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Is Uncle Sam Inducing the Elderly to Retire?

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Executive Summary

Many, if not most, baby boomers appear at risk of suffering a major decline in their living standard in retirement. With federal and state government finances far too encumbered to significantly raise Social Security, Medicare, and Medicaid benefits, boomers must look to their own devices to rescue their retirements, namely, working harder and longer. However, the incentive of boomers to earn more is significantly limited by a plethora of explicit federal and state taxes and implicit taxes arising from the loss of federal and state benefits as one earns more. Of particular concern is Medicaid and Social Security's complex earnings test and clawback of disability benefits. This study measures the work disincentives confronting those age 50 to 79 from the entire array of explicit and implicit fiscal work disincentives. Specifically, the paper runs older respondents in the Federal Reserve's 2013 Survey of Consumer Finances through The Fiscal Analyzer—a software tool designed, in part, to calculate remaining lifetime marginal net tax rates.

We find that working longer, say an extra five years, can raise older workers' sustainable living standards. But the impact is far smaller than suggested in the literature, in large part because of high net taxation of labor earnings. We also find that many baby boomers now face or will face high and, in very many cases, extremely high work disincentives arising from the hodgepodge design of our fiscal system. A third finding is that the marginal net tax rate associated with a significant increase in earnings, say $20,000 per year, arising from taking a full-time or part-time job (which could be a second job) can, for many elderly, be dramatically higher than that associated with earning a relatively small,

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say $1,000 per year, extra amount of money. This is due to the various income thresholds in our fiscal system. We also examine the elimination of all transfer program asset and income testing. This dramatically lowers marginal net tax rates facing the poor. Another key finding is the enormous dispersion in effective marginal remaining lifetime net tax rates facing seemingly identical households, that is, households with the same age and resource level. Finally, we find that traditional, current-year (i.e., static) marginal tax calculations relating this year's extra taxes to this year's extra income are woefully off target when it comes to properly measuring the elderly's disincentives to work.

Our findings suggest that Uncle Sam is, indeed, inducing the elderly to retire.

I. Introduction

Ten thousand baby boomers are retiring each day. Many, if not most, are either poorly or very poorly prepared to finance retirements that may last longer than they worked. One marker of this problem is the financial reliance of retirees on Social Security. Social Security was designed to provide a basic floor to a retiree's living standard. But it provides at least 90% of financial support to over one-third of elderly households, and almost two-thirds of older households receive at least half of their income from Social Security.[1]

This heavy reliance on Social Security is not due to particularly generous levels of Social Security benefits. Instead, it reflects the widespread failure of retirees to save for their retirements. One recent survey reports that 40% of baby boomers have no retirement savings whatsoever.[2] Data from the 2013 Survey of Consumer Finances show that median assets, including retirement accounts, of households age 55 to 64 equal just $537,225. Thirty-five percent of these households hold less than half of this amount, and 21% hold less than one-fifth of this amount. These and other dismal statistics hold dire implications for the economic well-being of baby boomers through time. According to Munnell, Orlova, and Webb (2013), over half of today's workers, including boomers who are now retiring, will be unable to maintain their living standards in retirement.

In fact, the baby boomers' retirements could well prove financially more stressful than those of current retirees. This is a particularly dire possibility as the financial condition of today's fully retired generations is, itself, quite dire. In 2015, over one-fifth of married or partnered re-

tirees and almost half of single retirees received 90% or more of their income from Social Security.[3] In that year, half of married or partnered retirees and three-quarters of single retirees received half or more of their income from Social Security.[4] Even those who initially have retirement savings are hardly set. Poterba, Venti, and Wise (2012) report that over half of the elderly outlive their financial assets.

The absolute level of income is another means to assess retirement finances. Roughly half of those now over 65 have less than $25,000 in annual income.[5] This is remarkably low given that the current poverty threshold for a single person is $11,800.[6] The Supplemental Poverty Measure (SPM) adjusts the official poverty measure for taxes, the value of food stamps and other in-kind benefits, the costs of out-of-pocket medical spending, geographic differences in housing expenses, and other factors. Based on this measure, one in seven people age 65 and older (15%) are poor compared to one in ten under the official measure. The SPM poverty rate among the elderly is far higher for minorities—28% for Hispanics and 22% for African Americans.

Why might baby boomers have a harder time financing their retirements than today's retirees? First, many baby boomers, particularly those with higher incomes, can expect to live longer. Indeed, one study predicts a 10% increase in their length of retirement.[7] Second, boomers are likely, on a risk-adjusted basis, to earn lower real returns on their savings given the prevailing real interest rates. Today's 30-year TIPS (Treasury Inflation Protected Securities) yield is less than 100 basis points. In 1998, when 30-year TIPS were first introduced, they yielded above 300 basis points.[8]

Third, thanks to the legislated increase in the full retirement age, many will experience lower Social Security replacement rates. Fourth, the failure to index the thresholds at which the first 50% and then 85% of Social Security benefits are subject to federal income taxation means that a growing number of boomers will experience an ever higher rate of Social Security benefit taxation. Indeed, these third and fourth factors imply significantly lower long-run Social Security replacement rates over the next 15 years. Ellis, Munnell, and Eschtruth (2014) foresee an almost 15% decline in the replacement rate between now and 2030.[9]

Fifth, there are now extra Medicare premiums facing those with higher incomes. Moreover, the thresholds at which these premiums take effect are also not inflation indexed. Sixth, the Affordable Care Act included two new high-income Medicare taxes. One levies an additional .9% tax on wage earnings above specified thresholds. The other applies a 3.8%

rate to asset income above the same thresholds. Again, these thresholds are, by law, explicitly and intentionally not indexed to inflation.

Seventh, out-of-pocket health care costs as well as the cost of supplemental health insurance (major medical) policies will likely continue to rise. These out-of-pocket costs include increases in out-of-pocket Medicare Part B costs due to three factors—higher Medicare premiums, higher Medicare Part B copayments, and health care costs of outpatient care not covered by Medicare Part B.[10] Indeed, rising out-of-pocket Medicare costs are projected to absorb roughly 2% more of baby boomers' Social Security benefit checks by 2030.[11] Eighth, out-of-pocket copays and deductibles for Medicare Part D, which covers prescription drug expenses, are also projected to rise in real terms.[12]

Ninth, current retirees can rely to a far greater extent on defined-benefit pensions than is the case for baby boomers. According to Form 5500 fillings, the US Department of Labor indicates that since 1975, the number of participants in defined-benefit pensions has been constant at around 40 million. This is true despite a near doubling of total US employment.[13] Meanwhile, participation in defined-contribution plans has increased from 11.5 million in 1975 to 92 million in 2013.[14] Instead, apart from Social Security, baby boomers will be relying primarily on their 401(k) and other defined-contribution retirement accounts. But participation in such retirement accounts has been very disappointing. Only 67% of boomers have retirement accounts of any kind and, as stated, many of those with retirement accounts have very low balances.[15]

Raising Social Security's benefit levels significantly could alleviate the boomers' financial plight, as well as that of many current poor and low-income elderly. But Social Security is 32.2% underfunded, that is, it is in extremely difficult financial straits.[16] What about the rest of the government's fiscal enterprise? Does it have the financial wherewithal to subsidize far higher Social Security benefits? The answer is clearly no, according to estimates by Auerbach and Gale (2016), based on recent Congressional Budget Office (2014) projections.[17]

If the boomers are short on regular assets, short on retirement-account assets, short on defined-benefit pensions, short on Social Security benefits, long on explicit and implicit taxes, and the government can't help, boomers have but one option to maintain their living standards—earn more by working more at their current jobs, delaying their retirements, or returning to work if they have already retired.

This is far easier said than done. Hour constraints at their current jobs, age discrimination, increasing preference for leisure, and health

limitations are four major factors that limit older workers' abilities and desire to raise their earnings through time. Older workers also experience age-related declines in productivity (Gokhale and Kotlikoff 1992) and, where applicable, negative private-pension accrual associated with ongoing work (Kotlikoff and Wise 1989).

Another major roadblock to higher earnings of older workers is government-imposed work disincentives operating through the tax and transfer system, which can limit the willingness of the elderly to work harder and longer. These work disincentives entail both explicit marginal taxation, such as FICA payroll taxes, implicit taxation associated with the loss of government benefits, such as food stamps, and increased premiums for such benefits as a result of increased earnings—for example, the income-based premiums for Medicare Part B.

This paper studies labor-supply work disincentives facing the elderly. Specifically, it measures the remaining lifetime marginal net tax rates of household heads and spouses/partners ages 50 through 79 included in the 2013 Federal Reserve Survey of Consumer Finances (SCF). The analysis is comprehensive, incorporating all major federal and state explicit and implicit taxes that were in place in 2013.[18] Of particular concern is the potentially huge perceived work disincentive facing those in their early sixties associated with Social Security's complex earnings test. We say "perceived" because Social Security's Adjustment of the Reduction Factor (ARF), which occurs at full retirement age, largely undoes the earnings test's work disincentive. But perception of the ARF seems so limited that we assume here that it is ignored completely.

A. Summarizing Our Methodology

Our methodology, at its core, is very simple. We run all SCF households through The Fiscal Analyzer (TFA)—a detailed life-cycle consumption-smoothing program, developed in Auerbach, Kotlikoff, and Koehler (2016), which incorporates both borrowing constraints and life span uncertainty. In the course of doing its consumption smoothing, TFA determines how much each household can spend in present expected value, where the term *expected* references averaging over different longevity outcomes and spending encompasses all expenditures, including terminal bequests net of estate taxes. Suppose, for example, that earning an extra $1,000 raises a household's expected present value of lifetime spending by $700. In this case, the household faces a 30% marginal net tax rate.

In forming these remaining lifetime net tax rates, TFA incorporates all major federal and state tax transfer programs. There are roughly 30 such programs, including many one would not necessarily associate with the taxation of labor supply, such as the corporate income tax, the estate tax, food stamps, and, as mentioned, income-related Medicare Part B premiums. Measuring marginal net tax rates facing workers from all major fiscal programs is a major departure from common practice. Other studies of marginal labor taxation consider, at most, a subset of the universe of fiscal programs such as the combination of the federal income and FICA payroll taxes. But other fiscal policies can have even larger impacts on work incentives. An example here is the potential dramatic loss in all Medicaid benefits by low-income workers who earn too much extra money.[19] In the extreme, "too much" can be as little as one dollar.

