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ABSTRACT

Inequality is ultimately about differences in spending, not differences in wealth or income that can be offset by fiscal policy. This study measures inequality in remaining lifetime spending (RLS) by cohort. Cohort specificity controls for growth and life-cycle effects. We measure RLS and lifetime net tax rates by running the 2016 Survey of Consumer Finances data plus imputed variables through a life-cycle, consumption-smoothing program that incorporates borrowing constraints and all major federal and state tax/transfer programs. Our findings are striking. First, inequality in income and, especially, wealth dramatically overstates RLS inequality. For example, the richest 1 percent of forty year-olds own 29.1 percent of their cohort's net wealth, but account for only 11.8 percent of its RLS. This cohort's poorest quintile owns just 0.4 percent of the cohort's wealth, but spends 6.6 percent of cohort RLS. Second, within-cohort inequality differs considerably from across-cohort inequality. Third, the U.S. fiscal system is highly progressive. To illustrate, for the bottom quintile of forty year-olds, the lifetime net tax rate is negative 44.4 percent. It's 34.7 percent for the top 1 percent. Fourth, current-year net tax rates substantially understate fiscal progressivity and, as our analysis of the 2017 Tax Cuts and Jobs Act shows, can significantly misstate a fiscal reform's fairness.

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I. Introduction

Inequality is a topic of intense national and international interest thanks to the apparent growth in the 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 poorest 50 percent grew by 21 percent. Auten and Splinter (2019), though, argue that the after-tax top income share of high-income American households has remained constant over time after one corrects for data biases as well as missing data.

Wealth shares are even more difficult to estimate. But there seems little doubt about the general direction of wealth inequality. The Congressional Budget Office (2016) estimates that the total net worth of families in the top 10 percent of the wealth distribution rose by 54 percent between 1989 and 2013, whereas median wealth rose by only 4 percent. By 2013, the 50 percent poorest Americans, ranked by net worth, 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

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[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

Goldin and Katz (2008) and Acemoglu and Autor (2011) show a steady and 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.[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, they omit the fiscal system. Yet 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. I.e., we seek to understand the progressivity of our fiscal system, not responses to it. Our assumption of uniform (across households) Leontief consumption preferences

[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.

with age-specific time-preference factors (assumed identical in our base-case calculations) as well as exogenous labor supply reflects 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 preference-dependent changes in current or future labor supply or saving in response to fiscal work and saving disincentives.

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 provide to ensure survivors can afford, to the dollar, the same future living standard as they would have enjoyed absent the decedent's death. Life insurance purchases are constrained to be non-negative, i.e., households don't buy annuities at the margin.[5]

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 and life insurance requirements 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 assess fiscal progressivity within

[5] This is well documented by Brown, et. al. (2008) and others.

a cohort by considering how these average remaining lifetime net tax rates change with remaining lifetime resources.[6]

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 measuring 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, RLS must be inferred. It can't be solicited in a survey. There are, of course, 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

[6] 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. The resource-weighted average net tax rate for any group is just the group's population-weighted sum of expected remaining lifetime net tax payments divided by the population-weighted sum of expected remaining lifetime resources.

remaining lifetime spending. Borrowing constraints of household-specific duration depress many, if not most households' current relative to their future consumption. Households also leave bequests, which we treat as a form of consumption. Whether intended, accidental, or involuntary (e.g., trapped home equity), bequests can render current consumption a poor proxy for future consumption and, therefore, RLS.

We measure both RLS and fiscal progressivity based on a) estimated lifetime resources – the household's current net wealth and its survivor-path contingent current and projected future labor earnings; b) its calculated survivor-path contingent current and future taxes net of in-cash and in-kind benefits; and c) assumed life-cycle consumption-smoothing behavior, captured by an assumed *uniform*, across households, desired longitudinal age-consumption profile (ACP), subject to borrowing constraints. Again, we consider uniform intertemporal preference – the same desired ACP – since our focus is on resource-driven, not behavior- driven inequality in RLS.

Our analysis incorporates economies of shared living and the relative cost of children. Hence, ACP is shorthand for the longitudinal age profile of living standard (consumption per equivalent adult). Our base case considers full consumption smoothing, i.e., a flat desired ACP, but our results are little changed by positing alternative ACP shapes. Regardless of the ACP targeted, age-living standard profiles are largely dictated by borrowing constraints.[7] Indeed, in our base case, the actual, as opposed to targeted, ACP is upward slopping through retirement for the average household. Moreover, actual ACPs differ dramatically across households due to differences in timing, duration, and severity of borrowing constraints.

[7] I.e., borrowing constraints override assumed ACP preferences.

One might quickly object that consumption growth rates vary by household due, not just, as mentioned, differences in intertemporal preferences, but also risk.[8] 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, labor-leisure preferences, and risk.

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).[9] As described below, 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. TFA's solutions are highly precise and can easily be verified via seven different tests discussed in note 18 below.

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) $$S_i = R_i - T_i,$$

[8] 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.

[9] 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.

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) $$R_i = W + H_i.$$

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

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

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

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

and

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

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

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

and

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

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*.

Clearly, were T proportional to R, inequality in *R* would equal inequality in *S*, making our measurement task much simpler. But that's not the case due to a range of factors including progressive explicit and implicit (embedded in benefit programs) tax schedules, household demographic differences, implicit marriage taxes, different tax treatment of labor and asset income, and household differences in actual ACPs arising from household-specific borrowing constraints. Determining *T* requires knowing taxable labor and asset income along each survivor path. As indicated, we project labor income. As for asset-income paths, they depend, in part, on spending paths, which, in turn, depend, in part, on net tax paths. In short, spending depends on taxes and taxes depend on spending. Another key simultaneity involves the interdependency between paths of life insurance holdings required to protect survivors and spending paths. The more life insurance the household holds, the more premiums it pays and the less it can spend when insureds are alive. But the less households spend, the less life insurance required to maintain survivors' living standards when an insured individual dies. TFA's iterative solution method was developed, in part, to resolve these chicken and egg problems.

All else equal, older cohorts will have smaller values of *S* simply because they have fewer years left to live. Hence, our study measures inequality in *S* on a cohort-specific basis, i.e., we do intragenerational accounting. We compare cohort-specific inequality in *S* 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*.[10] We also show that fiscal

[10] In doing so, we don't 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.

progressivity measured, within cohort, via the average remaining lifetime net tax rate, τ, defined in equation (9), can differ markedly from the standard fiscal-progressivity measure – current-year gross or net taxes divided by current-year income, which is generally not differentiated by age.

(9) $$\tau = {}^{T}/_{R}\,.$$

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, federal excise taxes, the federal corporate income tax, the federal 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 Medicaid benefits, Medicare benefits, Medicare Part B premiums (including IRMMA premiums), and Section-8 housing.[11] Details of TFA's tax and transfer calculations are provided in our online appendix.[12]

C. Valuation of Future Flows

Inequality, in our view, primarily concerns who gets to spend the economy's resources, where both spending and resources are valued in the present. As discussed below, our

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[11] We do not include state estate taxes or local property taxes. Section-8 housing is rationed. We incorporate this fact in our calculations.

[12] 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.

discount rate is the economy's average pre-tax real return, which provides the average terms on which future resources can be traded for current resources and future spending can be traded for current spending. Yet, the intertemporal terms of trade available, on average, to the economy are not necessarily the terms at which any particular households can convert future resources into current spending. Cash constrained households likely subjectively discount future resources and spending at an even higher rate than the already quite-high average real return on national wealth.

Since the realized path of pre-tax real returns comes into play in the economy's and, indeed, government's budget constraint, our perspective on inequality is that of the government. This has the merit of considering the allocation of the economy's resources in a manner that obeys the economy's and government's intertemporal budget constraints.[13] This said, we do take up the issue of valuation and borrowing constraints in our final section on sensitivity analysis. Specifically, we recalculate our present value measures placing 50 percent weight on net taxes, resource flows, and spending in years after the household becomes unconstrained. Remarkably, our portrait of inequality and progressivity is little changed by this alternative valuation method.[14]

D. Fiscal Labeling Issues

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[13] The economy's intertemporal budget equates the present values of realized annual resources and annual spending discounted at the realized annual return to national wealth. The government intertemporal budget equates the present value of realized annual receipts to the present value of realized annual outlays also discounted at the realized annual return to national wealth.

[14] We also take the perspective of the government's budget constraint in valuing transfer programs, whether cash or in-kind, at cost, rather than attempting to scale by the unobservable values that individuals may place on them. Large differences between cost and valuation would certainly raise the question of the optimality of government policy, which is beyond the scope of our analysis. For the same reason, we do not include the deadweight loss associated with tax and transfer policies in assessing these policies' benefits or burdens to individuals.

*A*s we emphasized in prior work (e.g., Kotlikoff, 1984 and 1988, Auerbach and Kotlikoff, 1987, Auerbach, Gokhale, and Kotlikoff, 1991, Kotlikoff, 2002, and Green and Kotlikoff, 2006), many macro measures, like GDP and consumption, are well-defined. But others, which depend on arbitrary fiscal labeling conventions, including taxes, transfer payments, and deficits, are not.[15] 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 reported flows of taxes and transfers and put Social Security's unfunded liability on the books. 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 non-employment related 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 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.[16]

[15] 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.

[16] The labelling problem is arguably less problematic for the youngest cohort, those 20-29, since they have spent less time under the fiscal system and, thus, less time having their payments to and receipts from the government labeled arbitrarily. The qualitative results for this cohort are the same as for the older cohorts.

E. 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 29.1 percent of total cohort net wealth, but only 11.8 percent of total cohort remaining lifetime spending. As for the lowest-resource quintile, it has just 0.4 percent of the cohort's net wealth, but 6.6 percent of its total spending power.

Part of the explanation is that spending depends, in part, on human wealth, which is far is more equally distributed than is net wealth. The top 1 percent of this cohort account for 10.0 percent of the cohort's human wealth, which is roughly a third of its net wealth share. The bottom 20 percent have 4.3 percent of total-cohort human wealth – roughly ten times its net wealth share. The other reason why spending inequality is far less severe than wealth inequality is the fiscal system. The average remaining lifetime net tax rate of the top 1 percent of 40 year-olds is 36.0 percent. It's -44.4 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 13.8 percent of RLS (their resource share), which is far below their 29.1 percent of net wealth and close to their 11.8 percent share of RLS taking taxes and transfers into account. Hence, the less unequal distribution of human wealth plays the key role in limiting the spending share of the top 1 percent. For the poorest 20 percent, with just 0.4 percent of total cohort net wealth, their share of cohort pre-fiscal resources is 3.5 percent compared with a 6.6 percent share of total cohort spending.[17] Hence, the more equal distribution of human wealth and fiscal policy play roughly equal roles in raising the RLS share of the poorest quintile.

