The End of Mandatory Retirement in the US: Effects on Retirement and Implicit Contracts

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ABSTRACT

This paper analyzes the economic effects of the end of mandatory retirement. It takes advantage of the unique variation in institutions affecting retirement behavior to study the change in labor force participation, job attachment and wages of older workers from the 1970s to the 1990s. In the 1970s, about 40% of male employees in the US were covered by rules mandating retirement at age 65. Then, in 1978 and 1986, mandatory retirement was abolished by stepwise amendments of the federal Age Discrimination in Employment Act. To mimic the ideal experiment offered by the change in legislation, I impute coverage of mandatory retirement to data from the monthly Current Population Survey and compare labor force trends for workers with high- and low-probabilities of coverage before and after the change. The results indicate that workers covered by mandatory retirement had a very high incidence of retirement at age 65, which declined significantly following the elimination of mandatory retirement. Overall, the results suggest that the labor force of workers 65 and older rose by 10% to 20% with the end of mandatory retirement. Neither job tenure nor wage-profiles of older workers were affected by the change.

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‘Retirement has been redefined. It is no longer an automatic shift in gears from work to non-work at a set age. It is, rather, a voluntary withdrawal from the work force at the age that best suits an individual’s abilities, interests, and career plans.’

[*The End of Mandatory Retirement.* Walker and Lazer (1978), page 14.]

1. Introduction

Mandatory retirement is an institution that allows employers to force all employees to retire at a certain age, usually age 65. Mandatory retirement was widespread in the US in the 1960s and 1970s, and still is common in many European countries today. Yet, by an extension of the Age Discrimination in Employment Act (ADEA) in 1978, US Congress outlawed mandatory retirement before the age of 70, and in 1986 abolished it altogether. This study analyzes the effect of the abolition of mandatory retirement (MR) on the employment outcomes of older workers. It aims first at obtaining an estimate of the changes in retirement behavior and labor force participation caused by the elimination of MR. Then it considers possible effects of the change in the law on job-attachment and wages of older workers.

In the 1960s and 1970s, roughly 50% to 40% of men in the US workforce were covered by a compulsory retirement rule. Such rules appeared an unsurprising feature of an economic environment in which retirement was a clearly defined stage of life. Under pressure from civil rights activists, an aging population, and budgetary problems of Social Security, the United States decided to abolish mandatory retirement and protect elderly workers from discrimination in the labor market. The change not only occurred with the hope of raising labor force participation, but it can also be seen as part of a transition to a more flexible definition of retirement. While institutional aspects of the elimination of MR were well publicized, it is surprising how little research has been devoted to the study of the abolition of mandatory retirement (and to the 1978 amendments to the ADEA in general).

The lack of systematic analysis of mandatory retirement is particularly surprising, since compulsory retirement rules were thought to be an integral part of implicit contracts between workers and firms. In a seminal paper, Lazear (1979) argued that mandatory retirement should be viewed as part of a life-cycle contract that allowed firms to pay older workers more than their actual productivity as a reward for having worked hard earlier in their careers. Yet, while Lazear's model is still a prominently cited reason for increasing tenure-wage profiles, no paper has taken the opportunity offered by the abolition of mandatory retirement to try to assess the predictions of implicit contract theory.

Publications in the human resource management literature also emphasize the potential effect of the change on the relation between employers and older workers. As workers grow older, loyalty to the firm may be no longer rewarded as workers become less productive if employers don't foresee the end of the relationship (Walker and Lazer 1978). Incentives featured in private pension plans may be affected as well. Yet, the only studies of the change in mandatory retirement rules are either based on simulations (Burkhauser and Quinn 1983, Morrison 1988) or were conducted *before* the change (e.g., Schulz 1974, Halpern 1978). None of these studies actually uses data covering the period of the actual change in the law. Moreover, while a recent paper by Neumark and Stock (1999) revived interest in the economic effects of age-discrimination legislation, that study mainly assesses the effect of state-specific age-discrimination laws using the Decennial Censuses until 1980. It does not focus on the effects of changes in mandatory retirement rules or the federal law change, whose main impact occurred after 1980.[1]

To remedy this gap in the literature, the present paper uses various data sources to assess the effect of the abolition of mandatory retirement on labor force participation. As in previous studies, both the Retirement History Survey (RHS) and the National Longitudinal Survey of Labor Market Experience (NLS) for mature men can be used to give an overview of the basic trends of mandatory retirement (MR). As the sample sizes of the RHS and the NLS are too small to measure a potentially small effect, this paper uses data from the monthly files of the Current Population Survey (CPS) covering the period from 1968 to 2006. The CPS-samples are large, but there is no direct information on mandatory retirement coverage, even in the period before 1979. Thus, I use information on industry, education and other variables to

[1] Neumark and Stock (1999) point out that their identification of changes in state-specific mandatory retirement provisions is weak, and cannot separately identify the effect of the federal law changes. A recent study by Charles (2004) has used coverage by mandatory retirement on a job in 1980 as one of the instruments for retirement in the 1980s in an analysis of retirement and well-being, without analyzing effects of the change in mandatory retirement.

impute coverage by mandatory retirement, and compare labor force trends for groups of workers with high and low probability of MR. A detailed robustness analysis gives confidence that the effects found on retirement patterns and labor force participation are indeed those due to the abolition of compulsory retirement rules.

In a second step, I exploit straightforward implications from Lazear's implicit contract model to briefly assess the impact of the change in mandatory retirement on job-attachment, pension plans and wage-profiles. In particular, I analyze whether workers more likely to be covered by mandatory retirement had indeed higher job-tenure and steeper wage profiles as the implicit contract model would predict, and whether these patterns vanished after mandatory retirement was abolished in 1979 and 1986.

While the results all pertain to the US labor market, the findings of the paper should be helpful in assessing future labor market trends in other countries that are currently considering the elimination or modification of mandatory retirement rules. The European Commission has been trying to foster measures to encourage labor force participation of older workers in Europe. Most importantly, it has passed a directive that required member states to pass legislation outlawing discrimination in the labor market by age by 2006.[2] While this directive explicitly does *not* limit regulations concerning compulsory or normal retirement ages, it can be seen as a first step in that direction. Some EU member countries, including the UK or Italy, are already planning to abolish a maximum retirement age. In either case, the experience in the US with age discrimination legislation should be a useful guidance for Europe in a relatively unknown territory.[3] [4]

The outline of the paper is as follows. The next section describes the evolution of age discrimination legislation and the enforcement mechanisms created by the ADEA. The third section

[2] As a part of the debate on active aging, the European Commission has been encouraging member states to reform their pension systems in a way to make the retirement decision more flexible, too.
[3] Until very recently, few academic publications on the effect of mandatory retirement in Europe existed. See a special report by the Rowntree Foundation (2001), a report by the European Commission (2005), and numerous articles by the Financial Times and the Economist and on the web. Riach (2006) and Adnett and Hardy (2007) also summarize aspects of the debate surrounding European anti-discrimination legislation.
[4] Most provinces in Canada have recently effectively abolished mandatory retirement, with British Columbia among the last province in 2008 (with the exception of Quebec and Manitoba, which had abolished it in the early 1980s). Shannon and Grierson (2004) find that the changes in the early 1980s had little effect on employment.

briefly discusses the previous literature and the fourth summarizes the basic facts on mandatory retirement. The fifth section presents the empirical approach and the imputation method and then analyzes retirement patterns across groups. The sixth studies the age-distribution in employment directly and draws implications for trends in the labor force. The following section presents a comprehensive robustness analysis. The eighth section gives an informal overview of the implicit contract model and briefly presents evidence on job-attachment, pension plans and wage profiles of older workers. The last section offers preliminary conclusions.

2. Age Discrimination Legislation in the US

The Age Discrimination in Employment Act (ADEA) as originally passed in 1967 protected all workers between the ages of 40 and 65 from discrimination in hiring, firing and promotion on the basis of age. The amendments that were signed into law 1978 expanded coverage under the Act to workers age 70, implicitly abolishing mandatory retirement at the most common age, 65. In 1986, the upper age limit was lifted altogether, outlawing any form of compulsory retirement.[5] Most observers agreed that enforcement of the ADEA really began in 1979, when the Equal Employment Opportunity Commission (EEOC) took over the duty of enforcing the law from the Department of Labor.[6] For the rest of the paper, 1979 will be taken as the date relevant for the analysis. The main stages in the development of the ADEA are summarized in Table 1.

The 1978 amendments to the ADEA, which outlawed mandatory retirement and transferred responsibility of enforcement to the EEOC, were preceded by a lively debate. This had the useful effect (for the purpose of the present study) of ensuring that the change in the law was actually known by workers. Two citations illustrate this point.

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[5] The ADEA also applies to pension plans. There are exceptions for certain occupations in which age is an important factor in qualification for a job (for example for airline pilots and, until recently, for academic faculty).
[6] The EEOC's original purpose was to hear claims and file charges under the 1964 Civil Rights Act. By the end of the 1970s, it therefore was a fully functioning and experienced government agency. Under the ADEA, a worker claiming to have suffered discrimination has to file a claim with the EEOC, which either decides to sue on the worker's behalf, or gives the worker the right to sue himself.

‘One likely explanation for the increased number of age charges may have been the Amendments to the ADEA, championed by Congressman Claude Pepper, chairman of the House Select Committee on Aging, and enacted with great public fanfare in 1978. The 1978 Amendments were widely debated and publicized, largely because they were to alter the institution of retirement, moving the permissible mandatory retirement age upward to 70 from 65. *The public discussion of mandatory retirement issues served to increase the nation’s awareness of age discrimination as a problem, while at the same time heightening older workers’ knowledge of their rights under the ADEA.*’

[McConnel (1983), page 165 (emphasis added)]

‘With strong opposition and a lack of substantial detail on the law’s future effects, why did the bill pass so quickly and overwhelmingly? The reasons may be many, but as one spokesman observed, “Age discrimination is the last frontier of civil rights. … It’s a very emotional issue, next to motherhood. It’s hard to vote against it!” […] And the climate was right in Washington, with President Carter talking about human rights and the “Gray Panthers” talking about the upcoming election year.’

[Walker and Lazer (1978), page 14-15.]

Enforcement-related charges under the ADEA rose steeply beginning in 1979 with the transfer of enforcement to the EEOC. The number of age-related charges had been roughly stable at about 5000 per year from 1975 to 1979 when the Department of Labor was in charge of enforcement. By 1981, the number had reached 9500 (McConnel 1983). The steep rise in claims suggests both awareness and enforcement of age discrimination law in the US changed in nature after 1979. This conclusion is confirmed by publications in law and industrial relations journals using data sources from both filed and actually heard court cases (e.g., Schuster and Miller 1984, Donohue III and Siegelman 1991, Rutherglen 1995). Moreover, although age discrimination cases represented 25% of the total EEOC caseload, they constituted 50% of the cases in which financial compensation was secured. Litigation under the ADEA in the early 1980s was thus both extensive and expensive.

From the literature it is also evident that a predominant fraction of charges brought under the ADEA involved cases of discharge.[7] While this included both firing *and* involuntary retirement, middle-aged workers brought the majority of cases. Of all ADEA charges filed with the EEOC in 1981, 22% were filed by workers above age 60. Nevertheless, among a sample of age discrimination cases actually

[7] McConnel (1983) reports that 50% of all cases filed with the EEOC in 1981 dealt with cases of job termination.

heard in court, Schuster and Miller (1984) report that half of the discharge cases dealt with involuntary retirement. Clearly, the practice of MR was directly challenged by the amendments to the ADEA. The numbers on judicial and administrative activity and the extent of workers covered under the law suggest that the ADEA had the potential to make an important impact on labor force participation.

In contrast to the sharp change in the legal environment affecting retirement in the US, most other OECD countries have only recently begun to consider changes in mandatory retirement laws. Table 2 summarizes the legislation regarding age discrimination and mandatory retirement in most EU and some other OECD countries. At present, Australia, Canada and the US are the only countries that have an explicit ban on mandatory retirement. Most European countries have age discrimination legislation covering workers age 65 and below, although most of the legislation was adopted relatively recently. This is no accident, as directive 2000/78/EC of November 2000 from the European Commission requires such legislation to be adopted by each member state by 2006. Although the European Commission's directive explicitly states that national compulsory retirement rules are unaffected, the trend seems to be towards flexible retirement, and this eventually is likely to imply flexibility towards higher ages as well. However, the topic remains hotly debated within Europe, with proponents and opponents of statutory retirement ages battling the interpretation of European law in court.[8]

3. Mandatory Retirement in the Previous Literature

There is a small literature in economics on the impact of mandatory retirement (MR). Most of the publications on the subject stem from the mid-1960s and early 1970s and have limited empirical scope. Yet, they help point out the relevance of MR in the debate on the rights of older workers and the reform of the social security system at the time. With no apparent increase in flexibility of retirement and against the backdrop of a heated debate, Reno (1971), Schulz (1974) and Halpern (1978) analyzed the first representative data on the subject. The surveys analyzed by these authors suggested that labor force might

[8] In a 2007 decision, the European Court of Justice upheld that the European Union's Equal Treatment Framework Directive does not prohibit member states from introducing mandatory retirement ages (*Palacios v Cortefiel Servicios SA)*.

rise by 10% to 15% in the absence of mandatory retirement. Given such a large fraction of workers had been covered by MR, and was thus potentially affected by the change, these estimates were perceived as small.[9] Nevertheless, Schulz (1974) points out that the 10% reduction ‘caused’ by mandatory retirement was still seen as a waste of resources and as an unnecessary cost to older workers. In addition, policy makers and researchers were aware that the abolition of MR could play a larger role if labor force participation were to rise in the future. Moreover, some analysts emphasized the effects of mandatory retirement on the financing of Social Security (Halpern 1978, Morrison 1988).

Burkhauser and Quinn (1983) is the only study attempting to disentangle the role of mandatory retirement from other factors affecting retirement at age 65, such as private pensions and social security benefits. These authors estimate a structural model of retirement decisions for workers not covered by MR and use it to predict the actions of workers actually covered. This ‘residual approach’ is akin to the counterfactual approach taken in this paper in that it has to assume the only difference between the two groups is the extent of coverage by MR. Given the high correlation of MR with the provision of private pensions, Burkhauser and Quinn’s method may have underestimated the potential effect of abolishing MR. On the other hand, as they point out, if workers select into MR jobs according to their preferences towards retirement, their methodology could overestimate the effect of MR.

Burkhauser and Quinn (1983) find huge effects of MR for the small subgroup of workers actually retiring due to MR, thus obtaining only an effect of 5 percentage points on the overall labor-force. Their conclusions are in part due to the nature of their sample, which comes from a single year of the RHS and

[9] Morrison (1988) also emphasizes this point. Morrison summarizes an Interim Report to Congress by the US Department of Labor of 1981 on the Age Discrimination in Employment Act Amendments and thus contains many further references on the subject. Other early literature includes Slavick (1966) who discusses a survey of establishments on mandatory retirement, finding that mandatory retirement is highly correlated with the incidence of private pension plans and concentrated in large firms. Herbert Parnes (US Manpower Administration 1970) obtains estimates of coverage rates of 59% percent for white male employees. Reno (1971) and Rubin (1973) find smaller coverage rates using the 1968 and 1969 Survey of New Social Security Beneficiaries at the ages 62 to 64. Yet, as Halpern (1978) points out, the selection of her sample is biased towards workers not affected by MR (i.e., workers with lower wages and lower attachment to the labor force). See also Neumark and Stock (1999) for additional references.

has a very low coverage by MR relative to other samples from around the same time.[10] In view of this difficulty, and the other conceptual aspects already noted, there is reason to view Burkhauser and Quinn's results as lower bound of the effect of the abolition of MR. For example, when estimated on a larger and more representative sample, the same structural model predicts a 15% increase in the labor force of workers 65 to 70 (Morrison 1988). Despite these potential concerns, it is Burkhauser and Quinn's analysis that formed the core of the Department of Labor's 1981 Interim Report to Congress on the Amendments of the ADEA.

