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Retirement and subjective well-being

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Retirement and Subjective Well-Being

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Retirement and Subjective Well-Being

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ABSTRACT

Retirement and Subjective Well-Being*

We provide an explanation for the common finding that the effect of retirement on life satisfaction is negligible. For this we use subjective well-being measures for life and domains of life satisfaction that are available in the German Socio-Economic Panel (GSOEP) and show that the effect of voluntary retirement on satisfaction with current household income is negative, while the effect on satisfaction with leisure is positive. At the same time, the effect on health satisfaction is positive but small. Following the life domain approach we then argue that these effects offset each other for an average individual and that therefore the overall effect is negligible. Furthermore, we show that it is important to distinguish between voluntary and involuntary retirement. The effect of involuntary retirement is negative because the adverse effect on satisfaction with household income is bigger, the favorable effect on satisfaction with leisure is smaller, and the effect on satisfaction with health is not significantly different from zero. These results turn out to be robust to using different identification strategies such as fixed effects and first differences estimation, as well as instrumental variables estimation using eligibility ages and plant closures as instruments for voluntary and involuntary retirement.

JEL Classification: J26, J14

Keywords: retirement, subjective well-being, satisfaction measurement

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1. Introduction

Retiring is a major event in life. It has many consequences on different aspects of life such as the financial situation, the allocation of time, social relations, as well as physical and mental health. These changes are likely to affect individual well-being in various ways. In this paper, we study the effect of retirement on satisfaction with household income, leisure, health, and life in general.[4]

It could be that the effect on life satisfaction is rather small, as a drops in consumption that parallel the drop in current (now retirement) income may be optimal from a life-cycle perspective because individuals can offset those in various ways, e.g. by engaging in more household production (Hurd and Rohwedder, 2003; Aguiar and Hurst, 2005; Skinner, 2007) or by consuming more leisure time (French, 2005; Laitner and Silverman, 2005). This is especially true if retirement occurs at the expected retirement age, i.e. when there is no uncertainty about the actual retirement age. However, retirement may also be driven by unexpected shocks such as lay-offs or a health shock. In such a case, *in*voluntarily (or unexpected) retirement is likely to be associated with a drop in well-being because individuals made their savings decisions under different expectations about the retirement date, so that the drop in consumption is bigger than expected (Blau, 2008).

In this paper, we use subjective well-being measures that are available in the German Socio-Economic Panel (GSOEP) and document that the effect of retirement on life satisfaction is negligible when retirement is voluntary and negative when it is involuntary. Using individual measures of satisfaction with different domains of life we show that the effect of voluntary retirement on satisfaction with current household income is negative, while the effect on satisfaction with leisure is positive. At the same time, the effect on health satisfaction is

[4] We use, interchangeably, the expressions subjective well-being, satisfaction with life, general satisfaction, life satisfaction, and satisfaction with life in general. The use of subjective measures in economics has been developing since the 1970's with the Leyden school's approach (van Praag and Frijters, 1999). Finkelstein *et al.* (2009), among others, argue that subjective reports on well-being are a good proxy for utility. A large number of economic studies that use subjective data has burgeoned since the mid 1990's. See e.g. Clark and Oswald (1994), Frey and Stutzer (2000), Frijters (2000), Di Tella *et al.* (2001), Easterlin (2001), McBride (2001), Ravallion and Lokshin (2001), Ferrer-i-Carbonell (2005), van Praag (2007), and Layard *et al.* (2008) for further references and discussions.

positive but small. Following the life domain approach we then argue that these effects offset each other for an average individual and that *therefore* the overall effect is negligible.[5] The effect of involuntary retirement on life satisfaction is negative because, as compared to the effects of voluntary retirement, the adverse effect on satisfaction with household income is bigger, the favorable effect on satisfaction with leisure is smaller, and the effect on satisfaction with health is not significantly different from zero. These results turn out to be robust to using alternative identification strategies to control for the endogeneity of voluntary and involuntary retirement. In particular, we perform fixed effects (FE) and first differences (FD) estimation, as well as instrumental variables (IV) estimation using eligibility ages and plant closures as instruments for voluntary and involuntary retirement, respectively.

There are a number of studies that characterize the relationship between well-being and retirement, but none of them has investigated the effects on domain satisfaction at the same time. In those studies, it is typically emphasized that the retirement decision might be related to unobserved individual characteristics that by themselves are related to the level of subjective well-being. Usually, this is addressed by performing FE or FD estimation (for linear models), the inclusion of Mundlak (1978) regressors (for nonlinear models), or IV estimation that exploits exogenous variation in retirement incentives.[6] Lindeboom *et al.* (2002) perform FD estimation to investigate the effect of major events in life on mental health for a representative sample of individuals from the Netherlands and find insignificant effects of retiring. Clark and Fawaz (2009) use the Survey of Health, Ageing and Retirement in Europe (SHARE) and the British Household Panel Survey (BHPS) and show that on average psychological well-being barely changes when individuals retire. Charles (2004) uses HRS data with outcomes "being depressed" and "feeling lonely" as well as NLSMature Men

[5] The so-called life domain approach assumes that responses on global happiness are the net outcome of reported satisfaction in different domains of life. These in turn reflect the extent to which objective outcomes match the respondent's goals or needs in that area. See also Campbell *et al.* (1976), Campbell (1981), van Praag *et al.* (2003), Easterlin (2006), Easterlin and Sawangfa (2007), and Rojas (2007).

[6] There are also some more descriptive studies. Midanik *et al.* (1995) compare individuals who retired to individuals who did not do so. Controlling for age, gender, marital status and education they find that retired individuals report lower stress levels and engage in regular exercise more often. They find no differences with respect to self-assessed mental health status, coping, depression, smoking, and alcohol consumption. Portnoi (1983) finds an association between retirement and depression. Bossé *et al.* (1987) find that both early and late retirees reported more psychological symptoms. Blanchflower and Oswald (2004) use ordered logit regressions and find that in the United States and Great Britain retirement has no overall effect on well-being.

data with outcome "subjective well-being" and finds a negative effect using the ordinary least squares (OLS) estimator, insignificant negative FE estimates, and positive IV estimates (some of these are significant). So, generally, effects are not found to be statistically different from zero.[7]

At least two studies characterize associated dynamics.[8] Kim and Moen (2002) find "higher morale" in the short run and more symptoms of depression in the long run. Börsch-Supan and Jürges (2009) find a strong association between early retirement and subjective well-being. Individuals are less happy in the years of early retirement than in the years before and after retirement.

Unemployment is similar to involuntary retirement in that individuals are not working but actually want to. It is well established that being unemployed is associated with lower levels of satisfaction (e.g. Clark and Oswald, 1994). Clark *et al.* (2001) find that life satisfaction is lower for currently unemployed individuals and decreases in past unemployment. However, these findings could be explained by the presence of FE that are negatively related to the probability of being unemployed and positively related to life satisfaction. In fact, Winkelmann and Winkelmann (1998) reject a model without FE and find "large non-pecuniary costs of unemployment" when controlling for FE. Also van Praag and Ferrer-i-Carbonell (2002) assess the monetary value of being in the labor force and find that it is substantial for many individuals. Lucas *et al.* (2004) and Clark *et al.* (2008) also control for FE and find the strongest effects of unemployment at the time individuals become unemployed. Clark *et al.* (2008) also find significant lag and lead effects.

This paper proceeds as follows. The next section contains a description of the data. We then discuss the econometric approach, present the results, and assess their robustness. The last section concludes.

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[7] An exception is the study by Pinquart and Schindler (2007) who use latent growth mixture modelling and GSOEP data to identify different groups with different effects of retiring. In Group 1, satisfaction declined at retirement but continued on a stable or increasing trajectory thereafter. Group 2 demonstrated a large increase in satisfaction at retirement but overall declining satisfaction. In Group 3, satisfaction showed a temporary very small increase at retirement. We take this as evidence for heterogeneity in the effect. In this study, we estimate average effects.

[8] It turns out that dynamics are less important in the data we look at. Figure 2 and 3 below show that the main effect is permanent and takes place at the time of retirement.

