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## The timing of employment breaks: how does it affect pension benefits? Empirical evidence from Germany

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**Discussion Papers**

**710**

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Opinions expressed in this paper are those of the author and do not necessarily reflect views of the institute.

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**The timing of employment breaks: How does it affect  
pension benefits?**

**Empirical evidence from Germany**

Berlin, July 2007

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## **Abstract**

This paper provides empirical evidence how the timing of employment breaks affects pension benefits in Germany. Analysing the biographical data set from the German Pension Insurance (SUF VVL 2004) the employment histories of individuals aged 21 to 60 can be mirrored in detail. We relate differences in pension benefits to employment breaks due to unemployment and parental leave in the individual life cycle, distinguishing by gender. Three different career phases (early, middle and late) are distinguished and respective social policy phases are considered. As predicted by human capital theory, the losses due to career interruptions in the early and middle employment period differ. However, the negative effects due to unemployment in the late employment period are only weak. This finding detects special characteristics of the covered age-groups in the data set.

**Keywords:** employment histories, career interruptions, pension benefits

**JEL Classification:** J26, J24

## 1 Introduction

Individual employment histories as well as social security policy determine the coverage when old. Pension benefits will be higher, the higher the individual earnings and the more continuous the career. In other words, employment breaks like unemployment or parental leave will reduce earnings and pension benefits in the future. Further, penalties are expected to differ in accordance with the individual life cycle. But overall, social policy might mitigate these losses. Focusing on this interaction, we analyze how the timing of employment breaks affects pension benefits. However, this paper is not the first to address this research question. In Potrafke and Steiner (2007) we also examine the impacts of individual employment histories on pension benefits in Germany. There we match two data sets: The population of pensioners in 2003 provided by the German Pension Insurance (SUF Rentenbestand 2003) and the German Socio-Economic Panel (GSOEP). It contains pensioners aged 61 to 75. Our results show that the timing of employment breaks indeed mattered: Unemployment in the late employment period reduced pension benefits for men and women. Further parental leave in the early employment period caused losses for women. However, in Potrafke and Steiner (2007) we examine pensioners born from 1928 to 1942 (stock), whereas the current paper covers pensioners born from 1939 to 1943 (inflow). This is an important difference – also for the interpretation of the results – as indeed different populations are considered.

The related literature stems from two fields. Pension benefits as well as the interaction of employment interruptions and wages are research areas of notable interest. Examining the impacts of employment breaks on earnings has been an issue in the empirical literature. Mincer and Polachek (1974) first investigate this effect for women in the US. Licht and Steiner (1992) analyze the impact of employment interruptions on labor income and human capital using data from the German Socio-Economic Panel (GSOEP) from 1984 to 1989. They find evidence for persistent loosing in income directly after the employment break. Further, an indirect effect due to the failure of human capital accumulation is identified. However, there is a so called “restoration effect” which describes the increasing income after reemployment. This effect compensates the first ones.

Beblo and Wolf (2002) examine the wage effects of different types of career interruptions. Using a data set of German social security accounts (IAB employment sample) they consider information on the employees’ entire working life. They find that job experience accumulated many years ago contributes less to the current income level than recent employment spells.

This finding holds for men and women. However, gender matters with respect to the wage penalties of discontinuous employment biographies. Whereas women's wages mainly decrease because of parental leave or additional home time, wage cuts for men are caused by unemployment and out-of-the-labor-force periods. Kunze (2002) also uses IAB data and finds that the impact of not working depends on the type of interruption. Wunder's study (2005) is in some sense closely related to the current paper. He analyses the impacts of unemployment on pension benefits, but irrespective of its timing. His results show that, especially for short employment histories, the effect due to the depreciation of human capital dominates the negative income effect expressed by lower contributions to the social security system.

The interaction of pension benefits and individual employment histories in Germany was first described by a survey study called AVID'96 (Altersvorsorge in Deutschland)<sup>1</sup>. In contrast to the current study, it focuses on pension benefits in monetary units. There are several descriptive evaluations of the AVID'96. Kortmann and Schatz (1999) illustrate the differences in pension benefits for women due to family and working status, number of children as well as residence in East and West Germany. Roth (2000) also explicates the differences between age cohorts and demonstrates that the younger age cohorts work more part time, are unemployed for a longer period and spend less time for parental leave. Bieber and Stegmann (2000) focus on the effects of part-time work of women. While pension benefits are lowest for women who did not work at all, claims increase with part time work. However, a part-time employment of 10 years functions as a kind of threshold because it results in relatively high deductions on the pension benefits. Overall, part-time work seems attractive since it acts as hinge between family- and full-time work. Steiner (2003) summarizes the literature and illustrates the protection of low-wage earners in old-age. He stresses remarkable differences between East- and West-Germans referring to the above named studies. Hauschild (2002) makes similar investigations and figures out how employment- and family-histories fulfil the qualifications for an old age security above the existence level. She concludes that marriage improves the women's economic situation when they become old and achieve retirement age. Roth et al. (2002) present the framework of an updated survey study AVID'2005. It particularly focuses on the impacts of additional old age insurances besides the compulsory system and relates to the whole popu-

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<sup>1</sup> The AVID'96 analyses the provision structure of statutory pension contributors aged 40 up to 60 and their spouses. The employment histories until age 65 were completed by use of micro simulation methods. See e. g. Schatz et al. (2002) for a more detailed description.

lation instead of only compulsorily insured persons. Related studies on the AVID'2005 are not yet available.

The paper is organized as follows. Section 2 discusses the theoretical and institutional background. The data set and the empirical model focusing on the coding of the employment history and social policy period variables as well as their interaction are presented in section 3. In section 4, the empirical results are illustrated and discussed, while section 5 concludes the analysis.

