ECONSTOR

WWW.ECONSTOR.EU

Der Open-Access-Publikationsserver der ZBW – Leibniz-Informationszentrum Wirtschaft
The Open Access Publication Server of the ZBW – Leibniz Information Centre for Economics

Hirsch, Boris; Zwick, Thomas

Working Paper

How selective are real wage cuts? A micro-analysis using linked employer-employee data

ZEW Discussion Papers, No. 13-086

Provided in Cooperation with:
ZEW - Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research

Suggested Citation: Hirsch, Boris; Zwick, Thomas (2013) : How selective are real wage cuts? A micro-analysis using linked employer-employee data, ZEW Discussion Papers, No. 13-086

This Version is available at:
http://hdl.handle.net/10419/88130

Nutzungsbedingungen:
Die ZBW räumt Ihnen als Nutzerin/Nutzer das unentgeltliche, räumlich unbeschränkte und zeitlich auf die Dauer des Schutzrechts beschränkte einfache Recht ein, das ausgewählte Werk im Rahmen der unter
→ http://www.econstor.eu/dspace/Nutzungsbedingungen
nachzulesenden vollständigen Nutzungsbedingungen zu vervielfältigen, mit denen die Nutzerin/der Nutzer sich durch die erste Nutzung einverstanden erklärt.

Terms of use:
The ZBW grants you, the user, the non-exclusive right to use the selected work free of charge, territorially unrestricted and within the time limit of the term of the property rights according to the terms specified at
→ http://www.econstor.eu/dspace/Nutzungsbedingungen
By the first use of the selected work the user agrees and declares to comply with these terms of use.

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Mitglied der Leibniz-Gemeinschaft

Discussion Paper No. 13-086

How Selective Are Real Wage Cuts?

A Micro-Analysis Using Linked Employer–Employee Data

Boris Hirsch and Thomas Zwick

ZEW

Zentrum für Europäische Wirtschaftsforschung GmbH

Centre for European Economic Research

Discussion Paper No. 13-086

How Selective Are Real Wage Cuts?

A Micro-Analysis Using Linked Employer–Employee Data

Boris Hirsch and Thomas Zwick

Download this ZEW Discussion Paper from our ftp server:

http://ftp.zew.de/pub/zew-docs/dp/dp13086.pdf

Die Discussion Papers dienen einer möglichst schnellen Verbreitung von neueren Forschungsarbeiten des ZEW. Die Beiträge liegen in alleiniger Verantwortung der Autoren und stellen nicht notwendigerweise die Meinung des ZEW dar.

Discussion Papers are intended to make results of ZEW research promptly available to other economists in order to encourage discussion and suggestions for revisions. The authors are solely responsible for the contents which do not necessarily represent the opinion of the ZEW.

Nontechnical Summary

Existing evidence suggests that workers face a low risk of experiencing a real wage reduction. However, there is so far virtually no evidence whether some employee groups are affected stronger by wage cuts than other groups. Insider–outsider and several branches of efficiency wage theory predict selective wage cuts especially for employees who are less important for firm performance, whereas some recent contributions discard selective wage reductions and stress fairness considerations instead. In this paper, we investigate whether employers who (have to) reduce real wages do so in a selective manner. Using German linked employer–employee panel data for the homogenous group of young workers in the first five years of their first job, we fit linear models for individuals' probability of experiencing a real wage cut. We include plant fixed effects that control for permanent differences in plants' wage policies. We find clear evidence that plants resort to selective wage reductions. Medium-skilled and especially high-skilled workers are less likely to face a real wage reduction than low-skilled workers. The same holds for workers who have just recently been hired. Adding workers' wage residual estimated from an extended Mincerian wage regression for the previous year as a measure of unobserved worker performance, we further find that workers with a higher residual have a significantly lower incidence of real wage cuts. Notably, the very same selectivity pattern shows up when restricting our analysis to firms covered by collective agreements or having a works council. Our finding is clearly in line with insider–outsider and several branches of efficiency wage theory. It is at odds, however, with fairness considerations pressing employers to selectively reduce wages such that wage dispersion among peers is reduced. We thus conclude that real wage reductions, though rare in general, are specifically aimed at those groups of workers who are less crucial to firm performance.

Das Wichtigste in Kürze

Die bisherige Literatur deutet darauf hin, dass reale Lohnreduktionen relativ selten sind. Es gibt bisher jedoch kaum Evidenz dazu, ob einige Beschäftigtengruppen stärker von Lohnreduktionen betroffen sind als andere. Insider–Outsider- und unterschiedliche Versionen von Effizienzlohntheorien sagen vorher, dass Lohnreduktionen selektiv und besonders bei Beschäftigtengruppen konzentriert sind, die für die Wettbewerbsfähigkeit des Arbeitgebers nicht so wichtig sind. In diesem Beitrag untersuchen wir, ob Arbeitgeber, die Reallohnkürzungen durchführen (müssen), dies selektiv tun. Auf der Basis von verknüpften Arbeitgeber–Arbeitnehmer-Paneldaten für die homogene Gruppe junger Arbeitnehmer in den ersten fünf Jahren ihrer ersten Beschäftigung schätzen wir lineare Modelle zur Erklärung der individuellen Wahrscheinlichkeit, eine reale Lohnreduktion zu erhalten. Hierbei berücksichtigen wir unternehmensfixe Effekte, um für permanente Unterschiede bei den Lohnpolitiken der Unternehmen zu kontrollieren. Wir finden deutliche Hinweise auf selektive Lohnreduktionen. Beschäftigte mit einer mittleren Qualifikation und insbesondere Beschäftigte mit einer hohen Qualifikation sind weniger gefährdet, eine Reallohnkürzung zu erfahren im Vergleich zu Beschäftigten mit einer niedrigen Qualifikation. Das Gleiche gilt für Beschäftigte, die gerade erst eingestellt wurden. Wir ergänzen das Lohnresidual eines Beschäftigten aus einer erweiterten Mincergleichung für das vergangene Jahr als Maß für die unbeobachtbare Leistung dieses Mitarbeiters. Hierbei finden wir, dass Beschäftigte mit einem höheren Residuum ein signifikant niedrigeres Risiko einer Lohnreduktion haben. Bemerkenswerterweise zeigen sich die gleichen Selektivitätsmuster für die Subgruppen tarifgebundener Betriebe und solcher mit einem Betriebsrat. Unsere Ergebnisse decken sich mit den Hypothesen aus der Insider–Outsider- und Effizienzlohntheorie, ist jedoch im Widerspruch zu Fairnessüberlegungen, denen zufolge Lohnreduktionen so eingesetzt werden, dass die Lohndispersion innerhalb von Peergruppen sinkt. Unsere Schlussfolgerung ist somit, dass Reallohnreduktionen, obwohl sie im Allgemeinen selten anzutreffen sind, spezifisch die Beschäftigtengruppen treffen, die nicht so wichtig für die Wettbewerbsfähigkeit der Unternehmen sind.

How selective are real wage cuts?

A micro-analysis using linked employer–employee data[*]

Boris Hirsch[#] and Thomas Zwick[+]

Abstract: Using linked employer–employee panel data for Germany, this paper investigates whether firms implement real wage reductions in a selective manner. In line with insider–outsider and several strands of efficiency wage theory, we find strong evidence for selective wage cuts with high-productivity workers being spared even when controlling for permanent differences in firms' wage policies. In contrast to some recent contributions stressing fairness considerations, we also find that wage cuts increase wage dispersion among peers rather than narrowing it. Notably, the same selectivity pattern shows up when restricting our analysis to firms covered by collective agreements or having a works council.

JEL classification: J30, J31

Keywords: real wage rigidity, real wage cuts, selectivity, Germany

---

[*] We are grateful to Florian Englmaier, Clemens Fuest, Steffen Müller, Claus Schnabel, and Carmit Segal for useful comments and suggestions. We further appreciate the comments received from participants of the 2013 Colloquium on Personnel Economics in Tübingen and the 2013 BGPE research workshop in Bamberg.

