Employers appreciate influence on terminating employment of older workers

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Abstract

This paper shows that the introduction of pension deductions for retirement between early and normal retirement age in Germany did not lead to a prolongation of employment of older men after early retirement age. We argue that the reason for this surprising result is that employers induced their employees to use the bridge options unemployment or partial retirement instead of the early retirement option for long-term insured. The main differences between these options is that in the bridge options employment exit is possible already before early retirement age and that employees are not autonomous in deciding when to retire. Old men using the pension for long-term insured increased employment after early retirement according to the Option Value Model. Old men in the bridge options however decreased employment with increasing pension deductions. Mainly employers with high employment adaption costs induced employees to use a bridge option because substantial compensation costs were necessary to do so.

1   Introduction

In response to the rising life expectancy, low fertility rates and a shrinking labor force, most OECD countries revised their retirement policies and introduced a series of pension reforms since the 1990s (OECD, 2007, 2015). They for example increased the statutory retirement age, early retirement age, tightened eligibility rules for early pension claims or introduced actuarial deductions on pension entitlements for employees who retired early. 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).[2] Most of these legislative efforts had in common that they 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 explicitly or implicitly assumed that employees could autonomously react to the labor supply incentives set by these reforms and that labor demand would react infinitely elastic (Dorn and Susa-Poza, 2010; Rabaté, 2017). The aim of this paper is to show that the employment effects of a pension reform in Germany cannot be explained by labor supply reactions. We argue instead that some employers thwarted the success of the pension reform by inducing employees to use pension forms that gave employers an influence on the employment exit decision and an option to leave the labor market even before early retirement.

The so-called 1992 pension[3] reform in Germany is one of the earliest attempts to increase employment of older employees (Schmähl, 2003; Geyer and Steiner, 2014; Deutsche Rentenversicherung Bund, 2015; Bönke et al., 2018). It exclusively addressed labor supply by introducing the following changes: Normal retirement age[4] was increased in monthly steps for almost all pension forms that granted access to early retirement. For older male employees, the pension forms affected by the reform were the pension for the long-term insured and early retirement after unemployment (pension for the unemployed). The reform also introduced actuarial deductions in pension entitlements for the difference between early retirement age and NRA. Early

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[2] Examples of pension reforms and their implementation years are: increase in statutory retirement age (Denmark in 2015, Germany in 2012, Italy in 2003, the UK in 2018 or the US in 2003), increase early retirement age (Belgium in 2013, Germany in 2012, Japan in 2001 or Sweden in 1998), tighten eligibility rules for early pension claiming (Belgium in 2013, France in 2014 or 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 on pension entitlements for employees who retired early (Germany in 1997 and Austria in 1996 and 2000).

[3] The reform is formally called *Rentenreformgesetz 1992* (BGB I 2261) from 28.12.1989. Several changes to this reform law have been 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 actually were implemented.

[4] The normal retirement age (NRA) is the age at which people can first draw full benefits without actuarial deductions. The OECD also calls this "pensionable age" (OECD, 2011: 20). In Germany, the NRA is lower than the statutory retirement age for several pension forms.

retirement age[5] was however unchanged for the early retirement options. Finally, the reform introduced an additional bridge option "partial retirement" that allowed employees early retirement comparable to the existing bridge option 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 ERA actually decreased with increasing deductions. The two main reasons for this surprising finding are a strong shift of employees from the pension for the long-term insured into the bridge options and a strong decrease in employment after ERA in the bridge option partial retirement although deductions for early retirement increased. The employment increase for employees who chose the pension for the long-term insured could not compensate these developments. This surprising finding is not compatible with individual utility maximizing behavior and predictions of ex-ante evaluations of the expected effects of the 1992 pension reform (Berkel and Börsch-Supan, 2004; Hanel, 2010). The pattern however is compatible with the interpretation that employers pushed their employees into bridge options in order to avoid longer employment after ERA induced by the reform. Employers correctly anticipated that employees who use the pension for long-term insured postpone employment exit with early retirement deductions because they can freely determine their employment exit age. The implementation phase of the pension reform however took place during a strong recession and employers had no interest in a prolongation of the employment of their older employees. The bridge options had the advantages that they offered an ERA of 60 instead of 63 valid for the pension of the long-term insured, that employers had an influence on the employment exit decision in these retirement options and that an employment exit even before ERA was possible. We show that compensation payments necessary to induce a shift from the pension for long-term insured into the bridge options were substantial and that mainly firms with high employment adaptation costs are responsible for the large influx into the bridge options, accordingly. To the best of our knowledge this is the first paper that shows that employers can completely thwart the goal of a pension reform to extend employment.

We use representative administrative social security data from the Institute for Employment Research (SIAB 7514) that cover labor market history and employer information for more than 24.000 men who were eligible for all three early retirement forms 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 birth cohorts affected by the reform (1937-1941) for the entire implementation period of the reform (1997-2006). All employees in a certain cohort are affected equally by the reform and therefore we cannot construct an intra-cohort comparison group (Bönke

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[5] The early retirement age (ERA) is the age at which people can leave the labor market the earliest given that they are eligible for one of the early retirement pension forms (60 or 63 years for our sample).

et al., 2018). For the identification of the pension reform effects, our diff-in-diff approach exploits the cohort-specific variation of the size of actuarial deductions given an early retirement age. Besides the impact 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. In these calculations the influence of institutional changes such as the introduction of partial retirement as additional early retirement option is included.

This paper provides several contributions to the literature. It presents for the first time an integral ex-post analysis of the effects of the 1992 pension reform on employment, unemployment, and partial retirement. We show that the positive employment effects predicted by individual utility maximization theory and by ex-ante studies of the reform have not been met by reality. Second, it presents average treatment effects on the treated because it uses a diff-in-diff estimation design on a sample of men eligible for the early retirement options.[6] Third, it includes a broad range of labor demand characteristics and explains how the labor market outcomes of older employees are influenced by employer behavior. Fourth, it discusses policy implications of the insight that employers with large employment adaptation costs have been able to thwart the intended positive employment effects of a pension reform.

The paper is organized as follows. In the next section, we describe the institutional background of the pension system in Germany and the 1992 pension reform. We also derive the theoretical predictions on the impact of the reform on the labor market situation of older men and discuss the relevant empirical literature. In Section 3, we introduce our data set and provide descriptive statistics of the labor market of old men. Section 4 explains our estimation approach and presents the estimation results. Section 5 discusses the results and section 6 provides some political implications. The last section concludes.

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 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).[7] The German statutory pension insurance provides the standard old age pension at age 65 for all cohorts we consider. To allow a "flexible retirement entry", there were mainly two early retirement options for men before the 1992 pension reform: the

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[6] Most previous papers on the 1992 pension reform also included individuals who could not react to the pension reform because they were not eligible for the early retirement options affected by the reform. These papers therefore obtain a lower bound of the pension reform effect (Hanel, 2010).

[7] Mainly civil servants and in some cases self-employed workers are not covered.

pension after unemployment (*Altersrente wegen Arbeitslosigkeit*, Social Code VI §237) and the pension for long-term insured (*Altersrente für langjährig Versicherte*, Social Code VI §236). In order to be eligible for the pension after unemployment, an employee needed at least 15 qualifying periods[8] and at least 8 years of compulsory contributions periods in the last 10 years before retirement.[9] In addition, the unemployment period had to be at least 52 weeks in the 1.5 years before retiring.[10] The pension after unemployment allowed entry into early retirement at age 60. As a consequence, older employees could exit employment as soon as with 57 years and four months because unemployment benefits were paid for a maximum period of 32 months. The early retirement age for the long-term insured was at age 63. In order to be eligible for the old age pension for the long-term insured, employees needed at least 35 years of 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%. The share of older men who used the early retirement option for the long-term insured however declined 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 the employment exit age and burdened the public unemployment insurance by 7.5€ billion in 1995 alone (Albrecht and Müller, 1996).

