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New Evidence on Earnings and Benefit Claims Following Changes in the Retirement Earnings Test in 2000

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Summary

This paper evaluates responses to the removal of the retirement earnings test in 2000 for persons at the full retirement age and older. We examine annual earnings and retirement benefit claims from Social Security administrative data that cover the 4 years before and after the change. Three findings emerge from the study.

First, the effect on earnings of removing the earnings test is uneven over the distribution of individuals' earnings. Quantile regression methods show that although the effect on earnings in the lower percentiles is not statistically significant, the effect on earnings in the higher (50th to 80th) percentiles is large and significant. Such a finding indicates that effects of the removal are limited to earnings levels above the test threshold. The largest increases in earnings are found at the 70th percentile for persons who have attained ages 65–69 (where earnings increase between $180 and $1,670) and at the 60th percentile for those turning 65 (where earnings increase between $1,500 and $2,800).

Second, there is no clear evidence of the effect of the test's removal on the labor force participation rate among individuals reaching age 65, whereas work participation among individuals who have attained ages 65–69 increased between 1 and 2 percentage points after the removal. Further analysis indicates that the increase in work participation is mostly attributable to retaining older workers rather than inducing older persons to return to the workforce. The effect appears to increase over the postremoval period,

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suggesting that the removal has long-lasting effects on work participation due to the state-dependent nature of labor force participation and labor market rigidities.

Third, following the removal of the earnings test, applications for benefits accelerated by 2 to 5 percentage points among individuals aged 65–69 and by 3 to 7 percentage points among those reaching age 65. Results show relatively constant effects for the same age cohorts for different years, indicating that the long-term effects can be estimated from reactions immediately after the test's removal or from reactions among persons who just attained the full retirement age.

Introduction

The retirement earnings test, which has been part of the Social Security Old-Age and Survivors Insurance (OASI) program since its inception in 1935, has been gradually modified by exempting certain age groups, increasing allowable earnings, and decreasing withholding rates. A rationale for modifications is to encourage older people to work so that their earnings can supplement their Social Security benefits as people live longer and healthier lives. The most recent major modification occurred in April 2000, when Congress enacted the Senior Citizens Freedom to Work Act of 2000, which removed the earnings test for individuals at the full retirement age (FRA), age 65 and over.[1] The 2000 removal of the test is one of the most substantial changes in recent years because it affects both the most recent cohorts of persons who have reached the FRA and a wider range of ages than had other modifications.

[1] The FRA has been 65 for those who reach 62 in 1999 or earlier, and it gradually increases to 67 for beneficiaries who reach age 62 in 2022 or later. The law was enacted April 7, 2000, but the elimination of the earnings test for beneficiaries was effective for taxable years ending after December 31, 1999. Earnings tests for individuals aged 75 or older, 72–74, and 70–71 were eliminated in 1950, 1954, and 1983,

Although the earnings test compensates individuals for postponing benefit entitlement by increasing their future benefit streams through the delayed retirement credit and automatic benefit recomputation, many people do not view those adjustments as actuarially fair. That is, many people view the earnings test as a tax on earnings above the test threshold, causing both a reduction in work effort (for example, hours of work, earnings, and work participation) of old-age beneficiaries and a delay in applications for Social Security retirement (old-age) benefits. This tax aspect of the earnings test causes kinks in the budget constraint in a static labor supply model (Burtless and Moffitt 1985, Friedberg 2000).[2] In the static model, removing the earnings test causes a decline in the marginal tax rate for those who earn above the threshold.

A number of studies have analyzed how incentives generated by Social Security program rules have affected work participation and benefit claims. Those studies relied primarily on cross-sectional variations in benefit amounts as identification information (see Krueger and Meyer (2002) for an overview and survey). In response to the identification problem caused by the fact that all workers face an identical benefit schedule in the Social Security system, the earnings test has drawn attention from economists who seek to investigate the disincentive effect that Social Security program rules have on labor supply. Three recent studies—Friedberg (2000), Gruber and Orszag (2003), and Loughran and Haider (2005)—used the experimental approach by noting that modifications of the earnings test in the United States affected some groups but not

respectively (Social Security Administration, *Annual Statistical Supplement to the Social Security Bulletin, 2003* (2004)).

[2] See the Senate debate on the 2000 elimination of the earnings test (http://www.socialsecurity.gov/history/senateret.html). The observation that people bunch at the kink and respond to changes in the earnings test rules has been considered to be a basis for supporting that view (Friedberg 2000).

others.[3] Although Friedberg's results indicated a small but significant effect of the earnings test on the labor supply of older workers, Gruber and Orszag indicated that the earnings test had no robust influence on labor supply and appeared to accelerate benefit receipt among eligible individuals. Results reported in Haider and Loughran indicated that the earnings test has a substantial impact on hours worked and benefits claimed for men. Disney and Tanner (2002) and Baker and Benjamin (1999) examined the elimination of a similar earnings test in the United Kingdom and Canada. Disney and Tanner reported that the elimination of the earnings test increased hours worked by men in the United Kingdom by about 4 hours per week. Baker and Benjamin found a shift from part-time to full-time work among Canadian men aged 65–69.

Unlike other studies, this study focuses on the most significant single change in the history of the U.S. earnings test.[4] It provides comprehensive empirical evidence on the effects of removing the earnings test for persons aged 65–69 by using a large and accurate Social Security Administration (SSA) administrative data set that covers the period from 4 years before to 4 years following the removal (1996–2003). By including 4 years of data after the removal, we are able to investigate reactions not only immediately following the removal but also for several years after. This extended period can help us understand dynamic responses to changes in the relative price of labor among older workers, some of whom face substantial constraints on reentering the labor force because of deteriorating health and outdated skills. Further, by using quantile regression methods,

[3] Friedberg investigated three changes in earnings test rules in 1978, 1983, and 1990. Effects reported in Gruber and Orszag (2000) for 1973–1998 and in Haider and Loughran (2005) for 1975–2003 are identified by all changes, including gradual increases in the test threshold in each year. See Leonesio (1990) for reviews of and references to early studies on the earnings test.
[4] Song (2003/2004) examined the 2000 earnings test removal using the Social Security Administration's administrative data matched with the Survey of Income and Program Participation (SIPP). Although the

we can examine the uneven impact of the earnings test removal across the distribution of earnings. That uneven impact, predicted by the kinked budget constraint in the presence of the earnings test, represents a key problem with using reduced-form analysis of the earnings test.

Earnings Test Rules and Theoretical Prediction

The retirement earnings test operates in a relatively simple manner. Social Security benefits are reduced if earnings exceed the threshold amounts, but the reduction in benefits is at least partially offset in the future through the delayed retirement credit and benefit recomputation.[5] Thus, the earnings test has both "tax" and "transfer" features.

The **tax feature** of the earnings test includes both threshold amounts and withholding rates. The threshold amount varies by the year in which the test applies and by the ages of the beneficiaries. Before the 2000 removal of the earnings test, the thresholds for persons aged 65–69 as of 1996, 1997, 1998, and 1999 were $12,500, $13,500, $14,500, and $15,500; for those aged 62–64 they were $8,280, $8,640, $9,120, and $9,600, respectively. The benefit withholding rate was $1 for each $3 of earnings above the earnings test threshold for individuals aged 65–69 and $1 for each $2 for those aged 62–64.

The **transfer feature** of the earnings test, often overlooked because of the focus on the tax feature, compensates for the withholding of benefits by increasing the primary beneficiary's future benefit stream. Two aspects of the Social Security rules compensate

study used innovative data sources, his analysis focused on the initial impact of the removal of the test by covering only the first year following the removal.

[5] The benefit recomputation after initial entitlement is not directly associated with the earnings test. However, the benefit recomputation is relevant if eliminating the earnings test affects earnings and if the new earnings are substantially higher than the lowest earnings in the current benefit computation.

individuals who are subject to the earnings test: the delayed retirement credit and benefit recomputation. Future benefits for individuals who have not received benefits because of the earnings test (or for any other reason) are increased for each month in which no benefits are paid. This increase is 1/4 of 1 percent for each month, plus 1/24 of 1 percent for each even numbered year, from 1990 through 2008, in which workers are at the FRA or older. Thus, for those who turned 65 in 2000–2001, the delayed retirement credit is 1/2 of 1 percent for each incremental month, or 6 percent per year.[6] A benefit recomputation rule may apply to persons who become entitled to benefits but who subsequently have substantial covered earnings. The recomputation can increase benefits when earnings in the additional years are higher than the lowest earnings used in the current computation.[7]

The earnings test does not apply to individuals who are entitled to benefits because of disability or who are living outside the United States and their work is not covered by Social Security.[8] When earnings exceed the test's threshold, the total family benefit is reduced accordingly, including all benefits (other than Disability Insurance) payable to anyone in the family entitled to benefits on the primary earner's earnings record. For purposes of the earnings test, an individual's earnings for the entire taxable year are counted, even if the individual has not been entitled for the entire year.[9] In

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[6] Note that for persons claiming early benefits, monthly benefits are reduced from the full benefit amount at the rate of 5/9 of 1 percent per month for the first 36 months and 5/12 of 1 percent for any additional months. The delayed retirement credit for those who reach age 65 in 2005–2006 is 2/3 of 1 percent for each incremental month (or 8 percent per year).

[7] Work by a person entitled to dependent benefits would not increase his or her benefit.

[8] The foreign work test can be applied for persons under the FRA who reside outside the United States. See Social Security Administration 2001.

[9] Monthly benefits are reduced by the amount of excess earnings beginning with the first month of the year in which the individual is entitled to benefits. In the first year that an individual is entitled to monthly benefits, benefits will not be reduced because of the retirement earnings test for any month that is a nonservice month, regardless of the amount of annual earnings for the year. A nonservice month is a month in which a person's earnings from employment do not exceed 1/12 of the annual exempt amount and he or she does not perform substantial services in self-employment. For persons reaching the FRA, only earnings before the month of attaining the FRA are counted for purposes of the test.

addition, self-employment earnings are counted for the year in which they are received, regardless of when they are earned. Countable income for the earnings test includes wages from covered employment, cash payments for agricultural or domestic work, cash tips, deferred compensation, and pay for work not covered by Social Security if the work is done in the United States.

After the earnings test removal in 2000, beneficiaries remain subject to an earnings test until they reach the FRA. Social Security benefits of persons aged 62–FRA* (that is, the FRA minus 1 month) at year-end are reduced by $1 for every $2 earned beyond the threshold, which was $11,520 in 2003. Those who reach the FRA during the year are subject to a more moderate test. Benefits are reduced $1 for every $3 earned beyond the threshold, which was $30,720 in 2003.[10] Thus, the removal of the earnings test in 2000 not only eliminated the test for those who had attained ages 65–69 (more precisely, FRA to 69), but it also considerably relaxed the test for those turning 65 (FRA).[11]

The direction and magnitude of the effects of eliminating the earnings test depend on several factors, such as the benefit withholding rate, test threshold, delayed retirement credit, cost-of-living adjustment, individuals' time preference, and mortality. Economic theory on the effects of the earnings test on labor supply is fairly straightforward and can

[10] See Social Security Administration, *Annual Statistical Supplement to the Social Security Bulletin, 2003* (2004, 240–241) for a brief history of changes in the retirement earnings test.