[#] University of Erlangen–Nuremberg, Chair of Labour and Regional Economics, Lange Gasse 20, 90403 Nuremberg, Germany, email: boris.hirsch@wiso.uni-erlangen.de, tel.: +499115302330, fax: +499115302721

[+] University of Würzburg, Chair of Human Resource Management and Organisation, Sanderring 2, 97070 Würzburg, Germany, email: thomas.zwick@uni-wuerzburg.de, tel.: +499313182755, fax: +499313182105; Centre for European Economic Research (ZEW), Mannheim; Research Centre for Education and Labour Market (ROA), Maastricht.

1 Introduction

There is overwhelming evidence that workers face a low risk of being hit by wage reductions (e.g. Kahn, 1997; Dickens *et al.*, 2007; Babecký *et al.*, 2010). For instance, Dustmann and Schönberg (2009) report that in Germany during the period 1996–1999 less than ten per cent of young workers working full-time hours experienced an annual decrease in real wages of five per cent or more. Theoretically, firms' reluctance to reduce real wages is typically explained in terms of implicit contract theory with employers insuring workers against real income losses (e.g. Baily, 1974; Azariadis, 1975), efficiency wage theory with firms shying away from the adverse consequences of wage cuts on worker effort, turnover, and quality (e.g. Yellen, 1984), and insider–outsider theory with insiders possessing considerable bargaining power to obviate wage reductions (e.g. Lindbeck and Snower, 1988).[1]

Whereas numerous empirical studies document that these theories are likely to contribute to the low incidence of real wage cuts (e.g. Campbell and Kamlani, 1997; Bewley, 1999; Franz and Pfeiffer, 2006; Agell and Bennmarker, 2007; Babecký *et al.*, 2010), existing studies – with the notable exception of Böckerman *et al.* (2007) – do not investigate differences in workers' individual risk of being exposed to real wage reductions, and to the best of our knowledge, there is no evidence on which groups of workers are disproportionally hit by wage reductions. Yet, we should expect to find such differences given our theoretical priors. Just to give an example, consider Shapiro and Stiglitz's (1984) shirking model. In this model, wage cuts increase the likelihood that workers shirk and thus adversely affect productivity, and we are left with a reason why wage cuts should be rare. However, this line

[1] In our analysis, we will follow Dustmann and Schönberg (2009) and define a real wage cut as a reduction in the real wage of five per cent or more relative to the previous year thereby ensuring that the wage cut is substantial enough to be felt by workers. As in our period of observation, inflation was well below five per cent, a real wage reduction coincides with a nominal wage reduction, and our analysis is also informative on the selectivity of nominal wage reductions. Yet our theoretical arguments for selective wage reductions are concerned with real rather than nominal, so we will restrict attention to real wage reductions in the following.

of argument applies to different groups of workers to a different extent. As a case in point, more skilled workers are likely to perform tasks that are more difficult to monitor than those performed by workers with low skills. Because of less effective monitoring preventing the more skilled workers from shirking, firms may rely to a greater extent on efficiency wage considerations for this group of workers. As a consequence, we expect higher skilled workers to face a lower risk of a real wage cut. That said, efficiency wage models based on fairness considerations and related evidence suggest selective wage reductions may be deemed unfair by workers, so that firms may be reluctant to implement selective wage cuts.

It is thus an open question *ex ante* whether firms actually resort to selective wage cuts – the point at the heart of this paper's contribution to the literature. While most of the extant evidence comes from employer surveys and lab experiments, we are able to use linked employer–employee data for Germany that allow us to analyse workers' individual risk of experiencing a real wage cut and whether some employee groups are disproportionally hit by wage reductions. In a first step, we investigate which individual and employer characteristics affect the probability that a worker faces a real wage reduction, restricting our sample to the homogenous group of young employees starting their first job. In a next step, we include firm fixed effects to our model to control for permanent differences in firms' wage policies. Finally, we add workers' wage residual estimated from an extended Mincerian wage regression for the previous year including a broad range of individual characteristics as well as firm fixed effects. Including the wage residual allows us to test whether employers spare high-performance workers from real wage cuts to prevent them from lowering their effort or leaving the firm, or rather cut wages in such a way reducing the wage dispersion among peers to promote fairness.

The remainder of this paper is organised as follows: In Section 2, we summarise the theoretical and empirical literature on real wage reductions and derive our hypotheses which

determinants are likely to affect workers' individual probability of facing a real wage reduction. Section 3 describes our data and Section 4 our econometric approach. Section 5 presents and discusses our results, and Section 6 concludes.

2 Existing Literature and Hypotheses

2.1 Efficiency Wage Theory

As stressed in the introduction, real wage cuts are rarely observed in real-world labour markets with efficiency wage, insider–outsider, and implicit contract theory providing explanations for this finding. According to efficiency wage theory, firms gain from paying wages above the market-clearing level, and wage reductions would thus put these gains at stake. Paying higher-than-necessary wages is expected to (i) reduce worker shirking (Shapiro and Stiglitz, 1984), (ii) depress turnover thereby lowering hiring and training costs (Stiglitz, 1974), (iii) improve the average quality of job applicants (Weiss, 1980), and (iv) increase workers' effort due to social norms and fairness standards (Akerlof, 1982; Akerlof and Yellen, 1990). Existing evidence from employer surveys suggests that efficiency wage considerations indeed play an important role in explaining the low incidence of wage reductions (Campbell and Kamlani, 1997; Franz and Pfeiffer, 2006; Agell and Bennmarker, 2007; Babecký *et al.*, 2010). Moreover, efficiency wage theories give rise to clear predictions on selective wage reductions. Shirking, labour turnover, and adverse selection models obviously provide rationales for selective wage reductions, as we shall detail below, whereas fairness considerations may leave firms to resort to selective wage reductions to a much lesser extent.

In Shapiro and Stiglitz's (1984) shirking model, paying wages above the market-clearing level results in equilibrium unemployment that prevents workers from shirking

because the queues of job applicants render a job loss costly to them. As a consequence, the increase in labour cost is compensated for by a rise in worker productivity, and firms are expected to be reluctant to cut wages lest to spoil this positive productivity effect. These considerations also make clear why we should expect to find selective wage reductions. In general, firms should spare high-productivity workers such as high-skilled workers from wage cuts as shirking of these individuals is likely to greatly influence firms' profits. In a similar vein, firms should also spare workers with a high wage residual (given important observable characteristics that explain differences in productivity), which we will consider as a measure of individuals' unobserved performance in the firm (details are given in Sections 4 and 5 where we discuss our econometric approach and results). We also expect firms to be more reluctant to cut wages for workers whose output is more difficult to monitor like high-skilled or high-productivity workers, who are more likely to perform non-standard tasks (Babecký *et al.*, 2010). Furthermore, monitoring is likely to be more costly in large firms (Oi and Idson, 1999) that may therefore refrain to a greater extent from wage cuts. What is more, for firms operating in East Germany, which still shows a much poorer labour market performance than West Germany, wage cuts are likely to be less harmful.

Other than the shirking model, in Stiglitz' (1974) labour turnover model, efficiency wages are paid to decrease worker turnover resulting in savings on hiring and training costs. These savings compensate for the increase in labour cost.[2] Furthermore, efficiency wages raise the average unobserved quality of the pool of firms' job applicants in Weiss' (1980) adverse selection model. Since turnover is particularly costly in case of high-productivity workers and these workers also have the highest propensity to quit in response to wage reductions in the adverse selection model, the labour turnover and the adverse selection model point at the same individual determinants of individual wage cuts as the shirking model.

[2] In line with this, Cornelißen and Hübler (2008) find for Germany that downward wage rigidity has a significantly negative impact on worker turnover.

Another remarkable point was made by Howitt (2002): wage reductions should be less prevalent if labour costs are just a small part of total costs because in this case negative effects on productivity are likely to dominate positive labour cost effects on profits. Extending this argument to different subgroups of workers, we expect that an individual's probability of being hit by a real wage cut is larger if the share of workers with the same individual characteristics in the firm's workforce is higher, as a larger share of similar workers in the workforce causes selective wage cuts for this group of workers to have a bigger impact on the firm's labour costs. Alluding to the well-known fourth Hicks–Marshall rule of derived labour demand, we will refer to the hypothesis that selective wage cuts are more likely for groups of workers representing a large part of the firm's workforce as the "importance of being unimportant".