The main aims of the 1992 pension reform therefore were to reduce the unsustainably high early retirement costs, the share of employees in unemployment before early retirement, and to extend employment beyond ERA for those eligible for early retirement. The strongly increased financial pressure on the unemployment insurance let politicians in 1996 to implement the reform already in 1997 instead of in 2001 as previously planned. The immediately affected birth cohort 1937 therefore was caught 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 respective pension form chosen. The NRA and the ERA were identical before the reform and the NRA increased

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[8] A qualifying period is roughly spoken a period in which an employee is active in the labor market, for example employment, unemployment or family breaks, for further details, see Lorenz et al. (2018).
[9] Since we cannot observe the retirement entry, we consider the labor market exit date to calculate the eligibility conditions.
[10] Since January 1st, 2000, people must have been unemployed for at least 52 weeks in total after reaching the age of 58 years and 6 months in order to be eligible for the pension for the unemployed. This change, however, had no practical consequences for financial incentives and eligibility rules for the old age pension for the unemployed.

for both early retirement options by one month each month starting in January 1996 until the statutory retirement age of 65 years was reached, i.e. 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 therefore was five years (60-65 years) after the full implementation of the reform and retiring at ERA induced maximum deductions of 18%. The difference between NRA and ERA for those who used the old age pension for long-term insured was two 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 respective year as shown in the official statistics. Accordingly, the pension benefits in year *t* can be calculated as follows before the 1992 pension reform:

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

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.

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

The deduction factor *D* depends on the month of birth *c* and the age of benefit claiming. For example, if an individual born in December 1937 retires after unemployment at the age 60 in December 1997, *D* equals 0.036. For an individual born one year later in December 1938, the deductions at retirement age 60 equal 7.2%.

Introduction of partial retirement option

Besides the increase in NRA and the introduction of pension deductions for early retirement, the pension reform 1992 extended the eligibility rules for the old age pension after unemployed to those employees whose employers offered them partial retirement according to the law on partial retirement *("Altersteilzeitgesetz")*, a so-called "progressive retirement plan"*.* The new partial retirement act was implemented on August 1st, 1996. It complemented similar rules already in place in collective bargaining agreements in selected sectors such as the insurance, chemical and tobacco industry as well as the banking sector (Schmähl, 2003). The existing partial retirement options and other early retirement options such as the Pre-Retirement Act or the Part-time Work in Old Age Act

had hardly been used before 1996 and therefore these earlier options had no measurable impact on employment or retirement behavior.

The introduction of the new partial retirement option was intended to extend employment of old employees (Oswald, 1999; Berg et al., 2019; Eurofound, 2016). Arguments for an employment extension were that a working time reduction could be an alternative for an early dropout from the labor market for workers who were not able to work full time any more (Wadensjö, 2006) or a reduction in tensions between work and caregiving (Berg et al., 2019). The crucial innovation of the new rules with respect to previous partial retirement rules however was its integration in the pension for the unemployment law, Schmähl (2003). The idea behind this integration was 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. As a consequence, in fact the law on partial retirement introduced a new early retirement option with the same eligibility rules, NRA, and ERA as the old age pension for the unemployed.[11] The attractiveness of the additional early retirement venue was further increased by offering the so-called block-model. The block-model was characterized by two periods of equal length: in the first half, the employee works full-time and in the second half, the employee is completely released from work *("Freistellungsphase")* (Kirchner and Mittelhamm, 2010; Bundesagentur für Arbeit, 2015; Huber et al., 2016). For a standard five-year partial retirement program, the employee therefore could exit employment at age 57.5 and retire at ERA.[12] 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 (Brussig et al., 2009).

In the first years, partial retirement only could be offered if the employer was subject to a collective bargaining agreement that included this option.[13] The employer was in addition bound by law to increase the current salary by at least 20% during partial retirement and wage earnings in excess of 50% of prior earnings were exempt from income taxes. Employers also had to pay additional pension contributions, at least 70% of the pre-partial retirement earnings. As a consequence, on average earnings during partial employment were about 73% of the previous gross salary (Klammer and

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[11] 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 had performed at least 24 months of employment under a progressive retirement plan after reaching the age of 55.

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

[13] Berg et al. (2019) show that besides the chemical industry, in the year 1997 only the metal, insurance, and the energy sector covering 5.5 million workers introduced partial retirement. In later years, more sectors followed. In 1999 already about 350 collective agreements relevant for 13 million workers covered partial retirement.

Weber, 2001) and pension entitlements accrued at a minimum of 90% of the rate obtained under full-time work (Berg et al., 2019).

Incentive effects of the 1992 pension reform on labor supply

We assume in accordance with most of the retirement literature that older men take the decision regarding the optimal date of employment exit according to the Option Value Model of Stock and Wise (1990). In this model, 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 four effects: (1) it lowers utility because wage earnings during the period between *s* and *t* are lost, (2) it increases utility because leisure is preferred to working during *s* and *t*, (3) it increases utility because pension benefits are paid between *s* and *t*, and (4) it reduces 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 is 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 pension forms. All other determinants of retirement entry remained unchanged.

The Option Value Model therefore predicts that older men eligible for early retirement extended employment or partial retirement between ERA and NRA.[14] The exit age from employment and partial retirement in addition should increase with birth cohorts because younger cohorts face larger differences between ERA and NRA. The Option Value Model also predicts that entry age into unemployment should increase because otherwise the later exit from the labor market is associated with an extension of unemployment (Engels et al., 2017; Riphahn and Schrader, 2019).

After having discussed the utility optimal reaction to the pension reform given one of the retirement options is chosen, we have to discuss whether the individual incentives to choose one or another pension options changed. The relative attractiveness of the bridge options in comparison to the pension for 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. The Option Value Model therefore does not predict a substitution effect induced by the reform for these cohorts. For the 1939 to 1941 birth cohorts, the relative attractiveness of the old age pension for persons with a long insurance record increased, however. The difference between

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[14] Exit from partial retirement can be extended either by shifting the partial retirement spell at a given spell duration and thereby a later exit from employment or by extending partial retirement spell at a given exit from employment. It is a-priori unclear, which version an older employee prefers because he has to weigh the utility costs of shorter leisure against financial costs of longer financial reductions during partial retirement.

the NRA of bridge options in comparison to the NRA for the pension for persons with a long insurance record decreased from three years for those born before 1939 to zero for those born in December 1941. For a given retirement age between ERA and NRA the additional pension penalty associated with the pension for persons with long insurance record in comparison to the bridge options accordingly decreased from 10.8% to zero. The Option Value Theory therefore predicts that for cohorts 1939-1941 the shares of employees who chose the pension for long-term insured increased.

Previous Empirical Analyses on the Effects of the 1992 Pension Reform

Berkel and Börsch-Supan (2004) and Hanel (2010) use Option Value Models to evaluate the effects of the 1992 pension reform ex ante. Hanel (2010) estimates transition rates out of employment after ERA. She only includes observations until the end of 2002 and therefore the youngest cohort included in the study (born in 1942) did not reach ERA at the end of the observation period. Hanel (2010) predicts a small positive employment effect of the pension reform. Berkel and Börsch-Supan (2004) simulate the effect of actuarially fair pension deductions according to the 1992 pension reform on the retirement decision. They use actual retirement behaviour of employees in a period before the reform (1984-1997). They predict an increase in retirement age for men by almost two years.