2. Data

The empirical analysis uses GSOEP data from 1995 to 2008.[9] The GSOEP is a longitudinal household survey that was started in the Federal Republic of Germany in 1984.[10] Our sample is restricted to men living in West-Germany who are between 50 and 70 years old and do not belong to the high-income subsample.[11] Moreover, we drop individuals who go back to work during the sampling period as the focus of this study is retirement, i.e. a permanent withdrawal from the labour market (it is also not clear whether they perceived the first exit out of the labor force as retirement or unemployment).[12] Finally, we drop all observations with missing or unreliable values for the variables used in the analysis. Our final sample includes 4,018 individuals constituting an unbalanced panel with 21,498 observations.

General and domains of life satisfaction

The GSOEP contains a wide range of questions about satisfaction with different domains of life (health, household income, work, free time, environment, family situation, standard of living, and housing) and satisfaction with life in general. Respondents are asked to evaluate their respective domain and general life satisfaction on a 10-point scale. The original questionnaire states

> *How satisfied are you today with the following areas of your life?*
> *Please answer by using the following scale:*
> *0 means totally unhappy, 10 means totally happy.*
> *How satisfied are you with . . .*

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[9] Our sample starts in 1995 because the health measures we use are not available in 1993 and 1994.

[10] The GSOEP is described in Wagner *et al.* (1993). It is sponsored by the Deutsche Forschungsgemeinschaft and administered by the German Institute for Economic Research (Berlin) and the Center for Demography and Economics of Aging (Syracuse University).

[11] There is a subsample with residents of West-Germany and one with foreigners living in West-Germany. An additional subsample including East-German households was added from 1990 onwards. In 1994 and 1995, a subsample of immigrants to West-Germany was added. A subsample of high-income households has been included in 2002. Besides, there are refreshment samples.

[12] In order to check whether our estimates suffer from selectivity bias because of this sample selection, we included those individuals into the sample and created an additional labour force status category when those individuals have been temporary unemployed. We find that the effect for them lies in-between the effect for individuals retiring voluntarily and the effect for individuals retiring involuntarily. Results are presented in Table 6 below.

– *your health?*

– *your household income?*

– *your free time?*

– *...*

These questions are placed at the beginning of the questionnaire. The very last question individuals answer reads

> *In conclusion, we would like to ask you about your satisfaction with your life in general.*
>
> *Please answer according to the following scale:*
>
> *"0" means completely dissatisfied, "10" means completely satisfied.*
>
> *How satisfied are you with your life, all things considered?*

In our analysis we use evaluations of satisfaction with life and three domains of life that are particularly relevant regarding life satisfaction and retirement: satisfaction with household income, satisfaction with free time, and satisfaction with health.[13,14]

Labor force status

Individuals are defined as working if they report being currently engaged in paid employment. The GSOEP includes a question about the intention of non-working individuals with respect to going back to work: *Do you intend to engage in paid employment (again) in the future? "No, definitely not"/"Probably not"/"Probably"/"Yes, definitely"*. Following Lazear (1986) we define an individual as voluntarily retired if he reports that he is not employed and has "definitely" no intention to go back to work.[15] Otherwise, individuals are classified as involuntarily retired. If an individual is classified as voluntarily retired or involuntarily retired but we observe that he goes back to work in one of the following waves, we drop him from the sample.[16] This means that we classify an individual as involuntarily

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[13] It is not clear from the questionnaire whether satisfaction with the free time refers to the quality or quantity of leisure. Therefore, we expect respondents to evaluate both at the same time.

[14] We tested whether retirement had an effect on the other domains of life and, with the exception of satisfaction with the standard of living, found no effect. For the latter, the effect was -0.645, but only present for involuntary retirement.

[15] To define individuals as voluntarily or involuntarily retired, we use the individual answer to this question in the first wave that he reports to be not working.

[16] This concerned about 12% of the individuals in our sample. Not doing so and classifying them as involuntarily retired or unemployed (a third category) did generally not change our results, as discussed below

retired if he is not working and reports in the first wave in which he is observed not to be working to have no intention to go back to work, and is moreover actually is not observed to go back to work in later waves. To summarize, we define non-working individuals as retired and distinguish between voluntary and involuntary retirement depending on whether they intend to go back to work.

Figure 1 shows how labor force status is related to age for West-German men. It shows that there is a substantial amount of early retirement, beginning at the age of 55. Although the normal retirement age is 65 we see that by then at least 90 per cent of the individuals are already retired according to our definition.

Figure 1 about here

Other explanatory variables

We use household characteristics and health indicators as additional explanatory variables to control for time varying factors that are likely to be related to both the well-being measures and voluntary or involuntary retirement. Household characteristics consist of an indicator that takes on the value one if the individual is living in a couple (married or not), and the number of adults and children in the household. We also include three objective health measures, namely the number of visits to the doctor within the last year, a dummy for at least one hospital stay within the previous year, and the legal degree of disability of the individual. In this paper, we are interested in the effect of voluntary and involuntary retirement on life satisfaction and satisfaction with the three domains of life. Therefore, as part of the effect is the effect on household income, we do intentionally not control for income because otherwise we would estimate the effects of retirement on those measures if we were able to hold household income fixed, which is a purely hypothetical situation, at least from a policy point of view.

Summary statistics and descriptive analysis

Table 1 presents summary statistics for all variables used in the analysis. They are reported by labor market status. Retired individuals are older on average and less healthy. This is also

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and shown in Table 6. In addition, we experimented with using a definition of retirement which also involved an answer to the question whether individuals were actively looking for a job, but also this did not change our results.

reflected in a lower level of satisfaction with health. Besides, they are more satisfied with their free time. Already from these summary statistics it is apparent that involuntarily retired individuals report substantially lower levels of satisfaction with life and income than voluntarily retired individuals.

Table 1 about here

OLS estimates that describe the associations between life satisfaction and satisfaction with income, leisure and health on the one hand, and voluntary and involuntary retirement on the other hand, are presented in Table 2. Retired individuals report lower levels of life satisfaction, lower levels of income satisfaction, higher levels of satisfaction with their free time, and lower levels of satisfaction with health. Those estimates have no causal interpretation because there could be selection into retirement. For example, the negative association between retirement and life satisfaction could be due to the fact that individuals that are generally less happy retire earlier.[17]

Table 2 about here

In our regressions, we do not control for income as we interpret the drop in income as part of the effect of retirement. To illustrate the effect of retirement on income, Figure 2 shows how household income evolved around the retirement date for individuals retiring voluntarily or involuntarily. On average, household income is higher for those retiring voluntarily. For both groups, it drops at the date of retirement, but besides that it is rather stable over time.

Figure 2 about here

[17] Re-running these regressions with an indicator for being retired (i.e., not working) we find that individuals who are retired report 0.448 less for life satisfaction, 0.835 less for satisfaction with household income, 1.286 more for satisfaction with free time, and 0.398 less for satisfaction with health. These estimates are significantly different from zero at the 1 per cent level.

3. Econometric Approach

Our main results consist of estimates of the effect of voluntary and involuntary retirement on life satisfaction and satisfaction with the domains of life. They are obtained using the standard linear FE (within-group) estimator, thus controlling for time invariant individual heterogeneity that is related to selection into retirement. By allowing for FE we also control for cohort effects that have been documented to be important determinants of life satisfaction (Jürges, 2003). It is worth noting that we do *not* have to assume that the answers to the satisfaction questions are fully interpersonally comparable because we control for FE that shift the location of the response scale. However, we assume that the scale is comparable across individuals as we estimate a linear model. Ferrer-i-Carbonell and Frijters (2004) have shown that doing so does generally not lead to different conclusions.[18]

The main assumption we make is that retirement and the other explanatory variables are unrelated to the transitory components of the error terms in all periods (strict exogeneity). These transitory components could be related to health shocks and changes in household characteristics. We address this concern by controlling for household and objective health characteristics. In Section 5, we assess whether this is sufficient by comparing our baseline results to FD estimates (OLS estimates using first-differenced data), relaxing the strict exogeneity assumption, and to IV estimates, relaxing the assumption that retirement is in addition not related to time varying unobserved individual heterogeneity. Moreover, in this section we report results that we obtain when we conduct the analysis using only individuals who do not suffer from health problems related to disability or stays in a hospital, arguing that they are unlikely to retire due to health reasons.

