The Impacts of Increasing Social Security Retirement Ages: Varied Responses Across Occupations

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Abstract: With U.S. Social Security payments to retirees now exceeding the payroll taxes that fund them, reforms are imminent. Further increasing the Social Security retirement age is one possible approach among many possibilities to achieve solvency. This paper considers the effects such a policy change would have on work, claiming, disability, and welfare across people in different occupations. Using data from the Health and Retirement Study (HRS), I show that past reforms were responded to differently by blue- and white-collar workers and estimate a dynamic model of work, savings, and decisions about Social Security under various existing and counterfactual Social Security rules. I find that increasing the Early Eligibility Age has large labor supply and disutility effects for blue-collar workers, and results in greater SSDI application and SSI eligibility for this group. This is driven primarily by those in blue-collar work having more steeply declining productivity with age and less margin on which to respond to policy changes. Increasing the Full Retirement Age affects the labor supply of white-collar workers but not blue-collar, however it does increase the savings somewhat for all. Finally, I show the effects of a more occupation-neutral Social Security policy design, which considers longer years of work history in benefit calculations. More generally, this study demonstrates the importance of incorporating preference and state heterogeneity in both predicting responses and measuring distributional welfare effects across policies: In this case, compared to a model of heterogeneous agents, a model with representative preferences and occupations overstates fiscal costs and understates average welfare reductions resulting from increases to Social Security retirement ages.

JEL Classifications: H55 (Social Security and Public Pensions), J14 (Economics of the Elderly; Economics of the Handicapped; Non-labor Market Discrimination), J26 (Retirement; Retirement Policies), J32 (Non-wage Labor Costs and Benefits; Retirement Plans; Private Pensions)

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1. Introduction

There have been significant increases in life expectancy in the United States, and this, coupled with declines in fertility and the "pay-as-you-go" design of Social Security old-age benefits, has led to the program's expenditures now exceeding revenues. Reserve funds that have been making up the difference between taxes and expenditures are projected to be depleted by 2033.[1] Under current law, without reforms, the amount payable to beneficiaries would decrease by nearly 20 percent—equal to the shortfall in expected payroll taxes and benefit obligations at that time—affecting over 60 million retired and disabled workers, spouses of retired workers, and survivors of deceased workers.

To improve the solvency of the program, increases to the Full Retirement Age (FRA) for claiming OASI benefits have already been implemented. Further increasing the FRA—or even the Early Eligibility Age (EEA)—is, among many reform possibilities, one conceivable way of ensuring the program's continued solvency. Although controversial, that rationale is that life expectancy in increases and compression of morbidity allow for both longer working lives and many years in retirement. One concern is that there are many notable patterns in retirement, disability, and saving behavior that differ across occupations. Intuitively, as this it is not a consideration in current or proposed policy design, differences would likely mean that such policy changes are not neutral across occupations. Given this, what would be the effects of such policy that increases either the EEA or FRA?

This paper takes a life-cycle perspective to study how the interactions among labor supply decisions, health, and Social Security vary across occupations through both observed differences in responses to past increases in FRA as well as a dynamic model to predict a number of responses to hypothetical future changes to the FRA and EEA. It captures heterogeneity in a number of areas, especially occupations. The model is estimated using data from the Health and Retirement Study (HRS) and O*NET data on occupational tasks to capture patterns in labor supply, saving, and OASDI program behavior for broadly defined occupations. The model is validated through matching the differences before and after FRA increases that have occurred in the past, in addition to numerous observed behaviors for HRS respondents.

In addition to this, I compare these results to a model with homogeneous preferences, and show how predictions of responses to policy and welfare changes are sensitive to these choices. In this case, homogeneous overstate the fiscal costs of increasing Social Security retirement ages, but also understate the reduction in overall welfare. Together, these methods help us understand the varied responses to past Social Security policy changes, and estimate and assess likely responses to policies not yet implemented.

This work aims to address three distinct but interrelated questions, all taking a dynamic, life-cycle approach emphasizing the role of occupations in later-life labor supply and the impact of Social Security OASI and DI. Accordingly, the literature this study builds on falls under three broad categories.

Retirement and occupations. The role of occupations and job tasks are a prominent part of this

[1] Expenditures have exceeded payroll tax and interest income since 2021, and the SSA Office of the Chief Actuary projects that the OASI Trust Fund will be depleted in 2033 the 2024 OASDI Trustees Report Social Security Trustees (2024).

study, and is part of a literature that looks at the role of jobs in retirement. A person can respond to increases in these claiming ages by saving more before leaving work to fund more non-work years before claiming FRA benefits, claiming early and reduced benefits, and working longer. Generally, compared to otherwise similar people who have worked in "white-collar" jobs, those in "blue-collar" jobs tend to retire earlier, save less, claim Social Security retirement benefits earlier, and are more likely to apply for and receive Disability Insurance (SSDI) benefits. Because of differences in productivity and labor supply patterns at older ages for people in blue-collar and white-collar occupations, however, we might expect the response to this policy change to differ among these groups. Earlier work includes Hayward et al. (1989), who investigates the effects of occupational characteristics on retirement, disability, and mortality, highlighting the independent role of occupational status in shaping these transitions. Chirikos and Nestel (1991), Engelman and Jackson (2015), and Rutledge et al. (2017)) study the ability of men to delay retirement and the impact of having physical demands, job stress, health, and flexibility on retirement behavior. More recently, Hudomiet et al. (2021) explores the effects of job characteristics on retirement preferences and expectations, emphasizing the importance of flexible work arrangements in influencing retirement decisions within the U.S., while Sauré et al. (2023) explores how occupations shape retirement behavior across different countries. Two studies that incorporate this include Jacobs (2023) on disability insurance across occupations and its influence on occupational choice and retirement behavior and Páez (2023), who studies the contribution of shifts in occupation characteristics to increased labor force participation among older Americans.

Social Security claiming behavior. The first set of literature looks primarily at labor supply and utility responses to changes in the OASI claiming age structure, including Behaghel and Blau (2012), Gustman and Steinmeier (2015), van der Klaauw and Wolpin (2008), and Staubli and Zweimüller (2013). Because the emphasis in this paper is how these responses vary by occupation, I will incorporate literature on the capacity to work at older ages Coile and Milligan (2017), and Cutler et al. (2013)) as well as work on later-life occupational differences in productivity (Chirikos and Nestel (1991), Hayward et al. (1989) , Hirsch et al. (2000), and Modrek and Cullen (2012)). Several papers, including Rust and Phelan (1997) have noted and sought to explain through structural models the large spike in both retirement from work and OASI claims at age 62. I find that this is EEA claiming is especially common for blue-collar (BC) workers. Gustman and Steinmeier (2015) explain this through time preferences, but another aspect when considering occupations as in this paper is that BC workers, even with the same time preferences, face more steeply declining productivity (which is captured here). My aim is to enhance existing research by measuring the variation in effects across the population by studying the welfare effects of the existing increases in OASI claiming ages and predicting how labor supply changes in response for people across occupations.

Modeling health, work and savings decisions to estimate the effects of policy. Methodologically, this work will model older-age dynamic decisions similarly to French (2005) and French and Jones (2011), with the added dimension of occupations and disability. I compare with estimates of Mastrobuoni (2009) on the effects of existing increases in the FRA, and compare this to Gustman and Steinmeier (2005) and Gustman and Steinmeier (2015), who develop a structural model of retirement and wealth incorporating features of the early retirement age in Social Security. By constructing a parameterized model of behavior, we can estimate what behavior would look like

under counterfactual scenarios and policies and decompose the channels through which declines in health affect the decisions of a heterogeneous set of individuals—decisions which constitute any larger trends of interest. Predicting responses to policies that have not yet been implemented cannot be readily done through non-structural methods, which are better equipped to assess responses to in-place policies. The counterfactual policies addressed in this paper are increases to the OASI EEA, which is currently 62, and the FRA, which is between 65–67 depending on one's year of birth. The simulated behavior of interest under these scenarios are (1) differences between people in blue-collar and white-collar jobs in the labor supply and utility responses to changes in the claiming ages, and (2) the interaction between increases in claiming ages and SSDI applications in different occupations.

Though the simulated counterfactual policy, I predict what the effects within the model will be on SSDI utilization for people in different occupations if the OASI claiming age were to change. One hypothesis of this paper is that while the aggregate change in DI utilization may be small, the response is potentially significant for those in more physically intense, blue-collar jobs. Because productivity in their work declines on average more quickly with age, they are less able to bridge the gap between when they otherwise would have stopped working and the new, higher EEA and FRA by working more years. Because that channel is less feasible for them, DI looks even more attractive to those blue- collar workers compared to white-collar workers. Many researchers have studied the interaction between the OASI FRA and SSDI, including Coe and Haverstick (2010), Duggan et al. (2007), and Li and Maestas (2008). This study is novel in two ways: Firstly, it will focus on the differential interaction effect over occupations. Secondly, this research will use structural modeling methods to address the question. Using this approach, this tells us the relative magnitude of and identifies the mechanisms through which responses vary for people in different occupations. Making these mechanisms clear can inform design of policy and expectations about how well policy changes are received among different populations.