Our results are qualitatively, if not quantitatively 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 34.7 percent net rate. For those in the top quintile the average net tax rate is 30.7 percent. But for those in the bottom quintile, every dollar of pre-tax resources is, to repeat, matched by a 44.4 percent net subsidy. Now consider those aged 60-69 in the top 1 percent of their cohort's resource distribution. Their remaining lifetime net tax rate is 25.7 percent. In contrast, those in the lowest quintile face a negative average remaining net tax rate of -601.2 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, but not much 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. Their negative average net tax rate would fall to –48.1 percent from –44.4 percent.

F. Organization of Paper

[17] This is slightly lower than their 4.3 percent share of human wealth.

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 U.S. 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 only 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. Their framework has important advantages over ours in considering the interplay between behavior and fiscal outcomes. However, Dynasim projects outcomes using reduced-form behavioral functions, whereas with borrowing constraints, one needs to solve for behavior using dynamic programming, i.e., working backwards. This makes the microsimulation inappropriate for achieving our goal, namely addressing inequality and the fiscal system holding constant the reaction to the fiscal system.

Some recent 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 careful account of program provisions 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. 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. While studying individual fiscal components is interesting in its own right, our focus is on the fiscal system's overall effects. This requires considering all major fiscal-system components at the state as well as federal levels.

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 main finding is that fiscal progressivity is greater on a current-year than on a lifetime basis. We find the opposite, but our results are hardly comparable given key measurement and methodological differences as well as their focus on Sweden, which has a very different fiscal system than the U.S.[18]

[18] First, the Swedish government appears to be much more generous than the U.S. to the middle class. Second, we incorporate all transfer programs, including in-kind transfers, such as healthcare. Third, we include additional taxes, including corporate and federal estate taxes. Fourth, we examine the fiscal system at a point in time, rather than looking at fiscal realizations through time – realizations that reflect behavioral responses and outcomes particular to their sample period. Fifth, they measure lifetime income as the discounted sum of realized pre- or post net-tax income received through time, not the sum of human plus non-human wealth at a point in time. The two measures can differ dramatically due to differences in consumption behavior. Sixth, they use a 3 percent real discount rate to form present values, whereas we use a pre-all-tax real return of 6.37 percent. Seventh, our focus is evaluating fiscal progressivity ex-ante, not ex-post after the system has adjusted to exigencies over time, including business-cycle fluctuations, changes in fiscal policies, and changes in household behavior. Eighth, they use a different measure of fiscal progressivity, whereas we simply focus on how average lifetime net tax rates vary by levels of lifetime resources.

III. TFA's Algorithm

As indicated, rather than solve its deterministic problem in a single dynamic program, TFA uses three such 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 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.[19] The third program calculates, for each year, the household's payments to and receipts from each of the different tax and cash benefit programs it faces. Once the three programs converge, TFA adds two things to the calculation of the present expected value of spending. The first is the present expected value of in-kind benefits calculated separately for each survivor path. The second is the value of the respondent-household's home. TFA assumes homes aren't sold. Hence, the value of a home is also the expected present value of imputed rent plus the expected present value of the bequest of the home.[20]

The first program considers the maximum survival path – the path in which each spouse lives to his or her maximum age of life. The program's goal is simple – achieve the highest affordable path of household living standard per effective member that accords with a pre-specified, targeted age-consumption profile (ACP) subject to the household's never incurring additional debt. This form of consumption smoothing is consistent with time-

[19] This routine calculates net taxes along each possible survivor path.

[20] Remaining balances on mortgages when the last survivor dies are netted against house value in helping determine the household's survivor-path specific bequest.

separable Leontief preferences with time-preference factors determining the targeted ACP. The second program determines how much life insurance the household head and, if present, the 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[21]) at annual levels at least as high as those that would arise were no one to die prematurely. The output of this second program is the non-negative life insurance premiums used by the first program. This second routine must and does calculate the net taxes and non-discretionary spending arising under each survivor path in which a household head or spouse/partner doesn't live to their maximum age of life. The third program calculates the net taxes the household will pay along the maximum survival path. It does so while 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 taxes. TFA solves each observation's problem in less than one second to a very high degree of accuracy. [22]

As stated, our base-case ACP is targeted to be flat. But, as Appendix figure 1 indicates, borrowing constraints preclude such an outcome and, instead, imply upward-sloping average age-consumption profiles. The figure shows, for 25 year-olds, 45 year-olds, and 65

[21] Unfortunately, the SCF doesn't report whether children in the home are disabled. Hence, we are forced to assume all leave at age 19.

[22] There are seven ways to verify that TFA's calculations are precisely correct. First, the three-part iteration process converges to several decimal points. Second, all survivor-path specific lifetime budget constraints are satisfied in present value to the dollar. Third, saving calculated as a flow equals annual differences in the stock of regular assets to the dollar. Fourth, when life insurance is positive, survivors have sufficient resources, to the dollar, to maintain their former living standard path. Fifth, when life insurance is zero, survivors have higher living standards. This is implied by the zero-annuitization constraint. Sixth, when a household is borrowing constrained it spends, to the dollar, all cash on hand the year before the constraint is lifted. Seventh, apart from changes in living standard associated with a household being relieved of its borrowing constraint, TFA's computed living standards are identical to the dollar through time.

year-olds, the average projected living standard under the optimal path, conditional upon survival.[23] 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.[24] For 65-year-olds, the average age-consumption profile is close to flat.

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[25] details sample selection, 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 as well as projected future covered earnings to calculate future Social Security benefits. As described below, we use past waves of the Current Population Survey (CPS) to impute past and future Social Security covered earnings. Second,

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[23] 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.

[24] 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.

[25] Posted at https://kotlikoff.net/wp-content/uploads/2019/03/Online-appendix-6-5-19-.pdf.

TFA needs state identifiers to calculate state-specific taxes and benefit payments. Unfortunately, the public-use SCF release doesn't provide them.[26] Consequently, we use the 2016 American Community Survey to allocate state-specific weights to each SCF household. Specifically, we statistically match the 2016 SCF households with the U.S. Census' 2016 American Community Survey. Our method assigns 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. We take 2019 as our initial year, benchmarking the SCF data to that year and using 2019 provisions for all federal and state tax and benefit programs.

A. Forecasting and Backcasting Labor Income

Our methodology requires, for each individual, a trajectory of lifetime labor earnings, not just to calculate Social Security benefits but also to determine 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 define cells in each wave of the CPS by age, sex, and education[27] 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, which is needed to help estimate their future Social Security benefits. 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

[26] The full SCF, available to Federal Reserve researchers, includes state identifiers, but doesn't include state-specific weights. Hence, their availability wouldn't help produce properly weighted national results.

[27] 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.

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, $\left(y_{ij}^a - \bar{y}_i^a\right)$, which 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*, $\hat{y}_{ij}^a$,

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

and assume that future earnings grow at the group average growth rate.[28] Further, guided by the literature (e.g., Gottschalk and Moffitt, 1995, and Meghir and Pistaferri, 2011), we

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

make the simplifying assumption that the permanent and temporary earnings shocks have the same variance, reducing (10) to:

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

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:

$$(11) \qquad \bar{y}_{i}^{a-t} + \frac{a-t}{a}\left(\hat{y}_{ij}^{a} - \bar{y}_{i}^{a}\right)\frac{\bar{y}_{i}^{a-t}}{\bar{y}_{i}^{a}} = \frac{t}{a}\bar{y}_{i}^{a-t} + \frac{a-t}{a}\hat{y}_{ij}^{a}\frac{\bar{y}_{i}^{a-t}}{\bar{y}_{i}^{a}}$$

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 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.

B. Measuring Capital Income

A key component of our calculations involving saving and wealth is the before-tax rate of return on national wealth. For this, we use the average return on national 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 national wealth, which is the total net 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 model mortality as a function of age, sex, birth year, and income quintile. In this analysis, income is measured using a truncated Social Security Average Indexed Monthly Earnings (AIME) calculation based on earnings between ages 40 and 50 and the AIME variable for couples is measured as the sum of spouses' truncated AIME divided by the square root of 2.[29] 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.[30]

D. Current Income as an Inaccurate Proxy for Lifetime Resources

Proxying lifetime spending inequality with current-year, pre-tax income inequality is questionable not just because that latter measure ignores net taxes, but also because households with low current income don't all have low lifetime resources. Table 1, which

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

[30] 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.

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 75.0 percent of the quintile's households would be ranked in the second quintile based on current income. I.e., current income would misclassify one fourth of such households, with 9.2 percent being ranked in the bottom quintile and 15.24 percent being ranked in the third quintile. For other lifetime-resources percentiles, the results are also troubling. Some 8 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 31 percent. For those in the fourth lifetime resource quintile, 24 percent are misclassified. And for the top quintile, almost 5 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 4 percent and less than 3 percent.

V. Main Results

This section presents 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 household trajectories of remaining resources and net taxes, rather than simply on income, whether pre- or post-net tax, in the current year. Appendix figures 2-4 show, for a young, a middle aged, and an older cohort, the per capita values of the key variables underlying the results below.

A. Inequality

For the adults studied here – those age 20-79, wealth is distributed highly unequally. As Figure 1 shows, the top 1 percent of the population holds just over 37 percent of total net wealth. This share is only slightly lower than the estimates in Saez and Zucman (2013). The remainder of the distribution is also consistent with these earlier estimates. But these results vary considerably by age cohort. For 20-29 year-olds, the top 1 percent holds 73.1 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 37.0, 32.6, 31.3, 31.7, and 33.5 percent for ten-year age cohorts 30-39 through 70-79, respectively.

Our measured distribution of pre-tax income is, 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 19.2 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.[31] Again, the results differ when one considers specific age cohorts, but with a different pattern than wealth. Whereas the top 1 percent wealth share generally falls with age, the top 1 percent share of current income generally rises. Moving from the age 20-29 cohort through the age 70-79 cohort, the share of current income of those in the top 1 percent of the income distribution is 12.5, 11.4, 13.2, 20.5, 22.4, and 29.0 percent, respectively.

