Actuarial Adjustments, Retirement Behaviour, and Worker Heterogeneity

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Abstract

Changes in retirement behaviour with respect to actuarial adjustments in the German public pension system are analysed. The introduction of actuarial adjustments is used as a source of exogenous variation, estimating discrete time transition rates into retirement. The analysis is conducted on administrative data from social security records and on survey data in a comparative scenario. Probability mass points that occur for institutional reasons and due to social norms are controlled for. Moreover, worker heterogeneity is taken into account, which has not been adressed in the previous literature. The results show some considerable postponement of retirement decisions due to financial punishment via actuarial adjustments. However, the degree of postponement is much smaller for manual workers compared to nonmanual workers which indicates that their retirement income may deteriorate.

Keywords: Labour Supply, Retirement Behaviour, Actuarial Adjustment, Worker Heterogeneity

JEL-Classification: C41, H55, J26

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1 Introduction

The purpose of this paper is to analyse changes in retirement behaviour with respect to a major reform that introduced actuarial adjustments into the German public pension system between 1997 and 2005. Actuarial adjustments are intended to redesign the pension system towards more actuarial fairness and therefore incentivise postponed retirement. The existing literature draws on administrative data and indicates a clear response to actuarial adjustments in terms of prolonged working careers (Hanel, 2010). However, those results are on a rather aggregate level, as social security data suffer from a lack of socio-demographic information. This paper compares results from two diametrically opposed data sources. First, administrative data are used to exploit precise information on worker biographies where exact retirement entries are documented on a monthly basis. Second, survey data are used to exploit a rich set of socio-demographic information on the individual and the household level. Such aspects may play an important role in the rather complex decision process that underlies retirement entry behaviour, which has not explicitly been adressed in the previous literature.

The main contribution of this study can be summarised as follows. First, a baseline scenario compares estimates of the effect of financial punishment on early retirement behaviour for social security records and survey data. In this baseline estimation, minimum information is used to estimate similar models. Second, survey data are exploited to draw on extraordinarily important information that may play a role in the rather complex retirement decision process. Such information are household characteristics such as marriage and income situation as well as individual health and educational degree. Most importantly, we compare manual to nonmanual workers. Third, data patterns that are relevant for the age group between 60 and 65 are explicitly modelled. That is, probability mass points with respect to retirement entries that are due to the institutional setting or social norms are taken into consideration.

We expect some response with respect to the labour force participation of the elderly and their timing of retirement. The main question in this context is whether old age labour supply increases and if so by how many months? There exists evidence that individuals are in fact incentivised to work longer due to increasing costs of early retirement (Hanel, 2010). We refine the answer to this question raised above, as we expect heterogeneous effects from an increased retirement age. That is, we may observe a different response behaviour for individuals with different socio-demographic background. There may be subgroups within the population that strongly respond to the reform by prolonging their working life for several months. On the other hand we may observe groups, such as manual workers, who are not at all able to postpone retirement due to their working biography. This gives rise to the assumption, that certain groups will suffer from retirement benefit reductions that are disproportionately high.

In a baseline scenario the impact of actuarial adjustments on the timing of retirement is investigated, using minimum information that is available in both data sources. The results indicate somewhat similar patterns with respect to their sign, suggesting that retirement is postponed substantially when benefit reductions in terms of actuarial adjustments apply. Using additional information from survey data reveals some clear patterns of worker heterogeneity. Irrespective of benefit reductions, manual workers retire earlier compared to nonmanual workers. The most remarkable finding in this context is, however, that their response to actuarial adjustments is systematically lower compared to nonmanual workers. That is, the timing of their retirement decisions is affected to a much lower degree, meaning that postponed retirement due to benefit reductions is a phenomenon that we observe more likely for nonmanual workers.

The remainder of this paper is structured as follows. Section 2 gives a short overview on the institutional setting and the reform to be analysed. Section 3 describes the two datasets and the sample construction. Section 4 explains the conceptual framework with respect to technical issues and the estimation strategy. Section 5 presents results and section 6 concludes.

