DISCUSSION PAPER

// SVENJA LORENZ, MONA PFISTER,
AND THOMAS ZWICK

Beware of the Employer:
Financial Incentives
for Employees May Fail
to Prolong Old Age
Employment

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Beware of the employer: financial incentives for employees may fail to prolong old age employment

Svenja Lorenz (University of Würzburg), Mona Pfister (University of Würzburg), Thomas Zwick (University of Würzburg; ZEW - Leibniz Centre for European Economic Research, Mannheim; Research Centre for Education and the Labour Market (ROA), Maastricht)[1]

Abstract

This paper shows that increasing the normal retirement age and introducing pension deductions for retirement before normal retirement age in Germany did not prolong employment of older men. The reason for this surprising result is that employers encouraged their employees to use the bridge options unemployment or partial retirement instead of the early retirement option for the long-term insured. Bridge options allowed employers to terminate employment considerably earlier than the pension for long-term insured. Employers however had to compensate their employees for the substantially higher costs of the bridge options. Therefore mainly employers with high employment adaption costs induced employees to use a bridge option during the implementation phase of the pension reform.

Keywords: cohort-specific pension reform, early retirement, partial retirement, unemployment, labor supply, labor demand

JEL classification: J14; J18; J22; J26.

1   Introduction

In response to rising life expectancy, low fertility rates, and a shrinking labor force, most OECD countries have revised their retirement policies and introduced a series of pension reforms since the 1990s (OECD, 2007, 2015). For example, these countries have increased the normal retirement age (NRA)[2] and early retirement age (ERA)[3], tightened eligibility rules for early pension claims, or introduced actuarial deductions from pension entitlements for employees who retired before the NRA. The main goal of these reforms was to increase labor supply among older employees and extend their working lives (see the overview presented by Börsch-Supan and Coile, 2018).[4] All of these legislative efforts have addressed labor supply to achieve their goals instead of increasing labor demand for older employees. Accordingly, most papers evaluating the labor market consequences of the pension reforms have explicitly or implicitly assumed that employees could react autonomously to the labor supply incentives set by these reforms and that labor demand reaction is infinitely elastic (Dorn and Sousa-Poza, 2010; Rabaté, 2019). In this paper, we show that the employment changes of older men after a pension reform in Germany addressing labor supply cannot be explained by employee reactions. We argue instead that some employers induced employees to early retirement forms that allowed them to terminate employment earlier than other retirement options. The massive shift into these retirement forms thwarted the success of the pension reform.

The 1992 pension[5] reform in Germany is the earliest attempt in Germany to increase employment of older employees (Schmähl, 2003; Geyer and Steiner, 2014; Deutsche Rentenversicherung Bund, 2015; Bönke et al., 2018). The reform therefore set an important example for other developed countries that introduced similar pension reforms later (Börsch-Supan and Coile, 2018). The reform exclusively addressed labor supply: The NRA was increased in monthly steps for almost all pension forms that granted access to early retirement. More specifically, for older male employees, the

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[2] The NRA is the age at which people can first draw full benefits without actuarial deductions. Other expressions are "pensionable age" (OECD, 2011: 20) or "social security statutory eligibility age" (SEA, Börsch-Supan and Coile, 2018). In Germany, the NRA is lower than the statutory retirement age for several pension forms.

[3] ERA is the earliest age at which people can leave the labor market if they are eligible for one of the early retirement pensions (60 or 63 years for our sample).

[4] Examples of pension reforms and their implementation years are as follows: increase in statutory retirement age (Denmark in 2015, Germany in 2012, Italy in 2003, the UK in 2018, and the US in 2003); increase in ERA (Belgium in 2013, Germany in 2012, Japan in 2001, and Sweden in 1998); tightening of eligibility rules for claiming pensions early (Belgium in 2013, France in 2014, and Italy in 2011); introduction of partial retirement options (Germany in 1996, Austria in 2000, Sweden in 1996, and France in 1988); introduction of actuarial deductions from pension entitlements for employees who retire early (Germany in 1997 and Austria in 1996 and 2000).

[5] The reform is formally called *Rentenreformgesetz 1992* (BGB I 2261) from 28.12.1989. Several changes to this reform law were introduced after its conception before the reform was implemented (*Gesetz zur Förderung eines gleitenden Übergangs in den Ruhestand*, 1996; *Wachstums- und Beschäftigungsförderungsgesetz*, 1997; *Rentenreformgesetz*, 1997). Also compare Berkel and Börsch-Supan (2004) and Börsch-Supan and Coile (2018), Fig. 3. We only refer to the parts of the reform laws that were actually implemented.

pension reform increased NRA for the pension for the long-term insured and for the pension after unemployment. The reform also introduced actuarial deductions in pension entitlements for the difference between retirement age and the NRA, but left the ERA unchanged (both, NRA and ERA used to be the same before the reform). Finally, the reform introduced a bridge option of partial retirement with eligibility rules comparable to the existing bridge option of early retirement after unemployment (Berg et al., 2019; Huber et al., 2016).

We show that the goal of longer employment has not been met for employees affected by the pension reform; employment after the ERA actually decreased with increasing NRA and the associated pension deductions. We argue that the main reason for the employment reduction is a large shift of employees from the pension for the long-term insured into the bridge options. In addition, we observe a large decrease in employment after the ERA in the partial retirement bridge option during the implementation phase. This surprising finding is not consistent with individual utility maximizing behavior, the predictions of ex ante evaluations of the expected effects of the 1992 pension reform, and international evidence on the employment effects of similar pension reforms. The pattern however fits the interpretation that employers pushed their employees into bridge options. They wanted to avoid longer employment after ERA for employees using the pension for long-term insured induced by the reform. The implementation phase of the pension reform took place during a deep recession and it was costly for many employers to prolong the employment of their older employees. We show that compensation payments necessary to induce a shift from the pension for the long-term insured into the bridge options were substantial and especially firms with high employment adaptation costs were mainly responsible for the large influx of older employees into the bridge options.

We use representative administrative social security data from the Institute for Employment Research (Sample of Integrated Labor Market Biographies, SIAB7514) that cover labor market history and employer information for more than 24,000 men eligible for all types of early retirement affected by the reform. We calculate the changes in labor market outcomes by comparing the behavior of birth cohorts not affected (1935 and 1936) with that of birth cohorts affected by the reform (1937–1941) for the entire implementation phase of the reform (1997–2006). To identify the pension reform effects, our diff-in-diff approach exploits the cohort-specific variation of the size of actuarial deductions given an ERA. In addition to the effect of financial incentives set by the pension reform, we also calculate the full effects of the reform by comparing labor market outcomes between the last cohort not affected by the reform and the cohorts affected.

This paper makes several contributions to the literature. It presents the first integral ex post analysis of the effects of the 1992 pension reform on employment, unemployment, and partial retirement on

men eligible for all early retirement options affected. To the best of our knowledge we for the first time show for a pension reform that financial incentives were thwarted by employers and that employment even decreased with pension penalties during its implementation phase. We therefore demonstrate that the positive employment effects predicted by individual utility maximization theory and by ex-ante studies of the reform have not occurred. We in addition show that especially employees working for employers with high employment adaptation costs used bridge options. Finally, we discuss the policy implications of the insight that employers have been able to thwart the intended positive employment effects of a pension reform.

The paper is organized as follows. In Section 2, we describe the institutional background of the pension system in Germany and the 1992 pension reform. We also derive theoretical predictions of the reform effect on the labor market and discuss the relevant empirical literature. In Section 3, we introduce our dataset and provide descriptive statistics of the labor market of older men. Section 4 explains our estimation approach and presents the estimation results. Section 5 discusses the results and Section 6 suggests some political implications. Section 7 provides a conclusion.

2 Institutional background and the 1992 pension reform

The German pension system

The German public retirement insurance is financed by a pay-as-you-go scheme (BMAS, 2016a). It covers about 80% of an average retiree's income in Germany (BMAS, 2016b: 11; Deutsche Rentenversicherung Bund, 2017: 9). Nearly 80% of the labor force is mandatorily covered by the public retirement insurance (Hanel, 2010).[6] The German statutory pension insurance provides the standard old age pension at age 65 for all cohorts we consider. To allow flexible retirement entry, there were two main early retirement options for men before the 1992 pension reform: the pension after unemployment (*Altersrente wegen Arbeitslosigkeit*, Social Code VI §237) and the pension for the long-term insured (*Altersrente für langjährig Versicherte*, Social Code VI §236). To be eligible for the pension after unemployment, an employee needed at least 15 qualifying periods[7] and at least 8 years of compulsory contributions periods in the last 10 years before retirement.[8] In addition, the unemployment period had to be at least 52 weeks in the 1.5 years before retiring.[9] The pension after

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[6] Mainly civil servants and some self-employed workers are not covered.

[7] A qualifying period is a period in which an employee is active in the labor market, for example, via employment, unemployment, or family breaks. For further details, see Lorenz et al. (2018).

[8] Because we cannot observe retirement entry, we use the labor market exit date to calculate the eligibility conditions.

[9] Since January 1, 2000, people must have been unemployed for at least 52 weeks in total after reaching the age of 58 years and 6 months to be eligible for the pension for the unemployed. However, this change had no practical consequences for financial incentives and eligibility rules for the old age pension for the unemployed.

unemployment allowed entry into early retirement at age 60. Hence, older employees could exit employment as soon as 57 years and 4 months because unemployment benefits were paid for a maximum period of 32 months. The ERA for the long-term insured was at age 63 and no exit from employment before ERA was possible. To be eligible for the old age pension for the long-term insured, employees needed at least 35 years of pension benefit contributions.

The 1992 pension reform

In the years before the implementation of the 1992 pension reform in January 1996, the share of older men who used the regular old age pension remained stable at about 20%. However, the share of older men who used the early retirement option for the long-term insured decreased from 20% in 1990 to 13% in 1995, and the number of those using the pension after unemployment increased from 14% to 24% during the same period (Deutsche Rentenversicherung Bund, 2018: 62). The shift towards the pension after unemployment decreased average employment exit age and burdened public unemployment insurance by 7.5 EUR billion in 1995 alone (Albrecht and Müller, 1996).

