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ABSTRACT

Career Interruptions and Current Earnings: The Role of Interruption Type, Compensation Component, and Gender

This study examines how career interruptions and subsequent wages of employees are related. Using individual panel data of middle managers from the German chemical sector, we are able to differentiate between different reasons for interruptions as well as between various compensation components. We show that career interruptions are more related to lower subsequent bonus payments than they are to fixed salaries and that interruptions caused by unemployment are associated with higher interruption pay gaps than those resulting from other reasons. In addition, the pay gap after career interruptions is more pronounced for male employees than it is for females.

JEL Classification: M52, J31, J33, J71

Keywords: career interruptions, gender pay gap, stigma effects, bonus payments, fixed salaries, total compensation

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1 Introduction

Many people experience interruptions to their occupational careers at some point of time due to parental leave, unemployment, or other reasons. Subsequent employers may take these interruptions into account in terms of compensation decisions. Expected or actual productivity may have suffered because of career interruptions in terms of human capital depreciation (Mincer & Polachek, 1974). Besides, they may lead to some kind of stigma effect in the sense of Gibbons & Katz (1991) if employers use career interruptions as signals of a lack of ability or a lack of career commitment. Hence, career interruptions may lead to lower subsequent wages.

Indeed, the vast majority of previous studies do find some interruption pay gaps (Albrecht et al., 1999; Beblo & Wolf, 2002a; Spivey, 2005; Evertsson & Grunow, 2012). These studies usually examine only the relation between interruptions and total compensation, either in the form of hourly wages or yearly earnings. The relation between career interruptions and various compensation components has not been considered so far. Lemieux et al. (2009) point out, however, that fixed salaries and variable payments depend to varying degrees on individual performance, so that bonus payments may be affected to a different degree than fixed salaries, for instance. We build on the existing literature by taking different types of interruptions as well as the role of gender into account and extend the analysis with regard to various compensation components.

Making use of a panel dataset of professionals and managers from the German chemical industry, we extend previous research on career interruptions by disentangling the relation between career interruptions and compensation components such as fixed salaries and bonus payments next to total yearly compensation. We consider the incidence as well as the duration of interruptions. We also distinguish between types of interruption, focusing on parental leave and unemployment in particular, and we take the role of gender for the relevance of career interruptions for current wages and gender pay gaps into account. By making use of a rather homogeneous sample of employees, we can exclude part of the (unobserved) heterogeneity which is relevant for conventional broad surveys of employees. We will use the term *interruption (pay) gap* to label lower wages of employees with (longer) periods of interruptions during their occupational careers.

The reminder of the paper is organized as follows: Section 2 imparts the relevant theoretical considerations and gives an overview of previous empirical research. On this basis, we derive hypotheses for the financial consequences of preceding career interruptions. We describe the data and variables in Section 3. In Section 4 we present our results. Section 5 concludes.

2 Theoretical considerations, previous empirical studies, and hypotheses

Two theoretical frameworks can mainly explain possible negative effects of career interruptions on subsequent earnings: (1) human capital theory in conjunction with the skill depreciation hypothesis and (2) stigma considerations. According to human capital theory, a worker's remuneration depends positively on her stock of human capital, since the level of acquired skills and knowledge determines the worker's productivity and therefore her or his value to the employer (Becker, 1964; Mincer & Polachek, 1974). During periods of inactivity, human capital is most likely not further accumulated - or may even depreciate - as long as people do not use periods of career interruptions for further education or training measures. Employees may forget accustomed operating processes as they are no longer using them or they may fail to adopt new techniques or to keep up with technical progress during their absence from work and may therefore be confronted with technical as well as economic obsolescence of their human capital (Grip & van Loo, 2002; Beblo & Wolf, 2002a; Edin & Gustavsson, 2008). Even if we assume that no depreciation of human capital occurs during the absence, we may still observe a roughly similar negative effect on earnings due to foregone experience, because human capital has still decreased relatively compared to workers without career interruptions, who have increased their stock of human capital during that period (Neuman & Weiss, 1995).

In line with these considerations, previous empirical research has identified a negative effect of career interruptions on compensation as a result of human capital depreciation (Mincer & Polachek, 1974; Mincer & Ofek, 1982; Light & Ureta, 1995; Beblo & Wolf, 2002a). We therefore formulate

Hypothesis 1: Employees with career interruptions will receive lower wages compared to employees with a continuous career path.

Previous studies have hardly paid any attention to the effect of career interruptions on certain wage components separately. However, there are good reasons to believe that interruptions might affect the wage components on various scales. At least large firms typically remunerate their employees according to a company-wide wage policy, e.g. by placing groups of jobs into specific job grades in order to subsequently attach a common compensation procedure. As a result, fixed salaries in particular are restricted within the ranges of the firm's salary structure (Eriksson & Gottfries, 2005). Lemieux et al. (2009) and La Rica et al. (2015) argue therefore that fixed salaries rely more heavily on job characteristics, or on a company-wide compensation system, while bonus payments are tied more closely to an employee's individual characteristics, such as effort, ability or career orientation. First evidence of a more narrow range of basic salary within a given type of job rather than across jobs is found by Bishop (1987). In line with that, Barth et al. (2012) confirm empirically that performance pay leads to greater wage differentials compared to payment systems based on fixed salaries. Therefore, we hypothesize that

Hypothesis 2: Career interruptions are more negatively related to bonus payments than they are to fixed salaries.