Constructing remaining *lifetime* rather than *current-year* marginal net tax rates is an innovation as well, but it is also theoretically appropriate. Households do not necessarily spend discrete increments to their current earnings in the year they earn them. Indeed, doing so would be inconsistent with the objective of consumption smoothing, which includes financing spending in retirement. Instead, they spread/smooth extra resources, potentially over all future years. Precisely how much more a household spends immediately versus in the future depends not just on its preferences, but also on borrowing constraints it may face over time. It also depends on the extent to which the household can transform current saving into future spending. This transformation process depends, of course, on asset-income taxation, which one would not typically associate with the taxation of labor supply. Yet determining the present expected value of extra spending arising from extra earnings, taking into account the household's consumption-smoothing preferences[20] and capacities to transform current saving into future spending, produces precisely the theoretically appropriate weighted average of year-specific marginal net taxes on labor supply.[21]

The third nonstandard feature of our analysis is the systematic incorporation of survival outcomes. Households don't live for sure for specific numbers of future years. Instead, their members die at unpredictable dates. Thus, a 40-year-old single woman whose maximum age of life is 100 has 60 different survival paths to consider. If the 40-year-old is married to another 40-year-old, the couple has 3,600 survival paths to consider. TFA determines spending and net taxation along all such paths, and its measure of the expected present value of future spend-

ing arising from additional earnings weighs the spending along each survival path (e.g., the husband dies in five years and the wife in 22 years) by the probability of that particular survival path. To ensure that all resources are fully spent no matter the particular survival path, the present value of terminal bequests net of estate taxes arising at the end of each path is treated as spending. Moreover, any estate taxes associated with the gross bequests are properly discounted and included as part of the household's total expected present value of remaining lifetime taxes.

B. Summarizing Our Findings

Our first set of findings concern the degree to which working an additional five years would raise the elderly's sustainable living standard. We find that if all elderly now working were to continue to work for five more years, they would, on average, raise their sustainable living standards (annual discretionary spending per household member with an adjustment for economies in shared living) by roughly 5 to 8% depending on their age and position in the resource distribution. These figures can be considerably lower for older elderly and considerably higher—as high as 13%—for younger elderly.

Turning to work disincentives, we find high median effective marginal net remaining lifetime net tax rates for all elderly from 50 to 79, with the exception of elderly of lesser means age 70 and above. For cohorts age 50–54, 55–59, 60–64, and 65–69, median net tax rates follow a common pattern. They are in the 30 to 40% range for the lowest resource quintile rising to near or above 40% for the second and third quintile, and close to or above 50% for the next two quintiles. Among the richest (measured by resources—the sum of net worth plus human wealth) 5% and 1%, median marginal net tax rates can exceed 60%.

We also examine the elimination of all transfer program asset and income testing. This dramatically lowers marginal net tax rates facing the poor and lower-resource households. The impact on higher-resource households is, as one would expect, considerably smaller.

We also find an enormous dispersion in effective marginal net tax rates even holding fixed the level of household resources. For example, nearly one-fifth of elderly in the lowest quintile face marginal net tax rates above 60%. Almost a quarter face marginal net tax rates below 20%. In the top resource quintile, a full third of elderly are in 60% or higher marginal net tax brackets, whereas 14% are in brackets below 40%.

The above-cited marginal net tax rate results are based on separately increasing the household head's and/or spouse/partner's earnings by $1,000 for just one year. But marginal net tax rates can be quite different, indeed, generally higher in the context of earning more for longer periods of time. This is due to Medicare income limits, Social Security earnings test limits, and Social Security income taxation thresholds, all of which come into play if extra earnings are sufficiently high. For example, increasing each elderly respondent's earnings by $10,000 for 10 years produces particularly high effective marginal net tax rates.

Consider, for example, the impact of this particular experiment on those age 62 through 65, 80% of whom are collecting Social Security benefits. Among the bottom-resource quintile in this sample, nearly two in five face marginal net tax rates above 80%. Over half face marginal net tax rates above 50%. Among this sample's top-resource quintile, over 80% face marginal net tax rates above 50%, and over half face rates above 60%.

Many of these households face the earnings test, which reduces benefits as an individual's labor market earnings increase. In our base specification, we assume that households perceive that the earnings test is a pure tax on benefits, that is, that they ignore the increase in future benefits that result. This seems reasonable, given the opacity and complexity of the Adjustment of the Reduction Factor formula. If individuals do understand the future benefits that result, their marginal tax rates would generally be lower, but still high. For example, Social Security recipients between ages 62 and 65 (i.e., those who potentially face the earnings test) in the middle quintile of the resource distribution would face a lifetime marginal tax rate of 47.7% rather than 55.1%. However, it is also possible that understanding that future Social Security benefits will increase *raises* lifetime marginal tax rates because this will induce a loss of other, means-tested benefits, notably Medicaid.

Our paper proceeds in section II with a brief literature review. Section III presents our methodology. Section IV describes the fiscal institutions included in our study including Social Security's earning test. Section V examines how much delaying retirement could mean financially to the elderly. Section VI presents our remaining lifetime marginal net tax rate results, and section VII concludes.

II. Literature Review

There are three types of prior studies that bear on our analysis. One type considers the general nature of labor supply among the elderly.

The second considers the impact of policy changes on labor supply, and the third attempts direct measurement of marginal tax rates.

Haider and Loughran (2010) use the Current Population Survey and the Health and Retirement Study to provide a broad survey of the employment of the elderly, which they define as those over age 64. The authors show that more educated, wealthier, and healthier elderly people are the most likely to work. But even among those who do work past age 64, employment is marked by voluntary or involuntary limitations on hours worked and relatively low wages attributable to the relatively heavy concentration of elderly employment in services. The authors also find that a disproportionate proportion of the working elderly are self-employed. This arguably constitutes evidence for age discrimination.

Forman and Chen (2008) document the general long-term decline in labor force participation of older men. This trend has reversed in recent years. The labor force participation rate of those over age 55 is now 35%, up from 30% a quarter century ago. Moreover, the BLS forecasts a 40% elderly participation rate by the early 2020s. Unfortunately, this projected rise appears too little, too late, to fix the baby boomers' retirement financing problem.

While our paper is perhaps the first to integrate the effects of the broad range of fiscal programs on the incentives for work by the elderly, there have been significant contributions estimating the impact of public-pension provisions on retirement incentives and retirement, including Kotlikoff and Wise (1989). Arguably, the most important is Gruber and Wise (1999), who compile analyses of the implicit tax rates on individuals over age 55 imposed by the various public-pension provisions in several leading economies (Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, the United Kingdom, and the United States), including early retirement provisions and delayed retirement credits. They find a wide variation in incentives, with implicit tax rates at the early retirement age ranging from –1% (in the United States) to 141% (in the Netherlands), and also find that there is a strong negative relationship between the "tax force" to retire (the sum of implicit tax rates between the early retirement age and age 69) and the labor force participation rate of males ages 55–65. While these estimates of incentives are important, they do not incorporate the effects of other significant fiscal programs, which can have a substantial additional impact on work incentives.

A number of other studies have examined how specific policies affect the labor supply of the elderly. Haider and Loughran (2008) and Song

and Manchester (2006) reported that, starting in 2000, the elimination of the earnings test for those who were at or above full retirement age had little influence on the elderly's labor supply.

Using HRS data, Johnson, Davidoff, and Perese (2003) showed that for an increase in health insurance premiums of $1,000, men (women) ages 51 to 61 are less likely to retire early by 0.17 (0.24) percentage points because of lack of retiree benefits. Thus, an expanded Medicare program covering individuals above age 61 would increase the retirement rate, although the impact is small.

Coile and Gruber (2004) analyzed the impact of two policies on the retirement rate. Raising the ERA (early retirement age, 62 years old) and NRA (normal retirement age, then 65 years old) by three years would, by their estimates, lead to a decrease in the average retirement rate of 1 to 3 percentage points (varying because of different assumptions in the model) for both men and women. Moving to a more generous policy, say, a system with a common replacement rate of 60% at age 65, would increase the average retirement rate by 2 to 3 percentage points.

Samwick (1998) estimated that the increase in pension coverage by 50% in the postwar period resulted in a 5% increase in the retirement rate of those ages 50–70, or 27% of the actual reduction of labor force participation. Munnell and Sass (2008) maintain that main-career jobs are no longer the norm for one's terminal job. This suggests that lower wages in second-career jobs may be inducing earlier retirement in the form of taking Social Security benefits early and then earning just up to the point at which the earnings test comes into play. French and Jones (2011) use HRS data to show that if the Medicare eligibility age were increased from age 65 to 67, workers ages 60 to 69 would work 0.074 more years on average; elimination of two years of Social Security benefits would lead to an additional 0.076 years of work.

Our method of computing lifetime marginal net tax rates is to compare the increase in the expected present value of spending with the increase in the expected present value of future lifetime earnings. Many previous papers have adopted similar concepts when calculating marginal tax rates, but without the detail or comprehensiveness of our forward-looking calculations, which incorporate the current and future effects of a broad range of tax and transfer programs.

Joines (1981) estimates current marginal federal income tax rates for the US tax system, estimating increments of personal income tax liability using a tax schedule inferred from taxes paid and income received by individuals in adjacent income classes. This is unlike our

approach in several respects, as we incorporate actual tax systems, include transfer payments as well, and measure taxes and income over time, in present values. Feldstein and Samwick (1992) develop a method similar to ours to calculate lifetime marginal net tax rates associated with Social Security taxes and benefits, estimating for different types of individuals (varying by income, age cohort, gender, and marital status) the incremental net tax rate on additional labor earnings, in present value. Our methodology extends such an approach to include a broad range of tax and transfer programs, not just Social Security.

Romich (2006) uses data from residents of Wisconsin to calculate marginal tax rates, considering both federal transfer programs like Temporary Assistance for Needy Families (TANF) and state programs, for example, the Homestead Credit, a housing subsidy for low-income tax filers. Family spending on child care and rents are hypothetical and the same for all families in this research, and calculations are based on current net taxes and income.