The main aims of the 1992 pension reform were to reduce the unsustainably high early retirement costs as well as the share of employees in unemployment before early retirement and to extend employment beyond the ERA for those eligible for early retirement. The huge increase in financial pressure on unemployment insurance led politicians in 1996 to implement the reform beginning in 1997, instead of in 2001 as previously planned. The immediately affected birth cohort 1937 accordingly was taken by surprise and could not adjust to the reform in advance (Riphahn and Schrader, 2019). The reform introduced permanent actuarial deductions in pension benefits for retirement benefit claims before the NRA (Deutsche Rentenversicherung Bund, 2015; Hanel, 2010; Hanel and Riphahn, 2012; Lalive and Staubli, 2015; Engels et al., 2017; Geyer et al., 2019). The deductions amounted to 0.3% of pension entitlements for each month the individual retired before the NRA of the pension form chosen. The NRA and ERA were identical before the reform and the NRA for early retirement options increased by 1 month each month starting in January 1996 until the statutory retirement age of 65 years was reached (in December 1997 for the pension for the long-term insured and in December 2001 for the pension after unemployment). The difference between NRA and ERA for the old age pension after unemployment was 5 years (60–65 years) after the full implementation of the reform and retiring at the ERA after unemployment resulted in maximum deductions of 18%. The difference between NRA and ERA for those who used the old age pension for the long-term insured was 2 years after the full implementation of the reform and the maximum deduction accordingly was 7.2%.

The pension entitlement is a product of the sum of the earnings points *(Entgeltpunkte)* and the annually adjusted current pension value *(aktueller Rentenwert)*. The annual earnings points are

calculated by relating the individual gross income to the average gross income of all German employees for the year, as shown in the official statistics. Accordingly, the pension benefits in year t can be calculated for before the 1992 pension reform as

$$Pension_t^{pre92} = \left(\sum_{t=age}^{ret.age} Pension\ point_t\right) \times Pension\ point\ value_t. \tag{1}$$

Pension entitlements are the sum of all annual pension entitlements collected over the entire career.

The pension formula in equation (1) is supplemented by an age factor, D, that causes a 0.3% permanent deduction of the pension benefits per month of retirement before the NRA after the 1992 pension reform:

$$Pension_t^{post92} = \left(\sum_{t=age}^{ret.age} pension\ point_t\right) \times pension\ point\ value_t \times (1 - D_{c,ret.age}). \tag{2}$$

In (2), D depends on month of birth c and the age of benefit claiming. For example, if an individual born in December 1937 retires after unemployment at age 60 in December 1997, D is 3.6%. For an individual born 1 year later in December 1938, the deductions at retirement age 60 are 7.2%.

Introduction of partial retirement option

In addition to increasing the NRA and introducing pension deductions for early retirement, the 1992 pension reform extended the eligibility rules for the old age pension after unemployment to employees whose employers offered them partial retirement according to the law on partial retirement (*Altersteilzeitgesetz*), a progressive retirement plan. The new partial retirement act was implemented on August 1, 1996. It complemented similar rules already in place in collective bargaining agreements in selected sectors, such as the insurance, chemical, and tobacco industries as well as the banking sector (Schmähl, 2003). The existing partial retirement options and other early retirement options, including the Pre-Retirement Act or the Part-time Work in Old Age Act, had hardly been used before 1996, and thus these early retirement options had no measurable effect on employment or retirement behavior.

Also the introduction of the new partial retirement option was intended to extend employment of older employees (Oswald, 1999; Berg et al., 2019; Eurofound, 2016). Arguments used were that reducing working time could provide an alternative for leaving the labor market early for workers who were not able to work full time any more (Wadensjö, 2006) or reduce tensions between work and caregiving (Berg et al., 2019). The crucial innovation of the new rules with respect to previous partial retirement rules was its integration into the pension for the unemployed law (Schmähl, 2003). This integration was intended to reduce the high cost burden on the unemployment insurance if employers offered early retirement after partial retirement instead of dismissing their older employees into early retirement after unemployment. Consequently, the law on partial retirement introduced a new early retirement option with the same eligibility rules, NRA, and ERA as the old age

pension after unemployment.[10] The attractiveness of the additional early retirement venue was further increased by offering the so-called block model. The block model consisted of two periods of equal length: in the first half, the employee worked full-time and in the second half, the employee was completely released from work (*Freistellungsphase*) (Kirchner and Mittelhamm, 2010; Bundesagentur für Arbeit, 2015; Huber et al., 2016). For a standard 5-year partial retirement program, the employee could exit employment at age 57.5 and retire at the ERA.[11] The block model proved to be much more popular than the continuity model (Koller, 2001). About half of the employers only offered the block model option (Klammer and Weber, 2001) and the share of employees using the block model was higher than 80% from the start and reached more than 90% in later years (Koller, 2001; Brussig et al., 2009).

Incentive effects of the 1992 pension reform on labor supply

In accordance with most retirement literature, we first assume that older men take the decision regarding the optimal date of employment exit according to the option value model of Stock and Wise (1990). Employees compare all possible future streams of utility from income and leisure and they delay employment exit if this increases their stream of utility. In this framework, exiting employment at any early date *s* instead of any later date *t* has the following effects: it decreases utility because wage earnings during the period between *s* and *t* are lost; it increases utility because leisure is preferred to working during *s* and *t*; it increases utility because pension benefits are received between *s* and *t*; and it decreases utility because the expected present value of future pension benefits is lower during the remaining lifetime. Hence, exiting employment earlier is preferred if the loss in earnings income and present values of pension entitlements are at least outweighed by higher utility from leisure and pension benefits received between *s* and *t*. The 1992 pension reform reduced the utility of early retirement because it reduced the present value of pension entitlements and the pensions received between *s* and *t* for all three early retirement forms. All other determinants of retirement entry, especially the ERA, pension eligibility and the calculation of pension claims remained unchanged.

The option value model therefore predicts that older men eligible for early retirement extended their employment or partial retirement between their ERA and NRA.[12] The exit age from employment and

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[10] Eligibility rules for the pension for the unemployed and partial retirement are identical. The minimum period of 52 weeks in unemployment corresponds to the requirement that employees were employed for at least 24 months under a progressive retirement plan after reaching the age of 55.

[11] The alternative partial retirement form was called the continuity model, in which employees could reduce their working hours (e.g., working half days) during the entire partial retirement period.

[12] Partial retirement employment after ERA can be extended either by shifting the partial retirement spell by a given spell duration, thereby delaying exiting employment, or by extending the partial retirement spell at a given exit from employment. It is unclear a priori which version an older employee prefers because he must

partial retirement should increase with birth cohort because younger cohorts face larger differences between the ERA and NRA.

After discussing the utility optimal reaction to the pension reform for the pension options, we discuss whether the individual incentives for choosing the pension options changed. The relative attractiveness of the bridge options compared with the pension for the long-term insured remained the same according to the option value model for all birth cohorts until 1939. The pension deductions increased in tandem for all three early retirement options and the ERA was unchanged. Therefore, the option value model does not predict a substitution effect between pension options for these cohorts. Nevertheless, for the 1939–1941 birth cohorts, the relative attractiveness of the old age pension for the long-term insured increased. The difference between the NRA of the bridge options compared with the NRA for the pension for the long-term insured was 3 years for those born before 1939 and it disappeared for those born in December 1941. The maximum additional pension penalty associated with the pension for the long-term insured compared with the bridge options decreased from 7.2% to 0% for the cohorts from December 1939 to December 1941.[13] Thus, the option value theory predicts that for the 1939–1941 cohorts, the shares of employees who chose the pension for the long-term insured increased.

Previous empirical analyses of the effects of the 1992 pension reform

Berkel and Börsch-Supan (2004) and Hanel (2010) used option value models to evaluate the effects of the 1992 pension reform ex ante. Hanel (2010) estimated the transition rates out of employment after the ERA, although only observations until the end of 2002 were included, and thus the youngest cohort included in the study (born in 1942) did not reach the ERA at the end of the observation period. Hanel (2010) predicted a small positive employment effect of the pension reform. Berkel and Börsch-Supan (2004) simulated the effect of actuarially fair pension deductions according to the 1992 pension reform on the retirement decision. They used the actual retirement behavior of employees in a period before the reform (1984–1997) and predicted an increase in retirement age for men of almost 2 years.

Bönke et al. (2018) analyzed the effects of the 1992 pension reform on West German men eligible for the pension for the long-term insured who still worked at age 63. The empirical analysis was based on the Insurance Account Sample (*Versicherungskontenstichprobe*) with a sample size between 44 and 122 men per birth cohort between 1935 and 1945. As a reaction to the reform, they found an average delay in retirement age of 5.2 months, and the delay increased from cohort 1937 to 1940, and then remained stable.

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weigh the utility costs of shorter leisure against financial costs of longer financial reductions during partial retirement.

[13] The maximum penalty between both pension forms occurred for a retirement age of 63.

Riphahn and Schrader (2019) analyzed the effects of the 1992 pension reform on West German men for birth cohorts 1937–1939. They concentrated on men eligible for the pension for the unemployed. In their intention to treat regressions, they did not find significant employment effects but a significant increase in unemployment duration after the ERA. They only included labor market effects between the ages of 60 and 62, and they could not distinguish partial retirement and regular employment spells.

Geyer and Welteke (2019), Engels et al. (2017), and Geyer et al. (2019) analyzed the effect of the pension reform on employment, unemployment, and partial retirement on female employees. Their estimation of the postponement of retirement by about 15 months corresponds to the value predicted by Berkel and Börsch-Supan (2004) in their ex ante prediction for females.

3 Data

We use a large, high-quality dataset of administrative individual labor market histories provided by the Federal Employment Agency in Germany (*Bundesagentur für Arbeit*). The dataset consists of a 2% sample of the population with social security contributions from 1975 to 2014 (SIAB 7514).[14] The dataset contains daily information about employment, receipt of benefits according to German Social Books II and III, job seeking, and active labor market measures. An advantage of the SIAB is that spells in partial retirement are identifiable. In the data, we cannot distinguish the two partial retirement models. As we know that more than 80% of the employees chose the block model, we assume that all employees in our sample choose the block model in our main specifications. Thus, we determine the actual employment exit for men in partial retirement by halving the period of partial retirement.[15]

Our data do not contain information on pension insurance, such as pension entitlements, eligibility, or actual pension choice.[16] Therefore, we determine individual pension entitlements, deductions associated with a certain pension age, the expectancy criteria for the pension forms, and the corresponding ERA and NRA according to Lorenz et al. (2018) and Pfister et al. (2018). We observe whether an individual used the pension for the unemployed and pension after partial retirement by checking whether the individual had at least 52 weeks of unemployment or 24 months of partial retirement before labor market exit. If older employees exit employment between their 63rd and 65th birthday without an unemployment spell of more than 52 weeks or a partial retirement spell before,

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[14] A detailed description of the SIAB can be found in Antoni et al. (2016).