Gibbons & Katz (1991) point out that labor-market-relevant issues observed by employers may lead to stigma effects, for instance because individual dismissals signal a low ability, which results in lower subsequent wages. In this sense, employers may also interpret past non-employment spells as a signal of lower ability or weaker career commitment. Then the question occurs as to whether all types of interruptions are associated with stigma effects to the same extent. Vishwanath (1989) highlights that stigma effects caused by periods of being unemployed may result in lower re-employment opportunities or lower wage offers

Previous empirical evidence is mixed. Some empirical studies do not find differences across types of interruptions (Hayter, 2014) or particular interruption pay gaps for maternity leave (Beblo & Wolf, 2002b; Kunze, 2002). There is also evidence of the specific relevance of wage penalties due to unemployment: Meurs et al. (2010) find for the French labor market that past periods of unemployment are the most penalizing for both females and males. Albrecht et al. (1999) find the negative effect of the incidence of unemployment to be twice as large as the effect of parental leave on subsequent earnings for Sweden.

Our conjecture is also that unemployment may have the largest relevance. In this case we, first, consider the signaling or stigma effects mentioned above to be more meaningful. Second, although negative consequences may also result from leaves of absence (e.g. Judiesch & Lyness, 1999), skill depreciation in terms of loss of firm-specific human capital and stigma effects are assumed to be more severe if the employment relationship is terminated and an employee is re-employed in another firm. This is much more obvious subsequent to interruptions caused by unemployment than it is in the case of parental leave or other types or interruptions.

These considerations lead to

Hypothesis 3: Unemployment spells are associated with larger wage losses than other forms of career interruption are.

The effect of career interruptions may further differ between men and women. Traditional gender roles have shaped complementary responsibilities of women and men in society and formed petrified patterns of expected social behavior over the decades (Reskin, 1994). Research has revealed that women experience more interruptions during their occupational career than male workers do (Albrecht et al., 1999; Beblo & Wolf, 2002b; Cebrìan & Moreno, 2015). As Hayter (2014) shows, men and women also differ in their reasons for their career interruptions, e.g. women take leave for family reasons more often than men do. Schneer & Reitman (1990) argue that women face lower cuts in salary subsequent to parental leave spells, as firms already expect these interruptions to some extent when they recruit females.

However, whether those gender differences lead to actual gender-specific interruption pay gaps is an ongoing debate. Hayter (2014) finds no gender differences across types of interruption for the U.S. using National Longitudinal Survey of Youth (NLSY) data. Schneer & Reitman (1990) find career interruptions to have a smaller detrimental effect on income for females than for male workers among M.B.A. degree holders in the U.S. in general. Albrecht et al. (1999) report similar results, when controlling for the duration of a career interruption for Swedish workers. They run separate regressions for men and women and estimate the effect of total time-out to be more damaging for males. In addition, when distinguishing between several types of interruptions, e.g. parental leave and unemployment periods, they observe that men suffer from greater wage penalties than women do, in both cases. They attribute the observed results to signaling effects. With regard to unemployment spells, also Beblo & Wolf (2002b) and Meurs et al. (2010) show that men face larger wage penalties on the French and German labor markets.

Based on the arguments above, we consider the type of interruption to be relevant, and we formulate

Hypothesis 4a: Interruption pay gaps are more pronounced for male employees than for females after parental leave.

Since the probability of being affected by unemployment is similar for men and women and the gender role/stereotyping argument is believed to be less relevant for unemployment than it is for parental leave, we form

Hypothesis 4b: Male and female workers face no differences in interruption pay gaps subsequent to unemployment spells.

3 Data and variables

3.1 Data and sample

Our data is based on a yearly salary survey among professionals and managers from the German chemical sector, collecting individual information on workers' demographics, such as work experience and field of study, and job characteristics, e.g. level of hierarchy, functional area, and firm size. The survey is conducted on an annual basis in collaboration with the German Association of Employed Academics and Executives in the Chemical Industry (Verband angestellter Akademiker und leitender Angestellter der Chemischen Industrie e.V. (VAA)). For our study, we make use of the three most recent waves (2013 – 2015). In those years, an average of 443,000 blue- and white-collar employees were working in the German chemical sector (Statista, 2017). An estimated share of 0.1 of those had jobs relevant to the VAA. During the period 2013-2015, the VAA contacted 18,100 active members on average. Therefore, the association is rather well organized with a quota of about 0.45 of suitable employees, covering a representative part of appropriate employees in the German chemical industry. The combination of a large sample size and the degree of information on compensation components, such as fixed salaries and variable payments, i.e. bonus and other payments, is a unique feature of our dataset. In addition, the dataset also allows us a more differentiated view of the occurrence and duration of various types of career interruptions in combination with gender.

We consider full-time working employees in Western Germany. We exclude top managers from the analysis, as their compensation contracts differ considerably from those of middle managers. In addition, we only consider university graduates with a STEM degree.[1] These restrictions lead to a rather homogenous sample of 11,038 observations.