## 2 Theoretical and Institutional Background

The differences in pension benefits due to personal events in the individual life cycle are determined by several factors. As we examine these impacts from a dynamic perspective, the theory of human capital accumulation provides the most important theoretical background for our purpose. Gary Becker (1964) states that human capital is a means of production, into which additional investment (via education, training etc.) will yield additional output. Mincer's (1974) famous "human capital earnings function" illustrates this empirically and relates the natural logarithm of income to the number of years of education and experience. Becker's and Mincer's early work on human capital theory<sup>2</sup> show that the life-cycle growth of earnings reflects the rate of accumulation of personal investments. In total, there is an increase in wages over the working life. From this theory also follows that career interruptions will cause lower earnings. Moreover the timing of employment breaks will matter because skills, knowledge and experience change in time elapsed. Likewise, they are valued differently on the labor market and the individual income is affected respectively. These effects directly concern pension benefits because they interact with earnings and thereby individual qualifications during the employment period.

The phenomenon of "human capital depreciation" is responsible for lower earnings because of career interruptions (e.g. Mincer and Polachek (1974)). Especially lengthy employment breaks might decrease the wage at re-entry in the labour market. Individuals might not keep up with the technological progress and might be demotivated. As a result, post interruption wages will be quite low initially. However, they will increase rapidly when the individual

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<sup>2</sup> A collection of Mincer's studies on human capital is provided by Mincer (1993).



starts working again. Human capital that depreciated during the employment break is restored. Mincer and Ofek (1982) describe this restoration effect which alleviates the income loss. Its impact will be dependent on the single period of life, of course. The restoration effect might be stronger in the early and middle compared to the late employment period. Further, direct losses might be higher in the late employment period. However, it remains as an empirical question to figure out the interaction of the named effects.

But furthermore, institutional factors affect pension benefits in Germany. They might counteract the theoretical implications. Losses due to employment breaks are mitigated by social policy. For example, times of unemployment were accounted for the pension benefits. However, these allowances also changed in time elapsed. Furthermore, some other particular features might be crucial. First, male bread-winner households were common during the past decades in Germany. It follows that men will receive higher pensions than women. Second, the number of children will have an impact, too. In particular, women who have worked instead of taking care of the children will profit, respectively. Third, there are differences due to the residence in Germany, distinguishing between East and West. East-Germans generally have had more continuous employment histories.

### **3 Data and empirical model**

#### **3.1 The data set – SUF VVL 2004**

The data analysed in the current paper is the Scientific Use File (SUF) “FDZ-Biografiedatensatz für die Biografiedaten zu Vollendeten Versichertenleben (VVL) 2004”. It is provided by the German Pension Insurance. The original sample contains 39 331 individuals and in turn represents a 25 % random sample of the population aged 30 to 65. The sample only contains cases of new entrants and no transmutations. Further it refers to pensions due to personal insurance and e.g. no widow’s pensions. Stegmann (2006) describes the preparation and the set up of this data set. Furthermore, some general features of the data set should be named. Stegmann (2006) and Fachinger and Himmelreicher (2006) compare the properties of the SUF VVL 2004 with other already existing data resources. In comparison to the GSOEP, the SUF VVL 2004 does not suffer from panel mortality. The GSOEP provides survey data, while the SUF VVL 2004 contains register data. Further, it contains wide-ranging information about the individual employment histories, whereas the IAB employment sample, the most

comprehensive data set covering biographical information so far in the time elapsed, only returns to 1975. However, the SUF VVL 2004 is not representative for the whole pensioner population in Germany in 2004, as it only covers the inflow and not the stock. This is an important feature we have to take into account for the comparison with the results from Potrafke and Steiner (2007). Overall, it constitutes a very interesting data source for our purpose.

First, the SUF reports on individual matters of fact like pension amounts, pension types and above all the “Earning Points” (Entgeltpunkte) as a measure of the pension benefits. The Earning Points are one of the four factors of the pension formula and describe the ratio of the individual income position to the average income of all compulsorily insured employees. Thus, in contrast to e.g. the monthly pension amount, the Earning Points mirror the relative earning position of the individuals. In addition, the Earning Points are independent of the real wage. We will use this very applicable measure as the dependent variable in our empirical model (see section 3.2).

Second, equally important information for the current paper is the application of the individual social earning situation in time elapsed (Variable SES). It distinguishes between 13 characteristics like unemployment and parental leave. The data set contains information about 624 months – from January 1953 to December 2004. The oldest individuals included are born in 1939 and the youngest ones in 1974. As we will focus on the working period till the age of 60, the paper concentrates on individuals born in the interval from 1939 to 1943. Hence in 2004, the youngest individuals were 61 and the oldest 65 years old. However, there is no complete information about the employment histories of all individuals. The sample contains missings – also in between the careers. Their interpretation is crucial for the current analysis. A missing value means that the respective month was not relevant from a social security law perspective. It does not affect the pension benefits in any way. From this follows, that one can circumscribe the periods for which information is available from all the other states. For example, the only relevant times of unemployment (from a social security law perspective) are the ones coded as unemployed. These can be distinguished from all the other states. (This logic exactly refers to the coding of variables like ALOS already contained in the data set.) Using the SES-Variable also makes sure that there is no overlapping of maybe parallel employment breaks relevant from a social security law perspective. However, the SES-variable

is coded hierarchically. From this it follows, that times of parental leave occurred parallel to a full-time employment are not considered. In this case, full-time employment takes priority.

Moreover, the data set contains information on other socio demographic characteristics like marital status, citizenship and number of children. In conclusion, the empirical model exclusively relates to variables stemming from the SUF VVL.

This analysis only considers pensioners living in West Germany (Berlin is also excluded) because the East Germans' careers were somewhat different due to the economic and political system of the former German Democratic Republic. But individuals living in the Western Part in 2004 might have spent their working live in the Eastern Part. The data set allows controlling for this effect using the Variable ANTEILOST. Hence we only include individuals in the sample that spent their whole working life in West Germany. Furthermore, we want to draw conclusions on persons for which the compulsory German Social Security was the core system. The variable RTZTMO refers to the months which were somehow accountable for the social security system like employment time as well as different times of allowance (e.g. times of self-employment are not taken into account). It enables to control for different specifications.