[15] An alternative would be to use the part-time indicator provided in the SIAB to identify those who use the block model and those who use the continuity model (also compare Berg et al., 2019). We do not use this method because employers were not required by law to report the working time of their employees, and thus this variable has many missings and is unreliable.

[16] We use the daily date of birth in the dataset for the exact calculation of pension entitlements. We are grateful to Philip vom Berge and Dana Müller from the FDZ at the IAB for merging this information as part of the Custom Shaped Administrative Data for the Analysis of Labor Market (CADAL) project.

we assume that employees chose the pension for the long-term insured. We observe labor market and employment exit, but not pension entry. Therefore, we calculate the maximum pension deductions induced if individuals stepped into retirement immediately after labor market exit. If there are gaps between labor market exit and pension entry, realized deductions are lower (Hanel, 2010).

Sample restrictions

We restrict our sample to men born between 1935 and 1941. We exclude civil servants and self-employed entrepreneurs because these population groups have not been eligible for the pension forms affected by the 1992 pension reform. To obtain average treatment of the treated effects, we restrict our sample further to the approximately 84% of men who fulfill the eligibility requirements for the pension after unemployment and the pension after partial retirement.[17] In addition, we restrict our sample to men with high labor market attachment in the years before they become eligible for an early pension. We use this further restriction because only these employees can choose when to retire and which pension to take because individuals who are unemployed or out of the labor market after age 55 for a long time are unlikely return to employment in Germany in the years included in this study (OECD, 2013). More specifically, our sample is restricted to men who are employed subject to social security at least once after the age of 55 (this restriction is also used, for example, by Hanel, 2010 and Geyer et al., 2019) and who are employed, in partial retirement, or unemployed at age 59.[18] Moreover, we do not consider men with missing information on the establishment-specific characteristics at the last employment.[19] Finally, we exclude the few seamen and miners because they enjoyed special protection of legitimate expectation rules for early retirement in the 1992 pension reform that we cannot identify in our dataset.[20]

In our data, we cannot test directly whether all employees included are eligible for the pension for the long-term insured. However, we know from an analysis based on the BASiD dataset that for our sample restrictions, about 93% of the men eligible for the bridge options were also eligible for the pension for the long-term insured (Lorenz et al., 2018). Thus, we assume that all employees in our sample who reached their 63rd birthday in employment were eligible for the pension for the long-term insured and that we incur only a small measurement error by assuming that all employees were eligible for all three early retirement forms. Please note that we do not differentiate between retirement at NRA and early retirement using the pension for the long-term insured because the

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[17]The share of eligible people in our data corresponds to the share of 86% we find in BASiD, another sample of the IEB (Integrated Employment Biographies) that includes the eligibility information on bridge options and other pension forms (Lorenz et al., 2018).

[18] In our sample, 13% of older employees are deleted in the first step and 23% are deleted in the second step.

[19] In our sample, 16% of older employees with missing employer characteristics are deleted.

[20] In our sample, less than 1% of older employees are seamen and miners.

share of employees who retired at age 65 was smaller than one percent for all birth cohorts included in our sample. After applying the sample restrictions, we are left with 24,882 men.

There were two other early retirement options available for men in the birth cohorts we look at that were not included in the 1992 pension reform. The employees in the old age pension for severely disabled people and the pension for those with reduced earnings capacity did not face pension deductions on early retirement (Riphahn and Schrader, 2019). To ensure that there is no program substitution, there ideally should be no employees eligible for these early retirement options in our dataset. The pension for those with reduced earnings capacity allowed employees to retire immediately when they were not able to work anymore in their occupation (*Berufsunfähigkeit/Erwerbsunfähigkeit*). Average retirement age for those with reduced earnings capacity was around age 53 for men born in the birth cohorts we focus on (Deutsche Rentenversicherung Bund, 2018). As a consequence, almost all men entering the pension for those with reduced earnings capacity left the labor market before age 59, and thus they are not included in our sample (Lorenz et al., 2018). In addition, reduced earnings capacity had to be assessed in a medical exam and it was hard to obtain eligibility without a legitimate reason.

We cannot discount the possibility that there are some employees who are eligible for the old age pension for severely disabled people in our dataset.[21] We should keep in mind that health-related eligibility criteria for disability pensions are relatively strict in Germany and that more than 50% of the applications for pensions for severely disabled people are rejected (Engels et al., 2017). Therefore, we can assume that there is no program substitution into other (unobservable) early retirement schemes as a reaction to the 1992 pension reform in our sample. However, we may attribute pension deductions to severely disabled people who retire before their NRA although they can leave at the ERA without pension deductions.

Descriptive evidence

We find sizeable differences in the employment rates between the cohorts (Figure 1). The age-specific employment rate, which includes regular employment without the active phase of partial retirement, was always higher for the pre-reform cohorts (red lines) up to age 63 than for the treated cohorts (blue lines). Although pension deductions for exiting employment before the NRA increased with cohort after 1937, the employment rates between the ERA and age 63 decreased with cohort. The reduction in regular employment was not compensated for by a shift of employment into partial retirement. Employment shares including the active phase of partial retirement also decreased with cohort between age 60 and 63 (Figure A1). After age 63, the employment rate of the cohorts affected

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[21] The share of employees who used the pension for severely disabled people was just 8% in the cohorts we focus on and there is no increase in usage of this pension form for birth cohorts affected by the reform (Deutsche Rentenversicherung, 2018).

by the pension reform exceeded the pre-reform rates. The employment increase therefore was positively related to the pension deductions for men choosing the pension for long-term insured (compare Figures 1 and A1).
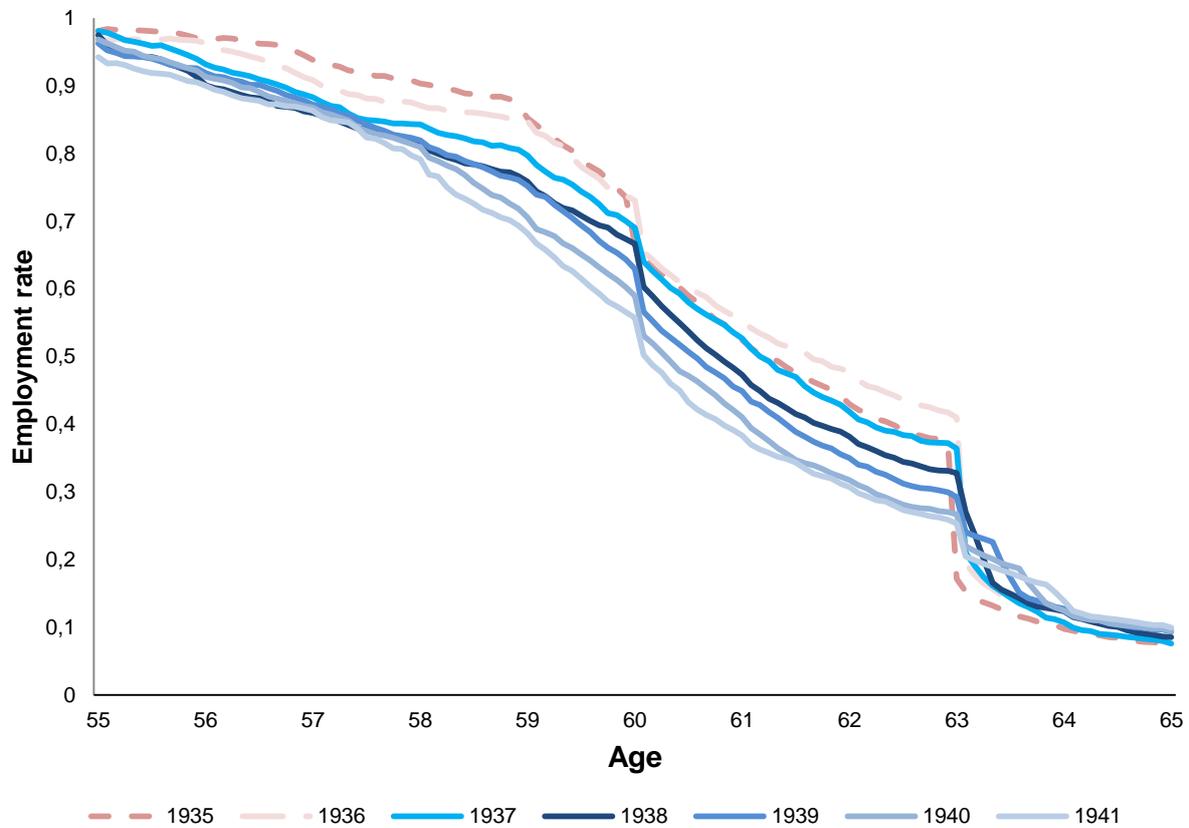

Fig. 1. Employment rate (without working phase of partial retirement) by age (monthly data) and cohort. Source: SIAB 7514, own calculations.

