^2+\sigma_e^2}$. This share grows with age, as permanent shocks accumulate. Using this estimate, we form the permanent component of current earnings for individual *j*, $\hat{y}_{ij}^a$,

$$(4) \qquad \hat{y}_{ij}^a = \bar{y}_i^a + \frac{a\sigma_p^2}{a\sigma_p^2+\sigma_e^2}\left(y_{ij}^a - \bar{y}_i^a\right) = \frac{a\sigma_p^2}{a\sigma_p^2+\sigma_e^2} y_{ij}^a + \frac{\sigma_e^2}{a\sigma_p^2+\sigma_e^2}\bar{y}_i^a$$

and assume that future earnings grow at the group average growth rate.[11] Further, we make the simplifying assumption that the permanent and temporary earnings shocks have the same variance, a reasonable one based on the literature (e.g., Gottschalk and Moffitt, 1995, and Meghir and Pistaferri, 2011), so that (4) reduces to:

[11] Because we ignore earnings uncertainty in our calculations, we set all future permanent and temporary shocks to zero.

(4') $$\hat{y}_{ij}^{a} = \frac{a}{a+1} y_{ij}^{a} + \frac{1}{a+1} \bar{y}_{i}^{a}$$

For backcasting, we assume that earnings for individual *j* were at the group mean at age 0 (i.e., the year of labor force entry), and diverged smoothly from this group mean over time, so that the individual's estimated earnings *t* years prior to the current age *a* are:

(5) $$\bar{y}_{i}^{a-t} + \frac{a-t}{a}\left(\hat{y}_{ij}^{a} - \bar{y}_{i}^{a}\right)\frac{\bar{y}_{i}^{a-t}}{\bar{y}_{i}^{a}} = \frac{t}{a}\bar{y}_{i}^{a-t} + \frac{a-t}{a}\hat{y}_{ij}^{a}\frac{\bar{y}_{i}^{a-t}}{\bar{y}_{i}^{a}}$$

That is, for each age we use a weighted average of the estimate of current permanent earnings, deflated by general wage growth for group *i*, and the estimated age-a group-*i* mean also deflated by general wage growth for group *i*, with the weights converging linearly so that as we go back we weight the group mean more and more heavily, with a weight of 1 at the initial age, which we assume is age 20.

B. Projecting Consumption

A key element of our analysis involves the computation of future taxes and transfers that result from an individual's resources and their allocation to present and survivor-state specific future consumption. The Fiscal Analyzer (hereafter, TFA) calculates both *S* and *T* based on *W*, the time path of earnings that determines *H*, and our estimates of past covered Social Security earnings. Appendix A describes TFA in detail. But, in a nutshell, TFA smoothes a household's consumption across all survivor paths, subject to borrowing constraints. In so doing, it accounts for economies in shared living and the relative cost of children.

To assess fiscal progressivity and to understand why spending and wealth inequality are different, we form values of remaining lifetime average net tax rates. The

average lifetime net tax rate for particular cohort members falling within specific percentiles of the pre-tax resource distribution is calculated as $-T/R$. Average lifetime net tax rates tell us the share of R that goes to the government.

We also calculate remaining lifetime marginal net tax rates, $-\Delta T/\Delta R$, based on the additional taxes, net of additional transfers, that result, in present value, from increasing a household's current labor income by $1,000. It's important to emphasize that this calculation considers not just the additional taxes on labor earnings that will be paid on the extra $1,000 in the current year, but all of the additional taxes and reductions in transfer payments that will arise in the current year and over the rest of the household's life (along each survivor path) as a result of the household's projected allocation of the extra $1,000 to future as well as current spending.

Stated differently, as part of their consumption smoothing behavior, households who earn an extra $1,000 will, if they aren't borrowing constrained, allocate these extra resources over future as well as current years. This means saving some portion of the $1,000. Such saving gives rise to higher future asset income, which in turn affects future taxable income as well as income tests for specific benefits programs, such as Medicare Part B premiums, Medicaid benefits, and the Earned Income Tax Credit, amounts of which can change dramatically if the household has just one extra dollar of income.

Given our approach, it is necessary to account for all net resources over which the individual has control, including those that are donated to charity or transferred to other individuals via gifts and bequests. In our base case, we treat all such transfers as elements of consumption, following the logic that these are based on individual choices, accounting

also for the tax consequences of transfers and donations, such as the estate tax[12] and the charitable deduction.

C. Projecting Mortality

A key element of our calculations is uncertain lifetimes, based on assumed mortality probabilities that vary by age, sex and, of particular relevance for our calculations, the level of resources. We utilize estimates from the recent study by the National Academies (2015), which modeled mortality as a function of age, sex, birth year and income quintile, where income was measured using a truncated AIME calculation based on earnings between ages 40 and 50 and the variable for couples was set equal to the sum of spouses' truncated AIME divided by the square root of 2.[13] We follow the same procedure to sort households to determine their quintile for purposes of assigning mortality profiles, except that we use a full AIME measure, imputed to age 60 in cases where individuals have only partial earnings records. Mortality is assumed to begin starting at age 55.

Note that the resource definition used for assigning mortality profiles is different from that used in our analysis below, for example not including wealth and being based on average earnings until age 60, rather than resources as of the individual's current age. However, there should be considerable overlap between the two methods of classification.

D. Calculating Average and Marginal Net Tax Rates

Our calculation of average net tax rates is resource-weighted. That is, rather than simply forming the ratio *T/R* for each household within a cohort-specific resource percentile range

[12] In our current estimates we implement the provisions of the estate tax but multiply the resulting estimate of tax liability by ½ as a rough way to account for tax avoidance that leads to only a fraction of lifetime wealth over the taxable threshold actually being subject to the estate tax.

[13] We are grateful to Bryan Tysinger for providing the code for these calculations.

and then applying SCF population weights, we instead apply resource weights. This places smaller weight on outlier households that have exceptionally large or small net tax rates, but who represent a relatively small share of the resource distribution.

As indicated, our calculation of marginal net tax rates entails determining how much *S* rises when *R* is incremented by $1,000 in the form of the household head's earning this extra money. Given that TFA smoothes each household's consumption, an extra $1,000 earned today will be spent gradually through time. Consequently, the household's levels of future as well as current income will rise. The extra income will also entail higher future wealth levels. The higher current labor earnings will, of course, induce higher current FICA taxes and, potentially, higher current federal and state income taxes. It will also induce higher immediate spending and, thus, higher current sales tax payments. For our base case, we assume corporate income taxes are born 100 percent by owners of capital in the form of lower returns to capital, although we also consider as an alternative the case where some of the corporate income tax is borne by labor through lower wages.

The increases in future levels of income and wealth can also translate into lower future transfer payments to the extent that the household is receiving income- and wealth-tested transfer payments and these tests are binding. [14] Another aspect of our marginal net tax calculation involves the additional Social Security benefits that workers and their dependents may accrue from earning an additional $1,000. If this extra income raises the worker's Average Indexed Monthly Earnings, it will raise the worker's own retirement Social Security benefit and, potentially, the auxiliary benefits available to family members

[14] An example of a non-binding income test on transfer payments is the range of the EITC in which additional earnings do not reduce the EITC.

on the worker's record. Such additional Social Security benefits will lower the household's remaining lifetime net taxes and thus its remaining lifetime marginal net tax rate.

As shown below, the marginal rates can, in some cases, be exceptionally high. For example, among the 40 to 49 year-old cohort, the highest marginal rate is found in the lowest quintile. It's the rate of a married couple earning roughly $21,000. The couple qualifies for Medicaid. But if the husband earns an extra $1,000 and smoothes this extra income, they end up losing Medicaid for a year. As a result, their marginal net tax rate is 933.7percent! That is, the extra $1,000 delivers an increase in remaining lifetime net taxes (equivalently a decline in remaining lifetime net spending) of over $9,000.

6. Findings for the 40-49 Year-Old Cohort

The results for the 40-49 year olds are broadly similar to those for other cohorts. Hence, we discuss findings for this cohort first before examining differences across cohorts.

A. Fiscal Progressivity

The U.S. fiscal system is highly progressive, with the lowest quintile in each cohort facing, on average, a significant net subsidy and the top quintile facing, on average, a significant net tax. For the cohort age 40 to 49 in 2013, Figure 1 shows that each dollar of pre-tax remaining lifetime resources of those in the top 1 percent of the resource distribution is taxed, on average, at a 45.0 percent rate. For those in the top quintile the average net tax rate is 32.5 percent rate. For those in the bottom quintile, every dollar of pre-tax resources is matched by a 34.2 percent net subsidy.

Figure 2 shows the impact on average spending of this progressive pattern of net tax rates. The figure compares the average level of spending (the present value of remaining

lifetime spending, both discretionary and non-discretionary) within each quintile with and without fiscal policy. Although spending remains highly unequal even with the application of fiscal policy, it's significantly less unequal as a result of fiscal policy, in accordance with Figure 1's findings.

Figure 3 translates the spending levels in Figure 2 into shares of overall spending by group, and juxtaposes these shares against the corresponding shares of wealth for these groups. Spending is much more equally distributed than is wealth. The top 1, 5, and 20 percent of the 40-49 year-old cohort own 18.9 percent, 40.1, and 69.5 percent of all wealth (financial assets plus home and other real estate equity less financial liabilities), respectively. But these three groups account for only 9.2, 22.4, and 48.1 percent of the cohort's spending power as measured by remaining lifetime resources net of remaining lifetime net taxes. Those in the lowest quintile have only 2.1 percent of wealth but 6.9 percent of the spending power. The next three quintiles also each account for much more of the cohort's spending power than of its wealth holdings.

B. Why Is Projected Spending Less Unequal Than Wealth?

Wealth is only one of four determinants of remaining lifetime spending. The others are remaining lifetime labor earnings, remaining lifetime gross taxes, and remaining lifetime gross transfer payments. Wealth is certainly very unequally distributed. But, as Figure 4 shows, remaining lifetime earnings is less unequally distributed. While those in the top 1 percent hold 18.9 percent of all wealth, they account for 11.3 percent of remaining lifetime earnings. Surprisingly, transfer payments are also skewed toward the rich, albeit much less dramatically: the top 1 percent of 40-49 year olds account for 1.3 percent of future transfer payments received. The remaining spending component – remaining lifetime tax payments

– is heavily skewed against the rich. The top 1 percent accounts for 18.2 percent of all tax payments, nearly as high as their share of cohort wealth.

Taxes remain highly skewed further down in the resource distribution. The top 5 percent of 40-49 year olds accounts for 35.9 percent of all remaining lifetime tax payments, and the top 20 percent accounts for 63.3 percent. Consistent with this high share of taxes at the top (and the relative unimportance of transfers in terms of redistribution), each of the bottom four quintiles has a share of spending that exceeds its share of resources. This can be seen by comparing the second series in Figure 3 and the first series in Figure 5. To be precise, the lowest quintile has 4.0 percent of the resources, but 6.9 percent of the spending. The second quintile has 8.1 percent of the resources, but 9.8 percent of the spending. The third quintile has 12.9 percent of the resources, but 14.6 percent of the spending. And the fourth quintile has 19.7 percent of the resources but 20.6 percent of the spending.

From this perspective, the top quintile is redistributing to all the other quintiles via the tax and transfer system. The result is a spending share of 48.1 percent among the top quintile compared to a resource share of 55.3 percent. The absolute gap is nearly as large for the top 5 percent, who account for 28.5 percent of all resources, but just 22.4 percent of all spending. The top 1 percent has 13.0 percent of all resources, but accounts for only 9.2 percent of all spending.

Clearly the U.S. fiscal system is highly progressive. Whether it is sufficiently progressive or overly progressive is a judgment that can be made only by weighing the social value of such redistribution against its efficiency costs. Moreover, assessing economically relevant inequality – inequality in spending power – requires understanding

all the elements determining spending. Focusing exclusively or even primarily on inequality in wealth, as in Piketty (2014), or, for that matter, on inequality in some other component of spending power, such as claims to Medicaid, can present a very incomplete and hence distorted picture of true overall inequality.

C. Effective Remaining Lifetime Marginal Net Tax Rates

As mentioned, this study also measures lifetime marginal net tax rates facing individuals in the United States. Figure 6 present these rates for those 40 to 49. Recall, the lifetime marginal tax rate is defined as the fraction of a current increase of $1,000 in pre-tax labor income, in present value, that is not spent over an individual's remaining lifetime. The discounting here is done at our assumed pre-corporate income tax return.

As the orange bars in Figure 6 indicate, among those in the 40-49 year-old cohort, median lifetime marginal net tax rates range are quite high no matter the location in the lifetime resource distribution. The lowest of these median rates is 39.0 percent. The highest is 68.0 percent. The median rates do not follow a strictly monotonic pattern, as they go from 42.2 percent to 39.0 percent between the first and third quintiles before rising steadily thereafter, to 47.4 percent for the fourth quintile, 55.2 percent for the top quintile, and 65.5 percent and 68.0 percent, respectively, for the top 5 percent and 1 percent of the lifetime resource distribution. Hence, the pattern of remaining lifetime marginal net tax rates is highly progressive at the top, although one should keep in mind that, ultimately, it is the progressivity in average net taxes, not marginal net tax rates, that affects inequality. The decline between the first and third quintiles, presumably, is accounted for by the greater importance of resource-based transfer payments, which are an important component of overall resources for those in the bottom quintiles.

How can median remaining lifetime marginal net tax rates (or average marginal net tax rates – not shown, but which are similar to the medians) be so much higher than the average remaining lifetime net tax rates (shown in the first series in Figure 1) regardless of what resource-percentile range we consider? There are two answers. First, the fiscal system has a variety of transfers and reductions in tax liability, such as Medicare benefits, standard deductions, etc., which reduce average net tax rates but have little or no effect on marginal tax rates. Second, as Figure 6 indicates, except near the bottom, the effective marginal net tax rate schedule rises with the level of resources, so that the marginal tax rate would exceed the average tax rate even if applied to the same tax base.

D. The Dispersion in Remaining Lifetime Marginal Net Tax Rates

The fact that the median remaining lifetime net tax rates range from high to very high may be expected given the seemingly independent design of so many tax systems and subsystems as well as so many transfer payments programs, all of which incorporate implicit tax schedules through the income-testing of the benefits they provide.