2.2 Insider–Outsider Theory

On top of efficiency wage theory, insider–outsider theory stresses that insiders possess bargaining power in the wage-setting process (Lindbeck and Snower, 1988), which they may well be able to use to prevent firms from implementing wage reductions. Obviously, different groups of workers may differ in their bargaining power. As a case in point, workers possessing high levels of specific human capital, i.e. more tenured workers, may be exempted from wage reductions (Holden, 1994; Malcomson, 1997). Implicit seniority wage contracts may be in place with high-tenured workers earning more than their actual productivity, however. As these workers may thus lack outside options offering comparable earnings, firms may be less reluctant to cut wages for high-tenure workers. This argument is also in line with the finding by Blinder and Choi (1990) that firms tend to cut wages for workers earning above-productivity wages.

Insiders' bargaining power is also likely to be influenced by several firm characteristics such as the industrial relations regime or the profit situation. In Germany,

industrial relations are characterised by a dual system of worker representation through trade unions and works councils (for details, see Addison *et al.*, 2010). In firms covered by collective agreements or having a works council, insiders should possess more bargaining power enabling them to prevent wage cuts to a greater extent. Moreover, these institutions may also foster implicit contracts, which are another reason given for the low incidence of real wage reductions. In particular, collective agreements at sector level are likely to prevent wage reductions, whereas this may hold to a lesser extent for collective agreements at firm level (Gürtzgen, 2009). Gartner *et al.* (2013) stress, however, that the existence of works councils or unions may also cause workers to regard real wage cuts as fair. For example, works councils may be able to credibly convince workers that wage moderation is necessary to increase competitiveness. Furthermore, in firms bound by collective agreements, wage cuts may not be perceived as unilaterally imposed by management. Finally, firms with a good profit situation can be expected to shy away from wage cuts and to share rents with their employees instead (Arai, 2003; Gützgen, 2009).

2.3 Fairness Considerations

Other than the efficiency wage and insider–outsider theories discussed so far, fairness considerations and the related empirical literature arrive at conclusions less favourable for selective real wage cuts. According to fairness models, firms abstain from reducing wages because workers are likely to lower effort due to reciprocity. As wage cuts are usually perceived as damaging by management, the empirical evidence on the reciprocity effects of wage reductions mainly relies on interview and survey studies. Two rare exemptions are the field experiments in Cohn *et al.* (2011) and Kube *et al.* (2011). In a natural field experiment, Kube *et al.* (2011) find that workers who had been hired at a certain wage showed significantly lower performance when starting the job and receiving a lower wage than

expected.[3] Furthermore, in a randomised field experiment, Cohn *et al.* (2011) observe teams of two salesmen in a temporary promotion campaign. Whereas a general wage cut to both team members is found to significantly decrease the team's overall performance, a selective wage reduction has even worse consequences: reducing the wage for just one team member triggers a drop in this team member's performance that is more than twice the size of the overall drop in performance from a general wage reduction. Consequently, firms should generally avoid selective wage cuts.

That said, fairness considerations also stress that newly hired workers who lack a long history of interactions with the management and an established position in the firm are likely to possess looser fairness standards than more senior workers; they should thus accept a wage cut more easily (Fehr and Götte, 2005). Finally, from interviews with managers Blinder and Choi (1990) document that firms tend to reduce wages for workers who earn more than comparable workers for fairness standards. We should therefore expect firms to implement selective wage cuts among observationally similar workers, such as for those with positive wage residuals, in order to reduce wage dispersion among peers.

2.4 Summary of Hypotheses

All in all, we therefore arrive at the following characteristics likely to influence individuals' probability of being hit by a real wage reduction, provided that firms implement selective wage cuts: individual characteristics likely to matter are skills, tenure, and the wage residual. Whereas high-skilled individuals are expected to face a lower risk of a real wage cut, the effects of the wage residual and tenure could be either positive or negative. In particular, the effect of the wage residual allows us to test whether individuals with high unobserved

[3] There are also some case studies on the effect of wage reductions on effort. For instance, Lee and Rupp (2007) find only a small and short-lived negative impact on effort following large and permanent pay cuts for commercial airline pilots in the US. They argue that this surprising result may be driven by this employee group's poor outside options during their period of observation and high absolute remuneration levels even after the pay cuts.

performance are exempted from wage reductions or whether they face a higher risk of wage cuts, as these are used to reduce the wage dispersion among peers due to fairness considerations. To investigate which groups of workers are disproportionally hit by wage reductions, the share of workers with a real wage reduction and interactions of this share with individual characteristics are added. Next, interactions of individual characteristics and the share of individuals with the very same characteristics in the workforce are included to see whether the selectivity of wage cuts is larger for groups of workers forming a large part of the firm's workforce, i.e. whether it is indeed important to be unimportant. Finally, plant characteristics likely to matter are those capturing the industrial relations regime, the profit situation, and firm size.

2.5 Existing Evidence and Contribution to the Literature

Most empirical evidence on selective wage cuts comes from studies that investigate the factors driving downward wage rigidities within a sector or firm. In line with expectations, these studies document that workforce composition, such as the shares of workers of different qualification, age, sex etc., and wage-setting institutions affect the extent of downward wage rigidity (e.g., Franz and Pfeiffer, 2006; Agell and Bennmarker, 2007; Babecký *et al.*, 2010; Du Caju *et al.*, 2012). As a case in point, in most studies the share of qualified workers increases downward rigidities. However, this sort of evidence on selective wage cuts just follows from an indirect route. To the best of our knowledge, the only study investigating the impact of individual and firm characteristics on workers' *individual* probability of experiencing a real wage cut is Böckerman *et al.* (2007) for Finland. They find that several individual and firm characteristics, such as age, experience or tenure, qualification, firm size, and firm profits, impact the incidence of real wage cuts.

In the following, we try to improve on the existing evidence in several ways: Analogously to Böckerman *et al.* (2007), we investigate the impact of worker and firm

characteristics on workers' probability of experiencing a real wage reduction. Our large data set for Germany allows us to base our investigation on a homogenous sample of young workers starting their first job. This sample reduction allows us to eliminate unobserved heterogeneity between workers with respect to labour market histories and entry conditions that may be related to the risk of being hit by real wage reduction. Since we use linked employer–employee data comprising almost all workers of a sample of firms who are covered by the social security system, we are also able to control for permanent firm differences in pay policies by including firm fixed effects. Furthermore, we are able to investigate which groups of firms' workers are disproportionally hit by wage cuts. As our data include detailed information on firms' workforce composition, we can also test the "importance of being unimportant" hypothesis, i.e. whether groups of workers with certain characteristics who represent a small block of firms' employment and labour costs are less frequent subject to wage reductions. Finally, we add workers' wage residual estimated from a Mincerian wage regression including several worker characteristics and firm fixed effects. This allows us to test whether firms selectively reduce wages in order to lower wage dispersion among similar workers as suggested by fairness considerations, or whether they exempt high-performers from wage cuts to prevent them from reducing effort or leaving the firm.

3 Data

To investigate individual differences in the exposure to real wage cuts, this paper uses seven waves of the German linked employer–employee data set of the Institute for Employment Research, the LIAB cross-sectional model, comprising the years 2000–2006. The LIAB combines a yearly survey of the same plants (not companies) with administrative data coming from the notification procedure of the German social insurance system (for details on the data, see Alda *et al.*, 2005, or Jacobebbinghaus and Alda, 2007). While the plant survey includes

information on plant size, sector, industrial relations, profitability, and workforce composition, the administrative data contains information on workers' gross daily real wage (deflated by the consumer price index), age, sex, nationality, schooling, and professional education at the 30th of June of each year. On average, more than 90 per cent of the workers in each plant who are covered by the social security system can be identified in the data. Due to the panel structure of the data set and the richness of the information contained, it is possible to both observe workers' professional career and their wage development as well as the characteristics of workers and their employers rendering the LIAB especially suitable for our purpose.

