Labor Force Transitions at Older Ages: Burnout, Recovery, and Reverse Retirement

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Abstract: Partial and reverse retirement are two key behaviors characterizing labor force dynamics for individuals at older ages, with half working part-time and over a third leaving and later re-entering the labor force. The high rate of exit and re-entry is especially surprising given the declining wage profile at older ages and opportunities for re-entry in the future being uncertain. In this paper we study the effects of wage and health transition processes as well as the role of accrued burnout and reduced-work recovery on the labor force participation patterns of older males. We first present descriptive statistics of the frequency and timing of re-entry and characteristics of those who re-enter using Health and Retirement Study (HRS) panel data. We then develop and estimate a dynamic model of retirement that captures the occurrence and timing of re-entry decisions observed in the data—as well as the transition to part-time work—while incorporating uncertainty in earnings, health, and a burnout-recovery process of stress accumulation and decumulation. The burnout-recovery process allows us to account for about 40 percent of re-entry, and one-quarter of the shifts to part-time work with age. We then use the estimated model to predict the effects of various policies reducing burnout, such as employer accommodation of older workers and sabbaticals.

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1. Introduction

Not so long ago, retirement ages were declining and retirement was characterized as a permanent withdrawal from the labor force (**?**). Since then, however, labor force participation at older ages has been increasing and the patterns of working behavior at older ages now take on a variety of forms. In addition to full and permanent withdrawal form the labor force, these patterns include greater partial retirement, second careers, and what is referred to as, following **?**, *reverse retirement*—returning to work after a period of retirement. The aim of our paper is to account for this increasingly common phenomenon of reverse retirement.

In the Health and Retirement Study (HRS) data, over one-third of men who identify themselves as retired later re-enter the labor force; the figure remains so if we instead look at men who cease working for pay and later begin working again. This figure seems surprisingly high given the well-documented trends of (1) flat or declining earnings in the labor market with age, (2) increasingly disutility of work with age and, at all ages, (3) some re-entry cost of returning to work.[1] In this paper, we propose and test a model of accumulated burnout through work and recovery from reduced or no work, which leads to eventual re-entry into the labor market. We find that this model can generate a large share of these reversals in labor force participation in later life, going well beyond behavior that can be accounted for through shocks to health and wealth or involuntary initial exit from the labor force.

This work is, to the best of our knowledge, the first paper to propose a structural model that directly accounts for reverse retirement. The motivation for our model comes from patterns in the HRS data we find on stress levels, financial and health shocks, and work. Our perspective is consistent with **?** in that we find little support for reverse retirement being a result of financial or health shocks and turn to the role of dynamic preferences for work. This model captures not only captures the dynamic nature of work choices, but also allows us to address several counterfactual policy questions.

With transition costs associated with changing work status, as well costs to retraining from the employers' perspectives, reverse retirement may be an unnecessarily high-cost way to diminish burnout from work. Are there workplace policies that could reduce this cost by providing some of the reduction in burnout? If so, what types of workplaces could benefit most? Making use of questions to respondents in their work, we address these questions through counterfactual simulations in which (i) there is increased employer accommodation of older workers, (ii) certain employers may offer a reduction in hours for a reduction in pay, and (iii) employers offer "sabbaticals".

In Section 2 we discuss existing work on the topic of reverse retirement and retirement

[1] **?**.

patterns more broadly. Section 3 presents descriptive statistics from the HRS showing features of the data we seek to explain through the burnout-recovery model of work decisions in later life in Section 4. We describe the estimation of the preference parameters of the model in Section 5 and give simulation results using these estimated parameter values in Section 6. We take these results to predict the effects of several counterfactual policies in Section 7 before concluding in Section 8.

2. Related Work

There are several studies directed at reverse retirement as well as partial retirement within the greater retirement literature. Our work complements the studies described here by formulating and estimating a structural model that can generate reverse retirement as the manifestation of a burnout-recovery process.

? present a burnout and recovery process to explain reverse retirement, as we do here. They develop an index of burnout arising from work stressors from questions in the HRS. This index varies over time and its path looks different for those who eventually reverse retire, those who partially retire, and all others. They argue that higher burnout levels increase the likelihood of an individual retiring. Though methodologically our work goes in another direction, we use a similar burnout index in the descriptive portion of the paper for motivation. The effects of burnout we estimate, are not from the data directly but rather are uncovered in estimation of the structural model.

?, also using HRS data, seeks to identify whether reverse retirement is a result of inadequate financial planning and health shocks or whether re-entry is anticipated before retirement occurs. Using different definitions, between 25 to 40 percent of retirees "unretire" and some of these individuals plus another quarter of the sample transition to full retirement through partial retirement or part-time work. She concludes that over 80 of all reverse retirements we planned prior to initial retirement. When conditioning on post-retirement information in her multinomial logit model, little explanatory power is added relative to the model with pre-retirement information.

An earlier related paper is **?**, which focuses on later-life work transitions beyond direct full-time work to retirement. These include post career "bridge" jobs, partial retirement and part-time work, and reverse retirement, characterizing the work choice paths for over half of all men at older ages. In his sample, about 25 percent reverse retire. This is lower than the 30-40 percent range we report here, though we use a different dataset and sample birth years.[2] **?** find a lower rate of reverse retirement—15 percent—when looking at those

[2] **?** uses Social Security Administration's Retirement History Longitudinal Survey (RHLS) data, years 1969-1979. Our sample, as we will see, is made up of individuals observed up to 18 years and is reduced to those who are seen for at least five of the biennial HRS waves and were working in at least one of them, as we only see characteristics about their work and subjective job experience when they are working.

who had left “career jobs” and re-entered.

? uses quarterly data from the Social Security Administration’s Retirement History Longitudinal Survey (RHLS) to give a descriptive analysis of labor force transition sequences at older ages. The quarterly data allow him to capture more of these transitions, as well as the sharp spike in labor force exit at age 65. He suggests that there are dynamic features in labor supply decisions that do not operate through the budget constraint but rather through preferences. A structural economic model—which we attempt to provide here—is then, he concludes, the proper context for studying more complicated labor force transitions at older ages.

Focusing on the effects of employer-tied health insurance, French and Jones (2011) is the basis on which we construct our model. They estimate a dynamic model of later-life work decisions using a method of simulated moments (MSM) procedure, allowing for permanent preference heterogeneity in leisure and rate of time preference, as in keane wolpin 2007 In Section 4, we add the burnout-recovery process to this and attempt to match, among many other moments, reverse retirement rates with the model.

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3. HRS Data and Descriptive Statistics

The data we use come from the Health and Retirement Study panel of men and women in the U.S. age 50 and older. There are 10 biennial waves available, with the survey years beginning in 1992 with the most recent available being from 2010. We include males from the *HRS Cohort*, born 1931-1941, who were observed for at least five waves and worked during at least one. This gives us a total of 3,241 respondents.[3] The rationale behind selecting those who were observed at least five times is to get an idea of the proportion of individuals to whom this is relevant, as we will miss fewer occurrences of reverse retirement this way. Table 1 gives a summary of our sample.

In the first Wave the sample is observed, nearly 93 percent report that they are “working for pay” at the time surveyed while less than 27 percent report working the Wave 10, which means many changes in labor force participation status are captured over this time period. The proportion of those men who consider themselves retired corresponds to this fairly well, though, for reasons we will discuss below, we will be focusing on whether respondents report that they are working for pay to measure participation.[4]

We categorize over 35 percent of the sample as being “Reverse Retirees” or RR. Though the definition of retirement is not straightforward as retirement may or may not indicate

[3]More details about our sample are found in the Appendix. Fewer are used in estimation of the model and some descriptive statistics as not all respondents answered all survey questions in every Wave.

[4]We use Rand HRS variable `rWwork` as the “working for pay” variable.

Table 1: *Some Characteristics of the HRS Sample Respondents*

Time-Invariant Characteristics:		
Educational Category (3,229)		
Less than HS	22.3%	
HS or GED	34.6%	
Some College	19.6%	
College and Above	23.5%	
Percent Ever Reverse Retiring (3,241)	35.5%	
Time-Varying Characteristics:		
	Wave 1	*Wave 10*
Average Age at Survey (3,117 and 2,287)	55.3	73.3
Self-Defined Retirement Status (2,865 and 2,187)		
Not Retired	89.2%	9.7%
Partly Retired	7.6%	20.4%
Completely Retired	3.3%	69.9%
Percent "Working for Pay" (3,115 and 2,283)	92.9%	26.8%
Self-Reported Health Status (3,117 and 2,286)		
Excellent	26.0%	9.3%
Very Good	32.9%	28.9%
Good	28.1%	37.2%
Fair	10.5%	19.2%
Poor	2.5%	5.3%
Marital Status (3,117 and 2,287)		
Married or Coupled	86.9%	79.8%
Divorced or Separated	8.8%	8.8%
Widowed	1.3%	8.8%
Never Married	3.0%	2.7%
Percent with Spouse "Working for Pay" (2,641 and 1,748)	67.0%	23.2%

Note: Number of responses in parenthesis above.

labor force participation, we will use "Reverse Retiree" to identify an individual who, around what might be colloquially understood as retirement age, ceases to work for pay ("retires") and later begins working for pay again ("reverses" his decision to stop working). Individuals whom we do not observe exiting and subsequently re-entering work are "Non-Reverse Retirees" or non-RR.[5]

Next we will look at the relevant patterns around retirement and reverse retirement that we find in the HRS data. Though our main contribution is providing and estimating a model that can generate the unretirement phenomenon, these descriptive figures will help us better understand the behavior of our sample.