2 Institutional Setting

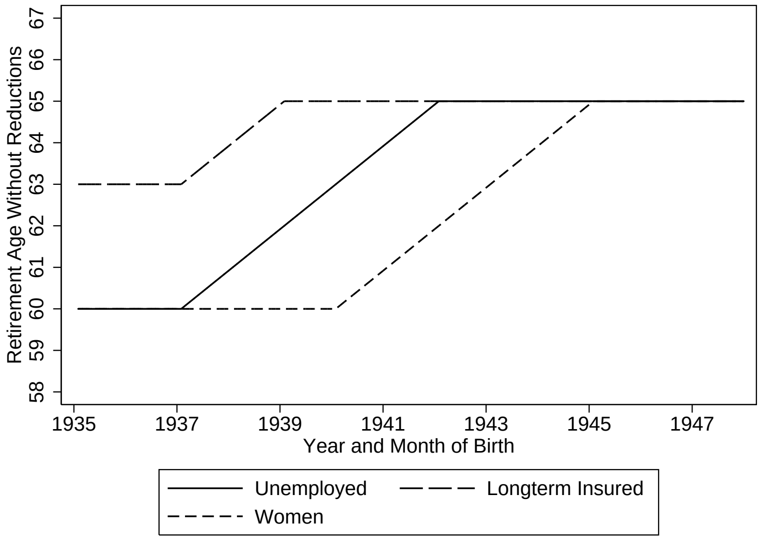
Germany has one of the oldest public pension systems of the world. After World War II, this system has been converted into a genuine pay-as-you-go pension scheme essentially without any privately funded pillar. As the result of an influential reform in 1972, during an era of prosperity and strong economic growth, the generosity of this pension scheme was increased dramatically. Consequently, the replacement rates were far above from what is known to be actuarially fair. Moreover, the design of the system imposed strong disincentives for labour supply at late stages of a working career and to retire early instead. Due to these disincentives and demographic change, the system inevitably ran into serious financing problems. Without considerable adjustments, either the replacement rate would have dropped or the contribution rate would have increased remarkably or both (see e.g. Borsch-Supan (2000)). A series of reforms starting in the early 1990's eventually introduced several mechanisms to countervail this process.

The relevant reform was introduced between January 1997 and December 2004 for the corresponding birth cohorts from 1937 to 1944. As of 2005, all individuals in the respective age are fully affected by the reform, if they have employment contracts that are subject to social security contributions. The reform imposes an adjustment factor to the pension formula, which effectively reduces pension claims by 0.3 percentage points for each month of early retirement relative to the statutory retirement age.[1] For a whole year of early retirement the reduction thus amounts to 3.6 percent of monthly retirement benefits. So far, *early retirement* in Germany was defined as to receive an old age pension before age 65. However, the early receipt of an old age pension is subject to some restrictions which, for the relevant period, can be described as follows. The minimum age to receive an old age pension early is 60 years and an individual is eligible, if he or she is *(i)* unemployed, *(ii)* a woman, or *(iii)* has contributed for at least 35 years. That is, only individuals who fulfill the aforementioned requirements can receive an old age pension before the normal retirement age of 65. As indicated, the reform has phased in gradually between 1997 and 2005, but with slihghtly different timing for the three different types of eligibility. Figure 1 describes the gradual increase in the retirement age without reductions by types of eligibility.

The reform raised the reduction-free retirement age of an old age pension *(i)* due to unemployment in the birth cohorts 1937 to 1941, *(ii)* for women in the birth cohorts 1937

[1] The pension formula is used to calculate the monthly public pension entitlements of each individual when entering retirement in Germany. It takes into account individual aspects such as years of contribution and income level but also aggregate aspects such as the current annuity value.

Figure 1: Gradual Increase of Retirement Age Without Reductions by Year and Month of Birth.



Source: Wachstums- und Beschäftigungsförderungsgesetz 1997.

to 1938 and *(iii)* for long-term contributors in the birth cohorts 1940 to 1944.

