Taxes and Retirement Decisions Among Women And Secondary Earners

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ABSTRACT

In this report, we use a panel of anonymized data derived from income tax returns filed between 1999 and 2010 and Social Security benefits data to study how the labor force participation of retirement-age couples responds to taxation. We examine the responses of primary and secondary earners of a couple using three different definitions of primary and secondary. First, given the age of this cohort, we assume that in each couple the wife is the secondary earner. Then we define the secondary earner either as having lower earnings two years previously or as having lower career earnings. We find that the retirements of women and secondary earners with lower career earnings are accelerated by taxes on their earnings while their spouses are not affected or are weakly affected. However, we find that the retirement decisions of women and workers with lower career earnings than their spouse are only affected by taxes when their spouses are not in the labor force.

CONTENTS

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INTRODUCTION

Policy analysts use estimates of labor supply elasticities to understand how tax policy changes affect labor supply and, by extension, tax revenues and total economic output. Many studies have estimated the effects of wages and taxes on both the labor force participation and the hours worked margins (see McClelland and Mok 2012 for a review). Overall, estimated elasticities are close to zero for prime-age married men, while estimated elasticities among prime-age married women, which have been historically higher than those of married men, are now also quite low. This decline is likely related to women's increasingly strong attachment to the labor force. For example, it is now becoming common for married women to be the primary earners in their families (see tables 25 and 26 of Bureau of Labor Statistics 2017). Increased labor force participation by women has been cited as an additional explanation (Heim 2007), but participation among married and unmarried prime-age women changed little between 1993 and 2009 (Johnson and Kaminsk 2010; US Census Bureau 2012).

Labor force participation by married and unmarried retirement-age women, however, has increased markedly (Johnson and Kaminski 2010). For example, between 1993 and 2009, the labor force participation rate of women ages 55 to 59 increased from 57.1 percent to 68.4 percent. Women in older age groups show even greater increases. For example, women ages 62 to 64 increased their participation from 31.7 to 44.0 percent. Despite this surge, women's labor force participation rate still remains below that for men.

Some of the difference in participation is likely attributable to married women, most of whom, despite progress, earn less than their husbands. Those lower relative earnings should affect labor force participation both because they have lower opportunity costs from exiting the labor force and because lower relative earnings can lead to higher effective tax rates.[1] The effect of taxes on the labor force participation of prime-age secondary earners has been explored previously (McClelland, Mok and Pierce 2014), but the participation of retirement-age workers has not.

In this report, we use a panel of anonymized tax data derived from returns filed between 1999 and 2010 that were matched to records of Social Security benefits to study how the labor force participation of retirement-age couples responds to taxation. We separately examine the response of the primary and secondary earner of a couple using three different definitions of primary and secondary. First, we examine the response of men versus women, which historically aligns with primary and secondary earners. Second, we examine the response of primary and secondary earners defined as higher-wage earners and lower-wage earners in a given year. Finally, we examine the response of primary and secondary earners defined as those with higher wages and those with lower wages over a 35-year work history.

We find that among retirement-age workers confronted with an increase in their effective tax rate, women and those with lower wages over a 35-year history are more likely than their spouses to exit the labor force. The responses are

[1] When calculating effective tax rates, the first dollar of a worker's income is taxed at the same rate as the last dollar of his or her spouse. This implies that when calculating effective tax rates in a progressive tax system, the first dollar of the higher earner will tend be taxed at a lower rate than the first dollar of the lower earner. The lower earner will therefore tend to face a higher effective tax rate.

somewhat small in any given year (we simulate a 10 percentage-point increase in effective tax rates and estimate that exits from the labor force increase by less than 2 percentage points), but they are statistically significant. In contrast, the responses of their spouses (the primary earners) are much smaller and statistically insignificant. Higher-wage earners in a given year, however, are more responsive to tax rates than their lower-earning spouses. We then resolve the apparent inconsistency that secondary earners defined by gender or work history are more likely to retire when taxes increase, while secondary earners defined by wages are not. We separately examine the response of women without working spouses, with working spouses, and with working spouses with higher incomes. We then similarly examine people of either gender with lower 35-year work histories than their spouses.

In both cases, we find that those with nonworking spouses are more likely to exit the labor force as taxes increase and those with working spouses have small and statistically insignificant responses to tax increases. In other words, the retirement decisions of secondary earners as defined by gender or 35-year work history respond to tax rates, but only when they have become the sole, primary earner. This result is consistent with research suggesting that women's opportunity cost of work rises with their husbands' retirements because that work prevents the couple from jointly consuming leisure. It also implies that lower effective taxes for primary earners provide a work incentive for those with retired spouses.

This paper makes several other contributions to the analysis of taxation and retirement decisions. First, the labor force participation elasticities of retirement-age couples have been only estimated using survey data. Our use of administrative tax return data allows us to more accurately measure labor force participation and the tax rate on labor income. Second, the panel aspect of this dataset allows us to observe how each member of a couple transitions out of the labor force. Finally, our data on individual earnings and Social Security payments allow us to examine the retirement decisions of a couple using several definitions of primary and secondary earners.

LITERATURE REVIEW

Although there is extensive research on the wages, taxes, and labor force participation of women, as well as a wealth of research on pensions and taxation, there is remarkably little on the intersection of taxation and retirement decisions by women and secondary earners.

Favreault, Ratcliffe, and Toder (1999) estimate the probability, conditional on working the previous year, of collecting Social Security benefits and not working, collecting benefits and working, or not collecting benefits and not working. To do this, they use Survey of Income and Program Participation data for 1990–93 matched with Social Security Administration Summary Earnings Records and Master Beneficiary Records. The sample is limited to people ages 62 to 69. Although the authors include separate dummy variables for married men and married women, they do not separately estimate the elasticities for men and women. They find relatively modest effects of tax rates overall.

Lalumia (2008) examines how the work effort of married couples was affected by the change in 1948 to tax married couples as a single unit rather than as individuals. The change increased the marginal tax rate on the first-dollar of income for secondary earners, assumed to be women. States with community property laws already taxed couples as a single unit, so those couples were unaffected by the change. The author concludes that the employment rate of highly educated married women declined by about 2 percentage points. The effects of joint taxation on married men's labor force participation and nonwage income were generally not statistically significant.

Shafer (2011) demonstrates that the labor force participation decision of a woman is more closely linked to her income relative to her husband's income than it is to either of their absolute incomes. Shafer's analysis uses the National Longitudinal Survey of Youth from 1979 to 2004 and focuses on women who were in the work force when they married. Using several models, she shows that the wife's wages relative to her husband's wages better predicts an exit from the labor force than either her income or her husband's income.

Baldwin, Allgrunn, and Ring (2011) compare relative elasticities of labor force participation for primary and secondary earners in dual-earner couples with the relative elasticities of husbands and wives using 1 percent samples of the Census in 1980, 1990, and 2000. They find that the own-wage elasticity of primary earners is greater than that of secondary earners in 1980 and 1990 and much greater than the elasticity of husbands in all three years. Their results suggest that primary and secondary earner status may be more useful than that earner's sex in categorizing the marginal worker.

Alpert and Powell (2014) present the research most closely related to ours. Using Health and Retirement Study data for 2000 through 2010, they separately examine how retirement decisions of retirement-aged men and women are affected by taxation. They find no effect on the number of hours worked, but they find strikingly large elasticities on the participation decision: 0.55 for men and 0.76 for women. Alpert and Powell rely on changes in tax rate caused by the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003 for identifying variation in rates. Independent variation arises because the tax rates of some income groups fell more than others.

Maestas (2018) notes that married women often have higher opportunity costs of retirement than do men. She shows that this occurs because women, who typically retire earlier than men, have higher life expectancies and because time taken for child-rearing means that their earnings are still rising. Using data from the Health and Retirement Study for 1992 through 2012, she confirms that the returns to additional years of work are higher for married women than married men. She also finds that working until age 70 would substantially increase the Social Security benefits of married women but that women with the largest potential increases retire early at the same frequency as women with smaller potential increases.

Selin (2017) examines the husband's retirement decision when the wife's retirement incentive changes. Using a pension reform that affected several categories of female-dominated occupations in Sweden, he finds that 63-year-old wives defer retirement in response to increased incentives to continue working. Men, however, did not change their retirement decisions. Gustman and Steinmeier (2004) draw a different conclusion: a wife's retirement significantly affects the retirement decisions of her husband, but the husband's retirement does not affect the wife's retirement decision.

DATA AND METHODOLOGY

MODEL

To model how taxes affect retirement decisions, we adapt the approach developed by Stock and Wise (1990), which models the option value of pensions and benefits, to consider the effects of taxation on exiting the labor force. In their model, the decision to retire depends on future earnings and retirement benefits, both of which vary with the age *R* when a person fully retires.

In our continuous-time expansion of this model, we attempt to incorporate the wages of a person's spouse as well as the effect of tax rates. We assume that at each point in time a worker optimizes the following value function:

$$(1) \qquad V_t(R) = \int_{\mathrm{j=t}}^{R} \mathrm{P_{j|t}} \delta_t(j) (\mathrm{y_j^*})^{\mathrm{g}} dj + \int_{\mathrm{j=R}}^{T} \mathrm{P_{j|t}} \delta_t(j) \left(\mathrm{B_j^*(R)}\right)^{\mathrm{g}} dj$$

where *R* is the age at which the worker retires, $P_{j|t}$ is the probability of living to the point in time *j* subject to being alive in year *t*, $\delta_t(j)$ is a term to discount future income, *g* is a term representing the decreasing marginal utility of additional dollars of income (or an increasing taste for leisure), *T* is the maximum lifespan and $B_j^*(R)$ is post retirement income defined below. The first component represents the expected utility derived from working from year *t* until the time of full retirement. The second component represents the expected utility from future pension benefits until the end of their life.

Preretirement after-tax income is represented by y_j^*,

$$(2) \qquad y_j^* = ky_j - [T(ky_j + p_j) - T(p_j)] + [\, p_j - T(p_j)]$$

where y_j is worker's earned income at *j*, *k* is a variable representing the disutility from work such that 0 < *k* < 1, $T(*)$ is a tax function based on total income, and p_j is nonlabor earnings, including earnings by the spouse.