2. Background on Social Security, Past Reforms, and Related Studies

2.1. Social Security Retirement Benefits

Social Security retirement benefits are administered by the Social Security Administration, and are the "old-age" component of the larger Old-Age, Survivor's, and Disability Insurance (OASDI) program. They began as part of the Social Security Act to reduce poverty among senior citizens, with the first payouts for retirement benefits coming in 1938. Currently, nearly all workers—over 90 percent—are in "covered" employment and pay payroll taxes and can expect to receive retirement old age benefits upon claiming. These benefits can be claimed between the ages of 62 and 70 and the amount that one receives is dependent on this cleaning age, their birth year and be full retirement age for their birth year, and their taxed earnings history. The normal or Full Retirement Age (FRA) depends on one's birth year; it varies between 65 (for those born before 1938) and 67 (for anyone born 1960 or after). The later a person claims these benefits, the more that they will receive up until their death.[2] The average monthly benefit amount in 2024 for a retired worker is

[2]For a married person, he or she can claim retirement benefits based off of their own earnings history or, if it is higher, up to half of what their spouse's benefit level. In the event of an insured worker's death, their spouse would receive survivors benefits that are at least 71.5 percent of what their spouse's benefits would be if the spouse had

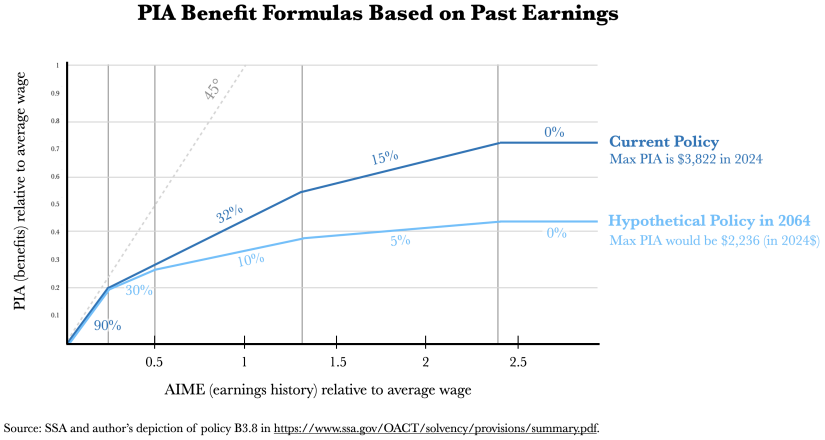


FIGURE 1: [earnings-benefits example] and [bend point graph]

about $1,900, and the number of recipients—including workers and spouses—is about 53 million.[3]

The payroll tax that finances OASDI comes as a 12.4 percent tax on earnings below some threshold for most classes of employees, with half paid by the employer and the other half by the employee. While there is not a separate financial account tied to each worker, the worker's earnings history, adjusted for growth in wages—the Average Indexed Monthly Earnings or AIME—will determine the amount paid out at various claiming ages, with the Primary Insurance Amount (PIA) the monthly benefit a worker receives at his or her FRA. The benefit formula is progressive in the sense that higher earnings do result in higher benefits, but increases in benefits are not proportionate to the amount taxed or earned.

While the Social Security benefit structure does not determine work decisions, it does influence labor force participation at older ages. This, as well as the question of how people decide when to claim Social Security benefits is the subject of numerous studies. Slavov (2023) gives an overview and documents changes in Social Security claiming behavior over two decades, considering factors such as delayed retirement credits, mortality improvements, and interest rates, and discusses the impact on optimal claiming decisions. Kopczuk and Song (2008) shows how Social Security benefit claiming has responded to changes in benefit taxation.

While U.S. Social Security influences work decisions—primarily through (1) the delay of benefit taxation while working and claiming and (2) increased benefits with delaying claiming—in other national systems the disincentive to work and claim is stronger, and to claim benefits almost necessarily implies stopping paid work. Kuitto and Helmdag (2021) shows how macro-level institutional factors shape retirement and labor market participation among older workers across OECD countries. This is in contrast to studies of responses to Social Security changes in the U.S, where responses in work are less pronounced.[4]

claimed at their full retirement age.

[3] https://www.ssa.gov/oact/STATS/OAbenies.html

[4] For example, Dolls and Krolage (2023), Rabaté et al. (2024), and Lalive et al. (2023) all show significant employment effects and employer influences across Europe.

2.2. Relationship to Disability Insurance

Social Security Disability Insurance (SSDI) provides benefits in the event that someone becomes significantly and permanently limited in performing paid work. It is administratively linked to old-age retirement benefits as part of OASDI program, and retirement benefits and Disability Insurance also share a common Primary Insurance Amount (PIA) formula based on past earnings history. Unlike retirement benefits, where approval is automatic upon verification of age and past contributions, SSDI approval is not guaranteed and is part of a longer determination process. The amount of retirement benefits received is also determined by claiming age (where approval is certain), where the amount is lower the earlier one claims. The SSDI benefits that awardees receive, on the other hand, are equal to benefits one would receive if claiming at his or her full retirement age. There are currently about 8.5 million recipients and dependents.[5]

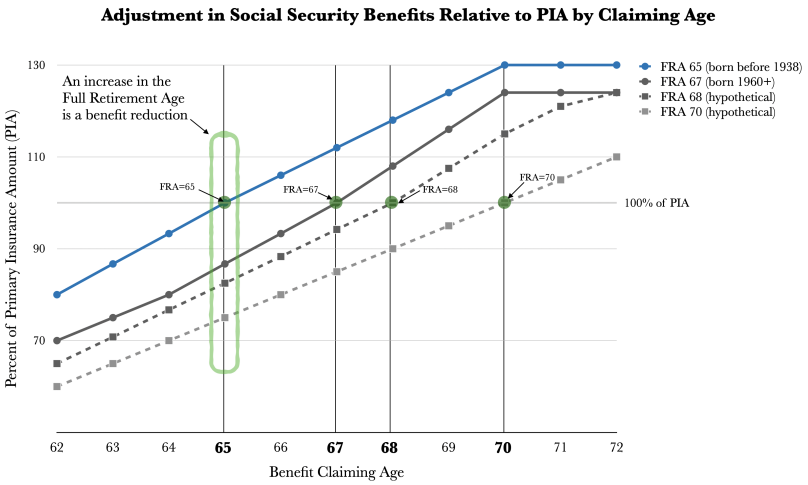
Increases to the full retirement age (FRA) for old-age retirement benefits also change the relative value of prospective SSDI benefits, which is an aspect I consider in this paper. Many researchers have studied how increases in the FRA and retirement benefit generosity interact with enrollment in the SSDI program, including Duggan et al. (2007), Li and Maestas (2008), and Coe and Haverstick (2010). To illustrate how this interaction operates, it is helpful to consider an example: Imagine a person whose earnings history corresponds to a PIA—what she would receive at her Full Retirement Age (FRA)—of $2,000. If she were to become disabled at age 61 and is approved for SSDI, she would receive the full $2,000 monthly benefit starting at age 61. However, SSDI approval is uncertain, and the process can be lengthy, requiring the applicant to demonstrate they have not engaged in substantial paid work during the application process. This uncertainty may lead her to compare the risks of applying for SSDI with the more predictable option of claiming early retirement benefits, even at a reduced rate. If she faces an FRA of 65, she could claim early retirement benefits at age 62, receiving 80 percent of her PIA, or $1,600 per month. This permanent monthly $400 reduction may be preferred to the risks associated with applying for SSDI, even if the potential benefit of $2,000 if awarded is higher. On the other hand, if her birth year is such that her FRA is 67, she would receive only 70 percent of her PIA by claiming retirement benefits at 62, or $1,400. With this larger permanent reduction of $600, she might choose to take the risk of not working, applying for SSDI, and possibly receiving $2,000 per month if awarded. So as the FRA increases, SSDI becomes relatively more valuable, even if uncertain.

This is particularly relevant for individuals in more physically demanding jobs, where the ability to continue working often declines more quickly with age, an aspect of this interaction that I study here. For the person in a more physically demanding job, the option of continuing work in some capacity is further limited, and the value of SSDI is that much greater with increases in the FRA.

2.3. Reforms Increasing the Full Retirement Age

There have been several amendments to Social Security in the decades following its inception, with the most recent being in 1983. Changes were aimed primarily at addressing near- and long-term solvency and included adjustments to payroll and benefit taxes, coverage, and, central to this paper, the increase in the full retirement age. Social Security is "self-funded" and benefits are financed legally by revenue from payroll taxes only. At the time of these reforms, Social Security

[5] https://www.ssa.gov/oact/STATS/DIbenies.html



Source: SSA and author's depiction of hypothetical increases in the FRA.

FIGURE 2: [claiming age and benefit comparison table]

was within a year of insolvency, obligated benefits to retirees would exceed the contemporaneous payroll taxes of workers. The deficit would only grow due to demographic changes of reduced fertility, leading to fewer workers relative to retired beneficiaries, who have increased average life expectancy. The reforms made the program immediately solvent, and excess revenues even ensured a growing Social Security Trust Fund to cover future deficits for some time. Indeed, since 2021, benefits paid out have exceeded payroll tax revenues, and this difference has been covered by Trust Fund reserves. These funds are projected to be depleted by 2034, making future reforms imminent.

