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How Important Are Wages to the Elderly? Evidence from the New Beneficiary Data System and the Social Security Earnings Test

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Abstract

More than 40 percent of Social Security beneficiaries continue to work after age 65. This research investigates the extent to which these individuals substitute labor across periods in response to anticipated wage changes induced by the Social Security earnings test. While we find that a disproportionate number of individuals choose earnings within a few percentage points of the earnings limit, we find no evidence that these individuals substitute labor supply between ages 69 and 70 when, in our sample, the tax on earnings falls from 50 percent to zero.

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1. Introduction

The growing importance of the elderly in the U.S. workforce is the product of two well-known trends, the aging of the U.S. population and the leveling off of the long-term decline in male labor force participation at older ages. In 2000, individuals ages 65 and above accounted for 13 percent of the U.S. population; by 2025 this percentage is projected to rise to 19 percent [Census 2000]. While male labor force participation at older ages declined over much of the 20th century, this long-run trend toward earlier retirement slowed considerably in the 1980s and some argue may have reversed itself in the 1990s [Quinn 1999; Purcell 2000]. By some estimates these two trends together imply the elderly will account for more than 5 percent of the total U.S. workforce in 2025 [Fullerton 1999].

For a variety of reasons, we might expect the labor supply of elderly workers to respond differently to financial incentives and non-pecuniary job characteristics than younger individuals. Perhaps most importantly, the overwhelming majority of elderly workers receives or is eligible to receive some level of guaranteed annuity income, whether it is from Social Security, private pensions, or private savings. Of equal importance, the elderly are much more likely than younger workers to suffer both acute and chronic episodes of poor health that affect the amount and kind of work they can perform. While many studies have documented the importance of these two factors in determining how individuals transition from full-time work to complete retirement around the early and normal Social Security retirement ages of 62 and 65, relatively little published work focuses on the labor supply decisions of those individuals who accept retirement benefits, but continue to work. Understanding what keeps these individuals in the labor force is of increasing importance as the elderly population grows and the question of how individuals and society can maintain adequate income at older ages looms larger.

In this paper, we use the longitudinal New Beneficiary Data System (NBDS), which surveyed a sample of new Social Security beneficiaries in 1982 and 1991, to explore the relative importance of wages in the labor supply decisions of elderly workers. We do this in two ways. First, we examine survey responses to a host of subjective questions in the NBDS regarding why individuals do or do not work following receipt of Social Security benefits. Second we estimate the extent to which elderly workers substitute work across periods in response to changes in wages induced by the Social Security earnings test.

Although a number of researchers have estimated the response of labor supply to changes in the Social Security earnings test — see, for example, Burtless and Moffitt (1985), Gustman and Steinmeier (1986), Friedberg (2000), and, for Canada, Baker and Benjamin (1999) — we are aware of no study that has studied the effect of the earnings test using panel data. Panel data allow us to directly estimate the intertemporal labor supply elasticity of elderly workers between the ages of 69 and 70 at which point the

effective tax rate on covered earnings falls from 50 percent to zero. In addition, the NBDS provides administrative data on covered earnings. Previous research has relied on self-reported earnings that are presumably measured with greater error than earnings recorded administratively. With administrative data on covered earnings, we can determine precisely which individuals are constrained by the earnings test and so which individuals should be most likely to respond to the elimination of that constraint.

We begin this paper in Section 2, with a review of the empirical literature on elderly workers including prior research on the earnings test. We then derive from a life-cycle model of labor supply an empirical specification that relates changes in hours of work to changes in wages and the disutility of work (Section 3). Our expression for labor supply is similar to that of Lee (2001), which is in turn attributable to earlier work on life-cycle labor supply by Altonji (1986) and MaCurdy (1981). Our model is distinguished by our focus on how changes the disutility of work affect the responsiveness of elderly workers to changes in wages. In Section 4, we describe the NBDS data and, in Section 5, respondents' own reasons for why they do or do not work following receipt of Social Security benefits. Section 6 presents estimates of the intertemporal labor supply elasticity between ages 69 and 70 relying on the earnings test for identification, compares those estimates to those for younger workers, and explains how they differ from other published estimates that rely on the earnings test. We conclude in Section 7.

2. Prior Research

Only a few studies have directly examined the characteristics of elderly workers and correlates of their labor force participation. Iams (1987) finds that new Social Security beneficiaries in the first wave of the NBDS tend to work fewer hours and for lower wages than they did prior to receiving benefits. Iams also finds that individuals who changed jobs following benefit receipt tend to move into service-oriented jobs. Using the National Longitudinal Survey of Older Men (NLSOM), Parnes and Sommers (1994) find that the probability of work among men ages 68 and older in 1989 is strongly correlated with good health and an individual's work ethic and attitudes toward retirement measured in earlier waves of the NLS. Parnes and Sommers also report a positive correlation between educational attainment and labor force participation and negative correlation between non-labor income and labor force participation in this population. Pienta, Burr and Mutchler (1994) 1994 focus on elderly women and the strong positive correlation between their labor force participation early and later in life.

Several studies have demonstrated that job characteristics affect the ability of older individuals to remain in the workforce. For example, a number of studies show retirement ages are lower for individuals who work in physically demanding occupations [Holden 1988; Gustman and Steinmeier 1986; Hayward and Grady 1990]. Given the long-term shift in the U.S. economy toward less physically demanding occupations, it is not clear how important this kind of impediment to work at older ages will

continue to be. There is little evidence in general that suggests older workers are less productive in their work activities [Mitchell 1990]. A survey of employer attitudes found that employers rate older workers above average in terms of experience, judgment, commitment to quality, and attendance and punctuality [CED 1999, p. 29]. The same survey found, though, that older workers exhibit less flexibility and adaptability.

Hurd and McGarry (1993) emphasize the likely importance of hours flexibility in determining labor force participation among older workers. In a standard labor supply model, individuals choose hours of work given exogenously offered wages, and there are many reasons to believe that older workers would prefer to reduce hours gradually rather than retire all at once. Indeed, transitioning from full-time to part-time employment, and frequently simultaneously to a new employer and even a fundamentally different job, is a common pathway to retirement for many older individuals [Hayward and Grady 1990; Blau 1994; Ruhm; and Hayward, Crimmins and Wray 1994; Herz 1995].

There is considerable evidence, however, that hours and wages are offered simultaneously and so workers cannot simply choose hours at a given wage [Lundberg 1985; Dickens and Lundberg 1993]. Hurd and McGarry (1993) investigate whether the ability to adjust hours within a job is correlated with retirement expectations. They find that individuals who currently work in jobs where work hours can be reduced or their responsibilities can be lessened report a substantially higher subjective probability of working past age 65, even after controlling for a host of demographic, financial, and health characteristics. Thus, the ability of employers to accommodate demands for flexibility may be an important determinant of labor supply among the elderly. While there is no direct evidence on this point in the case of the elderly, several studies do show that accommodation influences the likelihood that individuals suffering from a temporary or permanent disability return to work as well as their earnings in that job [Daly and Bound 1996; Burkhauser, et al. 1999].