But what one may find quite surprising is the enormous variation in marginal net tax rates among households within the same quintile of the resource distribution. As Table 2 shows, among the lowest quintile of 40 to 49 year-olds, the minimum marginal tax rate is –17.9 percent and the maximum is 933.7 percent. Of course, many in the bottom quintile have very low resources, which might exaggerate the swing in taxes as a share of resources. But extreme variation is present even in higher resource groups. For example, within the fourth quintile, the median lifetime marginal tax rate is 47.4 percent, but the lowest rate is –32.4 percent and the highest rate is 78.8 percent. Among the top 1 percent, which, again,

has a 68.0 percent median marginal rate, the minimum rate is 49.2 percent and the maximum is 74.7 percent.

In summary, the U.S. household net taxation system is extraordinarily non-linear, sensitive to small changes in circumstances. Some households can earn an extra dollar and lose all or much of their family's Medicaid benefits. (Indeed, loss of Medicaid benefits explains each of the chart's maximum marginal net tax rates.) Others can find they face dramatically higher Medicare Part B premiums. Apart from its cliffs, the slope of the net tax schedule can differ dramatically for households with the same resources because of other household characteristics like marital status, the presence and ages of children, the precise ages of the household head and, if married, that of the spouse.

Figure 7 presents scatter points of marginal lifetime net tax rates for each of the age 40-49 cohort's resource quintiles. Consistent with the previous discussion, the widest dispersion of marginal rates is near the bottom of the income distribution, where government transfer programs and their rules loom large relative to lifetime resources. But substantial dispersion remains even as one moves up the lifetime resource distribution – the large spreads between minimum and maximum marginal tax rates reflect this underlying dispersion, rather than being produced by special-case outliers.

Table 3 turns to an evaluation of current income as a proxy for remaining lifetime resources. Each row shows the breakdown of household (again, population weighted) observations in a given resource percentile range across different percentile ranges in the distribution of current income. The first five values for the five quintiles add up to 100 percent. Were current income a perfect proxy for remaining lifetime resources, all diagonal values of Table 3 would equal 100 percent. They don't, and in some cases aren't close.

Consider, for example, the 65.3 percent value in the third row and third column. This figure indicates that of those who are 40 to 49 and who fall within the third quintile of the resource distribution, fewer than two-thirds fall within the third quintile of the current income distribution. This means that if we use current-income to determine who is in the third quintile of the resource distribution, we'll miss over a third of households who are actually in this quintile. Over one-third of those in the third resource quintile would be misclassified in the second or fourth quintile.

E. The Inadequacy of Current-Year Tax Rates

Figure 2, Figure 6, and Table 2 show that current-year net tax rates, whether average or marginal, do a very poor job in approximating a) average remaining lifetime net tax rates, b) median marginal remaining lifetime net tax rates, and c) the dispersion in marginal net tax rates.

Figure 2 shows that current-year average net tax rates can dramatically understate the degree of progressivity in the U.S. fiscal system (the rate of ascent of the bars in the figure) as well as the average levels of net taxation of the rich and net subsidization of the poor. The lowest quintile is subsidized, on average, at a 34.2 percent rate. But its average current-year net subsidy is only 20.7 percent. For all of the remaining quintiles, too, the average current-year tax rates are higher than the average lifetime tax rate, but the difference declines steadily as one moves up the income distribution.

As Figure 6 indicates, medians of current-year marginal net tax rates can be dramatically lower than medians of remaining lifetime marginal net tax rates, regardless of the percentile resource range. The understatement is particularly large among top-quintile households. For example, the median marginal remaining lifetime net tax rate is 68.0

percent among the top 1 percent, while the median current-year marginal net tax rate is just 43.1 percent. The smallest discrepancy shown in the figure is for those in bottom quintile.

It is important to highlight the difference between our lifetime marginal tax rate and the current-year marginal tax rate, particularly because the latter is the marginal tax rate that economists typically use to measure possible incentive effects of taxation on labor supply. By ignoring any future tax consequences of an increase in current labor earnings, the standard calculation effectively assumes that all additional current earnings are spent immediately. But, assuming there are marginal net taxes on saving (as is the case for the United States, particularly as one moves up the income distribution), the full marginal tax rate arising from earning now, but spending later would incorporate not just the immediate net taxes on working, but also the net taxes on saving. Our approach – having the household allocate its extra spending power so as to sustain a smooth increase in its living standard – calculates a more comprehensive measure of the tax on working. It takes into account that not all extra earnings will, in general, be spent immediately, incorporating not just the traditional marginal labor income tax rate but also the marginal tax rate on saving for future expenditure.

The marginal net tax rate on saving in our calculations incorporates preferential capital gains and dividend tax treatment as well as deferral of asset income taxes via retirement accounts. But our calculations also take into account corporate taxes on asset income and the fact that both corporate and personal capital income taxes are not properly adjusted for inflation. As a consequence, the effective marginal net tax rate on saving can be much higher than the nominal marginal net tax rate on saving.

Finally, the dispersion of current-year marginal net tax rates, shown in Table 2, is quite different from that in remaining lifetime marginal net taxes. Take the fourth quintile, for example. While the maximum lifetime tax rate is higher than the maximum current-year rate (78.8 percent vs. 55.6 percent, respectively), the minimum remaining lifetime marginal net tax rate is lower, –32.4 percent versus 16.7 percent.

F. Findings for Other Cohorts

The results for other cohorts are in line with those of the one aged 40-49, but with subtle differences consistent with differences in the stage of the life cycle. Figure 8 provides a picture of the evolution of inequality over the life cycle, in terms of underlying resources and spending, which accounts not only for resources but also for the role of government taxes and transfers. The results for those aged 40-49 repeat those already discussed in Figures 3 (spending) and 5 (resources).

In considering these results, one should keep in mind that only the effects of future taxes and transfers (as defined by current government labeling conventions) are being taken into account. Thus, as one looks at older cohorts, net taxes decrease, as old-age transfers come to dominate interactions with the fiscal system. Also, one gets only a partial sense of progressivity when looking at net tax rates over remaining lifetimes. For example, for cohorts above age 60, any progressivity provided by the social security system will be coming predominantly through the benefit schedule, rather than through payroll taxes. Moreover, a household's net wealth and, thus, its resources at older ages, is not exogenous. It is determined in part by the net taxes it paid earlier in life. This is why we focus more attention on younger cohorts for whom the fiscal system has had less potential impact on their wealth accumulation.

For all cohorts, the fiscal system reduces inequality, producing lower shares of spending than resources for those in the top quintile and raising spending shares above resource shares for those in the bottom three quintiles as well as in the fourth quintile apart from that for those aged 20-29. This said, the underlying inequality in both the distributions of resources and spending increases steadily as one moves from younger to older cohorts, reflecting both a) differences in lifetime realizations of success and failure that separate the fortunate from the rest of the population and b) differences across households in their past saving behavior. The share of resources controlled by the top quintile rises from 42.7 percent among 20-29 year olds to 73.6 percent among 70-79 year olds, and the share of resources held by the top 1 percent rises from 5.1 percent to 24.1 percent. The share of spending done by the top quintile (1 percent) rises from 37.6 percent (4.1 percent) for those 20-29 to 5.52 percent (14.5 percent) for those 70-79.

This underlying evolution in inequality over the life cycle is also apparent in Figure 9, which shows the distribution of wealth as well as the present values of future income, taxes and transfer payments. By the later ages, wealth inequality has become quite large, as differences in past income realizations translate into differences in wealth accumulation.

Along with the increase in underlying inequality observed as one moves to older cohorts, there is also more redistribution through the system of taxes and transfers, particularly in the oldest age group, 70-79. To help understand this outcome, we consider the evolution of average remaining lifetime tax rates, shown in Figure 10 for all cohorts and income groups. Going from the youngest cohorts to middle age, we see an increase in the progressivity of average tax rates, with these rates falling for those in the bottom four quintiles and staying relatively flat at the very top. This is consistent with the increasing

inequality of resources and a progressive tax and transfer system, which imposes higher tax rates on those experiencing greater success. However, once one moves beyond the middle cohort – those aged 40-49 – lifetime tax rates decline for *all* income groups, even the most fortunate. This reflects the fact that as retirement approaches, the importance of old-age benefits increases relative to the burden imposed by income taxes during the remaining working years. Put simply, the *intergenerational* redistribution increases in importance in relation to *intragenerational* redistribution. As this happens, the progressivity of old-age benefits looms large, and the negative tax rates of the bottom four quintiles, together with quite positive net tax rates at the very top, contributes to the observed increase in progressivity in old age.

As already emphasized, marginal tax rates may be quite high even when average tax rates are not. Figure 11 illustrates this, showing the median marginal tax rates corresponding to the same age and lifetime resource groups in Figure 10. Though average tax rates fall among higher income groups past middle age, this is not necessarily the case for marginal tax rates, especially for those in top 5 and 1 percent of the resource distribution. Though individuals in these groups of the elderly affluent receive substantial government transfers, they still face very high marginal tax rates on any additional income earned. The same is true of the dispersion of marginal tax rates, as shown in the successive panels of Figure 12.

7. Sensitivity Analysis

Our results rely on many assumptions, and it is useful to consider the influence of particular assumptions on our findings.

A. Corporate Tax Incidence

Our base case assumption is that all capital bears 100 percent of the corporate income tax. While this corresponds to the standard Harberger (1962) approach, more recent analysis suggests alternative assumptions. For example, the CBO now allocates 75 percent of the corporate tax to capital and 25 percent to labor, in part to reflect increasing international capital mobility. Figure 13 shows the effect of this alternative assumption, relative to the results in Figure 10. The pattern of changes is what one would expect – reductions in lifetime tax rates for those at the top, except at the youngest ages (when prospective labor income is more important than current wealth) and increases lower in the resource distribution – but the overall impact of this alternative assumption is quite small.

B. Charitable Giving

Our base case treats charitable contributions as consumption, and hence the deduction for charitable contributions as a simple tax reduction. This has the effect of making the tax system appear less progressive, because charitable contributions are concentrated among those at or near the top of the income distribution. Figure 14 repeats Figure 10, this time ignoring the charitable deduction. As expected, this increases estimated lifetime tax rates by a small amount among those at the top. However, the impact on the overall results is small.

C. Differential Mortality

As discussed above, there is a large and growing gap in life expectancy between the top and bottom of the resource distribution, and this gap affects lifetime taxes and transfers, particularly for the old-age entitlement programs that are annuitized. In our base case, we

apply differential mortality using estimates taken from the recent National Academies (2015) study. To gauge the impact of this effect, we simulate outcomes under the assumption that all individuals of each age, gender and cohort have the same life expectancy as those in the top resource quintile (where, as discussed above, resources are based on an AIME calculation, in line with the groupings used in deriving the mortality estimates). Figure 15 displays the results of this simulation.

For lower resource quintiles, the effect of differential mortality quite clearly makes the fiscal system less progressive – average net tax rates are significantly lower when common mortality profiles are assumed, especially for older age groups, for whom a large share of remaining lifetime resources come from annuitized entitlement programs. Take, for example, those in the bottom resource quintile ages 40-49. Their average remaining lifetime net tax rate is negative 34.2 percent based on their actual assumed mortality. But with the mortality of the top quintile of those 40-49, their net tax rate drops to negative 47.0 percent. For the 70-79 year-old quintile, the baseline tax rate is negative 695 percent. With the survival prospects of the their top quintile contemporaries, the rate is negative 825 percent.

8. Conclusion

This paper provides a comprehensive analysis of U.S. inequality and fiscal progressivity, applying to the 2013 Federal Reserve's Survey of Consumer Finances (SCF) The Fiscal Analyzer (TFA), a life-cycle consumption-smoothing program specially designed to incorporate all major federal and state fiscal programs including the federal corporate income tax, personal federal and state income taxes, FICA taxes, state sales taxes, estate

taxes, Social Security benefits, Food Stamps, TANF, Social Security disability benefits, Medicare, and Medicaid benefits.

TFA's consumption smoothing incorporates borrowing constraints and also takes into account economies in shared living, the household's current and future demographic circumstances, and the relative costs of children. The SCF data provide TFA with the resource data it needs to determine the household's present expected (over survival paths) remaining lifetime spending.

Our findings clearly indicate that, while U.S. spending inequality is certainly unequal, it is far less unequal than one would presume from looking at wealth inequality across all cohorts, let alone within a cohort. Across all cohorts, the top 1 percent own 24.1 percent of all net worth, but they account for only 10.1 percent of the remaining expected lifetime spending. But comparisons mixing the old with the young can be very misleading, in contrast to the intragenerational accounting done here, which compares remaining lifetime spending and fiscal redistribution within cohorts.

Although not nearly progressive enough to equalize the spending distribution, the U.S. fiscal system is highly progressive. Average remaining lifetime net tax rates are negative or very small for the first two quintiles of remaining lifetime resources within each cohort, and very high for the top quintile within each cohort.

Our study also considered marginal net tax rates associated with increased earnings. These rates are generally very high and their pattern differs dramatically across cohorts. There is huge variation in effective marginal net tax rates within any particular cohort and resource category. This is understandable given that the close to forty major

fiscal programs defining the U.S. fiscal system appear to have been constructed with little or no attention paid to their cumulative impact on marginal rates.

Our remaining major finding is that assessing inequality and fiscal progressivity based on current income and tax rates is likely to misstate both and very significantly. The distribution of current income can differ dramatically from that of remaining lifetime spending, and current-year net tax rates can differ dramatically from remaining lifetime net tax rates, whether one is considering average or marginal taxes. This is true even if one considers net tax rates within generations.

There are many directions for future research, including understanding changes over time in spending inequality and fiscal progressivity, comparing spending inequality and fiscal progressivity across countries, assessing how major tax reforms would impact spending inequality and fiscal progressivity, evaluating marginal net taxation under alternative tax regimes, and calculating the labor supply responses as well as excess burdens associated with the current and alternative fiscal systems. This study's bottom line, however, will remain. Inequality and fiscal progressivity shouldn't be studied in isolation or in a piecemeal fashion, nor can they be accurately assessed by mixing very different age cohorts in the analysis.

References

Acemoglu, Daron and David Autor. 2011. "Skills, Tasks and Technologies: Implications for Employment and Earnings." *Handbook of Labor Economics*. 4(B), 1043-1171.

Altig, David, Alan J. Auerbach, Laurence J. Kotlikoff, Kent A. Smetters and Jan Walliser. 2001. "Simulating Fundamental Tax Reform in the United States." *American Economic Review* 91(3), 574-595.