That said, we should make clear that our data set has three limitations important to our analysis. First, the start of employment relationships is left-censored at 1st January 1975 for workers in West Germany and 1st January 1992 for workers in East Germany because the notification procedure of the social security system that produces our individual data was not in place before these dates in the respective part of Germany. Second, wages are top-coded at the social security contribution ceiling. As a consequence, we do not know the true wage of on average 4.6 per cent of workers. In both cases, crucial information is missing and we cannot use these individuals in our analysis. In addition, workers with a different labour market history are likely to show differences in their characteristics that are unobservable in our data, such as the attendance to certified training courses, certificates from previous employers, or different labour market entry conditions due to business cycle effects. To deal with these three limitations, our sample just comprises workers within their first five years in their first jobs. In our sample, censored wage, tenure, or experience information poses no problems. What is more, for workers in our sample experience equals tenure, so that after controlling for years all workers have the same initial conditions such as the state of the

business cycle when starting their employment careers (Flinn, 1986).[4] The latter point is important because in Germany, as in other countries, entry wages have been found to considerably react to business cycle changes (Stüber, 2013).

A third limitation of our data set is that we observe daily gross wages rather than hourly wage rates and detailed information on working hours is missing. We just observe a qualitative measure distinguishing full-time and two sorts of part-time employment. For this reason, we restrict our analysis to individuals working full-time hours, for whom daily gross wages are comparable. For the interpretation of our following results, it is thus important to bear in mind that cuts in real daily wages may occur due to a fall in the wage rate or due to reduced working hours. We argue, though, that this should not render our insights uninformative, as from a worker's point of view it is total real income that matters most, rather than the real hourly wage rate.

4 Econometric Approach

In a first step, we analyse the incidence of a real wage reduction of five per cent or more relative to the previous year for those workers who stay with the same plant using a linear probability model.[5] As individual covariates, we include (i) individual characteristics, (ii) interactions of these characteristics with the share of the plant's workers experiencing a real wage cut, and (iii) interactions of these characteristics with the share of other workers of the same characteristics in the plant's workforce. The inclusion of interactions of individual

[4] As apprentices usually experience automatic yearly wage increases during their apprenticeship period, we exclude workers during their apprenticeship and consider those in their first skilled employment instead. Therefore, the equality of workers' experience and tenure only holds if we do not regard a previous apprenticeship as tenure.

[5] Note that fitting probit models (without plant fixed effects) rather than linear probability models yields very similar results. The same holds when estimating complementary log–log models, which take into account that a real wage cut by five per cent or more is a quite rare event. Yet, estimating these non-linear binary response models does not allow us to include plant fixed effects in further analyses due to the incidental parameter problem, so that we stick to linear models in the following.

characteristics and the share of workers with a real wage cut allows us to investigate whether groups of workers with certain characteristics are disproportionally subject to wage reductions if the number of those affected increases. Moreover, adding interactions of individual characteristics with the share of other workers of the same characteristics enables us to analyse whether groups of workers forming a small block of the plant's employment and labour costs are less often subject to wage cuts, i.e. the "importance of being unimportant" hypothesis. Note that all interaction terms (the shares of workers with certain characteristics and of workers hit by a wage reduction) are centred around their sample means. Hence, the slope coefficient for a certain characteristic can be interpreted as the partial effect for the average worker.

Following our theoretical considerations in Section 2, individual characteristics included are groups of education and tenure dummies.[6] We further add a sex dummy and a dummy for German nationality as controls. Plant characteristics included are the shares of workers with the very same characteristics in the plant's workforce, the share of workers with a real wage reduction, the share of workers in their first jobs, a group of dummy variables capturing the plant's industrial relation regime (i.e. the existence of collective agreements either at sector or at firm level as well as works council existence), the percentage change in the plant's employment, a dummy for a good profit situation, a dummy indicating that management expects future employment decreases, groups of plant size as well as sector dummies, and a dummy for location in Eastern Germany. For descriptive statistics of key variables, see Table 1.

In a second step, we add plant fixed effects to our model and drop those plant

[6] We distinguish workers with three levels of education: low-skilled, medium-skilled (i.e. with an occupational degree), and high-skilled (i.e. with an academic degree) workers. Note again that in our sample of young workers in their first jobs tenure equals experience. Note further that we control for education and tenure years for young employees in their first job. Therefore, age dummies are highly correlated with the other covariates and we do not include them as regressors.

covariates that are (almost) time-invariant such as sector dummies or the variables capturing the plant's industrial relations regime. Doing so rinses out permanent differences in plants' wage policies that may not be fully captured by our plant covariates and thus bases our insights on a firmer footing.

In a final step, we add workers' wage residual estimated from an extended Mincerian wage regression for the previous year that includes several individual characteristics and a plant fixed effect as regressors to our wage reduction model.[7] The idea for this extension is that the wage residual can serve as a measure of individual performance or a specific value of the worker to the plant, both of which are unobservable for the researcher and result in a higher wage for this worker compared to his or her peer group of workers with the same observed characteristics. Since a plant fixed effect is included in the wage equation used to estimate the wage residual, it captures individual wage differences caused by unobserved individual characteristics given the plant's wage policy. The inclusion of the wage residual thus allows us to test whether employers exempt high-performance workers, i.e. those with a high wage residual, from wage cuts to prevent them from reducing their effort or leaving the plant as predicted by several strands of efficiency wage theory, or rather implement wage cuts in such a way that wage dispersion among peers is reduced as suggested by fairness considerations.

5 Results

5.1 Determinants of a Real Wage Reduction

As discussed in the previous section, Table 2 shows the results from fitting linear models for individuals' probability of being hit by a real wage reduction of 5 per cent or more comprising

[7] Further details on the specification of the wage equation are given in Section 5.

several worker and plant characteristics (Model 1), plant fixed effects (Model 2), and the wage residual estimated from an extended Mincerian wage regression (Model 3). As can be seen from Model 1 in Table 2, we find strong evidence of selective real wage cuts. In line with earlier findings, medium-skilled (high-skilled) workers have a 3.0 (1.6) percentage points lower probability of being hit by a real wage reduction than low-skilled workers (with the difference of the two effects not being statistically significant at the 10 per cent level). Whereas the effect for high-skilled workers is only statistically significant at the 10 per cent level, both effects are significant from an economic point of view, as only 13 per cent of workers experience real wage cuts in our sample of job starters (see Table 1). Furthermore, German and female workers are less often hit by real wage reductions. In addition, the risk of being subject to a wage reduction is significantly lower for workers with low tenure.[8] Yet interestingly, plants with a high share of low-tenure workers (two or less years of tenure) more often (have to) resort to real wage cuts. One reading of this finding is that plants that recently have expanded their workforce avoid firing these new hires when being forced to reduce their labour costs and cut wages instead – with the burden of wage reductions being shouldered by all of the plants' employees rather than by the newly hired exclusively.

Unsurprisingly, we also find that the share of the plant's workers affected by a real wage reduction increases the individual probability of a wage cut. As can be seen from the coefficient of the share of workers with a real wage reduction, the partial effect for the reference group of non-German, male, and low-skilled workers with two years of tenure is clearly below unity, so that this group is less than proportionally hit by wage reductions. Adding the interaction effects of the share of those affected and the respective individual

[8] One may wonder whether the positive impact of tenure on the risk of a real wage cut is the result of just considering workers with at most five years of tenure and reverses for more tenured workers. As a check of robustness we therefore redo our analysis for the larger sample of workers with at most ten years of tenure (again in their first job). As can be seen from Table A.2, which reports the coefficients for the tenure dummies only because those of other regressors are almost the same, this does not change our results.

characteristics, we see that non-German, male, and low-skilled workers with three or four years of tenure are nearly proportionally hit by real wage reductions, whereas those with five years of tenure are more than proportionally subject to wage cuts. Given the large positive interaction effect for high-skilled workers, all subgroups of workers with an academic degree are less than proportionally hit by wage reductions. As a consequence, real wage cuts seem to be highly selective with workers' skills and tenure being two crucial dimensions.

