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The anticipation and adaptation effects of intra- and interpersonal wage changes on job satisfaction[*]

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13th December 2017

Abstract

This paper analyses how individual job satisfaction is affected by wage changes. In order to account for potential dynamic effects of wage changes on job satisfaction, we include lead and lag effects of wage changes in our analysis. Furthermore, we examine the role of social comparisons. This strategy allows us to account for implications of behavioural theory and permits an appropriate methodological approach. Our results indicate that wage changes have a statistically significant positive effect on job satisfaction. This effect exhibits a dynamic pattern. We observe an anticipation effect and positive, but declining effects on job satisfaction four years after the wage increase, i.e., partial adaptation. We find that an additional increase in job satisfaction is obtained when the individual's wage change exceeds the average wage change for his reference group. However, this effect does not appear to persist, since it fades out two years after the wage change.

JEL-Classification: J28, M50, M52
Keywords: wage change, job satisfaction, anticipation and adaptation

Highlights:
The anticipation and adaptation effects of intra- and interpersonal wage changes on job satisfaction

- We investigate the effects of wage changes on employee job satisfaction

- Our analysis considers the implications of behavioural theory by accounting for potential intra- and interindividual anticipation and adaptation effects of wage changes on job satisfaction

- We observe positive anticipation effects in job satisfaction one year ahead of a wage increase

- We find that individuals partly adapt to wage changes, i.e., the positive effects of a wage increase decline within four years

- Results indicate that employers may align the timing of wage changes to the period of adaptation, albeit, our data do not permit a cost-benefit analysis

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Abstract

This paper analyses how individual job satisfaction is affected by wage changes. In order to account for potential dynamic effects of wage changes on job satisfaction, we include lead and lag effects of wage changes in our analysis. Furthermore, we examine the role of social comparisons. This strategy allows us to account for implications of behavioural theory and permits an appropriate methodological approach.

Our results indicate that wage changes have a statistically significant positive effect on job satisfaction. This effect exhibits a dynamic pattern. We observe an anticipation effect and positive, but declining effects on job satisfaction four years after the wage increase, i.e., partial adaptation. We find that an additional increase in job satisfaction is obtained when the individuals' wage changes exceed the average wage changes for their reference group. However, this effect does not appear to persist, since it fades out two years after the wage change.

1   Introduction

When dealing with labour relations in economics, wages and their influence on employee behaviour and well-being are among the most prominent objects of research interest. In this context, the study of job satisfaction has gained increasing interest as it measures the subjective evaluation of many job aspects that cannot be captured otherwise (Clark et al., 1998; Clark, 1999; Freeman, 1978). Employers should be concerned about their employees' job satisfaction as this can be considered a determinant, for example, of an individual's job-related well-being, commitment, and labour market mobility or turnover intentions (Freeman, 1978; Johnston and Lee, 2013). Workers who are more satisfied with their jobs presumably change them less often and more often invest in firm-specific human capital (Hamermesh, 2001).

On the other hand, firms have considerable discretionary power when setting wages, and thereby have the capacity to potentially affect employees' job satisfaction. The aim of this paper is thus to analyse whether individuals adjust their job satisfaction to a wage change; i.e., whether wages and especially positive wage changes can buy enhanced and persistent employee job satisfaction.

While in traditional economic theory employee utility typically depends on the absolute level of monetary outcomes, more recent evidence, which draws on behavioural theory, suggests that individuals also consider relative comparisons when evaluating their own income. Typically two types of reference points can be distinguished: an internal reference point (intraindividual or status quo comparison) and an external reference point (interindividual or social comparison) (Clark et al., 2008a). In the context of labour relations, internal reference points typically involve situations where individuals assess their current income in terms of former incomes. External reference points, on the other hand, usually relate to situations where individuals compare their outcome to the outcome of similar others, for example, co-workers, which is generally referred to as making "social comparisons".

In this paper, we combine these concepts and focus on the effects of (relative) wage changes on job satisfaction over time. More precisely, we aim to disentangle the effects of intra- and interindividual wage changes on job satisfaction. While there is an extensive literature on the link between life satisfaction and income (e.g., Di Tella et al., 2010; Ferrer-i-Carbonell, 2005; Frijters et al., 2004) and also a strand of experimental literature addressing the effects of wage changes on work morale and effort (see, e.g., Bracha et al., 2015; Kube et al., 2013; Sliwka

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and Werner, 2017), the relationship between job satisfaction and wage changes has attracted much less attention. Studies that are closest to ours and explicitly address job satisfaction and income changes were conducted by, for instance, Clark (1999), who examines current income and income changes with data from the British Household Panel Survey (BHPS), and Grund and Sliwka (2007), who theoretically and empirically evaluate the influence of current wages and wage increases on job satisfaction using the same data set as in this analysis, the German Socio-economic Panel (GSOEP). Smith (2015) considers the effects of an individual's wage and its changes on job satisfaction using data from the BHPS. Finally, Bossler and Broszeit (2017) use data from the Linked Personnel Panel (LPP), in order to analyse how the introduction of the German statutory minimum wage in 2015 affected the job satisfaction of individuals subject to this new legislation. While evidence is mixed on whether individuals' wage levels affect their job satisfaction, all mentioned studies conclude that job satisfaction is positively affected by wage changes.

However, the existing literature on job satisfaction and wages has not yet addressed the lead and lag dynamics of wage changes adequately. Yet, disregarding potential anticipatory and adaptive dynamics of job satisfaction in reaction to wage changes ignores basic implications of behavioural theory, according to which individuals evaluate outcomes with respect to reference points and not in absolute terms (Ferrer-i-Carbonell, 2005; Johnston and Lee, 2013; Stutzer, 2004). This is even more important, because reference points can shift over time (Burchardt, 2005; Ferrer-i-Carbonell, 2005; Kőszegi and Rabin, 2006), which, in the present context, would imply potential adaptation to absolute wage increases. Moreover, disregarding the lead and lag dynamics of the job satisfaction adjustment process may result in methodological issues in terms of biased estimates. Provided that there are lead and lag effects, not controlling for them, may result in an under- or overestimated point estimate of the effect of a present wage change on the present job satisfaction (see Hanglberger and Merz, 2015, for a detailed elaboration on this issue). Furthermore, several studies have emphasised the importance of social comparisons in wage discussions (e.g., Card et al., 2012; Clark and Senik, 2010; Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005). For the middle management in the German chemical industry, Grund and Rubin (2017) find positive effects of relative wage increases on job satisfaction.[1] Similar to our approach, Clark and D'Ambrosio (2015) evaluate the effects of expected and realised promotions

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[1]Grund and Rubin (2017) combine status quo and social comparison aspects and measure relative wage increases as the difference between the own wage increase and the wage increase of similar others.

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on job satisfaction with data from the GSOEP and additionally consider social comparisons. Using wage changes as a proxy for actual promotions, they find that job satisfaction is positively affected by wage changes.[2] However, both Grund and Rubin (2017) and Clark and D'Ambrosio (2015) have only partly addressed the anticipation and especially the adaptation aspects of relative wage changes, thus these aspects have not yet been appropriately taken into account by the job satisfaction literature.

With this study, we aim to close these gaps and thereby to contribute to the literature in several ways. Our main contribution is to explicitly address the influence of wage changes on job satisfaction, while additionally considering social comparisons as well as anticipation and adaptation effects. This approach permits us to elicit the role of reference points in the evaluation of job satisfaction. By addressing the relationship between the effects of wage changes on job satisfaction, we also add new insights on employee behaviour which complement experimental evidence on wage changes and employee effort, since in these contributions the covered time horizon usually does not span over several years as it does in our study. Also, our study presumably allows for a high level of external validity by utilising a large representative household data set, the German Socio-Economic Panel (GSOEP). A further advantage of the GSOEP is that these rich data allow us to follow some individuals' careers for almost two decades. Moreover, with this data set we can control for various confounding factors, such as job characteristics which may influence job satisfaction. Also, we include individual fixed effects in our regression in order to eliminate time-invariant unobserved individual heterogeneity. Our findings suggest that a wage increase has a statistically significant positive effect on job satisfaction, but that this effect exhibits a dynamic pattern. We observe an anticipation effect of a positive wage change, i.e., individuals are more satisfied with their job one year ahead of the wage increase. Also, we find statistically significant positive effects on job satisfaction up to four years after the wage increase. Thus, full adaptation of job satisfaction to wage changes does not take place, yet, the effect substantially fades out throughout the observation period, i.e., we observe partial adaptation. Moreover, we find an additional increase in job satisfaction when the individuals' wage increases are higher than the average wage increases for their reference group. In contrast to the intraindividual wage effect, the interindividual effect does not appear to be persistent, as it is only statistically significant for two years after the wage change. We also test whether

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[2]This result holds as long as these wage changes are lager than the wage changes in the respective comparison group.

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individuals are loss averse by conducting a heterogeneity analysis where we explicitly account for the direction of the wage change, i.e., positive or negative. Finally, our analysis is robust to a variety of sensitivity checks. Most importantly, we confirm our results with respect to individuals who did not change jobs between observations. Given that we utilise representative household data for our analysis, this robustness check considerably increases the generality of our findings with respect to the overall working population. With this analysis, we provide meaningful implications, since our study suggests that wage increases only exhibit their full effect on employee job satisfaction in the short-run. Our results also indicate that wage cuts appear to be more acceptable and have fewer negative effects on job satisfaction when they occur collectively; i.e., when similar others also experience wage cuts.

The remainder of this paper is structured as follows. Section 2 outlines the theoretical foundation of this paper. In Section 3, we review the related empirical literature. In Section 4, we present the data, our key variables, and descriptive statistics. Section 5 continues with our empirical strategy. In Section 6, we present and discuss our estimation results and subsequently analyse their heterogeneity and test their sensitivity in Section 7, before Section 8 concludes.

2   Theoretical Background

According to standard economic theory, individuals' job satisfaction should only depend on the evaluation of the own wage. Also, if individuals were more satisfied with their job due to a wage increase, they should permanently remain on the higher satisfaction level. However, both ideas are challenged by insights from behavioural theory, i.e., there are social and status quo comparisons.

The theoretical foundation of relative comparisons can be found in Markowitz (1952) and Kahneman and Tversky (1979). According to the former, both present income and previous outcomes (gains or losses) determine current behavioural strategies under uncertainty. Further, Kahneman and Tversky (1979) state in their prospect theory that individuals evaluate options with regard to a specific reference point rather than in absolute terms. These reference points are conceptualised as underlying individuals' behavioural choices and are influenced by contextual circumstances. They therefore may change over time; for example, when workers change their jobs or are promoted (Burchardt, 2005; Johnston and Lee, 2013).[3]

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[3]A theoretical model for reference-dependent preferences with endogenously determined reference points based

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The concept of social comparisons originated from the "relative income hypothesis" by Duesenberry (1949). In the context of consumer behaviour, he argues that individuals feel relatively deprived, when their own status level is below the status of similar others. The theory of social comparison processes introduced by Festinger (1954) and the equity theory of Adams (1963, 1965) further contributed to the topic with more emphasis on labour relations. In both theories, comparisons to similar others also have behavioural consequences and influence individual utility. The inequality aversion model of Fehr and Schmidt (1999) is related to these theories. According to Fehr and Schmidt (1999), self-centred, inequity-averse employees strive for equal outcomes, i.e., the own outcome is evaluated relatively to a reference state which is based on social comparisons. In their model, individuals are characterized as loss averse, which means that individuals dislike being worse off than others more than they dislike advantageous inequality. Consequently, receiving a wage increase that is lower than the wage increase of similar others may dampen the positive effect of a wage increase on job satisfaction.

Furthermore, social comparisons can reveal information about future earnings or career prospects.[4] Thus, the direction of the effect of social comparisons on individual well-being is a priori unclear, and as a result two opposing effects are generally distinguished: "status" or "envy" effects versus "signal" or "ambition" effects (Clark and Senik, 2010). The first effect concerns situations where well-being is reduced when individuals are worse off than others in their reference group, i.e., social comparison income and individual well-being are negatively correlated. In contrast, the second effect relates to situations where well-being is enhanced, when individuals perceive similar others to be better off than themselves. In this case, the amount of social comparison income and an individual's well-being are positively correlated. Hence, the resulting net effect consisting of the conflicting status and signal effects of social comparisons on well-being remains an empirical question.

The phenomenon of adaptation builds on this relative comparison framework and is also embedded in Brickman and Campbell's (1971) "hedonic treadmill" hypothesis. They state that major events merely lead to short-lived changes in well-being with individuals subsequently returning to their baseline level.[5] Powdthavee (2011, p. 1003) argues, that "(...), adaptation

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on individual expectations has been developed by Kőszegi and Rabin (2006). More precisely, reference points in their theoretical framework are determined by the economic environment and expectations in the past about future outcomes. Ultimately, this results in lower individual utility if expectations are not met.

[4]The signal effect of social comparisons dates back to the "tunnel effect" described by Hirschman and Rothschild (1973).

