Journal of Corporate Finance 78 (2023) 102322

Contents lists available at ScienceDirect

Journal of Corporate Finance

journal homepage: www.elsevier.com/locate/jcorpfin

Wage gap and stock returns: Do investors dislike pay inequality? ☆

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ARTICLE INFO

Editor: K Hankins

JEL classification:
G10
G12
G14
G32

Keywords:
Wage gap
Stock returns
Asymmetric mispricing
Inequality aversion

ABSTRACT

Recent research shows that a high wage-gap between managers and workers identifies better-performing firms, but the stock market does not seem to price this information. In this paper, we show that not all investors neglect pay inequality. Using a unique data set on German firms' employee compensation, we find that the mispricing of the wage gap is driven by limits to arbitrage. Specifically, some investors seem to bid up low-wage-gap stocks for non-monetary reasons, thus exhibiting a preference for low pay-inequality. The results suggest that firms with equitable pay schemes are rewarded with a lower cost of capital.

1. Introduction

In recent years, pay inequality between managers and workers has received increasing attention from academics, regulators, and the media.[1] On October 17, 2015, the Securities and Exchange Commission (SEC) adopted a new rule, effective from January 1, 2017, that requires U.S. companies to disclose the ratio of CEO pay to the median employee wage. In this regard, on May 11, 2016, the New York Times pointed out that *"the strong case for the rule (...) keeps getting stronger,"* providing support to the idea that corporations should *"rein in"* the difference in pay between managers and workers.

Interestingly, the populist anger that meets high executive premia does not seem to be justified on economic grounds. Recent research shows that high pay-inequality does not hinder firm performance (Cronqvist et al., 2009), and actually seems to improve it (Faleye et al., 2013; Mueller et al., 2017; Cullen and Perez-Truglia, 2018), which is in line with the conjecture that a larger wage gap reflects higher managerial effort. Despite the lower operating performance, however, low-wage-gap firms seem to trade at a premium (Mueller et al., 2017). In this paper, we shed new light on this issue.

☆ We thank Kristine Hankins (the Editor), two anonymous referees, Yakov Amihud, Nelson Camanho, William Forbes, Marc Gabarro, Juan-Pedro Gómez, Bharat Sarath, Esad Smajlbegovic, Geoffrey Tate, Walter Torous, Martijn van den Assem, Fernando Zapatero, and seminar participants at the Workshop on Corporate Governance and Investment at Oslo Metropolitan University, the Global Finance Conference at the ESSCA School of Management in Paris, the IFABS Asia Ningbo China Conference, the IFABS Corporate Finance Conference at the University of Oxford, the Finance Forum at Universitat Pompeu Fabra in Barcelona, the Behavioral Finance Working Group Conference at Queen Mary University of London, the Israel Behavioral Finance Conference at Tel Aviv University, and the Erasmus Finance brown bag for many insightful comments. We are grateful to Manfred Antoni, Benjamin Wirth, and Britta Gehrke for their precious help with data work at the German Federal Employment Agency. We acknowledge financial support from NWO through a Vici grant.

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[1] See, e.g., Crystal (1991), Pfeffer and Langton (1993) and Wade et al. (2006).

https://doi.org/10.1016/j.jcorpfin.2022.102322
Received 28 June 2021; Received in revised form 6 October 2022; Accepted 14 November 2022
Available online 19 November 2022

To derive theoretical guidance, we propose an asset pricing model in which the optimal wage gap between the CEO and rank-and-file workers increases with managerial effort. We show that the mispricing of the wage gap arises from the presence of limits to arbitrage. Using a unique data set on German firms' employee compensation, we provide support for the model's predictions. Specifically, we find that some investors seem to bid up low-wage-gap stocks for non-monetary reasons, thus exhibiting a preference for low pay-inequality. These results have important implications for equity funding. While companies with a high wage-gap achieve higher profitability, low-wage-gap firms face a lower cost of capital as a reward for their equitable pay schemes.

The findings provide novel support to the idea that some investors, much like the general public, exhibit pro-social preferences (Hong and Kacperczyk, 2009; Pan et al., 2022). While there is plenty of evidence for inequality-averse preferences in experimental studies (see, e.g., Fehr and Schmidt, 1999; Neilson and Stowe, 2010; Card et al., 2012), contemporaneous research shows that firms with inequality-averse investors experience negative abnormal announcement-returns when disclosing high pay-inequality (Pan et al., 2022). To the best of our knowledge, our paper is the first to show that inequality aversion also has a substantial effect on long-run abnormal returns.

In our theoretical analysis, we consider a three-period economy in which the optimal wage gap between the CEO and rank-and-file workers increases with managerial effort. At time zero, the representative firm appoints a manager to hire workers and carry out a project. The firm engages in efficient contracting, and chooses the optimal level of managerial effort by solving the following trade-off: high effort costs more, but improves the firm's productivity through a more efficient employment of resources. At time one, the firm seeks funding on the stock market to pay workers' wages and start production. At time two, the firm liquidates. In equilibrium, a high wage-gap between CEO and regular workers is an indication of high effort and high profitability.

We consider a financial market with arbitrageurs and pro-social investors. One way to make this distinction practical is to think of the former as hedge funds or mutual funds, and the latter as norm-constrained investors, such as, e.g., pension funds or religious institutions (Hong and Kacperczyk, 2009). Both investor types observe the wage gap, but pro-social traders also consider non-monetary arguments when investing (e.g., society's welfare). Specifically, they dislike high pay-inequality within firms. As a result, we refer to these investors as inequality-averse.[2]

Inequality-averse traders then exhibit a positive and a negative preference, respectively, in their evaluations of low- and high-wage-gap stocks. As a result, they overpay for the former, and shun the latter (Hong and Kacperczyk, 2009). In the presence of limits to arbitrage, this creates asymmetric mispricing. Low-wage-gap stocks become overpriced, and yield negative abnormal returns when the firm liquidates. High-wage-gap stocks are correctly priced instead, and yield zero abnormal returns, due to the absence of demand from pro-social investors.[3] The return differential between high- and low-wage-gap stocks increases with the difference in wage gaps, the proportion of inequality-averse traders, and their degree of inequality aversion.

In the empirical analysis, we take these predictions to the data. The major hurdle to overcome in this respect is the lack of publicly available data on rank-and-file workers' compensation. In the U.S., disclosure of workers' wages before January 1, 2017, was only discretionary, with low coverage. In this paper, we overcome this issue by using the "Establishment History Panel" database, maintained and made available by the German Federal Employment Agency. This is a unique data set that contains the annual gross wage for all workers in Germany from January 2001 to December 2011, together with information on the establishment in which they work. With respect to previous literature on the wage gap, the advantage of this data set is that it does not come from surveys.

Our story hinges on the idea that there is a positive relation between the wage gap and managerial effort, which ultimately translates into higher profitability. To validate this assumption, we begin our empirical analysis by examining the relation between return on assets and the wage gap between the CEO and rank-and-file workers. Consistent with our conjecture, we find a positive association between pay inequality and return on assets. This result moderates concerns about the alternative hypotheses that a high wage-gap might reflect rent extraction, or that there might actually be no relation between the wage gap and managerial effort.

To construct our test portfolios, we divide stocks into pay inequality quantiles. Then, we rebalance them at the beginning of each month, and define high- and low-wage-gap portfolios, respectively, as the stocks that lie at the top and the bottom 30%, 20%, or 10% of the distribution. We define the dependent variable as monthly excess returns on the top, bottom, and top-minus-bottom (i.e., long-minus-short) portfolios. To estimate abnormal returns, we run time-series regressions of Carhart's (1997) four-factor model, using the European risk factors from Kenneth French's website.

Consistent with the model's predictions, we find an asymmetric mispricing pattern that increases with the size of the wage gap. When considering the 30% breakpoint, we find that low-wage-gap stocks yield negative and significant abnormal returns of 0.80% per month. For high-wage-gap stocks, instead, the alpha is close to zero and not significant. The difference between these returns is also significant, and therefore constitutes a profitable long-short investment strategy (0.90% per month). Arbitrage returns become even larger when considering the 20% threshold (1.60% per month), and the 10% threshold (1.70% per month), and the results are again driven by the short leg.[4]

To provide further (and more direct) evidence on the relation between the mispricing of the wage gap and the presence of limits to arbitrage, we re-estimate our regressions in subsets of stocks that are difficult to evaluate and/or arbitrage. Specifically,

[2] It is possible that pro-social investors may not be inequality-averse per se, but rather exhibit a preference for low wage-gaps due to positive externalities such as better morale or higher productivity in the long run (e.g., Rouen, 2020; Boone et al., 2021). We acknowledge the validity of these alternative explanations, but still label such preferences as inequality-averse for the sake of simplicity.

[3] Specifically, the market price of high-wage-gap stocks only reflects the (correct) evaluations of arbitrageurs (see, e.g., Hirshleifer and Teoh, 2003).

[4] These empirical patterns are robust to a variety of alternative specifications, such as the German four-factor model from the Humboldt University of Berlin, alternative factor models from Pástor and Stambaugh (2003), Fama and French (2015), Novy-Marx (2013), and Stambaugh and Yuan (2017), Fama–MacBeth regressions from Brennan et al. (1998), cash rather than total CEO compensation, and the wage gap of the other members of the board excluding the CEO.

we consider companies with low market capitalization and extreme book-to-market ratios (Baker and Wurgler, 2006, 2007; Baker et al., 2012). With a lower concentration of arbitrageurs, we expect the mispricing of the wage gap to be particularly pronounced among these stocks. We find that the negative abnormal returns of low-wage-gap stocks are indeed concentrated around small stocks (i.e., below-median market capitalization), and stocks with extreme book-to-market ratios (i.e., top and bottom 30%).[5]

These findings raise the question whether the pricing error may be due to mere investor inattention to pay inequality, rather than aversion to it. The asset pricing implications of these two competing stories are similar, as both imply overpricing for low-wage-gap stocks, but there is one important difference. Under inequality-averse preferences, the mispricing of low-wage-gap stocks should vary with the degree of inequality aversion of pro-social investors. Unfortunately, we cannot directly identify inequality-averse traders as in Pan et al. (2022), due to the lack of stock holdings data for the German companies in our sample. However, we devise three empirical analyses that test specific asset pricing predictions of the inequality-aversion story.

First, we look into the relation between the wage gap and valuations. The model suggests that if inequality-averse investors are present, the price differential between high- and low-wage-gap stocks should decrease with the degree of inequality aversion. The intuition is that a stronger preference for low-wage-gap firms bids up the price of these stocks, thus reducing the difference in valuations with high-wage-gap firms. To test this prediction, we hypothesize that aversion to managerial premia increases when German income inequality becomes large.[6] We find that the price differential between high- and low-wage-gap stocks indeed decreases when country-wide income inequality is high.

Second, we identify investor optimism as a monthly proxy for inequality aversion. The reason is as follows. If inequality-averse investors are present, their aversion should increase when they are pessimistic about the economy.[7] As a result, they should reward low-wage-gap companies especially when sentiment is low. In the absence of inequality aversion, on the other hand, the overpricing of low-wage-gap stocks should be confined to times of high sentiment, because optimistic investors bid up the prices of lower-performing stocks (Yu and Yuan, 2011; Stambaugh et al., 2012). Consistent with the inequality-aversion hypothesis, we find that the overpricing of low-wage-gap stocks is entirely concentrated in times of low sentiment.

Third, we expect investors with a preference for fairness to be particularly sensitive to unjustified pay inequality, i.e., wage gaps that are not explained by economic fundamentals. To test for this, we follow Rouen (2020) and decompose CEO and workers' pay into an economically justified and an unjustified component. Under preferences for fairness, investors should reward firms that exhibit low unjustified wage-gaps, and discriminate against other firms. The empirical evidence lends support to this conjecture. We find that the results are confined to cash wage-gaps, which seems to reflect the fact that cash pay might be more salient to inequality-averse investors. Overall, these three empirical patterns are hard to reconcile with a simple story of investor inattention towards wage gaps.