For all cohorts affected by the pension reform, unemployment rates were higher than for cohorts not affected before age 60 (Figure 2). The rise in the unemployment rate before age 60 in the treatment cohorts seems to be a consequence of the general business cycle that led to large unemployment increases. Unemployment shares of West German males doubled between 1991 and 1997 from 5.6% to 11%. The unemployment of older employees increased more than proportionally; the share of unemployed aged 55–65 for all unemployed increased from 14% to 21% in the same period. After 1997, the unemployment share decreased to 8.5% in 2001. The share of unemployed aged 55–65 reached its peak of 23% in 1999, and then decreased (Bundesagentur für Arbeit, 2019). The unemployment pattern of men in our sample before age 60 closely followed the general business cycle with a peak of older unemployed for birth cohort 1938. After age 60, unemployment was higher between the ERA and NRA for almost all cohorts affected by the pension reform and unemployment after the ERA increased with pension deductions.
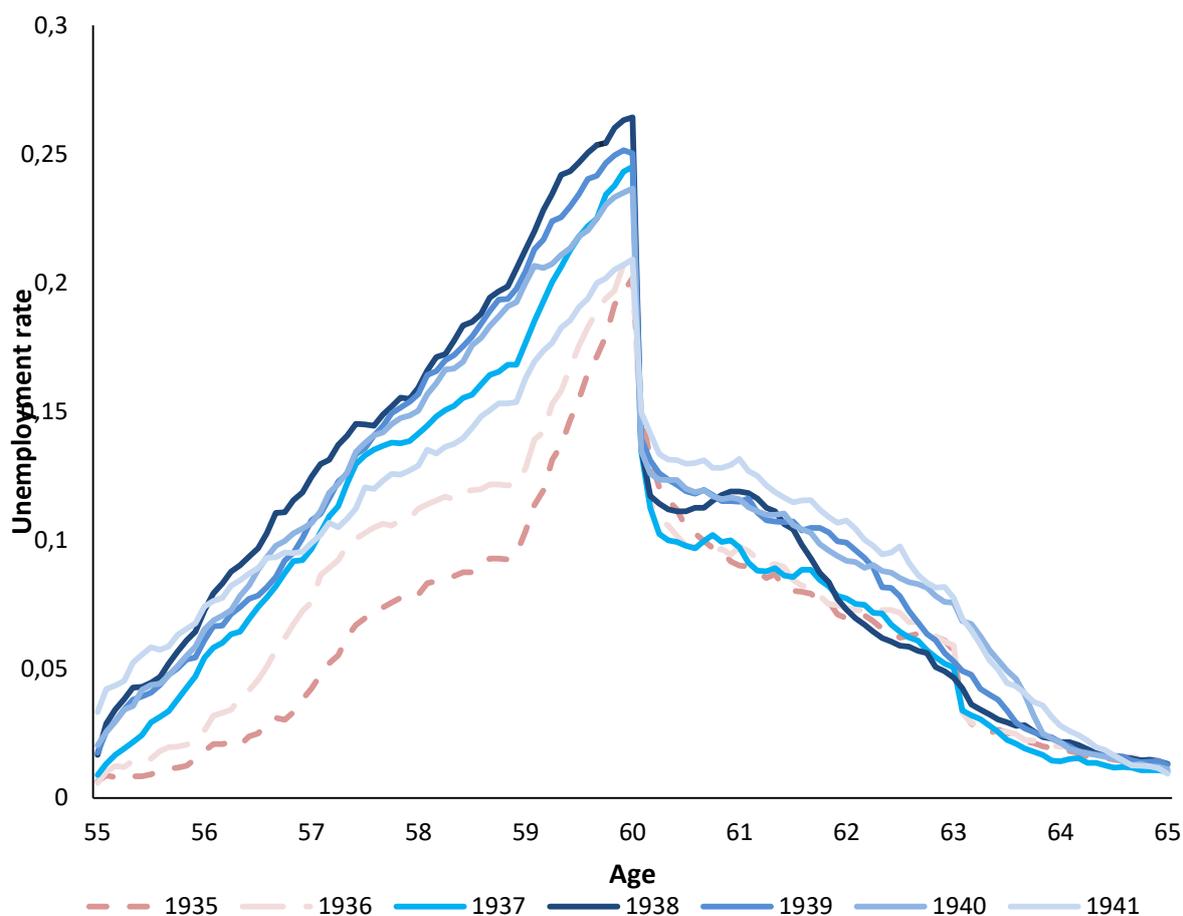
Fig. 2. Unemployment rates by age (monthly data) and cohort. Source: SIAB 7514, own calculations.

The incidence of partial retirement in cohorts 1935 to 1937 was almost 0% (Figure 3). Partial retirement increased greatly after the introduction of the new partial retirement rules. Few employees remained in partial retirement beyond age 63. Younger cohorts could enter partial retirement at a younger age; cohort 1937 was 60 years old when the first employers offered partial retirement in 1997. This is the reason why the minimum entry age into partial retirement decreased from cohort to cohort. The peak use of partial retirement decreased from men who were older than 62 to those aged 60. Therefore, we do not see the expected positive correlation between pension deductions for early retirement and partial retirement exit.

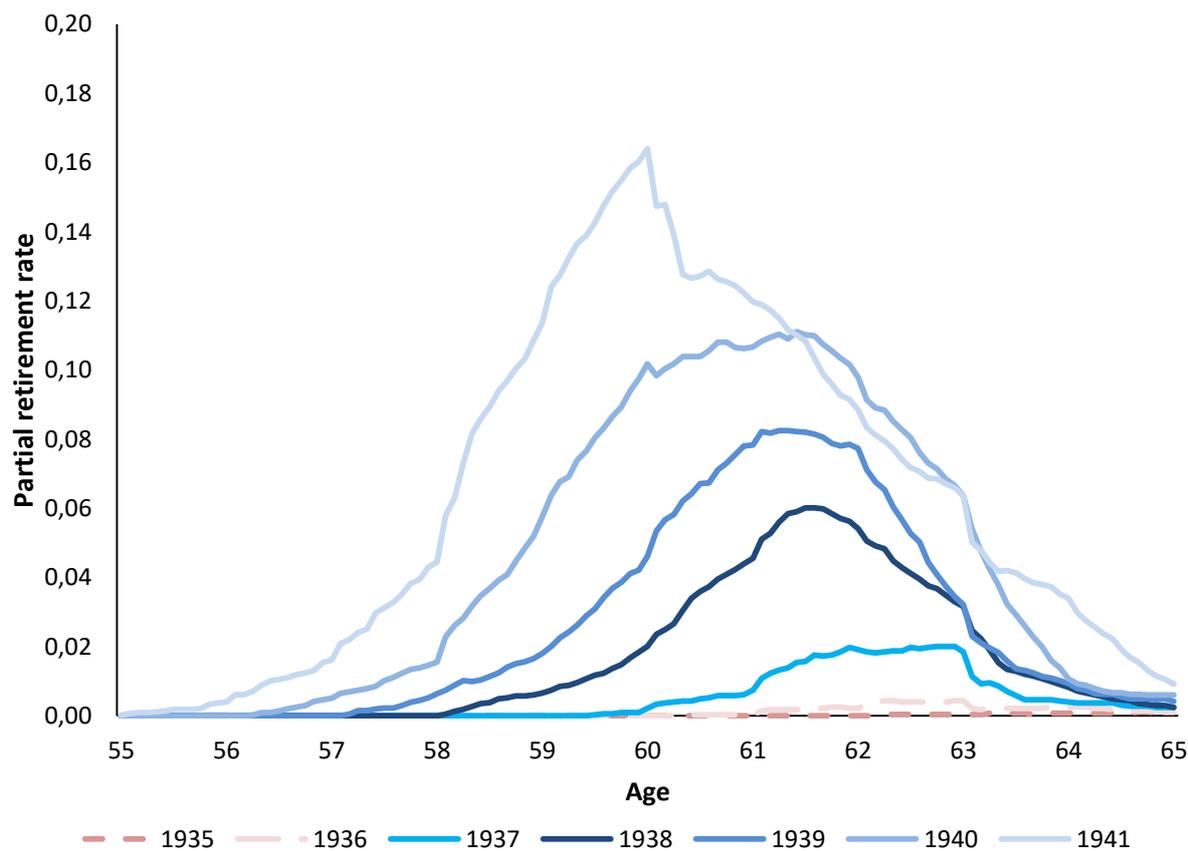**Fig. 3. Partial retirement rates by age (monthly data) and cohort.** Source: SIAB 7514, own calculations.

In the next step, we look more closely at aggregate statistics of labor market indicators by birth cohort. The analysis clarifies whether changes in labor market outcomes before and during the implementation phase of the pension reform come from changes in behavior given a retirement option or from substitution effects between retirement options. The first four columns of Table 1 show the development of average labor market exit age for different labor market states. Column 1 in Table 1 demonstrates that labor market exit age that includes release periods during partial retirement and unemployment only increased slightly with pension deductions for cohorts 1937 to 1941. The increase in labor market exit age was mainly driven by older men staying longer in unemployment (unemployment exit age increased by more than 9 months) and an increase in employment after the ERA by men using the pension for the long-term insured (labor market age increased by 6 months) (Table 1, columns II and IV). The positive correlations between pension deductions and labor market attachment for the unemployed and those in the pension for the long-term insured were compensated for by the strong reduction in average labor market exit age of those in partial retirement by 15 months (Table 1, column III). The strong decrease in labor market exit age for those in partial retirement also drove the slight reduction in average employment exit age including the active phase in partial retirement (Table 1, column V).

Table 2 shows changes in the incidence of pension forms. The share of older men using partial retirement as a bridge dramatically increased from almost 0% before the reform to more than 23% in cohort 1941. The increase in the share of employees in partial retirement did not reduce the share of employees in the pension after unemployment; their share instead also increased from 27% before the reform to 42% for the first cohorts affected by the pension reform. The share of older men who used the pension for the unemployed only started to decrease slightly for cohort 1941. The share of older men using the pension for the long-term insured almost halved from 72% in cohort 1935 to less than 40% in cohort 1941, accordingly (Table 2, column I).[22]

Cohort	Average labor market exit age	Average labor market exit age for pension after unemployment	Average labor market exit age for pension after partial retirement	Average labor market exit age for pension for long-term insured	Average employment exit age
	I	II	III	IV	V
1935	62.23	61.35		63.53	61.50
1936	62.40	61.39		63.64	61.52
1937	62.34	61.35	63.34	63.64	61.28
1938	62.51	61.66	62.83	63.84	61.14
1939	62.53	61.86	62.72	63.85	61.12
1940	62.56	61.95	62.46	63.93	61.07
1941	62.58	62.14	62.09	63.98	61.05
Total	62.47	61.75	62.42	63.77	61.21
N	24,882	9,198	2,494	13,190	24,882

Tab. 1. Descriptive statistics of labor market exit age by pension form. Age measured in years.
Notes: Values in the columns correspond to the mean. We set the age at 63 if we attribute the pension for the long-term insured and observe a labor market exit age below 63. Employment exit includes active phase of partial retirement. Source: SIAB 7514, own calculations.