Auerbach, Alan J. and Laurence J. Kotlikoff. 1987. *Dynamic Fiscal Policy*. Cambridge, England: Cambridge University Press.

Auerbach, Alan J. and Laurence J. Kotlikoff. 1991. "The Adequacy of Life Insurance Purchases." *The Journal of Financial Intermediation*. 1, 215-41.

Auerbach, Alan J., Jagadeesh Gokhale, and Laurence J. Kotlikoff. 1991. "Generational Accounts: A Meaningful Alternative to Deficit Accounting." *Tax Policy and the Economy*. NBER Volume 5. January. 55-106.

Congressional Budget Office. 2014. *The Distribution of Household Income and Federal Taxes, 2008 and 2009*. July. *The Distribution of Household Income and Federal Taxes, 2011*, November 12.

Feldstein, Martin S. 1974. "Social Security, Induced Retirement, and Aggregate Capital Accumulation." *Journal of Political Economy.* 82 (5), 905-26.

Flood, Sarah, Miriam King, Steven Ruggles, and J. Robert Warren. Integrated Public Use Microdata Series, Current Population Survey: Version 4.0. [Machine-readable database]. Minneapolis: University of Minnesota, 2015.

Fullerton, Don and Diane Lim Rogers. 1993. *Who Bears the Lifetime Tax Burden?* Washington: The Brookings Institution.

Goda, Gopi Shah, John B. Shoven, and Sita Nataraj Slavov. 2011. "Differential Mortality by Income and Social Security Progressivity." *Explorations in the Economics of Aging* (D. Wise, ed.). Chicago: University of Chicago Press. 189-204.

Goldin, Claudia and Lawrence Katz. 2008. *The Race Between Education and Technology*. Cambridge: Harvard University Press.

Gottschalk, Peter, and Robert Moffitt. 1995. "Trends in the Covariance Structure of Earnings in the US: 1969-1987." Working Paper, Boston College Department of Economics.

Green, Jerry and Laurence J. Kotlikoff. 2008. "The General Relativity of Fiscal Language," in *Institutional Foundations of Public Finance*. Alan J. Auerbach and Daniel Shaviro, eds. 241-56.

Harberger, Arnold C. 1962, "The Incidence of the Corporation Income Tax, *Journal of Political Economy* 70 (3), June, 215-240.

Kopczuk, Wojciech, Emmanuel Saez, and Jae Song. 2010. "Earnings Inequality and Mobility in the United States: Evidence from Social Security Data Since 1937. *The Quarterly Journal of Economics*. February. 91-128.

Kotlikoff, Laurence J. 1984. "Deficit Delusion." *The Public Interest,* 84, Summer. 53-65. http://www.kotlikoff.net/sites/default/files/deficit_delusion_0.pdf

Kotlikoff, Laurence J. 1988. "The Deficit Is Not a Well Defined Measure of Fiscal Policy." *Science*. August 12. 241. 791-95.

Kotlikoff, Laurence J. 2002. "Generational Policy." *Handbook of Public* Economics. Alan J. Auerbach and Martin Feldstein, eds. 4, 1873-1932.

Laibson, David. 1997. "Golden Eggs and Hyperbolic Discounting,"*The Quarterly Journal of Economics* 112(2), 443-477.

Meghir, Costas and Luigi Pistaferri. 2011. "Earnings, Consumption and Life Cycle Choices," in D. Card and O. Ashenfelter, eds., *Handbook of Labor Economics*, vol. 4b, 773-854.

National Academies of Sciences, Engineering, and Medicine. 2015. *The Growing Gap in Life Expectancy by Income: Implications for Federal Programs and Policy Responses*. Washington, DC: The National Academies Press.

Pechman, Joseph A. and Benjamin A. Okner. 1974. *Who Bears the Tax Burden*. Washington: The Brookings Institution.

Phelps, Edmund S., and Robert A. Pollak. 1968. "On Second-Best National Saving and Game-Equilibrium Growth," *The Review of Economic Studies* 35(2), 185-199.

Poterba, James M. 1989. "Lifetime Incidence and the Distributional Burden of Excise Taxes." *American Economic Review*. 79(2), 325-330.

Yellen, Janet. 2014. "Perspectives on Inequality and Opportunity from the Survey of Consumer Finances." Address to the Conference on Economic Opportunity and Inequality, Federal Reserve Bank of Boston. October 17, 2014.

Appendix A – The Fiscal Analyzer

This appendix describes our methodology – the Fiscal Analyzer (TFA) for computing future consumption, taxes and transfers for a given household.[15] TFA implements life-cycle consumption smoothing subject to borrowing constraints. Specifically, it finds the path of discretionary spending through time that equalizes each household's living standard per effective household member subject to not letting the household go into debt or into more debt if it is already indebted. Living standard per effective household member is defined as the household's discretionary spending per equivalent adult in the household with an adjustment for economies in shared living.[16]

Since the household's annual discretionary spending plus its annual non-discretionary spending equals its annual total spending, we can form *S* and, thus, assess inequality in *S,* by forming the appropriate present value of annual spending. Non-discretionary spending includes all housing costs, including rent, imputed, property taxes, homeowners insurance, and maintenance. Imputed rent is captured by the present value of mortgage payments plus the value of home equity. We assume that homes are retained through death. The other major component of non-discretionary spending consists of

[15] The Fiscal Analyzer builds on Economic Security Planner (ESPlanner) – a commercial lifecycle financial planning tool developed over the past two decades by Economic Security Planning, Inc. (of which Kotlikoff is President.) ESPlanner incorporates the the detailed calculations discussed below of federal and state income taxes, FICA taxes, Medicare Part B premiums, and Social Security benefits, including its earnings test. All other fiscal programs were added to TFA for this project over the course of a year of detailed programming and testing.

[16] We assume that children are 70 percent as costly as adults when it comes to providing them an equal living standard. We also assume that two can live as cheaply as 1.6 with further economies governed by this function: $(N + K)^{.678071905112638}$, where N is the number of adults in the household and K is the number of children measured in units of effective adults. For example, if there are 2 children, K equals 1.4 given our 70 percent equivalent-cost assumption.

special expenditures such as alimony payments, life insurance premium payments, and Medicare Part B premiums**.**

Although we assume that there is no uncertainty about future labor earnings or rates of return on capital, we do incorporate all possible lifespan outcomes, based on new estimates of survival probabilities by gender and income class developed in National Academies (2015). As the survival rates are distinguished by level of resources (as measured by quintiles of the value of covered earnings between ages 40 and 50) and reflect the recent growth in differential mortality by income, our estimates of inequality and cohort-specific tax rates take into account the fact, for example, that the rich, on average, receive Social Security and Medicare benefits for longer periods than do the poor.

Because of lifespan uncertainty, each of the terms in equations (1) and (2) in the text references a present expected value, where the expectation is over household lifespan outcomes. These equations hold in expectation because they hold for any given survival path. That is, for each survival path the realized present value of spending, including any terminal bequests, equals the realized present value of resources net of the realized present value of net taxes, including estate taxes.

In the process of finding its unique spending path along each survivor path, TFA makes extremely detailed tax and transfer payment calculations, as outlined in Table 1. The taxes include state income taxes (for now for the state of Ohio), the employee, employer, and self-employed FICA payroll tax, federal and state corporate income taxes, state sales taxes, federal excise taxes, estate and gift taxes, Medicare's Part B (non-inflation indexed) progressive premium, and the federal personal income tax.

TFA's tax code follows federal and state tax forms line for line. Thus, in the case of the federal personal income tax, TFA considers personal exemptions, the decision to itemize or take the standard deduction, the Child Tax Credit, the Earned Income Tax Credit, the income tax's seven tax brackets, the phase out of exemptions and deductions, the Alternative Minimum Tax, capital gains and dividend tax preferences, the new (non inflation-indexed) Medicare high-income taxes on labor income and asset income, the (non-inflation indexed) taxation of Social Security benefits, the special taxation of capital gains on home sales, the tax-excludability of contributions to 401(k), 403(b), regular IRA and other tax-deferred retirement accounts, the taxation of withdrawals from tax-deferred retirement accounts and of contributions to Roth-type accounts but not Roth withdrawals.

TFA also handles all major transfer programs taking full account of their assorted incomes and asset tests. The list here includes Social Security retirement, spousal, child-in-care spousal, divorcee spousal, widow(er), divorcee widow(er), mother (father), child, and child survivor benefits (all subject to the family benefit maximum), Medicare, Medicaid, Food Stamps, Supplemental Security Income, Transitional Aid to Families with Dependent Children, and Social Security Disability benefits. The program also considers in fine detail Social Security's earnings test, the adjustment of the reduction factor, early benefit reductions for retirees, spouses, widow(ers), the delayed retirement credit, deeming, the re-computation of benefits, the Windfall Elimination Provision, the Government Pension Offset provision, and all other major and minor factors associated with Social Security's benefit provisions, such as Social Security's use of British Common Law birthdates that says one turns age X the day before one's X^{th} birthday.

Solution Method

As indicated, to understand how much a household will pay in taxes and receive in benefits over its remaining lifetime, we need to determine what it will spend and save each year. These calculations, in turn, must be consistent with the taxes it will pay and benefits it will receive. On the other hand, the taxes and benefits paid and received each year depend on the path of spending and saving. Solving such problems requires use of iterative techniques. Since the date of death is uncertain, this planned allocation of spending power must be done through the latest age to which the household head or spouse can live. The planning horizon is, therefore, the maximum age of life, not the expected age of death.

TFA's algorithm iterates across three dynamic programs: one for consumption smoothing, one for life insurance needs, and one for tax and benefit calculations. Each program take the results from the other two programs as given, makes it own calculations, and passes its new results to the other programs for use in their next rounds of calculation. A solution is found when all outputs of all three programs converge, i.e., when each of the three distinct, but interdependent dynamic programs produce the same results from one iteration to the next to a very high degree of precision.

While we assume in this study that all households seek to maintain a constant living standard per effective household member, TFA can generate any desired profile of living standard by age. For example, one can tell the program to have the household's living standard decline by 1 percent per year starting, say, at age 80. This consumption behavior, in which the living standard (discretionary spending per household member) follows a fixed pattern independent of the interest rate, is the limiting behavior generated by time-

separable, isoelastic intertemporal consumption preferences with year-specific utility weights as the intertemporal elasticity of substitution goes to zero.[17]

Accommodating Uncertain Lifetimes

In running TFA, we take 100 to be the uniform maximum age of life for all household heads and, if married, spouses. In so doing we pin down each household's year-specific tax payments and benefit receipts.

Planning for a possibly living to 100 and actually reaching age 100 are, of course, two very different things. Our goal is describing the average fiscal treatment of households with different resources. Hence, we need to form our lifetime net tax rates taking into account each household's chances of living long enough to receive a given future year's benefits and pay that year's taxes. Stated differently, we need to actuarially discount future net tax payments. By the same reasoning, we need to actuarially discount the component of each household's resources that is survival contingent, namely future labor income. But switching from simple to actuarial present values does not invalidate equation (2), the household's remaining lifetime budget constraint. As previously indicated, this constraint holds in expectation because it holds along any survival path, provided a) bequests are included as part of lifetime spending, S, b) R, remaining lifetime resources, includes the present value of human wealth realized up to the point of each household member's date of death, and c) T, remaining lifetime net taxes includes estate taxes.

To see this, take the simplest setting in which an agent lives for at most two periods. The agent has initial wealth, W, earns E_y when young and E_o in the second period when old,

[17] Note that year-specific utility weights that are not exponential do not, as in Phelps and Pollack (1968) and Laibson (1997), introduce time-consistency problems providing the household's utility weights don't change as it ages.

if she lives. Assume the agent receives a net transfer of H_y when young, H_{oa} when old, if she lives, and H_{od} when old if she dies after one period. If these terms are negative, they represent net taxes. Also note that H_{od} includes any estate tax payments. Let P stand for the probability of dying before the second period. Assume the agent consumes C_y when young.

In (A1), the left-hand-side of the equation references the present expected value of spending, S. C_y is current spending and $(W + E_y + H_y - C_y)$ represents either the agent's bequest if she dies young or her old age consumption if she doesn't. The right-hand-side references, via the first three terms, the present expected value of resources, R, plus, in the last two terms, the present expected value of net transfers, T. Inspection shows the two sides are equal.

$$\text{(A1)}\quad C_y + P[(W+E_y+H_y-C_y)(1+R) + H_{od}]/(1+R) + (1-P)[(W+E_y+H_y-C_y)(1+R) + E_o + H_{oa}]/(1+R)$$
$$= W + E_y + (1-P)\,E_o/(1+R) + H_y + PH_{oa}/(1+R) + PH_{od}/(1+R)$$

But the equality is not just in expectation. Along each survivor path the simple present value of realized spending (including terminal bequests) equals the simple present value of realized resources. Intuitively, under any survival outcome, a household will spend, either on itself, on others, via gifts, or on its survivors, via bequests all its resources. Stated differently, the realized present value of spending under any survival outcome must equal the realized present value of resources less net taxes.

For example, in the two cases the individual lives for two periods, we have

$$\text{(A2)}\quad C_y + [(W+E_y+H_y-C_y)(1+R) + E_o + H_{oa}]/(1+R) = W + E_y + E_o/(1+R) + H_y + H_{oa}/(1+R),$$

and in the case she dies young, we have

(A3) $C_y + [(W+E_y+H_y-C_y)(1+R) + H_{od}]/(1+R) = W + E_y + H_y + H_{od}/(1+R)$.

Equations (A2) and (A3) are basic budget constraints that must hold and multiplying (A2) by (1–*P*) and (A3) by *P* and adding them together gives (A1).

Note also that our measures of *S, R,* and *T* are, in this context

(A4) $S = C_y + P(W+E_y+H_y-C_y) + (1-P)C_o/(1+R)$,

(A5) $R = [W+E_y] + (1-P)E_o/(1+R)$,

and

(A6) $T = H_y + PH_{oa}/(1+R) + PH_{od}/(1+R)$.

To summarize, the exact way to calculate the expected present values of spending, resources, and net taxes is simply to calculate annual spending (including bequests), initial wealth and annual earnings, and annual net taxes along each survival path and then a) discounting and b) multiplying these discounted values by the probability of the scenario before adding these products together.