Haider and Loughran (2001) present suggestive evidence from the Health and Retirement Study (HRS), Asset and Health Dynamics of the Oldest Old (AHEAD), and March Current Population Surveys (CPS) that non-pecuniary factors are important in the labor supply decisions of the elderly who are currently working. Labor supply in this population is concentrated among the healthiest, wealthiest, and most educated individuals, yet these individuals work for very low wages. Nearly 75 percent of individuals ages 70 and above earn wages in the bottom quintile of the overall wage distribution of those ages 50-61. Panel data suggests that declining wages with age is not due to selective retirement, but rather the gradual transition of individuals into part-time work with low wages. They also find that transitions out of the labor force in the AHEAD population are explained in large part by declining health.

Neumark and Johnson (1996) come to a similar conclusion in their longitudinal analysis of age-wage profiles in the NLSOM. Declines in wages are most pronounced at ages 62 and 65 and it would be

appear that a fraction of that decline is attributable to the shift from full-time to part-time employment and departures from career employers. They speculate that declines in wages at these ages are also due to unobserved changes in worker effort due to increases in unearned Social Security income. Neumark and Johnson (1996) see comparatively little decline in wages among elderly workers who do not receive Social Security benefits, although the select nature of that population complicates any inferences one might draw about the role of Social Security versus other factors in causing wage declines.

If it is the case that older workers accept lower wages in order to gain greater flexibility in terms of lower hours and perhaps other job attributes, it is tempting to think that these workers may be unconditionally less responsive to changes in wages than younger workers. That is, if older workers have a strong preference for low hours of work, then they will be less willing to substitute hours of work for consumption when wages rise than younger workers. We will show, however, that this inference is at odds with a theoretical model of life-cycle labor supply. Empirically, our only evidence on the labor supply elasticity of older workers comes from variation in wages induced by the earnings test and this evidence is mixed.

The earnings test reduces Social Security benefits for affected workers whose annual earnings exceed the established threshold. Although these reduced benefits are eventually refunded to workers in a roughly actuarially fair manner, the earnings test is nonetheless widely perceived as a pure tax on earnings and the empirical literature has consequently ignored this complication. There have been many changes to the earnings test over the years. During the 1980s, the earnings test covered those workers who were receiving retirement benefits between the ages of 62 and 69. For these individuals, the benefits were taxed back at a rate of $1 for every $2 earned. This tax rate was changed to $1 for every $3 earned in 1990. Most recently, the earnings test was eliminated in 2000 for workers ages 65 to 69. During the 1980s, the earnings threshold varied between $5,000 and $10,000 (in nominal terms) and reached $15,500 before it was eliminated in 2000.[1] Some workers have earnings sufficiently high to make them ineligible for Social Security benefits altogether and so, for them, the marginal reduction in benefits past this point is zero.

In theory, the elimination of the earnings test between ages 69 and 70 induces intertemporal substitution for those individuals just below or above the earnings threshold. Unless there exist large fixed costs associated with working any hours, only those individuals who, at ages less than 70, chose to work at or above the threshold, will experience a relevant change in their marginal tax rate. In Figure 1, the individual represented by indifference curve U_1 works h_1 hours before and after age 69 since the budget constraint only changes to the left of point a. Individual 2, on the other hand, experiences a 50

[1] See Gruber and Orszag (2000) for more detail on variation in the earnings test over time.

percent increase in his or her wage at age 70, inducing an unambiguous increase in hours of work (from $h_{2,1}$ to $h_{2,2}$) between ages 69 and 70, *all else equal*. An unanticipated decrease in the earnings test would also generate income effects that would lower labor supply and so, theoretically, the labor supply response to unanticipated change in the earnings test is ambiguous.

As evidence that the earnings test impacts labor supply, various authors have noted that a disproportionate number of workers choose earnings within a narrow range surrounding the earnings limit [see, for example, Vroman 1985; Burtless and Moffitt 1985; Friedberg 2000]. For example, using data from various years of the March CPS, Friedberg (2000) finds evidence of substantial bunching at the earnings threshold and that this bunching moves systematically with changes in the threshold over time.

The implications of this bunching for the responsiveness of the elderly to wage changes are less clear. Early studies [e.g., Burtless and Moffitt 1985; Gustman and Steinmeier 1986] conclude that the earnings test is relatively unimportant. However, these studies relied on relatively small law changes to identify the impact. Friedberg's (2000) estimates, which rely on the 1983 elimination of the earnings test for workers ages 70 to 71 and the 1990 tax rate change from 50 to 33 percent, imply that eliminating the earnings test will raise hours of work by 5.3 percent for those currently at or above the earnings threshold. Friedberg's estimates are generated by modeling labor supply responses to changes in the earnings test along the entire budget constraint. Gruber and Orszag (2000) use a reduced-form approach and conclude that the earnings test has little overall impact. Relying on a much different policy experiment, Baker and Benjamin (1999) examine the elimination of the earnings test in the Canadian public pension system. They find no impact on total hours worked, but they do find a substantial increase in weeks worked.

Only Friedberg (2000) uses estimates of the responsiveness of the hours of work to changes in the earnings test to compute a labor supply elasticity for the affected population. Friedberg interprets her estimated wage elasticity of 0.32 as an uncompensated wage elasticity, which captures both substitution and income effects related to changes in wages in a static model. This elasticity is larger than most estimated wage elasticities for prime-age males.[2]

In the work that follows, we focus on the intertemporal wage elasticity. The estimates of Friedberg (2000), Gruber and Orszag (2000) and others that use cross-sectional data do not isolate this particular parameter. The NBDS, however, allows us to examine within-individual changes in labor supply as their budget constraint changes between ages 69 and 70. In the following section, we examine a standard life-cycle model of labor supply that helps us to interpret changes in hours of work between ages 69 and 70 and how our elasticity estimates compare to that estimated by Friedberg (2000).

[2]Blundell and MaCurdy (1999) summarize these estimates.

3. A Model of Life-Cycle Labor Supply

Consider a standard life-cycle model of labor supply in which an individual seeks to maximize the sum of expected utility, U(c,h), over T periods:

$$V_t = \sum_{s=t}^{T} U_s(c_s, h_s)(1+\rho)^{s-t} \tag{1}$$

where c is consumption, h is hours of work, and ρ is the subjective rate of discount. The individual faces a budget constraint that equates the present discounted value of consumption with the present discounted value of labor income plus initial wealth, A_t:

$$A_t + \sum_{s=t}^{T} W_t h_t (1+r)^{s-t} = \sum_{s=t}^{T} c_t (1+r)^{s-t} \tag{2}$$

where W is the wage rate, r is the market rate of interest, and we assume individuals can borrow freely across periods.