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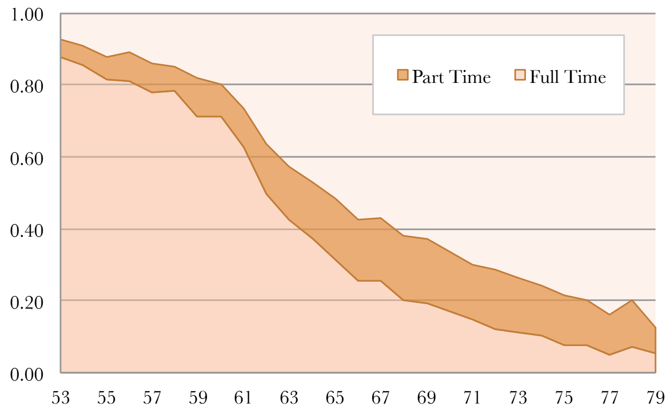
(formerly in introduction:)
As a suggestion that there may be some burnout-recovery process happening, we can see in the Health and Retirement Study (HRS) data that (1) these re-entry rates remain nearly as high at older ages when excluding those who initially left work involuntarily and (2) respondents report much lower job stress levels upon restarting work than those who had been working and continue to work.[6] We will see this and other relevant descriptive statistics which motivate our choice of a model that captures the burnout-recovery process. Because the degree of burnout is naturally dynamic as the process may depend on previous labor supply decisions, and since we cannot observe directly the effects of such a burnout-recovery process in the data—or what behavior would look like if this process did not exist—a structural model of its relationship with reverse retirement is well suited.

To motivate our burnout-recovery explanation of exit and re-entry, we first consider why—among those who eventually do re-enter the labor force—the individuals stopped working initially. Looking at the responses to the HRS "reason for stopping work" question, which will be described in more detail below, we see that: 17.4 percent initially stopped working because of health, and presumably re-enter when their health improves; 23.5 percent stop working because they were laid off or their business closed, and presumably re-enter when they are able to find another job (though this means it took them possibly years to do so given that HRS surveys occur every two years); 38.2 percent say their reason for stopping work was that they "retired", and may have found out they did not like being retired and went back to work *or* they don't think of retirement as stopping work. (This is quite common, as we will show in Table A2.); 11.9 percent left work initially due to what they described as "burnout", with, as we will model, perhaps the intention of taking a break, recovering, and going back to work, with the remainder giving "unknown" or one of many other miscellaneous reasons for stopping work. While we do account for

[5]Using this survey response, for a person to be counted as a reverse retiree over three Waves (working-not working-working), time out of the labor force could conceivably range from being out of the labor force on the day of the second of the three survey Waves for up to the nearly four years between the first and third of the three surveys.

[6]This is shown below in Table 10 and is true even when controlling for age.

Figure 1: *Labor Force Status by Age*



Note: 26,926 person-years from HRS sample described in text.

the effects of health shocks on participation decisions, the later two reasons—"retirement" and "boredom or burnout"—are what we wish to focus on here. If an individual in some way plans to stop working (retires or quits due to stress or boredom), starting to work again is not necessarily what we would expect to see though it is very common.

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3.1. The Timing of Initial and Reverse Retirement

First, in Figure 1 the proportion working by age , as well as the percent of those working who exit by age in Figure 2 on page 9.[7] Over 90 percent are working in their early fifties; by age 65 about half are. At younger ages, few are working part time, though from their late 60s onward, the majority of those working are working part time.

We have in Figure 2 the percent of respondents who begin to work after having previously stopped (as a proportion of those not working) by age, whom we refer to as the "reverse retirees". The chance of re-entering the labor force is very high for those who are not working under age 60 and declines with age. Since re-entry is conditional on not working, this could be capturing the fact that those who stop working at relatively early ages (before 62) are different in other ways that make them more likely to re-enter the labor force (e.g., they had initially left work due to a layoff). It may also have to do with the fact that the better health people experience at younger ages means the odds of still being able to perform work-related tasks are higher. We suspect that re-entry at the youngest ages is more likely a re-entry that occurs after unplanned exit or layoffs, whereas re-entry in later years arises from a burnout-recovery type of process as we model here.

[7]Using Rand HRS variables `rWwork` and `rWjhours` here. Part-time work involves less than 30 hours per week.

In Appendix Figure A1 on page 41, we have, among those who re-enter the labor force, whether their re-entry is into full-time or part-time work. At younger ages, re-entry is far more likely to be into full-time work (nearly 90 percent re-enter into full-time jobs at age 54). Again, this may indicate that those who re-enter at younger ages have circumstances very different from those re-entering when older. At older ages, re-entry is into part-time work for most, and re-entrants are much more likely to be working part time at those ages than those working overall. For instance, at age 75, 80 percent of re-entrants start part-time jobs, whereas just over 60 percent of all workers at age 75 are part time, as seen in Figure 1.

While many spouses appear to coordinate the timing of retirement (Casanova, 2010), it's not clear whether their decisions to return to work might be related. In our sample, about 16 percent of wives who were not working begin working again in the same period their husband reverse retires. We have excluded the spouses' working decisions in this version of the model as a simplification, though the model could readily be extended to account for joint decisions, especially if capturing the precise timing of re-entry is of interest.

3.2. How Do Reverse Retirees and Non-Reverse Retirees Differ?

Now we will see whether there are significant differences we can observe in the data between those who will reverse retire and those who do not. We consider health and other reasons for stopping work, possible differences in assets, education, permanent income, and retirement enjoyment and re-entry. We find that, in many ways, reverse retirees and others are remarkably similar on these observable characteristics.

Reasons for Stopping Work

Here we look at some of the reasons respondents give for stopping work. Table 2 gives respondents' reasons for stopping work, separated into those who eventually return (RRs) to work and those who do not (non-RRs). We can see that those who do return to work were slightly less likely to have stopped working due to being laid off (17.3 percent versus 18.2 percent), but somewhat more likely to have left work initially due to health reasons (20.3 percent versus 17.8 percent). "Retired" was a more common reason cited among those who never return to work (40.5 percent) than among those who do return (31.1 percent). Still, it is somewhat surprising that over 30 percent of those who ultimately reverse retire said they were stopping because they were retiring. We suspect they either do not think of retirement as the state of no longer working or they find that, unexpectedly, they do not like not working and would rather return to work.[8]

[8]Indeed, as we see in Table A2 of the Appendix, a high proportion—over three-quarters—of respondents, whether reverse retirees or not, say they intend to "continue paid work" post-retirement. Evidently, "retirement" doe not imply "not working" to most respondents *ex ante*. At the same time, responses in the HRS for whether the respondent considers himself retired line up quite well with whether he is "working

Figure 2: *Transitions Out of and Back Into Work*

Note: Includes 26,926 person-years.

Health, Exiting and Reverse Retirement

Looking at the relationship between health status and changes and labor force *exit*, we can see that the labor force is associated with poorer health and changes for the worse in health, as seen in Table 3. This is important since leaving the labor force due to health means the chances of re-entering in the future are also low due to health. Those in worse health to begin with are more likely to exit whether their health is worse or better.

Exiting the labor force is also associated with the respondent's wife's health status and changes in it, shown in Table 4. Again regardless of whether one's spouse is in better or worse health compared to the previous period, those whose spouse is in poor health are

Table 2: *Why Respondent Stopped Working*

Reason for Stopping Work	Non-Reverse Retirees	Reverse Retirees
Laid Off / Firm Reorg.	18.2%	17.3%
Poor Health, Disability	17.8%	20.3%
Business Closed	6.4%	6.2%
Retired	40.5%	31.1%
Bored	8.2%	11.6%
Family	1.4%	1.7%
Family Moved	1.1%	1.7%
Find Better Job	0.6%	0.9%
Other	5.8%	9.1%
Observations	2,267	1,166

Notes: "Other" includes family reasons or relocation, refused, doesn't know travel, pension incentive, and others.

Table 3: *Labor Force Exit by Self-Reported Health Status*

	Percent Who Remain Working when Health Is	
Current Health Status*	*Worse* or *Much Worse*	*Same*, *Better*, or *Much Better*
Excellent	75.58% (.10)	86.64% (.23)
Very Good	77.88% (.24)	83.23% (.36)
Good	73.53% (.37)	80.41% (.31)
Fair	64.51% (.23)	76.65% (.09)
Poor	58.23% (.06)	77.70% (.01)

Note: 2,706 person-years for *Worse* or *Much Worse* and 12,761 person-years for *Same*, *Better*, or *Much Better*.
*Parenthesized numbers sum to one in each column. In the first row of the first column, .10 indiscates that 10 percent of those whose health is *Worse* or *Much Worse* compared to last period currently report that they are in "Excellent" health.

for pay" or not.

less likely to remain in the labor force but not to a great extent.

Table 5 shows that re-entering the labor force is also associated with one's own health, but is less related to one's spouse's health status and change in health. Those whose own health became better were more likely to re-enter the labor force, while those whose wife's health was much *worse* were more likely to re-enter. This might be suggesting that returning to work to help pay for medical expenses is chosen over remaining out the labor force in order to provide some in-home care.

When faced with a negative health shock to one's spouse—which presumably requires additional care taking and medical procedures—an individual can choose whether to work providing care at home or to work and pay for care through additional income. When one's own health unexpectedly worsens, he may want to work more to finance medical expenses or he may need to work less due to poor health. Medical expenses are shown in Table A7 of the Appendix by age category. While the maximum reported can be quite high, the median level even for the oldest age categories is only around $1,500 for *out-of pocket* medical expenses.

In Figure A2 on page 41 of the Appendix, we can see that the probability of someone

Table 4: *Labor Force Exit by Spouse's Self-Reported Health Status*

	Percent Who Remain Working when Spouse's Health Is	
Spouse's Health Status*	*Worse* or *Much Worse*	*Same*, *Better*, or *Much Better*
Excellent	80.82 % (.08)	85.34 % (.24)
Very Good	78.28 % (.24)	81.45 % (.37)
Good	81.35 % (.32)	81.04 % (.29)
Fair	78.36 % (.23)	76.98 % (.09)
Poor	76.15 % (.13)	77.57 % (.02)

Note: 2,758 person-years for *Worse* or *Much Worse* and 10,443 person-years for *Same*, *Better*, or *Much Better*.
*Parenthesized numbers sum to one in each column.