The main results are accompanied by estimates of the importance of satisfaction with the three domains of life for life satisfaction. In our baseline specification we obtain those by regressing life satisfaction on the three measures of domain satisfaction, controlling for labor market status, age, as well as health and household composition, and for time invariant unobserved individual differences. For this we again use the FE estimator and also here we assume that there is no correlation between the transitory component of the error term and the domains of life satisfaction measures. This assumption could be violated if self-reported satisfaction measures are sensitive to the current mood of the individuals (mood or context effects), see, e.g., Schwarz and Clore (1983), Lucas *et al.* (1996), and Kahneman and Krueger

[18] See also Clark *et al.* (2008) for a discussion.

(2006). In such a case, the error term in the regression of life satisfaction on domain satisfaction would be positively correlated with the mood-driven components of the domain satisfaction measures, respectively, which would lead to an upward bias in the estimates of the coefficients on those measures. Schimmack (2006, p.72f) provides a short discussion of the related literature. He concludes that current mood has negligible effects on life satisfaction judgments, does not have a dominant influence on life satisfaction judgments, and sees this confirmed in the finding that the retest stability of life satisfactions judgments over a period of a few months is high.[19]

4. Results

Main results

Table 3 reports our main results. The first column is for the effect of voluntary and involuntary retirement on life satisfaction. We find that there is no significant overall effect of voluntary retirement on life satisfaction. This is consistent with Lindeboom et al. (2002)'s finding that there is no effect of retirement on mental health. However, we find that *in*voluntary retirement has adverse effects on life satisfaction. Considering that, according to Table 1, average life satisfaction for working individuals is 7.2, our estimate of a loss of 0.555 is large in terms of magnitude. This is consistent with the common finding that

[19] We have also performed a Monte Carlo study in which we generate a mood variable that is added to life satisfaction and the three domain satisfaction measures. This adds an *additional* mood effect, which should affect the estimates in the same way as the mood effect that is probably present in the original data. The mood variable is zero on average and takes on the values -2 and 2 with probability 0.1, respectively, -1 and 1 with probability 0.2, respectively, and 0 with probability 0.5. In the second column of Table 4 below we report that the coefficient on satisfaction with health is 0.200, on satisfaction with the household income is 0.160, and on satisfaction with the free time is 0.096. The corresponding average coefficients estimates we obtain in the Monte Carlo study with the additional mood effect are 0.304, 0.275 and 0.200. Hence, the respective differences between the estimated effect and those in the Monte Carlo are 0.104, 0.115, and 0.104. As these differences are roughly equal to each other, the differences between the coefficients, e.g. the difference between the coefficient on satisfaction with the household income and satisfaction with the free time, is almost not affected by the mood. This means that all coefficients are biased in a similar way and thus that the presence of such a mood effect does not affect the qualitative differences *between* the coefficients, the primary objects of interest in this study.

unemployment has large adverse effects on well-being (see e.g. Clark and Oswald, 1994; Winkelmann and Winkelmann, 1998).

Table 3 about here

The last three columns of Table 3 show that voluntary retirement has large and significant effects on satisfaction with the domains of life. Satisfaction with household income drops significantly due to retirement. The magnitude of the drop due to involuntary retirement is three times as high as the one due to voluntary retirement, and the difference is highly significant. At the same time, we observe a significant increase in satisfaction with the individuals' free time both for voluntary and involuntary retirement. The magnitude of this effect is bigger for voluntary than for involuntary retirement (however, the difference is only significant at the 10%-level). Finally, we find significant positive (but relatively small) effects of voluntary retirement on satisfaction with health, consistent with the findings of Coe and Lindenboom (2008), and Coe and Zamarro (2010), and significant negative (and bigger) effects for involuntary retirement. Notice that here we control for the health variables so that an interpretation could be that individuals are better able to adapt their lifestyle to health conditions when they are voluntarily retired. The negative effect of involuntary retirement might be due to deterioration in mental health. In fact, the estimated effect of voluntary retirement on health satisfaction is not significantly different from zero when we do not control for the health variables. Then, the effect of involuntary retirement is negative and significantly different from zero (-0.367, p=0.028). For the other domains and life satisfaction the estimates are very similar.

These results are illustrated in Figures 3 and 4, which were obtained by regressing the respective dependent variables in Table 3 on the same controls as above, as well as dummies for the time to, or since, voluntary and involuntary retirement, respectively. These variables are endogenous in the same way retirement is, and we therefore use the FE estimator to control for time invariant unobserved differences between individuals. The solid lines are second-order polynomial fits with a shift at the date of retirement, respectively.

Figures 3 and 4 about here

Both figures show that the main effects of retirement set in at the time of retiring and are permanent. There are, however, some exceptions. Satisfaction with household income increases again over the course of the first five years after retirement. This amounts to half of the drop for the voluntarily retired, and more than that for involuntarily retired individuals. This could be because the latter experience a higher drop in satisfaction with income at the time of retirement. Figure 2 shows the evolution of household income around the time of retirement. Interestingly, the trends in satisfaction with household income do not parallel the trends for household income. This suggests that individuals partially adapt to the change in household income that is due to voluntary or involuntary retirement. A similar pattern is observed regarding the effect of involuntary retirement on satisfaction with health. Within 5 years, individuals tend to recover from the drop that occurs at the time of retirement.[20] In light of this we interpret our fixed effects estimates as the average effect of being retired, averaging over time, rather than the effect of retiring.

Finally, it is interesting to compare the FE estimates in Table 3 to the OLS estimates in Table 2. OLS results for the effect of retirement are generally lower, suggesting that the respective individual FE in the satisfaction measures is negatively related to retiring. This means that those individuals in our sample who retire—both voluntarily and involuntarily—are less happy on average (as the fixed effect is positively related to satisfaction and negatively related to the likelihood to retire). The main difference between OLS and FE estimates is in the effects of retirement on life satisfaction and satisfaction with health, suggesting that especially time-invariant differences in health confound those satisfaction measures and retirement.

Importance of satisfaction with health, household income, and free time

The results that were presented above show that while there is no overall effect of voluntary retirement on life satisfaction, there is a negative effect on satisfaction with household income, a positive effect on satisfaction with free time, and a positive effect on satisfaction with health. This suggests that those effects offset each other.

[20] Adaptation theory in psychology argues that people's sense of well-being adjusts to long-term changes in objective life circumstances. This theory, however, is considered controversial (Schimmack, 2006, p.78). For example, Lucas *et al.* (2004) find that life satisfaction decreases sharply when individuals are laid off, increases again even when they remain unemployed, but not to its original level.

As already mentioned in the introduction, this argument can be attributed to the so-called life domain approach, which says that responses on global happiness are the net outcome of reported satisfaction in different domains of life. Regressing life satisfaction on satisfaction with the most important domains of life allows us to evaluate the importance of those domains for life satisfaction as a whole. Furthermore, we can thereby investigate whether the importance of the domains of life changes at retirement by adding interaction terms between satisfaction with the domains of life and labor market status to the right hand side variables. In order to control for the possibility that weights might also vary with age and confound with the change in weights due to retirement, we also include interaction terms between satisfaction with the domains of life and age. FE estimates are presented in Table 4. In all regressions, right hand side variables are de-meaned before being interacted with the retirement indicators so that coefficients on the retirement indicators represent average effects.

Table 4 about here

Column (i) repeats the baseline results of the life satisfaction equation from Table 3. Column (ii) presents the results of the model that also includes the three domains of life satisfaction measures as explanatory variables. From the differences in the sizes of the coefficients we can conclude that satisfaction with health is the most important determinant of life satisfaction, while satisfaction with free time is the least important.[21] The estimated effects of voluntary and involuntary retirement have now to be interpreted as the effects of retirement that are not captured by those three domains.[22] This residual effect of voluntary retirement is not significantly different from zero. It is significant and negative for involuntary retirement.

The model used in column (ii) assumes that the weights that individuals put on each domain are independent of retirement status. Those weights might however be affected by retirement

[21] This is because the three domain satisfaction measures use the same scale and the standard deviations of the domain satisfaction measures are very similar. They are 2.1 for satisfaction with income, 2.2 for satisfaction with the free time, and 2.3 for satisfaction with health.