We can obtain a labor supply function by maximizing the utility function in Equation (1) with respect to hours and consumption and subject to the budget constraint of Equation (2). Following previous studies [e.g., MaCurdy 1981; Lee 2001], we assume the period-specific utility function,

$$U_t(c_t, h_t) = \mathrm{Y}_{1,t}[c_t]^{\omega_1} - \mathrm{Y}_{2,t}[h_t]^{\omega_2}, \tag{3}$$

where Y_1 and Y_2 weight consumption and labor supply in the utility function and $0 < \omega_1 < 1$ and $\omega_2 > 1$ are time-invariant parameters. We can think of $Y_{2,t}$ as a measure of the disutility of work. This utility function yields a closed-form solution for the labor supply equation (assuming the existence of an interior solution),

$$\ln h_t = \frac{1}{\omega_2 - 1}\left[\ln\lambda + \ln W_t + t\ln\left(\frac{1+\rho}{1+r}\right) - \ln \mathrm{Y}_{2,t} - \ln\omega_2\right], \tag{4}$$

where λ *i*s the Lagrange multiplier associated with Equation (3) (i.e., the marginal utility of wealth).[3]

Within the lifecycle framework, there exist two different elasticities that capture how individuals respond to wage changes. The first elasticity, the intertemporal elasticity, allows us to examine how hours of work respond to known wage changes along a given age-wage profile or, in the language of MaCurdy (1981), an evolutionary wage change. The labor supply function in Equation (4) provides for a

[3] Equation (4) is equivalent to Equation (11) in MaCurdy (1981). Another justification for this labor supply function is that it is represents a log-linearization of an arbitrary labor supply function [Card 1994].

simple characterization of the intertemporal elasticity because the lack of income changes implies that the marginal utility of wealth, measured by λ, remains constant. Thus, the intertemporal elasticity is simply,

$$\alpha_I = \frac{\partial \ln h_t}{\partial \ln W_t} = \frac{1}{\omega_2 - 1}. \tag{5}$$

The intertemporal elasticity is a function only of the parameter ω_2 and so is independent of time-varying individual characteristics like the disutility of work. The intertemporal elasticity is the relevant elasticity when trying to understand how older workers will substitute labor from one period to the next in response to anticipated changes in wages.

The second elasticity captures how hours of work responds to a parametric shift in the age-wage profile. Individuals respond to such a shift both because the relative wage rate changes across periods (changes captured by the intertemporal elasticity) but also because it induces a change in the marginal utility of wealth. The latter effect is expected to be negative, implying that this second elasticity will be less than the intertemporal elasticity. This second elasticity is the relevant elasticity for evaluating the welfare effects of changes in the earnings test [Blundell and MaCurdy 1999; Card 1994].

Individuals may adjust labor supply between two periods for a variety of reasons other than changes in wages. For the elderly, increasing disutility of work may be a particularly important reason why we observe labor supply declining with age [see, for example, Weiss 1972]. As health declines, work is likely to become more onerous. The importance of rising disutility of work can be seen if we take first differences of Equation (4) to derive an expression for change in log hours of work:

$$\Delta_t \ln h = \frac{1}{\omega_2 - 1}\left[\Delta_t \ln W + \ln\left(\frac{1+\rho}{1+r}\right) - \Delta_t \ln \mathrm{Y}_2\right], \tag{6}$$

where the Δ_t signifies a first difference (e.g. $\Delta_t h = h_{t+1} - h_t$). Equation (6) makes clear that changes in hours across periods is a function of changes in wages but, importantly, the discount rate and market rate of interest, and changes in the disutility of work. Log hours will decrease at a constant rate $\ln\left(1+\rho/1+r\right)$ so long as $\rho < r$ and decrease at a rate equal to α_I as log disutility of work increases. Empirically, Equation (6) tells us that we need to control for changes in the disutility of work in order to produce an unbiased estimate of α_I. We discuss this point further in Section 6, where we develop an empirical specification of Equation (6).

4. The NBDS

The NBDS is a nationally representative, household panel survey of Social Security beneficiaries who first received benefits between mid-1980 and mid-1981.[4] The first wave was fielded in 1982. A second survey of the 1982 respondents or surviving spouses was fielded in 1991. The data contain extensive information on demographic, employment, martial, health, and wealth characteristics.

A major advantage of the NBDS for our purposes is the availability of matched administrative files of yearly covered earnings from 1951 to 1991. These data allow us to examine the earnings of individuals who are subject to the Social Security earnings test over time and without error.[5] In particular, it is exactly the earnings that are reported to the Social Security administration that matter for the earnings test. Moreover, because these data provide panel information, we can directly examine how an individual's behavior changes as the tax rate changes.

Our analysis focuses on the 9,519 individuals in the NBDS who were new beneficiaries of retired worker benefits during the sample selection period (mid-1980 through mid-1981) and qualified for these benefits based on their own earnings history. We focus on these individuals because they are the most likely to have a substantial attachment to the labor force and so respond to the incentives of the earnings test. We further limit our analysis to those individuals who were born in the years 1913 through 1919, which guarantees that we observe an individual's retired earnings for at least one year during their 60s. This restriction leaves us with 8,725 respondents.

Respondents in our sample were between 63 and 69 in 1982 and 72 and 78 in 1991. A little more than half of the sample (55 percent) is male; 77 percent are married and 12 percent is either black or Hispanic. Respondents have an average of 11 years of education. It is important to note that our sample excludes individuals receiving disability and those who qualify for retirement benefits by virtue of their spouse's earnings history. Consequently, it is likely that our sample is more likely to work past retirement than the general population.

5. Descriptive Analysis of Elderly Labor Supply

Before turning to a formal analysis of intertemporal substitution in the NBDS, we first present a broader picture of who in the NBDS is likely to be affected by the earnings test. About 22 percent of the sample is still working at age 69 (Figure 2), and so the elimination of the earnings test at age 70 can at best induce substitution among a small number of individuals. In Figure 2, we graph the fraction of

[4] The NBDS also contains a representative sampling of persons ages 65 and over who were entitled to Medicare benefits but whose earnings prevented them from receiving Social Security benefits as of July 1982. We do not analyze these respondents in the present draft.

[5] The administrative earnings data are reported to four digits of significance, so in the neighborhood of the earnings test, we observe social security earnings to the dollar.

respondents with positive Social Security earnings between ages 60 and 78.[6] At age 60, 80 percent of the sample has positive Social Security earnings. This percentage falls by 12 percentage points between ages 61 and 63 and another 23 percentage points between ages 64 and 66. After age 66, the fraction with positive earnings fall at an average rate of about two percentage points per year.

Figure 2 also graphs indices of hours/week, weeks/year, and total hours/year between ages 64 and 78. These indices are constructed using self-reports of hours and weeks worked between 1983 and 1991. Because they were collected retrospectively, these hours and weeks data are likely to be measured with greater error than in data sets like the CPS and HRS. Conditional on working at all, hours and weeks worked change relatively little between ages 64 and 74. Weeks/year drop sharply after age 74. Hours/week, weeks/year, and total hours per year fall by 4.0, 3.7, and 5.5 percent, respectively between ages 64 and 74. The average number of hours/week and weeks/year worked for those working at age 69 is 29 and 41. Haider and Loughran (2001) using CPS data also note that hours and weeks of work decline relatively little among those who do work between ages 65 and 74. It may be that elderly workers would like to work fewer hours, but cannot due to fixed employment costs. Only 11 percent of queried respondents, however, stated they would have preferred to work fewer hours.