The closest antecedents to this study are those by Gokhale and Kotlikoff (2002) and Gokhale, Kotlikoff, and Sluchynsky (2002). Their methodology is largely similar to ours, but leaves out alternative life-span paths and also is based on stylized, that is, hypothetical households. They, too, report remarkably high marginal tax rates on labor supply facing Americans at different levels of annual earnings. But since they are providing illustrative calculations, they are not able to evaluate the dispersion in marginal net tax rates.

III. Methodology, Data, and Past and Future Earnings Imputations

The appendix to Auerbach et al. (2016) describes precisely how TFA makes its calculations, but the basics of our approach can be captured in three equations.

A. Methodology

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

$$R = H + W, \tag{1}$$

where H, human wealth, is the present value of lifetime earnings and W is private net wealth. The measure R constitutes the lifetime resources available before taxes are paid or transfer payments are received.

Equation (2) defines remaining lifetime spending, S, as

$$S = R - T, \tag{2}$$

where T stands for the present value of remaining lifetime net taxes (taxes paid less transfer payments received).

Equation (3) clarifies our calculation of a household's remaining lifetime marginal net tax rate, τ.

$$\tau = 1 - \Delta S \,/\, \Delta R = \Delta T \,/\, \Delta R. \tag{3}$$

Note that equations (1) and (2) hold along any realized survival path since the present value of realized spending has to equal the present value of realized resources net of realized net taxes.[22] Hence, each of the variables, R, T, and S can be viewed as expected present values, that is, as weighted averages across all realized future survival paths of the path-specific realized present values of the variables, with the weights being the probability of the particular survival path occurring.

Formula (3) is quite general. It holds no matter the nature of the increase in labor earnings and, thus, human wealth, H. Consequently, we can just as easily use TFA to calculate the marginal net tax rate when H rises, say, due to a $1,000 increase in current-year earnings or a $20,000 increase in all current and future years earnings until retirement.

B. Data

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

Table 1 provides a count of our sample households by cohort and resource percentile. In total, we have 2,658 households with heads ages 50–79. As one would expect, the majority are in the younger age groups. Only 254 are age 75–79. Our percentile groups are formed using sample household population weights, and the households are distributed to the different resource percentiles based on their ranking across all SCF households, not just those 50–79. Note that the number of households in the top 5% and top 1% categories are larger than one would expect based on a nonstratified, random sample. But the SCF oversamples the rich.

The SCF provides the value of W, the household's (i.e., household head's and spouse's, if married) tangible wealth. All inputs from the

Table 1
Number of Household Observations

Quintile	Age 50–79	Age 50–54	Age 55–59	Age 60–64	Age 65–69	Age 70–74	Age 75–79
Lowest	351	91	81	75	59	39	27
Second	359	97	78	71	56	36	27
Third	382	92	85	72	59	41	25
Fourth	450	102	100	85	72	50	28
Highest	1,116	237	243	216	179	146	89
Top 5%	642	136	143	125	102	90	58
Top 1%	382	80	82	78	55	56	32
Total	2,658	619	587	519	425	312	196

2013 survey are transformed into 2015 dollars and all provisions of all fiscal systems are from 2015. The 2013 SCF has 6,015 families.[23] Appendix B in Auerbach et al. (2016) details our sample selection and coding decisions. It makes clear that we attempted to include all observations in the SCF. Unfortunately, the SCF data does not include state identifiers. We may, in future work, randomly assign households to different states. But in this study we assume that all SCF respondents reside in Ohio, which is unexceptional in terms of its state tax system and tax rates.

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%. To calculate nominal rates of return, we assume an inflation rate of 2%.

C. Imputing Future and Past Labor Income

To form H, the present expected value of future labor earnings, we need to forecast, for each individual, a trajectory of future labor earnings. In addition, we need to "backcast" past earnings in order to calculate Social Security-covered earnings, which enter into the calculation of future Social Security benefits.

In forecasting and backcasting labor earnings, we statistically match Current Population Survey (CPS) households to SCF households. In particular, we define cells in each wave of the CPS by age, sex, and education,[24] and use successive waves to estimate annual earnings growth rates by age and year for individuals in each sex and education cell. These cell growth rates are used to backcast each individual's earnings history. We also project future earnings for each particular cell defined by age and demographic group until age 67 (when we assume individuals claim retirement benefits) by using average historical growth rates by age, net of average overall earnings growth, and plus an assumed future annual general real growth rate of 1%.[25]

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 i.i.d 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, $(y_{ij}^a - \overline{y}_i^a)$, that is permanent is $a\sigma_p^2 / (a\sigma_p^2 + \sigma_e^2)$. This share grows with age as permanent shocks accumulate. Using this estimate, we form the permanent component of current earnings for individual j, $\hat{y}_{ij}^a$,

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

and assume that future earnings grow at the group average growth rate.[26] Further, we make the simplifying assumption that the permanent and temporary earnings shocks have the same variance, a reasonable one based on the literature (e.g., Gottschalk and Moffitt 1995; Meghir and Pistaferri 2011), so that equation (4) reduces to:

$$\hat{y}_{ij}^a = \frac{a}{a+1} y_{ij}^a + \frac{1}{a+1} \overline{y}_i^a \qquad (4')$$

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:

$$\overline{y}_i^{a-t} + \frac{a-t}{a}(\hat{y}_{ij}^a - \overline{y}_i^a)\frac{\overline{y}_i^{a-t}}{\overline{y}_i^a} = \frac{t}{a}\overline{y}_i^{a-t} + \frac{a-t}{a}\hat{y}_{ij}^a\frac{\overline{y}_i^{a-t}}{\overline{y}_i^a}. \quad (5)$$

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

D. *Intended and Imputed Ages of Retirement and Social Security Collection in the SCF*

Table 2 provides the distribution of retirement ages specified in our data for the different age cohorts. In forming this table and producing our results, we use respondents' stated retirement ages and assume they stop working entirely thereafter. For those who say they will never retire, we set their retirement age to the larger of (a) their current age plus three years, and (b) age 70. All working respondents are required by the SCF to answer the survey's question concerning their intended age of retirement. A relatively high share of the sample's individuals was already retired at the time they were interviewed by the SCF. Among those still working, a remarkably small share specify ages 62 or 66 for the ages at which they will retire. Indeed, among those between 50 and 59 who are still working, over half say they will either retire at or after age 70 or never retire. Either the respondents chose not to take this question seriously or they have, as a group, highly unrealistic expectations about how long they will be able or want to work. This may help explain why so many baby boomers appear so poorly financially prepared for retirement. Nonetheless, we use respondents' projected retirement age to specify, as indicated above, when respondents entirely stop earning money.

Unfortunately, the SCF does not ask respondents their intended dates for collecting their Social Security retirement benefits. As a result, we need to impute these dates. Our method is very simple. For each individual, we set the age of retirement benefit collection at the actual or

Table 2
Distribution of Intended/Imputed Age of Retirement (Percent of Cohort)

Cohort	Before 62 (%)	62 (%)	Greater Than 62 and Less Than 66 (%)	66 (%)	Greater Than 66 and Less Than 70 (%)	70 or Greater (%)	Never Retire (%)	Already Retired or Not Work (%)	Total (%)
50–54	14.0	3.9	14.4	0.7	3.7	11.5	32.0	19.9	100.0
55–59	9.5	4.6	12.5	2.4	5.5	17.3	25.8	22.5	100.0
60–64	2.5	1.9	13.2	4.7	5.0	11.5	22.4	38.7	100.0
65–69	0.8	0.6	1.0	1.2	5.8	14.2	17.1	59.3	100.0
70–74	0.5	0.2	1.4	0.3	0.8	11.3	10.0	75.6	100.0
75–79	0.0	0.0	0.8	0.5	0.0	5.9	5.5	87.2	100.0

imputed retirement age, or age 70 if the actual or imputed retirement age is later. We also set the ages for collection of spousal benefits and widows' benefits at the respondent's full retirement age. Unfortunately, the public-use SCF sample does not tell us if single respondents are divorced, widowed, or never married. As we have no information on the former spouse in the case of divorcees (whose ex may or may not be alive) or the decedent spouse in the case of widows, we are forced, in this study, to treat all single respondents as never married. We do assume that married spouses file for their spousal benefits starting at full retirement age and that married spouses who become widowed start receiving their widow's benefit at full retirement age. These collection ages are then subject to override by Social Security's deeming provisions.[27]

The SCF can be used to determine the ages that respondents who are already collecting first began collecting their retirement benefits. Table 3 presents these data. Note that almost half of respondents report taking their retirement benefit as soon as it became available, at age 62. Almost one-quarter took it at 65. All told, over 90% of respondents receiving Social Security took their retirement benefit at or below the current full retirement age, 66, and, obviously, well before age 70. This appears to be due, in part, to the inability of households to make it financially to 70 without Social Security. This liquidity constraint can, itself, reflect a decision by such households to stop working because they believe that, due to the earnings test, it doesn't pay. This assumes, of course, that they are unaware of the Adjustment of the Reduction Factor. Another explanation is that older Americans do not appreciate longevity risk and, instead, assume they will die "on time" (i.e., at their life expectan-

Table 3
Ages at Which Social Security Recipients Began Collecting Benefits

Cohort	Share (Percent of Cohort)
62	49.1
63	5.6
64	6.2
65	23.2
66	7.8

cies) or earlier. As a result, they can easily undervalue the far higher benefits available from waiting to collect benefits at higher ages.

E. Projecting Mortality

A key element of our calculations is uncertain lifetimes, based on assumed mortality probabilities that vary by age, sex, and, of particular relevance for our calculations, the level of resources. We utilize estimates from the recent study by the National Academies (2015), which modeled mortality as a function of age, sex, birth year, and income quintile, where income was measured using a truncated AIME calculation based on earnings between ages 40 and 50 and the variable for couples was set equal to the sum of spouses' truncated AIME divided by the square root of 2.[28] We follow the same procedure to sort households to determine their quintile for purposes of assigning mortality profiles, except that we use a full AIME measure, imputed to age 60 in cases where individuals have only partial earnings records. Mortality is assumed to begin starting at age 55.