Another aspect about which little is known is the reaction of employers to the abolition of MR. In a seminal paper Lazear (1979) argued that mandatory retirement may have been a way to end long term implicit contracts.[11] Elimination of MR may thus have had an effect on wage profiles and job attachment of older workers. This point has received renewed interest in the analysis of the economic impacts of age-discrimination in general. A recent paper by Neumark and Stock (1999) has used differences in state laws to analyze the impact of age discrimination legislation on labor force participation and wage profiles using Decennial Censuses until 1980. There are some costs and benefits in the use of state laws as a source of identification. While providing greater variation, it is more difficult to show the degree of enforcement of age-discrimination legislation at the state level. We view the study of the effects of the change in federal law on employment of older workers after 1980 analyzed in this paper as important complement to Neumark and Stock's study of the earlier period. Their results imply similar increases of labor force participation of older workers.

It is surprising that given the unsatisfying state of affairs the effects of the abolition of mandatory retirement have not been analyzed with representative data actually covering the entire period of interest.

[10] Their sample consists of male private employees aged 62 to 64 in the 1973 Retirement History Survey; only 12% of these workers affected by MR at the date they retire, as opposed to estimates around 24%-32% cited in Halpern (1978).
[11] That the reaction of employers may be a potentially an important question was understood before Lazear. Schulz (1974) emphasizes that firms avoided costly assessments of older workers' productivity that may have been viewed as partial or may have negatively affected worker morale. Schulz suggests that firms opted for MR after private pensions and social security benefits made this alternative appear less harmful to the financial situation of older workers.

Apart from data difficulties, the lack of studies may have been due to the presumption that the effects were small. As data is now available, its analysis will yield a useful complement to earlier predictions of the effect of MR. Moreover, the elimination of MR offers a discrete change in the institutional environment affecting retirement incentives. As these incentives all tend to occur at similar ages, a discrete variation may help to obtain separate identification of the effects of some of them. This is particularly important since the 1970s were a period of changes in the social security system and strong trends in the pattern of retirement.

4. Some Basic Facts About Mandatory Retirement

Rates of coverage by MR reported in the literature for male employees age 55 and older ranges from 35% to 60%.[12] To provide an overview of coverage patterns of MR, the National Longitudinal Study of Older Men (NLS) is chosen here among possible data sources, as it gives a consistent series of the fraction of workers covered by MR throughout the 1970s. Table 3 shows coverage rates from the NLS for male employees between the ages of 55 and 64.[13] Coverage at all compulsory retirement ages (shown in the first row) was at about 50% until 1978, when the Amendments to the ADEA were signed into law. From then on, the fraction covered fell to 20% in the early 1980s. As only MR at age 65 was prohibited by the amendments, workers could still face MR at age 70.

The pattern is even more distinct for workers covered at the compulsory retirement ages smaller 70, shown in the second row. This group includes the modal compulsory retirement age of 65. From slightly under 40% in the 1970s, coverage fell to 5% in the early 1980s. The largest decline occurred in 1979, when enforcement of the ADEA was transferred to the EEOC. The fraction of workers still reporting to be covered by MR at age 65 is low, as shown by the numbers in the 4th row. This may be due

[12] Differences may arise from differences in the age range of the workers considered, from different sample selection, or due to reporting errors. Survey measures may understate the true coverage by MR especially for younger workers. As Halpern (1978) reports, reported coverage rises with age, presumably because workers become aware of the constraints they face.

[13] The NLS, described in more detail below, follows a cohort of workers who are 45 to 59 years old as of 1966 over time. Despite the restriction of the age-range in the table, the age decomposition of the sample still shifts slightly. Note that due to attrition and aging the sample sizes of the cells in the early 1980s get very small.

to non-compliance, or simply to reporting errors. As can be seen in row five, the fraction of workers covered by compulsory retirement at ages 70 and older follows the opposite pattern. It rises after 1979, going from an average of 9% to 15%. For the rest of the paper I will treat 1979 as the date of the effective change in the law.

The third and sixth rows of Table 3 report the proportion of workers answering they wanted to work longer than their MR age for the groups covered by MR under age 70 and above age 70, respectively. For the main MR group this is a substantial fraction ranging from 30% to 40% before the change in the law. Consistent with the trend towards early retirement in the 1960s and 1970s it tends to decline over time. To obtain a rough estimate of the fraction of workers constrained by MR, one can combine these numbers with the actual coverage rates. For 1976 this implies that MR was a binding constraint for about 12% of workers. By 1983, the fraction constrained was about 4.2%. Due to small samples, the table shows that there are very few people left claiming to be covered and wanting to work longer. The NLS also asked currently retired workers whether they had left their main job due to MR, and of these how many would have liked to work longer. The corresponding figures (not shown) are 15% and 65% on average for the years prior to 1979, implying that about 10% of people were actually constrained. Again, the fraction of retirees reporting retirement due to MR declines substantially in the early 1980s.[14]

Table 4 gives more detailed information on which workers were most affected by mandatory retirement rules. Clearly, workers with more than a high-school degree, white collar workers, and workers in more densely populated areas were more likely to be covered. However, the most important differences were between industries. Among the larger sectors, workers in manufacturing, transport and communication and in the FIRE sectors were the most likely to be affected at age 65 (i.e., below age 70). Workers in trade and construction were least likely to be covered. Not surprisingly, due to the concentration of industries, workers the in East-North Central Census Division had the highest coverage

[14] Again after 1980 the fraction of workers reporting to be constrained is very small, below 10 per year. The fraction of workers who ever retired due to MR and wanted to work longer from the RHS in 1977 and 1979, another longitudinal data set described below, are roughly the same (i.e., 16% left due to MR of which 68% wanted to work longer).

at 50%, while West-North Central had the lowest at 27%. In all categories there was a substantial drop in reported coverage in the early 1980s.

These numbers suggest that the change in regulations really had an effect on coverage rates and on the number of people constrained by compulsory retirement rules. Workers seem to have been aware that the change was happening. The fractions of employees reporting to be constrained suggest that an end of MR would lead to an increase of the labor force between 7% and 16%.[15] Thus, the figures from the NLS and the RHS broadly confirm the estimates from the early literature (in part using early waves from the NLS). The rest of the paper will focus to what extent workers actually changed their behavior and worked past age 65 in response to the change.

5. Empirical Evaluation of the Abolition of Mandatory Retirement

Mandatory retirement used to be a very common feature of the US labor market, but the early literature had dismissed its role as a potential constraint of older workers, in part based on the numbers discussed in the previous section. However, no empirical studies of the actual effect of the elimination of mandatory retirement on retirement behavior exist. The next sections aim to fill this gap by a systematic analysis of relative trends in retirement and labor force participation rates.

5.1 Empirical Strategy

Did the abolition of MR reduce the incidence of retirement at age 65 and increase labor force participation? To answer this question, one would ideally make a straightforward comparison of the probability of retiring of workers covered by MR before and after the change. Using workers not covered by MR as a benchmark, such an approach can control both for factors affecting the decision to retire common across groups, as well as any incentives differing across groups but constant during the period. Since other factors correlated with MR, such as private pension coverage, are unlikely to change drastically over time, this approach overcomes the identification problem affecting Burkhauser and

[15] This is further discussed at the end of Section 6.

Quinn's (1983) study. Moreover, potential differences across groups we can not control for, occurring for example if workers select into jobs having the retirement patterns they desire, are likely to bias *against* finding any effect.[16]

Unfortunately, the straightforward approach cannot be implemented due to a lack of data. It appears that the NLS would be an appropriate data set for such an analysis, since it covers the period in question and has longitudinal data on the workers actually covered. Yet, using the NLS, one finds hardly any change in retirement rates. As some of the effects are likely to occur over time, this may arise in part because the NLS ends in 1983. More importantly, due to attrition and aging the number of older workers in the NLS gets very small towards the end of the sample. It is unlikely to be representative and may be too small to identify anything but large effects.

Given this situation, the strategy here will be to mimic the ideal data as closely as possible while overcoming the flaws of existing data sets. The NLS and RHS provide information on coverage by MR but are either too short or too small or both. On the other hand, the Current Population Survey (CPS) provides large samples of workers over the period from 1968 through 2006, but has no information on mandatory retirement. As discussed above (Table 4), workers covered by MR differ from those who are not by education, industry, residence, and occupation. The strategy followed in the rest of the paper is to use these characteristics to impute coverage by MR for workers in the CPS. Those workers with high probability of being covered will be those most likely affected by the abolition of MR.[17]

A first step consists in constructing groups with high- and low-probability of coverage by MR. To do so, I estimate probit-models of mandatory retirement coverage using data from the RHS and NLS, and assign the resulting coefficients on workers' characteristics to data from the CPS. Then, I split the CPS data into two groups with low and high probability of coverage, respectively. These are the groups of workers whose retirement behavior and labor force participation I compare in the main part of the empirical analysis. I interpret differential changes across these groups as an effect of the abolition of MR.

[16] I.e., the assumption is that conditional on observable characteristics the two groups are similarly affected by incentives from pension plans and social security. This will be discussed further at the end of Section 6.
[17] A similar approach is used by Chay (1998) to evaluate changes in civil rights legislation on minority employment.

The comparison is most meaningful if the new groups mimic the original groups as closely as possible. Thus, the main empirical part concludes by analyzing the sensitivity of the results regarding the choice of cut-off point and the specification used to predict MR.

5.2 Data and Outcomes

The information on MR comes from the Retirement History Survey (RHS) and National Longitudinal Study of mature men (NLS). The RHS is a bi-annual panel following men and women aged 58 to 62 in 1969 until 1979. The NLS, which was already used in the previous section, interviews a sample of men who were 45 to 59 years old in 1966 at irregular intervals until 1983. Of these two data sets, male employees aged 55 to 64 were selected and pooled together. Individuals with invalid observations on MR, industry, education and occupation were dropped from the sample. Years after 1976 were dropped as well, since coverage by MR is likely to have started to decline in 1978 as a response to the expected change in the law. The combined sample of individuals for all years has 9867 observations, 37% of which are from the RHS. Column 1 of Table 5 contains the means of the pooled sample.[18]

The data on labor force participation comes from the monthly files of the CPS. From 1976 to 2006 all monthly files are used. From 1968 to 1975 only three months were available (March, June and October). Again, the working sample consists of male employees with valid observations on industry, education and occupation.[19] Given the outcomes of interest, the analysis concentrates on workers between ages 55 and 75. The second column of Table 5 shows the means of the CPS sample from 1968 to 1978. The means across the two samples are very similar. The only difference is that for education, and it derives from a low educational attainment in both the NLS and RHS. However, the difference in education across imputed MR groups turns out to be the similar as across actual MR groups.

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[18] The original cohorts are both representative, and the weighted sample means of the RHS and NLS are similar. There are some differences in the industry distribution. However, as shown in Table 5, the industry distribution of the pooled sample is similar to that of the CPS. The weights of the original survey are combined to yield weights for the pooled sample. The years with information on MR were shown in Table 3.

[19] There have various changes in the industry code and occupation codes used in the CPS, the most recent and fundamental one in 2003. The data were recoded to be as comparable as possible at the 1-digit level.

Two peculiarities of the CPS are relevant for the present purpose. First, the CPS has an overlapping panel structure: each month a new group of households is interviewed and thereafter observed another seven times.[20] To obtain large enough samples in each year-, age-, and probability-group information from all the rotation groups is used here. Thus, there are multiple observations on single individuals in the sample and the standard errors have to be adjusted accordingly. Second, there is no information on industry and occupation at the last job for workers who are out of the labor force.[21] This precludes the direct analysis of labor force participation rates by probability groups. Instead, we have to infer effects on labor force participation from changes in retirement behavior.

Given this restriction, the basic unit of analysis in the paper is the proportion of workers of different ages in each of the two probability groups.[22] These age-proportions can be used to calculate the probability of retiring at different ages as follows. Let $p_g(a,t)$ be the proportion of workers in group g at time t with age a and $N_g(a,t)$ be the corresponding number of workers in the labor force. Then the probability of retirement at age a in group g in period t, conditional on having worked until period t-1 (i.e., the hazard of retiring $h_g(a,t)$) can be defined as

$$h_g(a,t) \equiv \frac{p_g(a-1,t) - p_g(a,t)}{p_g(a-1,t)} = \frac{N_g(a-1,t) - N_g(a,t)}{N_g(a-1,t)}, \quad where \quad p_g(a,t) \equiv \frac{N_g(a,t)}{N_g(t)},$$

which is the proportional change in workers in the labor force across ages.

This corresponds to the true probability of retiring if no worker switches between major industries (i.e., leaves $N_g(a-1,t)$ to become employed in the other group or join $N_g(a,t)$ from the other group) or reenter the labor force. For the workers age 55 to 75 these are unlikely to be strong assumptions.[23] Moreover, note that the hazard is defined within a *cross-section* of workers, not within a cohort. While the latter would be conceptually the correct approximation to use, changes in the sample size of the CPS and

[20] All households in each rotation group are followed for four consecutive months, then dropped for eight months, and then interviewed again for 4 months. In each months there are observations from 8 different rotation groups.
[21] This information is available in all months only starting 1988. Before, it is available only in the March CPS.
[22] Proportions have the advantage with respect to cell counts that they only capture shifts in the labor force at a specific age, not shifts affecting the entire group. Table 2 in the Appendix contains the straight cell proportions for ages 61 to 70.
[23] There is a small fraction of workers reentering the labor force even at ages above 55. However, it is stable over time.

errors in the classification of industries introduces potential disturbances across years to which the hazard is particularly sensitive. The cross-section measure is thus a more robust estimate of the hazard. Moreover, as the age-distribution changes relatively smoothly over time, the cross-section estimate can be shown to be close to the cohort-estimate.[24]

5.3 Quality of Imputation

The basic imputation predicts coverage of MR at ages below 70 by education and industry dummies.[25] Other specifications used include explanatory variables for occupation (white-collar), area of residence (SMSA, Division), and interactions between education, SMSA or white-collar and industry. Figure 1 shows the relation between actual and predicted mandatory retirement coverage in the original sample. Each panel shows a different specification of the mandatory retirement probit. The size of the rectangles represents cell-size within intervals of predicted probability. The lines are OLS regression lines of the actual on the predicted probability of coverage. The predictive power of all four models is quite good, ranging from 93% to 95%.[26] None of the slopes are significantly different from one. Interestingly, the fit of the lines is not particularly improved by any of the more sophisticated specifications. While the latter do give slightly more even predictions, the simple specification gives the clearest distinction of the original sample into high and low probability of coverage.

Given these results, the main imputation used throughout the paper is based on information on education and industry. The corresponding cut-off point chosen is .5, such that each individual with

[24] The differences between the estimates are indeed small. Aside from measurement errors, the main sources of difference between the two hazards are changes in the age distribution of the labor force. It can be shown to change smoothly and slowly over time. The error could be minimized further by working with hazards defined on groups of years (within which the age distribution is stable), but this would reduce the amount of variation and precision.