The 1983 reforms increased the Full Retirement Age (FRA) from 65 to 67 gradually, and depending on birth year, for all workers born in 1938 or later. While one can still claim benefits as early as age 62, an increase in the FRA changes the age at which unreduced benefits relative to one's PIA can be claimed. While increases in the FRA are equivalent to benefit cuts along all claiming ages, the FRA appears to remain a powerful reference point in claiming decisions. Deshpande et al. (2024) show that peak claiming tracks increases in the FRA, despite the adjustments relative to the FRA remaining linear; work decisions, however, are "sticky" at the old FRA due to employer pension effects and workplace norms. Others emphasizing reference points, with coupling of work choices being stronger outside US: Behaghel and Blau (2012) study framing effects in retirement behavior following changes in the full retirement age, revealing evidence of reference dependence with loss aversion. Siebold (2021) similarly shows the role of statutory retirement ages as reference points for retirement behavior and how pension reforms affecting these ages influences retirement decisions.

Below, I will show the effects in particular that these increases in the normal retirement age have had on people in different occupations. This is the primary motivation for the model, which is to predict the effects of potential future increases in the normal retirement age on people in different occupations.

3. Work, Retirement, and Social Security in the Health and Retirement Study Data

3.1. Blue- and White-Collar Workers in the HRS.

The primary data source here is the Health and Retirement Study (HRS). The HRS is a biennial panel data set of Americans over age 50 and their spouses, with rich information on health, savings and income, work, program participation, family, and many other factors. Its panel aspect is useful particularly for the understanding the dynamic processes of health, savings, and labor supply decisions central to the work proposed in this study. I also employ restricted-access variables on detailed occupations and Social Security earnings records to calculate expected OASI and SSDI benefits. The detailed occupations are then linked with O*NET data on occupational tasks to separate occupations in to more physically intense, *blue-collar*, and less physically intense, *white-collar* occupations. In particular, through linking the detailed occupational data in the HRS to O*NET, I create an indexed measure of the degree to which physical input is required for an occupation, which is a primary dimension along which retirement timing and OASDI program participation vary.[6]

The subset of the HRS respondents studied here includes 5,631 males born between 1931–1950, in biennial interview years ranging from 1992 to 2018.[7] Nearly all respondents are observed for more than one interview or wave of the data, resulting in 45,866 person-years, with an average age of 65.5 when surveyed. Table 1 gives a summary of of some characteristics of the sample.

The main focus of this paper is that many outcomes the differ for those in blue-collar and white-collar work, including differences in labor supply at older ages, the timing of OASI claiming, savings behavior, and rates of disability. This has implications for the response to any changes in the Social Security retirement program structure.

Beginning with the labor supply differences, the HRS interviews, for the majority of the sample respondents, span both working and entry into retirement given the average age at interview of 65.5. Figure **??** presents labor force behavior of the sample by broadly defined occupation. Overall, labor force participation, defined as "working for pay" at the time of the interview (as well as reporting positive earnings and working for more than five hours per week), declines rapidly from age 60 on. Also striking is the difference in work behavior between those in blue-collar and white-collar jobs. For all ages, the percent of those working whose career is in blue-collar work is lower at all ages, and by age 66, for instance, those in white-collar occupations are about 50 percent more likely to be working for pay compared to those in blue-collar jobs (around 45 versus 30 percent).[8] While some of this difference in work behavior is due to earnings levels across the occupations (those with lower

[6] More details are included in Appendix **??**.

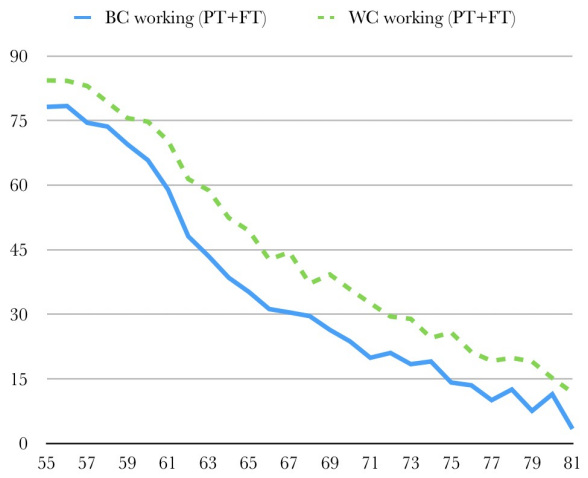
[7] The rationale behind restricting the sample presented here to males has two related rationales. The first is that, when estimating a model of behavior, the more similar the individuals are in preferences, the more precisely the model can be estimated. The men and women, especially of the birth-year cohorts analyzed here, have very different labor supply patterns suggests that their preferences might differ enough to justify separate models of decision making or joint household decisions with bargaining, for instance (e.g., Cassanova 2014). A related reason is that a large enough portion of married males have spouses who are not working when first observed in the HRS data, making the male respondent's decisions reflect the outcome of a joint household decision. Of those who are married, 54.3% have a spouse working FT when first observed (and are excluded from the parameter estimation).

[8] Also, while not shown in this graph, of those who are working at all, the share who report working part-time hours increases from about 5 percent at age 50 to well over half working part-time beyond age 70. Of those who are working, the proportion working part-time is roughly the same across occupations.

TABLE 1: *HRS Sample Respondents, Males*

Variable:	
Sample Size	5,631
Person-Years	45,866
Birth Years	1924–47
Average Age Observed in HRS	65.5
Marital Status (first observed)	84.6%
If married, % Spouse Working	54.3%
Occupation	53.3% BC, 46.7% WC
Education Category	
Less than HS	23.4%
HS or GED	35.5
Some College	19.6
College and Above	21.5

Percent in Labor Force by Age



earnings levels have somewhat earlier retirement regardless of job type), the relevant difference here is the extent to which this is driven by more steeply declining productivity in blue-collar work, as well as potentially greater disutility from working in blue-collar jobs with age or poor health.

Another difference to note among those whose work is in blue- versus white-collar jobs is the difference in assets held. Overall, even controlling for typical income, those working in white-collar jobs have significantly higher levels of savings. Table 2 specifically presents the savings behavior of the sample by occupation and earnings. As is typical for measures of wealth, the distribution is highly skewed, leading to the mean being much greater than the median. With BC workers in the upper and WC workers in the lower panel, the table shows the mean, median, and median level relative to typical income of non-housing financial assets when aged 55-59. It is divided up by typical income quintiles over all sample respondents, which is determined by annual income from work while observed as a respondent in the HRS while ages 50-59. Focusing on the middle (Third) quintile, for instance, despite blue- and while-collar workers having the same range of typical

income, mean financial assets are about $71K versus $96K, and the median assets similarly differ at $17K versus $29K. These differences conditional on income suggest that there may perhaps be very different average time preferences, levels of risk aversion, or other preferences across the two groups.

Another aspect of the data which differs between those in different broad occupations is in limitations to work due to health as well as SSDI application and receipt. Table 3 shows these patterns. For a given age, BC workers are far more likely to say that their health limits their work. In the first row of the table we see that among those ages 55-59, 27.3 percent of BC workers say that their health limits their work compared to 15.5 percent of WC workers, which is significant considering there is not a large difference in levels of health between the groups. Furthermore, the health limitation is more likely to prohibit work altogether for BC workers, as only about 34 percent work despite the presence of a health limitation compared to the 46 percent of WC workers who remain in work.

The same differences in health limitations to work also translate to differences in SSDI application and receipt. Nearly a quarter of the sample with a blue-collar occupation have applied for SSDI compared to under 11 percent of those in white-collar occupations.[9] At the time the respondents were age 60–64, about 12 percent of BC workers and 5 percent of WC workers were receiving SSDI benefits. While some of these differences may arise due to SSDI benefits looking relatively more attractive to BC workers, who have somewhat lower earnings overall, the effect, though diminished, remains when controlling for income. In any case, taking into account the differences between these occupations will be central to estimating how SSDI enrollment would change in response to changes in Social Security retirement benefits through increases in the Full Retirement Age.

TABLE 2: *Savings Behavior*

Non-Housing Assets (by income quintile for mean earnings ages 55-59)			
	Asset Mean ($)	Asset Median ($)	Rel. to Income
BC:			
Lowest Fifth	$16,998 (80,598)	$30	0.00
Second	32,875 (107,581)	5,932	0.16
Third	71,114 (267,071)	16,949	0.32
Fourth	88,607 (173,630)	33,333	0.45
Highest Fifth	146,572 (659,363)	29,710	0.28
WC:			
Lowest Fifth	81,308 (236,860)	11,276	0.61
Second	77,319 (278,478)	11,111	0.28
Third	96,203 (371,696)	28,813	0.54
Fourth	232,707 (1,390,846)	50,741	0.67
Highest Fifth	455,927 (1,987,947)	111,818	0.80

[9]This does not mean that only fewer than 50 percent of the SSDI applications were successful, as those who are observed in the HRS during ages 60–64 are selected on having survived to that age, which is less likely for someone receiving SSDI.