Postretirement income is represented by $B_j^*(R)$, which is defined in equation 3:

$$(3) \qquad B_j^*(R) = B_t(R) - [T(\mathrm{B_t}(R) + p_t) - T(p_t)] + p_t - \mathrm{T}(p_t)$$

where retirement income in year *t* is $B_t(R)$: a function of the year of retirement *R*.

Given equation 1 through 3, in appendix A, we show that in a simple linear tax system, an increase in a person's tax rate reduces the age of optimal retirement. This implies that secondary earners, who face higher tax rates than their spouses given our system of joint filing, may retire earlier than they would if they faced the same effective tax rate as their spouse.

DATA

In this study we use anonymized data drawn from a sample of tax returns in the IRS Statistics of Income 1999 Edited Panel (see Brady et al. 2017). The original 1999 Edited Panel included 83,434 tax returns, as well as information from Form 1040s, matched with information from the Social Security Administration on the filers' date of birth and sex. The panel created by Brady added information from Form W-2 (wages), Form SSA-1099 (social security benefits), Form 1099-R (retirement income from annuities, pensions, and individual retirement accounts, or IRAs), and Form 5498 (IRA contributions and balances). The data include weights to adjust for over-sampling of high-income tax units, making the sample representative of the 1999 filling population.

The panel dataset covers 1999 through 2010 and includes 1,310,811 tax returns, of which 400,298 are couples filing jointly. For our sample, we include only anonymized data drawn from tax returns filing jointly, excluding single, head-of-household, and married-filing-separately returns. The unit of analysis for our research is the individual taxpayer (as opposed to the tax return), so we create two separate observations for each return. We restrict our sample to people who were at least 55 years old in 1999 (that is, they were born by December 31, 1944) to focus labor supply decisions associated with retirement as opposed to exiting the labor force for other reasons. Although the person must be at least 55 in 1999, there are some taxpayer units in which the spouse is younger than 55 in that year. If a married couple divorces, they both drop out of the sample. However, if a couple marries during the period covered by the panel, they can enter the sample in that year.

We eliminate couples in which one member was born before 1900, nonfiling couples, and couples with residences outside of the 50 states or Washington, DC. We also exclude a small number of returns with presumed editing errors: those in which the sex of either spouse changed or was unknown and returns in which the Social Security numbers changed over time.

As shown in table 1, after these restrictions our sample contains 260,573 person-year observations, of which 146,352 are male and 114,221 are female. This difference in frequency between men and women is attributable to the higher share of men age 55 or over with spouses age 55 or younger in 1999. In 25 percent of cases (28 percent of weighted cases) men in our sample are married to women who were younger than 55 in 1999. Only 5 percent of women in our sample (6 percent of weighted cases) were married to men under age 55 in 1999.

TABLE 1

Sample of Married Couples

MFJ person-year observations, unweighted

Year	All MFJ Individuals			All MFJ Individuals over 55 in 1999			Final Sample		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
1999	40,610	40,610	81,220	15,297	12,148	27,445	.	.	.
2000	38,848	38,848	77,696	14,664	11,603	26,267	.	.	.
2001	37,432	37,432	74,864	14,074	11,107	25,181	5,786	2,345	8,131
2002	36,094	36,094	72,188	13,457	10,577	24,034	5,338	2,083	7,421
2003	34,823	34,823	69,646	12,889	10,089	22,978	4,832	1,852	6,684
2004	33,134	33,134	66,268	12,275	9,615	21,890	4,323	1,646	5,969
2005	32,477	32,477	64,954	11,828	9,185	21,013	3,918	1,442	5,360
2006	31,244	31,244	62,488	11,304	8,784	20,088	3,543	1,253	4,796
2007	30,151	30,151	60,302	10,850	8,407	19,257	3,251	1,084	4,335
2008	29,372	29,372	58,744	10,427	7,999	18,426	2,963	931	3,894
2009	28,696	28,696	57,392	9,942	7,593	17,535	2,647	790	3,437
2010	27,417	27,417	54,834	9,345	7,114	16,459	2,361	663	3,024
Total	**400,298**	**400,298**	**800,596**	**146,352**	**114,221**	**260,573**	**38,962**	**14,089**	**53,051**

Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.

Notes: MFJ = married filing jointly.

Because we are interested in the probability of retirement among workers, we study the retirement behavior of individuals in a given year who have wages over $1,000 in the previous two years.[1] Using a two-year history rather than just the previous year eliminates cases in which a worker exited the labor force sometime during the previous year. In that case, annual earnings and tax rates would be uncharacteristically low. Thus, workers exiting in the previous year would appear to have relatively low tax rates in that year and appear to be retiring in the current year, biasing toward zero the estimated effect of taxes on retirement. For example, consider a worker making $20,000 per year in 2004. If he or she retired on July 1 of 2005 the annual income in would be $10,000 income in 2005 and nothing in 2006. The effective tax rate would be lower in 2005 than 2004 and using 2005 tax rates would lead to a biased estimate of how taxes affect labor force participation.

We define work as having claimed earnings of more than $1,000 so that people working for a small number of days (e.g., to generate funds for holiday gifts) are not counted as participating in the labor force. This necessarily limits our sample to the 2001–10 period, although information from 1999 and 2000 is used for workers in 2001. After this restriction, the sample contains 60,635 person-year observations divided into 45,015 observations for men and 15,620 for women. The difference in male and female counts could be attributable to either female spouses' age or working history, and we will examine both below.

We define retirement as a drop in wages over two years such that (a) real wages are below $1,000 and (b) wages in a given year are less than 25 percent of wages two years before. Because we are examining labor force participation, simply filing for Social Security or receiving other retirement income does not count as being retired. We also allow for a person to exit retirement which we define as happening if his or her wage income more than quadruples over two years and exceeds $1,000 in real terms. This definition does mean that a person could retire and over time have his or her wages creep over the $1,000 line without ever technically exiting retirement, but we count these observations as retired and therefore exclude these 2,116 person-year observations from our sample. Table 2 shows to relative change of the sample size after limiting it by age and wage history.

We use three methods to distinguish between primary and secondary earners: gender, recent wages, and average indexed monthly earnings (AIME). Although many workers are classified with the same status in all three methods, they are fundamentally different determinants of secondary status. Using gender as the definition of secondary earner is consistent with the lower relative earnings of women in the cohort born no later than 1944 and it has been used in previous research, such as Eissa and Hoynes (2004) and Lalumia (2008). A second definition uses the relative position of recent wages to define primary and secondary earners. This has the advantage of best reflecting the couples' current circumstances, but it may not reflect the long-run circumstances of the couple. Finally, AIME, a measure of average lifetime earnings used to calculate Social Security benefits, suggests continuity (but not permanency) in status; the unusually high or low earnings of a partner in one year is unlikely to upend their primary or secondary status, but a permanent or long-lasting change might.

To distinguish between primary and secondary earners using recent wages as a criteria, we compare the wages of each spouse two periods ago. We have already restricted our sample to tax units with wages in each of the previous two years, so we can calculate the difference between their wages for all observations in our sample. We drop 793 returns in which the two taxpayers have exactly equal wages.

To distinguish between primary and secondary status using AIME as a criterion, we reverse the process by which the Social Security Administration calculates benefits. The Social Security Administration has data on the monthly earnings of an individual over the course of his or her working history, and they take the highest 35 years of earnings (indexed for average wage growth) and use those to construct the AIME. From the AIME, they calculate the actual Social Security payment based on the taxpayer's year of birth, age, and the age he or she began claiming Social Security benefits. Because our dataset contains benefits, year of birth, and age, we can calculate the AIME (and hence the primary and secondary income status) for any taxpayer who first received Social Security benefits while in our sample. For more information on this calculation, please see appendix B. For 4,715 people, we do not have data on the first year of Social Security earnings, so they are excluded.

TABLE 2

Limiting the Sample of Married Couples

MFJ person-year observations 55 or older in 1999 with wages over $1,000 in t-2, unweighted

Year	Individuals with wages over $1,000 in t-2	Individuals with equal wages in t-2	Individuals with undetermined AIME	Individuals observed as retired in t-1	All individuals in sample
1999	0	-	-	-	-
2000	0	-	-	-	-
2001	9,083	90	863	-	8,131
2002	8,207	66	725	-	7,421
2003	7,364	84	601	-	6,684
2004	6,645	72	491	116	5,969
2005	6,096	80	440	222	5,360
2006	5,547	84	394	278	4,796
2007	5,110	83	351	346	4,335
2008	4,672	83	309	389	3,894
2009	4,180	78	282	387	3,437
2010	3,731	73	259	378	3,024
Total	**60,635**	**793**	**4,715**	**2,116**	**53,051**

Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.

Notes: MFJ = married filing jointly; AIME = average indexed monthly earnings.

Our final sample contains 14,089 female taxpayer-year observations and 38,962 male taxpayer-year observations, for a total of 53,051 observations.[2] Overall, we follow 9,137 people from 2001 through 2010. Within our final sample, we observe that men are usually, though not always, the primary earner. As shown in table 3, roughly 82 percent of men in our sample have a higher AIME than their spouse, versus 31 percent for women. Similarly, 91 percent of men had higher wages two periods ago as opposed to 56 percent of women.

TABLE 3

Distribution Across Gender, Relative Wage, and Relative AIME

MFJ person-year observations in sample, unweighted

Alternative definitions	Gender		Total
	Male	Female	
Higher AIME	32,073	4,373	36,446
Lower AIME	6,889	9,716	16,605
Higher wages	35,473	7,927	43,400
Lower wages	3,489	6,162	9,651
Total	**38,962**	**14,089**	**53,051**

Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.

Notes: MFJ = married filing jointly; AIME = average indexed monthly earnings. Not every person-year observation has a corresponding spouse in the sample.

Not all the spouses of the taxpayers in our sample meet the wage history or age requirement to be in our sample themselves. In 2001, the first year of our sample, out of 8,131 person-year observations, 55 percent (or 4,475 filers) are men who do not have their spouse in the sample. Women who do not have their husband in the sample make up 13 percent. The remainder, 32 percent, consists of taxpayers with their spouses observed in the sample. Irrespective of a spouse's presence in the sample, we can observe their wages during the past two years (even if they were equal to $0), and we can calculate their AIME for comparison.