[31] 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.

In short, aggregate measures of inequality formed by pooling observations across all cohorts mask striking differences across cohorts in the degree of inequality and in the sources of inequality.[32] 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.

B. Fiscal Progressivity

Findings for the 40-49 Year-Old Cohort

The results for the 40-49 year-olds are qualitatively 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

[32] 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 a current 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.

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 34.7 percent rate. For those in the top quintile the average net tax rate is 30.7 percent rate. For those in the bottom quintile, every dollar of pre-tax resources is matched by a 44.4 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 between, 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 29.1 percent, 50.0, and 77.9 percent of all wealth (financial assets plus housing and other real estate equity less financial liabilities), respectively. But these three groups account for only 11.8, 24.4, and 49.8 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, to repeat, only 0.4 percent of wealth but 6.6 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 the distribution of lifetime earnings is much less unequal. While those in the top 1 percent hold 29.1 percent of all wealth, they account for just 10.0 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, albeit a negative component – remaining lifetime tax payments – is heavily skewed against the rich. The top 1 percent accounts for 15.0 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 30.4 percent of all remaining lifetime tax payments, and the top 20 percent for 58.4 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 3.5 percent of the resources, but does 6.6 percent of the spending. The second quintile has 8.5 percent of the resources, but does 9.8 percent of the spending. The third quintile has 13.3 percent of the resources, but 14.0 percent of the spending. And the fourth quintile has 19.7 percent of both resources and spending.

From this perspective, the top quintile is redistributing to the three lowest quintiles via the tax and transfer system. The result is a top-quintile spending share of 49.8 percent compared to a resource share of 55.1 percent. The absolute gap is also large for the top 5 percent, who account for 28.1 percent of all resources, but just 24.4 percent of all spending. The top 1 percent has 13.8 percent of all resources, but accounts for only 11.8 percent of all spending.

Differences among resource, wealth, and spending inequality can vary dramatically by cohort. The top 1 percent of 20-29 year-olds account for 11.2 percent of their cohort's resources, 68.2 percent of their cohort's wealth, but only 9.7 percent of their cohort's spending. For 40-49 year-olds, the corresponding three shares are 13.8 percent, 29.1 percent, and 11.8 percent. And for 60-69 year-olds, the three shares are 25.8 percent, 31.6 percent, and 19.1 percent.

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, one 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 overall inequality.

The Inadequacy of Current-Year Net Tax Rates

Figure 3 compares current-year average tax rates to lifetime net tax rates for 40-49 year-olds.[33] Clearly, current-year average net tax rates 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 44.4 percent rate. But its average current-year net subsidy rate is only 25.6 percent. For the remaining quintiles, 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 resource 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 the three lowest 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 lifetime resources. This is particularly true 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

[33] 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.

Affordable Care Act (Obamacare), which are large in size and highly concentrated in the bottom quintile of the lifetime resource distribution.

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 is generally lower, in terms of the gradient of tax rates with respect to resource group, than is the case for current tax rates. 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 for this age cohort, 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.[34] One useful check of our benchmarking procedure is to compare our results with those of the

[34] https://www.jct.gov/publications.html?func=startdown&id=5053

Joint Committee on Taxation, which are based on tax return data, albeit for 2013. Table 2 shows average current-year gross tax rates for 2019 under old law, under the TCJA, and the change between the two, from both JCT (2017) and our calculations, where we adhere as closely as possible to JCT's income classification and income and tax definitions.[35] 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 96.9 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 remaining lifetime and current-year 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, 1.5, 1.3, and 1.1, with reductions for the top 5 and top 1 percent of 0.8 and 0.2 percentage points, respectively. The current-year net tax rate

[35] 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.

reductions for the same groups are 1.4, 1.5, 1.4, 1.3, 1.3, 1.1, and 0.5.[36] Hence, the patterns are generally similar, although the net tax cuts are lower on a remaining lifetime basis than for the current year at both the bottom and top of the resource distribution.

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 either 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.

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 1.6, 1.7, 1.9, 1.6, 0.8, 0.4, and 0.0 percentage points, whereas the reductions in current-year net tax rates for the same respective groups are 2.1, 2.0, 2.2, 1.9, 1.2, 0.6, and 0.3 percentage points. Again, the net tax rate reduction is higher at the bottom and at the top for current-year net tax rates, although, in this case, the reduction is also higher in the middle of the distribution. Hence, among 20-29 year olds, both sets of net tax rate reductions appear progressive in terms of the relative net tax rate reductions for low- and high-resource individuals. Still, the differences between the two sets of net tax-rate reduction measures could well suffice to alter policy decisions were policymakers to focus on what we have argued is the conceptually more appropriate net tax-rate measurement.

[36] 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.

VII. Sensitivity Analysis

Our results rely on many assumptions, and it is useful to consider their influence on our findings. [37]

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 the four lowest resource quintiles and

[37] Some might view the assumptions as heroic since we are starting with a single, cross-section study and a) imputing past covered earnings, b) imputing future earnings, c) allocating households proportionally by state. But we have highly reliable data covering decades of U.S. labor-market experience to backcast and forecast labor earnings and have a massive Census study for imputing representative state residency rates for each SCF household respondent. Any analysis of a nation's fiscal fairness and inequality at a given point in time requires, we argue, projecting lifetime spending. This, in turn, requires these forms of estimates, which, we view as highly realistic.

is unchanged for those in the top quintile and above, for whom mortality assumptions have roughly not changed.[38] This indicates that the value of increased future benefits outweighs the increased future taxes. As for current-year tax rates, there are very minor changes at the bottom end of the resource distribution. They reflect changes in life insurance premia, which TFA calculates in line with prevailing life insurance rates, as well as slight changes in cohort-specific quintile compositions. To summarize, higher mortality among the poor appears to play a minor role in impacting RLS inequality or fiscal progressivity.

B. Lower Future Rates of Return on Savings

The rate of return before all taxes (including corporate taxes) used in our results is based on the historical return to U.S. national wealth, as discussed above. However, many have suggested that future rates of return may be lower, for example because of the demographic transition leading, at least in the developed world, to increases in capital-labor ratios. Also, to the extent that the measured return includes returns to risk and economic rents, we might wish to exclude these components from our analysis. To consider the potential impact on our findings, we repeat our analysis under the assumption that the real, before-tax return to savings is 4 percent, rather than 6.371 percent.

Figure 12 shows net tax rates faced by 40-49 year-olds under this alternative assumption. Compared with the base-case results 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 now accounted for by capital income, which faces a lower average current-year tax

[38] We say roughly here because the unchanged mortality assumption applies to the top quintile based on the AIME calculation, rather than remaining lifetime resources. However, the differences are sufficiently small that they do not show up at the level of precision reported in the figure.

rate than does labor income. The impacts on current-year tax rates at the low end of the resource distribution are small. On a lifetime basis, however, the pattern is different. While the top 1 percent still face a higher average tax rate, there are monotonically larger declines in the average net tax rate as one moves down the remaining resource distribution. This is due to the fact that applying a lower discount rate increases the present value of future old-age transfer payments, thereby reducing the present value of lifetime net taxes. This happens the more so as one moves down the resource distribution because of the increasing magnitude of future benefits relative to future taxes, which also increase in present value. Thus, from the remaining lifetime perspective, assuming a lower rate of return strongly increases the progressivity of the fiscal system.

C. Voluntary Bequests

Our consumption smoothing algorithm assumes that households seek the highest level of consumption possible given their resources and assumed 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. A simple way to do this is to assume 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 (0.5 percent) in their lifetime net tax rates. This results from the fact that greater asset accumulation entails more capital income and estate taxation. The result is more pronounced for 60-69 year-olds (an increase of 1.7 percent in the remaining lifetime tax rate), as the higher estate tax payments loom closer in the future. Here 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 considered and found no important differences 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). As one would expect, smaller (larger) consumption growth or smaller retirement consumption expenditures leads to lower (higher) lifetime tax rates because of changes in saving rates and capital income taxes. However, the patterns across resource groups seen in our baseline simulations are unaffected. This is evident in Appendix figure 5, which shows the lifetime and current-year average tax rates for 40-49 year-olds for the case of a 20 percent lower retirement consumption, which may be compared with the baseline results in figure 3. Part of the reason the desired shape of the ACP makes little difference to measured progressivity is that TFA's enforcement of borrowing constraints takes precedence and largely determines TFA's-generated ACP regardless of preferences.

E. Subjective Discounting

Figure 13 shows the 40-49 year-old average net tax rates by quintile if we place a 50 percent weight on the present value of all annual resource flows and spending that arise in years beyond the households initial constrained period, i.e., in years after the household's living standard first increases if, indeed, that occurs.

As a comparison of figures 13 and 3 makes clear, devaluing by even 50 percent all future resources and spending that can't, at the margin, be accessed in the present makes very little no difference to the measured progressivity of the U.S. fiscal system. These figures pertain to the 40-49 year-old cohort. But the level and pattern of remaining lifetime net tax rates are little changed for other age groups. This is to be expected for those in the top quintile, most of whom aren't constrained. For lower quintiles, it's somewhat surprising. But one needs bear in mind that both the denominator – remaining lifetime resources – and the numerator – remaining lifetime net taxes – are being reduced in this exercise, since both include flows beyond the period the household is initially constrained.

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 tax and benefit programs. TFA's consumption smoothing incorporates borrowing constraints, economies in shared living, the household's current and future demographics, and the relative costs of children. The 2016 SCF data, which we benchmark to 2019 aggregates, provide TFA with the resource information needed to determine the household's present expected (over survival paths) remaining lifetime spending. We statistically match the SCF and the Census' American Community Survey to allocate each SCF observation in appropriate proportion to each state.

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, either across or within cohorts. Across all cohorts, the top 1 percent (ordered by lifetime resources) owns 34.1 percent of all net worth, accounts for 19.2 percent of all income, receives 18.0 percent of all remaining lifetime resources, but ends up with only 15.7 percent of all remaining 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 presented here, which compares remaining lifetime spending and fiscal redistribution within cohorts. For example, the top 1 percent (by resources) of 40-49 year-olds own 29.1 percent of their cohort's total net worth, but account for (including on bequests) only 11.8 percent of the cohort's total spending. These figures aren't that different from those for all cohorts combined. But among 20-29 year-olds, the resource-richest 1 percent own 68.2 percent of net worth, but get to do only 9.7 percent of the cohort's spending.