Germany provides a unique setting for our analysis. There is ample evidence that German investors care about non-monetary values. In a 2016 Socially Responsible Investment (SRI) study, for example, Eurosif shows that Germany is one of the two European countries that invest the most in SRI stocks (along with France), with large participation of German institutional investors with a focus on societal values.[8] Labor rights constitutes one of the dimensions through which firms are evaluated.[9] Therefore, it is plausible that some of these investors may indeed exhibit pro-social preferences (Hong and Kacperczyk, 2009), such as an aversion to pay inequality (Pan et al., 2022). Specifically, they may either cater to their clientele's preferences, or actually exhibit such preferences themselves (see, e.g., Hong and Kostovetsky, 2012; DeVault et al., 2019).

Also, German investors are able to observe the wage gap at least indirectly. On the one hand, compensation for the CEO and other members of the managerial board is officially disclosed in the company's annual report. On the other hand, employee pay is informally reported by a number of sources. For example, media coverage provides a detailed ranking of firms on a number of relevant economic dimensions, including workers' salaries.[10] Furthermore, online job adverts provide an indication of the pay range that prospective employees can expect (see, for example, Gehalt.de).

Despite the country-specific setting, our results likely have a more general validity. Compared with the United States, the wage gap in Germany is lower. In a sample of U.S. firms with roughly the same size as those in our sample (e.g., in terms of total assets), Uygur (2019) finds an average wage-gap estimate of 243.9 for S&P 500 firms spanning the period between 1998 and 2016. By

[5] In additional tests, we find that the results from the subsample of extreme book-to-market stocks are driven by growth stocks. Since these stocks are characterized by high costs of shorting (D'Avolio, 2002; Jones and Lamont, 2002; Geczy et al., 2002), these findings lend further support to the mechanism we hypothesize.

[6] For example, income inequality has turned executive bonuses into a campaign issue in Germany (see Jennen, Buergin, and Delfs, "Executive bonuses targeted by Merkel rivals in German campaign," *Bloomberg*, 2017. For U.S. evidence, see, e.g., Wolfers, "All you need to know about income inequality, in one comparison," *New York Times*, 2015). Also, there seems to be a direct link between country-level and within-firm pay variation (Song et al., 2019).

[7] Plenty of anecdotal evidence shows that managerial premia spark public outrage during bad economic times. During the recent financial crisis, for example, German chancellor Angela Merkel called the payment of large managerial bonuses "irritating" (see Hall and Benoit, "Merkel supports bonus curbs," *Financial Times*, 2009). Similarly, U.S. President Obama called financial institutions "shameful" for giving themselves nearly $20 billion in bonuses in the midst of the crisis (see Stolberg, "Obama calls Wall Street bonuses shameful," *New York Times*, 2009).

[8] Specifically, pension funds account for nearly half (48%) of all assets under management invested in SRI, followed by religious institutions and charities (24%), and foundations (12%). See https://www.eurosif.org/news/eurosif-report-2016.

[9] In 2008, for example, Germany's leading association for private investors (DSW) warned that CEO compensation in tens of million euros jeopardizes social peace throughout the country (Frankfurter Allgemeine Zeitung, August 20, 2008). The article is one among many on inequality aversion in Germany. Other examples are more geared towards the wage gap within firms. For example, a board member of the Federation of German Trade Unions (DGB) severely criticized Deutsche Bank AG for handing over an annual compensation of €9.55 million to its CEO (Börsen Zeitung, March 17, 2010). The CEO–employee wage gap is also one argument to justify a strike at various companies, such as, e.g., Deutsche Lufthansa AG (Handelsblatt, July 15, 2008).

[10] See, e.g., arbeitgeber-ranking.de/rankings/studenten/faktor/hohes-einstiegsgehalt.

contrast, the average CEO–employee wage gap in our sample is 48.4. On the other hand, German investors exhibit stronger non-monetary preferences than in other countries (as attested, for example, by their SRI investments). The joint presence of a relatively lower level of pay-inequality and a higher level of inequality aversion might then balance each other out in Germany.

This paper makes several contributions to the literature. Pan et al. (2022) also find evidence that investors exhibit inequality aversion. They analyze the market reaction and portfolio rebalancing in response to the aforementioned SEC ruling on pay-inequality disclosure for U.S. public companies. They find that high pay-inequality is associated with lower abnormal announcement-returns, especially when shareholders are more inequality-averse. Also, such investors rebalance their portfolios away from high-pay-inequality stocks relative to other investors. Our paper complements their results by analyzing a smaller cross-section of firms but a longer time series. We show that inequality aversion also affects long-run abnormal returns, leading to a lower cost of capital for low wage-gap firms.

Mueller et al. (2017) find that low-wage-gap firms in the UK exhibit lower operating performance and negative abnormal returns. Their study suggests that managerial talent is not priced by the market, possibly because the wage gap is difficult to observe. In this paper, we document a similar empirical pattern in Germany. Our additional tests, however, suggest a novel and important point. Arbitrageurs correctly incorporate the wage gap in their evaluations, whereas other investors seem to exhibit a non-monetary preference for low-wage-gap stocks.

This paper finally speaks to the literature that studies the impact of values on investor behavior (see, e.g., Grinblatt and Keloharju, 2001; Bhattacharya and Groznik, 2008; Morse and Shive, 2010). Previous research shows that investors consider non-monetary variables in their trading strategies, such as moral issues (Hong and Kacperczyk, 2009), political affiliation (Kaustia and Torstila, 2011; Hong and Kostovetsky, 2012), and social responsibility (Riedl and Smeets, 2017; Hartzmark and Sussman, 2019). Our results extend these findings by providing evidence that a particular type of pro-social behavior, such as inequality aversion, provides long-run rewards to companies that adopt equitable pay schemes.

The rest of the paper is organized as follows. Section 2 introduces the model. Section 3 describes the data. Section 4 discusses the empirical results. Section 5 concludes. The appendices contain some further material.

2. Model

We consider a three-period economy. At time zero, the representative firm appoints a manager who exerts effort e to negotiate workers' wages w, hire L workers, and carry out a project of size K. Managerial effort cannot be contracted upon by the firm. The manager receives compensation $W(e)$ to induce him to exert the target effort. At time one, the firm seeks funding on the stock market to pay workers' wages and start production. At time two, the firm liquidates and pays off investors.

Managerial effort is costly. The manager's cost function $C(e)$ is known to himself and the firm, but not to outsiders. We assume $C'(e) > 0$ and $C''(e) > 0$. Under efficient contracting, the firm maximizes profits π by eliciting the level of effort that is also individually optimal for the manager:

$$\max_{e,L} \ \pi(e, L) = y(e, L) - w(e)L - W(e), \tag{1}$$

where $y(e, L) \equiv \theta(e)K^{1-\alpha}L^{\alpha}$ is the firm's output, with $\theta(e)$ indicating productivity. We assume $\theta'(e) > 0$ and $w'(e) \leq 0$. The firm's choice of optimal managerial effort (e^*) reflects the following trade-off: high effort costs more ($W'(e) > 0$), but also makes the firm's employees more valuable ($\theta'(e) > 0$), and can yield better outcomes in salary negotiations ($w'(e) \leq 0$). In Appendix A, we show that a high wage-gap between CEO and regular workers is an indication of high effort and high profitability.

The CEO skill varies across firms. The stock market then evaluates managers using the wage gap as a signal for effort. Specifically, we consider three types of investors: arbitrageurs, inequality-averse investors, and naive investors. Naive investors just neglect pay inequality, as they do not recognize its informativeness. Therefore, they evaluate low-wage-gap firms and high-wage-gap firms equally. Inequality-averse traders, on the other hand, are investors that observe the wage gap, but dislike high pay-inequality within firms. They evaluate low-wage-gap firms more favorably than arbitrageurs do, and vice versa for high-wage-gap firms. All investors are risk neutral and trade in a stock market from Hong and Sraer (2013). The total mass of investors' capital is normalized to one, and a fraction of these investors are arbitrageurs.

Naive investors are unsophisticated, and therefore face short-sales constraints (Chen et al., 2002; Hong and Sraer, 2016). Inequality-averse investors, on the other hand, are norm-constrained, and may not want to short for three reasons. First, they may face constraints similar to naive traders, because arbitrage activity is concentrated around hedge or mutual funds (Hong and Kacperczyk, 2009). Second, they are aware that high wage-gap firms are more profitable than low wage-gap firms, which makes shorting unattractive. Third, they may avoid short positions on moral grounds (Hong and Kacperczyk, 2009; Hong and Kostovetsky, 2012).[11] Therefore, we make the assumption that short-sales constraints are binding for both inequality-averse investors and naive investors.[12] Then these investors just shun high-wage gap stocks, rather than short them.

The equilibrium price in our model formally depends on whether short-sales constraints are binding. In Appendix B, we solve the model for each investor type, and show:

[11] An et al. (2021) spell out a number of reasons why institutions may be unwilling to engage in short-selling, even when they are formally allowed to do so. Among them, they cite pressure from clients motivated by worries about excess risk-taking, and social stigma associated with profiting from someone else's misfortune.

[12] The presence of short-sales constraints is for simplicity and without loss of generality. For example, a large literature shows that naive investors tend to leave the market when they hold pessimistic beliefs (see, e.g., Chen et al., 2002; Diether et al., 2002; Lamont and Thaler, 2003; Amromin and Sharpe, 2009; Grinblatt and Keloharju, 2009; Antoniou et al., 2016). They can also just sell their stock holdings to other investors (Hong and Stein, 2007), or decide not to buy (Antoniou et al., 2016).

Proposition 1. *Wage gap and stock returns.*

(a) *High-wage-gap stocks are correctly priced, as short-sales constraints are binding. Abnormal returns on high-wage-gap stocks are then equal to zero.*
(b) *Low-wage-gap stocks are overpriced, as short-sales constraints are not binding. As a result, abnormal returns on low-wage-gap stocks are negative.*
(c) *Stocks with high wage-gaps outperform stocks with low wage-gaps.*

Proof. See Appendix B.

Corollary 1. *The return differential between high- and low-wage-gap stocks:*

(a) *increases with the difference in wage gaps;*
(b) *decreases with the proportion of arbitrageurs in the market;*
(c) *increases with the inequality-aversion preference.*

Proof. See Appendix B.

The short-term equilibrium prices can then deviate from fundamental values, because they represent the weighted average of the valuations of different investor types.[13] In particular, the mispricing of the wage gap is asymmetric. When the firm liquidates, abnormal returns are negative for low-wage-gap stocks, and zero for high-wage-gap stocks.

To further separate naive investors from inequality-averse investors, we also obtain the following result:

Proposition 2. *The difference in market prices between stocks with high and low wage-gaps decreases when the inequality-aversion preference increases.*

Proof. See Appendix B.

Proposition 2 is important because it shows that investors with a high degree of inequality aversion bid up the price of low-wage-gap stocks, which can mitigate or eliminate the price differential with high-wage-gap stocks. Corollary 1c exclusively focuses on returns, and thus does not make predictions on the price differential between high- and low-wage gap stocks.

We also consider one alternative setup that is not mentioned yet, in which the wage gap is unobservable to all traders (see Appendix B). We show that the price differential between high- and low-wage-gap stocks is zero in this case, as neither arbitrageurs nor inequality-averse traders can incorporate the wage gap in their evaluations. The mispricing is then symmetric. When the firm liquidates, abnormal returns are positive for high-wage-gap stocks, and negative for low-wage-gap stocks.

Note that the allocation of different types of investors to separate cases (naive *or* inequality-averse) is for simplicity and without loss of generality. We obtain similar results when considering a framework with arbitrageurs, naive investors, and inequality-averse traders all together (unreported). In the empirical analysis that follows, we disentangle the inequality-aversion story from these alternative setups by testing their different predictions on returns and valuations.