[22] Using the coefficient estimates of the effect of voluntary retirement on the different satisfaction with domains of life from Table 3 and combining them with the coefficient estimates for each domain of satisfaction, we can calculate the net effect of the changes in the satisfaction with domains of life on life satisfaction that is actually equal to the difference between the two coefficient estimates of the voluntary retirement dummy in column (i) and (ii), by definition.

as well. Column (iii) presents the results of the model that takes this possibility into account. In particular, we include interaction terms between the retirement dummies and satisfaction with the three domains of life. Our estimates suggest that voluntarily retired individuals put more weight on satisfaction with free time and health, and put less weight on satisfaction with income. However, once we additionally include interaction terms between age and the domains of life in order to control for changes in the weights due to aging, the effect on the importance of satisfaction with health for voluntarily retired is not significantly different from zero anymore. Instead, we see that satisfaction with health becomes more important as individuals age.[23,24]

Taken together Tables 3 and 4 explain why we find no overall effect of being voluntarily retired on life satisfaction. In particular, the loss in income satisfaction (0.423) is compensated by gains in satisfaction with free time (1.171) and health (0.146). If anything, individuals who retire voluntarily amplify this by putting more weight on the domains in which the effect of retirement is positive, and putting less weight on the domain in which it is negative. Individuals who retire involuntarily suffer a loss in overall satisfaction because for them the drop in income satisfaction is higher (1.292), while the increase in leisure satisfaction is lower (0.800). Also the effect on satisfaction with health is lower (a drop of 0.247).

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[23] In psychology, several models attempt to describe strategies that people may employ to cope with the difficulties associated with ageing. One of the leading models is the lifespan model of selective optimization with compensation (SOC) developed by Baltes and Baltes (1990). In this model, individuals continuously *choose* life domains that are important to them and then optimize the resources and aids that facilitate success in these domains. By putting more or less weight on the different domains of life individuals adapt to biological, psychological, and socio-economic changes (Ouwehand *et al.*, 2007). This re-weighting becomes increasingly important at later stages in life since health and resources decrease (Marsiske et al., 1995, Baltes and Carstensen, 1996, Baltes and Lang, 1997, Freund *et al.*, 1999, Freund and Baltes, 2000). This view is not supported by our results as they indicate that individuals put more weight on health satisfaction as they age, while health satisfaction depends negatively on age.

[24] The additional variables that were included in column (ii), (iii) and (iv) were jointly significant, respectively. The corresponding *p*-values are 0.000, 0.000, and 0.036.

5. Robustness

In this section, we assess the robustness of our results to using different definitions of retirement, including individuals who are observed to go back to work, using subsamples of individuals for whom health shocks are less likely to occur, using the FD estimator instead of the FE estimator, and to using an IV estimator on first-differenced data that allows for fixed effects.

First, we abandon our distinction between involuntary and voluntary retirement and call individuals retired if they are not working and are not observed to go back to work during the sample period. Table 5 reports the results. The estimated effects are weighted averages of the effect of voluntary and involuntary retirement. More weight is put on the effect of voluntary retirement as more individuals retire voluntarily. Therefore, it is not surprising that the estimated effects of retirement are very similar to the one of voluntary retirement in Table 3.

Table 5 about here

In the analysis, we have dropped individuals who were observed to go back to work. We have done so because for them it was not clear whether they can be considered to be either voluntarily or involuntarily retired. Table 6 shows the results when we define them to be unemployed and include them in our sample. The estimates show that indeed, the effect of being unemployed is between the effect for involuntary and voluntary retirement. The latter two estimated effects remain largely unchanged.

Table 6 about here

Our main results in Tables 3 and 4 have been obtained using the FE estimator, assuming that the explanatory variables in all periods are unrelated to the error terms in all periods (strict exogeneity).This assumption is the weaker the less likely it is that individuals retire due to a health shock. This, in turn, is less likely to be the case if individuals don't report to be disabled over the whole sample period. Therefore, we reproduce Table 3 for individuals never reporting to be disabled.[25] The results are reported in Table 7 and are very similar to the

[25] Clearly, this is a selected sample of individuals. However, we control for sample selection by controlling for FE.

results reported earlier. We have also reproduced Table 3 for the sample of individuals who neither report to be disabled nor stay in a hospital over the whole sample period and find again similar results.[26]

Table 7 about here

The assumption needed for estimating the model on first-differenced data are weaker than strict exogeneity because we only need to assume that explanatory variables and error terms are uncorrelated in the same and adjacent periods. Table 8 presents results using the FD estimator (OLS estimates on first-differenced data). They are very similar to the results presented in Table 3, both in terms of significance and magnitude. An exception is the effect of being involuntary retired on satisfaction with free time that is not significantly different from zero anymore.

Table 8 about here

Finally, in order to assess whether unobserved shocks, in addition to time invariant individual differences, confound satisfaction with life and the domains of life on the one hand, and labor market status on the other hand, we obtain IV estimates that also control for FE. In particular, we use indicators for being older than 60, 63, and 65 years as instruments for voluntary retirement, assuming that reaching those ages affects well-being only through retirement once we control for a smooth age trend. This choice is based on the institutional rules, which, for the study population, provided financial incentives to retire no earlier than at age 60, and additional benefits if individuals retired at age 63 and more so at age 65.[27]

Figure 5 about here

[26] The same holds true when we reproduce Table 4 both without individuals reporting to be disabled at some point and individuals reporting to be disabled or have visited a hospital at some point. The results are omitted due to space limitations.

[27] See e.g. Börsch-Supan and Jürges (2009) for details on the institutional rules. This identification strategy to estimate the effect of retirement on different outcomes has been used by e.g. Charles (2004), Neumann (2007), Bernheim et al. (2001), and Haider and Stephens (2007).

Figure 5 shows the retirement hazard as a function of age, confirming that there is an empirical relationship between reaching age 60, 63, and 65, and the event of leaving the labor force. The figure shows that the hazard rate is highest at age 65. However, recalling Figure 1, most individuals are already retired by that age.

Besides, we use firm closures as an instrument for involuntary retirement. For the individuals in our sample it is highly unlikely that they find a new job once their firm closes because they are already older than 50 years. Hence, job loss is related to involuntary retirement. Salm (2009) finds no causal effect of exogenous job loss on various measures of physical and mental health, thus providing supporting evidence in favor of the necessary exclusion restriction that needs to hold, namely that a job loss due to a plant closure affects well-being only through retirement.

We implement the IV estimator on first-differenced data and use only data on individuals who have been working in the previous period. This is sensible as we drop individuals from our sample who are observed to go back to work and the instruments cannot have an effect on retired individuals when they are already retired. Table 9 shows our IV estimates. The first stage is a linear approximation to the hazard rate out of employment. The first column shows that the hazard rate out of employment and into voluntary retirement increases significantly when individuals turn 60, 63, and 65, respectively. This is not the case for involuntary retirement in the second column, which provides support for the way in which we distinguish between voluntary and involuntary retirement, as involuntary retirement should indeed not be related to financial incentives. A plant closure yields to an increase in the probability to retire in a given period by about 20 percentage points. The last four columns in Table 9 correspond to the four columns in Table 3. Very much in line with the results presented in Table 3 we find that voluntary retirement has only a small effect on life satisfaction, a sizable positive effect on satisfaction with free time, a smaller negative effect on satisfaction with income, and a small effect on satisfaction with health. However, it should be noted that, as usual, IV estimates on first-differenced data are less precise than plain FE estimates, and in fact we cannot conclude from this table alone that the effects of voluntary retirement on domain satisfaction are significantly different from zero.

Table 9 about here

Again very much in line with our previous findings presented in Table 3, we find that the effect of involuntary retirement on life satisfaction is negative. As compared to voluntary retirement, it is more negative on satisfaction with income, free time and health. The effects on satisfaction with these three domains of life are not estimated to be significantly different from zero, but the overall effect is.

Finally, having access to instruments that induce voluntary retirement and other instruments that induce involuntary retirement allows us to assess the validity of our definition of voluntary and involuntary retirement in yet another way. This is because once we treat not working as the endogenous variable, we estimate the average effect of retiring for those individuals who retire voluntarily when we use only instruments that are related to voluntary retirement, and the average effect of retiring for those individuals who retire involuntarily when we use only instruments that are related to involuntary retirement (Imbens and Angrist, 1994).[28] The reason for this is that the choice of the instrument determines who is a complier and IV estimates are average effects for compliers.