[5]For more background information on adaptation, see the changing expectations concept of Helson (1947), the adaptation-level theory of Helson (1964), and the "preference drift" concept of van Praag (1971). For a

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generally refers to the decline in satisfaction over time after the event has occurred." Adaptation is expected to be especially relevant when facing extrinsic rewards, for example, wages (Frey and Stutzer, 2014).[6] Headey and Wearing (1989) modified the "hedonic treadmill" hypothesis and developed a dynamic equilibrium model of subjective well-being proposing that personality characteristics influence an individual's baseline level in subjective well-being.[7] Furthermore, they argue that only life events that do not follow the pattern of the "usually" experienced life events provoke temporary reactions in subjective well-being (Headey and Wearing, 1989; Headey, 2006). Similarly, Diener et al. (2006) also suggest some revisions for the "hedonic treadmill" model. They state, inter alia, that individual set points are formed by personality characteristics and even though individuals adapt to certain life events, the extent of adaptation varies over individuals (Diener et al., 2006).[8] Thus, it is important to note that adaptation can also be incomplete or partial (Diener et al., 2006). For instance, Oswald and Powdthavee (2008) observe that people who are victims of a severe disability only partially return to their earlier life satisfaction level.

Related to the concept of adaptation is the idea of anticipation, i.e., the assumption that an individual's current satisfaction will increase owing to an expectation of a favourable life event in the near future (e.g., Di Tella et al., 2010; McBride, 2010; Clark et al., 2008b). Loewenstein (1987) includes the concept of anticipation based on Jevons' (1905) idea of "anticipal pleasure" and "anticipal pain" in a standard discounted utility model framework. In this model, the anticipation of future consumption enhances an individual's current utility. In doing so, the utility gained from anticipation is positively influenced by the duration of consumption and the utility of consumption itself, but negatively influenced by the time span until the consumption takes place (Loewenstein, 1987). However, the anticipation utility rises at an increasingly disproportionate rate as the life event comes closer (Loewenstein, 1987). If there is an anticipation effect associated with wage changes, one would expect job satisfaction to increase or decrease (depending on the direction of the wage change) in advance of the actual wage change.

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survey of hedonic adaptation, see, for example, Frederick and Loewenstein (1999). Evidence mainly in the field of psychology can be found in Diener and Biswas-Diener (2002).

[6]In contrast, Frey and Stutzer (2014) argue that there is less or no adaptation to intrinsic rewards, for example, meeting friends.

[7]The dynamic equilibrium theory of subjective well-being has been further revised by Headey (2006) and is also known under the term "set point theory".

[8]Besides, Diener et al. (2006) suggest that individuals have a non-neutral but rather positive baseline well-being level. Moreover, individuals are expected to have multiple set points or well-being components (Diener et al., 2006).

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3 Related Literature

In his seminal contribution, Easterlin (1974) observed that happiness did not increase in the post-World War II period in the United States despite a considerable growth in income. Ever since his publication, subjective well-being has gathered substantial attention in economics and other social sciences, especially in recent years (Clark and Georgellis, 2013; Ferrer-i-Carbonell and Frijters, 2004). While in cross-sectional analyses wealthier countries tend to be happier, this phenomenon cannot be observed within one country over time, a fact today known as the Easterlin paradox (Clark et al., 2008b; Di Tella and MacCulloch, 2006; Di Tella et al., 2010).[9] Di Tella and MacCulloch (2006) and Clark et al. (2008a) mention happiness adaptation to income changes and social income comparisons as two main explanations for the paradox.

Over the past few years, a strand of well-being literature has emerged which studies individuals' anticipation in expectation of, and adaptation in response to major life events. Within this domain, some studies predominantly focus on the adaptation of life satisfaction to income changes (e.g., Di Tella et al., 2010; Ferrer-i-Carbonell and van Praag, 2008).[10] While standard economic theory predicts zero adaptation to major life events, puzzling research evidence shows that major life events only have small, temporary effects on reported happiness, i.e., that full or at least partial adaptation occurs (Kahneman and Krueger, 2006). Di Tella et al. (2010) study happiness adaptation to income and status changes with data from the GSOEP. They find evidence for complete happiness adaptation to income changes within four years. However, they find no evidence for adaptation to status changes in their analysis. Drawing on data from the BHPS and focusing on satisfaction with income, Burchardt (2005) provides evidence that adaptation effects may be asymmetric, in that people are more likely to adapt to income rises than to income cuts. In contrast, the results of Ferrer-i-Carbonell and van Praag (2008) suggest that there might be happiness adaptation to wage cuts. However, they find no adaptation in response to wage increases.[11]

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[9]Later, Easterlin (1995) reconfirmed his earlier findings for the United States, nine European countries, and Japan. Most recently, Easterlin (2016) again stated that the paradox holds for the United States and several developed, emerging and less developed countries worldwide, when long-term trends in subjective well-being are properly taken into account. See also Blanchflower and Oswald (2004), for evidence on the Easterlin paradox for the United States and the UK.

[10]A literature review can be found in Clark et al. (2008b) and in Di Tella and MacCulloch (2006). An overview of the literature on subjective well-being can be found in Frey and Stutzer (2002) and Senik (2005).

[11]Besides income changes, further changes in life circumstances that have been examined are, for instance, changes in marital status (e.g., Lucas et al., 2003; Lucas, 2005; Lucas and Clark, 2006; Gardner and Oswald, 2006; Stutzer and Frey, 2006; Zimmermann and Easterlin, 2006) and disability (e.g., Oswald and Powdthavee, 2008; Powdthavee, 2009). Multiple life events are considered, for example, in Clark et al. (2008b), Clark and Georgellis (2013), Frijters et al. (2011), and Rudolf and Kang (2011). Overall, the evidence is rather indecisive,

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At the same time, empirical evidence suggests that individuals often anticipate events and accordingly adjust their satisfaction levels. For instance, in their analysis, Clark et al. (2008b) find that individual reported well-being already deviates from the baseline satisfaction level in advance; i.e., individuals strongly anticipate most of the life events considered.[12] Using quarterly data on multiple life events of the HILDA survey, Frijters et al. (2011) find evidence for anticipation, adaptation, and selection effects in life satisfaction.[13] For most life events, the authors find that people adapt almost completely within two years, except for changes in financial situation, death of a close relative, and serious illness. In sum, the degree to which people adapt to changing circumstances seems to depend on the respective life event and on personal characteristics, indicating the importance to control for individual fixed effects.

Since we employ a more job-related focus in our study, we are interested in whether wage changes lead to changes in overall job satisfaction and how persistent these changes are. Adaptation of job satisfaction to income changes has attracted much less attention than the life satisfaction-income relationship. Studies that explicitly address job satisfaction and income changes include Clark (1999), Grund and Sliwka (2007), and Smith (2015). In line with reference-dependent well-being considerations, Clark (1999) finds evidence for job satisfaction being positively associated with wage changes, while the absolute wage level and job satisfaction seem to be unrelated in his data. In contrast, Grund and Sliwka (2007) conclude that job satisfaction is positively influenced by wage increases as well as by an individual's absolute wage level. Smith (2015) finds significant positive effects of the wage level and wage increases on job satisfaction. Johnston and Lee (2013) evaluate how promotions affect job satisfaction using data from the HILDA survey. They also consider anticipation and adaptation effects in their study and find significant positive effects of promotions on individual job satisfaction. They find that promotion effects diminish and individuals return to their baseline satisfaction level (full adaptation)

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ranging from zero to full adaptation.

[12]Clark et al. (2008b) report anticipation effects for unemployment, marriage, divorce, birth of a child, and layoffs, but only weak evidence of anticipation effects for widowhood. Since some of these life events are often planned or foreseen and since most of them involve major life changes, rather than simple adjustments associated with wage changes as in our case, it is not surprising that the authors, to some extent, find quite long anticipation periods.

[13]Frijters et al. (2011) focus on change in financial situation, involuntary job loss, change in marital status, change in residence, birth/adoption of a child, death of a close relative, serious illness/injury, and being victim of a crime. The selection effect captures the idea that some individuals are more likely to experience a certain life event than others (Frijters et al., 2011). Clark et al. (2008b) include individual fixed effects in their regressions to ensure that the lead variables actually represent anticipation and not selection. Further, Frijters et al. (2011) note that the use of yearly life event data may lead to an underestimation of the true anticipation and adaptation effects. Also, effects are likely to be underestimated when anticipation effects are ignored and studies stick to cross-sectional data (Frijters et al., 2011).

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three years after a promotion, while they identify no evidence for anticipation effects prior to promotions (Johnston and Lee, 2013).[14] Since promotions are usually associated with wage increases,[15] the results of Johnston and Lee (2013) may suggest that individuals not only adapt to promotions, but also to wage changes. Dealing with UK data on university graduates, Lydon and Chevalier (2002) show that the direct wage effect on job satisfaction almost doubles, when controlling for possible endogeneity using the wage of the graduate's partner as an instrument for an individual's wage. In a related context, several papers, which apply experimental techniques, have addressed the question as to what extent and how wage changes affect employee effort and work morale. For instance, Sliwka and Werner (2017) analyse the frequency and increments of wage increases on employee effort and conclude that due to adaptive patterns, individuals react more positively (in terms of greater effort) to frequent, but small, wage increases.[16] When, on the contrary, analysing wage cuts, Buchanan and Houser (2017) find that individuals lower their effort after having experienced a wage cut. Additionally, Kube et al. (2013) provide evidence that wage cuts have substantial and lasting (at least for the duration of the field experiment) negative effects on productivity. Thus, there appears to be no adaptation to wage cuts.[17] Finally, some studies have evaluated worker well-being or utility with respect to interindividual reference points, i.e., social comparisons (e.g., Clark and Oswald, 1996; Clark et al., 2008b, 2009; Ferrer-i-Carbonell, 2005; Grund and Martin, 2017; Luttmer, 2005; McBride, 2001). In sum, the results of theses studies suggest that people actually care about social comparisons,[18] which is again supported by insights from the experimental literature. For instance, Bracha et al. (2015) find that individuals who know that their wage is lower than their peers' wage, will likely lower their work effort. Likewise, Gächter and Thöni (2010) find detrimental effects on experimental workers' effort levels for those being paid below their co-workers.

Although the implications of wage changes on job satisfaction seem essentially straight for-

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[14]Controlling for the current wage level and social comparison effects, Kosteas (2011) finds evidence for positive but declining effects of promotions on job satisfaction three to four years after a promotion (indicating partial adaptation), using the waves 1996-2006 of the NLSY79 dataset. Further, his results indicate that anticipation effects take place, as individuals report being more satisfied when they believe a promotion is possible within the next two years.

[15]See, for example, Clark and D'Ambrosio (2015) or Johnston and Lee (2012).

[16]Similarly, Ockenfels et al. (2015b) find positive and persistent performance responses to (unexpected) wage increases for workers performing an inventory task in a university library. They also stress the importance of the timing when dealing with wage increases, with more frequent and smaller wage increases likely producing more preferable outcomes.

[17]Kube et al. (2013) do not find positive productivity effects following a wage increase, indicating that individuals respond asymmetrically to wage changes.

[18]However, while most studies find support for the importance of status considerations in the context of social comparisons, Clark et al. (2009) find that signal effects outweigh status effects in wage comparisons among co-workers.

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ward, further research on this topic is necessary. Not only are we interested in whether wage changes lead to changes in overall job satisfaction, but also whether these changes are long-lived. Overall, the literature reviewed stresses the importance of anticipation and adaptation in well-being research. Especially with respect to job satisfaction, the evidence is rather scarce and does not yet address the lead and lag dynamics of wage changes adequately. Further, existing studies have emphasised the importance of social comparisons in wage discussions. We therefore enlarge current empirical approaches by simultaneously considering anticipation and adaptation effects as well as social income comparisons in our analysis.

4 Data

We use data from the German Socio-Economic Panel (GSOEP) for our analysis.[19] The GSOEP is an annual longitudinal household survey which has been conducted since 1984 and is considered to be the most important representative household survey in Germany. The GSOEP questionnaires contain a wide range of individual and job-related characteristics, including variables on different aspects of individual well-being.[20,21] We use data covering the years 1990 to 2013. Note, however, that data from the first four years and the last year are not included directly in our estimations, as we use this information in order to construct anticipation and adaptation effects, respectively. For the same reason, we are only able to include individuals who were interviewed in at least six consecutive years.

We restrict our sample to workers aged between 18 and 65.[22] Self-employed individuals, individuals enrolled in the army or civil service, individuals still in school, apprentices, and interns are excluded from the sample.[23] Furthermore, we restrict our sample to full-time employees, in order to ensure that increased job satisfaction is not merely due to a (desired) increase in working hours; i.e., the switch into full-time employment. We define individuals to be full-time employees if they report at least 35 contractual working hours per week.[24] The restriction to

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[19]German Socio-Economic Panel (GSOEP), data for years 1984-2013, version 30, GSOEP, 2015, doi:10.5684/soep.v30.

[20]For more detailed information about the GSOEP, see Wagner et al. (2007).

[21]The original questionnaires and their English translations can be retrieved online http://www.diw.de/de/diw_02.c.238114.de/frageboegen_methodenberichte.html.

[22]As we include one anticipation and four adaptation periods, the actual age of our sample ranges between 22 and 64 years (compare Table A.1 in the Appendix).

[23]Self-employed individuals are excluded from the analysis, because they are not subject to wage changes by an employer.

[24]The threshold of 35 hours per week corresponds to the lowest possible full-time working week specified in German collective bargaining agreements.

full-time employees and the fact that we require to observe individuals for at least six consecutive years (in employment) leads to our sample being over proportionally male and to a very low share of temporary employees.[25]

Finally, we follow Clark (1999) in clearing outliers, who report wage changes of below -50% or above 100%. After these procedures, we conduct our main analysis on the basis of an unbalanced sample containing 33,491 observations from 6,132 individuals. The descriptive statistics for all variables are reported in Table A.1 in the Appendix.