Table 1 and 2 illustrate the distribution of the Earning Points in relation to the affiliation time to the German Pension Insurance. After all, the logarithm of the Earning Points will be the dependent variable of the econometric model.

Table 1  
**Descriptive statistics on the sum of the Earning Points in relation to the affiliation time to the German Pension Insurance (RTZTMO-Variable). Men.**

	Overall	>=20 Years	>=25 Years	>=30 Years	>=35 Years	>=40 Years	>=45 Years	>=50 Years
<b>N</b>	4599	4399	4322	4237	4106	3895	3241	179
<b>Mean Earning Points</b>	52.11	54.05	54.70	55.36	56.17	57.27	58.59	62.01
<b>Standarddeviation</b>	17.30	15.00	14.28	13.61	12.95	12.10	11.46	13.27

Table 2

**Descriptive statistics on the sum of the Earning Points in relation to the affiliation time to the German Pension Insurance (RTZTMO-Variable). Women.**

	Overall	>=20 Years	>=25 Years	>=30 Years	>=35 Years	>=40 Years	>=45 Years	>=50 Years
<b>N</b>	3987	3534	3136	2719	2295	1634	785	10
<b>Mean Earning Points</b>	23.88	25.93	28.04	30.34	32.71	35.94	39.32	53.45
<b>Standarddeviation</b>	15.14	14.75	14.22	13.56	12.93	12.52	11.78	13.10

Table 1 reports that, on average, men's Earning Points add up to 52.11, when the affiliation time to German Pension Insurance is not considered any further. However, the sum of the Earning Points does not strongly increase the higher the affiliation time. Men affiliated to the German Pension Insurance for at least 40 years received 57.27 Earning Points on average. Things are somewhat different regarding women. They received 23.88 Earning Points on average in the unrestricted sample (Table 2). The distribution of the Earning Points changes the longer they were affiliated with the German Pension Insurance. Hence the mean rises to 30.34 Earning Points for an affiliation time of at least 30 years. The numbers presented refer to the final sub samples including all the variables used in the econometric models. Section 3.2 will present two different econometric specifications that refer first to an affiliation time of at least 25 years. Second, it will be interesting to compare the results with a longer affiliation time of at least 30 years for women and at least 40 years for men. These two benchmarks take into account the respective sample sizes and distributional properties.

### 3.2 The empirical model

#### 3.2.1 Estimation approach

The linear regression model looks as follows:

$$\log \text{ Pension Benefits}_i = \alpha_j \text{ Employment Breaks}_{ij} + \beta_k \text{ Social Policy Period}_{ik} + \gamma_l \text{ Employment Breaks}_{ij} * \text{ Social Policy Period}_{ik} + \delta_m \log X_{im} + u_i \quad (1)$$

with  $j=1, \dots, 5$ ;  $k=1, \dots, 5$ ;  $l=1, \dots, 3$ ;  $m=1, \dots, 13$

Where the dependent variable  $\log \text{ Pension Benefits}_i$  describes the logarithm of the pension benefits of individual  $i$  (Earning Points, Variable SUEGPT). Hence we might interpret the impacts on the independent variables on the pension benefits as changes in percentages. Em-

employment Breaks<sub>ij</sub> models the career interruptions. The next paragraph explains their set up. Social Policy Period<sub>ik</sub> are simple dummy variables that control for revisions of a statute. We illustrate the main amendments, our categorization and respective modelling below. Employment Break<sub>ij</sub> \* Social Policy Period<sub>ik</sub> describes their interaction. We will consider the interaction terms because there might be differences if the individuals spent a particular employment period in a particular policy period, respectively. Lastly, the vector log X<sub>im</sub> contains a constant and 12 explanatory variables for control purposes: Family status, citizenship, the number of children (for women), education and the logarithm of the retirement age.

### 3.2.2 Employment break variables

The essence is to model the particular events in the employment histories, so that we can test our hypothesis how particular employment breaks in time elapsed affect the pension benefits. Employment Breaks<sub>ij</sub> contains the respective variables. Our modelling is similar to the work history model first introduced by Light and Ureta (1995) and e.g. extended by Beblo und Wolf (2002). We distinguish between three different phases during the whole employment period with respect to the individuals' age. First, the early earning period will reach from an individual age of 21 to 35. Second, the middle interval covers the period from age 36 to 50. Third, we install the last period starting with age from 51 to 60. Then, we construct shares of the specific employment breaks in relation to the respective sub period. In particular, we sum up the single months an individual has spent on a single career phase and relate them to 180 months in the early and middle and 120 months in the last earning period.

Furthermore, we focus on unemployment as an important reason of employment breaks irrespective of the gender. Thus, we control for this type of career interruption for men as well as for women. In contrast, breaks due to parental leave are taken into account only for women because men interrupted their careers less frequently due to parental leave in Germany. Furthermore, Table 5 reports that parental leave occurred very rarely in the last employment period, of course. That is why we will not include this variable in the regression.<sup>3</sup>

Table 3 to 5 do not just indicate the means of these share variables when the career interruption occurred, but also their numerical frequency as well as the means of the Earning Points. As expected, unemployed men received less Earning Points than employed men. However,

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<sup>3</sup> For completeness, we were also running regressions including this variable. It was highly significant and strongly decreased pension benefits. However, this effect is only due to a few individuals.

there are differences between the single employment periods. We will stress two points. First, the difference between the unemployed with 45.79 Earning Points and employed with 56.69 is highest in the middle employment period. But it is less in the late period (50.61 to 55.76). Second, there were much more men unemployed in the late (884) in comparison to the early and middle working period. Further the duration was even higher. The average share of 0.201 tells us, that when unemployed, men interrupted their career for two years on average (20 percent of 120 months). In addition, we will point out that there is only very low correlation between unemployment in the single employment periods. This means for example, that unemployment in the middle period of life did not automatically cause unemployment in the late employment period. The presented values refer to an affiliation time to the German Pension Insurance of at least 25 years.

