The real costs of CEO compensation - the effect of behindness aversion of employees*

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Abstract

Do employees who compare themselves to the CEO matter for executive compensation? Using German establishment-level wage data, we show that employee wages are increasing in CEO compensation. When CEO compensation increases 1%, the median employee's wage increases by about 0.04%. Higher CEO compensation also increases the probability for the existence of employee stock ownership plans. We use a difference-in-difference setting to provide causal evidence for the relationship. Our findings suggest that behindness aversion of employees is an important driver of wages and increases the costs of executive compensation significantly. We structurally estimate a principal-agent model with two agents (CEO, representative employee) to identify the behindness aversion parameters.

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1. Introduction

Some of the strongest opposition against high and increasing CEO pay comes from rank and file employees, and in particular from employees within the same firm. It is difficult to explain this phenomenon with normative preferences, because formally CEOs are employees and paid by shareholders, so regular employees should, in principle, not object to them being overpaid. A potential explanation is that workers envy CEOs their higher pay, i.e. workers suffer disutility from the gap between their own pay and the CEO's pay. Formally, such preferences are called inequality aversion or, more precisely, behindness aversion (see Fehr and Schmidt (1999) and Neilson and Stowe (2010); for empirical evidence see Card, Mas, Moretti, and Saez (2012)).

Behindness aversion has two effects on optimal compensation in the firm. First, regular employee's pay will increase whenever CEO pay increases. The reason is that employees experience an additional disutility when CEO pay is raised, so that the firm raises employee's pay to compensate them for this disutility and to prevent them from leaving the firm. The second effect is an incentive effect. If the CEO receives more incentive pay than workers do, the pay gap (and consequently, the employee's disutility) increases with his effort. As a consequence, employees will have less incentives to work hard. In equilibrium, firms might therefore pay a higher wage or give equity-based compensation also to rank and file employees. Employee stock ownership plans (ESOPs) are indeed common in practice and they are difficult to justify with normative preference assumptions (see Oyer and Schaefer (2004)).

There can be direct and indirect channels through which CEO compensation affects employee wages. Through direct channel, workers observe the compensation of CEOs from published reports. They derive dis-utility directly from comparison. This means that workers near the bottom of the hierarchy are more sensitive to increases in CEO wage because the wage gap is larger. Another channel is indirect, which can also be referred as trickle-down effect. The top managers compare their wages to the CEO, and their dis-utility is compensated. Regular managers compare their wages to top managers, lower managers to regular managers, and regular employees compare their wage to lower managers. The effect of high CEO compensation gradually passes down to regular employees.

The main challenge in studying the effect of high CEO compensation on workers' pay is the

availability of data. We construct a matched CEO-employee panel data set for German firms by combining a data set on the CEO compensation with a data set on employee wages. Data on the CEO compensation is hand-collected from firms' annual reports. Data on employee wages comes from the Research Data Center (FDZ) of the German Federal Employment agency (BA). This agency has established a complete record of employee wages in German establishments since 1975 (for East Germany since 1992). The matched panel data set contains more than 200,000 establishment-year observations, and is available from 2000 to 2011. This unique data set enables us to test several hypotheses on the relationship of CEO compensation and employee wages.

Our paper shows that the level of CEO pay is associated with the level of employee pay across firms and across time. In addition, we show that a similar relation exists for Employee Stock Ownership Plan (ESOP). We show that the ESOP likelihood increases in CEO total pay. The positive relation between CEO and employee pay is robust to a battery of standard controls and additional checks, including firm and establishment fixed effects.

We find evidence that higher CEO compensation is positively related employee wages. When CEO compensation increases by 1%, the median employee wage increases by 0.04%. This finding not only holds in cross sectional regressions but also when we control for time invariant unobserved characteristics of the firm and establishment. To further alleviate potential endogeneity concerns, we adopt the difference-in-difference setting. In this analysis, we find that when CEO compensation becomes publicly observable, employees receive 13% more wage. Finally, we show that firms with higher CEO compensation are also more likely to provide ESOPs to rank and file employees.

These findings have far reaching consequences for executive compensation. Behindness aversion drives up the costs of executive compensation by increasing employee wages. Any additional dollar paid to the CEO for providing incentives also leads to higher employee wages to compensate employees for their (perceived) losses from behindness aversion. If an average CEO in our sample receives €2.6 million a year, then an extra compensation of 1% or €26,000 paid to her will incur an additional compensation of €14.4 to the median employee with an average annual salary of €35,000. For the average firm in our sample with 50,000 employees that means that an extra €26,000 paid to CEO increases total compensation of employees by €720,000 per year.

Finally, we estimate a principal-agent model with two agents (CEO, representative employee) in order to find out the behindness aversion parameters in the model of Fehr and Schmidt (1999).

The paper is organized as follows: Section 2 discusses the theoretical framework and the related literature. Section 3 presents the data. Section 4 documents the relation between CEO compensation and employee wages consistent with our employee-behindness-aversion-hypothesis. We present evidence for the causality of CEO compensation on employee wages in Section 5. Section 6 investigates employee turnover and Section 7 contains the ESOP analysis. Finally, we implement a structural estimation of a principal-agent model with behindness averse employees in Section 8. Section 9 concludes.

2. Theoretical framework and literature

It is widely accepted that the feeling of happiness relies not only on someone's own material payoff, but also the payoff of others. Schmitt and Marwell (1972) show that subjects withdraw from profitable experiments if they receive inequitable payoffs. Clark and Oswald (1996), using data on British workers, show that the satisfaction levels of workers are negatively related to their comparison wage rates. Akerlof and Yellen (1990) show that the fair wage of workers is determined not only by the market clearing wage, but also by the comparison with salient others. Bolton and Ockenfels (2000) posit that someone's true payoff consists of her own pecuniary and own relative payoff.

Fehr and Schmidt (1999) ascribe this phenomenon to the fact that people care about equity, they prefer more equitable payoffs. The authors provide a simple model to describe how utility of individuals is related to their own payoff and the payoff of others.

$$U_i(x) = x_i - \alpha_i \max(x_j - x_i, 0) - \beta_i \max(x_i - x_j, 0), \qquad i \neq j, \tag{1}$$

where x_i and x_j are payoffs and α_i and β_i parameters. The first term in equation (1) is the utility derived from the payoff person i receives. The second term shows that a person derives disutility from receiving less than others. The third term shows that a person also suffers from receiving more than others. Fehr and Schmidt (1999) assume that $\alpha > 0$ because people dislike disadvantageous states, and $\alpha > \beta$ since people dislike being behind more than being ahead. The later literature further extends this model and differentiates various kinds of attitudes towards inequality. People with $\alpha > 0$ are "envious" or "behindness averse" because they dislike disadvantageous inequity. People with $\beta > 0$ are "compassionate" since they dislike advantageous inequity. In contrast, people with

$\beta < 0$ are "competitive" because they derive positive utility from advantageous inequity. Whether people are compassionate or competitive in advantageous inequality varies in different situations, but it is commonly believed that (all) people are behindness averse.

A couple of papers investigate optimal wage contracts and incentive schemes when employees derive (dis-)utility from inequality. Grund and Sliwka (2005) and Neilson and Stowe (2010) consider a principal-agent model with two identical agents that are inequality averse or competitive. They discriminate two different effects. On the one hand, an agent would work harder if she is envious (incentive effect). On the other hand, the more inequality averse the agent is, the more the principal needs to compensate the negative utility from inequality (participation effect). These papers find that agents with inequality aversion exert higher efforts than those who are purely self-interested under certain tournament structures.

Besides peer comparison, regular employees also compare their wages to other groups of people within the firm. Akerlof and Yellen (1990) argue that a possible reference group for employees to compare their wages to are agents with higher income within the firm. Dur and Glazer (2008) are among the first who explicitly analyze the agency problem and optimal contracts when employees envy their CEO. They show that envy tightens the employees' participation constraint and causes higher pay or lower workload. The authors also show that workers and firms can benefit from profit-sharing programs because it reduces the expected disutility from envy. Similar to Dur and Glazer (2008) we also focus on the envy of employees towards their CEO, and neglect the envy between workers. Without peer comparison, we only need to focus on the behindness aversion of employees as signified by α in equation (1) because CEOs always earn more than regular workers. Additional assumptions on β in equation (1) (whether workers are compassionate or competitive) are not required.