Our dependent variable is overall job satisfaction, which is the response to the question "How satisfied are you with your job". This question is asked on an annual basis in the GSOEP. The possible answers range from 0 ("totally unhappy") to 10 ("totally happy"). Table 1 presents the descriptive statistics of this variable for our main sample, split by gender.[26] We observe a bunching towards higher values, which is a frequent pattern in well-being data (Clark et al., 2008b). The modal response for both sexes is 8, and only about 5% of our sample report the highest value of 10.

[Insert Table 1 about here]

Our explanatory variable is the wage change of individual n at time t. In our main specification, we calculate the percentage change in an individual's gross wage as compared to the year before the survey.[27] As our goal is to examine the anticipation and adaptation effects of a wage change, we also include lag and lead variables of an individual's wage change in our analysis. We follow Di Tella et al. (2010), who also use the GSOEP for their related research question, in specifying one anticipation and four adaptation periods.[28]

Furthermore, we are interested in the social comparison aspect of a wage change. There are

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[25]Men constitute approximately 70% of our sample (compare Table A.1 in the Appendix). Furthermore, the sample restriction to full-time employees and the exclusion of apprentices and interns considerably decreases the share of temporary employees in our sample. However, our estimation strategy, which requires to observe individuals for six consecutive years in employment contributes most to the low composition of temporary employees, because these individuals are unlikely to be employed in six consecutive years.

[26]All tables in this paper were produced with the help of various commands from the user-written Stata® package `estout` (Jann, 2007).

[27]The precise question in the GSOEP, which surveys the individual's wage, refers to the "(gross) income from employment last month."

[28]Although Di Tella et al. (2010) note that the choice of this specific lag structure is rather arbitrary, we consider our lag structure to be well suited to the context. Most importantly, a longer lag structure would deprive us of many observations, since the requirement of our empirical strategy is to consecutively observe individuals for the total lead and lag period. We provide the results of a specification with a longer lag structure as a robustness check in Section 7.2. With respect to our choice of including one anticipation period, we think that it is unreasonable to assume that an individual derives utility from an expected wage increase more than a year in advance. In a specification, which is not reported in the paper, we, nevertheless, account for two anticipation periods. While the main results remain qualitatively the same, the second lead of the wage changes is statistically not significant.

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many reference groups that people potentially compare themselves to, such as family members, friends, neighbours, or work colleagues. In our context, however, since we are concerned with job-related attributes, co-workers seem to be the appropriate reference group (Clark and Senik, 2010).[29] Since we cannot identify co-workers in our data, we try to approximate the "co-worker reference group" by using various individual and job-related characteristics when creating the reference groups. In specific, we construct peer groups with respect to the observation year, gender, age group, level of education, region (East and West Germany), and the industry sector.[30] On average, an individual has approximately 60 peers in our sample. We then calculate the percentage point difference between the individual's own wage change and the peer group's wage change and generate a dummy variable taking on value 1, if this difference is positive, and value 0 if this difference is zero or negative.[31,32] Thus, our social comparison variable catches whether individuals derive additional job satisfaction if their own wage change is larger than that for their peer group. We chose to include a dummy and not the percentage point difference itself in our calculations due to our approximate construction of peer groups. We prefer to rely on the general direction of the difference; i.e., whether the wage change is below or above the peer group's wage change. For the same reason, we do not restrict our dummy construction to certain minimum or maximum values, but consider the entire range of possible differences to the peer group.[33]

Table 2 presents the summary statistics for our dependent and main explanatory variables. While both the average individual wage and the average peer group wage lie in a similar range, the standard deviation for the individual wage is somewhat higher than for the peer group wage, as the latter is the average of the mean wage of groups with several individuals. Furthermore, the average wage change (over all periods) in our sample is 3.6%, and the average peer group wage change is roughly in the same range as are the changes' standard and within standard

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[29]Clark and Senik (2010) find that with respect to income, most individuals compare themselves to work colleagues. Further, they state that the likelihood of reporting work colleagues as the primary reference group increases with an individual's evaluation of the importance of social comparisons.

[30]The age groups are: younger than 25, 25-35, 35-45, and older than 45.

[31]The difference between an individual's n own wage change and the respective peer group's wage ($peerwage$) change in time t is calculated in the following way: $wagedif_{nt} = \frac{wage_{nt} - wage_{nt-1}}{wage_{nt-1}} - \frac{peerwage_{nt} - peerwage_{nt-1}}{peerwage_{nt-1}}$.

[32]For individuals without any comparable peers as defined by the specified grouping criteria, we replace the reference group wage with the individual's own wage in the respective period. By proceeding in that way, we do not lose observations if individuals do not have a peer group in a specific year. In our dummy variable construction, this procedure means that individuals without peers are in the reference category. If we drop individuals without a "real" peer group from our analysis, the results remain qualitatively the same. These results are not reported here, but are available from the authors upon request.

[33]However, we also considered to include the peer group effects as percentage point differences into our analysis. This is further discussed in footnote 44 in Section 6.

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deviations. Given these similar values and distributions, we conclude that we have succeeded in constructing appropriate peer groups for the individuals in our sample.

[Insert Table 2 about here]

5 Empirical Strategy

The aim of this analysis is to identify the effect of a wage change on individual job satisfaction. Therefore, we start our analysis with a simple regression of an individual's n job satisfaction in time t, denoted $jobsat_{nt}$, on her or his wage change in time t, wch_{nt}.

$$jobsat_{nt} = \alpha_0 wch_{nt} + X_{nt}\delta + f_n + \eta_t + \epsilon_{nt}. \tag{1}$$

In equation (1), f_n is the individual-specific, time-invariant fixed effect, η_t is a time fixed effect captured by a set of time dummy variables, and ϵ_{nt} denotes an idiosyncratic error term with zero mean and finite variance. As the estimation of the effect of a wage change on job satisfaction may be confounded by several observed factors, we include a large set of control variables denoted by the vector X in our estimation.

The vector X includes individual characteristics such as age, age squared, years of schooling, gender, nationality, marital status, the existence of children in the household, an individual's self-reported health status, as well as the number of hours devoted to leisure-time activities.[34] Our set of control variables is further enriched with job characteristics and variables from an individual's employment history that may affect job satisfaction. We consider the individuals' wage in t, their weekly actual working hours, the type of employment contract (fixed-term vs. permanent), whether the individual has participated in job-related training in the year preceding the observation,[35] whether the individual is employed in the public sector, the tenure with the respective company, and the number of years that an individual has experienced in unemployment and part-time occupations, respectively. We also include dummies for whether

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[34]Time-invariant variables such as years of schooling, gender, age, age squared, and nationality are excluded from the set of control variables when estimating the fixed effects model.

[35]In order to account for all available information on job training in our data, we combine the information from three questions (see Offerhaus, 2013, for a similar approach). In specific, individuals are asked whether they were in further job training or retraining in the previous year. We also integrate information on training or job retraining from the GSOEP calendar files. Finally, we utilise information from the GSOEP special module on training that was surveyed in 1993, 2000, 2004, and 2008. We chose to account for training in the preceding year, since higher wages should materialise after training completion. We have also tested, but not reported here, a specification with job-training in t, which did not qualitatively alter our results. We thank an anonymous referee for pointing out to us the importance of the relationship between job satisfaction and training.

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individuals have changed their employer and dummies for whether they have changed their position within their company as compared to the previous observation.[36] We thereby control for the case that a higher reported job satisfaction was caused by a job change and not the wage change per se. Moreover, we account for the fact that job changes are often associated with wage increases. The job-specific variables also include 14 occupation-level dummies, whereof 4 specify hierarchical levels for civil servants. We thereby also control for whether an individual is a civil servant. Also, we add dummies for the size of the company at which the individual is employed and for the company's sector affiliation. Finally, we include 15 regional dummies for the worker's region of residence and the regional unemployment rate in t into the set of our control variables.[37] In general, our selection of control variables aims at capturing all possible confounding factors taking into account empirical evidence on job satisfaction. For instance, fixed-term contracts are associated with lower job satisfaction (Chadi and Hetschko, 2016), while firm size and job satisfaction could be both negatively and positively related to job satisfaction (Idson, 1990; Oi and Idson, 1999).[38] Finally, our selection of control variables is also closely aligned to the related literature, such as Grund and Sliwka (2007), who use the same data as in this analysis. Table A.1 in the Appendix provides the definitions and descriptive statistics of the complete set of variables used in this study.

Equation (1) is estimated using both the pooled OLS (thereby ignoring f_n) and the within estimator. Following the happiness literature, we apply linear regression techniques and thereby treat our dependent variable, job satisfaction, as metric.[39] Ferrer-i-Carbonell and Frijters (2004) show that when analysing happiness data it is far more important to account for individual fixed effects than for the ordinal scale of the dependent variable. The advantage of specifying an individual fixed effects model is that time-invariant unobserved individual heterogeneity can be eliminated. In the present case, an example for unobserved heterogeneity is an individual's general attitude to life or optimism. Furthermore, the inclusion of individual fixed effects captures

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[36]In the GSOEP, the question about job changes refers to the period beginning on 31 December of the year preceding the last survey. Thus, if a job change took place in the year of the interview, but before the interview date, it is potentially captured twice, i.e., in two subsequent interviews (Chadi and Hetschko, 2017). We therefore compare the starting dates of new jobs and recode job changes as zeros if an individual had also reported a job change in last year's interview and indicated the same starting date as in this year's interview.

[37]Since we include regional and time fixed effects in our analysis, the regional unemployment rate essentially captures the deviations from the linear time and regional trends.

[38]On the one hand, work in larger firms tends to grant less autonomy to employees (Idson, 1990), which may negatively affect job satisfaction. On the other hand, larger firms usually remunerate their employees more generously and offer higher job security (Oi and Idson, 1999), which likely enhances an individual's job satisfaction.

[39]However, we address this issue to some extent by running a robustness check, where we standardise our dependent variable (see Section 7.2).

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also time-invariant personality characteristics, which, according to Diener et al. (2006), may influence an individual's inclination to adapt to certain life events.[40]

Although we employ a rich set of control variables, and account for time-invariant unobserved individual heterogeneity, our first specification does not consider possible anticipation and adaptation effects. Without a lead variable we cannot isolate potential anticipation effects, while without adaptation effects, we are not able to distinguish whether a wage change has a short-lived or persistent effect on an individual's job satisfaction. Therefore, we extend our regression model as follows:

$$
\begin{aligned}
jobsat_{nt} =& \alpha_0 wch_{nt} + \alpha_1 wch_{nt+1} + \sum_{i=1}^{4} \alpha_{-i} wch_{nt-i} \\
&+ X_{nt}\delta + JC_{nt+1}\gamma_1 + \sum_{i=1}^{4} JC_{nt-i}\gamma_{-i} + f_n + \eta_t + \epsilon_{nt}.
\end{aligned}
\tag{2}
$$

In equation (2), wch_{nt-i} are the adaptation effects to wage changes that occurred i periods before t. The inclusion of such effects allows us to test whether individuals fully adapt to a wage change. If we did not include adaptation effects, the estimated coefficient in t would constitute both the effect in t and its lags, which would potentially result in a biased estimation of the effect of wage changes on job satisfaction in t (see Hanglberger and Merz, 2015). If no adaptation takes place, then the null hypothesis of $\alpha_{-i} = 0$ should be rejected.[41] At the same time, we should not ignore the possibility that individual job satisfaction may increase in anticipation of a wage increase. Given this assumption, the evaluation of simple before and after comparisons would lead to a biased estimation of the wage change effect on job satisfaction in t, because the estimated coefficient would then comprise both the effect in t and the anticipation effect. So, wch_{nt+1} is the anticipation effect to a wage change that will occur one period after t. By including wch_{nt+1} in our regression analysis, we can capture possible changes in job satisfaction which are elicited by the prospect of receiving a wage change. By incorporating individual fixed effects, f_n, the estimated effect of the lead variable reflects effects of anticipation rather than the selection, which could occur because certain events are more likely for certain people, for instance, more satisfied individuals are also those more likely to receive wage increases (see, e.g.,

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[40]See Heineck and Anger (2010) and Cobb-Clark and Schurer (2012), for discussions about the stability of personality traits for adults. Since the mean age in our sample is 44.6, the assumption of stable personality characteristics, at least over a short period of time, should be reasonable.

[41]Note that if there was no adaptation at all, we would expect all coefficients, i.e., all values of α, to be of approximately the same size (Clark et al., 2008b).

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Clark et al., 2008b). As it seems implausible that people anticipate minor life events several years in advance, we address possible anticipation effects by focusing on the most recent year before a wage change. The null hypothesis of $\alpha_1 = 0$ should be rejected if individuals anticipate wage changes. Lastly, in equation (2), we enrich our set of control variables by including a vector of dummies for job changes in all lead $(t+i)$ and lag $(t-i)$ periods, denoted by JC. This vector is constituted of dummies for employer changes and position changes within the company. We include these control variables in their full lead and lag structure in our analysis, because we argue in line with Johnston and Lee (2013) that the correlation between wage and job changes should increase in higher lags. That is, individuals are arguably more likely to change jobs if they do not experience wage changes (increases) for a long time. Moreover, the inclusion of lagged job change dummies permits us to account for the so-called "honeymoon-hangover" effect as it is described in Boswell et al. (2005), who find that individuals' euphoric assessment of a new job is often followed by a disappointment. This essentially means that individuals' job satisfaction quickly adapts to a job change. Therefore, omitting lags of a job change in our vector of control variables may potentially lead to a biased estimation of the observed adaptation.