[11] The removal eliminated the test beginning with the month a beneficiary reaches the FRA. Note that the FRA gradually increases beginning with individuals born in 1938 or later. Since those who were born in 1938 reach the FRA in 2003, most of them (those born in March or later because the FRA is 65 and 2 months for the 1938 cohort) are subject to the 62–64 earnings test through 2002 and the modified earnings test in 2003.

be found in numerous studies.[12] A general consensus from those studies is that a delayed retirement credit that was actuarially fair would offset the effects of the earnings test. Yet they question whether the relevant population is aware of the transfer aspect of the earnings test. It is relatively straightforward to show that a static budget constraint contains kinks under the earnings test when the transfer aspect of the earnings test is ignored (or unfair) or when the discount rate is high. In those situations, eliminating the test would yield results equivalent to reducing marginal tax rates. In the case of the earnings test, however, effects of reducing the marginal tax rate depend on individuals' earnings levels and benefit entitlement status. In the presence of the earnings test, we expect to see negative income effects above the upper threshold where all benefits are withheld, both negative income effects and positive substitution effects between the upper and lower threshold, and no effects below the lower threshold. We also expect that removing the test would affect decisions about benefit claims as well as work participation and earnings. Moreover, evaluating the mean effect alone might miss the true effect of the test's removal (Heckman, Smith, and Clements 1997; Song 2003/2004; Bitler, Gelbach, and Hoynes 2003).

Data and Identification Strategy

Data

This study uses data from an extract of the Social Security Administration's 1 percent (active) sample, commonly known as the Continuous Work History Sample (CWHS)

[12] Some examples are Blinder, Gordon, and Wise (1980), Burkhauser and Turner (1981), Reimers and Honig (1983), Vroman (1985), Burtless and Moffitt (1985), Gustman and Steinmeier (1985, 1991), and Packard (1990).

active file.[13] The 1 percent samples are selected on the basis of certain serial digits of the Social Security number (SSN) and are generally considered to be random samples. Once a person is selected, he or she stays in the active sample for life. For selected SSNs, information on annual earnings (both capped and uncapped), OASDI (Old-Age, Survivors, and Disability Insurance) benefit entitlements, and death records, if any, are obtained from several SSA administrative files. The sources for the CWHS include the Numident, the Master Earnings File (MEF), and the Master Beneficiary Record (MBR). The Numident is a numerically ordered master file of assigned SSNs that contains birth and death dates, place of birth, race, and sex. The MEF contains annual FICA summary earnings from 1937 to the present. It also contains annual detailed earnings, Medicare taxable compensation, and total compensation from 1978 to the present for the U.S. population. The earnings records are taken directly from W-2 forms. A MEF record is created when the corresponding Numident record is created. The MBR file contains data related to the administration of the OASDI program, such as application and entitlement dates, benefit amounts, payment status, type of benefits, and demographic information. An MBR record is established when an individual applies for benefits and the application is processed.[14]

The 1 percent extract of SSA administrative records provides several advantages over other data used for studying the effects of the earnings test. First, the 1 percent extract contains accurate annual earnings records that are not plagued by the self-reporting problems that are common in survey-based records. Since the earnings test is

[13] There are two versions of the CWHS: an active file and an inactive file. The active file includes individuals with earnings from any employment, whether from covered or noncovered work.
[14] For further discussions on the MEF, MBR, and other SSA administrative files, see Panis and others (2000).

based on earnings amounts rather than on labor hours, accurate earnings data are crucial for analyzing responses around the test threshold. We use Medicare taxable earnings because deferred earnings are taxed for Medicare purposes and counted for purposes of the earnings test.[15] Second, SSA data contain the exact date of entitlement for old-age benefits. For the earnings test, individuals' earnings for an entire taxable year are counted even if the individuals were not entitled to benefits for the entire year.[16] Hence, whether or not an individual becomes entitled to retirement benefits during a given year is critical information. Third, the 1 percent sample contains a large number of observations that represent the general population. Some disadvantages exist as well, however. We have no information on hours of work or other covariates that are crucial in labor supply models, such as wages, other income, health status, education, and family characteristics. Hence it is not possible to use the data to estimate a structural model of labor supply.

In this study, we focus on the labor supply or earnings of primary workers who are fully insured, not survivors or dependents. Primary-worker beneficiaries are the largest group among Old-Age and Survivors Insurance beneficiaries; they constituted approximately 75 percent of total OASI beneficiaries in 2002 (Social Security Administration 2003). Further, while earnings of primary-worker beneficiaries that exceed the test threshold cause reductions in total family benefits, including benefits to spouses and children, excess earnings of a survivor or a dependent beneficiary reduce only the worker's monthly benefits. Moreover, a worker must be fully insured before retirement benefits can be paid to the worker or to his or her family. Thus, we subset our

[15] Further, since 1994, Medicare has taxed all covered wage and self-employment income, including deferred compensation, without limit.

[16] For those who are attaining the FRA, earnings up to the month before reaching the FRA are counted for purposes of the earnings test.

sample to include individuals who have accumulated enough quarters of coverage to be fully insured between the year they turn age 21 and the year they reach 62.[17] Our analytical samples exclude Social Security Disability Insurance (DI) beneficiaries, old-age beneficiaries converted from DI benefits, and those who are not fully insured under Social Security.

Defining Treatment and Control Groups

The main features of the 2000 change in the earnings test are (1) the complete elimination of the earnings test for individuals who have attained the FRA as of December 31 of the year before the relevant year and (2) a modified earnings test with significantly increased test threshold amounts for those who reach the FRA during the relevant year.[18] Hence we consider two separate treatment groups: those who turn 65 during the year and those who have attained ages 65–69 by January 1 of a particular year. As control groups, we consider those both older and younger than the treatment groups: individuals turning 62–64 and those who have attained ages 70–72.[19] During the study period, those who had attained ages 70–72 faced no earnings test, while those turning 62–64 faced the same test rules, except that the threshold amounts were gradually increased. As a result, there are

[17] Workers born before 1929 need less than 40 quarters of coverage to be fully insured (see Social Security Administration 2001).

[18] For the sample used in this paper, the FRA is 65 except for those born in 1938 or later. The 1938 birth cohort reaches the FRA in 2003 if born in October or earlier, or in 2004 if born in November or December. Thus, defining the control and treatment groups on the basis of age appears to be inconsistent with the rules in 2003. However, the FRA was 65 during the preremoval period considered in this paper. To maintain consistency throughout the study period, we maintain the definition of the control and treatment groups partitioned by age for the rest of this paper. We would expect to detect any anomalies arising from the FRA change by including year-by-year dummies in the analysis rather than one posttreatment dummy.

[19] For example, those who were born in 1936 through 1938 are turning 62–64 in 2000, and those who were born in 1927 through 1929 have attained ages 70–72 as of December 31, 1999. Those who were born in 1935 are turning 65 in 2000, and those who were born in 1930 through 1934 have attained ages 65–69 as of December 31, 1999. In 2000, therefore, the modified earnings test applies for those who were born in 1935, but the test no longer applies to those who were born in 1930 through 1934.

two treatment groups and two control groups in each calendar year from 1996 through 2003:

- Group 1—the younger control group, who turn ages 62–64;
- Group 2—the younger treatment group, who turn age 65;
- Group 3—the older treatment group, who have attained ages 65–69;
- Group 4—the older control group, who have attained ages 70–72.

The "treatment" in this study depends on both time and age because earnings test rules are specific to age as well as to calendar year. Thus, we cannot take full advantage of the longitudinal format of the SSA administrative data in defining treatment and control groups. Instead, we arrange the data such that each yearly cross section covers the age range 62–72, as shown in Table 1. The dependent variables of our study—earnings and labor force participation as well as benefit claims—are functions of the passage of time (aging); different age groups have their own time trends arising from interactions of group- and time-specific effects on the outcome variables. Thus, by defining control groups to include exactly the same age range in each year, our control groups can isolate both age- and year-specific effects. By including both older and younger age groups as control groups, we expect to learn more about the dynamics of labor supply in response to the removal of the earnings test.[20]

Our study period covers 4 years before and 4 years following the removal of the earnings test (that is, from 1996 through 2003) for the following reasons. First, data through 2003 were the latest available at the time of the analysis. Second, by including a multiple-year period before the removal of the earnings test, we are able to test whether

[20] We also expect that including both control groups improves the efficiency of our estimate. Meyer (1995, 157) suggested that "the more similar the comparison group is to the treatment group the better" and that "for a given degree of similarity with the treatment group, greater differences across comparison groups are desirable . . . ."

the outcome measures for the treatment and control groups are comparable during the preremoval period. The fundamental identification assumption in this kind of model is that the mean (or other measure) change in outcome in the absence of the treatment is the same for both the treated and the nontreated groups. We test this assumption by asking whether or not the coefficients of the treatment dummies (the treatment-group dummies interacted with calendar years) for 1996 through 1999 equal zero. Third, by including multiple years following the test's removal, we are able to examine responses in work participation and annual earnings for several years after the removal as well as immediately after the removal. One would expect that immediate responses to the removal of the earnings test might differ from longer-term responses because of the difficulty and cost in changing one's hours of work or returning to the labor market after a period of absence.

Sample sizes by calendar years vary from 168,486 to 178,217, depending on the reference year (Table 1). The age range of the sample in each year is exactly the same over the reference period. Observations consist of persons who are fully insured as of age 62 and are not receiving Disability Insurance benefits. Once selected, those persons remain in our analytical sample until they reach age 72 unless death occurs. Thus, sample attrition is caused entirely by deaths. The race and sex variables show that approximately 88 percent are white and 54 percent are male.

Descriptive Analyses on Work and Retirement Among Workers Aged 62–72

From 1996 through 2003, the data show movements in work participation and benefit entitlement of the treatment groups relative to the control groups (Table 2). If our

Table 1.
Sample size, by birth year and calendar years before and after the removal of the retirement earnings test

	Before removal				After removal				
Birth year	1996	1997	1998	1999	2000	2001	2002	2003	Group
1923	12,219								
1924	13,325	12,919							
1925	13,151	12,796	12,395						
1926	13,552	13,196	12,820	12,437					
1927	14,184	13,849	13,465	13,083	12,668				
1928	14,431	14,091	13,750	13,393	13,018	12,619			
1929	14,435	14,130	13,841	13,522	13,154	12,762	12,373		
1930	15,228	14,970	14,681	14,350	14,010	13,651	13,255	12,826	
1931	14,419	14,221	13,988	13,760	13,506	13,235	12,929	12,609	Group 4
1932	14,414	14,258	14,102	13,920	13,702	13,443	13,174	12,913	
1933	14,324	14,187	14,036	13,881	13,697	13,484	13,268	13,045	
1934	14,804	14,675	14,530	14,367	14,169	13,961	13,748	13,521	
1935		15,289	15,161	15,014	14,853	14,685	14,493	14,297	Group 3
1936			15,529	15,383	15,240	15,071	14,897	14,707	
1937				15,933	15,798	15,648	15,493	15,329	
1938					16,786	16,662	16,515	16,370	Group 2
1939						16,763	16,653	16,511	
1940							17,811	17,671	Group 1
1941								18,418	
All birth years	168,486	168,581	168,298	169,043	170,601	171,984	174,609	178,217	

SOURCE: Authors' tabulations using the 1 percent extract of the Social Security Administration's Master Earnings File and Master Beneficiary Record.

NOTE: Group 1 is the younger control group, who turn ages 62–64; Group 2 is the younger treatment group, who turn age 65; Group 3 is the older treatment group, who have attained ages 65–69; and Group 4 is the older control group, who have attained ages 70–72.