Things are different regarding women. The differences between the Earning Points of unemployed versus employed were negligible. Overall, women who were unemployed in their working life received 28.64 Earning Points on average compared to 27.57 in the reference group. It is interesting to remark, that the group of unemployed women received higher Earning Points on average than the employed reference group, except when unemployment occurred in the late employment period. Hence the descriptive statistics point to a compensation effect in the long run. As for men, the share of unemployed women was highest in the late employment period. The shares do not correlate with each other. Table 5 reports different results with respect to parental leave. It strongly affected pension benefits. Women taking care of the children in the early period of life received 25.53 Earning Points on average compared to 40.87 when women did not. In the middle period of life, the respective values are 19.16 versus 32.50. Moreover, there are much more women in the sample who interrupted their career for parental leave than women who did not.

Table 3  
**Distribution of the Earning Points and shares in relation to the (Un) employment periods.**  
**Men.**

	Early Employment Period		Middle Employment Period		Late Employment Period		whole Employment Period	
	unemployed	employed	unemployed	employed	unemployed	employed	unemployed	employed
N	494	3828	785	3537	884	3438	1605	2717
Mean Earning Points	48.78	55.47	45.79	56.69	50.61	55.76	50.08	57.44
Mean Share of Unemployment (Share if ≠0)	0.033	0	0.085	0	0.201	0	0.047	0

Table 4  
**Distribution of the Earning Points and shares in relation to the (Un)employment Periods. Women.**

	Early Employment Period		Middle Employment Period		Late Employment Period		whole Employment Period	
	unemployed	employed	unemployed	employed	unemployed	employed	unemployed	employed
N	387	2749	758	2378	748	2388	1370	1766
Mean Earning Points	30.69	27.66	28.31	27.95	27.98	28.05	28.64	27.57
Mean Share of Unemployment (Share if ≠0)	0.042	0	0.095	0	0.227	0	0.055	0

Table 5  
**Distribution of the Earning Points and shares in relation to the Periods of (no) Parental Leave. Women.**

	Early Employment Period		Middle Employment Period		Late Employment Period		Early und Middle Employment Period	
	Parental Leave	no Parental Leave	Parental Leave	no Parental Leave	Parental Leave	no Parental Leave	Parental Leave	no Parental Leave
N	2625	511	1086	2050	19	3117	2669	467
Mean Earning Points	25.53	40.87	19.16	32.50	12.92	28.13	25.55	42.26
Mean Share of Unemployment (Share if ≠0)	0.478	0	0.328	0	0.196	0	0.302	0

### 3.2.3 Policy period variables

Moreover, social security policy has changed during the last decades in Germany. The allowances of employment breaks were handled differently over time and e.g. changed in accordance with the pension reform 1992. Lühning (2006) describes the changes of the benefit legislation of the German Social Security System from 1957 to 2004. We distinguish between certain subperiods regarding the main amendments using dummy variables. The years, in which the policy changes became law were coded in accordance to the date they occur. For example, when law changed in May (first half of the year), we consider the whole year as affected by this statute. Changes in the second half of the year are taken into account beginning with the following year.

The amendments due to the allowances when the individuals were unemployed are as follows. Until 1978, no contributions were made by the Federal Employment Office. Periods of unemployment are considered only in the final assessment of the whole (potential) working life (period from the age of 17 to the start of the pension). From 1979 to 1991, there was a period in which career interruptions due to unemployment were considered as well as contributions to the social security system were made by the Federal Employment Office. We will not

model the respective amendments during this period in more detail. However, the year 1992 functions as a turning point. Henceforth, the Federal Employment Office mainly made (compulsory) contributions to the social security system.<sup>4</sup> We install simple dummy variables that take on the value 1 when the respective individual was unemployed in this period and zero otherwise. It is important to remark, that we cannot conclude in which way individuals benefited on average in the single policy periods, because it differs due to the single employment histories. The relationship between the average income and the last income before unemployment occurred emerges as crucial. For example, individuals with discontinuous employment histories might suffer from simple considerations, as the average income will function as a reference.

Parental leave was not considered as allowance for pension benefits before 1986. There are allowances due to parental leave since 1986; one year was credited when the child was born till 1991.<sup>5</sup> In 1992, the pension reform also appoints that three years of parental leave could be taken into account when the child was born in 1992 and later. Further, the so called “Riester” reform from 2002 contained an amendment that functioned retroactive to the beginning of 1992. Individuals which were in parental leave but have also worked (e.g. part time) during this period, have received higher Earning Points for their respective employment. The additional Earning Points could amount up to 50% of the initial Earning Points, yet, the sum must not be greater than 1 Earning Point (standard earnings). Thus this regulation confirms that there was a huge amendment in the beginning of 1992, so that we consider three different sub periods regarding the amendments of parental leave: The time before 1986, between 1986 and 1991 and after 1992. Again, we use simple dummy variables to control for career interruptions due to parental leave in the respective periods. In accordance with the employment break variables, parental leave in the last employment period is not considered and therefore we also do not include the last social policy phase dummy.

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<sup>4</sup> This categorization simplifies the amendments. One might notice that from July 1978 to the end of 1982, the Federal employment office made contributions to the public pension scheme on the basis of the gross labor income which constituted the claim for unemployment benefits. From 1983 to the end of 1991 it made contributions on the basis of the unemployment benefits granted. Furthermore, there was an interim arrangement from 1992 to 1997, so that periods of unemployment were also considered in the final assessment. Lastly, from 1995 contributions were made on the basis of 80 % of the gross labor income which constituted the claim for unemployment benefits.

<sup>5</sup> Technically, the SES variable of the SUF VVL 2004 does not distinguish between parental leave and home time. This might cause a bias. But the data set also includes a variable (KIND3) controlling for the fact if women took care of children aged 3 and less. Hence we use the last feature to identify the women who indeed interrupted their career because of parental leave.