TABLE 3: *Health Limitations and SSDI Behavior*

SSDI Claiming	BC	WC
Health limits work (ages 55-59)	27.3%	15.5%
Working with health limitation	33.7%	45.6%
SSDI Application Ever	24.8%	10.6%
Current SSDI Receipt, ages 60–64	12.1%	4.9%

3.2. Changes in Claiming Ages Following Past Reforms

Another way in which those in BC versus WC jobs differ is in their timing of Social Security OASI benefit claiming. The *Early Eligibility Age* (EEA) is 62 for all birth years, while the *Normal* or *Full Retirement Age* (FRA) is exactly 65 for much of the sample (born before 1938) and between 65 and 66 for those with later birth years.[10] Monthly benefits—the *primary insurance amount* or PIA—are determined based on earnings histories and are relative to the FRA. While a person can claim benefits as early as the EEA of 62, it is costly as monthly benefit amount is permanently lowered the earlier one claims. Claiming at the EEA of 62, there is a 20 percent reduction in benefits for those with and FRA of 65, and a 25 percent reduction for an FRA of 66. As shown in Figure 2 above, claiming later results in higher benefits.

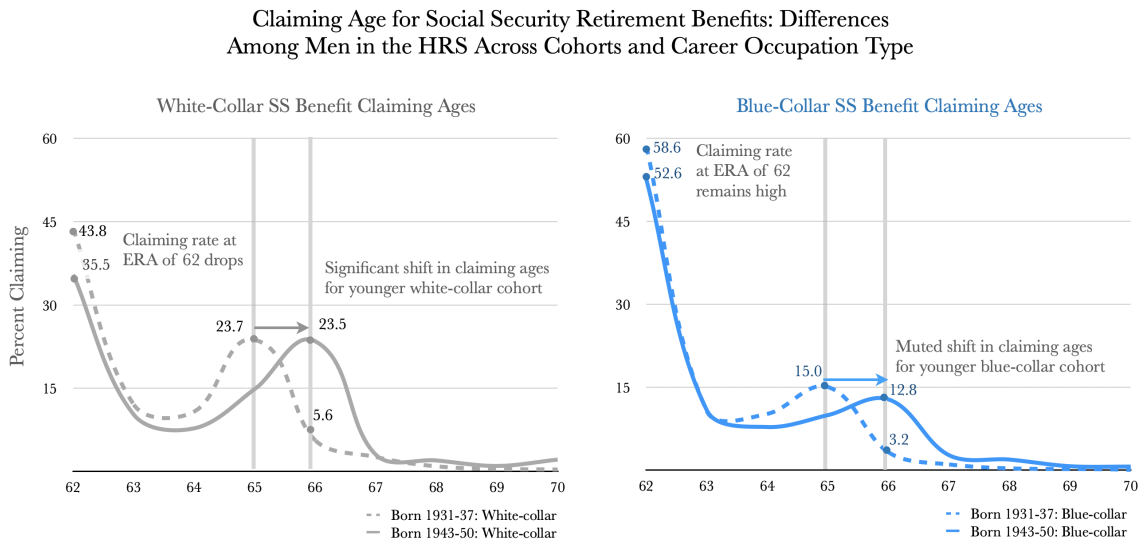
Claiming Social Security Retirement benefits at the earliest age possible is more common for those in blue-collar jobs, where as claiming at the FRA is significantly more common for white-collar workers. Figure 3 presents the OASI behavior of the sample by occupation and earnings. This may be for a number of reasons, including liquidity constraints, differences in risk aversion or patience levels, earnings paths, disutility form work with age, and mortality expectations—all of which would have slightly different implications for counterfactual policies and with many being of primary interest here. Among white-collar workers there was a large shift in the claiming age from 65 to 66 corresponding to the increase the FRA; fewer claimed at 62 as doing so because even more costly. For blue-collar workers, the response was muted: There was a reduction, but many remained claiming at age 62. The peak claiming at their FRA also shifted out, but with an even smaller share. The WC distribution of earnings is slightly higher, but this difference does not account for differences in claiming. Controlling for income and other observables, those in BC remain much more likely to claim Social Security benefits at earlier ages. Notably, this excludes those who are already recipients of SSDI which those in blue-collar occupations are much more likely to receive (Table 3).

4. Modeling Work, Saving, and Social Security Claiming Choices

We found that *past* policy changes that increased the FRA affecting those in blue- and white-collar occupations differently in the HRS sample. To predict responses to a potential *future* policy changes, I estimate a dynamic model of behavior of the mechanisms underlying the decisions ob-

[10] Please see Appendix **??** for more discussion of claiming ages and how benefits are calculated.

FIGURE 3: *OASI Benefit Claiming Ages by Occupation*



Note: 32,475 person-years.

served in the HRS data under existing policies and use the model to simulate decisions under counterfactual Social Security policies. Along with studying the effects of hypothetical policies, this approach also has the benefit of gauging relative changes in welfare, which may be of interest in its own right and also in getting a sense of the political feasibility and distributional desirability of prospective policy changes. Along with studying the effects of hypothetical policies, this approach also has the benefit of gauging relative changes in welfare, which may be of interest in its own right and also in getting a sense of the political feasibility and distributional desirability of prospective policy changes.

In this model of behavior, individuals are making annual choices about work, savings, Social Security OASI claiming and DI applications. People will differ in number of ways, in both state variables or background and preferences—most notably in that they work in either blue- or white-collar occupations.

The features of the data presented in Section 3 motivate this model of decision making in later life. The structural estimation of this model involves finding the parameters of the model that generate simulated agents who most closely replicate the behavior of real people observed in the HRS data. After estimating the parameters of this model, the parameterized model will be used to measure work, savings, Social Security claiming, and welfare changes under alternative policy scenarios where the EEA and FRA are increased.

4.1. The Individual's Problem: Occupation, Labor Supply, Savings, and Social Security Application Decisions

This builds on dynamic choice models in the retirement literature and is in line with French (2005), French and Jones (2011), Gustman and Steinmeier (2015), and Jacobs (2023).[11] Like all

[11] In Jacobs (2023), I consider the selection of occupation taking into account differences in later-life productivity, arguing that both the presence of DI and heterogeneous risk aversion levels matter for the early occupation choice,

others, it is designed to capture available decisions as realistically as possible, utilizing available data in estimation, while remaining analytically and computationally tractable. In the model, each individual begins making decisions annually from age 50 on, with a broad occupation they will remain in while working, an income history, and health status. Every annual period at time t, individuals make decisions about:

- Current-period labor supply: Individuals choose whether to not work, work part-time, or full-time. This is a simplification based on the observation that observed hours worked tend to be clustered around 1,000 and 2,000 hours annually. Participation is notated as $p_t \in \{0, PT, FT\}$.
- Consumption that period, c_t. This is by definition also the savings decision, with $c_t \leq A_t + y_t$, where A_t represents assets and y_t income in period t. Additionally consumption must be at least as great as a consumption floor made up of outside transfers, so that $g_t \leq c_t$. The constraint of no additional borrowing is imposed to reflect the presumed difficulty in obtaining uncollateralized loans at older ages, given the uncertain stream of income and there being no possibility of garnishing an individual's Social Security benefit payments.
- Whether to begin receiving OASI, if ages 62-70: $OASI_t^{app} \in \{0, 1\}$. OASI benefits depend on past contributions (a proportion of historical earnings), their year of birth as it determines their Full Retirement Age (FRA), and the age benefits are claimed.
- Whether to apply for SSDI if under their FRA: $DI_t^{app} \in \{0, 1\}$, which is received with some probability $p(DI_t^{rec}|DI_t^{app}, OCC_t, d_t) < 1$ that depends on occupation and functional limitation status, OCC_t and d_t, respectively (described below).

These decisions are summarized as $\mathcal{D}_t = \{p_t, c_t, OASI_t^{app}, DI_t^{app}\}$. All of these decisions are made given known current conditions—the is, the state space—for the current period t. The state variables at t are the individual's:

- Asset level, A_t, which includes all non-housing financial assets including pension estimates.
- Past income if working, y_{t-1} (varies by whether working part- or full-time).
- Current health status. This includes both overall, self reported health, $h_t \in \{good, bad\}$, and disability, as measured by existence functional limitation, $d_t \in \{0, 1\}$.
- OASI and SSDI status, which is whether they have already begun receiving in the past or not: $OASI_{t-1}^{rec} \in \{0, 1\}$ and $DI_{t-1}^{rec} \in \{0, 1\}$.
- Average Indexed Monthly Earnings, $AIME_t$, which is a function of past earnings which, along with their age relative to their FRA, determines the OASI and SSDI benefit level for an individual.
- Occupation, $OCC_t \in \{BC, WC\}$.

Vector $\mathcal{S}_t = \{A_t, y_{t-1}, h_t, d_t, OASI_{t-1}^{rec}, DI_{t-1}^{rec}, AIME_t, OCC_t\}$ represents the state space at period t. Individuals make these decisions with uncertainty over a number of state variables looking forward, knowing the distribution but not the future outcome. These are:

- Future health, including overall and functional limitations (disability), h_{t+1} and d_{t+1}. Both of these are a function of current health statuses and age.

savings, labor supply decisions. The model estimated in this work takes prior occupation choices as not affected by the counterfactual changes in OASI policy of interest here, and targets claiming ages under different FRA policies as moments to match.

- Income if working in period t, y_t, which depends on past income y_{t-1}, current wage, occupation, health statuses, and age.
- Whether the individual will receive benefits applying for SSDI, which depends on occupation and function limitations: $p(DI_t^{rec}|DI_t^{app}, OCC_t, d_t) < 1$.

