CENTER FOR LABOR ECONOMICS
UNIVERSITY OF CALIFORNIA BERKELEY
WORKING PAPER NO. 25

How Did the Elimination of Mandatory Retirement Affect Faculty Retirement?

Orley Ashenfelter
Princeton University and NBER

and

David Card
University of California, Berkeley and NBER

July 2000

ABSTRACT

We use information on retirement flows over the 1986-96 period for older faculty at a large sample of four year colleges and universities to measure the effect of the elimination of mandatory retirement. Comparisons of retirement rates before and after 1994, when most institutions were forced to stop mandatory retirement, suggest that the abolition of compulsory retirement led to a dramatic drop in retirement rates at ages 70 and 71. Comparisons of retirement rates in the early 1990s between schools that were still enforcing mandatory retirement, and those that were forced to stop by state laws, lead to the same conclusion. In the era of mandatory retirement, fewer than 10 percent of 70-year-old faculty were still teaching two years later. After the elimination of mandatory retirement this fraction has risen to 50 percent. Our findings suggest that most U.S. colleges and universities will experience a significant rise in the fraction of older faculty in the coming years.

JEL: J26, I21

*We are grateful to David Ashmore for managing the data collection effort underlying this research, and to Terry Layman, Linda Moskowitz, Ethan Lewis and Olivier Deschenes for their help in data collection and analysis. This project was funded by the Andrew W. Mellon Foundation and was conducted with the generous assistance of TIAA/CREF and the participating institutions. We are grateful to William Bowen and John Biggs for their support and encouragement, and to Brett Hammond for helpful comments.

Over the past three decades the institution of mandatory retirement has all but disappeared from American life. College and university professors were among the last group of employees exempted from the general prohibition of age-related employment barriers. Under the 1986 amendments to the Age Discrimination in Employment Act, postsecondary institutions were allowed to enforce mandatory retirement for faculty who reached the age of 70. The exemption was only a temporary measure, however, and following a review in the early 1990s Congress allowed it to expire on January 1, 1994.[1] The lifting of mandatory retirement took effect just as the wave of faculty hired in the early 1960s was about to reach traditional retirement age, leading some analysts to predict that U.S. colleges and universities soon would be overwhelmed by a gerontacracy of aging teachers and scholars (see, e.g., Rosovsky, 1990, pp. 211-212, and Epstein and MacLane, 1991). This concern has spawned a number of recent studies of faculty retirement (e.g., Clark, Ghent, and Kreps, 1998; Ehrenberg, Matier and Fontanella, 1998), and stimulated much interest in the age structure and retirement behavior of the American professorate.[2]

This paper presents the first comprehensive study of the effect of the elimination of mandatory retirement on faculty retirement patterns. Our analysis is based on detailed administrative records for more than 16,000 older faculty at 104 colleges and universities across the country. This new database – the Faculty Retirement Survey (FRS) – is a longitudinal panel formed by merging payroll records from individual colleges and universities with pension information from the TIAA/CREF system. The FRS includes all regular faculty age 50 or older who were employed at a sample of randomly selected four-year colleges and universities as of a fixed baseline date (in most cases, September 1, 1986). These individuals were followed over the next 9-11 years, yielding a rich source of information on faculty retirement flows in both the mandatory and post-mandatory eras.

---

[1]In granting the exemption Congress directed that a study be conducted by the National Research Council (NRC) to analyze the consequences of a permanent elimination of mandatory retirement for college and university faculty. The NRC report (Hammond and Morgan, 1991) concluded that a continuing exemption of tenured faculty from the general policy against mandatory retirement was unjustified.

[2]See for example Rees and Smith (1991), and the collection of papers in Holden and Hansen (1989).

We use the FRS to compare faculty retirement rates at different ages before and after the elimination of mandatory retirement. For faculty under the age of 70, we find that the elimination of mandatory retirement had no effect on retirement flows. About three quarters of 60-year-old professors retire before age 70, with a lower fraction at private research universities than at other institutions. For faculty who are still teaching at age 70, however, the elimination of mandatory retirement had powerful effects. In the mandatory era, the average retirement rate of 70-year-olds was about 75 percent, while the rate for 71-year-olds was about 60 percent. Immediately after the lifting of mandatory retirement these rates fell to less than 30 percent. These dramatic reductions have led to a substantial increase in the fraction of faculty who remain employed into their seventies. Whereas less than 10 percent of 70-year-old faculty were still employed at age 72 when mandatory retirement was in effect, now about one-half of 70-year-old faculty are still working two years later. Interestingly, the increases in the probability of remaining at work after age 70 have been fairly similar across different types of four-year institutions, suggesting that most U.S. colleges and universities will experience a significant rise in the fraction of older faculty over the next few years.

I. Background

a. College Enrollment and the Age Distribution of Post-Secondary Faculty

The implications of changing retirement patterns among college and university faculty depend critically on the relative size of the population of older faculty. The current age structure of the professorate is largely a reflection of historical hiring patterns, which in turn were driven by trends in post-secondary enrollment. Figure 1 shows two alternative measures of the inflow of new students to the postsecondary education system over the 1955-96 period. The first is the number of first-time freshman enrollees at four-year institutions; the second is the number of new high school graduates enrolled in 2- or 4-year colleges.[3] Both series show very

[3]New high school graduates are individuals age 16-24 who obtained a high school graduation diploma within the past 12 months. Thus, the series of new high school graduate enrollees approximates the inflow

rapid growth until the early 1970s, and relative stagnation thereafter. The growth in the number of college entrants up to 1970 was driven by a combination of rising cohort size (i.e., the baby boom) and increasing enrollment rates. Enrollment pressure in the 1960s led to a rapid expansion of the college and university system and a hiring boom for younger faculty. Although the number of college-age youth continued to rise over the next decade, the fraction who enrolled in college dropped sharply, resulting in a roughly constant inflow of college freshmen in the 1970s (see Card and Lemieux, 2000). Over the 1980s cohort size fell but enrollment rates rebounded, with the offsetting effects again leading to a roughly constant inflow of freshmen. The relative stability in enrollment inflows from 1970 to 1990 was associated with a prolonged era of depressed demand for new postsecondary faculty (see Bowen and Sosa, 1989).

Rapid faculty growth in the 1960s and much slower subsequent hiring rates created a "bulge" in the age distribution of college and university faculty that is still working its way through the system. This feature is illustrated in Figure 2, where we show estimated age distributions for U.S. faculty at four-year institutions in 1977, 1987, and 1996. The 1977 and 1987 data are taken from Bowen and Sosa (1989, Figure 2.1) and pertain only to faculty in the arts and sciences.[4] The 1996 data are derived from the FRS, and include faculty in business and professional schools as well as arts and sciences.[5] (FRS data for 1987 are very similar to the data reported by Bowen and Sosa). Examination of the three distributions shows that the highly skewed 1977 age distribution has gradually flattened and shifted right over the past 20 years, with a decline in the fraction

---

of "first-time" entrants to both 2- and 4-year colleges. The divergence in the two series in the 1960s reflects the rapid expansion of the 2-year college system: since the early 1970s the fraction of all college students enrolled in 2-year colleges has been fairly stable (see Card and Lemieux, 2000).

[4]Hammond and Morgan (1991, Table 1) report age distributions from the Survey of Doctorate Recipients (the same source used by Bowen and Sosa) for 1979-89. The 1977 and 1987 distributions are very similar to the 1977 and 1987 distributions in Figure 2.

[5]The FRS sample includes 59 institutions which provided data on all their faculty members, and 45 institutions that only provided data on those 50 and older. We used data for the former group in constructing Figure 2.

of faculty under age 40 and a rise in the fraction over age 55. Between 1977 and 1996 the median age of faculty at 4-year institutions rose by eight years, from 40 to 48.

A key implication of the shifting age distribution of college and university teachers is that a much higher fraction of faculty is now at risk to be affected by changes in retirement rates today than 20 years ago. For example, FRS data suggest that about 14 percent of all faculty in 1996 were between the ages of 60 and 69. As the "bulge" of faculty hired in the 1960s moves into their sixties, this fraction will continue to rise for another 5-10 years. The growing relative size of the older faculty population underscores the importance of understanding changes in retirement patterns associated with the recent lifting of mandatory retirement.

b. Previous Research on Mandatory Retirement

Prior to the phase-out of the exemption that allowed colleges and universities to continue mandatory retirement, two key studies were conducted to evaluate the likely effect of the law – Rees and Smith (1991), and the National Research Council (NRC) study mandated by Congress (Hammond and Morgan, 1991).[6] The Rees and Smith study is particularly interesting because it attempted to evaluate the effect of mandatory retirement laws by examining faculty retirement patterns at colleges and universities in states that had already passed state-specific laws banning mandatory retirement.[7] In particular, Rees and Smith compared the distribution of retirement ages at 12 colleges and universities that were covered by state laws prohibiting mandatory retirement to the distribution at 21 other institutions that were not covered by such laws. Contrary to expectations, their analysis suggested that the mean retirement age was lower at the "uncapped" institutions (those that were prohibited from enforcing mandatory retirement) than at the "capped" institutions (those that

---

[6]Previous research on the general issue of faculty retirement include Holden and Hansen (1989) and The Commission on College Retirement (1990). Bowen and Sosa (1989) also present some analysis of faculty retirement rates. Pencavel (1997) presents an analysis of the early retirement incentives offered to University of California faculty in the late 1980s and early 1990s.

[7]In many states these laws only applied to faculty at state institutions.

could enforce mandatory retirement). Moreover, a comparison of retirement ages at capped and uncapped institutions showed a higher fraction of retirements at age 70 at the *uncapped* institutions than at the capped colleges and universities (Rees and Smith, Table 2-5).[8] Based on this evidence, Rees and Smith concluded that the elimination of mandatory retirement was unlikely to have a significant effect on retirement flows at most institutions, although they cautioned that it might have a larger impact at institutions where more faculty remained employed until age 70.

The NRC study did not conduct an independent analysis of retirement flows, but it presented circumstantial evidence from a few uncapped institutions that seemed to support Rees and Smith's conclusion. In particular, the NRC study noted that only a handful of faculty remained employed after age 70 at the University of Wisconsin (where a state law eliminated mandatory retirement) and at Johns Hopkins University (which stopped enforcing mandatory retirement in the late 1980s). On the other hand, the NRC study also noted that the fraction of retirees leaving at age 70 or older varied widely across research universities, from less than 10 percent at several major state universities to more than 60 percent at some private research institutions (Hammond and Morgan, 1991, Table 3). These differences led the NRC study authors to echo Rees and Smith's conclusion that the elimination of mandatory retirement might have a bigger impact at research institutions where faculty were particularly likely to remain employed into their late sixties.

---

[8]Comparing the distributions of retirement ages at 5 public uncapped universities with those at 3 public capped universities, they found only 16 percent of retirements at exactly age 70 in the capped group, compared to 23 percent of retirements in the uncapped group. Similar results were found comparing retirement ages at capped and uncapped liberal arts colleges. This simple comparison may be misleading, because it fails to take into account the presence of older faculty who have not yet retired (i.e. the censoring of retirement ages). Moreover, the distribution of observed retirement ages for those who retire in a given time interval depends on the relative number of faculty who are entering retirement age. Faculty age distributions were shifting to the right during the 1980s, presumably leading Rees and Smith to understate the relative fraction of retirees at higher ages.

II. The Faculty Retirement Survey

The Faculty Retirement Survey (FRS) was developed to provide a large sample of data on retirement flows at a representative sample of four-year colleges and universities before and after the elimination of mandatory retirement. The FRS consists of longitudinal payroll records from 104 institutions, merged with pension information from the TIAA/CREF system. In this section we briefly describe the construction of the sample and highlight some of the features of the FRS data.

a. A Sample of Institutions

The target population of the FRS consists of older faculty at four-year colleges and universities in the U.S. who participate in the TIAA/CREF retirement system. We began our data collection procedure by constructing a sample universe of potential institutions. We used the CASPAR data base developed by the Carnegie Foundation for the Advancement of Teaching to derive a list of all research universities, doctorate-granting universities, comprehensive colleges and universities, and liberal arts colleges in the lower 48 states of the U.S. (The Carnegie Foundation's classification system for colleges and universities is described in Hammond and Morgan, 1991, Appendix C). We then eliminated specialized medical colleges from the list, as well as institutions that had no active contributors to TIAA/CREF as of mid-1995.

Column 1 of Table 1 shows the number of accredited four-year institutions in the U.S. in the four Carnegie classifications as of early 1992.[9] Nationwide there were 1,454 such colleges and universities. Column 2 of Table 1 shows the estimated number of institutions in each Carnegie classification with active TIAA/CREF participation, based on responses in the 1993 National Survey of Postsecondary Faculty (NSPF). Approximately 90 percent of institutions have some TIAA/CREF participation, with fairly similar rates of participation across the four types of institutions. Finally, column 3 of Table 1 shows the number of

[9]The data in columns 1 and 2 of Table 1 are taken from a report on the 1993 National Study of Postsecondary Faculty (NSPF): U.S. Department of Education (1997, Table 5.1).

institutions in the FRS sample universe. Note that with the exception of doctorate granting institutions, the numbers in columns 2 and 3 are quite similar. The divergence for the doctorate classification is attributable to the presence of specialized medical schools, which are included as doctorate institutions but excluded from the FRS universe.[10]

The second step in constructing the FRS was to devise a sampling scheme for collecting a representative sample of faculty. We decided to use a stratified quota sample, with 16 sample strata representing four geographic regions and four institution types. The original target sample population was 115 institutions: 40 research institutions, 20 doctorate-granting institutions, 25 comprehensive institutions, and 30 liberal arts colleges. The differential sampling rates reflected our desire to concentrate on institutions with larger numbers of faculty, and our experience in a pilot study, which suggested that larger research institutions are more likely to have high-quality and readily-accessible payroll data.

Once an institution was selected for the sample, a letter was sent to the head of the institution from the sponsors of the FRS study informing them of the objectives of the study and asking for their cooperation. We then contacted the institution to find out whether they would be willing to participate in the study, and to inquire about the availability of computerized payroll data. We also asked about the fraction of older faculty who used TIAA/CREF as their main pension provider. Institutions that were unwilling to participate, or lacked computerized payroll data for at least the past five years, or did not have a substantial fraction of older faculty in TIAA/CREF, were dropped from the study and replaced by another institution from the same sample stratum. Delays in finalizing participation of selected institutions led us to stop data collection in late 1997, when we had obtained data from a total of 100 institutions.[11] In addition to the institutions selected in this

---

[10]There were 110 doctorate institutions excluding specialized schools in 1988 (Hammond and Morgan, 1991, p. 130).

