

U.S. Inequality and Fiscal Progressivity

-- An Intragenerational Accounting

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

April 13, 2016, Revised August 29, 2019

We thank the National Center for Policy Analysis, the Searle Family Trust, the Sloan Foundation, the Goodman Institute, the Robert D. Burch Center for Tax Policy and Public Finance at the University of California, Berkeley, and Boston University for research support. We also thank Emmanuel Saez, other participants in the October 2015 Boskin Fest at Stanford, participants in the June, 2019 Journées Louis-André Gérard-Varet in Aix-en-Provence, and four anonymous referees for very helpful comments.

Abstract

This study measures inequality and fiscal progressivity. It differs from prior such analyses by measuring inequality based on remaining lifetime spending rather than particular resources, like wealth and current income, that only partially determine lifetime spending, and by considering inequality and progressivity within generations.

To estimate the distribution of remaining lifetime spending, we run the 2016 Federal Reserve Survey of Consumer Finances (after imputing missing data from other surveys) through The Fiscal Analyzer (TFA), a life-cycle consumption-smoothing program that incorporates remaining life-time resources, borrowing constraints and all major federal and state tax and transfer programs.

We find that inequality in wealth and income dramatically overstate inequality in remaining lifetime spending. For example, the richest 1 percent of forty year olds, where resources are measured as the sum of human plus non-human wealth, have 34.1 percent of the cohort's total non-human wealth, but account for only 14.5 percent of the cohort's total remaining lifetime spending. The poorest quintile of forty year olds own just 0.6 percent of the cohort's wealth, but account for 7.3 percent of its remaining lifetime spending.

We also find that within-cohort inequality differs considerably from inequality across the entire population, regardless of age, and that, for particular age cohorts, current-year net tax rates substantially understate the degree of progressivity. Finally, as we illustrate by for the 2017 Tax Cuts and Jobs Act, the progressivity of tax reform may be significantly misstated using conventional current-year analysis.

I. Introduction

Inequality is a topic of intense national and international interest thanks to the growing dispersion of income and wealth around the world and particularly in the United States. Piketty, Saez, and Zucman (2018) report that average real income of the top 10 percent of income-ranked U.S. households grew by 113 percent between 1984 and 2014, while the real income of the top 0.1 percent grew by 298 percent. By contrast, the average real income of the lowest 50 percent grew by 21 percent. While the trend in wealth shares is more difficult to estimate precisely because of the need to impute values of unobserved wealth components, there is little doubt about the direction of wealth inequality. For example, from 1989 through 2013, the Congressional Budget Office (2016) estimates that wealth of families in the top 10 percent of the wealth distribution rose by 54 percent, whereas median wealth rose by only 4 percent. By 2013, the 50 percent poorest Americans, ranked on the basis of their wealth, owned a mere 1 percent of total net wealth.¹ Indeed, the richest three Americans – Jeff Bezos, Bill Gates, and Warren Buffett – collectively own more wealth than the poorest 50 percent of Americans, who number 160 million!²

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 and dramatic 75

¹ Note that this ranks all households by wealth rather than remaining lifetime resources, the ranking method we use below. In our 2016 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 <https://www.forbes.com/sites/noahkirsch/2017/11/09/the-3-richest-americans-hold-more-wealth-than-bottom-50-of-country-study-finds/#330015943cf8>

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.³

These studies are important and interesting but, for understanding inequality they all fall short. None measures inequality in remaining lifetime spending (RLS), which is arguably the ultimate concern when assessing economic fairness.⁴ The shortcomings are two-fold. First, a sufficiently progressive fiscal system can transform the most unequal distribution of market resources into a more equal distribution of resources available for consumption. Second, individual components of current resources, whether wealth or current income, provide an inadequate measure of a household's overall capacity to finance consumption. Such components ignore both future labor income as well as future taxes and transfer payments, the importance of which varies systematically by age.

This study uses a life-cycle, consumption-smoothing program, called The Fiscal Analyzer (TFA), to infer remaining lifetime spending among respondents to the 2016 Federal Reserve Survey of Consumer Finances. TFA does life-cycle consumption-smoothing across all possible survivor paths taking into account survivor-path specific labor earnings, borrowing constraints, federal and state taxes, and federal and state transfer payments. Our goal is measuring remaining lifetime spending inequality controlling for preference differences and responses to the fiscal system. Our assumption of uniform (across households) Leontief consumption preferences with age-specific time-preference factors (assumed identical in our base case calculations) as well as exogenous labor supply achieves

³ See, in particular, Figure 1 in Acemoglu and Autor (2011).

⁴ By RLS we mean the present value of a household's remaining expected future lifetime expenditures, including imputed rent on owned homes and the household's expected future bequests, where "expected" references averaging over the realized present value of annual spending along each potential household survival path. We describe this measure further below.

this objective. Assuming that preferences are identical across households controls for preference differences; and the assumption of Leontief intertemporal consumption preferences and exogenous labor supply ensures no substitution of consumption or leisure today for consumption or leisure tomorrow in response to the fiscal system.

TFA smooths consumption over time, but also over survivor states by determining annual life insurance amounts that decedents in year t , were they to die in that year, need to leave survivors to ensure survivors can afford, to the dollar, the same future living standard as they would enjoy absent the decedent's death. Life insurance purchases are assumed to be non-negative, i.e., households don't buy annuities at the margin.

As described below, the TFA does its consumption smoothing over time and survivor states in one integrated, iterative process, which simultaneously determines the household's paths of net taxes under each survivor path. Once it has generated its survivor path-specific results, TFA determines each household's actuarial expected (average across survivor paths) present value of future spending, including bequests. The difference between expected remaining lifetime spending and expected remaining lifetime resources is the household's expected remaining lifetime net tax payment. The ratio of remaining lifetime net tax payments to remaining lifetime resources provides our measure of lifetime average net tax rates. We measure fiscal progressivity within cohort by considering how these average remaining lifetime net tax rates rise with remaining lifetime resources.⁵

⁵ 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 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.

A. The Remaining Lifetime Spending (RLS) Perspective

There are several reasons to take a lifetime- rather than a current-year (based on current-year wealth or income) perspective in assessing inequality and fiscal progressivity, and to do so separately for different age cohorts. First, the patterns of income, taxes, and transfer payments differ significantly and systematically over the life cycle. A current-year perspective may provide a distorted view of a household's lifetime spending capacity as well as the progressivity of the fiscal system. Second, annual variations in income, particularly due to the realization of capital gains, mean that annual income may be a very imperfect indicator of longer-run spending capacity. Finally, households at different ages, at different stages of the life cycle, have incomes, taxes, and transfer payments that relate quite differently to longer-run spending capacity. For example, a retiree who is a year from collecting their Social Security benefits and starting his or her retirement account withdrawals may have far higher income in future years.

Unfortunately, there are no longitudinal data that report RLS. There are data on current-year consumption (see, e.g., Meyer and Sullivan, 2017). But, even with consumption smoothing, current consumption may be an inadequate indicator of remaining lifetime spending. Borrowing constraints, which our analysis suggests affect the majority of SCF respondents, may depress current consumption relative to future consumption. Households also leave bequests, which we treat as a form of consumption spending. Here, too, current consumption can materially differ from future consumption.

Our methodology is based on a) estimated lifetime resources – the household's current net wealth and its current and projected future labor earnings; b) the taxes we estimate it will pay and transfer payments it will receive along all survival paths; and c)

assumed *uniform* life-cycle consumption-smoothing behavior subject to borrowing constraints. We use this method to assess both U.S. RLS inequality and fiscal progressivity. Notwithstanding our assumed preference for full consumption smoothing, the longitudinal age-consumption (age-living standard per equivalent adult) profiles of our SCF households differ dramatically due to differences in their timing and frequency of borrowing constraints.

One might quickly object that consumption growth rates vary by household due, not just, as mentioned, differences in intertemporal preferences, but also risk.⁶ We plan, in future work, to explore the interplay between resource inequality, preferences, risk, and government policy. But a first step in that process – the one taken here -- is examining spending inequality and fiscal progressivity controlling for differences in intertemporal preferences (and, for that matter, labor-leisure preferences).

To form our measures of RLS and fiscal progressivity, we run the 2016 Federal Reserve Survey of Consumer Finances (SCF) sample through The Fiscal Analyzer (TFA).⁷

As described briefly below and in detail in our online appendix, TFA does iterative dynamic program. Specifically, it iterates to convergence across three programs – a consumption smoothing program, a life insurance program, and a net tax program. Each program passes its results to the other two programs, which take those results as inputs.

⁶ Risks may also differ across households. This question, too is reserved for future research. Differences in intertemporal consumption preferences may reflect behavioral factors identified by Laibson (1997) and others. While we assume uniform retirement ages, our earnings projections are predicated on reported earnings, which reflect a combination of labor supply choice and wage rates.

⁷ This project initially relied on the 2013 SCF, switching to the 2016 SCF when it became available. The results from the 2013 SCF are remarkably similar to those reported here.

B. Household Remaining Lifetime Budget Constraints

Along any realized survival path, i , a household's realized present value of remaining lifetime spending, discretionary plus non-discretionary, is denoted S_i . The household's intertemporal budget requires

$$(1) \quad S_i = R_i - T_i,$$

where R_i and T_i reference, respectively, the realized present values of the household's remaining lifetime resources and remaining lifetime net taxes along survival path i . The realized present value of remaining lifetime resources, R_i , is the sum of the household's current net wealth, W , and the realized present value of its future labor earnings, H_i . I.e.,

$$(2) \quad R_i = W + H_i.$$

The expected present value of remaining lifetime spending, S , resources, R , and net taxes, T , satisfy

$$(3) \quad S = \sum_i p_i S_i,$$

$$(4) \quad H = \sum_i p_i H_i,$$

$$(5) \quad T = \sum_i p_i T_i,$$

and

$$(6) \quad R = \sum_i p_i R_i,$$

where p_i is the probability the household experiences survival path i . The above equations imply

$$(7) \quad R = W + H$$

and

$$(8) \quad S = R - T.$$

Again, while inequality in R and its two components, W and H , may be of independent interest and have been the subject of considerable recent research, our focus is on ultimate inequality, i.e., inequality in S . We would certainly anticipate that S , like R , is extremely unequally distributed in the United States. This said, a key policy 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 (i.e., intragenerational), compares it with cohort-specific inequality in W and H , and determines the degree to which cohort-specific inequality in T reduces cohort-specific inequality in S .⁸ We also show that fiscal progressivity measured, within cohort, via the average remaining lifetime net tax rate, τ , defined in equation (9), can differ markedly from the much more common measure of fiscal progressivity made on a current-year basis and without regard to age.

$$(9) \quad \tau = T/R.$$

The term “net taxes” references all major federal and state tax and 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 and state estate taxes, state-specific TANF welfare benefits, state-specific SNAP (Food Stamps) programs, Supplemental Security Income, state-specific Obamacare (ACA) healthcare subsidies, Social Security retirement benefits, Social Security auxiliary benefits, Social Security disability benefits, state-specific

⁸ 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.

Medicaid benefits, Medicare benefits, and Medicare Part B premiums. Details of TFA's tax and transfer calculations are provided here in the online appendix.⁹

C. 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.¹⁰ 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 the purchase of government bonds and future debt service under a "private" system, would have no impact on remaining lifetime spending, 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. Given the labeling problem, we

⁹ For example, in handling the federal personal income tax, it follows the 1040 form on a line-by-line basis taking into account the itemization decision, 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. For the Social Security benefit calculation, as another example, TFA 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, benefit-eligibility conditions.