Appendix B – Data Issues, Imputations, and Assumptions

Our Use of the Current Population Survey (CPS)

As described above, our backcasting and forecasting of wage growth is based on all available March CPS data sets starting in 1967 and continuing through 2014. The sample sizes for these surveys range from 28,924 to 99,986 households. For each year we selected households with a) a minimum of $3,000 in total annual income and b) household

members age 20 through 79 who reported labor earnings (including self-employment income) of at least $2 per year. Next we segmented the households into age groups (3, 2, and 1 year spans), sex, education, and year cells and calculated population-weighted mean values of labor income, including self-employment income within each cell. There are three education categories: Did not complete high school or receive a GED, Completed high school and may have completed some part of college, but has not graduated from college, and Has a college or higher degree.

We used the mean value for a cell from the narrowest span age group having at least 25 observations. For example, if a cell in the 1-year age group had too few observations, the value from the cell having the same sex, education, and year criteria in the 2-year age group was used. And if the 2-year group's cell had too few observations, the value from the 3-year age group was used. All cells in the 3-year age group set had at least 25 observations.

For backcasting, we used our three-year age groupings. For example, if someone is age 34 in the 2013 data and one of our age groupings is 33, 34, and 35, we'd give that person the annual past wage growth (in backcasting) for the age 33-35, sex, and education group between 2012 and 2013 and do the same between 2011 and 2012. But for 2011 to 2012, we'd use the growth rate for those 30-32 with that same sex and education.

Our backcasting is nominal; i.e., we project backwards what a respondent's nominal wage was in past years. Nominal past wages are used by TFA to determine nominal past wages covered by Social Security.

For forecasting, we used 3-, 2-, or single-year age groupings to form/impute annual real growth rates by single age, sex, education, and year cells going back in time. We then

subtracted mean growth rates in a given year across all single age, sex, and education growth rates for that year from that year's single age, sex, education, and year growth rates. Next we averaged across all year-demeaned single age, sex, and education cells to form growth rates by single-age, sex, and education for use in forecasting. Each of these growth rates was increased by our assumed 1 percent real growth rate.

The backcasted nominal earnings histories and forecasted real future earnings are used by TFA's Social Security benefit calculator to determine future Social Security benefits as well as smooth each household's consumption.

Our Use of the Survey of Consumer Finances (SCF)

Our analysis uses 4,939 of the 6,015 total observations in the 2013 SCF. The SCF comes in five versions or implicates. Each implicate assigns missing data based on alternative random imputation methods. Our results are based on implicate 1 since early analysis indicated no meaningful differences in results based on the particular choice of implicate compared to using all implicates.[18] Notwithstanding the SCF's imputation of missing data, not all SCF observations made it into our analysis. Observations were dropped for the following reasons:

1. Age of household head was out of range – The respondent's age had to be between age 20 to 79. We lost 310 observations due to this selection.
2. Insufficient resources – The observation was dropped if the present value of lifetime resources was less than $1,000. We lost 100 observations from this source.

[18] The program takes about 16 hours to process, so using all implicates can be very time consuming.

3. Negative consumption – The observation was dropped if TFA determined, based on the household's data, that a positive living standard was infeasible. We lost 260 observations due to this issue.
4. Failure to converge – If TFA could not reach a consumption-smoothing solution to its dynamic program. This occurs when households specify off-the-top housing and other expenses that leave the household very close to consuming zero in particular periods or provide mortgage data that are not mutually consistent. We lost 406 observations due to this source, two of which are due to bad mortgage data.

The SCF does not report day or month of birth. Consequently, we assume our sample is born on the 15th of June. We adjusted all data to 2015 dollars. The SCF also doesn't specify respondents' state of residence. Consequently, for this study, we assumed that all respondents live in Ohio. In future work, we intend to distribute SCF households across states based on a statistical match.

Listing of SCF Data Used in this Study

The following data is drawn from the SCF and sent to TFA. Since the SCF is a snapshot of a household's finances for a given year, any additional data need by the TFA, like past and future earnings, is imputed based on other studies or data sources as needed.

1. **Demographics**
    a. Household identifiers and population weight
    b. Primary and Secondary (if available) adult information
        i. Sex
        ii. Age
        iii. DOB – Only birth year is known so the DOB is 06/15 of the birth year.
        iv. Education Group

1. Non-high school graduate
2. High school graduate
3. College degree

v. Social Security dates
vi. Disabled status – True if currently receiving SSDI or if disabled is listed as a work status.
vii. Disabled Age – If disabled, the age became disabled.
viii. Employment status – Currently working, not working, or never in labor force
ix. Retirement date – imputed as the month prior to the receipt of Social Security benefits at their "full retirement age".

c. Marital status
   i. Single
   ii. Married
   iii. Partnered
d. Children
   i. Age
   ii. Must be child of the primary and/or secondary adults and financially dependent

2. Initial Assets

a. Bank Accounts
   i. Checking
   ii. Savings
   iii. CDs
b. Investments (Non-retirement)
   i. Mutual funds
   ii. Tax-free bond funds
   iii. Gov't bond funds
   iv. Other bond funds
   v. Combination funds
   vi. Savings bonds
   vii. Mortgage-backed bonds
   viii. Gov't bonds
   ix. Municipal bonds
   x. Foreign bonds
   xi. Other bonds
   xii. Stocks
   xiii. Other mutual funds
c. Non-managed Businesses (Net worth)
d. Life Insurance cash value
e. Additional calculations

i. The profile's Long Term Capital Gains Rate = the value of stocks, mutual funds, and ½ the combination funds, divided by the total household assets.
ii. The current year's inflation is added to the total assets before sending to the TFA. Inflation in future years is handled by the TFA's internal processes.

3. Homes and Real Estate

a. Primary and Vacation homes
   i. If Renting:
      1. Rent amount
   ii. If Owned:
      1. Market value
      2. Purchase price
      3. Property taxes
      4. Maintenance fees
      5. Mortgage
b. Real Estate
   i. Market value
   ii. Annual net income, if any
   iii. Mortgage/Loans

4. Earnings

a. Impute individual earning record for each adult currently working
   i. Set up average earnings progression from the CPS based on sex, the year and education of adult for past years, and age, sex and education for future years. This is used as an index to determine wage growth over time for the specific criteria combination.
   ii. Then, starting with the current annual wages from SCF, impute an earnings record from age 18 to their retirement date.
b. If the adult is not currently in the work force, attempt to impute individual earning record, if
   i. Not currently working
   ii. Not currently collecting Social Security
   iii. Has sufficient work history
   iv. If above are true, then use the most recent annual earnings to calculate an earnings record from age 18 to the last year worked using the growth progression from the CPS. The past earnings are used to calculate future Social Security benefits, if any.

5. **Employer-provided Health Insurance** – If a household indicated its employer provided health insurance, the imputed value of the associated premium is added to

the household's resources as non-taxable income. The value is also added to their non-discretionary spending.

6. **Retirement Accounts/Income**
    a. Currently received pensions[19]
    b. Future pensions
    c. Retirement Accounts for each adult
        i. Get current balances
            1. Individual
            2. Employer
            3. Roth
        ii. Impute annual contributions if individual provided information on the method (flat amount, percentage of income, etc.)
    d. Annuities – Any "cash in" value is added to the household assets.
    e. Trusts – Any "cash in" value is added to the household assets.

7. **Social Security Benefits**
    a. Retirement Benefits
        i. If currently receiving Retirement benefits:
            1. The reported benefit amount and the date they began receiving benefits is used by the TFA.
        ii. If not currently receiving Retirement benefits:
            1. Future benefits will be calculated by the TFA based on the individual's earnings history.
    b. Other Benefits
        i. Disability benefits
            1. The reported benefit amount and the date they began receiving benefits is used by the TFA. Note: At the year of full retirement age and beyond, SSDI is reported as Social Security Retirement benefits.
        ii. Widows/Widowers or other dependent benefits
            1. Note: The SCF reports these benefit types combined, so for the purposes of this study, it is assumed they continue until the individual's death.

8. **Personal Debt**
    a. Approach - If respondent provided sufficient information, a loan is created and the debt repaid as directed. If specifics are not provided, a loan is imputed and the debt repaid over the remaining life of the household.

[19] Unfortunately, the SCF does not record if the pension comes from non-covered employment. Hence, we cannot implement the Windfall Elimination and Government Pension Offset provisions in estimating Social Security benefits for those not yet receiving benefits.

b. Categories
    i. Vehicle Leases
    ii. Vehicle Loans
    iii. Lines of Credit
    iv. Purchase Loans
    v. Other Loans
    vi. Home Improvement Loans
    vii. Student Loans
    viii. Credit Card

Ranking SCF Respondents Based on Remaining Lifetime Resources

In order to determine the share of different variables, such as net wealth, resources (i.e., the present expected value of resources), and spending (i.e., the presented expected value of spending) owned or done by different percentiles of the SCF respondents ranked by their resources, we first calculated resources for each respondent and then ranked them, taking account of their population weight. In the case of married or partnered households, we set resources for each spouse/partner equal to total household resources divided by the square root of 2. We did this to adjust for economies in shared living. Once all respondents, single and married, were each arrayed by their adjusted resources we determined the cutoffs for the top 1, 5, 20th, 40th, 60th, and 80th percentiles in each of the age cohorts. Clearly, some respondents have sufficiently large population weights to overlap two percentile categories. If a household is split across a percentile boundary, the household is placed in the percentile where the majority of its population weight resides.

Imputation of Charitable Contributions

Charitable giving levels were imputed using "Tax Benefits of the Deduction for Charitable Contributions" data from the Tax Policy Center. (See Table T11-0253 at taxpolicycenter.org.) First, we used the income ranges for each quintile and calculated a

midpoint for each range. Next, we used the average tax benefit (in dollars) and the average federal tax rate for each quintile to calculate the dollar contribution that would yield the tax benefit. Finally, we divided the contribution by the income midpoint giving the average contribution rate for the quintile. We use the income level for each household to find the associated charitable contribution rate and impute an amount given to charity each year.

Adjusting for Ohio's Effective Sales Tax Rate

To calculate the effective sales tax rate in Ohio, we use data for 2012 from three sources. Starting with personal consumption expenditures for Ohio in that year, as reported by the Bureau of Economic Analysis, we impute (based on overall U.S. data, from Table 2.4.5 of the National Income Accounts) the share of household consumption expenditures accounted for by imputed rent on owner-occupied housing (63.4%) and subtract this fraction of household consumption expenditures from Ohio personal consumption expenditures. (We make this adjustment because we do not treat spending on housing as a discretionary consumption expenditure item.) We divide that year's Ohio sales tax revenue, as reported by the Tax Policy Center (http://www.taxpolicycenter.org/slf-dqs/pages.cfm) by this adjusted measure of Ohio consumption spending to arrive at our estimated effective sales tax rate, 2.93%.

Table 1
Fiscal Systems and Subsystems

1. **The U.S. Personal Income Tax**
   - Exemptions
   - Standard vs. Itemized Deductions
   - The Earned Income Tax Credit
   - The Child Tax Credit
   - The Alternative Minimum Tax
   - Preferential Taxation of Capital Gains and Dividends
   - Taxation of Social Security Benefits
   - High Income Medicare Payroll and Asset-Income Taxation
   - Progressive Tax Rates
   - Phase Out of Deductions and Exemptions

2. **The FICA Tax**

3. **Social Security Benefits**
   - Progressive Full Retirement Benefit (PIA) Calculation
   - Married/Divorced Spousal/Widow(er), Child, Disability, and Retirement Benefits
   - Early Retirement, Spousal, and Widow(er) Benefit Reductions
   - Earnings Test and Adjustment of the Reduction Factor
   - Re-computation of Benefits
   - Government Pension Offset and Windfall Elimination Provision
   - Delayed Retirement Credit
   - Deeming
   - Maximum Family Benefit

4. **Social Security Disability Benefits**
5. **Supplemental Security Income**
6. **The U.S. Corporate Income Tax**
7. **State Income Taxes for Ohio**
8. **State sales taxes for Ohio**
9. **Medicare benefits**
10. **Medicaid benefits for Ohio**
11. **Supplemental Nutrition Assistance Program (SNAP) for Ohio**
12. **Temporary Assistance to Needy Families (TANF) for Ohio**
13. **Medicare Part B Premiums**
14. **The Estate and Gift Tax**

Table 2

The Dispersion in Lifetime and Current-Year Marginal Net Tax Rates, Ages 40 - 49

Quintile	Median Marginal Lifetime Net Tax Rate	Median Marginal Current Year Net Tax Rate	Minimum Marginal Lifetime Net Tax Rate	Minimum Marginal Current Year Net Tax Rate	Maximum Marginal Lifetime Net Tax Rate	Maximum Marginal Current Year Net Tax Rate
Lowest	42.2%	36.6%	-17.9%	-22.4%	933.7%	925.4%
Second	40.7%	31.5%	15.5%	-18.2%	191.3%	488.5%
Third	39.0%	32.3%	9.1%	-36.8%	86.3%	45.2%
Fourth	47.4%	40.4%	-32.4%	16.7%	78.8%	55.6%
Highest	55.2%	38.7%	7.8%	0.8%	92.6%	63.6%
Top 5%	65.5%	41.8%	27.6%	12.1%	92.6%	59.4%
Top 1%	68.0%	43.1%	49.2%	12.1%	74.7%	52.1%