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[22] The changes in pension shares in our sample are also found for the universe of older men. The share of employees in the pension for the long-term insured gradually decreased from more than 17% in cohort 1937 to 11% in cohort 1941. The share of those claiming the pension for the unemployed/partial retirement gradually increased from around 25% to almost 31% between cohort 1937 and cohort 1941. The share of older men in the regular old age pension increased from less than 19% in cohort 1937 to 24% in cohort 1941 (Deutsche Rentenversicherung Bund, 2018).

Cohort	Share of men with old age pension for long-term insured in %	Share of men with old age pension after unemployment in %	Share of men with old age pension after partial retirement in %
	I	II	III
1935	72.66	27.34	/[23]
1936	70.03	29.97	/
1937	64.04	34.17	1.79
1938	50.87	41.94	7.20
1939	48.01	41.42	10.58
1940	41.42	40.91	17.67
1941	39.77	37.12	23.11
Total	53.01	36.97	10.02
N	24,882	24,882	24,882

Tab. 2. Descriptive statistics of shares of pension forms. Source: SIAB 7514, own calculations.

Finally, we look at important labor market indicators given a retirement path. Partial retirement duration increased by 0.6 years (or 7.6 months) (Table 3, column I). This increase was not a consequence of a longer labor market spell after the ERA (column II), but of a longer spell in partial retirement in the age bracket 55–60 from 0 years to more than 1.1 years (column III). Average employment exit age from partial retirement decreased by 1.5 years during the implementation period, accordingly (column V). The share of those employees who entered partial retirement after age 63 was negligible for all cohorts besides birth cohort 1937 (column IV).

Cohort	Partial retirement duration	Partial retirement duration after age 60	Partial retirement duration from age 55 to 60	Share entry in partial retirement after age 63 in %	Average employment exit age for those in partial retirement
	I	II	III	IV	V
1937	2.09	2.07	0.02	6.90	62.25
1938	2.15	1.95	0.19	1.53	61.71
1939	2.38	2.00	0.39	1.17	61.45
1940	2.51	1.83	0.68	0.92	61.22
1941	2.72	1.60	1.12	0.41	60.71
Total	2.52	1.79	0.74	0.96	61.13
N	2,494	2,494	2,494	2,494	2,494

Tab. 3. Descriptive statistics for those in partial retirement. Durations and age measured in years. Source: SIAB 7514, own calculations.

Total unemployment duration for those choosing the pension after unemployment only increased slightly with pension deductions (Table 4, column I). The large increase in unemployment duration after ERA (almost 4 months, column II) was partly compensated for by a decrease in the unemployment duration before age 60 by less than 2 months (column III). Thus, employers dismissed

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[23]The symbol form"/" means that for data protection reasons, all values based on fewer than 20 observations are deleted (Forschungsdatenzentrum der Bundesagentur für Arbeit, 2017).

their employees later; average employment exit age increased slightly by 4 months from cohort 1937 to 1941 (column V). The share of those older men using the pension after unemployment who entered unemployment after 63 was negligible (column IV).

Cohort	Unemployment duration	Unemployment duration after 60	Unemployment duration from age 55 to 60	Share entry in unemployment after 63 in %	Average employment exit age for unemployed
	I	II	III	IV	V
1935	2.02	0.89	1.13	/	59.42
1936	2.25	0.86	1.39	/	59.19
1937	2.37	0.78	1.59	/	59.03
1938	2.43	0.80	1.63	1.70	59.08
1939	2.41	0.88	1.53	1.38	59.22
1940	2.45	0.93	1.51	1.47	59.27
1941	2.58	1.10	1.48	1.96	59.36
Total	2.40	0.90	1.50	1.44	59.22
N	9,198	9,198	9,198	9,198	9,198

Tab. 4. Descriptive statistics for those in the pension after unemployment. Durations and age measured in years. Source: SIAB 7514, own calculations.

Employment exit for those using the pension for the long-term insured increased by 5 months from 63 years and 5 months to 63 years and 10 months during the implementation period. Given that employment exit decreased by 18 months for those in partial retirement (Table 4, column V) and increased by 4 months for those using the pension after unemployment (Table 5, column V), employers could increase the difference in average employment exit age during the implementation phase.

4 Multivariate estimations

We analyze whether the descriptive results of the changes before and during the implementation phase of the pension reform are also obtained when we control for changes in labor supply and demand factors. For the multivariate identification of the effects of the pension deductions on the labor market participation of older workers, we follow the empirical approaches proposed by Mastrobuoni (2009) and Engels et al. (2017). All employees in a certain cohort are affected equally by the reform, so we cannot construct an intra-cohort comparison group (Bönke et al., 2018). The impact of financial incentives induced by the pension reform on labor market states therefore is calculated for adjacent birth cohorts of older men as

$$y_{imt} = \alpha_m + \theta_{imt} + \lambda_{cm} + \lambda_m D_{it} + \beta_{xm}X_{it} + \beta_{ym}Y_{jt} + e_{imt}, \tag{3}$$

where y_{imt} is an indicator variable for labor state m of individual i at time t. The labor market state after the ERA can be employment (without and with the active phase of partial retirement), partial

retirement (including the release phase of partial retirement), and unemployment. The variable D_{it} measures the time-varying deductions from pension entitlements for those who enter retirement before the NRA (in months) when they have been born in a certain birth cohort (by birth month). We differentiate between the deductions taken owing to the NRA for the bridge options and the NRA for the pension for the long-term insured according to the pension an individual actually chose. Furthermore, we include monthly age fixed effects (θ_{imt}); monthly cohort fixed effects (λ_{cm}); individual labor supply variables, including pension wealth at age 55 and job exposure matrices (JEM) proposed by Kroll (2011) to measure overall, physical, and psycho-social job demands[24]. We also take into changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance (X_{it})[25]. In addition, we include labor demand indicators (Y_{jt}), such as regional unemployment rates at the place of work and characteristics of the last employer before leaving the labor market such as mean wage and characteristics of all employees and firm size The full list of explanatory variables and their averages can be found in Table A1.

The 1992 pension reform introduced partial retirement as an additional early retirement option that employers could offer to their workforce. Thus the effect of the reform may not be completely attributable to pension deductions and the increase in NRA. To calculate the overall effect of the pension reform on labor market outcomes including the introduction of partial retirement, we calculate differences in labor market outcomes between birth cohorts (in years). We assume that older men of adjacent birth cohorts should have behaved equally, given that there was no pension reform, if we control for individual and employer characteristics that influence labor market behavior (Krueger and Pischke, 1992; Mastrobuoni, 2009). We analyze differences in labor market behavior between the treated birth cohorts and the last non-treated cohort 1936 in the age group 60–65. More specifically, we calculate

$$y_{i,m} = \sum_{t=60}^{65} \mathbf{1}(T_i = t) \times (a_{t,m} + \sum_{c \neq 1936} \beta_{t,c,m} \times \mathbf{1}(C_i^* = c)) + \omega_j' X_{i,m} + \psi_j Y_{j,m} + \varepsilon_{i,m},$$
(4)

where $y_{i,m}$ is a binary variable that denotes labor market state m, $X_{i,m}$ are individual and $Y_{j,m}$ are establishment cohort-specific variables. The variable $\beta_{t,c,m}$ measures the average difference in $y_{i,m}$ at age t between cohort c and baseline cohort 1936. The sum of the $\beta_{t,c,m}$ coefficients equals the difference in the employment, partial retirement, or unemployment duration between cohort c and cohort 1936 as

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[24] We match the JEM to individuals by using the classification of occupations (KldB-10).
[25] A detailed description of the changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance can be found in Engels et al. (2017).

$$\Delta_{c,m} = \sum_{t=60}^{65} t \left[\text{Prob}_{t,c,m}(y_i = 1) - \text{Prob}_{t,1936,j}(y_i = 1) \right]$$

$$= \sum_{t=60}^{65} t \left[\beta_{t,c,m} - \beta_{t-1,c,m} \right]$$

$$= 60 \left(\beta_{60,c,m} - 0 \right) + 61 \left(\beta_{61,c,jm} - \beta_{60,c,m} \right) + \dots + 65 (0 - \beta_{65,c,m})$$

$$= \sum_{t=60}^{65} \beta_{t,c,m}. \qquad\qquad (5)$$

The first specification in Table 5 (odd columns) imposes a linear correlation between pension deductions and labor market outcomes, the second specification (even columns) relaxes this strong assumption and uses indicator variables for different penalty values. In columns III and IV, we add labor demand variables to the labor supply indicators. In accordance with the descriptive analysis presented in Section 3, pension deductions are not positively correlated with employment after the ERA. Employees instead accepted higher pension deductions and even reduced employment when pension deductions for exiting employment before the NRA increased. On average, an increase in the deductions by 1 percentage point (PP) was associated with a reduction in the employment rate by about 1.2 PP (column I). For the nonlinear specification (column II), we find significantly negative correlations between employment and all pension penalty groups. Men facing deductions up to 18% had an employment rate 18.4 PP lower than men without deductions. Controlling for regional unemployment and employer characteristics strongly increases the R^2 of the estimation and the pension penalty coefficients increase slightly (columns III and IV). The strong substitution of regular employment into partial retirement does not change the negative employment results. If we add employment during the active phase in partial retirement to regular employment, overall employment also decreased with pension deductions (compare Table A2, columns I–IV).

According to our descriptive results, pension deductions had a significantly positive correlation with unemployment length after the ERA. Deductions between 14.7% and 18.0% are associated with a significantly higher unemployment rate by 2.6 PP (column IV). Partial retirement duration after age 60 also increased with pension deductions. When we control for employer characteristics, treated men with deductions up to 18% increased partial retirement rates by about 12.3 PP (column IV). Thus, partial retirement incidence after age 60 increased more than unemployment incidence. However, in both bridge paths, older men had exited employment already before the ERA.

Table 6 shows the overall labor market changes during the implementation phase of the pension reform. According to our previous results, employment was reduced by almost 6 months in cohorts 1940 and 1941 in comparison to cohort 1936. During the entire implementation phase, regular employment after age 60 decreased by 5.5 months (= 5 × 1.187) (see last line in column I of Table 6). Column III shows that partial retirement increased by more than 0.6 months for each year of NRA increase. Column IV shows that unemployment was 0.3 months longer for cohort 1937 compared

with cohort 1936 and 2 months longer for cohort 1941. On average, unemployment spells increased by 0.4 months for each year of NRA increase.