[25] The specification for the Probit model consists of four education dummies, twelve industry dummies, four year dummies, a dummy for black and a dummy for being in the RHS. The dependent variable is one if the individual was covered by MR at an age below 70 in a given year. (The sample has been described above.) Sampling weights are used in the estimation. The coefficients are shown in Table 1 in the Appendix.

[26] The regressions use 100 brackets of *predicted* probability of coverage by MR. The dependent variable is the fraction of workers in each bracket actually covered. The adjusted R^2 is 94%, 94%, 95% and 93% for the four specifications, respectively (see Table 10). Not all division-dummies and industry-interactions are included. The final specifications are selected by assessing both their significance in the Probit model and their contribution to the predictive power of the model as measured by the R^2 of the ‘auxiliary’ regression.

imputed probability of MR greater one half will be assigned to the high-probability group. Table 6 compares the means of the resulting high- and low-probability groups in the CPS to those of workers with and without MR in the RHS/NLS. The relative differences are similar in the two samples. One can see that the imputation works by exaggerating the differences across groups; i.e., it assigns workers in highly covered industries entirely to the high probability group (and vice versa for industries with low coverage).[27] Similarly, the differences between education and fraction white-collar are greater in the imputed sample.

Note that the fraction of workers in the high-probability group exceeds that of the low-probability group; it rather matches the fraction of workers covered by MR at *all* ages instead of those covered at age smaller 70 (see Table 3). The difference is reversed at higher ages, such that the fraction in the high-probability at age 65 (the most relevant group) is 42%. The effect of the slight over-representation is ambiguous. On the one hand, it tends to include less affected workers in the high-probability group, potentially attenuating any effect; on the other hand it increases the cell size and thus helps precision, especially for high ages. Changes in the cut off point have little effect on the results (sensitivity with respect to the cut-off point will be further discussed below). Given these preliminaries, the rest of the analysis will compare the retirement behavior across the two identified groups.

5.4 Analysis of Hazards

Figure 2 shows the estimated conditional probabilities of retiring at ages 62 and age 65 by year for the low- and high-probability group, circled and starred, respectively. Consider first the right-hand panel for age 65.[28] In the 1970s, the high-probability group had much greater probability of retiring at that age. At its peak in the mid-70s, the difference was 20%, when the probability for the workers most likely

[27] The assignment of workers to the high-probability group across industries is shown for different imputations in Appendix Table 4.
[28] These and the other graphs shown in the paper are smoothed using a moving average.

to be covered was almost double the hazard for the low-probability group.[29] Then, in 1976 the hazard of retiring at 65 for the high-probability group began of stepwise relative decline. It fell more than 10% until 1979, with a jump in 1978, the year in which the law was signed, and in 1979, the year the EEOC took charge of implementing it. Then, a period of relative stability followed until 1985, when it jumped again and declined further to stabilize in the early 1990s. The two periods of rapid decline correspond surprisingly closely to the stepwise abolition of MR in 1979 and 1986.[30] Thus, it appears that the end of MR did affect retirement behavior. The fact that the decline starts after 1976 may be due to an anticipation of the law and is quite consistent with the pattern of actual MR coverage seen in Table 3.

The hazard for the low-probability group remained comparatively stable until the late 1980s. Similarly, one can hardly discern any changes for the hazard of retiring at age 62. Moreover, the differences between the probability groups are much smaller at that age, consistent with the fact that two groups differ mainly due to coverage by MR. Figure 3 shows the retirement hazards at all ages for the two groups in four different periods: 1968-1978, 1979-1981, 1988-1990, and 1997-2000.[31] In 1968-1978, the hazards for the two groups follow clearly distinct patterns, with the high probability group showing a large spike at age 65. The observation that this is the main difference across groups is consistent with the presumption that they differed mainly by MR coverage. Over time, the difference vanishes, with the retirement distribution becoming first bi-modal at age 62 and 65 in the 1980s, and finally experiencing only a slight increase at age 62 by the end of the 1990s. These figures underscore the conclusion that while in the 1970s there were two groups in the labor force with distinct retirement behaviors, the differences had almost vanished by the early 1990s.

[29] The magnitudes of the hazard of retiring at age 65 implied for the *entire* sample of workers corresponds very closely to that estimated in the literature. For the 1970s, the implied hazard of retiring is roughly 34% (= .55*.43+.45*.23), which almost matches exactly the numbers reported in Peracchi and Welch (1994) who calculate their hazards using matched March CPS data. Numbers reported by Lumsdaine and Mitchell (1999) from the HRS for the 1990s are very similar to the estimates implied here for that period as well.

[30] Recall that in 1986, any form of MR was outlawed. While this should have no direct effect on the hazard at age 65, it may have had if employers reacted by curbing other ways of retiring employees at that age, or if workers became more aware of their rights as MR was abolished altogether.

[31] We have also analyzed 2001-2006 and it looks similar to the pattern in 1997-2000. The figure is available in a supplementary appendix on request.

Table 7 displays a simple difference-in-difference analysis based on the annual hazards shown in Figure 2. The first two columns contain the average retirement rates at age 62 and 65 for the two probability-groups in different years. One can see that the difference between the hazards of the two groups shown in column three is significant at the 5% level and declining over time. The magnitude and significance of the gap in retirement rates at age 65 drops in the early 1990s and vanishes by 2000. The difference-in-difference estimate compares each period to the base period (1968-78). The results suggest that following the elimination of MR the hazard of retiring at age 65 for previously covered workers fell by 8% until 1983, and by 14% until 1993. The pattern of the time-effects suggests an immediate effect of the law in 1979, with other factors gaining influence as time passes. The lower panel of Table 7 shows the same regression for age 62. While some of the period-specific differences across groups are significant, the DD-estimates in the last column are stable over time, and relatively small.[32]

As mentioned above, care has to be taken to adjust the standard errors for the fact that part of the workers in the sample are observed several times within a year. This has two implications for the variances of the estimated hazards. First, the underlying observations are correlated within rotation groups, leading to underestimation of the variance of the age-proportions. To take care of this problem, the age proportions are calculated from the original sample using a linear probability model in which the standard errors are clustered within rotation groups. From these adjusted variances, the variances of the hazards are calculated using the delta-method.[33] The results are those shown in Table 7.

Second, as some of the rotation groups overlap into adjacent years, the hazards will be correlated across years. This is likely to lead to a negative correlation of the hazards' sampling errors. Moreover, as there is very little overlap between surveys more than one year apart, we would expect the sampling error

[32] Note that the rise in the estimated simple difference in 2001-2006 is entirely driven by the control group, not the treatment group. More than twenty years after the law change studied here, this is unlikely to be associated to the abolition in mandatory retirement.

[33] Note that the true variance is proportional to the variance calculated ignoring the within-group correlation, where the factor is a function of the within-group correlation coefficient. It can be shown that for the present case the cluster-correction also basically adjusts the original variances by the within group correlation coefficients. As there is only correlation between same individuals within a rotation group, the cluster-correction is too strong. Given what is known about the structure of the correlation, one could construct the covariance matrix using moments of OLS residuals and insert it into the White-estimator of the coefficients' covariance matrix. Here I stick to the 'conservative' estimate.

to follow an MA(1) process.[34] As we may observe some people in adjacent years at the same age, this could be an issue for the standard errors of the hazards in Table 7 as well. This suggestion is borne out by a simple analysis of the autocorrelation and partial autocorrelation functions of the two hazard series. For example, the autocorrelation function is negative (more negative for the high-probability group) and becomes very small after one lag. The standard errors adjusted for an MA(1) component are shown in the last column of Table 3 in the appendix.[35] The result is a *decline* of the standard errors of our estimates. Thus, the standard errors in Table 7 and the rest of the paper are conservative estimates.

The evidence discussed so far indicates that there were two groups with very distinct retirement patterns in the 1970s whose differences attenuated strongly during the decade that followed. Moreover, given the construction of the probability-groups and the timing of the changes, it appears very likely that the stepwise abolition of MR was an important part of the story. We thus have a first estimate of the effects from the end in MR. The change in retirement behavior is likely to have had an effect on labor force participation of older workers. Yet, retirement at age 65 may decline both due to an increase in the number of people working past 65 or due to a decline of workers arriving at that age. To see whether there was really an upward shift in labor force participation, the next section directly analyses the age-proportions with which the hazards are constructed. It then derives the implications of the abolition of MR for labor force participation.

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[34] The underlying 'true' observations for the hazards are dummy variables of whether an individual exits the current period or not. The sampling error is thus akin to a classification bias. It is a sum of individual sampling errors that each can take three values (either -1,0, or 1). The correlation should be negative since it was assumed that (actual or assigned) retirement is an absorbing state. E.g., classification errors for a person in two adjacent periods of {1,1} can not arise, as we would have to wrongly assign a person to be retired in two consecutive periods. A combination of {-1,-1} doesn't arise since the true underlying dummy for exit had to be 1 in two consecutive periods. All remaining combinations lead to zero or negative values of the products of the classification errors for the same person, and thus the covariance should be negative.

[35] The correction is done by inserting the covariance of the OLS-errors with its lag as off-diagonal element into the White-estimator of the covariance matrix.

6 Changes in Labor Force Participation

If we assume that labor force attachment at younger ages was unaffected by the abolition of MR, there is a simple relation between the hazard of retiring and the employment rates of older workers. Specifically, assuming that labor force participation at ages up to *a-1* are unaffected by the change in mandatory retirement, the changes in the labor force for workers of age a in the high probability group can be written as

$$\Delta N_g(a,t) = -\Delta h_g(a,t) \times N_g(a-1,t),$$

where $\Delta h_g(a,t)$ is the effect of the change in MR on the hazard of retiring. Yet, it would not be surprising if labor force participation at earlier ages, say at age 64, was affected by changes in mandatory retirement rules as well. To claim that the change in the hazard indeed implies an effect on labor force participation of older workers, it has to be that there is a permanent upward shift of the proportion of workers working in the high probability group at ages 65 to 69 – with such a shift occurring *neither* at ages 62-64, nor in the low probability group.

Looking at the age proportions directly has another advantage as well. Roughly speaking, the comparison across high- and low-probability groups is implicitly, say, between high skilled workers in manufacturing and transport and low skilled workers in trade and construction. To account for changes in the relative proportion of high- vs. low-probability workers at age 65 due to trends in the employment of particular skill- or industry-groups, one can use a younger group of workers as an additional control group. Thus, to eliminate any industry specific trends, below we will also condition on patterns of relative employment of workers between age 55 and 61. The implicit assumption is that the changes captured by this age group are the same at higher ages and unrelated to the change in MR.

Figure 4 shows the changes over time in the ratios of age-proportions in the labor force in the high vs. the low probability group for three age-ranges (i.e., the graph shows $p_H(a,t)/p_L(a,t)$ divided by $p_H(a,0)/p_L(a,0)$). Once can see that the only systematic changes seem to occur for the ratio at ages 65 to 69, which after a downward swing in the early 70s starts to rise in 1977 until 1990, when it reaches a permanently higher level. The gradual increase in the early 1980s evident from the Figure is expected. As consecutive cohorts cross the threshold of age 65 and remain in the labor force, the proportion of workers in the high-probability group rises. In contrast to the rise of 25-30% for older workers, not much happens throughout the period for the two other age groups. There is a small shift upward for both groups in the mid-70s, after which they decline slightly and then stay roughly constant. Interestingly, during the recession of the mid-1970s (starting in 1974) and the following expansion workers aged 62-64 and 65-69 move in parallel, while this co-movement completely vanishes in the 1980s and 1990s.[36]

These patterns seem to imply that there are no particular movements in the high-probability groups at lower ages that may be due to the abolition of MR (i.e., that are not offset by movements in the low probability group). Moreover, there do not seem to be strong trends in relative employment of the two younger age groups. It seems implausible that there should be any industry specific trends that affect *only* relative employment of workers beyond age 65. For example, if the recession of the early 1980s had led to relatively higher rate of retirement in the low-probability group (e.g., of lower educated workers in trade), it would be expected to affect workers age 62-64 or younger ages as well.

To explicitly control for changes occurring at younger age groups, Table 8 shows a difference-in-difference-in-difference (DDD) analysis of labor force proportions over time and across age- and probability-groups.[37] The first four columns show the average proportions by age- and probability-group; the fifth column shows the corresponding difference-in-differences across age- and probability-groups; the last column shows the change in this difference over time. As in Figure 4, the numbers reveal a gradual increase of the proportion of workers in the high-probability group older than 65. By 1985, the increase due to MR predicted by this regression is of half a percentage point, or about a 30% rise relative to their initial proportion. In that year, the proportion of the *entire* group of 65 to 69 year olds in

[36] NBER business cycle through dates for that period are 1970, 1975, 1980, 1982, and 1991. The corresponding peaks are 1973, 1980, 1981, and 1990. See the NBER's website (www.nber.org).

[37] The DDD-regression is $p_{itarm} = \delta_1 D_i + \delta_2 D_t + \delta_3 D_a + \delta_4 D_{ia} + \delta_5 D_{at} + \delta_6 D_{it} + \delta_7 D_{ita} + \varepsilon_{itarm}$, where the unit of observation is the proportion of workers in a given probability-age-year-rotation-month–cell and D represents various combination of dummy-variables. The coefficients D_{ita} are the DDD-estimates shown in the last column of Table 8. The residuals are clustered at the rotation group level to account for multiple observations within cells.

employment in the high probability group is about 10.5% (five times 0.016+0.005). By the early 1990s, the total increase is of about five percentage points. This constitutes a rise in the proportion of workers age 65-69 in the high probability group of about 50%.[38]

These numbers imply slightly bigger changes in the hazard of retiring at age 65 due to MR than the difference-in-difference regressions of Table 7. Whereas the change in the early to mid-1980s is around 10% in both cases, by the late 1980s the drop implied by the numbers in Table 8 is 15% and by the early 1990s it is 21% (as opposed to 10% and 14% in Table 7). While this may seem surprising given the apparently smooth development of the ratios the figure, the slight downward trend of employment at younger ages leads to an upward correction of the effect of MR.

Figure 5 shows the implications of the end of MR for the labor force of older workers. These numbers mean to give a broad idea of what order of magnitude the effect on the labor force might have been under the two counterfactual scenarios discussed so far. The calculations maintain that 40% of workers might have potentially been affected by the change, as this is the average fraction of workers in the high-probability group.[39] In both cases, the estimated effect on labor force participation begins to rise in 1979, the year when MR was abolished. The increase lasts until about the mid-1980s. As expected, the effect is stronger when we also control for changes occurring at ages 55 to 61. It may be that the abolition of MR helped older workers gain relative to that age group during the recession in the early 1980s. As the recession was the strongest in the US since the great depression, this is quite remarkable and underscores the potential role of the ADEA.

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[38] I.e., five times 0.016+0.009 divided by the baseline (five times 0.016).

[39] Specifically, the lines plot the proportional change in the labor force $\hat{lf} = (lf - \tilde{lf})/\tilde{lf} = \delta(\tilde{h} - h)/(1-\tilde{h})$, where δ is the fraction of high-probability workers in the labor force, and $\tilde{h}$ and $\tilde{lf}$ are the hazard of retiring and the labor force if MR had been kept unchanged, respectively. The lines fix the fraction of affected workers (δ) at 40%. As workers retire for many other reasons, this may overstate the fraction of people in the labor force at risk. On the other hand, our estimates of the change in the hazard are mitigated by the focus on a larger group of workers. Nevertheless, here the focus was kept on as large a group of workers as possible. Note that since the baseline population is not affected by the change, the effect on the labor force is the same as that on labor force participation.