Table 5: *Reverse Retirement by Self-Reported Change in Own and Spouse's Health*

Change in *Own* Health Since Last Period	Percent Re-Entering LF*	Change in *Spouse's* Health Since Last Period	Percent Re-Entering LF*
Much/Somewhat Better (.22)	14.29%	Much/Somewhat Better (.20)	11.93%
Same (.52)	11.96%	Same (.54)	12.74%
Somewhat/Much Worse (.26)	11.34%	Somewhat/Much Worse (.25)	14.57%

Note: 9,009 person-years for own-health changes and 6,903 for spouse health changes.
*Using changes in `rWwork` status.

Table 6: *Total Assets by Age Group and whether Reverse Retiree*

	Total Assets (Including Housing)				
	non-Reverse Retirees		*Reverse Retirees*		
Age Category	Mean	Median	Mean	Median	Obs.
50-54	$357,108	$142,417	$322,459	$159,167	2,278
55-59	460,596	193,056	381,729	175,000	5,978
60-64	567,724	223,953	486,295	213,284	7,519
65-69	652,218	260,760	570,851	249,454	6,985
70-74	641,595	273,369	644,357	251,965	4,399
75-79	515,784	238,384	761,379	252,000	1,321

returning to work depends not only on changes in his health, but also his level of health in the past period as well as his age. This figure graphs the predictive margins resulting from probit estimates of the probability of returning to work given one's change in health status, past self-supported health, and age. This figure gives the probability of re-entering the labor force for those whose health has improved by age. We can see that at all ages, those whose health had been good in the past are more likely to return at all ages relative to those whose health was fair and poor, and that the probability of returning decreases with age. A similar pattern holds for those whose health is the same or worse, though with the series representing the probability of returning being shifted down. This may be suggesting that voluntary time spent out of the labor force at these ages is not only intended to contribute to recovery from burnout but also physical convalescence.

Assets, Education, Income and Reverse Retirement

Now we will show the seemingly weak relationship between reverse retirees and non-reverse retirees on observable assets, education and income. The greatest difference between the two groups is in assets, but the fact that reverse retirees and non-reverse retirees are are quite similar overall by these measures is one motivation for a model in which the unobservable effects of burnout and recovery generate reverse retirement.

Table 6, gives total assets, including housing, by age category for both non-RRs and RRs. Mean assets grow until ages 65-69 (and to ages 70-74 for median assets) and decline after that for non-RRs, as labor force participation is quite low at that point. For reverse retirees, mean assets begin at a lower level than mean assets for non-RRs, but continue to increase for every age category; median assets start off slightly higher than non-RRs ages 50-54 and continue increasing, though the median assets are roughly similar for the two groups at all ages. Though not shown here, there are similar patterns for mean and median non-housing assets by age.

The probability of reverse retiring varies only slightly by educational attainment cate-

Table 7: *Reverse Retirement by Education Category*

	Percent Reverse Retiring
Less than HS (.24)	33.12%
GED (.06)	36.88%
High School (.30)	36.82%
Some College (.19)	35.78%
College (.21)	35.30%
Total (1.00)	35.43%

Note: 2,681 individual responses.

Table 8: *Reverse Retirement by Earnings Category*

Quantile (Median in Quantile)	Percent Reverse Retiring
Lowest ($18,506)	34.48%
2 (35,304)	29.22%
3 (49,317)	32.00%
4 (67,341)	29.38%
Highest (107,553)	34.69%
Total	31.96%

Note: 2,306 individual responses. Earnings quantile is based off of the average earnings for an individual when he is 50 to 60 years old. Those for whom we cannot observe average earnings somehow have higher rates of RR, as the 32% RR in this table is low.

gory and earnings when working between ages 50 and 60. Those in the educational attainment category of GED and High School were most likely to reverse retire (both nearly 37 percent), as seen in Table 7, while those with less than high school were only somewhat less likely (33 percent). Table 8 suggests that un-retiring may also have little to do with earnings history. In the first column is the earnings quantile based of of respondents' average earnings when he is observed between ages 50 and 60 in the HRS. As we can see, while the probability of reverse retirement is quite high for those with the highest level of earnings, at nearly 35 percent, it is almost equally as high for those with the lowest level of earnings. This again points to financial constraints perhaps not be a universal driving force for reverse retirement as re-entry does not vary across those who have very different earnings histories.

Retirement Enjoyment

Surprisingly, individuals are actually somewhat less likely to return to work if they report in the preceding interview that they do not enjoy retirement, as we see in Table 9. This could be due to a number of factors that go beyond measurement error. For instance, it could be that some retirees do not enjoy retirement because, while they may prefer to

Table 9: *Reverse Retirement by Prior Period's Satisfaction with Retirement*

	Percent Reverse Retiring Next Period	
Satisfied with Retirement?	*Unrestricted*[1]	*Enjoy Work*[2]
Very	7.50% (.61)	10.86% (.59)
Moderately	8.52% (.32)	13.54% (.34)
Not At All	5.43% (.07)	10.48% (.07)
Total (1.00)	7.68%	11.72%

[1]Entire sample. Includes 7,314 person-years.
[2]Includes 2,827 person-years. Sample is restricted to respondents who said they would work if the income was not necessary.

work, they are not working due to health reasons. The same health factors that lead them to be less happy in retirement are the same factors that may preclude re-entry for this group. In any case, if re-entry rates are essentially the same across retirement enjoyment levels, this question is not likely to help us explain "unanticipated" reverse retirement arising from shocks in utility of leisure as opposed to shocks in the budget constraint.

Even when we restrict the sample to respondents who have strong preferences for work, there appears to be no connection between unsatisfactory retirement and re-entry decisions. The rightmost column inTable 9 shows that among those who reported that they "would continue working even if [they] did not need the income," the reverse retirement rates are roughly the same regardless of whether they enjoyed or did not enjoy retirement in the preceding year. For these reasons, we do not include retirement experience as a contributor to reverse retirement in our model. Again, however, it is possible that the health factors that lead some retirees to be unhappily retired concurrently preclude them from re-entering the labor force. We capture this by allowing the quantity of leisure to depend on an individual's health status both when he is and is not working.

3.3. Stress and Work: Patterns in Exit and Re-Entry

We will close this descriptive portion of the paper by looking at the relationship between work and stress. At this stage in our modeling, we have not made a distinction between the concepts of "burnout", "boredom", and "stress". For the time being we will think of "burnout" as something that arises as work "boredom" and "stress" culminate, and diminishes when one is not working (and to a lesser extent when one works part-time as opposed to full-time). These stress measures, while related to the effect of burnout we would like to recover, give us insight possibly into the evolution while working, but cannot be observed when one is not working. We know how stressful one finds his job upon re-entering, however, and the fact that re-entrants find their jobs less stressful than those who

Table 10: *Job Stress for Re-Entrants and Continuous Workers*

	Stressful	Obs
Continuous Work	50.8%	12,262
Re-Entrants	31.2%	932

Table 11: *Job Stress by Occupation, Age and Whether Part-Time or Full-Time.*

	Proportion Reporting Stressful Job:		
Occupation	PT	FT	All
Managerial/Speciality	.37 (717)	.71 (4,264)	.66 (4,981)
Spec. Operator/Technical	.37 (1,015)	.67 (3,688)	.60 (4,703)
Sales	.35 (827)	.63 (2,422)	.56 (3,249)
Clerical/Admin.	.23 (289)	.59 (1,241)	.52 (1,530)
Farming/Forestry/Fishing	.26 (423)	.56 (1,142)	.48 (1,565)
Mechanics/Repair	.26 (217)	.59 (1,614)	.55 (1,831)
Construction/Extractors	.31 (297)	.49 (1,640)	.46 (1,937)
Precision Production	.28 (116)	.59 (1,090)	.56 (1,206)
Services	.19 (701)	.52 (1,883)	.43 (2,584)
Operators	.30 (963)	.51 (4,313)	.47 (5,276)

Stress by Age Category:

Age:	50-54	55-59	60-64	65-69	70-74	75-79
Stress:	.64	.60	.51	.40	.34	.34

were working continuously between waves suggests that there is some recovery process.[9] That the recovery process and its effect on work decisions cannot be observed motivates our model.

In Table 10 we can see that the job stress reported differs for those who just re-entered work and those who has been working the period prior. Those who have just re-entered are much more likely to report that their jobs are not stressful (nearly 51 percent) than those who had also worked the in the past period (31 percent). This might suggest that there was some burnout or stress recovery process happening for those who spent some time out of the labor market; they leave work due to high stress or burnout and re-enter when they have taken a break and recovered.[10]

Table 11 gives job stress reported by occupation category and whether working full time or part time, as well as the proportion within age categories who report that their job is stressful. While stress does differ somewhat across occupations, the difference between full-time and part-time workers' stress levels within each occupation is much greater. This suggests that knowing occupation may not be more informative than knowing whether a respondent is part-time or full-time, which is useful as we include the stress as a contributor to exit and subsequent reverse retirement and can more easily handle the full-time versus part-time work choice than we can occupation choice.

In our model, working part-time not only gives more leisure time than working full-time, we also allow for the possibility that working part-time contributes less to stress and burnout. We describe the model and this aspect of it in the next section.

4. A Model of Burnout and Recovery

In this section we will describe the setup of the model. The present framework extends French and Jones (2011) by incorporating a burnout-recovery process, allowing preference parameters to vary across individual types. Our goal is to have a model that can generate overall participation levels and reverse retirement occurrences by age and health status among other dimensions, explaining especially reverse retirement rates that are beyond what can be explained by health, financial, or preference shocks alone. It will allow us to determine the extent to which a burnout-recovery process matters for generating the high levels of reverse retirement we see in the data.

[9] At the same time, re-entrants also go into part-time work more often than full-time work at older ages and, as we will see, part-time workers report less job stress. Still, it is not clear why the reverse retirees would not instead go into part-time work earlier rather than stop work an restart. In any case, presenting further descriptive patterns on job stress could provide more insight.

