

Pension, Frictions and Poverty.

Structural Evidence on the Consequences of Pension Reforms

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Abstract — After introducing obligatory and unfunded PAYG pension plans in the 19th and early 20th century, many Western countries nowadays struggle too keep up generosity. By way of illustration, US, UK, Italy and Germany all were pressured towards upward-shifting their regular retirement age by low fertility and high life-expectancy. In the presence of rationed labor markets, these reforms can not take full effect. In this respect, distributional effects are of concern, since labor market frictions are of varying significance for individuals of different skills, experience and levels of tenure.

Having access to high-precision administrative data I estimate a dynamic discrete choice model of retirement. The model is identified by cohort specific variation in pension benefit rules and facilitates the probability of involuntary job loss to differentiate between voluntary and involuntary retirement. A subsequent policy-simulation suggests that the behavioral response to both a raise in early retirement deductions and regular retirement age is moderate and hampered by the unavailability of jobs. Due to frictions, already poverty-vulnerable groups can react least to pension reforms and consequently suffer most. Life-time income inequality is increased.

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1 Introduction

Low fertility and rising life-expectancy are putting pressure on public retirement schemes worldwide since most of them are largely unfunded pay-as-you-go systems. As a coping strategy, most welfare states initiated a reform process that often focuses on cutting back generosity and increasing the age of benefit eligibility. This happened or happens right now in the US, France, Germany, Denmark, Canada and many other countries. Most schemes by now have introduced early retirement benefit deductions while still allowing for an early receipt. This effectively puts a price on early retirement. The resulting trade-off is one between longer working life and bearing benefit reductions. Also, often pension receipt can to some extent be substituted with unemployment benefits or social assistance, creating a more diverse roadmap of retirement timing.

Generally, however, a financial incentive to postpone retirement comes to nothing if a longer working lifetime is not a possibility in the sense that jobs can not be found or retained. A rationed labor market for older people would hamper the attempt of a prolonged working life. As a natural consequence income is reduced if alternatives amount to nothing more than accepting early retirement deductions and unemployment. More specific, financial incentives can be effective in increasing average retirement age if and only if working is an available choice.

In the U.S. unemployment at ages 55–64 fluctuated between 2 and 8% for the last 5 decades (US. Bureau of Labor Statistics 2016). In the years between 1998 and 2015 the annual unemployment rate of people aged 55–64 in Germany often lay above 10%, peaking at 15.4% in 1998 (OECD 2016). Similar figures are available for other industrialized countries. Also, employment rates generally experience a considerable drop already long before regular retirement age.

Still, the differentiation between involuntary and voluntary job loss is important since unemployment benefit rules often are favorable to older people or had been in the past while early retirement is not always accessible.

Yet, I suspect the low educated and poor and persons with low tenure to have the highest risk of facing involuntary job losses. Therefore, I want to throw light on the likely consequences of pension reforms in terms of employment rates and income for this poverty-vulnerable group. While reduced benefits, by definition, hurt, raising working lifetime does not necessarily imply big sacrifices and on average can even induce income gains. Here, an analysis of distributional effects is informative on the (non-)generalizability of income gains of increased regular retirement ages.

There already is reduced forms studies utilizing discontinuities in pension regulations as natural experiments. Staubli and Zweimüller (2013) use variation in Austrian early retirement age across time to conclude that the employment

response to a reform is especially pronounced for skilled and healthy workers whereas low-skilled workers substituted retirement with unemployment benefits. Exploiting changing eligibility rules for ethnic German immigrants to Germany, Puhani and Tabbert (2016) argue that early retirement is too attractive for deduction increases to evoke behavioral responses. They suspect a corner solution with a great share of people willing to accept income cuts. To the contrary, my argument will be that of involuntary unemployment forcing people into retirement. Generally, reduced-form results are hard to generalize, ex-ante evaluation of forthcoming reforms is difficult. The exact process of retirement remains unclear.

Stock and Wise (1990) studied retirement behavior of U.S. workers eligible for a specific firm-based retirement program. The innovative semi-structural incentive measure they used, the *Option Value of Work*, intuitively is the difference between discounted lifetime income in case of immediate retirement and in case of continued work and thus postponed retirement. A high Option Value expresses high incentives of continued work and is shown to be associated with relatively late retirement. If frictions were modeled, restrained workers would have a low option value as their employment prospects are low. Also for the U.S., there already is structural evidence explicitly accounting for wealth and health in the retirement process (French 2005), or allowing for preference heterogeneity (Gustman and Steinmeier 2005). In a recent study, Manoli, Mullen, and Wagner (2015) use Austrian Social Security Data to fit a structural model to match reduced form estimates of price and income elasticities of older workers' labor supply. Additional to variation stemming from distinct working biographies they exploit exogenous variation from policy reforms. Simulations point into the intuitive direction of increased early retirement deductions leading to retirement postponement. Manoli, Mullen, and Wagner (2015) also perform a welfare analysis suggesting that welfare inequality increases for an upward-shift in early retirement deductions. This stems from the fact that low-skilled individuals typically retire early and bear the full shift in deduction levels — unlike high-skilled individuals who already retire at an, on average, nearly deduction-free age. The early retirement of low-skilled workers is rationalized by their low wages in combination with a working disutility largely insensitive to socio-demographic characteristics, but not a rationed labor market. Analyzing current reforms of the German pension scheme, Bönke, Kemptner, and Lüthen (2015) estimate a structural dynamic discrete choice model of retirement and subsequently calculate measures of inequality (e.g. the Gini-coefficient) of expected remaining lifetime consumption. They find large welfare losses in the medium income bracket and increased inequality in response to early retirement deductions. They assume no frictions to be present, that is the calculated behavioral responses are interpreted as the rational and intended reactions to incentives. In this

interpretation, small responses result from small incentives.

Already Blundell, Ham, and Meghir (1987) extended the standard static labor supply decision of British women by introducing a double-hurdle model, a generalization of the Tobit model. Intuitively, there is a probability of labor market rationing that may overrule the actual hours decision. Haan and Uhlenborff (2013), Haan and Prowse (2014), and Haan and Prowse (2015) all estimate dynamic discrete choice models of labor supply in the presence of frictions. A rationed labor market is introduced via a probability of involuntary job loss that constrains the individual in her choice set. These probabilities vary along certain socio-demographic characteristic and are internalized when forming expectations about the future. In a related setup, van der Klaauw and Wolpin (2008) use data on expectations over future changes in Social Security policy to estimate retirement behavior of US couples. This, they allow for the individual to consider the probability of future choice sets being restrained. In my analysis I will orientate myself specifically on the way frictions are handled in Haan and Prowse (2014).

To illustrate the ambiguity of pension reforms, I will perform an in-depth ex-ante evaluation of the most recent reform of the German Statutory Pension Scheme, the lifting of the regular retirement age to 67, fading in until 2031. Using detailed micro panel data as an auxiliary source of information, I know the extend to which job losses are involuntary in the age group 60+. This, I construct a probability of involuntary job losses varying along a range of characteristic. Already poverty-vulnerable groups face the highest risks of involuntary job loss. I use this probability in a dynamic discrete choice framework focusing on West German men aged 60 and older. I use precise register based employment histories to estimate the behavioral parameters of retirement timing. My model is identified by cohort-specific variation in pension regulations from reforms taking effect in the 90's and 2000's.