There exist a few empirical studies which examine the relation between CEO compensation and employee wages or productivity. Faleye, Reis, and Venkateswaran (2010) calculate the wage gap between the CEO and rank-and-file employees. They find that a larger wage gap results in lower employee productivity. Wade, O'Reilly, and Pollock (2006) regress the CEO compensation on CEO's personal traits and use the residuals as a proxy for CEO over- or underpayment. They show that CEO overpayment is related to higher pay for other managers. Our paper is the first to show that there exists a positive relation between CEO and rank-and-file employee pay, and we ascribe

this relation to the behindness aversion of employees.

3. Data

3.1 Data sources and sample construction

The sample firms are drawn from all companies included in the two main German stock market indices, DAX and MDAX, between 2000 and 2011. We hand collect data on executive compensation and corporate governance from annual reports and Hoppenstedt company profiles. We do not include non-listed firms, because information on executive compensation is usually unavailable. Stock market data comes from *Datastream*, balance sheet and accounting data from *Worldscope*.

Employment and wage data at the establishment level are obtained from the Institute of Employment Research (IAB). The IAB is the research organization of the German federal employment agency, the Bundesagentur für Arbeit (BA). The BA collects worker and employer contributions to unemployment insurance and distributes unemployment benefits. All German businesses are required to report detailed information on employment and wages to the BA.[1] The individual-level data is aggregated at the establishment level, made anonymous, and offered for scientific use by the IAB (the Establishment History Panel). An establishment is any facility having a separate physical address, such as a factory, service station, restaurant, or office building. The IAB offers detailed establishment level data on industry, location, employment, employee education, age, nationality, and wages, and provides these data in the form of establishment-level statistics, such as sums, medians, and quartiles on wages and employment according to different classifications and breakdowns.

IAB does not have a firm identifier, which is why manual matching is necessary. At our request, the IAB matched our sample of listed firms with their establishment-level database using an automatic procedure, based on company name and address information (city, zip code, street, and house number). Additionally, we provided the IAB with names of major subsidiaries listed in the annual reports of our sample firms in 2006. All cases not unambiguously matched by the automatic matching procedure are checked by hand to avoid mismatching. The matching was performed for

[1] German establishments are required to report salaries of their employees up to an upper earnings limit (social security contribution ceiling) that is annually adjusted (West German states: €52,800 in 2000 up to €66,000 in 2011. East German states: €43,600 in 2000 up to €57,600 in 2011). When this limit is reached, establishments are only required to report the ceiling. We delete in our data set 5.23% of the observations because the median average wage for the establishment was equal to the ceiling value for the respective year.

2004, 2005, and 2006. Firms are dropped if they do not exist during the period 2004 through 2006. All establishments are matched only once to our sample firms. This matching procedure does not allow us to identify changes in establishment ownership after 2006. (At the time of matching establishments to firms, establishment data was not available for 2007 and subsequent years.) Thus, if an establishment is acquired before 2004 or sold to another firm after 2006, it will be treated as if it belonged to the matched firm after the acquisition or before the sale. This will blur the match between firms and establishments and potentially lead to attenuation bias working against finding significant results. Table 1 provides an overview of our matching process.

While fiscal years of German firms are mostly from January to December, establishment years for IAB data are from July to June. We therefore lead all variables from *Worldscope* by six months relative to IAB years. Effectively, we assign year-end values from *Worldscope* to June 30 information on employment and wages of the same year.

3.2 CEO compensation and personal information

We hand-collected data on compensation for CEOs and other members of the management board from firms' annual reports. Before 2006, most firms only disclose the total compensation of the management board as a whole. Only a few firms reported the individual compensation. From 2006, the German Corporate Governance Code required firms to disclose the individual compensation of members of management board in their annual reports.[2] Hence, data on individual compensation for the management board is available for most firms after 2006. If a firm discloses the individual compensation, we record the payment for each executive, for all other firms the total compensation for the management board is recorded.

Managerial compensation consists of several components: fixed salary, remuneration in kind, annual bonus, and compensation from long term incentive programs. The long term incentive programs includes stock options, stock appreciation rights (SAR), and other stock based instruments.

[2]The German Corporate Governance Code (2006), Clause 4.2.4, requires that "The total compensation of each member of the Management Board is to be disclosed by name, divided into non-performance-related, performance-related, and long-term incentive components, unless decided otherwise by the General Meeting by three quarters majority." That means the disclosure of the compensation of each member of the management board is mandatory from 2006 as long as the general annual meeting has not decided otherwise with three quarters majority. Compare that to the German Corporate Governance Code (2005), Clause 4.2.4, "Compensation of the members of the Management Board shall be reported in the Notes of the Consolidated Financial Statements subdivided according to fixed, performance related and long-term incentive components." According to the Code, the word "shall" is used as recommendation but not regulation.

All these separate components of compensation are recorded if available. Some executives in our panel data set join or leave the management board during the year. Their remuneration is then adjusted for the period in office to make them comparable to the standard annual compensation.

The German Corporate Governance Code recommends firms to provide information on employee stock ownership programs (ESOPs) in their annual reports.[3] This information is also collected by us. The dummy variable *ESOP* is one if a firm indicates that it provides an ESOP, and it is zero if no information on an ESOP is found in the annual report.

Table 2 present summary statistics and variable definitions for firm level variables (Panel A) and establishment level variables (Panel B). The average firm-year in our sample has sales of €15.8 billion, which shows that our sample mostly comprises of large firms. The average CEO has a total annual compensation of €2.6 million and is 54 years old. The average median annual gross wage for our sample is €35,167. That is about 13% higher than the average annual gross wage of all employees covered by social security in Germany, which was €31,144 in 2010. However, it is about 10% below the average annual gross wage of full-time employees in Germany, which was €38,724 in 2010.

4. The relation between CEO compensation and employee wages

4.1 Baseline results

We start by analyzing the relation between CEO compensation and employee wages using the following baseline regression model:

$$\log(Wage)_{ijt} = \alpha_t + \alpha_k + \alpha_s + \beta \log(CEOtotal)_{jt-1} + \gamma X_{ijt-1} + \varepsilon_{ijt} \tag{2}$$

The dependent variable, $\log(Wage)_{ijt}$, is the logarithm of the median annual wage in establishment i and year t, where j indexes firms. $\log(CEOtotal)_{jt-1}$ is the logarithm of the CEO's total compensation over the prior year $t-1$. In our benchmark regressions we control for year fixed effects, α_t , industry fixed effects of the establishment, α_k, and state fixed effects, α_s. X_{ijt-1} is a vector of control variables, which include establishment-level variables like number, median age,

[3] In the German Corporate Governance Code (2009), Clause 7.1.3, "The Corporate Governance Report shall contain information on stock option programs and similar securities-based incentive systems of the company." We hand collect this variable for any sample firm from 2009 to 2013.

qualification, and nationality of employees, and firm-level variables like profitability, size, leverage, CEO ownership, and tenure. All explanatory variables are lagged by one year. We run fixed effects regressions and use White (1980) robust standard errors that allow for clustering at the firm level.

Table 3 presents our results. Specification (1) only includes industry, state, and year fixed effects. The following specifications slowly build the full model. First, adding establishment level controls in column (2) and then stepwise firm level controls (columns (3) to (7)). Across all specifications we observe that firms that pay their CEOs more also pay significantly higher wages to their other employees. In column (7), which includes observations after 2005 and the full set of control variables, the coefficient for CEO total compensation is 0.041 ($t = 2.93$). That means if CEO compensation increases by 1%, the median employees' wage increases by 0.04%. This effect is economically sizable. If an average CEO in our sample receives €2.6 million a year, then an extra compensation of 1% or €26,000 paid to her will incur an additional compensation of €14.4 to the median employee with an average annual salary of €35,000. For the average firm in our sample with 50,000 employees that means that an extra €26,000 paid to CEO increases total compensation of employees by €720,000 per year.