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

IV. Federal and State Fiscal Institutions

Table 4 lists the roughly 30 different fiscal institutions included in our analysis. The major elements in the table that concern the elderly are the federal personal income tax, Ohio's state income tax, Ohio's sales tax, the federal corporate income tax, the FICA tax, Social Security benefits,

Table 4
US Fiscal Systems and Subsystems Included in The Fiscal Analyzer

1. The US Personal Income Tax
Exemptions
Standard versus Itemized Deductions
The Earned Income Tax Credit
The Child Tax Credit
The Alternative Minimum Tax
Preferential Taxation of Capital Gains and Dividends
Taxation of Social Security Benefits
High-Income Medicare Payroll and Asset-Income Taxation
Progressive Tax Rates
Phase Out of Deductions and Exemptions
2. The FICA Tax
3. Social Security Benefits
Progressive Full Retirement Benefit (PIA) Calculation
Married/Divorced Spousal/Widow(er), Child, Disability, and Retirement Benefits
Early Retirement, Spousal, and Widow(er) Benefit Reductions
Earnings Test and Adjustment of the Reduction Factor
Recomputation of Benefits
Government Pension Offset and Windfall Elimination Provision
Delayed Retirement Credit
Deeming
Maximum Family Benefit
4. Social Security Disability Benefits
5. Supplemental Security Income
6. The US Corporate Income Tax
7. State Income Taxes for Ohio
8. State Sales Taxes for Ohio
9. Medicare Benefits
10. Medicaid Benefits for Ohio
11. Supplemental Nutrition Assistance Program (SNAP) for Ohio
12. Temporary Assistance to Needy Families (TANF) for Ohio
13. Medicare Part B Premiums
14. The Estate and Gift Tax

Medicaid benefits, Medicare benefits, Medicare Part B premiums, food stamps, Supplemental Security Income, and disability benefits.[29]

As the table shows, the federal personal income tax has many components that separately influence the rate of marginal net taxation. These components include progressive tax rates, the Earned Income Tax Credit, the Alternative Minimum Tax, preferential taxation of capital gains and dividends, the taxation of Social Security benefits, Medicare's new high-income payroll and asset-income taxes, and the phase-out of deductions and exemptions.

Figure 1 shows a breakdown of average lifetime resources, taxes, and

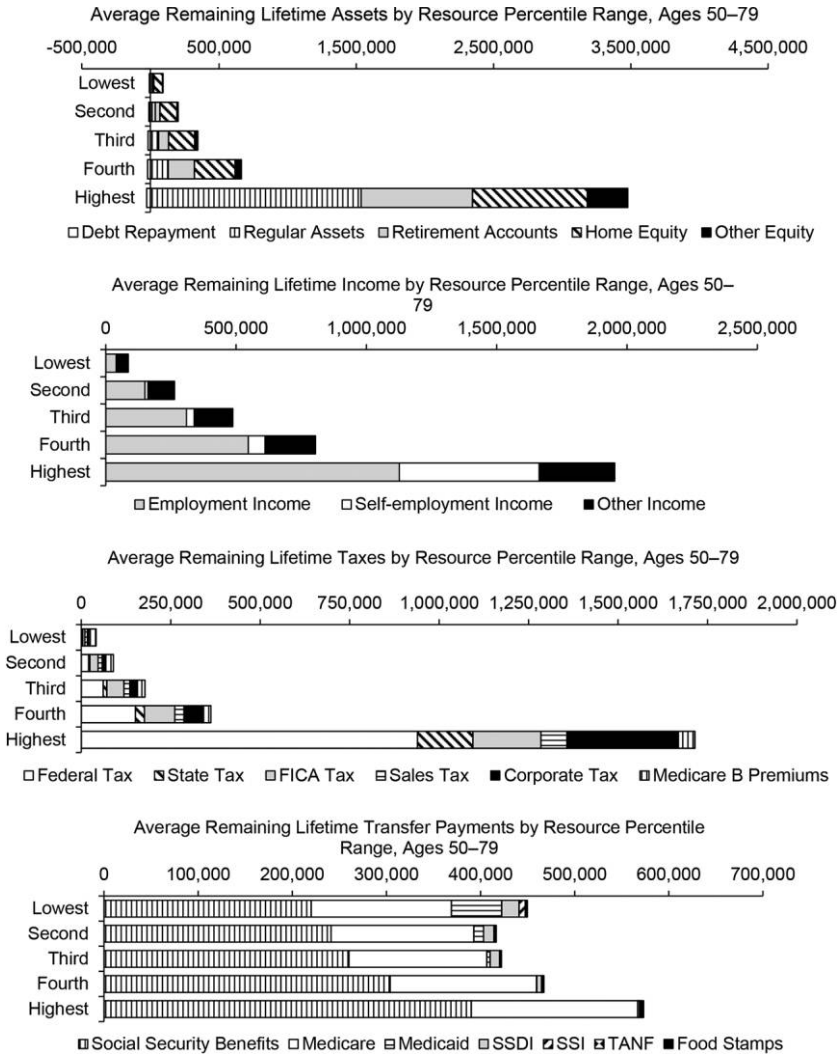

Fig. 1. Decomposing lifetime resources, taxes, and transfer payments

transfer payments by resource quintile. The 4th quintile, for example, references all households ranked from 61st to 80th in the distribution of remaining lifetime resources (the present value of remaining lifetime earnings plus household net wealth). All observations are pooled in this figure. The appendix (http://www.nber.org/data-appendix/c13866/appendix_c13866.pdf) presents comparable figures, but for the specific

cohorts. Figure 1 shows the relative and absolute importance of different types of assets and sources of income in determining overall resources. It does the same for the components of taxes and transfer payments. What we see is largely what we expect. Here are five examples. First, a disproportionate share of the assets of the top 20% is represented by regular assets as opposed to retirement accounts or home equity. Second, the poorest 20% of households have dramatically lower assets, on average, than households in other cohorts. Third, self-employment income is particularly important for the top quintile. Fourth, federal income taxes matter far more for higher-resource quintiles. And fifth, Social Security and Medicare benefits are the major transfer payments for all resource quintiles, with Medicaid benefits also playing a significant role for the poor.

Although figure 1 tells us about averages in the data developed and used in this study, it does not directly bear on the main question of this study—the size of marginal effective remaining lifetime net tax rates. The reason is simply that our tax and transfer system is highly nonlinear. Consequently, a tax or transfer that is quite small, on average, can have a huge impact on marginal work incentives.

A. Social Security's Earnings Test

Of particular interest and concern when it comes to the elderly's incentives to work is Social Security's earnings test. For those who file for their Social Security benefits early (before full retirement age, currently 66), which represents roughly over three-quarters of retirees, the earnings test can increase their effective marginal net tax rate by up to 50 percentage points.

We say "can" for four reasons. First, during the year one reaches full retirement age benefits are reduced 33¢, not 50¢ for each additional dollar earned, and only through the day one reaches full retirement age. Second, earnings have to exceed an exempt amount before they trigger benefit cuts. The 2016 annual exempt amounts were $15,720 for those between age 62 and January 1st of the year they will reach full retirement age, and $41,880 between January 1st of the year they will reach full retirement age and the day they reach full retirement age.

Third, Social Security's Adjustment of the Reduction Factor, if understood, undoes the labor supply tax associated with the earnings test. It does so at full retirement age by raising all of the specific type of benefits lost under the earnings test to fully offset, on an actuarial basis,

the earnings test's confiscation of those benefits. Indeed, those earning enough to lose all their benefits in a given year may face no marginal taxation from the clawback of Social Security benefits.

Fourth, for those who understand Social Security's Adjustment of the Reduction Factor (ARF) provision, the clawback *may*, thus, only be temporary. We emphasize the world "may" for two reasons. First, for households that are borrowing constrained, but do understand the Adjustment of the Reduction Factor, the value of receiving higher benefits in the future will not fully offset the loss of benefits now as the marginal utility of consumption in the present exceeds that in the future. Second, the ARF only raises the specific benefit that was lost due to the earnings test. For those who will receive a different benefit after full retirement age (e.g., a widow's benefit rather than a retirement benefit) having a higher benefit that one is not actually receiving is of no avail to those who were hit by the earnings test.[30]

The ARF is, however, sufficiently complex that very few workers subject to the earnings test appear to understand it. As a consequence, many workers who take Social Security early and are subject to the earnings test may perceive they are facing either a 50% or a 33% marginal Social Security tax when, in fact, their effective marginal tax arising from the earnings test is zero. This concern about misperception of the earnings test is supported by the propensity of workers potentially subject to the earnings test to bunch their earnings at or just below the earnings test exempt amounts.[31]

Workers can, of course, avoid the earnings test entirely by simply waiting until full retirement age to file for their benefits. But doing so raises another question of perception. Many workers who become eligible for Social Security may not realize that waiting to collect their benefits will fully, indeed, in most cases, more than fully compensate them for foregoing benefits in the short run. They may not be aware or understand the actuarial adjustments associated with waiting to collect. They may not realize that the higher benefits from waiting are real not nominal, that is, they are above and beyond future adjustments for inflation. And they may not understand the nature of actuarial calculations. In this regard, many workers appear to focus on their life expectancy, not their maximum age of death in considering their future longevity.

Social Security encourages this behavior by referencing life expectancy in different parts of its website and by providing a life expectancy calculator on their website.[32] For those convinced they will die at their life expectancy, waiting to collect a higher benefit will be perceived as

actuarially unfair even when it is fair or more than fair. This misperception will lead workers to take their benefits as soon as possible, at which point the complete or partial misperception of the ARF coupled with misperception of the AFR's real actuarial adjustments can leave workers in 33 to 50% higher perceived marginal tax brackets. Marginal tax rates of 33 to 50% represent a significant work disincentive on their own, but they come on top of other explicit and implicit marginal taxes.

In our basic calculations we assume that the elderly do not understand the AFR and we do not, therefore, incorporate it in our results. We do, however, show the sensitivity of our results to this assumption and, thereby, the potential impact of the earnings test on work disincentives.