For the remainder of this section we focus on two subpopulations: those who work at least one year after age 69 (workers) and those who do not (non-workers), where working is defined by positive Social Security earnings. Respondents who did not work after age 69 comprise 77 percent of the total sample. 55 percent of these respondents did not work at all between 1983 and 1991, 6 percent worked during at least one of those years, 25 percent died during those years, and 12 percent were not interviewed in 1991 for other reasons.

In 1991, the NBDS asked respondents who did not work at all between 1983 and 1991, why they chose not to. We tabulate those responses in Panel A of Table 1. As can be seen, 79 percent of these non-workers chose not to work because they had retired or because they did not want to work. Another 17 percent stated that they were too ill or disabled to work or did not work for family reasons. Only one percent did not work because no suitable jobs were available. In Panel B of Table 1 we itemized the reasons why respondents who did work sometime during 1983 and 1991 left their last job. Again, we see that the dominant reason for leaving their last job was wanting to retire (38 percent), poor health (25 percent), or their spouse's poor health (8 percent). About 14 percent of the sample left their last job because of poor business conditions, low wages, not liking the job, or to search for a better job.

The 1991 wave of the NBDS also asked these non-working respondents whether they would be willing to take a job if offered. Only 10 percent said that they would be willing to work if offered a job.

[6] We translate yearly Social Security earnings observations into age-specific observations using June as the cutoff in any given year.

The minimum wage these individuals would demand averaged $7.20 per hour. This compares to a mean wage of $x.x/hours for individuals ages 72 to 78 who report working in the CPS in 1991 and $x.x/hour for individuals ages 66 to 71.

In Table 2 we tabulate responses to the question, why did you take your last job? In Column A, we tabulate those responses for individuals who worked between in 1983 and 1991, but who did not work after age 69. Financial need or wanting to raise living standards was the most important reason for taking the last job for 34 percent of these respondents. Simply wanting to work counted as the most important reason for another 32 percent. We see similar percentages in Column B for the sample of respondents working after age 69. These individuals, however, were somewhat more likely to say they took their last job because they wanted to work (42 v. 32 percent).

Perhaps the most significant difference between respondents who worked after age 69 and those who did not is health. First, 25 percent of the sample not working after age 69 died before age 70. For those still living in 1991, self-reported health among those working after age 69 is substantially higher than for those not working after age 69. This can be seen in Table 3 where 36 percent of those working after age 69 report their health as being excellent or very good, compared to 26 percent of those not working. Workers are more likely than non-workers to report their health as superior relative to others their age as well (58 v 46 percent). As expected, workers are less likely to report that their health limits the kind or amount of work they can do (29 v. 41 percent).

While based on self-reports, the answers to these questions suggest that individuals who stop working after age 69 do so primarily because they do not want to work any more or because their health forces them to stop work. Revealing is the fact that only ten percent of the sample not working after age 69 would be willing to take a job even if it offered desirable wages and hours. We take this as evidence that rising disutility of work drives exit from the labor force. Curiously, for those who do work, we do not see much evidence that hours or weeks of work decline significantly between ages 66 and 74; moreover, only 11 percent of queried respondents reported they would prefer to work fewer hours, suggesting hours constraints related to fixed working costs is not keeping hours higher than they otherwise would be. Those individuals remaining in the labor force after age 69 are healthier than those who do not and are somewhat more likely to report that they work simply because they want to.

6. The Impact of the Earnings Test on Labor Supply

We begin our examination of intertemporal substitution by looking for graphical evidence that individuals subject to the earnings test choose earnings near the earnings limit (point *a* in Figure 1), an approach used by Friedberg (2000) and others. This analysis focuses on those individuals with positive

earnings in at least one year after age 65 — 40 percent of the respondents in our sample. In all of the analyses that follow, we exclude the entire year of earnings if an individual dies in that year.

Figure 3 presents the histogram of earnings relative to the earnings test by age. We generate the tabulations for this figure using respondents with positive earnings within 100 percent of the earnings test. The figure demonstrates that there is a distinct spike in the fraction of respondents with earnings within 10 percent below the earnings test for the two ages covered by the test (ages 67 and 69) but there is no such spike for those ages not covered by the test (ages 71 and 73). These results are more distinct than Friedberg's, especially in the relative drop in earnings after the earnings test. However, because the earnings test was between $6,000 and $9,720 in the years we examine, the 10 percent bands used in Figure 3 are not much more precise than Friedberg's $1,000 bands.

In Figure 4, we narrow our earning bands to intervals of 2.5 percentage points. Once again, the figure demonstrates that there is a distinct spike in the fraction of respondents who have earnings just below the earnings test, but this figure shows that the spike is driven by people locating within 2.5 percent of the earnings test. For example, for the 1988 earnings test of $8,400, this band implies that an unusually large fraction of individuals locate within $210 below the earnings test. These data suggest that at least some individuals had both precise knowledge of the earnings test and the ability to choose their earnings with precision. At the same time, some individuals locate on areas of the budget constraint just above the earnings test, behavior that is at odds with the theoretical predictions. Given that our data are measured without error, this provides evidence of the dangers in only using non-convexities in the budget constraint when measuring labor supply.[7]

Importantly, Friedberg is able to examine a question with her data that we are unable to examine. Friedberg examines how individuals respond to two different law changes. A 1983 law removed the earnings test for individuals ages 70 to 71 and a 1990 law reduced the marginal tax rate for those ages 65 to 69 from 50 to 33 percent. Friedberg estimates an uncompensated wage elasticity of 0.32 at the sample means, under the assumption that both of these law changes were unanticipated by the worker and thus represented a positive income shock. Because Friedberg does not rely on a life-cycle model, her elasticity does not strictly correspond to those discussed in the previous section, but it does provide a lower bound for the intertemporal labor supply elasticity characterized by Equation (5).

[7] In standard formulations of models that use non-convexities in the budget set, it is presumed that measurement error explains why individuals would locate just above the earnings test. See Blundell and MaCurdy (1999) for a discussion of these issues.

Our panel data, however, can be used to examine how individuals respond to the known change in the after-tax wage between ages 69 and 70.[8] The basic prediction of the model is that individuals choosing earnings at or above the earnings limit at age 69 will increase their labor supply between ages 69 and 70, all else equal. To examine this prediction, we group individuals who are 66 to 68, 69 and 70, and 71 to 73.[9] For each group, we then compute the mean percent change in earnings from this year to the next by earnings bands relative to the earnings test in the first period. We present these results in Figure 5.

Figure 5 shows that earnings growth is negative across most of the earnings distribution for all three age groups. Individuals age 69 or 70 with earnings near the earnings test, though, experience a slight positive increase in earnings as the earnings test is eliminated. The relative increase in earnings for these individuals is even more evident when compared to the changes in earnings for other age groups who choose earnings near the earnings test. The theory also predicts that individuals who choose earnings above the earnings test should also experience a relative increase in earnings growth when the earnings test is eliminated. We do not observe this in Figure 5, however.