3 Data

3.1 The Two Datasets

The analysis is conducted using administrative data provided by the German Federal Pension Insurance (DRV-Bund). The dataset of interest is the so called Insurant Account Sample (Versicherungskontenstichprobe, VSKT), which serves as basis for internal calculations of DRV-Bund and for political consulting. Altogether, the VSKT is a sample of about 240,000 individuals of age 15 to 67 regarding their insurance accounts. We make use of a 25% subsample of the VSKT, which is provided as a Scientific-Use-File and includes some 60,000 individual observations. The observed individuals have in common that they are subject to social security contributions. Thus, sample selection is present to the extent, that civil servants and self-employed individuals are ruled out from the analysis.[2] In contrast, the dataset contains process-produced data of high reliability and

[2]The German public pension systems offers the possibility to self-employed individuals, to contribute voluntarily and therefore receive pension benefits after retirement. In fact, there is a small number of voluntarily insured self-employed individuals who do participate. As this group is a somewhat specific group and a very small minority, they are ruled out from further analysis.

does not suffer from typical problems of survey data (see Himmelreicher and Stegmann (2008)). Information is available on contribution time, monthly amounts of contribution (which allows to calculate earnings), retirement entry and a number of socio-demographic variables such as age, sex, region, and most importantly on blue and white collar status. Social security records are particularly profitable for the present work as they essentially provide complete earnings biographies. Consequently, retirement entry, contribution level and contribution time can be traced back very precisely.

In a comparative scenario, survey data from the German Socio-Economic Panel Study (GSOEP) are used. The GSOEP is representative for the German population and includes some 11.000 households and about 20.000 individuals. Observations on the same subjects are repeated over several years. The GSOEP contains retrospective calendar data on employment and retirement. The resulting activity spells are on a monthly basis. In contrast to the administrative data, a rich set of socio-demographic information on the individual and the household level is available which is used to identify worker heterogeneity in retirement entry behaviour. Most notably, marriage status, health status and occupational information are available. Generally, the GSOEP allows to pin down the socio-demographic situation of individual observations in a much more detailed manner. This aspect is of particular importance, as the determinants of retirement entry are closely related to the household context as well as health status or occupational status. While administrative data provide very precise information on retirement entries, the analysis may show some imprecision with respect to relevant omitted variables.

3.2 Construction of the Sample

Both datasets are used to construct a similar data structure which can be described as follows. Observations are restricted to the relevant individual age range from 60 to 67, as the early receipt of an old age pension is possible starting at age 60.[3] A time variable indicates the first month of potential eligibility and then counts each subsequent month. However, it is important to note that individuals are allowed to enter the sample after age 60, which holds for social security records as well as for survey data. Each individual is observed as long as retirement has not taken place. In the specific month, where retirement

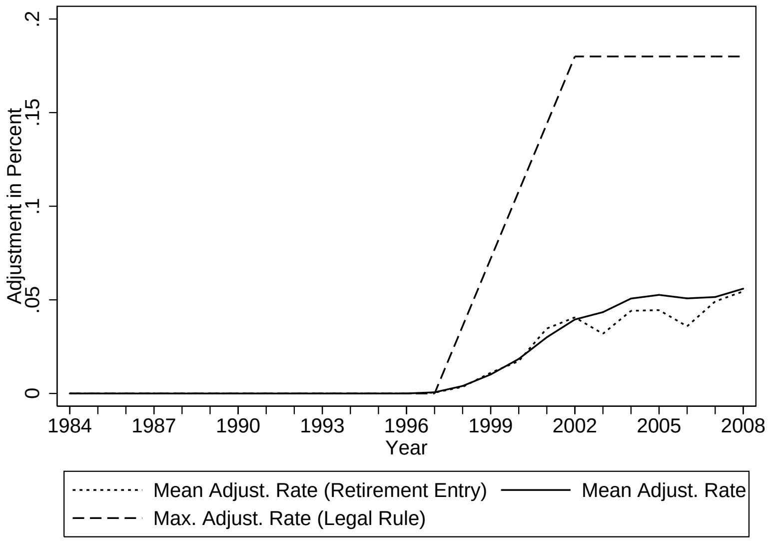
[3]Early receipt of an old age pension can be due to different, well defined, reasons. These reasons are subject to the German social security legislation. For details, see section 3 with a description of the relevant rules.

is observed, the spell ends and the corresponding individual is not observed any further. In this case, the dependent variable takes the value one and zero otherwise (i.e. in all previous months). For certain regressors it is more plausible to allow for variation over time. The models to be used and the specific data structure allow for time-varying regressors, such that variation is exploited.

3.3 Preliminary Descriptives

Figure 2 shows the gradual increase of actuarial adjustments in monthly steps by calendar time.