V. How Much Can The Elderly Raise Their Living Standards By Working More?

As a starting point for our analysis, we note the findings of Butrica et al. (2006), who use the Urban Institute's Dynamic Simulation of Income Model (DYNASIM) to study the financial impact of the elderly's working longer.[33] Their study suggests that workers' living standards can be raised by over 50% based on just five additional years of work from age 50 onward. To quote their study:

> Workers, according to DYNASIM3, could increase their annual income by an average of 5% from age 50 onward for one additional year of work, and 25% for five additional years of work.

If these findings are accurate, policies that discourage work by the elderly would be of far greater concern than many analysts, including us, have assumed. Consequently, we felt it important to repeat their analysis. Our results are shown in tables 5 and 6. The sample used in these tables encompasses those age 50–79 who are currently working. In the exercise, we extend the retirement age of both the household head and spouse/partner by either one or five years and assume workers earn the amounts projected based on our above-described method. Even though many, if not most, respondents do not likely understand the ARF, we include it in our analysis since the household will end up with this extra income and our goal here is to understand all the returns from working. The tables include working single households as well as households with couples where at least one spouse/partner is working. Hence, the weighted average percentage increase in lifetime spending reflects only what working households can expect, on average, if they

Table 5
Percentage Change in Remaining Lifetime Discretionary Spending If Retirement is Delayed by One Year

Resource Quintile	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	2.2	3.8	6.2	3.6	4.5	0.5
Second	2.4	2.4	3.3	1.6	8.0	0.5
Third	2.4	2.6	2.6	2.1	8.8	0.1
Fourth	2.2	2.4	2.7	2.6	3.6	1.8
Highest	2.0	2.2	1.9	1.9	2.0	0.2
Top 5%	2.1	2.4	1.6	1.9	1.7	0.4
Top 1%	1.8	2.4	1.2	1.4	1.0	0.5

postpone their retirements. For all households, including nonworking households, in any given cell the percentage increase in spending will be smaller.

Among those ages 60–64, the percentage gain for working five years more is 15.7% for those in the lowest quintile, 10.0% for those in the third quintile, 7.6% for those in the top quintile, and 5.1% for those in the top 1%. The corresponding figures for all households (not just those with at least one worker) are 8.1%, 7.9%, 6.4%, and 3.8%.

In the case of a one-year retirement extension, the results for the 60–64-year-old cohort for the same four percentile groups are 6.2%, 2.6%, 1.9%, and 1.2%. The percentage increases averaged across all households in this cohort are 3.2%, 2.1%, 1.6%, and .9%.

If we consider a younger cohort, those age 50–54, the results from working five additional years for the lowest, middle, and highest quintiles and the top 1% are 8.9%, 9.7%, 8.2%, and 7.7% among working households. Since most households in this age range are working, the results averaged across all households are not much smaller.

These percentage increases, even considering just working households, are much smaller than Butrica et al. (2006) report. Indeed, across all cells in tables 5 and 6, the largest percentage increase in the remaining lifetime discretionary spending is 20.0% for the lowest quintile in the age 70–74 cohort. Part of the reconciliation in the two sets of results is that Butrica et al. (2006) are considering gross income, not net income or discretionary spending. Discretionary spending is, of course, financed out of net remaining lifetime resources. This would make their percentage changes larger than ours. Another reason their changes should be larger is that discretionary spending is financed, in part, out of house-

Table 6
Percentage Change in Remaining Lifetime Discretionary Spending If Retirement is Delayed by Five Years

Resource Quintile	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	8.9	15.0	15.7	14.4	20.0	1.9
Second	9.7	8.6	13.1	7.3	14.7	1.8
Third	9.7	10.2	10.0	8.3	15.5	0.2
Fourth	9.1	9.6	10.2	9.8	7.9	4.5
Highest	8.2	9.5	7.6	7.8	7.6	1.1
Top 5%	8.8	10.4	6.8	7.8	6.7	1.5
Top 1%	7.7	10.7	5.1	5.6	4.8	2.0

hold assets, both regular and retirement account assets. Consequently, any given percentage change in labor earnings should have a smaller percentage impact on discretionary spending to the extent that the household has assets. This also explains why our percentage changes in discretionary spending are lower for cohorts in higher resource percentiles. A third reason for why we are finding a smaller percentage change in living standard is our inclusion of all transfer payments. The fourth and probably most important reason for the differences in results is that Butrica et al. (2006) assume that all extra funds earned are saved through retirement and then used to purchase an annuity.[34]

VI. The Elderly's Rates of Remaining Lifetime Marginal Net Taxation

We first consider median remaining lifetime marginal net tax rates arising from a $1,000 increase in current-year earnings. This is on top of our baseline projection of future earnings for the workers. Table 7 shows the results by resource quintile and the top 5 and top 1 percentiles for the entire sample, as well as for specific cohorts. These and all other medians were constructed taking into account SCF household sample weights.

The median rates in most cells are remarkably high. Take, for example, those age 55–59 in the third resource quintile. Their median marginal net tax rate is 46.2%, meaning that half those in this cell face even greater work disincentives. Or, consider those age 70–74 in the highest quintile; their median marginal net rate is 57.6%. At the very top end of the resource distribution, median rates exceed 60% for all age groups except the oldest. The basic pattern of median rates rising with

Table 7
Median Remaining Lifetime Marginal Net Tax Rates by Cohort Resulting from a One-Year, $1,000 Increase in Current Earnings

Resource Quintile	Age 50–79 (%)	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	31.6	38.0	36.5	32.7	32.2	22.3	38.4
Second	39.9	40.4	39.6	38.2	38.7	39.0	22.0
Third	43.9	41.1	46.2	41.6	46.5	47.0	27.0
Fourth	49.7	52.9	49.6	47.8	51.3	51.7	49.1
Highest	56.4	56.9	57.0	55.7	56.9	57.6	49.6
Top 5%	63.1	63.1	64.4	63.7	60.4	63.3	55.3
Top 1%	62.9	64.5	64.0	61.5	54.3	67.4	59.3

Table 8
Median Remaining Lifetime Marginal Net Tax Rates by Cohort Resulting from a One-Year, $10,000 Increase in Current Earnings

Resource Quintile	Age 50–79 (%)	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	40.8	52.5	42.5	48.1	40.3	29.0	42.6
Second	44.1	42.6	39.8	41.7	43.1	44.4	28.9
Third	46.8	44.6	47.1	43.8	50.2	50.7	35.6
Fourth	51.3	52.5	50.1	50.3	54.2	52.3	52.5
Highest	59.3	60.4	60.3	59.2	59.8	58.7	52.7
Top 5%	65.3	65.5	66.7	65.5	65.3	64.9	59.3
Top 1%	66.2	68.4	64.9	64.1	63.5	67.8	64.2

resources holds for all age groups except those 75–79, where there is a significant drop in going from the first to the second quintile, but with median rates rising thereafter for higher resource groups.

Tables 8 and 9 repeat Table 6's exercise, except their increments to current-year earnings are $10,000 and $20,000, respectively.[35] These larger earnings increments incur higher median marginal net tax rates. For example, the just-mentioned age 55–59 third quintile median marginal net rate is 49.3% in table 9 compared to 46.2% in table 7, and the top 1% of those 75–79 have a 64.2% median marginal rate in table 9 compared with a 59.3% median rate in table 7.

These particular cell differences are small, but for other cells the differences in marginal net taxation from a $1,000 increase in current earnings versus a $20,000 increase can be major. Take, for instance, the lowest age 50–54 quintile. Its median marginal net tax rate is 38.0% in the case of a

Table 9
Median Remaining Lifetime Marginal Net Tax Rates by Cohort Resulting from a One-Year, $20,000 Increase in Current Earnings

Resource Quintile	Age 50–79 (%)	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	47.8	77.4	53.2	82.5	46.5	35.3	43.9
Second	46.4	44.2	42.1	45.0	43.5	47.1	35.1
Third	48.9	47.4	49.3	47.0	51.1	51.1	41.5
Fourth	52.5	53.4	51.1	52.6	55.0	52.7	52.4
Highest	59.9	60.4	60.5	58.9	62.2	59.7	52.2
Top 5%	65.3	65.3	66.7	66.0	63.8	65.1	58.5
Top 1%	66.5	68.6	64.9	64.3	64.2	68.9	64.2

$1,000 earnings increment and 77.4% in the case of a $20,000 earnings increment. This reflects the loss of the poor's Medicaid benefits associated with earning so much more. Loss of Medicaid also plays a role in raising the median rate of 32.7% for those in the lowest quintile ages 60–64, arising from a $1,000 increment to current earnings to 82.5%, arising from a $20,000 increment. But the earnings test also comes into play for many respondents between 62 and 64 who are collecting Social Security because it puts them above the threshold at which the earnings test's 50% marginal rate comes into play. Figures 2 and 3, which consider $1,000 and $20,000 earnings increments lasting for one year, provide a good snapshot of the level of median marginal net tax rates facing all those age 50–79.

Table 10 considers the same increments to earnings, but lasting not one year, rather through retirement. Here again we consider median marginal net tax rates, but to economize on space, we group all age groups together. The table shows that for those in the lowest quintile, the median marginal net tax rate can be dramatically higher depending on the length of time the higher earnings continue. For example, a $10,000 increase for one year produces a median net tax rate of 40.8%. But the same $10,000 increase, if extended through retirement, produces an 82.5% marginal net rate! And this prohibitively high rate is just the median, meaning that half of the elderly in the lowest quintile lost more than 82.5 cents on the dollar were they to earn an extra $10,000 through retirement!