[10] Job stress and other factors just before stopping work for RRs and non-RRs are shown in Tables A5 and A6 in the Appendix on page 38.

4.1. Preferences

In this problem we have a household head who chooses work hours (0, part-time, or full-time), consumption level and savings, and whether to apply for Social Security benefits[11] in each year to maximize his expected lifetime utility at age t, $t = 1, 2, \ldots, T+1$.

In each period the individual faces some survival uncertainty. If he lives, which occurs with some probability s_t, he receives utility from consumption C_t and leisure L_t. The within period utility function takes the form

$$u(C_t, L_t, \epsilon_t, P_t) = \frac{1}{1-\nu}\left(C_t^{\gamma} L_t^{1-\gamma}\right)^{1-\nu} + \alpha_{S,p}\epsilon_t\left(P_t\right) \tag{1}$$

where $\epsilon_t\left(P_t\right)$ is the preference shocks associated with the participation choice P_t and is known by the individual at time t. The participation decision P_t can take on the values FT (full-time work), PT (part-time work) or R ("retired" or not working) in all periods. The quantity of leisure he enjoys, which will also depend on health and whether he was working last period, is given by

$$L_t = L - N_t - FC_t - \phi_{HF}\mathbb{1}_{\{H_t=\text{Fair},P_t\neq 0\}} - \phi_{HP}\mathbb{1}_{\{H_t=\text{Poor},P_t\neq 0\}} - \phi_{RE}RE_t \tag{2}$$

where L is the total annual time endowment measured in hours. The hours worked N_t is equal to zero when $P_t = \text{R}$, 1,500 when $P_t = \text{PT}$, and 2,000 when $P_t = \text{FT}$. Workers who leave the labor force re-enter at the time cost of ϕ_{RE} where RE_t is a 0-1 indicator equal to one when $P_t = \text{FT}$ or PT and $P_{t-1} = \text{R}$.[12]

To capture the empirical fact that health statuses are correlated with participation and reentry decisions, we allow the quantity of leisure to depend on an individual's health status $H_t \in \{\text{Good, Fair, Poor}\}$.

Finally, to incorporate the burnout-recovery process into the model, we define the fixed cost of working, FC_t, as

$$FC_t = (\alpha_P + \alpha_{P,t}t)\mathbb{1}_{\{P_t=\text{PT or FT}\}} + \alpha_{AP}AP_t, \tag{3}$$

The first coefficient α_P in (3) represents the fixed cost component to work. The second term, $\alpha_{P,t}$ allows the fixed cost of work to increase linearly with age. The third coefficient α_{AP} captures the burnout-recovery process where AP_t is the accumulated work periods.

If an individual works full-time in period t then AP_t increases by $\alpha_S > 0$ if the respondent reports that his work is stressful and by $\alpha_{nS} > 0$, while if he does not work then AP_t

[11] In this version, Social Security application is deterministic: Every individual will apply at age 65 exactly.

[12] In French and Jones (2011), the re-entry cost is equivalent to 94 hours of leisure in a year. Individuals are allowed to reenter the labor force after retirement, and are heterogeneous in their willingness to work. The focus of their paper is to assess the effects of health insurance on retirement behavior. We suspect that by matching the levels and timing of reverse retirement by age, health, and asset levels, our estimated re-entry cost should be lower than theirs.

In Casanova (2010), switching cost is modeled as a permanent wage decrease when one switches from full-time to part-time or retired.

decreases by α_{NW} in the following period. Formally, we define

$$AP_t = \begin{cases} AP_{t-1} + \alpha_S \mathbb{1}_{\{str_{t-1}=1\}} + \alpha_{nS} \mathbb{1}_{\{str_{t-1}=0\}} & \text{if } P_{t-1} = \text{FT or PT} \\ AP_{t-1} - \alpha_{NW} & \text{if } P_{t-1} = R \end{cases} \tag{4}$$

as the accumulated participation units in time t.

With probability s_t an individual remains alive at age t conditional on being alive at age $t-1$. An individual values the bequests of his assets, A_t, upon his death, which occurs with probability $1 - s_t$, according to the bequest function,

$$b(A_t) = \frac{\theta_b \left(A_t + K_0\right)^{(1-\nu)\gamma}}{1-\nu}\,. \tag{5}$$

The parameter K_0 measures the curvature of the bequest function. In estimation we will allow the consumption weight γ, the subjective discount factor β and, the fixed cost of work parameters $\alpha_P, \alpha_{P,t}$ to vary across types of workers.

4.2. Budget Constraints

The individual has three sources of income: current household income from working, Y_t^R, asset income rA_t where r is the pre-tax interest rate, and Social Security benefits ss_t^R. The asset accumulation equation is given by

$$A_{t+1} = (1+r)A_t + Y_t^R + ss_t^R \times B_t - C_t \tag{6}$$

where B_t is a 0-1 indicator equal to one if the individual is eligible for Social Security benefits. For simplicity, we do not include pension benefits, government transfers other than Social Security, and medical expenses in the budget constraint. This will, however, be included in future versions. Post-tax income is defined as $Y_t^R = Y\left(rA_t + W_t N_t, \tau\right)$ where τ is the income tax and W_t denotes annual wages.

Additionally, to both simplify the problem and reflect the difficulty in doing so at older ages, individuals cannot borrow,

$$A_t + Y_t^R + ss_t^R - C_t \geq 0\,. \tag{7}$$

We estimate the (log) annual earnings for an individual i as

$$\ln W_{it} = W(H_{it}, t) + \varphi N_{it} + f_i + \eta_{it} \tag{8}$$

where H_{it} is health status, N_{it} indicates full-time work, f_i represents an individual-specific effect and η_{it} is an idiosyncratic error term at age (time) t.

4.3. Value Function

Let X_t denote the state variables, which include $\{t, A_t, AP_t, H_t, P_{t-1}, W_t, ss_t\}$. The individual's recursive problem can be written as

$$\begin{aligned} V_t\left(X_t\right) &= \max_{C_t,P_t}\Big\{u(C_t, L_t, \epsilon_t, P_t) + \beta\left(1 - s_{t+1}\right) b\left(A_{t+1}\right) \\ &\quad +\beta s_t \int V_{t+1}\left(X_{t+1}, \epsilon_{t+1}\right) dF\left(X_{t+1}|X_t, C_t, P_t, \epsilon_t\right)\Big\}. \end{aligned} \tag{9}$$

subject to the borrowing constraint in equation (7). For simplicity, it is assumed in this version that workers receive Social Security benefits upon turning 65 years old and so B_t is not a choice variable.[13]

The solution to the individual's problem consists of the decision rules on consumption and participation choices that solve (9) backwards from terminal period T. To simplify the model solution, we assume that ϵ_t is drawn from an Extreme Value Type-1 distribution. Following Casanova (2011), the individual's problem can be solved in two steps as follows:

$$\begin{aligned} V_t\left(X_t\right) &= \max_{P_t}\Big\{\max_{C_t}\big[u(C_t, L_t, \epsilon_t, P_t) + \beta\left(1 - s_{t+1}\right) b\left(A_t\right) \\ &\quad +\beta s_t \int V_{t+1}\left(X_{t+1}, \epsilon_{t+1}\right) dF\left(X_{t+1}|X_t, C_t, \epsilon_t\right)\big] + \epsilon_t\left(P_t\right)\Big\}. \end{aligned} \tag{10}$$

In the first step, we solve the inner maximization by computing the optimal savings (equivalent to solving for consumption) conditional on each discrete participation choice. Given the optimal consumption in the first step, the outer maximization is then solved by choosing the participation choice that yields the highest value given the realization of preference shocks.

Table 12 summarizes the variables we have included in the model. Next we will describe the procedure for estimating this model.

5. Estimation Procedure

Through the method of simulated moments (MSM), we can find the preference parameters that generate simulated life-cycle decision profiles that best match the decision profiles found in our data. The model can be estimated using a two-stage approach similar to Gourinchas and Parker (2002), French (2005), French and Jones (2011) and others, which makes the problem easier computationally. In the first stage, the parameters that can be determined outside the model are estimated, which include the state transition

[13] In our sample, over 95 percent had claimed their Social Security benefits by the age of 65. As many claimed benefits before 65, however, it will be a priority in future versions to make applying for benefits a choice variable.

Table 12: *Summary of Variables*

	Description
State Variables:	
t	Age at time t
P_{t-1}	Participation decision last period
A_t	Total assets in 2010$
H_t	Health status: good, fair and poor
AP_t	Accumulated work periods
SS_t	Social Security earnings
str_t	Work stress level
Choice Variables:	
P_t	Labor force participation decision, $P_t \in \{\mathrm{R}, \mathrm{PT}, \mathrm{FT}\}$
C_t	Consumption
Preference Parameters:	
Shared:	
β	Time discount factor
ϕ_{H^F}	Leisure cost of fair health
ϕ_{H^P}	Leisure cost of poor health
$\alpha_{P,t}$	Fixed cost: linear age trend
α_{str}	Fixed cost: additional AP unit if job is stressful
$\alpha_{no\ str}$	Fixed cost: additional AP unit if job is not stressful
$\alpha_{no\ work}$	Fixed cost: decrease in AP when not working
Varying by Preference Type:	
ν	Coefficient of relative risk
γ	Consumption weight
θ_B	Bequest weight
K_0	Bequest shifter
ϕ_P	Fixed cost of working
ϕ_{RE}	Reentry cost
α_{AP}	Weight on burnout-recovery process

probabilities. In the second stage, the preference parameters of the model are estimated jointly with the type prediction parameters using first-stage estimates.