We turn to a regression framework in order to formally estimate an intertemporal labor supply elasticity using the earnings test. To do this, we make several modifications to Equation (6). Note first that the first-difference of the logarithm of pre-tax earnings (i.e., what we observe in our administrative data) is,[10]

$$\Delta_t \ln E = \Delta_t \ln h(W^\tau) + \Delta_t \ln W, \tag{7}$$

where W^τ represents after-tax wages. By assuming that the pre-tax wage does not change between adjacent periods, this expression implies that we can study changes in earnings to make inferences about changes in hours. Second, the assumption that the pre-tax wage does not change between adjacent years also implies that the after-tax wage will systematically change only as an individual ages past the earnings test and is in the relevant range of earnings in the initial year. Specifically, as someone turns age 70 and

[8] Other recent studies of the earnings test rely on cross-sectional data [Baker and Benjamin 1999; Friedberg 2000; Gruber and Orszag 2000]. See Blundell and MaCurdy (1999) for a discussion of when cross-sectional data can be used to estimate an intertemporal elasticity.

[9] Up to this point, we have ignored the fact that we observe earnings for calendar years, not age years. For the calendar year in which an individual turns 70, earnings in months before the birthday month are subject to the earnings test but earnings in subsequent months are not. To construct our data, we label an individual's age as the age that a person will be on the last day of the year. Thus, for someone with a December birthday, we would expect that the main impact of the earnings test would be between the years they are 70 and 71, not between the years they are 69 and 70. For people who have a birthday in the middle of the year, we would expect to observe half the impact in each year. Therefore, for this analysis, we group together those individuals who are 69 and 70.

[10] Although hours worked are asked retrospectively in our data, we believe that these would be measured with much error. Instead we adopt an approach that focuses on earnings.

has earnings just above the earnings test, the change in the after-tax wage will simply be equal to 0.69 ($0 - \ln(1-\tau)$), given the 50 percent tax rate in effect during the 1980s. Third, rather than specify the dependent variable to be the first difference of log-earnings, we instead use the percent change in earnings. This substitution allows us to include individuals who leave the labor force between periods.

Given these assumptions and, for the moment, ignoring changes in the disutility of work ($\Delta_t Y_2$), the reduced-form equation that corresponds to Equation (6) is

$$\%\Delta_t E_i = \beta_0 + \beta_1 (AGE69_{it} * 0.69 * AFFECTED_{it}) + \varepsilon_{it}, \tag{8}$$

where *AGE69* is a dummy variable for those who are 69 (turning 70 in the following year) and *AFFECTED* is a dummy variable for someone who is in the affected range of the earnings distribution.[11] The reduced-form parameters in this estimating equation map into the structural parameters as

$$\begin{aligned} \beta_0 &= \frac{1}{(\omega_2 - 1)} \ln\left(\frac{1+\rho}{1+r}\right) \\ \beta_1 &= \frac{1}{(\omega_2 - 1)} \end{aligned} \tag{9}$$

This estimating equation is similar to that employed by MaCurdy (1981). As in Lee (2001), we can interpret the error term, ε_{it}, as forecasting error (i.e., individuals do not perfectly anticipate all the factors that might affect their marginal utility of wealth in each period).

The primary issue that remains is to specify how the disutility of work changes over the life cycle. Previous studies have generally adopted specifications that allow for little systematic change in the disutility of work, consistent with their focus on prime-aged individuals. For example, MaCurdy (1981), Altonji (1986) and Lee (2001) estimate first-differenced models of hour changes (similar to Equation (8)). MaCurdy includes no other regressors. Altonji includes age and time fixed effects in some models, and Lee only includes time-fixed effects. Similarly, Bover (1989) and Ziliak and Kniesner (1999) estimate the labor supply equation in levels (see Equation (4)), with the former only including age and the number of children and the latter also including health status. Importantly, the level specification would need to include age even if it were posited that the disutility of work did not change with age because of the term $\ln\left(1+\rho \big/ 1+r\right)$ in the level model.

[11] To account for the differences between calendar year and age year (see footnote 9), we create a dummy variable that is a linear combination of the *AGE69* and *AGE70* dummy variables, where the weights of the linear combination are based on the fraction of the year they were a given age. We use this variable rather than the *AGE69* variable in all of our regressions. We also ignore the upper limit of the earnings test, the point at which all benefits are taxed away, because it is relevant for very few individuals in our sample.

Because we focus on older workers, we are explicit in allowing the disutility of work to vary with age. If we posit that the disutility of work changes linearly with age, then the intercept of the reduced-form model in Equation (8) would change with the addition of another term in the intercept, but the slope term would still measure the intertemporal elasticity of substitution. If we instead parameterize the level of disutility of work as a quadratic in age, then we need to include age in Equation (8) to isolate the intertemporal elasticity as the slope on *AGE69*. We present results for both specifications for age and with and without time fixed effects in Table 4. Specifically, we estimate the regression

$$\%\Delta_t E_i = \beta_0 + \beta_1(AGE69_{it} * 0.69 * AFFECTED_{it}) + \beta_2 AFFECTED_{it} + X_{it}\beta_3 + \varepsilon_{it}, \qquad (10)$$

where *AFFECTED* is defined as having earnings within twenty percent of the earnings test and *X* may include time dummies and age entered linearly.[12]

Missing from Equation (6) is mortality, which, in this population, may be changing rapidly. Mortality is often included in models of elderly consumption, savings, and bequests [e.g., Hurd 1989], but is typically left out of labor supply models. As Yaari (1965) and others have noted, the mortality hazard plays a role similar to the subjective rate of discount. Intuitively, intertemporal substitution is less likely if individuals perceive lower expected returns to consumption in later periods because of rising mortality. Thus, mortality risk would tend to cause more substitution across periods.

Formally, let $a_{s|t}$ be the probability that an individual is alive at time *s* conditional on being alive at time *t*. This mortality risk can then be incorporated into Equation (1) in the usual expected utility framework,

$$V_t = \sum_{s=t}^{T} U_s(c_s, h_s)(1+\rho)^{s-t} a_{s|t}. \qquad (11)$$

This objective function implies the following labor supply equation,

$$\Delta_t \ln h = \frac{1}{\omega_2 - 1}\left[\Delta_t \ln W + \ln\left(\frac{1+\rho}{1+r}\right) - \Delta_t \ln \mathrm{Y}_2 - \ln \Delta_t a_t\right] \qquad (12)$$

which suggests individuals are more willing to substitute labor supply across periods as mortality rises. If mortality risk increases at an exponential rate, then the effect of the mortality hazard will be captured as part of the age effect in the specification of Equation (10).

Turning to the results, the elasticity estimates are similar across the models. The intertemporal elasticity varies from 0.28 to 0.36. However, the standard errors are over twice as large as the point

[12] In results not presented here, we run the model without the primary effect *AFFECTED*, vary the definition of *AFFECTED*, and exclude individuals who have zero earnings in either year. The substantive results do not change.

estimates in each case. These imprecise estimates are despite the sample size of over 12,000 observations and a dependent variable measured without error.