Tables 10 and 11 show the results. The effects of being retired for those who stopped working because of reaching a certain age, presumably the voluntarily retired, are not significantly different from zero. The magnitudes are lower than the ones reported in Table 3 for voluntary retirement, but the relative effects are similar. In particular, we again find the effect on satisfaction with free time to be the biggest in terms of magnitude, and twice as big as the one on satisfaction with household income.

Table 10 about here

Interestingly, when we use plant closures as an instrument in Table 11, we find significant negative effects of retiring on life satisfaction and satisfaction with income. The estimate of the effect on satisfaction with free time and health is, however, not significantly different from zero, respectively.

Table 11 about here

[28] That is, we now have one endogenous variable, being retired, which takes on the value one if the individual is not working.

6. Concluding Remarks

This paper provides an explanation for the common finding that the average effect of voluntary retirement on life satisfaction is typically found to be negligible. We show that while satisfaction with current household income decreases substantially, satisfaction with free time increases. At the same time, the effects on health are relatively small. We complement these estimates with estimates of the importance of domain satisfaction for life satisfaction and allow this link to depend on labor market status. This shows that, if anything, individuals change the weights to their advantage, putting more weight on satisfaction with free time and less weight on satisfaction with income.

Furthermore, we show that while the average effect of voluntary retirement on life satisfaction is negligible, involuntary retirement has adverse effects on life satisfaction due to bigger negative effects on satisfaction with household income and smaller positive effects on satisfaction with leisure. At the same time, there are small adverse effects on satisfaction with health and individuals put less weight on satisfaction with leisure, the only domain in which the effect of retiring is positive.

In Germany, the vast majority of individuals retire voluntarily. Our results suggest that these individuals are well-prepared for retirement in the sense that they experience a drop in satisfaction with income, but are able to offset this by deriving more satisfaction from their leisure.

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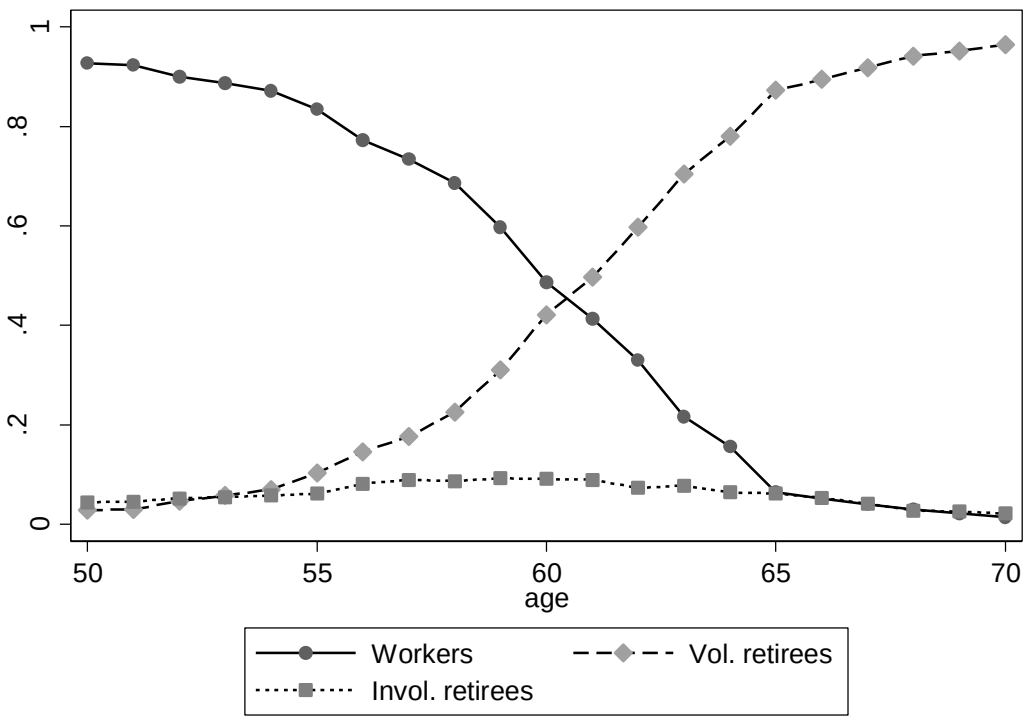
Tables and Figures

Table 1. Summary statistics

	All	Workers	Vol. retirees	Invol. Retirees
Number of observations	21,498	10,793	9,347	1,358
Life satisfaction	7.1	7.2	7.0	5.9
Satisfaction with leisure	7.4	6.7	8.3	7.6
Satisfaction with income	6.6	6.8	6.6	4.8
Satisfaction with health	6.2	6.6	5.8	5.2
Years of education	11.4	12.0	10.9	10.4
Age	59.5	55.5	64.2	59.0
Living in a couple	86.8%	87.1%	87.2%	81.8%
Number of adults	2.3	2.5	2.1	2.3
Number of children	0.2	0.3	0.1	0.1
Doctor visits	12.8	9.9	15.6	16.5
Legal degree of disability	14.9%	6.8%	23.8%	17.8%
Hospital stay	13.9%	10.3%	17.8%	16.3%

Note: GSOEP 1995-2008. Pooled sample.

Figure 1. Labor force status by age



Note: GSOEP 1995-2008.

Figure 2. Evolution of household income around the year of voluntary retirement.

Note: GSOEP 1995-2008. Calculated from FE estimates of the after-tax household income in 2008 Euros on indicator variables for year around retirement. Bars depict pointwise 95% confidence intervals.

Table 2. OLS results

	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Vol. retired	-0.181***	-0.440***	1.422***	-0.218***
	(0.063)	(0.080)	(0.077)	(0.071)
Inv. retired	-1.173***	-1.912***	0.916***	-0.890***
	(0.109)	(0.141)	(0.114)	(0.110)
Years of education	0.053***	0.112***	0.001	0.063***
	(0.008)	(0.010)	(0.010)	(0.009)
Age	-1.420	-0.716	-0.163	-1.203
	(0.864)	(1.087)	(1.037)	(0.998)
$Age^2/100$	2.525*	1.113	0.231	2.098
	(1.453)	(1.828)	(1.738)	(1.678)
$Age^3/1000$	-0.145*	-0.053	-0.009	-0.119
	(0.081)	(0.102)	(0.097)	(0.093)
Living in couple	0.550***	0.564***	0.337***	0.145
	(0.083)	(0.105)	(0.097)	(0.089)
Number of adults	-0.089***	-0.111***	-0.173***	-0.072**
	(0.030)	(0.038)	(0.041)	(0.035)
Number of children	-0.089**	-0.159***	-0.232***	-0.040
	(0.042)	(0.054)	(0.055)	(0.048)
Log(doctor visits+1)	-0.214***	-0.140***	-0.071***	-0.536***
	(0.014)	(0.017)	(0.017)	(0.016)
Legal degree of disability	-1.024***	-0.514***	-0.380***	-1.988***
	(0.102)	(0.121)	(0.108)	(0.108)
Hospital stay	-0.274***	-0.043	-0.031	-0.668***
	(0.044)	(0.051)	(0.050)	(0.050)
R^2	0.134	0.113	0.136	0.277
N	21,498	21,498	21,498	21,498