These results obtain after controlling observable characteristics known to influence employee wages. In particular, we control for establishment and firm size, employee characteristics, profitability, leverage, and union presence. As expected, employee wages are higher when employees are better educated, older, German, male, work in larger establishments or firms, have a higher risk to lose their jobs, leverage is lower, a union member has a board seat, and the establishment is close to the headquarter (see, for example, Cronqvist, Heyman, Nilsson, Svaleryd, and Vlachos (2009), Brown and Medoff (1989)).

4.2 Additional controls

While we control for a number of variables in the above regressions, other, potentially unobservable, variables may be driving our results. To minimize such concerns we report further results with additional firm-level controls in Table 4. First in column (1), we add the firm's annual *Stock return* as alternative measure of firm performance. The results show that employee wages are hardly influenced by stock returns above and beyond what is already captured in our other control variables. The statistical and economic significance of the coefficient on *ln(CEO total)* is not affected.

Second, we add *Board size*, defined as the number of members in the executive board. Again we don't observe any significant effect on employee wages or the coefficient on *ln(CEO total)*. Third, we add additional CEO characteristics: (1) *CEO switch* equals one if a new CEO is appointed in t-1; (2) *CEO age* in years; (3) *CEO out-hiring* equals one if CEO is recruited from outside the firm. None of these CEO characteristics has a significant influence on employee pay. Fourth, we add *ln(R&D to sales)*. The results in Table 4 show that firms with higher R&D expenditures (relative to sales) pay lower employee wages. However, the coefficient on *ln(CEO total)* is hardly affected even though we lose more than 60% of the observations. Fifth, we split up the dummy variable *Union* into four dummy variables to control separately for the influence of the four largest German unions (IG Metall, ver.di, IG BCE, and IG BAU). We find that firms with one of the four largest unions on their supervisory board pay their employees more on average but there is no significant difference between these four unions. The coefficient for *ln(CEO total)* is not materially affected.

5. Evidence of causality

In the last section we show the positive relationship between CEO compensation and employee wages. This positive relation is robust to a battery of standard controls. However, there still might be concerns that there is no causal relationship from CEO compensation on employee wages. In this section we present five set of additional results: (1) we investigate several compensation measures where we can more directly test our behindness aversion hypothesis; (2) we introduce different sets of fixed effects, including firm, establishment, and industry $\times$ year fixed effects into the model to minimize the effect of time-invariant or time-varying observables; (3) we provide regressions of employee wage changes on CEO wage changes; (4) we implement a difference-in-difference model; and (5) investigate several subsamples .

5.1 Timing and alternative measures of CEO compensation

In order to better understand the relationship between CEO and employee compensation we analyze different time lags of CEO total compensation. The most salient measure of CEO compensation for employees should be the total compensation from the last fiscal year, because that number is published during year t. Therefore we would expect the largest impact for $CEO\ total_{t-1}$. Table

5 Panel A shows exactly this result. $CEO\ total_{t-1}$ exhibits the largest coefficient and the highest t-statistic independent whether we use lagged or contemporaneous control variables. In fact, the contemporaneous CEO compensation only has a marginally significant impact on employee wages. In a second step we analyze the impact of different measures of executive compensation. If the correlation between CEO and employee compensation would be mainly driven by unobservables (e.g., some dimension of profitability not captured by our other controls, i.e., *ROA*, *Price to book ratio*, or *Stock return*) we would expect a similar correlation between average board or other executive compensation and employee wages. However, as Panel B of Table 5 shows that is not the case. CEO compensation has significantly more explanatory power than alternative measures of executive compensation. The explanatory power even increases if we use CEO premium (i.e., the difference between CEO and average other executive compensation)

5.2 Unobservables and fixed effects

A specific concern might be that the relationship between CEO compensation and employee wages is driven by firm-level or establishment-level unobservables. We address this concern using three approaches in Table 6. First, we include firm fixed effects instead of industry fixed effects. Second, we include both firm and industry fixed effects. Lastly, we control for establishment fixed effects. These tests are demanding on the data because wages of both CEO and workers are rather sticky. The results are nevertheless reassuring. While we lose economic significance, coefficients of *ln(CEO total)* are on average about 50% smaller, however, statistical significance remains intact.

Another concern may be that there are CEO-level unobservables. We investigate this possibility by adding CEO and CEO-firm fixed effects. Again we observe a reduction in economic significance but statistical significance is largely unaffected.

Finally, we might be concerned that the CEO-compensation-employee-wage relation might be driven by unobservable time-varying factors at the industry level, firm level, or state level. We include industry $\times$ year fixed effects, firm $\times$ year fixed effects, and state $\times$ year fixed effects. We find that neither economic nor statistical significance are materially affected. This analysis suggests that time-varying industry-level, firm-level and state level unobservables are not inducing our results.

5.3 Wage changes

To further test whether our model is robust, we ask whether the increases in employee wages are associated with the increases in CEO pay. The regression of changes on changes removes the effect of time-invariant unobservables. The change of the independent variable *ln(CEO total)* is the annual growth rate in CEO total compensation, and the change of the explanatory variable *ln(Wage)* is the annual growth rate in employees' wage. In order to rule out the possibility that the increase in employees' wage is driven by fast growing establishments, we drop the observations where the yearly growth rate of the number of employees in an establishment is above the 95% percentile. The Model 2 to Model 5 in Table 7 show that the coefficients on *CEO total increase* is still statistically significant at the 10% level. The coefficient can be interpreted as: when the annual growth rate of the CEO total compensation is increased by 1 percentage point, then the annual growth rate of the employees' wage will increase by 0.004 percentage points.

5.4 Difference-in-difference

The German regulation on mandatory disclosure of the CEO compensation was discussed in 2004, enacted in 2005 and became effective in 2006. This regulation does not directly affect employee wages, but it changes the channel through which the employees observe their firm's CEO compensation. Before the regulation came into effect, the employees could only observe the aggregate remuneration of all members in the management board (consequently the average remuneration of the board members). After the regulation was adopted by the firms, the employees are able to directly observe the CEO compensation, which is higher than the average compensation for the board members. Under the employee-behindness-aversion-hypothesis, we expect that employees in those firms that disclose for the first time their CEO compensation are feeling more disadvantaged and are paid more. Thus, we regard the change in policy as a natural experiment.

In the difference-in-difference setting, we select the firms that disclose their CEO compensation before 2003 (i.e., {2000, 2001, 2002}) as the control group. And we regard the firms that do not disclose before 2004 (i.e., {2000, 2001, 2002, 2003}) but do disclose in the year 2006 as the treatment group. The independent variable *Treatment* equals to 1 when an observation is in the treatment group, and *Post-2005* equals to 1 when the year is in or after 2005.[4] Table 8 presents the results. We

[4]Because the discussion and commencement of the regulation takes around three years (2004, 2005, and 2006), we

observe that the coefficients on *Treatment* × *Post-2005* in all four models are statistically significant at the 1% level. The results are also economically significant. When firms are required to make their CEO compensation publicly observable, they pay 13% higher wages to their employees.

One concern about the difference-in-difference setting is the assumption of random formation of the treatment and the control groups. Before 2006, firms can optionally choose whether to disclose their CEO compensation or not. From 2006, firms are required to disclose, unless decided otherwise by the General Meeting by three quarters majority. Therefore, our difference-in-difference method might suffer from potential selection-bias: firms that did not expect strong effects from publishing CEO salaries on employee wages might have self-selected into the control group and disclosed individual salaries before the regulation required it. This leaves those firms which expected stronger effects on employee wages for the treatment group. Therefore the estimated 13% treatment effect is probably overestimating the average effect on firms. However, the null-hypothesis is that employee wage and CEO compensation are independent from one another and this independence is highly significantly rejected. We interpret these results as strong evidence for a causal relationship of CEO compensation on employee wages consistent with the existence of the employee's behindness aversion.