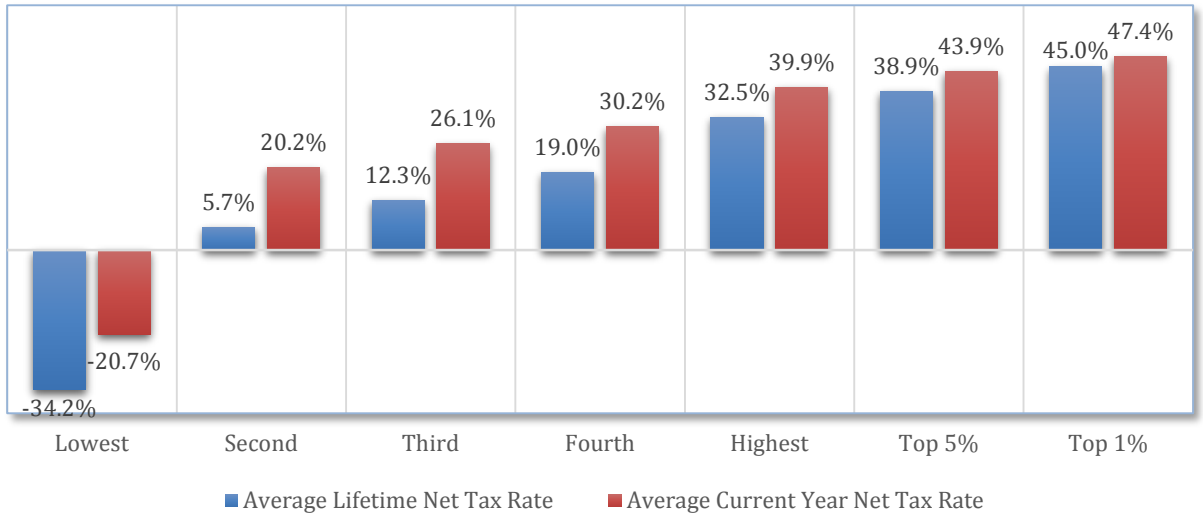
Table 3

Comparing Resource and Current-Income Distributions, Ages 40 – 49

	Share In Each Current Income Percentile						
Lifetime Resource Percentile	Lowest	Second	Third	Fourth	Highest	Top 5%	Top 1%
Lowest	85.2%	14.2%	0.0%	0.6%	0.0%	0.0%	0.0%
Second	14.6%	68.4%	15.8%	1.2%	0.0%	0.0%	0.0%
Third	0.6%	15.9%	65.3%	18.2%	0.0%	0.0%	0.0%
Fourth	1.1%	0.0%	18.3%	68.3%	12.2%	0.0%	0.0%
Highest	0.3%	0.0%	0.0%	6.1%	93.5%	48.1%	20.6%
Top 5%	0.0%	0.0%	0.0%	0.0%	100.0%	91.9%	43.2%
Top 1%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	90.0%

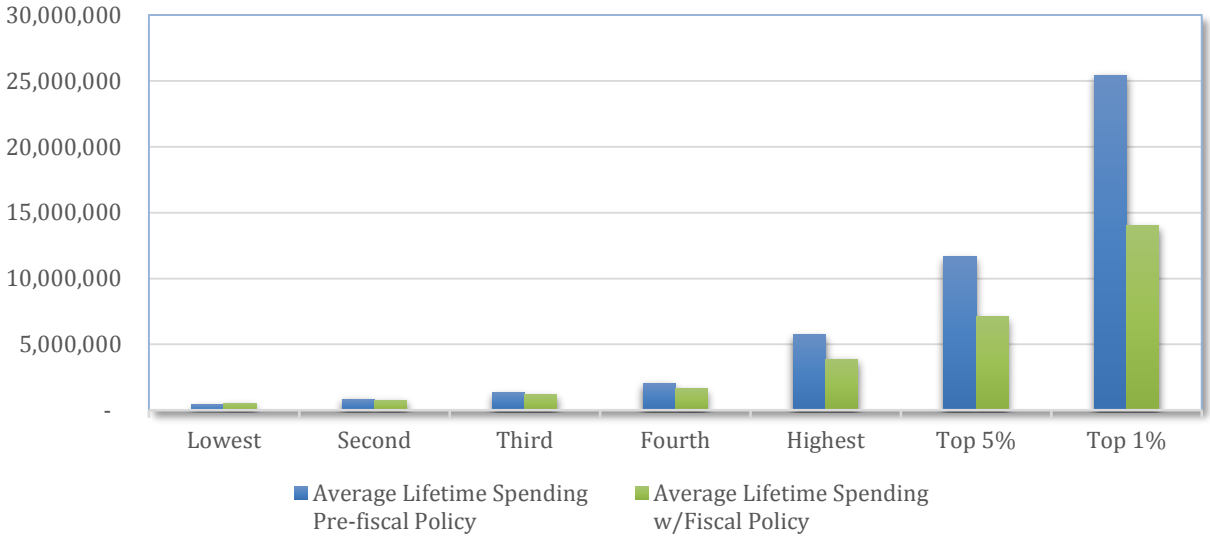
* Highest percentage in each row is green.

Figure 1
Average Lifetime and Current Year Net Tax Rates by Percentile Range, Ages 40 - 49



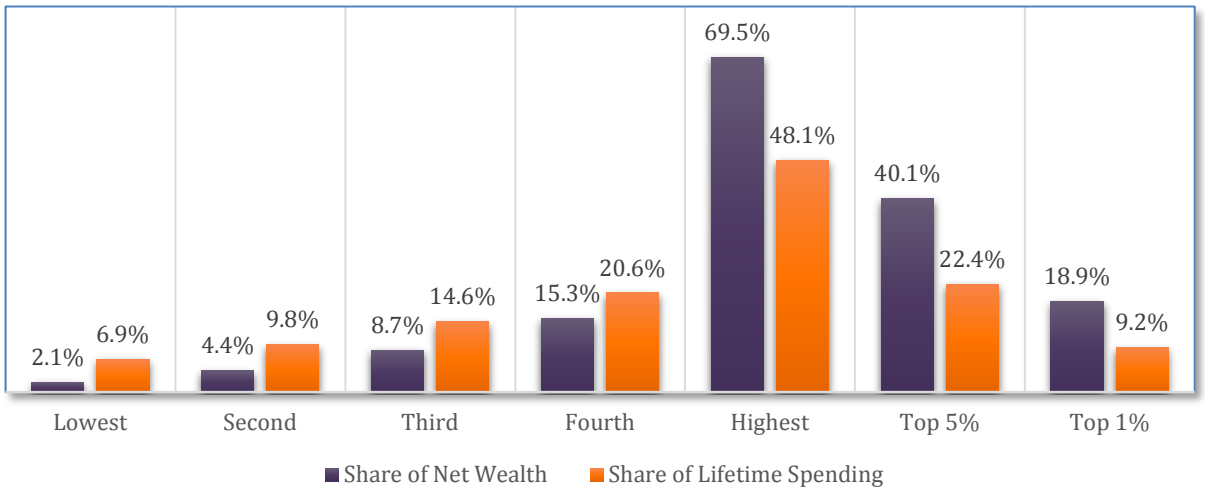
This chart presents remaining lifetime net tax rates – the ratio of the sum of all remaining lifetime net tax payments of all (population-weighted) households in the specified percentile resource range divided by the sum of the resources of all (population-weighted) households in that range. "Resources" refers to household net financial assets plus equity of homes and real estate holdings plus the present value of projected future labor earnings. The current-year net tax rate is calculated as the ratio of the sum of all (population weighted) 2013 household's net taxes divided by the sum of all (population weighted) 2013 household income (labor income plus, apart from the corporate income tax, pre net-tax asset income).

Figure 2
Average Lifetime Spending by Percentile Range, Ages 40 - 49



"Resources" refers to household net financial assets plus equity of homes and real estate holdings plus the present value of projected future labor earnings. The chart displays average spending levels by quintiles and top 5 percent and top 1 percent of the resource holders in the absence and presence of fiscal policy.

Figure 3
Net Wealth and Lifetime Spending by Resource Percentile Range, Ages 40 - 49



Spending refers to the present value of remaining lifetime spending. "Resources" refers to household net financial assets plus equity of homes and real estate holdings plus the present value of projected future labor earnings. Chart displays asset and spending shares of those in the five quintiles of the distribution of resources as well as those in the top 5 percent and top 1 percent.

Figure 4
Share of Wealth, Lifetime Labor Income, Lifetime Transfers, and Lifetime Taxes by Resource Percentile Range, Ages 40 - 49

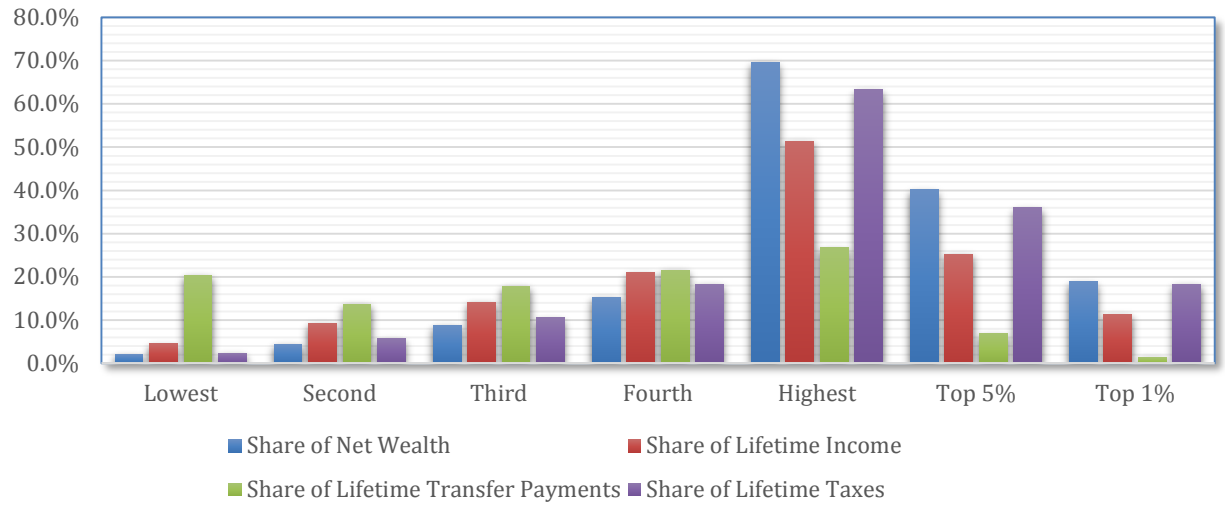


Figure 5
Lifetime Resources and Current Income by Resource Percentile Range, Ages 40 - 49

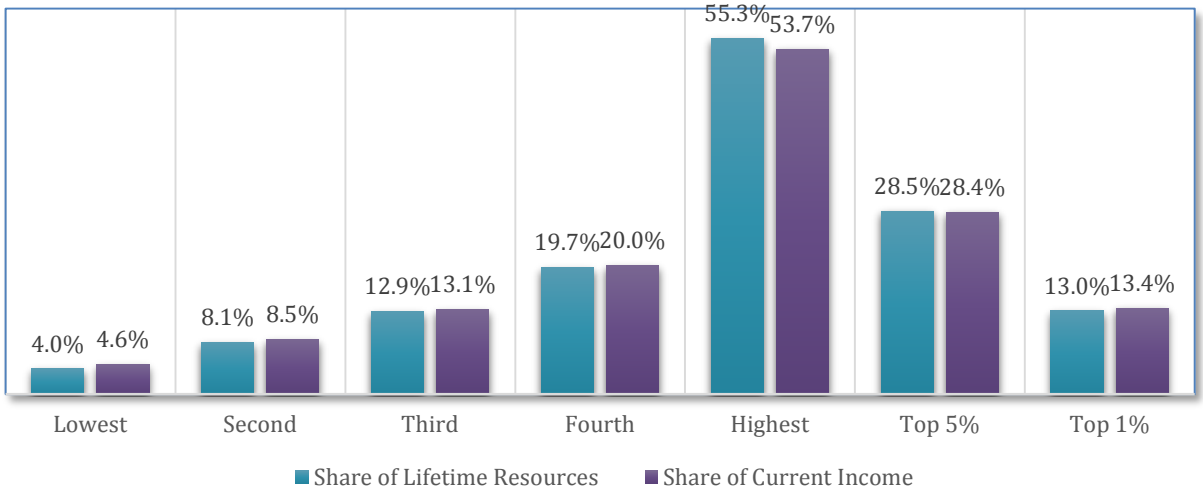


Figure 6
Median Marginal Lifetime and Current Year Net Tax Rates by Percentile Range, Ages 40 - 49