Figure 2: Maximum Adjustment Rate, Empirical Mean Adjustment Rate for Old Age Pensions Due to Unemployment.



Source: Own calculations using the GSOEP (1984-2009).
Note: Each tick marks the beginning of the respective year.

Maximum adjustment rates in Figure 2 are shown exemplary for the introduction of actuarial adjustments for old age pensions due to unemployment between January 1997 and December 2001 according to legislative rules. These maximum values are contrasted by empirical mean adjustment rates for individual transitions into retirement and for the whole sample including non-retirement for the respective years. This illustrates how the adjustment rate gradually increases and eventually remains on a level between 4% and 5% on average.

4 Conceptual Framework

4.1 Econometric Strategy

To identify the impact of actuarial adjustments on the timing of retirement decisions, discrete time duration models are used. Such models are commonly used in the literature to analyse transition behaviour (see e.g. Lancaster (1979)). Using the specific data structure as described previously, individuals at risk are followed until they exhibit the failure event retirement or censoring otherwise. Individuals are censored if they do not exhibit the exclusive failure event of retirement before the observation period ends. The discrete time duration framework is advantageous in this context as it *(i)* allows to control for censored spells, *(ii)* explicitly takes into account the discrete measurement of time in months, *(iii)* allows for a large number of transitions at particular points in time, i.e. probability mass points and *(iv)* is straightforward to implement. Depending on the underlying distributional assumption, proportional odds as well as proportional hazards are modelled. The proportional odds are modelled assuming a logistic specification whereas the proportional hazard is modelled by assuming a complementary log-log distribution. Let T denote a random variable for the duration in a spell of non-retirement and let t denote an arbitrary point in time where a failure takes place.[4] The probability density function can be written as

$$f(t) = dF(t)/dt \tag{1}$$

where the cumulative distribution function

$$F(t) = \text{Prob}[T < t] \tag{2}$$

describes the probability distribution of non-retirement spells and is a formal statement on the probability of failure within a given time interval. The survivor function is defined

[4] For a general overview on duration analysis, see Kiefer (1988). The formal notation follows Kiefer (1988) or Cox and Oakes (1984), where $F(t) = \text{Prob}[T < t]$ instead of the usual convention, where $F(t) = \text{Prob}[T \leq t]$ which is useful for a more precise statement of the hazard function.

as

$$S(t) = \text{Prob}[T \geq t] = 1 - F(t) \tag{3}$$

which is the probability of a spell to be greater or equal to t and therefore describes the right tail of the probability distribution. A common concept in duration analysis is the hazard function, which is defined as

$$\lambda(t) = f(t)/1 - F(t) = f(t)/S(t) \tag{4}$$

and thus is the instantaneous probability to exhibit a failure event at time t, conditional on survival until time t. In terms of probabilities, the hazard can be stated as

$$\lambda(t) = \lim_{h \to 0} \frac{\text{Prob}[t \leq T < t + h | T \geq h]}{h} \tag{5}$$

where h is an infinitesimal instant of time. In a rather intuitive manner, the hazard function can be interpreted as the transition rate at which spell durations end in a given point in time t (see Kiefer, 1988). In order to estimate the effect of actuarial adjustment on the timing of retirement using maximum likelihood techniques, the sample likelihood function needs to be constructed (see e.g. Willett and Singer (1995)). Let L denote the likelihood function and let this likelihood function be composed out of two components. The first component represents individuals i with uncensored spells with a likelihood contribution

$$L_i(\text{uncensored}) = \text{Prob}[T = t_i] = f(t_i) \tag{6}$$

which is the density for the i'th observation. For censored spells, the likelihood contribution is the survivor function

$$L_i(\text{censored}) = \text{Prob}[T > t_i] = S(t_i) \tag{7}$$

which is the probability that the failure event will take place after time t. Combining the two components in (6) and (7) gives the likelihood function

$$L_i = \prod_{i=1}^{N} f(t_i)^{1-\delta_i} S(t_i)^{\delta_i} \tag{8}$$

where δ_i is a binary indicator which is defined as

$$\delta_i = \begin{cases} 0 & \text{no censoring} \\ 1 & \text{right-censoring} \end{cases} \tag{9}$$

Inserting the corresponding density functions for the logistic and complementary log-log distribution and taking logs finally gives the log-likelihood function which must be maximised to obtain parameter estimates.