3. Data

3.1. Workers' compensation

The main hurdle in studies of workers' wages is the lack of publicly available data. In this paper, we overcome this issue by using the "Establishment History Panel" database, maintained and made available for the period from January 2001 to December 2011 by the German Federal Employment Agency (Bundesargentur für Arbeit, BfA). This is a publicly-available data set that reports the median and quartiles of the annual gross wage distribution in any given anonymized establishment in Germany. In years 2004 to 2006, the data set was matched by the agency itself with stock market data for 100 firms from the two stock market indices DAX and MDAX. The resulting matched data set is only accessible to us.

The database also contains individual characteristics such as nationality, age, gender, qualification, and type of work. While the complete database contains all these variables for each employee, the data set made available to researchers aggregates these variables across all workers at the establishment level. Our data set then contains the median and quartiles of the wage distribution in any given establishment, but not the wage of each individual worker or the average wage in a given establishment. We define workers' wage in a given establishment as the establishment-level median wage. To calculate the firm-level wage, we aggregate establishment-level data for each company in the sample, using the number of workers per establishment as a weight.

[13] This is due to the presence of limits to arbitrage. Agents in our model face liquidity constraints as in Hong and Sraer (2013), which prevents arbitrageurs from immediately correcting the mispricing. A similar result obtains in a setup with finite risk aversion (see, e.g., Hirshleifer and Teoh (2003) for a deeper discussion of this mechanism).

With respect to previous literature on the wage gap, the advantage of this data set is that it does not come from surveys. For example, Mueller et al. (2017) use a combination of paid work and survey data for British companies during the period 2004–2013, which implies a number of potential biases.[14] The average firm appears 3.7 times in their sample compared with yearly observations in our sample. Also, the firms in their sample are smaller, with an average of 10,014 employees (p. 3614). Conversely, our sample contains 100 listed firms in Germany, with an average of 50,019 employees (Table 2). Faleye et al. (2013) rely on discretionary disclosure of U.S. companies from Compustat during the period 1993–2006, which implies a potential self-selection bias. In Uygur's (2019) analysis of U.S. firms during the period 1998–2016, she overcomes this problem by calculating average workers' compensation using the average hourly worker pay for each industry. In comparison with these three studies, we use a time series of similar length (2001–2011), but our sample selection is random and the calculation of the wage gap is more exact. The lower level of noise in our data translates into a high goodness of fit in all the statistical tests that follow.[15]

3.2. CEO compensation

We hand-collect data on executive compensation from the companies' annual reports. The sample period includes the recent German reform on executive compensation disclosure. Before the reform, listed companies only had to report the aggregate pay of their management board. Since corporations were not keen on providing information on individual managers' pay, the Federal Government of Germany passed a regulation effective 2006 that made such disclosure mandatory.[16] We complement our data set using company-level accounting and stock market data from Worldscope and Datastream.

The number of firms of the matched data set at the start of the sample period is 66, peaking to 100 in 2005, and slowly decreasing to 84 by 2011. The number of establishments follows a similar pattern, starting at 16,471, peaking to 25,767 in 2006, only to slowly decrease to 15,607 by the end of the sample period.

The industry breakdown shows that the most represented sector in the sample is post and telecommunication (24%), followed by financial intermediation (17%), and retail trade (9%). The distribution of establishments by states, on the other hand, shows that the most represented regions are Nordrhein-Westfalen (18%), followed by Bayern (16%), and Baden-Württemberg (12%). A significant proportion of establishments is located in the same state as the firms' headquarters (18%).

The data set includes 146 CEOs and 734 executive board members overall. On average, the management board includes five members. The representative CEO in our sample is 54 years old, with a tenure of approximately six years. CEO turnover is relatively low (9%), and a substantial portion of CEOs is hired inside the firm (43%). On the other hand, the median worker's age is 41 years. The overwhelming majority of workers is German (97%). Most of them are highly qualified (73%), and have a white-collar job (61%).

In the empirical tests that follow, we define the wage gap as the log-difference between managers' pay and rank-and-file workers' wages. In any given company, we primarily define managerial compensation as the overall CEO pay, including both the variable and the fixed component, and workers' compensation as the average establishment-level median wage, weighted by the number of employees in each establishment.

Cronqvist et al. (2009) calculate the wage gap only using the establishments that are located in the same state as the firm's headquarters. In our baseline specifications, we follow their methodology for two reasons. First, we acknowledge the validity of their argument on proximity and ease of interaction between management and employees. Second, German regions are characterized by wide political and economic heterogeneity for historical reasons, which creates high dispersion in standards of living. As a result, workers' compensation also exhibits similar cross-regional variation. Therefore, we deem it particularly appropriate to compare managerial compensation with that of workers that live in the same state, to avoid potential distortionary effects of different local governments and costs of living.

In Table 1, Panel A, we report the summary statistics on managerial compensation for the full sample. The average CEO has an annual compensation of €2.65 million, of which €2.06 million in cash. Each non-CEO member receives an average total compensation of €1.45 million per year, of which €1.16 million in cash. Note that the salary of non-CEO managers is highly correlated with that of the CEO (80%). In unreported summary statistics, we find that the median wage at the establishment level for full-time rank-and-file workers is €35,167 per year, while the first and third quartiles of the distribution are, respectively, €31,678 and €37,301. The average ratio between CEO and workers' pay is then 48.4, and its first-order autocorrelation coefficient is 0.2.

[14] Mueller et al. (2017) themselves provide an excellent discussion on this issue, on pp. 3612–3613. Furthermore, the response rate for the survey is not reported. On the other hand, they are able to observe wages at the firm-hierarchy-year level, which addresses the potential issue that different job titles may involve different types of jobs across firms.

[15] For example, the R-squared from our baseline Fama–MacBeth regressions is 53.4% (Table 6, column (1)), while in Mueller et al. (2017) it is 0.3% (their Table 10, column (3)).

[16] The German Corporate Governance Code (2006), Clause 4.2.4, requires that "[t]he 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." This means that 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, which states that "[c]ompensation 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 a recommendation but not a regulation.

Table 1
Summary statistics: Managerial compensation.

Panel A. Full sample					
Variable	Observations	Mean	Std. deviation	Min	Max
CEO pay (€m)	607	2.65	2.47	0.02	16.60
CEO cash (€m)	607	2.06	1.71	0.02	12.90
Manager pay (€m)	606	1.45	1.07	0.02	8.17
Manager cash (€m)	606	1.16	0.79	0.00	6.87
CEO wage gap	605	48.42	2.94	0.55	5324.11
CEO cash wage gap	605	40.04	2.75	0.55	2779.43
Manager wage gap	604	29.37	2.64	0.61	2835.58
Manager cash wage gap	601	25.03	2.41	3.19	1863.11
Panel B. High wage-gap					
Variable	Observations	Mean	Std. deviation	Min	Max
CEO pay (€m)	174	5.30	3.02	1.30	16.60
CEO cash (€m)	174	3.81	2.06	0.76	12.90
Manager pay (€m)	174	2.50	1.14	0.65	8.17
Manager cash (€m)	174	1.83	0.78	0.45	5.62
CEO wage gap	174	157.59	2.32	62.80	5324.11
CEO cash wage gap	174	114.43	2.32	12.68	2779.43
Manager wage gap	174	76.71	2.46	19.30	2835.58
Manager cash wage gap	174	57.40	2.46	7.54	1863.11
Panel C. Low wage-gap					
Variable	Observations	Mean	Std. deviation	Min	Max
CEO pay (€m)	193	0.81	0.41	0.02	2.01
CEO cash (€m)	193	0.74	0.36	0.02	1.70
Manager pay (€m)	192	0.58	0.34	0.02	2.87
Manager cash (€m)	192	0.51	0.26	0.00	1.38
CEO wage gap	193	16.12	1.95	0.55	36.23
CEO cash wage gap	193	14.88	1.93	0.55	36.23
Manager wage gap	192	11.70	1.84	0.61	109.95
Manager cash wage gap	189	11.13	1.60	3.19	34.47

Summary statistics for managerial compensation in our sample. CEO and managers' pay are defined as the total annual compensation, including cash and stocks, or cash compensation only. The wage gap is defined as the ratio between CEO total annual compensation, including cash and stocks, and workers' wages, calculated as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% of the distribution at the beginning of a given month. We consider the full sample in Panel A, high-wage-gap stocks in Panel B, and low-wage-gap stocks in Panel C. CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. The sample period is from 2002 to 2011.

In comparison with other countries, our German wage gap estimate of 48.4 is high, but still only 20% of the U.S. value of 243.9 that Uygur (2019) finds for S&P500 firms that are roughly the same size (total assets) as our firms. On the other hand, Faleye et al. (2013) calculate a ratio of 95.47 for the broader sample of S&P1500 firms in a sample that spans the period 1993–2006. Pan et al. (2022) find that the average disclosed pay ratio in 2018 is 145. On the other hand, Mueller et al. (2017) consider British companies during the period 2004–2013, and show that the average pay ratio between top-level executives (e.g., finance and HR directors) and employees at the bottom of the hierarchy (e.g., cleaners and unskilled workers) is 8.3. However, the latter finding reveals little about the CEO–worker pay ratio as the managers in their sample seem to be some levels of hierarchy away from the CEO.

We rank all stocks in pay inequality quantiles each month.[17] We define high- and low-wage-gap portfolios, respectively, as the stocks that lie at the top and the bottom 30% of the distribution. In Table 1, Panels B and C, we report the summary statistics for high- and low-wage-gap firms, respectively. Companies that rank at the top 30% of the wage gap distribution pay their average CEO €5.30 million, whereas those at the bottom 30% pay €0.81 million. The average wage gap is 157.6 among the former and 16.1 among the latter.

3.3. Firm characteristics

In Table 2, Panel A, we report the summary statistics on firm characteristics for the full sample. The average firm has total assets of €57.08 billion, and employs 50,019 workers overall.[18] The average Tobin's q, defined as enterprise value (debt plus market value

[17] We opt for monthly rebalancing because the fiscal year starts in different months across firms, and the information on workers' pay may actually be observed throughout the year as it becomes available.

[18] The minimum value of 2 employees comes from a firm that is in bankruptcy proceedings.

Table 2
Summary statistics: Financial and accounting variables.

Panel A. Full sample					
Variable	Observations	Mean	Std. deviation	Min	Max
ROA (%)	914	6.03%	11.06%	−73.65%	42.37%
Tobin's q	821	1.27	2.51	0.01	34.65
Total assets (€b)	920	57.08	214.34	0.03	2193.95
Employees	922	50,019	91,628	2	536,350
Stock returns (%)	921	0.02%	10.38%	−50.97%	57.08%
Book-to-market	821	0.91	0.12	0.38	1.84
Dividend yield	668	0.02	0.02	0.00	0.09
Market cap (€b)	920	2.37	7.17	0.00	233.28
Trading volume (million)	900	0.19	6.61	0.00	32.38
Panel B. All German firms					
Variable	Observations	Mean	Std. deviation	Min	Max
ROA (%)	4870	5.78%	14.83%	−73.65%	50.22%
Tobin's q	4436	1.60	1.61	0.01	38.15
Total assets (€b)	5134	10.95	89.80	0.02	2193.95
Employees	3095	15,193	52,949	2	536,350
Stock returns	3834	−0.26%	43.79%	−94.55%	77.55%
Book-to-market	4438	0.80	0.55	0.14	2.18
Dividend yield	4553	0.02	0.03	0.00	0.13
Market cap (€b)	4435	2.03	7.73	0.00	233.28
Trading volume (million)	5015	0.28	1.54	0.00	32.38
Panel C. High wage-gap					
Variable	Observations	Mean	Std. deviation	Min	Max
ROA (%)	173	7.93%	7.61%	−28.07%	28.97%
Tobin's q	154	1.58	3.68	0.02	26.48
Total assets (€b)	174	170.88	369.08	0.14	2155.37
Employees	174	138,565	145,932	171	536,350
Stock returns (%)	174	0.58%	8.89%	−40.76%	26.03%
Book-to-market	154	0.90	0.08	0.64	1.03
Dividend yield	147	0.02	0.02	0.00	0.06
Market cap (€b)	174	18.77	3.32	0.92	233.28
Trading volume (million)	171	0.45	4.57	0.01	17.42
Panel D. Low wage-gap					
Variable	Observations	Mean	Std. deviation	Min	Max
ROA (%)	192	2.78%	15.71%	−73.65%	34.29%
Tobin's q	162	1.24	1.95	0.01	16.39
Total assets (€b)	193	12.32	71.34	0.03	750.73
Employees	193	8228	14,504	2	122,600
Stock returns (%)	192	0.11%	10.54%	−33.57%	44.54%
Book-to-market	162	0.92	0.17	0.38	1.84
Dividend yield	96	0.02	0.02	0.00	0.09
Market cap (€b)	192	0.57	5.53	0.00	45.71
Trading volume (million)	187	0.11	6.96	0.00	16.90

Summary statistics for the financial and accounting variables in our sample. We consider our full sample in Panel A, all listed German firms in Panel B, high-wage-gap stocks in Panel C, and low-wage-gap stocks in Panel D. The wage gap is defined as the ratio between CEO total annual compensation, including cash and stocks, and workers' wages, calculated as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% of the distribution at the beginning of a given month. Return on assets (ROA) is defined as EBITDA divided by total assets. Tobin's q is defined as enterprise value (debt plus market value of equity) divided by book value (debt plus book value of equity). Return on assets and stock returns are expressed in percentage points, total assets in billion euros, market capitalization in billion euros, and trading volume in million shares. Company-level accounting and stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. The sample period is from 2002 to 2011.

of equity) divided by book value (debt plus book value of equity), is 1.27. The average return on assets, defined as EBITDA divided by total assets, is 6.03%.