Column 1 of the last two panels of Table 10 gives corresponding numbers for four periods. The implied effect on the labor force from the end in MR ranges between 7% and 19% until the early 1990s. These match surprisingly well the effect predicted by the numbers in the RHS and NLS. There, 10% of all retirees had said they would like to work longer, implying an increase of the labor force of about 7%. Similarly, about 10% of workers had said they would like to work longer than their MR age. That would imply an increase in the labor force of about 16%.

Summarizing, the evidence thus far indicates that there may have been important effects of the abolition of MR on the probability of retiring. Moreover, there seem to have been significant and non-negligible effects on the labor force participation of older workers. The range of the effects is consistent with the evidence from direct surveys. The estimate preferred by the Department of Labor, 5%, lies on the lower bound of the range of estimates obtained here (Morrison 1988). These results contribute both to the understanding of the effects of changes in age discrimination legislation, as well as of the sources of secular changes in retirement behavior. In particular, the spike of retirement at age 65 has been a puzzle in the retirement literature (Hurd 1990, Lumsdaine et Al. 1996). The results here suggest that the spike was a predominant feature of a particular group of the labor force, and has declined dramatically since the late 1970s, at least in part due to the end of MR.

The interpretation of these results as effect of the change in MR rules depends on the appropriateness of the 'ideal' control and treatment groups. As mentioned above, workers covered by MR tended also to be covered by private pension plans, which had made the separate identification of the two effects difficult. Moreover, Burkhauser and Quinn (1983) had noticed that the wage net of (negative) pension accrual past age 65 was higher for workers covered by MR. However, neither of the two factors changed as abruptly as the abolition of MR during the period. First, during the 1980s coverage by private pension plans fell only slightly and for *both* probability groups until 1986, when the decline for the low-probability group accelerated (see Figure 1 in the Appendix). From 1980 to 1989 the decline was 1% and

3.6% for the two groups, respectively.[40] Thus, changes in the coverage shouldn't have had big differential effects. There also have been changes in the characteristics of pension plans that made it easier to retire early. While this could have affected workers in the high-probability group over-proportionally, this is not borne out by differential movements of age proportions across high- and low-probability groups at younger ages. Nevertheless, they could be part of the story and will be further discussed below.

Second, the actuarial adjustment of the monthly Social Security benefit for each month worked between ages 65 and 72 rose for workers turning 65 in 1981 from 1/12 to 1/4 of 1% (Halpern 1978). After 1981, for 5 additional years worked after age 65 the adjustment yields a 15% increase of monthly social security benefits ($=5\times12\times0.0025$), up from 5% previously ($=5\times12\times0.00083$). This change left the rate of accrual negative (Coile and Gruber 2001) and applied equally to all workers. It is thus unlikely to have had a particular effect on workers in the high-probability group. In simulations, Anderson et al. (1999) find that all changes to Social Security until 1989 may have raised labor force of workers past 65 by up to 5%. Despite the controls for changes in the low-probability group, it is conceivable that the estimates here pick up some of this effect as well. Last, Burkhauser and Quinn (1983) worry that the sample of workers with MR is selected based on unobservable tastes for retirement. As workers selected in this way would presumably not work longer at the end of MR, this would imply an *underestimation* of the effect of its abolition. If anything, then, the estimates in Table 10 are potentially too conservative.

The interpretation of the numbers as an effect of the abolition in MR also depends on the quality of the approximation that had to be used to mimic the ideal 'experiment'. It was shown above that the imputation used gives a very good fit in the original sample. Moreover, the effects are concentrated among workers older than 64, as expected. Nevertheless, an element of uncertainty remains regarding the imputation and definition of the groups analyzed. Therefore, the next section will present results of a more extensive sensitivity analysis.

[40] Throughout the 1980s and 1990s, 75% of workers in the high-probability group and 45% of workers in the low-probability group worked in establishments offering private pension plans. For workers in these establishments, from 1980 to 1989, the drop in coverage was 3% for the high- and 8% for the low-probability group (starting from 96% and 90% for high and low, respectively). Multiplying the fractions gives the numbers in the text. The decline continued until the mid-1990s only for the low probability group.

7 Sensitivity

Despite the care taken in their choice, the probability groups as defined until now necessarily contained an element of arbitrariness. Yet, as Table 3 in the Appendix shows, the results are robust to different choices of the cut-off point. One can go a step further by making sure that the extent of 'exposure' to the 'treatment' of removing mandatory retirement really leads to a monotonically increasing effect on labor force participation. In the present case, this would mean that prior to 1979, the higher the probability of coverage by MR, the greater was the probability of retiring at age 65 (i.e., the greater is the effect of MR). Moreover, the decline in retirement rates at age 65 should be proportionally higher for workers with a greater probability of MR coverage.

Such a relationship is shown in Figure 6. The graphs depict the hazard of retiring at age 65 by ten brackets of imputed probability of coverage by MR. The different lines correspond to different year-groups, and the different panels correspond to different imputations. For all three specifications shown the hazard of retiring increases monotonically with the probability of coverage. Moreover, the lines tend to shift downward over time. This confirms that the imputed probability of coverage is indeed positively correlated with the intensity of an exposure to MR.[41]

Table 9 displays a regression capturing the patterns shown in the first panel of Figure 6. The last two columns show the same for age 62. The key number summarizing the appropriateness of the imputation approach is the slope on the probability-index. It is significant and large in the first period, and then experiences a steady and significant decline over time. Importantly, the slope for age 62 is much smaller and does not change over time, as we would expect if the imputation captures the effect of being covered by MR. A Chi-Squared test is unable to reject the specification of a linear trend. The regressions

[41] Note that Figure 6 is the corresponding graph to Figure 1, where the fraction of actual coverage by MR in the RHS/NLS is plotted against probability-brackets. We have reproduced the figure including a line for the years 2001-2006, which is similar to 1997-2000. It is available in a supplementary appendix upon request.

corresponding to the other specifications are shown in the second panel of Table 10 and produce very similar results.[42]

Table 10 summarizes the results of the basic stages of the analysis of the paper repeated for six different methods for imputing mandatory retirement. For each MR-probit, the table first shows the quality of imputation and the key results of the basic difference-in-difference analysis. It then displays the results for ‘monotonous treatment’ regressions as discussed in the previous paragraphs. Last, it shows the changes in labor force participation implied by the use of different control groups: first, the results when only workers with low-probability of MR coverage (the DD effect) are used as control group, second, the results when younger workers are added as well (the DDD effect).

The first column contains the basic specification discussed in the main body of the paper. The second specification simply adds dummies for white collar, SMSA and two census divisions (East-North Central and Pacific). The third specification interacts the dummies for white collar, SMSA and education with industry-dummies as well. Interactions were included based on significance tests and contribution to the predictive power of the model as measured by the R^2 obtained by regressing the fraction of MR by brackets of *predicted* probability of coverage on an indicator (see the discussion in Section 5.3).[43] This is the R^2 shown in the first row of Table 10. The last three specifications repeat the basic model for the RHS and NLS separately, as well as for all workers covered by MR (i.e., not just those covered at ages smaller than 70).

[42] The regressions in Table 9 also resolve the potential problem that estimates based on an imputed coverage dummy suffer from misclassification bias. This bias leads our main estimates to be an *underestimate* of the impact of mandatory retirement (e.g., Freeman 1984). Jappelli, Pischke, and Souleles (1998) show that the coefficient on the fitted probability of coverage in Table 9 can be treated as a consistent estimator of the effect of mandatory retirement on employment, had we direct information on coverage in the CPS. It is clear from comparing estimates for ages 62 and 65, that the effect of MR and its abolition on employment would be estimated to be higher using this approach. This confirms that the estimates presented in the main analysis provide a *lower bound* of the effect of mandatory retirement on employment.

[43] The interactions kept in this way are white-collar and agriculture, mining, FIRE, professional services and government; education and transport/communication, trade, FIRE, professional services; SMSA and construction, entertainment, business services, and professional services. Division dummies are excluded from this specification.

As discussed earlier, the predictive fit of the different imputation models is very similar.[44] The second panel of Table 10 shows that the results for the difference-in-difference regression of the hazards are very similar across models as well. The only exception is the fully interacted specification (column 3), where the decline in the hazard of retiring at age 65 for the high-probability group looses significance and occurs with a lag. This may be in part due to the fact that some of the cells from which the coefficients in the interacted Probit-model are identified are small (see Table 4). Thus, the estimated coefficients are unstable, and the exclusion restrictions tend to become somewhat arbitrary. It may also be due to the particular choice of cut-off point. This is suggested by the third panel, which shows that the slopes of the probability index are positive and declining over time for all specifications.

The effect on labor force participation of the abolition of MR implied by the different specifications is displayed in the last two panels. Again with the exception of the third specification, the estimates are quite similar. They range between 5% and 11% for the years 1979 and 1985. For 1986 to 1993 they range from 8% to 20%. For the specification using the NLS only (Column 6), which is the survey some of the earlier studies are based on, the immediate effect is between 5% and 6%. In 1986 to 1993, it increases to the range of 11% to 16%. For the RHS only, which is the survey used by the Department of Labor’s Interim Report, the effect ranges from 6% to 19% from 1979 until the early 1990s.

The robustness of the results for different specifications used for defining the groups underlying the analysis (and for a wide range of values for the imputed probability of coverage) gives confidence in the range of magnitude of the estimated effects as well as in their interpretation. On balance, it seems as if the abolition of MR significantly reduced the hazard of retiring at age 65 for those previously constrained and thereby led to an increase in the labor force participation of older workers in the 1980s between 5% and 20%, with the effect rising slightly over time.

A related paper by Neumark and Stock (1999) analyzes the effect of changes and differences in state-specific age-discrimination laws on labor force participation of older workers using Decennial

[44] Table 4 in the Appendix summarizes how the specifications assign workers in different industries across probability groups.

Censuses up to 1980. For workers above age 60, they find that the presence of a state law banishing age-discrimination raises the employment-population rate by 6%. Although Neumark and Stock's source of identification, data structure, and time period is not directly comparable to the one used here, their results are compatible with the order of magnitude of estimates reported here. Interestingly, without analyzing it in isolation Neumark and Stock report that states passed their own statutes explicitly eliminating mandatory retirement after 1979. If one compares changes in labor force participation rates among older workers in the states that were tough on mandatory retirement to participation in other states, the estimated effect of the end of mandatory retirement is again a little less than 10%.[45]

8. Implicit Contracts and Job Attachment

Age-discrimination laws and mandatory retirement may have economic effects that go beyond a change in labor force participation. In a seminal paper Lazear (1979) has argued that MR was an integral part of efficient implicit contracts between workers and firms.[46] In Lazear's model firms cannot monitor workers' unobservable effort, but they can fire workers if they catch them shirking. By offering employees less than their marginal product at the beginning of their careers and more than their marginal product later in life, a firm implicitly maintains a debt to the worker it can withhold upon malfeasance. As workers earn more than their marginal product at the end of their career, they want to work longer than the optimal retirement date. On the other hand, firms should want to fire workers earlier. Mandatory

[45] Results are available from the author. Care has to be taken in using cross-state variation in laws as source of identification, as these laws may not be equally enforced across states. As a simple check, one can sort states into groups with different degrees of protection against age-discrimination, and see whether the amendments to the federal law in 1978 had bigger effects on states that had not previously passed any age-discrimination laws. The results of such a comparison (not reported here, but available from the author) do not unequivocally support the assertion that state laws were enforced, since employment in both those states with lowest and with highest previous protection against age discrimination appears to have changed in reaction to the federal law. Leahy (2006) also analyzes state-specific responses to the federal law change. Leahy finds that states with prior age-discrimination statutes experienced slight declines in weeks worked in the mid 1970s, but had similar and roughly stable weeks worked around the time of the federal law change (see Figure 1).

[46] It has been a puzzle why firms were willing to enforce compulsory retirement at a particular age – given that workers appeared perfectly employable before. The early literature on MR rather vaguely suggested that firms did so to avoid arbitrariness or costly evaluations of productivity. Lazear's model has also obtained attention since it presents an efficient solution to the moral hazard problem arising when workers' effort is not observable. It also represents one of the few papers addressing the role of employers in workers' retirement decisions.

retirement rules would imply an easily enforceable commitment on both sides to end the implicit contract at the efficient date.[47]

Implicit contract theory gives a few clear predictions regarding the effects of the abolition of MR, most of which have not been directly tested before.[48] If implicit contracts were an important feature of compensation packages of workers covered by MR, then clearly this gives a rationale why workers should want to work longer as it is abolished. In addition, if firms continue to offer implicit contracts, one should see a substitution of MR by other mechanisms to end the contract, such as private pension plans. Their prevalence should increase and their characteristics should change in response to an end of MR (Lazear 1985). Alternatively, firms may react by terminating implicit contracts by their own initiative. This may on the one hand mean firing older workers or reducing their wages. On the other hand, this may imply that firms start to phase out the use of implicit contracts for younger cohorts of workers. In both cases, job attachment should decline and tenure-wage profiles should flatten. Moreover, as wage profiles rotate, the starting wage of workers entering long-term jobs may rise.

In the 1978 National Longitudinal Survey of Older Men, 43% of workers at age 65 had tenure over 20 years, part of which presumably were on long term contracts. If, as estimated above, a fraction of 10% of these workers wanted to work longer, this could have made a significant difference to the way these contracts were implemented or on their role as compensation mechanism. The fraction of workers wanting to work longer among those previously covered by MR is even higher, about 30% (see Table 3). Thus, if implicit contracts indeed played an important role in the compensation of older workers, we should observe some form of change along the lines discussed above.

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[47] Such delayed payment contracts, and thus mandatory retirement, can also be generated by firms' desire to sort workers according to their ability (Wang and Weiss 1998). Papers discussing various aspects of implicit contracts and mandatory retirement are Lang (1989), Stern (1987) and Lapp (1985). Leigh (1984) gives a brief overview of how mandatory retirement could be explained by firm specific human capital alone.

[48] Papers testing Lazear's implicit contract theory specifically for older workers are Hutchens (1986,1987) and Leigh (1984), among others. Hutchens focuses on the particular characteristics of jobs covered by MR, pension plans and stable job-attachment. Leigh repeats Lazear's analysis of the incidence of MR based on the characteristics of older employees.

As information on pension plans, tenure and wages is available from various supplements to the CPS, it is possible to assess those hypotheses directly. Thereby, the group of workers most likely to be covered by MR is that which according Lazear's model is most likely to have been on an implicit contract.[49]

8.1 Job Attachment

Overall, job attachment of older workers has declined since the mid-1980s. Whereas average job-tenure of a worker at age 60 was 17.6 years around 1980, it was only 15.1 years a decade later. This change is in of itself interesting.[50] Using the data from various tenure, mobility and benefit supplements from the CPS, and applying the same imputation procedure as in the rest of the paper, one can compare the change in job-tenure across groups with high- and low-probability of coverage by MR.

Table 11 reproduces regressions of average job tenure by bracket of coverage-probability, as had been done above for the hazard of retirement (see Table 9). The Table shows the slope of the probability-indicator and its change from 1979, the first year in which data on job tenure is available.[51] One would expect job tenure to increase with coverage probability, and the slope to flatten over time if the abolition of MR led to a displacement of older workers or to a reduction in the use of implicit contracts. As it is unclear at which age the strongest impact should occur, separate regressions are shown for older, younger and middle aged workers.