### 3.2.4 Interaction Terms

The individuals considered in the current study are born in the interval from 1939 to 1943. Therefore they experienced their individual phases of life in different policy phases. We will control for this effect and thereby test for the impacts. The coding might be first explained for unemployment. The first amendment with respect to unemployment occurred in 1978. Hence all the individuals born from 1939 to 1943 were affected in their early period of life (age from 21 to 35) by the first policy phase. Thus, the interaction term between the first period of life and the dummy referring to the first policy period is not different from the employment break variable itself. In contrast, there are differences for the middle period of life. Older individuals, e.g. born in 1939, have experienced the first years of their middle period of life (age from 36 to 50) under the first policy regime till 1978. But younger individuals, e.g. born in 1943, have experienced most of their middle period of life in the second policy phase from 1979 to 1991. Hence we will control for the interaction of unemployment in the middle period of life with the period after the first amendment in 1978. We will focus on this interaction because it is numerically most relevant. The setting is similar regarding the late period of life (age from 51 to 60). Older individuals, e.g. born in 1939, spent the first years of their late period of the employment life in the policy period from 1979 to 1991. In contrast, younger pensioners experienced their late employment phase after the last amendment in 1992. Therefore, we consider the interaction of the late employment period with the third policy phase.

Regarding parental leave (only for women), we could only consider the interactions between the middle employment period and the respective policy phase. Before the first amendment in 1986, all the individuals already finished their early stage (age 21 to 35), so that an interaction term with the early employment period and first policy phase cannot be included in the model. Most importantly, we will consider the interaction of the middle period of life and the policy phase from 1986 to 1991.

## 4 Results

### 4.1 Regression results

Table 6 reports the regression results. However, the aim of this section will be to determine the marginal and level effects of the respective career interruptions in the early, middle and

Table 6  
**Regression Results. OLS, robust standard errors. At least 25 years affiliation time to the German Pension Insurance. Regressions including insignificant interaction terms.**

Variable	Women	Men
Constant	16.199*** (9.53)	11.647*** (11.60)
Family Status (Married)	-0.242*** (-15.11)	0.121*** (9.74)
Citizenchip (German)	0.102** (2.22)	0.209*** (7.97)
log Retirement Age	-3.068*** (-7.48)	-1.944*** (-8.04)
Lower school (Hauptschule)	0.068*** (2.86)	-0.057*** (-2.88)
Secondary School (Realschule)	0.210*** (10.44)	0.140*** (9.22)
High School Diploma (Abitur) with professional training	0.301*** (3.88)	0.143*** (3.30)
High School Diploma (Abitur) without professional training	0.273*** (3.20)	0.219*** (3.14)
Advanced Technical College Degree	0.354*** (4.12)	0.311*** (17.07)
University Degree	0.426*** (8.16)	0.238*** (11.54)
1 Child	-0.018 (-0.81)	-
2 Children	-0.020 (-0.80)	-
3 Children and more	0.044 (1.48)	-
Unemployment Early	-0.564 (-1.30)	-0.675** (-2.08)
Unemployment Middle	-1.526** (-2.21)	-1.815* (-1.73)
Unemployment Late	-0.813 (-0.54)	-1.129 (-1.46)
Parental Leave Early	-0.738*** (-24.94)	-
Parental Leave Middle	-0.719*** (-13.83)	-
Unemployment Policy 1 (till 1978)	0.041 (1.58)	-0.039** (-2.50)
Unemployment Policy 2 (from 1979 to 1991)	0.007 (0.35)	-0.144*** (-7.85)
Unemployment Policy 3 (since 1992)	0.024 (0.87)	-0.017 (-1.03)
Parental Leave Policy 1 (till 1985)	-0.189*** (-5.87)	-
Parental Leave Policy 2 (from 1986 to 1991)	-0.343*** (-2.66)	-
Unemployment Middle * Policy 2	1.187* (1.70)	1.262 (1.20)
Unemployment Late * Policy 3	0.609 (0.41)	0.971 (1.25)
Parental Leave Middle * Policy 2	0.505*** (2.66)	-
R <sup>2</sup>	0.529	0.250
N	3136	4322

t-statistics in parentheses: \*/\*\*/\*\*\*: significant at the 0.10/0.05/0.01 level.

Table 7  
**Regression Results. OLS, robust standard errors. At least 25 years affiliation time to the German Pension Insurance. Regression without the insignificant interaction terms.**

Variable	Women	Men
Constant	16.276*** (9.60)	11.791*** (11.72)
Family Status (Married)	-0.242*** (-15.13)	0.121*** (9.70)
Citizenship (German)	0.102** (2.22)	0.208*** (7.95)
log Retirement Age	-3.087*** (-7.54)	-1.979*** (-8.16)
Lower school (Hauptschule)	0.068*** (2.86)	-0.056*** (-2.86)
Secondary School (Realschule)	0.210** (10.42)	0.139*** (9.21)
High School Diploma (Abitur) with professional training	0.301*** (3.88)	0.144*** (3.31)
High School Diploma (Abitur) without professional training	0.273*** (3.20)	0.219*** (3.16)
Advanced Technical College Degree	0.354*** (4.12)	0.311*** (17.10)
University Degree	0.426*** (8.17)	0.239*** (11.58)
1 Child	-0.018 (-0.80)	-
2 Children	-0.020 (-0.80)	-
3 Children and more	0.044 (1.48)	-
Unemployment Early	-0.567 (-1.31)	-0.636* (-1.94)
Unemployment Middle	-1.529** (-2.22)	-0.578*** (-5.71)
Unemployment Late	-0.209** (-2.26)	-0.159** (-2.38)
Parental Leave Early	-0.738*** (-24.94)	-
Parental Leave Middle	-0.719*** (-13.83)	-
Unemployment Policy 1 (till 1978)	0.041 (1.59)	-0.046*** (-2.90)
Unemployment Policy 2 (from 1979 to 1991)	0.006 (0.29)	-0.111*** (-7.62)
Unemployment Policy 3 (since 1992)	0.025 (0.93)	-0.016 (1.02)
Parental Leave Policy 1 (till 1985)	-0.189*** (-5.86)	-
Parental Leave Policy 2 (from 1986 to 1991)	-0.342*** (-2.66)	-
Unemployment Middle * Policy 2	1.187* (1.70)	-
Unemployment Late * Policy 3	-	-
Parental Leave Middle * Policy 2	0.504*** (2.66)	-
R <sup>2</sup>	0.529	0.249
N	3136	4322

t-statistics in parentheses: \*/\*\*/\*\*\*: significant at the 0.10/0.05/0.01 level.