Table 2.
Work participation and benefit entitlement status, by age group

Status	1996		1997		1998		1999		2000		2001		2002		2003	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Group 1, turning ages 62–64																
Total sample																
All	43,542	100.00	44,151	100.00	45,220	100.00	46,330	100.00	47,824	100.00	49,073	100.00	50,979	100.00	52,600	100.00
Working	22,784	52.33	23,588	53.43	24,412	53.98	25,324	54.66	26,623	55.67	27,348	55.73	28,235	55.39	29,128	55.38
Beneficiaries already entitled on January 1																
All	9,258	21.26	9,331	21.13	9,421	20.83	9,745	21.03	10,058	21.03	9,766	19.90	10,040	19.69	9,988	18.99
Working	4,649	10.68	4,689	10.62	4,842	10.71	4,852	10.47	5,194	10.86	5,221	10.64	5,042	9.89	5,037	9.58
Beneficiaries becoming entitled during year																
All	14,768	33.92	14,596	33.06	14,880	32.91	14,952	32.27	15,226	31.84	15,719	32.03	15,703	30.80	15,601	29.66
Working	4,810	11.05	4,880	11.05	4,948	10.94	5,217	11.26	5,295	11.07	5,148	10.49	5,200	10.20	5,098	9.69
Group 2, turning age 65																
Total sample																
All	14,419	100.00	14,258	100.00	14,036	100.00	14,367	100.00	14,853	100.00	15,071	100.00	15,493	100.00	16,370	100.00
Working	5,843	40.52	5,988	42.00	6,026	42.93	6,253	43.52	6,661	44.85	6,795	45.09	6,992	45.13	7,327	44.76
Beneficiaries already entitled on January 1																
All	9,352	64.86	9,172	64.33	8,807	62.75	9,070	63.13	9,219	62.07	9,295	61.67	9,520	61.45	9,877	60.34
Working	2,631	18.25	2,773	19.45	2,634	18.77	2,834	19.73	2,892	19.47	2,952	19.59	3,008	19.42	2,954	18.05
Beneficiaries becoming entitled during year																
All	2,989	20.73	2,977	20.88	3,076	21.92	3,179	22.13	4,113	27.69	4,159	27.60	4,244	27.39	4,099	25.04
Working	2,167	15.03	2,189	15.35	2,252	16.04	2,307	16.06	3,122	21.02	3,161	20.97	3,235	20.88	3,071	18.76
Group 3, have attained ages 65–69																
Total sample																
All	71,830	100.00	71,261	100.00	70,362	100.00	69,433	100.00	69,084	100.00	68,808	100.00	69,580	100.00	70,899	100.00
Working	18,890	26.30	19,432	27.27	19,926	28.32	20,290	29.22	21,221	30.72	21,628	31.43	22,163	31.85	22,752	32.09
Beneficiaries already entitled on January 1																
All	63,680	88.65	63,070	88.51	62,033	88.16	61,051	87.93	60,772	87.97	62,143	90.31	62,907	90.41	64,058	90.35
Working	16,021	22.30	16,466	23.11	16,904	24.02	17,133	24.68	18,032	26.10	19,630	28.53	20,144	28.95	20,626	29.09
Beneficiaries becoming entitled during year																
All	810	1.13	776	1.09	838	1.19	1,005	1.45	1,838	2.66	475	0.69	395	0.57	588	0.83
Working	548	0.76	549	0.77	599	0.85	717	1.03	1,399	2.03	272	0.40	228	0.33	331	0.47

(Continued)

Table 2.
Continued

Status	1996		1997		1998		1999		2000		2001		2002		2003	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Group 4, have attained ages 70–72																
Total sample																
All	38,695	100.00	38,911	100.00	38,680	100.00	38,913	100.00	38,840	100.00	39,032	100.00	38,557	100.00	38,348	100.00
Working	6,109	15.79	6,401	16.45	6,643	17.17	6,847	17.60	7,328	18.87	7,366	18.87	7,509	19.48	7,502	19.56
Beneficiaries already entitled on January 1																
All	35,308	91.25	35,685	91.71	35,542	91.89	35,777	91.94	35,745	92.03	35,804	91.73	35,420	91.86	35,216	91.83
Working	5,574	14.40	5,926	15.23	6,181	15.98	6,382	16.40	6,850	17.64	6,850	17.55	7,018	18.20	7,036	18.35
Beneficiaries becoming entitled during year																
All	240	0.62	90	0.23	50	0.13	40	0.10	48	0.12	33	0.08	46	0.12	49	0.13
Working	74	0.19	36	0.09	25	0.06	22	0.06	29	0.07	17	0.04	25	0.06	23	0.06

SOURCE: Authors' tabulations using the 1 percent extract of the Social Security Administration's Master Earnings File and Master Beneficiary Record.

NOTE: The sample universe comprises persons who are fully insured in the year they turn age 62 and are not receiving Disability Insurance benefits.

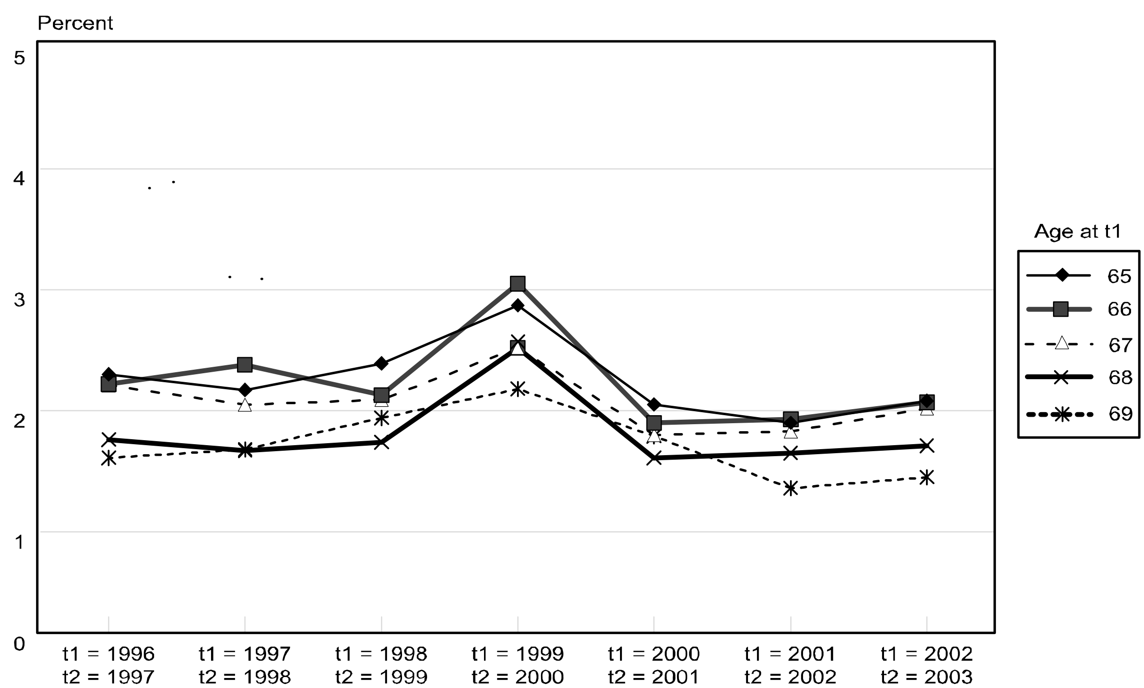
control groups are valid, we expect to see parallel movements in outcome variables of the treatment and control groups during the pre-2000 period. Work participation rates during the preremoval period among those in the age groups 62–64, 65, 65–69, and 70–72 are approximately 52 percent to 55 percent, 40 percent to 44 percent, 26 percent to 29 percent, and 16 percent to 18 percent, respectively. At the beginning of each reference year, old-age benefit entitlement rates during the preremoval period for the four groups are approximately 21 percent, 63 percent to 65 percent, 88 percent to 89 percent, and 91 percent to 92 percent, respectively.

The percentage of beneficiaries who became entitled in 1999 and 2000 increased from 22 percent to 28 percent for the younger treatment group (those who were turning 65). Over the same period, the percentage nearly doubled for the older treatment group (those who had attained ages 65–69). During the postremoval period, benefit entitlement rates increased slightly for the two older age groups, but they decreased slightly for the two younger age groups. Work participation rates increased slightly over the study period to the following levels: 55 percent to 56 percent, 45 percent, 31 percent to 32 percent, and 19 percent to 20 percent, respectively. Benefit entitlement rates among those aged 64 or younger tended to fall slightly over the study period, but rates for those aged 65 or older tended to increase slightly over time.

Although the descriptive results show no clear evidence of effects of the earnings test removal on work participation rates, they suggest that benefit entitlement rates for persons turning 65 are somewhat higher after the removal. The magnitude of the increase does not appear to be large, perhaps because most individuals have already become entitled to old-age benefits before they reach age 65.

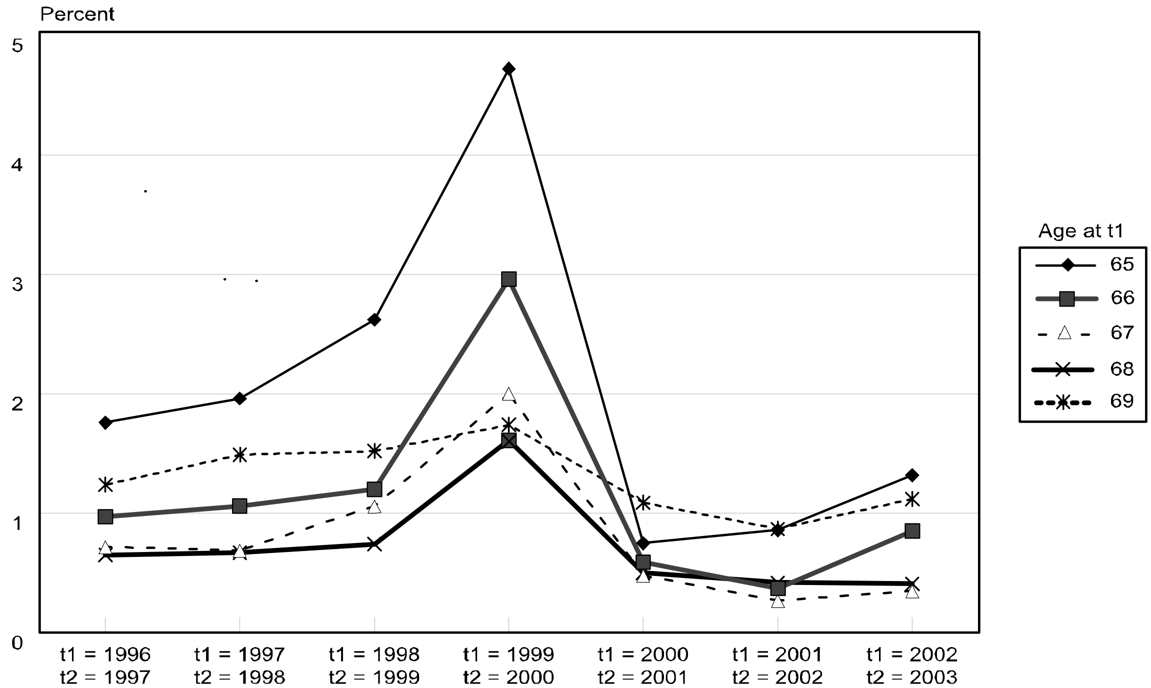
The large sample size and the longitudinal format of our data allow us to construct transition matrices so that we can follow persons of a particular age from one year to the next. For each age 65 through 69 as of the end of year t1, Chart 1 presents joint probabilities of transitions from “not working” in year t1 to “working” in year t2 from 1996 through 2003. Similarly, Chart 2 presents age-specific probabilities of transitions from “not entitled” to “entitled.” Results show that the probability of transition from “not working” to “working” increased noticeably between 1999 and 2000 but then stabilized at a lower level for ages 65–69. The probabilities of transition from “not-entitled” to “entitled” for those aged 65–66 more than doubled between 1999 and 2000, then stabilized at a lower level after 2000. The numbers suggest that the 2000 removal of the earnings test had a clear impact on work and benefit claims among older workers.

Chart 1.
Transition from *not working* to *working*, by age at the end of t1



SOURCE: Authors’ tabulations using the 1 percent extract of the Social Security Administration’s Master Earnings File and Master Beneficiary Record.

Chart 2.
Transition from *not entitled* to *entitled*, by age at the end of t1



SOURCE: Authors' tabulations using the 1 percent extract of the Social Security Administration's Master Earnings File and Master Beneficiary Record.