5.1. Moment Conditions and Identification

The parameters we find will be those that generate moments from simulated data that are closest to the same moments from the HRS data using simulated method of moments techniques The moments for each age between 61-72 are matched to give identification of the behavioral parameters. Moments at ages 50-60 may be less informative about the burnout-recovery process since at these ages we have reason to think that transitions out of and back into work may be more due to layoffs or other involuntary exits as opposed to the burnout-recovery process that leads to reverse retirement at older ages. There are $51T$ moments, with $T = 12$:

1. Labor force participation by health status and age ($2 \times 2 \times T = 4T$ moments).
2. Assets at the 25$^{\text{th}}$, 50$^{\text{th}}$, and 75$^{\text{th}}$ percentiles by health status and age ($3 \times 2 \times T = 6T$ moments).
3. Labor force participation by assets ($2 \times 3 \times T = 6T$ moments).
4. Transitions from full-time to not working and not working to full-time work by age ($T + T = 2T$ moments).
5. Proportion decreasing work (FT to PT, FT to not working, or PT to not working) or increasing work (not working to PT, not working to FT, or PT to FT) by accumulated stress level (1-10) and age ($2 \times (10 \times T) = 20T$ moments).
6. Labor force re-entry by time out of labor force (1-5) and accumulated stress level (high or low) and age ($5 \times 2 \times T = 10T$ moments).
7. Participation by work preference index (high or low) and age ($2T$ moments).
8. Labor force exit rates by age (T moments).

The parameters of the model are identified through these moments. In particular:

- Parameters for the consumption weight γ and the coefficient of relative risk aversion ν are identified through moments on savings rates and participation rates (whether full-time, part-time, or out of the labor force) by age and asset levels.
- The utility cost of working while in poor health, φ_H, is identified by the proportion working by age and health status.

- The fixed cost of labor force participation, φ_P, is identified by transition rates from (to) full-time participation to (from) retirement, with no part-time work in between.
- The coefficient on accumulated participation utility cost, or "burnout", α_{AP}, is identified with the rate of exit from the labor force or the transition from full-time to part-time work by accumulated participation levels by age category. If α_{AP} is greater than zero, we should see higher exit rates when burnout is high.
- The coefficient on the reduction of burnout—the "recovery" coefficient α_{NW}—is identified by the re-entry rates by accumulated participation, time out of the labor force, and age.
- $\varphi_{P,t}$ participation by age and health.
- The bequest weight θ_b and bequest shifter K_0 are identified by asset levels by age (asset levels should be decreasing with age, with there being a lower probability of survival in the next period, if these parameters are low); K_0 is also identified by assets by age and health level, to distinguish bequests from precautionary saving in the expenses incurred or lost earnings in event of bad health.

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

$$\widehat{\theta} = \underset{\theta}{\operatorname{argmin}} \; \widehat{\varphi}\,(\theta, \widehat{\chi})' \, \Omega \; \widehat{\varphi}\,(\theta, \widehat{\chi}) \tag{11}$$

where $\widehat{\varphi}$ denotes the $51T$ vector of moment conditions, and Ω is a symmetric weighting matrix. We use a weighting matrix that contains the inverse of the estimated variance-covariance matrix of the estimates of the sample moments along the diagonal and zero elsewhere.

The solution to (11) is obtained by the following procedure

1. Compute sample moments and weighting matrix Ω from the sample data.
2. From the same data, we generate an initial distribution for health, wages, AIME, assets, accumulated work periods and preference type assigned using our type prediction equation (described below). Many of the first-stage parameters contained in χ are also estimated from these data.
3. Using $\widehat{\chi}$, we generate matrices of random health, wage, mortality, burnout from part-time work, and preference shocks. The matrices hold shocks for 10,000 simulated individuals.

4. Each simulated individual receives a draw of assets, health, wages, accumulated work periods, AIME, as well as preference type from the initial distribution, and is assigned one of the simulated sequences of shocks.
5. Given $\widehat{\chi}$ and an initial guess of θ, we compute the decision rules and simulate profiles for the decision variables.
6. Compute moment conditions by finding the distance between the simulated and true moments, which we seek to minimize as shown in (11).
7. Pick a new value of θ, update the simulated distribution of preference types, and repeat steps 4-7 until we find the $\widehat{\theta}$ that minimizes (11).

5.2. Preference Heterogeneity

To account for unobservable differences among reverse and non-reverse retirees, we allow permanent preference heterogeneity across individuals. This approach was used in such influential papers as Heckman and Singer (1984) and Keane and Wolpin (1997) and adopted by French and Jones (2011). In these models, each individual is assumed to belong to one of a finite number of preference types. The probability of belonging to a particular type is given by a logistic function of the individual's initial state vector which includes age, initial wages, health status, AIME, and preference index.

We estimate the type probability parameters jointly with the preference parameters in the second step. We have two types and allow for consumption weight γ, discount factor β, and fixed cost of work parameters α_0, α_1, α_2 and α_3 to differ by type. The probability of being a certain type will depend on initial health, assets, income, age, AIME, and one's *work preference index* level. We will describe this index briefly.

Work Preference Index

The work preference index is used as a measure of "willingness to work" as in French and Jones (2011). They construct a work preference index based on responses to three HRS questions given in Wave 1 interviews and our is very similar but not identical. While there may not be a strong connection with this preference index and re-entry, it will allow us to have types that better match *levels* of labor force participation. Here we present responses to these questions, also noting how the responses, and thus the preference index constructed from them, are independent of whether one is a "reverse retiree" or not in our categorization.

The work preference index is constructed using three HRS questions. The first of the three questions asks whether the respondent would continue working even if he did not need the income from his job.[14] Overall, nearly 70 percent of respondents either "agree" or

[14] Question `V3319` in the HRS files.

"strongly agree" with the statement. We can see that if we look separately at those whom we identify as reverse retirees (RR) and those who are not (non-RR), there is almost no difference. These responses are given in Table 13.

The second question used to construct the work preference index asks respondents whether the are looking forward to retirement.[15] The results are in Table 14. While most people say they would continue to work if the income from their jobs was not needed, as we saw in Table 13, at the same time a majority also look forward to their retirement. Fewer than 20 percent said the idea of retirement made them "uneasy". But again, whether one looks forward to retirement or not does not differ on average across those who do and do not re-enter the labor force after exiting: There is less than one percentage point difference for each response across non-reverse retirees and reverse retirees. The third question that informs the French and Jones (2011) preference index asks respondents how much they enjoy their jobs on a scale of 0 (dislike) to 10 (like a great deal).[16] This question was not asked of most respondents—only 146 in our sample. We will not use this as part of our index due to the low number of responses, though the results are in Table 15.

These HRS questions were only asked in the 1992 Wave 1. As in French and Jones (2011), we constructed the index by first regressing participation in future Waves 4 onwards on responses to the "would work even if I didn't need the money" and "look forward to retirement" questions, as well as age, average income ages 50 to 60, future participation levels, health, and interactions of these terms. The preference index is then the responses times the coefficient estimates. We divided the index into *low* (about 63 percent of the sample) and *high*, where the highest index individuals would have responded that they "strongly agree" with the statement "I would work even if I didn't need the money" and that they do not look forward to retirement. The preference index will not inform reverse retirement directly, only whether the individual is more likely to work or not in any given period and which preference parameter type he is more likely to be assigned to.[17]

Table 13: *Whether Respondent Would Work if the Income Was Not Necessary*

Would Work Even if Income Wasn't Necessary	non-RR	RR
Strongly Agree	14.1%	14.2%
Agree	54.0%	54.9%
Disagree	23.0%	22.6%
Strongly Disagree	9.0%	8.4%
Observations	2,170	705

[15]HRS question `V5009`.

[16]HRS question `V9063`.

[17]Some correlations between willingness to re-enter, measured by preference index, and health can be seen in Tables A8 and Table A9 on page 40 of the Appendix.

Table 14: *Whether Respondent Looks Forward to Retirement*

Feelings about Retirement	non-RR	RR
Looking Forward	69.1%	69.3%
Mixed Feelings	13.7%	13.1%
Uneasy	17.2%	17.6%
Observations	1,670	648

Table 15: *Whether Respondent Enjoys Job*

Like or Dislike Current Job?	
Dislike (0 to 3)	1.4%
Neither Like nor Dislike (4 to 6)	15.0%
Like (7 to 10)	84.6%
Observations	146

5.3. First-Stage Estimates

In the first stage we obtain parameters for what are determined outside of our model: wages, health transition probabilities, survival probabilities, and work stress.

Health Transitions

Health transitions are measured through an ordered probit, in which expectations on future health status depend on current self-reported health status and age. The statuses are divided into *"Good, Very Good, or Excellent"*, *"Fair"*, and *"Poor"*. While, at most ages, the majority of respondents report that they are in the *"Good, Very Good, or Excellent"* category, we choose these groupings because movements among them may have significant consequences for labor force participation. In other words, a change from *"Good"* health to *"Poor"* health is more significant than movements from *"Good"* to *"Excellent"*. Conditional health transition probabilities for ages 55, 65, and 75 are shown above in Table 16.

Wage Estimates

Table 17 gives estimates of Equation (8), with the outcome being log of annual earnings. All else equal, with these coefficients on age and age squared, wages are declining with age after 52. One can expect lower earnings with fair and poor health relative to the best health category (good, very good, end excellent self-reported health). Selection is on age, health, and dummies for ages 62 and 65 (the "early" and "full" Social Security retirement ages).[18]

[18] Casanova (2013): "The smoothly declining wage profile often estimated in the literature is a reflection of the increasing proportion of part-time employees as workers age." (Though this leads us to ask why there

Table 16: *Sample Health Transition Probabilities*

		Next Period Health		
	Current Health	G/VG/E	Fair	Poor
Age=55	G/VG/E	.87	.12	.01
	Fair	.46	.37	.17
	Poor	.15	.36	.49
Age=65	G/VG/E	.84	.14	.02
	Fair	.42	.39	.20
	Poor	.12	.34	.54
Age=75	G/VG/E	.82	.16	.02
	Fair	.37	.40	.23
	Poor	.10	.32	.58

Table 17: *Wage Estimates*

Outcome: ln *Annual Earning*, n = 13,064		
Variable	*Coefficient*	(*s.e.*)
Age (years)	.1753	(.0651)
Age^2	-.0017	(.0006)
Health		
Fair	-.0702	(.0379)
Poor	-.1835	(.1120)
Full-Time Work (φ)	.7852	(.0230)
Inv. Mills	-.0152	(.1707)
Constant	5.4025	(1.7257)
$\hat{\rho}$	.4529	
$\hat{\sigma}_\eta^2$	.7236	
$\hat{\sigma}_\xi^2$ (trans.)	.6584	

Mortality Profiles

Both Casanova (2010) and French (2005) compute their conditional survival probabilities using Bayes' Rule, with

$$s_t = P(\text{Survive}_t \mid H_{t-1} = H) = \frac{P(H_{t-1} = h \mid \text{Survive}_t)}{P(H_{t-1} = H)} \times P(\text{Survive}_t)\,.$$

We adopt their method and will assume in the model that individuals die with probability one at age 90 regardless of health status, so $P(\text{Survive}_{90}|H_{89} = H) = 0$ for all $H = \text{VE}, \text{F}, \text{P}$.[19]

are so many part-time workers—is it because preferences change or declines in productivity really translate into fewer hours rather than lower wages.) She concludes that the "correct specification for the offered wage profile is flat in age."