Bönke et al. (2018) analyse 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 is based on the Insurance Account Sample (*Versicherungskontenstichprobe*, VSKT) with a sample size between 44 and 122 men per birth cohort between 1935 and 1945. Bönke et al. (2018) find an average delay in retirement age by 5.2 months as a reaction to the reform. The delay in retirement increases from cohort 1937 until 1940 and then remains stable.

Riphahn and Schrader (2019) analyse the effects of the 1992 pension reform on West-German men for birth cohorts 1937-1939. They concentrate on men eligible for the pension for the unemployed. In their Intention to Treat regressions, they do not find significant employment effects but a significant increase in unemployment duration after ERA. They only include labor market effects between age 60 and 62 and cannot distinguish between partial retirement and regular employment spells.

Geyer and Welteke (2017), Engels et al., (2017) and Geyer et al., (2019) analyse the effect of the pension reform on employment, unemployment and partial retirement on female employees. Their estimation of a 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. They find a substantial

increase in employment by about two months for each year of NRA increase. Engels et al. (2017) find a shift in rather than an extension of the unemployment spell.

3   Data

We use a large and high quality administrative individual labor market history dataset provided by the Federal Employment Agency in Germany (*Bundesagentur für Arbeit*). The dataset consists of a two percent sample of the population with social security contributions from 1975 to 2014 (Sample of Integrated Labor Market Biographies SIAB7514)[15]. The data set contains daily information about employment, receipt of benefits according to German Social Books II and III, job seeking, and active labor market measures or training. An advantage of the SIAB is that spells in partial retirement are identifiable. In the data, we can unfortunately not distinguish between the two partial retirement models. Based on the fact that more than 80% of the employees chose the block model (Koller, 2001; Brussig et al., 2009), we assume that all employees 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.[16]

In our multivariate analyses we can include the main labor supply drivers for the labor market behavior of old employees, social security wealth, option value, education, and job exposure matrices (JEM) proposed by Kroll (2011) to measure overall, physical and psycho-social job demands[17]. Moreover, we add a rich set of labor demand drivers of the labor market of old employees (Geyer et al., 2019).[18] We match the monthly regional unemployment rates from the Federal Employment Agency to the place of work and calculate the average annual regional unemployment rates between 1991 and 2014 for each region as an additional indicator for labor demand.

Our data do not contain information on pension insurance, such as pension entitlements, eligibility or actual pension choice.[19] We therefore 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

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

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

[17] We match JEM to individuals by using the classification of occupations (KldB-10).

[18] The labor demand information comes from the IAB Establishment History Panel (BHP).

[19] We can 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 to merge this information as part of the Custom Shaped Administrative Data for the Analysis of Labor Market (CADAL) project.

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, we assume that employees chose the pension for the long-term insured. We only 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. In order to obtain average treatment of the treated effects (ATT), we further restrict our sample to the approximately 83% of men who fulfill the eligibility requirements for the pension after unemployment and the pension after partial retirement.[20] In addition, we restrict our sample to men with a high labor market attachment in the years before they get eligible for an early pension. The reason is that 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 have no chance to return into employment (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.[21] Moreover, we do not consider men with missing information on the establishment-specific characteristics at the last employment.[22] 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 we cannot identify in our data set.[23]

We cannot directly test in our data whether all employees included are eligible for the pension for the long-term insured. We know however from an analysis on the basis of the BASiD data set that for our sample restrictions about 93% of the men eligible for the bridge options also were eligible for the pension for the long-term insured (Lorenz et al., 2018). It therefore seems safe to 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

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

[21] In our sample, 13% of older employees are deleted in the first step and 24% are deleted in the second step.

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

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

that all employees were eligible for all three early retirement forms. 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 following pension forms did not face pension deductions on early retirement: the old age pension for severely disabled persons and the pension for those with reduced earnings capacity (Riphahn and Schrader, 2019). In order to make sure that there is no program substitution, there ideally should be no employees eligible for these early retirement options in our data set. The pension for those with reduced earnings capacity allowed employees to immediately retire 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 cohorts we focus at (Deutsche Rentenversicherung Bund, 2018). In other words, almost all men entering the pension for those with reduced earnings capacity left the labor market before age 59 and they are therefore not included in our sample (Lorenz et al., 2018). In addition, reduced earnings capacity had to be assessed in a medical exam and it therefore was hard to obtain without a cause. We cannot exclude that there are some employees who are eligible for the old age pension for severely disabled persons in our data set.[24] We should keep in mind however 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 persons are rejected (Engels et al., 2017). We therefore can assume that there is no program substitution into other (unobservable) early retirement schemes as a reaction to the pension reform 1992 in our sample. We however might attribute pension deductions to severely disabled persons who retire before their NRA although they can leave at 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) of the pre-reform cohorts (red lines) is always higher until age 63 compared to the treated cohorts (blue lines). Although pension deductions for exiting employment before NRA increase with the cohorts after 1937, the employment rates between ERA and 63 decrease with each cohort. The reduction in regular employment is not compensated by a shift of employment into partial retirement, compare, Fig. A.1 – employment shares including the active phase of partial retirement also decrease with cohorts between age 60 and 63. After age 63, the employment rate of

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[24] The share of employees who used the pension for the severely disabled was just 8% in the cohorts we focus on. We show that the share of severely disabled is even smaller in a sample with high labour market attachment at old age (Lorenz et al., 2018).

the cohorts affected by the pension reform however exceeds the pre-reform rates. The employment increase is positively related with the pension deductions (compare Figures 1 and A.1).
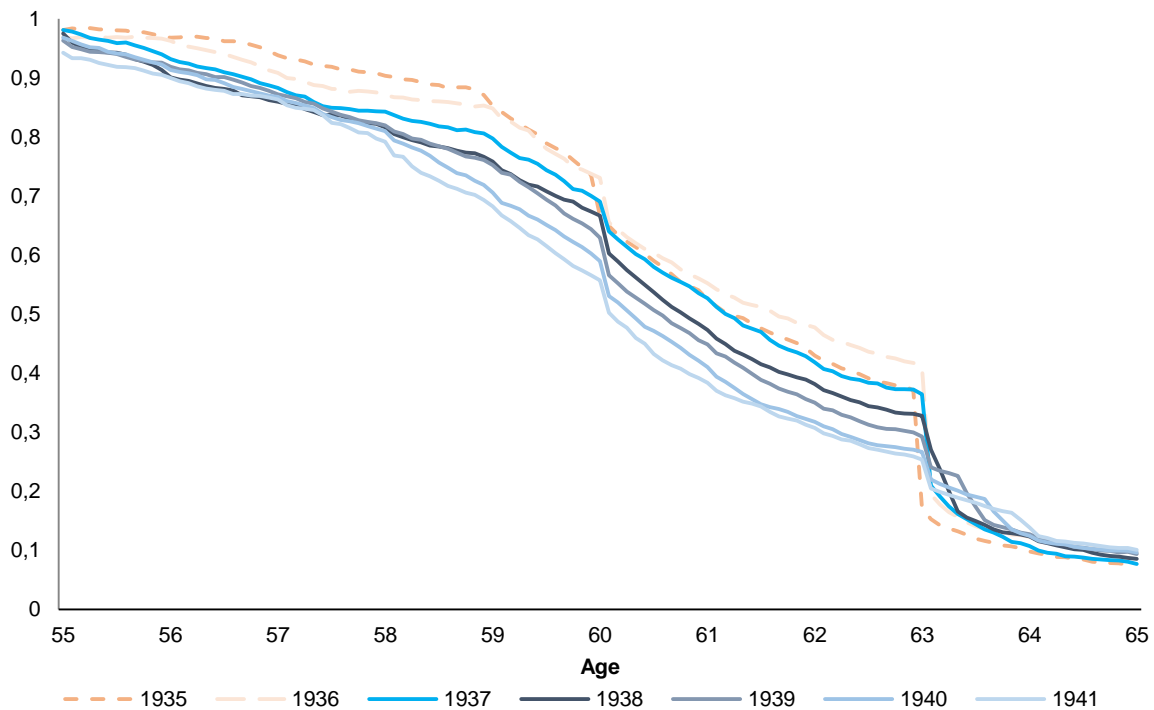
Fig. 1. Employment rate (without working phase of partial retirement) by age (monthly data) and cohort. Source: SIAB7514, own calculations.