¹⁰ 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.

need to be precise as to what our remaining lifetime net tax rates tell us. They tell us the percentage reduction in the present value of remaining lifetime spending relative to the lifetime spending that would arise were government taxes and transfer payments, *as currently labeled/defined by government*, totally eliminated.

D. Preview of Findings

Our findings are striking. Under current law (including the provisions of the Tax Cuts and Jobs Act of 2017, and assuming those provisions are permanent), the distribution of remaining lifetime spending, while 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 34.1 percent of total cohort net wealth, but only 14.5 percent of total cohort remaining lifetime spending. As for the lowest-resource quintile, it has just 0.6 percent of the cohort's net wealth, but 7.3 percent of its total spending power.

Part of the explanation is that human wealth is more equally distributed than is net wealth. The top 1 percent of this cohort account for 13.7 percent of the cohort's human wealth, which is roughly a third of its net wealth share. The bottom 20 percent have 4.9 percent of total-cohort human wealth – roughly eight times its net wealth share. The other reason for lower spending than wealth inequality is the fiscal system. The average remaining lifetime net tax rate of the top 1 percent of 40 year olds is 34.5 percent. It's -46.6 percent among those in the lowest quintile.

Which factor – greater equality in the distribution of human wealth or our progressive fiscal system – makes the distribution of remaining lifetime spending so much more equal than that of net wealth? The answer depends. With no fiscal system, the richest 1 percent of 40-49 year olds would account for 17.9 percent of RLS (their resource share),

which is far below their 34.1 percent of net wealth and close to their 14.5 percent of RLS. For the poorest 20 percent, with just 0.6 percent of total cohort net wealth, their share of cohort pre-fiscal resources is 4.0 percent.¹¹ Hence, the more equal distribution of human wealth and fiscal policy play a roughly equal role in raising the RLS share of the poorest quintile.

Our results are generally similar across cohorts. 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 34.5 percent net rate. For those in the top quintile the average net tax rate is 28.4 percent. But for those in the bottom quintile, every dollar of pre-tax resources is matched by a 46.6 percent net subsidy. Or, take those aged 60-69 in the top 1 percent of their cohort's resource distribution. Their remaining lifetime net tax rate is 20.6 percent. In contrast, those in the lowest quintile face a negative average remaining net tax rate of -438.7 percent, reflecting their proximity to receiving what for this group are vitally important Social Security, Medicare, and Medicaid benefits.

Interestingly, longevity plays a relatively small role in determining fiscal progressivity. Average net tax rates of those in the poorest quintile in each cohort would be lower were they to live as long as those in the top quintile and, thereby, collect far more benefits. Take the lowest quintile of 40-49 year olds and 60-69 year olds. These negative

¹¹ This is slightly lower than their 4.9 percent share of human wealth

average net tax rates would fall to -48.1 percent and -495.0 percent from their respective values of -46.6 percent and -438.7 percent.

E. Organization of Paper

The paper proceeds in Section II with a short literature review. Section III discusses TFA's methodology. Section IV presents our data and projections. Section V provides our main results, first for the 40-49 year-old cohort and then, in less detail, for other cohorts. Section VI provides an illustration of the model's capacity to evaluate changes in tax policy, using the 2017 Tax Cuts and Jobs Act, and compares our findings to those based on traditional approaches. Section VII discusses the sensitivity of our results to particular assumptions. Finally, Section VIII concludes with a review of our key findings and their implications.

II. Prior Studies of Fiscal Progressivity

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

Economists have long suggested that current consumption, which is a proxy for lifetime net of net-tax resources, rather than current income was more appropriate in

distinguishing the permanently rich from the permanently poor. Poterba (1989), for example, compares the progressivity of excise taxes based on classifying households by annual income with that based on classifying households by annual consumption. He shows that the first approach makes excise taxes look much more regressive than the second. Meyer and Sullivan (2017) find that the trend in increasing US inequality based on income, even when accounting for taxes and transfers, is much less evident when one looks at household consumption, not only because of consumption smoothing but also because of the difficulties of measuring certain sources of income.

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 a subset of U.S. programs and model them in broad, rather than fine detail.

Favreault, Smith, and Johnson (2015)'s major improvements to the Urban Institute's classic micro-simulation Dynasim Model provide a powerful tool for assessing the fiscal system's impact on households not just in the present, but through time. Their model grows its sample demographically and stochastically, tracing likely socioeconomic and fiscal impacts arising from predictable and unpredictable changes through time. Without question, their framework has important advantages over ours in considering the interplay between behavior and fiscal outcomes. This said, Dynasim's behavioral assumptions, about saving and labor supply, are ad hoc and, household specific. This makes the tool impractical for achieving our goal, namely addressing inequality and the fiscal system holding constant

the reaction to the fiscal system. Dynasim drives its outcomes a forward basis, whereas with borrowing constraints, one needs to do dynamic programming, i.e., work backwards. In short, we have a different approach, which we judge far more straightforward to address the questions we pose.

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 of 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.

A recent paper by Bengtsson, Holmlund, and Waldenstrom (2016) comes closest to ours in focusing on lifetime fiscal progressivity and comparing lifetime with annual progressivity. The authors use official Swedish data to track individuals over the years 1968 through 2009. Their methodology differs from ours in many respects. For example, we incorporate all transfers, including healthcare transfers, we incorporate estate taxation, we hold constant saving and labor supply behavior, and we examine the fiscal system at a point in time, rather than looking at fiscal realizations as potentially modified by behavioral responses and random outcomes. This is in line with our principal focus – understanding

whether current U.S. fiscal institutions are collectively progressive and assessing the degree to which current-year average net tax rates approximate average remaining lifetime net tax rates.¹² Our approach also lets us evaluate the effects of actual or prospective changes in tax and transfer policies on fiscal progressivity, as we do below for the recent Tax Cuts and Jobs Act.

In their study, Bengtsson et al. (2016) show that progressivity is much smaller when measured on a lifetime rather than a current-year basis. They attribute this, in part, to mobility over time in one's position in the income distribution. We view this as a very important insight and one we intend to pursue in future research. In addition, they find that transfer payments contribute significantly to the lower estimated lifetime progressivity. Presumably, this is due to the fact that many important transfer payments, such as old-age pensions and unemployment compensation, go to individuals whose current income is low relative to their lifetime incomes. As we look separately at households in different age cohorts, even our measures of progressivity based on current income will control for this phenomenon to the extent that it is related to age (as in the case of old-age pensions).

III. TFA's Algorithm

Rather than solve its deterministic problem in one program, TFA uses three dynamic programs that iterate with one another, with each program taking the output of the other two programs as given. The first program does consumption smoothing subject to borrowing constraints, taking the time paths of life insurance premiums and net taxes as given. The

¹² We intend to examine uncertainty in earnings and rates of return in future research. Of particular interest is assessing the extent to which the fiscal system insures against uncertainty in these variables.

second determines the life insurance needed by each spouse/partner at each date to ensure survivors experience no decline in their living standard, where the living standard path is determined in the first program.¹³ The third program calculates, for each year, the household's payments to and receipts from each of the different tax and benefit programs it faces.

The first program smooths the household's consumption over the maximum survival path – the path in which each spouse lives to his or her maximum age of life taking the time path of net taxes and life insurance premiums on this maximum survival path as given. The first routine's goal is simple – maintain the household's living standard per effective member subject to a no-borrowing constraint. This form of consumption smoothing is consistent with time-separable Leontief preferences. The second program determines how much life insurance the household head and the potential spouse/partner need each year to ensure the maintenance of survivors' living standards (through their maximum ages of life and through age 19, in the case of children) at annual levels at least as high as those that would arise were no one to die prematurely.¹⁴ The output of this second program is the non-negative life insurance premiums used by the first program. The third program calculates the net taxes the household will pay along the survival path in which neither spouse dies prematurely. It does so taking into account the path of total spending calculated in the first program as well as the life insurance premiums calculated in the second program. In each iteration, TFA updates its guesses about paths of spending, life insurance premium, and net

¹³ This routine calculates net taxes along each possible survivor path.

¹⁴ A reminder: 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. This second routine also calculates the net taxes and non-discretionary spending arising under each survivor path.

taxes using simple Gauss-Seidel weighting of old and new spending, insurance premiums, and net tax paths.

Consumption-smoothing in our analysis is set to achieve a perfectly stable living standard per household member subject, again, to the no-borrowing constraint. But, as Appendix Figure 1 shows, the objective of complete smoothing subject to the no-borrowing constraint leads to upward-sloping average age-consumption profiles. The figure shows, for 25 year-olds, 45 year-olds, and 65 year-olds, the average projected living standard under the optimal path, conditional upon survival.¹⁵ For 25 year olds, there is a considerable upward slope until roughly age 40, indicating that borrowing constraints lead to spending that tracks rising labor income. The growth of spending slows thereafter, but remains positive.¹⁶ For 65-year olds, there is a smooth, slowly rising average consumption profile.

IV. Data and Projections

As mentioned, our primary data come from the 2016 Survey of Consumer Finances (SCF) - a cross-section survey that oversamples wealthy households in the process of collecting data from some 6,500 American households. Our online appendix details sample selection,

¹⁵ Living standard is defined here as the household's discretionary spending per adult with adjustments for economies in shared living and the relative cost of children. Discretionary spending references all spending apart from housing expenses and other off-the-top expenditures. The assumed relationship between discretionary spending, C , and living standard per equivalent adult, c , is given by $C = c(N + .7K).6781$, where N is the number of adults in the household and K the number of children. The constants $.7$ and $.6781$ reflect, respectively, our assumptions that children are 70 percent as expensive as adults and that two adults can live as cheaply together as 1.6 separately.

¹⁶ The large jumps at age 70 for 25 and 45 year olds reflect our assumption that individuals who indicate that they plan to work at least until age 70 or who express no plan to retire begin collecting Social Security benefits and begin making retirement account withdrawals at age 70, as is consistent with the maximum age for claiming Social Security benefits and for commencing retirement account withdrawals. Our online appendix discusses our procedures in more detail.

imputations and benchmarking of the 2016 SCF data. The survey includes data on assets, liabilities, income, demographics, and a host of other socio-economic variables.

Running the TFA requires additional information not provided by the SCF. First, it needs covered earnings histories to calculate future Social Security benefits. Second, it needs state identifiers so that it can calculate state-specific taxes and transfer payments. As described below, we 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.

Also, the public-use SCF release doesn't provide state identifiers.¹⁷ Consequently, we use the 2016 American Community Survey to allocate state-specific weights to each SCF household such that the sum across states of each household's weights equals the household's original SCF weight. Stated differently, we statistically matched the 2016 SCF households with the U.S. Census' 2016 American Community Survey. Our method assigned each SCF household to each of the 51 states (including D.C.) in appropriate proportion such that the sum of each household's state-specific weight equals its original SCF weight.

A. Forecasting 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 key component of remaining lifetime resources. We use the CPS to statistically match SCF households for this purpose. In particular, we

¹⁷ The full SCF, available to Federal Reserve researchers, includes state identifiers, but they are not representative of a given state. I.e., one can't use them to generate state-specific results.

define cells in each wave of the CPS by age, sex, and education¹⁸ 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 through 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 economy-wide average real wage growth rate of 1 percent.