Concerning the setup of the model, as long as people are not retired, the choice set consists of retirement and a continued working life. Working people face some external risk of unemployment and subsequent forced retirement, effectively restraining their choice set. I differentiate between two paths into retirement. First, immediate pension claiming, and, second, unemployment benefit claiming preceding regular retirement. Eventual retirement is modeled as an absorbing state. Individuals form rational expectations about future periods, including the risks of unemployment.

In comparison to a non-friction specification, the estimated CRRA parameter γ is increased. This has implications for subsequent simulations. In a preliminary simulation scenario, a 10% increase of already existing deductions results in an average retirement postponement of 0.45. In the absence of frictions, the reaction would be 0.76 months. Simulation seems to be sensitive to the introduction of frictions.

While pushing the mean retirement age is an aim of current German and international reforms of retirement schemes, harming vulnerable groups with reforms seldom is. There are groups less likely to alter behavior in response to policy reforms inasmuch as people less educated, poor, with low tenure, or sick are generally the ones most endangered by involuntary job loss. This, I will thoroughly investigate the financial implications for vulnerable groups stemming from the frictions-caused inability to adjust retirement behavior. In advance of the results, discussing demand side measures to avoid old-age poverty might be worthwhile.

Explicitly analyzing the ambiguous consequences of pension reforms for different societal groups in the presence of labor market frictions is a contribution to the literature. The structure of this paper is as follows: I proceed by describing the model in section 2 and continue by discussing the data in section 3. Furthermore, I discuss issues of estimation and identification in section 4, including a short explanation of the German statutory pension scheme and recent reforms. Estimation results are presented in section 5. Ex-ante evaluating a shift in regular retirement age, I use my estimates to analyze the fate of vulnerable groups under a new pension regime from both a behavioral as well financial perspective. This is done in section 5.1. I will discuss my results and conclude in section 6.

2 Model

This section is devoted to explaining the dynamic discrete choice model structure. I begin with an overview of the retirement process that explicitly accounts for labor market frictions. The model starts with age 60 and ends 5 periods later, with age 65. For a subsequent simulation it is extended to age 67.

In section 2.2 I introduce and describe the flow utilities of the different labor market states. Next, I discuss how flow utilities are incorporated into the value function V (see section 2.3) and derive choice probabilities (section 2.4). Essential to the decision process are budget constraints discussed in section 2.6. To round off, I give a few remarks on the nature of the labor market frictions in my model in section 2.5.

2.1 Overview

I make use of a Dynamic Discrete Choice model to implement the retirement decision. Every period, that is every year, individuals are confronted with the decision whether to retire or not. Retirement is assumed to be an absorbing state in the sense that once retired people can not return to the labor market. Choosing to work retains the possibility to make further decisions in the fu-

ture. I assume that there is no certainty about the possibility (or necessity) of further decision making: In the spirit of Haan and Prowse (2014), individuals are affected by involuntary job loss with probability Φ . By not allowing for job offers after age 60, individuals are forced into retirement upon job loss¹. The resulting one-period decision problem is visualized as a decision tree in In figure 1. Starting left, working people (at node W) either face frictions and involuntarily lose their job, or can decide what to do next period. I distinguish between two empirically relevant pathways into retirement. First, immediate pension claiming. Second, pension claiming after unemployment. This, unemployment spells after age 60 are already treated as retirement in the sense that they form the first stage of an irreversible pathway eventually leading to pension claiming. Consequently, my definition of retirement status differs from the legal act of pension benefit claiming: *Retired* is whoever stopped working. However, it is crucial to note that unemployment generally is not necessary to eventually claim pension benefits. If age requirements are met, people can retire directly through $R1$.² Also, the initial experience of frictions does not determine the eventual retirement pathway. Whereas only non-rationed individuals retain the option to continue work, both rationed and non-rationed individuals can choose between the two pathways into retirement: regular retirement status $R1$ is reachable as well as retirement after unemployment $R2$. Retirement after unemployment $R2$ implies a spell of unemployment benefit receipt followed by actual retirement. The unemployment spell is not necessarily induced by frictions but can be opted for voluntarily.

Retirement with preceding periods of unemployment, nevertheless, is, from a financial point of view, mostly the more attractive option: first, spending some time in unemployment circumvents deductions on early retirement benefits, and second, unemployment benefits are typically well above the level of pension benefits, at least for some time. To rationalize the share of immediate pension benefit claims observed nonetheless, I introduce a stigma parameter for those in unemployment.

Only observing the final status but not the presence of labor market frictions, I can not distinguish between those forced into retirement due to frictions and those who voluntarily decide to retire. This, I utilize externally estimated probabilities of involuntary job loss Φ . Since Φ varies over socio-demographic characteristics and tenure, I have additional variation at hand to identify the

¹ This assumption is backed up by auxiliary information from SOEP, a German Household Panel showing that only 5% will ever find a job after spells of unemployment at age 60 or beyond.

² In the special case of Germany, once retired from work and above age 63, people are maximizing over the different paths into retirement, unemployment with subsequent benefit claiming $R2$ and immediate benefit claiming $R1$, respectively. Before age 63, however, access to old-age pension is restricted to people with previous spells of unemployment, immediate pension claiming is legally not possible. Thus, while the decision tree applies to all the analyzed cohorts in a similar fashion, the pathway choice simplifies to solely allowing for retirement option $R2$ for ages 60-62.

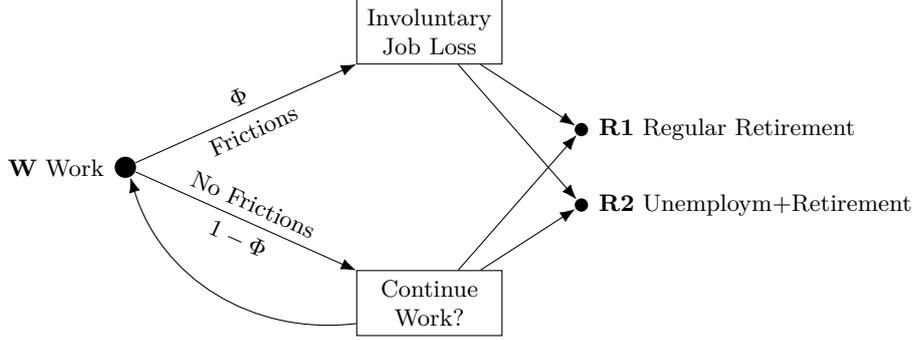


Figure 1: Period-wise Decision Tree for Individuals Still Working

model. Section 2.5 deals with the construction of Φ from external survey data in more detail.

2.2 Flow Utility

Looking at the period-wise flow utilities of work and different types of retirement, they differ slightly in construction. Common to all flow utilities is the basic structure of a constant relative risk aversion (CRRA) utility function with a risk aversion $\gamma > 0$. Consumption is determined by income Y_s , with the level dependent on the source of income $s = \{w, r, u\}$, income from labor, retirement benefits and unemployment benefits, respectively. The composition of Y is explained in more detail in section 2.6 on the budget constraint.