For all cohorts affected by the pension reform, unemployment rates are 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 lead to strong 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 on all unemployed increased from 14% to 21% in the same period. After 1997, the unemployment share decreased somewhat to 8.5% in 2001. The share of unemployed aged 55-65 reached its peak in 1999 with 23% and then decreased (Bundesagentur für Arbeit, 2019). The unemployment pattern of men in our sample before age 60 therefore closely follows the general business cycle with a peak of older unemployed for birth cohort 1938. After age 60, unemployment is higher between ERA and NRA for almost each cohort affected by the pension reform and unemployment after ERA increases with pension deductions.
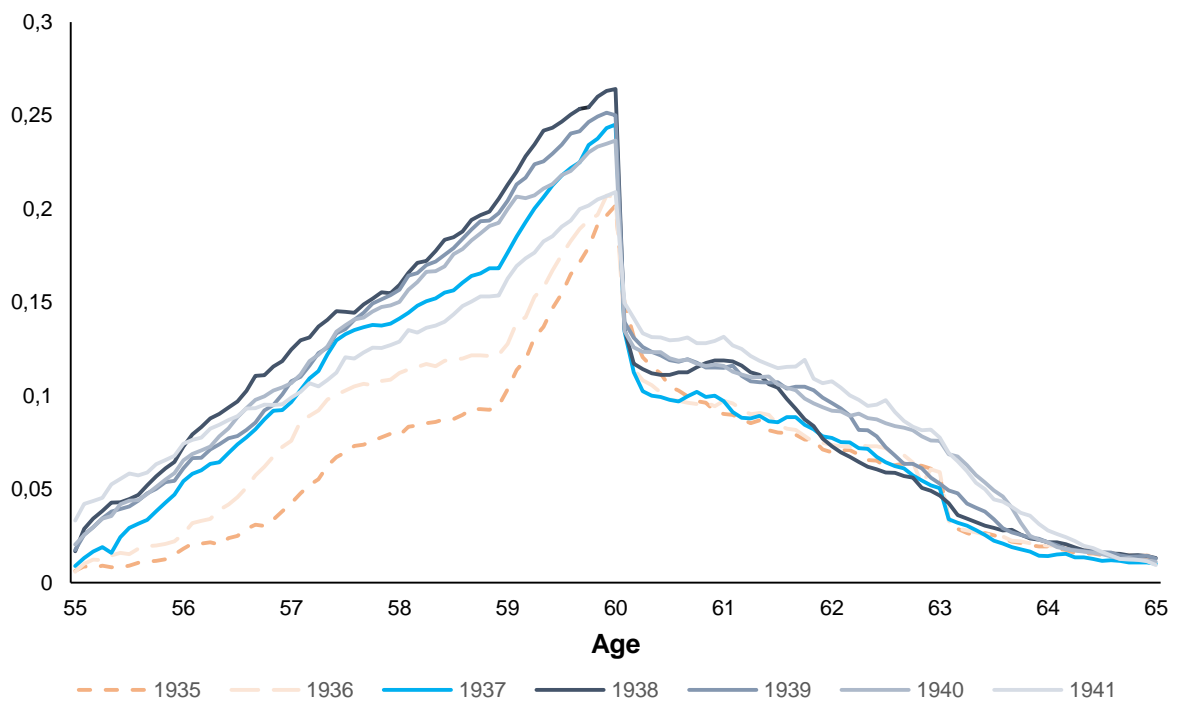
Fig. 2. Unemployment rates by age (monthly data) and cohort. Source: SIAB7514, own calculations.

The incidence of partial retirement in cohorts 1935 to 1937 was almost zero (Figure 3). Partial retirement however strongly increased after the introduction of the new partial retirement rules with the number of firms and collective agreements offering it. 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 with age 60. We therefore do not see the expected positive correlation between pension deductions and partial retirement exit.
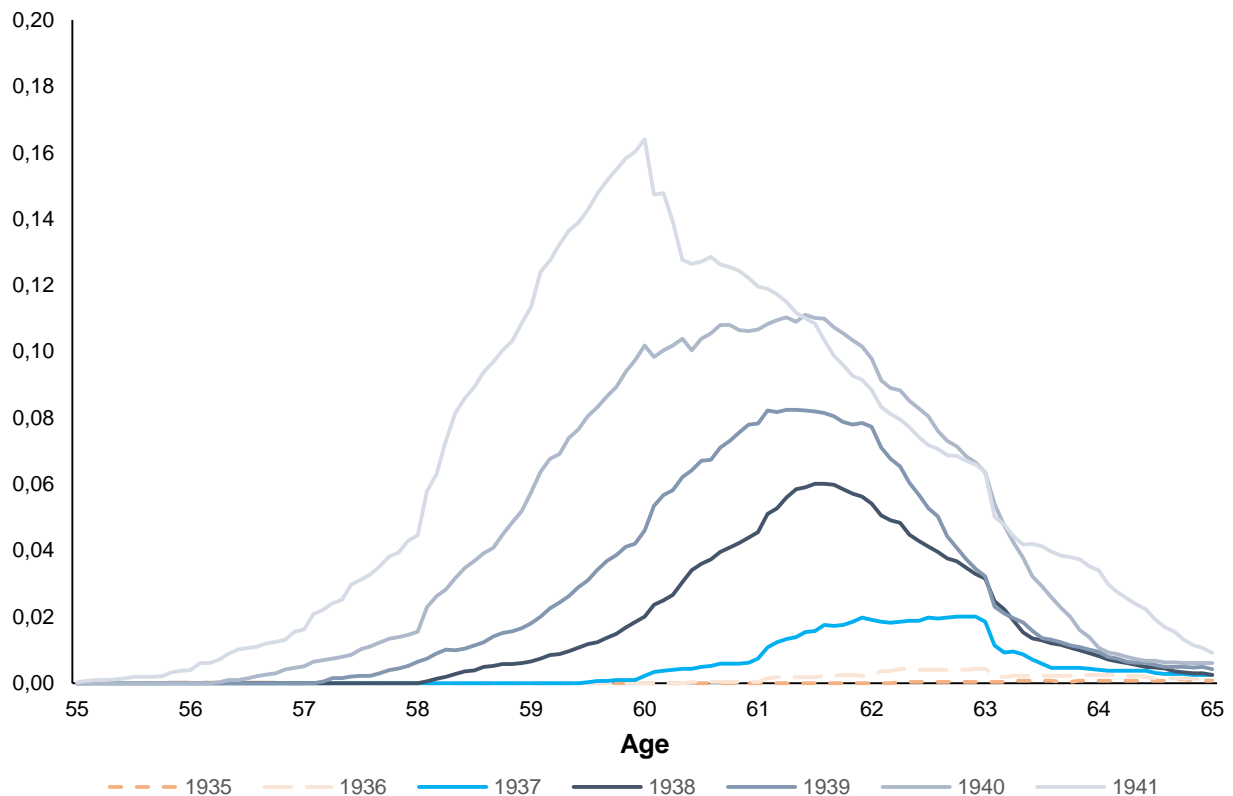
Fig. 3. Partial retirement rates by age (monthly data) and cohort. Source: SIAB7514, own calculations.