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, $(y_{ij}^a - \bar{y}_i^a)$, which is permanent is $\frac{a\sigma_p^2}{a\sigma_p^2 + \sigma_e^2}$. This share grows

¹⁸ 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.

with age, as permanent shocks accumulate. Using this estimate, we form the permanent component of current earnings for individual j , \hat{y}_{ij}^a ,

$$(10) \quad \hat{y}_{ij}^a = \bar{y}_i^a + \frac{a\sigma_p^2}{a\sigma_p^2 + \sigma_e^2} (y_{ij}^a - \bar{y}_i^a) = \frac{a\sigma_p^2}{a\sigma_p^2 + \sigma_e^2} y_{ij}^a + \frac{\sigma_e^2}{a\sigma_p^2 + \sigma_e^2} \bar{y}_i^a$$

and assume that future earnings grow at the group average growth rate.¹⁹ Further, guided by the literature (e.g., Gottschalk and Moffitt, 1995, and Meghir and Pistaferri, 2011), we make the simplifying assumption that the permanent and temporary earnings shocks have the same variance, reducing (10) to:

$$(10') \quad \hat{y}_{ij}^a = \frac{a}{a+1} y_{ij}^a + \frac{1}{a+1} \bar{y}_i^a$$

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:

$$(11) \quad \bar{y}_i^{a-t} + \frac{a-t}{a} (\hat{y}_{ij}^a - \bar{y}_i^a) \frac{\bar{y}_i^{a-t}}{\bar{y}_i^a} = \frac{t}{a} \bar{y}_i^{a-t} + \frac{a-t}{a} \hat{y}_{ij}^a \frac{\bar{y}_i^{a-t}}{\bar{y}_i^a}$$

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 in time, we weight the group mean more and more heavily, with a weight of 1 at the initial age, which we assume is age 20.

¹⁹ Because we ignore earnings uncertainty in our calculations, we set all future permanent and temporary shocks to zero.

B. Measuring Capital Income

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 1948-2015 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 6.371 percent. To calculate nominal rates of return, we assume an inflation rate of 2 percent.

C. Projecting Mortality

An important 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 Auerbach, et al. (2017), who 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 2.²⁰ 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

²⁰ We are grateful to Bryan Tysinger for providing the code for these calculations.

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. Current Income as an Inaccurate Proxy for Lifetime Resources

Table 1, which focuses on 40-49 year-olds, points out the difficulty of using current income as a proxy for lifetime resources. To understand the table, consider the second poorest quintile of households in this cohort when ranked based on lifetime resources. Only 67.2 percent of the households in this quintile would be ranked in the second quintile based on current year. Hence, current income would misclassify almost one third of such households, with 16.8 percent being ranked in the bottom quintile and 11.4 percent being ranked in the 3rd quintile. Indeed, over three percent of 40-49 year olds in the second quintile of lifetime resources would, based on current-year income, be ranked among the top quintile. For other lifetime-resources percentiles, the results are also troubling. Some 15 percent of those in the bottom quintile of lifetime resources are misclassified in higher quintiles when current income is used. Among those in the third lifetime resource quintile, current year income misclassifies over 44 percent. For those in the fourth lifetime resource quintile, 43 percent are misclassified. And for the top quintile, over 10 percent are classified as ranking in a lower quintile. Among the remaining lifetime richest top 5 and top 1 percentiles, the mistakes are smaller – less than 7 percent and less than 3 percent.

These results suggest that measuring lifetime spending progressivity based on current-year income is questionable not just because of major differences in how net tax rates are formed, but also because of major differences in classifying where households rank by resources.

V. Main Results

In this section, we present our main findings concerning the distributions of remaining lifetime spending, net wealth, and human wealth as well as our measures of remaining lifetime net tax rates. In so doing, we highlight the importance of looking separately at different cohorts and of focusing on a household's trajectory of remaining resources and net taxes, rather than only those for the current year.

A. Inequality

For the entire adult population studied here -- those 20-79, wealth is distributed highly unequally. As Figure 1 shows, the top 1 percent of the population holds just under 40 percent of all net wealth, a share consistent with the estimates in Saez and Zucman (2013). The remainder of the distribution is also consistent with these earlier estimates.

But these results vary considerably across age cohorts. For 20-29 year-olds, the top 1 percent holds 76.8 percent of all wealth, and the bottom two quintiles have substantially negative net wealth. The wealth distribution generally becomes less unequal with increases in age, with the top 1 percent accounting for 58.7, 41.4, 34.6, 32.6, and 33.8 percent for ten-year age cohorts 30-39 through 70-79, respectively.

Our results for the distribution of income, as opposed to net worth, are, in the aggregate, also consistent with other estimates of inequality. Figure 2 shows the distribution

of current-year, before-tax income among those age 20-79, with the share of the top 1 percent, at 21 percent, in line with that estimated by Piketty, Saez, and Zucman (2018) even though we are ranking households, in this figure, based on lifetime resources.²¹ Again, the results differ when one looks at specific age cohorts, but with a different pattern than wealth. Top 1 percent wealth inequality falls with age, but rises with current income. Running from the age 20-29 cohort through the age 70-79 cohort, the share of current income accounted for the top 1 percent of the income distribution is 14.3, 15.1, 15.9, 21.3, 22.3, and 27.0 percent, respectively.

In short, aggregate measures of inequality formed by pooling observations across all cohorts mask differences across cohorts in the degree of inequality and in the sources of inequality.²² This is illuminating in itself, but also provides a strong rationale for looking separately at different cohorts when considering the impact of fiscal policy on the distribution of resources. Moreover, as income, taxes, transfers, and, indeed, mortality follow different trajectories for different groups, there is an equally strong rationale to consider progressivity from a remaining lifetime perspective, rather than simply on a current-year basis.

²¹ The figure also shows the distribution of remaining lifetime resources across this population, indicating somewhat greater inequality. However, this measure is not as comparable across cohorts having different life expectancies.

²² As a thought experiment, consider a stationary economy in which the lifetimes of all agents are identical in all respects – they all earn (in wages and asset income), pay net taxes, consumption and save the same amounts at a given age regardless of their year of birth. This economy would, by construction, be fully egalitarian. But if one compares the old with the young, the old who have had more time to save will appear rich and the young poor. On an income basis, the young, who are still working, will appear rich, while the old who are retired, will appear poor. By pooling together different-aged households, one will infer inequality in wealth and income when there is no intrinsic inequality whatsoever.

B. Fiscal Progressivity

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

The results for the 40-49 year olds are broadly similar to those for other cohorts and represent something of a balance, with a shorter horizon than the younger cohorts but still substantial future labor earnings, unlike older cohorts. Hence, we discuss findings for this cohort first before examining differences across cohorts. But, as indicated below, for this and all other cohorts, the U.S. fiscal system is highly progressive, with the lowest quintile in each cohort facing, on average, a significant remaining lifetime net subsidy rate and the top quintile facing, on average, a significant remaining lifetime net tax rate.

For the cohort age 40 to 49 in 2019, Figure 3 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 34.5 percent rate. For those in the top quintile the average net tax rate is 28.4 percent rate. For those in the bottom quintile, every dollar of pre-tax resources is matched by a 46.6 percent net subsidy. The figure also shows, as discussed below, the inability of current-year net tax rates to even roughly capture fiscal progressivity at the bottom end of the resource distribution.

Figure 4 shows the impact on RLS 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 3's findings. For example, RLS among the top 1 percent is reduced by over one third by the U.S. fiscal system. As the figure shows, this still leaves massive inequality in average remaining

lifetime spending among, say, the bottom quintile and the top 1 percent. But this differential would be far greater absent fiscal policy.

Figure 5 translates the remaining lifetime spending levels in Figure 4 into shares of overall spending by group, and juxtaposes these shares with 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 34.1 percent, 60.7, and 82.0 percent of all wealth (financial assets plus housing and other real estate equity less financial liabilities), respectively. But these three groups account for only 14.5, 28.0, and 50.1 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 0.6 percent of wealth but 7.3 percent of their cohort's total spending power. The next three quintiles also each account for much more of the cohort's spending power than of its wealth holdings.

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 6 shows, remaining lifetime earnings is less unequally distributed. While those in the top 1 percent hold 34.1 percent of all wealth, they account for just 13.7 percent of remaining lifetime earnings. Surprisingly, transfer payments are also skewed toward the rich, albeit far less dramatically: the top 1 percent of 40-49 year olds account for 1.2 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 20.4 percent of all tax payments.

Taxes remain highly skewed further down the resource distribution. The top 5 percent of 40-49 year olds account for 35.6 percent of all remaining lifetime tax payments, and the top 20 percent for 60.2 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 findings in Figures 3 and 5. To be precise, the lowest quintile has 4.0 percent of the resources, but 7.3 percent of the spending. The second quintile has 8.8 percent of the resources, but 10.4 percent of the spending. The third quintile has 12.7 percent of the resources, but 13.7 percent of the spending. And the fourth quintile has 18.2 percent of the resources but 18.5 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 50.1 percent among the top quintile compared to a resource share of 56.3 percent. The absolute gap is nearly as large for the top 5 percent, who account for 32.8 percent of all resources, but just 28.0 percent of all spending. The top 1 percent has 17.9 percent of all resources, but accounts for only 14.5 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. But whatever one makes of these findings, on thing is clear -- assessing economically relevant inequality – inequality in spending power – requires understanding all the elements determining spending. Focusing exclusively or even primarily on inequality in wealth or current-year income, 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.

The Inadequacy of Current-Year Net Tax Rates

Figure 3 shows that current-year net tax rates are an imperfect indicator of the longer-run fiscal burden represented by average remaining lifetime net tax rates. The figure compares current-year average tax rates to lifetime net tax rates for 40-49 year-olds.²³ The figure shows that current-year average net tax rates can 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, especially, net subsidization of the poor. The lowest quintile's lifetime resources are subsidized, on average, at a 46.6 percent rate. But its average current-year net subsidy rate is only 9.8 percent. For all of the remaining quintiles, too, the average current-year net tax rates are higher than the average lifetime net tax rate, but the difference declines steadily as one moves up the income distribution.

Components of Taxes and Transfers

The fiscal progressivity of the U.S. federal system reflects a combination of different tax and transfer components. Figure 7 shows the contribution of each component to the overall net taxes of the 40-49 year-old cohort. For the top quintile, the federal income tax accounts for more than half of all tax payments, whereas for all other quintiles, the payroll tax is the largest tax component. This regressivity of the payroll tax is, of course, balanced by the progressive pattern of payroll-tax funded Social Security and Medicare benefits. While Social Security benefits grow in size across income quintiles, they do so at a slower rate than

²³ Current-year net tax rates equal current-year taxes net of transfers divided by current-year income, measured as current-year labor income plus the imputed rate of return on assets multiplied by assets.

lifetime resources. This is even truer of Medicare, which increases across lifetime resources groups at a slower rate (the increase due in part to the greater longevity of higher-income individuals). However, substantial progressivity is provided by the other transfers associated with health care, namely Medicaid and the subsidies under the Affordable Care Act (Obamacare), which are large in size and highly concentrated in the bottom quintile of the lifetime resource distribution.

2. Findings for Other Cohorts

Figures 8 and 9 show current-year and lifetime tax rates for those in other cohorts, aged 20-29 and 60-69. For the younger cohort, in Figure 8, lifetime net tax rates are higher, primarily because of the longer lag until the receipt of large transfer payments in old age. Also, the progressivity of lifetime net tax rates and current-year net tax rates have a less clear ranking, the latter being less progressive at the top, but more progressive at the bottom. This is likely due to the fact that there is a much lower rank correlation in this cohort between lifetime resources and current income – many of those at the top of the current income distribution will not be near the top of the lifetime resource distribution and, therefore, are less subject to higher taxes. This lower rank correlation relates to the longer remaining horizon for labor earnings as well as the relatively greater importance of wealth in determining inequality among the young.