4.2 Identification of Actuarial Adjustments

Making use of the abovementioned methodology, hazard rates of entering retirement are estimated.[5] Starting at age 60 (precisely in the month after the 60th birthday), individuals are observed repeatedly until they enter retirement. In the estimation framework, the dependent variable takes the value zero for each non-retirement month and the value one if an individual enters retirement.[6] Thus, the effect of financial punishment on early retirement patterns can be examined. Clearly, the introduction of actuarial adjustment must be identified as a source of exogenous variation in order to be interpreted as a causal effect. This is supported by the fact, that the reform affects individuals only by

[5] So far, this is irrespective of any pre-state. Further analysis is intended to examine pre-state dependence.

[6] An important difference arises with respect to social security records and survey data. While panel attrition does not take place in social security records besides few exceptions, it does so in survey data. In the former, leaving the state "employee" to self-employed or civil servant may cause an exit from the sample but is a rare event. However, in survey data, several reasons for sample drop-outs such as refusal of further participation occur frequently.

their month of birth and year of birth. However, this requires assuming that no birth cohort heterogeneity is present whatsover. Under such circumstances the reform can be interpreted as a natural experiment (Hanel, 2010). This is achieved by discriminating between a treatment group that is affected by the reform and a control group that is not affected. In a first simple version, adjustments enter the model by defining a variable that gives the adjustment rate which applies for each individual at each point in time according to the rules. Consequently, this variable takes the value zero if an individual is not affected at a given point in time. If an individual is affected, this variable is equal to the adjustment rate and thus gives the relative share of the reduction in monthly retirement benefits which are received by the retiree as soon as he claims benefits. Effectively, the adjustment variable can take values between the minimum of zero and the maximum of 18 (percent). The maximum of 18% applies if an individual is fully affected by the reform and retires at age 60, i.e. at first eligibility.

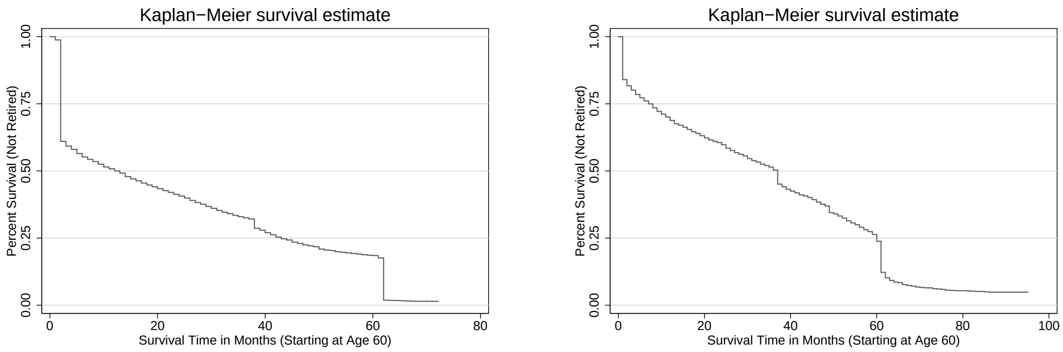
4.3 Specific Data Patterns

The German public pension system shows very specific retirement patterns with respect to age. These patterns occur for different reasons. First, they appear due to institutional settings that are usually linked to the age of first eligibility of a certain type of retirement benefit. That is, once the first month of eligibility for the early receipt of an old age pension (for whatever reason) is reached, a large fraction enters benefit claiming. Second, occupational agreements with employers that do not necessarily comply with applicable law, may influence retirement patterns. Third, social norms may as well have an impact. While the first explanation is easily traced back, the other two are difficult to measure.

In Figure 3, Kaplan-Meier survival estimates are displayed. From this figure we can infer, that a large fraction of retirement entries takes place one month (age 60), 37 months (age 63) and 61 months (age 65) after the 60th birthday. Those probability mass points cause a considerable amount of variation that needs to be taken into account when identifying the causal effect of (exogenous) actuarial adjustments. That is, motives may be different from financial incentives due to the adjustments but rather be explained by the aspects mentioned above. In the further analysis, probability mass points are controlled for by including corresponding dummy variables.[7] Previous work on actuarial adjustments

[7]The resulting three dummies are defined to be one in the first three months following the 60th, 63rd

Figure 3: Relative Share of Non-Failures and Probability Mass Points.