In the next step, we look more closely at aggregate statistics of labor market indicators by birth cohort in order to get a clearer picture of the changes in labor market outcomes before and during the implementation phase of the pension reform. 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 makes clear that labor market exit age that also includes release periods during partial retirement and unemployment only slightly increased with pension deductions for cohorts 1937 to 1941. The increase in labor market exit age mainly is driven by older men staying longer in unemployment (unemployment exit age increased by more than three quarters of a year or nine months) and an increase in employment after ERA by men who use the pension for the long-term insured (employment exit age increased by half a year or six months) (see Table 1, columns 2 and 4). The positive correlations between pension deductions and labor market attachment for the unemployed and those in the pension for the long-term insured are however compensated by the reduction in average labor market exit age of those in partial retirement by 15 months (Table 1, column 3). The strong decrease in labor market exit age for those in partial retirement also drives the slight reduction in average employment exit age including the active phase in partial retirement (Table 1, column 5).

We cannot distinguish between changes in labor market behavior given an employee chose a route to retirement and a substitution between pension forms from our descriptive analysis so far. Table 2 therefore shows changes in the incidence of pension forms. The share of older men using partial retirement as a bridge dramatically increased from almost zero before the reform to more than 23% in cohort 1941. The increase in the share of employees in partial retirement did however not reduce the share of employees in the pension after unemployment - their share instead also increased from 27% before the reform to 40% for the first cohorts affected by the pension reform. The share of older men who used the pension for unemployment only decreased slightly for cohort 1941. The share of older men using the pension for the long-term insured[25] almost halved from 72% in cohort 1935 to less than 40% in cohort 1941, accordingly (Table 2, column 1).[26]

Cohorts	Average labor market exit age	Average labor market exit age for the 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 long-term insured and observe a labor market exit age below 63. Employment exit includes active phase of partial retirement. Source: SIAB7514, own calculations.

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[25] The share of those retiring regularly at or later than the statutory pension age in our sample is around 10%. We also include these employees in our share of older men retiring via the pension for the long-term insured because pension eligibilities are identical for both pension forms for them.
[26] The changes in pension shares in our sample are also found for all 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 a pension for unemployed/partial retirement gradually increased from around 25% to almost 31% between cohort 1937 and cohort 1941. The share of older men in regular old age pension increased from less than 19% in cohort 1937 to 24% in cohort 1941 (Deutsche Rentenversicherung Bund, 2018).

Cohorts	Share of men with old age pension for the long-term insured	Share of men with old age pension after unemployment	Share of men with old age pension after partial retirement
	I	II	III
1935	72.66	27.34	/[27]
1936	70.03	29.97	/
1937	64.04	34.17	1.79
1938	50.09	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 venues. Source: SIAB7514, own calculations.

Finally, we look at important labor market indicators given an older employee chose the pension the pension after partial retirement or the pension after unemployment. Partial retirement duration increased by seven and a half months (Table 3 column 1). This increase however is not a consequence of longer partial retirement after ERA (column 2) but of a longer spell in partial retirement in the age bracket 55-60 from zero to more than 13 months (column 3). The share of those employees who entered partial retirement after age 63 was negligible for all cohorts besides in birth cohort 1937 (column 4). Average employment exit age from partial retirement decreased by 18 months during the implementation period (column 5). As average partial retirement duration increased, employment exit could be reduced even stronger than the labor market exit age (Table 1, column 3) with employees entering partial retirement at an increasingly younger age.

Cohorts	Partial retirement duration	Partial retirement duration after age 60	Partial retirement duration between age 55-60	Share entry in partial retirement after age 63	Average employment exit age for those in partial retirement
	I	II	III	IV	V
1937	25.03	24.79	0.24	6.90	62.25
1938	25.74	23.42	2.33	1.53	61.71
1939	28.59	23.97	4.62	1.17	61.45
1940	30.12	21.98	8.15	0.92	61.22
1941	32.66	19.20	13.46	0.41	60.71
Total	30.29	21.44	8.85	0.96	61.13
N	2494	2494	2494	2494	2494

Tab. 3. Descriptive statistics for those in partial retirement. Durations measured in months, age in years. Source: SIAB7514, own calculations.

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[27]The symbol " / " means that for data protection reasons, all values based on less than 20 observations are deleted (FDZ, 2017).

Cohorts	Unemployment duration	Unemployment duration after 60	Unemployment duration between 55-60	Share entry in unemployment after 63	Average employment exit age for those with unemployment
	I	II	III	IV	V
1935	24.18	10.67	13.51	/	59.42
1936	27.01	10.37	16.64	/	59.19
1937	28.38	9.30	19.08	/	59.03
1938	29.13	9.54	19.60	1.70	59.08
1939	28.90	10.54	18.35	1.38	59.22
1940	29.35	11.20	18.15	1.47	59.27
1941	30.93	13.23	17.71	1.96	59.36
Total	28.77	10.81	17.96	1.44	59.22
N	9198	9198	9198	9198	9198

Tab. 4. Descriptive statistics for those in pension after unemployment. Durations measured in months, age in years. Source: SIAB7514, own calculations.

Total unemployment duration for those choosing the pension after unemployment only slightly increased with pension deductions (Table 4, column 1). The strong increase in unemployment duration after ERA (almost four months, column 2) was partly compensated by a decrease of the unemployment duration before age 60 by less than two months (column 3). Employers therefore dismisses their employees later – average employment exit age slightly increased by four months from cohort 1937 to 1941 (column 5). The share of those old men using the pension for unemployed who entered unemployment after 63 was negligible (column 4).

4   Multivariate estimations

In the next step, 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).

The impact of financial incentives induced by the pension reform on labor market states of adjacent birth cohorts of older men is calculated by the following regression:

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

where y_{imt} is an indicator variable for labor state m of individual i at time t. The labor market state after 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 on pension entitlements for those who enter retirement before NRA (in months) when they have been born in a certain birth cohort (by birth month). We

differentiate between the deductions induced by 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 the social security wealth (SSW) with planning age 55 as well as the option value[28], changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance (X_{it})[29], plus labor demand indicators such as characteristics of the last employer before leaving the labor market (mean wage of all employees, branch, firm size, share of (full-time/part time) employees, share of (full-time) regular workers, share of apprentices, share of (full-time) unskilled employees, share of (full-time) qualified employees, share of (full-time) high qualified employees, share of employees aged 55-59, share of employees aged 60-64, and mean age of all (full-time) employees), and regional unemployment rates (Y_{jt}). The full list of explanatory variables and their averages can be found in Appendix Table A1.