This ambiguity disappears when one looks at the same tax-rate comparison for 60-69 year-olds, in Figure 9. Here, current-year net tax rates are low because of lower labor force participation, and remaining lifetime net tax rates are lower still because of the impending receipt of substantial old-age transfer payments. These payments, taking all programs together, are substantially progressive, making the decline in net tax rates as one

moves from right to left in the figure far greater for the lifetime net tax rate series than for the current-year net tax rate.

VI. Evaluating the Impact of the Tax Cuts and Jobs Act (TCJA)

The TCJA, enacted in late 2017, was the most significant change in the federal income tax since the Tax Reform Act of 1986. Among its key provisions were a reduction in the corporate tax rate from 35 percent to 21 percent, a reduction in individual tax rates, increasing the standard deduction, capping of the itemized deduction for state and local taxes, eliminating the corporate Alternative Minimum Tax (AMT), scaling back the individual AMT, and a new reduced tax rate on qualifying non-corporate businesses.

Many of TCJA's tax provisions become less favorable to taxpayers over the course of the 10-year budget period. In addition, many of its individual tax cut provisions are set to expire by the end of the decade. These features appear to have been included simply to meet arbitrary budget targets within the budget period and to limit the growth in projected deficits beyond the budget period. Meeting the budget targets and limiting future projected deficits were needed to permit passage of the bill with a simple majority in the Senate. However, there was no coherent policy reason offered for such temporary provisions, nor are we aware of any. Consequently, in this analysis, we assume TCJA's provisions are permanent. This assumption is important to keep in mind when interpreting our results and comparing them with those of other studies that adhere strictly to the letter of TCJA's law.

In modeling the TCJA, we reduced our corporate tax rate, by 12.4 percent. This is the average, over the next five years, due to TCJA, in the Joint Committee on Taxation's projected

corporate tax revenue loss divided by the 2017 NIPA estimate of corporate tax revenue.²⁴ One useful check of our benchmarking procedure is to compare our results with those of the Joint Committee on Taxation, which are based on tax return data, albeit for 2013. Table 2 shows average current-year gross tax rates under old law, under the TCJA, and the change between the two, from JCT (2017) and according to our calculations, where we adhere as closely as possible to JCT's income classification and income and tax definitions.²⁵ As the table shows, our gross tax rate measures are relatively close to JCT's. Indeed, the correlation coefficient between our TCJA average rates and the JCT's across the income categories in the table is 96.0 percent. Moreover, like JCT, we find an increase in percentage tax cuts as income increases, with the exception of the highest income group, although the upward trend is less pronounced in our analysis. The fact that we are able to come reasonably close to the JCT's analysis of progressivity with the SCF data suggests that it is not differences in data, but differences in methodology that underlie our different findings about fiscal progressivity and inequality.

Figure 10 shows average and current year remaining lifetime net tax rates for the age 40-49 cohort under old law, which can be compared to figure 3 to see the distributional impact of the TCJA based on these two measures. The lifetime net tax rate reductions by quintile, in percentage points, are 1.1, 1.5, 1.7, 1.6, and 1.3, with reductions for the top 5 and

²⁴ <https://www.jct.gov/publications.html?func=startdown&id=5053>

²⁵ <https://www.jct.gov/publications.html?func=startdown&id=5054>. We are unable to include certain components of JCT's expanded income measure, including worker's compensation, alternate minimum tax preference items, individual share of business taxes, and excluded income of U.S. citizens living abroad. The JCT is also using 2013 IRS data, which is the latest such data available, whereas our SCF data reference either 2015 or 2016. Our approach and the JCT's both assume that the incidence of the corporate income tax falls 100 percent on owners of capital. The JCT also assumes that nearly 10 percent of corporate income accrues to foreign owners, whose burden is excluded from their calculation (JCT, 2013). We make no adjustment in our analysis for foreign ownership.

top 1 percent of 1.2 and 0.8 percentage points, respectively. The current-year net tax rate reductions for the same groups are 1.6, 1.4, 1.4, 1.4, 1.3, 1.2, and 0.6.²⁶ Hence, the patterns are generally similar, although the net tax cut in the lowest income quintile is lower on a remaining lifetime basis than for the current year, and the progressivity of the TCJA is somewhat lower as well.

Note that focusing on net rather than gross tax rates, holding age fixed within a range, and partitioning by resource-percentile group produces, in this case, a different assessment of TCJA's progressivity than that suggested by the JCT's analysis or our version of the JCT's analysis. On a current-year net tax rate basis, the reform, for forty year olds, is progressive. On a remaining lifetime net tax rate basis, it favors the middle class over the poor and the rich. Precisely how much of the difference in these and our version of JCT's results arise from these other factors is another subject for future research.

A similar relative pattern is present for other cohorts. For 20-29 year olds, for example, the lifetime net tax rate reductions, from the lowest quintile to the highest percentile, are 1.7, 1.7, 2.0, 1.9, 1.0, 0.7, and 0.1 percentage points, whereas the reductions in current net tax rates for the same respective groups are 2.2, 1.8, 2.1, 2.0, 1.3, 0.5, and -0.3 percentage points. Again, the net tax rate reduction is higher at the bottom and lower at the top (in this case, a small increase) for current tax rates. One factor likely underlying this greater similarity across resource groups for the remaining lifetime net tax rates is that current-income differences overstate differences in lifetime resources, even when one is segregating by age group, because of the assumed process for labor earnings. One difference

²⁶ Note that the decline in net tax rate reductions beginning in the top quintile is not inconsistent with the results in Table 2, given that the top quintile includes those in the highest income group, who experience a lower tax rate reduction.

among 20-29 year olds is that that both sets of net tax rate reductions appear more progressive across income groups in terms of the relative net tax rate reductions for low- and high-resource individuals. We conjecture that this difference may relate to the difference in dispersion of all lifetime resources across groups in the two cohorts; 20-29 year olds have a lower concentration of lifetime resources at the top but a stronger concentration of wealth. We will explore the reasons for this difference in subsequent drafts.

VII. Sensitivity Analysis

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

A. Differential Mortality

Auerbach et al. (2017), on which our mortality assumptions are based, focuses on the decline in progressivity of old-age transfer payments with the increasing income-longevity link. As old-age transfer payments are survival-based, higher mortality translates into lower benefits, in present value, even in cases, such as Social Security, where the underlying annual payments are progressive, delivering a higher replacement rate for retirees with lower lifetime incomes. However, mortality affects not only the receipt of transfer payments, but also the payment of taxes.

To gauge the impact of these effects, 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 11 displays the results of this simulation for the 40-49 year old cohort, which may be compared

to the results in Figure 3, which differ only with respect to the mortality assumption. For this cohort, the lifetime net tax rate falls for those in two lowest resource quintiles, but generally rises in the other resource groups, suggesting that the relative importance of higher future net taxes is larger as income rises, consistent with the redistributive nature of old-age transfer programs.²⁷

For 60-69 year olds, depicted in Figure 12 (which can be compared to Figure 9) lifetime net tax rates are lower for all resource groups except the top 5 and 1 percent, for whom there is no change. For this cohort, the longer period of transfer-payment receipt dominates, except at the top, where most individuals have the same mortality assumptions in the two cases.²⁸

We conclude that ignoring differential mortality, though not having a large quantitative impact on our estimates of progressivity, would make the system look more progressive than it is by making the old-age transfer system appear more generous to those in lower resource groups.

B. A Lower Rate of Return on Saving

The rate of return before all taxes (including corporate taxes) used in our results is based on the historical return to capital, as discussed above. However, many have suggested that future rates of return may be lower, for example because of the demographic transition

²⁷ Note that these tables compare groups based on the ranking of lifetime resources under the respective scenarios, which will differ somewhat across the two cases. This explains why current-year tax rates differ across the scenarios, because current income and current taxes are the same for each individual in the two cases.

²⁸ Note that these results for 60-69 year olds must be interpreted with some care, as the changes in mortality affect the composition of the population. This is not the case for 40-49 year olds, as all changes in mortality are assumed to begin at age 50.

leading, at least in the developed world, to increases in capital labor ratios. To consider the potential impact on our findings, we repeat our analysis under the assumption that the real, before-tax return to capital is 4 percent, rather than 6.371 percent.

Figure 13 presents the results of this simulation for the net tax rates faced by 40-49 year-olds, which can be compared to the base case simulations in Figure 3. Current-year tax rates are higher for those in the top resource groups, because a smaller share of these groups' current income is accounted for by capital income, which faces a lower average current-year tax rate than does labor income. On a lifetime basis, however, the pattern is less clear. While the top 1 percent still face a higher average tax rate, there is little net impact for the top 5 percent, and lower average net tax rates for the other groups. This is due to the fact that the lower discount rate associated with a lower rate of return increases the present value of future old-age transfer payments, thereby reducing the present value of lifetime net taxes. Thus, from the remaining lifetime perspective, assuming a lower rate of return increases the progressivity of the fiscal system. These effects on lifetime net tax rates are even more pronounced for 60-69 year olds (see Figure 14, which may be compared to Figure 9), where even the top 5 percent of the resource distribution experience a drop in remaining lifetime net tax rates. For this cohort, the value of transfer payments looms larger as a component of net tax rates.

C. A Voluntary Bequest Motive

Our consumption smoothing algorithm assumes that households seek the highest, level of consumption possible, given resources and borrowing constraints. This means that bequests occur as a consequence of dying before the maximum age, to the extent that assets are not annuitized. But the algorithm does not provide for intentional bequests. While there

is considerable uncertainty about the motivations for observed bequests, we consider the impact of introducing a voluntary bequest motive. In our model, a simple way of introducing this motive is to assume that there is a ceiling on the annual amount of spending that a household will undertake, so that wealthy households, who under the consumption-smoothing algorithm would exceed the ceiling, simply roll assets forward. This results in intentional bequests among those wealthy enough to hit the ceiling.

Simulations under this alternative assumption, for the case of an annual ceiling on the standard of living of \$5 million, has a minor impact on estimated lifetime average net tax rates, although the changes are consistent with what one would expect. Among 40-49 year-olds, those in the top 1 percent of resources experience a small increase (about one half of a percent) in their lifetime net tax rates. This results from the fact that, with more future asset accumulation, there will be more capital income taxes and estate taxes to pay. The result is more pronounced for 60-69 year-olds (an increase of about 2 percent in the remaining lifetime tax rate), as the higher estate tax payments loom closer in the future. Again, this modification of our assumptions results in greater progressivity in the fiscal system, from a remaining-lifetime perspective.

D. Cheaper Consumption in Retirement and Different Time Preference Rates

We also consider and found no material difference in our findings from the assumptions that households wish to have their living standards per effective adult rise or fall annually by 2 percent or that households plan for their consumption outlays to drop, other things equal, by 20 percent once they reach retirement, reflecting the potential of lower consumption cost in retirement raised by Aguiar and Hurst (2005).