Clearly, average tenure increases significantly with the probability of coverage by MR. In the pre-79 period, for workers age 50 to 70 an increase in the probability of coverage by 10% raises average tenure by about one year. The corresponding effect for workers ages 36-49 and 25-35 is 0.35 and 0.26

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[49] The implications of Lazear's model had also motivated Neumark and Stock (1999)'s work. Citing Lang (1989), they add to Lazear's hypothesis that a high cost of commitment to a particular wage profile may reduce the incidence of implicit contracts. In this case, age-discrimination laws would have the *opposite* implication of the basic model. However, for the implicit contract mechanism to work, the firm's ability to fire workers is crucial. Thus, under costly bonding the impact of age-discrimination laws becomes ambiguous.

[50] These numbers are obtained from the CPS. The downward trend is significant for most ages above forty. Only tenure for workers age 70 increases significantly by 2.5 years.

[51] Tenure is also available in supplements to the January CPS in 1973 and 1978, but due to change in wording of the tenure question these years are difficult to incorporate in the rest of the sample.

years, respectively. However, there is no change in the slope of the indicator over time for older and middle aged workers. The only barely statistically significant change we see is a decline in the relation between the probability of coverage and average job-tenure for younger workers starting in the 1990s. While this is in itself interesting, it is probably too late to be related to age-discrimination laws. Moreover, the importance of implicit contracts in that age-range is less clear.

These results do not suggest a significant relative reduction in job-attachment for older and middle aged workers previously covered by mandatory retirement. Of course, this does not necessarily imply that implicit contracts became less prominent, if pension plans or other features of wage contracts adjusted to substitute for MR.

8.2 Pension Plans

As shown in Figure 1 of the Appendix, coverage by private pensions declined during the 1980s. As already mentioned above, the trend seemed to be common to all workers. In addition, the fraction of defined benefit plans, which can be manipulated more easily to provide particular incentives to retire than defined contribution plans, has fallen from 90% in the early 1970s to 70% in the late 1980s.[52] Thus, from the trends in pension coverage it does not appear that MR retirement was substituted by private pensions. Yet, as coverage among workers affected by MR was very high initially, it may be that the characteristics of these plans were simply changed to discourage workers from staying on their job longer than the implicit contract specified.

Data from the RHS and the Survey of Consumer Finances reported in Andersen, Gustman and Steinmeier (1999) suggest that pension plans have evolved toward encouraging early retirement. While the normal retirement age was 65 in 82% of all pension plans in 1969, this was the case for only 43% of plans in 1983. Further, Anderson et al. (1999) report that the accrual rate of pensions declined for ages

[52] See Gustman and Steinmeier (1992). Dorsey (1987) provides an empirical comparison the circumstances in which the two type of plans are chosen.

around 60 during the 1980s, and that the fraction of plans offering early retirement options rose from 75% to almost 100%.

Yet, the trend toward early retirement slowed during the mid 1980s: the fraction of pension plans with normal retirement age at 65 increased to 54% in 1989. Moreover, the overall impact of changes in pension plans for workers 65 and above was estimated by the Andersen et al. to *increase* labor force participation. They interpret this to be due to the end of common practices such as capping wages service years or reducing wages at age 65 in response to the change in the ADEA, consistent with the results from the first half of the paper.

One way to interpret the data on pension plans is that employers did not need to make pension plans more stringent for employees towards the end of working life because they already had sufficiently increased the incentives for early retirement. Yet, it does not appear from the retirement patterns shown in Figure 2 that the probability of retiring at age 62 rose more for those covered by MR. While there was a slight rise in the mid-1970s, this compensated for a decline in the hazard of retiring at age 62 in the years before and is not significant (see Table 7). From the late 1970s retirement patterns of the two groups move together. Although clearly more research is needed, on balance the evidence from pension plans does not suggest they were used as substitute for the function of MR.

8.3 Tenure-Wage Profiles

The Lazear-model also predicts that, all else equal, tenure-wage profiles of workers covered by mandatory retirement should be steeper than wage-profiles of workers not covered. Specifically, workers covered by mandatory retirement should be on long-term implicit contracts, and their wages should be lower than productivity at the beginning of their career, and higher later. For other workers, wages should be equal to their productivity at all times. Thus, if mandatory retirement linked to implicit contracts was an important feature of the labor market in the 1970s, then the slope estimated tenure-wage profiles for workers with and without MR should differ. In addition, if MR had been a constitutive part of implicit contracts, we would expect that after its elimination wage profiles of workers traditionally covered by mandatory retirement become flatter.

Figure 7 shows estimated tenure-wage profiles separately for workers covered and not covered by mandatory retirement rules in 1969. The figure displays the coefficients on indicators for five-year intervals of job tenure in a standard Mincerian-regression of log average weekly earnings from the Retirement History Survey (RHS).[53] Since job-tenure may be endogenously determined, these estimates should be seen more as an empirical correlation rather than as causal estimates of the return to tenure. Strikingly, Figure 7 shows that even before the elimination of mandatory retirement the wage-patterns predicted by the Lazear-model do not attain. For job-tenure less or equal 30 years, the estimated tenure-profiles for the two groups of workers are essentially identical. The only difference occurs for workers at more than 30 years of tenure. Such a long job attachment occurs for only 20% of those with, and 10% of those without mandatory retirement.

This result has no implication regarding implicit contracts if workers not covered by mandatory retirement had steeper productivity-profiles. However, this is unlikely, as workers not covered by MR tended to lower higher education, lower average wages and shorter tenure-spells. Workers not covered also tended to work in low-wage industries. Nevertheless, even if uncovered workers with high job tenure were positively selected based on unobserved skills, it would not affect a comparison of wage-profiles over time. This is shown in Figure 8. The figure shows estimated coefficients on five-year tenure dummies separately for groups with high and low probability of being covered by mandatory retirement in the Current Population Survey. Note that instead of having to estimate tenure-wage profiles in a cross-section, the CPS allows me to make a comparison across different *cohorts* of entry into the labor market who should have been more or less affected by mandatory retirement.[54]

[53] The sample includes all male employees from the 1969 RHS with valid observation on average weekly earnings. Other independent variables are years of education, potential labor market experience, experience squared, and a dummy for being black. The excluded tenure bracket is that of workers with less than one year of tenure. The age range of workers in the 1969 RHS is 58 to 63.

[54] The data from the CPS supplements is described in the notes to Table 11. The coefficients are obtained by a regression of log real average weekly earnings on education, experience, experience squared, a dummy for black,

The left hand panel shows the wage-profiles for workers with high and low probability of coverage by mandatory retirement that entered the labor market between 1934 and 1968. These are the workers beginning to work in an environment were mandatory retirement was pervasive and legal. Again, the graphs do not show the wage-profile of workers with high probability of MR coverage to be steeper. The second graph shows the same for workers who entered between 1969 and 1985, a period in which the importance of mandatory retirement was declining.[55] To keep the two cohorts comparable, only workers between the ages of 30 and 50 are kept in the sample. Comparing the two panels of Figure 8, it is obvious that very little seems to change across cohorts. In particular, the group of workers in the younger cohort who would have had a high chance of being covered by MR, and who thus should have been most affected by its elimination, does not experience a rotation of the tenure-wage profile.[56]

In summary, there seems to be no evidence for a change in job attachment or pension plans in response to the elimination of mandatory retirement. Moreover, the predictions of implicit contract theory for wage-profiles do not seem to hold for the period before the change. Neither are wage profiles of workers covered by mandatory retirement steeper than profiles of workers not covered before the change, nor do they rotate after the end of mandatory retirement. The section started out by claiming that if a large fraction of older workers were covered by implicit contracts, at least some of the predictions of implicit contract theory should have appeared in the data. While these preliminary results cast some doubt on the

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and five-year tenure dummies. To achieve comparability across years, wages are top-coded at $1000 in 1983 prices. Observations of weekly wages with less than $40 are dropped. The results are not affected by a change in the topcoding of wages.

[55] To be able to estimate tenure-wage profiles for higher tenure years in the younger cohort, too, the transition period of the 1970s is included as well. Excluding it does not affect the basic result.

[56] These results may appear at odds with findings by Neumark and Stock (1999), who analyze changes in age-gradients at the cohort-level using observations on earnings from five calendar years (corresponding to five Censuses up to 1980). However, the results are not comparable for multiple reasons. First, here we use annual data and look for effects in the 1980s and 1990s of changes in federal mandatory retirement rules in 1979. We thus have many more observation per cohort, a different time period, and a different law change. Second, our data allows us to focus on correlation of wages and job tenure, which may be more directly related to the prediction of the contracting model. Last, we help to draw a cohesive picture by complementing our analysis on wages with incidence of job tenure and pension plans.

pervasiveness of the implicit contract model, it may still be that these contracts end in a way unrelated to MR or pension plans. This is a subject for future research.

9. Conclusion

This paper has analyzed the economic effects of the elimination of mandatory retirement by an amendment of the Age Discrimination in Employment Act in 1979. I take advantage of differences across workers in the probability of coverage by mandatory retirement (MR) to study the relative changes in labor force attachment of older workers from the 1970s to the 1990s. The results indicate that in the 1970s there were two distinct groups in the labor force. One was characterized by mandatory retirement and a very high incidence of retirement at age 65, the other was not covered by mandatory retirement and had a much smaller spike of retirement at the ‘normal’ age. After mandatory retirement was eliminated by the Amendments to the Age Discrimination in Employment Act, this difference gradually disappears: by the 1990s the group of workers with high previous MR coverage had retirement age profiles very similar to those with low previous coverage. The changes suggest the abolition of MR raised labor force participation of workers age 65 to 70 by 10% to 20% in the course of the 1980s.

These results provide a first direct estimate of the effect of federal age-discrimination legislation on retirement patterns and labor force participation. The range of estimates confirms numbers from the previous literature on MR based on policy simulations or surveys made before the change. The preferred estimate of the Department of Labor developed in anticipation of the 1978 amendments of the ADEA, lies on the lower bound of this range. The paper also contributes to the literature on puzzles and trends in retirement behavior – whereas there is still an unexplained spike of retirement at age 65 today, the evidence here suggests that it was much bigger in the early 1970s and has declined since then, due to a significant extent to the end of MR. Overall, the paper implies policies aiming to raise labor force participation of older workers do seem to have some effect.

The paper has also provided evidence from the end of MR on the prevalence of implicit contracts among older workers. The tilted wage-profiles implied by such contracts gave employees an incentive to work longer, and should have triggered employers to either substitute MR by private pension plans or to move away from these types of contracts. However, one does neither see a change in pension plans affecting workers previously covered by MR, nor a decline in their job attachment. Moreover, before the change tenure-wage profiles of workers covered by mandatory retirement were not steeper than profiles of uncovered workers. Similarly, no rotation of wage profiles occurred after the abolition of mandatory retirement. Thus, if implicit contracts were an important aspect of the labor market, there must have been other ways than mandatory retirement or pension plans to end long-term relationships between firms and employees.

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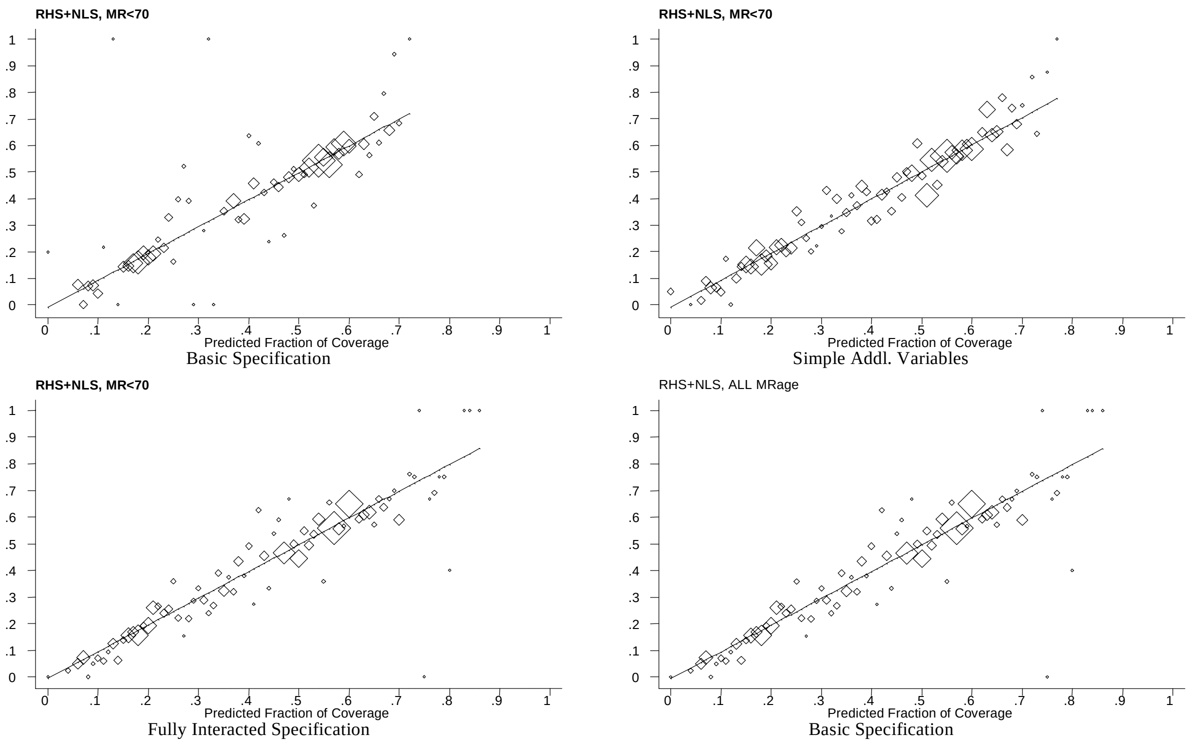
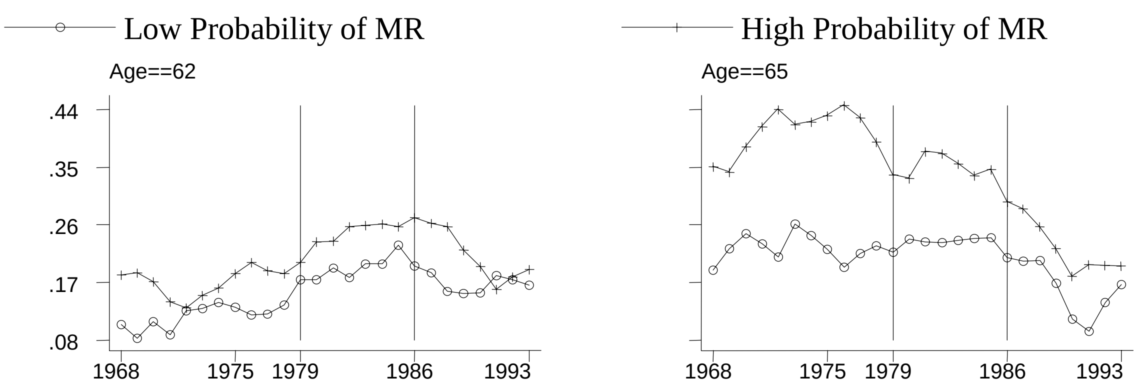