Given that we limit our sample to taxpayers age 55 or older in 1999, one concern may be that our sample will shrink over time. This decrease occurs for three reasons: a person could retire and therefore not meet our wage standard, he or she could stop filing taxes before meeting our definition of retirement, or he or she could die. Indeed, the number of people in our sample drops from 8,131 to 3,024 from 2001 to 2010. We examine this attrition issue in several ways. First, we observe the number of years a person appears in our dataset (as opposed to our restricted sample). For 73 percent of our sample, we can observe tax data on the person in question for the full 12 years of our dataset (1999 to 2010). These people may have retired at some point and therefore will not be in our sample, but we know if they have reentered the workforce. Before 2010, 316 sample-eligible individuals die and 811 stop filing returns without dying, making up 0.6 and 1.5 percent of our sample, respectively.

The sample size naturally declines as people retire, and in every year after 2001 more people leave than enter the sample. After 2001, only 1,006 new people enter the sample, primarily in 2002 and 2003. Before 2010 (the last year of our sample), 6,113 people leave the sample. However, a large portion of our sample remains for several years. Unweighted, 28 percent of people in our sample remain for all 10 years, indicating they never experienced a decrease in wages equivalent to retirement. A further 31 percent exit after at least five years in the sample. The remaining 41 percent are in our sample for one to four years. (See table 4 for details.) Weighted, 18 percent of people are in our sample for all 10 years, 25 percent are observed in the sample for six to nine years, and 56 percent are in our sample for five years or fewer.

TABLE 4

Entry to and Exit from Sample

MFJ individuals observations in sample, unweighted

Year	First year in sample	Last year in sample	Years in sample	Male	Female	Total
2001	8,131	978	1	776	438	1,214
2002	309	965	2	727	348	1,075
2003	271	771	3	558	259	817
2004	98	686	4	485	233	718
2005	87	639	5	447	213	660
2006	70	545	6	380	179	559
2007	59	510	7	375	171	546
2008	47	526	8	387	180	567
2009	37	493	9	328	130	458
2010	28	3,024	10	1,993	530	2,523
Total	**9,137**	**9,137**	**Total**	**6,456**	**2,681**	**9,137**

Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.

Notes: MFJ = married filing jointly.

EMPIRICAL MODEL

Our model adapts the elasticity of taxable income methodology outlined by Gruber and Saez (2002) and in subsequent papers (see Saez, Slemrod, and Giertz 2012 for a review). Unlike most research, which estimates the response of labor income to tax rates, we estimate the response of labor force participation among the elderly. Retirement-age workers exiting the labor force rarely return (only 85 taxpayers in our sample return to the labor force in a subsequent year), so we are analyzing retirement decisions.

Our key insight is that the lower earner in a two-earner couple faces, on average, higher effective tax rates (ETR) than the worker with higher wages, providing those lower earners with a stronger incentive to retire. When worker *i* is considering the decision to work or retire independent of his or her spouse, the ETR on earnings is

(4) $$ETR_i = \frac{T(W_i+W_s+NL)-T(W_s+NL)}{W_i}$$

where *T(*)* is the tax liability based on income *, W_i represents the individual's wage income, W_s the spouse's wage income, and *NL* represents all the couple's nonwage income. Note that in a progressive tax system, the last dollar of wages is taxed at higher rates as annual wages rise. Further, when calculating the *ETR*, the first dollar of the income of person *i* is taxed at the same rate as the last dollar of his or her spouse. This implies that when calculating *ETR*s, the first dollar of the higher earner will tend be taxed at a lower rate than the first dollar of the lower earner. The higher earner will therefore tend to face a lower effective tax rate.

Secondary earners using any criteria may also be less attached to the workforce, so their retirement decisions may be more strongly influenced by effective tax rates. As mentioned, we alternatively define primary and secondary earners using three separate criteria. Secondary workers, as defined by gender, recent wages, or 35-year work history, may be less attached to the labor force. Secondary earners as defined by wages may face a higher ETR than their spouse.

We separately test the response of primary and secondary earners using identifying variation in changes in federal and state tax rates over time and across the income distribution. Because pretax income determines the tax rate and retirees have lower salary income by definition, we cannot use the effective tax rate on contemporaneous income to determine how tax rates affect retirement. Instead, we calculate taxes on potential income by applying then-current tax law to income from two periods ago, adjusted by the personal consumption expenditure deflator. Essentially, we compare variation in potential income and effective tax rates on that income to variation in retirement outcomes.

As detailed previously, attrition is present mechanically as retirees exit our sample. Although the responsiveness to tax rates could be independent of the number of years a taxpayer stays in the sample, it is also possible that higher responsiveness leads, on average, to earlier exits. We bound this responsiveness by separately estimating the effect of taxes on early exits and those remaining in the sample for longer periods.

Defining the retirement decision, our dependent variable, is complex, and researchers have used many measures based on income, hours worked, and the presence or absence of pensions or Social Security. Because we are interested in labor force participation, and tax data do not contain the number of hours worked, we focus on changes in reported wages and salaries, aggregated from all W-2s filed by an individual. We omit self-employment income from the definition of work both to avoid confusing postretirement avocations and hobbies with employment in the labor force and because in many cases reported self-employment earnings underestimate actual self-employment earnings.

We consider a person to be retired if he or she meets three criteria: if his or her real wage income has dropped 75 percent over two years, if his or her current real wage is under $1,000, and if he or she does not claim any unemployment benefits in the current year. Recall that all people in our sample have wage income of over $1,000 real dollars in the two prior periods. The first criterion defines retirement as a dramatic drop in wage income; the second tells us if the person's income has dropped below the minimum income typically used to define labor force participation, and the last separates out those who are leaving the labor force involuntarily. Once retired, an individual remains retired unless his or her wage income rises by a factor of four and exceeds $1,000 in real terms.

Our regression model estimates the variation in the probability of retirement across earners facing different tax rates. We separately analyze primary and secondary earners for all three of our definitions: gender, recent wages, and AIME. For each of these groups, we use a generalized estimation equation of a probit-type regression for workers:

(5) $$\Phi(\mathrm{E}[R_{it}]) = \beta_1 \log(ETR_{it}) + \boldsymbol{X}_{it}\gamma$$

where E[R_{it}] is the expected value of an indicator equal to 1 if the individual (i) retires in year (t) and 0 otherwise. ETR_{it} is the effective tax rate of individual (i), and $\boldsymbol{X}_{it}$ is a vector of additional covariates.

Consistency of the generalized estimation equation model makes fewer assumptions than a random-effects probit model, a frequently used alternative (See chapters 12, 13, and 15 of Wooldridge 2010 for more information), but the model still requires that the explanatory variables be exogenous. As described later in this section, our income variables are based on incomes lagged two years. This means we assume that the contemporaneous error term is not correlated with income two periods ago. This would not be the case, for example, if individuals frequently cut back on their hours worked or the intensity of work several years before retiring. To address the possibility that the error term might be correlated over time, we estimate our covariance matrix under the assumption that the errors are serially correlated.[3] The generalized estimation equation approach also readily incorporates the use of sampling weights and heteroskedasticity-robust standard errors, which are important considerations given that our dataset oversamples high-income taxpayers, so we use sampling weights to avoid overrepresenting the experience of high-income taxpayers.

To measure the ETR, we calculate the total tax liability from the employer and employee portions of payroll Federal Insurance Contributions Act taxes and federal and state income taxes using the National Bureau of Economic Research's TAXSIM program. We make three separate calculations: one in which only the individual works, one in which only the spouse works, and one in which both work. In each case, we calculate potential income using income variables from two periods ago adjusted forward using the personal consumption expenditure index to produce an estimate of current tax liability.

To identify the effects of the ETR on labor participation, we exploit variation in tax rates over time and across states (see Gruber and Saez 2002 for a discussion of this approach). A major change in the federal rate structure occurred in 2001, with an acceleration of income tax rate cuts in 2003. During the 12 years covered by the panel, 28 states changed their tax rates. Over that period, some states increased their marginal tax rates while others lowered them (Dowd, McClelland, and Muthitacharoen 2015; McClelland, Mok and Pierce 2014).[4]

We include additional covariates measuring several sources of potential income. We address the possibility endogeneity of each income source by using values from two years prior, moved forward by the personal consumption expenditure deflator. We include the natural log of wages of the taxpayer's spouse.[5] We also include a set of variables in log form for the individual's nonwage income, which includes Social Security benefits, gross traditional IRA benefits, gross Roth IRA benefits, and the sum of all nonlabor and nonretirement income for the tax return. We also include the log of the lagged value of the fair market value of an individual's IRA balance from Form 5498. To account for the spouse's retirement income, we include a set of dummy variables equal to 1 if the spouse's Social Security benefits, total IRA benefits, or IRA balance are positive. We also use dummy variables to control for the presence of capital gains income, self-employment income of the individual and the spouse, and pension income.

Our vector of additional covariates also includes the age and square of age for our individual, dummy variables for the number of dependents (up to four), dummy variables for each year, and the age difference between spouses. The age variables account for life cycle effects that might affect both work decisions and spousal income. The year dummy variables prevent conflating the effects of national economic conditions with those of federal tax rates. The weighted means and standard deviations for our regression variables, by primary or secondary definition and status, are presented in table 5.

For primary earners, average annual retirement rates are relatively constant between 11.4 and 11.6 percent; secondary earners face a slightly higher rate between 12.4 and 12.5 percent. Women face slightly lower effective tax rates than men, while individuals with lower wages two periods ago face much higher effective tax rates than their partners. The tax rates for higher and lower AIME spouses are almost equal. For every definition of primary or secondary workers, primary workers reported around $60,000 in lagged wages; secondary workers have lower lagged wages, between $22,000 and $38,000. The average nonwage and nonretirement income for primary earners ranges between $36,956 for men and $32,456 for higher AIME partners. For secondary earners, these figures are lower, at between $18,000 and $26,000. Roth IRA distributions are low across the board, and traditional IRA distributions and the fair market value of IRA balances are unsurprisingly higher for primary than for secondary workers. Between 32 and 37 percent of all individuals report capital gains income, but only 5 to 11 percent of returns report self-employment income. Women in our sample tend to be 2.09 years younger than their husbands, and men tend to be 3.73 years older than their wives.