3.2 Measures and controls

Dependent variable

We are able to subdivide total yearly compensation into its components, comprising fixed salaries and contingent payments. Fixed salaries account for 0.79 of total compensation. In addition to fixed remuneration, 9 of 10 employees also receive a bonus payment and almost two thirds some other payment, such as stocks and stock options, specific compensation for inventions, and supplementary payments such as those for anniversaries as well as a perquisite due to a company car. In sum, bonus payments account for 0.16 and other payments for 0.05 of total compensation.

Table 1 shows averages, standard deviations and coefficients of variation of total compensation and its components. All of these figures have been averaged across years but are deflated by the consumer price index to the base year of 2013, as prices increased only very slightly in 2014 (0.009) and 2015 (0.003). An employee in the chemical sector receives on average 128,000 €. While the dispersion of fixed income accounts for 0.27 compared to the mean, variable payments show coefficients of variation over three times greater than that, which hints at a higher relevance of more individually based determination of contingent pay.

We observe a raw pay gap between those who have interrupted their careers and employees who have a continuous career path of -0.21. This interruption gap differs across components and is less pronounced for fixed salaries (-0.17) compared to bonuses (-0.33) and other payments (-0.34) if received. We focus on fixed salaries and bonus payments next to total compensation in this contribution, since the aggregated category of other payments consists of very different components, which would make it difficult to interpret.[2]

[1] We further delete 43 observations because those individuals report an implausible total yearly compensation of less than € 20,000 or abstain from providing any information on total compensation.
[2] Other payments contain very different single components such as stocks, anniversary payments, and inventors' bonuses. The authors will provide corresponding results on request.

Table 1: Mean amount of pay components by occurrence of career interruptions

	All (n=11,038)			No interruption occurred (n=9,260)			Interruption occurred (n=1,778)			Gap
	Mean	**SD**	**CV[1]**	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	
Total compensation	127,733 €	51,923	40.7	132,277 €	52,921	40.0	104,066 €	38,530	37.0	-0.213
Fixed salaries	100,881 €	27,523	27.3	103,651 €	27,479	26.5	86,452 €	22,848	26.4	-0.166
Bonus payment	20,642 €	20,892	101.2	21,965 €	21,650	98.6	13,750 €	14,566	105.9	-0.374
Share of bonus >0	0.906	--	--	0.916	--	--	0.853	--	--	--
Bonus payment (if received)	22,793 €	20,807	91.3	23,988 €	21,525	89.7	16,116 €	14,511	90.0	-0.328
Other payments	6,210 €	17,732	285.5	6,661 €	18,571	278.8	3,863 €	12,222	316.4	-0.420
Share of other >0	0.645	--	--	0.658	--	--	0.574	--	--	
Other payments (if received)	9,634 €	21,327	221.4	10,121 €	22,115	218.5	6,727 €	15,522	230.7	-0.335

[1] CV: Coefficient of variation (CV = (SD/Mean)*100)

Independent variables

We focus on career interruptions. We can distinguish between parental leave, unemployment, and other types of interruptions. The latter category aggregates interruptions due to sabbatical leave or caring for relatives, for instance. For each category, participants are asked to report the total number of months they have been in that situation since the beginning of their career. We use this information in two ways. First, we explore the *incidence* of interruptions and construct a dummy variable indicating whether a (specific) interruption occurred or not. One of six employees has interrupted their working life at least once (see Table 2). The incidence of unemployment and parental leave is equally relevant (each 0.08). Second, we examine the *duration* of interruptions, which amounts to 0.8 years (10 months) on average.

We observe considerable gender differences in both the incidence and the duration of interruptions. The share of female employees whose career has been interrupted is twice as large (0.30) as that of male workers. Females also report considerable longer periods of absence from work on average (1.5 years on average). Their longer periods of absence from the labor market are mainly caused by longer periods of taking care of children or due to other reasons. Since the latter reason is of no particular relevance in the sample, because only 0.014 of the whole sample was affected, we will not go into more detail throughout this study.[3]

Table 2: Types of career interruptions (by gender)

	All employees **Share of employees affected**			**Employees with interruptions** **Total duration in years**		
	Whole sample **(n= 11,038)**	**Males** **(n=9,681)**	**Females** **(n=1,357)**	**All** **(n= 1,778)**	**Males** **(n= 1,372)**	**Females** **(n= 406)**
Career interruptions	0.161	0.142	0.299	0.810	0.587	1.564
Types of interruption						
Parental leave	0.081	0.063	0.203	0.695	0.343	1.480
Unemployment	0.082	0.079	0.107	0.618	0.584	0.797
Other type	0.014	0.012	0.031	1.697	1.343	2.641

Note: The indicated shares for/durations of each type of career break might not add up to the indications made for interruptions in general, as the same individual might have experienced several types of interruptions during her or his career.

[3] Since we do not consider the likelihood of re-entering the labor market but only investigate the compensation effects for those who are currently employed, the sample selection may be relevant in particular for women. Therefore, our results regarding the impact of the interruption on current compensation may be biased downwards.