[11]One institution (not included in the totals reported in Table 1) provided data but had no faculty over age 50 as of 1986, and was subsequently dropped from the final sample.

manner, we include in the FRS database four non-randomly selected institutions that participated in a pilot study conducted in 1995 to judge the feasibility of the FRS data collection effort.

Participating institutions were asked it to provide a complete set of payroll records for all regular (tenured or tenure-track) faculty who were age 45 or older as of September 1, 1986.[12] A small number of institutions could only provide computerized data beginning at a later date. For these institutions we collected the available data for regular faculty age 45 and older on a more recent baseline date -- in no case later than September 1, 1991. The payroll data include individual salaries for each academic year from the baseline date forward, and information on the date and reason for any subsequent employment termination. We also collected basic descriptive information for each faculty member including age, gender, race, academic department, highest degree, academic rank, and (in most cases) information on employment status during the year (i.e., full time, part-time, on leave, etc.).

In the final step of data assembly the payroll records for individual faculty members were matched by name and social security number to pension accounts held by TIAA/CREF. The TIAA/CREF data include the total value of all pension accounts as of January 1 of each calendar year from 1986 onward, along with the amounts of any pension contributions after 1986. In this paper we only use data on total pension wealth, with no distinction between the types of retirement accounts (TIAA versus CREF), or the source of pension contributions (employer contributions versus employee contributions to 403(b) accounts). It should be noted that faculty members may have other sources of pension wealth besides their TIAA/ CREF account. This is particularly likely for faculty who currently either work at a state institution, or have done so in the past, since many public universities do not participate in TIAA/CREF, and others give faculty the option of joining

[12]We also include permanent lecturers as regular faculty, but exclude adjuncts, part-time lectureres, and other "temporary" faculty.

TIAA/CREF or some other pension plan.[13] Faculty may also have other personal retirement accounts, such as Keough accounts, that are excluded from our TIAA/CREF totals.

b. Sample Representativeness

Column 4 of Table 1 shows the distribution of institutions in the FRS sample, while columns 5-7 report information on the average size of the institutions in each Carnegie classification, and the average fraction of older faculty (as of the survey baseline date). We successfully recruited 34 research universities and 70 other institutions to participate in the FRS. Notice that the FRS includes over one-third of all research universities in the sample universe (34/94), and about 16 percent of all doctorate-granting institutions (17/104), but only about 5 percent of the comprehensive colleges (24/521) and 5 percent of the liberal arts colleges (29/479) in the universe. The representation of faculty in the FRS is even more highly skewed, since research and doctorate universities are substantially larger than comprehensive and liberal arts institutions (see column 5). Despite the differences in average size, institutions in the four Carnegie classifications had fairly similar fractions of older faculty at the sample baseline date, ranging from 33 to 40 percent.[14]

We can evaluate the representativeness of FRS sample by comparing the characteristics of older faculty in the FRS against those of older faculty in the 1993 National Survey of Postsecondary Faculty (NSPF).[15] As documented in Appendix Table 1, this comparison suggests that within each of the four Carnegie

---

[13]Some public institutions have switched their pension plans over the years, so that faculty hired before a certain date are covered by one pension plan and those hired later are covered by another.

[14]Bowen and Sosa (1989) used the 1987 Survey of Earned Doctorates to estimate the fractions of arts and sciences faculty at four-year college and university faculty age 50 or older. Their estimates (Table 2.1) are roughly 39 percent for research, doctorate, and comprehensive institutions, and 33 percent for liberal arts colleges – very similar to our estimates in each category.

[15]Since the public use micro samples of the NSPF do not contain sufficiently rich detail on characteristics such as age and salary, we used the interactive data analysis system (DAS) operated by the National Center for Education Statistics to construct characteristics of the NSPF sample. The number of faculty in the NSPF is relatively small: approximately 1000 observations each at research and doctorate

classifications the FRS sample is very similar to the NSPF sample. In particular, the FRS and NSPF samples have nearly identical age distributions, similar fractions of female and nonwhite professors, and fairly similar mean salaries. The largest discrepancy occurs in average salaries for liberal arts colleges: relative to the NSPF, salaries for liberal arts faculty in the FRS are higher. We suspect that this gap is related to the fact that the liberal arts colleges in the FRS tend to be somewhat larger than those in the overall population of such colleges (an average of 98 tenured and tenure-track faculty in the FRS, versus 69 in the overall population).[16] This differential should be kept in mind in interpreting our results for liberal arts colleges.

c. Mandatory Retirement Provisions Prior to 1994

Although most institutions in the FRS enforced mandatory retirement until December 31, 1993, a total of 14 schools in the sample had eliminated mandatory retirement before that date. In all but one case, this decision was driven by a state law that prohibited mandatory retirement.[17] Table 2 shows the composition of institutions and older faculty in the overall FRS sample, and in three subgroups of institutions: those that were capped until the federal law took effect in 1994; those that uncapped relatively early (before 1989); and those that uncapped somewhat later (mainly in 1990 or 1991). The early uncapped group includes all institutions in Wisconsin, Maine, and Utah, along with one school that voluntarily eliminated mandatory retirement in the late 1980s. The later uncapped group includes public institutions in Alabama, Arizona, Connecticut, Florida,

---

institutions, 1800 at comprehensive institutions, and 480 at liberal arts colleges.

[16]Recall that schools in the FRS had to have computerized payroll records for the period starting in 1990 (at the latest). Some of the smaller liberal arts colleges that were contacted to participate in the FRS did not have such records. For the other three categories of schools the average number of tenured and tenure track faculty in the FRS is quite consistent with data from the 1988 NSPF.

[17]In a few cases the state law prohibited mandatory retirement at both public and private institutions (specifically, the statutes in Wisconsin, Maine, Montana, Nevada and Utah) whereas in most cases it applied only to public institutions. See Hammond and Morgan (1991, Table 1) and Rees and Smith 1991, page 6) for a list of state laws.

Idaho, Louisiana, New Hampshire, New York, Texas, Virginia, and Wyoming and all institutions in Montana and Nevada.

A comparison of the characteristics of older faculty in the three subgroups of institutions reveals many similarities and a few key differences. Owing to the nature of the state laws, schools that uncapped before 1994 are more likely to be public institutions. On the other hand, the age distributions and fractions of female and nonwhite faculty are similar in the three subgroups, as are the fractions of faculty with a Ph.D., the fraction in arts and sciences (as compared to professional schools such as Engineering, Business, or Law), and the average annual salary as the sample baseline date. In all three subgroups of institutions the majority of older faculty is made up of white men, about 80 percent hold a Ph.D., 70 percent are full professors, and about one-half teach in the arts and sciences. The mean annual salary of older faculty at the sample baseline year (in most cases, 1986) was around $70,000.

In the overall FRS sample some 80 percent of individual faculty have a TIAA/CREF retirement account. This fraction varies substantially across schools, however, ranging from a low of 30 percent at a couple of state institutions to 100 percent at many private institutions. The fraction of faculty with TIAA/CREF accounts is relatively low in the early uncapped schools, and also somewhat below average in the later uncapped schools, reflecting the high fraction of state institutions in these subsamples. Among faculty with a TIAA/CREF account, mean pension wealth is about three times annual salary (the median ratio is 2.8, the mean is 3.3), although again there is variation across schools, with a tendency for lower average wealth levels at a few public schools that offered state pension funds to faculty in the past. This observation underscores the incomplete nature of our pension wealth measure. As expected, faculty with higher salaries tend to have higher pension wealth, although the correlation is imperfect (the simple correlation coefficient is

0.28), reflecting differences in age, the number of years as a college teacher, the pension contribution rate of current and previous employers, the past history of pension allocation decisions, and other factors.[18]

III. Retirement Flows

The FRS design allows us to develop a variety of measures of faculty retirement flows. In this paper, we focus on 1-year exit rates (hazard rates) defined for specific age groups and for specific reasons for leaving employment. We begin by defining the subset of individuals who are at risk to exit at a particular age. To account for the fact that the typical academic year starts in the early fall, we measure age as of September 1. Thus, the group at risk to retire at age 65 in a particular year consists of those who 0have reached their 65th birthday by September 1 of that year and who were employed in the previous academic year. The mandatory retirement rate at age 65 is defined as the fraction of this at-risk group whose payroll records indicate that their date of separation is before September 1, and whose reason for separation is recorded as a compulsory retirement.[19] We define voluntary retirements and "other exits" (quits, terminations, people who leave because of disability) similarly.

Figure 3 shows the average exit rates at each age for older faculty at capped schools in the FRS during the years from 1987 to 1993 (i.e., before the end of mandatory retirement). As has been found for other samples of U.S. workers, the retirement rate for college and university faculty rises discretely at age 62, when retirees are first eligible for social security benefits, and has another peak at age 65, when retirees are eligible for full social security benefits (see, e.g., Phelan and Rust, 1997; Lumsdaine, Stock and Wise, 1995). Between

---

[18]Some variation in measured pension wealth also arises at some of the state schools in the sample because individuals may have been begun their careers in a state pension system and then moved to TIAA/CREF later.

[19]Note that someone who works in the fall semester and retires in December at age 65 will be coded as retiring at age 66. An examination of the data for retirees suggested that almost all retirements take place at the end of the academic year. Thus, people whose birthdays fall after September typically work one year longer than those born earlier in the year.

the ages of 66 and 69, the average faculty exit rate in the pre-mandatory era was 16.3 percent per year, with 15.0 percentage points of this total due to retirement and the balance attributable to other exits. At age 70 the overall exit rate was 76 percent. Interestingly, most of the rise in exit rates between 69 and 70 was attributable to a jump in the *noncompulsory* retirement rate, rather than to compulsory retirements. The exit rate at age 71 was also quite high (65 percent), and includes a sizeable fraction of compulsory retirements. The high rate of retirement at age 71 is explained by the fact that many capped institutions allowed faculty to work in the academic year that they turned 70. Our coding conventions record such individuals as retiring at age 71.

The patterns in Figure 3 suggest two important conclusions about faculty retirement in the pre-mandatory era. First, age 70 appears to have been a crucial barrier for continued employment of faculty. Taking account of all forms of exit, only 8 percent ($= (1-0.76)\times(1-0.65)$) of those who were teaching at age 69 were still employed two years later. Second, most of the exits at age 70 were not recorded as mandatory retirements, but rather as normal (or "voluntary") retirements. Of course many faculty who would have preferred to continue teaching after age 70 may have decided to voluntarily retire to avoid the embarrassment and/or administrative burden of a forced retirement. Given the fact that employers could force faculty members to retire after age 70, and the observed rise in voluntary retirements at age 70, we do not believe it is useful to distinguish between voluntary and mandatory retirements. Consequently, in the remainder of the paper we focus on a simple classification of exits into retirements and other exits.

a. Changes in Retirement Rates at the Capped Institutions After January 1 1994

How did exit rates of faculty at various ages change after the elimination of mandatory retirement? A first answer to this question is provided by comparing retirement rates at different ages in the capped institutions (those that maintained mandatory retirement until the change in the federal law) before and after 1994. Figure 4a shows average retirement rates at different ages in the pre-mandatory and post-mandatory periods for faculty at the 90 capped institutions in the FRS. Figure 4b shows average rates of other exits in

the two periods. (Note that the scales of the vertical axes are very different in these two graphs). The data in the upper panel reveal that average retirement rates at ages 58 to 69, and at ages 72-73, were quite similar in the pre-mandatory and post-mandatory periods. Retirement rates at ages 70 and 71, however, were sharply lower in the post-mandatory era, and more nearly in line with rates at ages 68-69 and 72-73. In other words, after the elimination of mandatory retirement, the pronounced "spike" in retirement rates at ages 70 and 71 was substantially reduced. Looking at the rates of other exits, it appears that exit rates were slightly lower in the post-mandatory era for all age groups (the average differential is 0.4 percentage points for ages 60 to70), with a noticeable drop at ages 71 (3.2 percentage points, with standard error 1.8) and 72 (4.2 percentage points, with standard error 3.5). Nevertheless, before 1994 only a small fraction of faculty at the capped institutions was not retired (or mandatorily retired) by age 71. Thus, the apparent "spike" in the rate of other exits at ages 71 and 72 in the pre-mandatory era arises from the exit behavior of only a handful of individuals.[20] Given this fact, the declines in the rates of other exits at ages 71 and 72 after the elimination of mandatory retirement are not statistically significant.

While the results in Figure 4a suggest that average retirement rates were very similar before and after 1994 for all ages other than 70 or 71, it is important to check that this apparent stability is not masking underlying variability in age specific retirement rates over time. The stability of age-specific retirement rates in the FRS sample is confirmed in Figure 5, where we plot the average retirement rates for six different age groups in each year from 1987 to 1996. Although the rates vary slightly from year to year, retirement rates at ages 60, 62, 65, and 68 are all relatively constant, with no obvious trend over the 1987-96 period. By comparison, the drops in the retirement rates of 70 and 71-year-olds between 1993 and 1994 are very pronounced. This simple figure provides support for the contention that these declines were attributable to

[20]The rate of other exits at age 71 in the pre-1994 period is the result of behavior by 11 faculty (4 of whom died), while the rate of other exits at age 72 in the pre-1994 period is the result of behavior by 4 faculty (1 of whom died).

mandatory retirement, rather than to other underlying factors that happened to coincide with the timing of the law.

Table 3 presents a series of comparisons of age-specific retirement rates before and after the elimination of mandatory retirement. This table shows the number of faculty at uncapped institutions in the FRS who were "at risk" of retiring at each age between 60 and 72, the average retirement rates in the 1987-93 and 1994-96 periods, and the difference in average retirement rates between the periods. In order to check whether this difference is confounded by changes in the composition of the sample at risk of retiring at each age in the two periods, the final column of the table shows an adjusted difference in retirement rates obtained from a series of logistic regression models. These models are fit separately to each age group, and include a set of 19 control variables, as well as a dummy variable indicating whether the potential retirement event took place before or after 1994. The controls include indicators for gender, nonwhite race, holding a Ph.D., geographic region of the U.S., Carnegie classification and public/private status of the institution, and indicators for six broad departmental categories. For comparability with the unadjusted differences in retirement rates, the estimated coefficients of the post-1994 dummy variable from the logistic regression are transformed into (approximate) estimates of the difference in the average probability of retirement before and after 1994.

An examination of the unadjusted and adjusted differences in average retirement rates in Table 3 confirms the key findings in Figure 4a. Apart from ages 70 and 71, retirement rates before and after the elimination of mandatory retirement were very similar. Indeed, none of the differences in retirement rates at ages other than 70 or 71 is even close to statistical significance. In addition, the large drops in retirement rates observed for 70 and 71-year-old faculty are very similar whether or not adjustments are made for the changing characteristics of older faculty.

b. Comparisons of Retirement Rates at Capped and Uncapped Institutions Before 1994

A second way to evaluate the impact of the elimination of mandatory retirement is to compare retirement flows at different institutions before 1994, when some schools had already eliminated mandatory retirement and others had not. This is the research design used by Rees and Smith (1991), although at the time of their study only a small number of institutions were uncapped, and most had been uncapped for only one or two years. Table 4 presents the results of such a comparison, utilizing retirement flows in the 3-year period from 1991 to 1993. The advantage of limiting the comparison to this period is that there are only two groups of schools: those that retained mandatory retirement (and did so until January 1994), and those that had uncapped sometime before 1991.