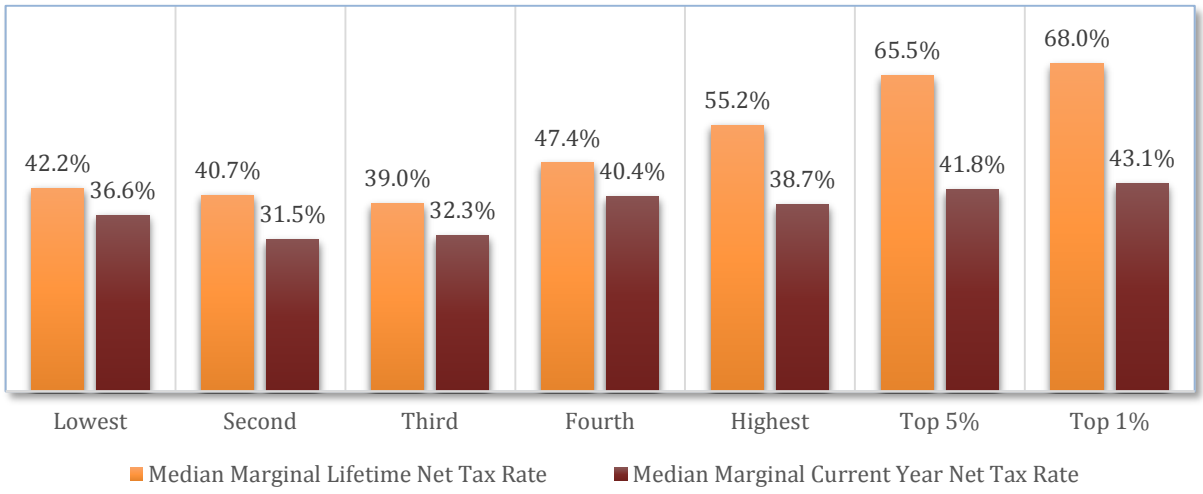


Figure 7
Marginal Remaining Lifetime Net Tax Rates, Ages 40 - 49

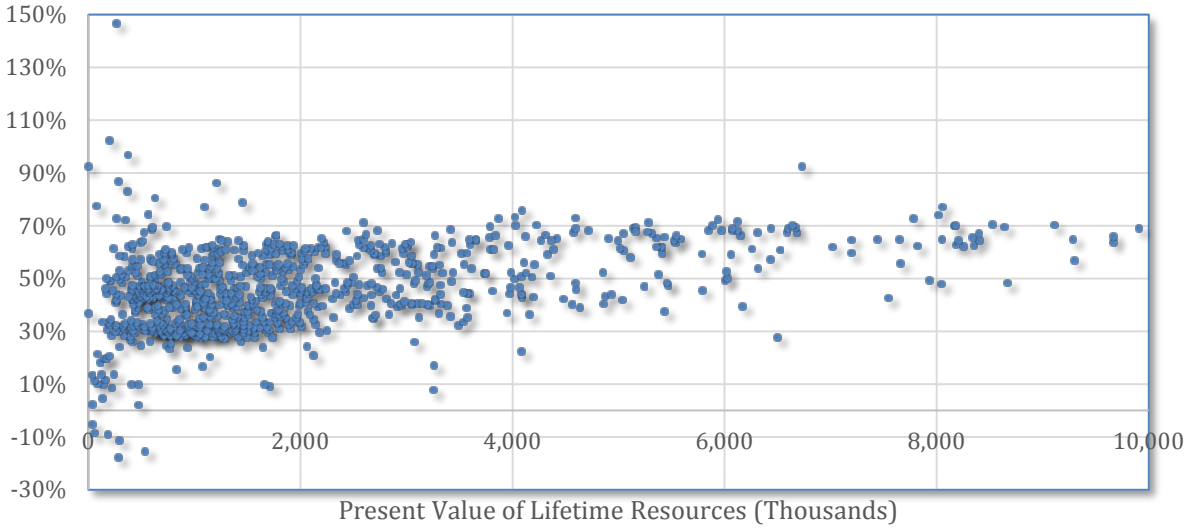


Figure 8

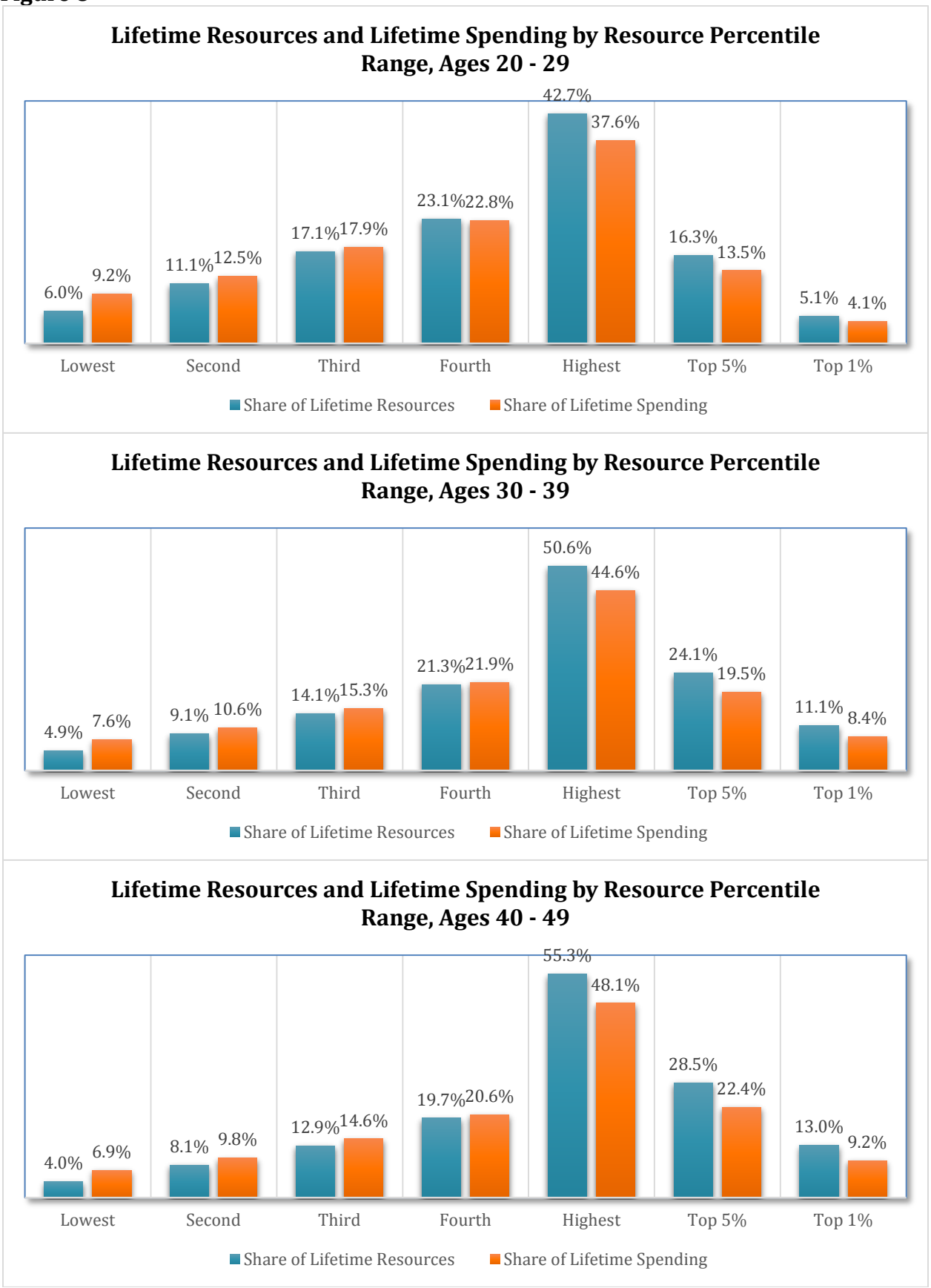

Lifetime Resources and Lifetime Spending by Resource Percentile Range, Ages 20 - 29
6.0%
9.2%
11.1%
12.5%
17.1%
17.9%
23.1%
22.8%
42.7%
37.6%
16.3%
13.5%
5.1%
4.1%
Lowest
Second
Third
Fourth
Highest
Top 5%
Top 1%
Share of Lifetime Resources
Share of Lifetime Spending
Lifetime Resources and Lifetime Spending by Resource Percentile Range, Ages 30 - 39
4.9%
7.6%
9.1%
10.6%
14.1%
15.3%
21.3%
21.9%
50.6%
44.6%
24.1%
19.5%
11.1%
8.4%
Lowest
Second
Third
Fourth
Highest
Top 5%
Top 1%
Share of Lifetime Resources
Share of Lifetime Spending
Lifetime Resources and Lifetime Spending by Resource Percentile Range, Ages 40 - 49
4.0%
6.9%
8.1%
9.8%
12.9%
14.6%
19.7%
20.6%
55.3%
48.1%
28.5%
22.4%
13.0%
9.2%
Lowest
Second
Third
Fourth
Highest
Top 5%
Top 1%
Share of Lifetime Resources
Share of Lifetime Spending

Figure 8 (continued)

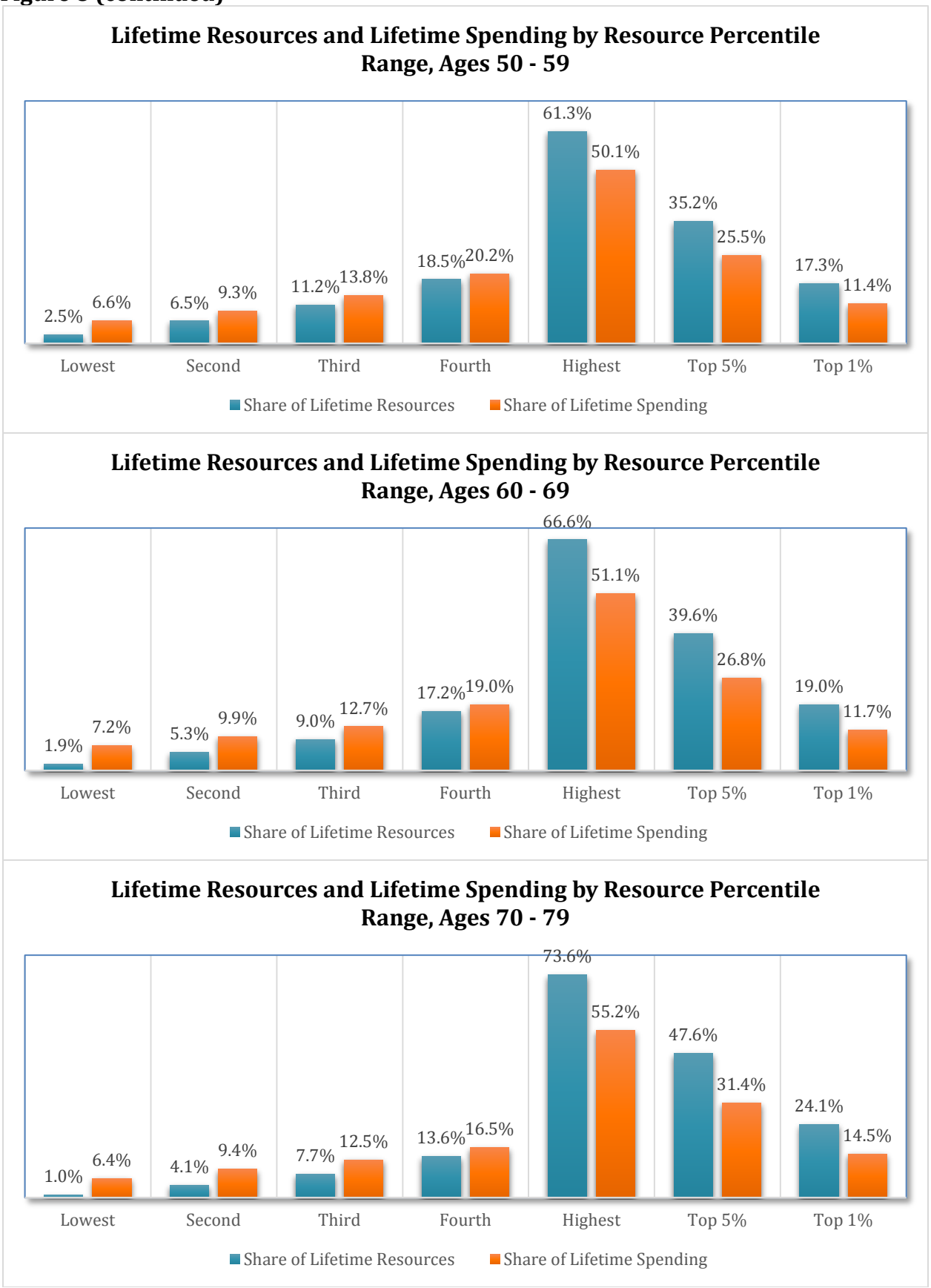


Figure 9

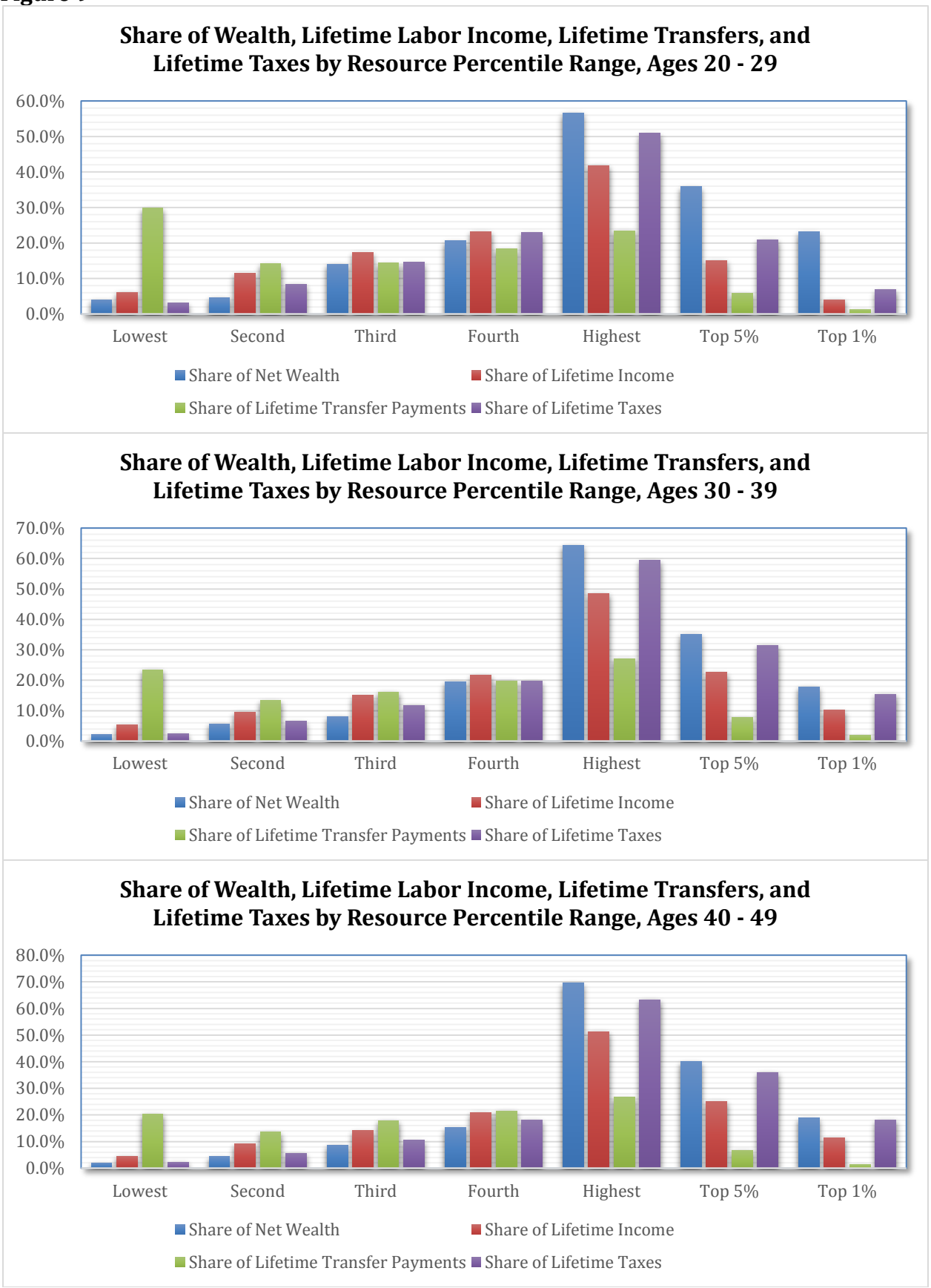

Share of Wealth, Lifetime Labor Income, Lifetime Transfers, and Lifetime Taxes by Resource Percentile Range, Ages 20 - 29
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Lowest
Second
Third
Fourth
Highest
Top 5%
Top 1%
Share of Net Wealth
Share of Lifetime Income
Share of Lifetime Transfer Payments
Share of Lifetime Taxes
Share of Wealth, Lifetime Labor Income, Lifetime Transfers, and Lifetime Taxes by Resource Percentile Range, Ages 30 - 39
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Lowest
Second
Third
Fourth
Highest
Top 5%
Top 1%
Share of Net Wealth
Share of Lifetime Income
Share of Lifetime Transfer Payments
Share of Lifetime Taxes
Share of Wealth, Lifetime Labor Income, Lifetime Transfers, and Lifetime Taxes by Resource Percentile Range, Ages 40 - 49
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Lowest
Second
Third
Fourth
Highest
Top 5%
Top 1%
Share of Net Wealth
Share of Lifetime Income
Share of Lifetime Transfer Payments
Share of Lifetime Taxes