Assessing inequality and fiscal progressivity based on current income and net, let alone gross 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 under current policy, 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 lines, however, will remain. Inequality is about spending, future as well as current. And remaining lifetime spending can't be proxied by poorly related current-income or wealth measures that ignore current and future net tax burdens. As for fiscal progressivity. it shouldn't be studied program by program or on a current-year basis. Finally, neither inequality nor fiscal progressivity can be accurately assessed by combining very different age cohorts in the same analysis.

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Table 1
Comparing Lifetime-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	92.1%	7.3%	0.6%	0.0%	0.0%	0.0%	0.0%
Second	9.2%	75.0%	15.2%	0.5%	0.0%	0.0%	0.0%
Third	0.6%	17.0%	68.4%	13.9%	0.0%	0.0%	0.0%
Fourth	0.6%	0.9%	14.3%	76.3%	7.9%	0.0%	0.0%
Highest	0.0%	0.0%	0.0%	4.9%	95.1%	45.3%	21.5%
Top 5%	0.0%	0.0%	0.0%	0.0%	100.0%	96.4%	46.7%
Top 1%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	97.3%

* Highest percentage in each row is green.

Table 2
Distributional Effects of the Tax Cuts and Jobs Act

	TFA Estimates			JCT (2017a) Estimates		
Income Category	**Avg. Tax Rate Under Present Law**	**Avg. Tax Rate Under TJCA**	**Difference**	**Avg. Tax Rate Under Present Law**	**Avg. Tax Rate Under TJCA**	**Difference**
Less than 10,000	14.84	14.81%	-0.02%	9.10	8.60%	-0.50%
10,000 to 20,000	1.69	1.34%	-0.35%	-0.70	-1.20%	-0.50%
20,000 to 30,000	2.13	1.35%	-0.78%	3.90	3.40%	-0.50%
30,000 to 40,000	6.67	5.32%	-1.35%	7.90	7.00%	-0.90%
40,000 to 50,000	9.77	8.53%	-1.24%	10.90	9.90%	-1.00%
50,000 to 75,000	12.48	11.10%	-1.39%	14.80	13.50%	-1.30%
75,000 to 100,000	15.03	13.55%	-1.49%	17.00	15.60%	-1.40%
100,000 to 200,000	19.29	17.67%	-1.62%	20.90	19.40%	-1.50%
200,000 to 500,000	25.33	23.51%	-1.82%	26.40	23.90%	-2.50%
500,000 to 1,000,000	32.63	30.89%	-1.73%	30.90	27.80%	-3.10%
1,000,000 and over	37.79	37.29%	-0.49%	32.50	30.20%	-2.30%

JCT estimates are for calendar year 2019.

Figure 1

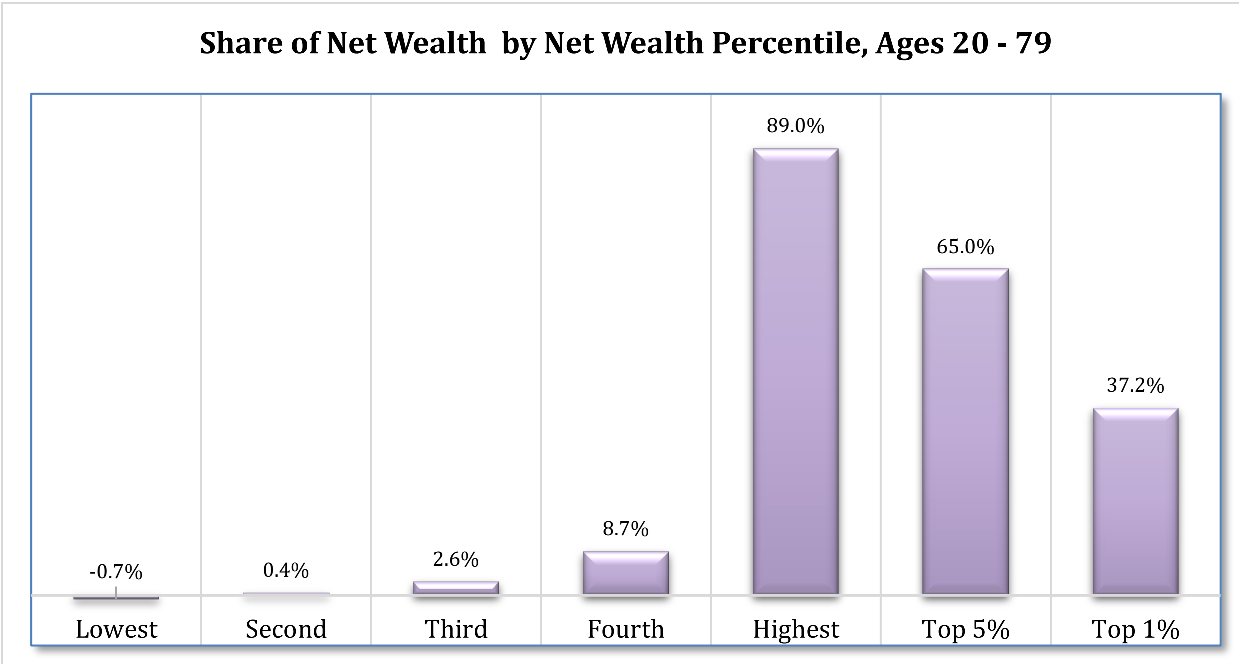


Figure 2

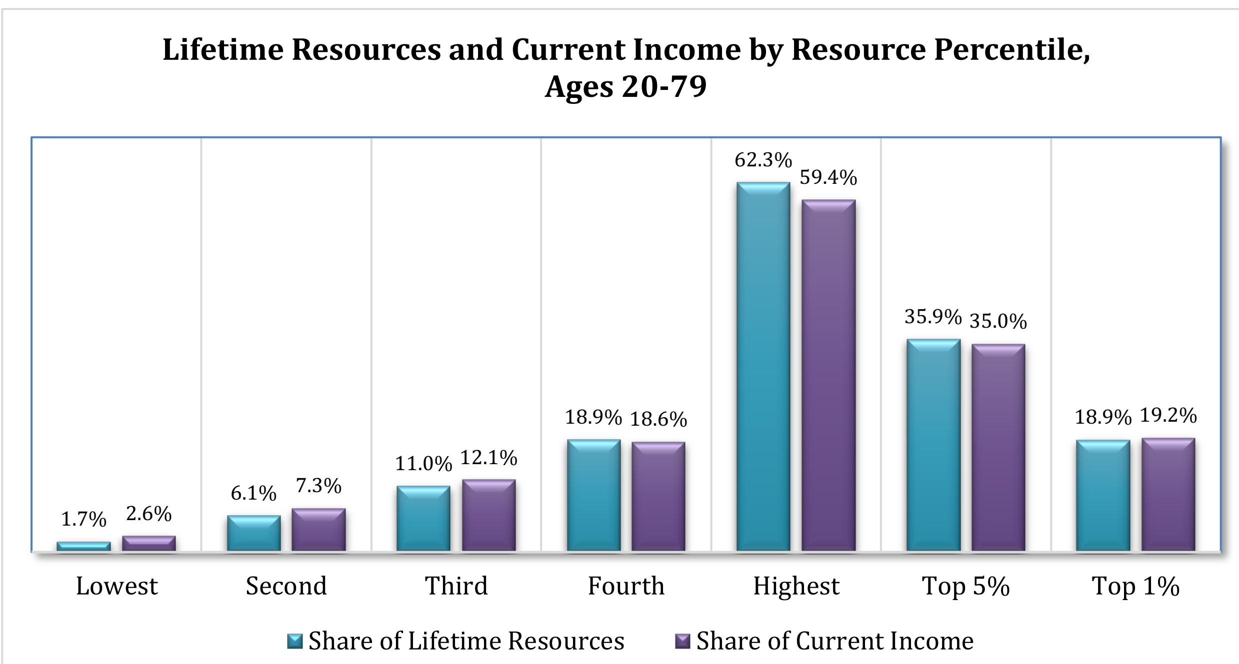
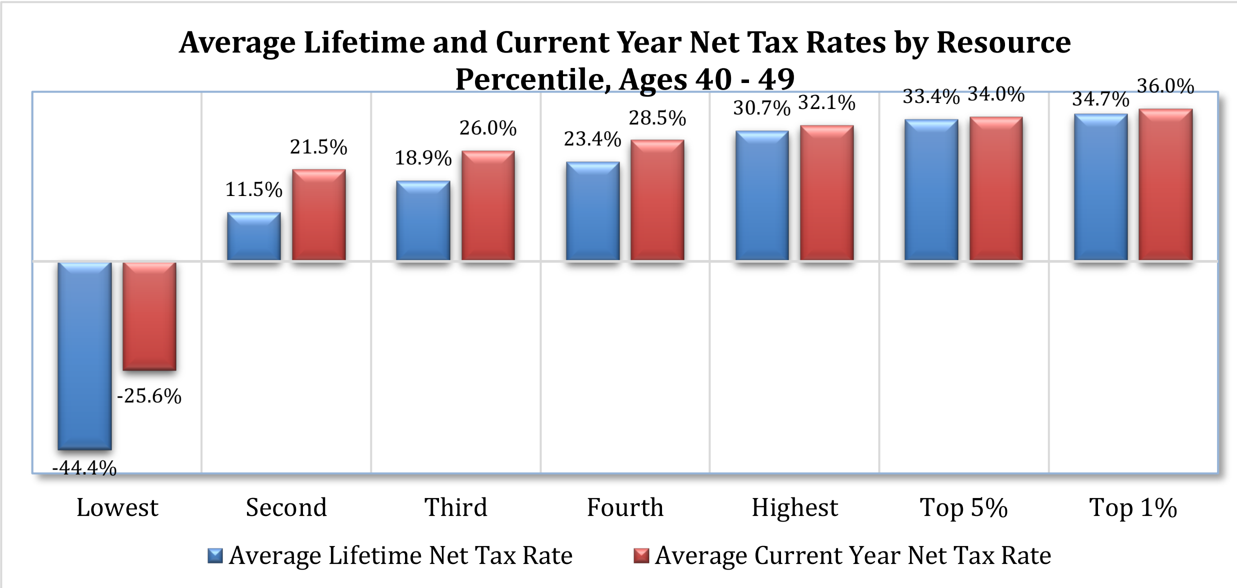
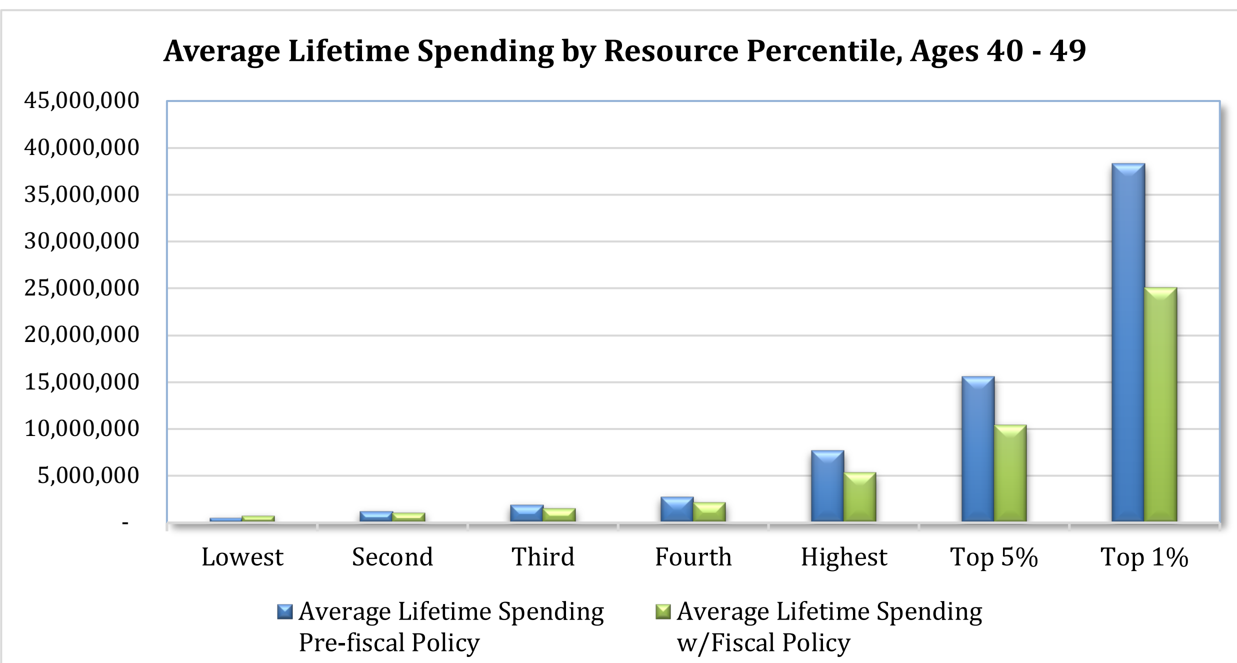