The 1992 pension reform introduced partial retirement as an additional early retirement option employers could offer to their workforce. The full effect of the reform therefore may not be completely attributable to pension deductions. In order 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 hereby 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 therefore 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

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

where $y_{i,m}$ is a binary variable that denotes one of the labor market states m, $X_{i,m}$ are individual and $Y_{j,m}$ 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 the 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:

$$\Delta_{c,m} = \sum_{t=60}^{65} t\left[\text{Prob}_{t,c,m}(y_i = 1) - \text{Prob}_{t,1936,j}(y_i = 1)\right]$$
$$= \sum_{t=60}^{65} t\left[\beta_{t,c,m} - \beta_{t-1,c,m}\right]$$
$$= 60\left(\beta_{60,c,m} - 0\right) + 61\left(\beta_{61,c,jm} - \beta_{60,c,m}\right) + \dots + 65(0 - \beta_{65,c,m})$$
$$= \sum_{t=60}^{65} \beta_{t,c,m} \qquad\qquad (5)$$

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[28] A detailed description of the calculation of the SSW can be found in Geyer et al. (2019).
[29] 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).

The first specification in Table 5 (uneven columns) imposes a linear impact of the pension deductions on 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 the previous section, pension deductions did not have a positive employment effect after ERA. Employees instead accepted higher pension deductions and even reduced employment when deductions for exiting employment before NRA increased. On average, an increase in the deductions by one percentage point was associated with a reduction in the employment rate by about 1.2 percentage points (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 a 18.4 PP lower employment rate than men without deductions. After controlling for regional unemployment and employer characteristics, the R^2 of the estimation strongly increases and the pension penalty coefficients slightly increase (columns III and IV). The strong substitution of regular employment into partial retirement cannot turn the negative employment results. If we add employment during the active phase in partial retirement to regular employment, overall employment also decreases with pension deductions (compare Table A2, columns I-IV).

Also according to our descriptive results, pension deductions had significantly positive effects on unemployment length after ERA. Deductions between 14.7% and 18.0% increased the unemployment rate significantly by 2.6 PP (column IV). Partial retirement duration after age 60 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). Partial retirement incidence after age 60 therefore increased stronger than unemployment incidence. In both bridge paths, older men however exited employment already before ERA, however.

Table 6 measures the overall labor market changes during the implementation phase of the pension reform. According to our previous multivariate results, we find a reduction in employment that increases to almost six months in cohorts 1940 and 1941. During the entire implementation phase, regular employment after age 60 decreased by 5.5 months (5*1.187), see last line in column 1 of Table 6. Column 2 shows that partial retirement increased by more than 0.6 months for each year of NRA increase. Column 3 finally highlights that unemployment was 0.3 months longer for cohort 1937 in comparison to cohort 1936 and two 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 in %	-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
Obs.	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			
R²	0.179	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: SSW is calculated with the planning age 55 at the age of 59. SSW multiplied by 1,000,000. We control in all specifications for changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance, 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: SIAB7514, own calculations.

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

Tab. 6 Overall effects of the pension reform for employment without partial retirement, partial retirement with release phase and unemployment in months. Notes: Standard errors in parentheses are clustered on the individual level. Reference is cohort 1936. Treatment effect T measures average change in employment for increase in NRA by one year. We control in all specifications for SSW at age 55, changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance, job exposure, education, regional unemployment rates and firm characteristics; Significance levels: * $p < 0.05$, ** $p < 0.01$. Source: SIAB7514, own calculations.

5   Discussion

Our descriptive and multivariate analyses give a consistent picture of the changes in labor market outcomes before and after the gradual implementation of the 1992 pension reform. Pension deductions for early retirement did not increase employment of older men after ERA. Employment even decreased stronger with higher pension deductions. The employment decrease is the result of a massive shift of employees affected by the reform from the pension for the long-term insured with their earliest retirement option at 63 into bridge options with ERA at 60. In addition, also employment after ERA in partial retirement decreased with pension deductions. Employment exit age before unemployment increased somewhat, labor market exit age of those using the pension for unemployed increased, however. As a consequence, total unemployment spell lengths increased with deductions.

All of these labor market changes for older men are not in accordance with the changes intended by the pension reform. They are also not accordance with the predictions derived on basis of the Option Value Model (an increase in employment after ERA and a substitution from bridge paths into pension for the long-term insured for cohorts 1939-1941). Our results are also not in accordance with positive employment predictions from ex-ante evaluations of the reform (Berkel and Börsch-Supan, 2004; Hanel, 2010). They are finally not in accordance with empirical evaluations of the labor market

consequences of an increase in NRA combined with actuarial deductions for retirement before NRA 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 and a large increase in unemployment for men (Mastrobuoni, 2009). For the Swiss reform that introduced an increase in the NRA by one year each in two steps and an actuarial pension penalty of 3.4% for retirement of one year before NRA, lead to a large positive employment effect for older women (Hanel and Riphahn, 2012; Lalive and Staubli, 2015).

Our explanation for the surprising deviations from all these predictions is that employers succeeded in motivating an increasing share of older men to use bridge options instead of the pension for long-term insured. Bridge options offer employers influence on when the employee exits employment and employers seem to have used this influence to get employees out of their labor forces earlier even when deductions for an earlier exit from employment increased. This argument is in line with the observation by Rabaté (2017) that an influence of employers on retirement age has a negative impact on employment of old employees.[30]

We now propose several arguments that employers thwarted the employment effects of the 1992 pension reform. They used their influence on employment exit by pushing older employees into bridge options. The first argument is that older men from our sample who are in employment on their 63rd birthday act according to the Option Value Theory. Practically all of these employees use the pension for the long-term insured instead of a bridge option (compare Tables 3 and 4, column 4). They use their autonomy to determine employment exit and increase their employment with pension deductions. Employment after 63 on average increases by almost 5 months from cohort 1937 to cohort 1941 (from 5.5 to 10 months). 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 increases by about 0.15 months per year of NRA increase, compare Table 8. The increase in regular employment with deductions clearly dominates the effects. Employment with and without active phase in partial retirement are practically the same (compare columns 1 and 2 of Table 8) and the changes in partial retirement and unemployment with pension deductions are negligible and negative (compare columns 2 and 3 of Table 7). Our results are in line with the positive effect of the pension reform on pension entry for those using the pension for long-term insured obtained by Bönke et al. (2018).

Cohorts	Employment without	Employment with active

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[30] Rabaté (2017) uses a variation in age at which an employee could be dismissed without a cause (mandatory retirement) in France. He shows that employees had to retire significantly earlier if their employers could use mandatory retirement.

	active phase in partial retirement 63-65	phase in partial retirement 63-65
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)	(0.099)
1941	0.279**	0.349**
	(0.103)	(0.105)
Average changes in employment per year increase in the NRA with deductions of 3.6% (in months)	0.141**	0.148**
	(0.039)	(0.039)
Observations	622.050	622.050

Tab. 7 Overall effects of the pension reform on employment. Notes: Standard errors in parentheses are clustered on the individual level. Reference is cohort 1936. We control in all specifications for SSW at age 55, changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance, job exposure, education, regional unemployment rates and firm characteristics; Significance levels: * $p < 0.05$, ** $p < 0.01$. Source: SIAB7514, own calculations.

	Employment without partial retirement				Unemployment				Partial retirement			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Penalty in %	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
Obs.	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. 8. Regression results: direct effects on employment rate with partial retirement, unemployment rate, and partial retirement rate (both phases) for 63-65 years old employees. Notes: SSW is calculated with the planning age 55 at the age of 59. SSW multiplied by 1,000,000. We control in all specifications for changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance, 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: SIAB7514, own calculations.

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). Practically all women affected by the 1992 pension reform went into the pension for women and hardly any woman chose a bridge option.[31] The pension effects for women at age 60 therefore are comparable to those for men at age 63. The pension for women and the pension for long-term insured both granted autonomy on employment exit[32]. It therefore seems that men and women actually behave according to the Option Value Theory if they use a pension form that grants them autonomy in deciding when to exit employment.