Turning to the differences, only working implies disutility from work ν (see eq. (1)) varying over basic socio-demographic characteristics inclusive a linear age term. Receipt of unemployment benefits implies a constant stigma term τ_{stigma} (see eq. (3)) that disappears for subsequent actual retirement benefit receipt. Immediate retirement (eq. (2)) neither implies stigma nor working disutility. The stochastic error terms are assumed to be drawn from a extreme value type 1 distribution, $\epsilon_W, \epsilon_{R1}, \epsilon_{R2} \sim EV_1(0, 1)$.

$$u_W = \frac{Y_w^{1-\gamma} - 1}{1-\gamma} + \nu + \epsilon_W \quad (1)$$

$$u_{R1} = \frac{Y_r^{1-\gamma} - 1}{1-\gamma} + \epsilon_{R1} \quad (2)$$

$$u_{R2}(s) = \frac{Y_s^{1-\gamma} - 1}{1-\gamma} + \mathbf{1}(s = u) \cdot \tau_{stigma} + \epsilon_{R2} \quad (3)$$

2.3 Value Functions

The related value functions reflect the dynamic nature of the decision problem. The value of being at work at age a is denoted in eq. (4). It comprises the current flow utility u_W and the continuation value of work, that is the expectation about the uncertain future. This expectation hinges on the different options and their pay-offs, and on the risk of facing frictions. With probability Φ individuals experience an involuntary job loss and the choice set

is limited to the two retirement options of immediate pension benefit claiming (with payoff V_{a+1}^{R1} , see eq. (5)) or delayed claiming (with payoff V_{a+1}^{R2} , see eq. (6)). With probability $1 - \Phi$ the individual can choose between retirement and continued work. Choosing to work implies a repeated decision in the following period $a + 1$. Choosing to retire implies a follow-up decision on the form of retirement, just like in the case of involuntary job loss. As retirement is an absorbing state, neither V^{R1} , nor V^{R2} imply any further decisions. They are constructed as sums over the utility derived from future unemployment and retirement benefits. As I will describe in section 2.6, the receipt of unemployment benefits generally is of limited duration and assumed to be followed by immediate pension claiming. Also, I abstract from cases of intermediate receipt duration, that is I assume people to either not claim unemployment benefits at all, or receive them for the maximum amount of time³.

Throughout my analysis I assume a discount factor $\beta = 0.95$, a popular value in the literature. The survival probability π is taken from the Federal Statistical Office's projections based on sex and year of birth.

$$V_a^W = u_W + \beta \cdot \pi_{a+1|a} \cdot [\Phi_{a+1} \cdot E \max_{R1, R2} \{V_{a+1}^{R1}, V_{a+1}^{R2}\} + (1 - \Phi_{a+1}) E \max_{R, W} \{E \max_{R1, R2} \{V_{a+1}^{R1}, V_{a+1}^{R2}\}, V_{a+1}^W\}] \quad (4)$$

$$V_a^{R1} = u_{R1} + \sum_{t=a+1}^T \beta^{t-a} \cdot \pi_{t|a} \cdot E[u_{R1}] \quad (5)$$

$$V_a^{R2} = \underbrace{u_{R2}(u) + \sum_{t=a+1}^{t_u} \beta^{t-a} \cdot \pi_{t|a} \cdot E[u_{R2}(u)]}_{\text{Unemployment until } t_u} + \underbrace{\sum_{t=t_u+1}^T \beta^{t-a} \cdot \pi_{t|a} \cdot E[u_{R2}(r)]}_{\text{Pension from } t_u + 1 \text{ on}} \quad (6)$$

2.4 Choice Probabilities

Assuming EV1 stochastic error terms I can derive closed form solutions of the choice probabilities. On the notational side, I introduce \bar{V}^K as the K^{th} -alternative value function V^K minus ϵ_K with $K = \{W, R1, R2\}$ as introduced in eqs. (4) to (6). The expected value of the first stage decision to retire (agnostic of the best type of retirement, $R1$ or $R2$), V^R , is found in eq. (7).

$$V^R = E \max \{V^{R1}, V^{R2}\} = 0.5772 + \ln(\exp V^{R1} + \exp V^{R2}) \quad (7)$$

The closed form probabilities to opt for one of the three possibilities $C = W, R1, R2$ are described in eqs. (8) to (10).

In each of the equations, the first term refers to the decision whether to retire

³ The data supports this assumption.

or not, the (optional) second term refers to the decision between the two forms of retirement, $R1$ and $R2$. Since the described probabilities are equivalent to a multinomial logit model, I need the IIA assumption. However, I have no reason to contest it, given my observables (the superiority of leisure over working is already captured in working disutility ν).

$$\begin{aligned} Pr(C = W) &= (1 - \Phi) \cdot Pr(\bar{V}^R < V^W) = (1 - \Phi) \cdot Pr(V^W - \bar{V}^R > 0) \\ &= (1 - \Phi) \cdot \frac{1}{1 + e^{\bar{V}^R - V^W}} \end{aligned} \quad (8)$$

$$\begin{aligned} Pr(C = R1) &= \langle \Phi + (1 - \Phi) \cdot Pr(V^R > V^W) \rangle \cdot Pr(V^{R1} > V^{R2}) \\ &= \langle \Phi + (1 - \Phi) \cdot \frac{1}{1 + e^{\bar{V}^W - \bar{V}^R}} \rangle \cdot \frac{1}{1 + e^{\bar{V}^{R2} - \bar{V}^{R1}}} \end{aligned} \quad (9)$$

$$\begin{aligned} Pr(C = R2) &= \langle \Phi + (1 - \Phi) \cdot Pr(V^R > V^W) \rangle \cdot Pr(V^{R1} < V^{R2}) \\ &= \langle \Phi + (1 - \Phi) \cdot \frac{1}{1 + e^{\bar{V}^W - \bar{V}^R}} \rangle \cdot \frac{1}{1 + e^{\bar{V}^{R1} - \bar{V}^{R2}}} \end{aligned} \quad (10)$$

The probabilities in eqs. (8) to (10) are used in a Maximum Likelihood estimation routine. Typical for dynamic discrete choice models, a recursive approach is taken to calculate expectations of future periods' value functions well in advance and use them to determine initial value functions, for an extensive overview see Keane, Todd, and Wolpin (2011).

2.5 Labor Market Frictions

The risk of losing a job depends on various personal characteristics and furthermore varies by region. As a auxiliary data source, I use a Micro-Panel to perform a first stage logit regression to associate the binary outcome of involuntary job loss to various socio economic characteristics, an approach similar to the attempt of Haan and Prowse (2014). The resulting predicted risk of job loss Φ of this first stage regression can be replicated in the main analysis' administrative data set since comparable variables are available there, too.

At age 65 definite job destruction is assumed due to the unique legal possibility of cost-free lay offs at the employee's regular retirement age. This possibility is used by virtually every firm. As another disincentive to hire or retain old workers, from age 65 onwards temporary contracts become illegal. As a consequence, assuming definite job loss at age 65 together with zero chances of re-entry into employment afterwards seems reasonable. Thus, $\Phi_{s,t} = 1$ for $s \geq 65$.

2.6 Budget Constraint

The different incomes Y_s can be traced back to the legal employment status of work, unemployment and pension receipt, $s = \{w, u, r\}$. Consumption is

assumed to equal income.⁴

The net labor income Y_w is computed as the monthly gross income from labor minus the corresponding levels of income tax (for a single man) and social security contributions. However, wages are only observed for the currently working individuals, but have to be projected into the future to rationalize decision making. In the previous literature several ways of projecting are discussed. For example, future labor income can be estimated in a wage regression on tenure, experience, industry sectors, education and occupations, sometimes adjusted by a individual specific constant term to fit at least the current observation perfectly (see e.g. Alan L. Gustman 1986; Gustman and Steinmeier 2005). Potential earnings after reaching the regular retirement age are assumed to only be reduced by a reset of tenure to zero, that is, a obligatory job separation is modeled, however, with the possibility of immediate re-entry into new employment using the same wage equation (wages are assumed to change only little due to reduced tenure). This reflects the automatism of lay-off at regular retirement age also found in German data but probably heavily over-estimates the earnings prospects of workers aged 65+.