To interpret these results, we first note that the standard life-cycle labor supply model suggests that the intertemporal elasticity does not vary by age. Our estimate of approximately 0.32 is somewhat lower than that obtained for younger populations in previous studies. For example, Lee (2001) obtains an estimate of approximately 0.5 using a approach that corrects for finite sample bias arising from weak instruments. Pistaferri (2002) obtains an estimate of approximately 0.7 relying on subjective reports of future wage growth.

We can also compare our findings to that of Friedberg (2000). She estimates that the uncompensated wage elasticity based on changes in the earnings test is 0.32. Although such an estimate cannot be compared directly to our intertemporal elasticity, it must be a lower bound [see Blundell and MaCurdy 1999). Our estimates are very similar to Friedberg's, a finding that suggest a small, perhaps implausibly small, wealth response.

Baker and Benjamin (1999) find that the elimination of the earnings test in Canada induced no change in reported hours of work, but did induce some individuals to shift from part-year, full-time work to full-year, full-time work. They interpret this discrete change in labor supply in response to the elimination of the earnings test as evidence of labor market rigidities that prevent continuous changes in hours. To check for this possibility in our data, we estimated Equation (10) with the dependent variable equal to one for individuals with zero earnings in year t and positive earnings in year t+1 and equal to zero otherwise. We see no evidence of discrete changes in labor supply between ages 69 and 70 using this specification.

7. Conclusions

The recent repeal of the Social Security earnings test for individuals ages 65 to 69 was motivated at least in part by a concern that this rule leveled an unfair penalty on older workers and unnecessarily reduced their labor supply.[13] We find mixed evidence that the labor supply of elderly workers subject to the earning test responds to the increase in after tax wages between ages 69 and 70. When examining earnings levels for those ages 66 to 69, we see significant "bunching" around the earnings test. Such bunching is predicted by standard labor supply theory and has been noted in previous studies using self-reported earnings data. The administrative earnings data in the NBDS allow us to identify the bunching more precisely. We find that this bunching occurs very close to the earnings test, mostly within 2.5 percent below the earnings limit. This finding suggests that a sizable fraction of individuals have sufficient flexibility in their work to achieve specific earnings targets. We also find evidence that some

[13] Echoing these concerns, the law was entitled, "The Senior Citizen's Freedom to Work Act."

individuals locate just above the earnings test, which is at odds with a standard model of life-cycle labor supply. On the other hand, we find little evidence of systematic increases in labor supply as individuals age from 69 to 70 and the earnings test is removed. Given the high-quality nature of our earnings data and reasonably large sample size, we believe this second finding indicates the elderly in fact do not make large substitutions in labor supply across periods even when after-tax wages change sharply as they do between ages 69 and 70.

We are left with several possible explanations for these contradictory findings. One possibility is simply that elderly workers do not care much about wages. Other factors, rising disutility of work in particular, drive decisions to change hours or exit the labor force at older ages. Responses to subjective questions in the NBDS regarding decisions to work or not work are consistent with this interpretation. The vast majority of individuals who do not work report they do not work because they no longer want to work and would be unwilling to work even if offered a job with amenable hours and wages. Poor health is clearly an important factor pushing elderly workers out of the labor force.

This does not necessarily explain our finding of a statistically insignificant intertemporal labor supply elasticity, however. Another interpretation, then, is that we have failed to adequately control for rising disutility of work with our age effects. In subsequent work, we will exploit the recent elimination of the earnings test to estimate both parametric and intertemporal labor supply elasticities simultaneously. This law change, which affected all individuals ages 65 to 69, coupled with longitudinal data on earnings, will allow us to control for age effects, and hence, disutility of work, more convincingly.

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Figure 1 — The Earnings Test and Labor Supply