5.5 Subsamples

In Table 5 we have seen that employee wages react stronger to increases in CEO compensation than, for example, average management board compensation. However, before 2006 firms were not required to publish management board compensation individually. Even today the German Corporate Governance Code still allows not to disclose management board compensation individually, if the annual general meeting approves the non-publication with a three-quarters majority. That means employees cannot observe the CEO's compensation for many German firms before 2006 and for some after 2006. If inequality aversion is indeed the driver behind the CEO-compensation-employee-wage relation, we expect two effects from the regulatory change in 2006: (1) for firms that do not disclose management compensation individually before and after 2006, the impact of *ln(Board total)* on employee wages is largely unchanged and similar to the impact of *ln(CEO total)*; (2) for firms that disclose management compensation individually after 2006, *ln(Board total)* becomes insignificant.

use the year 2005 as the year of treatment. The results are still robust when we chose 2004 or 2006 as the year of treatment.

That is exactly what we observe in our subsample analysis in Table 9. Only looking at firms that do not disclose management compensation individually (column (1)), we find a positive and significant coefficient on *ln(Board total)*. The economic effect is more than cut half and statistical significance disappears, if we look at the sample of firms disclosing management compensation individually (column (2)). Both effects are even more pronounced for the non-disclosing firms before 2006 (column 4) and the disclosing firms after 2006 (column 5). This result is also confirmed when we use both measures *ln(Board total)* and *ln(CEO total)* in the same regression (columns (3) and (6)). These findings suggests that employees benchmark their own salaries towards the most salient management compensation figure available. If compensation is disclosed individually, employees seem to compare their wage to the CEO's compensation. If it is not available, the closest proxy, average management board compensation, is used as a benchmark. In sum, these empirical patterns lend strong support to the hypothesis that behindness aversion is an important driver in setting wages for rank-and-file employees.

6. Employee wage distribution and employee turnover

6.1 Employee wage distribution

Under the employee-behindness-aversion-hypothesis we expect that an increase in CEO compensation will shift the wage distribution of employees at each establishment towards the right. Meanwhile, the shape of the distribution might also change because workers with lower wages have a larger pay gap between themselves and the CEO. If we assume that the pay gap is the only influencing factor we should observe that employees with lower wages are compensated relatively more than those who receive higher wages. This reasoning implies that the 1st quartile wage in an establishment is more sensitive (larger β) to changes in CEO compensation than the median wage. The same should apply to the median and the 3rd quartile wage. These different sensitives might actually lead to a compressed wage distribution, if the low wages relatively outgrow the high wages. The wage spread between the 3rd quartile wage and 1st quartile wage would be smaller in this case. We test this hypotheses by rerunning our benchmark model for the 1st quartile and 3rd quartile wages, results are reported in Table 10. We find indeed that the sensitivity is higher for the 1st quartile wage (column 1) than for the median wage (column 2) and for the 3rd quartile wage

(column 3). However, the spread between the 1st and the 3rd quartile wage (column 4) does not decrease, which implies that the wage distribution is not significantly compressed by higher CEO compensation.

6.2 Employee turnover

If firms compensate employees sufficiently for the disutility from behindness aversion, employees should be indifferent about staying in or leaving their firm when CEO compensation increases. Therefore, we should observe that increases in CEO compensation do not affect the employee turnover rate. We test this hypothesis using the employee inflow/outflow data provided by the IAB. We define two employee turnover variables: (1) *Outflow* as *Outflow of employees*$_t$/#*Employees*$_{t-1}$ and (2) *Inflow* as *Inflow of employees*$_t$/#*Employees*$_{t-1}$.

Table 11 presents the results. We observe that *Outflow* and *Inflow* are negatively correlated with CEO compensation. This result holds for all employees and for the subsample of white-collar employees. However, it is only significant for *Outflow* at the 5%-level. This finding implies that employees are on average overcompensated for their behindness aversion, leading to a reduction in turnover because outside options are comparably less attractive. An alternative but related explanation could be that firms with higher CEO compensation provide more profit-sharing programs to their employees, e.g., employee stock ownership plans (ESOPs). These long-term incentive programs are usually structured such that employee turnover is reduced. We test this conjecture in the next section.

7. Employee stock ownership plans

Dur and Glazer (2008) show that, when employees envy their CEO, profit-sharing schemes can be beneficial for employees and the firm. Higher CEO compensation is often linked to equity based pay and therefore ESOPs offer the possibility to increase employee compensation proportionally. Therefore, the behindness aversion hypothesis provides a straightforward explanation to why many firms provide equity based pay to their rank-and-file employees.

We collect information on ESOPs from their annual reports for any sample firm from 2009 to 2013. We create a dummy variable, *ESOP*, which is one when a firm indicates in their annual

report that it provides an ESOP, and zero when no information on an ESOP is found in the annual report. We match this variable with other firm-level data, i.e., CEO compensation and firm characteristics. We run logit regressions with *ESOP* as the dependent variable and different sets of firm-level controls. All independent variables are lagged by one year.

The results are presented in Table 12. Across all specifications, we find that with higher CEO compensation also the probability that a firm has an ESOP in place significantly increases. The coefficient for *ln(CEO total)* in column (3) implies, for example, that a 1% increase in CEO compensation, increases the odds ratio of providing an ESOP by 0.685%.

8. Structural estimation

Finally, we attempt to estimate the behindness aversion parameter α (from equation (1)) using structural estimation.

8.1 The model

We employ a standard principal-agent model with one principal (shareholders) with two agents, the CEO and one representative employee. We formally develop the model in Appendix A and provide the intuition here. We assume that the employee's effort is observable and contractible. Hence, employees only add a participation constraint to the principal's problem. In contrast, the CEO's effort is not observable, so she adds a participation constraint and an incentive compatibility constraint. Exerting effort e leads to private costs $C(e)$ that are increasing and convex in e.

The shareholders propose a contract that is signed by the CEO and the worker at time $t = 0$. After that, the CEO makes her effort decision e. At time $t = T$, the consequences of the CEO's effort become apparent in the form of the firm's stock price $P_T(e)$. Then the CEO receives a wage $W_T^C(P_T)$ and the worker receives $W_T^W(P_T)$. Shareholders are risk-neutral whereas the CEO and the worker are risk-averse with utility functions $V^C(x)$ and $V^W(x)$, respectively.

The worker is behindness averse. His utility is given by $U(W_T^W, W_T^C) = V^W(W_T^W) - \alpha S(W_T^C - W_T^W)$, where $S(.)$ is a positive and increasing function and α is the degree of behindness aversion. Fehr and Schmidt (1999) assume that $S(.)$ is linear and increasing. Other papers assume that it is strictly increasing (Bartling and von Siemens (2010)) or strictly increasing and convex (Neilson and

Stowe (2010)), or the quadratic function (Dur and Glazer (2008)).

These assumptions lead to the following optimization problem:

$$\begin{aligned}
&\max_{e,W_T^C,W_T^W} \int_0^\infty (P_T - W_T^C - W_T^W) g(P_T \mid e) dP_T \\
s.t. \quad &\int_0^\infty V^C(W_T^C) g(P_T \mid e) dP_T - C(e) \geq \overline{U}^C \\
&\int_0^\infty V^C(W_T^C) g_e(P_T \mid e) dP_T - C'(e) = 0 \\
&\int_0^\infty \left[V^W(W_T^W) - \alpha S(W_T^C - W_T^W)\right] g(P_T \mid e) dP_T \geq \overline{U}^W,
\end{aligned}$$

Two predictions follow from this structure (proofs are provided in Appendix A):

Prediction 1 *If $S(.)$ is convex, the worker's wage increases with the CEO's wage: $dW_T^W/dW_T^C > 0$.*

Prediction 2 *If the worker is not behindness averse or if $S(.)$ is linear, he receives a fixed wage W_T^W.*

8.2 Results

Based on this model we show in the Appendix A how to derive the following regression model describing the link between CEO compensation and employee pay. We assume that $S(x) = x^\xi$.

$$\ln \frac{\Delta W_T^W}{\Delta W_T^C - \Delta W_T^W} = \delta_0 + \delta_1 \ln W_T^W + \delta_2 \ln(W_T^C - W_T^W), \tag{3}$$

where

$$\delta_1 = \gamma_w + 1 \tag{4}$$

$$\delta_2 = \xi - 2 \tag{5}$$

$$\delta_0 = \ln \alpha\xi(\xi - 1) - \ln \gamma_w, \tag{6}$$

where γ_w is the worker's CRRA risk aversion parameter.