Figure 3



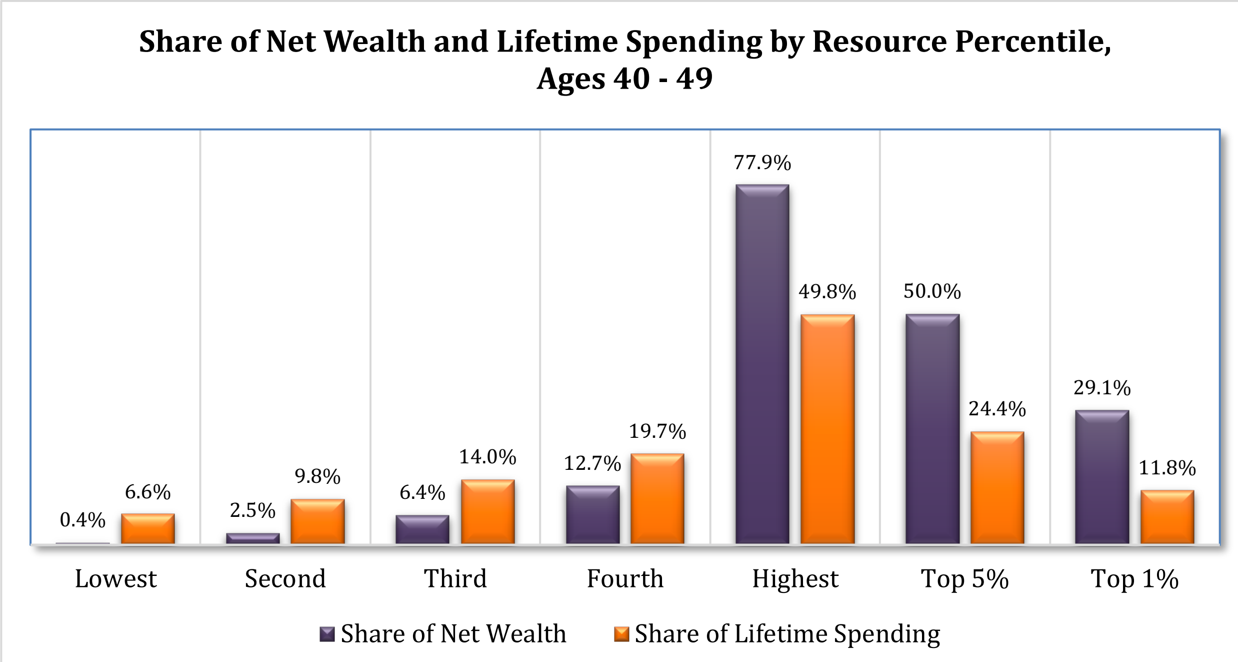
This chart presents remaining lifetime net tax rates – the ratio of the sum of all remaining lifetime net tax payments of all (population-weighted) households in the specified percentile resource range divided by the sum of the resources of all (population-weighted) households in that range. "Resources" 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 current-year 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

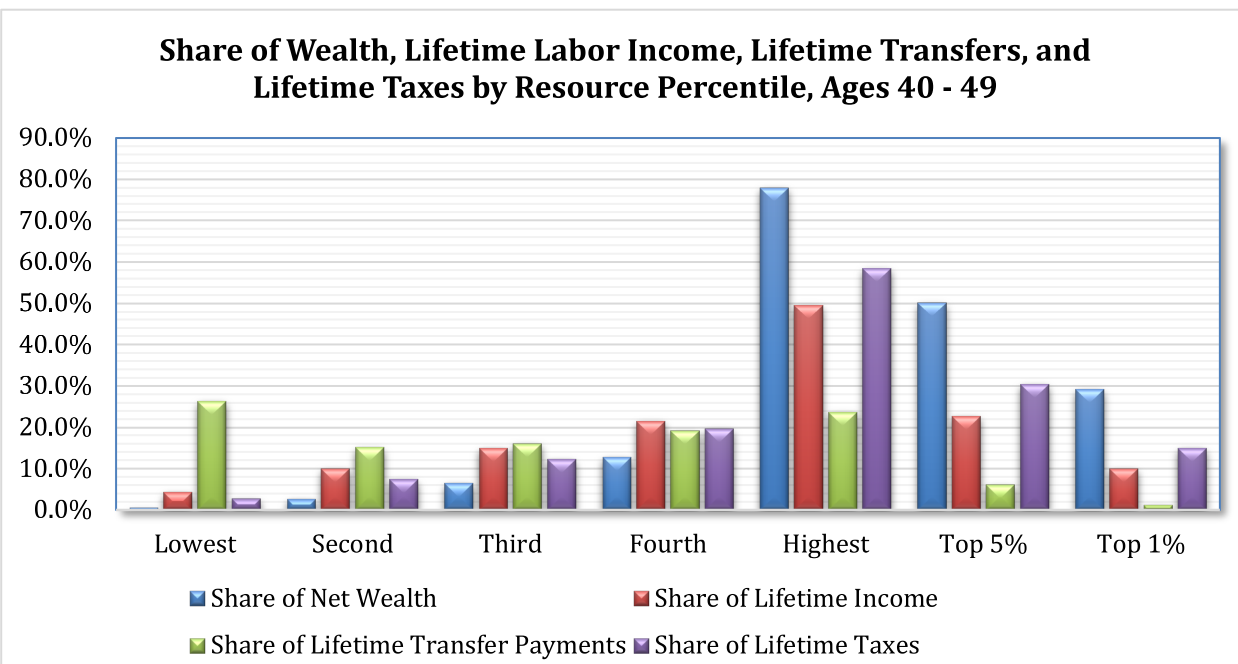
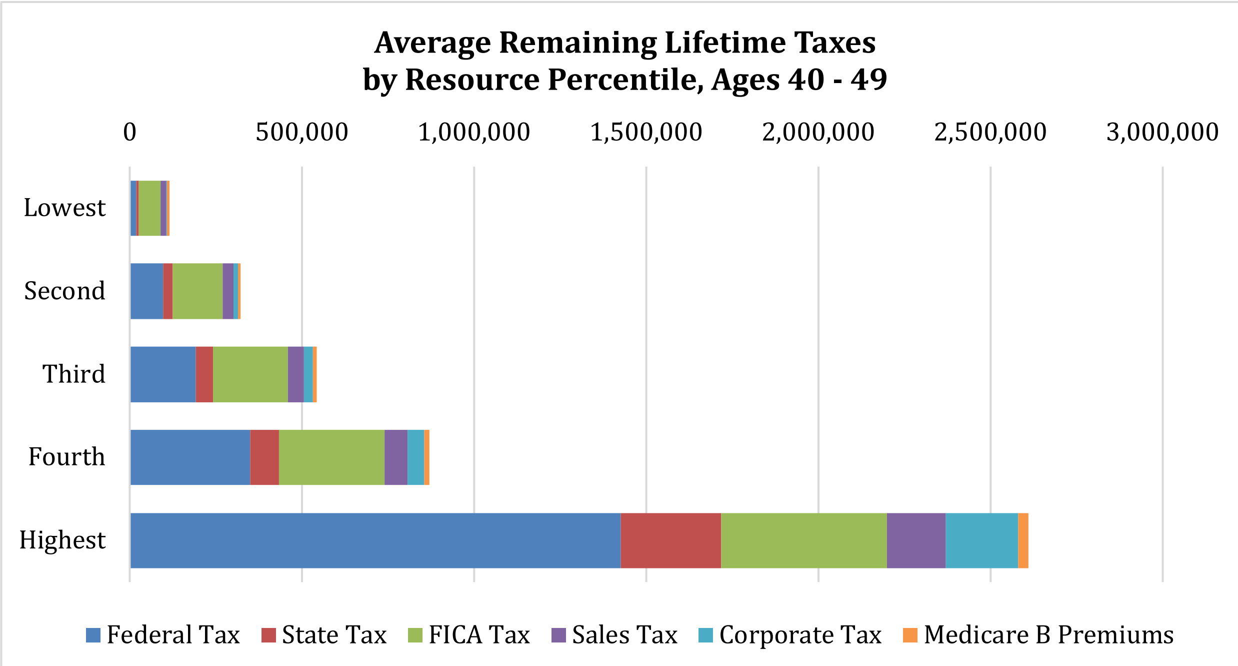