The patterns in Table 4 are similar to those in Table 3, and lead to the same conclusion about the effect of the elimination of mandatory retirement on retirement rates at ages 70 and 71. In particular, the retirement rate at age 70 was 45 percentage points higher at the capped institutions than at the uncapped institutions in the early 1990s, while the retirement rate at age 71 was 32 percentage points higher. These differentials are remarkably similar to the declines in average retirement rates observed for the capped schools after 1994, and provide additional confirmation of the strong effect of mandatory retirement rules on retirement flows of 70 and 71-year-old faculty. Unlike the patterns in Table 3, however, there is some indication in Table 4 that retirement rates at ages 60-69 were slightly different at the uncapped institutions than at the schools that maintained compulsory retirement. Such differences suggest that the retirement profile of faculty at the uncapped institutions may not be an entirely appropriate counterfactual for the behavior of those at capped

institutions in the absence of mandatory retirement.[21] Nevertheless, compared to the differences in retirement rates at ages 70 and 71, the differences at earlier ages are quite small.

It is also possible to use FRS data to examine changes in retirement rates at the institutions that eliminated mandatory retirement before 1994. Figure 6 graphs the retirement rates of 70-year-old faculty at institutions that uncapped early (before 1990), later (1990 or 1991), or not until 1994. The patterns for all three sets of institutions suggest that the elimination of mandatory retirement led to a sharp reduction in the retirement rate at age 70.[22] The declines were similar for the institutions that uncapped in 1990-91 and those that retained mandatory retirement until 1994, but somewhat smaller at institutions that uncapped before 1990. The latter group of schools had relatively low retirement rates for 70-year-olds in the earliest years of the FRS sample. It should be noted, however, that the number of 70-year-old faculty at these schools is very small (10-14 per year). Consequently, the retirement rates in the 1987-89 period at the early uncapped institutions are not significantly different from the rates at the other two sets of schools.[23]

c. Pooled Models

The results in Figures 4-6 and Tables 3-4 provide compelling evidence that the elimination of mandatory retirement led to a large reduction in faculty retirement rates at ages 70 and 71, with little systematic

---

[21]Appendix Table 2 presents a comparison of average retirement rates before and after the lifting of mandatory retirement at the three groups of institutions described in Table 2 (early uncapped schools, later uncapped schools, and schools that maintained compulsory retirement until 1994). These comparisons suggest that prior to the elimination of mandatory retirement, retirement rates were quite similar at the three groups of schools. After the lifting of mandatory retirement, however, retirement rates of 60-68 year-olds rose by 3-5 percentage points at schools that eliminated mandatory retirement before 1994, whereas they were relatively constant at other schools.

[22]Graphs similar to those in Figure 6 for faculty age 71 are not very informative because of the very small numbers of 71-year-olds in the pre-mandatory era.

[23]Some of the schools in the early uncapped group eliminated compulsory retirement before 1989, although the precise timing at one of the institutions is unclear. When this school's data are eliminated, the retirement rates at age 70 are not much different.

change at other ages. Morever, the estimated effects of uncapping are similar whether we compare changes in retirement rates before and after 1994 at institutions that remained uncapped until the federal law change, or differences in retirement rates between capped and uncapped institutions in the early 1990s. To probe these results even further, we decided to fit a series of pooled logistic regression models that combine the data on retirement rates at different ages for all the institutions in the FRS sample.[24] These models take the form

$$(1)\quad \log \{ P(i,a,t) / (1-P(i,a,t)) \} = X(i,j,a,t)b + c_a(j,t),$$

where $P(i,j,a,t)$ is the probability that individual i, who is employed at institution j at age a in year t retires before the start of the next academic year, conditional on having remained in employment up to age a, $X(i,j,a,t)$ represents a set of observed characteristics of individual i and institution j, and $c_a(j,t)$ represents a set of baseline retirement probability parameters for people of age a in year t at institution j. A simple specification of the baseline retirement probabilities is

$$(2)\quad c_a(j,t) = d_a + \Delta_a \times 1[\, t \geq \text{Uncap}(j) \,],$$

where $1[\cdot]$ is the indicator function and $\text{Uncap}(j)$ is the date that institution j uncapped. This specification includes an unrestricted parameter d_a for the retirement rate at age a under a mandatory retirement regime, and another parameter Δ_a for the change in the baseline probability of retirement at age a after uncapping. A more parsimonious specification of the baseline, suggested by the patterns in Figures 4-6, imposes the restriction that the baseline retirement rates at ages other than 70 and 71 are unaffected by the lifting of mandatory retirement (i.e., $\Delta_a = 0$ for $a \neq 70$ or 71).

Table 5 presents estimation results for a series of models based on equations (1) and (2). The specification in the first column of the table includes a full set of unrestricted baseline parameters for each age, and a full set of interactions of the baseline age effects with a post-uncapping indicator, but excludes any other control variables. The estimated coefficients of the post-uncapping interaction terms with ages 70 and 71 are

---

[24]See Prentice and Kalbfleisch (1980), Allison (1982) and Efron (1988) for discussions of the use of logistic regression models to model hazard probabilities.

shown in the first two rows of the table, while the approximate changes in the probability of retirement for 70 and 71-year-olds after uncapping are reported in the bottom rows of the table.[25] Column 2 presents an expanded specification that adds 21 control variables (the 19 covariates used in the models in Table 3 plus two indicators for institutions that uncapped early and later). Although many of the control variables exert statistically significant effects on individual retirement probabilities, their inclusion has no effect on the estimated change in retirement rates for 70 or 71-year-olds after uncapping.

The coefficients associated with the key control variables are reported in Table 5, and show some interesting patterns. Retirement rates are higher at public research universities than at private comprehensive institutions (the omitted group in the models), while rates at private research universities are lower. Retirement rates are also higher at liberal arts colleges (all of which are private) than at the reference private comprehensive institutions. Finally, publicly controlled non research institutions have significantly higher retirement flows. Interestingly, the public-private difference in the log odds of retirement among the non research institutions is only slightly bigger than the corresponding difference between public and private research universities (0.45 for the model in column 2).

Turning to the coefficients of the individual faculty characteristics, the estimates suggest that females at research universities, nonwhites, and faculty who hold a Ph.D. have lower average retirement rates. On the other hand, female faculty at non research institutions have slightly higher retirement rates than their male colleagues.[26] Although the coefficients are not reported in the table, there are also some significant differences in retirement rates by region, discipline, and between the institutions that uncapped earlier versus later.

---

[25]Given the properties of the logit model, the model in column 1 of Table 5 leads to predicted probabilities of retirement for each age group before and after uncapping that exactly match the sample average probabilities. The reported changes in the probability of retirement are constructed using the approximation $\Delta_a \times P_a \times (1-P_a)$ where P_a is the average probability of retirement at age *a* prior to uncapping.

[26]We experimented with a number of other interactions between gender, race, and type of institution but found that only the female × research university interaction was statistically significant.

Retirement rates at institutions in the West and Midwest are higher than those in the Northeast and South. Retirement rates for faculty in social sciences and physical sciences are significantly lower than those for faculty in humanities or life sciences, while retirement rates for faculty at professional schools tend to be higher than for other groups. Finally, retirement rates at schools that uncapped early (i.e., before 1990) or later (1990 or 1991) tend to be higher than rates at the institutions that maintained mandatory retirement until 1994.

The specification in column 3 of Table 5 is similar to one in column 2, but it imposes the restriction that retirement rates of faculty at all ages except 70 and 71 are the same before and after uncapping. A comparison of the fit of this model to the fit of the specification in column 2 shows that this restriction is easily accepted (chi-square = 12.0 with 13 degrees of freedom, p-value = 0.53). Moreover, the coefficient estimates for the control variables are very similar in the two specifications.

The model in column 4 is fit to retirement outcomes in the period from 1987 to 1993. Identification of the effect of uncapping in this specification is obtained by comparing post-uncapping retirement probabilities at institutions that eliminated mandatory retirement prior to the change in federal law to the rates at the same institutions prior to uncapping, and to the rates at other institutions that maintained mandatory retirement until 1994. As suggested by the patterns in Table 4, the estimate of the effect of uncapping on retirement rates at ages 70 and 71 in this model is very similar to the estimate obtained using all the available data. In light of this similarity, we believe that the pooled specifications in the other columns of the table are justified.

The model in column 5 of Table 5 is fit to the subset of individuals who are ages 65 or older. A comparison of the parameter estimates from this model to the estimates in column 3 provides an indication of whether the control variables have a differential effect at different ages, and whether such differences have any effect on inferences about the change in retirement probabilities for 70 and 71-year-olds after uncapping. Although the estimated coefficients of some of the covariates are slightly different in the subsample of those age 65 and older, these differences have virtually no effect on the implied changes in retirement rates after uncapping.

The models in columns 1-5 do not include any controls for the salary level or pension wealth of individual faculty. Such controls are potentially important since standard economic models suggest that faculty members are less likely to retire if they can earn a higher salary, and more likely to retire if they expect a higher level of pension income during retirement (see, e.g., Lumsdaine and Mitchell, 1999). Moreover, although salary levels for older faculty were fairly constant over the 1987-96 period, pension wealth levels rose over the 1990s, leading to a potential difference between faculty who were at risk of retiring in the mandatory and post-mandatory periods. Column 6 fits a specification similar to the one in column 3, but with the addition of a variable representing the log of the faculty member's real annual salary in the previous academic year.[27] As expected, salary levels exert a strong effect on retirement. On average, a faculty member with a 10 percent higher salary has about a 1 percent lower probability of retiring at ages 66-69 (conditional on having worked up to the previous year).[28] The addition of salary information also leads to modest changes in the estimated effects of several other covariates that are correlated with salary, such as gender, race, and type of institution.[29] Nevertheless, the introduction of controls for salary levels has little effect on the magnitude of the estimated changes in retirement rates at ages 70 and 71 after uncapping.

As noted in Table 2, only about 85 percent of older faculty in the FRS have a TIAA/CREF pension account. The model in column 7 of Table 5 reproduces the specification from column 3, but fit to the subset

---

[27]Salary information is missing for a small fraction of observations. The characteristics of the subsample with observed salaries are very similar to those of the overall sample, and parameter estimates for a retirement model that excludes the salary variable are very similar in the subsample and the overall sample.

[28]The measured effects of a higher salary are not necessarily attributable to pay alone, since faculty with higher salaries may also have lower teaching loads, or may enjoy their work more.

[29]An analysis of salaries shows that average pay is similar at private comprehensive institutions, public doctorate-granting institutions, and liberal arts colleges. Relative to this reference group, salaries are about 25 percent higher at private research universities, 15 percent higher at public research universities, and 6 percent higher at private doctoral granting institutions. Among the older faculty in the FRS, women are paid 10 percent less than men and nonwhites are paid 2 percent less than whites, controlling for age, rank, full-time status, highest degree, and institutional characteristics.

of observations that have valid data on both salary in the previous academic year and TIAA/CREF pension wealth. This subsample gives rise to parameter estimates that are fairly similar to the estimates for the overall sample. The model in column 8 includes controls for salary and pension wealth. As in the specification in column 6, the estimates from this model suggest that salary exerts a strong negative effect on the probability of retirement. The level of pension wealth works in the opposite direction, but has a much smaller effect and is only marginally significant. We suspect that the effect of observed pension wealth on retirement rates is biased toward zero by the measurement error in this variable. Ideally, we would like to control for an individual's *total* pension wealth, including TIAA/CREF accounts, social security, and other pension funds. The observed value of a faculty member's TIAA/CREF accounts is likely to be a noisy measure of this ideal wealth number. A second factor that may lead to a downward-biased estimate of the effect of pension wealth on retirement rates is the fact that pension wealth depends on previous earnings and saving decisions. If faculty members with a stronger preference to continue working at older ages earned higher salaries earlier in their careers, or tended to contribute more to optional savings accounts, their pension wealth will be higher, leading to an attenuation of the measured effect of higher pension wealth on retirement. In any case, the estimates in column 8 suggest that the addition of controls for pension wealth has little effect on inferences about the changes in retirement rates at age 70 and 71 after uncapping.

d. Additional Specification Checks

One limitation of the FRS is that we lack any data on non pecuniary job conditions that may influence the retirement decisions of individual faculty. Teaching loads are typically lighter and other working conditions (e.g., office assignments, research and administrative support) are better for faculty who are regarded as more productive by department chairs and deans. These faculty also typically receive the highest salaries in their respective institutions. This line of reasoning suggests that an individual's rank within the salary distribution of his or her institution may provide a reasonable proxy for working conditions (at least relative to those of

other faculty in the same institution). Table 6 presents a series of retirement models that include controls for various measures of salary rank, in place of or in addition to the level of salary. All of these models include the same controls as the models in Table 5, although for simplicity we show only the coefficients of the salary and rank terms, and the interaction terms that represent the changes in retirement rates at ages 70 and 71 after the elimination of mandatory retirement. For reference purposes, column 1 reproduces the specification in column 6 of Table 5: this baseline model includes the log of (real) salary in the previous academic year, along with the 21 other control variables described earlier. The model in column 2 replaces the log of the individual's salary with the rank in the salary distribution of older faculty at his or her institution in the previous academic year (measured on a scale from 0 to 1), while the model in column 3 includes both the level of salary and salary rank, and the model in column 4 includes salary level, salary rank, and an indicator for being in the top 10 percent of the salary distribution. These models suggest that both the absolute level of salary and salary rank influence the retirement decision. For example, according to the model in column 4, a faculty member in the 0.95 centile of the salary distribution of his or her institution has a -0.35 lower log odds of retirement than one at the median of the salary distribution, controlling for the actual levels of their salaries. Nevertheless, the introduction of controls for salary rank has no effect on the measured impact of uncapping on retirement rates at ages 70 and 71, nor on the coefficients of the other control variables in the models. These conclusions also hold when pension wealth is added as an additional control variable (column 5).

A second and related problem with the FRS is that we lack information on various institution-wide characteristics that may influence faculty retirement rates. One way to address this shortcoming is to include controls for the identities of individual institutions (i.e., institution fixed effects). Assuming that institutional characteristics do not change when mandatory retirement is eliminated, institution fixed effects will absorb any unobserved factors that may confound the comparison of retirement flows before and after uncapping. It is possible to include institution fixed effects in the logistic retirement models used in Tables 5 and 6. As an alternative, however, in Table 7 we present a series of linear probability retirement models that exclude or

include unrestricted institution fixed effects. A comparison of the estimates from these models to the results in Tables 5 and 6 allows us to assess the robustness of our inferences to functional form assumptions, and to the presence of permanent unobserved characteristics of different institutions.