The individual's continuation value for decisions $\mathcal{D}_t$ at time t, given state space $\mathcal{S}_t$ is

$$V(\mathcal{S}_t) = \max_{\mathcal{D}_t} V(\mathcal{S}_t, \mathcal{D}_t) \tag{1}$$

where $V(\mathcal{S}_t, \mathcal{D}_t)$ includes the current period utility $u(\cdot)$ plus future discounted utility, which depends on survival $s(h_t, t)$:

$$V(\mathcal{S}_t, \mathcal{D}_t) = u(\cdot) + \beta \left[s(h_t, t) EV_{t+1}(\mathcal{S}_{t+1}) + (1 - s(h_t, t)) B(A_t) \right] , \tag{2}$$

with the future expected continuation value defined as

$$EV(\mathcal{S}_{t+1}) = \max_{\mathcal{D}_{t+1}} \int V(\mathcal{S}_{t+1}, \mathcal{D}_{t+1}, \epsilon_{t+1}) \, dF(\mathcal{S}_{t+1} \,|\, \mathcal{S}_t, \mathcal{D}_t) \, . \tag{3}$$

From equation (2), current period utility, which is specified below, will depend on current consumption, c_t, labor force participation, p_t, health, h_t, and whether one has applied for DI, DI_t^{app}. The future period is discounted at factor β; with probability $s(h_t, t)$ the person survives to the next period, otherwise he leaves a bequest over which he receives utility $B(A_t)$. The individual does not know what precisely health, disability, DI receipt, wage or survival status will be in the future periods, but does know the probability distribution conditional on current health status, age, wage, and occupation. These transition probabilities are described in detail in Appendix B.2. In practice, to calculate $EV(\mathcal{S}_{t+1})$ in equation (3), requires that for each alternative-specific shock vector ϵ, the sample mean of $\max_{\mathcal{D}_t} V(\mathcal{S}_t, \mathcal{D}_t)$ is used as an approximation.

Consumption c_t must satisfy the following budget constraint, with $Y(\cdot)$ being income that includes earnings from work and transfers:

$$c_t \leq \begin{cases} [1 + r(1-\tau)] \, A_t + Y(\cdot) & \text{if } \; A_t \geq 0 \\ Y(\cdot) & \text{if } \; A_t < 0 \end{cases}$$

so that in each period savings is allowed but additional borrowing is not. Assets evolve as follows:

$$A_{t+1} = [1 + r(1-\tau)] \, A_t + Y \left(w_t + g_t + OASI_{t-1}^{rec} + DI_t^{rec}, \boldsymbol{\tau} \right) - c_t \, ,$$

where r is interest earned on savings, τ is the tax on asset income, g_t is a consumption floor,[12] and $\boldsymbol{\tau}$ captures the income tax structure.

[12] This follows French and Jones (2011) and Hubbard et al. (1995), where outside transfers g_t provide a consumption floor with $c_t \geq \underline{c} > 0$: $g_t = \max\{0, \; \underline{c} - (A_t + Y_t(\cdot))\}$. As is discussed further below, consumption floor $\underline{c}$ is important for the identification of estimated risk aversion levels.

4.2. Preferences

Preference specification. Utility in time t is assumed to exhibit constant relative risk aversion (CRRA) and is specified by

$$u_t = u(c_t, L_t, p_t, \varepsilon_t) = \frac{1}{1-\eta}\left(c_t^{\alpha_c} L_t^{1-\alpha_c}\right)^{1-\eta} + \alpha_{X^{\mathcal{D}}}\varepsilon_t(\mathcal{D}_t)\,. \tag{4}$$

The weight on consumption relative to leisure is α_c, and η (with $\eta > 0$) measures the degree of curvature of the function from which we obtain measures of risk aversion and labor supply elasticity ($= 1/\eta$). Parameter vector $\alpha_{X^{\mathcal{D}}}$ weighs the preference shocks associated with decisions on occupation labor force participation, OASI or SSDI application, and consumption in that period. The utility costs of work, receiving SSDI, and performing work while in poor health enter through the leisure component of utility. A number of utility parameters come through the L_t leisure variable, which is given by

$$\begin{aligned} L_t =& L - N_t - \varphi_p \mathbb{1}_{\{p_t=1\}} - \varphi_{DI}\mathbb{1}_{\{DI_t^{app}=1\}} \\ &- \varphi_{BC,h^p}\mathbb{1}_{\{OCC=BC,\, h=\text{poor},\, p_t=1\}} - \varphi_{WC,h^p}\mathbb{1}_{\{OCC=WC,\, h=\text{poor},\, p_t=1\}} \end{aligned} \tag{5}$$

and is measured in hours. It enters utility as a function of total hours available, L, number of hours worked, N_t, and the psychic fixed costs—or possible benefits—of working (φ_p), receiving disability insurance benefits (φ_{DI}), working in a blue-collar job while in poor health (φ_{BC,h^p}), and working in a white-collar job while in poor health (φ_{WC,h^p}).[13]

If the individual does not survive to time t, which occurs with probability $1 - s(h_t, t)$, he gets utility from bequest

$$B(A_t) = \frac{\alpha_B (A_t + K_0)^{(1-\eta_B)\alpha_c}}{1-\eta_B}$$

and zero utility thereafter to age 95, with the functional form just as in French and Jones (2011). Here, α_B represents the utility weight on bequests and K_0 gives the extent to which bequests are a luxury good.[14]

To reflect population preference heterogeneity that underlies the variety of decisions we see in the data for people who look observationally similar, individuals can differ by type in preference parameters η (risk aversion) and φ_p (the fixed utility cost of performing work). Indeed, this preference heterogeneity plays an important role in matching observed work, savings, and OASI claiming behaviors. Table 7 summarizes the variables included in the model.

The preference parameters of the model are estimated in two main stages as in Gourinchas and Parker (2002), French and Jones (2011), and others. The first-stage estimates are of parameters that are not generated through the model but come from outside. These include the distributions and transition processes for earned income, health and disability, and survival—which are estimated from HRS data—and the rate of return on assets and the discount rate, which are taken from

[13] As an alternative to the consequences of working while poor health entering through leisure, in Jacobs (2014), the cost comes solely through the effect on wages, which similarly is allowed to differ depending on occupation. As poor health has larger estimated negative effects on wages for those in blue-collar jobs, we should expect estimates to be such that $\varphi_{BC,h^p} > \varphi_{WC,h^p}$.

[14] It is difficult to distinguish bequest motives from precautionary savings without K_0, which **?** use to measure the level of wealth at which savings can be interpreted as bequest motives as opposed to precautionary savings.

estimated in existing literature. These parameters are then transferred into the second stage of estimation.

In the second stage, the utility parameters are estimated along with the preference type prediction parameters through Simulated Method of Moments. Through this process, the parameters that generate simulated behavior that aligns most closely, in a *generalized method of moments* sense, with behavior observed in the Health and Retirement Study data for select data moments. The moments of the data that are matched and identify the parameters of the model include: Wealth, work decisions, Social Security retirement benefit claiming and DI application all by age and occupation. The age at which people who face different full-retirement ages choose to claim retirement benefits is a prominent set of data moments to match, as the primary counterfactual policies of interest are further increases in full-retirement claiming ages. The estimation procedure, identification and all data moments and results are described in greater detail in Appendices B and B.4.

4.3. Model Parameter Estimates

The results from the parameter estimation are presented in Table 4, where preference parameters shared across individuals are in the upper panel and those differing by type are in the power panel. Here I will briefly interpret the estimates, highlighting their sensitivity to specific modelling and data choices when relevant.

Beginning with the consumption weight α_c, it is, at .49, in the range of estimated from other estimated models; this measure might look higher if the behavior of interest was of somewhat younger men. The utility cost of work that varies with age, φ_p is 15. The interpretation of this is that as one ages, assuming health and other factors are unchanged, it feels *as if* one is experiencing 15 fewer hours of leisure each year. As mentioned earlier, this is one component of the model that brings about increasing exit from the labor force with age.

The utility costs of working in poor health in either occupation, φ_{BC,h^p} and φ_{WC,h^p}, which are identified by moments of exit from work of blue- and white-collar workers by age and health status, show that working in poor health is more costly when the work is in a blue collar job (as if there is 301 fewer hours of leisure to enjoy during the year). This is one part of the model, along with wages, that generates relatively earlier retirement for those in blue-collar jobs, all else equal. These results are most sensitive to the earnings profiles, which differ by occupation.

The bequest function parameter θ_b, the estimated weight placed on bequests, is somewhat lower than expected, though this may be a results of considering only non-housing financial assets, as housing is a major component of realized bequests. The bequest shifter K_0, at about \$212,000, represents the baseline level of assets for which assets beyond that can be assumed to be intentional bequests.