In another approach, wages are assumed to stagnate or linearly increase with time, Manoli, Mullen, and Wagner (2015), for example, pick 1.75% as a factor of yearly wage growth. Job separations only play a role to determine tenure related parts of retirement benefits. However, both the methods do not allow for income losses stemming from involuntary and persistent unemployment.

In this paper I will start out with the second variant as, despite its parsimonious formulation, it seems to fit the data very good. It accounts for the very low inter-temporal variance within individuals at higher ages in case they pertain their jobs. Most other covariates are constant anyway. I calculate a wage growth of roughly 2% per year. I use this factor to project all future

⁴ Unlike Manoli, Mullen, and Wagner (2015), Gustman and Steinmeier (2005) and many others, in my model I ignore savings. This is mainly data driven in the sense that I do not observe savings. Possibilities of handling this issue differently are limited. In a comparable situation Manoli, Mullen, and Wagner (2015) use saving *estimates* of little variance to enrich their data set. However, following Gustman and Steinmeier (2005), I argue that high time preferences make positive savings unlikely in the first place. Together with the popular assumption of non-negativity of savings, that is borrowing against future income is impossible, the only reason to have a considerable amount of savings is a need to smooth consumption in a life-cycle perspective with low time preferences. The already relatively high replacement rate of retirement benefits in Germany allow for consumption smoothing without substantial savings. To be precise, benefits average at about 58 to 70% of the last wage and constitute for 80% of available income for households lead by retirees aged 64+, see Puhani and Tabbert (2016) for a wrap-up on these issues. Furthermore, Frick and Grabka (2010) show that 70% of the German populace posses more wealth in pension entitlements than in all other forms of wealth. Thus, assuming immediate consumption seems plausible especially since net wealth in Germany is at rock bottom in a European comparison with a household median of only €51,400 (\$56,100) in 2013, excluding pension entitlements and largely driven by low homeownership but nevertheless the lowest value in the Euro area according to (Mathä, Porpiglia, and Ziegelmeier 2014), whereas Frick and Grabka (2010) estimate a median wealth of only €15,288 using different data for 2007, also excluding pension entitlements. Also, by 2010 Germany's wealth to income ratio was rising, but still low in European comparison (Piketty and Zucman 2014). Hence, ignoring wealth is a reasonable simplification of little account in the case of Germany.

wages. However, this does not mean I ignore the income risk of involuntary job separations. Quite the opposite, I introduce a separate and forced path into retirement by incorporating risks of involuntary job loss as a restriction of the choice set.

Once labor market participation ends, for whatever reason, individuals claim unemployment benefits Y_u if they choose for retirement path $R2$. The receipt of receiving unemployment benefits creates a stigma τ .

In Germany, according to birth year and employment history, individuals are eligible to claim unemployment benefits for a varying interval of time, spanning from 0 to 32 months. After this time span a automatic transfer into pension receipt is modeled. The amount of unemployment benefits equals 60% of the last gross labor income minus taxes but not social security contributions. Normally, this amount is higher than pension benefits.

Pension benefits Y_r are received immediately after ending employment (if $R1$ is chosen), or after unemployment benefit eligibility ends (if $R2$ chosen). For ages 60 to 62 only the second option is available.

3 Data

The Biographical Data of Social Insurance Agencies in Germany (BASiD) is a register-based data set supplied by the German Statutory Pension Scheme and the Federal Employment Agency. The Statutory Pension Scheme provides a 2% random sample of the insured population – including precise information on employment status, contributions and wages. Other characteristics, especially citizenship, county of residence and education, however, are gathered from registers of the Federal Employment Agency. For an overview see Hochfellner, Müller, and Wurdack (2012).

Unlike the pension data, the Federal Employment Agency’s data has gaps for some characteristics as most information is not routinely collected but in certain circumstances, for example participation in a job creation scheme. These gaps are dealt with by imputation: in a carry-forward algorithm gaps are filled, for example for place of residence and citizenship. If there is not a single valid information of an individual, the individual’s whole case is dropped – except for citizenship which is set to foreign if unknown.

Educational information is imputed in a little more advanced way. Fitzenberger, Osikominu, and Völter (2006) give some advice on how to deal with the two major shortcomings of BASiD data with regards to education: a great share of missing values and a general inconsistency in the reporting rule. The basic idea is to believe in the highest reported degree and overwrite other and missing information. There is evidence that outcomes are not affected much and imputation works good (Fitzenberger, Osikominu, and Völter 2006). This, I end up with educational informations for 96.45% of male observations. The remaining observations are dropped. I restrict myself to the male observation

because of low labor market attachment of many West German females and less variation in pension rules for females captured in the data.

The subsample finally used in the analysis is restricted to the birth cohorts 1940, the first cohort of the data set, to 1946, the last cohort that can retire through old-age pension within the observational period of the pension scheme data source lasting from 1951 to 2007. Thus, there is right-censoring for some birth cohorts.

For those who reached retirement all further observations are dropped since retirement is an absorbing state. Regarding employment histories, left-censoring is not present.⁵

The effect of health on working hours is believed to be positive, i.e. people of poor health work less hours (Currie and Madrian 1999). Intuition would suggest that those of poor health consequently also wish to retire earlier. Including such an item in my working disutility term, I follow Börsch-Supan et al. (2004). The dummy used as a proxy for poor health status takes up the value of one if someone was absent from work longer than 5 months due to health related issues before turning 50. Counted are only periods of absence lasting at least 6 weeks.

Education is assumed to be associated with meaningful and physically less demanding jobs, that is, jobs that create less of working disutility. Thus, I assume a negative impact of high education levels on retirement propensity. Another important influence on the decision when to retire might be the behavior of one's spouse. Due to the specific nature of my dataset, I have no information on marital status of spousal financial resources. This is a disadvantage.

However, the tendency of joint retirement of spouses is a long studied and undisputed fact (Hurd 1990; Honoré and de Paula 2014; Hospido and Zammaro 2014). Nevertheless, theoretical arguments on the probable causality behind this phenomenon are sparse in the economic literature. Most prominently joint retirement is attributed to taste for joint leisure time of spouses. Also simultaneous shocks on taste for leisure, consumption or labour demand are discussed (Honoré and de Paula 2014). From a theoretical point of view,

⁵ There might be some estimation bias induced by immigrant workers who came to Germany after they began to work in some other country. In those cases the set of information is restricted. It is not obvious whether those immigrants already gained some claims in another retirement system. This lack of information might induce a threat to the estimation since the sum of pension benefits available to the individual is error-prone for immigrants. Because the generosity of the German Pension Scheme is high and immigrant numbers are small, I assume the effect to be negligible. Same applies to people with periods of self employment and minor voluntary contribution making. They might have substantial additional funds accumulated elsewhere but I can not identify them. However, I dropped all individuals with less than 15 years of contribution making, just to be safe. In no circumstances civil servants are member of the Statutory Pension Scheme. This, together with the self-employed individuals I probably dropped, reduces the share of the population covered with the analysis by roughly 15%. Nevertheless, these 85% seem to be representative with respect to the income distribution of the population (Bönke, Corneo, and Lüthen 2015).

spousal financial resources should play a role in retirement timing. There also is a very limited strand of literature discussing rather sociological explanations for joint retirement. Financial dependency might proxy a wife’s overall dependency on her husband and reflect the bargaining power. Effects are probably small or non-existent (c.f. Ho and Raymo 2009). The importance of gender role attitudes for joint retirement is not researched yet. However, Fortin (2005) shows gender role attitudes’ connectedness with labor force participation of women across Europe. Thus, although gender role attitudes and the situation of spouses (or the very existence of a spouse) might determine retirement timing, I have to abstract from this due to lack of information.