	Employment without partial retirement				Unemployment				Partial retirement			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Penalty (%)	-0.012**		-0.014**		0.001**		0.001**		0.007**		0.006**	
	(0.0005)		(0.0005)		(0.0003)		(0.0003)		(0.0003)		(0.0003)	
No penalty		Base		Base		Base		Base		Base		Base
0.3–3.6		-0.031**		-0.034**		0.015**		0.015**		0.024**		0.024**
		(0.003)		(0.003)		(0.002)		(0.002)		(0.001)		(0.001)
3.9–7.2		-0.071**		-0.079**		0.015**		0.016**		0.040**		0.039**
		(0.004)		(0.004)		(0.003)		(0.003)		(0.002)		(0.002)
7.5–10.8		-0.109**		-0.123**		0.018**		0.019**		0.058**		0.056**
		(0.005)		(0.005)		(0.003)		(0.003)		(0.003)		(0.003)
11.1–14.4		-0.147**		-0.169**		0.021**		0.022**		0.085**		0.082**
		(0.006)		(0.006)		(0.004)		(0.004)		(0.003)		(0.003)
14.7–18.0		-0.184**		-0.213**		0.025**		0.026**		0.125**		0.123**
		(0.008)		(0.008)		(0.006)		(0.006)		(0.005)		(0.005)
Observations	1,517,802	1,517,802	1,517,802	1,517,802	1,517,802	1,517,802	1,517,802	1,517,802	1,517,802	1,517,802	1,517,802	1,517,802
X variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Y variables	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Pre-reform mean	0.355				0.062				0.001			
R^2	0.180	0.179	0.259	0.259	0.040	0.040	0.054	0.055	0.050	0.050	0.076	0.076

Tab. 5. Regression results: direct effects on employment rate without partial retirement, unemployment rate, and partial retirement rate (both phases). Notes: In all specifications, we control for labor supply determinants. In columns III and IV, we additionally control for labor demand determinants. Standard errors in parentheses are clustered on the individual level. Significance levels: *$p < 0.05$, **$p < 0.01$. The pre-reform mean is calculated for pre-reform cohorts 1935 and 1936. Source: SIAB 7514, own calculations.

Cohort	Employment without partial retirement	Employment including partial retirement	Partial retirement	Unemployment
1937	-0.639	-0.343	0.296**	0.295
	(0.464)	(0.467)	(0.079)	(0.216)
1938	-2.733**	-1.300**	1.433**	0.771**
	(0.455)	(0.463)	(0.124)	(0.227)
1939	-4.015**	-1.928**	2.087**	1.219**
	(0.448)	(0.455)	(0.143)	(0.235)
1940	-5.728**	-2.527**	3.201**	1.817**
	(0.448)	(0.458)	(0.169)	(0.251)
1941	-5.806**	-2.920**	2.886**	2.165**
	(0.517)	(0.539)	(0.240)	(0.315)
Average change in employment per year increase in NRA with deductions of 3.6% (months)	-1.187** (0.176)	-0.570** (0.178)	0.617** (0.035)	0.395** (0.086)
Observations	3,010,722	3,010,722	3,010,722	3,010,722

Tab. 6 Overall effects of the pension reform for employment without partial retirement, employment with partial retirement (both phases), partial retirement with release phase, and unemployment in months. Notes: Standard errors in parentheses are clustered on the individual level. Reference is cohort 1936. In all specifications, we control for labor demand and labor supply determinants. Significance levels: *$p < 0.05$, **$p < 0.01$. Source: SIAB 7514, own calculations.

5 Discussion

Our descriptive and multivariate analyses give a consistent picture of the changes in labor market outcomes before and after the implementation of the 1992 pension reform. Pension deductions for early retirement plus an increase in the normal retirement age did not increase employment of older men after the ERA. Employment decreased more strongly with higher pension deductions at a certain retirement age after ERA, instead. The employment decrease is the result of a massive shift of employees affected by the reform from the pension for the long-term insured into bridge options. In addition, employment exit age from partial retirement also decreased with pension deductions. The increases in employment exit age before unemployment and before the pension for the long-term insured could not compensate for the negative employment factors.

The decrease in employment and the strong shift into bridge options are not consistent with the changes intended by the pension reform. These changes are also not consistent with the predictions derived on basis of the option value model. They are also not consistent with positive employment predictions from ex ante evaluations of the reform (Berkel and Börsch-Supan, 2004; Hanel, 2010). Finally they contradict empirical evaluations of the labor market consequences of comparable pension reforms in other countries: the increase of the NRA plus actuarily fair pension deductions for early retirement in the USA led to a modest increase in employment for men (Mastrobuoni, 2009). A

Swiss pension reform that introduced an increase in the NRA by 1 year each in two steps and an actuarial pension penalty of 3.4% for retirement of 1 year before the NRA led to a large positive employment effect for older women (Hanel and Riphahn, 2012; Lalive and Staubli, 2015).

Our explanation for the surprising findings is that employers motivated an increasing share of older men to use bridge options instead of the pension for the long-term insured. Bridge options allowed employers to terminate employment of their older workers on average more than four years earlier (see Table 4 column V) if they took unemployment instead of the pension for long-term insured and between more than 1 year earlier in cohort 1937 and about 3 years earlier in cohort 1941 for partial retirement (see Table 3 column V). The recession with strongly increasing unemployment rates made it necessary for employers to push employees into bridge options who were eligible for it. As most of these older men also were eligible for the pension for the long-term insured, employers had to compensate them for the higher financial costs of bridge options (see below).

We propose several arguments that labor demand is responsible for the negative employment development during the implementation phase of the 1992 pension reform for men. The first argument is that men eligible for all three pension forms who were in employment on their 63rd birthday acted according to the option value theory. Practically all of these employees used the pension for the long-term insured instead of a bridge option (compare Tables 3 and 4, column IV). They used their autonomy to determine employment exit and increased their employment with pension deductions. We can replicate this descriptive finding if we include labor demand and supply variables and calculate the impact of pension deductions and the overall effect on labor market states on employment for those who reached age 63 in employment. Employment significantly increased by about 0.15 months per year of NRA increase (compare Table 8).

	Employment without partial retirement				Unemployment				Partial retirement			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Penalty (%)	0.063**		0.036**		-0.009**		-0.008**		-0.005**		-0.008**	
	(0.001)		(0.0008)		(0.0004)		(0.0004)		(0.0003)		(0.0004)	
No penalty		Base		Base		Base		Base		Base		Base
0.3–3.6		0.147**		0.054**		-0.016**		-0.012**		-0.0006		-0.011**
		(0.005)		(0.003)		(0.002)		(0.002)		(0.001)		(0.001)
3.9–7.2		0.329**		0.183**		-0.046**		-0.041**		-0.022**		-0.038**
		(0.007)		(0.005)		(0.002)		(0.002)		(0.002)		(0.002)
Observations	622,050	622,050	622,050	622,050	622,050	622,050	622,050	622,050	622,050	622,050	622,050	622,050
X variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Y variables	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Pre-reform mean	0.128				0.022				0.001			
R^2	0.150	0.145	0.313	0.309	0.026	0.025	0.036	0.035	0.028	0.027	0.065	0.063

Tab. 7. Regression results: direct effects on employment rate with partial retirement, unemployment rate, and partial retirement rate (both phases) for employees 63–65 years old. Notes: In all specifications, we control for labor supply determinants. In columns III and IV, we additionally control for labor demand determinants. Standard errors in parentheses are clustered on the individual level. Significance levels: *$p < 0.05$, **$p < 0.01$. The pre-reform mean is calculated for pre-reform cohorts 1935 and 1936. Source: SIAB 7514, own calculations.

Employment increase with and without the active phase in partial retirement is similar (compare columns I and II of Table 8) and the changes in partial retirement and unemployment with pension deductions are negligible (compare columns II and III of Table 7). Our results are consistent with the positive effect of the pension reform on pension entry for those using the pension for the long-term insured reported by Bönke et al. (2018). Employers therefore had to take into account that employment of those employees eligible for all three pension forms would shift by about half a year during the implementation phase of the pension reform if they did not push them into bridge options (compare VI of Table 1).

Cohort	Employment without active phase in partial retirement age 63–65 (months)	Employment with active phase in partial retirement age 63–65 (months)
	I	II
1937	0.259**	0.255*
	(0.099)	(0.100)
1938	0.369**	0.392**
	(0.102)	(0.103)
1939	0.410**	0.430**
	(0.098)	(0.099)
1940	0.266**	0.308**
	(0.099)	(0.100)
1941	0.279**	0.349**
	(0.103)	(0.105)
Average changes in employment per year increase in NRA with deductions of 3.6% (months)	0.141**	0.148**
	(0.039)	(0.039)
Observations	622.050	622.050

Tab. 8 Overall effects of the pension reform on employment. Notes: Standard errors in parentheses are clustered on the individual level. Reference is cohort 1936. In all specifications, we control for labor supply and labor demand determinants. Significance levels: *$p < 0.05$, **$p < 0.01$. Source: SIAB 7514, own calculations.

The second argument is that in contrast to our results for men, previous studies on the effects of the 1992 German pension reforms on women found that employment increased with pension deductions (compare our literature review in Section 2). Practically all women affected by the 1992 pension reform went into the pension for women and hardly any women chose a bridge option.[26] Although the bridge options allowed employment before ERA, the pension for women (ERA was the same for the pension for women and the bridge options) was more attractive for practically all women eligible for all three pension forms. Thus, the pension effects for women at age 60 are

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[26] The share of women who chose the pension for the unemployed and partial retirement before and after the implementation of the 1992 pension reform was less than 2%, compare Geyer et al. (2019).

comparable to those for men at age 63.[27] If bridge options and pension for the long-term insured had the same ERA, we therefore can assume that we would not have observed the shift of older men into bridge options with their associated employment decrease after age 60.

Our third argument is that employers had to be willing to offer substantial sums of money to motivate employees to use a bridge option instead of the pension for the long-term insured, especially for the cohorts more strongly affected by the pension reform. Participation in partial retirement is voluntary and older employees eligible for the pension after unemployment are well protected against dismissals and therefore usually get severance pay when they are dismissed (Schmähl, 2003).[28] Appendix B shows that realized financial cost differences between the pension for the long-term insured and the bridge options increased to 8 earnings months (or 28,000 EUR) for partial retirement and 10 earnings months (or 25,000 EUR) for unemployment.