TABLE 5

Summary Statistics by Primary and Secondary Earnings Definition and Status

MFJ person-year observations, in sample or over 55 in 1999, weighted

Variables		Gender		Wage		AIME	
		Primary	Secondary	Primary	Secondary	Primary	Secondary
Count		30,408,596	17,583,400	36,953,374	11,038,621	31,070,441	16,921,554
Retirement tag	Mean	11.4%	12.5%	11.6%	12.4%	11.4%	12.4%
	Standard deviation	0.32	0.33	0.32	0.33	0.31	0.33
Effective tax rate	Mean	32.52	31.90	30.88	37.23	32.28	32.34
	Standard deviation	10.57	11.72	11.20	8.65	10.64	11.65
Lagged wages	Mean	64,864	28,418	60,316	22,017	59,085	38,083
	Standard deviation	306,255	49,495	279,424	31,257	277,878	168,146
Lagged wages of spouse	Mean	15,388	25,077	7,772	57,358	16,125	24,012
	Standard deviation	38,759	93,782	21,356	121,315	52,471	82,410
Lagged nonlabor, nonretirement income	Mean	36,956	18,745	32,663	22,719	32,456	26,749
	Standard deviation	993,688	479,005	911,529	547,333	925,546	646,157
Lagged Social Security retirement benefits	Mean	9,265	5,068	8,040	6,829	8,724	5,969
	Standard deviation	8,672	5,120	8,091	6,585	8,424	6,139
Lagged Roth IRA distributions	Mean	22	13	19	21	20	18
	Standard deviation	357	114	317	158	345	120
Lagged traditional IRA distributions	Mean	25,932	4,204	20,253	10,146	21,829	10,766
	Standard deviation	123,167	25,420	111,003	47,648	110,179	77,791
Lagged fair market value of IRA balance	Mean	118,200	35,230	100,952	44,952	106,051	55,730
	Standard deviation	557,786	86,991	505,080	135,125	521,993	258,754
Dummy for lagged spouse's Social Security retirement	Mean	0.40	0.65	0.54	0.32	0.43	0.61
	Standard deviation	0.46	0.47	0.48	0.42	0.47	0.48
Dummy for lagged spouse's IRA distributions	Mean	0.19	0.47	0.30	0.25	0.22	0.42
	Standard deviation	0.35	0.45	0.42	0.39	0.37	0.45
Dummy for lagged spouse's IRA balance	Mean	0.49	0.52	0.49	0.54	0.48	0.54
	Standard deviation	0.50	0.50	0.50	0.50	0.50	0.50
Dummy for lagged capital gains for return	Mean	0.36	0.34	0.36	0.32	0.35	0.37
	Standard deviation	0.48	0.47	0.48	0.47	0.47	0.48
Dummy for lagged self-employment income	Mean	0.11	0.05	0.10	0.07	0.10	0.07
	Standard deviation	0.31	0.22	0.29	0.26	0.30	0.25
Dummy for lagged spouse's self-employment income	Mean	0.06	0.15	0.10	0.08	0.07	0.13
	Standard deviation	0.24	0.36	0.30	0.27	0.26	0.34
Age	Mean	67.8	66.4	67.5	66.4	67.4	67.1
	Standard deviation	4.93	3.91	4.78	3.95	4.67	4.56
Age difference between self and spouse	Mean	3.73	-2.09	1.36	2.65	3.01	-0.92
	Standard deviation	4.95	4.35	5.45	5.60	5.57	4.37
Count of dependents capped at 4	Mean	0.11	0.05	0.09	0.08	0.11	0.06
	Standard deviation	0.45	0.27	0.40	0.36	0.44	0.29

Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.

Notes: MFJ = married filing jointly; AIME = average indexed monthly earnings. Nonlabor and nonretirement income includes capital gains, dividends, interest income, Schedule E income, alimony, gambling, and other income. In the model, all dollar values are in log form.

RESULTS

STYLIZED FACTS

Within our sample of workers, the average age of retirement is 67. This retirement age is older than that of the entire population, but our sample consists of those of age 55 and above who were working in 1999. When we break this average down by primary and secondary status, the average age is around 1.6 years greater for men than for women and 1.5 years greater for those individuals with higher wages than their partner. However, individuals with the higher AIME tend to be 0.9 years older when they retire than their lower AIME counterparts.

TABLE 6

Mean Age of Retirement

MFJ person-year observations in sample, weighted

Status	Weighted			Unweighted		
	Gender	Wage	AIME	Gender	Wage	AIME
Primary earner	67.6	67.4	67.3	68.1	67.8	67.7
Secondary earner	66.0	65.9	66.4	66.1	66.2	67.1
Total	67.0	67.0	67.0	67.5	67.5	67.5
Primary minus secondary	1.6	1.5	0.9	2.1	1.7	0.6

Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.

Notes: MFJ = married filing jointly; AIME = average indexed monthly earnings. Not every person-year observation has a corresponding spouse in the sample.

Across our sample, the average effective tax rate was 32.4 percent.[6] This rate is consistent across our sample; in 2001 and 2010 the maximum effective is at around 33.2 percent, while in 2005 the effective tax rate drops to its lowest point at 31.0 percent. Our data show that secondary workers face a much higher average effective tax rate. Within our sample, the average effective tax rate for individuals with higher wages than their spouse was 30.9 percent; individuals with lower wages faced an average effective tax rate of 37.3 percent.

TABLE 7

Mean Effective Tax Rates and Counts

MFJ person-year observations in sample, weighted

Earnings definition	Status	Mean (percent)			Count (thousands)		
		Total	Working spouse	Nonworking spouse	Total	Working spouse	Nonworking spouse
Gender	Primary earner	32.52	35.35	29.73	30,409	15,127	15,282
	Secondary earner	32.09	36.28	27.36	17,583	9,311	8,272
	Total	32.36	35.71	28.90	47,992	24,438	23,554
Wage	Primary earner	30.88	34.37	28.90	36,953	13,399	23,554
	Secondary earner	37.33	37.33	.	11,039	11,039	-
	Total	32.36	35.71	28.90	47,992	24,438	23,554
AIME	Primary earner	32.27	35.23	29.39	31,070	15,304	15,766
	Secondary earner	32.54	36.50	27.90	16,922	9,134	7,788
	Total	32.36	35.71	28.90	47,992	24,438	23,554

Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.

Notes: MFJ = married filing jointly; AIME = average indexed monthly earnings. There are no secondary earners according to the wage defintion with nonworking spouses. This is because in our sample you must have real wages over $1,000 for the prior two periods, and that secondary spouse according to the wage defintion must have wages less than that of his or her parter. It would be impossible to both be in our sample and have a nonworking spouse with higher wages.

Several factors affect the magnitude of these rates. First, many of members of our sample are two-earner couples, who face higher effective tax rates than one-earner couples. This occurs because many elements of the tax code, such as personal exemptions and a progressive rate structure, usually do not lower the effective tax rate of a taxpayer with a working spouse. Second, many workers in our sample are in their peak earnings years, and many have nonwage income. In our sample, average wages in 1999 are $67,510 for men and $29,348 for women. Including other forms of income, such as capital gains, dividends, interest income, traditional IRA distributions, and the wages of the spouse, the total family income is approximately $131,700 for men and $82,440 for women. These levels of income are typical of all people over age 55, although our sample has higher wages than the population because our sample consists of workers. Finally, the effective tax rate includes the employer and employee portions of payroll FICA and state taxes as well as federal taxes.

TABLE 8

Mean Income by Gender and Type of Income in 1999

MFJ person-year observations, in sample or over 55 in 1999, weighted

Definition	Gender	Count	Wages	Spouse's wages	Nonlabor and nonretirement income	Social Security benefits	Traditional IRA payments	Total
Sample	Men	5,078,040	67,509.81	17,885.89	32,801.30	3,779	9,710	131,686
	Women	3,123,971	29,347.70	31,246.58	18,113.07	1,689	2,044	82,440
	Total	8,202,011	52,974.68	22,974.69	27,206.86	2,983	6,790	112,929
All MFJ individuals over 55 in 1999	Men	14,343,087	31,880.93	13,268.76	31,227.39	7,255	14,902	98,534
	Women	11,728,341	10,528.27	27,137.60	31,002.24	3,951	3,290	75,909
	Total	26,071,428	22,275.34	19,507.72	31,126.11	5,769	9,678	88,356

Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.

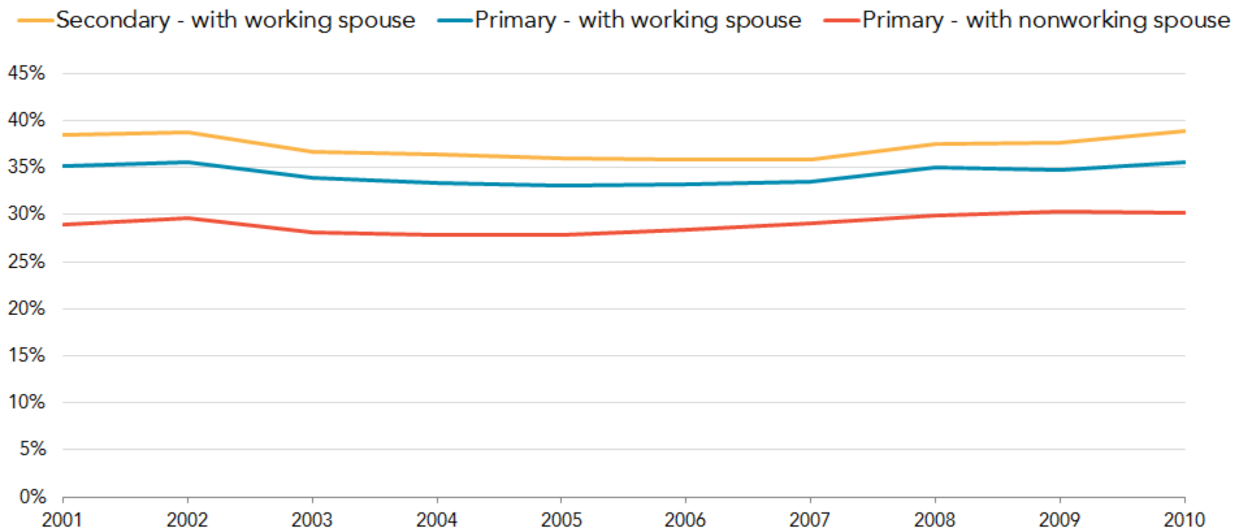
Notes: MFJ = married filing jointly. Nonlabor and nonretirement income includes capital gains, dividends, interest income, Schedule E income, alimony, gambling, and other income.