We estimate this regression model including our standard set of controls and fixed effects and present the results in Table 13. The coefficients δ_1 and δ_2 are significant at the 1% level (Panel A). In Panel B, we report the estimated parameters α, ξ, and γ_w. Our results are $\alpha = 0.202$, $\xi = 1.147$,

and $\gamma_w = 0.019$. So $\alpha > 0$ implies that employees on average are "behindness averse". $\xi > 1$ implies that the function $S(.)$ is increasing and convex. The results are in accord with what Fehr and Schmidt (1999) assume. Our estimate for risk-aversion, γ_w, is positive but rather low. Implying a very low risk-aversion of employees in our sample.

Setting γ_w and estimating α and ξ Because we are mostly interested in parameters α and ξ, which measure behindness aversion, we set the CRRA parameter, γ_w, to sensible values between 0.5 to 30. Panel C of Table 13 presents the estimated parameters of behindness aversion: α and ξ. Each line corresponds to a certain γ_w. All regressions include our standard set of control variables and fixed effects. The estimates of α and ξ are always in the expected range, i.e., $\alpha > 0$ and $\xi > 1$ (see derivation in Appendix A). The estimates for ξ are relatively stable and independent of γ_w. However, the estimates of α are quite sensitive to the assumed level of risk-aversion.

9. Conclusion

In this paper we document a strong positive effect of CEO compensation on wages of rank-and-file employees. This pattern is not explained by established determinants of employee wages and is unlikely to be caused by unobservables at the industry, firm, CEO, establishment, or state-level. A difference-in-difference analysis suggest a causal interpretation for our findings. The evidence is most consistent with firms paying higher wages to their employees in order to compensate them for the disutility caused by the pay gap to the CEO. The most likely driver underlying this phenomenon is behindness aversion of employees.

Our evidence of employee behindness aversion implies that managerial compensation incurs additional "inequality costs", which need to be taken into consideration when determining the optimal contracts for both CEOs and employees. Any additional dollar paid to the CEO for providing incentives also leads to higher employee wages to compensate employees for their (perceived) losses from behindness aversion.

Appendix A: Principal-agent model with inequality averse employees

The principal's optimization problem is (assuming that the first-order approach holds):

$$\begin{aligned}
\max_{e,W_T^C,W_T^W} & \int_o^\infty (P_T - W_T^C - W_T^W) g(P_T|e) dP_T \\
s.t. & \int_o^\infty V^C(W_T^C) g(P_T|e) dP_T - C(e) \geq \overline{U}^C \\
& \int_o^\infty V^C(W_T^C) g_e(P_T|e) dP_T - C'(e) = 0 \\
& \int_o^\infty \left[V^W(W_T^W) - \alpha S(W_T^C - W_T^W)\right] g(P_T|e) dP_T \geq \overline{U}^W
\end{aligned}$$

The Lagrangian is:

$$\begin{aligned}
\mathcal{L} \;=\; & \int_o^\infty (P_T - W_T^C - W_T^W) g(P_T|e) dP_T \\
& + \lambda_{PCC} \left(\int_o^\infty V^C(W_T^C) g(P_T|e) dP_T - C(e) - \overline{U}^C \right) \\
& + \lambda_{ICC} \left(\int_o^\infty V^C(W_T^C) g_e(P_T|e) dP_T - C'(e) \right) \\
& + \lambda_{PCW} \left(\int_o^\infty \left[V^W(W_T^W) - \alpha S(W_T^C - W_T^W)\right] g(P_T|e) dP_T - \overline{U}^W \right)
\end{aligned}$$

The employee's wage

$$\frac{d\mathcal{L}}{dW_T^W} = -g(P_T|e) + \lambda_{PCW} \left[V^{W\prime}(W_T^W) + \alpha S'(W_T^C - W_T^W)\right] g(P_T|e)$$

Setting $\frac{d\mathcal{L}}{dW_T^W} = 0$ yields:

$$V^{W\prime}(W_T^W) = \frac{1}{\lambda_{PCW}} - \alpha S'(W_T^C - W_T^W) \tag{7}$$

If $S(.)$ is linear or convex, an increase in α results in an decrease in $V^{W\prime}(W_T^W)$, i.e., an increase in

the worker's wage W_T^W.[5] If $S(.)$ is linear or if $\alpha = 0$, the employee's wage W_T^W is constant. This proves Prediction 2.

Relation between CEO and employee's wage Using the implicit function theorem, we get

$$G(W_T^C, W_T^W) = \frac{d\mathcal{L}}{dW_T^W} = -1 + \lambda_{PCW}\left[V^{W\prime}(W_T^W) + \alpha S'(W_T^C - W_T^W)\right].$$

$$\begin{aligned}
\frac{\partial G}{\partial W_T^W} &= \lambda_{PCW}\left[V^{W\prime\prime}(W_T^W) - \alpha S''(W_T^C - W_T^W)\right] && (8)\\
\frac{\partial G}{\partial W_T^C} &= \lambda_{PCW}\alpha S''(W_T^C - W_T^W) && (9)\\
\Rightarrow \frac{dW_T^W}{dW_T^C} &= -\frac{\partial G/\partial W_T^C}{\partial G/\partial W_T^W} && (10)\\
\frac{dW_T^W}{dW_T^C} &= \frac{\alpha S''(W_T^C - W_T^W)}{\alpha S''(W_T^C - W_T^W) - V^{W\prime\prime}(W_T^W)} && (11)
\end{aligned}$$

This expression is positive if S(.) is convex, which proves Prediction 1.

Structural estimation The solution in equation (11) links CEO compensation and employee pay. However, estimating this equation would require to employ a non-linear regression model. Therefore we will make some assumptions about functional forms and finally linearize the model, which largely reduces the difficulty of the estimation. We assume that $V^W(x) = \frac{1}{1-\gamma_w}x^{1-\gamma_w}$. So, $V^{W\prime}(x) = x^{-\gamma_w}$ and $V^{W\prime\prime}(x) = -\gamma_w x^{-\gamma_w - 1}$. We also assume that $S(x) = x^\xi$. So $S'(x) = \xi x^{\xi-1}$ and $S''(x) = \xi(\xi-1)x^{\xi-2}$. For the parameters the following relationships should hold: (1) $\gamma_w > 0$ since agents are risk-averse; (2) $\alpha > 0$ since workers are inequality-averse; (3) $\xi > 1$ since $S(\cdot)$ is assumed to be convex.

Replacing the differentiation by difference, the equation (11) can then be rewritten as a discrete-

[5] This can be shown more formally with the implicit function theorem by setting $G(W_T^W, \alpha) = \frac{d\mathcal{L}}{dW_T^W}$.

time model:

$$\frac{\Delta W_T^W}{\Delta W_T^C} = \frac{\alpha\xi(\xi-1)(W_T^C - W_T^W)^{\xi-2}}{\alpha\xi(\xi-1)(W_T^C - W_T^W)^{\xi-2} + \gamma_w (W_T^W)^{-\gamma_w-1}}$$

$$\implies \Delta W_T^W \alpha\xi(\xi-1)(W_T^C - W_T^W)^{\xi-2} + \gamma_w (W_T^W)^{-\gamma_w-1}\Delta W_T^W = \Delta W_T^C \alpha\xi(\xi-1)(W_T^C - W_T^W)^{\xi-2}$$

$$\implies \gamma_w (W_T^W)^{-\gamma_w-1}\Delta W_T^W = (\Delta W_T^C - \Delta W_T^W)\alpha\xi(\xi-1)(W_T^C - W_T^W)^{\xi-2}$$

$$\implies \ln\gamma_w - (\gamma_w+1)\ln W_T^W + \ln\Delta W_T^W = \ln(\Delta W_T^C - \Delta W_T^W) + \ln\alpha\xi(\xi-1) + (\xi-2)\ln(W_T^C - W_T^W)$$

$$\implies \ln\Delta W_T^W = (\gamma_w+1)\ln W_T^W + (\xi-2)\ln(W_T^C - W_T^W) + \ln(\Delta W_T^C - \Delta W_T^W) + \ln\alpha\xi(\xi-1) - \ln\gamma_w$$

$$\implies \ln\frac{\Delta W_T^W}{\Delta W_T^C - \Delta W_T^W} = (\gamma_w+1)\ln W_T^W + (\xi-2)\ln(W_T^C - W_T^W) + \ln\alpha\xi(\xi-1) - \ln\gamma_w.$$

This linear equation can be easily rewritten as a linear regression model:

$$\ln\frac{\Delta W_T^W}{\Delta W_T^C - \Delta W_T^W} = \delta_0 + \delta_1 \ln W_T^W + \delta_2 \ln(W_T^C - W_T^W),$$

where

$$\delta_1 = \gamma_w + 1 \in (1,2)$$

$$\delta_2 = \xi - 2 \in (-1,\infty)$$

$$\delta_0 = \ln\alpha\xi(\xi-1) - \ln\gamma_w.$$

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TABLE 1

Sample

This table displays the number of firms and establishments in the sample for each year between 2000 and 2011.