East and West Germany have long been separate states leaving behind a population divided by their very different employment history. East German men and women were normally full-time employed till re-unification in 1990. After re-unification the East German economy collapsed. Not to speak about the differences in mentality, already the mere economic circumstances are not comparable in any way. Thus, I will only work with the West German sample. As a secondary data source I use the household panel SOEP⁶ to estimate labor market frictions. In case either plant closure, a temporary contract or a lay off are the reason for a job loss, the job loss can be considered involuntary following Haan and Prowse (2014). Augmenting observable characteristics like age, region of residence, experience, tenure, education, and migration background I estimate a logit regression predicting the risk of involuntary job loss Φ .

The administrative information on gross labor income is transformed applying a tax function $T(Y_{gross}) = Y_w$. I model income taxation for singles and social security contributions. Unemployment benefits Y_u are constructed in a similar fashion, applying the relevant legislation that differs greatly for birth cohorts. Potential retirement benefits can also be computed accurately if eligibility rules are implemented. This, I compute individual expected pension benefit levels for the future. In case of unemployment benefit receipt, deductions are avoided to some extent, in case of immediate retirement, they take full effect, also, different pension types are accessible in the two cases. More information on reforms and variation can be found in section 4.

3.1 Descriptive Statistics

The sample means are shown in Table 1 for men excluding the East German population. Given are means over individuals at age 60. *pension_pts* relates to the number of pension scheme earning points. One point is equal to one year of contributions from an average wage job. Male contributions over a life course roughly are twice the amount of female contributions. Same is true for the 85th wage percentile. Years of unemployment before age 50 are rare, for

⁶ For a detailed description see Wagner, Frick, and Schupp (2007)

Table 1: Sample Means

	Mean	Std.Err.
tbc[1940-46]	x	x
tbc %	9.55	3.7443
tbc %	8.70	4.2622

$N=XX,XXX$;
Source: BASiD Data, birth cohorts 1940-46, West Germany; own calculations

both men and women half a year in average.

The imputation of educational information yields an differentiated image. 11.2% of men neither accomplished a professional training nor an academic degree. While 10.7% of men have a university degree, an additional 6.0% have a degree from an university of applied science (FH), a German form of post-secondary education that is less theoretical and focused on practical training. The distribution of retirements over age is not uniform as can be seen from the Kaplan-Meier curve in figure ???. Hazard rates do differ widely with years of birth, as can be seen in figure 2. Changed retirement rules (as visualized in figure 4 in the Appendix) seem to induce a shift to later retirement. For some cohorts we see a non-linearity around age 63.

[FIGURE KAPLAN-MEIER here]

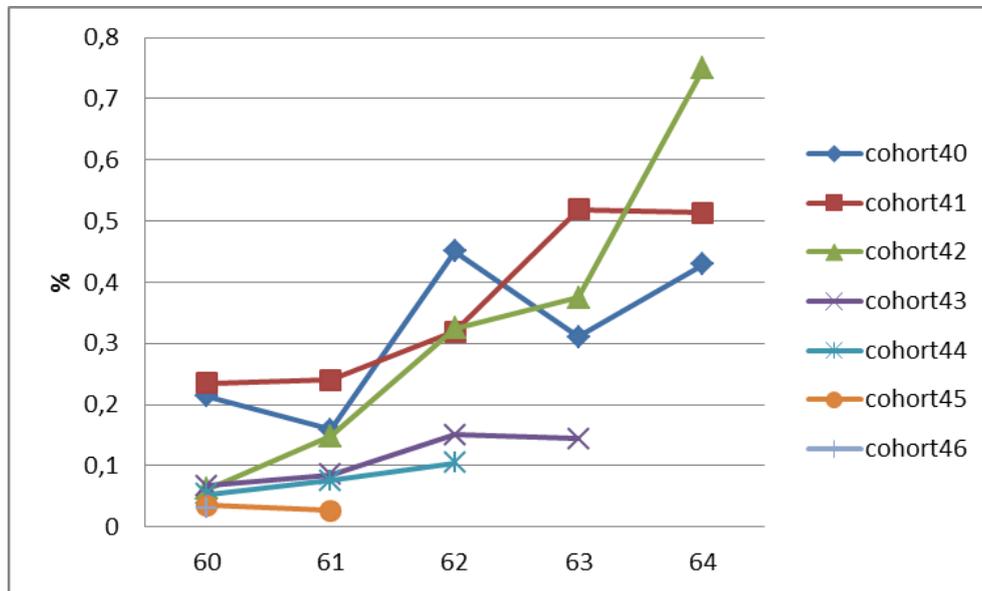


Figure 2: Hazard Rates of Retirement Claiming by Cohort (Source: own calculations)

4 Estimation & Identification

A PAYG pension scheme is found in most western countries and, in the introduction days, proved to be cheap and handy. By now PAYG schemes often are under pressure. Generally, solvency of schemes is sensitive to a rising dependency ratio, that is the number of dependent persons relative to the size of the labor force, and is also sensitive to the level of employment within the labor force.

Germany, like the US, Denmark, UK, Sweden, France and many other countries, introduced some pension reforms to cope with demographic change. The most important reform of the last 20 years introduced deductions on early retirement. This, benefit levels are reduced by 3.6% for every year of early retirement. Introduction was gradually and is found in the data according to figure 4 (in the appendix), cohorts 1940 to 1946 are all affected to different degrees while being comparable with respect to other characteristics like values, education and general labor market attachment. I use this reform to identify my model. In a subsequent analysis I will simulate another reform, the shift of the regular retirement age from age 65 to 67. A detailed description of recent innovations, types of pension and their requirements, and the general setup of the German Pension Scheme can be found in Lüthen (2015).

Summing up, a recent reform put a price tag on early retirement that differs by cohort. This makes retirement timing subject to financial incentives. Since rules changed considerably over time, I have the necessary data variation at hand to identify the model. Different deduction levels let me identify the risk averseness parameter γ . Differing pension claiming behavior along socio-demographics identifies ν , the working disutility. I use the surprisingly low take-up of unemployment benefits to identify a stigma parameter.

Estimation is carried out with a maximum likelihood procedure. Value functions are recursively solved. The computational burden is low, since most state variables evolve in a deterministic fashion.⁷

5 Results

This section will only put forward preliminary results stemming from a slightly simplified model. To be precise, this preliminary model only models one way into retirement, pension claiming after one year of unemployment benefit receipt. This is the most popular way to retire and if it was not for a stigma effect, usually the more attractive. However, benefit amounts do differ only slightly. Thus, the information which way into retirement is taken remains, for the moment, unused. Expectations over future payments are formed keeping only this one path in mind. This is a misspecification I will correct soon.

⁷ The MATLAB estimation code is available upon request.

Within a logit regression framework, I explain the binary outcome of involuntary job loss augmenting the independent variables age, region of residence, years of employment in the last 5 years, and a dummy variable for tenure of more than 5 years, education, log-wage and migration background. I used the last ten waves of the German micro-panel SOEP, restricted to individuals aged 60+, employed in the previous year, which roughly gives me 3.000 observations.