Finally, we are also interested in the effect of social comparisons. Therefore, we extend equation (2) in the following way:

$$
\begin{aligned}
jobsat_{nt} =& \alpha_0 wch_{nt} + \alpha_1 wch_{nt+1} + \sum_{i=1}^{4} \alpha_{-i} wch_{nt-i} \\
&+ \beta_0 dtp_{nt} + \beta_1 dtp_{nt+1} + \sum_{i=1}^{4} \beta_{-i} dtp_{nt-i} + \\
&+ X_{nt}\delta + JC_{nt+1}\gamma_1 + \sum_{i=1}^{4} JC_{nt-i}\gamma_{-i} + f_n + \eta_t + \epsilon_{nt}.
\end{aligned}
\tag{3}
$$

In equation (3), dtp_{nt}, dtp_{nt-i}, and dtp_{nt+i} are the corresponding dummies indicating whether an individual's wage change in the respective period was above or below the associated peer group's wage change. The null hypothesis of $\beta_{-i} = 0$ and $\beta_1 = 0$ should be rejected, if there is an additional effect of social comparisons on job satisfaction.

It should be mentioned that, while we account for possible endogeneity due to time-invariant unobserved individual heterogeneity (e.g., if personality traits drove both wages and job satisfaction) or a selection bias (e.g., if individuals who exhibit a higher level of job satisfaction were also more likely to receive wage increases) by including individual fixed effects, our empirical strategy does not allow us to consider possible endogeneity due to a simultaneity bias. A source

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for this simultaneity bias could be, for instance, that satisfied employees signal more motivation and are therefore more likely to receive a wage increase. There are several to a greater or lesser extent satisfying solutions for this issue. Ideally, we would utilise data from a quasi natural experiment that exogenously caused wage variations, for instance, the introduction of a statutory minimum wage. This has been the case in Germany in 2015. This quasi natural experiment will permit an analysis comparable to ours, i.e., an analysis which accounts for adaptation effects spanning over several observational periods, in several years. Nevertheless, the utilisation of the introduction of the statutory minimum wage would limit the analysis to individuals who are subject to minimum wages and thereby presumably exclude all mid to high skilled individuals. This in turn may considerably reduce the external validity of the associated findings.[42] Next, we considered to instrument wage changes, however, we did not succeed in finding a useful instrument for wage changes that would have satisfied the exclusion restriction, provided sufficient statistical power for instrument relevance, and, at the same time, leave us with a sample size comparable to the one in our main analysis. Di Tella et al. (2010, p. 845) comment on a similar issue, where they regress life satisfaction on income and status: "Note that our status estimates may also be affected by a simultaneity bias (but the literature has not so far explored possible instruments)."[43] Also, we have previously argued that the consideration of the anticipation effect is necessary from a methodological perspective, because the omission of this variable would lead to a biased estimation of the other wage change variables. For the case of positive anticipation, i.e., if we assume that wages changes and job satisfaction are positively correlated and at the same time expect individuals to derive "anticipal pleasure" in expectation of a wage change, this bias would result in an underestimation of the effect of a wage change on job satisfaction (see Hanglberger and Merz, 2015). In Section 7.2, we therefore run a robustness check, where we omit the anticipation variables, in order to provide a lower bound for the estimates of the other wage change variables. Finally, in the same section, we also present a robustness check that includes lagged job satisfaction in the set of regressors. By specifying a lagged dependent vari-

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[42]Bossler and Broszeit (2017) analyse the effects of the introduction of the statutory minimum wage in Germany on employee job satisfaction, however, they do not account for anticipation and adaptation effects. They find a statistically significant effect of the minimum wage on job satisfaction, attributing most of this effect to an increase in wage satisfaction.

[43]In an attempt to find a suitable instrument, we borrowed on the idea of Lydon and Chevalier (2002), who instrument individuals' wages with the wages of the their partners by instrumenting the individuals' wage changes with the wage changes of their partners. Since our estimation technique requires to observe individuals for six consecutive years and for these individuals to be employed in full-time throughout the entire period, this must also hold for the individual's partner, which left us with a resulting instrumental variables (IV) sample constituted of less than 7,000 observations. We therefore restrained from further following this approach.

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ables (LDV) model, we also utilise its bracketing property as suggested by Angrist and Pischke (2009). That is, if the correct model was the fixed effects specification, but we implemented the LDV model, our estimated coefficients would present the lower bound of the true effect.

6   Results

The estimation results of our regression analyses on the effects of a wage change on job satisfaction are presented in Table 3. Columns (1)-(3) of Table 3 display the estimation results according to equation (1). In column (1), we present a regression of individual's n job satisfaction in t on the associated wage change in t without control variables, in order to show an unconditional correlation between these two variables. Column (2) displays the same regression with control variables X, and in column (3), we additionally control for time-invariant unobserved individual heterogeneity by including individual fixed effects. In all three regressions, the coefficient of the wage change is positive and statistically significant at the 1% level, indicating that there is a strong positive association between a (positive) wage change and job satisfaction.

[Insert Table 3 about here]

While these first results seem rather straightforward, the persistence of such a positive effect on job satisfaction is our primary interest. Therefore, in column (4) we present the results from equation (2), which account for anticipation and adaptation effects. We see that the null hypotheses of $\alpha_{-i} = 0$ and $\alpha_1 = 0$ can be rejected for all coefficients. This means that, individuals already exhibit a significantly higher job satisfaction one year before a wage change takes place and do not fully adapt (i.e., do not return to their baseline job satisfaction) for the entire duration of the four years following the wage change.

In columns (5) and (6), we present results from equation (3). In this specification, we include the dummies for whether the wage changes were above the respective peer groups' wage changes. We start by setting $\alpha_1 = \alpha_0 = \alpha_{-1} = ... = 0$ in equation (3). The results from this regression are presented in column (5). We see that the immediate effect of having a wage increase larger than the peer group's wage increase is positive and statistically different from zero at the 1% significance level. We also find a significant coefficient for the first two lags and as well as the lead coefficient, whereas the last two lags remain statistically insignificant. From this specification, we conclude that individuals derive job satisfaction when their wage change surpasses the one

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of their peers, but that this additional satisfaction only persists for two years following the wage change.

Finally, we present the results from the unrestricted equation (3) in column (6), our preferred specification. In this specification, we combine the intra- and interindividual effects into one regression. The estimated coefficients for the interindividual effects in column (6) are smaller than in column (5) and further lose statistical significance. In column (6), only the coefficient of the immediate wage change as well as the first two lags remain statistically significant. Additionally, we test for the joint significance of the interindividual effects and find that the null hypothesis that the coefficients of the interindividual effects are jointly equal to zero (F-test) can be rejected at the 1% level. With respect to the intraindividual effects, the results in column (6) remain qualitatively similar to the results presented in column (4). However, the coefficients from the lead, the immediate, and the first two lagged variables slightly lose in size and the coefficients from lag three and four slightly increase. The hypothesis that full adaptation takes place within four years must, therefore, be rejected. As the effect clearly diminishes over time, we speak of partial adaptation.[44]

The obtained results are also graphically depicted in Figure 1.[45] The figure shows that there is a considerable effect one year prior to the wage change, and that it is largest in the year when the wage change takes place. It steadily decreases thereafter, but as mentioned before, remains statistically significant for all considered years (four) after the wage change. Put in numbers, in t, a one-percentage point increase in the explanatory variable translates into a 0.47 point increase in job satisfaction, which constitutes roughly one quarter of its standard deviation. So, for the average individual, job satisfaction would shift from 6.94, which is the mean value of our sample, to 7.41 points. Additionally, individuals experience a 0.27 point increase in job satisfaction from merely anticipating a wage change in the year preceding its realisation, and a slightly larger effect in the year following the wage change.

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[44]We replaced the peer effect dummies by the respective percentage point differences. Compared to our main specification, the coefficients of the intraindividual third and forth lag lost statistical power (significant at the 10% level), while the interindividual effects completely lost their statistical significance. As mentioned earlier, we assume that our construction of approximate peer effects is insufficient to capture exact differences between the individuals' own wage changes and their peer groups' wage changes. We therefore prefer to rely on the indicative direction provided by the dummy variable. Second, including both, intra- and interindividual wage changes in terms of percentages and percentage point differences, respectively, into the regression would methodologically imply that we regress twice job satisfaction on an individual's wage change. Recall that we construct the peer effect as the difference between the own wage change and the respective peer group's wage change (compare footnote 31). When we, however, regress job satisfaction on dummies of the individual's own wage change and the percentage point differences between the own wage change and the peer group, the peer group effects, found in column (6), remain largely intact.

[45]Figures 1 and 2 were plotted with the user-written Stata® command `coefplot` (Jann, 2014).

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[Insert Figure 1 about here]

As for the social comparison effect, it is now weaker than before the inclusion of intrapersonal effects with only three significant coefficients; namely, in the year of the wage change itself and the two succeeding years. This can also be seen in Figure 2. We suppose that including the intrapersonal wage comparison absorbs most of the the previously observed interpersonal effect.

[Insert Figure 2 about here]

When dealing with job satisfaction, different reasons or circumstances come to mind that may affect job satisfaction through the channel of wage changes. The most prominent reasons are obviously a promotion or an employer change, but also, for instance, training, or union membership and the results of collective bargaining agreements. The completion of job-related education or training courses is often associated with both a wage increase and greater job satisfaction (see, e.g., Georgellis and Lange, 2007; Jones et al., 2009). Thus, the observed results may reflect not mere satisfaction due to a wage increase but also because training may result in, for instance, task enrichment and therefore greater job satisfaction. We have, however, addressed this issue by controlling for job-related training in the year preceding the job satisfaction evaluation. Formal job changes are also not only associated with wage increases, but also with (temporary) increased job satisfaction (Boswell et al., 2005). The potentially increased job satisfaction of individuals who have changed jobs may be so pronounced that it outweighs the average effect for individuals who did not change their jobs. We therefore deal extensively with this issue by rerunning our main regressions under the exclusion of individuals who have changed their jobs in a robustness check in Section 7.2.1.[46]

Since we cannot identify and therefore control for small-scaled promotions in our data (i.e., promotions that are neither associated with employer changes nor with position changes within a firm), we additionally attribute increased job satisfaction due to a wage increase to promotions (Johnston and Lee, 2013). If individuals anticipated promotions and were more satisfied with their jobs ahead of a promotion as well as did not immediately adapt to the increased job satisfaction which they derived from an actual promotion, we would likely observe these effects in form of statistically significant coefficients of our wage change variables. That is, because we assume that a promotion not only increases job satisfaction through a salary increase, which

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[46]We thank an anonymous referee for pointing out the necessity of validating our main results with respect to this issue.

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we account for, but also increases task autonomy and decision competences. Thus, although our job change dummies are expected to control for most promotions, i.e., those associated with employer changes or position changes within a firm, we cannot rule out that a part of the observed effect is due to promotions and that our coefficients may therefore be somewhat overestimated.[47]

Finally, wages may increase because of the collective bargaining efforts of trade unions, while there may be systematic differences between the job satisfaction of members and non-members of trade unions. Our data do not allow us to control thoroughly for union membership or whether an individual is subject to collective bargaining agreements.[48] However, relying on the findings of Goerke and Pannenberg (2011), we assume that union members do not earn higher wages than non-members in Germany, since the authors argue that employers typically extent collective bargaining agreements to all their employees. Additionally, such agreements are also applied by employers that are not legally covered.[49] Moreover, by considering social comparison effects in our regressions, we partially capture the impact of wage increases due to collective bargaining agreements on job satisfaction, as an individual's peers are likely also affected by such agreements.[50] Next to the direct wage effect of union membership, the exit-voice idea of Hirschman (1970) and its embedment in the labour market context by Freeman (1980) suggests that less satisfied employees will more likely become union members, in order to express their dissatisfaction instead of quitting their job. However, by considering this employee selection and the working conditions of union and non-union members, recent evidence contradicts the long term opinion of a negative association between union membership and job satisfaction (e.g., Bryson et al., 2004; Gordon and Denisi, 1995). Analogous considerations can also be applied to the relationship between work councils and job satisfaction. As shown by Grund and Schmitt (2013), wages and job satisfaction are not driven by work councils for job stayers. For these reasons, we are not too worried by omitting union membership from the set of our control variables. If, however, there was a negative causal effect of union membership on job

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[47]Yet, it remains unclear to what extent workload rises with promotions. In this respect, our obtained results may also be underestimating the true effect of a wage change, because a heavier workload is likely to have a detrimental effect on job satisfaction.

[48]For instance, union membership is surveyed in the GSOEP in 1985, 1989, and 1993, thus, it would be rather preposterous to impute this information into the following 20 years, which our analysis covers.

[49]See, for instance, Garcia-Serrano (2009) or Krieg et al. (2013), for discussions about the relationship between job satisfaction and the extension of union membership benefits to non-members.

[50]Using a more precise measure of industry affiliation when generating our peer groups would allow us to more accurately trace the collective bargaining agreements by our social comparison variable. However, by using a more narrow industry specification in the grouping process, we would end up with too small peer groups for a reasonable analysis.

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satisfaction, then our estimates may be somewhat biased downwards.