Table 8  
**Regression Results. OLS, robust standard errors. Affiliation time to the German Pension Insurance at least 30 years (women) and at least 40 years (men). Regression without the insignificant interaction terms.**

Variable	Women	Men
Constant	6.749*** (3.94)	3.833*** (5.10)
Family Status (Married)	-0.203*** (-13.13)	0.117*** (11.32)
Citizenship (German)	0.127*** (2.79)	0.037 (1.16)
log Retirement Age	-0.774* (-1.87)	0.005 (0.03)
Lower school (Hauptschule)	0.018 (0.77)	-0.074*** (-4.73)
Secondary School (Realschule)	0.158*** (7.80)	0.080*** (7.26)
High School Diploma (Abitur) with professional training	0.256*** (3.32)	0.120*** (3.72)
High School Diploma (Abitur) without professional training	0.189** (2.19)	0.171*** (3.98)
Advanced Technical College Degree	0.258*** (3.09)	0.227*** (17.33)
University Degree	0.392*** (8.33)	0.167*** (12.48)
1 Child	-0.022 (-1.00)	-
2 Children	-0.025 (-0.99)	-
3 Children and more	0.005 (0.19)	-
Unemployment Early	-0.392 (-0.92)	-0.338 (-1.23)
Unemployment Middle	-1.568** (-2.52)	-0.557*** (-6.32)
Unemployment Late	-0.205** (-2.35)	-1.914* (-1.86)
Parental Leave Early	-0.678*** (-23.30)	-
Parental Leave Middle	-0.671*** (-12.70)	-
Unemployment Policy 1 (till 1978)	0.023 (0.93)	-0.055*** (-4.29)
Unemployment Policy 2 (from 1979 to 1991)	-0.001 (-0.07)	-0.111*** (-8.95)
Unemployment Policy 3 (since 1992)	0.017 (0.65)	-0.017 (-1.34)
Parental Leave Policy 1 (till 1985)	-0.175*** (-4.40)	-
Parental Leave Policy 2 (from 1986 to 1991)	-0.300** (-2.23)	-
Unemployment Middle * Policy 2	1.183* (1.88)	-
Unemployment Late * Policy 3	-	1.866* (1.81)
Parental Leave Middle * Policy 2	0.359* (1.86)	-
R <sup>2</sup>	0.477	0.261
N	2719	3895

t-statistics in parentheses: \*/\*\*/\*\*\*: significant at the 0.10/0.05/0.01 level.

late employment period. That is why we will first present the regression results and then calculate the marginal and level effects in the second step. Currently, we will focus on the statistical significance of the core variables. Hence, the employment break variables as well as their interaction with the particular policy period dummies are of main interest. Table 6 reports that the interaction term of unemployment in the late employment period and the third policy period is insignificant for men and women. Regarding men, this is also the case for interaction term of unemployment in the middle employment period and the second policy period. That is why we can exclude them from the model. In conclusion, Table 6 only provided the whole model for completeness, whereas we have to focus on the regression results of Table 7 to determine the marginal and level effects. They refer to an affiliation time to the German Pension Insurance of at least 25 years. In the next step, Table 8 provides the results of affiliation times of at least 30 years for women and at least 40 years for men.<sup>6</sup> As before, these regressions do not include insignificant interaction terms.

## 4.2 Marginal and Level Effects

Marginal and level effects will be most important for the interpretation of the regression results. The marginal effects will tell us, by how much percent the pension benefits change when the employment break variables (shares) will change by a certain amount. For example, we might determine the effect on the pension benefits in percent, when the employment break variable change from 0.2 to 0.3, hence by 10 percentage points. Table 9 and 10 provide these marginal effects.

The employment break variables function as regressors themselves but are also included by the interaction terms. Thus, the first question will be if these two effects might cancel each other. Common F-Tests will decide on this issue. The null hypothesis will be that e.g.  $\alpha_5 + \gamma_3 = 0$ .<sup>7</sup> If this test cannot be rejected, this means that the two effects cancel each other and the respective marginal effect is zero. We get this result for parental leave in the middle period of life. But regarding unemployment in the late employment period, we reject the null hypothesis. Thus the two effects do not add up to zero.

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<sup>6</sup> The next section will also briefly comment on the robustness of the results due to the affiliation time.

<sup>7</sup> Note that this refers to the notation of the regression equation and would mean that we refer to parental leave in the middle employment period and its interaction with policy phase 2.

Table 9  
**Marginal Effects. Affiliation time at least 25 years**

	Women	Men
<b>Unemployment</b> Early Employment Period	no effect determinable	-0.064
<b>Unemployment</b> Middle Employment Period	-0.034	-0.058
<b>Unemployment</b> Late Employment Period	-0.021	-0.016
<b>Parental Leave</b> Early Employment Period	-0.074	
<b>Parental Leave</b> Middle Employment Period	0.000	

Table 10  
**Marginal Effects. Affiliation time at least 30 years for women and at least 40 years for men**

	Women	Men
<b>Unemployment</b> Early Employment Period	no effect determinable	-0.034
<b>Unemployment</b> Middle Employment Period	-0.039	-0.056
<b>Unemployment</b> Late Employment Period	-0.021	-0.005
<b>Parental Leave</b> Early Employment Period	-0.068	
<b>Parental Leave</b> Middle Employment Period	-0.031	

Tables 9 (affiliation time at least 25 years) and 10 (affiliation time at least 30 years for women and at least 40 years for men) provide the marginal effects. Regarding men, it follows, that career interruptions due to unemployment in the early and middle employment period indeed decreased pension benefits. Increasing the share of the employment break variable by 10 percentage points results in reductions of 6.4 or rather 5.8 percent in the first and 3.4 or rather 5.6 percent in the second scenario. Hence the higher the affiliation time, the more discriminative are the effects in the early and middle period of life. However, F-Tests report that the effects do not strongly differ between the early and the middle employment period. The inference regarding the timing changes, when the late employment period is considered, too. F-Tests on all the three employment break variables report that these coefficients differ statistically. However, the negative effects due to unemployment in the late employment period are weak. This basically does not fulfil our prospects. We will have to discuss and explain this effect in the next subsection.