VIII. Conclusion

This paper provides a new and comprehensive analysis of U.S. inequality and fiscal progressivity. It applies The Fiscal Analyzer (TFA) to the 2016 Federal Reserve's Survey of Consumer Finances (SCF). TFA is 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, Obamacare, 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 cohort-specific remaining lifetime spending is highly unequal, it is far less unequal than one would presume from looking at wealth inequality or even annual income inequality, across all cohorts. Across all cohorts, the top 1 percent own 39.1 percent of all net worth if one orders households by wealth and 35.7 percent if one orders households by lifetime resources. Ordering by current income, the top 1 percent account for 21.0 percent of income or 20.9 percent ordered by remaining lifetime resources. But, ordered by remaining lifetime resources, the top 1 percent account for only 17.9 percent of future lifetime spending. Moreover, whether one looks at fiscal progressivity or the underlying inequality in the distribution of resources, comparisons mixing the old with the young can be highly misleading, in contrast to the intragenerational accounting

done here, which compares remaining lifetime spending and fiscal redistribution within cohorts.

Assessing inequality and fiscal progressivity based on current income and gross, let alone net tax rates is likely to misstate both and very significantly. The distribution of current income differs from that of remaining lifetime spending and current-year net tax rates generally understate the degree of progressivity of the tax and transfer system. This is true even if one considers net tax rates within generations. One can also reach different conclusions about the progressivity of tax reforms, as our analysis of the Tax Cuts and Jobs Act shows.

There are many directions for future research, including understanding changes over time in spending inequality and fiscal progressivity and comparing spending inequality and fiscal progressivity across countries. Also, our analysis applies to the current fiscal system, projected forward, even though there is a general consensus that major changes will be needed to sustain fiscal balance. How fiscal balance is restored will have an impact on our measures, depending on the distribution of fiscal adjustments within and across generations.

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 combining 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.

Aguiar, Mark and Eric Hurst. 2005. "Consumption vs Expenditure." *Journal of Political Economy*, October 2005, 113(5), 919-948.

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., Kerwin K. Charles, Courtney C. Coile, William Gale, Dana Goldman, Ronald Lee, Charles M. Lucas, Peter R. Orszag, Louise M. Sheiner, Bryan Tysinger, David N. Weil, Justin Wolfers, and Rebecca Wong. 2017. "How the Growing Gap in Life Expectancy May Affect Retirement Benefits and Reforms," *The Geneva Papers on Risk and Insurance* 42(3), 475-499, July.

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

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.

Bengtsson, Niklas, Bertil Holmlund, and Daniel Waldenstrom. 2016. "Lifetime versus Annual Tax and Transfer Progressivity: Sweden, 1968-2009." *The Scandinavian Journal of Economics* 118(4), 619-645.

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

Congressional Budget Office. 2016. *Trends in Family Wealth, 1989-2013*. August.

Favreault, Melissa M., Karen E. Smith, and Richard W. Johnson. "The Dynamic Simulation of Income Model (DYNASIM)." *Urban Institute Program on Retirement Policy Research Report* (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.

Joint Committee on Taxation. 2013. *Modeling the Distribution of Business Income*. JCX-14-13. October 13. <https://www.jct.gov/publications.html?func=startdown&id=4528>

Joint Committee on Taxation. 2017. *Distributional Effects of the Conference Agreement for H.R.1 "The Tax Cuts and Jobs Act."* JCX-68-17. December 18. <https://www.jct.gov/publications.html?func=startdown&id=5054>

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.

Meyer, Bruce D., and James X. Sullivan. 2017. "Consumption and Income Inequality in the US Since the 1960s." No. w23655. *National Bureau of Economic Research*.

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

Piketty, Thomas, Emmanuel Saez, and Gabriel Zucman. 2018. "Distributional National Accounts: Methods and Estimates for the United States," *Quarterly Journal of Economics* 133(2), 553-609.

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

Table 1
Comparing Lifetime-Resource and Current-Income Distributions, Ages 40 – 49

Lifetime Resource Percentile	Share In Each Current Income Percentile						
	Lowest	Second	Third	Fourth	Highest	Top 5%	Top 1%
Lowest	85.2%	8.6%	2.0%	3.7%	0.5%	0.0%	0.0%
Second	16.8%	67.2%	11.4%	1.4%	3.2%	0.0%	0.0%
Third	0.3%	25.1%	55.9%	17.3%	1.4%	0.0%	0.0%
Fourth	0.0%	0.8%	32.4%	56.4%	10.4%	0.0%	0.0%
Highest	0.0%	0.0%	0.5%	9.9%	89.6%	50.8%	23.3%
Top 5%	0.0%	0.0%	0.0%	0.0%	100.0%	93.7%	46.3%
Top 1%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	97.6%

* Highest percentage in each row is green.

Table 2
Distributional Effects of the Tax Cuts and Jobs Act

Income Category	TFA Estimates			JCT (2017a) Estimates		
	Avg. Tax Rate Under Present Law	Avg. Tax Rate Under TJCA	Change	Avg. Tax Rate Under Present Law	Avg. Tax Rate Under TJCA	Change
Less than 10,000	14.04%	12.62%	-1.42%	9.10%	8.60%	-0.50%
10,000 to 20,000	3.33%	2.56%	-0.77%	-0.70%	-1.20%	-0.50%
20,000 to 30,000	1.64%	0.56%	-1.09%	3.90%	3.40%	-0.50%
30,000 to 40,000	6.45%	5.18%	-1.27%	7.90%	7.00%	-0.90%
40,000 to 50,000	10.69%	9.40%	-1.29%	10.90%	9.90%	-1.00%
50,000 to 75,000	11.79%	10.44%	-1.35%	14.80%	13.50%	-1.30%
75,000 to 100,000	14.57%	13.02%	-1.55%	17.00%	15.60%	-1.40%
100,000 to 200,000	18.92%	17.17%	-1.76%	20.90%	19.40%	-1.50%
200,000 to 500,000	26.00%	23.83%	-2.17%	26.40%	23.90%	-2.50%
500,000 to 1,000,000	34.35%	32.17%	-2.19%	30.90%	27.80%	-3.10%
1,000,000 and over	38.40%	37.42%	-0.98%	32.50%	30.20%	-2.30%