Figure 1: Actual vs. Predicted Coverage by Mandatory Retirement



Mandatory Retirement at Age 65 Outlawed in 1979

Figure 2: Hazard of Retiring Across Probability-Groups

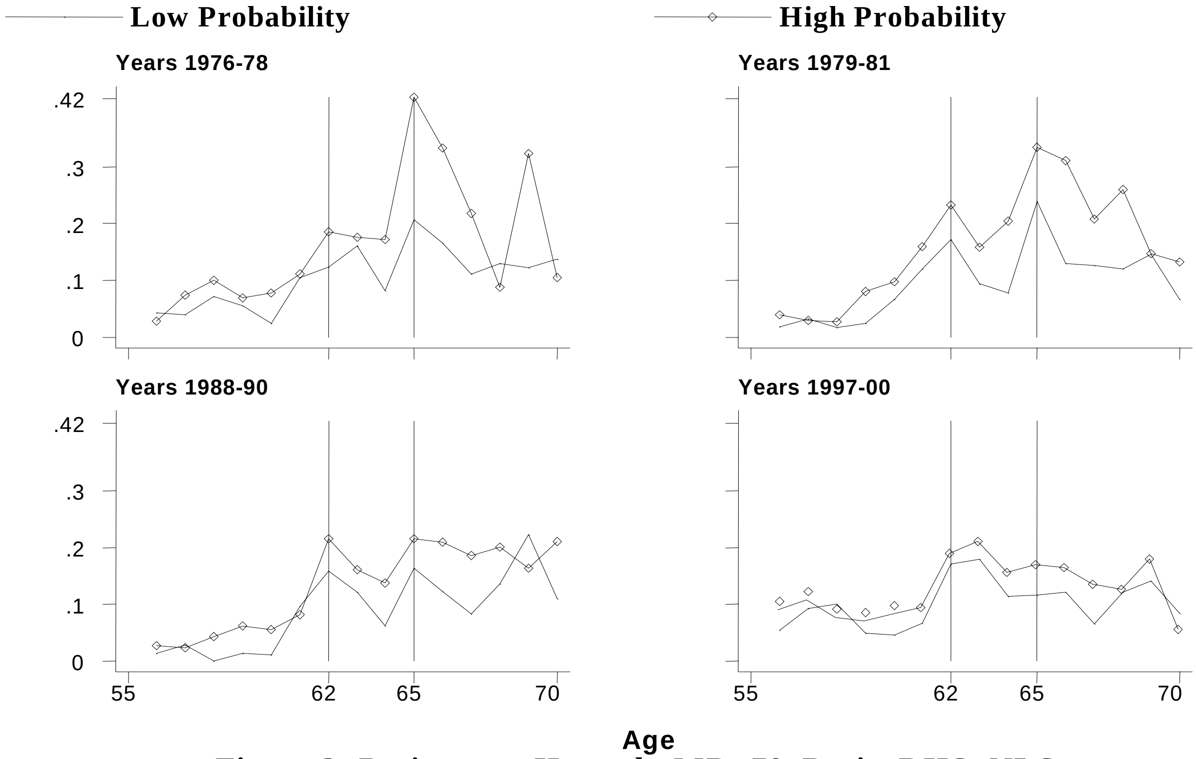


Figure 3: Retirement Hazard - MR<70, Basic, RHS+NLS

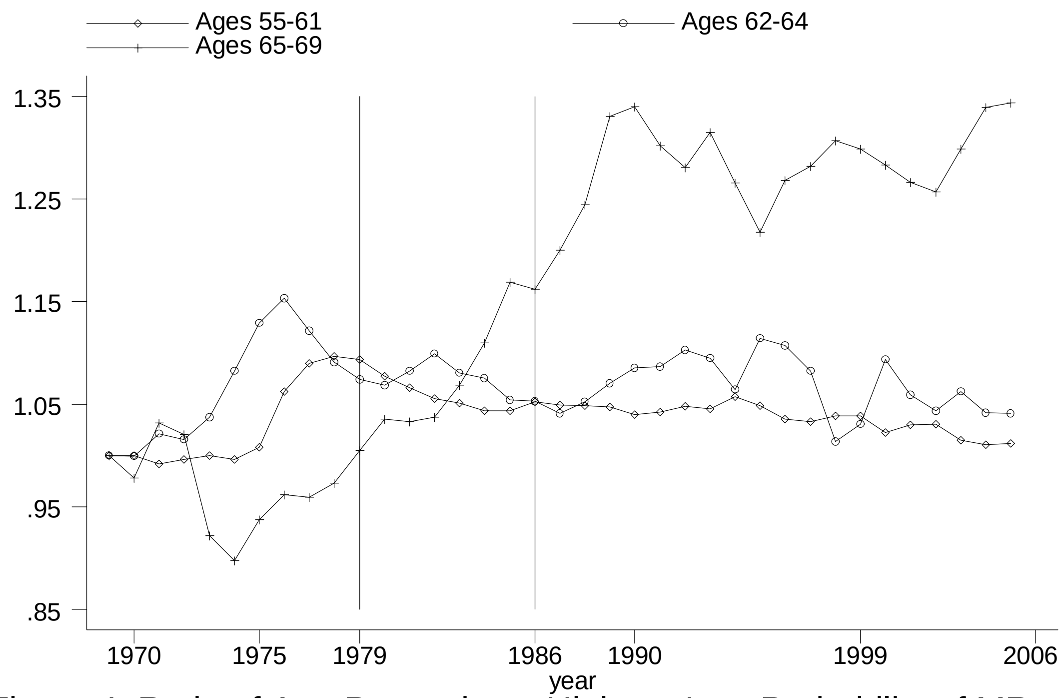


Figure 4: Ratio of Age Proportions: High vs. Low Probability of MR

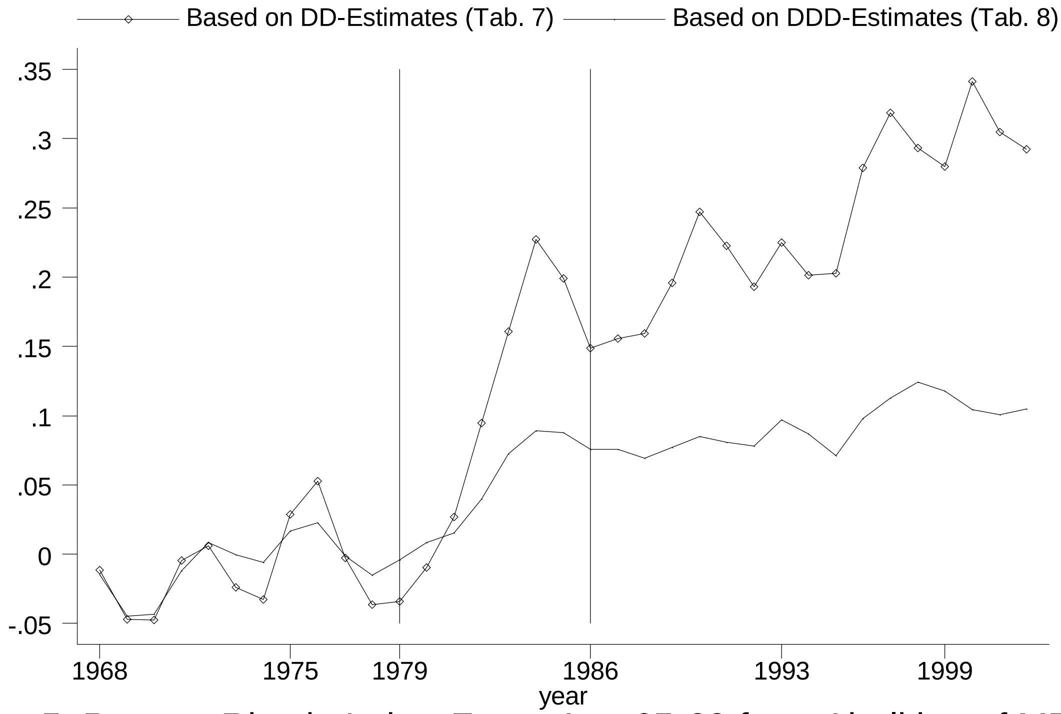


Figure 5: Percent Rise in Labor Force Age 65-69 from Abolition of MR

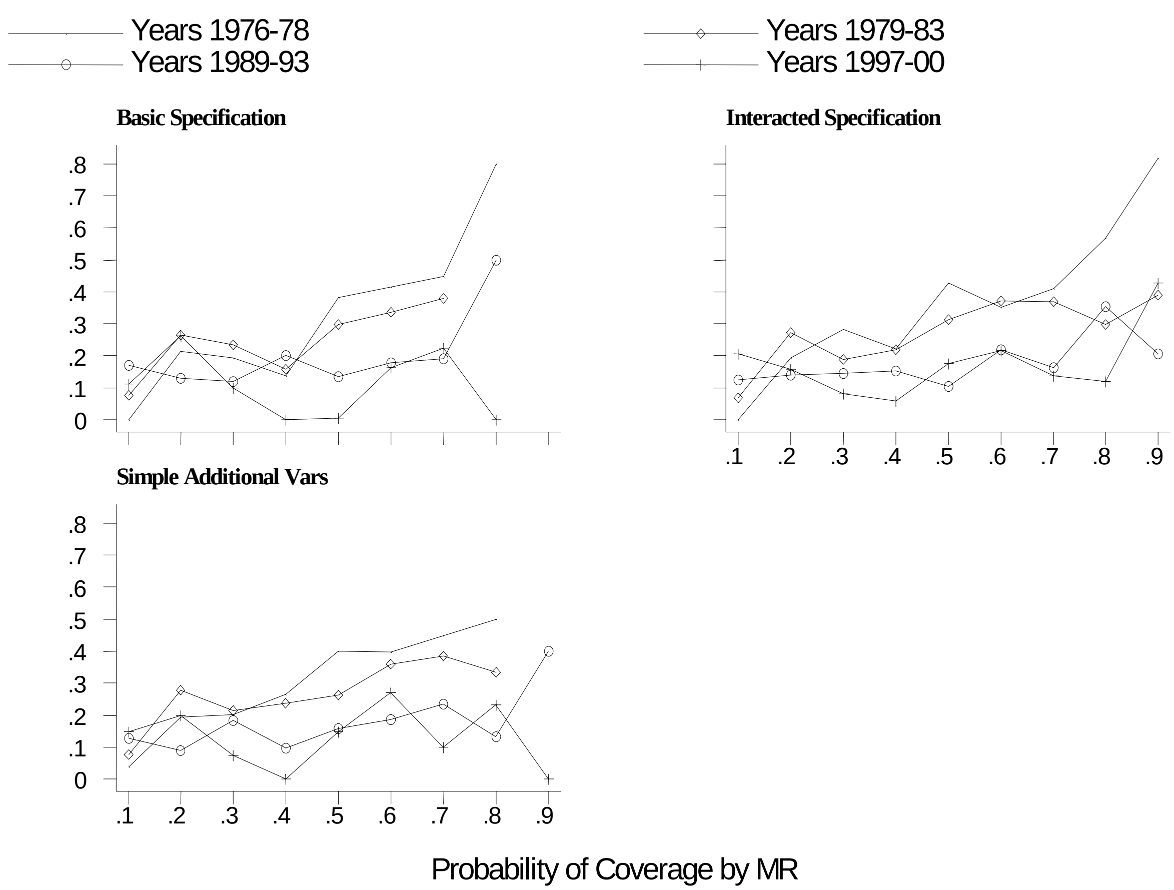


Figure 6: Retirement Hazard by Prob-Brackets

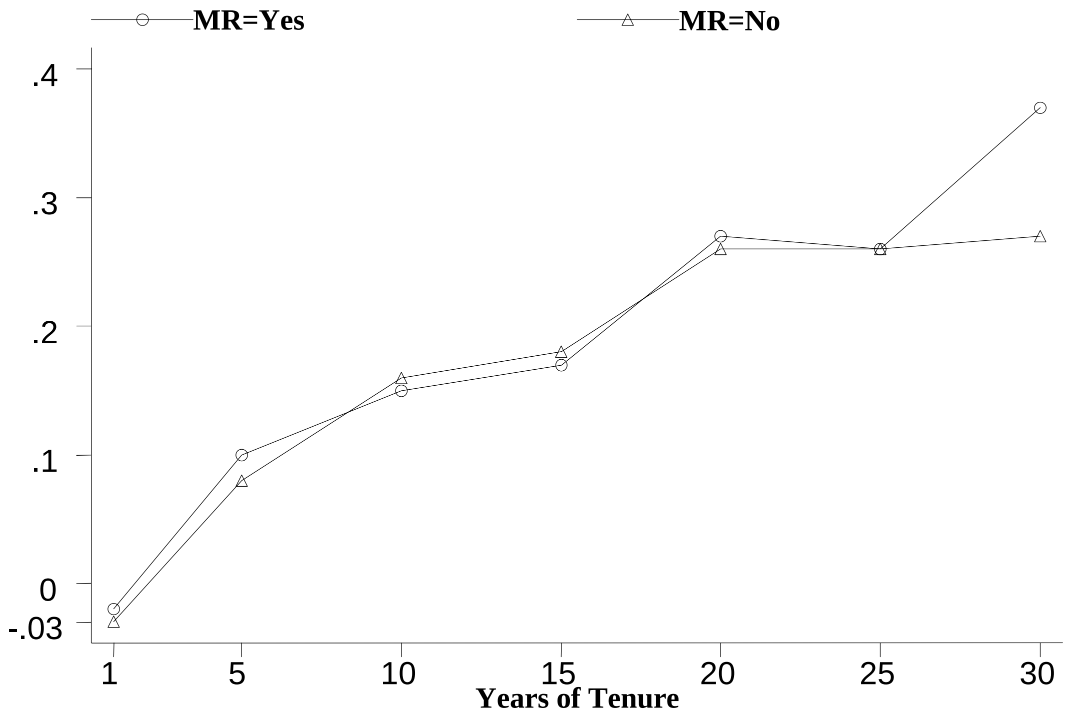
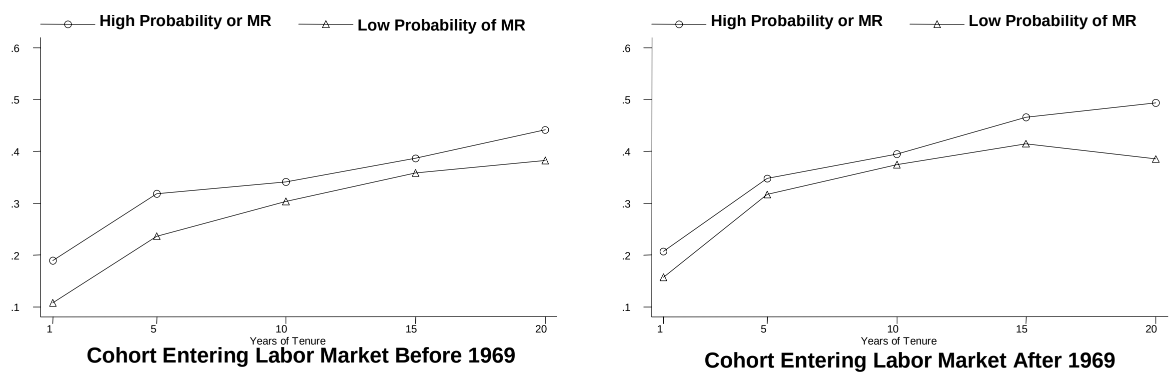
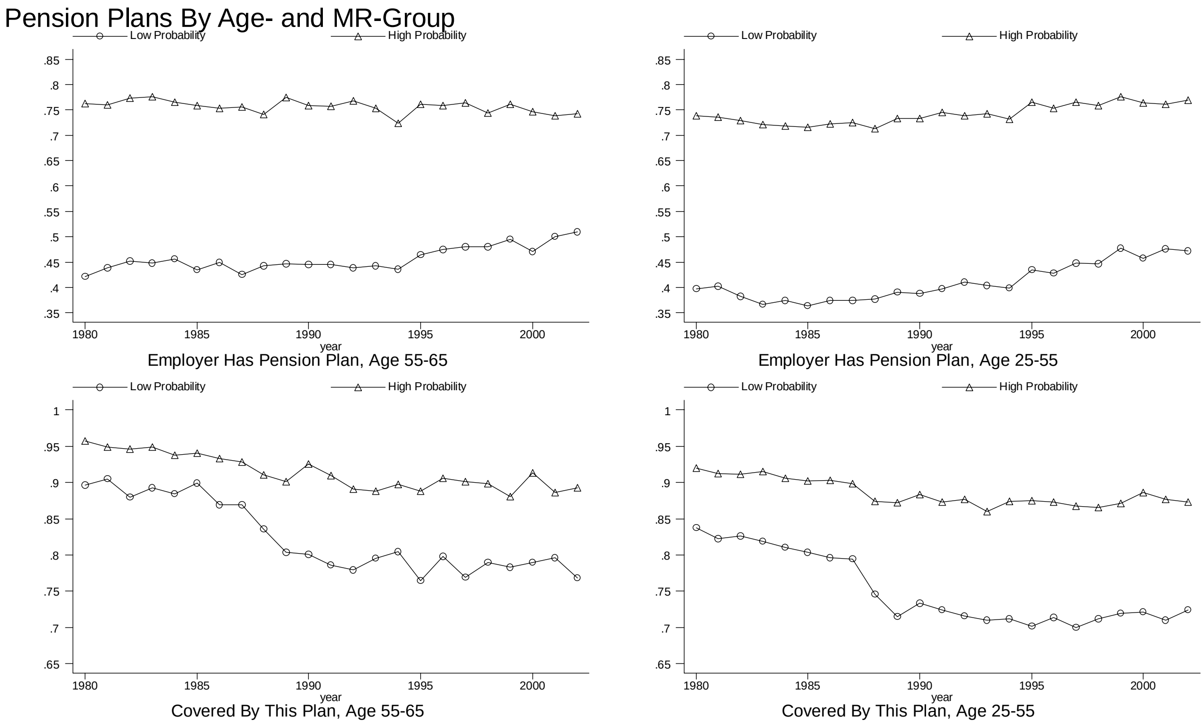