Regarding women, penalties due to unemployment are somewhat smaller. Overall, there is no effect determinable in the early employment period as the respective coefficient is not significant. But unemployment in the middle and late employment period caused penalties. Increasing the share of the employment break variable by 10 percentage points results in reductions of 3.4 or rather 2.1 percent in the first and 3.9 or rather 2.1 percent in the second scenario. But as before, these effects do not differ statistically. In contrast, the results report higher penalties due to parental leave in the early period of life. An increase of the share of the employment break variable by 10 percentage points reduces the pension benefits by 7.4 or rather 6.8 percent. But, in the middle period of life, there is a compensation effect when parental leave occurred in the second policy period from 1986 to 1991 in comparison to the first policy period. In the second scenario (Table 10), the null hypothesis, that the coefficients of the employment break variable and the interaction sum up to zero, is rejected on a 10 significance level. Hence it results a negative effect of 3.1 percent. This compensation effect is perfectly compatible with the institutional changes. However, the comparison between the two specifications points out that it becomes smaller, the higher the affiliation time to the German Pension Insurance.

Moreover, we will stress an important finding: The marginal effects determined by the interaction of the employment break variables and the policy period variables correspond with the effects of more simple model specifications without policy variables. These models only use the employment breaks variables and indicate somewhat higher losses due to unemployment in the first two employment periods. The impact of unemployment in the late employment period is still negative but numerically smaller. From this follows, that the small marginal effects referring to the late employment period reported in Tables 9 and 10 are not driven by social policy. This could have been a sensible result if strong policy changes in favour of the unemployed/pensioners would have appeared from the second to the third policy phase. However, such a compensation effect due to social policy occurred with respect to parental leave in the middle employment period. Our model without political interactions also predicts losses due to parental leave in this period.

Alternatively, one could determine level effects instead of marginal effects. Calculating the level effects we also have to take into account the social policy dummy variables. The level effects will tell us by how much percent the pension benefits change when an employment break occurred in a particular employment period (Tables 11 and 12). We evaluate these ef-

fects using the means of the employment break variables when the respective employment break occurred (if share  $\neq 0$ ). F-Tests on the joint significance of the employment break variables and the social policy dummies tell us, whether we have to consider the insignificant dummy variables respectively. In comparison to the pattern given by the marginal effects, it becomes more differentiated. Unemployment in the middle employment period had a stronger impact on men's pension benefits than when it occurred in the early (or late) employment period. Pension benefits decreased by 16.0 or rather 15.4 percent compared to 6.7 or rather 6.8 percent in the early period, on average. As predicted by human capital theory, we might interpret this finding by smaller direct losses due to lower incomes in the beginning of the career and a maybe stronger restoration effect in time elapsed. Regarding women, the level effects point out that unemployment only weakly affected pension benefits and that the timing did not matter. In contrast, parental leave in the early employment period strongly reduced women's pension benefits by 54.2 or rather 48.5 percent. The penalties referring to the middle employment period were 34.2<sup>8</sup> or rather 39.7 percent. Hence social policy mitigated the respective losses. Interestingly, the penalties due to unemployment in the late employment period are again smaller than expected by the theoretical implications. This somewhat surprising effect needs to be explained. The next section provides two interesting arguments.

Table 11

**Level Effects. Affiliation time at least 25 years**

	Women	Men
<b>Unemployment</b> Early Employment Period	no effect determinable	-0.067
<b>Unemployment</b> Middle Employment Period	-0.026	-0.160
<b>Unemployment</b> Late Employment Period	-0.022	-0.048
<b>Parental Leave</b> Early Employment Period	-0.542	
<b>Parental Leave</b> Middle Employment Period	-0.342	

<sup>8</sup> Note that we do not consider the numerical difference between the employment break variable and the interaction term because they compensate each other.



Table 12

**Level Effects. Affiliation time at least 30 years for women and at least 40 years for men**

	Women	Men
<b>Unemployment</b> Early Employment Period	no effect determinable	-0.068
<b>Unemployment</b> Middle Employment Period	-0.038	-0.154
<b>Unemployment</b> Late Employment Period	-0.030	-0.026
<b>Parental Leave</b> Early Employment Period	-0.485	
<b>Parental Leave</b> Middle Employment Period	-0.397	

Lastly, we will comment on the robustness of these results regarding the affiliation time with the German Pension Insurance. First, results change when we do not control for the affiliation time and consider the whole sample. In this case, there were no significant losses due to unemployment in the early and late employment period for women. Furthermore, unemployment in the middle employment period even slightly increased women's pension benefits. Parental leave caused higher losses in the early and smaller losses in the middle employment period. Regarding men, unemployment in the early employment period strongly decreased pension benefits. However, these effects are not that meaningful, as the overall sample contains individuals with very special employment histories and we want to focus on individuals for which the German Pension Insurance was the core system. Second, increasing the affiliation time does not fundamentally change the results given in the current section. The effects due to unemployment of women are very robust. The losses due to parental leave were mitigated somewhat less. Unemployment in the late employment period reduced men's pension benefits steadily about 3 percent (level effect). It increases to 5 percent when an affiliation time of at least 47 years is considered.