A. Marginal Net Taxation Facing Social Security Recipients

For Social Security recipients, the tax rates embodied in the Social Security system's rules are of paramount importance. As already discussed,

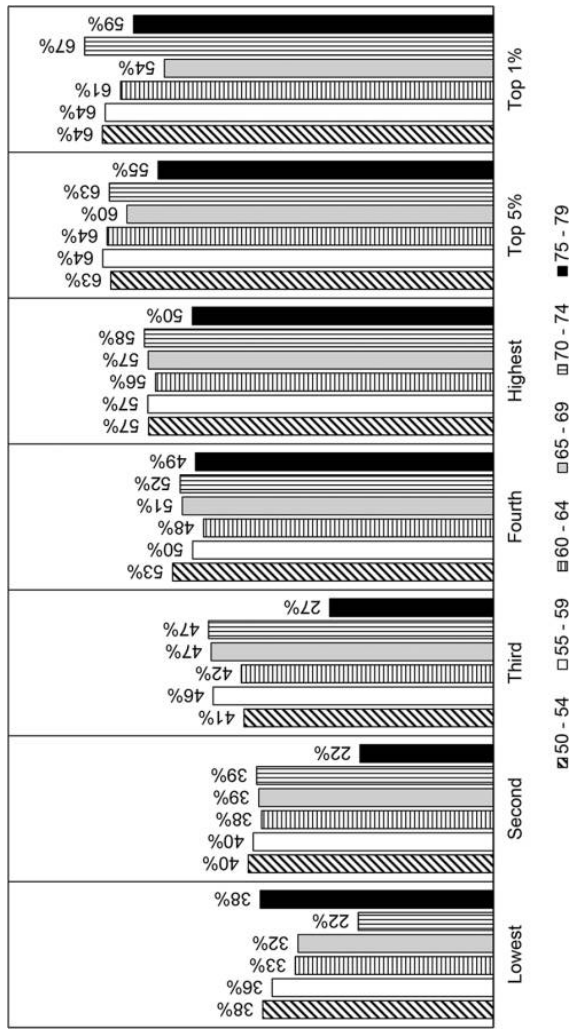

Fig. 2. Median marginal lifetime net tax rates by percentile range, ages 50–79, based on a $1,000 increase in earnings for one year.

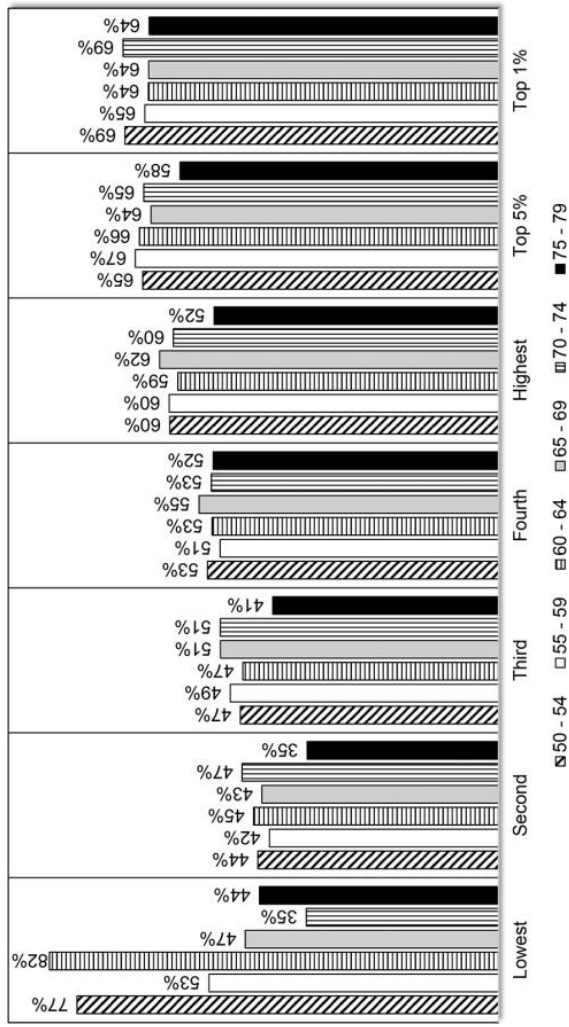

Fig. 3. Median marginal lifetime net tax rates by percentile range, ages 50–79, arising from a $20,000 increase in earnings for one year.

Table 10
Median Remaining Lifetime Marginal Net Tax Rates, Age 50–79 ($1,000, $10,000, and $20,000 Annual Increases in Earnings for One Year and through Retirement)

Resource Quintile	$1,000 Increase for One Year (%)	$1,000 Increase Through Ret. (%)	$10,000 Increase for One Year (%)	$10,000 Increase Through Ret. (%)	$20,000 Increase for One Year (%)	$20,000 Increase Through Ret. (%)
Lowest	31.6	77.4	40.8	82.5	47.8	35.3
Second	39.9	44.2	44.1	45.0	46.4	47.1
Third	43.9	47.4	46.8	47.0	48.9	51.1
Fourth	49.7	53.4	51.3	52.6	52.5	52.7
Highest	56.4	60.4	59.3	58.9	59.9	59.7
Top 5%	63.1	65.3	65.3	66.0	65.3	65.1
Top 1%	62.9	68.6	66.2	64.3	66.5	68.9

though, these rules are both complex and poorly explained, meaning that the impact on work and retirement incentives depends very much on how these rules are perceived.

To illustrate the importance of these perceptions, table 11 provides alternative estimates of median lifetime tax rates exclusively for Social Security recipients, ages 62–65 (individuals who could face the earnings test by earning additional current labor income). The first three columns of the table repeat the calculations from tables 7–9 for Social Security recipients. The remaining three columns provide marginal tax rates under the alternative assumption that individuals correctly perceive how ARF works. As one would expect, estimated marginal tax rates generally decline with this assumption, as individuals understand that losing current benefits through the earnings test is in good part offset by earning higher future benefits.

For example, those in the middle quintile earning an additional $20,000 in the current year would face a median marginal tax rate of 55.1% if ARF is not taken into account, but 47.7% if ARF is correctly understood. What is initially surprising, though, is that marginal tax rates may *increase* when the effects of ARF are included in the calculation. This can be seen by comparing marginal tax rates for those in the lowest quintile earning an additional $20,000, whose median marginal tax rate rises from 74.7% to 77.2%. Such low-resource individuals can face higher marginal net tax rates from earning extra income with the ARF turned on and assumed to be fully understood because the extra ARF

Table 11
Median Remaining Lifetime Marginal Net Tax Rates, Social Security Recipients, Ages 62–65 ($1,000, $10,000, and $20,000 Increases in Earnings for One Year With and Without ARF)

Resource Quintile	$1,000 Increase No ARF (%)	$10,000 Increase No ARF (%)	$20,000 Increase No ARF (%)	$1,000 Increase With ARF (%)	$10,000 Increase With ARF (%)	$20,000 Increase With ARF (%)
Lowest	28.1	51.4	74.7	27.8	47.8	77.2
Second	41.5	51.9	56.5	40.7	49.6	51.9
Third	41.6	49.5	55.1	41.6	45.4	47.7
Fourth	49.3	51.3	57.4	49.3	51.3	53.9
Highest	54.1	60.3	66.8	54.1	59.5	59.4

income leaves them (prior to earning more money) close to Medicaid and other means-tested, transfer-payment thresholds.

As discussed (see fn. 28), the ARF, though conceived to provide an actuarial offset to the earnings test, will provide only a partial offset to the extent that actual rates of return exceed those on which the ARF adjustment is based, as is the case for our assumed rate of return. As an alternative, one can consider the impact of simply eliminating the earnings test, which is an equivalent—in present value—to an exact actuarial offset, including one that would take into account differential mortality across income groups.

Table 12 provides estimates of marginal tax rates for Social Security recipients ages 62–65 for our base case (with no ARF) and under the assumption that the earnings test is eliminated. The first three columns of the table repeat those in table 11, and the last three columns show median marginal tax rates assuming the earnings test is eliminated. These columns can be compared to the corresponding columns of table 11 to see how much of a difference the alternative assumptions about the earnings test (ARF vs. elimination) make.

In making this comparison, it is important to keep in mind that while both ARF and eliminating the earnings test increase the present value of resources, relative to an earnings test without ARF, the timing of their adjustments differs. ARF offsets the current reduction in benefits caused by the earnings test with an increase in future benefits, while eliminating the earnings test simply increases current benefits. This difference is what underlies the big difference in median marginal tax rates for the lowest-income quintile earning an additional $20,000 in the current year. While ARF actually increases the perceived marginal tax rate (as discussed above), eliminating the earnings test reduces the marginal tax

Table 12
Median Remaining Lifetime Marginal Net Tax Rates, Social Security Recipients, Ages 62–65 ($1,000, $10,000, and $20,000 Increases in Earnings for One Year With and Without Earnings Test, No ARF)

Resource Quintile	$1,000 Increase No ARF (%)	$10,000 Increase No ARF (%)	$20,000 Increase No ARF (%)	$1,000 Increase No Earnings Test and No ARF (%)	$10,000 Increase No Earnings Test and No ARF (%)	$20,000 Increase No Earnings Test and No ARF (%)
Lowest	28.1	51.4	74.7	26.5	41.5	54.7
Second	41.5	51.9	56.5	40.8	48.1	49.5
Third	41.6	49.5	55.1	45.3	50.4	52.3
Fourth	49.3	51.3	57.4	47.7	50.2	51.9
Highest	54.1	60.3	66.8	50.3	59.4	61.8

rate from 74.7% to 54.7% because individuals in this group will be much less subject to increased future benefit loss.

For higher-resource groups, benefit phase-outs are less important; for these groups, eliminating the earnings test typically reduces median tax rates slightly more than incorporating ARF, because by our assumptions the ARF is not fully actuarially fair. For example, individuals in the highest quintile earning an additional $20,000 experience a decline in their median marginal tax rate from 66.8% to 59.4% under elimination of the earnings test, but to 61.8% when including the ARF.

B. The Impact of Eliminating All Income and Asset Tests of Transfer Programs

Table 13 shows how marginal net tax rates would look were all income and assets tests of all transfer programs jointly eliminated. The table considers a one-year $20,000 increase in earnings and can be directly compared with table 9.

As one would expect, median rates are dramatically lower for poor and lower-income households. For example, take the cohort age 50–54. The first quintile median marginal net tax rate is 77.4% with the transfer program marginal taxation included (i.e., as reported in table 9). It is 31.5% without (as reported in table 13). For the third quintile in this cohort, the two rates are 47.4% and 41.1%. Or, consider those ages 60–64. The first quintile's table 9 median rate is 82.5%, but it is only 27.6% in table 13. For those in this age range in the third quintile, the median rate falls from 47.0% to 39.2%.