[19] Survival probabilities are obtained from the U.S. Social Security Administration's *Office of the Chief*

Stress Transitions

An individual's expected level of stress arising from work depends on whether he is working full- or part-time, his health, age, past participation status, and stress level when first observed.[20] To clarify the role of stress in the model, whether one can expect to be stressed if he chooses to work is observed and is also predicted by observables, whereas the coefficient on stress in the utility function, in terms of equivalent leisure hours lost in (4), is unobserved.

Table 18: *Stress Estimates*

Outcome: ln *Reports Job is Stressful*, $n = 42{,}195$		
Variable	*Coefficient*	*(s.e.)*
Age	-.024	.001
Acc. Work After 50	.005	.002
Initial Health		
Fair	.192	.021
Poor	.217	.047
Works Part-Time	-.692	.027
Constant	1.69	.083

6. Simulation

To examine whether the model can generate any of the reverse retirement seen in the data, we have simulated decisions for a given set of preference parameters, some of which are in the range of estimated parameters found in models similar to the model here. Using these values, we present some actual profiles from the HRS data and compare them with the simulated profiles using the estimated in Table 19 on page 28 to show the profiles most of interest here.

6.1. Simulated Profiles

Figure 3.1 shows the simulated full-time, part-time, and non-participation decisions generated from the a model with the preference parameters in Table 19. The figures also include the actual participation by age. The model, with these parameters, is able to capture some of the patterns of declining full-time participation and modestly increasing

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. We use the 1936 birth year cohort (the birth years in our sample range from 1931 to 1941).

[20]RAND HRS variable `rWjstres`.

Table 19: *Parameter Estimates*

Shared Preference Parameters		*Estimates*			
β	Time Discount Factor	.982			
ϕ_{H^F}	Leisure cost of fair health	270			
ϕ_{H^P}	Leisure cost of poor health	367			
$\phi_{P,t}$	FC of Work: Linear Age Trend	31			
α_{str}	AP Increase, Job Stress	.63			
$\alpha_{no\ str}$	AP Increase, No Job Stress	.12			
$\alpha_{no\ work}$	AP Decrease, Not Working	.88			
*Type-Specific Preference Parameters**		*Type 1* (2.4%)	*Type 2* (41.8%)	*Type 3* (48.3%)	*Type 4* (7.5%)
η	Risk Aversion	2.24	2.24	5.61	5.61
α_C	Consumption Weight	.52	.52	.49	.49
α_B	Bequest Weight	1.94	1.94	2.09	2.09
K_0	Bequest Shifter	$12K	$93K	$12	$93
ϕ_P	FC of Participation	180	391	180	391
ϕ_{RE}	Re-entry Cost	217	289	217	289
α_{AP}	Weight on Stress/Recovery	10	17	10	17

*Type 1 interpretation: low risk aversion, low burnout
Type 2: low risk aversion, high burnout
Type 3: high risk aversion, low burnout
Type 4: high risk aversion, high burnout

part-time participation with age, though the levels are somewhat high for full-time and low for part-time work.

In Figure 3.2, three graphs show both simulated and actual HRS assets at the 25^{th}, 50^{th}, and 75^{th} percentiles. The simulated asset levels are close to the actual asset levels in the data, as they were selected to do so, though the pattern is somewhat different with age. In the HRS data, at all these percentiles there is an increase in assets with age. In the simulated behavior, only assets at the 25^{th} percentile increases; there is, in the simulated behavior, more participation at older ages for those holding these levels of assets, adding to—or at least not subtracting from—accumulated assets. For the 50^{th} and 75^{th} percentiles, however, in the simulated behavior there is a very modest draw down of assets while in the actual data it continues to increase through age 72.

Given that the simulated asset levels are somewhat close to the actual levels while the simulated participation is too high, the risk aversion parameter ν used may be too high.

Figure 3: *Data and Simulated Labor Force Participation*

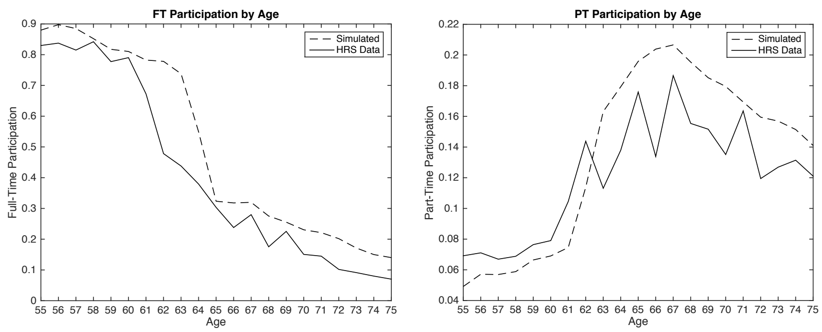


Figure 4: *Data and Simulated Re-Entry Rates*

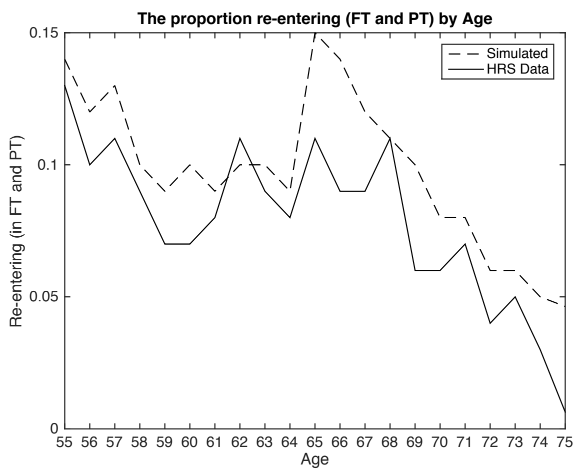


Figure 5: *Data and Simulated Assets*

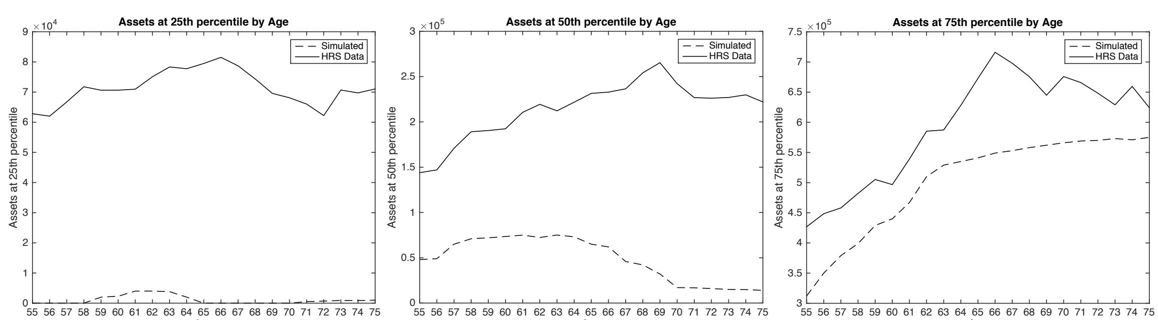


Table 20: *Type Prediction Parameters*

Coefficient		*Value*	*Coefficient*		*Value*
Bequest Intent High	β_1	0.37	Risk Aversion Response	β_5	-1.89
Initial Health: Poor	β_2	-0.94	Initial Asset Level	β_7	-0.85
Initial Health: Fair	β_3	-0.21	SS Earnings	β_8	0.11

*Variables are expressed in 10,000 dollars.

Higher risk aversion is manifested not only in greater savings but also greater levels of participation.

6.1.1. Preference Type Prediction

In the second stage of estimation we would also obtain type prediction parameters. Since we are simulating behavior for a given set of parameters, in this exercise we have chosen these parameters as well. There are two types: Type 1 and Type 2. The interpretation is that one type, Type 1, experiences lower disutility of working (relatively high consumption weight γ) and gets "burnt out" less quickly from work (lower α_{AP}). We estimate logistic function $P(\text{Type } 1|X) = 1/(1+e^{-\beta X})$ where

$$\begin{aligned} \beta X &= \beta_0 + \beta_1 \text{Bequest Intent}^{high} + \beta_2 \mathbb{1}_{\{H_{initial}=\text{Poor}\}} + \beta_3 \mathbb{1}_{\{H_{initial}=\text{Fair}\}} \\ &\quad + \beta_4 \text{Risk Aversion} + \beta_5 \text{Assets}_{initial} + \beta_6 \text{SS Earnings}\,. \end{aligned}$$

We expect that those with the higher work preference index (Index^{high}) are more likely to be Type 1, as are those in better health.

As reverse retirement is one of the main behaviors we study here, we would like to see whether our model is able to generate it. A counterfactual exercise, we look at simulated labor-force re-entry behavior when all the stress-burnout related parameters (α_{AP}, α_S, α_{nS}, and α_{NW}) are shut down, and compare this to the simulated behavior when these parameters are set as in Table 19 and reverse retirement in the HRS data.