It is notoriously difficult to obtain information on compensation payments made by employers before a dismissal or partial retirement.[29] The only information source on severance pay for dismissed employees we are aware of is the survey evidence provided by the German Socio-Economic Panel. Grund (2006) and Jahn (2009) reported an average severance pay of between 20,000 and 25,000 EUR in the years 2000–2006 in case of a mutual dismissal agreement. They found severance payments of up to 400,000 EUR and a large increase in severance pay with age and tenure. Severance pay increased by between 0.6 and 0.74 monthly earnings for each year of tenure. If we consider that older men in our sample had 15 years of tenure before they were dismissed, the tenure effect on severance pay alone would be at least 9 earnings months. Given that age has a separate positive effect on severance pay in addition to tenure, the calculations by Grund (2006) and Jahn (2009) are consistent with severance payments necessary to compensate older men for the financial costs of a dismissal compared with using the pension for the long-term insured. From the employer's perspective, a dismissal was financially more attractive than partial retirement (Schmähl, 2003). Besides the severance pay and other possible compensations necessary to obtain the employee´s agreement for a dismissal, the firms faced almost no further costs when they dismissed their older employees. For partial retirement, employers had to form accruals for the passive phase of the block model and pay higher hourly wages for the entire period of partial retirement (see Appendix B). Oswald (1999) demonstrates that partial retirement was substantially more expensive for the employer than a dismissal *ceteris paribus*.

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[27] In principle, women also could choose the pension for the long-term unemployed. This pension form however implied lower pension entitlements compared with the pension for women, and thus few women chose it (Lorenz et al., 2018).

[28] Only employers with fewer than five employees are exempted from the dismissal protection rules that specifically protect employment of older employees.

[29] Compensation and severance payments were not subject to social security payments, so they are not reported in our administrative social security data.

The high compensation costs necessary to induce older men to use a bridge option implies that mainly employers with high adaptation costs for an increase in employment of older men offer bridge options. In order to show this hypothesis empirically, we first argue which employer characteristics indicate high adaptation costs. The SIAB data set only entails a short list of employer characteristics and we therefore cannot present a structural model on the employer determinants for bridge options. In general, prolonging the employment of an older employee usually means that a young employee cannot be hired, does not get a promotion or has to be dismissed (Boeri et al., 2016). In our estimation model for the usage of bridge options we therefore take indicators of how many younger employees are affected by a prolongation of employment of older employees and how costly this is for the employer.

Employment adaption costs increase for employers with a strong need to reduce their workforce and the use of bridge paths therefore may be negatively correlated with the business cycle. If we assume that the regional unemployment level is positively related with the need to a workforce reduction, a high or an increasing regional unemployment rate[30] should increase the probability that an employee uses a bridge path (Dorn and Sousa-Poza, 2010). Similarly, employers that enjoyed a growing workforce[31] should use bridge paths less frequently. Large employers usually have a professional human resources department that can cope with the legal requirements for partial retirement. Large employers are also more frequently subject to a collective bargaining agreement and have a works council. Unions and works councils supported the usage of bridge options because they recognized them as a socially acceptable form of labor flexibility and therefore these industrial relation institutions reduced the costs of bridge options (Schmähl, 2003; Berg et al., 2019; BMAS, 2018). Finally, employers with a large share of employees aged 55–59 in the year before an employee retires, that is, employers with a high treatment intensity, should use bridge paths more because their adaptation costs are higher than those of firms with low treatment intensity (Boeri et al., 2016).

In Table 9, our multivariate regression explains which older employees from our sample use a bridge option before retirement instead of the pension for the long-term insured employees. We control for many individual drivers of labor market decisions of older employees and the economic sector of the employer. Our ordinary least squares regression indeed shows that older men who work at larger employers, at employers in regions with high and increasing unemployment, and with a high treatment intensity used bridge paths more frequently. In contrast, older men who worked at

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[30] We choose the regional unemployment level at age 55 and the change in regional unemployment in the year before entry into bridge employment or between age 54 and 55 for those who did not choose bridge employment to obtain values in the years the decision for or against a bridge option was taken. The results are robust if we take the unemployment (change) values at a later age up to 60.

[31] We measure the change in employment in the last year before the employee entered the bridge path or between age 54 and 55, analogously. Varying the employment measurement at different ages produces robust results.

growing employers used the pension for the long-term insured. If we add employer information to the individual characteristics, R^2 more than doubles from 0.049 to 0.11.[32]

	Employee uses bridge path before retirement
Employer size × 10,000	0.070**
	(0.008)
Regional unemployment rate at age 55	0.012**
	(0.001)
Increase in regional unemployment in year before entry into bridge employment or between age 54 and 55	0.024**
	(0.007)
Growing employer	-0.082**
	(0.007)
Treatment intensity	0.414**
	(0.040)
Individual characteristics	Yes
R^2	0.11
Observations	19,982

Tab. 9. Determinants of bridge paths. Notes: Ordinary least squares regression. Standard errors in parentheses are clustered on the individual level. Individual characteristics included are pension wealth at age 55, six birth year dummies, highest education (three levels), tenure (three levels), and economic sector at the last employer prior to retirement. Significance levels: *$p < 0.05$, **$p < 0.01$. Source: SIAB 7514, own calculations.

Our last argument that employer behavior drives the shift into bridge options during the implementation phase of the pension reform is provided by Dorn and Sousa-Poza (2010). They showed that half of those employees who retired early in Germany between 1984 and 1997 did so involuntarily. The involuntary retirement share was one of the highest in their international comparison spanning 19 countries and the share increased towards the end of the observation window. The large and increasing share of involuntary early retired in Germany is consistent with our interpretation that employers pushed many employees into partial retirement and the pension after unemployment.

6 Policy implications

We argue that the negative development in employment after ERA is a consequence of employers pushing their employees into bridge options. Early retirement options that give employers a say on employment exit are widespread. For partial retirement, Austria, Germany, Sweden, and some schemes in the Netherlands provide examples of rules that allow employers to influence when an employee exits employment. Some papers already show that employers used their influence on

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[32] We obtain the qualitatively same results if we use a Probit regression instead of an ordinary least squares regression.

employment exit to reduce older employee employment. Graf et al. (2011) find that most employees in partial retirement substituted full employment for part-time employment and retired early in Austria. Therefore, employment exit age declined after the introduction of partial employment. Lachowska et al. (2009) performed a case study of employees at Stockholm University that showed that after controlling for individual retirement incentives, the financial situation of the university department had a highly significant negative effect on early retirement incidence. Allen et al. (2004) found that introducing partial retirement at the University of North Carolina caused a large share of employees to reduce working time at the end of their career and enter retirement earlier. In contrast, Wadensjö (2006) showed that Sweden's partial retirement program on average led to a net increase in the number of hours worked by older workers. However, older workers opting for the partial retirement program had to give up another early retirement option that would have allowed them to exit the labor market even earlier than with the partial retirement program.

Early retirement after unemployment also depends strongly on employer decisions. Many countries offer early retirement after a certain unemployment spell (for example, Portugal, Finland, Belgium, and the Netherlands, see European Commission, 2019). Employers in these countries might use compensation for financial losses of unemployment for employees enjoying dismissal protection in order to push them into early retirement (Cremer et al., 2009). Rabaté (2019) for example shows that the influence of employers on retirement age after dismissal without a cause (so-called "mandatory retirement") had a negative effect on employment of older employees in France.

The experience in Sweden and the differences in the employment changes during the implementation period of the 1992 pension reform between men and women in Germany point to an important proviso of our findings: the costly push of old employees into bridge options was only attractive for employers because bridge options had an ERA three years earlier than the earliest alternative ERA for the employees in our sample.

7   Conclusions

This paper shows that the increase in the NRA plus the introduction of pension deductions for retirement before the NRA did not have the intended positive pension reform effect on the employment of older men. During the implementation phase of the pension reform, employment declined by 1.2 months per annual increase in NRA. This finding markedly differs from theoretical predictions by the option value theory, empirical ex ante analyses of the 1992 pension reform in Germany, and international evidence on employment effects of comparable pension reforms. We found two main reasons for the negative employment development during the introduction phase of the pension reform: Strong substitution of employees from a pension for the long-term insured to

the bridge options unemployment and partial retirement and a decline in employment age of old men using the partial retirement option.

The strong substitution of regular employment into the bridge options may partly have been an unintended side effect of the reform. Employers could have correctly expected that older employees eligible for the pension for the long-term insured would stay longer in employment (they in fact stayed five months longer on average at the end of the implementation period than before the reform). The depression phase during the implementation period of the pension reform led employers to use their influence to avoid employment adaptation costs induced by older employees who were free to opt for a later employment exit. Thus, employers were willing to compensate their employees for financial cost differences of using bridge options that amounted to up to 10 earnings months. Accordingly, we find that mainly employers with higher costs for keeping older employees longer in employment pushed their employees into the bridge options.

Papers on reactions to pension reforms usually frame their models assuming forward-looking individuals who maximize their expected life-cycle utility in each period of time by deciding between labor market participation and retirement. These models imply autonomous employee decisions on retirement and do not consider employer behavior. Thus, these studies assume a perfectly elastic labor demand reaction to pension reforms. This assumption excludes the employers' option to push employees into alternative retirement paths that imply an earlier ERA and an influence of the employer on employment exit. To the best of our knowledge, this is the first paper that shows that employers have thwarted the expected positive employment effect of a pension reform by using their influence on employment exit of their older employees. Our results suggest that for pension types for which employees are not autonomous in their retirement decisions, employer behavior can have a decisive impact on the labor market effects of pension reforms.

In light of our results, we assume that later increases in the NRA in Germany had stronger positive employment effects after the early retirement options after unemployment and partial retirement were abolished in Germany starting for birth cohorts 1952 (1999 pension reform). For older men born after 1952 who were eligible for bridge options, the pension for the long-term insured was the earliest retirement option and bridge options lost their attractiveness for employers with high employment adaptation costs. Our paper also suggests that similar pension reforms as the 1992 pension reform introduced during boom phases may have a more positive employment effect. Employers are not willing to compensate employees for the financial costs associated with using earlier retirement options when it is not costly to keep older employees in work longer.