Especially the tenure variable proves to be very predictive for involuntary job loss, as can be seen in table 2. The fitted values give me the individual job loss probability $\Phi_{a+1,a}$ with a mean of 7.4% and a SD of 2.6%; the probability to be able to retain a job simply is the counter-factual $(1 - \Phi_{a+1,a})$.

Table 2: Estimation results : Involuntary Job Loss, Logit Estimates

Variable	Coefficient	(Std. Err.)
age	-0.002	(0.033)
yrs of employm last5yr	-0.073	(0.115)
tenure at least 5yr	-1.359	(0.365)
lnwage	-0.142	(0.101)
educyrs	-0.111	(0.034)
migback	0.216	(0.155)
east german	0.821	(0.187)
Intercept	-0.199	(2.482)

N=3,3511, GSOEP (waves 2004-2013), own calculations.

Fitting the Dynamic Discrete Choice model with a Maximum-Likelihood procedure, I gain estimates for the risk aversion $\gamma = 2.48$ and working disutility ν . The fit is mediocre (see figure ??). The estimates of γ and ν are per se not very informative but will be used for a, again simplified, policy simulation. Based on the age 60 observations of birth cohorts 1943 to 1945 I simulate work biographies and retirement decisions, see figure 3 for predicted hazard rates. In a subsequent reform step I increase deductions by 10% (0.0360→0.0396) and recalculate potential pension benefits. These new benefits are used in a second simulation of retirement behavior. The yearly probability to retire shrinks in response to the reform. However, the part of the probability that refers back to frictions can not shrink. The behavioral response is 0.45 months of later retirement for a 10% increase in deductions. The analysis of Bönke, Kemptner, and Lüthen (2015) is based on cohorts fully affected by the 1992 reform of old-age pension for the long-time insured. They ex-post estimate the reforms full effect to be around 6 month, which is comparable to 0.6 month for a 10% increase, that is a value 33% above my estimate.

Interestingly, setting frictions $\Phi = 0$, that is not allowing for forced retirements, and re-estimating and re-simulating changes results fundamentally. The aforementioned elasticity, shift in retirement timing response per 10% in-

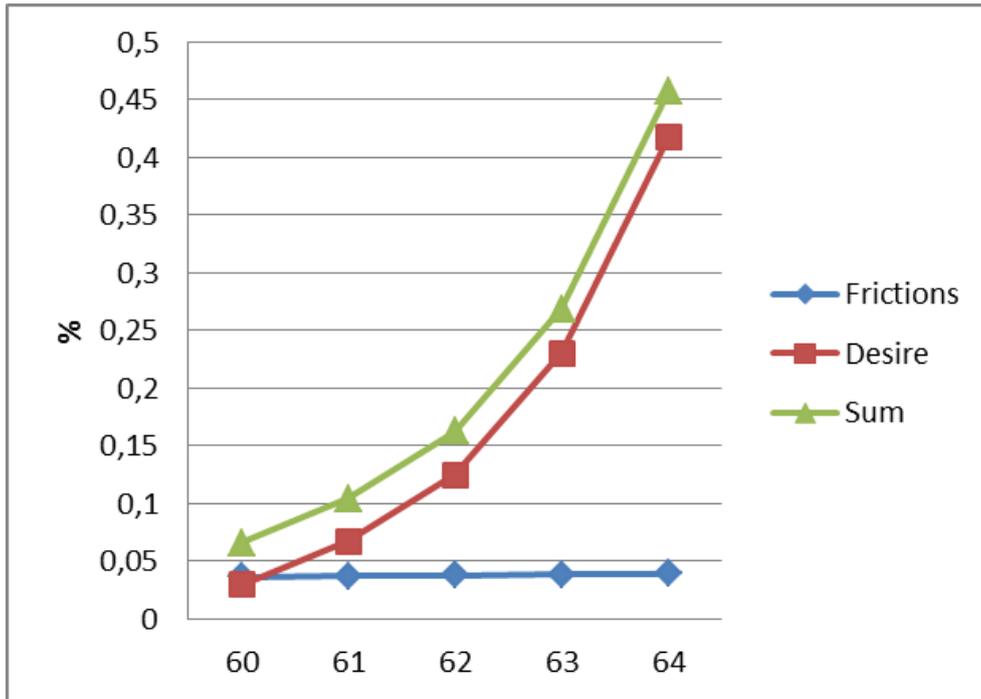


Figure 3: Hazard Rates of simulated 1943-1945 cohorts, linear age trend (Source: own calculations)

crease in deductions is calculated to be 0.74 months, a substantial increase very much in line with ex-ante projections of Börsch-Supan et al. (2004).

This, behavioral responses to policy reforms can be increased if frictions are minimal. At the same time, people with a high risk of a involuntary job loss will react only little to such incentivizing (or punishing) reforms. From a social policy point of view, this is of importance since high job loss probability is associated with low education, wage and wealth. To put it in a nutshell, for some already poverty-vulnerable groups rationed labor markets make it hard to adjust to pension reforms. Their small behavioral response can be translated into severe benefit cuts. This is worrisome.

5.1 Simulation: Shifting Regular Retirement Age

The reform I actually want to analyse in this study was announced in 2007. The shift of the regular (deductions free) age threshold is gradually lifted to age 67 by 2031 taking full effect for cohorts 1964 and younger. Eligibility for deduction-prone benefits will then start at age 65, at 63 for long-term insured persons, with a maximum of 7.2% of deductions each.⁸

This reform, known as the "Rente mit 67", loosely translated as "Retirement at age 67" lead to many societal stakeholders, including labor unions, voicing misgivings. A very prominent concern was that employment options could be scarce for older people. While solvency of the scheme is improved either

⁸ Different deduction levels and accessibility compared to the previous situation is also displayed in table 3 in the appendix.

way, be it via postponed retirement or lowered benefits, warnings were more concerned with the poverty risk of certain groups.

In simulation, this reform confronts me with the problem of how to model individuals' labor market status and prospects from their age 60 on, my current starting point until the new minimal retirement age of 63. A first naive simulation will assume that unemployment risk is still defined by Φ and unemployment practically leads to an irreversible transition to (inner) retirement, that is unemployment benefit and social assistance receipt until age 63.

This is contrasted by Hairault, Sopraseuth, and Langot (2010) presenting evidence that employment differs by distance to retirement age. This, it might be naive to assume that the number of people working at age 60 will stay constant for a major change in regular retirement age. This can have both demand- and supply-side reasons.

[tbc]

5.2 Distributional Effects

Concerning income inequality, Germany has something to lose, other states like the US already face a big problem of old age poverty. Whereas the Netherlands are the OECD country with the lowest old age income poverty rate, Germany scores at least in the midfield. Only 1.4% of the Dutch population above age 64 receive income of less than 50% of the national median equivalised income, 10.5% in Germany, but already 19.9% in U.S and a staggering 35.5% in Australia, 12.9% being the 2010 OECD average (OECD 2013). In parts, this is due to the Netherlands having a funded pension scheme with benefits relative to former incomes and contributions, whereas the US and Australia have non-proportional elements in their pension scheme and, in general, a low replacement rate. To further qualify the results for the US, one has to say that the income poverty rates looking at the whole population are anything but substantially lower. For Australia, however, they are.

In a simulation study, Arent and Nagl (2010) predict pension inequality and old-age poverty to be rising in East and West Germany for new retirees in 2020. Especially endangered are low-skilled workers and women. I want to extend this research using a different data source, method and accounting for frictions.