Table 13
Median Remaining Lifetime Marginal Net Tax Rates Assuming No Earnings or Asset Testing of Transfer Payments, Ages 50– 79, $20,000 Increase in Earnings for One Year

Resource Quintile	Age 50–79 (%)	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	25.8	31.5	30.2	27.6	26.0	23.8	23.4
Second	36.6	37.8	35.3	34.8	39.9	33.7	25.9
Third	41.6	41.1	41.0	39.2	46.6	49.8	36.2
Fourth	47.8	48.6	47.4	45.5	53.5	52.3	50.2
Highest	58.1	59.0	58.7	57.0	62.3	58.0	51.3
Top 5%	65.1	65.2	66.4	65.1	63.1	66.1	56.6
Top 1%	66.6	66.8	65.1	64.1	65.0	68.9	64.2

C. The Dispersion of Remaining Lifetime Marginal Net Tax Rates

Figure 4 and table 14 show the remarkable dispersion of remaining marginal net tax rates across all SCF sample respondents (i.e., household heads and, where applicable, their spouses or partners) ages 50 to 79. The figure and table consider the marginal lifetime net tax rates arising from a $20,000 increase in earnings for one year. The figure and table are limited to observations with marginal tax rates ranging from zero to 200%. Dispersion results for other hypothetical increases in earnings lasting one or more years are quite similar. Note from the figure that most of the very high marginal net tax rates are those of respondents who are collecting either Medicaid benefits, Social Security benefits, or both.

The fact that the median remaining lifetime net tax rates range from high to very high may be expected given the seemingly independent design of so many tax systems and subsystems as well as so many transfer payments programs, all of which incorporate implicit tax schedules through the income testing of the benefits they provide. But what we find remarkably surprising is the enormous variation in marginal net tax rates among households within the same cohort and quintile of the resource distribution.

Cohort-specific tables in the appendix show that the dispersion holds within each age group, but the dispersion tends to be much greater at lower resource levels. Anyone familiar with optimal tax theory would likely view the dispersion in marginal net tax rates displayed in figure 4 with chagrin. It appears to be strongly at odds with what that body of theory recommends. In particular, it does not recommend net tax rates

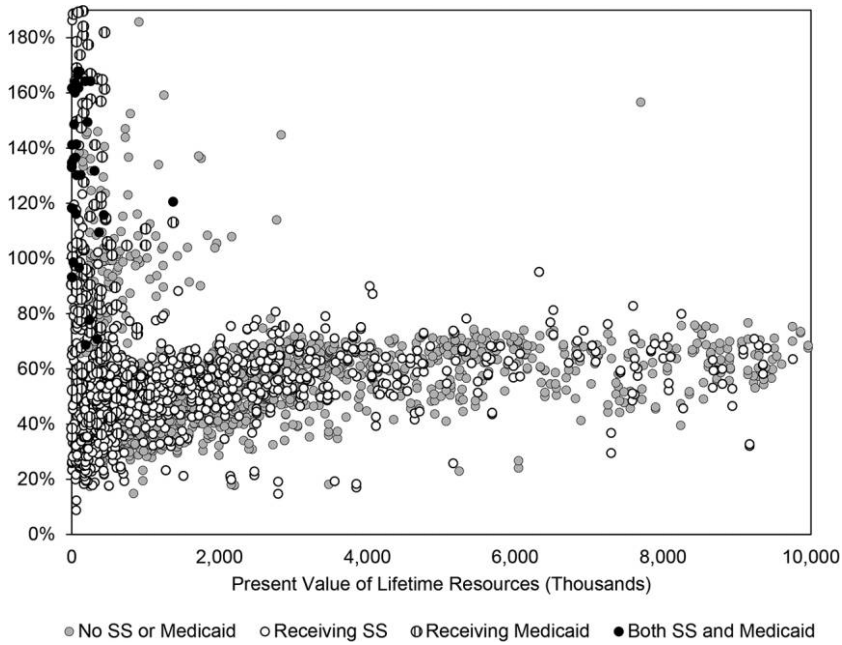

Fig. 4. Distribution of marginal remaining lifetime net tax rates, ages 50–79, arising from a $20,000 increase in earnings for one year.

so high as to effectively lock large numbers of older workers, particularly the poor and the rich, out of the work force.

Consider, for example, the implications for those age 60–64 earning $20,000 more for one year. Among the lowest quintile, 51% will lose more than 80 cents of every extra dollar earned, 8% will lose between 61 and 80 cents, and 7% will lose between 51 and 60 cents. Hence, two-thirds of the poorest members of this cohort that face marginal net tax rates above 50% and over half face marginal net tax rates above 80%. Among those in the top quintile, 39% are in a 61 to 80% marginal net tax bracket and 33% are in a 51 to 60% marginal net tax bracket. Hence, almost three-quarters are in marginal net tax brackets that exceed 50%.

Very high marginal net taxation holds for a significant minority of the poor of all cohorts. It is also present for many of the upper-middle class and the rich—at all ages. For example, take those age 70–74. Sixty-five percent of those in the fourth quintile face a marginal net tax rate between 51 and 60% on earnings of $20,000 in the current year. In the top

Table 14
Marginal Lifetime Net Tax Rate (Share of Population by Range, Cohort 50–79, Resulting from a One-Year, $20,000 Increase in Current Earnings)

Quintile	Percent Below 0%	Percent 0% to 20%	Percent 21% to 30%	Percent 31% to 40%	Percent 41% to 50%	Percent 51% to 60%	Percent 61% to 80%	Percent Over 80%
Lowest	0	2	15	22	15	5	7	33
Second	0	0	5	27	30	17	8	13
Third	0	0	3	26	28	34	3	6
Fourth	0	0	2	14	29	46	7	2
Highest	0	1	1	3	17	33	44	1

Table 15
Maximum Lifetime Marginal Net Tax Rates Arising from a $20,000 increase in Current-Year Earnings

Resource Quintile	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	301.5	299.1	287.7	627.9	226.5	414.8
Second	469.5	152.4	208.0	164.3	392.0	225.2
Third	136.7	196.8	108.2	104.9	272.0	131.8
Fourth	105.5	136.3	159.2	104.7	60.8	109.5
Highest	115.5	156.6	128.2	90.0	150.2	95.1
Top 5%	115.5	156.6	128.2	81.8	150.2	95.1
Top 1%	115.5	77.0	128.2	81.8	150.2	74.7

quintile of this cohort, 83% lose more than half the additional $20,000, and almost half lose between 61% and 80%.

D. Maximum and Minimum Marginal Net Tax Rates

Another way to assess the variance in marginal net tax rates is to consider the maximum and minimum rates. Tables 15 and 16 present these values again for the case of a one-year, $20,000 increase in earnings. The highest rate recorded in table 14, which presents maximums, is 627.9%. This for a respondent whose household is in the lowest-resource quintile in the cohort 65–69.

Table 16's minimum marginal net tax rates are far smaller, but many of the figures are still fairly high. For example, in the top quintile of those age 55–59, the lowest rate is 32.5%. The table's lowest rate is 8.8%—the minimum marginal net tax rates for the lowest quintiles ages 50–54, as well as 65–69. Thus, in the case of the poorest 65–69-year-olds, the marginal net tax rates range from 8.8% to 627.9%—quite a range!

The household with a marginal lifetime net tax rate of 8.8% is a single woman, age 66, with a young child (age five) in her care. Her primary source of income is Social Security, but she also receives food stamps and Supplemental Security Income. She owns a modest home and has a small mortgage. The low marginal tax rate she faces is due to her having the child in her home. If she earns an additional $20,000 in the current year, her federal taxes will decrease. Indeed, she will receive a federal income tax refund due to the Child Tax Credit and the Earned Income Tax Credit. Her food stamp benefits will, however, be reduced

Table 16
Minimum Lifetime Marginal Net Tax Rates Arising from a $20,000 increase in Current-Year Earnings

Resource Quintile	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	24.7	25.5	22.8	8.8	12.3	19.9
Second	14.8	27.1	25.3	17.6	21.7	17.8
Third	27.9	19.5	24.7	29.6	19.3	23.1
Fourth	30.3	28.7	28.4	20.3	33.8	22.0
Highest	22.9	32.5	17.8	17.0	14.7	21.2
Top 5%	22.9	39.5	23.4	40.1	29.5	25.8
Top 1%	45.1	46.4	23.4	46.4	49.6	56.1

in the current year but that is more than offset by the refund, leaving her with a small positive marginal net tax rate.

The household with the marginal lifetime net tax rate of 627.9% is a married couple whose husband is age 65 and wife is age 61. The husband is currently collecting Social Security and has modest self-employed income of roughly $8,000 per year. The wife is disabled and receives Social Security Disability Income. They own a modest home with no mortgage. Their high marginal tax rate is due to the loss of their Medicaid benefits in the years prior to the wife reaching age 65. The additional $20,000 in the current year increases their Modified Adjusted Gross Income, which determines their Medicaid eligibility. The additional labor earnings in the current year eliminate their current-year Medicaid eligibility. But, since they save a portion of the additional income and, as a result, have more assets in asset income, after the first year, they also lose Medicaid eligibility in future years. Indeed, they lose it for four years in a row.

E. Comparing Current and Remaining Lifetime Marginal Net Tax Rates

Table 17 presents current-year marginal net tax rates defined as the change in this year's net taxes divided by the increment to earnings—$1,000 in this case. The figures in this table should be compared with those in table 7, reproduced here in bold font, which also consider a one-year, $1,000 rise in labor earnings, but take into account that households smooth their consumption over time. Accordingly, the present values of their net taxes exceed what they pay in the current year.