Our second argument is that employers had to be willing to offer substantial sums of money in order to motivate employees to use a bridge option instead of the pension for the long-term insured, especially for the cohorts stronger affected by the pension reform. Appendix B shows that pure financial cost differences between the pension for the long-term insured and the bridge options were up to 18 earnings months or 63.000€ for partial retirement and 13 earnings months or 30.000€ for unemployment. It is practically impossible to obtain objective information on compensation payments made by employers before a dismissal or partial retirement. The only information source on severance pay for dismissed employees we are aware of is the survey evidence provided by the GSOEP. Grund (2006) and Jahn (2009) report an average severance pay of between 20.000€ and 25.000€ in the years 2000-2006 in case of a mutual agreement. They however also find very high severance payments up to 400.000€ and a strong increase in severance pay with age and tenure. The increase in severance pay by tenure is between 0.6 and 0.74.[33] If we take into account that employees who went into early retirement had 15 years of tenure on average, 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, their calculations are compatible with severance payments necessary to compensate older men for financial costs of a dismissal in comparison to using the pension for the long-term insured. We are not aware of any evidence with respect to payments for employees who use partial retirement. Several authors however note that many firms paid more than the legally required earnings during partial retirement and compensated losses in pension eligibility (Berg et al., 2019).

The high compensation costs should however have the consequence that mainly employers with higher adaptation costs for an increase in employment of older men successfully can offer the bridge

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[31] The share of women who chose the pension for the unemployed and partial retirement was less than two percent, compare Geyer et al. (2019).

[32] Also women in principle could choose the pension for the long-term unemployed. This pension form however implied lower pension entitlements in comparison to the pension for women and therefore hardly any women chose it (Lorenz et al., 2018).

[33] Employers were therefore willing to pay more than the informal rule to offer 0.5 of the last gross income for each tenure year in case of mutual agreement on a dismissal.

options. In Table 9, our multivariate regression explains which older employees use a bridge option before retirement instead of the pension for long-term insured employees. We again use our sample of older men who are eligible for all retirement options. In addition to our labor demand variables, we control for the usual drivers of labor market decisions of old employees: SSW at age 55, the highest education level, tenure at the last employer, birth year and economic sector at the last employer prior retirement.

Employment adaption costs increase for employers with a strong pressure to reduce their workforce. We therefore assume that the usage of bridge paths is negatively correlated with the business cycle. A high or an increasing regional unemployment rate[34] therefore should increase the probability that an employee gets into a bridge path (Dorn and Susa-Poza, 2010). Employers that enjoyed a growing workforce[35] should use bridge paths less, analogously. Large employers usually have a professional human resources department that can cope with the legal requirements for partial retirement. They also frequently have the financial means to pay compensations for their older employees for using a bridge path instead of retirement after regular employment. Finally, large employers more frequently are subject to a collective bargaining agreement and have a works council. Unions and works councils supported the usage of bridge options because they accepted them as a socially acceptable form of labor flexibility (Schmähl, 2003; Berg et al., 2019; BMAS, 2018). Therefore, there was an implicit agreement between employers and employees to use the bridge options as an instrument of externalization of employers´ staffing and restructuring problems. We assume that large firms tend to use a bridge path more often. Employers with a large share of employees aged 55-59 in the year before an employee retires, i.e. employers with a high treatment intensity should be interested in sending their employees into bridge paths because their adaptation costs are higher than those of firms with low treatment intensity (Boeri et al., 2016).

We indeed find in an ordinary least squares regression (Table 9) that older men who work at larger employers, at employers in regions with high and increasing unemployment, and with a high treatment intensity use bridge paths more frequently. Older men who work at growing employers however rather use the pension for long-term insured. If we add employer information to the individual characteristics, the R^2 more than doubles from 0.049 to 0.11. We obtain qualitatively the same results if we use a probit regression instead of an OLS regression.

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[34] We chose 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 a bridge employment in order 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 between until 60.

[35] We measured the change in employment in the last year before the employee entered the bridge path or between age 54 and 55, analogously. Again, a variation of the employment measurement at different ages produced robust results.

	Employee uses bridge path before retirement
Employer size*10000	0.070**
	(0.008)
Regional unemployment rate at age 55	0.012**
	(0.001)
Increase 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 SSW at age 55, six birth year dummies, highest education (three levels), tenure (three levels) and economic sector at the last employer prior retirement; Significance levels: * $p < 0.05$, ** $p < 0.01$. Source: SIAB7514, own calculations.

Our last piece of evidence that employer behavior drives the labor market changes before and during the implementation phase of the pension reform instead of employee decisions is provided by Dorn and Sousa-Poza (2010). They show that half of those employees who retired early in Germany between 1984 and 1997 did so involuntary. This is one of the highest shares of involuntary early retirement in their international comparison spanning 19 countries. The share of involuntary early retired increased towards the end of the observation window. The large and increasing share of involuntary early retired in Germany is in accordance with our interpretation that employers pushed many employees into partial retirement and the pension after unemployment.

6   Policy Implications

We find that employees retire earlier although this incurs substantial financial costs if employers can induce their workers to use early retirement forms that give employers an influence on employment exit. Early retirement options that give employers a say on employment exit are widely spread. For partial retirement, Austria, Germany, Sweden and some schemes in the Netherlands are examples for rules that allow employers an influence on the point in time an employee exits employment. There are some papers that show that employers used their influence on employment exit to reduce older employee employment. Graf et al. (2011) find in a matching approach that most employees in partial retirement substituted full employment for part-time employment and retired early in Austria. As a consequence, employment exit age declined after the introduction of partial employment. Lachowska et al. (2009) show in a case study for employees at Stockholm University

that after controlling for individual retirement incentives, a bad financial situation of the university department had an additional highly significant positive impact on take-up of early retirement. Allen et al. (2004) find that the introduction of partial retirement at the University of North Carolina induced a large share of employees to reduce working time at the end of their career and enter retirement earlier. Wadensjö (2006) shows that Sweden´s partial retirement program on average led to a net increase in the number of hours worked by older workers. Older workers opting for the partial retirement program however had to give up an 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 is another retirement scheme that strongly depends on employer decisions. Especially employees who are not subject to dismissal protection rules may have no influence on being dismissed and then forced into early retirement. Other employees may be offered what Cremer et al. (2009) call a "bribe" – a compensation for the financial losses during unemployment as a route to early retirement. In countries with the option to retire early after a certain unemployment spell (examples are Portugal, Finland, Belgium, and the Netherlands, see European Commission, 2019) and low transition rates from unemployment back to employment for older people, employer behavior may have a negative influence on employment at old age. We are not aware of studies that assess the employment impact of these schemes.

7   Conclusions

This paper shows that the increase in NRA plus the introduction of pension deductions for retirement before NRA did not have the intended positive 1992 pension reform effect on employment of older men. This finding markedly differs from ex-ante analyses of the pension reform (Berkel and Börsch-Supan, 2004; Hanel, 2010) and an ex-post analysis concentrating on the effects of the reform on employees who used the pension for long-term insured (Bönke et al., 2018). We found mainly three reasons for the negative employment development during the introduction phase of the pension reform: Older men who used the bridge option partial retirement before early retirement reduced employment after ERA with increasing pension deductions. Also those older men who used the bridge option unemployment reduced employment and instead increased their unemployment duration after ERA with deductions. Finally, the strong substitution of employees from a pension for long-term insured to employees who used the bridge options unemployment and partial retirement further reduced employment after ERA because bridge options allowed exit from employment at least three years earlier. Overall, during the implementation phase of the pension reform, employment declined by 1.2 months per annual increase in NRA, unemployment increased by 0.4 months and partial retirement increased by 0.6 months after age 60.