Column 1 of Table 7 reports a linear probability model that is comparable to the logistic model in column 3 of Table 5, while column 2 reports a similar specification that also includes institution fixed effects. The estimates of the coefficients representing the change in the probability of retirement at ages 70 and 71 after uncapping are very similar to the implied changes from the logistic model (reported in the bottom rows of Table 5). Moreover, the estimates are very similar for models with and without institutional fixed effects. These similarities suggest that inferences about the effect of the elimination of mandatory retirement are highly robust to functional form and to the presence of unobserved institutional characteristics.

The models in columns 3-5 of Table 7 include controls for salary, salary rank, and pension wealth, as well as institution fixed effects. For comparability with the coefficient estimates from the logistic regression models, the coefficients of the salary and rank variables from the linear probability models are multiplied by 10. Since the average retirement rate (over all ages from 58 to 72) is 10 percent, this re-scaling converts the linear probability coefficients to approximate effects on the log odds of retirement. Comparisons of the models in Table 7 to those in Table 6 suggest that the effect of log salary on retirement rates is very similar regardless of functional form or the addition of institution fixed effects. Once institution fixed effects are included, however, salary rank has a much smaller effect on retirement flows (compare the specification in column 4 of Table 7 to the one in column 4 of Table 6). Our interpretation of these results is that salary levels rather than salary ranks are the key determinants of retirement rates, but that average salaries are correlated with unobserved institutional characteristics that effect retirement rates, leading to a measured effect of salary rank (which is highly correlated with the deviation of an individual's salary from the mean level of salary for the

institution) when institutional effects are not included.[30] Importantly, however, our key inferences about the effect of uncapping on retirement rates at ages 70 and 71 are unaffected by these issues.

e. Estimates of the Effect of Lifting Mandatory Retirement on Subgroups

Up to this point we have been ignoring the possibility that the elimination of mandatory retirement had a differential effect on faculty at different types of institutions, or in different disciplines. Figures 7 and 8 address this concern by plotting age-specific retirement rates before and after uncapping by institution type and discipline. Figure 7a graphs retirement rates for faculty at public research universities while 7b shows the rates at private research universities. Both types of institutions show similar drops in the probability of retirement at ages 70 and 71 following uncapping, with only modest (and largely unsystematic) changes at other ages. As suggested by the coefficients in Table 5, however, retirement rates at all ages tend to be higher at the public research universities. Generally similar patterns are also evident at the doctorate granting, comprehensive, and liberal arts institutions, although the decline in retirement rates for 70 and 71-year-olds at the comprehensive colleges is somewhat smaller than at other institutions.

These visual impressions are confirmed by the results in the upper panel of Table 8, where we have reported average retirement rates at ages 70 and 71 before and after uncapping for the five types of institutions. As in Table 3, we show the unadjusted differences in age-specific retirement rates before and after uncapping as well as an adjusted difference obtained from a logistic regression model fit by age and institutional type. The results suggest that there were similar declines in average retirement rates at ages 70 and 71 across the different types of institutions, with the exception of the comprehensive institutions, where the changes were smaller. Given the relatively small numbers of observations at these institutions, however, the changes are not

---

[30]If an individual's salary and the difference between his or her salary and the mean for the institution are included jointly, the coefficient on the latter will be the same as the one obtained for individual salary in a fixed effects specification, while the coefficient on the former will reflect the covariance between mean institutional salaries and unobserved institution-level factors that affect retirement flows.

significantly different from those observed at other types of colleges and universities. Indeed, one cannot reject the hypothesis that the log odds of retirement at ages 70 and 71 fell by the same amount at the five types of institutions after uncapping.

Figures 8a - 8e show average retirement rates before and after uncapping for faculty in five sets of disciplines: humanities, social sciences, physical and life sciences (including mathematics), engineering, and business and professional schools. The patterns of relative retirement rates at different ages in the mandatory and post-mandatory eras are similar across disciplines, with uniform declines in retirement rates at ages 70 and 71, and few systematic changes at other ages. The changes in average retirement rates at 70 and 71 are summarized in the lower panel of Table 8. As with the analysis across institutional categories, the declines in retirement rates across disciplines are similar enough that one cannot reject the hypothesis of equal effects. Perhaps surprisingly, the evidence suggests that uncapping had very similar effects on faculty retirement rates across all the disciplines.

f. Summarizing the Effect of the Elimination of Mandatory Retirement

Estimated exit rates for faculty at different ages derived from the FRS can be used to construct two useful summary measures of faculty retirement flows before and after the lifting of mandatory retirement. The first is the fraction of faculty who are employed at a given age (say 60) who can be expected to remain employed until age 70. The second is the fraction of those who are employed at age 70 who will remain to ages 71, 72, 73, etc. Estimates of these summary measures are presented in Table 9. We provide estimates for all faculty, for those at public and private research universities, and for those at other types of institutions (doctorate universities, comprehensive institutions, and liberal arts colleges).[31]

---

[31]We pool doctorate, comprehensive, and liberal arts institutions to increase the reliability of the estimates.

The upper panel of Table 9 shows estimated survival probabilities to age 70 for faculty who are ages 60 and 65. These survival probabilities incorporate the risks of both retirement and other exits (including quits and death). As might be expected given the evidence presented so far, the estimated survival probabilities up to age 70 are very similar before and after the elimination of mandatory retirement. However, the fraction of older faculty who are expected to stay until age 70 varies across institution types, with a relatively higher fraction at private research universities than at other institutions. Just over 20 percent of 60-year-old faculty will remain employed to age 70 at public research universities, and at the non research institutions, compared to about 40 percent of 60-year-olds at private research universities. This differential suggests that the elimination of mandatory retirement probably will have a bigger long-run effect on faculty composition at the private research universities than at other institutions.

The lower panel of Table 9 shows the employment survival probabilities after age 70 for those who were still working at that age. (Note that the exit rates at age 70 differ from the estimates in Table 8 because they include both retirements and other forms of exit). In the mandatory era, roughly 75 percent of those who were still employed in the academic year before they turned 70 retired in the next year. This fraction was fairly similar across the different types of institutions. After the abolition of mandatory retirement this rate has fallen to about 30 percent. Again, the drops were similar at public research universities, private research universities, and at the other institutions. As a consequence of these changes, and of similar drops in the probability of leaving at age 71 (for those who survive past age 70), the expected fraction of faculty who will remain employed until age 72 has risen from 8-13 percent in the

mandatory era to about 50 percent in the post-mandatory period. Unfortunately, given the very small fraction of faculty who stayed past age 71 in the mandatory era, and the relatively short time that has elapsed since the lifting of mandatory retirement, we cannot reliably forecast survival probabilities beyond age 73.

The combination of the probabilities in the two panels of Table 9 provides a way to assess the impact of the lifting of mandatory retirement on the expected fraction of faculty who will continue working into their

mid-70s. For example, when mandatory retirement was in place, less than 1 percent of 60-year-old faculty were still employed at age 73. In the post mandatory era, we estimate that about 9 percent of 60-year-old faculty at public research universities can be expected to remain working until age 73. The comparable fraction for private research universities is 20 percent, while the fraction for other non research institutions is about 8 percent. Given the current age distribution of college and university faculty in the U.S. (Figure 2) these numbers imply that over the next few years the fraction of faculty in their mid-seventies will rise sharply.

An initial indication of the extent to which such changes are occurring is provided by a tabulation of the fraction of schools in the FRS that had at least one faculty member age 71 or older. In September 1986, only 10 of the 104 schools in the FRS had a faculty member who was 71 or older employed in the upcoming term. By the fall of 1996 this number had risen to 67 schools (including all but three of the research universities in the sample).

IV. Summary

In this paper we use data from a new longitudinal data base of faculty retirement flows to estimate the effect of the elimination of mandatory retirement on faculty retirement behavior. This database – the Faculty Retirement Survey -- incorporates information on retirement flows for about 16,000 older faculty employed at a randomly-selected sample of 104 colleges and universities across the United States. Comparisons of the characteristics of the faculty in the FRS to those in the 1993 National Survey of Postsecondary Faculty suggest that the FRS provides a representative sample of older faculty at four-year colleges and universities.

We use the longitudinal structure of the FRS to derive estimates of faculty turnover rates (including retirement and other exits) by calendar year and age of the faculty. Analysis of these rates shows that faculty retirement rates at ages other than 70 and 71 have been remarkably stable over the late 1980s and 1990s. Retirement rates at ages 70 and 71, however, dropped dramatically after the elimination of mandatory retirement. The net effect of these changes is a sharp increase in the fraction of 70-year-old faculty who will

remain employed for at least three more years. In the mandatory era, only about 10 percent of faculty who were working at age 70 were employed three years later. After the lifting of mandatory retirement this rate has risen to about 50 percent. Our analysis also allows us to forecast what fraction of current faculty in their early sixties will stay on to age 70. We find that about 25 percent of 60-year-old faculty at public research universities will remain employed until age 70, compared with about 40 percent at private research universities and just under 25 percent at doctoral granting, comprehensive, and liberal arts institutions. Taken together with our findings on retirement rates after age 70, these findings suggest that a sizeable fraction of the faculty cohort currently in their sixties will remain employed well into their seventies. These rises will be experienced at all types of institutions, and among all disciplines, with the greatest increases at private research universities.

References

Allison, P. D. "Discrete-time Methods for the Analysis of Event Histories." In S. Leinhardt, editor *Sociological Methodology*. San Fransisco, CA: Josey-Bass, 1982.

Bowen, William G. and Julie Ann Sosa. *Prospects for Faculty Retirement in the Arts and Sciences*. Princeton, NJ: Princeton University Press, 1989.

Card, David and Thomas Lemieux. "Dropout and Enrollment Trends in the Post-war Period: What Went Wrong in the 1970s?" National Bureau of Economic Research Working Paper No. 7658. Cambridge, MA: NBER, 2000.

Clark, Robert L., Linda S. Ghent, and Juanita Kreps. "Faculty Retirement and the Impact of the Elimination of Mandatory Retirement at Three North Carolina Universities". Unpublished manuscript, May 1998.

Commission on College Retirement. *Pension and Retirement Policies in Colleges and Universities*. San Francisco, CA: Josey-Bass, 1990.

Efron, Bradley. "Logistic Regression, Survival Analysis, and the Kaplan-Meier Curve." *Journal of the American Statistical Association* 83 (June) 1988.

Ehrenberg, Ronald G., Michael Matier, and David Fontanella. "Cornell University Confronts the End of Mandatory Retirement". Unpublished manuscript, May 1998.

Epstein, Richard A. and Saunders MacLane. "Keep Mandatory Retirement for Tenured Faculty." *Regulation* 14 (Spring) 1991.

Hammond, P. Brett and Harriet P. Morgan, editors. *Ending Mandatory Retirement for Tenured Faculty*. Washington DC: National Academy Press, 1991.

Holden, Karen C. and W. Lee Hansen (editors). *The End of Mandatory Retirement in Higher Education*. San Francisco, CA: Jossey-Bass, 1989.

Lumsdaine, Robin L., James H. Stock and David A. Wise. "Why Are Retirement Rates So High At Age 65?" National Bureau of Economic Research Working Paper Number 5190. Cambridge MA: NBER, 1995.

Lumsdaine, Robin L. and Olivia S. Mitchell. "New Developments in the Economic Analysis of Retirment". In Orley Ashenfelter and David Card, editors, *Handbook of Labor Economics* (volume 4). Amsterdam: North Holland, 1999.

Pencavel, John. "The Response of Employees to Severance Pay Incentives: Faculty of the University of California, 1991-94. Stanford University Department of Economics Unpublished Manuscript, July 1997.

Phelan, Christopher and John Rust. "How Social Security and Medicare Affect Retirement Behavior in a World of Incomplete Markets." Econometrica 65 (July 1997): 781-832.

Prentice, R. and J. Kalfleisch. *The Statistical Analysis of Failure Time Data*. New York: John Wiley, 1980.

Rees, Albert and Sharon P. Smith. *Faculty Retirement in the Arts and Sciences*. Princeton, NJ: Princeton University Press, 1991.

United States Department of Education, Office of Educational Research and Improvement. "1993 National Study of Postsecondary Faculty: Institutional Policies and Practices". Washington, DC: US Department of Education, 1997.

Table 1: Faculty Retirement Survey Design

	Number of Institutions:				Average Number Of Faculty		
	Total (1)	In T/CREF (2)	In FRS Universe (3)	In FRS Sample (4)	All (5)	Age 50+ (6)	Percent Age 50+ (7)
Research	102	93	94	34	921	353	39.5
Doctorate Granting	176	157	104	17	322	133	41.6
Comprehensive	603	548	521	24	170	77	39.7
Liberal Arts	573	507	479	29	98	31	33.0
All (weighted)[a/]	1454	1305	1198	104	420 (202)	164 (82)	37.6 (37.8)

Notes: Column 1 is the number of accredited 4-year colleges and universities in the sample frame of the 1992 National Survey of Postsecondary Faculty (NSPF) - see Table 5.1 of NCES (1998). Column 2 is the estimated fraction of institutions that have at least some participation in TIAA/CREF, based on the results of the NSPF Institutional Survey (NCES, 1998, Table 5.1). Column 3 is the number of institutions in the Faculty Retirement Survey (FRS) sample universe. This was obtained from a list of institutions with substantial TIAA/CREF participation in 1995. Column 4 is the number of institutions that participated in the FRS survey. Columns 5-7 report the characteristics of the faculty in the FRS sample institutions, as of the survey baseline date (typically 1986). Total number of all faculty is imputed for some schools.

[a/]The entry in parentheses is the weighted average, using FRS institutional sample weights.