There is only slight evidence in line with the "importance of being unimportant" hypothesis stating that employers are more prone to selectively reduce wages for groups of workers who form a large fraction of the plant's workforce, as this arguably has a big impact on overall labour costs. We find that the share of workers with a certain characteristic in the firm's workforce, say three years of tenure, increases the individual risk of workers with the very same characteristic, viz. three years of tenure, to experience a wage reduction.[9] Yet, these positive effects are generally not statistically significant, with some few exceptions such as medium-skilled workers or those with three years of tenure, and of modest size.

Turning to plant characteristics, we find that working for a plant covered by a collective agreement at sector level significantly decreases the likelihood of facing a real wage reduction, whereas neither the profit situation nor managers' expectations about future employment changes have a significant impact. What is more, small plants resort to wage cuts more often than large plants as do Eastern German compared to Western German plants, which is clearly in line with our expectations.[10]

Adding plant fixed effects to the model does not change the picture (see Model 2 in Table 2). Our findings are thus not driven by unobserved differences in plants' time-invariant wage policies. In particular, all coefficients of individual characteristics are of similar

[9] A positive interaction effect between the incidence of real wage cuts for females and their share in the workforce is also found by Böckerman *et al.* (2007) in some of their models.

[10] Note that running separate regressions for workers employed by Western and Eastern German plants does not change our insights.

magnitude as before, so that we are still left with strong evidence of highly selective wage cuts.

5.2 Including Workers' Wage Residual

Further including the wage residual estimated from an extended Mincerian wage regression for the previous year provides additional insights (see Model 3 in Table 2). As regressors to the wage equation we include a group of education dummies, a sex dummy, a dummy for German nationality, age (linearly and quadratic), tenure (linearly and quadratic), a group of dummy variables capturing the tenure in the previous job, a dummy variable indicating whether this job is the individual's first one, and a plant fixed effect. Table A1 in the appendix exemplarily reports the estimates for the year 2000. The very same model has been estimated for the years 2001–2006 with estimated coefficients being very similar to those reported for the year 2000. Note that in these regressions observations for all full-time employed workers are included in order to consider plants' entire workforce, with top-coded wages being multiply imputed according to the method proposed by Addison *et al.* (2010).[11]

While including the wage residual to the model does not change much for the other variables included, we find that workers with a higher wage residual face a significantly lower probability of a real wage cut. Earning 10 per cent more than one's peers (i.e. other workers in the same plant with the very same individual characteristics) decreases the probability of a real wage cut by about 2.8 per cent on average.[12] In the light of our discussion in Section 2, we interpret this finding as an indication that plants selectively spare high-performance

[11] Our results remain virtually unchanged when estimating individuals' wage residuals from (i) a joint wage regression for all years, (ii) yearly wage regressions excluding plant fixed effects, or (iii) yearly wage regressions excluding individuals with top-coded wages.

[12] As the wage residual is estimated from a wage equation for the previous year, one might argue that a positive wage residual just reflects above-average working hours, say, because of working overtime in that year, and therefore is likely to be reversed in the current year. Clearly, this would cause the residual to have a positive impact on the wage reduction probability rather than a negative which is found here. While we cannot rule out that the wage residual indeed reflects such working hours fluctuations, the positive impact found would thus be even more pronounced if these fluctuations were absent. Therefore, our conclusions are not driven by this point.

workers from real wage cuts, thereby avoiding increased turnover and/or decreased effort of this crucial group of workers. Whereas this finding is in line with theoretical considerations relying on non-fairness efficiency wage and insider–outsider models, it is clearly at odds with fairness considerations pressing employers to use wage cuts in such a way to reduce wage dispersion among peers.[13]

5.3 Heterogeneities by Industrial Relations

Up to now, we have controlled for industrial relations either by a group of industrial relations dummies or a plant fixed effect and thereby have restricted the individual and plant characteristics to show the same impact on individuals' probability of being hit by a real wage reduction in plants with different industrial relations regimes. Yet, the existence of collective agreements or works councils may affect employers' ability to engage in selective wage cuts. The subgroups of workers employed by plants bound by collective agreements or having a works council may therefore show different selectivity patterns in wage cuts than those found when pooling all plants. To check this, we repeat our analysis for workers employed by three subgroups of plants: (i) plants covered by a collective agreement at sector level, (ii) plants bound by an agreement at firm level, and (iii) plants with a works council. As can be seen from Table 3, which reports linear models for the individual wage reduction probability of these three groups of workers (analogous to Model 3 in Table 2), our findings for all firms also hold in these three subgroups, with only little differences across groups.[14]All in all, we thus find clear and robust evidence that employers make use of selective real wage cuts.[15]

[13] We also checked whether the effect of the wage residual is symmetric or differs for positive and negative residuals. We found a somewhat weaker effect for positive than for negative residuals. This did not change our results, however.

[14] In further regressions, we also redid this analysis for even finer subgroups of plants such as plants with both a works council and a collective agreement at sector level. This did not change our findings.

[15] Obviously, (selective) wage cuts are only one alternative for employers to decrease labour costs. Another alternative is to rely on (selective) layoffs. To see whether plants resort to selective layoffs and which groups of workers are more likely to be laid off, we estimated a linear model for the individual probability of job termination mirroring Model 3 from Table 2. As can be seen from Table A.3, several regressors have an

6 Conclusions

In this paper, we have investigated whether employers who (have to) reduce real wages do so in a selective manner. Using German linked employer–employee panel data for the homogenous group of young workers in the first five years of their first job, we fitted linear models for individuals' probability of experiencing a real wage cut including plant fixed effects that control for permanent differences in plants' wage policies. We find clear evidence that firms resort to selective wage reductions, which is in line with insider–outsider and several branches of efficiency wage theory, but in contrast to some recent contributions discarding selective wage reductions and stressing fairness considerations instead.

Medium-skilled and high-skilled workers are less likely to face a real wage reduction than low-skilled workers. Especially high-skilled workers are less than proportionally hit by wage cuts. The same holds for workers who have just recently been hired. We find almost no evidence for what we termed the "importance of being unimportant" hypothesis. That is, workers' individual risk of a real wage reduction seems not to be higher if the share of workers with the same individual characteristics is higher in the workforce, so that wage reductions for this very group are likely to have a big impact on the employer's total labour costs. Adding workers' wage residual estimated from an extended Mincerian wage regression for the previous year as a measure of unobserved worker performance, we further find that workers with a higher residual have a significantly lower incidence of real wage cuts. Our finding is clearly in line with bargaining and several branches of efficiency wage theory, it is at odds, however, with fairness considerations pressing employers to selectively reduce wages

analogous impact as in the wage reduction equation such as workers' wage residual, skills, and nationality, thereby further substantiating our findings, whereas covariates such as tenure and sex point in the opposite direction. These findings might be a first indication that some employee groups such as higher educated employees and employees with unobservable positive characteristics are strongly shielded against negative shocks both in terms of wage and employment stability. Other workers such as females or employees in their first and second year of employment have a lower risk to suffer wage reductions. However, this comes at the cost of a higher employment termination risk.

such that wage dispersion among peers is reduced. We thus conclude that real wage reductions, though rare in general, are specifically aimed at those groups of workers who are less crucial to firm performance.

References

Addison, J., P. Teixeira, and T. Zwick (2010), "German works councils and the anatomy of wages", *Industrial and Labor Relations Review*, **63**(2): 247–260.

Agell, J. and H. Bennmarker (2007), "Wage incentives and wage rigidity: a representative view from within", *Labour Economics*, **14**(3): 347–369.

Akerlof, G.A. (1982), "Labor contracts as partial gift exchange", *Quarterly Journal of Economics*, **97**(4): 543–569.

Akerlof, G.A. and J.L. Yellen (1990), "The fair wage–effort hypothesis and unemployment", *Quarterly Journal of Economics*, **105**(2): 255–283.