Figure 7: Tenure-Wage Profiles: Retirement History Survey 1969, Ages 58-63



Age Range 30 to 50

Figure 8: Tenure-Wage Profiles Across Cohorts and Probability Groups



App Fig 1: Employer Pensions Plans by Mandatory Retirement Groups

Table 1: The US Age in Employment Discrimination Act (ADEA) of 1967 and its Amendments

Year of Passage/ Amendment	Covered Age Range	Effective Enforcement
1967	**40-65**	**Department of Labor**
1978	**40-70**	**" "**
1979(*)	**40-70**	**EEOC**
1986	**40 and above**	**" "**

Source: The US Equal Employment Opportunity Commission (EEOC) (2001), 'The Age Discrimination in Employment Act of 1967,' http://www.eeoc.gov/laws/adea.html.

Notes: (*) The 1978 amendment transfered enforcement to the EEOC effective January 1979.

Table 2: Legislation Affecting Age-Discrimination in Employment and Mandatory Retirement Rules

	Protection against Age-Discrimination	Country	Mandatory Retirement Prohibited	Year Enacted	Determination of Retirement Age, Coverage of Age-Discrimination Law, and Other Specifics
EU	**General**	Belgium	Yes	2007	MR allowed only for certain occupations.
		Ireland	No	2004	Protection at all ages. MR allowed .
		Finland	No	2004	MR allowed at age 68
		Netherlands	No	2004	MR allowed at age 65
		Spain	No	2003	Retirement age set by collective bargaining/individual employment contract.
		Sweden	No	2001	MR allowed at age 65, 70 starting in 2010.
		Portugal	No	2006	MR allowed at age 65; 67 from 2012-2029.
		Austria	No	2006	MR allowed at age 65; Proposed legislation to abolish MR.
		Denmark	No	2009	MR allowed at age 67; Reduced rights age 67+.
		France	No	2004	MR allowed at age 70.
		Germany	No	2004	MR allowed at age 70.
		Italy	No	2003	Anti-discrimination legislation does not prohibit mandatory retirement.
		UK	No	2003	MR allowed at 65.
Non-EU	**General**	USA	Yes	1978	All ages 40+. 70+ protected since 1986.
		Canada	Yes	1982	MR to be abolished in all provinces by July 1, 2009.
		Australia	Yes	2004	
	None	Japan	No	-	

Sources: Gruber and Wise (1998). European Commission (2005). Rowntree Foundation (2001). www.agediscrimination.info. Text of Non-Discrimination Acts of the respective country.

Notes: General protection means older workers are protected from unfair treatment in promotion, hiring, and dismissal. Most countries allow for mandatory retirement if age is part of an occupational qualification (e.g., in the case of airline pilots).

Table 3: Fraction of Male Employees Covered by Mandatory Retirement

	1966	1967	1969	1971	1976	1978	1980	1981	1983
Total Fraction Covered by MR	**0.45**	**0.47**	**0.44**	**0.47**	**0.49**	**0.39**	**0.28**	**0.19**	**0.22**
Fraction Covered at MR-Age<70	**0.36**	**0.38**	**0.36**	**0.38**	**0.40**	**0.28**	**0.12**	**0.07**	**0.06**
Fraction Wanting to Work Longer	0.44	0.34	0.37	0.31	0.31	0.25	0.39	0.33	0.27
Number Covered at MR-Age<70	343	402	549	594	551	255	72	44	11
Fraction Covered at MR-Age>=70	**0.09**	**0.09**	**0.08**	**0.09**	**0.09**	**0.11**	**0.16**	**0.11**	**0.16**
Fraction Wanting to Work Longer	0.25	0.15	0.22	0.21	0.20	0.20	0.17	0.20	0.16
Number Covered at MR-Age>=70	82	92	491	139	125	97	97	66	31

Notes: National Longitudinal Survey of Older Men, 1966-1983. Sample is restricted to male employees between ages 55 and 64 with valid observations on mandatory retirement.

Table 4: Coverage by Mandatory Retirement Coverage Across Different Groups of Workers in NLS and RHS

	1960s-70s		1980s	
	MR<70	MR>=70	MR<70	MR>=70
Total	0.37	0.10	0.09	0.14
High Education	0.42	0.17	0.08	0.26
Low Education	0.36	0.08	0.10	0.11
White Collar	0.39	0.17	0.07	0.22
Blue Collar	0.37	0.07	0.10	0.10
In SMSA	0.40	0.10	0.10	0.14
Not in SMSA	0.31	0.09	0.08	0.15
Agriculture	0.08	0.02	0.02	0.05
Mining	0.41	0.02	0.11	0
Construction	0.17	0.08	0.04	0.07
Manufacturing	0.55	0.02	0.12	0.19
Transp, Communication	0.52	0.10	0.16	0.15
Trade	0.19	0.01	0.04	0.06
FIRE	0.37	0.06	0.04	0.09
Business Services	0.21	0.02	0.06	0.06
Private Services	0.04	0	0	0
Entertainment	0.13	0.06	0.11	0.11
Professional Services	0.33	0.23	0.08	0.20
Government	0.23	0.53	0.16	0.20
New England	0.38	0.11	-	-
Middle Atlantic	0.37	0.10	-	-
E.N. Central	0.51	0.06	-	-
W.N. Central	0.27	0.09	-	-
South Atlantic	0.30	0.10	-	-
E.S. Central	0.34	0.05	-	-
W.S. Central	0.30	0.09	-	-
Mountain	0.34	0.10	-	-
Pacific	0.42	0.10	-	-

Notes: Retirement History Survey, 1969 and National Longitudinal Survey of Older Men, 1966-1983. Sample consists of male employees age 55 to 64. Division of residence is not reported in the latter years of the surveys. High education is defined as at least 13 years of college. Numbers in the first column are counts of positive respondends for all years and all mandatory retirement-ages.

Table 5: Basic Sample Statistics

	RHS and NLS 1966-1976	CPS 1968-1978	CPS 1968-2006
N	9867	217822	1681013
Mean Age	58.85	58.75	59.91
Mean Education	9.82	11.03	12.55
Fraction Black	0.08	0.09	0.11
Fraction White Collar	0.32	0.36	0.52
Fraction Smsa	0.71	0.67	0.65
Fraction RHS	0.37	-	-
Agriculture	0.03	0.02	0.02
Mining	0.01	0.01	0.01
Construction	0.10	0.09	0.08
Manufacturing	0.35	0.34	0.25
Transp, Communication	0.12	0.10	0.10
Trade	0.12	0.15	0.16
FIRE	0.04	0.05	0.06
Business Services	0.02	0.03	0.05
Private Services	0.02	0.02	0.02
Entertainment	0.01	0.01	0.01
Professional Services	0.10	0.11	0.16
Government	0.08	0.08	0.06
New England	0.07	0.07	0.06
Middle Atlantic	0.21	0.20	0.17
E.N. Central	0.21	0.20	0.18
W.N. Central	0.07	0.07	0.07
South Atlantic	0.15	0.14	0.18
E.S. Central	0.06	0.06	0.06
W.S. Central	0.09	0.09	0.10
Mountain	0.03	0.04	0.05
Pacific	0.12	0.13	0.14
Fraction With MR			
All	47.0	-	-
MR<70	37.2	-	-
MR>=70	9.8	-	-

Notes: RHS (Retirement History Survey), NLS (National Longitudinal Survey of Older Men) and CPS (Current Population Survey). Sample consists of male employees ages 55 to 64 with valid observations on industry ad education. Sampling weights are used. Information on division is only available in NLS.

Table 6: Sample Means Across Groups with High and Low Coverage by Mandatory Retirement in RHS, NLS and CPS

	Original Sample by Actual Coverage		CPS Sample by Predicted Probability of Coverage	
	No	**Yes**	**Low**	**High**
Fraction of Total	0.54	0.37	**0.45**	**0.55**
Mean Age	58.62	58.25	**58.92**	**58.66**
Mean Education	9.34	10.09	**10.32**	**11.56**
Fraction Black	0.09	0.09	**0.10**	**0.08**
Fraction White Collar	0.28	0.34	**0.31**	**0.40**
Fraction Smsa	0.70	0.77	**0.63**	**0.69**
Agriculture	0.05	0.01	**0.05**	**0**
Mining	0.01	0.01	**0.03**	**0.01**
Construction	0.14	0.04	**0.20**	**0**
Manufacturing	0.28	0.50	**0**	**0.61**
Transp, Communication	0.07	0.16	**0**	**0.18**
Trade	0.20	0.07	**0.34**	**0**
FIRE	0.05	0.05	**0.08**	**0.02**
Business Services	0.03	0.01	**0.06**	**0**
Private Services	0.02	0.002	**0.04**	**0**
Entertainment	0.01	0.005	**0.02**	**0**
Professional Services	0.09	0.08	**0.14**	**0.08**
Government	0.04	0.05	**0.04**	**0.11**
New England	0.05	0.06	**0.06**	**0.09**
Middle Atlantic	0.18	0.18	**0.18**	**0.20**
E.N. Central	0.16	0.27	**0.16**	**0.23**
W.N. Central	0.07	0.05	**0.09**	**0.07**
South Atlantic	0.22	0.16	**0.15**	**0.13**
E.S. Central	0.08	0.06	**0.06**	**0.06**
W.S. Central	0.11	0.08	**0.10**	**0.08**
Mountain	0.03	0.02	**0.07**	**0.04**
Pacific	0.10	0.12	**0.13**	**0.12**

Notes: Left hand columns: RHS (1969) and NLS (1966 to 1976), male employees age 55 to 64. Sample in left hand column consists of all those reporting age 65 or less as their mandatory retirement age. Sample in right hand column consists of all those reporting no mandatory retirement. Fraction MR doesn't add up to one due to workers covered at age 70 and above, which are excluded. Information on division only available in the NLS. The fractions are similar among the RHS and NLS taken separately. Sampling weights are used.

Right hand columns: CPS, own Calculations. Imputation is done using basic specification for all those covered by mandatory retirement at ages smaller than 70 (see text). Ages 55 to 64 only. Sampling weights are used.

Table 7: Difference-in-Difference Analysis of Retirement Probabilities

Age	Year-Group	Low Prob	High Prob	Difference	Diff-in-Diff Relative to 1968
65	**1968-1978**	0.22	0.43	**0.21**	-
		(0.019)	(0.016)	(0.024)	-
	1979-1983	0.24	0.36	**0.12**	**-0.09**
		(0.023)	(0.024)	(0.033)	(0.041)
	1984-1988	0.24	0.35	**0.11**	*-0.10*
		(0.038)	(0.031)	(0.049)	(0.054)
	1989-1993	0.17	0.23	**0.06**	**-0.14**
		(0.024)	(0.02)	(0.031)	(0.04)
	1994-1996	0.14	0.22	**0.09**	**-0.12**
		(0.029)	(0.028)	(0.041)	(0.047)
	1997-2000	0.11	0.19	*0.08*	**-0.12**
		(0.037)	(0.033)	(0.05)	(0.055)
	2001-2006	0.05	0.19	**0.15**	-0.06
		(0.029)	(0.024)	(0.037)	(0.045)
62	**1968-1978**	0.12	0.17	0.05	0.00
		(0.019)	(0.015)	(0.024)	(0.)
	1979-1983	0.20	0.23	0.03	-0.02
		(0.023)	(0.02)	(0.03)	(0.039)
	1984-1988	0.20	0.29	**0.09**	0.04
		(0.029)	(0.015)	(0.032)	(0.04)
	1989-1993	0.18	0.24	**0.06**	0.007
		(0.022)	(0.016)	(0.027)	(0.036)
	1994-1996	0.16	0.19	0.04	-0.02
		(0.023)	(0.022)	(0.032)	(0.04)
	1997-2000	0.18	0.21	0.03	-0.02
		(0.032)	(0.024)	(0.039)	(0.046)
	2001-2006	0.13	0.22	**0.08**	0.033
		(0.021)	(0.017)	(0.028)	(0.037)

Notes: Standard errors in parentheses. Bold coefficients are significantly different from zero at 5% level, italicized coefficients are significant at 10% level. Dependent variable is the annual cross-sectional hazard of retiring, computed from the CPS. Dummies for year-groups are included. The regression uses the variances of the hazards as weights to adjust for heteroscedasticity and to account for differences in cell-size. These variances are calculated from the variances of the corresponding proportions using the delta-method. The latter variances are corrected for correlation within rotation groups due to repeated observations using STATA's cluster command. Standard errors are not corrected for potential moving average component. In a few cells the columns don't add up due to rounding.