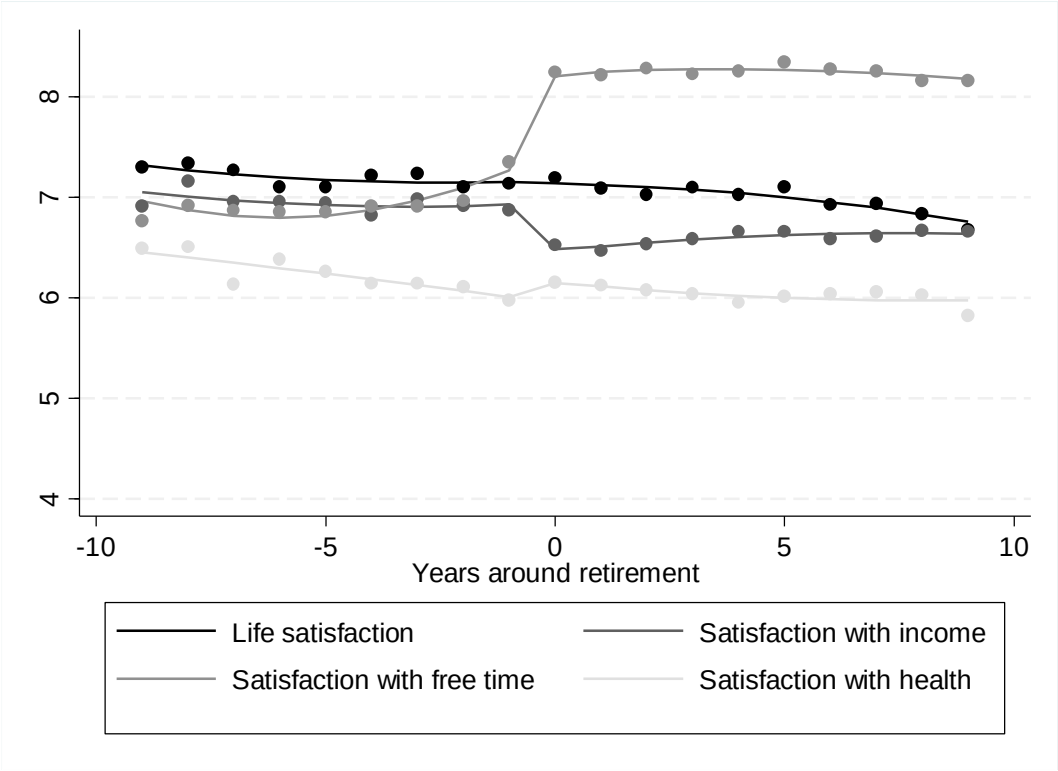
Note: GSOEP 1995-2008. Ordinary least squares estimates. Cluster robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 3. Effect of retirement on life and domain satisfaction

	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Vol. retired	0.047	-0.423***	1.171***	0.146**
	(0.051)	(0.067)	(0.075)	(0.064)
Inv. retired	-0.555***	-1.292***	0.800***	-0.247
	(0.150)	(0.165)	(0.207)	(0.160)
Age	-2.909***	-2.671***	-1.770*	-2.034**
	(0.740)	(0.893)	(0.937)	(0.907)
$Age^2/100$	4.988***	4.411***	2.931*	3.478**
	(1.243)	(1.500)	(1.574)	(1.522)
$Age^3/1000$	-0.285***	-0.241***	-0.160*	-0.200**
	(0.069)	(0.083)	(0.087)	(0.085)
Living in couple	0.334***	0.145	0.188	0.044
	(0.115)	(0.127)	(0.131)	(0.112)
Number of adults	-0.029	0.013	-0.063*	-0.014
	(0.026)	(0.033)	(0.036)	(0.032)
Number of children	0.020	0.181***	-0.144**	0.058
	(0.046)	(0.054)	(0.056)	(0.056)
Log(doctor visits+1)	-0.108***	-0.047***	-0.017	-0.313***
	(0.010)	(0.011)	(0.012)	(0.013)
Legal degree of disability	-0.598***	-0.158	-0.185	-0.665***
	(0.106)	(0.117)	(0.125)	(0.122)
Hospital stay	-0.211***	-0.055	0.033	-0.437***
	(0.031)	(0.035)	(0.039)	(0.041)
Within-R^2	0.031	0.021	0.050	0.077
N	21,498	21,498	21,498	21,498

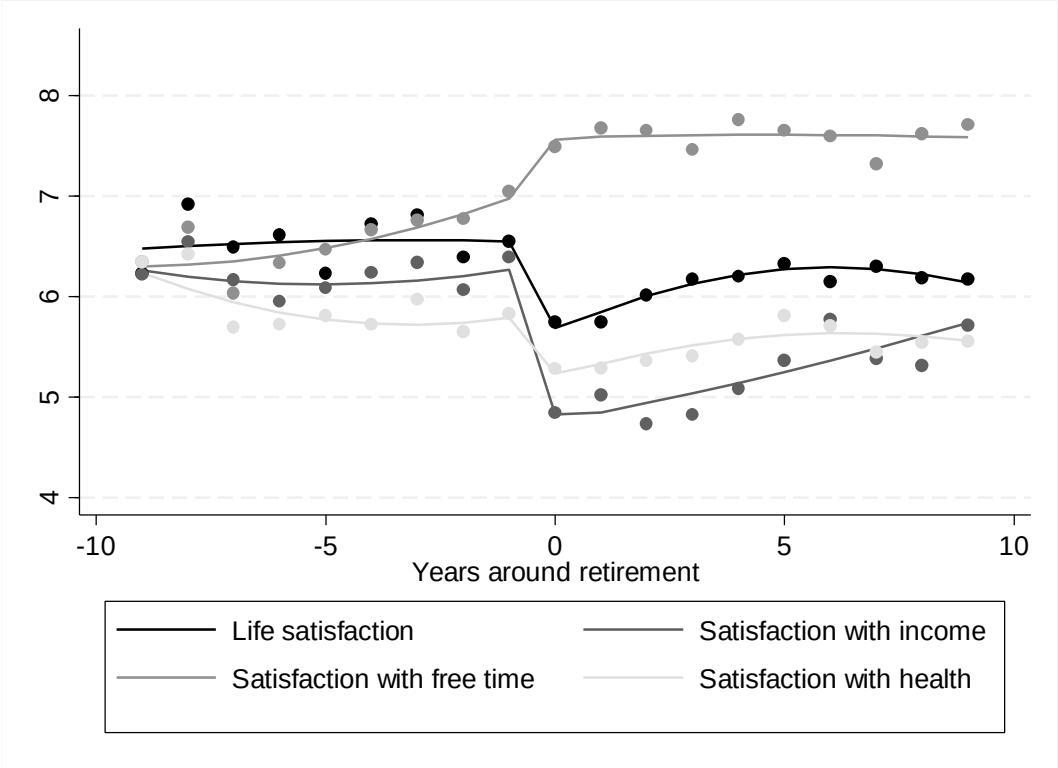
Note: GSOEP 1995-2008. FE estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Figure 3. Effect of voluntary retirement



Note: GSOEP 1995-2008. The solid lines are FE estimates, imposing that the expected satisfaction variables are second-order polynomial in the year around retirement, with a shift at the date of retirement. The dots are predicted values for the years before and after retirement that we obtain by using a specification with year dummies. We control for household and health characteristics.

Figure 4. Effect of involuntary retirement



Note: GSOEP 1995-2008. The solid lines are FE estimates, imposing that the expected satisfaction variables are second-order polynomial in the year around retirement, with a shift at the date of retirement. The dots are predicted values for the years before and after retirement that we obtain by using a specification with year dummies. We control for household and health characteristics.

Table 4. Domains of life model

	Life satisfaction			
	(i)	(ii)	(iii)	(iv)
Vol. retired	0.047	-0.027	-0.041	-0.047
	(0.051)	(0.044)	(0.045)	(0.045)
Inv. retired	-0.555***	-0.376***	-0.232*	-0.228*
	(0.150)	(0.116)	(0.124)	(0.124)
Satisfaction with health		0.200***	0.177***	0.189***
		(0.008)	(0.010)	(0.011)
Satisfaction with income		0.160***	0.177***	0.180***
		(0.009)	(0.012)	(0.013)
Satisfaction with free time		0.096***	0.073***	0.063***
		(0.008)	(0.009)	(0.010)
Vol. retired x Satisfaction with health			0.042***	0.015
			(0.014)	(0.018)
Vol. retired x Satisfaction with income			-0.050***	-0.056***
			(0.016)	(0.019)
Vol. retired x Satisfaction with free time			0.054***	0.074***
			(0.016)	(0.019)
Inv. retired x Satisfaction with health			0.043	0.031
			(0.032)	(0.032)
Inv. retired x Satisfaction with income			0.048	0.044
			(0.034)	(0.033)
Inv. retired x Satisfaction with free time			0.036	0.044
			(0.033)	(0.033)
Age x Satisfaction with health				0.004**
				(0.002)
Age x Satisfaction with income				0.001
				(0.002)
Age x Satisfaction with free time				-0.003*
				(0.002)
Age	-2.909***	-1.907***	-1.919***	-2.021***
	(0.740)	(0.646)	(0.644)	(0.642)
$Age^2/100$	4.988***	3.308***	3.322***	3.458***
	(1.243)	(1.085)	(1.081)	(1.077)
$Age^3/1000$	-0.285***	-0.191***	-0.192***	-0.197***
	(0.069)	(0.060)	(0.060)	(0.060)
Living in couple	0.334***	0.284***	0.278***	0.284***
	(0.115)	(0.102)	(0.102)	(0.103)
Number of adults	-0.029	-0.022	-0.024	-0.025
	(0.026)	(0.023)	(0.023)	(0.023)
Number of children	0.020	-0.007	-0.010	-0.011
	(0.046)	(0.039)	(0.039)	(0.039)
Log(doctor visits+1)	-0.108***	-0.037***	-0.038***	-0.038***
	(0.010)	(0.009)	(0.009)	(0.009)
Legal degree of disability	-0.598***	-0.422***	-0.395***	-0.385***
	(0.106)	(0.093)	(0.093)	(0.093)
Hospital stay	-0.211***	-0.118***	-0.117***	-0.116***
	(0.031)	(0.028)	(0.028)	(0.028)
Within-R^2	0.031	0.168	0.171	0.172
N	21,498	21,498	21,498	21,498

Note: GSOEP 1995-2008. FE estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 5. Fixed effects results
(no distinction between vol. and invol.)