In Figure 7, we have the proportion, out of all simulated or HRS individuals, who transition from being out of the labor force back into it by age. The solid black line represents the re-entry rates in our HRS sample, which go from around 1.5 percent at the earlier ages, up to over 2.5 percent at ages 66 and 67, going back down to under 1.5 percent at age 70. The simulated re-entry with Table 19 parameters gives rates that are within the range of real HRS re-entry; although the simulated participation rates are generally much higher than the true HRS participation in Figure 3, the re-entry (and exit) rates are much closer.

The lowest line in Figure 7 represents the simulated re-entry rates when the burnout-recovery part of the model is shut down, with the other parameters being unchanged. These re-entry rates are lower than both the series above, ranging from 0.5 to 0.8 percent at all ages. This suggest that, at least when holding the other selected parameters fixed, the burnout-recovery aspect of the model is indeed able to generate re-entry beyond what arises from shocks to wages, health, and preferences, giving re-entry behavior much closer to the true rates.

Figure 6: *Data, Simulated, and Counterfactual Re-Entry*

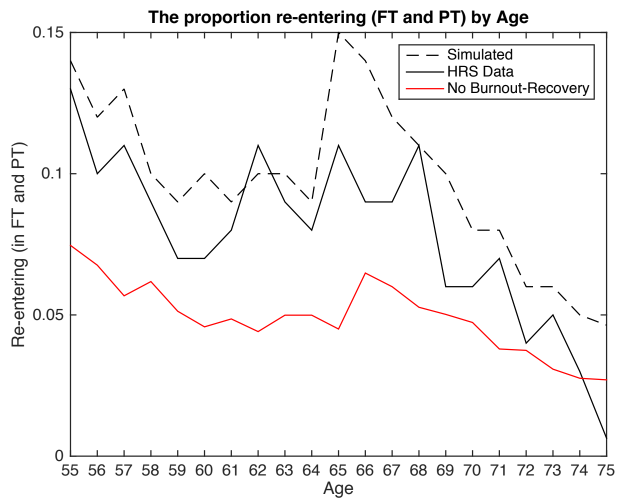
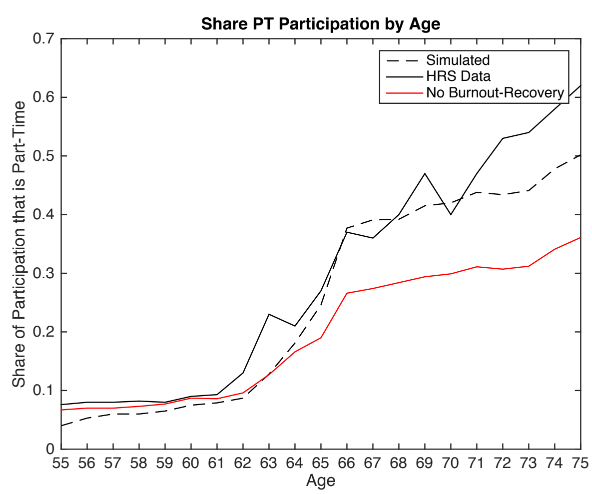


Figure 7: *Data, Simulated, and Counterfactual Part-Time Participation*



7. Counterfactual Experiments

(1) Employer accommodation of older workers

(2) Employer allows reduction of hours for reduction in pay.

How much of reverse retirement is due to the lack of option to work fewer hours?

(3) The effects of sabbaticals

(4) Does RR cause more full-time equivalent work years in total?

8. Discussion

In this paper we developed a model of burnout and recovery to account for the high proportion of people reverse retiring. We showed patterns in reverse retirement and argued that the groups of those who do and do not reverse retire look very similar on many observable demographic characteristics. This motivated our use of a structural model that could generate re-entry into work from the burnout-recovery process, as opposed to re-entry arising from financial, health, or retirement enjoyment shocks.

Through this model we can also account to some extent for the increasing fraction in part-time work at older ages. While models typically have part-time work giving more leisure, in our model choosing part-time work also means choosing a less stressful job—or at least one that has a lower probability of contributing to burnout. One question that could be addressed by this model is Social Security brings about periods of non-participation in between working periods. (I.e., to see how Social Security "subsidizes" periods of exit at certain times at the cost of taxing it on others, whereas agents would otherwise smooth work choices). We will determine this by changing eligibility ages.

Another issue that could be considered is whether the lack of a being able to choose from a range of work hours would actually reduce rates of labor force exit followed by re-entry. Being able to choose only from "non-smooth" part-time or full-time hours, which is the case in our model and tends to be true in reality, may be contributing to this non-smooth exit and re-entry behavior. Finally, it would be interesting to see the effects of "sabbaticals" and whether they are possibly less costly to employers than the turnover that could be generated when individuals are making participation decisions in the context of a burnout-recovery model.

The phenomenon of reverse retirement—as well as increased part-time work with age—is worth understanding foremost due the fact that we observe such a high proportion of it occurring in the data. Additionally, the burnout-recovery model we develop and estimate here is process that can exist for any age: For older workers we see more labor force exits and re-entrances because their productivity puts them closer to the labor-leisure cutoff.

We do not see this same in-and-out of the labor force action as much for younger workers because they are generally further from that cutoff. It could, however, explain why such a high number switch jobs or even careers for reasons beyond earnings. If instead of thinking of continued participation contributing to burnout (as we have here), we would have that continued work with the same employer or occupation contributes to burnout; switching diminishes the effect. In any case, the model may be relevant for all stages of work life.

The final reason we think reverse retirement is worth understanding has to do with the cost of switching participation status. That we can generate high rates of exit and subsequent re-entry—along with fixed participation costs being low relative to what is found in related literature—suggests that the cost of switching participation status is not very high. Alternatively, the cost of switching may be high but is outweighed by the burnout-recovery process.

9. Appendix

9.A. Appendix: The HRS Data

The main sample of respondents whose data used in estimations come from the *HRS Cohort*, born 1931 to 1941. This cohort was chosen for two reasons. First, this cohort was observed in every wave of the HRS. Second, they are observed over ages for which we observe wages when working as well as when might observe reverse-retirement activity: ages 51-83.

Variable Descriptions.

Below are descriptions of select RAND HRS variables used here. Further descriptions can be found through through RAND's documentation.[21]

- *Participation*: A respondent is considered to be participating in the labor force if he answers that he is "working for pay" and not participating in the labor force if he is "not working for pay" (HRS variable `RwWORK`). These binary responses are fairly consistent with similar questions in the Study, such as whether the respondent considers himself retired (HRS variable `RwSAYRET`) or his labor force status (`RwLBFR`). There is no distinction here between part-time and full-time participation.

- *Non-Housing Financial Wealth*: `HwATOTF` The net value of non-housing financial wealth is calculated as the sum of the appropriate wealth components less debt: Stocks, checking account balance, CDs, bonds, and other non-housing wealth minus debt. (HRS variables `(HwASTCK + HwACHCK + HwACD + HwABOND + HwAOTHR) - HwADEBT`.)

- *Earnings*: Annual earnings come from the HRS variable `RwIEARN`. The nominal reported amounts are converted to 2010 dollars using the CPI. `RwIEARN` is the sum of a respondent's wage or salary income, bonus and overtime pay, commissions, and tips.

- *Physical Health*: In the HRS there are five categories of self-reported health (variables `RwSHLT`): *Excellent*, *Very Good*, *Good*, *Fair*, and *Poor*. In estimation, physical health status is divided into only three categories: "GE", which includes *Excellent*, and *Very Good*, and *Good*, "F", which includes *Fair*, and "P" for *Poor* self-reported health.

- *Retirement Earnings*: Variable `RwISRET` includes annual Social Security income, including retirement, spouse, or widow benefits, but not including benefits received due to disability. `RwIPENA` gives income from pensions and annuities.

[21] Available at `http://www.rand.org/content/dam/rand/www/external/labor/aging/dataprod/randhrsL.pdf`.

9.B. Appendix: Selecting the Estimation Sample

The sample of respondents from the HRS that are selected for model estimation is more restricted than the sample included in the descriptive statistics presented. Including only male respondents leaves us with 16,334 out of 37,495 total respondents found in all twelve waves. Keeping only those in the original HRS cohort, born 1931-1941 reduces the sample to 4,977. Excluding those observed in fewer than five waves or never observed working leaves us with 3,269; excluding those whose longest career is in "Public Administration" leaves 2,995; keeping only married respondents whose wife is never observed working leaves 772 respondents in the model estimation sample.

9.C. Appendix: Primary Insurance Amount

In future revisions, Average Indexed Monthly Income (AIME), which is used to determine an individual's Social Security Primary Insurance Amount (PIA) will come from HRS restricted data. In place of this, we currently take AIME to be an individual's average earnings between the ages of 50 and 60. The (2010) formula for calculating PIA can be obtained at: `http://www.ssa.gov/oact/cola/bendpoints.html`.

9.D. Appendix: Additional Descriptive Statistics

Participation Rates

Those whom we categorize as reverse retirees overall have lowers rates of labor force participation at younger ages, and higher rates at older ages.

Table A1: *Proportion Working by Age and Whether Reverse Retiree*

Age Category	non-RR	RR
50-54	97.7%	77.6%
55-59	90.8	74.2
60-64	68.9	60.4
65-69	40.6	50.2
70-74	25.8	43.0
75-79	17.1	26.8
All Ages	59.2%	56.6%
Person-Years	19,163	8,445

What Does Retirement Mean?

A surprisingly high proportion of people, whether we categorize them as reverse-retirees or not, say that they plan to continue paid work after retirement, as seen in Table A2.