In sum, our results support reference-dependent preferences with well-being depending not only on absolute, but also on relative considerations. In our case, intrapersonal comparisons seem to be more substantial than social comparisons. In line with Clark (1999) and Grund and Sliwka (2007), we find that job satisfaction is positively correlated with intrapersonal wage changes. Moreover, the observed effect on job satisfaction is strongest in the year when the wage change occurs. Similar results concerning the peak impact of several life events on well-being have been found by, for instance, Clark et al. (2008b).

Further, we find evidence for considerable anticipation and adaptation effects on job satisfaction from wage changes. First of all, individuals seem to anticipate future wage changes at least one year prior to their occurrence. Positive anticipation effects have also been found by Di Tella et al. (2010), with changes in income between the current and the subsequent year having a significant impact on current life satisfaction. Similarly, Lydon and Chevalier (2002) find that future wage expectations significantly influence current job satisfaction. Second, the effects of wage changes appear to be of transitory nature, with people at least partially returning to their baseline satisfaction level within a short period of time. Thus, our results to some extent support Di Tella et al. (2010), who find full adaptation to income within four years. Strong adaptation effects have also been reported by Johnston and Lee (2013), with job satisfaction returning to the baseline level three years after receiving a promotion.[51]

Our results concerning social comparisons weakly support the existence of interpersonal preferences. More specifically, our findings support the idea of status effects outweighing potential signal effects, which contradicts the findings of Clark et al. (2009). A wage change above the wage change of the respective peer group appears to temporarily enhance job satisfaction. Similarly, Ferrer-i-Carbonell (2005) finds that individuals' happiness increases with the difference between their own income and the comparison income. Further, empirical evidence on interpersonal preferences has been found, for example, by Luttmer (2005) and Smith (2015). The latter argues that an individual's reaction to a wage cut concerning work morale or job satisfaction, respectively, is driven by the perceived fairness of the wage change; i.e., if the wages of similar others are also cut. Our social comparison effect completely vanishes within three years after a wage change. Hence, we conclude that interpersonal comparisons matter, but that the inclusion

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[51]Since most workers' wages typically increase after a promotion, the results of Johnston and Lee (2013) can also provide some insights on adaptation to income changes.

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of anticipation and adaptation dimensions considerably lowers their importance for job satisfaction. Thus, our finding contradicts Ferrer-i-Carbonell (2005) or Grund and Martin (2017) to a certain extent, who conclude that social comparisons appear to be just as important or even more important than the individual's own income level with respect to life and job satisfaction.

7 Heterogeneity and Sensitivity Analysis

In this section, we aim at checking the heterogeneity and robustness of the results obtained in the previous section. In Section 7.1, we analyse the heterogeneity of our main results with respect to positive and negative wage changes. In Section 7.2, we will check the sensitivity of our main results by running various robustness checks with a particular focus on individuals who did not change their jobs between observations.

7.1 Heterogeneity Analysis

We begin by analysing to what extent our main results are heterogeneous with respect to the direction of the wage change, i.e., positive and negative. It seems plausible to assume an asymmetric effect if one considers that due to loss aversion individuals should react stronger to a wage decrease than an increase (Kahneman and Tversky, 1979, 1984). To do so, we rewrite equation (3) in the following way:

$$
\begin{aligned}
jobsat_{nt} =& \alpha_0 wch_{nt}^+ + \alpha_1 wch_{nt+1}^+ + \sum_{i=1}^{4} \alpha_{-i} wch_{nt-i}^+ \\
&+ \gamma_0 wch_{nt}^- + \gamma_1 wch_{nt+1}^- + \sum_{i=1}^{4} \gamma_{-i} wch_{nt-i}^- \\
&+ \beta_0 dtp_{nt} + \beta_1 dtp_{nt+1} + \sum_{i=1}^{4} \beta_{-i} dtp_{nt-i} + \\
&+ X_{nt}\delta + JC_{nt+1}\gamma_1 + \sum_{i=1}^{4} JC_{nt-i}\gamma_{-i} + f_n + \eta_t + \epsilon_{nt}.
\end{aligned}
\tag{4}
$$

In equation (4), wch_{nt}^+ is a dummy equal to 1, if an individual experienced a wage change above 5% in period t. wch_{nt+1}^+ and wch_{nt-i}^+ are the corresponding anticipation and adaptation dummies for periods $t+1$ and $t-i$. Analogously, wch_{nt}^- is a dummy equal to 1, if an individual experienced a wage change below -5% in period t, with wch_{nt+1}^- and wch_{nt-i}^- representing the corresponding anticipation and adaptation dummies. Thus, a wage change between -5% and 5% serves as reference category. We chose to restrict our positive and negative dummies to values

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above 5% and below -5%, respectively, in order to catch important wage changes that are not confounded by reporting errors or temporary wage changes due to overtime pay received in the month of the survey.[52]

[Insert Table 4 about here]

Table 4 reports the results from equation (4). In column (1), we report results from an unconditional OLS regression, namely we regress job satisfaction on all wage change dummies. All coefficients with the exception of the last lag of a negative wage change are statistically significant, and exhibit the expected signs, i.e., the dummies for the positive wage changes are positively associated with job satisfaction, and those for a negative change are negatively associated with job satisfaction. In column (2), we run a further OLS specification, where we condition the outcome on a vector of control variables X. The results remain qualitatively the same, where now only the effect in t of the negative wage change dummies is statistically significant. This would mean, that in comparison to peers who did not experience a wage cut individuals fully adapt to a wage decrease within one year. In a within individual comparison, i.e., once we control for individual time-invariant fixed effects (column (3)), all negative wage change variables are statistically significant, albeit sometimes only at the 10% level. For positive wage changes, on the other hand, the third and fourth lags become statistically insignificant, which supports the idea of full adaptation to a wage increase after two years.

Finally, we also control for social comparisons by adding the interindividual wage change dummies to our specification (column (4)). With respect to the positive wage change dummies, the sole difference to the previous specification is that the statistical significance of the lead variable decreases to the 10% level. For the negative wage change dummies, however, lags one and two now become statistically insignificant and the statistical significance of the immediate effect decreases to the 5% level. Given these results, we assume that the social comparison dummies partly absorb the effect of wage changes, and in particular decreases, on job satisfaction. It seems plausible to assume that many of the realised wage decreases are due to industry-specific wage cuts or shocks that reduce overtime hours and the earnings associated with them. So, assuming that individuals compare themselves to their peers, it appears easier to cope with a wage cut if it also applies to one's own peers. This result is in line with Cohn et al. (2014), who

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[52]Recall that the question concerning an individual's wage refers to the earnings gained in the previous month. Thus, minor changes because of an irregular overtime pay are possible despite a stable gross annual salary specified in the employment contract.

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find that collective wage cuts result in smaller effort declines than individual wage cuts and thus appear to be more accepted by workers. As for the social comparison effect itself, we still find a small statistical significance in the year of the wage change itself and the following two lags.

The overall picture of our heterogeneity analysis confirms our previous findings. In general, individuals react strongly to experiencing a wage change; however, its effect decreases over time. In contrast to our main specification, where we found partial adaptation, we observe full adaptation within three years for the upside scenario and strong partial adaptation for the negative scenario. While this result is modestly in line with the findings of Ferrer-i-Carbonell and van Praag (2008) on wage cuts and life satisfaction, it contradicts to some extent experimental evidence on the effect of wage cuts on effort, which suggests that individuals lower their effort consistently following a wage cut (Kube et al., 2013).

7.2 Robustness Checks

7.2.1 Job Satisfaction for Job Stayers

Empirical evidence suggests that there is a strong relationship between job changes and job satisfaction (Boswell et al., 2005; Chadi and Hetschko, 2017).[53] Moreover, in our main specification, the estimated coefficients of the job change variables were both large in size and statistically highly significant (see Table A.2 in the Appendix). Finally, the attainment of wage increases and career progresses in terms of higher ranked positions can be considered as typical motives for voluntary job changes. We therefore attempt to assert that our main results are not solely driven by individuals who changed their employers or within firm positions. For this purpose, we run our main specification according to equation (3) under the exclusion of individuals who changed their jobs.

[Insert Table 5 about here]

Table 5 reports the results of this analysis. While our focus lies on individuals who did not change their jobs (further on referred to as job stayers) in t as depicted in column (1), we build further up by subsequently excluding individuals who changed their jobs in the lead and lag periods (columns (2)-(7)). So, column (2) presents the results for a sub-sample of individuals

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[53]Chadi and Hetschko (2017) provide an extensive analysis on the relationship between job changes and job satisfaction. They stress the importance of the reason associated with job changes and find that while voluntary job changes lead to increased job satisfaction in the short run, exogenously triggered job changes do not result in higher job satisfaction.

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who neither changed their job in t nor in $t+1$, column (3) repeats this analysis for individuals who neither changed their job in t nor in $t-1$, column (4) refers to job stayers in $t-1$ through $t+1$, while columns (5)-(7) subsequently add lagged periods $t-2$ to $t-4$.[54] For all specifications, the results remain qualitatively similar to the main results in terms of statistical significance. With respect to the coefficients' size, the interindividual effects remain largely in line with our main estimates, while the estimated coefficients for the intraindividual effect of a wage change in t on job satisfaction tend to decline as we proceed in excluding individuals who did not change their jobs in consecutive years. Yet, it should be noted that the main coefficient of interest, which refers to the sample of individuals who did not change their jobs in t and is presented in column (1) loses no more than 25% of its initial magnitude. In other words, while in our main analysis, a one-percentage point increase of the wage change variable translated into an increase in job satisfaction by about one quarter of a standard deviation, it translates into roughly one fifth of a standard deviation for job stayers. It is also noteworthy that over one half of the initial effect remains intact, once we require individuals to neither have changed their employer nor their position within their firm for six consecutive years.

These results support two ideas. First, they provide a lower bound for our main effect, because we can assert that the now observed effect is more clearly attributable to wage changes per se and not increased job satisfaction because of a new job. Second, since job changes are usually associated with larger wage increases than those realised without job changes,[55] we asserted that our main findings are not driven by the upper tale of the wage increase distribution in our sample.

Yet, the most interesting observation from this robustness check is that the estimated coefficients of the adaptation effects seem to be proportionally larger than the respective coefficients in our main specification. This result indicates that individuals who did not change their jobs but realised a wage increase, appear to adapt slower to wage increases than their counterparts. This result favours the findings of Boswell et al. (2005), since it suggests that a share of the adaptation which we observe in our main results may be driven by the job changers that experience the so called "hangover-effect". Thus, omitting these individuals from our specification yields a less pronounced adaptation pattern in job satisfaction.

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[54] Arguably, individuals who did not change their jobs neither their within firm position for six consecutive years may constitute a biased sample. However, one should also bear in mind that the average job tenure in our sample is 15 years (see Table A.1), while this variable's modal value is 8 with a majority of individuals reporting a job tenure of 6 to 8 years.

[55] This observation also holds for a simple means comparison of our sample.

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7.2.2 Further Robustness Checks

[Insert Table 6 about here]

Table 6 reports the results of our further robustness checks. First, we address the choice of the lead and lag structure in our main analysis. While, it is reasonable to assume that individuals do not react anticipatively to a wage change more than a year in advance, the choice of our lag structure was mainly guided with reference to the related literature and the trade-off between adding further lags and losing observations, since every further lag would have required to observe the respective individuals for one additional year. We add one further lag, i.e., $t-5$, of the intra- and interindividual wage changes to equation (3).[56] Column (1) reports the results from this specification. We find results, that are qualitatively the same as our main results. Neither the intra- nor the interindividual wage change is statistically significant for the fifth lag. We therefore conclude that the observed partial adaptation in our main specification results in a full adaptation after four years.

In the main analysis, we calculate the individuals' wage changes based on their monthly gross wages. However, due to the highly varying tax load owing to an individual's marital status and family situation, the effective net wage and the resulting wage change may differ for individuals with the same monthly gross wage. Since our main specification applies a within estimator and we control for potential changes in the individuals' marital status and family situation, these concerns appear to be rather negligible. Nevertheless, we replace monthly gross wages with monthly net wages, recalculate both intra- and interpersonal wage changes, and run our main specification with these variables. The associated results are displayed in column (2). With respect to our main results, we observe two differences. First, the last lag of the intraindividual wage change now becomes statistically insignificant, indicating that full adaptation takes place after three years. Second, the coefficients of the social comparisons variables now completely lose statistical significance. We assume that calculating peer wages on the basis of net wages is rather inappropriate, because individuals compare wages with respect to their work and not their family situation, while the latter highly distorts net wages in the German case.

Although by applying a linear regression technique to an ordinary scaled dependent variable, we resort to a well-established approach in the happiness literature (Ferrer-i-Carbonell and

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[56]We also add the fifth lag for the control variables which were aligned to the lead and lag structure of our explanatory variables.

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Frijters, 2004), we attempt to alleviate the methodological concerns by generating a metric dependent variable. In order to do so, we standardise the reported job satisfaction into a variable with mean 0 and variance 1 by subtracting the sample's mean from each observation and dividing the result by the sample's standard deviation. Column (3) presents the results from this specification. Both the coefficients of the intra- and interindividual effects exhibit the same statistical significance levels. The interpretation of these coefficients has now, however, changed. For instance, the coefficient of the wage change in t, i.e., 0.256, translates into one quarter of a standard deviation increase for the dependent variable, which is approximately the same magnitude as in our main specification. Since the interpretation of our results is more convenient and intuitive with a dependent variable ranging from 0 to 10, we, nevertheless, prefer our main specification over this robustness check.