Table 2: Characteristics of Institutions and Faculty by Uncapping Status

	All	Capped Until 1994	Early Uncapped	Later Uncapped
Number of Institutions:				
Total	104	90	5	9
Public Research	19	12	1	6
Private Research	15	14	1	0
Doctorate Granting	17	16	0	1
Comprehensive	24	21	1	2
Liberal Arts	29	27	2	0
Faculty Characteristics:				
Number of Faculty Age 50-plus	16,450	13,411	1,072	1,967
Type of Institution (%):				
Public Research	50.0	42.6	73.7	88.0
Private Research	21.0	24.3	18.5	0.0
Doctorate Granting	13.1	15.2	0.0	5.9
Comprehensive	10.7	11.8	3.5	7.0
Liberal Arts	5.2	6.1	4.3	0.0
Age Distribution (%):				
50-54	36.0	36.3	34.5	35.3
55-59	31.7	31.5	31.9	33.1
60-64	22.7	22.6	22.4	23.6
65+	9.5	9.6	11.2	8.0
Percent Female	13.7	13.9	10.4	14.3
Percent Nonwhite	8.1	8.1	6.3	9.1
Percent With Ph.D.	81.7	81.0	84.2	84.9
Percent Full Professors	71.5	71.0	89.0	64.6
Percent Arts&Sciences	54.1	54.1	51.0	55.8
Mean Salary (1996$)	69,100	68,200	74,000	72,600
Percent in TIAA/CREF	83.5	87.5	54.1	72.1
Mean Pension (1996$)	219,500	229,100	80,667	201,200

Notes: Mean salary for refers to salary in sample baseline year (typically 1986). Mean pension wealth refers to average accumulation (for those in TIAA/CREF)as of sample baseline year.

Table 3: Age-Specific Retirement Rates, Before and After 1994

Age	Number Of Observations	Percent Post-1994	Average Retirement Rate		Change in Retirement Rate	
			1987-93	1994-96	Unadjusted	Adjusted Using Logit Model
60	7,183	31.7	3.18	2.81	-0.37	-0.27
			(0.25)	(0.35)	(0.43)	(0.47)
61	6,890	32.2	4.05	4.23	0.19	0.27
			(0.29)	(0.43)	(0.52)	(0.51)
62	6,552	32.9	10.13	8.76	-1.36	-1.28
			(0.46)	(0.61)	(0.76)	(0.84)
63	5,747	34.5	8.40	7.15	-1.25	-1.10
			(0.45)	(0.58)	(0.73)	(0.82)
64	5,148	35.4	8.42	8.29	-0.12	0.00
			(0.48)	(0.65)	(0.81)	(0.82)
65	4,583	35.0	18.93	17.77	-1.16	-1.38
			(0.72)	(0.95)	(1.19)	(1.26)
66	3,616	35.0	14.63	12.73	-1.90	-2.06
			(0.73)	(0.94)	(1.19)	(1.30)
67	2,942	34.2	13.75	13.80	0.06	-0.13
			(0.78)	(1.09)	(1.34)	(1.36)
68	2,435	34.3	14.30	14.75	0.44	0.80
			(0.88)	(1.23)	(1.51)	(1.51)
69	1,987	33.6	15.45	16.64	1.19	0.43
			(1.00)	(1.44)	(1.75)	(1.71)
70	1,586	35.1	75.61	29.26	-46.34	-43.66
			(1.34)	(1.93)	(2.35)	(2.55)
71	498	58.4	60.39	23.37	-37.02	-32.07
			(3.41)	(2.48)	(4.22)	(3.94)
72	182	67.0	16.67	25.41	8.74	-3.67
			(4.85)	(3.96)	(6.26)	(7.24)

Notes: Standard errors in parentheses. Sample is restricted to individuals at 90 uncapped institutions (see Table 2). An individual's retirement age is measured as of September 1 following the date of retirement. The adjusted change in retirement rates is the normalized regression coefficient from a logit model for the event of retirement, fit by age and including a total of 19 covariates: gender, PhD, nonwhite race, region (3 dummies), Carnegie classification and public/private status of institution, and 6 department dummies.

Table 4: Age-Specific Retirement Rates at Capped and Uncapped Institutions, 1991-1993

	Capped Institutions		Uncapped Institutions		
Age	Number	Rate	Number	Rate	Difference: Capped-Uncapped
60	2438	3.7 (0.4)	573	5.8 (1.0)	-2.1 (1.0)
61	2344	5.3 (0.5)	545	5.1 (0.9)	0.2 (1.1)
62	2196	10.0 (0.6)	501	10.8 (1.4)	-0.8 (1.5)
63	1901	9.2 (0.7)	435	10.6 (1.5)	-1.4 (1.6)
64	1653	8.2 (0.7)	374	8.6 (1.4)	-0.3 (1.6)
65	1479	18.8 (1.0)	368	21.5 (2.1)	-2.7 (2.4)
66	1130	14.2 (1.0)	279	17.2 (2.3)	-3.0 (2.5)
67	951	13.9 (1.1)	226	22.1 (2.8)	-8.2 (3.0)
68	772	15.0 (1.3)	180	17.8 (2.9)	-2.8 (3.1)
69	645	17.1 (1.5)	149	15.4 (3.0)	1.6 (3.3)
70	537	74.9 (1.9)	124	29.8 (4.1)	45.0 (4.5)
71	123	61.0 (4.4)	72	29.2 (5.4)	31.8 (7.0)
72	39	17.9 (6.2)	30	20.0 (7.4)	-2.1 (9.7)

Notes: Standard errors in parentheses. See notes to table 3. Sample is restricted to observations from 1991 to 1993.

Table 5: Parameter Estimates for Pooled Logistic Hazard Model of Retirement

	No Controls (1)	Full Sample With Controls (2)	(3)	Pre-1994 Only (4)	Ages 65+ Only (5)	Subset with Wages (6)	Subset with Wage and Pension Data (7)	(8)
Age 70 x Uncapped	-1.98	-2.10	-2.10	-2.18	-2.10	-2.18	-2.21	-2.24
	(0.11)	(0.11)	(0.11)	(0.20)	(0.11)	(0.11)	(0.13)	(0.13)
Age 71 x Uncapped	-1.46	-1.56	-1.56	-1.39	-1.57	-1.68	-1.64	-1.64
	(0.17)	(0.17)	(0.17)	(0.29)	(0.17)	(0.19)	(0.23)	(0.23)
Dummies for Other Ages Interacted with Uncapped	yes	yes	no	no	no	no	no	no
Institutional Characteristics:								
Public Research University	--	0.22	0.22	0.24	0.21	0.47	0.57	0.74
		(0.07)	(0.07)	(0.08)	(0.09)	(0.07)	(0.09)	(0.09)
Private Research University	--	-0.23	-0.23	-0.35	-0.26	0.03	-0.14	0.15
		(0.06)	(0.06)	(0.08)	(0.09)	(0.07)	(0.08)	(0.09)
Doctorate-Granting Institution	--	0.12	0.12	-0.03	0.09	0.28	0.22	0.38
		(0.06)	(0.06)	(0.07)	(0.09)	(0.06)	(0.08)	(0.08)
Liberal Arts College	--	0.36	0.36	0.29	0.39	0.49	0.60	0.71
		(0.08)	(0.08)	(0.10)	(0.11)	(0.08)	(0.10)	(0.10)
Public Institution (non-research)	--	0.54	0.54	0.62	0.30	0.64	0.94	0.92
		(0.06)	(0.06)	(0.08)	(0.09)	(0.07)	(0.08)	(0.08)
Faculty Characteristics:								
Female at Research University	--	-0.08	-0.08	-0.02	-0.23	-0.19	0.08	-0.01
		(0.07)	(0.07)	(0.08)	(0.10)	(0.07)	(0.08)	(0.08)
Female at Other Institution	--	0.09	0.10	0.09	0.07	-0.02	0.05	-0.08
		(0.05)	(0.05)	(0.06)	(0.06)	(0.05)	(0.05)	(0.08)
Nonwhite	--	-0.18	-0.18	-0.10	-0.17	-0.25	-0.27	-0.29
		(0.05)	(0.05)	(0.06)	(0.07)	(0.05)	(0.07)	(0.07)
Hold Ph.D.	--	-0.21	-0.21	-0.25	-0.08	-0.15	-0.27	-0.18
		(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)
Log Wage Last Year	--	--	--	--	--	-0.75	--	-0.86
						(0.04)		(0.05)
Log Pension Last Year	--	--	--	--	--	--	--	-0.02
								(0.01)
Controls for Region and Department?	no	yes	yes	yes	yes	yes	yes	yes
Implied Change in Mean Retirement Rate After Uncapping (%):								
At Age 70	-40.8	-43.2	-43.2	-44.9	-43.2	-44.9	-45.5	-46.1
	(2.3)	(2.2)	(2.2)	(4.1)	(2.3)	(2.3)	(2.7)	(2.7)
At Age 71	-27.4	-29.3	-29.3	-26.1	-29.4	-31.5	-30.7	-30.7
	(3.1)	(3.1)	(3.1)	(5.4)	(3.2)	(3.6)	(4.3)	(4.3)

Notes: Standard errors in parentheses. Models fit to retirement probabilities for ages 58-72 in 1987-96. All models include unrestricted age dummies for baseline retirement hazard. Other controls include 3 region dummies and 6 department dummies. Models in columns 1 and 2 include fully unrestricted age dummies for pre- and post-uncapping. Other models assume uncapping only affects retirement rates at ages 70 and 71.

Table 6: Alternative Specifications of Logistic Retirement Model

	Subset with Wage Data:				Subset with Wage&Pension Data
	(1)	(2)	(3)	(4)	(5)
Age 70 x Uncapped	-2.18	-2.19	-2.19	-2.19	-2.25
	(0.11)	(0.11)	(0.11)	(0.11)	(0.13)
Age 71 x Uncapped	-1.68	-1.73	-1.70	-1.70	-1.66
	(0.19)	(0.19)	(0.19)	(0.19)	(0.24)
Log Wage Last Year	-0.75	--	-0.55	-0.55	-0.63
	(0.04)		(0.06)	(0.06)	(0.07)
Centile in Salary Distribution	--	-0.86	-0.34	-0.22	-0.30
		(0.05)	(0.07)	(0.08)	(0.10)
Indicator if in Top 10% of Salaries	--	--	--	-0.25	-0.21
				(0.06)	(0.07)
Log Pension Last Year	--	--	--	--	0.02
					(0.01)
Controls for Faculty and Institution Characteristics	yes	yes	yes	yes	yes
Implied Change in Mean Retirement Rate After Uncapping (%)					
At Age 70	-44.9	-45.1	-45.1	-45.1	-46.3
	(2.3)	(2.2)	(2.2)	(2.3)	(2.7)
At Age 71	-31.5	-32.4	-31.9	-31.9	-31.1
	(3.6)	(3.6)	(3.6)	(3.6)	(4.5)

Notes: Standard errors in parentheses. Models fit to retirement probabilities for ages 58-72 in 1987-96. All models include unrestricted age dummies for baseline retirement hazard, controls for type of institution, gender and race, region and department. Models assume uncapping only affects retirement rates at ages 70 and 71.

Table 7: Linear Probability Models for Retirement, with and without Institution Effects

	All Observations		Subset with Wage Data		Subset with Wage&Pension Data
	(1)	(2)	(3)	(4)	(5)
Age 70 x Uncapped	-47.3	-47.0	-46.8	-46.8	-48.3
(coefficient x 100)	(1.3)	(1.3)	(1.3)	(1.3)	(1.4)
Age 71 x Uncapped	-38.2	-37.9	-37.4	-37.4	-37.4
(coefficient x 100)	(2.4)	(2.4)	(2.4)	(2.4)	(2.7)
Log Wage Last Year	--	--	-0.70	-0.71	-0.70
(coefficient x 10)			(0.03)	(0.07)	(0.08)
Centile in Salary Distribution	--	--	--	0.09	0.02
(coefficient x 10)				(0.07)	(0.08)
Indicator if in Top 10% of Salaries	--	--	--	-0.11	-0.07
(coefficient x 10)				(0.04)	(0.04)
Log Pension Last Year	--	--	--	--	0.02
(coefficient x 10)					(0.01)
Controls for Faculty and Institution Characteristics?	yes	yes	yes	yes	yes
Institutional Fixed Effects?	no	yes	yes	yes	yes

Notes: Standard errors in parentheses. Models fit to retirement probabilities for ages 58-72 in 1987-96. All models include unrestricted age dummies for baseline retirement hazard, controls for type of institution, gender and race, region and department. Models assume uncapping only affects retirement rates at ages 70 and 71. Models in columns 2-5 include unrestricted indicators for each of 104 institutions.

Table 8: Retirement Rates at Ages 70 and 71, Before and After Elimination of Mandatory Retirement

	Retirement Rates at Age 70					Retirement Rates at Age 71				
				Change in Rate:					Change in Rate:	
	Number Obs.	Average Rate: Capped	Uncapped	Unadj.	Adjusted (Logit)	Number Obs.	Average Rate: Capped	Uncapped	Unadj.	Adjusted (Logit)
By Carnegie Classification:										
1. Public Research	834	79.1	29.2	-49.9	-42.0	304	70.1	25.1	-45.0	-49.0
		(1.9)	(2.3)	(3.0)	(3.7)		(5.3)	(2.9)	(6.0)	(7.2)
2. Private Research	656	72.6	27.4	-45.1	-37.4	220	58.9	23.2	-35.7	-35.6
		(2.2)	(3.0)	(3.7)	(3.9)		(5.1)	(3.8)	(6.4)	(7.0)
3. Doctorate	244	77.4	30.6	-46.8	-56.5	79	54.2	27.3	-26.9	-31.2
		(3.6)	(4.4)	(5.7)	(7.4)		(10.4)	(6.1)	(12.1)	(16.4)
4. Comprehensive	129	56.8	30.9	-25.8	-27.2	56	34.6	33.3	-1.3	-6.2
		(5.8)	(6.3)	(8.6)	(9.6)		(9.5)	(8.8)	(12.9)	(17.5)
5. Liberal Arts	78	70.2	25.8	-44.4	-36.9	33	53.3	16.7	-36.6	-24.5
		(6.7)	(8.0)	(10.5)	(13.4)		(13.3)	(9.0)	(16.1)	(38.9)
By Department:										
1. Humanities	366	77.6	21.1	-56.5	-47.9	132	54.3	28.9	-25.4	-23.6
		(2.8)	(3.4)	(4.4)	(5.1)		(8.5)	(4.6)	(9.7)	(8.7)
2. Social Science	373	80.6	30.8	-49.8	-47.5	123	59.5	25.6	-33.9	-48.4
		(2.7)	(3.7)	(4.6)	(5.5)		(8.2)	(4.7)	(9.5)	(13.0)
3. Sciences	433	76.9	31.9	-45.0	-44.3	150	77.5	22.7	-54.8	-61.9
		(2.7)	(3.4)	(4.3)	(5.2)		(6.7)	(4.0)	(7.8)	(11.5)
4. Engineering	200	68.3	26.3	-42.0	-33.5	82	53.6	33.3	-20.3	-8.3
		(4.3)	(5.0)	(6.6)	(7.0)		(9.6)	(6.5)	(11.6)	(13.2)
5. Professional, Business and Unknown	569	69.3	30.9	-38.4	-36.5	205	54.6	19.4	-35.2	-9.2
		(2.5)	(3.0)	(3.9)	(4.3)		(5.1)	(3.8)	(6.4)	(14.3)

Notes: Standard errors in parentheses. Unadj. change in rate refers to simple difference in average retirement rates before and after uncapping. Adjusted change refers to a normalized coefficient estimate from a logistic regression model that controls for covariates listed in Table 3.