(a) Social Security Records (b) Survey Data

Source: Own calculations using SUFVSKT (2005-2008) and GSOEP (1984-2009).

does not explicitly take this into account.

5 Results

In a baseline scenario, minimum information is used to estimate discrete time transition rates into retirement for both social security records and survey data. That is, only those regressors are used, that are available in both datasets. In such a scenario, we self-evidently expect some kind of omitted variable bias as there exists a large set of characteristics that may influence the timing of retirement. The baseline scenario therefore - in a first step - serves for comparative purposes. The results are shown in Table 1.

The results on social security records are shown in the upper part and those for survey data are to be found in the lower part of Table 1. The discrete (binary) choice models presented in the three columns are robust over different distributional assumptions of the error term. The adjustment rate is given exogenously and is only determined by year of birth and month of birth. The corresponding response in the timing of retirement entry is analysed. Clearly, assuming that the observed period and cohorts do not allow for large-scale birth cohort heterogeneity we can speak of a source of exogenous variation. The results on both datasets are very similar with respect to their sign but differ by magnitude. The adjustment rate, which is central to this analysis, varies between 0% for individuals and periods that are not affected up to 18% for individuals and periods

and 65th birthday respectively and zero otherwise.

Table 1: Comparative Scenario: Actuarial Adjustments and Retirement Transitions in Social Security Records vs. Survey Data.

Variable	Logit		Probit		Compl. Log-Log	
	m.eff.	s.e.	m.eff.	s.e.	m.eff.	s.e.
Social Security Records						
Adjustment Rate	–.0029	(.0001)	–.0026	(.0001)	–.0033	(.0001)
Spell Dur. (Months)	–.0008	(.0001)	–.0006	(.0001)	–.0010	(.0001)
PM60	.171	(.006)	.166	(.005)	.174	(.006)
PM63	.064	(.004)	.056	(.003)	.072	(.004)
PM65	.610	(.011)	.575	(.011)	.656	(.013)
Male	–.006	(.001)	–.005	(.001)	–.007	(.001)
West	–.036	(.001)	–.034	(.001)	–.040	(.001)
Monthly Income	–.012	(.005)	–.008	(.004)	–.013	(.005)
Avg. Transit. Rate (%)	4.42		4.42		4.43	
Obs.	121778		121778		121778	
Survey Data						
Adjustment Rate	–.0005	(.0000)	–.0005	(.0000)	–.0005	(.0000)
Spell Dur. (Months)	–.0001	(.0000)	–.0001	(.0000)	–.0001	(.0000)
PM60	.071	(.001)	.067	(.001)	.073	(.001)
PM63	.032	(.001)	.030	(.001)	.033	(.001)
PM65	.314	(.004)	.313	(.004)	.322	(.004)
Male	.002	(.000)	.003	(.000)	.003	(.000)
West	–.014	(.000)	–.014	(.000)	–.014	(.000)
Monthly Income	–.008	(.002)	–.007	(.002)	–.008	(.002)
Mean Transit. Rate (%)	3.23		3.24		3.24	
Obs.	88396		88396		88396	

Source: Own calculation using the Insurant Account Sample (SUFVSKT2005-SUFVSKT2008) and the GSOEP (1984-2009). *Note:* Reported values are marginal effects at the sample mean. Standard errors are in parentheses. Mean transition rates (Mean Transit. Rate) in percent and numbers of observations (Obs.) are given for each model separately. Adjustment rates are measured in percent, i.e. the minimum is 0 and the maximum is 18.