The differences are strikingly large. Consider the 31.6% median lifetime marginal net tax rate for the lowest quintile age 50–79 (in bold

Table 17
Current-Year (Not Bold) Versus Lifetime (Bold) Median Marginal Net Tax Rates (Resulting From $1,000 Increase in Current Earnings)

Resource Quintile	Age 50–79 (%)	Age 50–54 (%)	Age 55–59 (%)	Age 60–64 (%)	Age 65–69 (%)	Age 70–74 (%)	Age 75–79 (%)
Lowest	14.8	30.4	26.6	23.4	14.5	14.4	14.5
Lowest	**31.6**	**38.0**	**36.5**	**32.7**	**32.2**	**22.3**	**38.4**
Second	30.4	31.0	30.0	30.6	25.6	15.3	14.4
Second	39.9	40.4	39.6	38.2	38.7	39.0	22.0
Third	31.3	31.9	31.2	31.1	34.5	31.4	24.0
Third	**43.9**	**41.1**	**46.2**	**41.6**	**46.5**	**47.0**	**27.0**
Fourth	38.3	39.3	38.6	37.3	36.4	39.8	41.5
Fourth	**49.7**	**52.9**	**49.6**	**47.8**	**51.3**	**51.7**	**49.1**
Highest	39.7	36.1	39.2	39.7	41.3	41.6	40.7
Highest	**56.3**	**56.9**	**57.0**	**55.7**	**56.9**	**57.6**	**49.6**
Top 5%	41.4	39.7	39.6	41.7	41.6	44.5	42.0
Top 5%	**63.1**	**63.1**	**64.4**	**63.7**	**60.4**	**63.3**	**55.3**
Top 1%	43.7	43.0	44.0	43.6	34.5	43.6	45.0
Top 1%	**62.9**	**64.5**	**26.6**	**61.5**	**54.3**	**67.4**	**59.3**

font). This is over twice the 14.8% median current year net tax rate (in normal font). Or, take those age 60–64 in the third quintile. Their remaining lifetime marginal net tax rate, in bold, is 41.6%, but their current-year marginal net tax rate is only 31.1%. A third example is the richest 1% of those ages 70–74. Their median remaining lifetime marginal net tax rate is 67.4%, far higher than the 43.6% rate current-year net tax rate.

VII. Conclusion

This paper provides a comprehensive analysis of the marginal net taxation of the elderly by running observations from the 2013 Federal Reserve's Survey of Consumer Finances (SCF) through The Fiscal Analyzer, 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, Social Security's earnings test, food stamps, Social Security disability benefits, Medicare benefits, Medicare Part B premiums, and Medicaid benefits.

Our findings show that older workers typically face high, very high, or remarkably high marginal net taxation on their extra earnings. Work disincentives are largest for those at the bottom and top ends of the

resource distribution. The disincentives are also highly nonlinear; the marginal net tax rate facing those earning an extra $20,000 in the current year and those earning an extra $1,000 can be dramatic.

Another central finding is that the marginal net tax on earning any given amount, but for a longer period of time, is no higher than earning extra money over a shorter period of time. Finally, we find that marginal current-year net tax rates are very poor proxies for the more appropriate lifetime measures.

We also find a far smaller impact on marginal net tax rates than expected arising from the earnings test because either eliminating it or making workers cognizant of the ARF leaves them with higher incomes and thus closer to Medicaid and other transfer-payment thresholds. In other words, lessening the importance of one marginal net tax can enhance the strength of others. On the other hand, eliminating all earnings and asset tests of transfer programs leads to dramatically lower median marginal effective remaining lifetime net tax rates for poor and lower-income households.

Marginal net tax rates levied on the elderly can vary enormously even within a resource quintile for a given cohort. This is to be expected given that individual fiscal policies have not been designed with their overall impacts on work incentives in mind, but is quite at odds with the lessons of optimal tax theory.

A final key finding is that the current-year marginal net tax rates can dramatically understate the work disincentives facing the elderly because they incorrectly assume that all increments to earnings are spent in the same year they are earned.

We conclude by addressing the question posed in this paper's title, "Is Uncle Sam Inducing the Elderly to Retire?" Based on the work disincentives Uncle Sam imposes on the elderly, the answer seems clearly to be yes. But an open question is the extent to which the elderly correctly perceive these disincentives. Indeed, given the complexity and interactions of our fiscal system and the heretofore reliance on current-year marginal net tax rates, it is hard to believe that policymakers, themselves, are cognizant of the level and spread of the work disincentives they are imposing on the elderly.

Endnotes

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1. https://www.ssa.gov/policy/docs/chartbooks/fast_facts/2015/fast_facts15.html#pagei.
2. www.cnbc.com/2015/04/13/retiring-well-not-most-baby-boomers.html.
3. https://www.ssa.gov/policy/docs/chartbooks/.
4. A caveat is in order. Andrew Biggs suggests that these Social Security estimates may overstate retirees' dependence on the system. (See http://andrewgbiggs.blogspot.dk/2008/03/how-dependent-are-retirees-on-social.html.)
5. http://kff.org/medicare/issue-brief/poverty-among-seniors-an-updated-analysis-of-national-and-state-level-poverty-rates-under-the-official-and-supplemental-poverty-measures/.
6. https://www.payingforseniorcare.com/longtermcare/federal-poverty-level.html.
7. Ellis, Munnell, and Eschtruth (2014, figure 3.1 and table 3.1).
8. https://research.stlouisfed.org/fred2/tags/series?t=30-year\%3Btips.
9. Ellis, Munnell, and Eschtruth (2014, figure 3.3).
10. This is in addition to the prospect of having to face the high-income Medicare premium due to inflation raising nominal, but not real incomes.
11. Ellis, Munnell, and Eschtruth (2014, 39).
12. http://kff.org/medicare/fact-sheet/the-medicare-prescription-drug-benefit-fact-sheet.
13. https://fred.stlouisfed.org/series/PAYEMS.
14. https://www.dol.gov/ebsa/pdf/historicaltables.pdf.
15. http://time.com/money/4258451/retirement-savings-survey/.
16. According to table VIF1 in the 2016 Social Security Trustees Report, the system faces a $32 trillion fiscal gap over the infinite horizon. This is the difference between (a) the present value of the system's projected future benefit outlays, and (b) the sum of the present value of the system's projected future taxes and its current trust fund. The $32 trillion fiscal gap is 32.3% of the present value of projected future Social Security taxes. Consequently, the Social Security system is 32.3% underfinanced. Stated differently, it needs a 32.3% immediate and permanent tax hike to continue paying promised benefits through time. Since such tax hikes appear unlikely in the current political environment, the system seems to be in no position to raise its expenditures even further to help bail out the baby boom generation.
17. Auerbach and Gale estimate that the infinite horizon fiscal gap for the entire federal government is between 6 and 11% of GDP—between a third and more than half of government revenues, on an annual basis, depending on which government forecast of medical spending growth one uses.
18. The implicit taxation of labor earnings under Obamacare due to the loss in health insurance premium subsidies and increase in premiums associated with higher income is not included in this study.
19. We count Medicare and Medicaid at their government costs notwithstanding the potential for providers to add on costs that participants do not receive or for participants not to value $1 of benefits in these programs at $1 as discussed in Finklestein, Hendren, and Luttmer (2015).
20. The precise nature of consumption smoothing depends on preferences. At present, we assume all households wish to maintain a stable living standard per household member through time, where living standard is defined as discretionary spending per effective adult with an adjustment for economies in shared living. However, our methodology can accommodate any desired profile of relative consumption by age. The inclusion of borrowing constraints leads to higher relative consumption by age among those so constrained. We will, in future work, consider alternative assumption about the desired age-consumption profile. Assuming that people wish, other things equal, to have lower spending when old than when young would reduce the impact of asset-income taxation. This would be particularly important for the rich who have relatively more assets. On the other hand, it may be that the rich have relatively steeper age-consumption profiles. For purposes of this study, our objective is to describe the fiscal system people face assuming

they share the same intertemporal preferences. This lets us isolate the impact of the fiscal system. We also assume that households know their future labor earnings and asset returns, a simplification that we hope to relax in future work.

21. An example of a year-specific marginal net tax on labor supply is the amount one can spend exactly 20 years from now from earning an extra amount of money today, assuming all the extra money was allocated solely to spending more in exactly 20 years.

22. Again, our treatment of the present value of bequests net of estate taxes as part of S and our inclusion of the present value of estate taxes as part of T, ensures that all resources are either spent by the household or paid to government. (If T is negative, which is certainly can be, the payment to the government is negative.)

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

24. 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.

25. The appendix to Auerbach et al. (2016) provides full details of our use of the CPS data in forming our backcasts and forecasts.

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

27. For example, a couple who are both 55-year-olds in 2013 and indicate that they will take their retirement benefits at 70 will, under the assumption that they both take their spousal benefit at 66, be forced to take their retirement benefit at 66 as well. This reduces or raises their lifetime benefits depending on their relative sizes and absolute levels of past covered earnings.

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

29. We ignore housing subsidies, which are also income tested, because based on our understanding subsidized apartments and other forms of housing subsidies are limited in number and are allocated on a waiting-line basis. While the incidence of the corporate income tax may fall on workers to a large extent, the corporate income tax represents a marginal tax assessed on additional asset income since any given worker's additional saving (arising from additional earnings) will entail receiving a lower return due to the corporate tax, but that worker's work and saving responses to the tax will be too small to influence the system's overall incidence.

30. One additional factor in our calculations is that the ARF is not actuarially fair on a discounted present value basis, given the before-tax rate of return used in our calculations. The ARF is based on an underlying roughly 3% real return. But our TFA model uses the average return on assets in the economy in the postwar period, which as discussed in Auerbach et al. (2016), is 6.371%. This return has been remarkably stable, exhibiting a standard deviation of just .49%. The fact that the real pretax return to assets is over twice the 3% used to form the ARF means that, in our calculations, the ARF offsets somewhat less than half of the earnings test, even assuming that it is correctly perceived by workers (i.e., that the fourth caveat raised above does not hold).

31. See Friedberg (1999).

32. www.ssa.gov/planners/lifeexpectancy.html.

33. DYNASIM, the tool that Butrica et al. (2006) uses, ages a starting self-weighting sample of about 100,000 individuals from the 1990 to 1993 Survey of Income and Program Participation in yearly increments to 2050. Parameters in DYNASIM are estimated from longitudinal data sources. DYNASIM can project retirement age and Social Security take-up age, and simulate major sources of retirement income like SS benefits and pension income.

34. Presumably a nominal annuity will be frontloaded in terms of its impact on consumption, given the fact that inflation will erode the future purchasing power of the annuity.

35. Again, these earnings are in addition to baseline projected future earnings.

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