Figure 9 (continued)

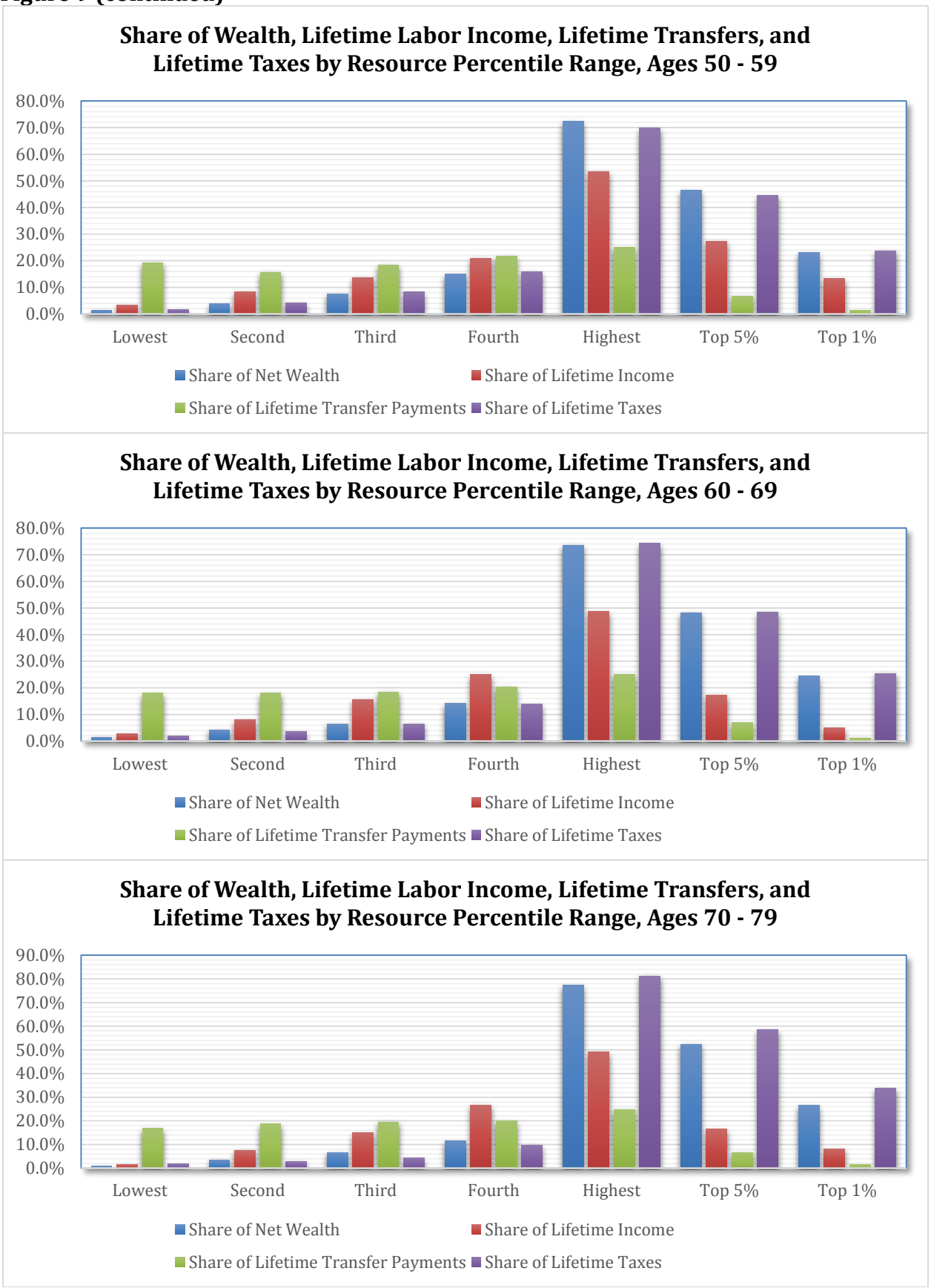


Figure 10
Average Lifetime Net Tax Rates by Percentile Range, Ages 20 - 79

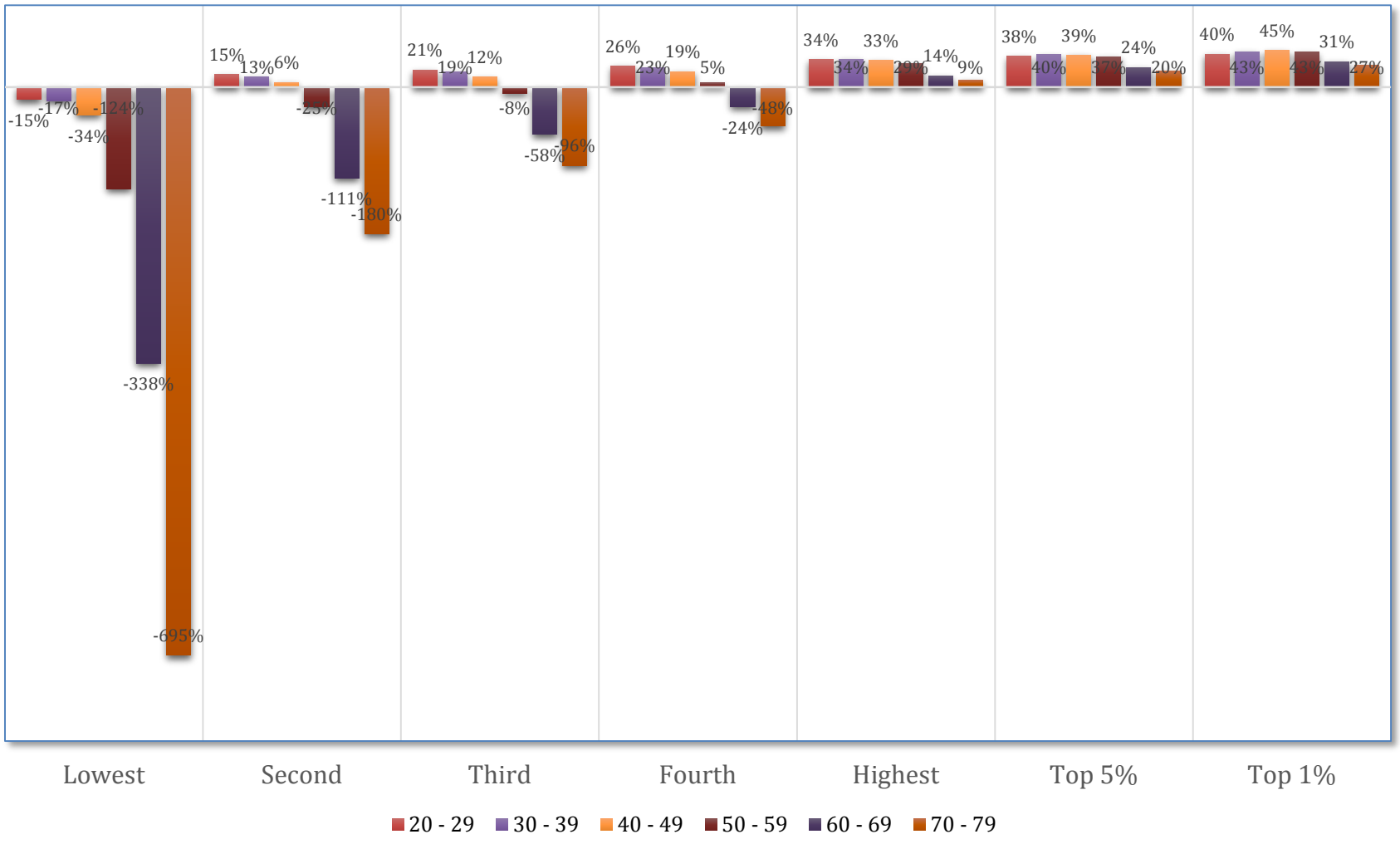


Figure 11
Median Marginal Lifetime Net Tax Rates by Percentile Range, Ages 20 - 79