Alda, H., S. Bender, and H. Gartner (2005), "The linked employer–employee dataset created from the IAB Establishment Panel and the process-produced data of the IAB (LIAB)", *Schmollers Jahrbuch*, **125**(2): 327–336.

Arai, M. (2003), "Wages, profits, and capital intensity: evidence from matched worker–firm data", *Journal of Labor Economics*, **21**(3): 593–618.

Azariadis, C. (1975), "Implicit contracts and underemployment equilibria", *Journal of Political Economy*, **83**(6): 1183–1202.

Babecký, J., P. Du Caju, T. Kosma, M. Lawless, J. Messina, and T. Rõõm (2010), "Downward nominal and real wage rigidity: survey evidence from European firms", *Scandinavian Journal of Economics*, **112**(4): 884–910.

Baily, M.N. (1974), "Wages and employment under uncertain demand", *Review of Economic Studies*, **41**(1): 37–50.

Bewley, T.F. (1999), *Why Wages Don't Fall During a Recession*, Cambridge, MA: Harvard University Press.

Blinder, A. and D. Choi (1990), "A shred of evidence on theories of wage stickiness", *Quarterly Journal of Economics*, **105**(4): 1003–1015.

Böckerman P., S. Laaksonen, and J. Vainiomäki (2007), "Who bears the burden of wage cuts? Evidence from Finland during the 1990s", *International Journal of Manpower*, **28**(2): 100–121.

Campbell, C.M. and K.S. Kamlani (1997), "The reasons for wage rigidity: evidence from a survey of firms", *Quarterly Journal of Economics*, **112**(3): 759–789.

Cohn, A., E. Fehr, B. Herrmann, and F. Schneider (2011), Social Comparison in the Workplace: Evidence from a Field Experiment, IZA Discussion Paper no. 5550, Institute for the Study of Labor: Bonn.

Cornelißen, T. and O. Hübler (2008), "Downward wage rigidity and job mobility", *Empirical Economics*, **34**(2): 205–230.

Dickens, W.T., L. Götte, E.L. Groshen, S. Holden, J. Messina, M.E. Schweitzer, J. Turunen, and M.E. Ward (2007), "How wages change: micro evidence from the International Wage Flexibility Project", *Journal of Economic Perspectives*, **21**(2), 195–214.

Du Caju, P., C. Fuss, and L. Wintr (2012), "Sectoral differences in downward real wage rigidity: workforce composition, institutions, technology and competition", *Journal for Labour Market Research*, **45**(1): 7–22.

Dustmann, C. and U. Schönberg (2009), "Training and union wages", *Review of Economics and Statistics*, **91**(2): 363–376.

Fehr, E. and L. Götte (2005), "Robustness and real consequences of nominal wage rigidity", *Journal of Monetary Economics*, **52**(4): 779–804.

Flinn, C.J. (1986), "Wages and job mobility of young workers", *Journal of Political Economy*, **94**(3): S88–S110.

Franz, W. and F. Pfeiffer (2006), "Reasons for wage rigidity in Germany", *Labour*, **20**(2): 255–284.

Gartner, H., T. Schank, and C. Schnabel (2013), "Wage cyclicality under different regimes of industrial relations", *Industrial Relations*, **52**(2): 516–540.

Gürtzgen, N. (2009), "Rent-sharing and collective bargaining coverage: evidence from linked employer–employee data", *Scandinavian Journal of Economics*, **111**(2): 323–349.

Jacobebbinghaus, P. and H. Alda (2007), *LIAB-Datenhandbuch: Version 2.0*, Nuremberg: Institute for Employment Research.
Retrieved 16/04/2013 from http://doku.iab.de/fdz/reporte/2007/DR_02-07.pdf

Holden, S. (1994), "Wage bargaining and nominal rigidities", *European Economic Review*, **38**(5): 1021–1039.

Howitt, P. (2002), "Looking inside the labor market: a review article", *Journal of Economic Literature*, **40**(1): 125–138.

Kahn, S. (1997), "Evidence of nominal wage stickiness from microdata", *American Economic Review* **87**(5): 997–1008.

Kube, S., M.A. Maréchal, and C. Puppe (2011), Do Wage Cuts Damage Work Morale? Evidence from a Natural Field Experiment, IEW Working Paper no. 471, Zurich: Institute for Empirical Research in Economics

Lee, D. and N.G. Rupp (2007), "Retracting a gift: how does employee effort respond to wage reductions?", *Journal of Labor Economics*, **25**(4): 725–761.

Lindbeck, A. and D.J. Snower (1988), "Cooperation, harassment, and involuntary unemployment: an insider–outsider approach", *American Economic Review*, **78**(1): 167–188.

Malcomson, J.M. (1997), "Contracts, hold-up, and labor markets", *Journal of Economic Literature*, **35**(4): 1916–1957.

Oi, W.Y. and T.L. Idson (1999), "Firm size and wages", *in* O.C. Ashenfelter and D.E. Card (eds.), *Handbook of Labor Economics*, vol. 3B, pp. 2165–2214, Amsterdam: Elsevier.

Shapiro, C. and J.E. Stiglitz (1984), "Equilibrium unemployment as a worker discipline device", *American Economic Review*, **74**(3): 433–444.

Stiglitz, J.E. (1974), "Alternative theories of wage determination and unemployment in LDCs: the labor turnover model", *Quarterly Journal of Economics*, **88**(2): 194–227.

Stüber, H. (2013), *Wage Rigidity in Germany*, IAB-Bibliothek No. 340, Bielefeld: W. Bertelsmann Verlag.

Weiss, A. (1980), "Job queues and layoffs in labor markets with flexible wages", *Journal of Political Economy*, **88**(3): 526–538.

Yellen, J. (1984), "Efficiency wage models of unemployment", *American Economic Review (Papers and Proceedings)*, **74**(2): 200–205.

Table 1: Selected descriptive statistics (means)

	Full sample	Sample of young workers in first job
Share of workers with real wage reduction	0.134	0.131
Low-skilled (no occupational degree)	0.131	0.235
Medium-skilled (occupational degree)	0.684	0.521
High-skilled (academic degree)	0.136	0.254
Female	0.267	0.394
German	0.923	0.806
Share of workers with tenure no more than 5 years	0.348	1.000
Share of workers in first job	0.197	1.000
Log wage	4.573	4.230
Yearly change in log real wages	0.027	0.023
Relative employment change	0.007	0.009
Expected employment reduction	0.373	0.354
Works council	0.866	0.818
Collective bargaining at sector level	0.722	0.694
Collective bargaining at firm level	0.137	0.114
Good profit situation	0.199	0.277
Plant size 1–20	0.028	0.036
Plant size 21–200	0.195	0.203
Plant size 201–500	0.186	0.186
Plant size 501–2000	0.294	0.310
Plant size larger than 2000	0.297	0.255
East Germany	0.178	0.169

Notes: The data set used is the LIAB cross-sectional model, waves 2000–2006.