Figure 7


Average Remaining Lifetime Taxes
by Resource Percentile, Ages 40 - 49
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
3,000,000
Lowest
Second
Third
Fourth
Highest
Federal Tax
State Tax
FICA Tax
Sales Tax
Corporate Tax
Medicare B Premiums

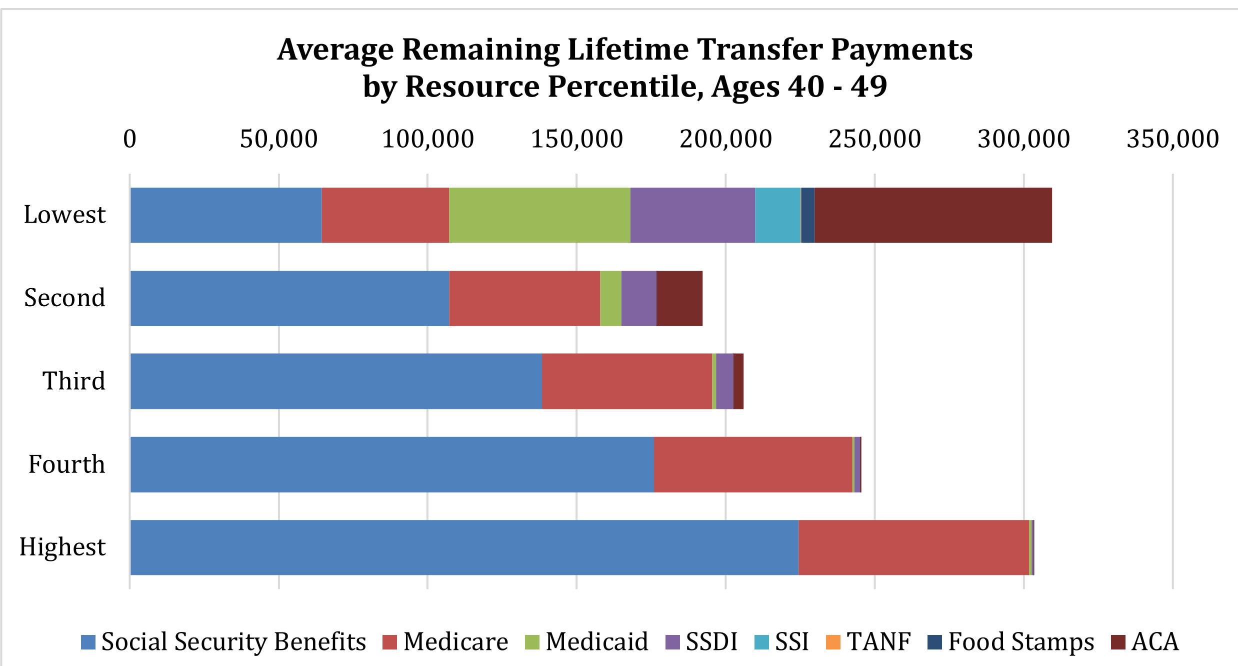

Average Remaining Lifetime Transfer Payments
by Resource Percentile, Ages 40 - 49
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
Lowest
Second
Third
Fourth
Highest
Social Security Benefits
Medicare
Medicaid
SSDI
SSI
TANF
Food Stamps
ACA