We consider several individual and job-based characteristics (see Table 3). The vast majority of the participants are males (0.88) and are quite advanced in their careers, reporting 22 years of (potential) work experience on average. We distinguish between seven fields of studies within the STEM area. More than 0.8 of survey participants hold a degree in chemistry or engineering and more than 0.7 also hold an additional doctoral degree. In particular, for the discipline of chemistry, it is very common for graduates in Germany to complement their studies with a doctoral degree. The chemical sector is characterized by stable work relations, which is expressed by an average amount of firm tenure of 17 years. We control for four categories of firm size based on the number of employees. The chemical industry is dominated by large firms with more than 10,000 employees. We further distinguish between three levels of the firms' hierarchies. Individuals report levels from level 4 (some management responsibilities) to level 2 (senior management). The top management (level 1) is excluded because of essential different compensation principles as stated above.[4] We also consider actual weekly working hours and the year of the observation.

Distinguishing between employees who experienced a career break and those with a continuous career path, we observe some differences in these characteristics. It is particularly noticeable that workers who had interrupted their careers report substantially shorter firm tenure and are employed at a lower level of the hierarchy in the current firm. The incidence of interruptions is further negatively associated with actual working time. Besides, female employees and employees currently working in smaller firms are more likely to report interruptions during their careers so far.

[4] Around 19 percent of the employees on level 1 have experienced a career interruption during their careers, which is slightly more than the average of the other hierarchy levels. However, we find no significant difference in the duration of those interruptions compared to lower hierarchy levels (≈ 0.157 years).

Table 3: Descriptive statistics

	Whole Sample		No interruption occurred		Interruption occurred		t-test / X^2 -test
	Mean	SD	Mean	SD	Mean	SD	p-value
Individual characteristics							
Female	0.123		0.103		0.228		0.000
(Potential) Experience in years	21.81	8.478	22.38	8.419	18.88	8.175	0.000
Field of Study							0.000
Chemistry	0.557		0.536		0.583		
Engineering	0.268		0.259		0.161		
Biology	0.045		0.044		0.072		
Physics	0.028		0.027		0.022		
Medical science	0.016		0.015		0.025		
Pharmaceutics	0.051		0.049		0.055		
Other natural sciences	0.035		0.034		0.055		
Doctoral degree	0.719		0.710		0.765		0.000
Job characteristics							
Tenure (in years)	16.27	32.213	17.37	29.464	12.1	43.535	0.000
Level of hierarchy							0.000
Level 2	0.112		0.117		0.083		<
Level 3	0.519		0.542		0.381		
Level 4	0.370		0.338		0.536		
Functional area							0.000
Production	0.184		0.188		0.165		
Research & Development	0.319		0.309		0.369		
Technical & Process engineering	0.109		0.119		0.056		
Applications engineering	0.060		0.061		0.056		
Sales, marketing, logistics, sourc-ing	0.091		0.090		0.095		
Finance, controlling, human re-sources	0.038		0.041		0.026		
Technical supervision	0.060		0.064		0.042		
IT	0.022		0.021		0.026		
Other	0.117		0.108		0.165		
Firm size							0.000
Fewer than 1,000	0.200		0.186		0.271		
1,000 - 5,000 employees	0.212		0.213		0.205		
5,001-10,000	0.115		0.116		0.112		
>10,000	0.474		0.485		0.412		
Actual weekly working hours	45.97	5.411	46.26	5.469	44.48	4.837	0.000
Year							0.000
2013	0.348		0.358		0.297		
2014	0.326		0.326		0.329		
2015	0.325		0.316		0.375		
# Observations	11,038		9,260		1,778		

4 Results

We conduct Mincer-type wage regressions using pooled OLS estimations with robust standard errors clustered at the firm level to examine the relation of previous career interruptions and current earnings.[5] We use the log of total compensation, fixed salaries, and bonus payments as dependent variables. Corresponding to the literature on gender pay gaps, we speak of possible *interruption pay gaps (*or short *interruption gaps)* if people with interruptions receive lower wages in their subsequent careers. Work experience and the level of hierarchy are most important for the decrease of the interruption coefficient, since interruptions hinder employees from climbing the internal hierarchical ladder.

We start by examining the relation of incidence of a career interruption in the career so far (independent of its reason) as a binary variable and total compensation in Table 4. Model (1) takes only year dummies into account and shows a raw interruption gap of -0.21. Additional individual characteristics (gender, potential experience, field of study, and tenure) and job-specific characteristics (hierarchy level within the firm, functional areas, working hours, and firm size) are considered successively in Models (2) and (3). Controlling for individual characteristics (Model 2) the interruption pay gap decreases to 0.13. Considering the job characteristics, the gap further shrinks to 0.08, but remains highly statistically significant. This decrease of the coefficient indicates that managers with career interruptions have lower chances of achieving well paid jobs. Work experience and the level of the hierarchy are most important for the decrease of the interruption coefficient, indicating that interruptions hinder employees from climbing the internal hierarchical ladder. In Model (4), we additionally consider the aggregated duration of career interruptions in years as an independent variable next to the individual and job-specific characteristics. On average we observe a conditional gap of 0.04 per year of career interruption.