6 Conclusion

Based on my findings I can negate the thesis that a rationed labor market is of little relevance in retirement timing. Also, my findings suggest that heightening deductions for early retirement result in a shift in average retirement age of 0.45 month per 10% increase in deductions. This is substantial but lower than the 0.74 months found in an alternative model assuming no frictions.

I can state that some groups suffer financially from retirement reforms as they barely react to incentives.

[**tbc:**] A further step is to analyze the currently fading-in reform of shifting the regular retirement age in Germany from 65 to 67; especially regarding distributional effects.

References

- Alan L. Gustman, Thomas L. Steinmeier (1986). “A Structural Retirement Model”. In: *Econometrica* 54.3, pp. 555–584.
- Arent, Stefan and Wolfgang Nagl (2010). “A Fragile Pillar: Statutory Pensions and the Risk of Old-Age Poverty in Germany”. In: *FinanzArchiv: Public Finance Analysis* 66.4, pp. 419–441.
- Blundell, Richard, John Ham, and Costas Meghir (1987). “Unemployment and Female Labour Supply”. In: *Economic Journal* 97.388a, pp. 44–64.
- Bönke, Timm, Giacomo Corneo, and Holger Lüthen (2015). “Lifetime Earnings Inequality in Germany”. In: *Journal of Labor Economics* 33.1, pp. 171–208.
- Bönke, Timm, Daniel Kemptner, and Holger Lüthen (2015). *Effectiveness of Early Retirement Disincentives: Individual Welfare, Distributional and Fiscal Implications*. Discussion Paper 10/2015-044. Netspar.
- Börsch-Supan, Axel et al. (2004). “Micro-modeling of retirement decisions in Germany”. In: *Social security programs and retirement around the world: Micro-estimation*. University of Chicago Press, pp. 285–344.
- Currie, Janet and Brigitte C. Madrian (1999). “Health, health insurance and the labor market”. In: *Handbook of Labor Economics*. Ed. by O. Ashenfelter and D. Card. Vol. 3. Handbook of Labor Economics. Elsevier. Chap. 50, pp. 3309–3416.
- Fitzenberger, Bernd, Aderonke Osikominu, and Robert Völter (2006). “Imputation Rules to Improve the Education Variable in the IAB Employment Subsample”. In: *Schmollers Jahrbuch : Journal of Applied Social Science Studies / Zeitschrift für Wirtschafts- und Sozialwissenschaften* 126.3, pp. 405–436.
- Fortin, Nicole M (2005). “Gender Role Attitudes and the Labour-market Outcomes of Women across OECD Countries”. In: *Oxford Review of Economic Policy* 21.3, pp. 416–438.
- French, Eric (2005). “The Effects of Health, Wealth, and Wages on Labour Supply and Retirement Behaviour”. In: *Review of Economic Studies* 72.2, pp. 395–427.

- Frick, Joachim R. and Markus M. Grabka (2010). “Old-Age Pension Entitlements Mitigate Inequality: But Concentration of Wealth Remains High”. In: *Weekly Report* 6.8, pp. 55–64.
- Gustman, Alan L. and Thomas L. Steinmeier (2005). “The social security early entitlement age in a structural model of retirement and wealth”. In: *Journal of Public Economics* 89.2–3, pp. 441–463.
- Haan, Peter and Victoria Prowse (2014). “Longevity, life-cycle behavior and pension reform”. In: *Journal of Econometrics* 178, Part 3, pp. 582–601.
- Haan, Peter and Victoria L. Prowse (2015). *Optimal Social Assistance and Unemployment Insurance in a Life-Cycle Model of Family Labor Supply and Savings*. IZA Discussion Papers 8980. Institute for the Study of Labor (IZA).
- Haan, Peter and Arne Uhlenhorff (2013). “Intertemporal labor supply and involuntary unemployment”. In: *Empirical Economics* 44.2, pp. 661–683.
- Hairault, Jean-Olivier, Thepthida Sopraseuth, and François Langot (2010). “Distance to Retirement and Older Workers’ Employment: The Case for Delaying the Retirement Age”. In: *Journal of the European Economic Association* 8.5, pp. 1034–1076.
- Ho, Jeong-Hwa and James M. Raymo (2009). “Expectations and Realization of Joint Retirement Among Dual-Worker Couples”. In: *Research on Aging* 31.2, pp. 153–179.
- Hochfellner, Daniela, Dana Müller, and Anja Wurdack (2012). “Biographical data of social insurance agencies in Germany—improving the content of administrative data”. In: *Schmollers Jahrbuch* 132, pp. 443–451.
- Honoré, Bo and Áureo de Paula (2014). *Joint Retirement in Europe*. Netspar Discussion Paper 10/2014-052. Netspar.
- Hospido, Laura and Gema Zamarro (2014). *Retirement Patterns of Couples in Europe*. IZA Discussion Papers 7926. Institute for the Study of Labor (IZA).
- Hurd, Michael D. (1990). “The Joint Retirement Decision of Husbands and Wives”. In: *Issues in the Economics of Aging*. NBER Chapters. National Bureau of Economic Research, Inc, pp. 231–258.

- Keane, Michael P., Petra E. Todd, and Kenneth I. Wolpin (2011). “Chapter 4 - The Structural Estimation of Behavioral Models: Discrete Choice Dynamic Programming Methods and Applications”. In: ed. by Orley Ashenfelter and David Card. Vol. 4, Part A. *Handbook of Labor Economics*. Elsevier, pp. 331–461.
- Lüthen, Holger (2015). “Rates of Return and Early Retirement Disincentives: Evidence from a German Pension Reform”. In: *German Economic Review*, n/a–n/a.
- Manoli, Day, Kathleen J. Mullen, and Mathis Wagner (2015). “Policy Variation, Labor Supply Elasticities, and a Structural Model of Retirement”. In: *Economic Inquiry*, forthcoming.
- Mathä, Thomas Y., Alessandro Porpiglia, and Michael Ziegelmeyer (2014). *Household wealth in the euro area: The importance of intergenerational transfers, homeownership and house price dynamics*. BCL working papers 91. Central Bank of Luxembourg.
- OECD (2013). “Old-age income poverty”. In: *Pensions at a Glance 2013*.
- OECD (2016). *Unemployment rate*. OECD. URL: <http://stats.oecd.org/index.aspx?queryid=36499>.
- Piketty, Thomas and Gabriel Zucman (2014). “Capital is Back: Wealth-Income Ratios in Rich Countries 1700–2010”. In: *The Quarterly Journal of Economics* 129.3, pp. 1255–1310.
- Puhani, Patrick A. and Falko Tabbert (2016). “The effects of pension changes on age of first benefit receipt: Regression discontinuity evidence from repatriated ethnic Germans”. In: *Labour Economics* 38, pp. 12–23.
- Staubli, Stefan and Josef Zweimüller (2013). “Does raising the early retirement age increase employment of older workers?” In: *Journal of Public Economics* 108, pp. 17–32.
- Stock, James H and David A Wise (1990). “Pensions, the Option Value of Work, and Retirement”. In: *Econometrica* 58.5, pp. 1151–80.
- US. Bureau of Labor Statistics (2016). *Unemployment Rate: 55 to 64 years, 1948 to 2015*. Ed. by Federal Reserve Bank of St. Louis. URL: <https://research.stlouisfed.org/fred2/series/LNU04000095/>.

Van der Klaauw, Wilbert and Kenneth I. Wolpin (2008). “Social security and the retirement and savings behavior of low-income households”. In: *Journal of Econometrics* 145.1-2, pp. 21–42.