Figure 1

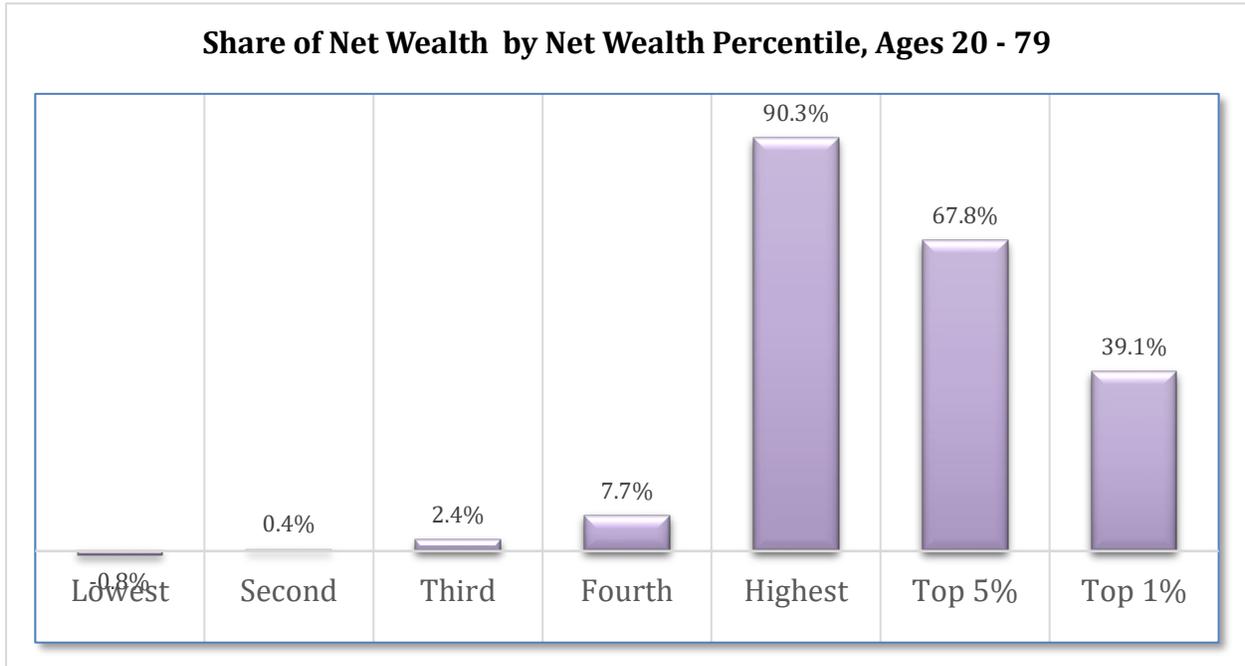


Figure 2

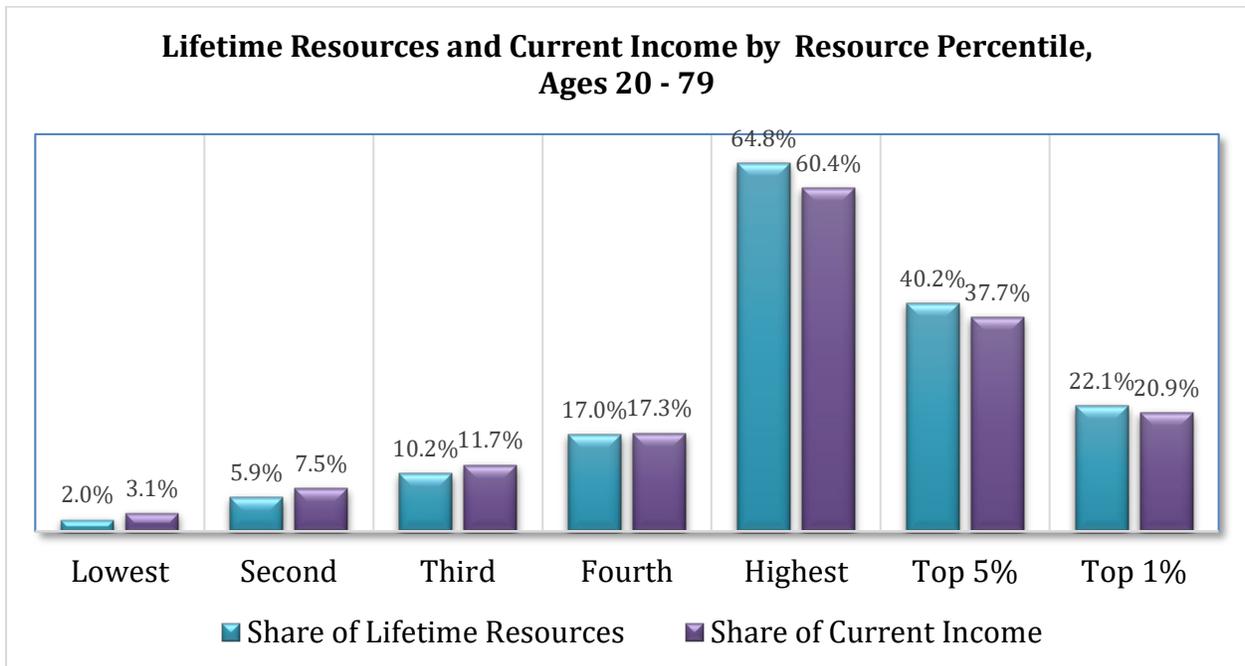
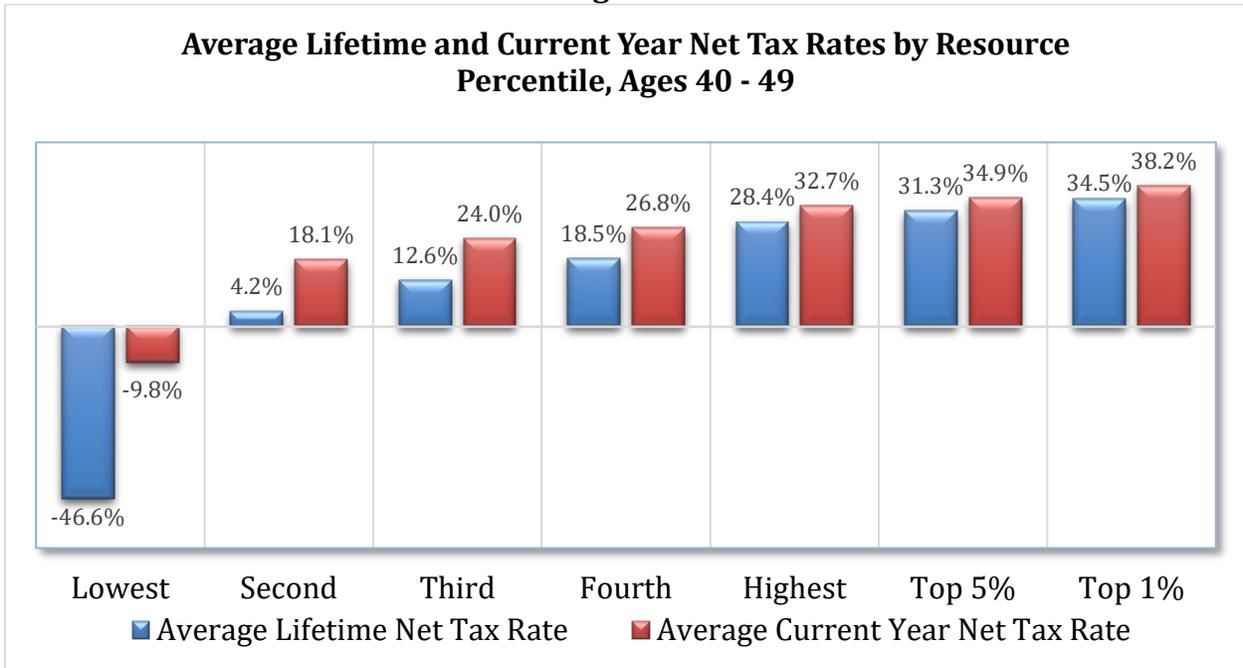
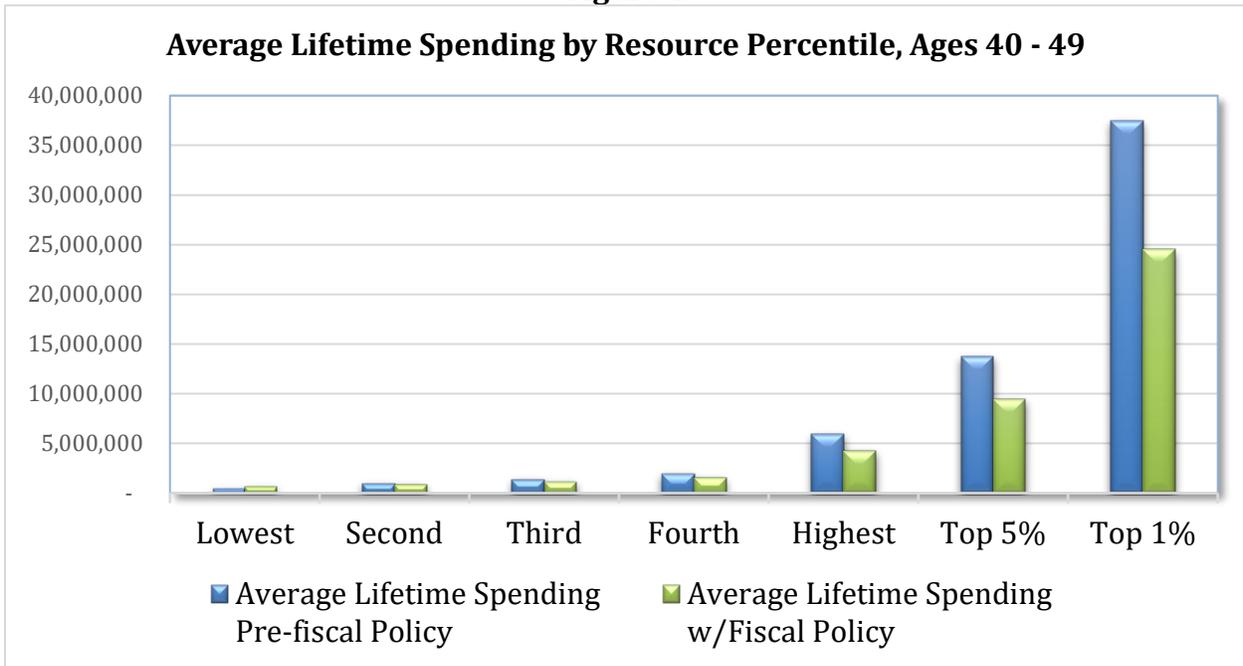


Figure 3



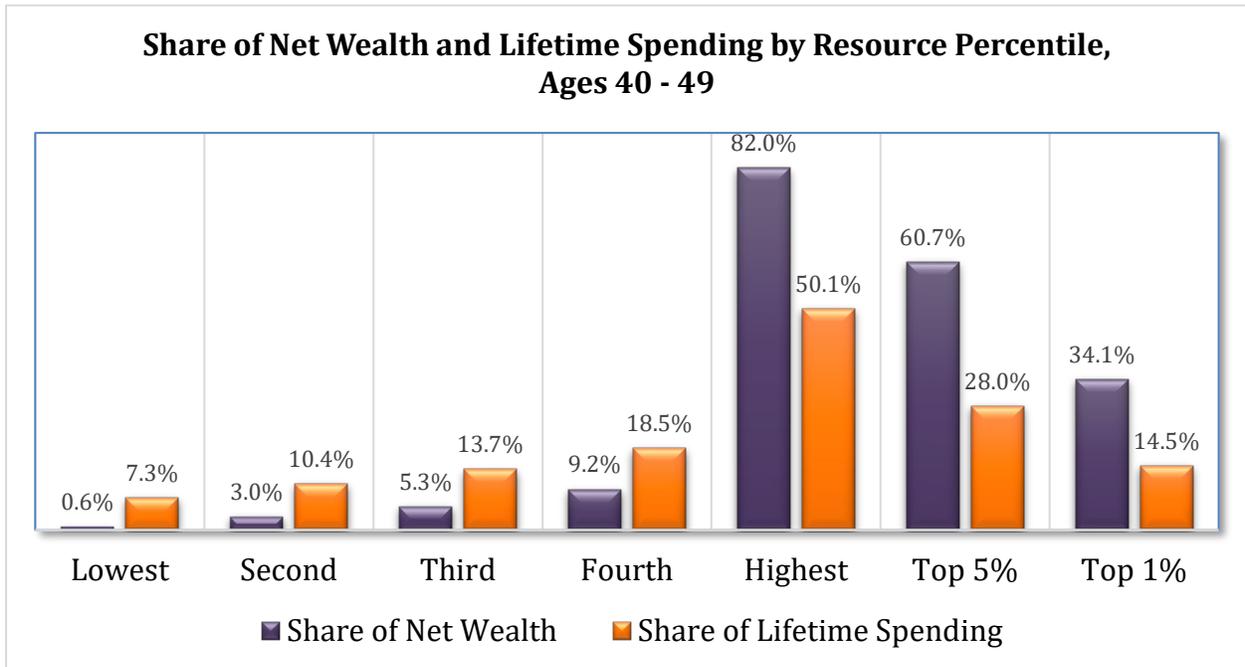
This chart presents remaining lifetime net tax rates – the ratio of the sum of all remaining lifetime net tax payments of all (population-weighted) households in the specified percentile resource range divided by the sum of the resources of all (population-weighted) households in that range. “Resources” 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) of the household’s net taxes divided by the sum of all (population weighted) household income (labor income plus, apart from the corporate income tax, pre net-tax asset income).