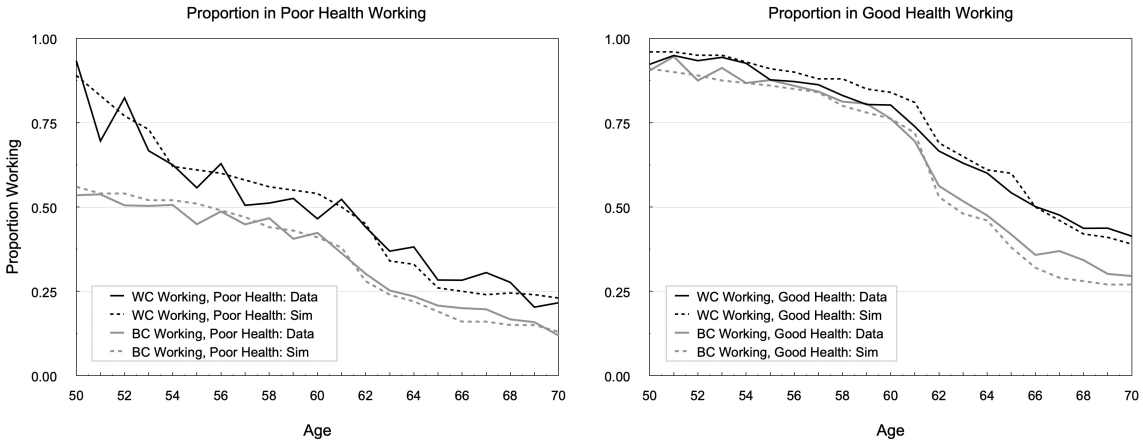
As for the shared preference parameters, the individual *Types* are distributed roughly evenly across high and low levels of risk aversion, with 47 percent predicted to have lower levels of risk aversion ($\eta = 2.67$) and 53 percent higher ($\eta = 5.02$). Risk aversion η levels are in some sense higher than anticipated given that the asset measure they are identified through—non-housing financial assets—would tend to show lower risk aversion than, say, assets with housing included. However this is perhaps less surprising considering the low bequest weight θ_b; less importance is placed on leaving bequests, so more savings is interpreted as precautionary rather than intentional bequests.

TABLE 4: *Parameter Estimates*

Shared Preference Parameters		*Estimates*			
α_c	Consumption weight	.49			
φ_p	Utility cost of work, time trend	15			
φ_{BC,h^p}	Cost of working in poor health, BC	301 (hours)			
φ_{WC,h^p}	Cost of working in poor health, WC	125 (hours)			
φ_{DI}	Cost of applying for SSDI	298 (hours)			
θ_b	Bequest weight	.01			
K_0	Bequest shifter	212 ($1,000s)			
*Type-Specific Preference Parameters**		*Type 1* (32%)	*Type 2* (15%)	*Type 3* (22%)	*Type 4* (31%)
η	Risk aversion	2.67	2.67	5.02	5.02
N_t	Fixed cost of work (hours)	114	340	114	340
Percent in each Type category		BC		WC	
	Type 1	34		30	
	Type 2	22		12	
	Type 3	17		25	
	Type 4	27		33	

Turning to the lower panel of Table 4, we have for each occupation the percent estimated to be of each of the four Type categories.

FIGURE 4: *Data and Simulated Labor Force Participation*



5. Responses to Counterfactual Social Security Policies

Motivated by evidence of existing differences by occupation in the response to past Social Security FRA increases, presented in Section 3, in this section I show estimates of what various responses to potential increases to Social Security claiming ages would be. Taking the estimated preference parameters of the dynamic choice model, I simulate labor supply, Social Security OASI claiming, SSDI application rates, and savings for individual agents facing alternative Social Security policy

changes and compare this to levels under current policy. The first counterfactual policy raises the Early Eligibility Age from 62 to 64, keeping the FRA as is (65 to 66 for those in the HRS data over which the model was estimated). The second set raises the FRA to age 68 and 70, keeping the EEA at age 62.

Two general findings to highlight here are that (1) increasing the Early Eligibility Age has larger labor supply and disutility effects for blue-collar workers and results in greater DI application, and (2) increasing the Full Retirement Age affects the labor supply of white-collar workers more than for blue-collar workers, however it does increase the savings somewhat for the latter group. In Table 6, these and several other responses to counterfactual policy changes are summarized relative to the simulated moments under the policy in the model.

5.1. Increasing the Early Eligibility Age

The middle column of Table 6 shows the effect of increasing the EEA from 62 to 64 on a number of behaviors. The first is the number of years worked between the ages of 60–69. With the existing claiming age structure, those (simulated) in blue-collar occupations worked 4.07 out of those ten years and those in white-collar occupations worked over one year more on average, 5.14 years. When the EEA is raised to 64, BC workers respond primarily by working longer, 5.19 years from 60–69 and save only slightly more at about $18K versus under $16K.

Also worth noting is the interaction between SSDI application and increased claiming ages across occupations. SSDI application for those in BC occupations goes up by almost 6 percentage points, while for WC the rate increases by under 2 percentage points. Regardless of occupation, those applying now for SSDI were disproportionately early OASI claimers under the status quo policy. This compares to Mastrobuoni (2009) and Staubli and Zweimüller (2013) who look at the increase in SSDI with the increase in the FRA in the US. The Social Security projections on the solvency effects of a similar reform indeed consider this interaction and assume that a reform increasing the EEA would result in a higher number of SSDI applicants and beneficiaries. Their estimates suggest that the increase in benefits paid due to a greater number of SSDI beneficiaries would

TABLE 5: *Benefits Relative to FRA by Claiming Age*

	Benefits Relative to FRA under Current Policy		Benefits Relative to FRA under Counterfactual Policies		
	65 FRA (b. 1935-36)	67 FRA (b. 1960+)	68 FRA	70 FRA	64 EEA
			(birth years... 1990+		
62	80.0	70.0	65.0	60.0	-
63	86.7	75.0	70.8	65.0	-
64	93.3	80.0	76.7	70.0	70.0
65	**100.0**	86.7	82.5	75.0	80.0
66	106.0	93.3	88.3	80.0	90.0
67	112.0	**100.0**	94.2	85.0	**100.0**
68	118.0	108.0	**100.0**	90.0	108.0
69	124.0	116.0	109.0	95.0	116.0
70+	130.0	124.0	118.0	**100.0**	124.0

outweigh any reduction in expenditures from increasing the EEA, *worsening* solvency overall for the combined OASDI program. The estimates here would not point to an overall increase in total OASDI expenditures; although more people would be on SSDI (and receiving the higher level of benefits they would have received if claiming at their FRA), about the same percentage of people would claim at the new EEA of 64. This is likely for two reasons: The first is that the estimates here assume that neither the costs of applying or probability of approval change alongside the increase in the EEA. If such an increase in the EEA were implemented, there might in fact be (demand for)/(simultaneously implemented) changes the application and approval process to be less costly or not require non-work for this age group. Age and occupation do currently affect DI determinations, and so the avenue already exists already. However, the second reason is that by not separating effects by occupation, the effect could be overstated. Indeed, results in a model with a uniform occupations indeed show higher increases in DI application when the EEA increases from 62 to 64 (see appendix). This is due to preferences being convex over work; when occupations are distinct, overall, those particularly in WC occupations are more able to "absorb" the increase in the EEA, which offsets the degree to which those in BC occupations are not.

Finally, welfare loss resulting from increasing the EEA is lower for those in WC occupations, who experience a welfare loss of 2.1 percent compared to 5.7 percent for those in BC occupations. This is presumably because WC workers can adjust along the lines of labor supply in a less costly way. In summary, raising the EEA seems to be especially costly for the typical blue-collar worker. This is driven primarily by the fact that those in blue-collar work have more steeply declining productivity with age and are also more likely to be the lower η preference type, which wants to hold fewer assets giving less margin on which to respond to policy changes.[15]

5.2. Increasing the Full Retirement Age

The rightmost column of Table 6 shows behavior when the FRA is raised to age 68. Comparing to labor supply changes when the EEA is raised, the effects for BC workers are quite minimal, and a smaller than the effects for WC workers; the number of years worked while aged 60–69 goes up by only .08 years for BC workers compared to nearly .7 years for WC workers.

Increasing the FRA has the effect for both occupations of decreasing the percent who claim OASI benefits at the EEA, and more so for WC workers than for BC workers. The effect, however, is very small compared to the large *increase* due to raising the EEA. For workers in both occupations, the rate of SSDI application goes up—by 4.6 percentage points for BC workers and by 3.6 percentage points for WC workers, which is a relatively higher increase for the latter.

Generally, for all behaviors, raising the EEA induces more of a response from BC workers, while raising the FRA has a relatively greater response for WC workers. The increase in SSDI applications, however, shows an exception. The increase in the SSDI application rate among white-collar workers when the FRA goes up to 68 is greater (from 11.3 to 14.9 percent) and than when the EEA increases (from 11.3 to 12.8 percent). This is likely due to the variation within white-collar workers being such that the least risk-averse types within white-collar workers are most responsive.

[15] All counterfactual responses are sensitive to the fact that simulated individual agents are behaving as if they were aware of the counterfactual policy at age 50. This would overstate welfare loss if in fact the policy were known perfectly at an earlier age as individuals would have more potential periods over which to adjust.