In an effort to more closely examine the effects on earnings at different points along the distribution, we look at nominal earnings at the 40th through 80th percentiles for those who work over the study period, by age group (Table 3). Results show gradual increases in the earnings of working individuals over the study period, measured either by the simple mean over the entire sample or at each decile of the earnings distribution. The gradual increases in earnings at the various deciles appear to accelerate slightly in 2000 for both treatment groups, which could indicate that earnings of the treatment groups are affected by the earnings test removal.[21]

[21] It is tempting to look at earnings of beneficiaries because the earnings test is applicable only to OASI beneficiaries. Since the pool of beneficiaries after the 2000 removal includes new entrants who are induced to claim benefits, results that examine work and earnings of beneficiaries before and after the earnings test removal are seriously flawed (Moffitt 1992). Perhaps we could examine work and earnings of beneficiaries who had become entitled before turning 65. However, if benefit entitlement status for those who have not

Table 3.
Nominal earnings, by age group and earnings percentile, 1996–2003
(in dollars unless otherwise indicated)

Earnings percentile	1996	1997	1998	1999	2000	2001	2002	2003
				Group 1, turning ages 62–64				
All								
Number in group	43,542	44,151	45,220	46,330	47,824	49,073	50,979	52,600
Mean earnings	14,596	15,715	17,196	17,207	18,173	19,094	19,825	20,263
Working								
Number in group	22,784	23,588	24,412	25,324	26,623	27,348	28,235	29,128
Mean earnings	27,893	29,414	31,853	31,480	32,644	34,262	35,795	36,591
40th percentile	10,866	11,578	12,444	13,096	13,571	14,885	15,642	16,476
50th percentile	16,471	17,214	18,282	19,063	19,679	21,002	21,825	22,936
60th percentile	22,366	23,381	24,583	25,300	25,934	27,418	28,337	29,789
70th percentile	28,893	30,177	31,502	32,504	33,488	35,169	36,350	38,083
80th percentile	38,453	40,167	41,765	43,146	44,942	46,360	48,000	50,094
				Group 2, turning age 65				
All								
Number in group	14,419	14,258	14,036	14,367	14,853	15,071	15,493	16,370
Mean earnings	10,707	10,134	11,046	13,028	12,426	12,973	13,509	14,849
Working								
Number in group	5,843	5,988	6,026	6,253	6,661	6,795	6,992	7,327
Mean earnings	26,421	24,130	25,728	29,932	27,707	28,773	29,935	33,175
40th percentile	7,800	8,174	9,000	9,138	10,263	10,850	11,618	12,285
50th percentile	10,562	11,196	12,479	12,313	14,609	15,300	16,606	17,200
60th percentile	14,494	15,149	16,972	16,214	19,931	21,330	22,747	23,894
70th percentile	22,185	23,008	24,651	23,918	27,825	28,564	30,200	31,986
80th percentile	32,206	33,065	35,825	35,247	38,596	39,082	41,564	44,174
				Group 3, have attained ages 65–69				
All								
Number in group	71,830	71,261	70,362	69,433	69,084	68,808	69,580	70,899
Mean earnings	4,843	5,543	5,785	5,869	6,741	7,480	7,602	8,223
Working								
Number in group	18,890	19,432	19,926	20,290	21,221	21,628	22,163	22,752
Mean earnings	18,418	20,326	20,427	20,084	21,946	23,798	23,866	25,625
40th percentile	5,754	5,888	6,264	6,639	6,984	7,875	8,304	8,787
50th percentile	7,884	8,207	8,586	9,111	9,600	10,791	11,497	12,250
60th percentile	10,400	10,912	11,359	11,997	12,750	14,468	15,508	16,737
70th percentile	12,766	13,551	14,437	15,394	17,000	19,602	21,337	23,120
80th percentile	21,549	22,208	22,632	23,652	25,354	28,824	30,882	33,023

(Continued)

reached age 65 has been affected by the removal, those results are also flawed. Similarly, results that examine benefit entitlements by current work status or earnings levels are flawed as well.

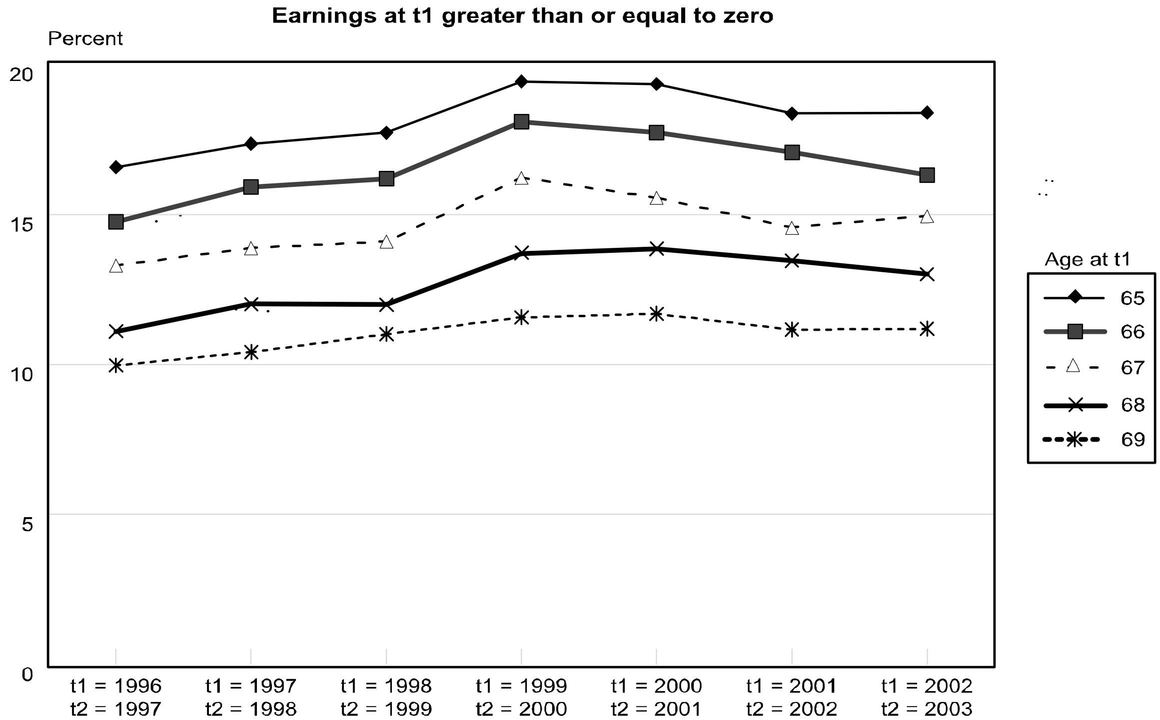
Table 3.
Continued

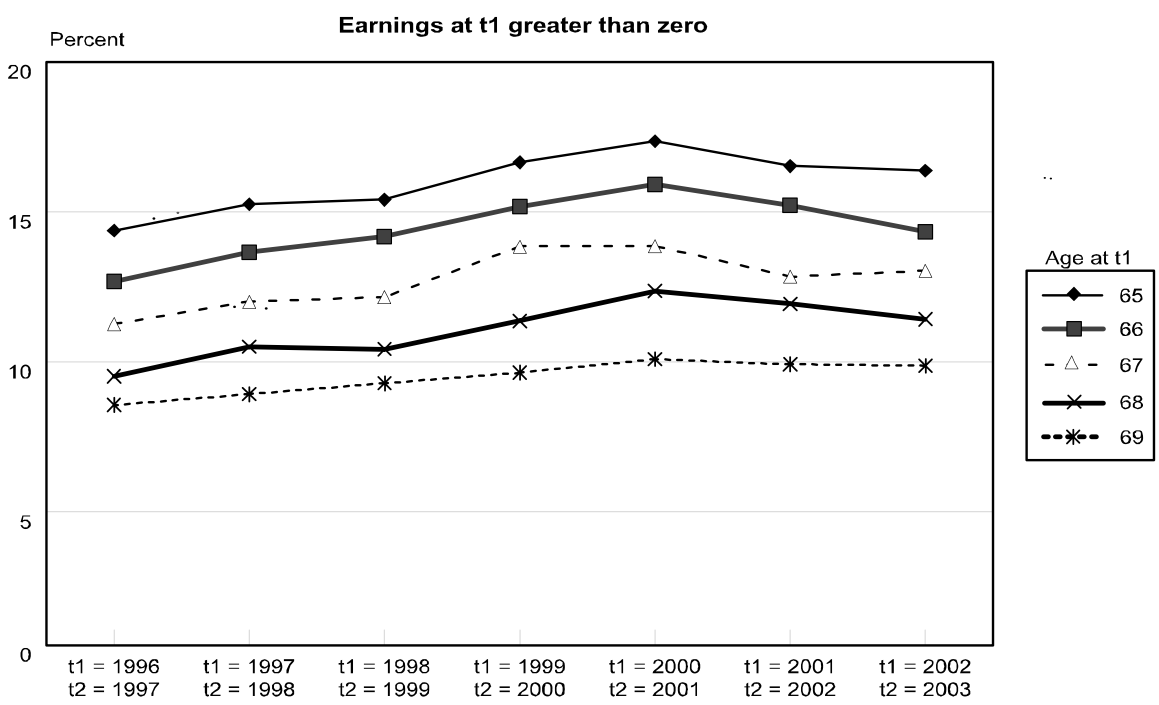
Earnings percentile	1996	1997	1998	1999	2000	2001	2002	2003
				Group 4, have attained ages 70–72				
All								
Number in group	38,695	38,911	38,680	38,913	38,840	39,032	38,557	38,348
Mean earnings	2,376	2,657	3,029	3,107	3,275	3,288	3,394	3,658
Working								
Number in group	6,109	6,401	6,643	6,847	7,328	7,366	7,509	7,502
Mean earnings	15,049	16,149	17,638	17,657	17,356	17,421	17,426	18,700
40th percentile	4,348	4,784	4,945	5,180	5,083	5,685	5,678	6,181
50th percentile	6,341	6,632	7,008	7,193	7,259	7,934	8,064	8,757
60th percentile	8,795	9,114	9,522	9,722	9,850	10,617	10,968	11,641
70th percentile	11,566	12,000	12,364	13,000	13,278	14,400	14,597	15,717
80th percentile	16,546	16,900	17,517	18,200	18,332	20,182	20,774	22,431

SOURCE: Authors' tabulations using the 1 percent extract of the Social Security Administration's Master Earnings File and Master Beneficiary Record.

Numbers on upward earnings mobility by age indicate that the percentage of individuals with increased earnings over a 2-year span is strictly greater in later years than in earlier years (Chart 3). Between 1999 and 2000, the probabilities of observing increased earnings for workers aged 65–69 rose by approximately 2 percentage points relative to earlier years, for all ages 65–69. Individuals with increased earnings can be decomposed into (1) those whose earnings rose from zero to a positive amount and (2) those who had positive earnings followed by even larger earnings. The first component of earnings mobility is equivalent to transitions in work participation from "not working" to "working." The lower panel of Chart 3 shows the second component of earnings mobility. Results indicate that most of the increases in earnings between 1999 and 2000 are attributable to higher earnings among those who were already working. This result is

Chart 3.
Probability of an increase in earnings if earnings at t1 are greater than or equal to zero or greater than zero, by age at t1





SOURCE: Authors' tabulations using the 1 percent extract of the Social Security Administration's Master Earnings File and Master Beneficiary Record.

NOTE: Earnings are in current dollars.

more powerful than results based on pooled cross-sectional data because it comes from comparing earnings of the same individual over 2 consecutive years.[22]

Clustering just below the earnings test threshold provides simple evidence of labor supply reactions to the earnings test (Friedberg 2000). Thus, we show the distribution of earnings in $1,000 intervals relative to the threshold for all four groups during the preremoval and postremoval period (Chart 4). Results show clustering just below the threshold for those turning 62–64 in both periods because the earnings test is in effect for them. For those turning 65 and those who have attained ages 65–69, we observe clustering in the preremoval period but not in the postremoval period. Those who have attained ages 70–72 show no clustering in either period. The clustering results indicate that the kink in the static budget constraint created by the earnings test affects the labor supply behavior of some individuals.