We can further decompose the set of primary workers based on wage into two groups: those with working spouses and those without working spouses. Over the time frame of our sample, primary earners whose spouses did not work faced the lowest effective tax rates at 28.9 percent; those with working spouses faced average effective tax rates of 34.4 percent. Effective tax rates for both are lower than the effective tax rates of secondary earners.

FIGURE 1

Average Effective Tax Rates by Relative Wage and Spouse's Work Decisions

MFJ person-year observations in sample, weighted



Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.
Note: MFJ = married filing jointly. By definition there are no secondary earners according to the relative wage criteria with non-working spouses.

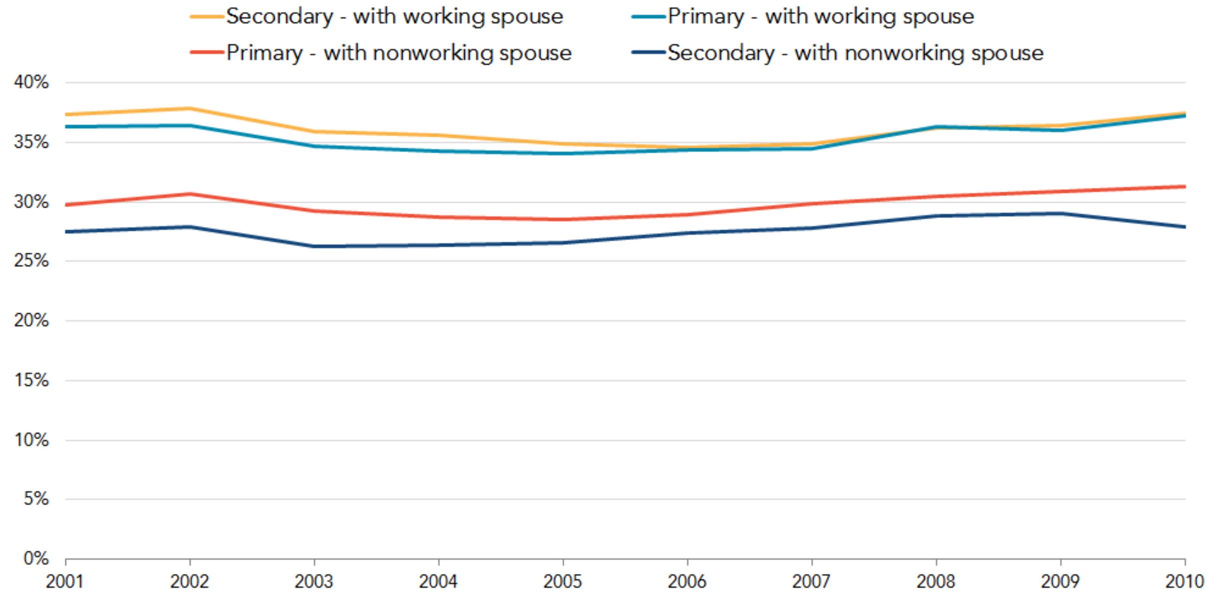
The difference in effective tax rates between primary and secondary workers is less stark for people divided by gender or by relative AIME. For these definitions, secondary workers have effective tax rates within 1 percentage point of primary workers. However, the effective tax rates of primary and secondary workers (as defined by AIME and gender) differ when considering the working decisions of spouses. In short, the gap between the average effective tax rates of individuals with and without working spouses is larger for secondary workers than primary workers. Across our sample, the effective tax rates for women whose husbands work is 36.3 percent, versus 27.4 percent for women whose husbands have stopped working. This difference exists for primary workers, but is smaller (35.4 to 29.7 percent) for men.

Over time, as individuals (and their spouses) in our sample age, working spouses become less common. In 2001, 59 percent of women and 55 percent of men have working spouses. By 2010, the percentage of our sample with working spouses drops for both men and women, to around 40 and 42 percent, respectively. Given that the relative drop in the effective tax rate is much larger for women than for men, a similar decrease in the share of working spouses leads to a relatively larger reduction in women's effective tax rates.[7]

FIGURE 2

Average Effective Tax Rates by Gender and Spouse's Work Decisions

MFJ person-year observations in sample, weighted

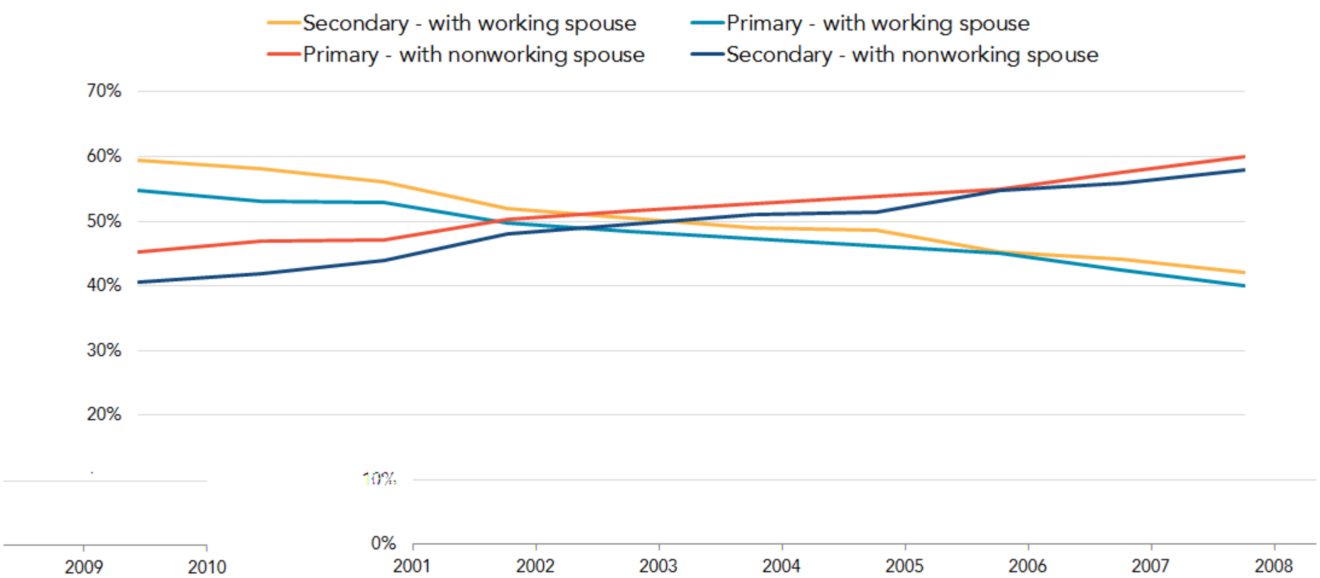


Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.
Note: MFJ = married filing jointly.

FIGURE 3

Percent of Men and Women by Spouse's Work Decisions

MFJ person-year observations in sample, weighted



Source: IRS Statistics of Income Division's Retirement Panel and authors' calculations.
Note: MFJ = married filing jointly.

REGRESSION RESULTS

Tables 9 through 11 show the effect of a one-unit change of an explanatory variable on the probability of retiring in a given year. Table 9, lists the results from separately estimating our model on primary and secondary workers as defined by gender. Table 10 lists the results from separately estimating our model using wages to define primary and secondary earners, and table 11 lists the results from using higher and lower AIME. Because the tax variables are in log form, a one-unit change corresponds to multiplying the effective tax rate by 2.71, increasing it from an average of about 30 percent to about 82 percent. A tax rate of 82 percent exceeds all tax rates in our sample, so these values should be interpreted with caution. We also calculate the effect of increasing and decreasing effective tax rates by 1 percentage point by calculating the predicted probabilities of retirement at the mean of all variables, including the effective tax rate, then predicting the probabilities with an effective tax rate 1 percentage point higher or lower, leaving other variables at their means. We then simulate a 10 percentage-point increase and decrease in the effective tax rate.

Our results from estimating the effect of taxes on the retirement decisions of men and women are shown in table 9. The effective tax rate has a small but statistically significant effect on the retirement decisions of women: multiplying rates by tax rates by 2.71 increases the probability of exiting in any year from about 12 percent to 16 percent. This effect is, however, more than four times as large as the estimated effect on men, which is not statistically significant.

In table 12 we simulate 1 and 10 percentage-point increases and decreases in the effective tax rate. The probability of a woman exiting the labor force each year is 13.8 percent. Increasing the effective tax rate by 10 percentage points increases the probability of retirement of women by about 1.2 percentage points. A 10 percentage-point cut has a slightly larger effect, decreasing the probability of retirement by 1.5 percentage points. These correspond to elasticities of approximately 0.30. Men, on the other hand, respond to 10 percentage-point changes by increasing or decreasing the probability of exiting the labor force by only 0.3 percentage points. With a predicted probability of 12.2 percent each year, this represents an elasticity of about 0.08. Changing the effective tax rate by only 1 percentage point has a much smaller effect, on the order of 0.1 percentage point or less. These results contrast with those of Alpert and Powell (2014), who find elasticities of 0.76 for women and 0.55 for men.

Income and Social Security benefits both have a negative effect on retirement decisions. It is not surprising that workers with larger potential incomes are more reluctant to retire than those with lower incomes. It is more surprising that Social Security benefits decrease the probability of retirement, but these benefits can be claimed regardless of work status. As expected, increased age increases the probability of retirement.