In Panel B, we report summary statistics for all listed firms in Germany during our sample period. Our sample includes companies from the two largest indices (DAX and MDAX). As a result, our firms are larger than the universe of German firms in terms of total assets (€57.08 vs. €10.95 billion), number of employees (50,019 vs. 15,193), and market capitalization (€2.37 vs. €2.03 billion). The difference in size becomes even more pronounced when considering medians instead of means for total assets (€3.11 vs. €0.11 billion), number of employees (11,712 vs. 656), and market capitalization (€2.02 vs. €0.06 billion). Our sample represents big,

Table 3
Summary statistics: Stock returns.

Panel A.					
Variable	Observations	Mean	Std. deviation	Min	Max
R30 high	120	−0.0006	0.0795	−0.3693	0.3152
R30 low	120	−0.0086	0.0749	−0.3109	0.2076
R30 high–low	120	0.0080	0.0474	−0.1368	0.2279
R20 high	120	−0.0015	0.1029	−0.5642	0.5422
R20 low	120	−0.0127	0.0829	−0.3019	0.2585
R20 high–low	120	0.0112	0.0785	−0.2623	0.4613
R10 high	108	0.0062	0.0608	−0.1986	0.1787
R10 low	108	−0.0101	0.0997	−0.3518	0.4647
R10 high–low	108	0.0163	0.0840	−0.2860	0.2828
Panel B.					
Variable	P5	P25	P50	P75	P95
R30 high	−0.1404	−0.0315	0.0064	0.0393	0.1077
R30 low	−0.1356	−0.0435	−0.0010	0.0359	0.0896
R30 high–low	−0.0595	−0.0183	0.0085	0.0291	0.0896
R20 high	−0.1691	−0.0313	0.0067	0.0371	0.1153
R20 low	−0.1609	−0.0574	−0.0103	0.0308	0.1204
R20 high–low	−0.1222	−0.0250	0.0178	0.0430	0.1232
R10 high	−0.0942	−0.0253	0.0128	0.0392	0.1118
R10 low	−0.1377	−0.0589	−0.0175	0.0355	0.1503
R10 high–low	−0.1170	−0.0234	0.0252	0.0578	0.1324
Panel C.					
Variable	Observations	Mean	Std. deviation	Min	Max
MKT	120	0.0034	0.0615	−0.2503	0.1291
SMB	120	0.0019	0.0204	−0.0719	0.0474
HML	120	0.0033	0.0208	−0.0471	0.0719
UMD	120	0.0081	0.0486	−0.3006	0.1293

Summary statistics for stock returns in our sample. We consider portfolio returns in Panels A and B, and European factor data in Panel C. Portfolio returns are equal-weighted and calculated on stocks with a high wage-gap between CEO and workers, stocks with a low wage-gap, and a portfolio with a long position in high-wage-gap stocks and a short position in low-wage-gap stocks. The wage gap is defined as the difference between CEO total annual compensation, including cash and stocks, and workers' wages, calculated as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month. In any given month, we define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30%, 20%, and 10% of the distribution. For each of these three thresholds, high-wage-gap portfolios include an average number of stocks equal to 16.2, 10.7, and 5.0, respectively. For low-wage-gap portfolios, the numbers are respectively 17.1, 11.6, and 5.9. European factors data include the returns on the market (MKT), size (SMB), book-to-market (HML), and momentum (UMD) factors. In Panels A and C, we report the number of observations, mean, standard deviation, minimum, and maximum of the distribution. In Panel B, we report percentiles 5, 25, 50, 75, and 95 of the distribution. Company-level stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, workers' data is from the German Federal Employment Agency, and factor-mimicking portfolios are from Kenneth French's website. The sample period is from January 2002 to December 2011.

more established firms which have limited growth opportunities, as implied by a lower Tobin's q (1.27 vs. 1.60). Moreover, our firms share roughly the same characteristics as those of the universe of German firms, such as return on assets (6.03% vs. 5.78%), book-to-market (0.91 vs. 0.80), and dividend yield (0.02 for both).[19]

In Panels C and D, we split the sample again into high- and low-wage-gap firms, respectively. The breakdown shows that high-wage-gap firms are much larger, with average total assets of €170.88 billion and 138,565 employees. These numbers are €12.32 billion and 8228, respectively, for low-wage-gap firms. Finally, high-wage-gap firms exhibit a higher return on assets than low-wage-gap firms (7.93% vs. 2.78%), and a higher Tobin's q (1.58 vs. 1.24).

In Table 3, Panels A and B, we rank again all stocks in pay inequality quantiles. We consider not only the 30% threshold, but also 20% and 10% as additional thresholds. Our variables of interest are then the returns on the top portfolios, the bottom portfolios, and the top-minus-bottom portfolios. The summary statistics show that the difference in average returns between high- and low-wage-gap stocks is positive, and increases with the wage gap. Finally, we summarize our European factor data in Table 3, Panel C.

[19] The German firms we consider also exhibit similar characteristics to those reported by Pan et al. (2022) for U.S. firms. The average firm in our sample has a market capitalization of €2.39 billion, return on assets of 6.03%, and a book-to-market ratio of 0.91. These numbers are respectively $2.14 billion, 7.87%, and 0.51 for the sample from Pan et al. (2022).

3.4. Institutional details

For much of our sample period, there was no restriction on short-sales. After the global financial crisis on September 19, 2008, the Federal Financial Supervisory Authority (BaFin) banned short selling on eleven German finance stocks. Of these eleven stocks, nine are in our sample. The ban expired on January 31, 2010, and was not renewed. After that, a law that became effective on July 27, 2010, banned naked short-selling of shares but does not affect covered short-selling according to Daniel and Lhabitant (2012). This ban is easily circumvented as the law does not cover intraday short positions. Accordingly, investors can establish a naked short position if they cover it (i.e., borrow the corresponding shares) on the same day. Also, the ban does not apply to other derivatives, such as stock options.

4. Empirical results

First, we provide empirical support to the idea that a high wage-gap represents compensation for better managerial skills. In the second subsection, we estimate abnormal returns, and look into whether the results are driven by limits to arbitrage. In the third subsection, we explore whether the results reflect investors' inattention to the wage gap, or their aversion to it. In the fourth subsection, we address a number of alternative explanations. The fifth and final subsection provides results for a variety of alternative specifications.

4.1. Firm performance

As a preliminary test, we validate the model's assumption that high-wage-gap firms are run better than low-wage-gap firms. This is an important test also to mitigate concerns about the alternative hypotheses that the wage gap might be uninformative or represent agency issues. To this purpose, we estimate the following panel regressions:

$$ROA_{it} = \alpha_t + \beta w_{it-1} + \gamma S_{it} + \epsilon_{it}, \tag{2}$$

where ROA_{it} is the return on assets for company i in year t, α_t is year fixed-effects, w_{it-1} is the logarithm of the wage gap of stock i in the previous year, and S_{it} is the logarithm of the company's number of employees as a proxy for size.[20] Standard errors are clustered by firm.[21]

The results are in Table 4, Panel A. In a restricted specification without controls, we find that a ten-percent increase in the total wage gap is associated with a 0.25% increase in return on assets, whereas the effect is 0.37% for cash compensation. In the unrestricted model with controls, a ten-percent increase in the wage gap is associated with a 0.27% increase in return on assets when considering cash compensation, whereas the coefficient is positive but not significant for total compensation.

In Panel B, we find that these estimates actually hide interesting cross-sectional effects. We split the sample into firms that belong in competitive vs. non-competitive industries, defined as those whose Herfindahl–Hirschmann index takes on below- and above-median values, respectively.[22] The results indicate that the coefficient of the wage gap is positive and significant only in highly competitive industries, which supports our conjecture that high-wage-gap firms are indeed better managed. In additional tests, we find similar results for cash pay when replacing the Herfindahl–Hirschmann index with the Lerner index (see Table C.1, Panel B).

Finally, we address two residual concerns. First, the estimates may be driven by some specific industries. However, we find that the results are robust to using industry-adjusted ROA (see Table C.1, Panel C), constructed by subtracting the industry median across all firms in Amadeus in the same two-digit SIC industry and year. Second, these regressions may be affected by reverse causality. To address this issue, we analyze the relation between CEO pay and lagged ROA. The reason is that CEO pay, which represents a key ingredient of the wage gap, may depend on past realizations of ROA, which in turn might be persistent over time. Reassuringly, however, we find that the wage gap is not explained by several lags of ROA (see Table C.1, Panel D).

4.2. Limits to arbitrage

Four-factor model

In our first set of time-series regressions, we test Proposition 1. To this end, we use European financial data from Kenneth French's website. Our main test equation is Carhart's (1997) four-factor model, which allows us to control for a number of well-known risk factors:

$$R_{it} = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + u_i UMD_t + \epsilon_{it}, \tag{3}$$

[20] We acknowledge that part of the relation between ROA and the wage gap might be mechanical. Since the bulk of the wage expense is driven by non-manager employees, firms with lower wage-gaps might also be more likely to have a lower ROA because of a higher salary expense.

[21] In our baseline specifications, we do not use firm fixed-effects because it substantially reduces the number of degrees of freedom in our sample. We cluster standard errors by firm instead, as we have enough firm clusters to achieve consistency (see, e.g., Petersen, 2009). However, the results that follow are similar when using firm and year fixed-effects, with clustering by firm and year (see Table C.1, Panel A).

[22] The Herfindahl–Hirschmann index is the sum of squared market shares in a given industry and year. Industries are based on two-digit SIC codes. Market shares are based on firms' sales using all German firms in Amadeus.

Table 4
CEO–workers wage gap and firm performance.