5.3. A More Occupation-Neutral Benefit Formula

This counterfactual policy credits workers with longer work histories. Under current policy, the benefit formula is a function of the 35 highest earning years. However, on average, those with a lower number of years of formal education enter work earlier and have longer work histories; while not aligned precisely with occupation, they are also more likely to work in physically-intense, blue-collar jobs. For example, someone who begins work at age 18 might have up to 44 years of full-time work, while if the same person beginning work at age 22 would have only 40 years of work *and taxed earnings*. In some ways, the progressive structure of the formula might compensate in practice, but only because of the differences in average levels (and not years worked).

This counterfactual policy reflects proposed reforms that would extend the number of years in AIME calculations from the 35 highest-earning years to 40. To estimate past earnings history, I use current earnings as well as the HRS question of total number of years worked to obtain the trajectory of earnings as in Jacobs et al. (2021). From this, I calculate the benefits under both current policy and counterfactuals.

Overall, I find that this has very little effect on closing the gap between those in different occupations. For instance, under current policy, OASI EEA claiming and SSDI application rates are unchanged for blue-collar workers but increase by about 1 percentage point for white-collar workers. This could be due in part to the additional years of earnings in the benefit calculation being lower for all groups, but bringing down the average of those in white collar work more.

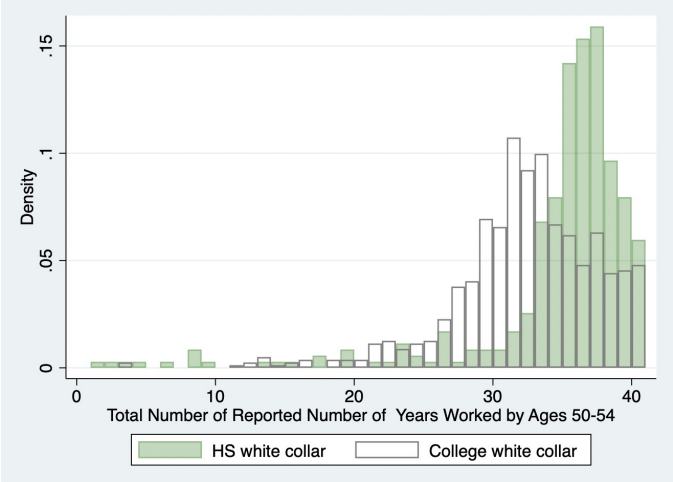
TABLE 6: *Summary of Counterfactual Policy Results*

		Alternative Social Security Policies		
	Current (Simulated)	Raising EEA to 64	Raising FRA to 68	Raising FRA to 70
Labor Supply: Years worked 60-69				
Blue-Collar	4.07	5.19	4.15	4.30
White-Collar	5.14	5.47	5.82	6.05
OASI EEA claiming				
Blue-Collar	55.5%	65.2	49.4	46.4
White-Collar	37.8	47.7	31.4	29.0
SSDI application rate				
Blue-Collar	21.2%	26.9	25.8	26.1
White-Collar	11.3	12.8	14.9	15.4
Welfare changes*				
Blue-Collar	-	-5.7%	-4.4	-4.8
White-Collar	-	-2.1	-3.1	-3.5
Savings Approaching Retirement (median, age 55-59, in $1,000s)				
Blue-Collar	$15.5	17.9	16.1	16.8
White-Collar	30.7	33.2	32.9	33.1

*These changes are in total remaining welfare, calculated for age 50 on for a person with median characteristics.

[table for the effects of expanding working years in benefit calculation here]

FIGURE 5: *Reported years worked for Ages 50-54, White-collar workers*



Note: 45,866 person-years.

6. Discussion and Future Work

This work has demonstrated that accounting for preferences and state heterogeneity has meaningful effects on both welfare estimates and predictions of responses to policy changes. The effect individual heterogeneity has on estimates of aggregate responses has been recognized in literature on demand estimation and optimal taxation, as demonstrated in Cosaert and Demuynck (2018), Lockwood and Weinzierl (2015), and Jacquet and Lehmann (2020) and others. The difference between estimates with and without heterogeneity depend on (1) whether it comes through linearly and (2) how any heterogeneity in a non-linear component of preferences—for instance, for consumption relative to leisure—is correlated with income.

This matters for both estimates of welfare and predicting response magnitudes, which are theoretically ambiguous and require empirical approximation. Here I have found that incorporating even basic heterogeneity in occupations and risk aversion levels changes the estimates of responses to increasing the EEA and FRA. In this case, a homogeneous model shows *smaller* responses in work and savings and reductions in welfare compared to a model that incorporates reasonable differences in preferences and work.

Preference heterogeneity also affects predictions of the fiscal impact of policy changes. Social Security Administration projections show that the reforms considered here are all effective to various degrees at improving the program's solvency, especially long-term.[16] My estimates are complementary in showing work, savings, and welfare effects in addition to claiming decisions, but also show possible differences in the fiscal impact. For instance, my estimates suggest that the fiscal effects of increasing the EEA would *not* be offset by increases in benefits through SSDI awards.

[16]Projections here https://www.ssa.gov/oact/solvency/provisions/index.html by the Social Security Administration show estimates of shortfalls eliminated for a number of policy reforms.

As the nature of work changes and the size of the older population continues to grow, understanding connections between occupations, health and aging, and the implications for Social Security programs—for both projection and evaluative purposes—will become increasingly important. This paper has shown that past increases to the Full Retirement Age was responded to differently by people in blue- and white-collar work who were otherwise similar. It confirms the intuition that further increases in early and normal retirement ages would have large distributional effects: Hypothetical increases affect behavior on work, claiming, savings, and inferred utility more negatively for those in more physical, blue-collar work.

Appendices

A. Additional Tables

TABLE 7: Summary of Variables

	Description
State Variables:	
t	Age at time t
p_{t-1}	Participation decision last period
A_t	Total assets (quintile)
h_t	Health status: good, fair and poor
d_t	Functional limitation (binary)
OCC	Occupation
$AIME_t$	Average Indexed Monthly Earnings (SS Covered Income History)
Choice Variables:	
p_t	Labor force participation (none, PT, FT)
c_t	Consumption/savings
$OASI_t$	OASI benefit claiming
DI_t	SSDI benefit application
Preference Parameters:	
α_c	Consumption weight
β	Time discount factor
η	Coefficient of relative risk
N_t	Fixed utility cost of work, intercept
φ_p	Utility cost of work, with time trend
φ_{BC,h^p}	Utility cost of working in poor health, BC occupation
φ_{WC,h^p}	Utility cost of working in poor health, WC occupation
φ_{DI}	Utility cost of applying for DI
θ_b	Bequest weight
K_0	Bequest shifter

B. Data Moments, Identification, and Parameter Estimates

B.1. Data Moments

The moments capture the main behavior the model seeks to explain. Below is a sketch of how the parameters are identified through matching as closely as possible the various simulated and real data moments. The parameters for this model are estimated using a total of 184 data moments, while additional moments may be used to validate the model:

- *75th/25th percentile asset ratios by age category (55–59, 60–64, 65–69, 70–75), income quin-*

TABLE 8: *SS claiming by subjective life expectancy and occupation*

	When claimed SS benefits		
	By age 62	63-64	65 and Older
Physical Intensity of Work			
White-Collar	48.4	17.2	34.4
Blue-Collar	59.0	18.6	22.4
Prob. of Living Past 75			
0 to 39 percent	73.7	12.9	13.4
40 to 60 percent	64.9	16.2	18.9
61 to 100 percent	58.9	16.0	25.1

Note: Includes 2,390 observations.

tiles, and occupation.[17] This gives $4 \times 3 \times 2 = 24$ moments. These moments are relevant since, given the same level of permanent income, we would expect a blue-collar worker who faces on average fewer potential productive working years to save more than the white collar worker. Variation in assets held helps identify risk aversion parameters for types as well as the bequest motive at higher asset levels.

- *Proportion working part-time or full-time by age (55-59, 60, 61, 62, 63, 64, 65, 66, and 67-70), occupation, and health status.* This makes $2 \times 9 \times 2 \times 2 = 72$ moments. These moments reflect the primary labor supply decisions of interest, which should be generated by the model. This, in addition to the asset moments, helped identify η, as more risk averse types would tend to work more hours at younger ages in order to save more.
- *Percent applying for SSDI by age (55-59 and 60-64), permanent income quintile, health status, and occupation.* This gives $2 \times 3 \times 2 \times 2 = 24$ moments. These moments recover the hassle or utility cost parameter of applying for SSDI.
- *OASI claiming status by age (62, 63–64, 65-66, 67-70), occupation, and permanent income quintile, and birth-year cohort.* This gives $5 \times 2 \times 5 \times 2 = 100$ moments.

B.1.1. Results on correlation between occupation and estimated time preference or risk aversion.

[Panel of graphs of data versus data moments here]

B.2. First-Stage Estimates

B.2.1. Health and Disability Transitions

The transition processes for overall, self-reported health (h) that may diminish productivity in work and lead to greater levels of precautionary savings is shown, conditional on current health and age, in Table 9 for select ages. In this table, we see that the probability of remaining in good health

[17] Income here is the "permanent income" measure that corresponds to respondents' AIME levels.

declines with age, as does the probability of transitioning from poor to good health. While the distribution of health is somewhat different for those in blue-collar and white-collar occupations, the transition probabilities themselves are not significantly different, at least at the older ages analyzed here. While the transition process faced by individuals does not depend on occupation, we will see in the wage estimates shown in Table 11 that the effects on productivity of worsening health are greater for those in blue-collar occupations.