Table 8: Regression of Tripple-Differences of Age Proportions in Employment

	55-61		65-69			
Year-Group	**P(MR)= Low**	**P(MR)= High**	**P(MR)= Low**	**P(MR)= High**	**Diff-Diff Across Groups Within Years**	**Change of Diff-Diff Over Time**
1968-1978	0.086	0.104	0.03	0.016	**-0.032**	**-**
	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0008)	-
1979-1981	0.087	0.106	0.029	0.016	**-0.032**	-0.0002
	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0009)	(0.0012)
1982-1985	0.090	0.106	0.027	0.016	**-0.026**	**0.005**
	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.001)	(0.0013)
1986-1989	0.086	0.101	0.031	0.021	**-0.025**	**0.006**
	(0.0007)	(0.0006)	(0.0006)	(0.0005)	(0.0011)	(0.0014)
1990-1993	0.082	0.095	0.034	0.026	**-0.022**	**0.009**
	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.001)	(0.0013)
1994-1996	0.085	0.099	0.032	0.022	**-0.024**	**0.008**
	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0013)	(0.0015)
1997-2000	0.087	0.100	0.030	0.022	**-0.022**	**0.010**
	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0013)	(0.0015)
2001-2006	0.089	0.101	0.029	0.021	**-0.021**	**0.011**
	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.001)	(0.0013)

Notes: Standard errors are in parentheses. Bold effects in the last two columns are significantly different from zero at 5% level. Dependent variable is the proportion of workers in a given age*year*mandatory retirement*rotation*month-cell. Controls include dummies for MR-group, age-group, year-group, and all possible interactions. The coefficient in the last column is the coefficient in this regression on the three-way interaction of age-, year-, and mandatory retirement groups. Base-category is that with ages 55-61, years 1968-78 and group with low probability of coverage by mandatory retirement. Standard errors are clustered at the level of rotation group to account for multiple observations on individuals within and across years.

Table 9: Regression of Retirement Hazards on Probability-Indicator

	Age 65		Age 62	
	Constant	**Slope**	**Constant**	**Slope**
Base Period				
1968-1978	**0.10**	**0.49**	**0.08**	*0.14*
	(0.04)	(0.08)	(0.04)	(0.08)
Change				
1979-1983	0.05	-0.18	0.07	0.00
	(0.06)	(0.12)	(0.05)	(0.1)
1984-1988	0.06	**-0.24**	*0.10*	-0.03
	(0.06)	(0.12)	(0.05)	(0.11)
1989-1993	0.01	**-0.37**	0.06	-0.06
	(0.06)	(0.12)	(0.06)	(0.11)
1994-1996	-0.12	-0.07	0.03	0.01
	(0.1)	(0.18)	(0.08)	(0.15)
1997-2000	0.05	**-0.47**	0.04	-0.003
	(0.08)	(0.15)	(0.07)	(0.13)
2001-2006	-0.08	**-0.25**	0.02	0.01
	(0.07)	(0.13)	(0.06)	(0.11)
Chi-Squared	0.10		0.08	
(P-Value)	(0.99)		(0.99)	

Note: CPS, 1968-2000. Standard errors are in parentheses. Bold coefficients are significant at 5% level, italicized coefficients at the 10% level. The dependend variable is the hazard of retiring at the given age in different years and with different probabilities of coverage. The probability index is split into ten equal intervals, within which the hazard is computed. If the imputation is successful, the hazard of retiring at age 65 should increase across the ten intervals. Thus, the regressors are a linear trend across the ten probability brackets, a constant, and interactions of each with year-groups. To correct for heteroscedasticity, the inverse sampling variances of the hazards are used as weights. These variances are computed in a first stage accounting for the clustering of the standard errors. The weighted sum of squared residuals can be used to test the specification relative to an unrestricted model. It is distributed chi-squared with N-k degrees of freedom (these are 34 and 36 for the two regressions, respectively).

Table 10: Sensitivity Analysis - Main Outcomes for Different Specifications used for Imputing Coverage by MR

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Quality of Imputation (R^2)	0.944	0.943	0.95	0.948	0.945	0.925
Difference in Hazards	**0.21**	**0.21**	**0.15**	**0.20**	**0.18**	**0.25**
Change in Difference						
1979-1985	**-0.09**	**-0.07**	0.01	**-0.10**	**-0.09**	*-0.08*
1986-1993	**-0.15**	**-0.13**	-0.04	**-0.14**	**-0.13**	**-0.17**
1994-2000	**-0.10**	**-0.11**	*-0.09*	**-0.11**	*-0.08*	**-0.15**
2001-2006	-0.06	**-0.10**	-0.03	-0.07	-0.02	*-0.09*
Slope of Probability-Index	**0.49**	**0.50**	**0.43**	**0.36**	**0.46**	**0.56**
Change over Time						
1979-1985	*-0.19*	-0.15	-0.06	-0.15	*-0.21*	-0.17
1986-1993	**-0.34**	**-0.30**	**-0.25**	**-0.24**	**-0.30**	**-0.34**
1994-2000	**-0.28**	*-0.28*	-0.21	-0.14	*-0.24*	*-0.29*
2001-2006	*-0.25*	-0.17	*-0.12*	-0.17	-0.16	*-0.31*
Chi-Squared Test	0.06	0.08	0.09	0.15	0.07	0.09
Proportional Difference in Labor Force Age 65-69 Implied By Diff-in-Diff						
1979-1985	0.07	0.05	-0.01	0.08	0.06	0.05
1986-1993	0.10	0.08	0.02	0.09	0.08	0.11
1994-2000	0.06	0.06	0.05	0.06	0.04	0.09
2001-2006	0.03	0.06	0.02	0.04	0.01	0.05
Proportional Difference in Labor Force Age 65-69 Implied By DDD-Estimates						
1979-1985	0.07	0.03	-0.09	0.11	0.11	0.06
1986-1993	0.19	0.12	-0.03	0.20	0.19	0.16
1994-2000	0.34	0.19	0.04	0.33	0.24	0.22
2001-2006	0.31	0.25	0.03	0.33	0.21	0.29

Specifications:

(1) RHS+NLS, MR<70, Basic Imputation Based on Industry and Education **[Main Model]**

(2) RHS+NLS, MR<70, Additional Variables in Imputation (White Collar, SMSA, Division)

(3) RHS+NLS, MR<70, Interactions of Industry, White Collar with Education

(4) RHS+NLS, All MR Ages, Basic Imputation

(5) RHS, MR<70, Basic Imputation

(6) NLS, MR<70, Basic Imputation

Notes: Bold coefficients are significantly different from zero at the 5% level. Italicized coefficients are significant at the 10% level. The 'quality of imputation' is the R^2 from a regression in the RHS+NLS of the probability of MR conditional on the fitted probability of coverage on a linear trend. If the fit is perfect, the conditional probabilities would all lie on a line with slope one and intercept zero. All the estimated regressions have slopes and intercept insignificantly different from one and zero, respectively. See Table 9 regarding the Chi-Squared Test. The corresponding P-value for all columns is 0.99. The implied effects on the labor force are calculated assuming that 40% percent of the labor force is potentially affected by the change.

Table 11: Average Tenure by Intervals of Probability of Coverage by MR

Age-Group	50-70		36-49		25-35	
	Constant	Slope	Constant	Slope	Constant	Slope
Base Period						
1979+1983	**10.09**	**10.12**	**6.96**	**3.52**	**3.13**	**2.60**
	(1.64)	(3.31)	(0.99)	(1.93)	(0.34)	(0.69)
Change						
1987-1993	-0.78	0.16	-0.89	2.52	0.69	-1.63
	(2.30)	(4.58)	(1.40)	(2.74)	(0.49)	(0.97)
1996-2006	-1.47	-2.34	-1.54	2.02	0.33	*-1.75*
	(2.28)	(4.54)	(1.39)	(2.75)	(0.49)	(0.98)
Chi-Squared	7.0		4.4		1.0	
(P-Value)	(0.99)		(0.99)		(0.99)	

Notes: Standard errors are in parentheses. Bold coefficients are significantly different from zero at the 5% level, and italicized coefficients are significant at the 10% level. Data is from CPS Tenure and Mobility Supplements (1983,1987,1996,1998,2000,2002,2004,2006), CPS Pension and Benefit Supplements (1979,1988,1993), and CPS Training Supplement (1991). Average tenure by ten probability brackets is regressed on an index, a constant, dummies for two year-groups and interactions of year-groups and index. Cell size by bracket is used as weight. Results are similar if 100 brackets are used. The Chi-Squared 'goodness-of-fit' statistics are the residual sum of squares of the same regressions weighted by the inverse of the standard deviation of tenure within probability brackets. Degrees of freedom are 18 in each case.

App Table 1: Coefficients of Various Probit Models of Coverage by Mandatory Retirement

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Constant	0.003	**-0.15**	**-0.18**	-0.01	**-0.05**	**0.01**
Education	**0.05**	**0.08**	**0.08**	**0.13**	**0.16**	**0.10**
Black	0.06	0.07	0.08	0.03	**0.11**	**0.03**
Agriculture	**-1.50**	**-1.43**	**-1.49**	**-1.42**	**-1.71**	**-1.44**
Mining	**-0.24**	*-0.21*	**-0.36**	**-0.24**	**-0.20**	**-0.26**
Construction	**-1.08**	**-1.07**	**-0.84**	**-0.84**	**-1.24**	**-1.01**
Transp, Communication	0.03	-	-0.0003	**0.13**	**-0.15**	**0.14**
Trade	**-1.04**	**-1.04**	**-1.08**	**-1.04**	**-1.19**	**-0.98**
FIRE	**-0.45**	**-0.46**	**-0.67**	**-0.40**	**-0.50**	**-0.41**
Business Services	**-0.96**	**-0.97**	**-0.56**	**-0.94**	**-0.72**	**-1.13**
Private Services	**-1.71**	**-1.74**	**-1.74**	**-1.72**	**-1.77**	**-1.66**
Entertainment	**-1.09**	**-1.09**	*-0.48*	**-0.89**	**-1.18**	**-1.05**
Professional Services	**-0.45**	**-0.44**	0.08	**-0.13**	**-0.40**	**-0.48**
Government	**-0.16**	**-0.17**	0.01	**0.54**	**-0.08**	**-0.19**
RHS-Dummy	0.05	**0.07**	0.0009	**0.09**	-	-
SMSA	-	**0.12**	**0.25**	-	-	-
White-Collar	-	**0.13**	**0.11**	-	-	-
Center North-East Div.	-	**0.18**	-	-	-	-
Pacific Division	-	**0.23**	-	-	-	-
Log-Likelihood	-5405.25	-5380.13	-5335.31	-5989.57	-1.2E+06	-5.8E+06
Observations	8916	8914	8914	9867	3206	3053
Number MR=Yes	3745	3744	3744	4736	1379	1252
Interactions	No	No	Yes	No	No	No

Specifications:

(1) RHS+NLS, MR<70, Basic Imputation Based on Industry and Education
(2) RHS+NLS, MR<70, Additional Variables in Imputation (White Collar, SMSA, Division)
(3) RHS+NLS, MR<70, Interactions of Industry, White Collar with Education
(4) RHS+NLS, All MR Ages, Basic Imputation
(5) RHS, MR<70, Basic Imputation
(6) NLS, MR<70, Basic Imputation

Notes: Bold coefficients are significantly different from zero at the 5% level. Italicized coefficients are significant at the 10% level. Dependent variable is a dummy equal to one if an employee is covered by MR. Other regressors include year-dummies as well as interaction of white-collar, education and SMSA with industry dummies. Education is coded in four cathegories (less than high-school, high-school, some college, BA or above). Sampling weights are used. For the joint sample, sampling weights of RHS and NLS are adjusted to sum to one over the entire sample.

App Table 2: Proportions of Single Ages in Labor Force Ages 55-70 by Probability-Group

Year-Group	1968-1978		1979-1985		1986-1993	
Age(*)	**Low MR**	**High MR**	**Low MR**	**High MR**	**Low MR**	**High MR**
61	0.086	0.104	0.089	0.106	0.084	0.098
62	0.063	0.066	0.060	0.060	0.062	0.062
63	0.055	0.054	0.053	0.049	0.055	0.051
64	0.050	0.046	0.048	0.039	0.050	0.044
65	0.039	0.026	0.037	0.025	0.042	0.034
66	0.033	0.018	0.030	0.018	0.038	0.027
67	0.029	0.014	0.027	0.015	0.033	0.021
68	0.026	0.012	0.024	0.012	0.027	0.018
69	0.022	0.010	0.021	0.010	0.024	0.015
70	0.014	0.006	0.013	0.007	0.015	0.009

Notes: These are fractions of workers at different ages within groups of high and low probability of coverage by mandatory retirement. Current Population Survey. All proportions are significantly different from zero at the 1% level accounting for clustering at the rotation group level.
(*) Age 61 shows the average proportions of workers ages 55-61. Age 70 shows the same for workers age 70-75.

App Table 3: Hazard-Regressions with Different Cut-Off Points and Adjustment for MA-Component of Errors

Year-Group	Cut-Off Point					Adjusted for MA(1)
	0.45	0.48	0.50	0.52	0.55	
Baseline	**0.22**	**0.21**	**0.21**	**0.24**	**0.20**	**0.21**
	(0.023)	(0.024)	(0.024)	(0.025)	(0.028)	(0.026)
1979-1983	**-0.10**	**-0.09**	**-0.09**	-0.06	-0.02	**-0.09**
	(0.039)	(0.041)	(0.041)	(0.044)	(0.047)	(0.02)
1984-1988	**-0.10**	*-0.10*	*-0.10*	-0.11	**-0.13**	**-0.10**
	(0.052)	(0.053)	(0.054)	(0.057)	(0.064)	(0.041)
1989-1993	**-0.16**	**-0.15**	**-0.14**	**-0.15**	**-0.09**	**-0.15**
	(0.038)	(0.039)	(0.04)	(0.042)	(0.047)	(0.03)
1994-1996	**-0.13**	**-0.11**	**-0.12**	**-0.18**	**-0.13**	**-0.11**
	(0.046)	(0.046)	(0.047)	(0.048)	(0.052)	(0.037)
1997-2000	**-0.16**	**-0.13**	**-0.12**	**-0.14**	-0.10	**-0.13**
	(0.054)	(0.055)	(0.055)	(0.062)	(0.062)	(0.03)
2001-2006	**-0.08**	**-0.07**	-0.06	**-0.11**	-0.06	**-0.07**
	(0.043)	(0.044)	(0.045)	(0.047)	(0.053)	(0.018)

Notes: Standard errors are in parentheses. Bold coefficients are significantly different from zero at a 5% confidence level, italicized coefficients at 10% confidence level. Table contains coefficients on Difference-in-Difference-regressions of annual hazards of exiting labor force at age 65. In each column, a different cut-off point is chosen to define the groups of workers comprising control and treatment group. The higher the cut-off point, the fewer people are in the treatment group. The middle column corresponds to the results shown in the main DD-table. The last column shows a regression with cut-off point 0,48 in which the standard errors have been adjusted for an MA(1) component. See text for discussion.

App Table 4: Fraction of Workers Assigned to High Probability Group Across Industries By Different Imputations

	Industry	RHS+NLS			RHS	NLS	RHS+NLS
Industry	**Share**	**Basic**	**More Vars**	**Interactions**	**Basic**	**Basic**	**All MR Ages**
Agriculture	1.9	0	0	0.06	0	0	0
Mining	1.1	0.20	0.26	0.24	0.47	0.16	0.45
Construction	8.7	0	0	0	0	0	0
Manufacturing	28.8	1	0.87	0.67	1	1	1
Transport & Communication	10.3	1	0.88	0.69	0.61	1	1
Trade	15.3	0	0	0	0	0	0
FIRE	5.5	0.24	0.08	0.25	0.24	0.00	0.24
Business Services	4.3	0	0	0	0	0	0
Personal Services	1.7	0	0	0	0	0	0
Entertainment	1.2	0	0	0	0	0	0
Professional Services	14.5	0.42	0.15	0.38	0.51	0	0.78
Public Sector	6.7	0.77	0.58	0.44	1	0.73	1

Notes: All imputations are based on the pooled Retirement History Survey (1969) and National Longitudinal Survey of Older Men (1966 to 1976). The fractions in the table are obtained from early years of the monthly Current Population Survey (1968 to 1978) and for ages 55 to 64. For calculation of industry shares, sampling weights are used.