Figure 8

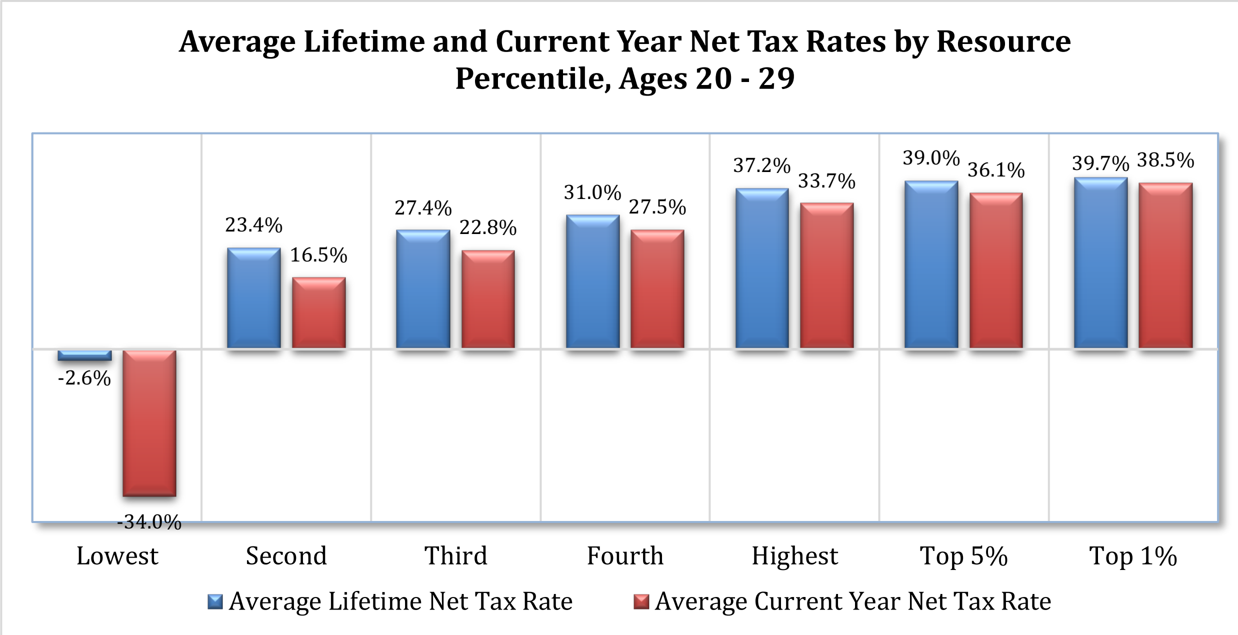


Figure 9

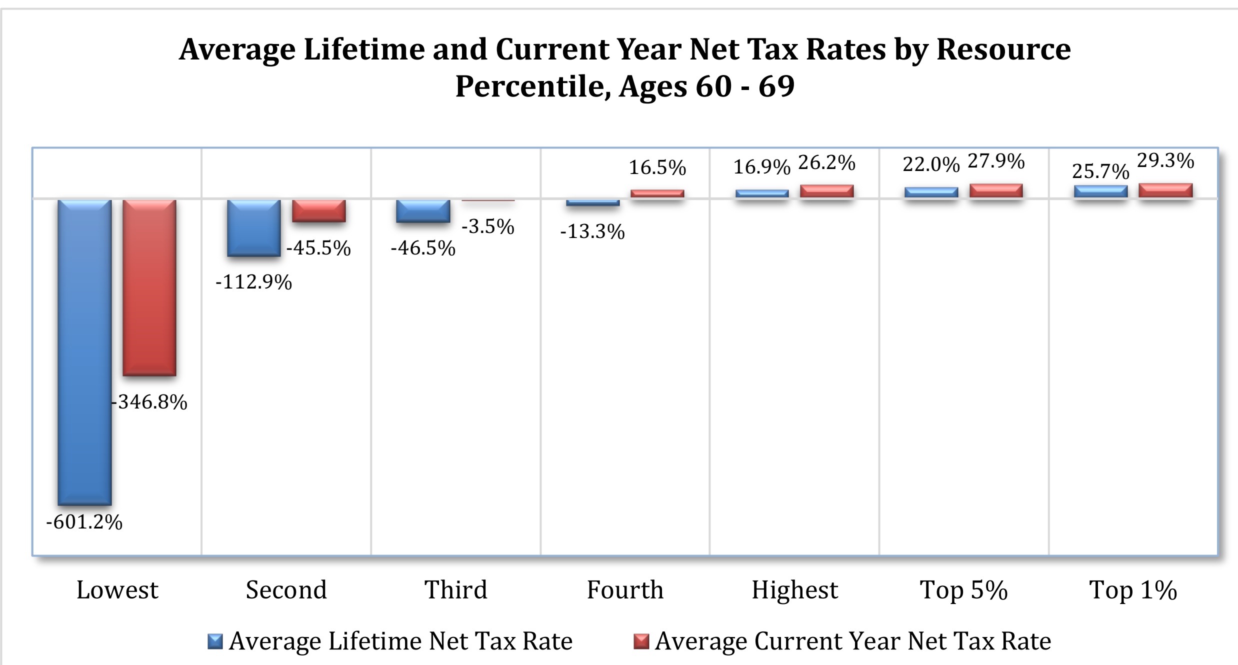


Figure 10

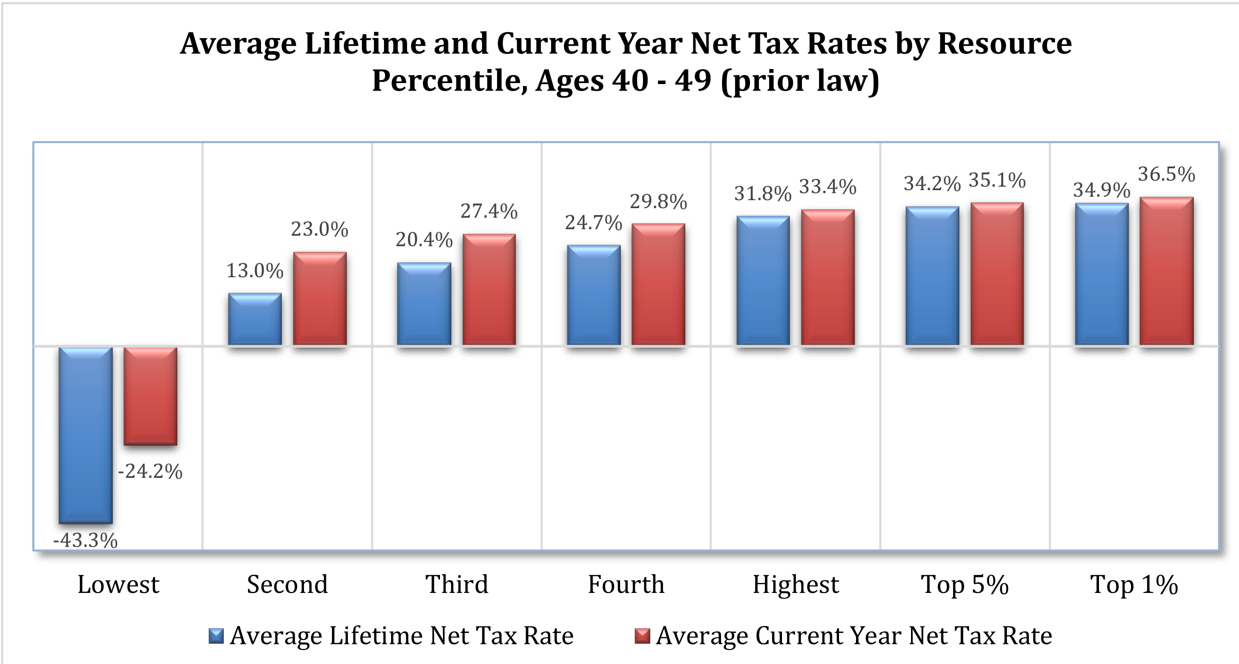


Figure 11

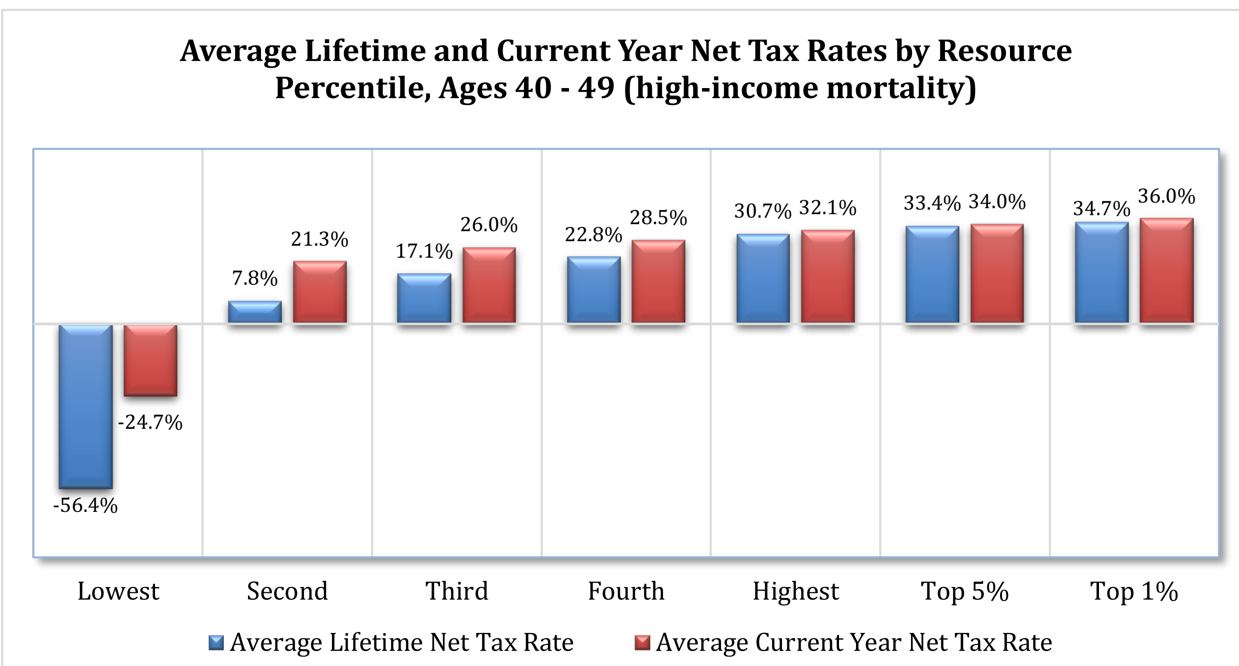


Figure 12

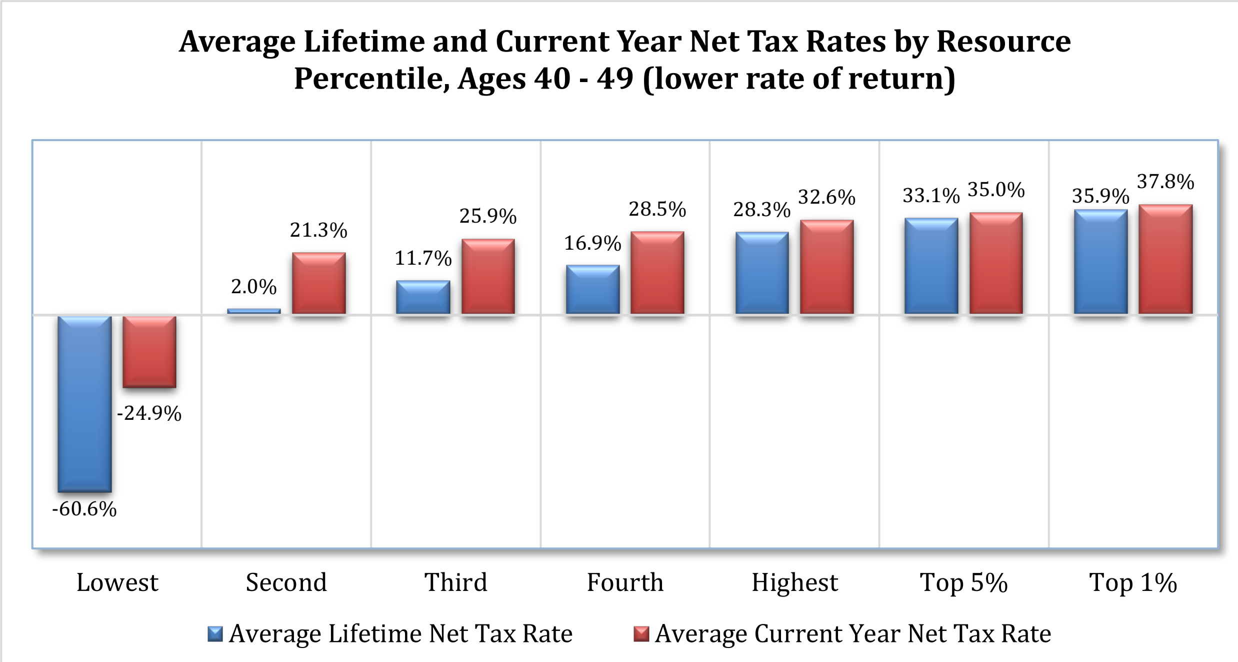
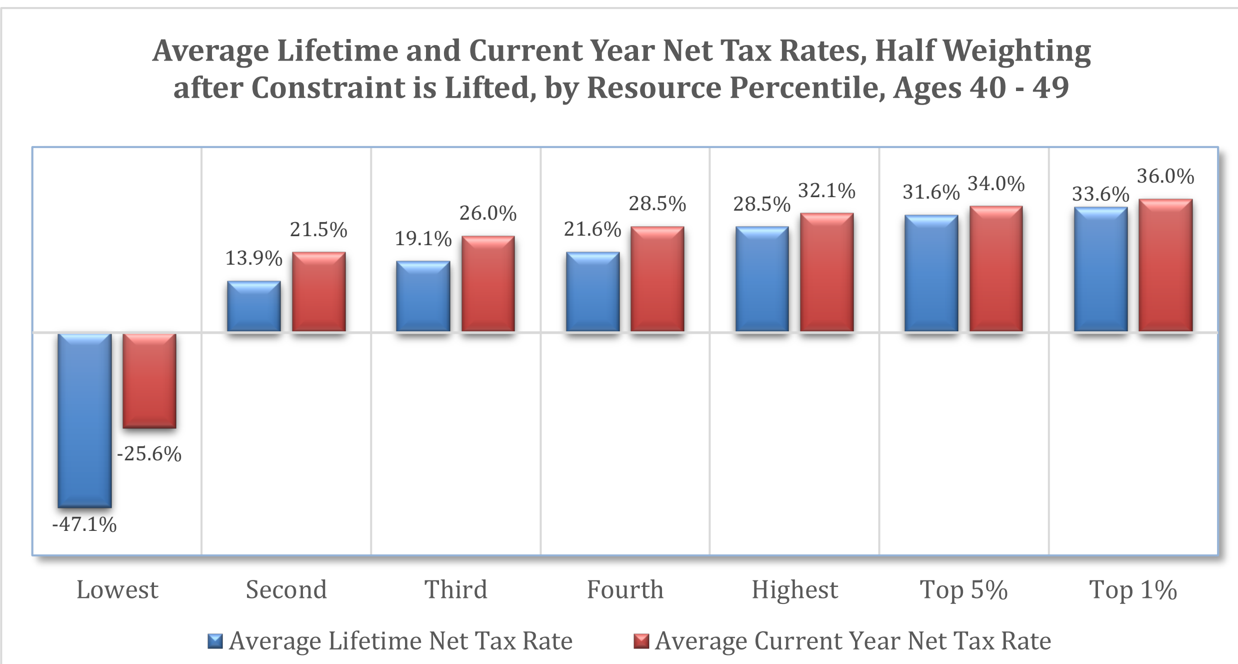
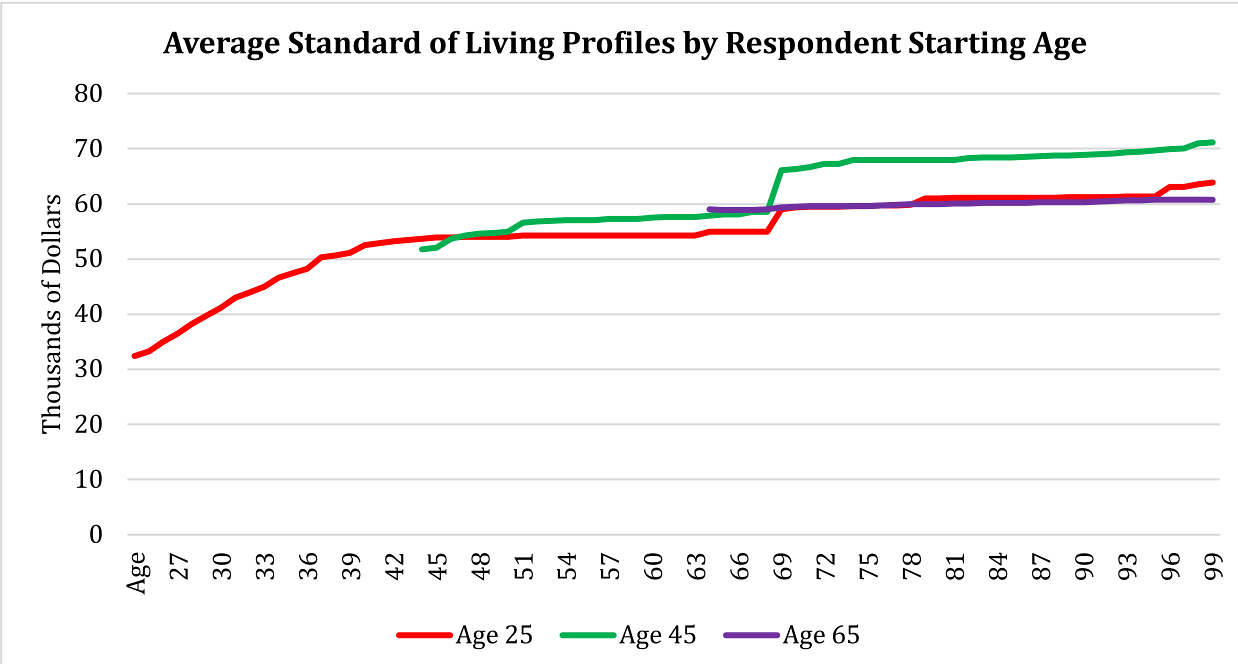