In table 10 we list our estimation results when primary and secondary earnings are defined in terms of relative income two years prior. In this case, surprisingly, effective tax rates have a statistically significant impact on the probability of retirement for the primary earner, but a smaller, insignificant effect on the secondary earner. In table 12, a 10 percentage-point increase in effective tax rates increases the probability of a primary earner retiring 0.4 percent per year and increases the probability of the secondary earner 0.1 percent. As before, higher potential earnings reduce the probability of retirement, as do Social Security benefits and increased age. For primary earners, increased potential earnings by a spouse decrease the probability of retirement. For secondary earners, increased potential earnings by a spouse increase the probability of retirement.

Table 11 lists our estimation results for primary and secondary earners as defined by their relative values of AIME. As in the gender-based definition, secondary earners have larger, more statistically significant reactions to effective tax rates than primary earners. In this case, however, the effect on primary earners is statistically significant at the 10 percent level. In table 12, a 10 percentage-point increase in effective tax rates increases the probability of a secondary earner retiring by nearly 1 percentage point per year and increases the probability of the primary earner by nearly 0.5 percentage point per year. Decreases in the effective tax rate have slightly larger effects on the probability of retiring, decreasing the probability of retiring by 1.1 percentage points and 0.5 percentage points for secondary and primary workers, respectively. As in the previous two exercises, increased potential income and Social Security benefits decrease the probability of retirement, and increased age increases the probability of retirement.

We have estimated a model in which the tax rate has a constant effect across all years. But those exiting the sample early might have a higher probability of exiting in any given year, while those exiting the sample later or not at all might have a lower probability of exiting. We test this by estimating our model from 2001 to 2003 and again from 2007 to 2010. The results, shown in table 13, demonstrate that in each case, the shorter time period leads to stronger effects, and the shorter time period leads to weaker effects. Simulating changes in effective tax rates leads to similar changes. For example, the results imply that a 10 percentage-point increase in the effective tax rate increases the probability of women's retirement by 1.8 percentage points per year in 2001 through 2003 and 0.9 percentage points per year in 2007 through 2010. Our results in tables 9 through 12 should then be interpreted as midpoint estimates.

TABLE 9

Regression Results by Gender

Margins and standard errors

Variables	Male	Female	Variables	Male	Female
Effective tax rate	0.0106	0.0437***	Age	0.00588***	0.00693***
	(0.00787)	(0.0107)		(0.00119)	(0.00181)
Potential wages	-0.0205***	-0.0336***	Age difference between self and spouse	-0.000249	0.000312
	(0.00297)	(0.00491)		(0.000697)	(0.00109)
Potential wages of spouse	-0.00372	-0.000996	One dependent	-0.0216**	-0.0223
	(0.00304)	(0.00404)		(0.0106)	(0.0188)
Potential nonlabor, nonretirement income	0.000441	0.000118	Two dependents	-0.0499***	0.0216
	(0.000761)	(0.00111)		(0.0160)	(0.0563)
Potential Social Security retirement benefits	-0.00299***	-0.00344**	Three dependents	0.0304	0.0493
	(0.00106)	(0.00141)		(0.0509)	(0.107)
Potential Roth IRA distributions	0.00768	-0.000108	Four dependents	-0.0391	0.241
	(0.00646)	(0.00894)		(0.0497)	(0.263)
Potential Traditional IRA distributions	0.000980	0.000455	Year = 2002	0.00661	-0.00501
	(0.000683)	(0.00114)		(0.00975)	(0.0133)
Lagged fair market value of IRA balance	-0.00161***	-3.77e-05	Year = 2003	0.00106	-0.0319**
	(0.000624)	(0.000932)		(0.0101)	(0.0134)
Dummy for lagged spouse's Social Security retirement benefits	-0.0182*	0.00842	Year = 2004	-0.00820	-0.0198
	(0.00939)	(0.0117)		(0.0103)	(0.0142)
Dummy for lagged spouse's IRA distributions	0.0207***	0.00398	Year = 2005	0.00930	-0.0134
	(0.00788)	(0.00885)		(0.0112)	(0.0150)
Dummy for lagged spouse's IRA balance	0.0172**	0.00785	Year = 2006	0.00625	-0.00833
	(0.00673)	(0.00975)		(0.0125)	(0.0171)
Dummy for lagged capital gains for return	0.00644	0.00781	Year = 2007	0.00365	0.0133
	(0.00612)	(0.00805)		(0.0121)	(0.0177)
Dummy for lagged self-employment income	-0.0170*	-0.00248	Year = 2008	0.000555	0.0213
	(0.00888)	(0.0176)		(0.0126)	(0.0191)
Dummy for lagged spouse's self-employment income	-0.00400	-0.0233**	Year = 2009	-0.0192	-0.0291
	(0.0112)	(0.0108)		(0.0128)	(0.0183)
Dummy for lagged pension income	0.0182***	0.00633	Year = 2010	-0.0147	-0.0338*
	(0.00589)	(0.00808)		(0.0137)	(0.0195)
Unweighted count	38,962	14,089			

Notes: IRA = Individual Retirement Account. The margins represent the change in probability from a one-unit change for the explanatory variable. The standard errors are calculated using the delta-method from robust standard errors on the estimated coefficients.

*** p<0.01, ** p<0.05, * p<0.1

TABLE 10

Regression Results by Wage

Margins and standard errors

Variables	Higher-wage	Lower-wage	Variables	Higher-wage	Lower-wage
Effective tax rate	0.0158**	0.00493	Age	0.00495***	0.0110***
	(0.00656)	(0.0215)		(0.00110)	(0.00230)
Potential wages	-0.0187***	-0.0349***	Age difference between self and spouse	6.22e-05	4.80e-05
	(0.00285)	(0.00655)		(0.000633)	(0.00116)
Potential wages of spouse	-0.0102***	0.0175**	One dependent	-0.0235**	-0.0189
	(0.00284)	(0.00782)		(0.0103)	(0.0211)
Potential nonlabor, nonretirement income	0.00138**	-0.00278**	Two dependents	-0.0640***	0.00938
	(0.000699)	(0.00139)		(0.0161)	(0.0370)
Potential Social Security retirement benefits	-0.00282***	-0.00525***	Three dependents	0.0247	0.0999
	(0.000944)	(0.00184)		(0.0568)	(0.0912)
Potential Roth IRA distributions	0.00698	-0.00174	Four dependents	-0.00642	
	(0.00602)	(0.0121)		(0.0587)	
Potential Traditional IRA distributions	0.00122*	0.000681	Year = 2002	0.00757	-0.0142
	(0.000643)	(0.00131)		(0.00872)	(0.0177)
Lagged fair market value of IRA balance	-0.00149***	0.000164	Year = 2003	-0.00392	-0.0348*
	(0.000578)	(0.00117)		(0.00890)	(0.0181)
Dummy for lagged spouse's Social Security retirement benefits	-0.00792	0.00775	Year = 2004	-0.00180	-0.0510***
	(0.00803)	(0.0158)		(0.00926)	(0.0187)
Dummy for lagged spouse's IRA distributions	0.0183***	0.00236	Year = 2005	0.00538	-0.0167
	(0.00629)	(0.0127)		(0.00979)	(0.0207)
Dummy for lagged spouse's IRA balance	0.0145**	0.0127	Year = 2006	0.0243**	-0.0685***
	(0.00626)	(0.0121)		(0.0116)	(0.0206)
Dummy for lagged capital gains for return	0.00867	-0.00256	Year = 2007	0.0109	-0.00793
	(0.00548)	(0.0109)		(0.0109)	(0.0237)
Dummy for lagged self-employment income	-0.0153*	-0.0160	Year = 2008	0.0265**	-0.0640***
	(0.00871)	(0.0195)		(0.0119)	(0.0219)
Dummy for lagged spouse's self-employment income	-0.0152*	-0.0135	Year = 2009	-0.0108	-0.0671***
	(0.00822)	(0.0182)		(0.0117)	(0.0230)
Dummy for lagged pension income	0.0139***	0.0133	Year = 2010	-0.00300	-0.0893***
	(0.00530)	(0.0104)		(0.0127)	(0.0227)
Unweighted count	43,400	9,646			

Notes: IRA = Individual Retirement Account. The margins represent the change in probability from a one-unit change for the explanatory variable. The standard errors are calculated using the delta-method from robust standard errors on the estimated coefficients.

*** p<0.01, ** p<0.05, * p<0.1

TABLE 11

Regression Results by AIME

Margins and standard errors

Variables	Higher-AIME	Lower-AIME	Variables	Higher-AIME	Lower-AIME
Effective tax rate	0.0141*	0.0339***	Age	0.00659***	0.00504***
	(0.00775)	(0.0108)		(0.00123)	(0.00175)
Potential wages	-0.0208***	-0.0318***	Age difference between self and spouse	-0.000403	0.00216*
	(0.00304)	(0.00440)		(0.000652)	(0.00126)
Potential wages of spouse	-0.00587*	0.00115	One dependent	-0.0178	-0.0275
	(0.00302)	(0.00402)		(0.0110)	(0.0176)
Potential nonlabor, nonretirement income	0.000970	-0.000758	Two dependents	-0.0449**	-0.0221
	(0.000762)	(0.00111)		(0.0185)	(0.0313)
Potential Social Security retirement benefits	-0.00259**	-0.00449***	Three dependents	0.0503	0.0170
	(0.00103)	(0.00146)		(0.0566)	(0.0871)
Potential Roth IRA distributions	0.0103*	-0.0104	Four dependents	-0.0352	0.866***
	(0.00602)	(0.0116)		(0.0503)	(0.00485)
Potential Traditional IRA distributions	0.00116*	0.000156	Year = 2002	0.00869	-0.00657
	(0.000702)	(0.00103)		(0.00964)	(0.0136)
Lagged fair market value of IRA balance	-0.00148**	-0.000221	Year = 2003	0.00181	-0.0322**
	(0.000636)	(0.000908)		(0.00988)	(0.0138)
Dummy for lagged spouse's Social Security retirement benefits	-0.0193**	0.0196	Year = 2004	-0.00464	-0.0236
	(0.00883)	(0.0126)		(0.0101)	(0.0147)
Dummy for lagged spouse's IRA distributions	0.0187**	0.00236	Year = 2005	0.0119	-0.0163
	(0.00730)	(0.00912)		(0.0109)	(0.0156)
Dummy for lagged spouse's IRA balance	0.0157**	0.0102	Year = 2006	0.0288**	-0.0469***
	(0.00682)	(0.00960)		(0.0127)	(0.0164)
Dummy for lagged capital gains for return	0.00944	0.00232	Year = 2007	0.0156	-0.00462
	(0.00603)	(0.00827)		(0.0122)	(0.0177)
Dummy for lagged self-employment income	-0.0174*	-0.00483	Year = 2008	0.00803	0.0117
	(0.00939)	(0.0152)		(0.0126)	(0.0193)
Dummy for lagged spouse's self-employment income	-0.00758	-0.0249**	Year = 2009	-0.00949	-0.0450**
	(0.0104)	(0.0113)		(0.0130)	(0.0179)
Dummy for lagged pension income	0.0119**	0.0175**	Year = 2010	-0.00282	-0.0530***
	(0.00583)	(0.00817)		(0.0140)	(0.0188)

Notes: AIME = average indexed monthly earnings; IRA = Individual Retirement Account. The margins represent the change in probability from a one-unit change for the explanatory variable. The standard errors are calculated using the delta-method from robust standard errors on the estimated coefficients.