Table A2: *Post-Retirement Intentions*

	non-RR	RR
Stop Paid Work	23.0%	14.4%
Continue Paid Work	77.0%	85.6%
Observations	1,819	914

Table A3: *What Does Considering Onesself Retired Mean for Future Participation?*

	Percent Working...				
	Next Wave	+2 Waves	+3 Waves	+4 Waves	Obs.
All					
Not Retired	.829	.719	.625	.537	11,276
Completely Retired	.119	.134	.138	.145	9,575
Partially Retired	.649	.555	.476	.411	4,536
non-RR					
Not Retired	.863	.741	.631	.532	8,426
Completely Retired	.026	.022	.020	.024	6,671
Partially Retired	.688	.576	.484	.392	2,506
RR					
Not Retired	.727	.655	.611	.553	2,850
Completely Retired	.323	.363	.368	.359	2,904
Partially Retired	.601	.529	.465	.434	2,030

In Table A3, we say whether one's response to "Do you consider yourself retired?" tells us anything about participation in future Waves. We can see that, combining the respondents (to include RRs and non-RRs), 11.9 percent of this who consider themselves "Completely Retired" are working in the next Wave, while slightly higher numbers are working in future periods.

Defining Reverse Retirement

There are a number of possible ways to define reverse retirement occurrence. For instance, we could look at changes in the statuses of (1) whether one subjectively considers himself retired, (2) whether he reports working for any pay, (3) hours worked, or (4) level of income.[22] We'll compare responses for the first two definitions, as the later two require more judgement about what the cutoff levels should be, though we may look at these measures further in the future.

Table A4 gives the percent who un-retire—which, in the data, we observe from 0 to

[22]These correspond to HRS variables (1) `rWsayret`, (2) `rWwork`, (3) `rWhours`, and (4) `rWiearn`.

Table A4: *Reverse Retirement Occurrences: Comparing Definitions*

Reverse Retirement Occurrences	Change in "Working for Pay"	Change in "Considers Self Retired"
0	64.48	66.72
1	30.23	25.29
2	4.80	6.99
3	0.45	0.97
4	0.04	0.04

Note: 2,689 individual respondents.

4 times for an individual—during the time they are observed in the HRS under two definitions. Under the first, a change in the "Working for Pay" status from not working to working for pay, over 35 percent reverse retire at least once in our observations of them. Using the second definition, in which a respondent says he considers himself completely or partially retires one period and not retired in the next period, more than 33 percent reverse retire.

The definition of reverse retirement we will use in many the descriptive statistics that follow, unless otherwise noted, is a change from "Not Working for Pay" to "Working for Pay". In some ways a change in whether one considers himself retired is somewhat more interesting; if retirement is more a "state of mind" it's surprising that there would be so many reversals. However, though it's not immediately obvious why, the responses to whether one considers himself retired and whether he is working for pay line up quite well, and if we look at the later, we are more likely to get the wage observations necessary if looking at periods in which respondents say they are "Working for Pay".

Differences Just Before Stopping Work

Next we look at responses given on income, hours worked, and job stress in the period before stopping work in Table A5 for non-RRs and RRs. Those who eventually returned to work had lower income, hours per week, and slightly lower stress just before leaving (and though not shown here, those in the RR category are somewhat older). Table A6 gives the percent who reported that their jobs were stressful for eventual RRs and non-RRs in the three Waves before stopping work.

Medical Expenses and Reverse Retirement

Out-of-pocket medical expenses are shown in Table A7, which include all payments for the two year proceeding the HRS interview. These expenses rise with age, but on average are not especially high relative to permanent income. The maximum out-of-pocket expenses can be quite high, on the other hand. However, some of these tend to be incurred (necessarily) by people with rather high assets who self-insure against catastrophic events, so it's not clear whether these expenses themselves should affect labor force decisions for this group.

Un-Retirement Scenarios

Re-entry into the labor force at older ages may by due to (unplanned) shocks and/or (planned) preferences. We'll now list a few scenarios that fall under these categorizations inspired by descriptive statistics.

Shocks: Either initial retirement or re-entry is not planned.

- Unplanned retirement: Not working due to bad health (own or wive's), re-enter LF when health is better.
- Unplanned re-entry: Not working as planned, but then experience negative shock to

Table A5: *Responses Just Before Stopping Work*

	non-RR	RR
Annual Income	$49,385	$42,066
Hours per Week	38.5	35.9
Job is Stressful	52.8%	48.2%
Observations	1,323	1,014

Table A6: *Job Stress Before Stopping Work. Percent Reporting Stressful Job:*

Full-Time and Part-Time Workers:	3 Waves Prior	2 Waves Prior	1 Wave Prior
non-RR	52.1	51.2	50.0
RR	54.2	48.3	44.4
Observations	1,834	2,171	2,876
Full-Time Workers Only:	3 Waves Prior	2 Waves Prior	1 Wave Prior
non-RR	57.0	57.3	58.2
RR	62.8	59.0	56.5
Observations	1,436	1,626	1,906
Part-Time Workers Only:	3 Waves Prior	2 Waves Prior	1 Wave Prior
non-RR	28.0	27.9	28.7
RR	26.5	22.5	25.3
Observations	348	488	834

Table A7: *Out of Pocket Medical Expenses, Previous Two Years*

	Out-of-Pocket Expenses			
Age Category	Mean	Median	Maximum	Obs.
50-54	$1,629	$491	$77,762	2,278
55-59	1,931	651	140,278	5,978
60-64	2,780	945	1,453,705	7,519
65-69	3,292	1,307	262,048	6,985
70-74	3,500	1,540	314,359	4,399
75-79	3,126	1,500	87,600	1,321

finances/wife's health/own health that requires income from working.

- Unplanned re-entry: Not working as planned, but the person does not enjoy retirement as much as he thought he would so he goes back to work.

Preferences. Both initial retirement and re-entry are anticipated.

- A leisurely job search: (This would apply to those who worked in jobs with less flexible hours and more rigid pension structures.) Before leaving his career job, a person expects that he will continue working afterwards, possibly part-time in work unrelated to his prior job, because he likes to stay busy and enjoys the additional income. He does not search for a new job at all before leaving his career employment, and after leaving he does not search intensely as there is no financial urgency. (Does not require utility of leisure declines with age.)

- Taste for variety: In this scenario, a person likes retirement for a certain period of time, but knows at some point he'll get bored with it and will find a new job (probably not the same as what he initially retired from) to keep life interesting or challenging. (Also does not require utility of leisure declines with age.)

- Leisure time: Both productivity and utility of leisure decline with age, but at rates such that one is inclined to take time to vacation while utility is still high (even though earning potential is still high relative to later years).

Table A8: *Health Status and Reverse Retirement*

	Low Preference Index		High Preference Index	
Current Health Status: Improved	nonRR	RR	nonRR	RR
Excellent/Very Good/Good	87.76	12.24	87.27	12.73
Fair	92	8	92.96	11.32
Poor	96.46	3.54	92.96	7.04

Table A9: *Retirement Satisfaction and Reverse Retirement*

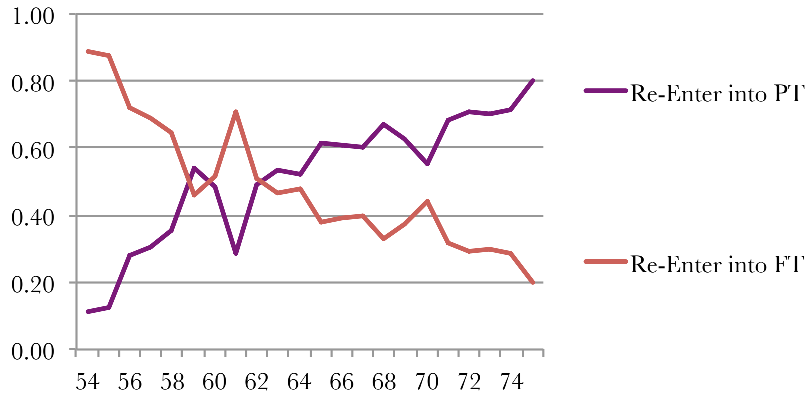
	Low Preference Index		High Preference Index	
Retirement Satisfaction Last Period	nonRR	RR	nonRR	RR
Very	91.27	8.73	90.61	9.39
Moderately	87.44	12.56	88.24	11.76
Not at all	95.61	4.39	85.34	14.66

9.E. Transitions Out of and Back Into Work

Table A8 shows that people with the high preference index are more likely to return to work when their health improves, particularly when their health statuses are fair or poor. Table A9 shows that people with the high preference index are more likely to re-enter the labor force when they do not enjoy retirement while there is no pattern between retirement satisfaction and work re-entry for people with low preference index. Figure 2 shows transitions out of full-time work, part-time work, and non working. We can see that at older ages, more individuals leave full-time work and enter into both part-time work and retirement at higher rates. At younger ages, those working part time are more likely to transition into full-time work at younger ages than they are beyond age 62. This may be capturing "underemployment" for younger part-time workers, who would prefer working full-time and take those offers when available. At older ages, part-time work could be considered more preferred. Transitions out of not working to either full-time or part-time work are highest at younger ages (where we suspect not working is more likely to be involuntary and re-entry thus more expected), but still over 10 percent in ages 60-70.

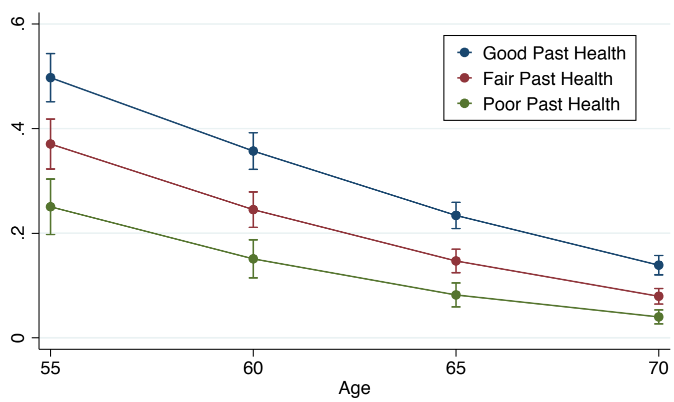
9.F. Additional Figures

Figure A1: *Labor Force Re-Entry into Part-Time versus Full-Time by Age*



Note: 8,864 person-years.

Figure A2: *Labor Force Re-Entry Rates When Health Improves by Past Health and Age*



Note: 8,864 person-years.