The strong substitution of regular employment into the bridge options may even partly have been an unintended side-effect of the reform. Employers may correctly have expected that the older employees eligible for the pension for long-term insured would stay longer in employment if they did not induce them to use a bridge option. As a consequence, employers induced their employees to use a bridge option and exit employment even earlier than before. As a consequence, the realized financial costs of early retirement increased much stronger with pension deductions for employees in bridge options in comparison to employees using the pension for long-term insured. For the youngest cohort 1941 they add up to 18 monthly earnings for partial retirement and to 12 monthly earnings for early retirement after unemployment. All older men in our sample have the option to use the pension for the long-term insured and we therefore can assume that employers had to pay increasingly higher sums to induce those employees to use a bridge option. We accordingly find that mainly the employers with higher costs for keeping older employees longer in employment get their employees into the bridge options. Employers with higher adaption costs are for example employers in regions with high and increasing unemployment, employers that did not experience a workforce growth, and employers with a large treatment intensity. Also large employers get their employees to use bridge options, probably with the help of unions or works councils.

Papers on reactions to pension reforms usually frame their models on the basis of 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 (Rust and Phelan, 1997; Mastrobuoni, 2009; Rabaté, 2017; Bönke et al., 2018). These models imply autonomous employee decisions on retirement and do not take into account employer behavior (Rabaté, 2017). These studies therefore assume a perfectly elastic labor demand reaction on pension reforms (Peichl and Siegloch, 2012). This assumption does not reflect that employers might have the option to "bribe" employees into alternative retirement paths that give them a higher autonomy such as early retirement after unemployment or some forms of partial retirement implemented in some countries (Cremer et al., 2009). To the best of our knowledge, this is the first paper that shows that employers thwart the intended 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.

Early retirement after unemployment abolished in Germany. Early exit from the labor market after partial retirement. In the light of our results it seems interesting to see whether the abolishment of pension options that provide employers with an influence on employment exit analogously led to an increase of employment of older employees. The reduction of employment of older employees in the face of substantial deductions for early retirement might be a consequence of a high pressure on the

employers to reduce their older work force in times of raising unemployment. Similar reforms during boom phases therefore might not have had similarly clear employer reaction effects.

Our data only include aggregated employer characteristics derived from the employment statistics. We therefore do not have for example information about industrial relations or individual compensation agreements such as severance pay for dismissed older employees. Linked employer-employee data are therefore necessary to for example analyze whether works councils, collective bargaining structure or certain human resource measures such as training for older employees can explain which employer uses bridge options to retire older men earlier. It however seems hard to collect data on the compensation payments employers are willing to pay for bridge paths.

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Appendix A

Characteristics of the last employer before labor market exit	mean	sd
number of employees in total	1341.76	4683.27
imputed gross daily earnings of full-time employees	98.08	37.21
employee age	41.89	4.75
age full-time employees	42.29	4.6
share women	0.28	0.22
share full-time	0.83	0.17
share part-time	0.083	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
Option Value at age 55	217039.9	439161.4
Social Security Wealth at age 55	235801.9	59321.2

Tab. A1. Descriptive statistics for the variables used in the multivariate regression Table 5, Number of Observations: 1,517,802. Source: SIAB7514, own calculations.

	Employment including partial retirement			
	I	II	III	IV
Penalty in %	-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
Obs.	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: SSW is calculated with the planning age 55 at the age of 59. SSW multiplied by 1,000,000. We control in all specifications for monthly-cohort and age fixed effects, for changes in the legislation for disability pensions and in the entitlement rules for unemployment insurance, 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: SIAB7514, 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 in comparison to the pension for the long-term insured given actual retirement behaviour during the implementation phase of the 1992 pension reform. Our previous analyses show that older workers who use the pension for the long-term insured increased their employment with pension deductions and they therefore could contain the negative financial consequences of the reform. In partial retirement, pension deductions and the partial retirement spell duration however increased during the implementation period. Also for users of the pension after unemployment the unemployment spell and pension deductions increased. We therefore assume that for later cohorts financial compensation payments for using bridge options had to increase because all employees had the option to use the pension for the long-term insured, instead.

We first calculate average pension deductions in all three pension forms. Table B1 shows that employees using the pension for long-term insured faced relatively low pension deductions. Average pension deductions for them reached a peak of 2.2% for cohort 1939 and then decreased again. [36] Pension deductions reached a much higher level for those men using partial retirement (9.5%) and pension after unemployment (8.5%) for birth cohort 1941. In order 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 life expectancy of retirees born in a given birth cohort (Statistisches Bundesamt, 2019). For the bridge options, we in addition take into account financial disadvantages in earnings and pension eligibilities collected 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 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 90% of regular earnings (Berg et al., 2019). Table B2 shows that financial costs of those older men who used the pension for the long-term insured remained relatively low with a maximum of 15,000€ or five earnings months. Financial costs of those using the pension after unemployment increased from 17,282€ in cohort 1937 to 43,545€ in cohort 1941. The costs of partial retirement even amounted to 78,010€ in cohort 1941. The difference in financial

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[36] Although not all employees directly enter pension after exiting employment (Hanel, 2010), our calculations of the realized pension deductions are very similar to those published by the German pension insurance. Average pension deductions increase 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). Bönke et al., (2018) also find according to our results that pension deductions for employees using the pension for the long-term insured increased from cohort 1937 to cohort 1939 and then decreased again.

costs increases from about two monthly earnings before the reform to more than one year´s earnings for cohort 1941 for the pension after unemployment. Financial costs for partial retirement amount to up to one and a half year´s earnings in comparison to the pension for the long-term insured. Bridge options allow older men to retire substantially earlier than the pension for the long-term insured and therefore part of the financial costs might be compensated by the utility derived from longer leisure. We therefore consider the differences as an upper bound of compensation payments necessary to persuade employees to agree to a bridge option.

Cohorts	Average	Pension for the unemployed	Partial retirement	Long-term insured
1935	0	0	0	0
1936	0	0	0	0
1937	0.25	0.72	0	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	3010722	9198	2494	13190

Tab. B1. Realized pension deductions by cohort by percent. Notes: Values in the columns correspond to the mean. Source: SIAB7514, own calculations.

Cohorts	Total costs pension after unemployment	Unemployment costs	Unemployment penalty costs	Total costs partial retirement	Partial retirement costs	Partial retirement penalty costs	Total costs pension for long-term insured
1935	17,282 (1.93)	17,282					
1936	16,773 (1.90)	16,773					
1937	19,179 (2.75)	14,658	4,521	58,316 (18.12)	58,316	0	4,816 (1.79)
1938	25,895 (6.78)	14,563	11,332	56,135 (17.43)	55,613	522	12,461 (5.05)
1939	31,144 (10.69)	15,406	15,738	62,488 (18.89)	57,987	4,501	15,296 (5.33)
1940	37,309 (13.73)	16,593	20,716	69,805 (20.29)	53,882	14,930	14,110 (5.05)
1941	43,545 (18.69)	18,664	24,881	78,010 (22.74)	48,005	30,005	14,859 (5.00)

Tab. B2. Calculation of pension penalty and bridge costs. In brackets: costs expressed in earnings in months. Source: SIAB7514, own calculations.