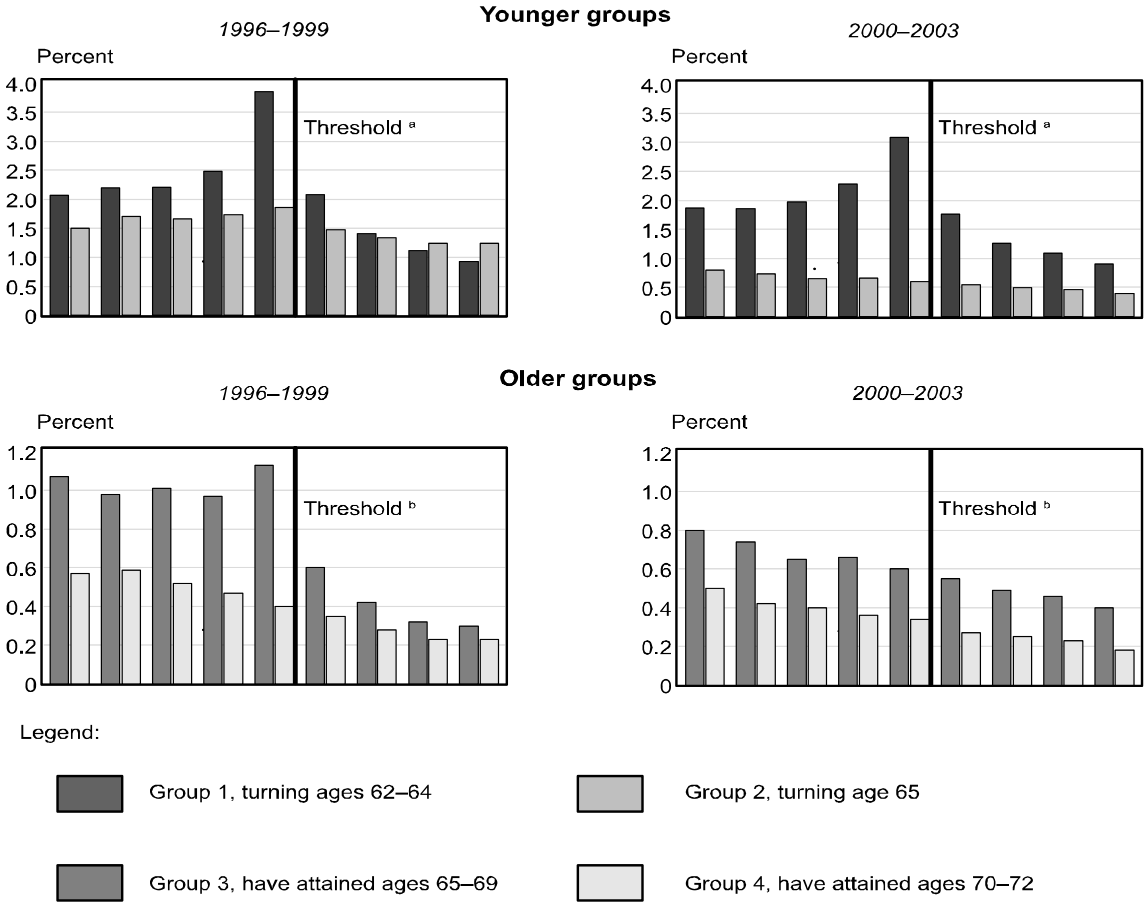
Regression Analysis

In this section, we present two sets of reduced-form regression estimates. We estimate the effects on work participation and benefit entitlement using a Probit specification and the effects on the earnings distribution using ordinary least squares (OLS), truncated, and percentile regressions. The regression estimates are based on the difference-in-difference model

$$y_{it}^{j} = a + g\Delta_t + h\Delta^j + \beta\Delta_t^j + c'X_i + e_{it}^j ,$$

[22] One can argue that the stock market crash after September 11, 2001, may have caused some older workers to work more hours. The argument could be relevant in our analyses if ratios of stocks to financial assets among those aged 65–69 are significantly different from those of the control groups. However, we find no such evidence in tabulations of Poterba (2004) using the Survey of Consumer Finances.

Chart 4.
Distribution of old-age beneficiaries with earnings in $1,000 intervals relative to the earnings test threshold for treatment and control groups, before and after removal



SOURCE: Authors' tabulations using the 1 percent extract of the Social Security Administration's Master Earnings File and Master Beneficiary Record.

a. Threshold values for Group 1 for 1996–1999 are $8,280, $8,640, $9,120, and $9,600; for 2000–2003 they are $10,080, $10,680, $11,280, and $11,520. Threshold values for Group 2 for 1996–1999 are $8,280, $8,640, $9,120, and $9,600; for 2000–2003 they are $17,000, $25,000, $30,000, and $30,720.

b. For illustrative purposes, we assume the thresholds of Group 4 to be the same as those for Group 3 in 1996–1999 ($12,500, $13,500, $14,500, and $15,500), and the thresholds for both groups to be $16,500, $17,500, $18,500, and $19,500 for 2000–2003.

where X is a vector of the individual's characteristics; Δs are dummy variables; index $j = 1$ for the treatment groups (those turning 65 and those who have attained ages 65–69; index $j = 0$ for the control groups (those turning 62–64 and those who have attained ages 70–72); and time index $t = 1996, 1997, \ldots, 2003$.[23] Thus, effects of the earnings test removal are identified by the β s that are the coefficients on the year-specific, posttreatment dummies. Since effects immediately after the removal may differ from later effects, we include yearly treatment dummies rather than just one treatment dummy to cover the whole postremoval period. The dependent variable (y) is either benefit entitlement status, work participation status, or observed annual earnings.

Choosing the specification for evaluating effects on benefit entitlement and work participation is straightforward because observed outcomes are binary, discrete variables. We use a Probit specification for both binary outcome variables. Choosing the earnings specification is more difficult. Because the earnings of a large fraction of the samples are zero, we need to account for the difference between the censored zero observations and the continuous nonzero observations in estimating the effects on earnings.[24] Although the Tobit (Type I) regression method is a simple and popular way to account for the difference, it is problematic in our context because earnings cannot take on negative values (Hausman and Wise 1977, Maddala 2001). Here we use the truncated regression method to examine average effects over individuals with earnings.[25] Neither truncated

[23] Hence $\Delta_{1996} = 1$ if $t = 1996$ and 0 otherwise; $\Delta^j = 1$ if $j = 1$ and 0 otherwise; and $\Delta^j_{2000} = 1$ if $t = 2000$ and $j = 1$, and 0 otherwise.
[24] Although the OLS approach can be useful in measuring the mean effect over the whole sample, it fails to distinguish between censored and noncensored values of earnings. Further, when the dependent variable is censored, OLS estimates over all samples tend to be biased toward zero (Amemiya 1985).
[25] Results based on the Tobit model can be provided on request. We acknowledge that the truncated regression method is also problematic because we are ignoring information in the independent variables for those zero earners. An appropriate approach would be a general Tobit (Type II) that accounts for the two-step process for the labor supply decision that generates observed zero and nonzero earnings (Amemiya

regression nor OLS-based estimates are appropriate to capture the uneven impact over the distribution that is predicted by theory. Thus, we use quantile regression methods, where we limit the sample to working individuals (nonzero earners).

The difference-in-difference model presented above relies on two critical assumptions: (1) no contemporaneous shock other than the 2000 earnings test removal has affected the dependent variable of the treatment groups relative to the control groups, and (2) any change in the dependent variable in the absence of the treatment is the same for all groups. Thus, we offer a simple specification test to see whether the estimate of β is zero in the absence of changes in the earnings test. If β identifies the effects of the earnings test removal, coefficients of the pretreatment (false treatment) dummies (Δ^j_{1997}, Δ^j_{1998}, and Δ^j_{1999}) would each equal zero. To show that our model captures the causal effect, we present estimates from the model, including year-specific, pre- and posttreatment dummies; a second specification includes year-specific, posttreatment dummies (true treatment dummies).[26]

Estimated Effects on Benefit Entitlement

We report estimated effects of the earnings test removal on benefit claims from two separate regressions, one for each treatment group (individuals who have attained ages 65–69 and those who are turning 65) (Table 4). Model I includes the full set of

1985). However, one needs to model the work decision separately from the decision about work hours (or earnings). Further, two conditions must hold: (1) the covariance term of the equation for work participation and the equation for earnings level must be zero; (2) at least one variable in the earnings equation cannot be included in the work participation equation (Maddala 1983). It is not feasible for us to use the general Tobit specification because the SSA administrative data contain limited information on individuals' characteristics. Therefore, caution is necessary in interpreting truncated regression results and using the estimate for other purposes.

[26] Here Δ^j_{1996} is the omitted interaction dummy. See Angrist and Krueger (1999) for further discussion on the specification test for the difference-in-difference model.

Table 4.
Probit estimates of effects on benefit entitlement

Variable	Model I Estimate	Model I Standard error	Model II Estimate	Model II Standard error	Marginal effects Estimate	Marginal effects Standard error	Model III Estimate	Model III Standard error	Model IV Estimate	Model IV Standard error
					Effects on those who have attained ages 65–69					
Treatment dummy, 1997	0.0076	0.0116	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1998	0.0029	0.0116	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1999	0.0120	0.0116	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 2000	0.0936	0.0117	0.0880	0.0093	0.0219	0.0023	0.0986	0.0099	0.0656	0.0133
Treatment dummy, 2001	0.1396	0.0118	0.1340	0.0093	0.0333	0.0023	0.1449	0.0099	0.1109	0.0132
Treatment dummy, 2002	0.1610	0.0117	0.1553	0.0093	0.0386	0.0023	0.1787	0.0098	0.0951	0.0133
Treatment dummy, 2003	0.2076	0.0117	0.2020	0.0092	0.0502	0.0023	0.2368	0.0097	0.1070	0.0133
N	1,250,952		1,250,952				940,976		871,233	
Log of likelihood	-518,157.04		-518,157.66				-436,402.95		-247,676.07	
					Effects on those turning age 65					
Treatment dummy, 1997	0.0036	0.0197	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1998	-0.0173	0.0197	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1999	0.0189	0.0196	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 2000	0.2485	0.0204	0.2471	0.0165	0.0748	0.0050	0.2571	0.0167	0.2312	0.0192
Treatment dummy, 2001	0.2438	0.0202	0.2424	0.0162	0.0734	0.0049	0.2528	0.0164	0.2240	0.0189
Treatment dummy, 2002	0.2449	0.0199	0.2435	0.0159	0.0737	0.0048	0.2656	0.0161	0.1897	0.0187
Treatment dummy, 2003	0.1090	0.0191	0.1077	0.0147	0.0326	0.0045	0.1444	0.0150	0.0060	0.0177
N	808,562		808,562				498,586		428,843	
Log of likelihood	-391,760.93		-391,762.66				-307,996.83		-124,504.34	

SOURCE: Authors' estimates.

NOTES: The dependent variable is old-age benefit entitlement status (1, entitled; 0, not entitled).

Other covariates included in the regression are a constant, male, race (white), age group dummies (62–64 and 70–72), and calendar-year dummies from 1996 through 2002.

Model I includes the two control groups and false treatment dummies; Model II, the control groups and only true treatment dummies; Model III, the younger control group (62–64) and true treatment dummies; and Model IV, the older control group (70–72) and true treatment dummies. Model II is the base model.

. . . = not applicable.

interaction dummies from 1997 through 2003 for purposes of the specification test, and Model II includes interaction dummies for the postremoval period. We consider Model II to be our base model, and marginal effects on the base model are also included in the table. To show how estimates vary by the choice of control group, we report separate estimates from models that include only the younger control group (Model III) or only the older control group (Model IV).