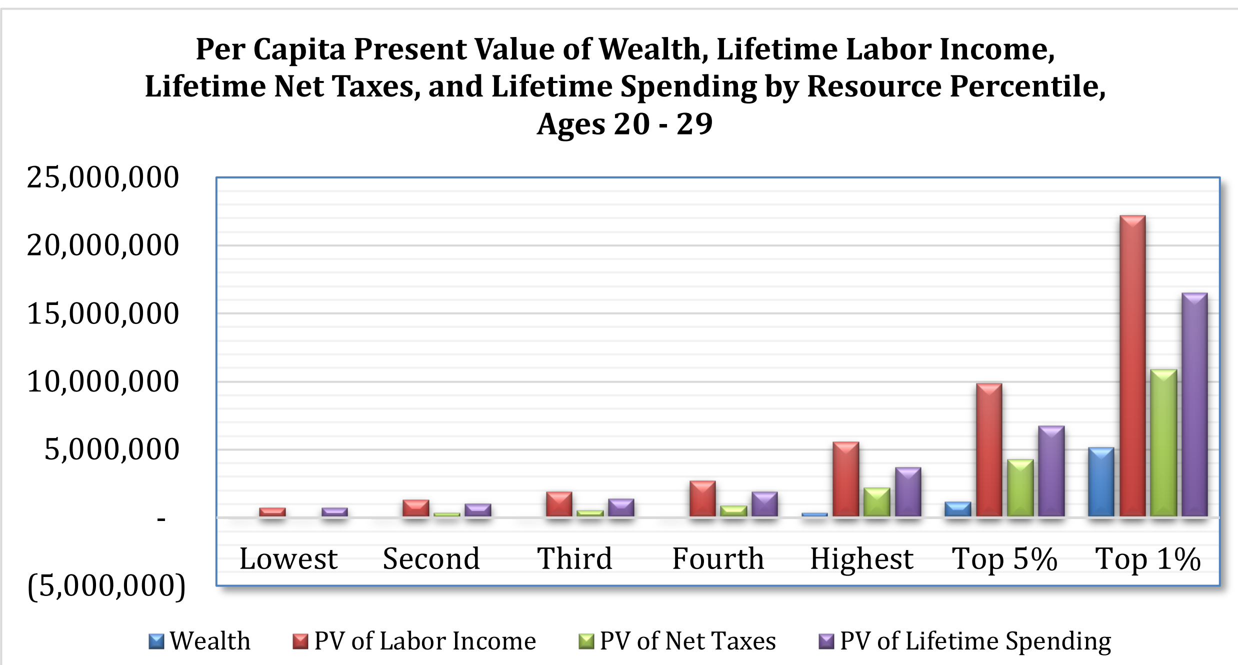
Figure 13



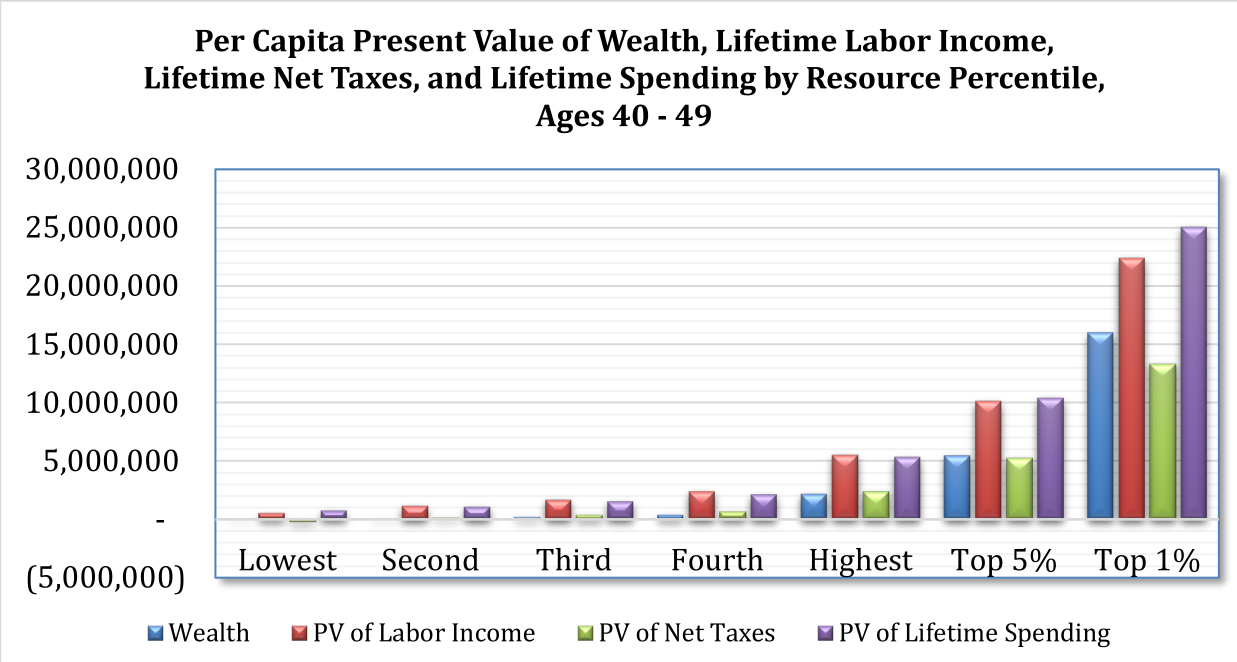
Appendix Figure 1



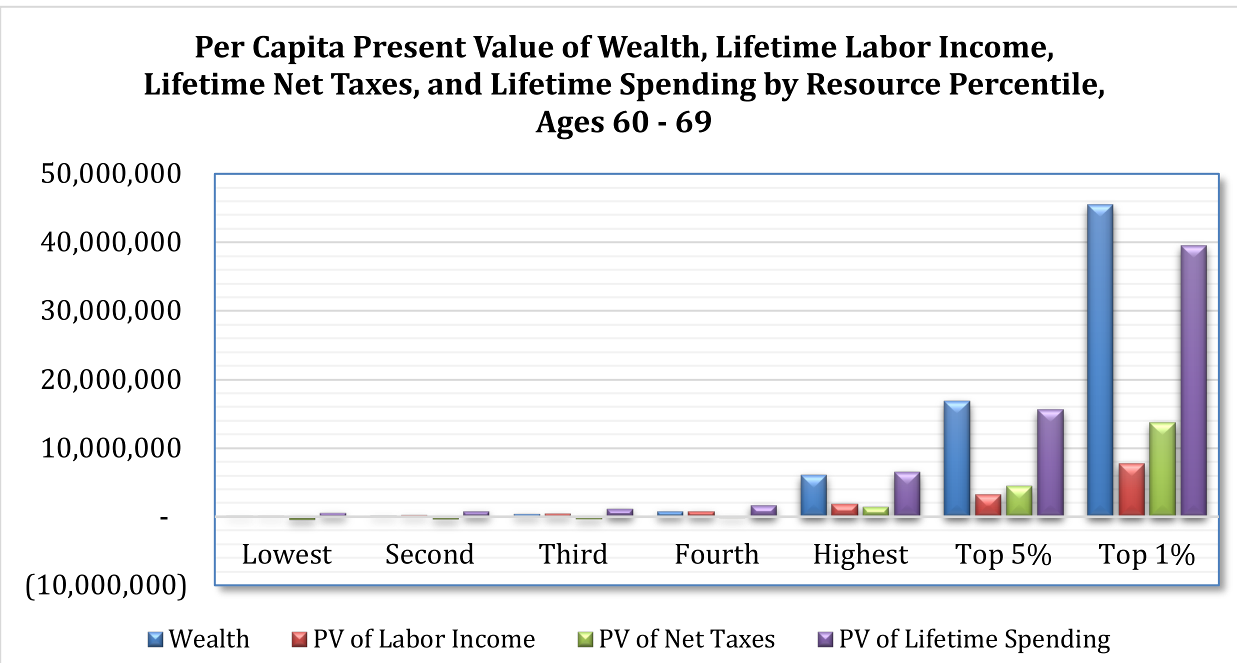
Appendix Figure 2



Appendix Figure 3



Appendix Figure 4



Appendix Figure 5