Table 2: Individual probability of facing a real wage reduction

Regressand: dummy for real wage reduction	Model 1: OLS		Model 2: plant FE		Model 3: plant FE	
Regressors:	Coef.	SE	Coef.	SE	Coef.	SE
Wage residual in previous year					-0.277 **	(0.011)
Medium-skilled (occupational degree)	-0.030**	(0.005)	-0.031 **	(0.005)	-0.048 **	(0.005)
High-skilled (academic degree)	-0.016	(0.008)	-0.018 *	(0.008)	-0.042 **	(0.009)
Female	-0.024**	(0.004)	-0.023 **	(0.004)	-0.012 **	(0.004)
German	-0.054**	(0.006)	-0.056 **	(0.006)	-0.078 **	(0.006)
Tenure 3 years	0.051**	(0.005)	0.054 **	(0.005)	0.061 **	(0.005)
Tenure 4 years	0.122**	(0.005)	0.125 **	(0.005)	0.135 **	(0.005)
Tenure 5 years	0.132**	(0.006)	0.135 **	(0.006)	0.145 **	(0.006)
Share of workers with real wage reduction	0.802**	(0.024)	0.753 **	(0.027)	0.747 **	(0.027)
Relative employment change	-0.014*	(0.007)	-0.003	(0.007)	-0.004	(0.007)
Share of medium-skilled workers	-0.032	(0.018)	0.021	(0.061)	0.008	(0.062)
Share of high-skilled workers	-0.114**	(0.027)	-0.102	(0.109)	-0.092	(0.108)
Share of female workers	0.010	(0.017)	0.120	(0.083)	0.146	(0.082)
Share of German workers	0.039	(0.031)	0.105	(0.110)	0.086	(0.109)
Share of workers with 1 year tenure	0.147**	(0.021)	0.063	(0.043)	0.100 *	(0.043)
Share of workers with 2 years tenure	0.161**	(0.029)	0.076	(0.045)	0.089	(0.046)
Share of workers with 3 years tenure	0.045	(0.027)	-0.010	(0.035)	-0.007	(0.036)
Share of workers with 4 years tenure	-0.013	(0.026)	-0.022	(0.025)	-0.021	(0.028)
Share of workers with 5 years tenure	0.024	(0.024)	0.029	(0.024)	0.032	(0.025)
Share of workers with first job	0.016	(0.015)	0.074	(0.081)	0.061	(0.078)
Works council	-0.004	(0.006)				
Collective bargaining at sector level	-0.024**	(0.006)				
Collective bargaining at firm level	-0.002	(0.012)				
Expected employment decrease	0.037	(0.056)	0.197 *	(0.094)	0.219 **	(0.083)
Good profit situation	-0.008	(0.005)	-0.009	(0.006)	-0.008	(0.006)
Plant size 1–20	0.033**	(0.010)	-0.008	(0.036)	-0.012	(0.036)
Plant size 21–200	0.014**	(0.005)	0.006	(0.017)	0.000	(0.017)
Plant size 501–2000	0.006	(0.006)	-0.027	(0.016)	-0.027	(0.016)
Plant size larger than 2000	-0.011	(0.009)	-0.048	(0.029)	-0.060 *	(0.027)
East Germany	0.027**	(0.006)				
Medium-skilled * share medium-skilled	0.087**	(0.030)	0.067	(0.036)	0.059	(0.038)
High-skilled * share high-skilled	0.074*	(0.037)	0.039	(0.042)	-0.000	(0.043)
Female * share females	0.065**	(0.017)	0.049 **	(0.017)	0.033 *	(0.017)
German * share Germans	-0.108**	(0.035)	-0.110 **	(0.039)	-0.131 **	(0.045)
Tenure 3 years * share tenure 3 years	0.068	(0.036)	0.045	(0.042)	0.029	(0.040)
Tenure 4 years * share tenure 4 years	0.049	(0.039)	0.054	(0.042)	0.040	(0.047)
Tenure 5 years * share tenure 5 years	0.022	(0.037)	0.022	(0.041)	0.007	(0.041)
Wage residual * share real wage reduction					-0.018	(0.050)
Medium-skilled * share real wage reduction	-0.074**	(0.019)	-0.069 **	(0.022)	-0.062 **	(0.021)
High-skilled * share wage reduction	-0.216**	(0.031)	-0.183 **	(0.035)	-0.178 **	(0.036)
Female * share wage reduction	-0.047**	(0.016)	-0.057 **	(0.018)	-0.059 **	(0.018)
German * share wage reduction	-0.061*	(0.024)	-0.063 *	(0.028)	-0.062 *	(0.027)
Tenure 3 years * share real wage reduction	0.132**	(0.020)	0.141 **	(0.022)	0.138 **	(0.021)
Tenure 4 years * share real wage reduction	0.266**	(0.020)	0.298 **	(0.022)	0.298 **	(0.022)
Tenure 5 years * share real wage reduction	0.299**	(0.021)	0.331 **	(0.023)	0.324 **	(0.023)
Number of observations: 108,003	R^2: 0.163		R^2 (overall): 0.152		R^2 (overall): 0.161	

Notes: The data set used is the LIAB cross-sectional model, waves 2000–2006. Only workers in their first job and with at most 5 years tenure are included. **/* denotes statistical significance at the 1/5 per cent level, where robust standard errors are clustered at the plant level. Reference group: low-skilled worker with 2 years of tenure working for a plant with 201–500 employees with neither a works council nor a collective agreement; further regressors included are 16 sector and 6 year dummies and a constant. In all interaction terms, the shares of workers with certain characteristics and of workers hit by a real wage reduction are centred around their sample means.

Table 3: Individual probability of facing a real wage reduction by industrial relations

Regressand: dummy for real wage reduction	Collective agreement at sector level		Collective agreement at firm level		Works council	
Regressors:	Coef.	SE	Coef.	SE	Coef.	SE
Wage residual in previous year	-0.255**	(0.013)	-0.325**	(0.030)	-0.261**	(0.012)
Medium-skilled (occupational degree)	-0.054**	(0.007)	-0.027	(0.015)	-0.050**	(0.006)
High-skilled (academic degree)	-0.039**	(0.011)	-0.073**	(0.019)	-0.040**	(0.010)
Female	-0.014**	(0.005)	-0.013	(0.011)	-0.015**	(0.005)
German	-0.081**	(0.007)	-0.069**	(0.012)	-0.079**	(0.006)
Tenure 3 years	0.056**	(0.006)	0.095**	(0.015)	0.061**	(0.005)
Tenure 4 years	0.136**	(0.006)	0.149**	(0.014)	0.139**	(0.006)
Tenure 5 years	0.146**	(0.007)	0.170**	(0.016)	0.151**	(0.006)
Share of workers with real wage reduction	0.684**	(0.033)	0.737**	(0.062)	0.688**	(0.031)
Relative employment change	0.005	(0.009)	-0.026**	(0.007)	-0.009	(0.007)
Share of medium-skilled workers	0.032	(0.091)	-0.045	(0.202)	-0.000	(0.085)
Share of high-skilled workers	-0.115	(0.130)	-0.017	(0.283)	-0.116	(0.126)
Share of female workers	0.012	(0.108)	-0.418	(0.304)	0.152	(0.122)
Share of German workers	0.039	(0.158)	0.652	(0.591)	0.106	(0.210)
Share of workers with 1 year tenure	0.074	(0.062)	0.074	(0.137)	0.115*	(0.058)
Share of workers with 2 years tenure	-0.024	(0.067)	0.152	(0.147)	0.014	(0.067)
Share of workers with 3 years tenure	-0.025	(0.046)	0.059	(0.109)	-0.034	(0.043)
Share of workers with 4 years tenure	-0.042	(0.026)	0.020	(0.084)	-0.045	(0.026)
Share of workers with 5 years tenure	0.022	(0.028)	-0.014	(0.088)	0.029	(0.028)
Share of workers with first job	-0.102	(0.102)	-0-108	(0.264)	0.031	(0.116)
Good profit situation	-0.015*	(0.007)	0.004	(0.015)	-0.011	(0.006)
Plant size 1–20	0.010	(0.051)	0.181	(0.207)	0.114	(0.091)
Plant size 21–200	0.021	(0.025)	-0.012	(0.040)	0.012	(0.021)
Plant size 501–2000	-0.003	(0.021)	0.001	(0.039)	-0.028	(0.018)
Plant size larger than 2000	-0.065	(0.033)	0.059	(0.061)	-0.059*	(0.029)
Medium-skilled * share medium-skilled	0.095*	(0.048)	-0.081	(0.073)	0.086*	(0.044)
High-skilled * share high-skilled	0.012	(0.060)	0.026	(0.097)	-0.003	(0.049)
Female * share females	0.018	(0.020)	0.103*	(0.046)	0.038*	(0.018)
German * share Germans	-0.128*	(0.054)	-0.173	(0.109)	-0.131*	(0.051)
Tenure 3 years * share tenure 3 years	0.061	(0.053)	0.153	(0.139)	0.021	(0.048)
Tenure 4 years * share tenure 4 years	0.061	(0.054)	0.045	(0.143)	0.079	(0.052)
Tenure 5 years * share tenure 5 years	0.013	(0.047)	0.008	(0.137)	0.042	(0.050)
Wage residual * share real wage reduction	-0.007	(0.061)	0.154	(0.155)	0.021	(0.061)
Medium-skilled * share real wage reduction	-0.056*	(0.029)	0.064	(0.052)	-0.049	(0.026)
High-skilled * share wage reduction	-0.147**	(0.046)	-0.087	(0.088)	-0.147**	(0.039)
Female * share wage reduction	-0.082**	(0.020)	-0.133*	(0.051)	-0.082**	(0.021)
German * share wage reduction	-0.086*	(0.038)	-0.130**	(0.045)	-0.081**	(0.031)
Tenure 3 years * share real wage reduction	0.129**	(0.027)	0.223	(0.051)	0.157**	(0.025)
Tenure 4 years * share real wage reduction	0.311**	(0.028)	0.380	(0.049)	0.363**	(0.025)
Tenure 5 years * share real wage reduction	0.363**	(0.029)	0.397	(0.049)	0.402**	(0.025)
Number of observations	74,949		12,317		88,286	
R^2 (overall)	0.134		0.168		0.137	