B.2.2. Functional Limitation Transition Process

The probability of a functional limitation being present in the next period and limiting work depends on an individual's current self-reported health (h_t), occupation (OCC_t), and existing functional limitation status (d_t). The probability of having at least one functional limitation in the next period, given that an individual is in good health in the current period is shown in Table 10. We can see that the conditional probability of a functional limitation arising is always greater for those in blue-collar jobs; though interpretation of this is not entirely straightforward. Because more physical jobs have a higher standard for physical capability, whether significant loss of a function prohibits work depends on the nature of the work. Furthermore, even if the functional limitation does not prohibit work altogether, as with worsening general health, it does result in a greater loss of earnings for those in blue-collar jobs, as presented in Table 11.

B.2.3. Wage Estimates

This is an important aspect: BC worked exit earlier due to more steeply declining wages and increasingly greater disutility from physical work.

Estimated wages depend on age, health, and functional limitations interacted with occupation.

TABLE 9: *Sample Health Transition Probabilities*

		Next Period Health		
	Current Health	G/VG/E	Fair	Poor
Age=55	G/VG/E	.89	.09	.02
	Fair	.44	.35	.21
	Poor	.15	.35	.50
Age=65	G/VG/E	.85	.13	.02
	Fair	.44	.38	.18
	Poor	.13	.33	.55
Age=72	G/VG/E	.81	.16	.02
	Fair	.40	.38	.22
	Poor	.12	.32	.56

TABLE 10: *Probability of Having at least one Functional Limitation Preventing Work Next Period for Select Ages and Good Health by Occupation*

	BC Career		WC Career	
	Current Limitation		*Current Limitation*	
Age	No	Yes	No	Yes
55	.47	.53	.72	.28
65	.42	.58	.56	.44

TABLE 11: *Wage Equation Estimates*

Outcome: ln*Annual Earnings*		
Variable	*Coefficient*	*(s.e.)*
Age (years)	.111	(.028)
Age^2	-.001	(.000)
Functional Limitation, f_{it}		
White-Collar	-.006	(.018)
Blue-Collar	-.079	(.019)
Poor Health, h_{it}		
White-Collar	-.015	(.015)
Blue-Collar	-.052	(.017)
Full-Time Work, N_{it}	.740	(.032)
$\widehat{\rho}$ (autoreg. coeff.)	.940 (.019)	
$\widehat{\sigma}_\nu^2$ (trans.)	.031 (.009)	

Note: Observations n=18,052, individuals=5,216. Controls for year and Census division. Being just above Early and Full Social Security claiming ages used as exclusion restrictions.

Specifically,

$$\begin{aligned} \ln w_t = &+ \gamma_0 + \gamma_1 N_t + \gamma_2 \text{Age}_t + \gamma_3 \text{Age}^2 \\ &+ \gamma_4 \mathbb{1}_{\{BC, poor\ H\}} + \gamma_5 \mathbb{1}_{\{WC, poor\ H\}} \\ &+ \gamma_6 \mathbb{1}_{\{BC,\ func.\ lim.\}} + \gamma_7 \mathbb{1}_{\{WC,\ func.\ lim.\}} + \varsigma_t \end{aligned} \tag{6}$$

autoregressive component $\varsigma_t = \rho_\varsigma \varsigma_{t-1} + \nu_t$, with correlation coefficient ρ and transitory shock $\nu_t \sim N(0, \sigma_\nu^2)$. It is assumed that the individual knows ς_{t-1} and the distribution of future ν_t but not ν_t itself.

B.2.4. Mortality Profiles

Both Casanova (2011) and French (2005) compute their conditional survival probabilities using Bayes' Rule, with

$$\begin{aligned} s(h_t, t) &= \Pr(\text{Survive}_t \,|\, t_{t-1} = h) \\ &= \frac{\Pr(h_{t-1} = h \,|\, \text{Survive}_t)}{P(h_{t-1} = h)} \times \Pr(\text{Survive}_t) \quad \text{for } h\text{=good, bad.} \end{aligned}$$

I assume that individuals die with probability one at age 90 regardless of health status, so $P(\text{Survive}_{90}|H_{89} = h) = 0$ for all h.[18]

B.3. Preference Heterogeneity

The preference type prediction parameters are also found in the second stage. I assume that there are four preference types, with individual agents possibly differing on the coefficient of relative risk aversion η and cost of performing work (high N_t) parameters: (1) *Type 1* is less risk averse (low η) and has a lower cost of working (low N_t); (2) *Type 2* is less risk averse (low η) and has a higher cost of working (high N_t); (3) *Type 3* is more risk averse (high η) and has a lower cost of working (low N_t); and (4) *Type 4* is more risk averse (high η) and has a higher cost of working (high N_t). Though η is sometimes determined outside of the model in similar studies,[19] I estimate this in the second stage and allow it to differ by type given that, as we will see, this parameter plays a significant role in determining the cost of health and disability risks and, consequently, the value of disability insurance. I allow for heterogeneity in N_t to account for different inclinations to work.

To predict the types, I estimate a multinomial logistic regression within the second stage, where the probability of individual i being *Type* n, $n = 1, 2, 3, 4$, is

$$\Pr(i\text{=}\textit{Type } n) = \frac{\exp(\mathbf{fi}_n \mathbf{X}_i)}{1 + \sum_{k \neq n} \exp(\mathbf{fi}_k \mathbf{X}_i)} \tag{7}$$

where

$$\mathbf{fi}_n \mathbf{X}_i = \beta_{n,0} + \beta_{n,1}(\text{Assets at 50})_i + \beta_{n,2}(\text{Work Enjoyment})_i + \beta_{n,3}(\text{Income Gamble})_i \,,$$

so that the probability of having a high or low η and N_t is predicted by an HRS respondent's assets relative to permanent income at age 50, responses to a work enjoyment question, and responses to a gambling question intended to capture risk aversion.

[18] Survival probabilities are obtained from the U.S. Social Security Administration's *Office of the Chief Actuary* reports: Actuarial Study 120, "Life Tables for the United States Social Security Area 1900-2100" by Felicitie C. Bell and Michael L. Miller. Available at `http://www.ssa.gov/oact/NOTES/as120/LOT.html`. These give one-year survival probabilities at age t by sex and birth year cohort, conditional on survival up to age t. I use the 1945 birth year cohort (the birth years in the sample ranging from 1938 to 1953).

[19] For example, **?** set a parameter with roughly the same interpretation as η in this paper to 1.5, while **?** set the coefficient of relative of risk aversion to 3 for their exercises.

B.4. Computational Procedure

First, the individual agent's problem expressed in equation (1) is solved for a given set of parameters, in which the optimal savings (and equivalently consumption) is computed conditional on each labor supply choice p_t (full-time, part-time, and not working), Social Security Old-Age and Survivor's Insurance (OASI) benefit claiming choice $OASI^{app}$ (which can be claimed at age 62 or later), and Disability Insurance (DI) application DI^{app}. Next, whether to apply for DI and then whether to apply for OASI. Finally, the optimal participation choice in any period is the one that yields the greatest value given the optimal savings, DI and OASI application choice, and the realization of the preference shock $\epsilon_t(P_t)$. Next the outer maximization problem of searching across parameters to find the set which generates the behavior of simulated individuals that best matches the data is solved using the two-stage approach.

The parameters estimated in the first stage are represented by $\widehat{\chi}$. Further, let θ denote the vector of parameters estimated in the second stage, which includes parameters of utility function, fixed costs of work, and type prediction. The estimator $\widehat{\theta}$ is given by

$$\widehat{\theta} = \underset{\theta}{\operatorname{argmin}}\ \widehat{\varphi}\left(\theta, \widehat{\chi}\right)' \Omega\ \widehat{\varphi}\left(\theta, \widehat{\chi}\right) \tag{8}$$

where $\widehat{\varphi}$ denotes the vector of moment conditions described below, and Ω is a symmetric weighting matrix. The weighting matrix contains the inverse of the estimated variance-covariance matrix of the estimates of the sample moments along and off the diagonal.

The solution to (8) is obtained by the following procedure

1. First compute sample moments and corresponding weighting matrix Ω from the sample data.
2. From the same data, generate an initial joint distribution for wages, health, functional limitations and disability, AIME, assets, occupation type, and variables used in estimating the preference type assigned using the type prediction equation (described in Subsection B.3). Some of the first-stage parameters contained in χ are also estimated from these data.
3. Using $\widehat{\chi}$, generate matrices of random health, disability, wage, mortality, and work preference shocks for 3,000 simulated individuals.
4. Each simulated individual receives a draw from the initial distribution in Step 2, and is assigned one of the simulated sequences of shocks from Step 3.
5. Given $\widehat{\chi}$ and an initial guess of parameter values contained in θ, compute the decision rules over the entire state space and generate simulate decision profiles for the decision variables.
6. Compute moment conditions by finding the distance between the simulated moments from Step 5 and true moments, solving equation (8).
7. Using an updated value of θ, evaluate the value function over the state space and compute decisions for the simulated distribution of preference types, repeating Steps 4 through 7 until the $\widehat{\theta}$ that minimizes (8) is found.

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