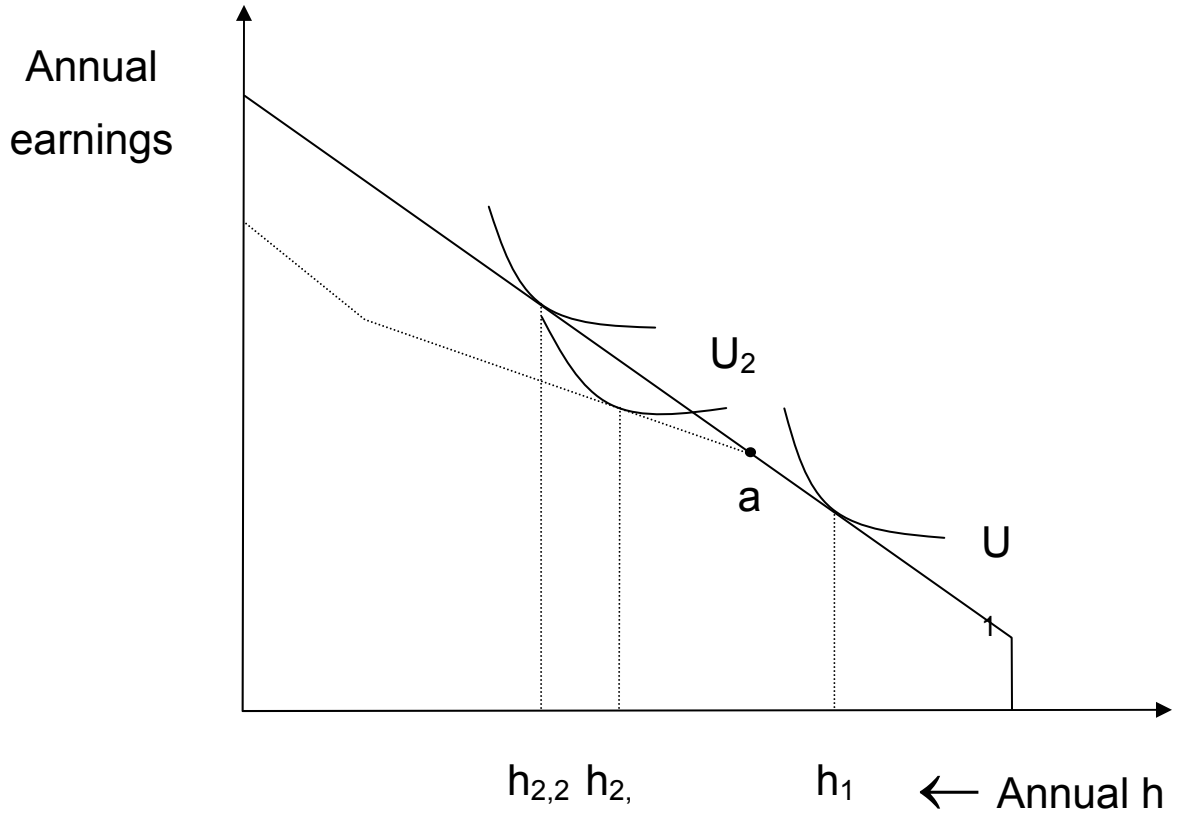


Figure 2—Labor Force Participation, Hours, and Weeks Worked by Age

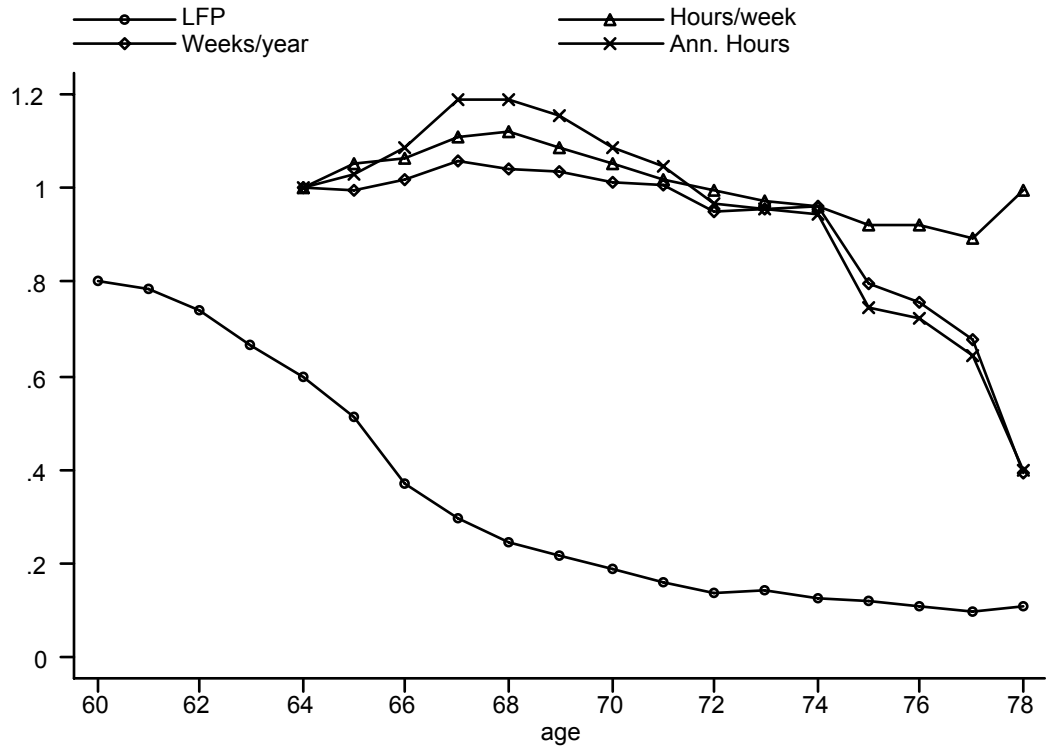
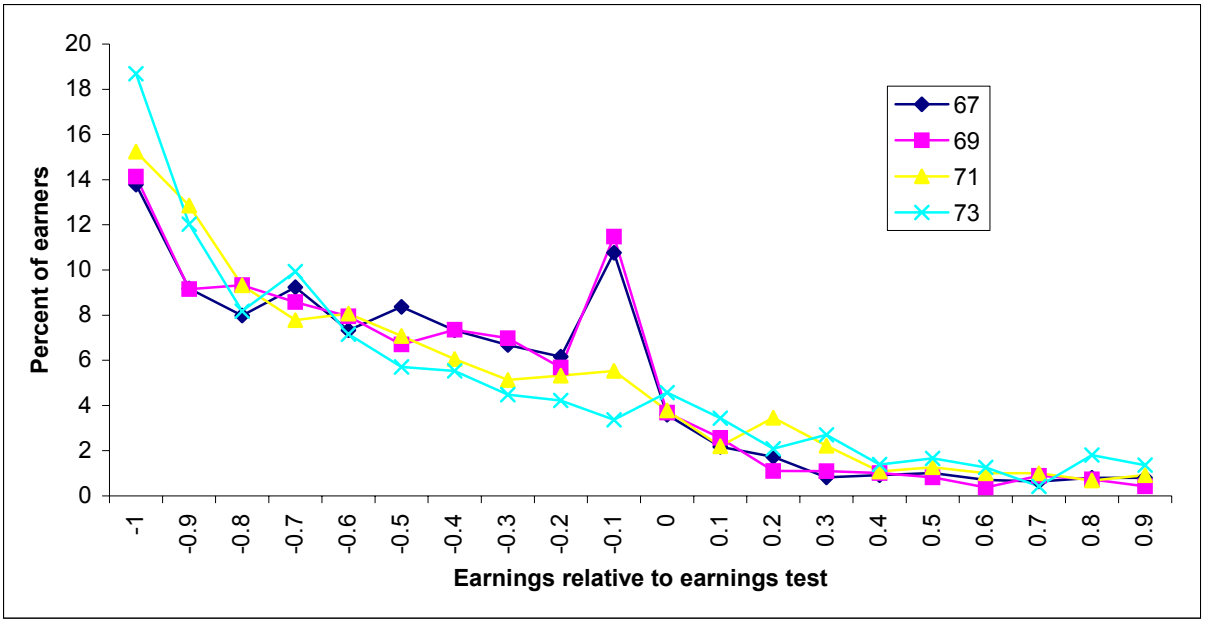
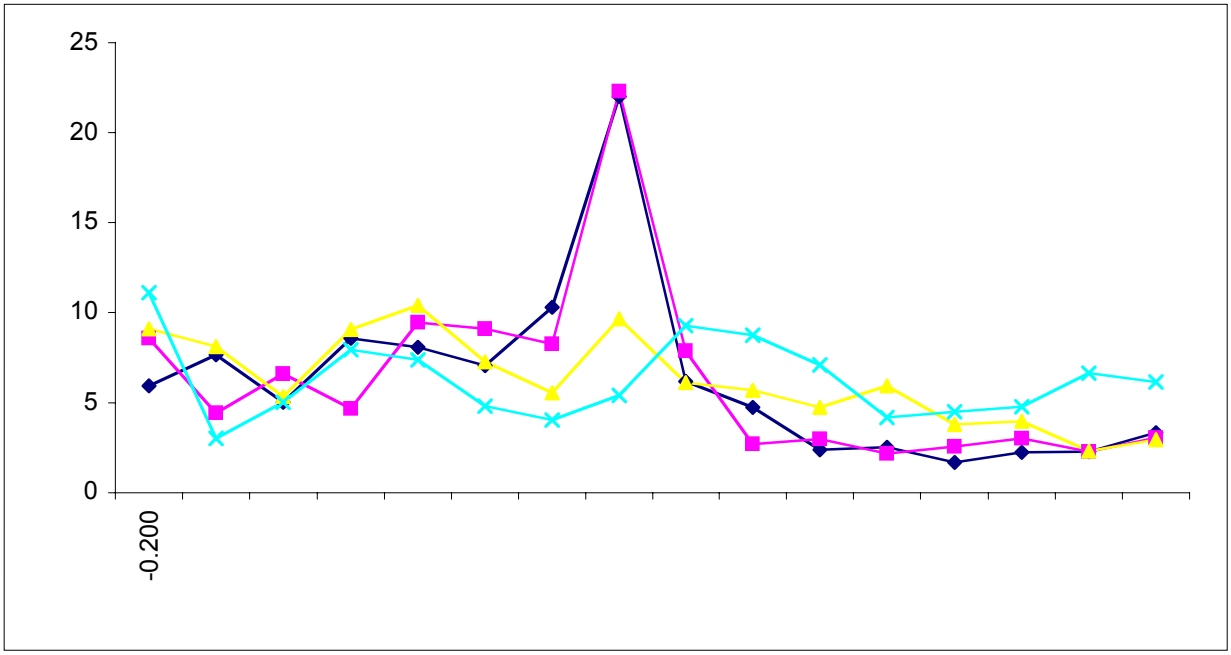