While we are not worried about the simultaneity bias with respect to the lagged variables of an individual's wage change, reasonable concerns refer to the wage change in t and mostly to the anticipation effect measured in $t+1$. Provided that the omission of the anticipation effect would lead to an underestimation of the coefficient of current and lagged variables (see Hanglberger and Merz, 2015), we drop the lead variables from our main specification, in order to inspect the lower bound for our main estimates and thereby assure that our results remain statistically significant and exhibit the correct signs. Therefore, we proceed by excluding all lead variables from the main equation (3). The associated results are presented in column (4). The results remain similar to the ones obtained from our main specification, yet, as expected, the coefficient of the intraindividual wage change in t as well as its lags decrease in size. The coefficient of the intraindividual wage change in t is now 0.366 as opposed to 0.473 in our main specification. This result demonstrates that the omission of the lead variable does not lead to qualitatively different results, i.e., its inclusion does not distort the estimation of the other coefficients.

Since adjustments to wage changes may also depend on the extent of previous absolute levels of job satisfaction, we also specify a lagged dependent variable (LDV) model, which includes an individual's job satisfaction in the preceding year, i.e., $t-1$, into the set of our control variables. As a by-product of specifying this robustness check, we can also benefit from the bracketing property (see Angrist and Pischke, 2009), according to which, the true effect is bounded by the fixed effects model (i.e., our main specification) and the LDV model if either of the two was correct.[57] According to Angrist and Pischke (2009), the true effect would be overestimated if

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[57]A recent application of this property can be found, for instance, in Falk et al. (2017).

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one specified a fixed effects model, but the correct model was LDV and on the contrary, the true effect would be underestimated if one specified a LDV model, while the correct model was a fixed effects specification. In line with this proposition, we find that the estimated coefficients presented in column (5) are smaller than our main estimates, for instance, the effect of wage changes on job satisfaction in t is 0.435 points vs. 0.473 points in our main specification. Also, the third lag is no longer statistically significant, which is similar to our findings from the heterogeneity analysis (see Section 7.1). Finally, the second lag of the interindividual effect is now statistically insignificant as compared to the previous significance at the 10% level.

Finally, we relax our sample restriction to full-time employees by including part-time employees into our analysis. In order to control for an increased job satisfaction merely due to a desired shift into full-time employment, we now include dummies for full-time employment as well as the associated lead and lag variables into our analysis. The results from this specification are presented in column (6) and remain qualitatively comparable to the main results with slightly stronger adaptation tendencies for the intraindividual wage changes.

8 Conclusion

Wage increases are one of the most common methods used by firms to stimulate employee motivation. On the superficial level, this seems to be a reasonable practice, since hardly anybody would argue that employees dislike positive wage changes. Yet, the persistence of employee satisfaction remains a far more arguable matter. With this analysis we have contributed to answering the question of whether wage increases really buy enhanced and persistent employee job satisfaction. We thereby also elicited the reference dependence of individuals' evaluation of job satisfaction. In our analysis, we have estimated a job satisfaction equation and simultaneously included a lead and lag structure of wage changes in our model and accounted for social comparisons using representative individual panel data for Germany from 1990 to 2013.

Our findings indicate that individuals anticipate wage changes one year prior to their actual occurrence. Further, our results show that people at least partially or even fully adapt to wage changes within three to four years after a realised wage change. Furthermore, receiving a wage increase above one's respective peer group enhances individual job satisfaction. On the other hand, social comparisons appear to play a minor role in job satisfaction when simultaneously controlling for intraindividual comparisons. When we disentangled positive and negative wage

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changes, we found that individuals fully adapt to positive wage changes and that wage decreases are partly absorbed by interindividual comparisons. Finally, adaptation appears to decelerate once we cleared our sample of individuals who have changed their job between the observations, indicating that adaptation to wage changes is partly driven by the associated adaptation to a new job for individuals who assumed new within-firm positions or changed their employer.

Our results provide meaningful policy implications for the wage setting policy of a firm. First of all, wage increases induce positive effects on employee job satisfaction in the short-run. However, these positive satisfaction effects appear not to be of a permanent nature, since people (partially) adapt to realised positive wage changes within a short period of time. Consequently, wage increases at regular intervals may be a solution to achieve more enhanced and persistent employee motivation. In doing so, the frequency of wage increases should be aligned to the duration of adaptation, by means of seniority wages or regular promotions. Nevertheless, this policy advice should be only regarded as a cautious indication. First, recent evidence, suggests that individuals positively react to unexpected wage increases (Bellemare and Shearer, 2009; Gneezy and List, 2006; Ockenfels et al., 2015b), which would not be the case with "automated" wage increases.[58] Second, our data do not permit a cost-benefit analysis. Thus, in the framework of this analysis, it cannot be asserted that the overall effect of regular wage increases and the associated costs of doing so may provide a benefit for employers. However, by comparing different, cost-neutral wage treatments in an experimental setting, Sliwka and Werner (2017) show that frequent wage increases in small increments enhance employee performance as compared to the same total of wage raises distributed in bigger, but less frequent steps.

In line with Cohn et al. (2014) and based on our evidence from the social comparison analysis, wage cuts appear to be more acceptable and have less pronounced negative effects when they are executed collectively; i.e., when similar others also experience wage cuts. Thus, it is therefore recommended that firms, when obliged to cut wages, should consider their employees' relative wage situations. Furthermore, wage cuts may have less detrimental effects on employees' behaviour and labour supply if the reasons for the firm's wage cuts are considered as adequate/justified by the affected employees in case of, for instance, a bad firm situation (see, e.g., Bewley, 2005; Bracha et al., 2015; Chen and Horton, 2009; Gerhards and Heinz, 2017; Greenberg, 1990), although Bewley (2005, p. 308) argues that even in this case there may be a

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[58]However, while in the studies of Gneezy and List (2006) and Bellemare and Shearer (2009) the positive effects are only short-lived, the positive effects persist for the duration of the experiment in the study of Ockenfels et al. (2015b).

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negative effect on work morale, since it is considered a "breach of implicit reciprocity".

Finally, caution is advisable with respect to wage transparency (see, e.g., Ockenfels et al., 2015a). On the one hand, transparent wages may further stimulate employee motivation in recognition of an employee's superior work. On the other hand, transparent wages might have a disincentive effect on job satisfaction (Card et al., 2012) and effort (Bracha et al., 2015; Gächter and Thöni, 2010), when employees perceive their wages to be below their peers' wages. At the same time, recent evidence suggests that under an adaptive reference standard, individuals' productivity may not react to frequent wage increases if individuals know their wage profiles in advance (Sliwka and Werner, 2017). Thus, concealing wage profiles from employees, while executing frequent small increases, may be more profitable to firms than wage transparency.

Given these results, we advise employers to consider alternative and/or complementary instruments, in order to enhance and sustain employee motivation. Provided that the existing evidence on job satisfaction and personnel practices that adequately account for both social comparisons and the lead and lag structure is rather scarce, a future avenue of research may lie in the analysis of the effect of other personnel policies on job satisfaction.

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Tables and figures

Table 1: Descriptive statistics of job satisfaction

Job satisfaction	N (male)	N (female)
"Totally unhappy" (0)	81	45
1	132	48
2	386	145
3	789	340
4	946	466
5	2,447	1,206
6	2,803	1,126
7	5,144	2,196
8	6,878	2,716
9	2,875	1,048
"Totally happy" (10)	1,207	467
Total	23,688	9,803

Note: N is the number of observations.
Source: German Socio-Economic Panel (SOEP), years 1990-2013, own calculations.

Table 2: Summary statistics of the main variables of the job satisfaction analysis

Variable	Mean	Std	within-Std	Min	Max
Job satisfaction	6.94	1.86	1.20	0	10
Wage change	0.036	0.14	0.14	-0.50	1.00
Peer group wage change	0.035	0.14	0.13	-0.86	4.59
Gross income	2,889	1,314	449	642	21,500
Peer income	2,822	975	388	570	17,500

Notes: The number of observations is 33,491. Std is the standard deviation, within-Std is the within standard deviation. Gross and peer income values are denoted in Euro and rounded to full digits.
Source: German Socio-Economic Panel (SOEP), years 1990-2013, own calculations.

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Figure 1: Job satisfaction and intraindividual wage change

Job satisfaction and intraindividual wage change
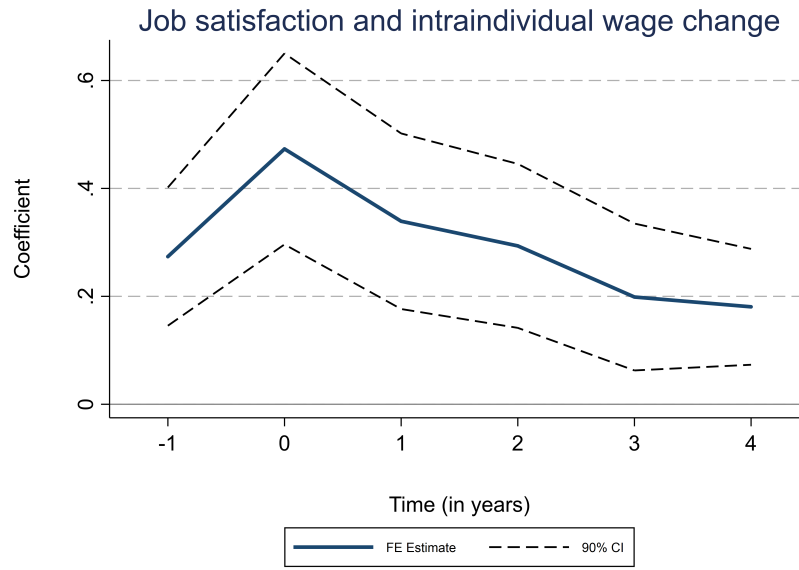
Notes: The above figure plots the estimated intraindividual coefficients of equation (3), which are denoted by the blue line and the 90% confidence interval (grey dashed line).
Source: German Socio-Economic Panel (GSOEP), years 1990-2013, own calculations.

Figure 2: Job satisfaction and interindividual wage change

Job satisfaction and interindividual wage change

Notes: The above figure plots the estimated interindividual coefficients of equation (3), which are denoted by the blue line and the 90% confidence interval (grey dashed line).
Source: German Socio-Economic Panel (GSOEP), years 1990-2013, own calculations.

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Table 3: Job satisfaction and wage changes

Dependent variable				Job satisfaction		
	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) FE	(6) FE
Wage change $t+1$				0.277^{***} (0.068)		0.274^{***} (0.078)
Wage change t	0.555^{***} (0.064)	0.259^{***} (0.066)	0.212^{***} (0.069)	0.579^{***} (0.099)		0.473^{***} (0.108)
Wage change $t-1$				0.460^{***} (0.093)		0.339^{***} (0.099)
Wage change $t-2$				0.357^{***} (0.086)		0.294^{***} (0.092)
Wage change $t-3$				0.174^{**} (0.076)		0.199^{**} (0.083)
Wage change $t-4$				0.151^{**} (0.059)		0.181^{***} (0.065)
Peer group dummy $t+1$					0.037^{**} (0.017)	0.002 (0.020)
Peer group dummy t					0.101^{***} (0.019)	0.060^{***} (0.021)
Peer group dummy $t-1$					0.088^{***} (0.020)	0.068^{***} (0.021)
Peer group dummy $t-2$					0.059^{***} (0.020)	0.037^{*} (0.021)
Peer group dummy $t-3$					-0.000 (0.019)	-0.012 (0.021)
Peer group dummy $t-4$					0.005 (0.018)	-0.016 (0.020)
Controls	NO	YES	YES	YES	YES	YES
Observations	33,491	33,491	33,491	33,491	33,491	33,491
Adj. R^2 / R^2-within	0.002	0.137	0.048	0.062	0.061	0.063

Notes: $*/**/***$ denotes statistical significance at the 10/5/1% level. The values in parentheses represent robust standard errors clustered at the individual level (6,132 individuals and 5.5 years). The descriptive statistics for *job satisfaction* is provided in Section 4. The specifications in columns (2)–(5) contain a set of covariates introduced in Section 5.
Source: German Socio-Economic Panel (GSOEP), years 1990-2013, own calculations.