Results from our base model (II) show that estimated coefficients of β for all 4 years are large and statistically significant, which suggests that the earnings test removal in 2000 has increased benefit entitlements for both treatment groups. The effects tend to increase over the 4 years for the older treatment group, but they are relatively stable for the younger treatment group. Estimated marginal effects indicate that the benefit entitlement rate for the older treatment group increased approximately 2 to 5 percentage points after the test's removal.[27] It also increased approximately 3 to 7 percentage points for the younger group.

Results from Model I show that estimated coefficients of the false treatment dummies are all small and not statistically significant, indicating that in the absence of the treatment the changes in benefit entitlement rates are similar for all groups. From Models I and II, we can easily calculate the likelihood test statistics for testing the model specification. The likelihood test statistic of the model is 1.24 (3 d.f.) for individuals who have attained ages 65–69 and 3.46 (3 d.f.) for those who are turning 65. Thus, we cannot reject the null hypothesis of $\beta_{1997} = \beta_{1998} = \beta_{1999} = 0$ at the 5 percent significance level, indicating that estimates from our base model do capture the effect of the earnings test removal.

Although the base model (II) is preferable to the models that include only the younger control group (III) or only the older control group (IV), Models III and IV provide additional insights into the reliability of estimates from the base model and response dynamics. Some economists argue that eliminating the earnings test for individuals who have attained ages 65–69 could have spillover effects on benefit-claiming behavior for those younger than 65 (Vroman 1985, Packard 1990, Gruber and

[27] The estimated increase in benefit claims of 2.2 percentage points in 2000 following the test's removal is not surprising and appears to be consistent with the result reported in Song (2003/2004). The estimated magnitude of 2 to 5 percentage points may not seem large, but it indicates a substantially large impact on benefit claims among those who had not yet become beneficiaries by age 65. Only 10 percent of those who had attained ages 65–69 had not yet claimed old-age benefits before 2000.

Orszag 2003).[28] If such spillover exists, using those who are turning 62–64 as the only control group might cause us to overestimate the effect. Likewise, using those who have attained ages 70–72 as the only control group might cause the effect to be underestimated, because any causal effect on the benefit entitlement of those who have attained ages 65–69 will eventually affect the benefit entitlement of those who have attained ages 70–72. The magnitude of the underestimation is likely to increase over time, because all observations in the current treatment group will eventually enter the control group (those who have attained ages 70–72). Results from Models III and IV are consistent with these speculations. The estimated effects from Model III are all larger than those from Model IV. Estimates from Model III can be considered to be upper-bound estimates, and those from Model IV can be considered to be lower-bound estimates.[29]

Estimated Effects on Work Participation

In Table 5, we present estimated effects on work participation from four models for each treatment group, as we did in estimating effects on benefit entitlement. Results from Model II (base model) show that the estimated coefficients for all four treatment dummies are statistically significant for those who have attained ages 65–69 but not for those turning 65. Estimated marginal effects indicate that the work participation rate

[28] An individual aged 62–64 who wants to claim benefits may decide to continue working until reaching age 65 rather than to reduce work (or to retire). Similarly, an individual aged 62–64 who works above the earnings test threshold may decide not to claim benefits until reaching age 65. Both types of spillover are likely to occur because of labor market rigidities. Because of older workers' declining health and outdated skill levels, reentry into the labor market would be quite limited for them.

[29] Obviously, the presence of such dynamics could undermine the accuracy of our estimates. Since the dynamics work in opposite directions for the older and younger control groups, we attempt to neutralize potential bias by including both control groups in our base model.

Table 5.
Probit estimates of effects on work participation

Variable	Model I Estimate	Model I Standard error	Model II Estimate	Model II Standard error	Marginal Effects Estimate	Marginal Effects Standard error	Model III Estimate	Model III Standard error	Model IV Estimate	Model IV Standard error
Effects on those who have attained ages 65–69										
Treatment dummy, 1997	0.0029	0.0097	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1998	0.0149	0.0097	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1999	0.0246	0.0097	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 2000	0.0332	0.0097	0.0225	0.0076	0.0082	0.0027	0.0335	0.0086	0.0046	0.0100
Treatment dummy, 2001	0.0521	0.0096	0.0414	0.0075	0.0150	0.0027	0.0520	0.0085	0.0241	0.0100
Treatment dummy, 2002	0.0610	0.0096	0.0504	0.0075	0.0183	0.0027	0.0724	0.0084	0.0130	0.0099
Treatment dummy, 2003	0.0669	0.0095	0.0562	0.0074	0.0204	0.0027	0.0793	0.0083	0.0162	0.0099
N	1,250,952		1,250,952				940,976		871,233	
Log of likelihood	-746,984.89		-746,988.99				-601,411.83		-485,697.76	
Effects on those turning age 65										
Treatment dummy, 1997	0.0110	0.0164	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1998	0.0142	0.0164	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1999	0.0129	0.0163	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 2000	0.0108	0.0161	0.0013	0.0127	0.0005	0.0048	0.0125	0.0133	-0.0168	0.0142
Treatment dummy, 2001	0.0162	0.0161	0.0067	0.0126	0.0025	0.0048	0.0174	0.0132	-0.0108	0.0142
Treatment dummy, 2002	0.0155	0.0160	0.0059	0.0125	0.0023	0.0047	0.0281	0.0130	-0.0316	0.0141
Treatment dummy, 2003	0.0054	0.0158	-0.0041	0.0122	-0.0015	0.0046	0.0192	0.0128	-0.0443	0.0139
N	808,562		808,562				498,586		428,843	
Log of likelihood	-488,129.76		-488,130.23				-342,543.26		-226,842.87	

SOURCE: Authors' estimates.

NOTES: The dependent variable is work participation status (1, working (earnings > 0); 0, not working (earnings = 0)).

Other covariates included in the regression are a constant, male, race (white), age group dummies (62–64 and 70–72), and calendar-year dummies from 1996 through 2002.

Model I includes the two control groups and false treatment dummies; Model II, the control groups and only true treatment dummies; Model III, the younger control group (62–64) and true treatment dummies; and Model IV, the older control group (70–72) and true treatment dummies. Model II is the base model.

. . . = not applicable.

among individuals who have attained ages 65–69 has increased by 0.8 to 2 percentage points following the earnings test removal in 2000. Results further show that those effects increased over the study period.

Likelihood test statistics for Model II against Model I are 8.2 (3 d.f.) for individuals who have attained ages 65–69 and 0.94 (3 d.f.) for those turning 65. Hence we only marginally reject the null hypothesis of $\beta_{1997} = \beta_{1998} = \beta_{1999} = 0$ at a 5 percent significance level for those who have attained ages 65–69. That is, estimates of βs for those aged 65–69 may be capturing effects other than the pure causal effect. Estimates from Model I show a gradual increase in the magnitude of estimates for interaction dummies over our study period, suggesting that a group-specific time trend, independent of the earnings test removal, may contaminate the estimates. If this gradually increasing time trend is not controlled in the model, we could overestimate the true effects of the test's removal. However, we expect the bias to be small.

Finding a gradual increase in the effect of removing the earnings test on work participation is not surprising, for several reasons. Returning to the labor market may require a difficult and costly job search for those aged 65–69. Thus, estimated effects immediately following the removal are probably biased downward. However, additional years of job search may not significantly affect the work participation of those older workers, because their declining health and outdated skill levels constrain their labor market choices. If this is true, then an increase in work participation over time can result from the gradual increase in the number of older workers remaining in the labor market, not from older workers returning to the labor market. The gradual increase in work participation may have affected the work participation of those aged 70–72 as well. If work participation in this older group is affected with a lag by the 2000 removal of the earnings test, estimated effects using those aged 70–72 as the only control group may underestimate the true causal effects. One can also speculate on a spillover effect to a younger age group. If labor market rigidities limit entry into and exit out of the labor force, we expect to see a positive spillover effect on those turning 62–64. However, estimates from Model III contradict this speculation, because the estimates are larger than those from the base model. It seems plausible that the difference in estimates from Models III and IV is not caused by spillover effects but rather by time trends specific to the different age groups.

Estimated Effects on Earnings

We estimate the reduced form, difference-in-difference equation using the following specifications: truncated regression, OLS over samples with nonzero earnings, and quantile regressions over samples with nonzero earnings. Estimates from the truncated regression specification of the difference-in-difference model show that estimated coefficients of effects for individuals who have attained ages 65–69 are large and statistically significant in the base model (Model II). Since the dependent variable is the logarithm of earnings, coefficients of treatment dummies indicate the percentage change in earnings after the 2000 removal. Earnings increase approximately 4 percent to 10 percent per year among working individuals (Table 6). Effects in 2000 appear to be much smaller than effects in 2001–2003. The result for persons who have attained ages 65–69 seems plausible because the law was enacted in April 2000 and older people needed time to respond. Effects on earnings for individuals turning 65 are also found here; estimates for 2000–2003 are 6.5 percent, 5.3 percent, 6.4 percent, and 7.5 percent, respectively.

Estimates of false treatment dummies (Model I) for those who have attained ages 65–69 are not only statistically insignificant but also small in magnitude. It is particularly notable that the magnitude of the estimates jumps from 1999 to 2000. The likelihood ratio test statistics indicate that our specification of the model appropriately captures the effect of removing the earnings test for both experimental groups. The likelihood ratio statistic is 0.6 (3 d.f.) for those who have attained ages 65–69 and 2.4 (3 d.f.) for those

Table 6.
Truncated regression estimates of effects on earnings

Variable	Model I		Model II		Model III		Model IV	
	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
				Effects on those who have attained ages 65–69				
Treatment dummy, 1997	-0.0143	0.0220	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1998	-0.0128	0.0219	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1999	-0.0102	0.0217	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 2000	0.0357	0.0215	0.0452	0.0166	0.0411	0.0172	0.0582	0.0272
Treatment dummy, 2001	0.0701	0.0214	0.0795	0.0164	0.0856	0.0170	0.0567	0.0271
Treatment dummy, 2002	0.0964	0.0213	0.1058	0.0163	0.1066	0.0168	0.1032	0.0269
Treatment dummy, 2003	0.0957	0.0211	0.1051	0.0161	0.1171	0.0167	0.0595	0.0268
N	429,449		429,445		373,744		222,007	
Log of likelihood	-831,459.00		-831,459.30		-718,322.60		-442,343.90	
				Effects on those turning age 65				
Treatment dummy, 1997	0.0384	0.0329	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1998	0.0495	0.0328	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 1999	0.0286	0.0325	. . .	. . .	. . .	. . .	. . .	. . .
Treatment dummy, 2000	0.0946	0.0320	0.0652	0.0247	0.0602	0.0246	0.0804	0.0335
Treatment dummy, 2001	0.0819	0.0319	0.0525	0.0245	0.0581	0.0243	0.0303	0.0334
Treatment dummy, 2002	0.0938	0.0317	0.0644	0.0242	0.0652	0.0241	0.0611	0.0331
Treatment dummy, 2003	0.1040	0.0314	0.0746	0.0238	0.0867	0.0237	0.0278	0.0328
N	315,032		808,562		259,327		107,590	
Log of likelihood	-601,195.80		-601,197.00		-487,526.20		-212,979.60	

SOURCE: Authors' estimates.

NOTES: The dependent variable is the logarithm of earnings.

Other covariates included in the regression are a constant, male, race (white), age group dummies (62–64 and 70–72), and calendar-year dummies from 1996 through 2002.

Model I includes the two control groups and false treatment dummies; Model II, the control groups and only true treatment dummies; Model III, the younger control group (62–64) and true treatment dummies; and Model IV, the older control group (70–72) and true treatment dummies. Model II is the base model.

. . . = not applicable.

reaching 65. Such results indicate that we cannot reject the null hypothesis $\beta_{1997} = \beta_{1998} = \beta_{1999} = 0$ at a 5 percent significance level in both models.[30] Estimated effects from either Model III or Model IV are comparable with those from the base model.