Wagner, Gert, Joachim Frick, and Jürgen Schupp (2007). “The German Socio-Economic Panel Study (SOEP) – Scope, Evolution and Enhancements”. In: *Schmollers Jahrbuch : Journal of Applied Social Science Studies / Zeitschrift für Wirtschafts- und Sozialwissenschaften* 127.1, pp. 139–169.

Appendix

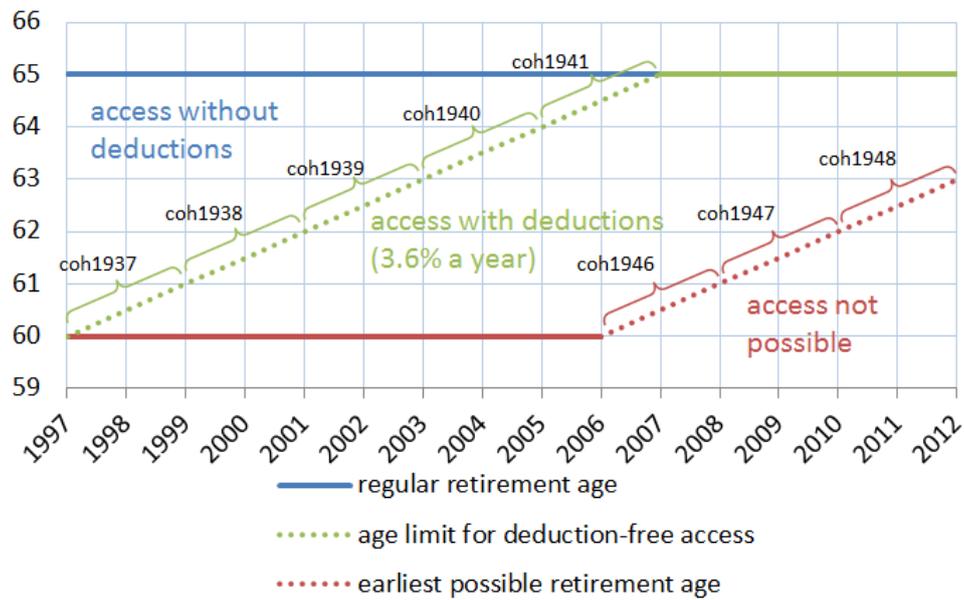


Figure 4: Age Limits of the Old Age Pension for Unemployed People and the Old Age Pension after Old Age Part-time Employment (Source: own illustration)

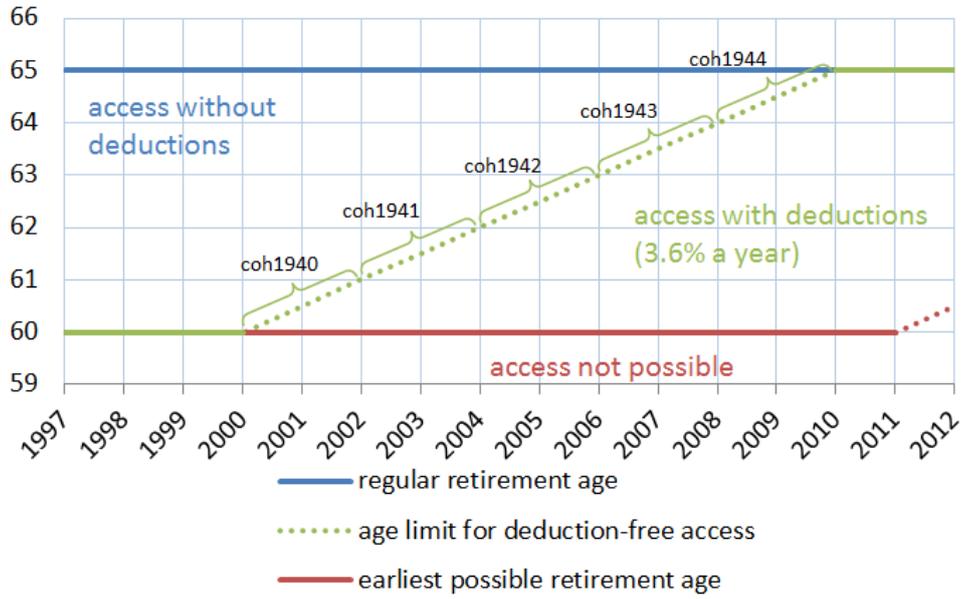


Figure 5: Age Limits of the Old Age Pension for Women (Source: own illustration)

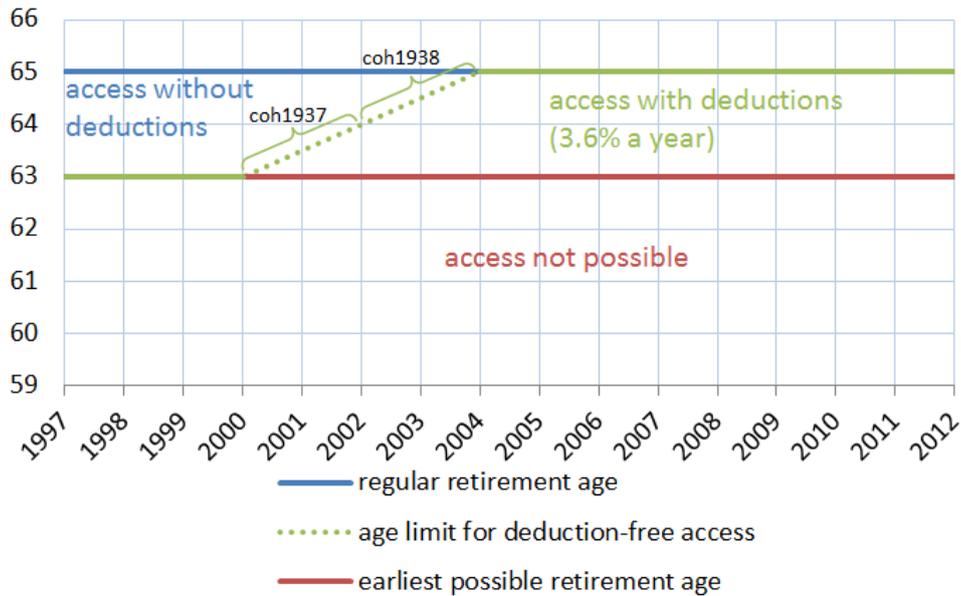


Figure 6: Age Limits of the Old Age Pension for Long-time Insured People (Source: own illustration)

Table 3: Access Factors of Different Pension Forms, 1992/96 & 2007 Reforms

	pre reform			1992/96 reform			2007 reform		
	pension type								
age	regular pension	long-term insured	pension after unempl	regular	long-term	unempl	regular	long-term	
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
60	0.0	0.0	100.0	0.0	0.0	82.0	0.0	0.0	
61	0.0	0.0	100.0	0.0	0.0	85.6	0.0	0.0	
62	0.0	0.0	100.0	0.0	0.0	89.2	0.0	0.0	
63	0.0	100.0	100.0	0.0	92.8	92.8	0.0	92.8	
64	0.0	100.0	100.0	0.0	96.4	96.4	0.0	96.4	
65	100.0	100.0	100.0	100.0	100.0	100.0	92.8	100.0	
66	100.0	100.0		106.0	106.0		96.4	100.0	
67	100.0	100.0		112.0	112.0		100.0	100.0	
68	100.0	100.0		118.0	118.0		106.0	106.0	

Access factors before and after the retirement reform acts 1992 and 2007; 100= full/regular benefits
Own illustration