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Table 4: Job satisfaction and asymmetric wage changes

Dependent variable	Job satisfaction			
	(1) OLS	(2) OLS	(3) FE	(4) FE
Positive wage change $t+1$	0.062^{***}	0.067^{***}	0.038^{**}	0.038^{*}
	(0.023)	(0.022)	(0.019)	(0.021)
Positive wage change t	0.206^{***}	0.131^{***}	0.131^{***}	0.113^{***}
	(0.023)	(0.023)	(0.022)	(0.024)
Positive wage change $t-1$	0.185^{***}	0.136^{***}	0.105^{***}	0.083^{***}
	(0.023)	(0.023)	(0.022)	(0.023)
Positive wage change $t-2$	0.137^{***}	0.102^{***}	0.065^{***}	0.050^{**}
	(0.023)	(0.022)	(0.022)	(0.024)
Positive wage change $t-3$	0.082^{***}	0.060^{***}	0.022	0.036
	(0.023)	(0.022)	(0.021)	(0.024)
Positive wage change $t-4$	0.080^{***}	0.055^{**}	0.006	0.011
	(0.023)	(0.022)	(0.020)	(0.022)
Negative wage change $t+1$	-0.065^{**}	-0.031	-0.062^{**}	-0.061^{**}
	(0.030)	(0.028)	(0.026)	(0.027)
Negative wage change t	-0.121^{***}	-0.062^{**}	-0.072^{***}	-0.059^{**}
	(0.030)	(0.029)	(0.027)	(0.028)
Negative wage change $t-1$	-0.101^{***}	-0.043	-0.056^{**}	-0.040
	(0.030)	(0.029)	(0.028)	(0.029)
Negative wage change $t-2$	-0.085^{***}	-0.027	-0.048^{*}	-0.036
	(0.031)	(0.029)	(0.028)	(0.029)
Negative wage change $t-3$	-0.069^{**}	-0.008	-0.053^{*}	-0.063^{**}
	(0.031)	(0.029)	(0.027)	(0.028)
Negative wage change $t-4$	-0.036	-0.012	-0.049^{*}	-0.052^{*}
	(0.032)	(0.030)	(0.027)	(0.027)
Peer group dummy $t+1$				0.004
				(0.020)
Peer group dummy t				0.046^{**}
				(0.022)
Peer group dummy $t-1$				0.053^{**}
				(0.022)
Peer group dummy $t-2$				0.038^{*}
				(0.022)
Peer group dummy $t-3$				-0.027
				(0.022)
Peer group dummy $t-4$				-0.010
				(0.021)
Controls	NO	YES	YES	YES
Observations	33,491	33,491	33,491	33,491
Adj. R^2 / R^2-within	0.008	0.149	0.062	0.063

Notes: */**/*** denotes statistical significance at the 10/5/1% level. The values in parentheses represent robust standard errors clustered at the individual level (6,132 individuals and 5.5 years). The descriptive statistics for *job satisfaction* is provided in Section 4. The specifications in columns (2)-(4) contain a set of covariates introduced in Section 5.
Source: German Socio-Economic Panel (GSOEP), years 1990-2013, own calculations.

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Table 5: Job satisfaction and wage changes without job changes

Dependent variable	Job satisfaction						
	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE	(7) FE
Job not changed in …	t	$t+1/t$	$t/t-1$	$t+1/t/t-1$	$t+1/t/t-2$	$t+1/t/t-3$	$t+1/t/t-4$
Wage change $t+1$	0.248***	0.224***	0.231***	0.214***	0.209**	0.212**	0.200**
	(0.079)	(0.081)	(0.080)	(0.082)	(0.083)	(0.085)	(0.086)
Wage change t	0.367***	0.346***	0.330***	0.323***	0.330***	0.285**	0.261**
	(0.110)	(0.112)	(0.113)	(0.115)	(0.117)	(0.119)	(0.120)
Wage change $t-1$	0.295***	0.260**	0.299***	0.270**	0.293***	0.264**	0.274**
	(0.101)	(0.103)	(0.105)	(0.106)	(0.109)	(0.111)	(0.114)
Wage change $t-2$	0.277***	0.261***	0.288***	0.271***	0.286***	0.277***	0.287***
	(0.094)	(0.094)	(0.096)	(0.096)	(0.099)	(0.101)	(0.104)
Wage change $t-3$	0.205**	0.170**	0.194**	0.168**	0.172**	0.170*	0.171*
	(0.083)	(0.084)	(0.085)	(0.085)	(0.087)	(0.089)	(0.092)
Wage change $t-4$	0.182***	0.184***	0.191***	0.189***	0.168**	0.165**	0.169**
	(0.066)	(0.067)	(0.067)	(0.067)	(0.069)	(0.070)	(0.073)
Peer group $t+1$	0.000	-0.001	0.004	0.001	0.002	0.005	0.005
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)	(0.021)
Peer group t	0.066***	0.059***	0.072***	0.062***	0.060***	0.062***	0.067***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)	(0.022)	(0.022)
Peer group $t-1$	0.077***	0.080***	0.073***	0.075***	0.073***	0.079***	0.076***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.023)	(0.023)
Peer group $t-2$	0.040*	0.040*	0.037*	0.038*	0.041*	0.044*	0.042*
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.023)	(0.023)
Peer group $t-3$	-0.004	-0.001	-0.004	-0.000	0.004	0.003	0.001
	(0.021)	(0.021)	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)
Peer group $t-4$	-0.011	-0.012	-0.007	-0.009	-0.004	-0.002	-0.003
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)	(0.021)
Controls	YES	YES	YES	YES	YES	YES	YES
Individuals	6,074	5,988	5,998	5,900	5,804	5,672	5,510
Observations	32,467	31,596	31,574	30,794	30,022	29,183	28,229
Adj. R^2 / R^2-within	0.058	0.047	0.055	0.046	0.046	0.045	0.045

Notes: * / ** / *** denotes statistical significance at the 10/5/1% level. The values in parentheses represent robust standard errors clustered at the individual level. The descriptive statistics for *job satisfaction* is provided in Section 4. All specifications contain a set of covariates introduced in Section 5. Source: German Socio-Economic Panel (GSOEP), years 1990-2013, own calculations.

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Table 6: Job satisfaction and wage changes – Robustness checks

Dependent variable	Job satisfaction		Std. job sat.		Job satisfaction	
	(1) FE	(2) FE	(3) FE	(4) FE	(5) LDV	(6) FE
Job satisfaction $t-1$					0.516*** (0.008)	
Wage change $t+1$	0.299*** (0.083)	0.172** (0.079)	0.147*** (0.042)		0.233*** (0.075)	0.283*** (0.066)
Wage change t	0.464*** (0.119)	0.494*** (0.114)	0.256*** (0.058)	0.366*** (0.101)	0.435*** (0.082)	0.460*** (0.088)
Wage change $t-1$	0.380*** (0.114)	0.468*** (0.105)	0.186*** (0.053)	0.283*** (0.097)	0.132* (0.075)	0.324*** (0.081)
Wage change $t-2$	0.318*** (0.109)	0.436*** (0.100)	0.162*** (0.050)	0.264*** (0.092)	0.158*** (0.072)	0.267*** (0.077)
Wage change $t-3$	0.274*** (0.098)	0.213** (0.089)	0.109** (0.044)	0.189** (0.083)	0.064 (0.069)	0.108 (0.068)
Wage change $t-4$	0.219*** (0.084)	0.100 (0.071)	0.098*** (0.035)	0.185*** (0.066)	0.139** (0.061)	0.108* (0.055)
Wage change $t-5$	0.079 (0.067)					
Peer group dummy $t+1$	−0.002 (0.021)	0.008 (0.020)	0.001 (0.011)		0.014 (0.019)	−0.004 (0.017)
Peer group dummy t	0.046** (0.023)	0.010 (0.021)	0.033*** (0.011)	0.061*** (0.020)	0.046** (0.019)	0.033* (0.019)
Peer group dummy $t-1$	0.057** (0.024)	0.017 (0.022)	0.037*** (0.012)	0.066*** (0.021)	0.050*** (0.019)	0.062*** (0.019)
Peer group dummy $t-2$	0.047** (0.024)	−0.012 (0.022)	0.020* (0.012)	0.035* (0.021)	0.012 (0.019)	0.035* (0.018)
Peer group dummy $t-3$	−0.019 (0.024)	−0.026 (0.021)	−0.006 (0.011)	−0.014 (0.021)	−0.029 (0.019)	0.030 (0.019)
Peer group dummy $t-4$	−0.021 (0.023)	−0.021 (0.020)	−0.009 (0.011)	−0.019 (0.020)	−0.008 (0.018)	−0.017 (0.017)
Peer group dummy $t-5$	−0.021 (0.021)					
Controls	YES	YES	YES	YES	YES	YES
Individuals	5,234	6,124	6,132	6,132	6,122	7,827
Observations	28,645	33,473	33,491	33,491	33,283	43,185
Adj. R^2 / R^2-within	0.060	0.060	0.058	0.052	0.381	0.057

Notes: */**/*** denotes statistical significance at the 10/5/1% level. The values in parentheses represent robust standard errors clustered at the individual level. The descriptive statistics for *job satisfaction* is provided in Section 4, the descriptive statistics for *std. job satisfaction* is provided in Table A.1 in the Appendix. All specifications contain a set of covariates introduced in Section 5. In column (6), this set of controls is additionally including a dummy variable and its lead and lags indicating whether an individual is employed in full-time. In column (2), the wage changes and the dummies indicating, whether they exceed the wage changes of the individuals' peers, refer to an individual's net wages.
Source: German Socio-Economic Panel (GSOEP), years 1990-2013, own calculations.

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Appendix

Table A.1: Definition and descriptive statistics of all variables used in the job satisfaction analysis

Variable	Definition	N	Mean	Std	Min	Max
Job satisfaction	Job satisfaction indicated on a 0 ("totally unhappy") to 10 ("totally happy") scale	33,491	6.94	1.86	0	10
Job satisfaction $t-1$	Job satisfaction in $t-1$	33,279	6.98	1.84	0	10
Job satisfaction (std)	Standardised measure of job satisfaction	33,491	0	1	-4.05	1.73
Wage change (gross) $t+1$	Gross wage change of employee in $t+1$	33,491	0.03	0.15	-0.5	1
Wage change (gross) t	Gross wage change of employee in t	33,491	0.04	0.14	-0.5	1
Wage change (gross) $t-1$	Gross wage change of employee in $t-1$	33,491	0.04	0.15	-0.5	1
Wage change (gross) $t-2$	Gross wage change of employee in $t-2$	33,491	0.05	0.15	-0.5	1
Wage change (gross) $t-3$	Gross wage change of employee in $t-3$	33,491	0.05	0.16	-0.5	1
Wage change (gross) $t-4$	Gross wage change of employee in $t-4$	33,491	0.06	0.17	-0.5	1
Wage change (gross) $t-5$	Gross wage change of employee in $t-5$	28,645	0.06	0.17	-0.5	1
Pos. wage change $t+1$	Dummy variable indicating whether employee's wage change was above 5% in $t+1$	33,491	0.34	0.47	0	1
Pos. wage change t	Dummy variable indicating whether employee's wage change was above 5% in t	33,491	0.35	0.48	0	1
Pos. wage change $t-1$	Dummy variable indicating whether employee's wage change was above 5% in $t-1$	33,491	0.37	0.48	0	1
Pos. wage change $t-2$	Dummy variable indicating whether employee's wage change was above 5% in $t-2$	33,491	0.39	0.49	0	1
Pos. wage change $t-3$	Dummy variable indicating whether employee's wage change was above 5% in $t-3$	33,491	0.41	0.49	0	1
Pos. wage change $t-4$	Dummy variable indicating whether employee's wage change was above 5% in $t-4$	33,491	0.43	0.49	0	1
Neutr. wage change $t+1$	Dummy variable indicating whether employee's wage change was in between -5% and 5% in $t+1$	33,491	0.48	0.5	0	1
Neutr. wage change t	Dummy variable indicating whether employee's wage change was in between -5% and 5% in t	33,491	0.47	0.5	0	1
Neutr. wage change $t-1$	Dummy variable indicating whether employee's wage change was in between -5% and 5% in $t-1$	33,491	0.46	0.5	0	1
Neutr. wage change $t-2$	Dummy variable indicating whether employee's wage change was in between -5% and 5% in $t-2$	33,491	0.44	0.5	0	1
Neutr. wage change $t-3$	Dummy variable indicating whether employee's wage change was in between -5% and 5% in $t-3$	33,491	0.43	0.49	0	1
Neutr. wage change $t-4$	Dummy variable indicating whether employee's wage change was in between -5% and 5% in $t-4$	33,491	0.41	0.49	0	1
Neg. wage change $t+1$	Dummy variable indicating whether employee's wage change was below -5% in $t+1$	33,491	0.18	0.39	0	1
Neg. wage change t	Dummy variable indicating whether employee's wage change was below -5% in t	33,491	0.18	0.38	0	1
Neg. wage change $t-1$	Dummy variable indicating whether employee's wage change was below -5% in $t-1$	33,491	0.17	0.38	0	1
Neg. wage change $t-2$	Dummy variable indicating whether employee's wage change was below -5% in $t-2$	33,491	0.17	0.38	0	1
Neg. wage change $t-3$	Dummy variable indicating whether employee's wage change was below -5% in $t-3$	33,491	0.16	0.37	0	1
Neg. wage change $t-4$	Dummy variable indicating whether employee's wage change was below -5% in $t-4$	33,491	0.16	0.37	0	1
Wage change (net) $t+1$	Net wage change of employee in $t+1$	33,473	0.03	0.13	-0.5	1
Wage change (net) t	Net wage change of employee in t	33,473	0.03	0.13	-0.5	1
Wage change (net) $t-1$	Net wage change of employee in $t-1$	33,473	0.04	0.14	-0.5	1
Wage change (net) $t-2$	Net wage change of employee in $t-2$	33,473	0.04	0.14	-0.5	1
Wage change (net) $t-3$	Net wage change of employee in $t-3$	33,473	0.05	0.15	-0.5	1
Wage change (net) $t-4$	Net wage change of employee in $t-4$	33,473	0.05	0.16	-0.5	1
Peer group (gross) $t+1$	Dummy variable indicating whether employee's gross wage change will be higher than his peer group's gross wage change in $t+1$	33,491	0.5	0.5	0	1