We next estimate the models using nominal earnings (in thousands of dollars) as the dependent variable using both OLS and quantile regression methods to capture the change in actual earnings (Table 7).[31] Estimates based on OLS are small and not

[30] As was true for the estimates for benefit claims and work participation, we found similar results if one or the other of the control groups was used.

[31] We also estimated effects on earnings from a semi-log specification of the difference-in-difference percentile regression over samples with nonzero earnings. Those estimates can be interpreted as the percentage change in earnings at specific points along the earnings distribution after the test was removed. We do not include these results in the paper, but they can be provided on request. In this paper, we report

Table 7.
Regression estimates of effects on earnings (earnings in thousands of dollars)

Variable	Quantile regression 0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	Ordinary least squares
	Effects on those who have attained ages 65–69 (N = 429,449)									
Constant	1.2611	3.7817	6.5156	8.7451	10.4437	12.5956	16.0643	22.1667	35.3851	11.5920
	(0.0511)	(0.1118)	(0.1019)	(0.1564)	(0.1523)	(0.1986)	(0.2661)	(0.3703)	(0.5893)	(0.7176)
Treatment dummy, 2000	0.0226	-0.1162	-0.4192	-0.1956	-0.0847	0.4013	0.1802	-0.1921	-1.4246	0.0291
	(0.0529)	(0.0852)	(0.1049)	(0.1704)	(0.1622)	(0.2163)	(0.2863)	(0.4263)	(0.8158)	(0.8684)
Treatment dummy, 2001	-0.0819	-0.3305	-0.3824	-0.2646	0.1469	0.7335	0.9565	1.2221	-0.5214	0.5189
	(0.0474)	(0.1051)	(0.0991)	(0.1694)	(0.1687)	(0.2161)	(0.3102)	(0.4273)	(0.6319)	(0.8616)
Treatment dummy, 2002	-0.0135	-0.2453	-0.4848	-0.3165	0.1112	1.0662	1.4596	1.4536	-0.6260	-0.7408
	(0.0545)	(0.1013)	(0.1039)	(0.1507)	(0.2053)	(0.2809)	(0.2971)	(0.4973)	(0.7177)	(0.8528)
Treatment dummy, 2003	-0.1236	-0.3394	-0.6633	-0.5580	0.0609	1.1379	1.6702	1.5430	-0.6693	0.0322
	(0.0384)	(0.1223)	(0.1141)	(0.2203)	(0.1657)	(0.2566)	(0.2864)	(0.4734)	(0.8642)	(0.8444)
R-square	0.0053	0.0131	0.0194	0.0239	0.0372	0.0517	0.0581	0.0609	0.0672	0.0149
	Effects on those turning age 65 (N = 315,032)									
Constant	1.8091	4.9622	8.3903	10.7848	12.5908	16.4331	21.9045	30.3644	43.1540	16.8818
	(0.0718)	(0.1252)	(0.1297)	(0.1776)	(0.1718)	(0.2936)	(0.3609)	(0.4686)	(0.7872)	(0.9468)
Treatment dummy, 2000	0.0547	0.2140	0.1771	0.8382	1.5987	1.6765	1.5675	1.2879	1.1383	-1.2780
	(0.1045)	(0.2020)	(0.2092)	(0.2543)	(0.4175)	(0.4982)	(0.5302)	(0.6200)	(0.8661)	(1.4282)
Treatment dummy, 2001	0.1682	0.1408	-0.0576	0.3256	1.5221	1.7235	1.4488	0.3402	-0.1752	-1.3841
	(0.0979)	(0.2141)	(0.2366)	(0.3364)	(0.3633)	(0.4453)	(0.5336)	(0.6856)	(1.2814)	(1.4169)
Treatment dummy, 2002	0.0372	0.1992	0.1845	0.5874	2.3427	2.5045	1.9187	0.5939	0.3488	-1.3584
	(0.0865)	(0.2363)	(0.2226)	(0.3308)	(0.2967)	(0.3754)	(0.5043)	(0.7411)	(1.4093)	(1.4012)
Treatment dummy, 2003	0.1207	0.2729	0.2287	0.6025	2.1035	2.3703	2.8352	0.9764	1.1521	0.9228
	(0.1185)	(0.2080)	(0.1878)	(0.2295)	(0.3859)	(0.5114)	(0.5456)	(0.9951)	(1.4436)	(1.3781)
R-square	0.0150	0.0121	0.0178	0.0229	0.0363	0.0468	0.0533	0.0598	0.0686	0.0146

SOURCE: Authors' estimates.

NOTES: The dependent variable is annual earnings in thousands of dollars.

The sample includes observations with nonzero earnings.

Numbers in parentheses are standard errors. Standard errors are calculated by bootstrap resampling with 40 repetitions.

Other covariates used in this regression are constant, male, race (white), age group dummies (62–64 and 70–72), and calendar-year dummies from 1996 through 2002.

significant at the 10 percent level, indicating that the mean earnings of persons who have attained ages 65–69 were not affected by the earnings test removal (see Gruber and Orszag 2003). Although results based on OLS regression show no significant effect on mean earnings, results based on quantile regression show that the removal has increased earnings for individuals who have attained ages 65–69 at the 60th conditional percentile of the earnings distribution in 2000, 60th to 70th percentiles in 2001, and 60th to 80th

results based on a model with nominal earnings (in thousands of dollars) as the dependent variable because the primary interest of the paper is the location on the earnings distribution where significant effects are observable.

percentiles in 2002 and 2003 by statistically significant amounts, indicating that the effects are uneven across the earnings distribution (Table 7, top panel).[32] At the 60th percentile, earnings in 2001, 2002, and 2003 are increased by $734 (5.8 percent), $1,066 (8.5 percent), and $1,138 (9.0 percent), respectively. At the 70th percentile, earnings in 2000, 2001, 2002, and 2003 are increased by $180 (1.1 percent), $966 (5.9 percent), $1,460 (9.0 percent), and $1,670 (10.4 percent), respectively. Earnings at the 80th percentile in 2001–2003 also increase by similar amounts. Interestingly, our estimated effects in years immediately following the removal of the test (1–2 years) are comparable with the estimate (5.3 percent) reported in Friedberg (2000), where an entirely different empirical approach was taken.

Our quantile regression results indicate that the effects on earnings are concentrated around the 60th to 80th conditional percentiles of the earnings distribution. Thus, it is worthwhile to find out how these conditional percentile values are related to the earnings test threshold. Since our regression controls for sex (male) and race (white) in addition to group and year dummies, estimates of the intercept terms represent percentile values for nonwhite females at ages 65–69. Our regression estimates indicate that earnings at the 60th to 80th percentiles in 1999 for nonwhite females aged 65–69 are $8,863, $11,336, and $15,444, respectively.[33] Corresponding earnings percentiles for white males aged 65–69 are $14,961, $21,901, and $34,874, respectively. Accordingly, the earnings test threshold in 1999 ($15,500) is just around the 80th percentile for

[32] Because the rule was changed in April 2000 and effective retroactively from January 2000, relatively small effects in 2000 are not surprising. See Buchinsky (1998) for the interpretation of quantile regression estimates.

[33] Note that we estimated the model by including year dummies from 1996 through 2002. When the 1999 year dummy is omitted instead of the 2003 year dummy, the estimated intercept terms for the 60th to 80th percentile regression would be the estimate of the intercept terms plus the estimates of the 1999 year dummy, that is $8,863 (= 12,596 − 3,733), $11,336 (= 16,064 − 4,728), and $15,444 (= 22,167 − 6,723).

nonwhite females aged 65–69 and between the 60th and 70th percentile for white males aged 65–69.[34] These results indicate that the removal of the earnings test has affected the earnings distribution just below the test threshold and up, as predicted by economic theory.

Again, the estimates using OLS show no effects on earnings for persons turning age 65. However, results based on quantile regressions indicate that the test's removal affects the 40th to 80th conditional percentiles of earnings in 2000, the 50th to 70th percentiles in 2001 and 2002, and the 40th to 70th percentiles in 2003. More specifically, at the 50th percentile, earnings in 2000, 2001, 2002, and 2003 increased by $1,599 (12.7 percent), $1,522 (12.1 percent), $2,343 (18.6 percent), and $2,104 (16.7 percent), respectively. At the 60th percentile, earnings in 2000–2003 increased by $1,677 (10.2 percent), $1,724 (10.5 percent), $2,505 (15.2 percent), and $2,370 (14.4 percent), respectively. It is notable that estimated effects are larger for persons who are turning age 65 than for those who have attained ages 65–69. This result is not surprising, because the younger age group has not only better health and skills but also more choices in the labor market.

Earnings at the 50th, 60th, and 70th percentiles in 1999 for nonwhite females turning age 65 are $9,624, $12,631, and $17,197, respectively. Corresponding earnings for white males turning age 65 are $15,640, $22,420, and $31,958, respectively.[35] The earnings test thresholds for those attaining age 65 in 1999–2003 were $9,600, $17,000,

[34] Note that 88 percent of persons in our sample are white and 54 percent are male.

[35] The earnings test thresholds in 2000–2003 for persons reaching 65 were $17,000, $25,000, $30,000, and $30,720, respectively. Earnings at the 70th percentile in 2000–2003 were $27,825, $28,564, $30,200, and $31,986, respectively. (See Table 3 for other percentile values.)

$25,000, $30,000, and $30,720, respectively. Thus, those percentiles where the effects are significant correspond to the earnings test threshold for those attaining age 65.

To summarize, a conventional mean-based evaluation fails to detect the effect of the earnings test removal on earnings. A significant effect on a relatively small fraction of the sample could be overlooked if we were to focus on mean effects only (Heckman, Smith, and Clements 1997). But by analyzing the effects over different percentiles of the earnings distribution, this study finds statistically significant effects of the test's removal in a way that is exactly predicted by economic theory.

In both treatment groups, we found small and sometimes negative estimates for the 90th percentile, suggesting the presence of income effects. However, examining the income effect using quantile regression on earnings alone seems inappropriate because the upper threshold, where all benefits are withheld, depends on (family) benefit amounts and not just the primary worker's earnings. Even at the 90th percentile, earnings of those who have very high benefit amounts would be affected not only by the income effect but also by the substitution effect. Thus, estimated effects on high earnings quantiles would imprecisely measure the income effect. The income effects could be precisely measured by responses in earnings among those who earn above the upper threshold. Thus, our small and statistically insignificant effects at the 90th percentile are not surprising.[36]

Lastly, we estimate quantile regressions by including interaction dummies for 1997–2003 and plot point estimates of those effects by year and percentile (Chart 5).[37]