Figure 4



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 5



The 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 6

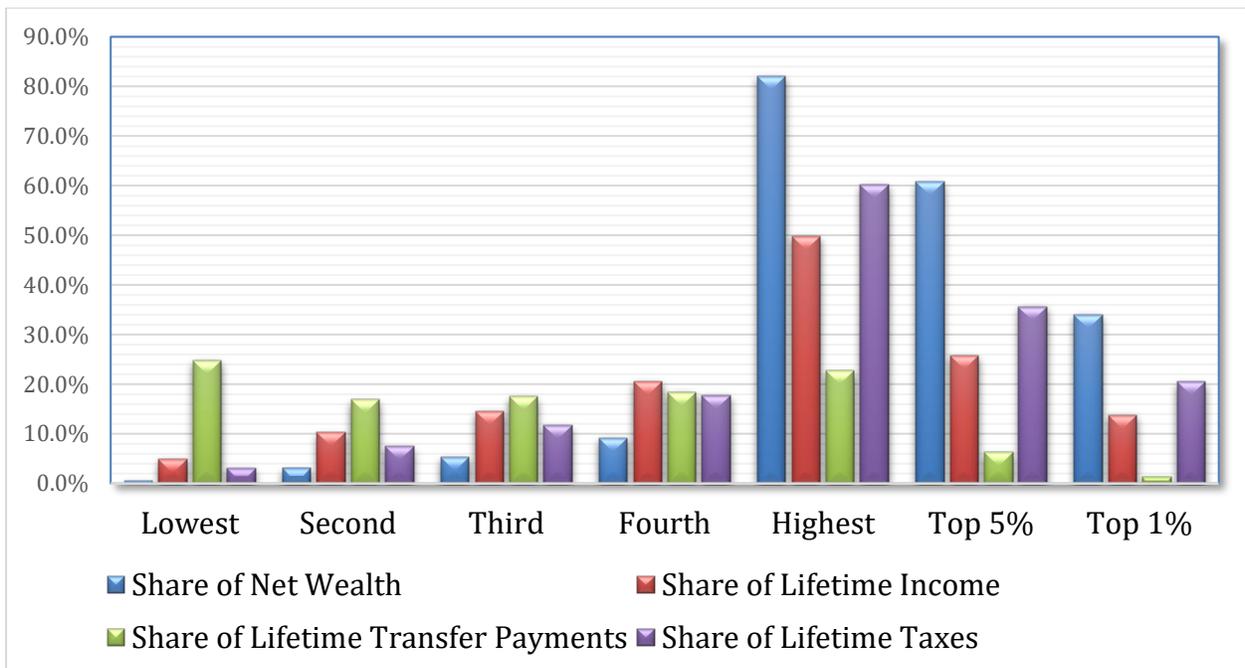


Figure 7

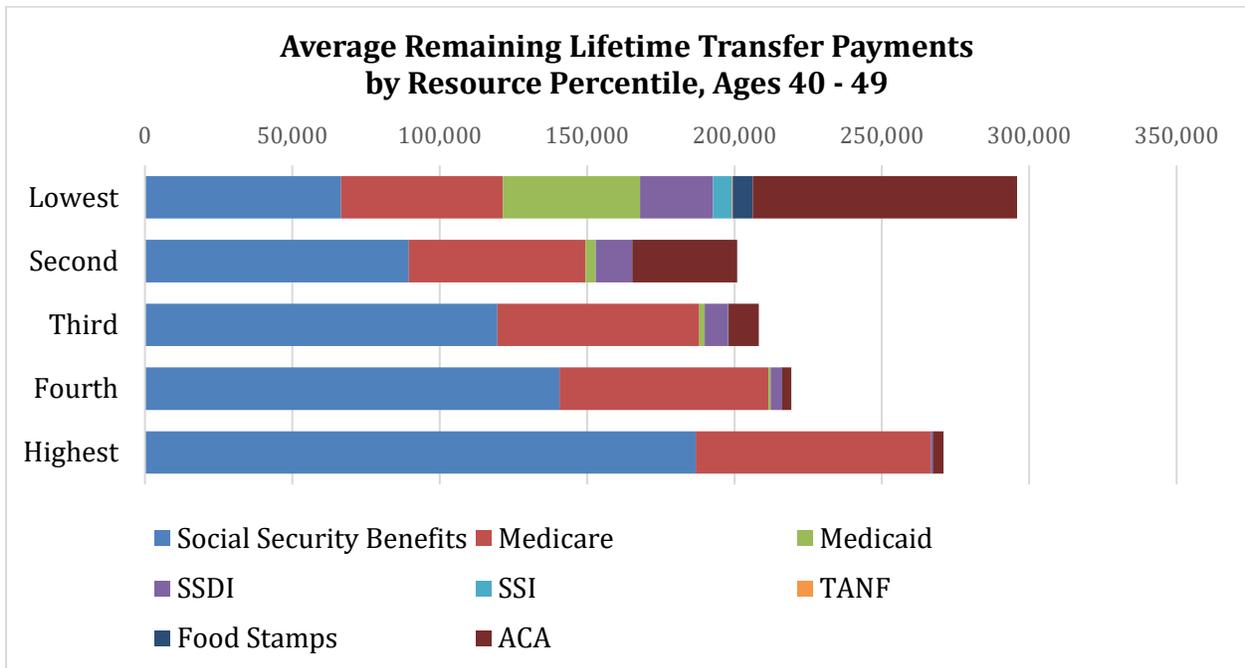
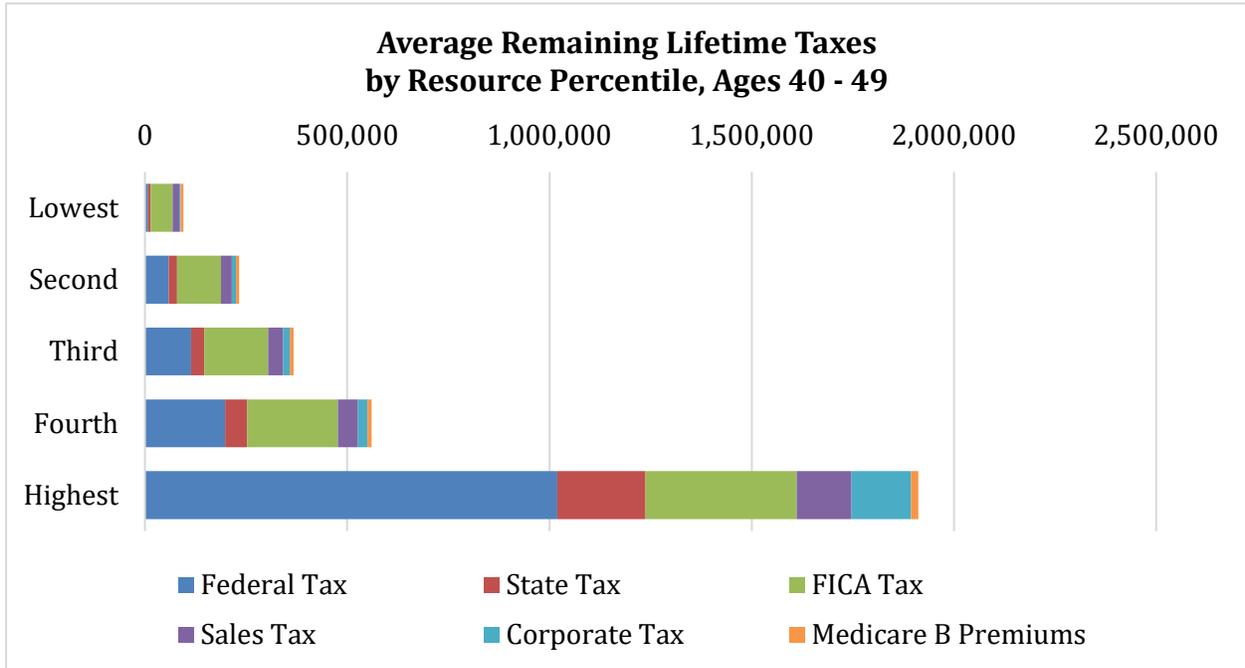