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... table A.1 continued

Variable	Definition	N	Mean	Std	Min	Max
Peer group (gross) t	Dummy variable indicating whether employee's gross wage change was higher than his peer group's gross wage change in t	33,491	0.5	0.5	0	1
Peer group (gross) $t-1$	Dummy variable indicating whether employee's gross wage change was higher than his peer group's gross wage change in $t-1$	33,491	0.51	0.5	0	1
Peer group (gross) $t-2$	Dummy variable indicating whether employee's gross wage change was higher than his peer group's gross wage change in $t-2$	33,491	0.5	0.5	0	1
Peer group (gross) $t-3$	Dummy variable indicating whether employee's gross wage change was higher than his peer group's gross wage change in $t-3$	33,491	0.5	0.5	0	1
Peer group (gross) $t-4$	Dummy variable indicating whether employee's gross wage change was higher than his peer group's gross wage change in $t-4$	33,491	0.51	0.5	0	1
Peer group (gross) $t-5$	Dummy variable indicating whether employee's gross wage change was higher than his peer group's gross wage change in $t-5$	28,645	0.5	0.5	0	1
Peer group (net) $t+1$	Dummy variable indicating whether employee's net wage change will higher than his peer group's net wage change in $t+1$	33,473	0.49	0.5	0	1
Peer group (net) t	Dummy variable indicating whether employee's net wage change was higher than his peer group's net wage change in t	33,473	0.5	0.5	0	1
Peer group (net) $t-1$	Dummy variable indicating whether employee's net wage change was higher than his peer group's net wage change in $t-1$	33,473	0.5	0.5	0	1
Peer group (net) $t-2$	Dummy variable indicating whether employee's net wage change was higher than his peer group's net wage change in $t-2$	33,473	0.5	0.5	0	1
Peer group (net) $t-3$	Dummy variable indicating whether employee's net wage change was higher than his peer group's net wage change in $t-3$	33,473	0.5	0.5	0	1
Peer group (net) $t-4$	Dummy variable indicating whether employee's net wage change was higher than his peer group's net wage change in $t-4$	33,473	0.5	0.5	0	1
Position change $t+1$	Dummy variable indicating whether employee has changed jobs within company in $t+1$	33,491	0.01	0.08	0	1
Position change t	Dummy variable indicating whether employee has changed jobs within company in t	33,491	0.01	0.08	0	1
Position change $t-1$	Dummy variable indicating whether employee has changed jobs within company in $t-1$	33,491	0.01	0.07	0	1
Position change $t-2$	Dummy variable indicating whether employee has changed jobs within company in $t-2$	33,491	0	0.07	0	1
Position change $t-3$	Dummy variable indicating whether employee has changed jobs within company in $t-3$	33,491	0	0.06	0	1
Position change $t-4$	Dummy variable indicating whether employee has changed jobs within company in $t-4$	33,491	0	0.06	0	1
Position change $t-5$	Dummy variable indicating whether employee has changed jobs within company in $t-5$	28,645	0	0.05	0	1
Employer change $t+1$	Dummy variable indicating whether employee has changed employers in $t+1$	33,491	0.02	0.15	0	1
Employer change t	Dummy variable indicating whether employee has changed employers in t	33,491	0.02	0.16	0	1
Employer change $t-1$	Dummy variable indicating whether employee has canged employers in $t-1$	33,491	0.03	0.16	0	1
Employer change $t-2$	Dummy variable indicating whether employee has changed employers in $t-2$	33,491	0.03	0.16	0	1
Employer change $t-3$	Dummy variable indicating whether employee has changed employers in $t-3$	33,491	0.03	0.18	0	1

II

... table A.1 continued

Variable	Definition	N	Mean	Std	Min	Max
Employer change $t-4$	Dummy variable indicating whether employee has changed employers in $t-4$	33,491	0.04	0.2	0	1
Employer change $t-5$	Dummy variable indicating whether employee has changed employers in $t-5$	28,645	0.04	0.2	0	1
Male	Dummy variable indicating whether respondent is male	33,491	0.71	0.46	0	1
Age	Age of respondent	33,491	44.6	8.86	22	64
Age squared	Age of respondent squared and divided by 100	33,491	20.68	7.92	5	40.96
Foreign nationality	Dummy variable indicating whether respondent is of non-German nationality	33,491	0.1	0.3	0	1
Schooling	Years of schooling	33,491	12.27	2.55	7	18
Marital status	Dummy variable indicating whether respondent has a settled living partner	33,491	0.81	0.39	0	1
Children aged under 16	Dummy variable indicating whether respondent has one or more children aged under 16 who currently live in the household	33,491	0.37	0.48	0	1
Public employee or civil servant	Dummy indicating whether individual is civil servant or public employee	33,491	0.14	0.35	0	1
Monthly gross wage	Gross wage of respondent in the month before the survey	33,491	2889.14	1314.1	642	21.500
Monthly net wage	Net wage of respondent in the month before the survey	33,473	1878.49	826.56	430	11.500
Fixed-term contract	Dummy variable indicating whether an employee has a fixed-term contract	33,491	0.01	0.12	0	1
Job tenure	Years of job tenure	33,491	15.16	9.71	0	49.80
Part-time experience	Years of experience in a part-time job	33,491	0.65	2.12	0	34.30
Unemployment experience	Years of unemployment experience	33,491	0.28	0.8	0	15.30
Actual working hours	Actual weekly working hours	33,491	42.61	5.62	0	99.90
Job training	Individual participated in job-related training in $t-1$	33,491	0.12	0.32	0	1
Regional unemployment rate in t	Regional ("Bundesland") unemployment rate in t	33,491	11.18	4.62	4.2	22.10
Firm size 1-19	Dummy variable indicating whether employee works in a firm with 1 to 19 employees (serves as reference category in the analysis)	33,491	0.13	0.34	0	1
Firm size 20-199	Dummy variable indicating whether employee works in a firm with 20 to 199 employees	33,491	0.28	0.45	0	1
Firm size 200-1999	Dummy variable indicating whether employee works in a firm with 200 to 1999 employees	33,491	0.29	0.46	0	1
Firm size ≥ 2000	Dummy variable indicating whether employee works in a firm with equal or more than 2000 employees	33,491	0.29	0.45	0	1
Hobbies and other leisure activities	Number of hours devoted to hobbies and other leisure activities on a typical working day	33,491	1.59	1.26	0	14
Current health: very good	Dummy variable indicating whether respondent assesses her current health status as very good (serves as reference category in the analysis)	33,491	0.07	0.26	0	1
Current health: good	Dummy variable indicating whether respondent assesses her current health status as good	33,491	0.48	0.5	0	1
Current health: satisfactory	Dummy variable indicating whether respondent assesses her current health status as satisfactory	33,491	0.34	0.47	0	1
Current health: poor	Dummy variable indicating whether respondent assesses her current health status as poor	33,491	0.09	0.29	0	1
Current health: bad	Dummy variable indicating whether respondent assesses her current health status as bad	33,491	0.01	0.1	0	1
Full-time employment dummies	Dummy variable (and dummies for leads/lags) indicating whether individual is employed in full-time					
Occupation dummies	15 occupational dummies					
Regional dummies	16 regional dummies					
Sector dummies	9 industry sector dummies					
Time dummies	19 time dummies					

Std is the standard deviation. The monthly wages are denoted in Euro and rounded to full digits.

Source: German Socio-Economic Panel (GSOEP), years 1990-2013, own calculations.

III

Table A.2: Job satisfaction and wage changes - Full regression output

Dependent variable				**Job satisfaction**		
	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) FE	(6) FE
Wage change $t+1$				0.277*** (0.068)		0.274*** (0.078)
Wage change t	0.555*** (0.064)	0.259*** (0.066)	0.212*** (0.069)	0.579*** (0.099)		0.473*** (0.108)
Wage change $t-1$				0.460*** (0.093)		0.339*** (0.099)
Wage change $t-2$				0.357*** (0.086)		0.294*** (0.092)
Wage change $t-3$				0.174** (0.076)		0.199** (0.083)
Wage change $t-4$				0.151** (0.059)		0.181*** (0.065)
Peer group dummy $t+1$					0.037** (0.017)	0.002 (0.020)
Peer group dummy t					0.101*** (0.019)	0.060*** (0.021)
Peer group dummy $t-1$					0.088*** (0.020)	0.068*** (0.021)
Peer group dummy $t-2$					0.059*** (0.020)	0.037* (0.021)
Peer group dummy $t-3$					-0.000 (0.019)	-0.012 (0.021)
Peer group dummy $t-4$					0.005 (0.018)	-0.016 (0.020)
Position change $t+1$				-0.247** (0.119)	-0.253** (0.120)	-0.247** (0.120)
Position change t		0.002 (0.146)	0.120 (0.119)	0.130 (0.140)	0.122 (0.141)	0.129 (0.140)
Position change $t-1$				0.146 (0.152)	0.140 (0.152)	0.149 (0.152)
Position change $t-2$				0.123 (0.146)	0.113 (0.147)	0.124 (0.147)
Position change $t-3$				0.020 (0.170)	0.010 (0.171)	0.022 (0.170)
Position change $t-4$				0.151 (0.169)	0.130 (0.169)	0.153 (0.169)
Employer change $t+1$				-0.969*** (0.081)	-0.964*** (0.081)	-0.968*** (0.081)
Employer change t		0.119* (0.069)	0.253*** (0.071)	0.309*** (0.073)	0.325*** (0.073)	0.312*** (0.073)
Employer change $t-1$				0.186*** (0.070)	0.200*** (0.070)	0.189*** (0.070)
Employer change $t-2$				0.212*** (0.061)	0.222*** (0.061)	0.213*** (0.061)
Employer change $t-3$				0.089 (0.054)	0.097* (0.054)	0.087 (0.054)
Employer change $t-4$				0.132*** (0.047)	0.144*** (0.047)	0.132*** (0.047)
Male		-0.027 (0.049)				
Foreign nationality		0.023 (0.068)				

Continued on next page...

IV

... table A.2 continued

Dependent variable		Job satisfaction				
Years of schooling		-0.045***				
		(0.010)				
Age		-0.058***				
		(0.017)				
Age squared		0.071***				
		(0.019)				
Marital status		0.007	-0.115*	-0.105*	-0.105*	-0.105*
		(0.050)	(0.059)	(0.059)	(0.059)	(0.059)
Children under 16		0.050	0.032	0.033	0.034	0.032
		(0.039)	(0.040)	(0.039)	(0.040)	(0.039)
Fixed-term contract		-0.159	-0.167*	-0.115	-0.121	-0.116
		(0.102)	(0.100)	(0.097)	(0.097)	(0.097)
Job tenure		-0.004	-0.036***	-0.018***	-0.018***	-0.018***
		(0.003)	(0.006)	(0.006)	(0.006)	(0.006)
Part-time exp.		0.002	0.053	0.045	0.048	0.044
		(0.008)	(0.043)	(0.043)	(0.043)	(0.043)
Unemployment exp.		-0.024	0.182	0.229	0.225	0.218
		(0.022)	(0.264)	(0.259)	(0.256)	(0.259)
Actual working hours		-0.014***	-0.006*	-0.006**	-0.006**	-0.007**
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Public Employee		0.158**	0.156*	0.155*	0.150	0.156*
		(0.077)	(0.094)	(0.091)	(0.091)	(0.091)
Monthly wage (×100)		0.010***	0.007**	0.003	0.007**	0.002
		(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Job training		0.064*	0.069**	0.064**	0.066**	0.065**
		(0.037)	(0.029)	(0.029)	(0.029)	(0.028)
Firm size 20-199		0.029	0.061	0.019	0.017	0.018
		(0.057)	(0.070)	(0.068)	(0.068)	(0.068)
Firm size 200-1999		0.041	0.140*	0.079	0.077	0.078
		(0.060)	(0.079)	(0.077)	(0.077)	(0.077)
Firm size ≥ 2000		0.030	0.123	0.064	0.063	0.062
		(0.063)	(0.089)	(0.086)	(0.086)	(0.086)
Hobbies (h/week)		0.070***	0.007	0.010	0.009	0.009
		(0.011)	(0.009)	(0.009)	(0.009)	(0.009)
Health: good		-0.706***	-0.351***	-0.354***	-0.354***	-0.353***
		(0.048)	(0.038)	(0.038)	(0.038)	(0.037)
Health: satisfactory		-1.507***	-0.701***	-0.701***	-0.701***	-0.701***
		(0.055)	(0.045)	(0.044)	(0.044)	(0.044)
Health: poor		-2.248***	-1.176***	-1.170***	-1.170***	-1.169***
		(0.074)	(0.060)	(0.060)	(0.060)	(0.060)
Health: bad		-3.130***	-1.778***	-1.779***	-1.776***	-1.781***
		(0.171)	(0.152)	(0.152)	(0.152)	(0.152)
Industry-FE	NO	YES	YES	YES	YES	YES
Occupation-FE	NO	YES	YES	YES	YES	YES
State-FE	NO	YES	YES	YES	YES	YES
Year-FE	NO	YES	YES	YES	YES	YES
Observations	33,491	33,491	33,491	33,491	33,491	33,491
Adj. R^2 / R^2-within	0.002	0.137	0.048	0.062	0.061	0.063

Notes: * / ** / *** denotes statistical significance at the 10/5/1% level. The values in parentheses represent robust standard errors clustered at the individual level (6,132 individuals and 5.5 years). The descriptive statistics for *job satisfaction* is provided in Section 4.

Source: German Socio-Economic Panel (GSOEP), years 1990-2013, own calculations.

V