### 4.3 Discussion

#### 4.3.1 Special characteristics of the data set

The different accession behaviour to retirement as well as the employment positions of the age-groups 1939 to 1943 contained in the VVL2004 provide essential explanations for the only weakly negative effects due to unemployment in the late employment period. The age-group 1939 describes the standard pensioners entering retirement with age 65. However, the individuals who indeed retired with age 65 could not afford to retire earlier because of indi-

vidual reasons. From a social security law perspective, this age-group could have retired earlier due to long-time insurance (“Rente für langjährig Versicherte”). However, individuals retiring earlier due to this law are not included in the VVL 2004, of course. In conclusion, the ones still included are in fact a selection of bad risks. As a result, the individuals born in 1939 accumulated much less Earning Points than the younger age-groups included in the data set. Moreover, the age-group 1941 is also somewhat special. In 2004, they had the last opportunity to retire earlier without penalties when they were currently unemployed (“Altersrente für Arbeitslose”). This was due the amendment “Wirtschaftsförderungsgesetz 1997”. Hence this might be indeed interpreted as an institutional factor influencing this particular age-group. Table 13 impressively points out how this arrangement seems to have affected the individuals included in the sample. More than one third of the individuals who were unemployed in the late employment period refer to the age-group 1941. The mean of the Earning Points of this group (54.21) is only somewhat smaller compared to the one of the employed individuals (56.41). Further it is even higher than the mean of not unemployed individuals of other age-groups in the sample, respectively. The numerical importance is also stressed by the high shares of this age-group when unemployed. These circumstances will drive the small negative effect of unemployment on the pension benefits in the late employment period.

Furthermore, we examined the respective effects for the single age-groups separately. Not surprisingly, we find that unemployment in the late employment period strongly decreased pension benefits for the individuals born in 1939. This finding is in line with the prospects of the human capital theory. Lastly, Table 14 reports the differences between the single age-groups of the data set also for women. The effects are similar, so that we will not comment on them any further.

Table 13

**Differences between the age-cohorts due to unemployment in the late employment period. Men.**

	1939		1940		1941		1942		1943	
	un-employed	employed	un-employed	employed	un-employed	employed	un-employed	employed	un-employed	employed
N	109	833	117	876	320	1055	174	370	164	279
Mean Earning Points	39.12	52.48	44.77	58.59	54.21	56.41	53.29	55.76	52.53	55.39
Mean Share of Parental Leave (Share if ≠0)	0.130	0	0.148	0	0.188	0	0.261	0	0.248	0

Table 14  
**Differences between the age-cohorts due to unemployment in the late employment period. Women.**

	1939		1940		1941		1942		1943	
	un-employed	employed	un-employed	employed	un-employed	employed	un-employed	employed	un-employed	employed
N	79	685	34	164	133	432	272	660	230	447
Mean Earning Points	16.96	19.11	24.72	30.70	28.56	28.62	31.13	34.06	28.21	31.37
Mean Share of Parental Leave (Share if ≠0)	0.199	0	0.171	0	0.217	0	0.243	0	0.234	0

In conclusion: The individuals unemployed in the late employment period were mostly wealthy or simply accumulated relatively many Earning Points so far. In particular, these were the age-groups 1941, 1942 and 1943. They were unemployed for an over proportionally long time and also form a relatively large group. Their influence seems to explain the reported marginal and level effects referring to unemployment in the late employment period.

#### 4.3.2 Endogeneity of the retirement age

There is a second argument that relates to the relatively low Earning Points of the age-group 1939 – the oldest in the current sample. This constellation also causes the effect that the retirement age does not affect the pension benefits in a positive way. But a positive relationship should be observable according to the German Pension Formula. In particular, a higher retirement age implies higher pension benefits when we control for the employment history, sociodemographic variables like education etc. at the same time. However, the regression results in Table 7 and 8 do not point out a positive effect of the retirement age, but rather a negative on the pension benefits. Thus, there seem to exist other factors, that drive the retirement age and thereby explain the selection of bad risks. The retirement age could be affected by the individual wealth, the income situation of the spouse or individual health. In other words, the coefficient of the retirement age might be biased and, thus, the same might hold for the coefficients of the employment break variables. In Potrafke and Steiner (2007) we can control for this potential endogeneity of the retirement age using respective instrumental variables from the GSOEP. Indeed, we find good instruments. Further, regressing the logarithm of the retirement age on the instruments and other variables of the model points out that there is a strong negative impact of unemployment in the late employment period on the retirement

age. We can also show this effect for the current data. But there are no eligible instrumental variables in the VVL 2004, unfortunately. The potential endogeneity of the retirement age could affect the current regression results. In Potrafke and Steiner (2007) we demonstrate how the effects could change. Thus, in conclusion, we have to interpret the current regression results somewhat carefully.

## 5 Conclusion

This paper provides empirical evidence how employment breaks in the individual life cycle affected pension benefits in Germany for West German individuals retiring in 2004. The data set “Vollendete Versichertenleben” (SUF VVL 2004) also allowed to distinguish between different affiliation times to the German Pension Insurance, so that our analysis could focus on pensioners for which the German Pension Insurance was the core social security system. We made two contributions: First, we explicitly took into account the timing of career interruptions distinguishing between three different employment periods. Second, we considered the changes in social policy that affected the allowances of employment breaks and controlled for their interaction. The results demonstrated that, regarding men, unemployment in the middle employment period reduced pension benefits more severely than when occurred in the early employment period. Unemployment was not that important regarding women. But parental leave emerged as crucial for women: Pension benefits were reduced due to parental leave in the early employment period. Considering the middle employment period, the penalties were somewhat compensated by social policy. Referring to human capital theory, we got the very surprising result, that unemployment in the late employment period only weakly decreased the pension benefits. We provided two strong explanations for this finding. First, there were very special characteristics of the age-groups 1939 to 1943 contained in the data set. The individuals unemployed in the late employment period accumulated relatively many Earning Points. Therefore the numerical distribution and institutional settings are responsible for current results. Second, the retirement age might be endogenous so that instrumenting would be necessary. But this is not possible due to data set restrictions. According to Potrafke and Steiner (2007), the application of instrumental variables could change the results fundamentally. Hence, we should interpret the current results carefully. Overall, we conclude, that the timing of employment breaks indeed matters. However, to be more concrete on the exact way it does, further studies are necessary. Comparing the current results with the ones of

Potrafke and Steiner (2007), we stress that it is very important to take structural differences in the data sets and their respective interpretations into account.

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