Figure 8

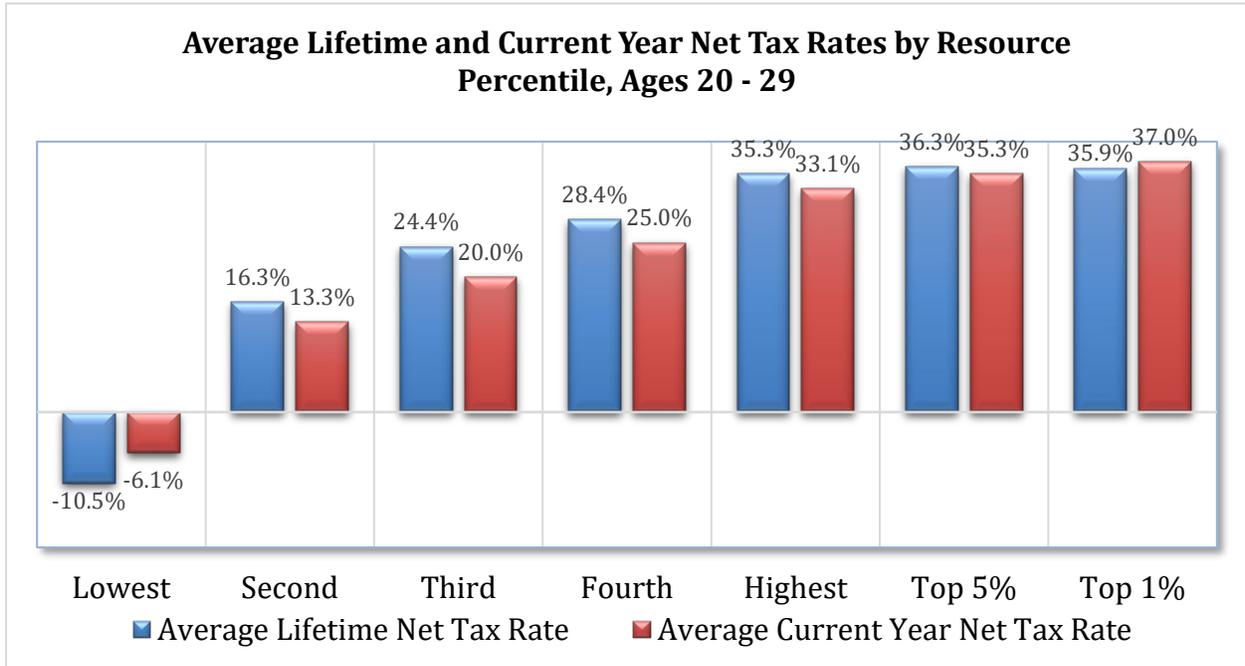


Figure 9

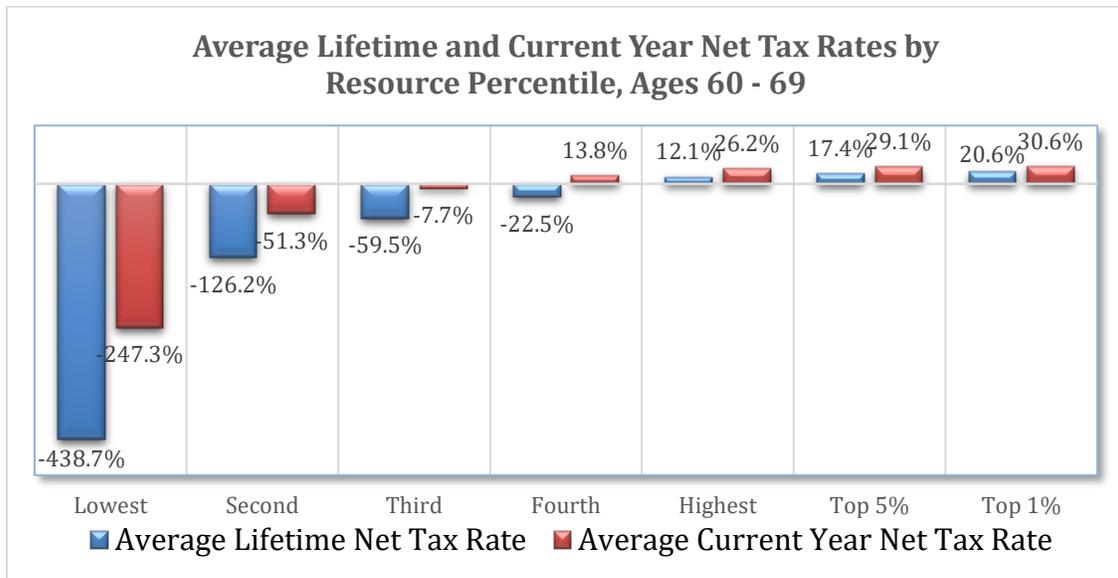


Figure 10

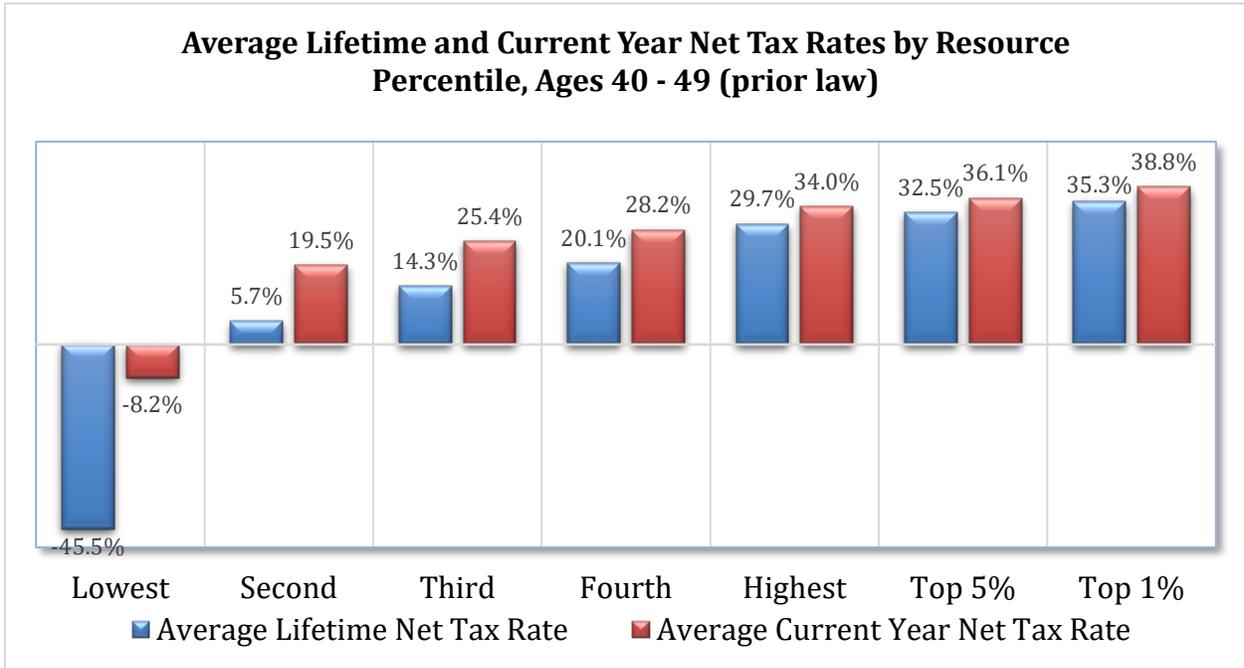


Figure 11

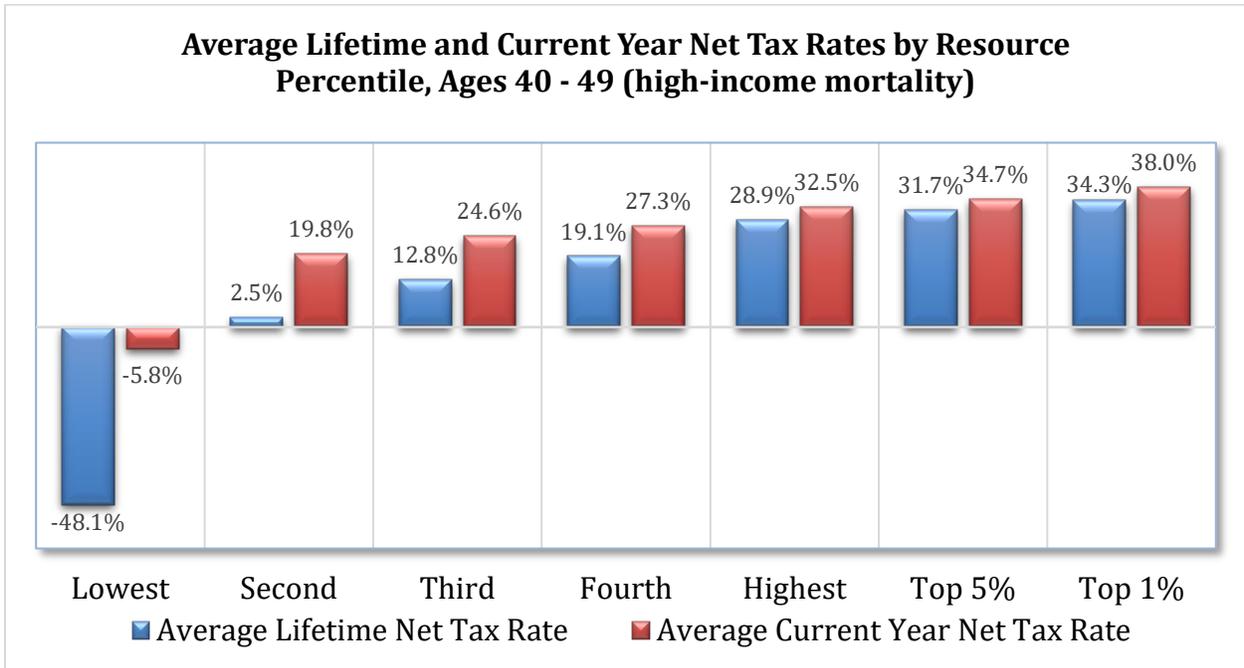


Figure 12

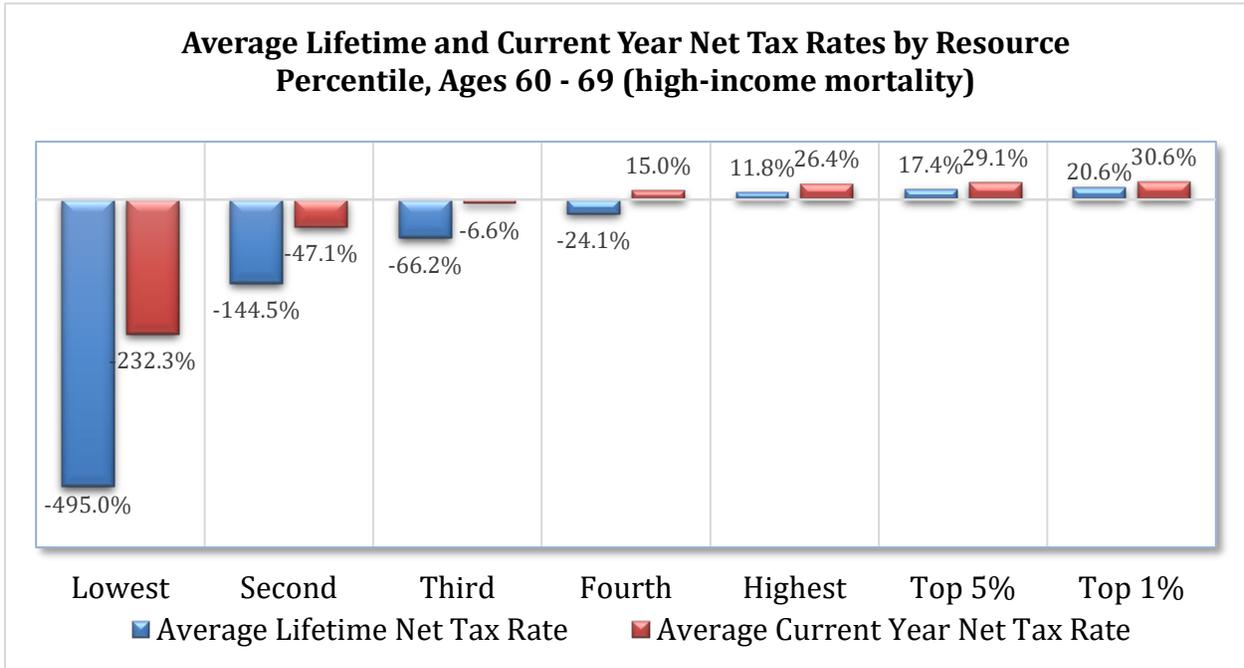


Figure 13

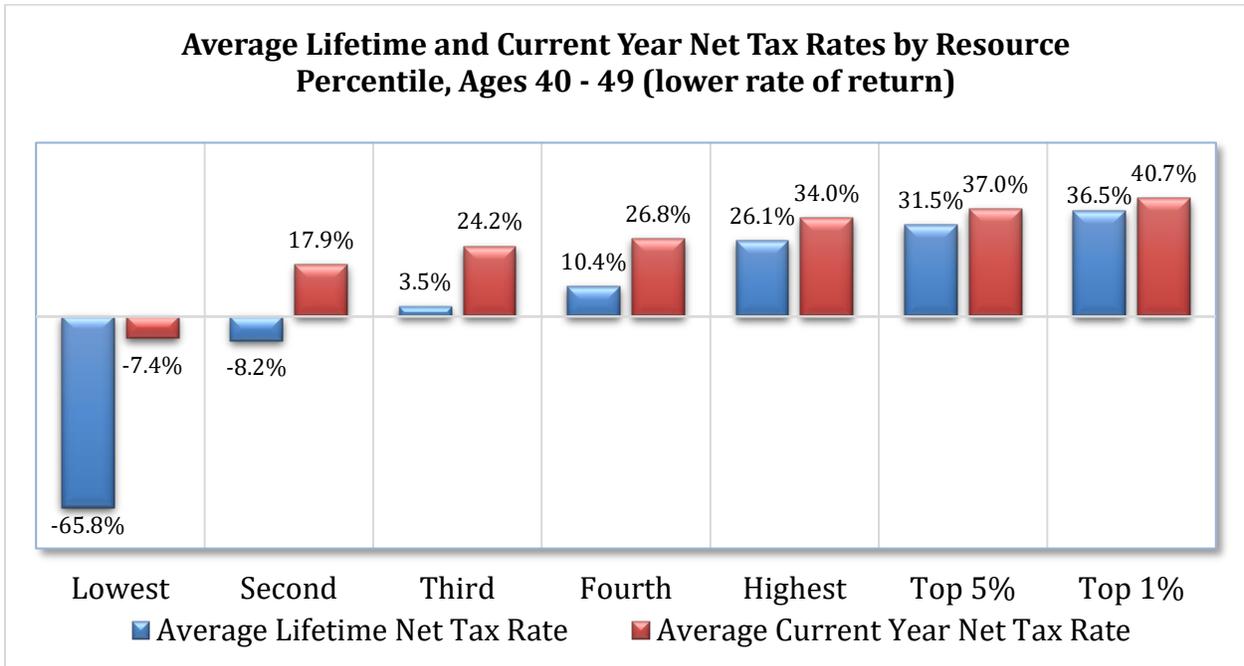
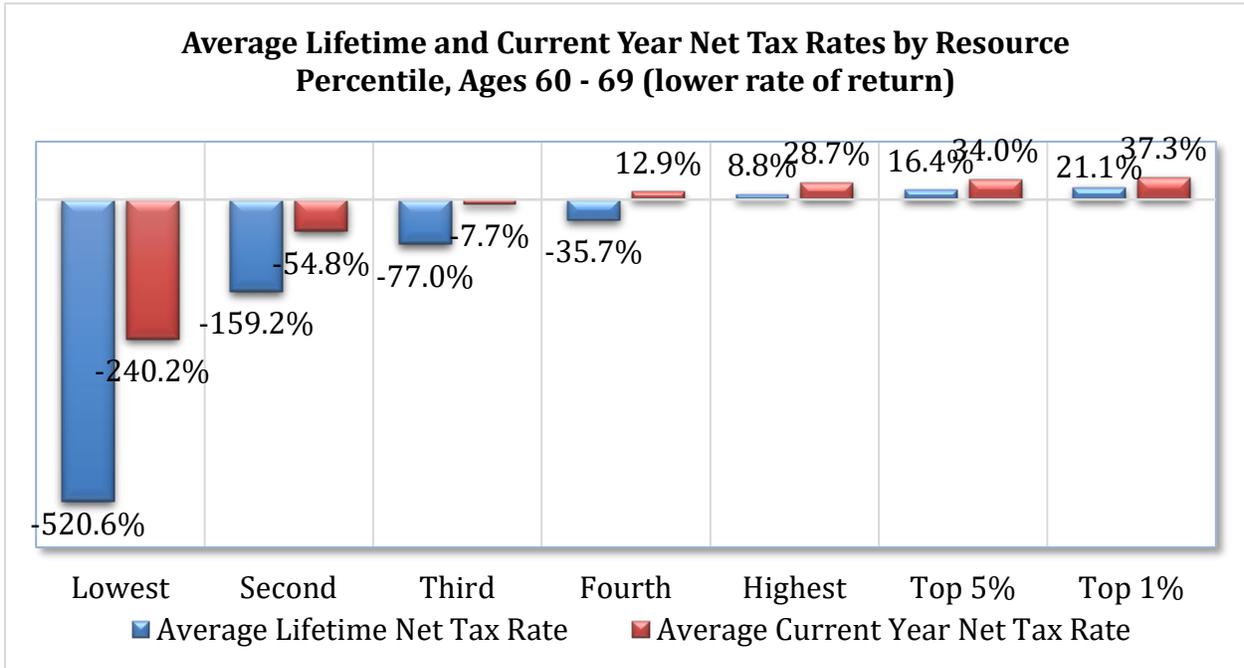


Figure 14



Appendix Figure 1