[5] Note that most career interruptions occurred before our period of observation and that the salary survey contains no further information about the dates during which a career interruption occurred, so we are not able to control for employees' fixed effects.

Table 4: Pooled wage regressions on total earnings

	(1)		(2)		(3)		(4)	
Career interruption (1=yes)	-0.234***	(0.013)	-0.140***	(0.016)	-0.0818***	(0.014)		
Total duration of career interruption (in years)							-0.0434***	(0.010)
Experience			0.0595***	(0.002)	0.0431***	(0.003)	0.0433***	(0.003)
Experience squared			-0.000858***	(0.000)	-0.000591***	(0.000)	-0.000585***	(0.000)
Field of Study (base: chemistry)								
Engineering			0.111***	(0.023)	0.0709***	(0.018)	0.0710***	(0.019)
Biology			-0.0121	(0.023)	0.00365	(0.018)	0.000890	(0.018)
Physics			0.0417	(0.030)	0.0266	(0.021)	0.0237	(0.020)
Medical Science			0.0901**	(0.044)	0.0867***	(0.024)	0.0894***	(0.028)
Pharmaceutics			0.0886***	(0.023)	0.0792***	(0.016)	0.0783***	(0.015)
Other natural sciences			0.0328	(0.021)	0.0232	(0.016)	0.0200	(0.015)
Doctoral degree			0.116***	(0.009)	0.0647***	(0.009)	0.0624***	(0.010)
Female			-0.0741***	(0.012)	-0.0403***	(0.009)	-0.0334***	(0.007)
Tenure					0.000243***	(0.000)	0.000248***	(0.000)
Level of hierarchy (base: level 3)								
Level 2					0.230***	(0.036)	0.229***	(0.037)
Level 4					-0.171***	(0.013)	-0.175***	(0.013)
Functional area (base: R&D)								
Production					0.0185*	(0.010)	0.0175*	(0.010)
Technical & Process engineering					-0.00391	(0.013)	-0.00291	(0.013)
Applications engineering					-0.00419	(0.018)	-0.00433	(0.018)
Sales, marketing, logistics, sourcing					0.0593***	(0.016)	0.0573***	(0.015)
Finance, controlling, human resources					0.0571***	(0.014)	0.0605***	(0.013)
Technical supervision					-0.0104	(0.012)	-0.00714	(0.011)
IT					-0.00752	(0.017)	-0.00538	(0.017)
Other					-0.0173*	(0.010)	-0.0183*	(0.010)
Firm size (base: 1,000 - 5,000 employees)								
Fewer than 1,000					-0.139***	(0.015)	-0.142***	(0.015)
5,001-10,000					0.0370**	(0.018)	0.0361*	(0.018)
>10,000					0.138***	(0.016)	0.138***	(0.015)
Actual weekly working hours					0.00889***	(0.001)	0.00916***	(0.001)
Year dummies	Yes		Yes		Yes		Yes	
Intercept	11.71***	(0.049)	10.76***	(0.042)	10.58***	(0.094)	10.56***	(0.097)
Observations	11,038		11,038		11,038		11,038	
Adj. R-squared	0.054		0.436		0.650		0.649	

Cluster-robust standard errors in parentheses; significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

In contrast to previous research, which has only determined the relation of interruptions on total income, we additionally investigate the effect on compensation components. In Table 5 we re-estimate Models (3) and (4) of Table 4, using log of fixed salaries and bonus payments rather than total compensation as the dependent variable. We only report the estimates for interruption gaps here. The first two columns present estimated coefficients considering the incidence of career interruptions, whereas the final two columns present estimates based on the accumulated years of career interruptions. As not all employees receive bonus payments, the sample size is reduced by 0.09 when investigating the relation of interruptions on bonus payments.[6] The interruption gap differs considerably between components. It is considerably larger in bonus payments (0.08) than for fixed salaries (0.06). Considering durations rather than the incidence of interruptions, we even observe a twice as large interruption gap in bonus payments than in fixed salaries (-0.03 > -0.06, Wald-test: p=0.007). The results in Table 6 are therefore consistent with our hypothesis 2. Fixed salaries, on the other hand, tend to vary in a narrower range due to company wage systems.

Table 5: Pooled wage regressions on compensation components

	(1) Log fixed salaries	(2) Log bonus payments	(3) Log fixed salaries	(4) Log bonus payments
Career interruption (1=yes)	-0.0627*** (0.012)	-0.0860*** (0.022)		
Years of career interruption			-0.0291*** (0.008)	-0.0570*** (0.015)
Indiv. characteristics	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	11,038	9,996	11,038	9,996
Adj. R-squared	0.648	0.378	0.645	0.378

Cluster-robust standard errors in parentheses; significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

In the next step, we disaggregate our interruption variable in order to differentiate between the respective reasons for the career interruption (see Table 6). Considering the aggregated duration of parental leave, unemployment, and other types of interruption, we find that an additional year of not working on account of unemployment is associated with a subsequent disadvantage in total compensation of 0.10. In contrast, interruptions due to parental leave, or other non-employment spells, are significantly less related to total compensation (Wald-Test: p<0.001), as they are associated with comparatively low pay gaps of 0.01 to 0.03.