Table 9: Estimated Probabilities of Remaining Employed Until Age 70, and Remaining Employed After Age 70

	Faculty Affected by Mandatory Retirement				Faculty Exempt from Mandatory Retirement			
		Research				Research		
	All	Public	Private	Others	All	Public	Private	Others
Probability of Staying to Age 70 (percent):								
from Age 60	26.4	20.5	41.4	23.6	25.7	21.9	39.0	24.0
from Age 65	39.4	31.7	54.3	37.7	38.8	34.8	50.7	36.6
Employment Outcomes For those Working at Age (percent):								
Leave at 70	76.6	80.4	75.1	72.4	29.7	29.4	29.6	30.5
Still Employed:								
at Age 71	23.4	19.6	24.9	27.6	70.3	70.6	70.4	69.5
at Age 72	8.5	5.6	8.6	13.1	51.7	52.5	52.9	48.6
at Age 73	6.3	3.5	6.8	10.1	39.5	41.5	40.8	33.7

Notes: Based on estimated exit hazard rates (for retirement and other reasons). Faculty affected by mandatory retirement include individuals who reached age 70 at a capped institution.

Appendix Table 1: Comparison of Faculty Characteristics in FRS and NSPF

	Faculty Retirement Survey				Nat. Survey of Postsecondary Faculty			
	Research	Doctorate	Comp.	Lib. Arts	Research	Doctorate	Comp.	Lib. Arts
Mean Age	57.3	57.2	56.6	56.6	58.1	57.6	56.9	57.6
Age Distribution (%)								
50-54	35.0	36.0	40.0	41.3	34.0	37.5	41.1	36.1
55-59	31.9	31.4	31.8	29.8	30.0	27.9	29.2	29.7
60-64	22.9	23.2	21.7	21.6	20.8	20.4	19.6	21.6
65+	10.2	9.3	6.4	7.2	15.2	14.2	10.1	12.6
Percent Female	12.3	14.2	19.4	20.2	12.2	18.3	26.1	28.6
Percent Nonwhite	7.2	7.5	10.8	17.1	7.6	8.0	10.5	6.0
Percent With Ph.D.	84.2	81.0	68.0	78.3	75.7	69.7	72.4	67.4
Percent Full Professor	74.7	67.0	54.0	75.0	75.6	62.6	55.9	61.3
Percent Arts and Sciences	52.8	51.9	54.4	77.2	44.4	41.6	47.5	62.1
Mean Salary (1996$)	73,200	65,200	52,500	56,800	79,500	67,600	54,700	48,200
Percent in TIAA/CREF	81.9	88.0	83.6	93.1	--	--	--	--
Mean Pension (1996$)	241,200	205,400	112,600	190,900	--	--	--	--
No. Observations	11,675	2,158	1,753	864	--	--	--	--

Notes: Tabulations refer to faculty age 50 and older. Mean salary for FRS refers to salary in sample baseline year (typically 1986). Mean salary for NSPF refers to annual salary in 1992. Mean pension wealth refers to average accumulation (for those in TIAA/CREF)as of sample baseline year. Tabulations from NSPF were performed using the DAS system, using observations for tenured and tenure-track faculty at 4 year institutions age 50 and older.

Appendix Table 2: Retirement Rates Prior to the Elimination of Mandatory Retirement, and Subsequent Changes in Retirement Rates, for Three Sets of Institutions

	Retirement Rates in Mandatory Period:				Change in Retirement Rates After Uncapping:			
	Capped To 1994 (1)	Early Uncapped (2)	Late Uncapped (3)	Chi-Sq. (4)	Capped To 1994 (5)	Early Uncapped (6)	Late Uncapped (7)	Chi-Sq. (8)
60	3.2	3.1	4.0	0.8	-0.4	2.5	1.7	6.6*
	(0.3)	(1.4)	(0.9)		(0.4)	(1.7)	(1.3)	
61	4.0	1.8	4.3	4.7	0.2	3.1	3.6	7.8*
	(0.3)	(1.0)	(1.0)		(0.5)	(1.5)	(1.4)	
62	10.1	9.2	7.2	4.6	-1.4	2.8	4.3	9.5*
	(0.5)	(2.3)	(1.3)		(0.8)	(2.8)	(1.8)	
63	8.4	5.9	7.9	1.6	-1.2	3.7	5.1	12.0*
	(0.5)	(1.9)	(1.4)		(0.7)	(2.5)	(2.0)	
64	8.4	11.6	7.0	2.3	-0.1	-2.8	6.0	8.9*
	(0.5)	(2.7)	(1.4)		(0.8)	(3.1)	(2.1)	
65	18.9	20.9	18.6	0.3	-1.2	3.6	1.3	1.8
	(0.7)	(3.8)	(2.3)		(1.2)	(4.6)	(3.0)	
66	14.6	17.8	15.7	0.7	-1.9	1.5	2.9	3.2
	(0.7)	(4.0)	(2.5)		(1.2)	(4.9)	(3.2)	
67	13.7	18.7	16.6	2.0	0.1	4.4	4.3	2.9
	(0.8)	(4.5)	(2.8)		(1.3)	(5.5)	(3.7)	
68	14.3	11.5	12.3	0.8	0.4	4.7	6.0	2.2
	(0.9)	(4.1)	(3.1)		(1.5)	(5.2)	(3.9)	
69	15.5	26.4	18.4	3.6	1.2	-8.1	-1.0	1.8
	(1.0)	(6.1)	(4.2)		(1.8)	(7.1)	(4.9)	
70	75.6	52.8	71.0	7.9*	-46.3	-28.8	-40.5	3.9
	(1.3)	(8.3)	(5.5)		(2.3)	(9.4)	(6.6)	
71	60.4	37.5	64.3	3.5	-37.0	-21.1	-28.2	1.7
	(3.4)	(12.1)	(12.8)		(4.2)	(12.9)	(13.7)	
72	16.7	20.0	50.0	1.8	8.7	0.0	-38.4	3.6
	(4.8)	(12.6)	(25.0)		(6.2)	(13.9)	(25.5)	

Notes: Standard errors in parentheses. Entries in columns 1-3 are age-specific retirement rates prior to the elimination of mandatory retirement. Entry in column 4 is chi-squared test for equality of retirement rates in 3 sets of institutions. A * indicates significance at the 5 percent level. Entries in columns 5-7 are age-specific changes in retirement rates after elimination of mandatory retirement, with corresponding test for equality across the three sets of institutions in column 9.

Figure 1: College Enrollment Inflows, 1955-1996

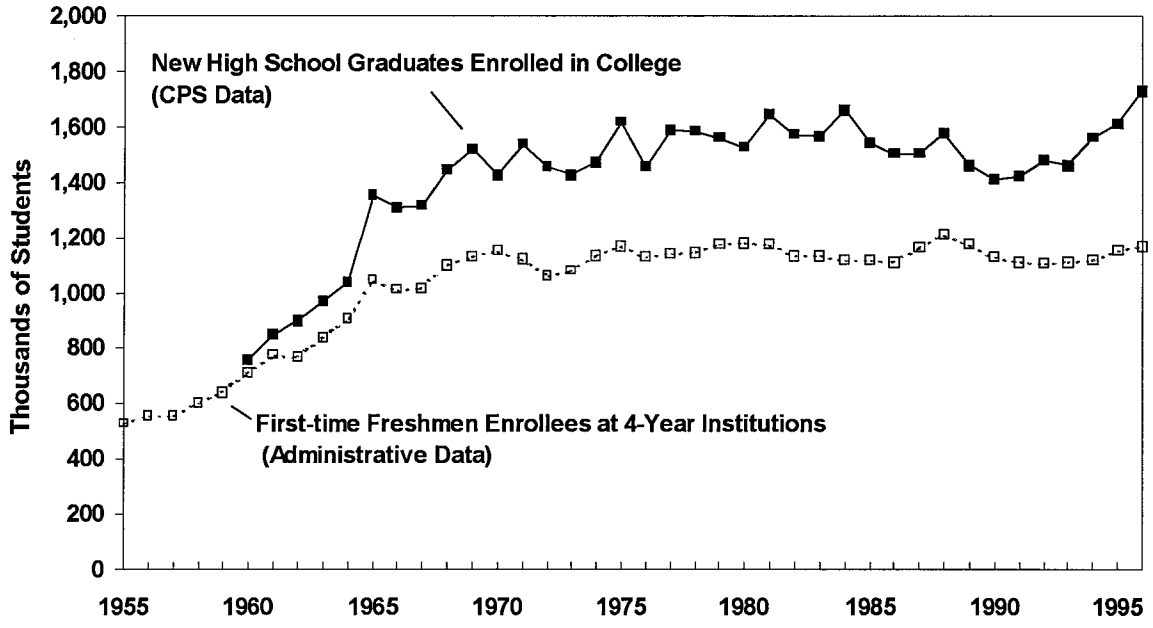


Figure 2: Age Distribution of Faculty and Four-Year Institutions, 1977, 1987, 1996

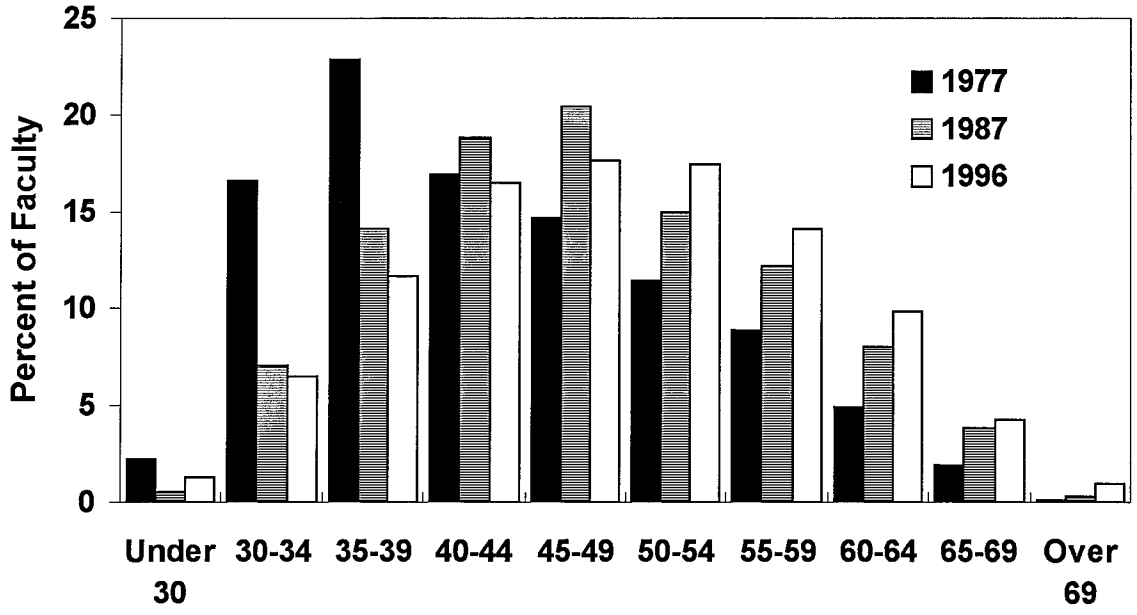


Figure 3: Age-Specific Exit Rates of Faculty at Capped Institutions, 1987-93

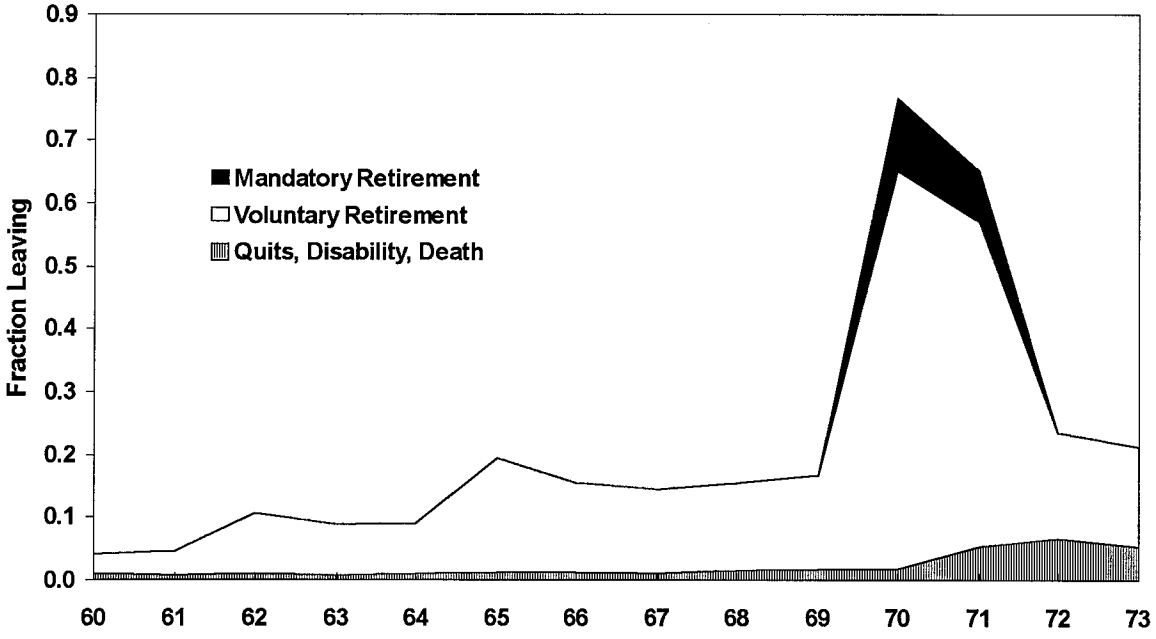
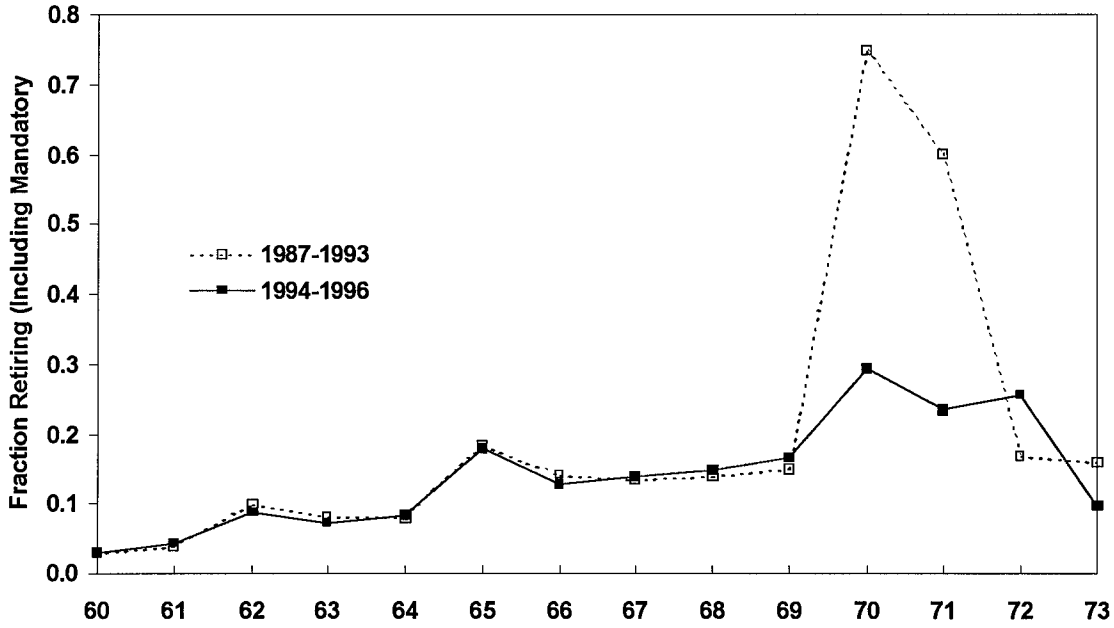