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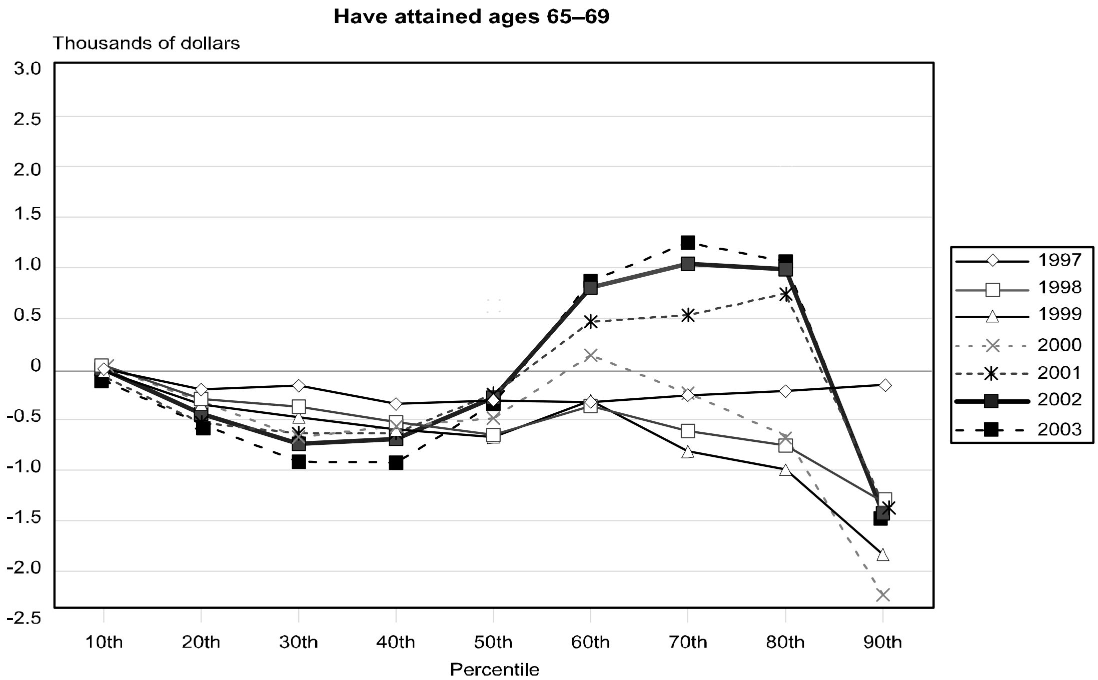
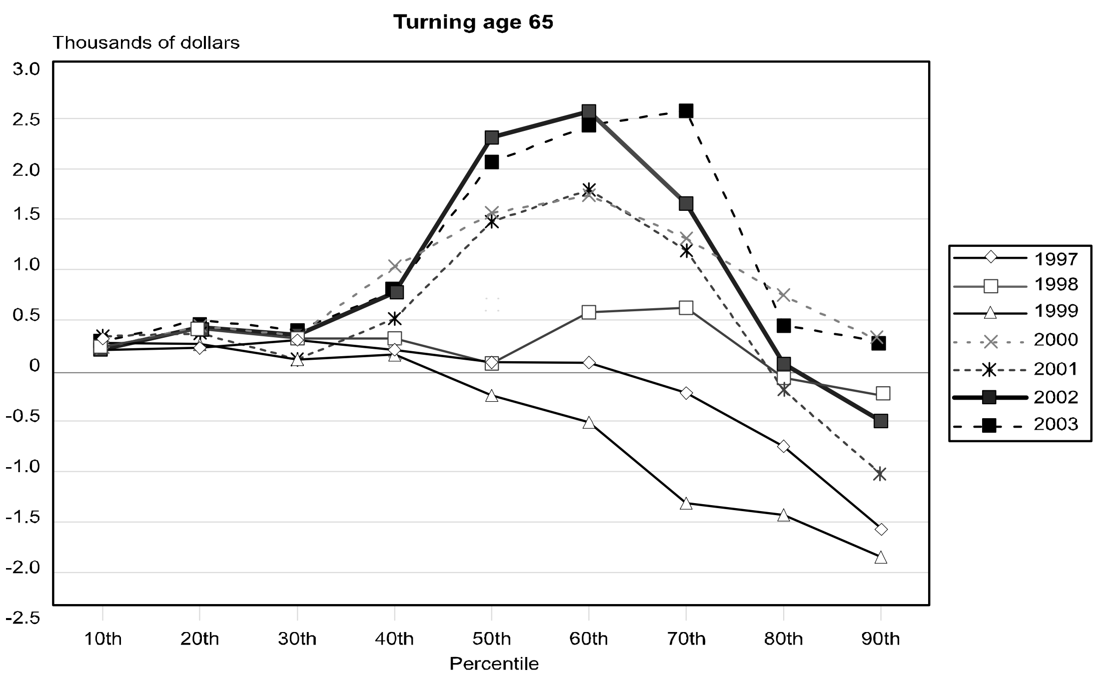
[36] We are currently undertaking a follow-up study to investigate the income effect using a different empirical framework.

[37] Results for logged earnings can be provided on request.

Chart 5.
Estimates of the effects on earnings, by percentile and year





SOURCE: Authors' estimates.

NOTE: The dependent variable is annual earnings in thousands of dollars. The samples include observations with nonzero earnings. Other covariates used in this regression are a constant, male, race (white), age group dummies (62–64 and 70–72), and calendar-year dummies from 1997 through 2002.

The chart shows (1) how the earnings distributions of the treatment groups have evolved since 1996 after controlling for both time and group effects and (2) that the earnings distributions of the treatment groups during the postremoval period have not changed significantly from those of 1996, thereby lending support to the specification of our model. For persons who have attained ages 65–69, earnings at the 60th to 80th percentiles of the distributions during the postremoval period clearly contrast with earnings of the preremoval period. Similarly, earnings at the 50th to 70th percentiles of the distributions for persons turning 65 are clearly affected by the test's removal. More important, estimates for the false treatment dummies (1997–1999) are located near the horizontal line that indicates an estimate of zero. If our estimates captured effects caused by factors other than the earnings test removal, we would not expect to see the observed pattern of changes in the earnings distributions of the treatment groups.

Ideas for Future Research

The results shown in this paper apply specifically to a change in the retirement earnings test, but the response to changes in thresholds may generalize to other policies. For example, the amount that Disability Insurance beneficiaries can earn without losing benefits, known as the substantial gainful activity (SGA) limit, increased from $500 per month during the 1990s to $700 per month in July 1999. On January 1, 2001, the SGA limit became $740 per month and was indexed to average wage growth. We might expect to find increased earnings among persons close to the threshold after the increase in the SGA, just as we found increased earnings among persons close to the earnings test threshold for whom the earnings test was relaxed or eliminated.

We have several ideas for future research. First, we would like to explore the work activities and claiming behavior of women in response to the removal of the earnings test separately from that of men. Second, the behavior of high-income beneficiaries in response to the removal of the earnings test might be worth further exploration. Those workers received a windfall when the earnings test was eliminated, but it appears from our results that they did not change their earnings or the timing of benefit claims much, perhaps because of reasons we discussed earlier in the paper. Such a result could also be caused by small sample sizes in the top end of the earnings distribution of high-income workers, or it might be the result of some as yet unexplored factors. Third, policymakers are interested in the net programmatic cost or gain to the Social Security system that arises from three sources: the loss of revenue following the elimination of the earnings test, higher payroll taxes coming from older workers who earn more, and accelerated benefit claims. Estimating both an annual cost and a long-term cost would be informative. Fourth, we would like to expand our analyses of spillover effects among persons who are younger than the FRA.

References

Amemiya, Takeshi. 1985. *Advanced Econometrics*. Cambridge, MA: Harvard University Press, 1985.

Angrist, Joshua D., and Alan B. Krueger. 1999. "Empirical Strategies in Labor Economics." In *Handbook of Labor Economics*, vol. 3A, edited by Orley C. Ashenfelter and David Card. Amsterdam: Elsevier Science Publishers B.V.

Baker, Michael, and Dwayne Benjamin. 1999. "How Do Retirement Tests Affect the Labour Supply of Older Men?" *Journal of Public Economics* 71(1): 27–52.

Bitler, Marianne P., Jonah B. Gelbach, and Hilary W. Hoynes. 2003. *What Mean Impacts Miss: Distributional Effects of Welfare Reform Experiments*. NBER Working Paper No. 10121. Cambridge, MA: National Bureau of Economic Research.

Blinder, A., R. Gordon, and D. Wise. 1980. "Reconsidering the Work Disincentive Effects of Social Security." *National Tax Journal* 33(4): 431–442.

Buchinsky, Moshe. 1998. "Recent Advances in Quantile Regression Models: A Practical Guideline for Empirical Research." *Journal of Human Resources* 33(1): 88–126.

Burkhauser, Richard V., and John Turner. 1981. "Can Twenty-Five Million Americans Be Wrong? A Response to Blinder, Gordon, and Wise." *National Tax Journal* 34(4): 467–472.

Burtless, Gary, and Robert A. Moffitt. 1985. "The Joint Choice of Retirement Age and Postretirement Hours of Work." *Journal of Labor Economics* 3(2): 209–236.

Disney, Richard, and Sarah Tanner. 2002. "The Labour Supply Effect of the Abolition of the Earnings Rule for Older Workers in the United Kingdom." *Economic Journal* 112(478): c136–c152.

Friedberg, Leora. 2000. "The Labor Supply Effects of the Social Security Earnings Test." *Review of Economics and Statistics* 82(1): 48–63.

Gruber, Jonathan, and Peter Orszag. 2003. "Does the Social Security Earnings Test Affect Labor Supply and Benefit Receipt?" *National Tax Journal* 56(4): 755–773.

Gustman, Alan L., and Thomas L. Steinmeier. 1985. "The 1983 Social Security Reforms and Labor Supply Adjustments of Older Individuals in the Long Run." *Journal of Labor Economics* 3(2): 237–253.

———. 1991. "Changing the Social Security Rules for Work After 65." *Industrial and Labor Relations Review* 44(4): 733–745.

Hausman, Jerry A., and David A. Wise. 1977. "Social Experimentation, Truncated Distributions, and Efficient Estimation." *Econometrica* 45(4): 919–938.

Heckman, James J., Jeffery Smith, and Nancy Clements. 1997. "Making the Most Out of Programme Evaluations and Social Experiments: Accounting for Heterogeneity in Programme Impacts." *Review of Economic Studies* 64(4): 487–535.

Krueger, Alan B., and Bruce D. Meyer. 2002. "Labor Supply Effects of Social Insurance." In *Handbook of Public Economics*, vol. 4, edited by Alan Auerbach and Martin Feldstein, 1–34. Amsterdam: North-Holland.

Loughran, David, and Steven Haider. 2005. *Do the Elderly Respond to Taxes on Earnings? Evidence from the Social Security Retirement Earnings Test*. Working Paper WR-223. Santa Monica, CA: RAND.

Leonesio, Michael V. 1990. "Effects of the Social Security Earnings Test on the Labor Market Activity of Older Americans: A Review of the Evidence." *Social Security Bulletin* 53(5): 2–21.

Maddala, G.S. 1983. *Limited Dependent and Qualitative Variables in Econometrics*. New York: Cambridge University Press.

———. 2001. *Introduction to Econometrics.* New York: John Wiley & Sons.

Meyer, Bruce D. 1995. "Natural and Quasi-Experiments in Economics." *Journal of Business and Economic Statistics* 13(2): 151–161.

Moffitt, Robert. 1992. "Evaluation Method for Program Entry Effects." In *Evaluating Welfare and Training Programs,* edited by Charles Manski and Irwin Garfinkel. Cambridge: Harvard University Press.

Packard, Michael D. 1990. "The Earnings Test and the Short-Run Work Response to Its Elimination." *Social Security Bulletin* 53(9): 2–16.

Panis, Constantijn, Roald Euller, Cynthia Grant, Melissa Bradley, Christine E. Peterson, Randall Hirscher, and Paul Stinberg. 2000. *SSA Program Data User's Manual*. Baltimore, MD: Social Security Administration.

Poterba, James. 2004. *The Impact of Population Aging on Financial Markets*. NBER Working Paper No. 10851. Cambridge, MA: National Bureau of Economic Research.

Reimers, Cordelia, and Marjorie Honig. 1983. "The Perceived Budget Constraint Under Social Security: Evidence from Reentry Behavior." *Journal of Labor Economics* 11(1): 184–204.

Social Security Administration. 1997–2004. *Annual Statistical Supplement to the Social Security Bulletin*. Washington, DC: SSA, Office of Policy, Office of Research, Evaluation, and Statistics.

———. 2001. *Social Security Handbook*, 14th ed. Baltimore, MD: SSA.

Song, Jae G. 2003/2004. "Evaluating the Initial Impact of the Elimination of the Retirement Earnings Test." *Social Security Bulletin* 65(1): 1–15.

Vroman, Wayne. 1985. "Some Economic Effects of the Social Security Retirement Earnings Test." In *Research in Labor Economics*, edited by Ronald Ehrenberg, 31–89. Greenwich, CT: JAI Press.