[6] Qualitative results hold with Tobit estimations, though. The results will be provided by the authors on request.

Our findings confirm the general results of Albrecht et al. (1999) and Beblo & Wolf (2002b) that it is important to control for the reason for the career interruption. For fixed salaries and bonus payments, we observe the same patterns as for total compensation. Again, interruption gaps are highest for unemployment spells (compared to parental leave and other types of interruption) and for bonus payments compared to those in fixed salaries.

Table 6: Pooled wage regressions on compensation components evaluating interruption types

Incidence of interruption	(1) Log total compensation	(2) Log fixed salaries	(3) Log bonus payments
Parental leave (1=yes)	-0.0248** (0.010)	-0.0232*** (0.008)	-0.0105 (0.031)
Unemployment (1=yes)	-0.0976*** (0.025)	-0.0860*** (0.023)	-0.167*** (0.029)
Other type (1=yes)	-0.0276 (0.018)	-0.0306* (0.018)	0.0409 (0.043)
Indiv. characteristics	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	11,038	11,038	9,996
Adj. R-squared	0.651	0.649	0.379
Years of career interruptions	(5) Log total compensation	(6) Log fixed salaries	(7) Log bonus payments
Parental leave	-0.0264*** (0.007)	-0.0202*** (0.005)	-0.0344** (0.016)
Unemployment	-0.109*** (0.005)	-0.0896*** (0.004)	-0.180*** (0.018)
Other type	-0.0139*** (0.003)	-0.00920*** (0.002)	-0.0287* (0.015)
Indiv. characteristics	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	11,038	11,038	9,996
Adj. R-squared	0.651	0.649	0.379

Cluster-robust standard errors in parentheses; significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Rather than just being caused by skill depreciation, wage penalties therefore seem to be also the result of some stigma or signaling effects associated with specific non-employment spells. Our findings further support our hypothesis 3 that unemployment spells are associated with greater compensation disadvantages compared to other forms of career interruption. The estimated interruption gap stemming from unemployment is four times stronger than when taking parental leave.

As stated above, male and female workers differ considerably in their tendency to pursue their careers, which is why occurring interruption gaps may also be different in size (hypothesis 4). Considering a moderating effect of gender on the relation between career interruptions and compensation, we interact the female dummy with the total duration of (the respective type of) interruptions. Results are shown for the different compensation components in Table (7).

The career interruption gap with regard to total compensation is much lower for females (0.02) than for males (0.06) (see Model (1)). The same pattern holds for the different reasons for interruptions. Contrary to our expectations, we not only observe a gender-based difference subsequent to parental leave but also to unemployment periods (see Model (2)). Taking time off for the duration of one year to care for children is also associated with lower total compensation in the amount of 0.06 for males, while we estimate a smaller interruption gap of 0.02 for women who have been on parental leave. Both males and females face greater interruption subsequent to unemployment spells. Gender differences in coefficients are even larger. For male workers, the interruption gap adds up to 0.13, in contrast to 0.05 for female workers (Wald-Test: $p<0.001$).

Disaggregating total compensation into fixed salaries and bonus payments, we observe the same general patterns, with interruption gaps being again greater for bonus payments. Irrespective of the compensation component, male workers suffer more from career interruptions than women do. The only exception is for bonus payments, where we observe no gender differences in the aftermath of parental leave (see Model (6)).

Our results therefore mainly confirm our hypothesis 4a that male workers have to face greater earnings disadvantages subsequent to parental leave. Contrary to our conjecture (hypothesis 4b), interruption gaps resulting from unemployment are also larger for males. Employers may have gender-specific expectations about career interruptions in general, which leads to some kind of gender pay gap. Then, males in particular will be affected by interruptions because of

not having met the expectation.[7] An alternative explanation for the lower interruption gap of female workers is that only those female managers with better career prospects, due to some form of greater unobserved ability, have interrupted their careers so that the observed gender pay gap may underestimate the true effect.

Table 7: Pooled wage regressions on compensation components evaluating the interaction of gender and duration of interruption by types

Duration of interruption	(1) Log total compensa-tion	(2) Log total compensa-tion	(3) Log fixed salaries	(4) Log fixed salaries	(5) Log bonus payments	(6) Log bonus payments
Female	-0.0408***	-0.0430***	-0.0315***	-0.0330***	-0.0669	-0.0718*
	(0.009)	(0.009)	(0.006)	(0.006)	(0.041)	(0.039)
Years of interruption	-0.0670***	---	-0.0529***	---	-0.122***	---
	(0.019)	---	(0.016)	---	(0.041)	---
Years of parental leave		-0.0595***		-0.0454***		-0.0949*
		(0.014)		(0.011)		(0.055)
Years of unemployment		-0.143***		-0.115***		-0.277***
		(0.015)		(0.011)		(0.037)
Years of other type		-0.0103		-0.00691		-0.0340**
		(0.010)		(0.007)		(0.017)
Female x Years of interruption	0.0438***	---	0.0385**	---	0.0966**	---
	(0.016)	---	(0.016)	---	(0.042)	---
Female x Years of Parental leave		0.0382**		0.0291**		0.0690
		(0.019)		(0.015)		(0.062)
Female x Years of Unemploy-ment		0.0940***		0.0719***		0.250***
		(0.023)		(0.016)		(0.056)
Female x Years of Other type		-0.00909		-0.00612		0.00663
		(0.017)		(0.016)		(0.041)
Indiv. characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,038	11,038	11,038	11,038	9,996	9,996
Adj. R-squared	0.650	0.652	0.647	0.650	0.379	0.380