Panel A				
Dep. variable: ROA	Total pay		Cash pay	
	(1)	(2)	(3)	(4)
Wage gap (−1)	0.025*	0.012	0.037**	0.027**
	1.87	0.83	2.44	2.21
Employees		0.012		0.008
		1.17		0.95
Constant	−0.043	−0.110	−0.081	−0.126
	−0.74	−1.19	−1.28	−1.30
Year FE	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm
Adj. R-squared	0.040	0.066	0.080	0.091
Observations	552	552	552	552
Panel B				
Dep. variable: ROA	Total pay		Cash pay	
	(1) High HHI	(2) Low HHI	(3) High HHI	(4) Low HHI
Wage gap (−1)	0.000	0.024*	0.017	0.029**
	0.03	1.76	1.16	2.14
Employees	0.017	0.002	0.014	0.000
	1.60	0.15	1.49	0.04
Constant	−0.112	−0.050	−0.144	−0.052
	−1.27	−0.47	−1.39	−0.49
Year FE	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm
Adj. R-squared	0.094	0.065	0.106	0.077
Observations	284	299	284	299

Panel regressions of firms' return on assets, defined as EBITDA divided by total assets, on the wage gap between CEO and workers, lagged one year and expressed in logs, and the logarithm of the firm's employees. CEO compensation is measured as total annual pay, including cash and stocks, in columns (1) and (2), and as cash only in columns (3) and (4). Workers' pay is measured as the annual wage paid in establishments that are located in the same state as the firm's headquarters, calculated as a weighted average across establishments, where the weights are represented by the number of employees in each establishment. All specifications include year fixed-effects, and standard errors are clustered by firm. In Panel A, we consider the full sample. In Panel B, we split the sample into firms that belong in competitive vs. non-competitive industries, defined as those whose Herfindahl–Hirschmann index takes on below- and above-median values, respectively. Company-level accounting and stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, workers' data is from the German Federal Employment Agency. Observations are annual, and the sample period is from 2002 to 2011. The numbers below the coefficients are t statistics, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

where the dependent variable is the excess returns on equal-weighted portfolios of stocks with a high ($i = H$) or low ($i = L$) wage gap between CEO and workers, or the returns on the long-minus-short portfolio ($i = H - L$). The independent variables are excess returns on the market portfolio (MKT), and factor-mimicking portfolios for size (SMB), book-to-market (HML), and momentum (UMD). The intercept captures abnormal returns. Proposition 1a implies zero abnormal returns for high-wage-gap stocks ($\alpha_H = 0$), Proposition 1b predicts that low-wage-gap stocks trade at a premium ($\alpha_L < 0$), and Proposition 1c implies positive abnormal returns on the long-short portfolio ($\alpha_{H-L} > 0$). Standard errors are corrected for heteroskedasticity and serial correlation.

The results are in Table 5. In Panel A, we construct the portfolios using the 30% threshold. In columns (1) to (3), we consider total compensation. We find that the alpha is negative and highly significant for the low-inequality portfolio (−0.8%), while close to zero and insignificant for the high-inequality portfolio (0.1%). As a result, the long-short portfolio yields positive and significant abnormal returns of 0.9% per month. This pattern is in line with the model's predictions. The estimates are virtually unchanged when considering cash compensation only, in columns (4) to (6). In additional tests, we find analogous results when we rebalance the portfolios annually (see Table C.2), and when we consider total managerial pay excluding the CEO (see Table C.3).

Of particular importance is the inclusion of the size factor, because pay inequality seems to be related to firm size. The idea is that executive ability is worth more to firms that own a larger amount of resources. This mechanism leads to "assortative matching," where better managers are hired by larger firms (Terviö, 2008; Gabaix and Landier, 2008). Therefore, we need to make sure that any difference in abnormal returns between high- and low-wage-gap stocks does not simply reflect a size premium, but rather constitutes a separate effect.

The coefficients of the regressions of the arbitrage portfolio provide two additional insights. First, the coefficient of size is negative and highly significant for high-inequality stocks (−1.08), which shows that these stocks tend to co-move positively with the returns on large firms. This is consistent with the idea that pay inequality is positively related to firm size. Second, the market beta is positive and significant for the long-short portfolio (0.16), which indicates that high-wage-gap stocks tend to exhibit stronger co-movement with the market.

Table 5
CEO–workers wage gap: Portfolio returns.

Panel A						
30% threshold	Total wage gap			Cash wage gap		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.001	−0.008**	0.009***	0.001	−0.008**	0.010***
	0.33	−2.42	3.12	0.37	−2.47	2.87
MKT	0.951***	0.790***	0.160**	0.913***	0.776***	0.137
	8.40	7.05	2.27	7.70	6.74	1.55
SMB	−0.899***	0.181	−1.080***	−0.914***	0.163	−1.077***
	−2.75	0.66	−3.09	−2.63	0.62	−2.96
HML	−0.322	−0.134	−0.188	−0.317	−0.115	−0.203
	−1.51	−0.41	−0.99	−1.36	−0.36	−1.35
UMD	−0.269**	−0.383**	0.114*	−0.275**	−0.399***	0.125*
	−2.11	−2.49	1.66	−2.08	−2.62	1.69
Adj. R-squared	0.701	0.584	0.223	0.695	0.575	0.202
Observations	120	120	120	120	120	120
Panel B						
20% threshold	Total wage gap			Cash wage gap		
	(1) R20 high	(2) R20 low	(3) R20 high–low	(4) R20 high	(5) R20 low	(6) R20 high–low
Alpha	0.004	−0.012***	0.016***	0.005	−0.012***	0.017***
	0.82	−2.97	3.06	1.03	−2.58	3.31
MKT	1.025***	0.842***	0.182	1.009***	0.858***	0.152
	5.76	5.69	1.39	5.37	5.99	1.01
SMB	−1.625***	0.303	−1.928***	−1.462**	0.198	−1.660**
	−2.69	0.99	−3.06	−2.31	0.62	−2.39
HML	−0.722*	−0.295	−0.427*	−0.793**	−0.240	−0.553***
	−1.95	−0.77	−1.68	−2.09	−0.62	−2.68
UMD	−0.457**	−0.433***	−0.024	−0.481**	−0.383**	−0.098
	−2.27	−2.94	−0.22	−2.44	−2.33	−0.86
Adj. R-squared	0.608	0.528	0.265	0.588	0.522	0.211
Observations	120	120	120	120	120	120
Panel C						
10% threshold	Total wage gap			Cash wage gap		
	(1) R10 high	(2) R10 low	(3) R10 high–low	(4) R10 high	(5) R10 low	(6) R30 high–low
Alpha	0.004	−0.013*	0.017***	0.005	−0.011	0.016***
	1.53	−1.82	2.83	1.16	−1.49	3.45
MKT	0.669***	0.864***	−0.196	0.607***	0.633***	−0.025
	5.63	4.68	−0.83	6.44	4.6	−0.17
SMB	−0.820***	0.678*	−1.499***	−0.700***	0.472	−1.172***
	−5.48	1.81	−3.71	−3.84	1.09	−3.65
HML	0.254	−0.294	0.547	0.267	0.063	0.203
	1.02	−0.59	1.51	0.91	0.11	0.43
UMD	−0.108	−0.514	0.406	−0.034	−0.623**	0.589***
	−1.05	−1.55	1.31	−0.22	−1.99	3.08
Adj. R-squared	0.619	0.394	0.156	0.446	0.351	0.190
Observations	108	108	108	108	108	108

Carhart's (1997) four-factor model regressions of equal-weighted returns on a portfolio of stocks with high inequality between CEO and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 5), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). Pay inequality is defined as the difference in earnings between CEO and workers. CEO compensation is calculated as the overall annual pay, including cash and stocks, in columns (1–3), and as cash pay in columns (4–6). Workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% (Panel A), 20% (Panel B), and 10% (Panel C) of the distribution. Company-level stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Observations are monthly, and the sample period is from January 2002 to December 2011. Heteroskedasticity and autocorrelation-robust *t*-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6
CEO–workers wage gap: Fama–MacBeth regressions.

Dep. variable: Returns	Total pay		Cash pay	
	(1) 30% threshold	(2) 20% threshold	(3) 30% threshold	(4) 20% threshold
Wage gap (d)	0.010**	0.024***	0.008*	0.040***
	2.08	2.65	1.95	2.65
Book-to-market (−1)	−0.001	−0.009	−0.011	0.063
	−0.03	−0.28	−0.45	0.77
Dividend yield (−1)	−0.010**	−0.011**	−0.007	−0.022**
	−2.04	−2.01	−1.53	−2.33
CumRet (−2,−3)	0.036	0.024	0.014	0.131
	1.42	0.83	0.59	1.63
CumRet (−4,−6)	0.030	0.045*	0.027	0.139
	1.53	1.67	1.18	1.24
CumRet (−7,−12)	0.026**	0.028	0.041***	0.030
	2.29	1.23	3.42	1.55
Size (−2)	−0.001	0.002	−0.001	−0.03
	−0.30	0.36	−0.13	−1.32
Stock price (−2)	−0.002	−0.004	−0.001	0.005
	−0.79	−0.78	−0.38	0.36
Trading volume (−2)	−0.003	−0.006*	−0.002	0.019
	−1.07	−1.71	−0.86	1.06
Constant	−0.041	−0.074*	−0.030	0.091
	−1.22	−1.66	−0.91	0.59
R-squared	0.534	0.704	0.528	0.697
Observations	2722	1774	2718	1761

Fama–MacBeth regressions from Brennan et al. (1998) of returns on German stocks on a dummy-variable wage-gap that takes on value one if firm i's wage gap is among the top 30% (columns 1 and 3) or 20% (columns 2 and 4) at the beginning of the month, and a vector of firm characteristics, which includes: the log of the book-to-market ratio (calculated each July and held constant through the following June), the ratio of dividends in the previous fiscal year to market value at calendar year-end (calculated each July and held constant through the following June), the log of cumulative returns over months $t-3$ through $t-2$, months $t-6$ through $t-4$, and months $t-12$ through $t-7$, size (defined as the log of market capitalization at the end of month $t-2$), the log of the dollar volume of trading in the stock in month $t-2$, and the log of the stock price at the end of month $t-2$. In columns (1) and (3), we exclude the middle 40% wage-gap stocks. In columns (2) and (4), we exclude the middle 60% wage-gap stocks. CEO compensation is measured as total pay in columns (1) and (2), and cash pay in columns (3) and (4). Workers' pay is measured as the annual wage paid in establishments that are located in the same state as the firm's headquarters, calculated as a weighted average across establishments, where the weights are represented by the number of employees in each establishment. Company-level stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Observations are monthly, and the sample period is from January 2002 to December 2011. The numbers below the coefficients are t statistics, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Corollary 1 a states that the mispricing of pay inequality should increase when considering larger wage gaps. To test for this, we set a progressively higher threshold for the construction of our wage gap portfolios. Consistent with the prediction, the estimates increase in magnitude. In columns (1) to (3), the long-short portfolio yields positive and significant returns of 1.6% per month for the 20% threshold (Panel B), and 1.7% per month for the 10% threshold (Panel C).[23] We obtain similar estimates when considering cash compensation only, in columns (4) to (6).

The pattern and magnitude of our baseline results are similar to those from Mueller et al. (2017), even though they consider data from a different country (the UK), and terciles (instead of the 30% threshold). In their analysis of returns (their Table 9), they find that an equal-weighted portfolio of low-wage-gap stocks earns negative and significant abnormal returns of 0.8% per month in Carhart's (1997) four-factor model, while abnormal returns are insignificant for high-wage-gap stocks (0.2%). As a result, their arbitrage portfolio yields positive and significant abnormal returns of 1.0% per month. For comparison, our 30%-threshold arbitrage portfolio yields abnormal returns of 0.9% per month.

Pan et al. (2022) show that pro-social preferences might be a matter of degree rather than kind. Some pro-social investors might then feel less strongly about inequality, and trade accordingly, possibly holding some high-wage-gap stocks. However, our regression results suggest that the role of inequality-averse investors in the market for high wage-gap stocks is marginal. Although the alpha of the long leg of the arbitrage portfolio is positive across specifications, and closer to statistical significance for the 10% threshold, it never crosses the rejection region (see Table 5). The participation of inequality-averse investors in high wage-gap stocks then seem limited, as predicted by our model, with correspondingly little price pressure.

More generally, the magnitudes of our estimates are comparable to those of previous portfolio analyses of abnormal returns. For example, Stambaugh et al. (2012) document benchmark-adjusted returns ranging from 0.4% to 1.8% per month for a number of

[23] For the 10% threshold, we do not have enough stocks for the first year of the sample.

stock market anomalies. Our abnormal returns from Table 5 are well within this range (from 0.9% to 1.7% per month). Overall, then, our results seem well-placed in this literature.