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Appendix A
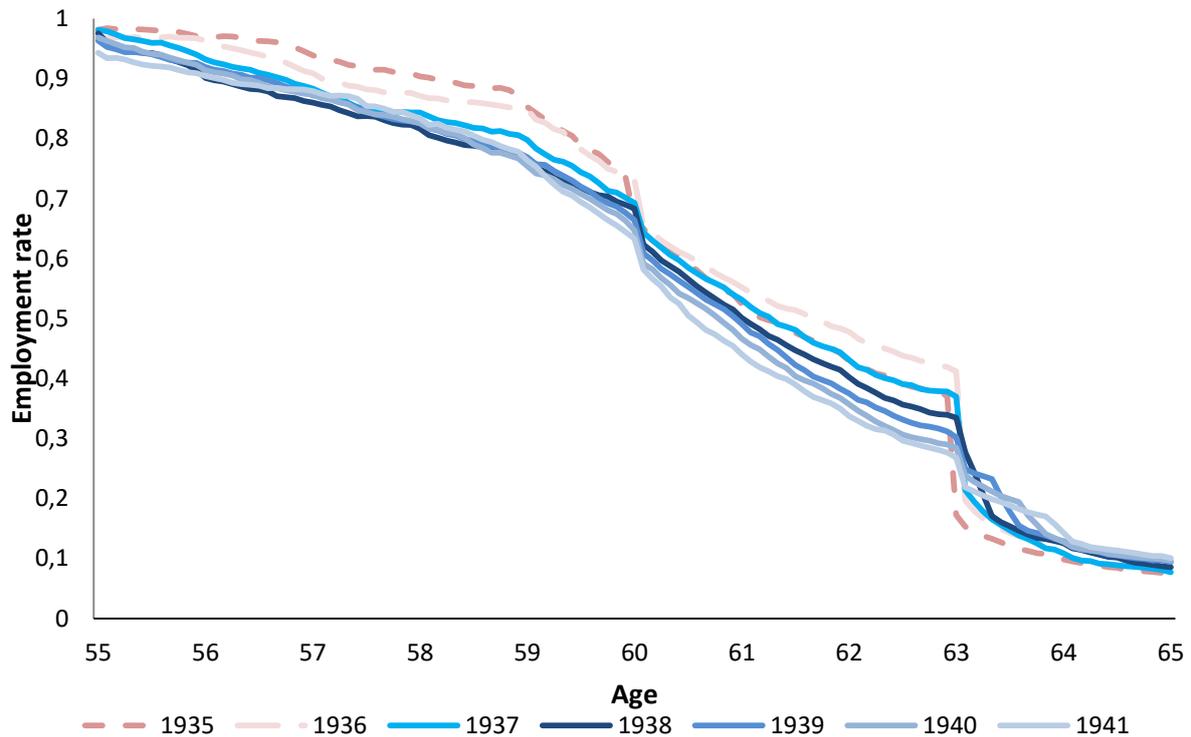

Fig. A1. Employment rate (with working phase of partial retirement) by age (monthly data) and cohort. Source: SIAB 7514, own calculations.

	Mean	SD
Characteristics of the last employer before labor market exit		
Number of employees in total	1,341.76	4,683.27
Imputed gross daily earnings of full-time employees (EUR)	98.08	37.21
Employee age (years)	41.89	4.75
Age full-time employees (years)	42.29	4.6
Share women	0.28	0.22
Share full-time	0.83	0.17
Share part-time	0.08	0.13
Share regular	0.91	0.11
Share apprentices	0.04	0.06
Share women full-time	0.18	0.15
Share women part-time	0.07	0.11
Share regular full-time	0.83	0.18
Share low-skilled	0.15	0.13
Share medium-skilled	0.73	0.17
Share high-skilled	0.12	0.16
Share low-skilled full-time	0.09	0.11
Share medium-skilled full-time	0.63	0.20
Share high-skilled full-time	0.10	0.14
Share 55–59 years old	0.12	0.10

Share 60–64 years old	0.06	0.1
Regional unemployment rate	10.57	4.2
Individual characteristics		
Job exposure index: Overall Job Index	6.04	2.99
Job exposure index: Overall Physical Exposure Index	6.22	3.03
Job exposure index: Overall Psycho-social Exposure Index	5.35	2.84
Job exposure index: Carcinogenic Agent Index	6.44	2.87
Job exposure index: Heavy Work Index	5.68	2.87
Pension wealth at age 55	235,801.9	59,321.2

Tab. A1. Descriptive statistics for the variables used in the multivariate regression in Table 5. Number of observations: 1,517,802. SD: standard deviation. Source: SIAB 7514, own calculations.

	Employment including partial retirement			
	I	II	III	IV
Penalty (%)	-0.005**		-0.007**	
	(0.0005)		(0.0005)	
No penalty		Base		Base
0.3–3.6		-0.007**		-0.011**
		(0.003)		(0.003)
3.9–7.2		-0.031**		-0.040**
		(0.004)		(0.004)
7.5–10.8		-0.051**		-0.067**
		(0.005)		(0.005)
11.1–14.4		-0.062**		-0.087**
		(0.007)		(0.007)
14.7–18.0		-0.058**		-0.091**
		(0.009)		(0.009)
Observations	1,517.802	1,517.802	1,517.802	1,517.802
X variables	Yes	Yes	Yes	Yes
Y variables	No	No	Yes	Yes
Pre-reform mean	0.356			
R^2	0.199	0.199	0.291	0.291

Tab. A2. Regression results: direct effects on employment rate with partial retirement (both phases). Notes: In all specifications, we control for pension wealth at age 55, monthly cohort and age fixed effects, for changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance, and for job exposure and education. In columns III and IV, we additionally control for the regional unemployment rates and employer characteristics. Standard errors are clustered on the individual level. Significance levels: *$p < 0.05$, **$p < 0.01$. The pre-reform mean is calculated for pre-reform cohorts 1935 and 1936. Source: SIAB 7514, own calculations.

Appendix B: Assessment of the financial disadvantages induced by the 1992 pension reform costs by pension form

This appendix assesses the changes in the financial disadvantages associated with the bridge options compared with the pension for the long-term insured given actual retirement behavior during the implementation phase of the 1992 pension reform.

First, we calculate average pension deductions for all three pension forms. Table B1 shows that employees using the pension for the long-term insured had relatively low pension deductions. Their average pension deductions reached a peak of 2.2% for cohort 1939, and then decreased again.[33] Pension deductions reached a much higher level for those men using partial retirement (9.5%) and the pension after unemployment (8.5%) for birth cohort 1941. To get a rough estimation of the average financial costs of the pension reform for the retirees, we multiply the individual pension deductions with individual monthly pension eligibilities times the expected length of the retirement spell given the life expectancy of retirees in a birth cohort (Statistisches Bundesamt, 2019). For the bridge options, we also consider financial disadvantages in earnings and pension eligibilities accumulated during the bridge phase. We calculate the financial disadvantage of the pension after unemployment by assuming that during the unemployment spell, transfers were 60% and collected pension entitlements were 80% of that of regular earnings (Engels et al., 2017). We calculate the costs for partial retirement by assuming that earnings during partial retirement were 75% and collected pension entitlements were 90% of regular earnings (Klammer and Weber, 2001; Berg et al., 2019).

Table B2 shows that the financial costs of the pension reform for those who used the pension for the long-term insured remained relatively low with a maximum of 15,000 EUR or 5 months earnings. Financial costs of those using the pension after unemployment increased from more than 15,000 EUR in cohort 1937 to 39,500 EUR in cohort 1941. The costs of partial retirement even amounted to 43,000 EUR in cohort 1941. If we compare the pension for the long-term insured with the pension after unemployment, the difference in financial costs increases from about 2 monthly earnings before the reform to 10 monthly earnings for cohort 1941. Financial costs for partial retirement amount to up to 8 months earnings compared with the pension for the long-term insured. Bridge options allow older men to retire substantially earlier than the pension for the long-term insured. If we take the difference in employment exit between pension for the long-term insured and the

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[33] Although not all employees directly enter a pension after exiting employment (Hanel, 2010), our calculations of the realized pension deductions are similar to those published by the German pension insurance. Average pension deductions increased from 0.02% in 1997 to 0.05% in 1998, 0.08% in 1999 and 2000, and 0.10% in 2001 (Deutsche Rentenversicherung Bund, 2018). Consistent with our results, Bönke et al. (2018) also found that pension deductions for employees using the pension for the long-term insured increased from cohort 1937 to cohort 1939, and then decreased again.

pension after unemployment before the reform (cohort 1936) as reference, the leisure advantage when retiring early after unemployment hardly increased and it was always lower for those in partial retirement than in pension after unemployment. Therefore the necessary compensation to push employees into bridge options was higher during the implementation phase than before the reform.

Cohort	Average	Pension for the unemployed	Partial retirement	Long-term insured
1935	0.00	0.00	0.00	0.00
1936	0.00	0.00	0.00	0.00
1937	0.25	0.72	0.00	0.53
1938	1.03	2.40	0.17	1.91
1939	1.68	3.66	1.45	2.16
1940	3.25	5.86	4.76	2.00
1941	5.33	8.44	9.46	1.89
Total	1.93	3.73	5.46	1.18
N	3,010,722	9,198	2,494	13,190

Tab. B1. Realized pension deductions by cohort by percent. Notes: Values in the columns correspond to the mean. Source: SIAB 7514, own calculations.

Cohort	Total costs of pension after unemployment	Unemployment costs	Unemployment penalty costs	Total costs of partial retirement	Partial retirement costs	Partial retirement penalty costs	Total costs of pension for long-term insured
1935	12,606 (4.27)	12,606					
1936	12,534 (4.16)	12,534					
1937	15,415 (4.50)	10,894	4,521	19,439 (6.15)	19,439	0	4,817 (1.79)
1938	22,217 (6.08)	10,885	11,332	19,158 (5.99)	18,681	477	12,462 (5.05)
1939	27,943(8.43)	12,205	15,738	23,476 (7.22)	19,512	3,964	15,297 (5.33)
1940	33,856 (10.88)	13,140	20,716	31,289(9.63)	18,200	13,089	14,111 (5.05)
1941	39,505 (14.94)	14,624	24,881	42,777 (13.29)	16,183	26,594	14,859 (5.00)

Tab. B2. Calculation of pension penalty and bridge costs. In brackets: costs expressed in earnings in months in EUR. Source: SIAB 7514, own calculations.

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