Cluster-robust standard errors in parentheses; significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

We conduct a series of robustness checks and additional estimations to assess the stability of our estimates across the compensation distributions and over a number of subsamples. First, we re-estimated the specifications used for Tables 4 to 7 by applying quantile regressions. The estimated interruption pay gaps are quite stable across the distributions. If at all, they are slightly

[7]Applying a median-split on work experience (=23 years), we find a larger moderating effect of gender on the interruption gap for the more experienced managers. Due to data constraints, a distinction between either age or generation effects as a reason for the different results is not feasible.

more pronounced at the bottom of the distribution (see Table A in the Appendix). We observe the same pattern when additionally checking for different relations across the distributions of the compensation components. We have also considered a possible moderating effect of hierarchy level. Our results indicate that interruption pay gaps are more pronounced for managers on higher levels of the hierarchy (see Table B in the Appendix). Moreover, we checked for robustness with regard to outliers in terms of the duration of interruption. Re-estimating Model (1) of Table 5 without the 273 observations with the top 1 percent in terms of the duration of interruptions (more than 2.25 years), the interruption gap increases considerably from -0.04 to -0.09.[8] The estimated coefficients of interruption gaps on earnings can therefore be seen as more conservative estimations of the true effect.

Our study is also linked to research on the gender pay gap, since we are able to show that career interruptions do explain observed earnings differences between male and female employees to some extent (see Table 8). We gradually introduce further information about the observed employees and their jobs to the source specification, which only takes sex and year dummies into account. Adding person and job characteristics reduces the conditional gender wage gap from initial 0.19 in Model (1) to 0.04 in Model (3). However, a statistical significant gender pay gap remains unexplained even after controlling for person or job characteristics. The gender pay gap further decreases at each stage to finally 0.03, when adding information about the total duration of all career interruptions. A more detailed analysis (available on request) has shown that parental leave is able to explain the gender wage gap to a greater extent than other interruptions, such as unemployment, are.

[8] The detailed results will be provided by the authors on request.

Table 8: Gender pay gap, pooled regressions on log total compensation

Duration of interruption	(1)		(2)		(3)	
Female	-0.206***	-0.186***	-0.0916***	-0.0672***	-0.0440***	-0.0307***
	(0.029)	(0.028)	(0.012)	(0.009)	(0.009)	(0.007)
Duration of career interruption	No	**Yes**	No	**Yes**	No	**Yes**
Indiv. characteristics	No	No	**Yes**	**Yes**	**Yes**	**Yes**
Job characteristics	No	No	No	No	**Yes**	**Yes**
Year dummies	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Observations	11,038	11,038	11,038	11,038	11,038	11,038
Adjusted R-squared	0.034	0.040	0.418	0.428	0.645	0.649

Cluster-robust standard errors in parentheses; significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As does every empirical work, our study also has some limitations. A common, but inevitable, problem regards a possible selection bias, as we only observe wages of employees who have returned to the active workforce after a career break. We cannot take into account whether employees who actually returned have certain individual characteristics that positively influence their career expectations. Besides, certain types of interruptions, such as caring for relatives or parental leave, might be more fulfilling or have greater importance attached to them than others, such as unemployment. We cannot consider possible interruption type return probabilities, either. Hence the estimated depreciation rates rather underestimate the true effect, as those employees who anticipate the largest penalties are not expected to return to the active workforce (Corcoran, 1979; European Commission, 2013).

It might be reasonably assumed that the observed pay gap in the various earnings components depends on the point in time when these earnings are measured. Light & Ureta (1995) and Spivey (2005) have shown that the timing of career interruptions may significantly alter the effects on total salary, by applying the work-history model. According to Mincer & Ofek (1982), the observed human capital depreciation rates depend on the elapsed time since the interruption and may to some extent be reversible. In the period of re-entering the labor market, wages are therefore both of the following: first, lower compared to the time before the interruption and second, relatively lower on average compared to those without an interruption. However, earnings would rapidly increase in the subsequent period due to the restoration of previously eroded human capital. In the long-run, the wage growth should settle at a similar rate as that of employees with continuous career paths, but more likely at a lower wage level.

Although no information about the timing of the interruption was provided by those surveyed, we were able to approximate the time when the interruption occurred, at least for unemployment. Since the last period during which an employee was employed may only be observed before the start of the current employment, we determine the last unemployment episode by referring to tenure. Re-estimating the models of Table 5, an interaction term between the duration of unemployment and tenure, we find that current income disadvantages do significantly decrease, the further back an interruption due to unemployment dates. Conversely, interruptions which occurred a longer time ago seem to have a lower effect on earnings. Hence, the aforementioned coefficients in Tables 4-8 might be underestimated, as most of the respondents are characterized by shorter tenure (50% of the employees with former unemployment spells have been employed for fewer than 8 years).