Figure 3 — Histogram of Earnings Relative to the Earnings Test: 10 Percent Earnings Bands



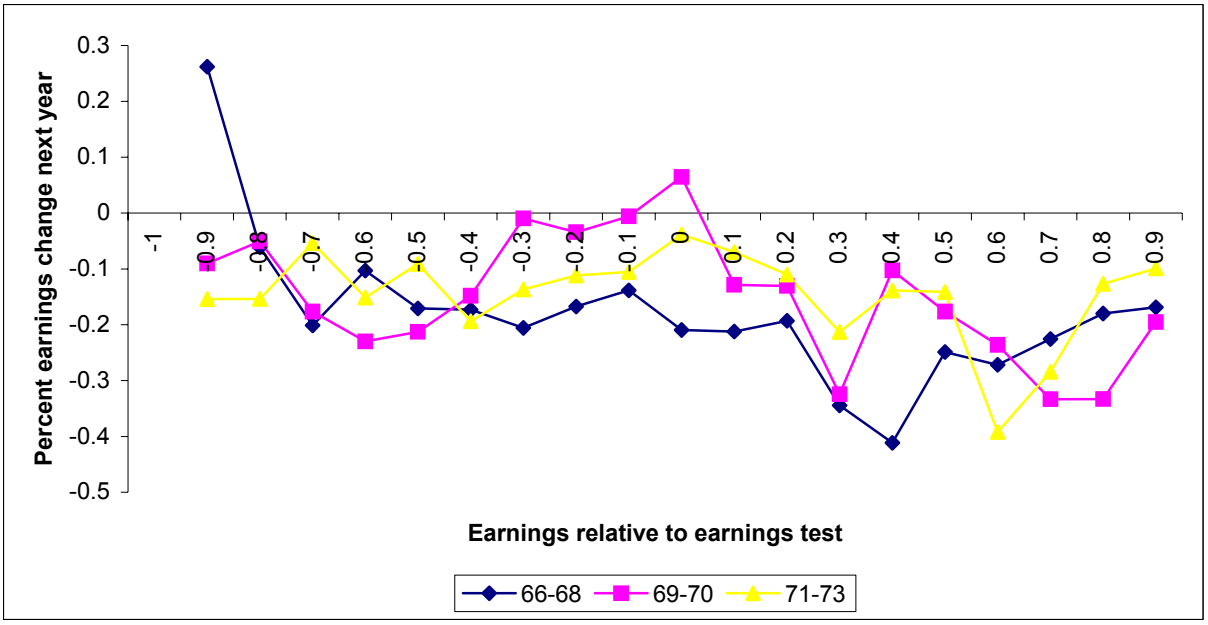
Notes: The results graphed in this figure are based on 1,843, 1,802, 1,335, and 963 observations for the 67, 69, 71, and 73 age groups, respectively. *Data Source*: NBDS.

Figure 4 — Histogram of Earnings Relative to the Earnings Test: 2.5 Percent Earnings Bands



Notes: The results graphed in this figure are based on 473, 481, 243, and 151 observations for the 67, 69, 71, and 73 year olds, respectively. *Data Source*: NBDS.

Figure 5 — Mean Earnings Changes Relative to the Earnings Test



Note: The results graphed in this figure are based on 4,696, 3,410, and 3,468 observations for the 66 to 68 age group, 69 to 70 age group, and 71 to 73 age group, respectively. *Data source*: NBDS.

Table 1 — Most Important Reason for Not Working/Leaving Last Job

Reason	Fraction
A. Reason not working 1983-91 (*n*=3,666)	
Personal, family reasons	0.03
Ill or disabled, unable to work	0.14
Did not want to work	0.05
Retired	0.74
No suitable jobs available	0.01
Labor dispute	0.00
Other	0.03
B. Reason left last job (*n*=339)	
Lost job	0.06
Business bad	0.04
Pay too low	0.01
Disliked job	0.03
Transportation problem	0.01
Moved	0.02
To get Social Security	0.03
Apply for SS disability	0.00
Avoid cutoff of benefits	0.00
To keep Medicate	0.00
To get a pension	0.00
To care for others	0.04
To get a better job	0.00
Spouse retired	0.04
Spouse health changed	0.04
Wanted to retire	0.38
Compulsory retirement	0.03
Health problems	0.25

Notes: Sample restricted to respondents not working after age 69. *Data source*: NBDS.

Table 2—Most Important Reason for Taking Last/Current Job

Reason	Did Not Work After Age 69	Worked After Age 69
Financial need	0.34	0.35
Raise standard of living	0.04	0.04
Buy item	0.01	0.01
Want to work	0.32	0.42
Found job	0.00	0.00
Health now allows	0.01	0.01
Spouse health changed	0.00	0.01
Rehab. Enabled work	0.00	0.00
Raise Social Security	0.03	0.02
Raise pension	0.01	0.00
Social security stopped	0.00	0.00
Medicare not affected	0.00	0.00
Other reason	0.25	0.15
n	167	845

Data source: NBDS.

Table 3 — Subjective Health

	Did Not Work After Age 69	Worked After Age 69
A. Subjective health assessment		
Excellent	0.09	0.13
Very good	0.17	0.23
Good	0.30	0.31
Fair	0.27	0.23
Poor	0.16	0.10
B. Health compared to others		
Better	0.46	0.58
Same	0.41	0.34
Worse	0.13	0.08
C. Work limitations		
Any work limitation	0.41	0.29
Work limitation prevents all work	0.73	0.67
n	4,258	1,540

Data source: NBDS.

Table 4 — Regression Estimates of the Intertemporal Labor Supply Elasticity

	(1)	(2)	(3)	(4)
α_I	0.284	0.336	0.312	0.361
	(0.997)	(1.02)	(0.999)	(1.02)
AGE	—	—	-0.043	-0.030
			(0.043)	(0.076)
AFFECTED	-0.531	-0.559	-0.533	-0.547
	(0.242)	(0.246)	(0.242)	(0.248)
Year-effects	No	Yes	No	Yes
R^2	0.000	0.001	0.001	0.001

Notes: The regressions are based on each person/year that we observe after 1981, that are between the ages 66 and 73 (inclusive) and have positive earnings in an initial year, and that are alive the entire following year. The dependent variable is the percent change in earnings from the initial year to the following year. See Equation (10). The regressions are based on 12,541 observations. The regressions are weighted. Standard errors are in parentheses. *Data source*: NBDS.