Fama-MacBeth regressions

We acknowledge that factor models may not entirely capture systematic risk. In particular, the wage gap may be correlated with other firm characteristics that affect stock returns in their own right. To address this concern, we estimate Fama–MacBeth regressions from Brennan et al. (1998), in which we control for a large number of firm characteristics:

$$R_{it} = \beta_0 + \beta_1 d_{it-1} + \delta' Z_{it} + \epsilon_{it}, \tag{4}$$

where R_{it} is the return on stock i in month t; d_{it-1} is a dummy variable that takes on value one if the wage gap of stock i at the beginning of the month is among the top 30% of the distribution; and Z_{it} is a vector of firm characteristics that includes: size (defined as the log of market capitalization at the end of month $t-2$), the log of the book-to-market ratio (calculated each July and held constant through the following June), the ratio of dividends in the previous fiscal year to market value at calendar year-end (calculated each July and held constant through the following June), the log of cumulative returns over months $t-3$ through $t-2$, months $t-6$ through $t-4$, and months $t-12$ through $t-7$, the log of the dollar volume of trading in the stock in month $t-2$, and the log of the stock price at the end of month $t-2$. To compare extreme wage gaps, we leave out the stocks that lie in the middle 40% of the wage gap distribution. In Fama–MacBeth regressions of this sort, the coefficient of the dummy variable can be interpreted as abnormal returns (Gompers et al., 2003; Mueller et al., 2017).

The results are in Table 6. We find again a positive and significant association between the wage gap and stock returns. When considering the total wage gap, the top 30% wage-gap stocks earn 1.0% higher abnormal returns than the bottom 30%. For the cash wage gap, the return differential between top and bottom 30% stocks is 0.8%. The coefficients increase, in both magnitude and significance, for the 20% threshold (2.4% and 4.0%, respectively).[24] Altogether, the results are similar to those from the time series analysis.[25] Overall, the results lend support to Proposition 1 and Corollary 1a.

Double-sorted portfolios

To provide more direct evidence on the relation between the mispricing of the wage gap and the presence of limits to arbitrage, we turn to Corollary 1b, which states that the pricing error should increase in the presence of a lower proportion of arbitrageurs in the market. To test this prediction, we repeat the analysis in subsets of stocks that are difficult to evaluate and/or arbitrage. Examples of such companies are those of small size, defined as low market capitalization, and with extreme book-to-market ratios.[26] With a lower concentration of arbitrageurs, we expect the mispricing of the wage gap to be particularly pronounced among these stocks. To test this conjecture, we double-sort our stocks in portfolios formed on these measures, calculated annually, and the wage gap. In the first sort, we distinguish between stocks with above- and below-median market capitalization, or stocks with middle 40% and extreme (i.e., top or bottom) 30% book-to-market, respectively. In the second sort, we identify stocks with top and bottom 30% wage gaps.

It is important to note that despite the relatively small number of firms, there is wide variation in both market capitalization and the book-to-market ratio in our sample. Table 2, Panel A, reports that market capitalization varies between €4.7 million and €233.3 billion, with a standard deviation of €2.4 billion. The book-to-market ratio varies from a minimum of 0.38 to a maximum of 1.84, with a standard deviation of 0.12. These estimates suggest that there is enough heterogeneity among our firms for the double sorting to be meaningful.

This methodology, however, presents two hurdles in our data. First, both sorts use market prices, and might then reflect similar information. To tackle this concern, we consider the cash wage gap for these tests. Second, we have relatively few stocks to construct four separate monthly portfolios because some monthly observations are missing, and firm coverage is rather low in the first few years of our sample. To address this concern, we start our analysis in 2005, and rebalance our portfolios annually rather than monthly.

The results, reported in Table 7, lend support to our conjecture. In Panel A, abnormal returns on the long-short portfolio are positive and highly significant among small stocks (1.8%), while close to zero and not significant among large stocks (0.2%). In Panel B, the long-short portfolio yields positive and highly significant abnormal returns for extreme book-to-market stocks (1.1%), but near-zero abnormal returns for middle book-to-market stocks (0.1%). The results from the full sample are then confined to small and extreme book-to-market stocks, as expected. The estimates from these subsamples are of larger magnitude, because they exclude stocks in which the wage gap is correctly priced. The full-sample estimates then likely underestimate the mispricing of the wage gap.

Overall, the findings suggest that arbitrageurs observe the wage gap. If the wage gap were not observed by any investors, including arbitrageurs, the portfolios formed on large stocks and middle book-to-market stocks should also exhibit non-zero alphas,

[24] The magnitude, however, needs to be interpreted with caution due to the lower number of degrees of freedom.

[25] Table C.4 uses the continuous measure of the wage gap instead of the dummy variable that takes on value one for the top 30% or 20%, respectively. We find that the coefficient of the wage gap as a continuous variable is positive but outside of the rejection region. We believe that this result reflects the fact that the comparison between the top and the bottom of the wage gap distribution is more salient to inequality-averse investors. Our specification with the dummy variable allows us to capture exactly this effect, and also enables us to interpret the coefficient in terms of abnormal returns (Gompers et al., 2003; Mueller et al., 2017).

[26] See Baker and Wurgler (2006, 2007) for evidence from the U.S., and Baker et al. (2012) for international evidence.

Table 7
CEO–workers wage gap: Double-sorted portfolios.

Panel A						
30% threshold	Small stocks			Large stocks		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.011	−0.007**	0.018***	−0.002	−0.005	0.002
	1.60	−2.19	2.69	−0.94	−0.66	0.45
MKT	0.991***	0.499***	0.493***	0.748***	0.822***	−0.074
	14.18	6.25	4.11	12.31	6.54	−0.70
SMB	0.399	0.182	0.217	−0.298***	0.383**	−0.682***
	1.24	0.62	0.81	−2.59	2.02	−4.37
HML	−0.321	0.493*	−0.814	0.186	0.351	−0.165
	−0.61	1.70	−1.50	0.94	0.95	−0.58
UMD	−0.284**	−0.116	−0.168**	0.023	−0.129	0.152
	−2.16	−0.99	−1.98	0.20	−0.96	0.92
Adj. R-squared	0.561	0.463	0.175	0.684	0.598	0.100
Observations	84	84	84	84	84	84
Panel B						
30% threshold	Extreme B/M			Middle B/M		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.002	−0.009**	0.011***	−0.003	−0.004	0.001
	0.80	−2.33	3.58	−0.92	−1.00	0.41
MKT	0.791***	0.553***	0.238***	0.762***	0.738***	0.024
	13.29	6.62	3.30	11.43	5.68	0.17
SMB	−0.341**	−0.074	−0.268	−0.069	1.063***	−1.131***
	−2.34	−0.28	−1.18	−0.57	6.61	−7.62
HML	−0.068	0.422	−0.490*	0.419	0.345	0.075
	−0.33	1.26	−1.75	1.63	1.10	0.23
UMD	−0.058	−0.144	0.086	−0.048	−0.101	0.053
	−0.47	−1.26	1.14	−0.45	−0.95	0.43
Adj. R-squared	0.646	0.466	0.041	0.675	0.591	0.170
Observations	84	84	84	84	84	84

(*continued on next page*)

because in that case the mispricing of the wage gap is orthogonal to the proportion of arbitrageurs in the market for high- and low-wage-gap stocks (see the model in Appendix B, Case 1). Rather, we find that the wage gap is correctly priced in these stock categories, which lends support to the idea that arbitrageurs include the wage gap in their evaluations.

The results are confined to stocks that are harder to evaluate and/or arbitrage. In additional tests, we look further into the role of limits to arbitrage. Previous research shows that stocks with low book-to-market ratios are more costly to short (D'Avolio, 2002; Jones and Lamont, 2002; Geczy et al., 2002). If limits to arbitrage partly explain our results for the extreme book-to-market portfolios, then the mispricing should be more pronounced for growth stocks than value stocks, where these two stock categories are respectively defined as stocks with a low and high book-to-market ratio. In Table 7, Panel C, we find evidence consistent with this prediction. The mispricing of the wage gap is entirely concentrated among growth stocks.

Value-weighted returns

Baker and Wurgler (2006) show that value-weighting tends to obscure mispricing patterns in the analysis of returns, because large firms are characterized by a larger presence of arbitrageurs. If such investors evaluate the wage gap correctly, then we expect our results to become weaker when forming value-weighted instead of equal-weighted portfolios. In Table C.5, we find evidence consistent with this line of reasoning. We find that abnormal returns on value-weighted arbitrage portfolios are lower and all outside the rejection region.

4.3. Inequality aversion

Next, we try to establish whether the pricing error is driven by inequality aversion, or mere inattention to pay inequality. Both stories imply overpricing for low-wage-gap stocks. Under inequality-averse preferences, however, the mispricing of low-wage-gap stocks should vary with the degree of inequality aversion (Proposition 2 and Corollary 1c). To identify inequality-averse traders, we devise three sets of empirical tests.

Table 7 (*continued*).

Panel C						
30% threshold	Value stocks (Top B/M)			Growth stocks (Bottom B/M)		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.001	−0.005	0.006	0.000	−0.014**	0.015***
	0.22	−0.90	1.32	0.10	−2.04	2.73
MKT	0.206	0.432**	−0.226	0.648***	0.666***	−0.018
	0.87	2.33	−0.60	19.21	10.88	−0.23
SMB	−1.524***	−0.048	−1.476***	−0.428***	0.072	−0.501**
	−4.40	−0.14	−3.85	−3.42	0.30	−2.54
HML	1.907***	0.557	1.350**	−0.298**	−0.079	−0.218
	5.25	1.27	2.04	−2.01	−0.32	−0.64
UMD	−0.246	−0.037	−0.209	−0.037	−0.295***	0.258***
	−1.12	−0.33	−0.87	−0.44	−3.35	3.63
Adj. R-squared	0.545	0.243	0.190	0.576	0.582	0.074
Observations	60	60	60	60	60	60

Carhart's (1997) four-factor model regressions of equal-weighted returns on a portfolio of stocks with high inequality between CEO and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 5), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). In Panel A we consider stocks whose market capitalization is below the median (columns 1–3), or above the median (columns 4–6), at the end of the previous year. In Panel B we consider stocks whose book-to-market ratio lies in the extreme (i.e., top and bottom) 30% of the distribution (columns 1–3), or in the middle 40% (columns 4–6), at the end of the previous year. In Panel C, we consider value stocks (columns 1–3) and growth stocks (columns 4–6), respectively defined as stocks whose book-to-market ratio lies at the top or bottom 30% of the distribution at the end of the previous year. The average number of stocks in these portfolios is as follows. Among large stocks, high- and low-wage-gap portfolios respectively include 23.3 and 11.4 stocks on average. Among small stocks, these numbers are respectively 9.6 and 21.6. Among extreme book-to-market stocks, high- and low-wage-gap portfolios respectively include 18.6 and 21.0 stocks on average. Among middle book-to-market stocks, these numbers are respectively 14.3 and 12.0. Among value stocks, high- and low-wage-gap portfolios respectively include 5.9 and 12.0 stocks on average. Among growth stocks, these numbers are respectively 6.4 and 14.6. Pay inequality is defined as the difference in earnings between CEO and workers. CEO compensation is calculated as the cash salary, while workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each year. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 50% of the distribution. Company-level stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Observations are monthly, and the sample period is from January 2005 to December 2011. Heteroskedasticity and autocorrelation-robust t-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Valuations and income inequality

First, we look into the relation between the wage gap and valuations. Proposition 2 predicts that an increase in the inequality-aversion preference brings the prices of high- and low-wage-gap stocks closer to each other than they should be from a rational standpoint. To test for this mechanism, we study how the effect of the wage gap on company valuations varies with income inequality. Specifically, we re-estimate Eq. (2) using Tobin's q as a dependent variable. On the right-hand side, we add an interaction term between the wage gap and a dummy that takes on value one if income inequality in Germany increases over a given year, and zero otherwise. The intuition is that managerial pay receives greater public criticism when income inequality is high, which should map into a greater aversion to within-firm pay inequality.