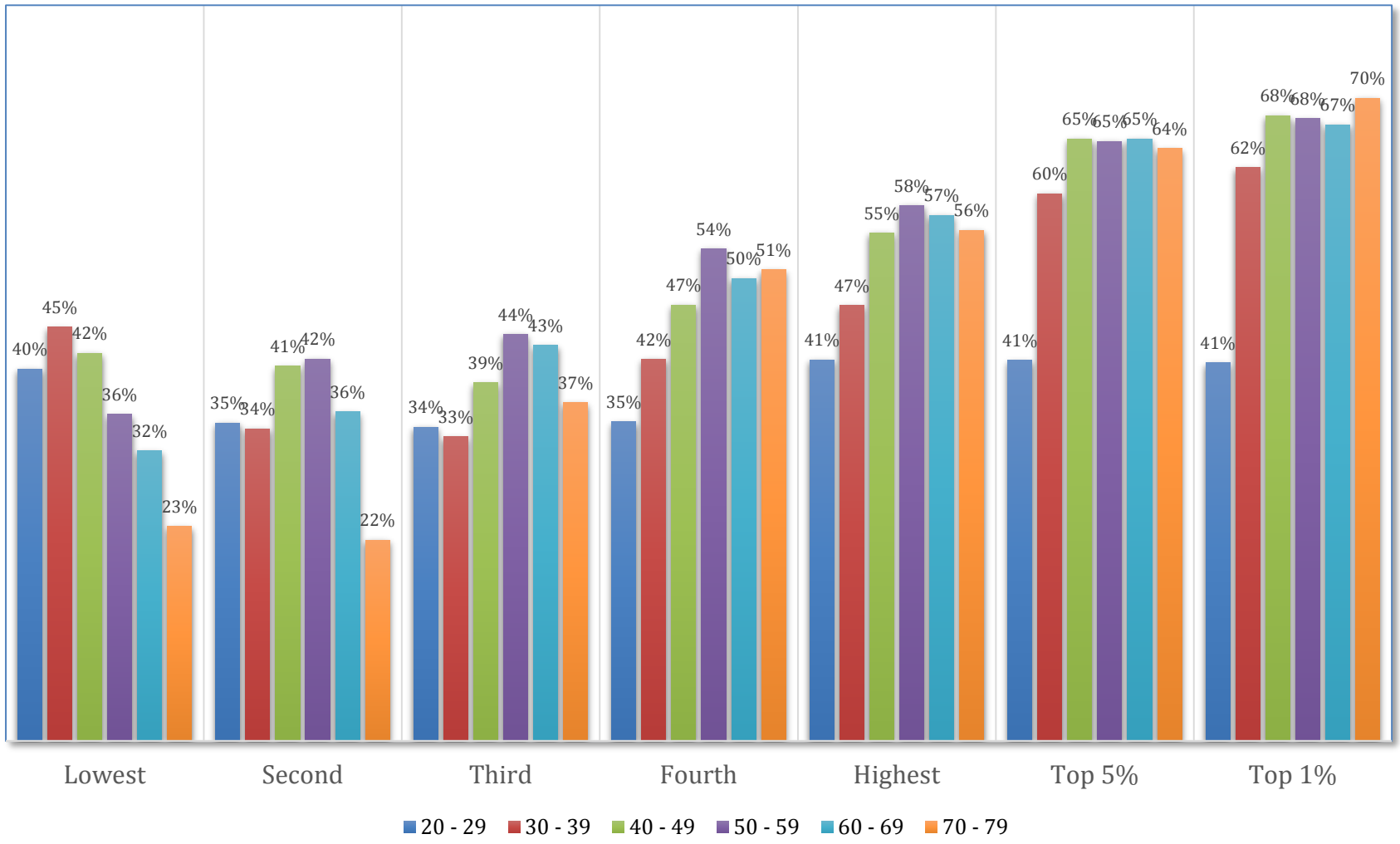


Figure 12

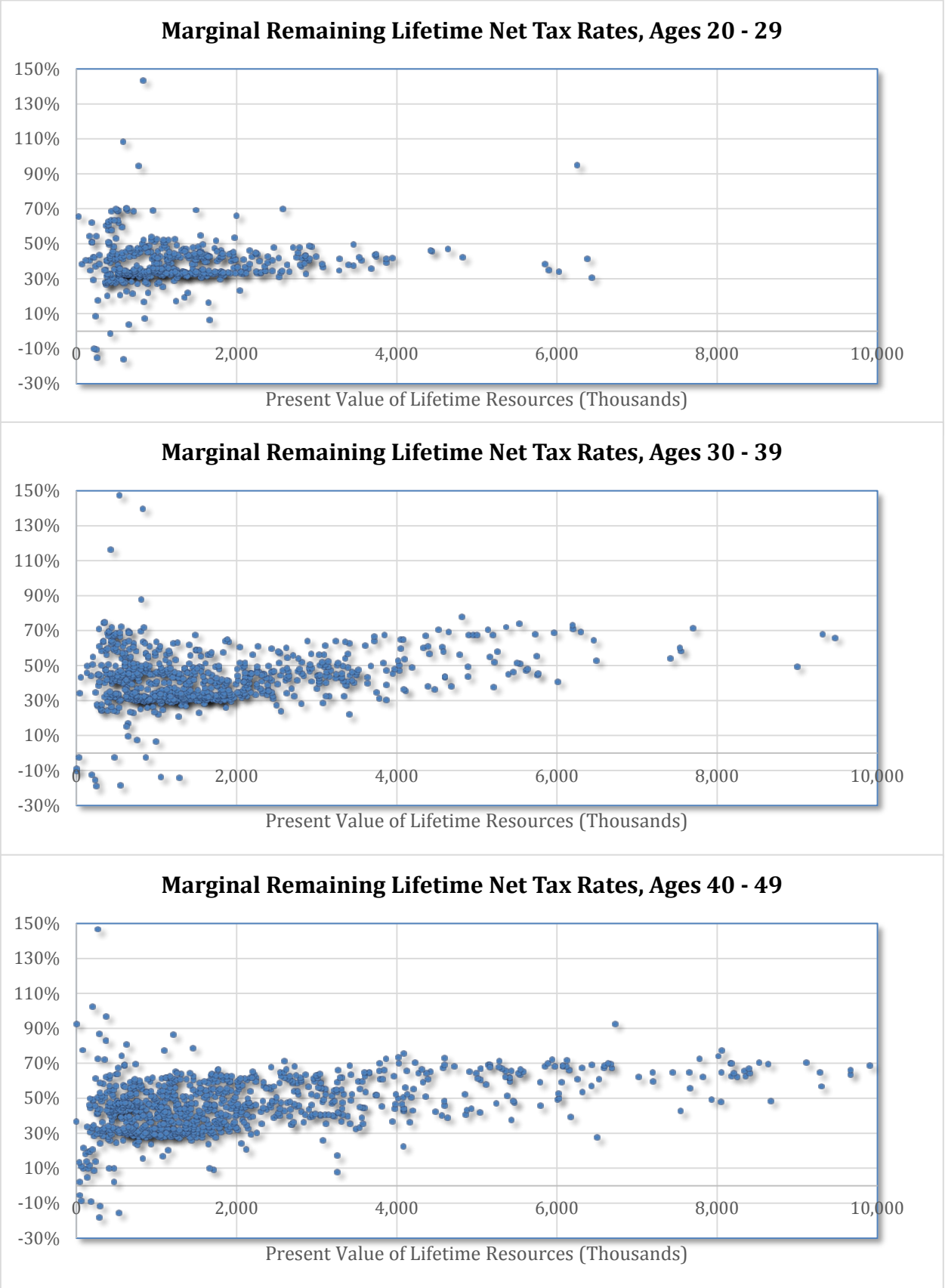

Marginal Remaining Lifetime Net Tax Rates, Ages 20 - 29
150%
130%
110%
90%
70%
50%
30%
10%
-10%
-30%
0
2,000
4,000
6,000
8,000
10,000
Present Value of Lifetime Resources (Thousands)
Marginal Remaining Lifetime Net Tax Rates, Ages 30 - 39
150%
130%
110%
90%
70%
50%
30%
10%
-10%
-30%
0
2,000
4,000
6,000
8,000
10,000
Present Value of Lifetime Resources (Thousands)
Marginal Remaining Lifetime Net Tax Rates, Ages 40 - 49
150%
130%
110%
90%
70%
50%
30%
10%
-10%
-30%
0
2,000
4,000
6,000
8,000
10,000
Present Value of Lifetime Resources (Thousands)

Figure 12 (continued)

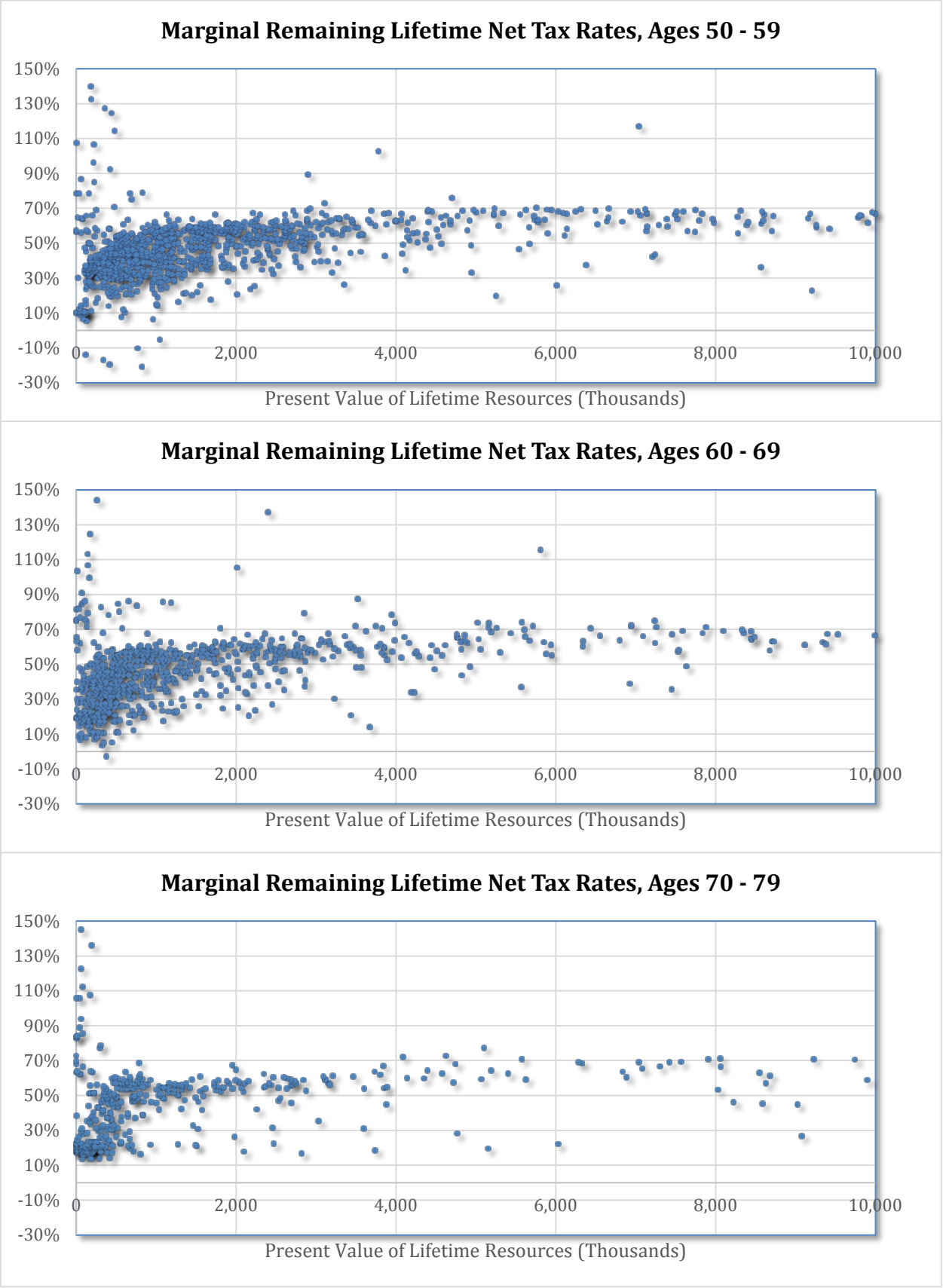


Figure 13
Average Lifetime Net Tax Rates by Percentile Range, Ages 20 - 79
Alternative Corporate Tax Incidence Assumption

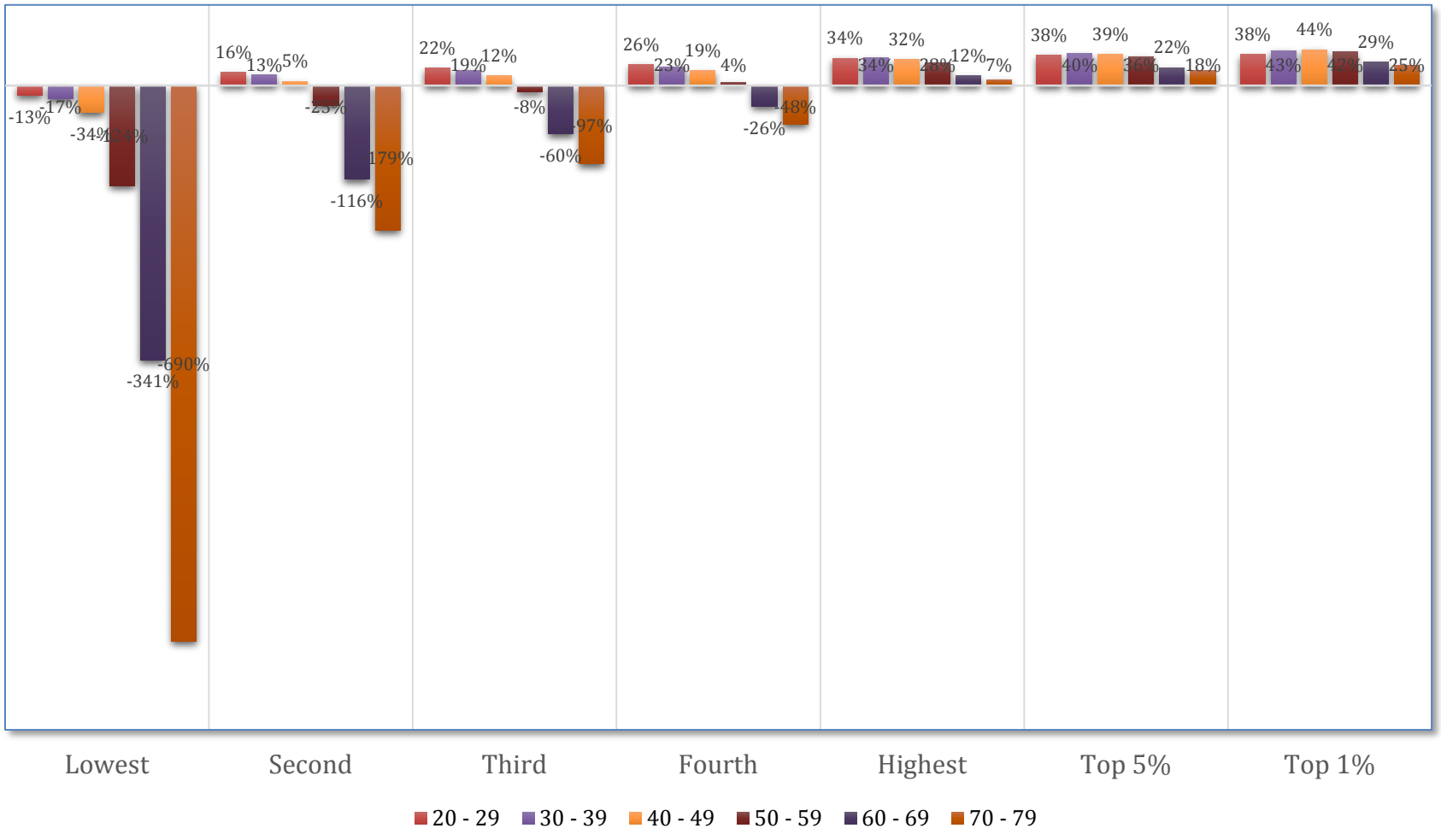


Figure 14
Average Lifetime Net Tax Rates by Percentile Range, Ages 20 - 79
Alternative Charitable Contribution Assumption

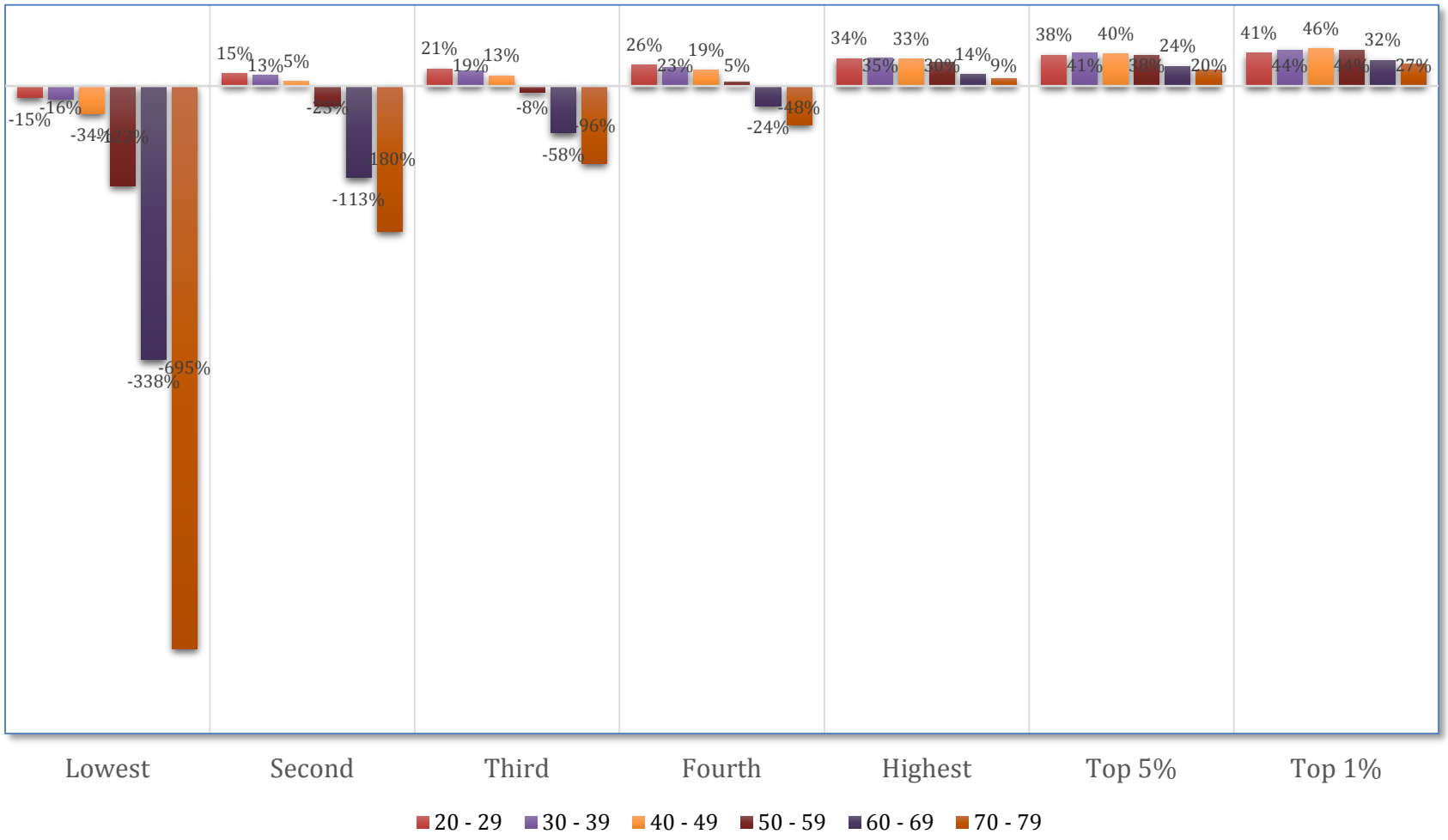


Figure 15
Average Lifetime Net Tax Rates by Percentile Range, Ages 20 - 79
Highest Quintile Mortality