Notes: The data set used is the LIAB cross-sectional model, waves 2000–2006. Only workers in their first job and with at most 5 years tenure are included. **/* denotes statistical significance at the 1/5 per cent level, where robust standard errors are clustered at the plant level. Reference group: low-skilled worker with 2 years of tenure working for a plant with 201–500 employees with neither a works council nor a collective agreement; further regressors included are 16 sector and 6 year dummies and a constant. All estimates include plant fixed effects and are thus comparable to Model 3 in Table 2. In all interaction terms, the shares of workers with certain characteristics and of workers hit by a real wage reduction are centred around their sample means.

Appendix

Table A1: Wage regression including plant fixed effects for the year 2000

Regressand: log wage	Plant FE	
Regressors:	Coef.	SE
Medium-skilled (occupational degree)	0.145**	(0.004)
High-skilled (academic degree)	0.551**	(0.007)
Female	-0.137**	(0.002)
German	0.045**	(0.003)
Age	0.021**	(0.001)
Age squared/100	-0.020**	(0.000)
Tenure	0.018**	(0.001)
Tenure squared/100	-0.035**	(0.002)
Tenure before the job 2–5 years	0.006**	(0.002)
Tenure before the job 6–10 years	0.023**	(0.002)
Tenure before the job more than 10 years	0.058**	(0.003)
First job	0.002	(0.002)
Number of observations: 1,477,192	R^2 (overall): 0.357	

Notes: The data set used is the LIAB cross-sectional model, waves 2000–2006. **/* denotes statistical significance at the 1/5 per cent level, where robust standard errors are clustered at the plant level.

Table A2: Individual probability of facing a real wage reduction (10 years of tenure)

Dependent variable: dummy for real wage reduction	Plant FE	
Regressors:	Coef.	SE
Tenure 3 years	0.060**	(0.005)
Tenure 4 years	0.135**	(0.005)
Tenure 5 years	0.145**	(0.006)
Tenure 6 years	0.159**	(0.006)
Tenure 7 years	0.181**	(0.006)
Tenure 8 years	0.193**	(0.006)
Tenure 9 years	0.201**	(0.006)
Tenure 10 years	0.212**	(0.006)
Tenure 3 years * share tenure 3 years	0.023	(0.041)
Tenure 4 years * share tenure 4 years	0.064	(0.043)
Tenure 5 years * share tenure 5 years	-0.000	(0.037)
Tenure 6 years * share tenure 6 years	0.075*	(0.037)
Tenure 7 years * share tenure 7 years	-0.007	(0.042)
Tenure 8 years * share tenure 8 years	0.048**	(0.013)
Tenure 9 years * share tenure 9 years	0.025	(0.014)
Tenure 10 years * share tenure 10 years	-0.031	(0.020)
Tenure 3 years * share wage reduction	0.135**	(0.021)
Tenure 4 years * share wage reduction	0.284**	(0.022)
Tenure 5 years * share wage reduction	0.315**	(0.023)
Tenure 6 years * share wage reduction	0.344**	(0.022)
Tenure 7 years * share wage reduction	0.395**	(0.021)
Tenure 8 years * share wage reduction	0.427**	(0.023)
Tenure 9 years * share wage reduction	0.405**	(0.026)
Tenure 10 years * share wage reduction	0.454**	(0.026)
Number of observations: 417,898	R^2 (overall): 0.218	

Notes: The data set used is the LIAB cross-sectional model, waves 2000–2006. Only workers in their first job and with at most 10 years tenure are included. **/* denotes statistical significance at the 1/5 per cent level, where robust standard errors are clustered at the plant level. Reference group: low-skilled worker with 2 years of tenure working for a plant with 201–500 employees with neither a works council nor a collective agreement; further regressors included are those from Model 3 in Table 2. In all interaction terms, the shares of workers with certain characteristics and of workers hit by a real wage reduction are centred around their sample means.

Table A3: Individual probability of job end

Regressand: dummy for job end	Plant FE	
Regressors:	Coef.	SE
Wage residual in previous year	-0.109**	(0.008)
Medium-skilled (occupational degree)	-0.031**	(0.004)
High-skilled (academic degree)	-0.025**	(0.005)
Female	0.030**	(0.003)
German	-0.027**	(0.004)
Tenure 3 years	-0.027**	(0.004)
Tenure 4 years	-0.051**	(0.004)
Tenure 5 years	-0.052**	(0.004)
Share of workers with job end	0.882**	(0.010)
Relative employment change	-0.001	(0.005)
Share of medium-skilled workers	-0.000	(0.044)
Share of high-skilled workers	0.034	(0.098)
Share of female workers	-0.072	(0.076)
Share of German workers	0.132	(0.087)
Share of workers with 1 year tenure	-0.091**	(0.033)
Share of workers with 2 years tenure	-0.142**	(0.032)
Share of workers with 3 years tenure	0.060*	(0.030)
Share of workers with 4 years tenure	0.024	(0.024)
Share of workers with 5 years tenure	0.014	(0.019)
Share of workers with first job	0.470**	(0.068)
Expected employment decrease	-0.274**	(0.084)
Good profit situation	-0.011*	(0.005)
Plant size 1–20	0.015	(0.029)
Plant size 21–200	-0.019	(0.012)
Plant size 501–2000	-0.004	(0.014)
Plant size larger than 2000	-0.026	(0.026)
Tenure 3 years * share tenure 3 years	-0.082*	(0.032)
Tenure 4 years * share tenure 4 years	-0.028	(0.028)
Tenure 5 years * share tenure 5 years	0.017	(0.029)
Medium-skilled * share medium-skilled	-0.000	(0.020)
High-skilled * share high-skilled	0.057	(0.029)
Female * share females	0.003	(0.014)
German * share Germans	-0.070	(0.042)
Wage residual * share job end	0.135**	(0.012)
Tenure 3 years * share job end	0.066**	(0.008)
Tenure 4 years * share job end	0.091**	(0.007)
Tenure 5 years * share job end	0.099**	(0.007)
Medium-skilled * share job end	0.013*	(0.006)
High-skilled * share job end	-0.021*	(0.008)
Female * share job end	-0.045**	(0.004)
German * share job end	0.030**	(0.006)
Number of observations: 108,003	R^2 (overall): 0.589	

Notes: The data set used is the LIAB cross-sectional model, waves 2000–2006. Only workers in their first job and with at most 5 years tenure are included. **/* denotes statistical significance at the 1/5 per cent level, where robust standard errors are clustered at the plant level. Reference group: low-skilled worker with 2 years of tenure working for a plant with 201–500 employees with neither a works council nor a collective agreement; further regressors included are 16 sector and 6 year dummies and a constant. In all interaction terms, the shares of workers with certain characteristics and of workers hit by a real wage reduction are centred around their sample means.