	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Not working	-0.041	-0.551***	1.116***	0.089
	(0.051)	(0.065)	(0.072)	(0.061)
Age	-3.151***	-3.019***	-1.918**	-2.192**
	(0.741)	(0.896)	(0.942)	(0.906)
$Age^2/100$	5.369***	4.961***	3.165**	3.727**
	(1.245)	(1.503)	(1.581)	(1.521)
$Age^3/1000$	-0.305***	-0.270***	-0.172**	-0.213**
	(0.069)	(0.084)	(0.088)	(0.085)
Living in couple	0.338***	0.152	0.191	0.047
	(0.116)	(0.128)	(0.131)	(0.112)
Number of adults	-0.031	0.011	-0.065*	-0.015
	(0.026)	(0.033)	(0.036)	(0.032)
Number of children	0.022	0.183***	-0.143**	0.059
	(0.046)	(0.054)	(0.056)	(0.056)
Log(doctor visits+1)	-0.109***	-0.048***	-0.017	-0.313***
	(0.010)	(0.011)	(0.012)	(0.013)
Legal degree of disability	-0.597***	-0.157	-0.185	-0.664***
	(0.106)	(0.118)	(0.125)	(0.121)
Hospital stay	-0.213***	-0.058*	0.031	-0.438***
	(0.032)	(0.035)	(0.039)	(0.041)
Within-R^2	0.029	0.018	0.049	0.077
N	21,498	21,498	21,498	21,498

Note: GSOEP 1995-2008. FE estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 6. Fixed effects results
(including those going back to work)

	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Vol. retired	-0.038	-0.476***	1.064***	0.099*
	(0.046)	(0.062)	(0.066)	(0.058)
Inv. retired	-0.569***	-1.217***	0.829***	-0.246*
	(0.120)	(0.141)	(0.173)	(0.129)
Unemployed	-0.303***	-0.607***	0.848***	-0.009
	(0.071)	(0.091)	(0.088)	(0.077)
Age	-3.207***	-3.394***	-2.206**	-3.220***
	(0.701)	(0.831)	(0.865)	(0.831)
$Age^2/100$	5.494***	5.609***	3.688**	5.410***
	(1.178)	(1.394)	(1.451)	(1.395)
$Age^3/1000$	-0.313***	-0.307***	-0.203**	-0.304***
	(0.066)	(0.077)	(0.081)	(0.078)
Living in couple	0.376***	0.234*	0.059	0.064
	(0.105)	(0.120)	(0.121)	(0.104)
Number of adults	-0.033	-0.004	-0.058*	-0.019
	(0.025)	(0.033)	(0.033)	(0.029)
Number of children	0.012	0.144***	-0.159***	0.032
	(0.044)	(0.054)	(0.049)	(0.047)
Log(doctor visits+1)	-0.103***	-0.048***	-0.009	-0.308***
	(0.009)	(0.011)	(0.011)	(0.012)
Legal degree of disability	-0.554***	-0.188*	-0.118	-0.703***
	(0.100)	(0.109)	(0.114)	(0.112)
Hospital stay	-0.212***	-0.066**	0.029	-0.449***
	(0.029)	(0.032)	(0.036)	(0.038)
Within-R^2	0.031	0.026	0.049	0.078
N	25,138	25,138	25,138	25,138

Note: GSOEP 1995-2008. FE estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 7. Effect of retirement on life and domain satisfaction (only individuals reporting no disability during the sampling period)

	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Vol. retired	0.047	-0.414***	1.207***	0.214***
	(0.063)	(0.083)	(0.100)	(0.074)
Inv. retired	-0.670***	-1.277***	1.132***	-0.161
	(0.194)	(0.206)	(0.275)	(0.171)
Age	-3.015***	-2.806**	-2.516**	-3.120***
	(0.847)	(1.100)	(1.178)	(1.072)
$Age^2/100$	5.115***	4.634**	4.099**	5.325***
	(1.426)	(1.852)	(1.980)	(1.803)
$Age^3/1000$	-0.289***	-0.254**	-0.220**	-0.306***
	(0.080)	(0.103)	(0.110)	(0.100)
Living in couple	0.340**	0.176	0.226	0.113
	(0.150)	(0.158)	(0.183)	(0.133)
Number of adults	-0.058*	-0.017	-0.092**	-0.064*
	(0.031)	(0.038)	(0.045)	(0.038)
Number of children	-0.030	0.177***	-0.117*	-0.017
	(0.053)	(0.062)	(0.070)	(0.064)
Log(doctor visits+1)	-0.085***	-0.034**	-0.006	-0.280***
	(0.011)	(0.014)	(0.016)	(0.015)
Hospital stay	-0.208***	-0.000	0.049	-0.458***
	(0.043)	(0.051)	(0.055)	(0.057)
Within-R^2	0.022	0.021	0.059	0.075
N	13,278	13,278	13,278	13,278

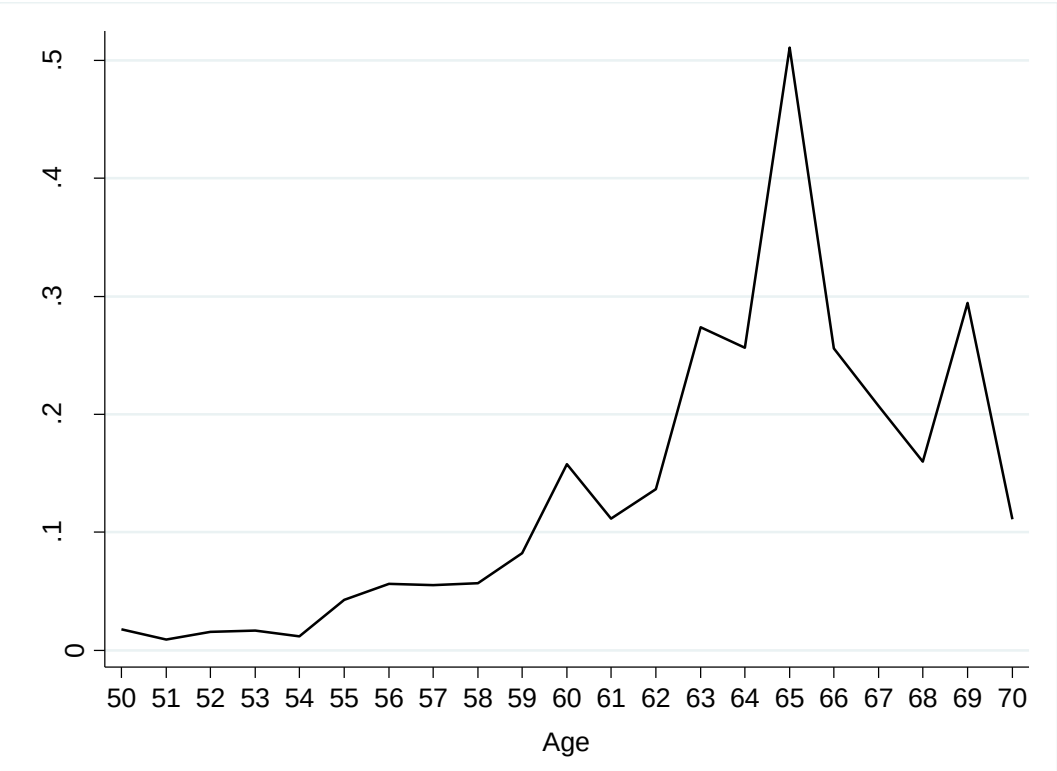
Note: GSOEP 1995-2008. FE estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 8. First difference results