*** p<0.01, ** p<0.05, * p<0.1

TABLE 12

Simulated Effect of Tax Rates on Retirement

Simulated Effective Tax Rate	Gender		Wage		AIME	
	Primary earner	Secondary earner	Primary earner	Secondary earner	Primary earner	Secondary earner
Mean - 10	-0.30%	-1.50%	-0.60%	-0.10%	-0.50%	-1.10%
Mean - 1	0.00%	-0.10%	-0.10%	0.00%	0.00%	-0.10%
Mean + 1	0.10%	0.10%	0.00%	0.00%	0.10%	0.10%
Mean + 10	0.30%	1.20%	0.40%	0.10%	0.40%	0.90%

Note: AIME = average indexed monthly earnings.

TABLE 13

Testing the Effect of Attrition from the Sample

Margins, standard errors, and counts

Sample	Statistics	Gender		Wage		AIME	
		Primary earner	Secondary earner	Primary earner	Secondary earner	Primary earner	Secondary earner
2001–2003	Margin	0.0249*	0.0584***	0.028***	0.0334	0.0302**	0.0480**
	Standard error	(0.0129)	(0.0169)	(0.0107)	(0.0387)	(0.0120)	(0.0186)
	Count	15,955	6,276	17,845	4,387	15,058	7,174
Full sample	Margin	0.0106	0.0437***	0.016**	0.0049	0.0141*	0.0339***
	Standard error	(0.00787)	(0.0107)	(0.00656)	(0.0215)	(0.00775)	(0.0108)
	Count	38,962	14,089	43,400	9,646	36,446	16,605
2007–2010	Margin	-0.0700	0.125	0.0082	-0.0812	-0.0467	0.103
	Standard error	(0.0622)	(0.0808)	(0.0536)	(0.137)	(0.0626)	(0.0813)
	Count	14,727	4,717	16,204	3,238	13,556	5,888

Note: The margins represent the change in probability from a one-unit change for the explanatory variable. The standard errors are calculated using the delta-method from robust standard errors on the estimated coefficients.

*** p<0.01, ** p<0.05, * p<0.1

TABLE 14

The Effect of the Spouse's Working Decision on Secondary Earners

Margins, standard errors, and counts

Sample	Statistics	Secondary Earnings Status Determined by	
		Gender	AIME
Only working spouses	Margin	0.0213	0.0259
	Standard Error	(.0246)	(.0235)
	Count	7,882	7,939
No working spouses	Margin	0.0379 ***	0.0337 **
	Standard Error	(.0134)	(0.0137)
	Count	6,196	8,655
Only working spouses with higher income	Margin	-0.0151	0.0153
	Standard Error	(.0350)	(0.0325)
	Count	5,950	5,087

Note: The margins represent the change in probability from a one-unit change for the explanatory variable. The standard errors are calculated using the delta-method from robust standard errors on the estimated coefficients.

*** p<0.01, ** p<0.05, * p<0.1

DISCUSSION AND CONCLUSION

Our analysis shows that married women can face higher effective tax rates than their spouses. Women with a working spouse face the highest effective tax rate, while women without a working spouse face the lowest effective tax rate. We also show that secondary workers, defined as the wife or as the spouse with the lower wages over a 35-year work history, retire earlier in response to increased tax rates, but secondary workers as defined by potential wages do not. Rather, increasing taxes on the member with higher potential wages increases his or her probability of retirement; doing so has a a smaller, statistically insignificant effect on the member with lower potential wages. We now explore why taxes affect the retirement decisions of secondary earners (but not primary earners), but they affect the primary earner (but not the secondary earner) as defined by potential wages.

First, we separate female workers into three groups: those without working spouses, those with working spouses, and those with working spouses who have higher potential earnings. We then estimate our model on each of these groups (table 14). Higher effective taxes on women without working husbands (most of whom have probably retired) have a statistically significant effect that is similar to the effect on all women. Higher effective taxes on women whose husbands work, and whose husbands have higher potential earnings, have small and statistically insignificant effects. Ironically, when women are the primary earners and therefore face lower effective tax rates, their retirement decisions are more strongly affected by taxes than when they are the secondary earners and therefore face higher effective tax rates.

We then separate lower-AIME workers into the same three groups: those without working spouses, those with working spouses, and those with working spouses who have higher potential earnings. As with the results for women, secondary earners whose spouses do not work are more likely to retire in response to increased effective taxes, but other secondary earners are not. This might be reflecting those lower-AIME workers who are earlier in their careers.

These results are consistent with the opportunity cost explanation for wives' retirement described in Maestas (2018). Once a spouse has retired, the opportunity cost of continued work by the wife increases. This would raise the after-tax reservation wage, effectively increasing the remaining worker's tax elasticity.

But our research also suggests that the same tax system that discourages labor force participation by prime-age secondary earners (McClelland, Mok, and Pierce 2014) encourages participation by retirement-age secondary earners with retired spouses. As table 7 shows, women and lower-AIME workers face high tax rates if their spouses are working and low tax rates if their spouses are not. If our research is correct, that disparity encourages secondary workers to continue their labor force participation.

APPENDIX A. EXPANDED STOCK AND WISE MODEL

In this section, we prove that, given the following definitions and assumptions, higher taxes will lead to an earlier optimal moment in time of retirement. We start with equations 1 through 3 as provided previously, which we briefly restate here; we then lay out five assumptions regarding these equations (now referred to as definitions 1 through 3).

DEFINITIONS

Definition 1: $V_t(r)$

The retirement decision is a function of income earned before retirement and income from retirement benefits earned after retirement, illustrated as follows:

(D1) $$V_t(R) = \int_{j=t}^{R} P_{j|t}\delta_t(j)\left(y_j^*\right)^g dj + \int_{j=R}^{T} P_{j|t}\delta_t(j)\left(B_j^*(R)\right)^g dj$$

where R is the year of retirement, $P_{j|t}$ is the probability of living to year j subject to being alive in year t, $\delta_t(j)$ is a term to discount future income, g is a term representing the decreasing marginal utility of additional dollars of income, and T is the maximum age an individual could reach. Both y_j^* and $B_j^*(R)$ are more complex functions that represent income before retirement and income after retirement.

Definition 2: y_t^*

Preretirement income is defined as follows:

(D2) $$y_t^* = y_t k - [T(y_t + p_t) - T(p_t)] + p_t - T(p_t)$$

$$= y_t k - T(y_t + p_t) + p_t$$

where y_t is earned income from the individual in question in year t, k is a variable that represents the disutility from working such that 0 < k < 1, $T(*)$ is a function the calculates taxes based on income *, and p_t is nonlabor earnings, which includes spousal earnings.

Definition 3: $B_t^*(R)$

Postretirement income is defined as follows:

(D3) $$B_t^*(R) = B_t(R) - [T(B_t(R) + p_t) - T(p_t)] + p_t - T(p_t)$$

$$= B_t(R) - T(B_t(R) + p_t) + p_t$$

where retirement income in year t is $B_t(R)$, a function of the year of retirement R.

ASSUMPTIONS

We assume the following:

1. We are operating in a world with a piece-wise linear tax schedule.

2. For any year R, $B_R(R) < y_R$.
3. $V_t(R)$ is strictly concave with respect to R.
4. There exists a global maximum of $V_t(R)$ found at some optimal retirement year, R*.
5. $(y_{R^*} + p_{R^*})$ and $(B_{R^*}(R^*) + p_{R^*})$ are in the same tax bracket and neither lies near a kink point in the tax schedule, so that we can write $T(y_R + p_R) = a_0 + \tau(y_R + p_R - b_0)$ for the tax owed about $y_{R^*} + p_{R^*}$ and $T(B_{R^*}(R^*) + p_{R^*}) = a_0 + \tau(B_{R^*}(R^*) + p_{R^*} - b_0)$ for the tax owed about $B_{R^*}(R^*)$.
6. $0 < g < 1$.

THEOREM 1

Given these assumptions, the derivative of $V_t(R)$ with respect to τ is negative.

PROOF. Our goal with this proof is to show that if the tax rate (τ) increases, the optimal date of retirement (R^*) will decrease. This means the optimal date of retirement is earlier. The proof will proceed as follows: First, we will take the derivative of $V_t(R)$ with respect to R and find the resultant critical point, R^*. By assumption the function is concave, so this critical point is the global maximum. Second, we show that the derivative of $\frac{dV_t(R)}{dR}$ with respect to the tax rate, τ, evaluated at $R = R^*$ is negative.