Year	Firms	Establishments
2000	35	3,486
2001	47	7,261
2002	59	8,329
2003	66	16,471
2004	98	20,814
2005	100	23,783
2006	99	25,767
2007	97	24,436
2008	95	21,310
2009	83	19,246
2010	84	16,924
2011	84	15,607

TABLE 2

Summary statistics

Panel A in this table displays definitions and descriptive statistics for the main firm level variables used in our analysis. Panel B in this table displays definitions and descriptive statistics for the main establishment level variables used in our analysis.

Panel A: Summary statistics for main firm level variables

Variable name	Definition	Mean	Std.	Obs.
Compensation				
CEO total	Annual total compensation of the CEO	2,564,779	2,395,251	555
CEO cash	Annual cash income of the CEO	2,002,491	1,657,132	555
Board total	Average annual compensation for all management board members: total compensation for the board / board size	1,411,901	1,096,341	939
Other total	Average annual total compensation for management board members excluding the CEO	1,421,626	1,073,914	554
CEO premium	ln(CEO total compensation - Other executives total compensation)	13.43	1.21	524
CEO pay ratio	CEO total compensation / Other executives total compensation	1.85	1.29	554
CEO characteristics				
CEO tenure	Time since first appointed as the CEO (year)	6.41	6.00	536
CEO ownership	=1 if the CEO holds more than 1% shares of the firm outstanding shares	0.01	0.07	551
CEO switch	=1 if the another person takes over the CEO position	0.09	0.29	555
CEO age	Age of CEO (in years)	54.05	6.91	527
CEO out-hiring	=1 if the CEO is hired from outside the firm	0.43	0.50	536
Firm-level characteristics				
ROA	Return on asset	0.10	0.12	910
ROE	Return on equity	0.34	0.30	910
Price to book ratio	Price to book ratio	2.33	2.45	931
Size (millions)	Total sales of the firm	15,844	27,976	924
Leverage	Total debt / total asset	0.63	0.20	932
# Firm employees	Number of employees working for the firm in Germany	49,899	90,643	934
Employee risk	Standard deviation of change in number of employees at firm level	0.13	0.09	935
Union	=1 if one of the major German labor unions has representatives in the firms supervisory board	0.95	0.22	939
Disclosure	=1 if the compensation of CEO is disclosed in annual reports	0.59	0.49	939
Stock return	Total annual stock return calculated using the return index provided by Datastream	0.15	0.49	838
Board size	Number of members in the executive board	4.74	2.11	939
R&D to sales	R&D to sales ratio	9.58	42.07	623
ESOP	=1 if a firm indicates in the annual report that it provides ESOP	0.22	0.42	404

Panel B: Summary statistics for main establishment level variables

Variable name	Definition	Mean	Std.	Obs.
Wage structure				
Wage	Median gross average daily wage for full-time employees × 365	35,167	13,428	158,545
Q1 wage	First quartile gross average daily wage for full-time employees × 365	31,678	12,554	163,531
Q3 wage	Third quartile gross average daily wage for full-time employees × 365	37,301	13,967	142,865
Employee structure				
# Establishment Employees	Total number of full-time employees at the establishment	64.79	691.72	203,434
Female %	Proportion of full-time female employees	0.43	0.36	167,296
Low qualified %	Proportion of full-time low-qualified employees	0.04	0.12	167,296
Qualified %	Proportion of full-time median-qualified employees	0.08	0.19	167,296
Highly qualified %	Proportion of full-time high-qualified employees	0.73	0.33	167,296
German %	Proportion of German employees	0.97	0.10	167,296
Manager %	Proportion of managers	0.03	0.13	167,296
White-collar %	Proportion of white-collar workers	0.61	0.46	167,296
Employees age	Median age of full-time employees at establishment level	41.46	8.29	203,434
Other variables				
Close to head	=1 if the establishment is located in the same federal state as the firm's headquarter	0.18	0.38	203,434
Outflow	Outflow of employees$_t$ / # Establishment Employees$_{t-1}$	0.21	0.22	76,616
Outflow white-collar	Outflow of white-collar employees$_t$ / # Establishment Employees$_{t-1}$	0.14	0.22	76,616
Inflow	Inflow of employees$_t$ / # Establishment Employees$_{t-1}$	0.42	5.68	76,616
Inflow of white-collar	Inflow of white-collar employees$_t$ / # Establishment Employees$_{t-1}$	0.29	4.33	76,616
Industry	2-digit NACE code (economic division) of the the establishment (edition: 2003)			
State	Federal state where the establishment is located			

TABLE 3

CEO compensation and employee wages: Regression results

This table presents results for regressions with the log median annual wage of full-time employees in the establishment as the dependent variable. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. In specification (7), we consider the observations after 2005 only. We use the White (1980) robust standard errors clustered at firm level. The t-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	ln(Wage)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(CEO total)	0.051**	0.046**	0.040***	0.039***	0.037***	0.038***	0.041***
	2.14	2.22	3.67	3.60	3.71	3.71	2.93
ROA			-0.096	-0.303*	-0.16	-0.109	-0.219*
			-1.12	-1.82	-1.20	-0.81	-1.87
Price to book ratio			-0.024**	-0.019*	-0.020*	-0.024**	-0.025**
			-2.11	-1.81	-1.97	-2.16	-2.13
ln(Size)			0.003	0.009	-0.03	-0.021	-0.039
			0.17	0.50	-1.17	-0.83	-1.42
Leverage				-0.133	-0.195*	-0.268*	-0.279*
				-1.31	-1.83	-1.92	-1.81
Union					0.121*	0.127*	0.153**
					1.91	1.93	2.32
ln(# Firm employees)					0.038*	0.032	0.049**
					1.78	1.56	2.15
Employee risk					0.485**	0.505**	0.609**
					2.25	2.42	2.62
CEO ownership						-0.009	0.007
						-0.19	0.14
CEO tenure						0.003*	0.004**
						1.84	2.07
ln(# Estab. Employees)		0.045***	0.044***	0.044***	0.044***	0.044***	0.050***
		3.65	3.68	3.67	3.73	3.72	4.19
Female %		-0.280***	-0.265***	-0.262***	-0.274***	-0.274***	-0.277***
		-3.73	-3.71	-3.68	-3.70	-3.67	-3.54
Low qualified %		-0.011	-0.012	-0.013	-0.011	-0.008	-0.018
		-0.19	-0.23	-0.24	-0.20	-0.15	-0.33
Qualified %		0.504***	0.514***	0.513***	0.509***	0.510***	0.503***
		11.20	12.35	12.49	13.37	13.41	12.90
Highly qualified %		0.220***	0.221***	0.220***	0.213***	0.212***	0.212***
		5.48	5.73	5.79	5.84	5.78	5.25
German %		0.256***	0.255***	0.252***	0.251***	0.255***	0.250***
		5.33	5.24	5.25	5.38	5.43	5.05
Manager %		0.017	0.023	0.024	0.04	0.043	0.047
		0.63	0.84	0.88	1.52	1.52	1.44
White-collar %		0.167***	0.161***	0.161***	0.175***	0.176***	0.190***
		7.71	6.91	6.85	8.33	8.36	9.10
Employee age		0.004**	0.004**	0.004**	0.004**	0.004**	0.004**
		2.49	2.52	2.55	2.60	2.58	2.21
Close to head		0.031**	0.028**	0.028**	0.029**	0.030**	0.031**
		2.41	2.23	2.23	2.20	2.24	2.48
Industry, state, and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.520	0.618	0.609	0.610	0.613	0.615	0.622
Number of obs.	108,363	106,341	103,961	103,961	103,960	103,581	68,356