	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Vol. retired	0.091	-0.426***	0.942***	0.221**
	(0.073)	(0.092)	(0.098)	(0.092)
Inv. retired	-0.771***	-1.318***	0.277	-0.380*
	(0.208)	(0.226)	(0.234)	(0.200)
Age	-3.417***	-2.827**	-4.091***	-1.309
	(1.005)	(1.178)	(1.239)	(1.233)
$Age^2/100$	5.789***	4.654**	6.792***	2.203
	(1.691)	(1.976)	(2.067)	(2.074)
$Age^3/1000$	-0.328***	-0.254**	-0.372***	-0.127
	(0.094)	(0.110)	(0.114)	(0.116)
Living in couple	0.266*	0.249	0.075	-0.075
	(0.159)	(0.156)	(0.160)	(0.172)
Number of adults	0.027	-0.007	-0.065	0.026
	(0.036)	(0.041)	(0.049)	(0.047)
Number of children	0.127*	0.090	-0.025	0.163**
	(0.070)	(0.068)	(0.082)	(0.076)
Log(doctor visits+1)	-0.085***	-0.030**	-0.013	-0.237***
	(0.011)	(0.012)	(0.013)	(0.014)
Legal degree of disability	-0.467***	-0.010	-0.146	-0.417***
	(0.123)	(0.120)	(0.122)	(0.147)
Hospital stay	-0.094***	-0.048	0.045	-0.240***
	(0.035)	(0.036)	(0.042)	(0.042)
R^2	0.013	0.007	0.009	0.036
N	16,903	16,903	16,903	16,903

Note: GSOEP 1995-2008. FD estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Figure 5. Retirement hazard



Note: GSOEP 1995-2008. The figure shows the probability to retire by age conditional on working the previous year.

Table 9. IV estimates for voluntary/involuntary retirement

	Vol. Retired	Inv. Retired	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Vol. retired	-	-	0.042	-0.299	0.677	0.121
			(0.434)	(0.535)	(0.596)	(0.613)
Inv. retired	-	-	-2.736**	-1.537	-0.786	-1.136
			(1.299)	(1.167)	(1.378)	(1.360)
Age	1.572**	-0.051	-1.392	2.015	-1.070	-0.360
	(0.630)	(0.279)	(2.504)	(2.935)	(3.433)	(3.994)
$Age^2/100$	-3.227***	0.098	2.101	-3.824	0.816	0.504
	(1.141)	(0.497)	(4.577)	(5.347)	(6.283)	(7.346)
$Age^3/1000$	0.220***	-0.005	-0.102	0.237	0.022	-0.026
	(0.069)	(0.029)	(0.279)	(0.326)	(0.384)	(0.451)
Living in couple	-0.008	0.005	0.123	0.134	0.136	-0.274
	(0.025)	(0.005)	(0.189)	(0.185)	(0.200)	(0.235)
Number of adults	-0.003	-0.001	0.008	-0.033	-0.054	-0.017
	(0.007)	(0.004)	(0.042)	(0.049)	(0.064)	(0.056)
Number of children	0.003	0.002	0.083	0.027	-0.029	0.080
	(0.009)	(0.004)	(0.078)	(0.080)	(0.098)	(0.087)
Log(doctor visits+1)	-0.000	0.001*	-0.082***	-0.022	-0.028	-0.253***
	(0.002)	(0.001)	(0.013)	(0.016)	(0.019)	(0.018)
Legal degree of disability	0.248***	0.004	-0.452	-0.110	0.143	-0.350
	(0.047)	(0.017)	(0.275)	(0.277)	(0.331)	(0.312)
Hospital stay	0.007	0.004	-0.042	-0.050	0.082	-0.255***
	(0.008)	(0.004)	(0.050)	(0.052)	(0.066)	(0.063)
Age 60+	0.039**	0.006	-	-	-	-
	(0.015)	(0.006)				
Age 63+	0.118***	0.006	-	-	-	-
	(0.029)	(0.009)				
Age 65+	0.342***	0.002	-	-	-	-
	(0.049)	(0.014)				
Closure of the firm	0.199***	0.232***	-	-	-	-
	(0.056)	(0.056)				
N	8,699	8,699	8,699	8,699	8,699	8,699

Note: GSOEP 1995-2008. FD IV estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 10. IV estimates for voluntary retirement (age related instrument)

	Retired	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Retired	-	-0.025	-0.332	0.639	0.048
		(0.404)	(0.518)	(0.577)	(0.592)
Age	1.448**	-0.925	2.236	-0.816	-0.011
	(0.656)	(2.297)	(2.855)	(3.333)	(3.871)
$Age^2/100$	-3.003**	1.235	-4.235	0.345	-0.159
	(1.185)	(4.180)	(5.190)	(6.086)	(7.108)
$Age^3/1000$	0.208***	-0.052	0.261	0.050	0.014
	(0.071)	(0.255)	(0.316)	(0.372)	(0.437)
Living in couple	-0.007	0.115	0.130	0.132	-0.278
	(0.025)	(0.189)	(0.185)	(0.200)	(0.236)
Number of adults	-0.003	0.009	-0.032	-0.054	-0.017
	(0.008)	(0.041)	(0.050)	(0.064)	(0.055)
Number of children	0.004	0.080	0.026	-0.031	0.078
	(0.010)	(0.077)	(0.080)	(0.098)	(0.087)
Log(doctor visits+1)	0.001	-0.086***	-0.023	-0.030	-0.255***
	(0.002)	(0.013)	(0.016)	(0.018)	(0.018)
Legal degree of disability	0.246***	-0.438	-0.103	0.151	-0.333
	(0.050)	(0.269)	(0.277)	(0.328)	(0.310)
Hospital stay	0.011	-0.053	-0.055	0.077	-0.259***
	(0.008)	(0.049)	(0.052)	(0.065)	(0.063)
Age 60+	0.044***	-	-	-	-
	(0.016)				
Age 63+	0.123***	-	-	-	-
	(0.030)				
Age 65+	0.348***	-	-	-	-
	(0.049)				
N	8,699	8,699	8,699	8,699	8,699

Note: GSOEP 1995-2008. FD IV estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 11. IV estimates for involuntary retirement (plant closure instrument)

	Retired	Life satisfaction	Satisfaction with income	Satisfaction with free time	Satisfaction with health
Retired	-	-1.425**	-0.946*	-0.089	-0.482
		(0.581)	(0.541)	(0.636)	(0.639)
Age	3.262***	3.574	4.208	1.526	1.692
	(0.768)	(2.866)	(3.085)	(3.552)	(3.675)
$Age^2/100$	-6.412***	-7.628	-8.119	-4.268	-3.513
	(1.381)	(5.310)	(5.634)	(6.511)	(6.742)
$Age^3/1000$	0.421***	0.531	0.517	0.353	0.235
	(0.082)	(0.330)	(0.345)	(0.400)	(0.414)
Living in couple	-0.001	0.109	0.128	0.129	-0.280
	(0.026)	(0.195)	(0.186)	(0.205)	(0.239)
Number of adults	-0.004	0.003	-0.035	-0.057	-0.019
	(0.008)	(0.042)	(0.050)	(0.065)	(0.057)
Number of children	0.004	0.083	0.027	-0.029	0.079
	(0.011)	(0.078)	(0.080)	(0.100)	(0.089)
Log(doctor visits+1)	0.001	-0.084***	-0.023	-0.029	-0.254***
	(0.002)	(0.014)	(0.016)	(0.019)	(0.018)
Legal degree of disability	0.250***	-0.098	0.047	0.328	-0.204
	(0.051)	(0.300)	(0.275)	(0.325)	(0.320)
Hospital stay	0.011	-0.039	-0.048	0.084	-0.254***
	(0.008)	(0.050)	(0.051)	(0.065)	(0.064)
Closure of the firm	0.436***	-	-	-	-
	(0.065)				
N	8,699	8,699	8,699	8,699	8,699

Note: GSOEP 1995-2008. FD IV estimates. Robust standard errors are in parentheses. (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1% level, respectively.