First, by the second fundamental theorem of calculus:

$$\frac{dV_t(R)}{dR} = P_{R|t}\delta_t(R)\left[(y_R^*)^g - \left(B_R^*(R)\right)^g\right]$$

Note that $P_{R|t} > 0, \delta_t(R) > 0$ for all $R > t$. Therefore,

$$\frac{dV_t(R)}{dR} = 0 \iff (y_R^*)^g - \left(B_R^*(R)\right)^g = 0$$

$$\iff (y_R^*)^g = \left(B_R^*(R)\right)^g \iff y_R^* = B_R^*(R)$$

The last equality holds because $y_R^*, B_R^*(R) > 0$ for all R. By assumption, such a critical point exists. Call this critical point R^*. Then, by the above, $y_{R^*}^* = B_{R^*}^*(R^*)$. By assumption $V_t(R)$ is strictly concave; thus, $V_t(R^*)$ maximizes $V_t(R)$.

Next, we evaluate $\frac{dy_t^*}{d\tau}$ and $\frac{dB_t^*(R)}{d\tau}$. Recall

$$y_t^* = y_t k - T(y_t + p_t) + p_t$$

By assumption 5,

$$= (y_t k + p_t) - (a_0 + \tau(y_t + p_t - b_0))$$

Thus,

$$\frac{dy_t^*}{d\tau} = -(y_t + p_t - b_0)$$

By an equivalent argument,

$$\frac{\mathrm{d}B_t^*(R)}{\mathrm{d}\tau} = -(B_t(R) + p_t - b_0)$$

Let $V_t'(R) = \frac{\mathrm{d}V_t(R)}{\mathrm{dR}}$. Then

$$\frac{\mathrm{d}V_t'(R)}{\mathrm{d}\tau}|_{R=R^*} = P_{R^*|t}\delta_t(R^*)g[-(y_t + p_t - b_0)(y_{R^*}^*)^{g-1} + (B_t(R) + p_t - b_0)\left(B_{R^*}^*(R^*)\right)^{g-1}$$

Since $y_R^* = B_R^*(R)$

$$= P_{R^*|t}\delta_t(R^*)g(y_R^*)^{g-1}(\mathrm{B}_{R^*}(R^*) - \mathrm{y}_{R^*})$$

Because $P_{R^*|t} > 0, \delta_t(R^*), g, (y_{R^*}^*)^{g-1} > 0$ and $\mathrm{B}_{R^*}(R^*) < \mathrm{y}_{R^*}$, the above is less than 0. That is,

$$\frac{\mathrm{d}V_t'(R)}{\mathrm{d}\tau}|_{R=R^*} < 0$$

In other words, for any given situation there exists an optimal retirement time R^* that obtains when the derivative of the benefits function, $\frac{\mathrm{d}V_t(R)}{\mathrm{dR}}$, equals 0. Increasing the tax rate shifts the derivative of the benefits function evaluated at R^* left; consequently, $\frac{\mathrm{d}V_t(R)}{\mathrm{dR}}|_{R=R^*} < 0$ and R^* exceeds the maximum. In other words, increasing the tax rate shifts the optimal retirement date earlier.

Relaxing our assumption that the secondary earner's tax rate in retirement equals their tax rate out of retirement complicates our results. Suppose the benefits function reaches its maximum for a given piece-wise linear tax schedule $T(*)$ at R^*. Also, suppose that $(y_{R^*} + p_{R^*})$ and $(B_{R^*}(R^*) + p_{R^*})$ are in different brackets and that neither lies near a kink point in the tax schedule. It can be shown that the sign of the $\frac{\mathrm{d}V_t'(R)}{\mathrm{d}\tau}|_{R=R^*}$ depends on how much $(y_{R^*} + p_{R^*})$ and $(B_{R^*}(R^*) + p_{R^*})$ exceed their respective brackets. If $(y_{R^*} + p_{R^*})$ exceeds its bracket by the same or more than $(B_{R^*}(R^*) + p_{R^*})$ exceeds its bracket, then the above theorem holds. If $(y_{R^*} + p_{R^*})$ exceeds its bracket by less than $(B_{R^*}(R^*) + p_{R^*})$ exceeds its bracket, the sign of $\frac{\mathrm{d}V_t'(R)}{\mathrm{d}\tau}|_{R=R^*}$ is ambiguous.

APPENDIX B. CALCULATING AIME FROM TAX DATA

To calculate AIME from the tax data, we assume each taxpayer faces the normal Social Security calculation. For each individual in our sample, we calculate AIME from observed Social Security earnings in the first year he or she collected Social Security benefits. We then use this AIME for that taxpayer in each year in our sample, though this may present issues for taxpayers who continue to work after collecting benefits. In a given taxpayer's year of retirement, we rely on the following information to calculate AIME: amount of benefits received, earnings in that year, the year, and age. We also use supplementary data on average wage indexes, cost-of-living adjustments, and the full retirement age for the calculator's parameters. We ignore the month of birth and assume that everyone is born January 1 and retires January 1.

Under our simplified assumptions, for any given taxpayer, moving from AIME to Social Security benefits in the first year of collection is a bijective function from $\mathbb{R} \rightarrow \mathbb{R}$. Consequently, it can be inverted by stepping backwards from observed social security benefits to AIME. The unwinding consists of the following steps in the presented order:

1. Remove the decrease in benefits attributed to the earnings test.
2. Remove the cost-of-living adjustment.
3. Remove the smoothing effects from early or late retirement to arrive at the primary insurance amount (PIA).
4. Invert the PIA calculation.

Each step is explored in detail below.

Let

$$AWI_{yr} = AWI\ in\ year\ yr,$$

$$BEN = observed\ social\ security\ benefits,$$

$$EARN = earnings,$$

$$year = year,$$

$$age = age\ in\ years,$$

$$year60\ = year\ the\ person\ turned\ 60,$$

$$yearBorn = year\ the\ person\ was\ born,$$

$$fullRetirementAge = full\ retirement\ age\ for\ the\ person\ in\ months,$$

$$nMonthsEarly = the\ number\ of\ months\ before\ the\ full\ retirement\ age,$$

$$nMonthsLate = the\ number\ of\ months\ after\ the\ full\ retirement\ age,$$

$$round_x(*) =\ round * to\ the\ nearest\ x\ .$$

Step 1. Remove the decrease in benefits attributed to the earnings test

The social security earnings test only applies to people who retire before their full retirement age. Furthermore, there are separate rules for those retiring in the year of their full retirement age.

For those retiring before the year of their full retirement age, the earnings test reduces their social security benefits by half the amount that earnings exceed a floor, called the exemptAmt:

$$exemptAmt = round_{10}\left(670 * \frac{AWI_{yr-2}}{AWI_{1992}}\right) * 12$$

$$earningsLim = \max(0, (EARN - exemptAmt))$$

For those retiring early in the year of their full retirement age, the earnings test reduces their social security benefits by half the amount that earnings exceed a floor, called the exemptAmt:

$$exemptAmt = round_{10}\left(1420 * \frac{AWI_{yr-2}}{AWI_{2000}}\right) * 12$$

$$earningsLim = \max(0, (EARN - exemptAmt))$$

To take out the effect of the limitation:

$$BEN_1 = BEN + earningsLim.$$

Step 2: Remove the cost-of-living adjustment

The total cost of living adjustment, or $colaAdj$, is the product of the adjustment each year between the year the taxpayer turned 62 and $year$. To take out the effect of the COLA:

$$BEN_2 = \frac{BEN_1}{colaAdj}.$$

Step 3: Remove the smoothing effects from early or late retirement to arrive at the PIA

Benefits are reduced by $\frac{5}{9}$ of 1 percentage point for each of the 36 months prior to the full retirement age and $\frac{5}{12}$ of 1 percentage point for each month before then:

$$reduct = \min(36, nMonthsEearly) * \frac{5}{9} + \max(0, nMonthsEarly - 36) * \frac{5}{12}.$$

Benefits are increased by 8 percentage points for each year after reaching full retirement age until age 70:

$$inc = \max(0, \min(age, 70) - fullRetAge) * 8.$$

Thus, to back out the smoothing effects from early or late retirement, let

$$BEN_3 = BEN_2/(1 + \frac{inc - reduct}{100}).$$

Step 4: Invert the PIA calculation

BEN_3 is the PIA. The PIA formula contains 90 percent, 32 percent, and 15 percent brackets with two bend points. The two bend points are

$$bend_1 = round_1(180 * \frac{AWI_{year60}}{AWI_{1977}})$$

$$bend_2 = round_1(1085 * \frac{AWI_{year60}}{AWI_{1977}})$$

Therefore, the maximum PIA calculated in the first two brackets is

$$PIA_{bend_1} = bend_1 * 0.9$$

$$PIA_{bend_2} = PIA_{bend_1} + (bend_2 - bend_1) * 0.32$$

Finally, we calculate AIME:

$$AIME = \begin{cases} \dfrac{BEN_3}{0.9}, & BEN_3 < PIA_{bend_1} \\ \dfrac{BEN_3 - PIA_{bend_1}}{0.32} + bend_1, & BEN_3 < PIA_{bend_2} \\ \dfrac{BEN_3 - PIA_{bend_2}}{0.15} + bend_2, & BEN_3 > PIA_{bend_2} \end{cases}$$

NOTES

[1] By deciding to include only person-year observations with recorded wages from the prior two periods, we must also exclude observations with gaps in their IRS records in the prior two years. If a person filed returns two years ago and this year, he or she would have a gap in his or her wage history and would be excluded in year t. However, he or she could be included in the sample in some later year.

[2] In our analyses we impose both the restrictions necessary to sort spouses by their AIME and the restrictions necessary to sort spouses by their wage, which reduces the sample size more than necessary for analysis of either group. We test the effect of separately imposing the necessary restrictions and find that our conclusions are quantitatively very similar and qualitatively identical.

[3] We assume that all individuals share a single correlation parameter. This is the same assumption used in a random effects probit, although in the literature on generalized estimation equations, it is known as the exchangeable working correlation matrix assumption.

[4] Giertz (2007) raises the possibility that the state rate faced by a taxpayer may be endogenous to some degree because of migration across states but finds that there is little, if any, effect on elasticity estimates.

[5] For all logged income variables, we include a dummy variable equal to 1 if the income variable is equal to 0. Often times, this dummy variable is perfectly collinear with other dummy variables, in which case we omit the dummy variables.

[6] Recall that these rates are based on tax laws in year t and inflated income from year t-2.

[7] These same trends in effective tax rates and the count of our sample with working spouses holds equally well for the AIME definition of primary and secondary workers.

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