To define income inequality, we follow Joyce et al. (2019) and consider the top 1% fiscal income share. As they note, most of the public discourse about economic inequality is concerned with the top 1% earners, and whether policymakers should tax them more aggressively. We retrieve data on income inequality in Germany from the World Inequality Database, and express the series in changes due to its high persistence.[27] Note that the standalone inequality dummy is absorbed by the year fixed-effects.

The estimates are in Table 8, Panel A. We leave out the interaction term in columns (1) and (4), and include it in the other specifications. The results lend support to our theoretical arguments in two ways. First, we find that the there is no unconditional difference in valuations between high- and low-wage-gap stocks, as the coefficient of the wage gap as a standalone variable is not significant (columns (1), (2), (4), and (5)). Second, we find that the difference in valuations between high- and low-wage-gap stocks becomes indeed significant when conditioning on income inequality (columns (3) and (6)). High-wage-gap stocks trade at a higher price than low-wage-gap stocks in times of low inequality, whereas the prices become closer to each other when income inequality is high.[28]

[27] The years characterized by an increase in income inequality are 2004–2008, and 2010. Specifically, the index of income inequality in Germany decreased from 0.0999 in year 2001 to 0.0994 in year 2002, and 0.0939 in year 2003, then rose to 0.1043 in 2004, 0.1176 in 2005, 0.1207 in 2006, 0.1303 in 2007, and 0.1309 in 2008, then plunged to 0.1170 in 2009, and slightly rose again to 0.1181 in 2010 and 2011.

[28] As an additional test, we tried to split the sample into above- and below-median wage-gaps. However, the interaction effect is not significant probably due to the low number of observations in each subsample (see Table C.6).

Table 8
CEO–workers wage gap, income inequality, and valuations.

Panel A.						
Dep. variable: Tobin's q	Total pay			Cash pay		
	(1)	(2)	(3)	(4)	(5)	(6)
Wage gap	0.314	0.727	0.948*	0.228	0.625	0.970*
	0.92	1.61	1.83	0.59	1.37	1.82
Employees		−0.397**	−0.402**		−0.358**	−0.363**
		−2.24	−2.27		−2.29	−2.33
Wage gap x Inequality (d)			−0.277*			−0.439**
			−1.77			−2.26
Constant	0.087	2.278**	2.248*	0.467	2.427*	2.359*
	0.07	2.01	1.98	0.36	1.88	1.86
Year FE	Y	Y	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R-squared	0.048	0.110	0.110	0.039	0.089	0.092
Observations	525	525	525	525	525	525
Panel B.						
Dep. variable: Tobin's q	Total pay			Cash pay		
	(1)	(2)	(3)	(4)	(5)	(6)
Adj. wage gap	0.337	0.849	1.039*	0.083	0.516	0.984*
	0.99	1.63	1.91	0.19	1.13	1.90
Employees		−0.494*	−0.498*		−0.391**	−0.396**
		−1.84	−1.86		−2.07	−2.11
Adj. wage gap x Inequality (d)			−0.239*			−0.598**
			−1.69			−1.97
Constant	1.328***	6.049**	6.090**	1.330***	5.067**	5.117**
	5.03	2.19	2.20	4.93	2.50	2.53
Year FE	Y	Y	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R-squared	0.034	0.101	0.100	0.023	0.063	0.068
Observations	525	525	525	525	525	525

Panel regressions of firms' Tobin's q, defined as enterprise value (debt plus market value of equity) divided by book value (debt plus book value of equity), on the wage gap between CEO and workers, lagged one year and expressed in logs, the logarithm of the firm's employees, and an interaction term between the wage gap and a dummy that takes on value one if income inequality, defined as the top 1% fiscal income share in Germany, has increased over a given year, and zero otherwise. CEO compensation is measured as total annual pay, including cash and stocks, in columns (1) to (3), and as cash only in columns (4) to (6). Workers' pay is measured as the annual wage paid in establishments that are located in the same state as the firm's headquarters, calculated as a weighted average across establishments, where the weights are represented by the number of employees in each establishment. In Panel B, we adjust the wage gap by subtracting the average wage gap for all companies in the sample in a given year. All specifications include year fixed-effects, and standard errors are clustered by firm. Company-level accounting and stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, workers' data is from the German Federal Employment Agency, and income inequality data is from the World Inequality Database. Observations are annual. The sample period is from 2002 to 2011. The numbers below the coefficients are t statistics, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As a further test, we repeat our analysis by adjusting the wage gap for a candidate reference point. For each year of our sample, we calculate the average wage gap across all stocks and subtract it from the wage gap of each individual stock. This test is closer in spirit to the model, and allows us to analyze whether the valuations of stocks that lie either side of the reference point indeed become closer to each other when inequality aversion is high. The results are in Table 8, Panel B. Consistent with our prediction, we find a similar empirical pattern to that from Panel A. The adjusted wage gap is associated with higher valuations in times of low income inequality, but the magnitude of the effect is significantly smaller when income inequality is high.

One potential concern with these findings is that high countrywide income-inequality may partly overlap with economic downturns. Since low-wage-gap firms tend to be of small size (Mueller et al., 2017), and particularly sensitive to local economic conditions (Ma and Ruzic, 2020), these companies should rapidly lose collateral and become riskier during recessions, causing investors to require a higher premium for holding their shares (Cooley and Quadrini, 1997; Perez-Quiros and Timmermann, 2000). In light of this, an alternative hypothesis would be that better managerial skills have a stronger positive effect on firm valuations during recessions (as proxied by a high income-inequality dummy). However, this prediction is counterfactual. The coefficient of the interaction term between the wage gap and the income-inequality dummy is negative and significant, which indicates that the stock prices of high-wage-gap companies are comparatively lower during times of high income-inequality. Therefore, we reject this hypothesis.

The variation in arbitrage forces over the business cycle could also affect our results. Moser et al. (2021) find that a contraction in credit supply is associated with a decrease in the wage gap both within and between firms. On the one hand, then, a local credit crunch makes arbitrage forces weaker, as measured by capital available to arbitrageurs. On the other hand, however, a narrower

Table 9
CEO–workers wage gap and sentiment.

Panel A						
30% threshold	Total wage gap			Cash wage gap		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	−0.003	−0.018***	0.015***	−0.004	−0.018***	0.014***
	−0.56	−3.50	3.17	−0.61	−3.54	3.33
Sentiment (d)	0.009	0.019**	−0.011**	0.009	0.019**	−0.009*
	1.12	2.25	−1.97	1.20	2.21	−1.94
MKT	0.935***	0.754***	0.181***	0.896***	0.742***	0.154*
	7.55	6.20	2.73	6.97	5.98	1.85
SMB	−0.938***	0.093	−1.031***	−0.955***	0.080	−1.035***
	−3.04	0.36	−2.96	−2.93	0.32	−2.82
HML	−0.345*	−0.186	−0.159	−0.342	−0.164	−0.178
	−1.66	−0.59	−0.86	−1.53	−0.52	−1.17
UMD	−0.283**	−0.414***	0.131**	−0.290**	−0.430***	0.140**
	−2.42	−3.16	2.13	−2.40	−3.28	2.08
Adj. R-squared	0.701	0.596	0.228	0.696	0.585	0.204
Observations	120	120	120	120	120	120
Panel B						
30% threshold	Low sentiment			High sentiment		
Total wage gap	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	−0.004	−0.019***	0.015***	0.002	0.001	0.001
	−0.85	−5.32	2.94	0.64	0.22	0.43
MKT	0.891***	0.736***	0.155	0.972***	0.786***	0.187***
	9.14	8.73	1.34	4.94	3.49	2.92
SMB	−1.301**	−0.386	−0.915**	−0.444***	0.728**	−1.172***
	−2.49	−1.43	−2.21	−2.97	2.32	−4.74
HML	0.161	0.624***	−0.463*	−0.654	−0.717	0.063
	0.42	3.14	−1.68	−1.38	−1.31	0.42
UMD	−0.299***	−0.335**	0.036	−0.115	−0.425*	0.311***
	−3.14	−2.45	0.33	−0.44	−1.68	2.69
Adj. R-squared	0.767	0.753	0.165	0.569	0.342	0.255
Observations	53	53	53	67	67	67

Carhart's (1997) four-factor model regressions of equal-weighted returns on a portfolio of stocks with high inequality between CEO and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 5), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). In Panel A, the regressions include a dummy variable that equals one if German consumer sentiment has increased over the previous month and zero otherwise. In Panel B, we split the sample into months characterized by low and high beginning-of-period sentiment, respectively. Pay inequality is defined as the difference in earnings between CEO and workers. CEO compensation is calculated as the overall annual pay, including cash and stocks, in columns (1–3), and as cash pay in columns (4–6). Workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% of the distribution. Company-level stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Consumer confidence data is from the OECD. Observations are monthly, and the sample period is from January 2002 to December 2011. Heteroskedasticity and autocorrelation-robust *t*-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

wage-gap distribution across firms reduces the overbidding of inequality-averse investors for low-wage-gap stocks. Which of these two opposing effects dominates is unclear.

Overall, these empirical patterns are consistent with the idea that high inequality-aversion bids up the prices of low-wage-gap stocks, and thus hard to reconcile with a simple story of investor inattention or lack of information. Therefore, inequality-averse investors seem to be present in the stock market.

Sentiment

Second, we analyze how the mispricing of the wage gap varies with investor optimism. Stambaugh et al. (2012) find that a large number of asset pricing anomalies become stronger when beginning-of-period sentiment is high, because unsophisticated investors overbid for lower-performing stocks. They find that high sentiment is followed by negative abnormal returns on the short leg of the investment strategy. The long leg, however, remains unaffected, as unsophisticated investors face limits to arbitrage.

Table 10
CEO–workers wage gap: Justified vs. unjustified pay.

Panel A						
30% threshold	Justified **total** pay			Unjustified **total** pay		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.000	−0.002	0.002	0.000	−0.005	0.005
	0.00	−0.51	0.32	0.01	−1.59	1.49
MKT	1.029***	0.783***	0.247	0.858***	1.058***	−0.200*
	5.85	12.50	1.56	16.45	7.80	−1.78
SMB	−1.321***	0.136	−1.457***	−0.216**	−0.269	0.053
	−2.85	0.52	−3.07	−2.05	−0.66	0.15
HML	−0.526	0.156	−0.682**	0.077	−0.546	0.623
	−1.28	0.50	−2.07	0.42	−1.31	1.39
UMD	−0.377***	−0.298***	−0.079	−0.128*	−0.439***	0.311***
	−3.11	−4.07	−0.67	−1.72	−3.15	2.76
Adj. R-squared	0.707	0.606	0.315	0.680	0.641	0.104
Observations	120	120	120	120	120	120
Panel B						
30% threshold	Justified **cash** pay			Unjustified **cash** pay		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.000	−0.001	0.000	0.004	−0.005*	0.010**
	−0.09	−0.19	0.03	0.93	−1.81	2.09
MKT	1.071***	0.821***	0.250	1.069***	0.897***	0.171
	6.44	11.49	1.59	5.82	10.38	0.91
SMB	−1.270***	0.153	−1.422***	−1.241*	0.280**	−1.521**
	−2.73	0.66	−3.06	−1.87	2.12	−2.53
HML	−0.620	0.090	−0.710**	−0.710*	−0.092	−0.618***
	−1.58	0.30	−2.21	−1.78	−0.42	−2.71
UMD	−0.360***	−0.266***	−0.094	−0.519***	−0.234***	−0.285*
	−2.92	−4.06	−0.82	−2.64	−4.38	−1.83
Adj. R-squared	0.710	0.635	0.321	0.591	0.692	0.249
Observations	120	120	120	120	120	120

Following Rouen (2020), we construct an economically justified wage-gap (columns 1–3), and an unjustified one (columns 4–6). The justified component is a linear combination of a large set of firm characteristics from Rouen (2020). For CEO pay, the explanatory variables are return on assets, average stock returns over the previous year, the logarithm of CEO tenure, the logarithm of CEO age, a dummy variable that takes on value one for years with negative income (defined as EBIT), the logarithm of total assets, the book-to-market ratio, and the ratio between total debt and total assets. For workers' pay, the explanatory variables are the proportion of highly qualified workers, the proportion of women, workers' median age, a dummy variable that takes on value one if the establishment is in the same region as the firm's headquarters, the percentage change in the number of employees from the previous year, state fixed-effects, the logarithm of total assets, return on assets, the ratio between sales and the number of employees, the book-to-market ratio, and the ratio between total debt and total assets. Unjustified pay represents the part of compensation that is not explained by economic fundamentals, i.e., the difference between the actual wage gap and the explained wage gap. The table reports Carhart's (1997) four-factor model regressions of equal-weighted returns on a portfolio of stocks with high inequality between CEO and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 6), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). CEO compensation is calculated as the overall annual pay, including cash and stocks, in Panel A, and as cash pay in Panel B. Workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% of the distribution. Company-level accounting and stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Observations are monthly, and the sample period is from January 2005 to December 2011. Heteroskedasticity and autocorrelation-robust t-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Under inequality-averse preferences, as outlined in Corollary 1c, we expect the mispricing of the wage gap to follow the opposite pattern. Large managerial premia spark public outrage when agents become more pessimistic about the economy. Therefore, inequality-averse investors should bid up low-wage-gap companies especially in times of low sentiment. This means that low sentiment should be followed by negative abnormal returns on the short leg on the investment strategy.