TABLE 4

CEO compensation and employee wages: Robustness checks with additional controls

This table presents results for regressions with the log median annual wage of full-time employees in the establishment as the dependent variable using additional control variables: (1) Stock return, (2) board size, (3) additional CEO characteristics, (4) R&D to sales, and (5) union variables. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. We use the White (1980) robust standard errors clustered at firm level. The t-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	ln(Wage)				
	(1)	(2)	(3)	(4)	(5)
ln(CEO total)	0.038***	0.039***	0.036***	0.034**	0.039***
	2.99	3.91	3.23	2.03	4.21
Stock return	-0.008				
	-0.58				
Board size		0.005			
		0.80			
CEO switch			0.002		
			0.14		
CEO age			0.001		
			0.40		
CEO out-hiring			-0.016		
			-0.65		
ln(R&D to sales)				-0.019**	
				-2.29	
IGBAU					0.179**
					2.57
IGBCE					0.109*
					1.77
IGMetall					0.115
					1.48
Verdi					0.133*
					1.81
Firm variables	Yes	Yes	Yes	Yes	Yes
Establishment variables	Yes	Yes	Yes	Yes	Yes
Industry, state, and year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.605	0.615	0.615	0.496	0.615
Number of observations	100,112	103,581	103,574	40,952	103,581

TABLE 5

Alternative measures of CEO compensation

This table presents results for regressions with the log median annual wage of full-time employees in the establishment as the dependent variable. Panel A displays results for regressions with different time lags for independent variables: (1) all independent variables are lagged by 1 year (baseline specification), (2) all independent variables are lagged by 2 years, (3) no lag, (4) only CEO total compensation is lagged by 1 year, (5) only CEO total compensation is lagged by 2 years. Panel B displays results for regressions when alternative measures of executive compensation are used as independent variables. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. We use the White (1980) robust standard errors clustered at firm level. The t-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Panel A: Different time lags

Dep. var.:	ln(Wage)				
	(1)	(2)	(3)	(4)	(5)
ln(CEO total) (t-1 for all)	0.038***				
	3.71				
ln(CEO total) (t-2 for all)		0.032***			
		3.36			
ln(CEO total)			0.021*		
			1.68		
ln(CEO total) (t-1)				0.025**	
				2.27	
ln(CEO total) (t-2)					0.022**
					2.06
Firm variables	Yes	Yes	Yes	Yes	Yes
Establishment variables	Yes	Yes	Yes	Yes	Yes
Industry, state, and year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.615	0.606	0.617	0.624	0.620
Number of observations	103,581	84,815	125,173	107,880	89,112

Panel B: Alternative measurements of top executives compensation

Dep. var.:	ln(Wage)				
	(1)	(2)	(3)	(4)	(5)
ln(Board total)	0.022*				
	1.68				
ln(Other total)		0.010			
		0.65			
ln(CEO cash)			0.037***		
			2.76		
CEO premium				0.039***	
				5.33	
CEO pay ratio					0.098***
					3.89
Firm variables	Yes	Yes	Yes	Yes	Yes
Establishment variables	Yes	Yes	Yes	Yes	Yes
Industry, state, and year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.600	0.614	0.614	0.616	0.616
Number of observations	125,247	103,581	103,581	102,702	103,581

TABLE 6

CEO compensation and employee wages: Different sets of fixed effects

This table presents results for regressions with the log median annual wage of full-time employees in the establishment as the dependent variable. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. The table displays results for regressions with different sets of fixed effects. The unreported control variables are the same as in specification (1), (2), (4), (5), and (6) of Table 3. We use the White (1980) robust standard errors clustered at firm level. The t-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	ln(Wage)				
	(1)	(2)	(3)	(4)	(5)
Firm, year and state fixed effects					
ln(CEO total)	0.019**	0.018**	0.015**	0.016**	0.016**
	2.14	2.45	2.45	2.45	2.36
Adjusted R^2	0.401	0.553	0.550	0.550	0.550
Number of observations	108,589	106,538	104,150	104,149	103,770
Firm, industry, year and state fixed effects					
ln(CEO total)	0.018*	0.017*	0.017**	0.017**	0.017**
	1.91	1.93	2.17	2.10	2.16
Adjusted R^2	0.566	0.646	0.638	0.638	0.638
Number of observations	108,363	106,341	103,961	103,960	103,581
Establishment and year fixed effects					
ln(CEO total)	0.015**	0.016**	0.013**	0.013**	0.013**
	2.42	2.51	2.20	2.23	2.18
Adjusted R^2	0.066	0.077	0.082	0.082	0.082
Number of observations	108,589	106,538	104,150	104,149	103,770
CEO, year and state fixed effects					
ln(CEO total)	0.021**	0.022***	0.020***	0.020***	0.020***
	2.03	2.70	3.25	3.21	3.22
Adjusted R^2	0.401	0.553	0.550	0.550	0.550
Number of observations	108,547	106,496	104,108	104,107	103,770
CEO × firm, year and state fixed effects					
ln(CEO total)	0.021**	0.022***	0.020***	0.020***	0.020***
	2.03	2.70	3.25	3.21	3.22
Adjusted R^2	0.401	0.553	0.550	0.550	0.550
Number of observations	108,589	106,538	104,150	104,149	103,770
Industry × year and state fixed effects					
ln(CEO total)	0.053**	0.048**	0.039***	0.037***	0.037***
	2.04	2.07	3.23	3.29	3.27
Adjusted R^2	0.524	0.620	0.612	0.615	0.617
Number of observations	108,363	106,341	103,961	103,960	103,581
Firm × year and state fixed effects					
ln(CEO total)	-0.025***	0.003	-0.004	0.050***	0.020***
	-12.31	0.3	-0.66	10.13	4.21
Adjusted R^2	0.403	0.553	0.551	0.551	0.551
Number of observations	108,589	106,538	104,150	104,149	103,770
State × year and firm fixed effects					
ln(CEO total)	0.018*	0.017**	0.015**	0.016**	0.015**
	1.97	2.31	2.3	2.36	2.27
Adjusted R^2	0.404	0.554	0.552	0.552	0.552
Number of observations	108,589	106,538	104,150	104,149	103,770

TABLE 7

Increase in CEO compensation and increase in employee wages

This table presents results for regressions with the annual increase in the median annual wage of full-time employees in the establishment as the dependent variable. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. The variable *CEO total increase* is the annual increase in CEO total compensation. We only use the observations where the yearly changes of the numbers of employees at establishment level is below the 95% percentile. We use the White (1980) robust standard errors clustered at firm level. The t-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	Wage increase				
	(1)	(2)	(3)	(4)	(5)
CEO total increase	0.005	0.004*	0.004*	0.004*	0.004*
	1.61	1.68	1.74	1.73	1.68
ROA			-0.04	-0.032	-0.026
			-1.42	-1.27	-1.11
Price to book ratio			0.002	0.002	0.001
			1.15	1.45	0.92
ln(Size)			0.001	0.000	0.001
			0.83	0.04	0.33
Leverage			0.008	0.003	0.006
			0.53	0.18	0.3
Union				0.014*	0.011
				1.98	1.59
ln(# Firm employees)				0.000	-0.001
				0.04	-0.17
Employee risk				0.044	0.042
				1.13	1.09
CEO ownership					0.020*
					1.99
CEO tenure					0.000
					0.67
ln(# Establishment Employees)		-0.002***	-0.002***	-0.002***	-0.002***
		-4.74	-4.83	-5.1	-5.17
Female %		0.026***	0.024***	0.023***	0.023***
		3.6	3.14	3.03	2.97
Low qualified %		0.023*	0.022*	0.023*	0.023*
		1.88	1.89	1.84	1.88
Qualified %		-0.015**	-0.016**	-0.016**	-0.016**
		-2.17	-2.27	-2.3	-2.32
Highly qualified %		-0.010***	-0.009***	-0.010***	-0.010***
		-3.58	-3.76	-3.85	-3.84
German %		-0.025***	-0.023**	-0.024**	-0.024**
		-2.83	-2.59	-2.58	-2.6
Manager %		-0.029***	-0.030***	-0.029***	-0.028***
		-4.78	-4.51	-4.5	-4.54
White-collar %		0.007***	0.008***	0.009***	0.010***
		3.02	2.86	3.5	4.27
Employee age		-0.001***	-0.001***	-0.001***	-0.001***
		-4.29	-4.32	-4.35	-4.21
Close to head		-0.000	-0.000	-0.000	-0.000
		-0.07	-0.19	-0.12	-0.06
Industry, state, and year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.002	0.005	0.005	0.006	0.006
Number of observations	85,660	85,660	85,546	85,546	85,348