that are fully affected by actuarial adjustments. Thus, the marginal effect (logit, social security records) suggests, that increasing the adjustment rate by one percentage point (i.e. one unit), will decrease the probability to retire by 0.29 percentage points (i.e. units) on average for a given point in time. While this effect seems small in absolute terms, evaluated at the predicted sample mean of 4.42%, this is an average decrease of 6.5% in the probability to observe a transition into retirement in a given period. For survey data, the marginal effect (logit) of the adjustment rate is somewhat lower, indicating that increasing the adjustment rate by one percentage point (i.e. one unit), will decrease the probability to retire by 0.05 percentage points (i.e. units) on average for a given point in time. The model on survey data also predicts a lower mean transition rate of 3.23%. Thus, evaluated at the predicted mean transition rate, this model suggests an average decrease of 1.6% in the probability to observe a transition into retirement in a given period. The difference in the magnitude of the estimated coefficients (and respective average marginal effects) seems substantial. One difference seems between datasets seems to occur with respect to sex. While the model on social security data suggests a negative effect for male workers which is negligible in economic terms, on survey data a slightly positive effect is obtained. The estimated coefficients and the corresponding marginal effects of the probability mass points are large relative to the other coefficients. As discussed earlier, this is not surprising, as they represent institutional and social aspects, that play a major role in the timing of retirement in Germany. This confirms the importance of taking this phenomenon into consideration.

Now we take into account, that a precise interpretation of the previous results may be misleading in the presence of ommitted variable bias. Retirement decisions are rather complex and are influenced by a variety of aspects. The survey data of the GSOEP allow us to identify such aspects and include them into the model. Important aspects are the family context with respect to marital status and household income, individual educational level and health status. The role of marital status seems to be of particular importance with respect to the other spouses labour force status, which is not modelled here. Married individuals may condition their retirement entry decision on their spouses retirement behaviour (see Blau and Riphahn (1999)). Household income is important is important as financial incentives play a major role in retirement entry behaviour (see e.g. Coile and Gruber (2000) ; Coile and Gruber (2001)). However, the regressor of upmost interest is worker heterogeneity concerning manual versus nonmanual jobs. Here, a dummy variable indicates, whether jobs are of manual type (=1) or not (=0). To investigate, how actuarial adjustments affect manual and nonmanual workers differently, an additional interaction term between manual and the adjustment rate is included.

Using additional information on worker heterogeneity shows, that the marginal effect in the baseline scenario (survey data) seems to be slightly upward biased. Including regressors with respect to marital status, income, educational level, health, and, most notably manual/nonmanual workers leads to a larger marginal effect in absolute terms (i.e. more negative). The marginal effect for the adjustment rate (logit) suggests, that increasing the adjustment rate by one percentage point (i.e. one unit), will decrease the probability to retire by 0.11 percentage points (i.e. units) on average for a given point

Table 2: Actuarial Adjustments, Retirement Transitions, and Worker Heterogeneity using Survey Data.

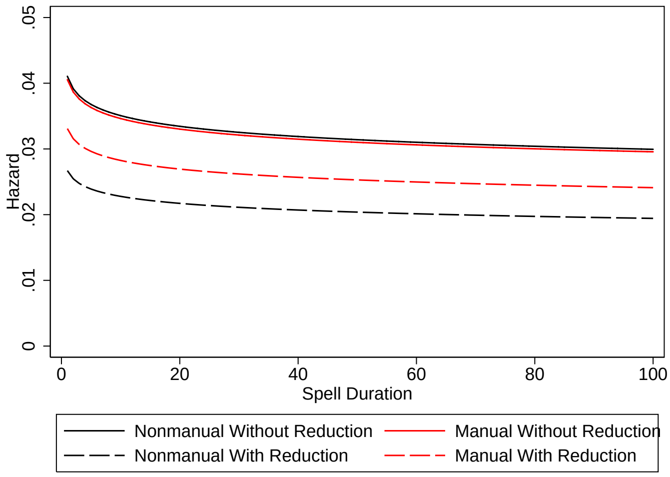
Variable	Logit		Probit		Compl. Log-Log	
	m.eff.	s.e.	m.eff.	s.e.	m.eff.	s.e.
Survey Data						
Adjustment Rate	–.0011	(.0000)	–.0011	(.0000)	–.0011	(.0000)
Spell Dur. (Months)	–.0001	(.0000)	–.0001	(.0000)	–.0001	(.0000)
Manual	.0012	(.0004)	.0011	(.0004)	.0011	(.0004)
Adjust X Manual	.0004	(.0001)	.0004	(.0000)	.0004	(.0000)
PM60	.076	(.001)	.071	(.001)	.078	(.001)
PM63	.028	(.001)	.026	(.001)	.029	(.001)
PM65	.309	(.004)	.312	(.004)	.313	(.004)
Male	–.001	(.000)	–.0004	(.004)	–.001	(.000)
West	–.014	(.000)	–.014	(.000)	–.014	(.000)
Married	–.006	(.000)	–.007	(.000)	–.006	(.000)
Middle Educ	.008	(.000)	.007	(.000)	.008	(.000)
Higher Educ	.005	(.001)	.005	(.000)	.005	(.001)
Satisfact. Health	–.001	(.000)	–.001	(.000)	–.001	(.000)
Poor Health	.002	(.000)	.002	(.000)	.002	(.000)
Monthly Income	–.006	(.002)	–.005	(.002)	–.006	(.002)
Mean Transit. Rate (%)	3.35		3.35		3.35	
Obs.	76423		76423		76423	