Figure 4: Age-Specific Exit Rates At Capped Institutions Before and After 1994

A. Retirement



B. Other Exits

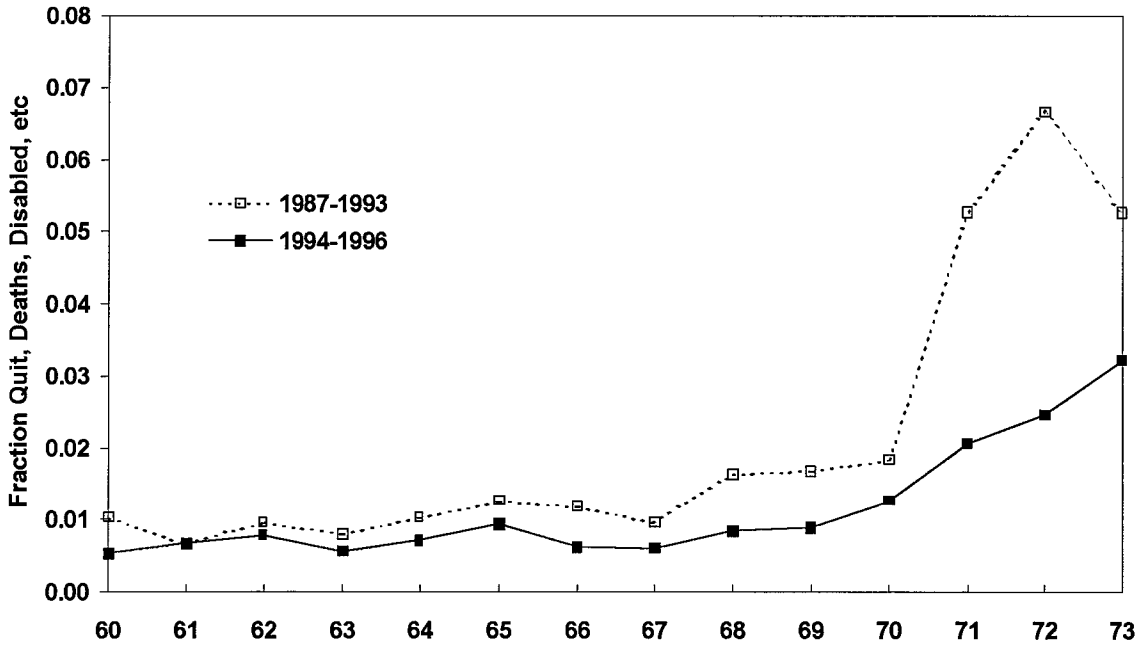


Figure 5: Age-Specific Retirement Rates at Capped Institutions, 1987-1996

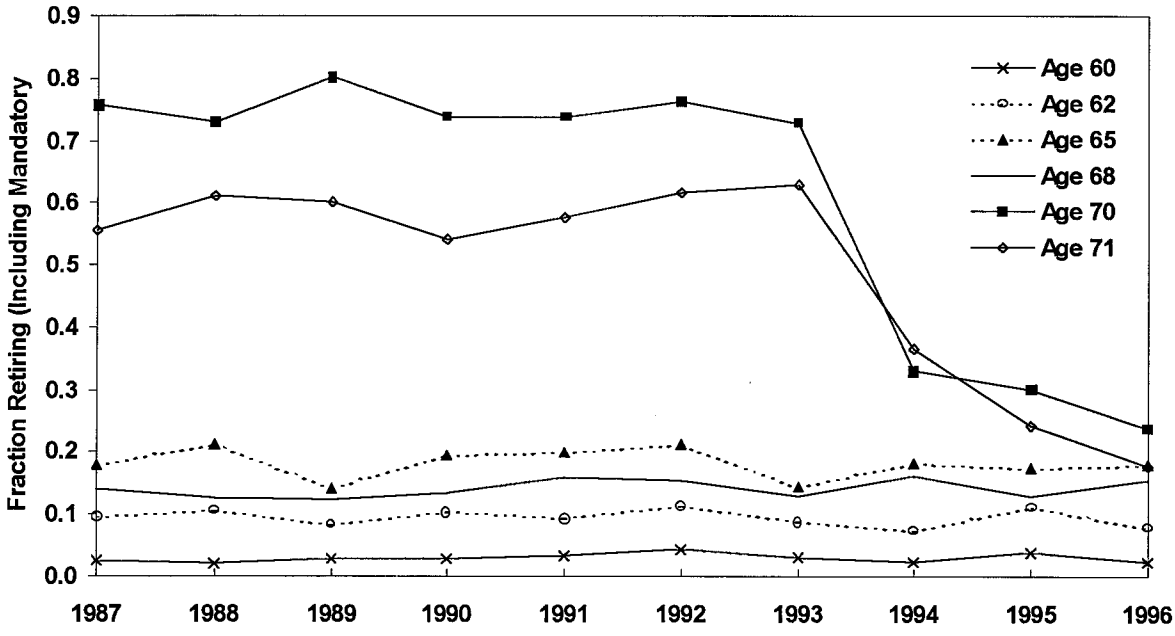


Figure 6: Retirement Rates at Age 70 at Three Groups of Institutions, 1987-1996

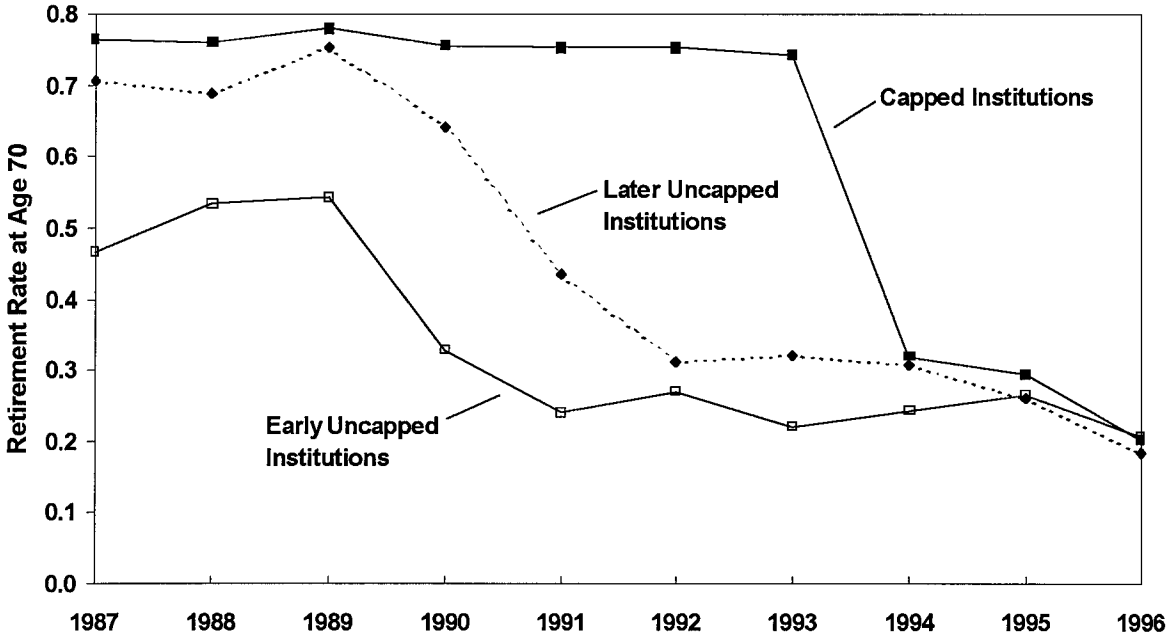
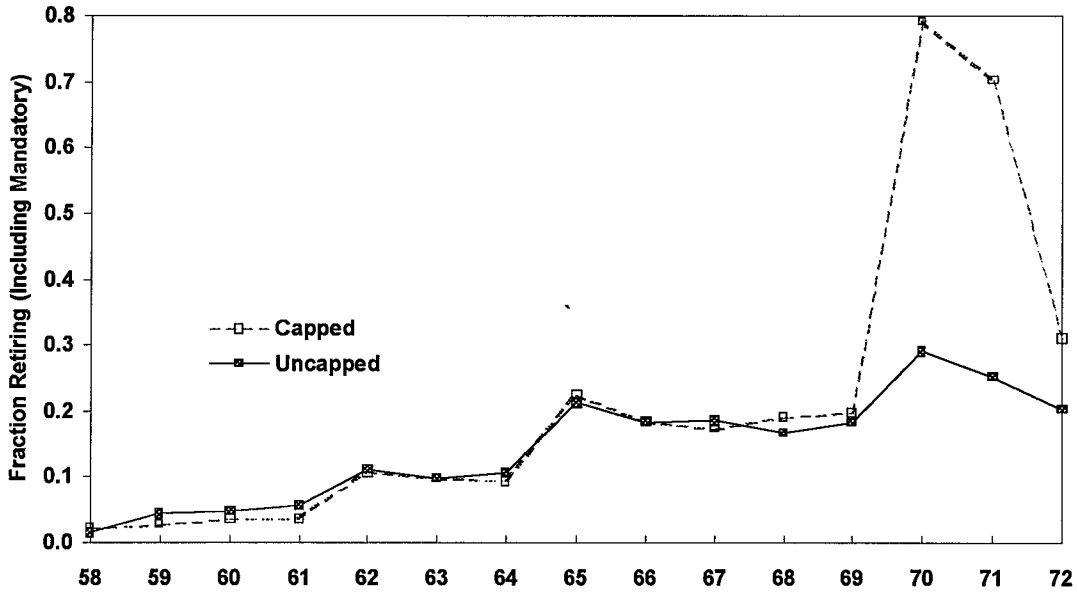


Figure 7: Age-Specific Retirement Rates Before and After Uncapping, By Institutional Type

A. Public Research Universities



B. Private Research Universities

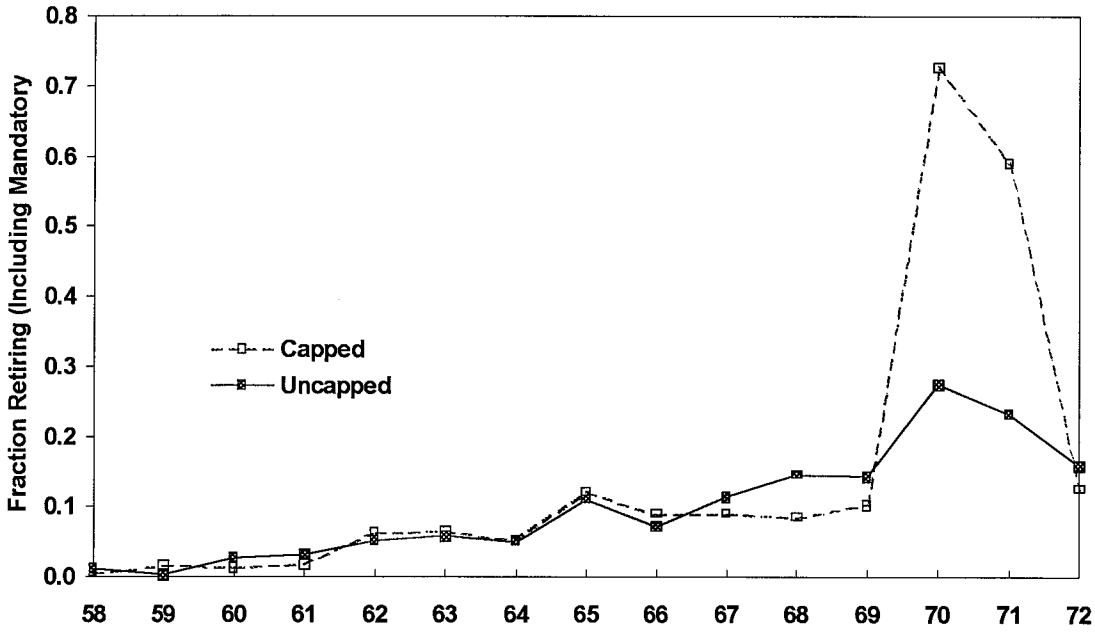
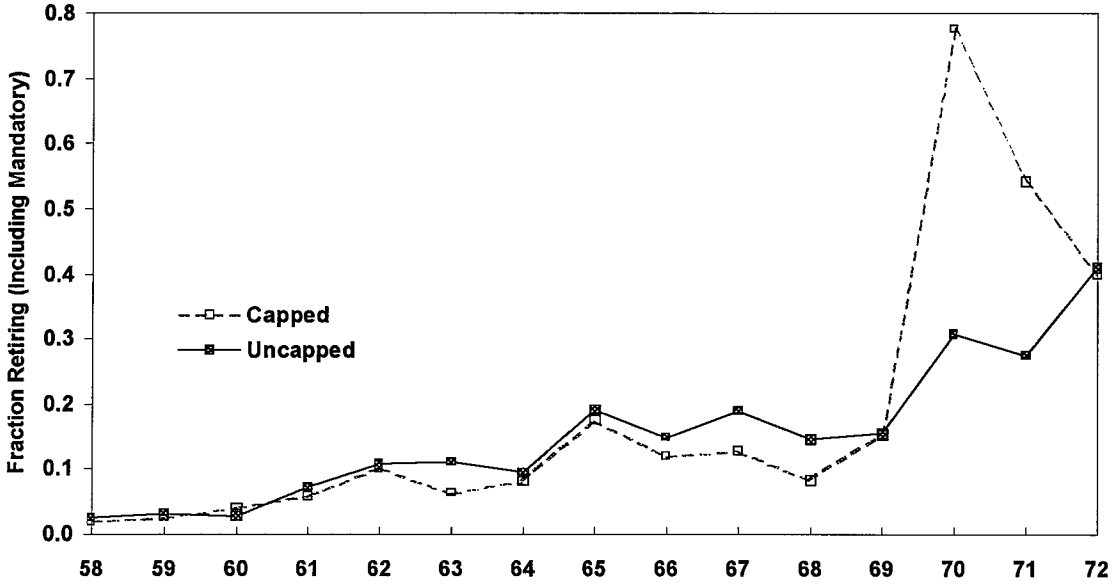