TABLE 8

Difference-in-difference regressions

This table presents results for regressions in a difference-in-difference setting with the log median annual wage of full-time employees in the establishment as the dependent variable. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. The control group contains the firms which disclose before 2003 (i.e., {2000, 2001, 2002}). The treatment group contains the firms which do not disclose before 2004 (i.e., {2000, 2001, 2002, 2003}), but do disclose in the year 2006. The independent variable *Treatment* equals to 1 when an observation is in the treatment group. *Post*-2005 equals to 1 when the year is in or after 2005. We use the White (1980) robust standard errors clustered at firm level. The *t*-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	ln(Wage)			
	(1)	(2)	(3)	(4)
Treatment × Post-2005	0.172***	0.126***	0.141***	0.130***
	4.35	5.09	3.83	3.79
Treatment	-0.074**	-0.049***	-0.059	-0.064
	-2.4	-2.81	-1.59	-1.35
ROA			-0.213	-0.251*
			-1.49	-1.83
Price to book ratio			-0.017	-0.01
			-1.54	-1.03
ln(Size)			0.025	0.009
			1.42	0.28
Leverage			-0.475***	-0.464***
			-3.06	-2.88
Union				0.140*
				1.95
ln(#Firm Employees)				0.004
				0.12
employee risk				0.221
				0.69
ln(#Establishment Employees)		0.066***	0.063***	0.063***
		4.85	4.96	5.03
Female %		-0.454***	-0.433***	-0.434***
		-12.13	-10.78	-10.6
Low qualified %		-0.076	-0.041	-0.039
		-1.1	-0.57	-0.55
Qualified %		0.470***	0.495***	0.494***
		6.84	11.3	11.57
Highly qualified %		0.172***	0.179***	0.174***
		3.9	4.26	4.37
German %		0.281***	0.270***	0.266***
		8.36	7.81	7.62
Manager %		0.054	0.069*	0.071*
		1.65	1.69	1.71
White-collar %		0.154***	0.177***	0.187***
		3.59	3.74	3.7
Employee age		0.001	0.002	0.002
		0.63	0.97	0.97
Close to head		0.025*	0.021	0.023*
		1.79	1.5	1.74
Industry, state, and year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.549	0.661	0.645	0.647
Number of observations	70,138	68,164	59,497	59,497

TABLE 9

Subsample analysis

This table presents results for regressions with the log median annual wage of full-time employees in the establishment as the dependent variable. The "Disclosure" ("No disclosure") sample includes all establishment-year observations of firms disclosing (not disclosing) the individual CEO compensation in a given year. "No disclosure" means that a firm only discloses the aggregated compensation of all members in the management board in a given year. Since 2006, the German Corporate Governance Code requires firms to disclose the individual compensation of all management board members. The German Corporate Governance Code still allows not to disclose management board compensation individually if the annual general meeting approves the non-publication with a three-quarters majority. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. We use the White (1980) robust standard errors clustered at firm level. The *t*-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	ln(Wage)					
Sample:	No disclosure all	Disclosure all	Disclosure all	No disclosure before 2006	Disclosure after 2006	Disclosure after 2006
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Board total)	0.058**	0.021	-0.125**	0.075**	0.016	-0.143***
	2.15	1.64	-2.60	2.56	0.88	-2.78
ln(CEO total)			0.141***			0.155***
			3.31			3.52
Firm variables	Yes	Yes	Yes	Yes	Yes	Yes
Establishment variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry, state, year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.569	0.612	0.614	0.569	0.620	0.622
Number of obs.	21,287	103,960	103,960	18,746	68,442	68,442

TABLE 10

Differences among employees: Employee wage quartiles

This table presents results for regressions with different employee wage quartiles as dependent variables. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. We use the White (1980) robust standard errors clustered at firm level. The t-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	ln(Q1 wage)	ln(Wage)	ln(Q3 wage)	ln(Q3 - Q1 wage)
	(1)	(2)	(3)	(4)
ln(CEO total)	0.039***	0.038***	0.027**	0.03
	3.76	3.71	2.00	1.25
Firm variables	Yes	Yes	Yes	Yes
Establishment variables	Yes	Yes	Yes	Yes
Industry, state, year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.559	0.615	0.599	0.257
Number of obs.	107,162	103,581	93,293	77,933

TABLE 11

Employee turnover

This table presents results for regressions with different employee turnover variables as dependent variables. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. We use the White (1980) robust standard errors clustered at firm level. The t-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	Outflow	Outflow white-collar	Inflow	Inflow white-collar
	(1)	(2)	(3)	(4)
ln(CEO total)	-0.023**	-0.016**	-0.041	-0.045
	-2.59	-2.61	-0.58	-0.66
Firm variables	Yes	Yes	Yes	Yes
Establishment variables	Yes	Yes	Yes	Yes
Industry, state, and year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.131	0.395	0.015	0.014
Number of observations	56,922	56,922	57,601	57,601

TABLE 12

Employee stock ownership plans

This table presents results for Logit regressions with the dummy variable $ESOP$ (=1 if the firm offers an employee stock ownership plan) as the dependent variable. All independent variables are lagged by one year. See Table 2 for a detailed overview of variable definitions. We use the White (1980) robust standard errors clustered at firm level. The t-statistics are reported in small font size below the estimates. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels.

Dep. var.:	ESOP		
	(1)	(2)	(3)
ln(CEO total)	0.943***	0.636*	0.685*
	2.82	1.70	1.81
ROA		-0.025	-0.036
		-0.84	-1.15
Price to book ratio		0.056	0.071
		0.52	0.63
ln(Size)		0.21	0.315
		1.49	1.09
Leverage			-1.062
			-0.60
ln(#Firm employees)			-0.000
			-0.50
Employee risk			-0.813
			-0.31
Union			0.147
			0.19
Number of observations	250	244	241

TABLE 13

Calibration results

This table presents the estimated risk-aversion parameters and inequality-aversion parameters for the principal-agent model described in Section 8. Panel A presents the estimated coefficients for the general regression model. We use the White (1980) robust standard errors clustered at firm level. ***, ** and * indicate that the value is significantly different from 0 at the 1%, 5% and 10% levels. Panel B presents the inferred values for risk-aversion parameters and behindness-aversion parameters. Panel C presents the estimated behindness-aversion parameters when the risk-aversion parameter is calibrated to different values.

Panel A:

	(1)
δ_1	1,019***
δ_2	-0,853***
δ_0	0.584

Panel B:

	(1)
γ_w	0.019
ξ	1.147
α	0.202

Panel C:

γ_w	$\xi - 2$	$ln\left(\alpha * \xi * \frac{(\xi-1)}{\gamma_w}\right)$	Observations	ξ	α
0.5	-0.82***	6.29***	57,897	1.179	1,273.540
1	-0.82***	5.19**	57,897	1.177	864.920
2	-0.83***	3.01	57,897	1.174	198.032
3	-0.83***	0.82	57,897	1.170	34.280
4	-0.83***	-1.37	57,897	1.167	5.236
5	-0.84***	-3.55*	57,897	1.163	0.755
10	-0.85***	-14.49***	57,897	1.146	3.057×10^{-5}
20	-0.89***	-36.35***	57,897	1.112	2.614×10^{-14}
30	-0.92***	-58.22***	57,897	1.077	1.877×10^{-23}