Source: Own calculation using the GSOEP (1984-2009). *Note:* Reported values are marginal effects at the sample mean. Standard errors are in parentheses. Mean transition rates (Mean Transit. Rate) in percent and numbers of observations (Obs.) are given for each model separately. Adjustment rates are measured in percent, i.e. the minimum is 0 and the maximum is 18.

in time. Evaluated at the predicted sample mean of transition rates of 3.35%, this is an average decrease of 3.3% in the probability to observe a transition into retirement in a given period. For married individuals, the probability of a transition into retirement in a given point in time seems to be slightly lower. Thus, married individuals seem to retire later compared to non-married individuals. Moreover, increasing household income seems to lower the probability to retire at a given point in time as well.

Irrespective of actuarial adjustments, manual workers seem to retire earlier compared to nonmanual workers, as their probability of a transition into retirement is slightly higher in a given point in time, holding everything else constant. Most importantly, the positive marginal effect for the interaction between the manual-dummy and the adjustment rate indicates, that manual workers respond to a much lower degree to actuarial adjustments compared to nonmanual workers. This finding is illustrated in Figure 4. The predicted hazard rates indicate, that nonmanual workers show a substantially larger response behaviour with respect to actuarial adjustments.

Figure 4: The Response in Hazard Rates for Manual and Nonmanual Workers.



Source: Own calculation using the GSOEP (1984-2009).

6 Conclusion

This study investigates the effect of the introduction of actuarial adjustments into the German public pension system between 1997 and 2005. A specific data structure allows to estimate simple discrete time duration models, where exits into retirement are defined as failure event. The baseline analysis is conducted on two different datasets with very specific strengths and weaknesses. On the one hand, social security records provide very reliable information on retirement entries, earnings biographies and therefore contribution levels but contain only few explanatory variables which may be important. On the other hand, survey data provide a rich set of socio-demographic information but retirement behaviour is documented with less precision. Using survey data allows to control for worker heterogeneity and - most importantly - to discriminate between manual and nonmanual workers.

Hazard rates that reflect the instantaneous probability of entering retirement in a given month, given survival until that month, are estimated. The results on very different data sources suggest that introducing actuarial adjustments, substantially decreases the probability to enter retirement in a given month. However, this result largely varies in magnitude when estimating baseline models with identical information on both datasets. Evaluated at the predicted mean transition rate, this model suggests an average decrease between 6.5% and 1.6% in the probability to observe a transition into retirement in a given month for administrative data and survey data respectively. Given the fact, that time is measured in months, this effect is substantial. Despite the differences in magnitude over different data sources, the results are robust over different distributional assumptions such as logistic, standard normal and complementary log-log. When using survey data to conduct the same exercise with additional information, the effect of actuarial adjustments on the timing of retirement seems to be slightly larger (i.e. more negative). Discriminating between manual and nonmanual workers suggests substantially higher response rates among nonmanual workers compared to manual workers. That is, we do observe a different response behaviour for individuals with different socio-demographic background. Nonmanual workers seem to respond more strongly by postponing benefit claims, while manual workers seem to be less able to extend their working careers to the same extent. This result indicates, that certain groups will suffer from retirement benefit reductions that are disproportionately high. This has policy implications in a sense of a heterogeneous treatment, as pension incomes may deteriorate for the group of manual workers. This issue presently gains more importance, as the normal retirement age in Germany is shifted upwards gradually from 65 to 67 (beginning in January 2012), while the mechanism of actuarial adjustments applies similarly in the case of early retirement. In this scenario, mean reductions would be even larger if no behavioural change takes place whatsoever.

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