Figure 7 (Continued)

C. Doctorate Granting Institutions



D. Comprehensive Institutions

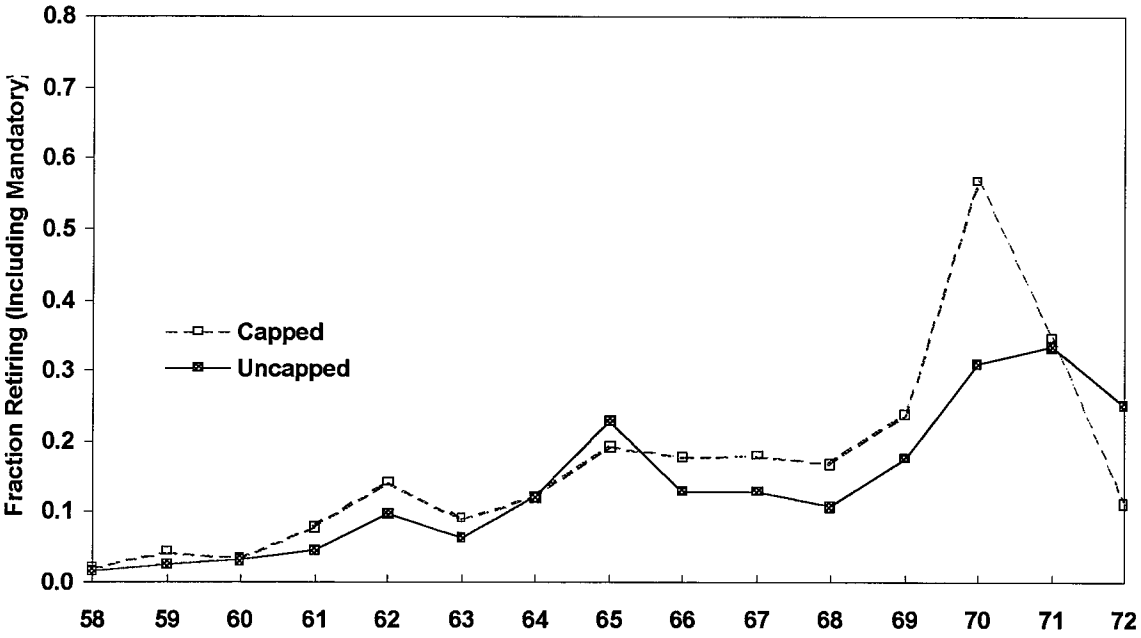


Figure 7 (Continued)

E. Liberal Arts Colleges

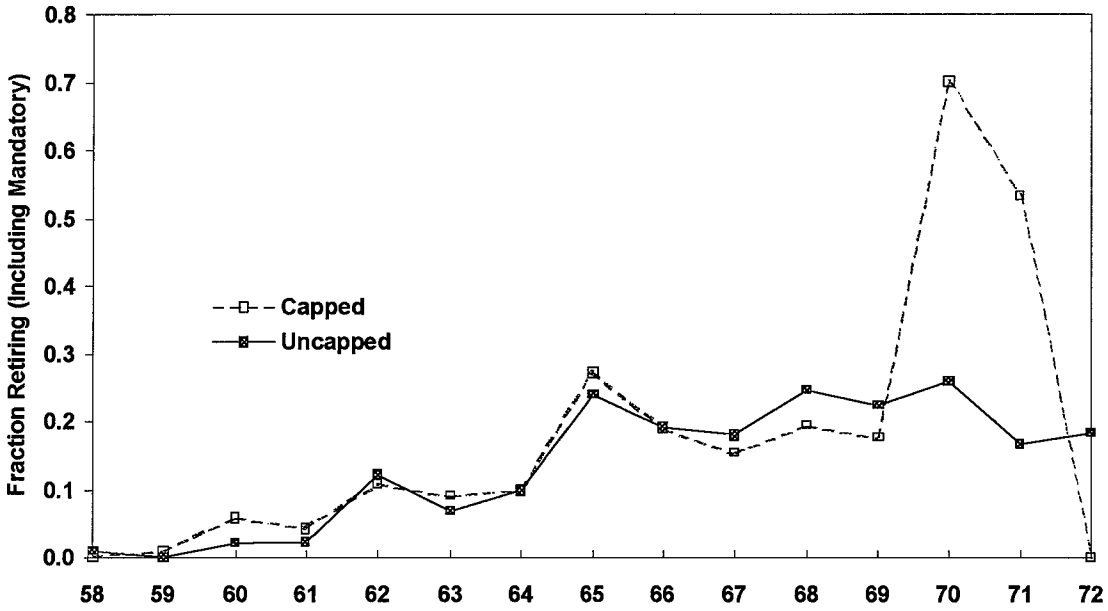
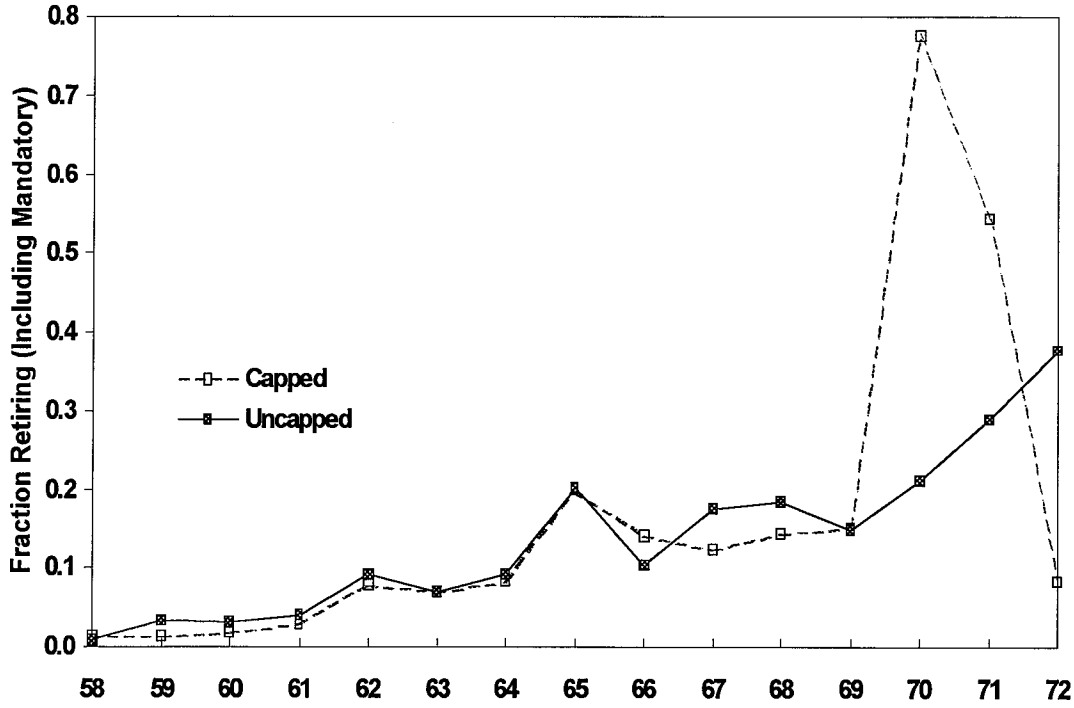


Figure 8: Age-Specific Retirement Rates Before and After Uncapping, By Discipline

A. Humanities



B. Social Sciences

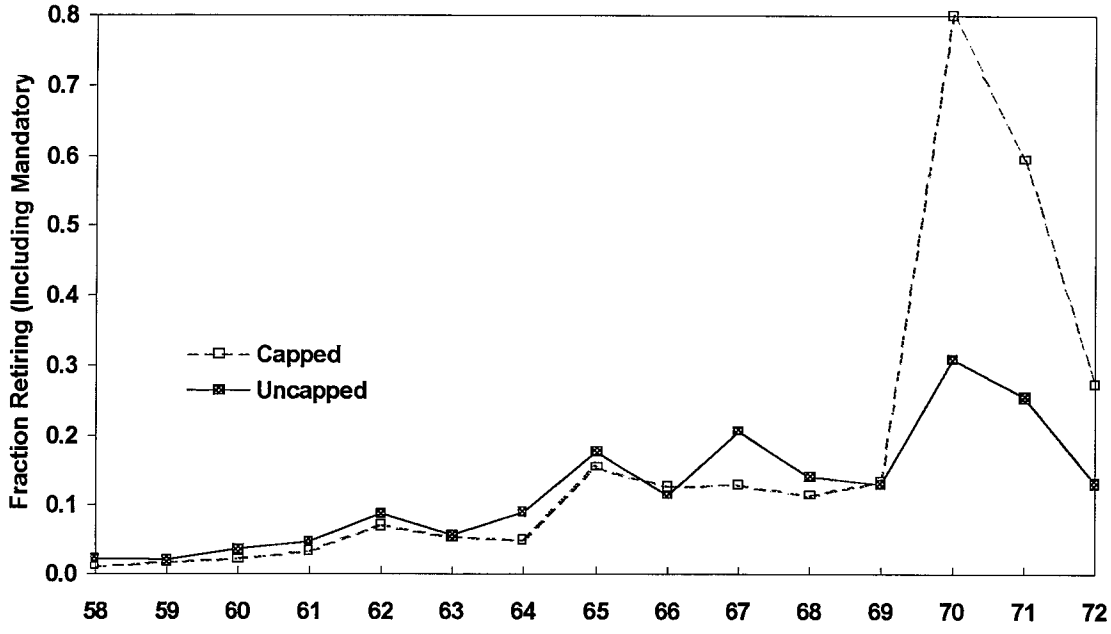
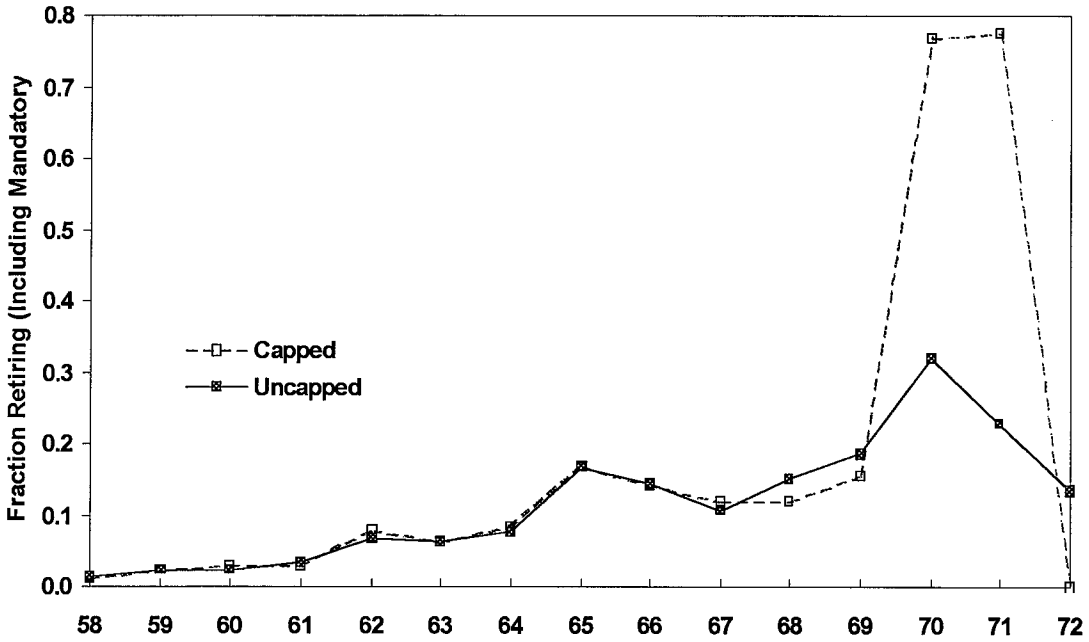


Figure 8 (Continued)

C. Physical and Life Sciences, Mathematics



D. Engineering

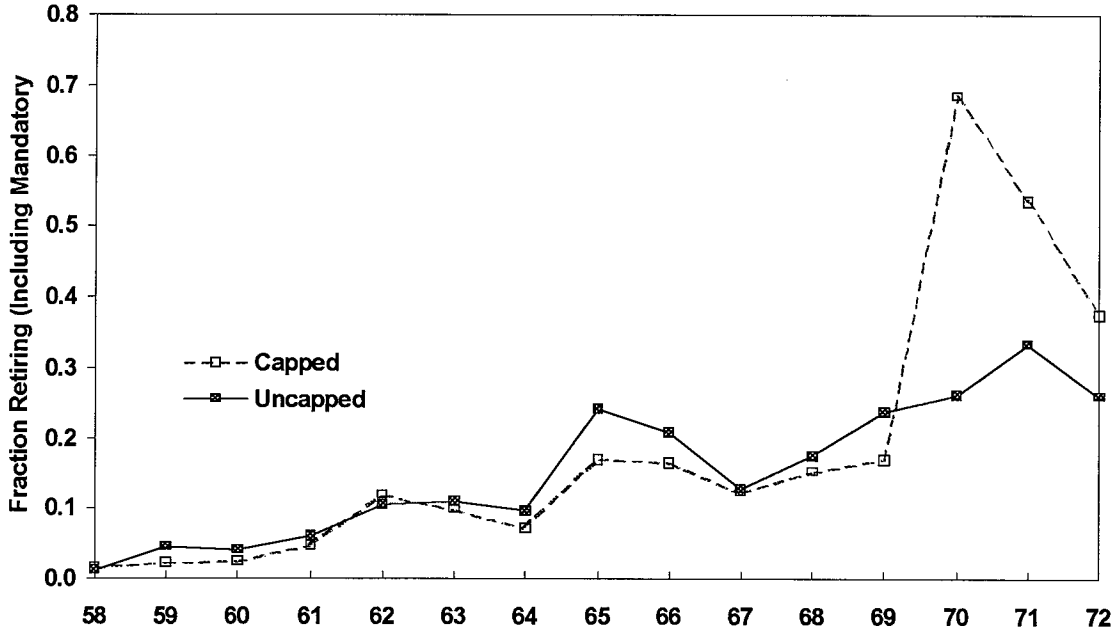


Figure 8 (Continued)

E. Professional Schools