5 Conclusion

In this paper, we have used individual panel data of managers from the German chemical sector to examine the link between career interruptions and subsequent compensation and its components. We examine a rather homogeneous and high-qualified group of employees working in the same sector and show that former interruptions are indeed associated with lower current earnings, which is in line with previous research. We also show that earlier unemployment spells have a greater effect on earnings than non-employment periods that stem from parental leave or other reasons do, indicating that human capital depreciation does not explain the complete interruption gap, but that some kind of stigma effect may be relevant. In addition, we find that male managers face larger interruption pay gaps in their subsequent career than females do. Our results hint at the reasoning that traditional gender stereotypes are responsible for the divergent results, although they seem to be less pronounced among the younger generation. Future research may explore the question of whether this result is actually based on age or whether the compensation policy of firms has changed so that there are differences across generations. Indeed, there are hints that some firms relevant for our study have recently started to adjust wages in the course of a person returning from parental leave in accordance with the average increases that have occurred during that period (Grund, 2015). A second development refers to the German Parental Leave Law being reformed in 2007. Since then, male employees do take more parental leave due to additional monetary incentives (Statistisches Bundesamt, 2016). We show that, nowadays, gender differences in career interruptions still account for a considerable part of the gender pay gap. The recent developments may lead to a further assimilation of wages between females and males.

We extend previous research by investigating the effect of career interruptions not only on current total compensation but also on its components – fixed salaries and bonus payments in particular. We find that bonus payments are much more related to career interruptions than fixed salaries are. This is an interesting result, as although the German chemical sector is dominated by large firms, where collective agreements are relevant, these collective agreements hold only for regular employees but not for the managers explored in our study. Still, firms seem to determine fixed salaries in a more formal, non-individualistic way than the way in which they proceed with bonus payments.

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Appendix

Table A: Quantile regression on total compensation and its components (coefficients of interruption only)

Incidence of interruption	OLS	P10	P25	P50	P75	P90
Total compensation	-0.0818***	-0.0656***	-0.0655***	-0.0543***	-0.0515***	-0.0518***
	(0.014)	(0.015)	(0.008)	(0.012)	(0.009)	(0.010)
Fixed salaries	-0.0627***	-0.0656***	-0.0472***	-0.0479***	-0.0484***	-0.0499***
	(0.012)	(0.011)	(0.011)	(0.010)	(0.011)	(0.014)
Bonus payments	-0.0860***	-0.0659	-0.0636***	-0.0824***	-0.0750***	-0.102***
	(0.022)	(0.077)	(0.017)	(0.020)	(0.025)	(0.020)
Duration of interruption	OLS	P10	P25	P50	P75	P90
Total compensation	-0.0434***	-0.0720***	-0.0542**	-0.0328***	-0.0273***	-0.0246***
	(0.010)	(0.021)	(0.023)	(0.006)	(0.004)	(0.006)
Fixed salaries	-0.0291***	-0.0624***	-0.0409**	-0.0260***	-0.0169***	-0.0149**
	(0.008)	(0.013)	(0.021)	(0.005)	(0.003)	(0.007)
Bonus payments	-0.0570***	-0.0467**	-0.0433***	-0.0589***	-0.0549***	-0.0427*
	(0.015)	(0.022)	(0.007)	(0.009)	(0.008)	(0.025)

Cluster-robust standard errors in parentheses; significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B: Pooled wage regressions on compensation components evaluating the interaction of level and duration of interruption by types

Duration of interruption	(1) Log total compensation	(2) Log fixed salaries	(3) Log bonus payments
Hierarchy level (base: Level 3)			
Level 2	0.245***	0.163***	0.410***
	(0.033)	(0.019)	(0.055)
Level 4	-0.165***	-0.120***	-0.378***
	(0.014)	(0.010)	(0.039)
Years of parental leave	-0.00958	-0.00665	0.0295
	(0.011)	(0.007)	(0.026)
Years of unemployment	-0.0866***	-0.0702***	-0.240***
	(0.010)	(0.010)	(0.035)
Years of other type	-0.0113**	-0.00534*	-0.0215
	(0.004)	(0.003)	(0.022)
Level 2 x parental leave	-0.184***	-0.0969***	-0.627***
	(0.035)	(0.023)	(0.193)
Level 4 x parental leave	-0.0196	-0.0176*	-0.0822***
	(0.013)	(0.009)	(0.031)
Level 2 x unemployment	-0.176***	-0.112***	-0.104*
	(0.026)	(0.016)	(0.063)
Level 4 x unemployment	-0.0136	-0.0168	0.105**
	(0.013)	(0.014)	(0.048)
Level 2 x other type	0.00910	-0.0434**	0.175***
	(0.050)	(0.018)	(0.064)
Level 4 x other type	-0.0157*	-0.0172***	-0.0500
	(0.009)	(0.005)	(0.053)
Indiv. characteristics	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	11,038	11,038	9,996
Adj. R-squared	0.653	0.650	0.380

Cluster-robust standard errors in parentheses; significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$