Following this line of reasoning, we test for structural breaks in abnormal returns in times of low consumer sentiment, which represents a measure of economic expectations (see, e.g., Carroll et al., 1994). This variable can then be roughly thought of as the

monthly counterpart to the annual income-inequality index from the valuation regressions.[29] We retrieve country-specific consumer sentiment data for Germany from the OECD, and express it in changes rather than levels due to the high persistence of the series. In the empirical tests, we introduce a dummy variable that equals one if German consumer sentiment increases at the end of the previous month and zero otherwise.

The results are in Table 9, Panel A. We find that the mispricing of the wage gap indeed increases in times of low sentiment. The coefficient of the sentiment dummy is not significant for high-wage-gap stocks, which lends further support to the idea that pro-social investors shun these stocks. Conversely, the coefficient is positive and significant for low-wage-gap stocks, indicating that these stocks decrease in value as expectations about the economy become more optimistic. The resulting coefficient of −1.1% for the long-minus-short portfolio is significant and large in absolute value.

The results further show that the alpha coefficient nearly offsets the coefficient of the sentiment dummy, so the mispricing is entirely confined to times in which German consumers expect the economy to do worse. This empirical pattern suggests an additional robustness test. We split the sample into months characterized by low and high beginning-of-period sentiment, respectively. The results are in Table 9, Panel B. Consistent with our previous set of results, we find that the mispricing of the wage gap is entirely confined into the low-sentiment subsample. Following low beginning-of-month sentiment, low-wage-gap stocks exhibit a negative and significant alpha. Correspondingly, the high-minus-low wage-gap portfolio yields positive and highly significant abnormal returns. Conversely for the high-sentiment subsample, the alpha is close to zero in magnitude and significance in all three specifications.

Since pay inequality tends to grow with firm size, one potential concern with these results is that the mispricing of low-wage-gap stocks may reflect their comparatively higher difficulty to cope in bad economic times. However, this explanation is unlikely for two reasons. First, firms that are riskier during recessions yield high expected returns during economic downturns (see, e.g., Perez-Quiros and Timmermann, 2000). This story counterfactually implies that the returns on low-wage-gap stocks should be higher in times of low consumer sentiment. Second, it is important to note that the size (SMB) and book-to-market (HML) factors already contain information on the state of the economy (Liew and Vassalou, 2000; Fama and French, 2004), and investment opportunities (Petkova, 2006). A potentially different response to economic shocks between high- and low-wage-gap stocks is then already captured by the coefficients of the risk factors, rather than the regression constant (i.e., abnormal returns).

Justified pay vs. unjustified pay

Third, we decompose CEO and workers' pay into an economically justified and an unjustified component. Following Rouen (2020), we estimate the justified component of CEO pay through a linear combination of firm i's characteristics in year t:

$$\begin{aligned} CEO\ pay_{i,t} &= \alpha + \beta_1 ROA_{i,t} + \beta_2 Ret_{i,t-1} + \beta_3 Ln\ CEO\ tenure_{i,t} + \beta_4 Ln\ CEO\ age_{i,t} + \beta_5 Ln\ Loss_{i,t} + \beta_6 Ln\ Assets_{i,t} \\ &+ \beta_7 BTM_{i,t} + \beta_8 Ln\ Leverage_{i,t} + \epsilon_{i,t} \end{aligned} \tag{5}$$

where the explanatory variables are return on assets for firm i in year t, average stock returns over the previous year, the logarithm of CEO tenure, the logarithm of CEO age, a dummy variable that takes on value one for years with negative income (defined as EBIT), the logarithm of total assets, the book-to-market ratio, and leverage, defined as the ratio between total debt and total assets. The fitted values from this regression represent justified CEO-pay.

For workers' pay, on the other hand, the justified component is a linear combination of firm i and establishment j's characteristics in year t:

$$\begin{aligned} Workers'\ pay_{i,j,t} &= \alpha + \beta_1 Qualified_{i,j,t} + \beta_2 Women_{i,j,t} + \beta_3 Age_{i,j,t} + \beta_4 Headquarters_{i,j,t} + \beta_5 Turnover_{i,j,t} + \beta_6 State_{i,j,t} \\ &+ \beta_7 Ln\ Assets_{i,t} + \beta_8 Ln\ ROA_{i,t} + \beta_9 Productivity_{i,t} + \beta_{10} BTM_{i,t} + \beta_{11} Leverage_{i,t} + \epsilon_{i,t}. \end{aligned} \tag{6}$$

At the establishment level, we consider the proportion of highly qualified workers, the proportion of women, workers' median age, a dummy variable that takes on value one if the establishment is in the same state as the firm's headquarters, employee turnover, defined as the percentage change in the number of employees from the previous year, and state fixed-effects. At the firm level, we consider the logarithm of total assets, return on assets, productivity, defined the ratio between sales and the number of employees, the book-to-market ratio, and leverage, defined as above. The fitted values from this regression represent justified workers' pay, calculated at the establishment level. We subsequently aggregate this measure for each company using the number of workers per establishment as a weight.[30]

As in Rouen (2020), we define the justified wage-gap (JWG) for firm i in year t as the ratio between justified CEO pay and firm-level justified workers' pay:

$$JWG_{i,t} = \frac{Justified\ CEO\ pay_{i,t}}{Justified\ workers'\ pay_{i,t}}, \tag{7}$$

[29] Specifically, both are proxies for the degree of inequality aversion from the model (i.e., parameter β). Here we use a monthly proxy (rather than an annual one) because most mispricing corrections of returns typically happen on a monthly basis (see, e.g., Stambaugh et al., 2012). Conversely, we do not use sentiment for our analysis of valuations because the effect of sentiment is confined to the short-term, and then washes out at lower frequencies (see, e.g., Baker and Wurgler, 2006, 2007; Baker et al., 2012). Attesting to this view, the correlation coefficient between the inequality dummy and the sentiment dummy (aggregated at the annual frequency) is only 0.2.

[30] We acknowledge that the ideal specification for a model of worker pay is at the individual level (Abowd et al., 1999), whereas we only have establishment-level data. While this feature of the analysis may add some noise to our empirical estimates, we do not expect it to bias the results in any obvious way.

and the unjustified wage-gap (UWG) as the difference between the actual wage-gap (WG) and the justified wage-gap:

$$UWG_{i,t} = WG_{i,t} - JWG_{i,t}. \tag{8}$$

This is an important breakdown, because investors with a preference for fairness should be particularly sensitive to unjustified pay-inequality.[31]

Following Corollary 1c, we expect arbitrageurs to observe the wage gap, whether justified or unjustified, and price it correctly. Naive traders, on the other hand, should neglect both types of wage gap, and then price neither one correctly. According to our model, inequality-averse investors do not distinguish between these two types of wage gap, so they would formally behave as naive traders here. Alternatively, inequality aversion can be thought of as a more general preference for fairness. While the economically justified wage gap is fair, its unjustified counterpart is not. If we replace the unconditional wage-gap with the unjustified wage-gap, then inequality-averse investors will only price the unjustified wage-gap incorrectly.[32]

As a result, our priors are as follows. In the presence of arbitrageurs only, there should be no abnormal returns on the long-short portfolio for either the justified or the unjustified wage-gap. In a setup with arbitrageurs and naive investors, we should observe positive abnormal returns in both specifications. The same prior applies to a setup with arbitrageurs and inequality-averse investors, if the latter dislike large pay inequality regardless of whether it is explained by the company's fundamentals. If inequality-averse investors only care about economically-unjustified pay, instead, we should only observe abnormal returns for the unjustified wage-gap specification.

The results are in Table 10. We separate the analysis in CEO total pay (Panel A) and CEO cash pay (Panel B). The long-minus-short portfolio exhibits near-zero abnormal returns for justified total-pay (0.2%, Panel A), and exactly zero for justified cash-pay (0.0%, Panel B). Conversely, abnormal returns on the arbitrage portfolio are positive for unjustified total-pay, even though small and outside of the rejection region (0.5%), while positive, large, and significant for unjustified cash-pay (1.0%). The results support the hypothesis that the mispricing is driven by investors that exhibit a preference for fairness.

The different findings in Panel A and Panel B seem to reflect the fact that cash pay might be more salient to inequality-averse investors. This is for two reasons. First and foremost, media attention is geared towards excessive CEO bonuses, which are included in our measure of cash pay. Second, cash compensation is arguably easier to understand, and also represents a large component of total managerial pay (78%, see Table 1).

Prior literature suggests that smaller unjustified wage-gap leads to better worker morale and productivity (see, e.g., Rouen, 2020; Boone et al., 2021), which makes them (in principle) a desirable investment also for arbitrageurs. Our model suggests, however, and the empirical results seem to confirm, that stocks with a low unjustified wage-gap are worth more to inequality-averse investors than to arbitrageurs, because the former like low pay-inequality as a form of non-monetary preferences. As a result, inequality-averse investors overbid for these stocks, causing them to become overpriced, and thus making arbitrageurs unwilling to hold them.[33]

Overall, the findings provide support to Corollary 1c, which states that the return differential between high- and low-wage-gap stocks is related to (and increases with) the inequality-aversion preference. That is, inequality-averse investors exhibit a preference for low pay-inequality, and thus reward such companies with higher equity valuations and a lower cost of capital.

4.4. Alternative explanations

One potential concern is that these findings may reflect some alternative type of preferences. For example, some investors tend to exhibit a preference for speculative investments, such as those with high idiosyncratic volatility (see, e.g., Polkovnichenko, 2005; Dimmock et al., 2021), lottery or penny stocks (see, e.g., Kumar, 2009; Bhootra, 2011), and high-beta stocks (Frazzini and Pedersen, 2014). As a result, these stocks earn negative abnormal returns. However, the analysis that follows suggests that none of these preferences seem to affect our analysis.

Stocks with high idiosyncratic volatility tend to be of small size, just like low-wage-gap stocks, but seem unrelated to the book-to-market ratio (see, e.g., Bali and Cakici, 2008). If our results were merely driven by a demand for stocks with high idiosyncratic volatility, then, the mispricing of the wage gap should be similar across stocks with different book-to-market ratios. However, our findings from the analysis of double-sorted portfolios are inconsistent with this prediction.

We also propose a formal test to rule out this alternative story. We repeat the analysis of stock returns from the Fama–MacBeth regressions introducing a measure of idiosyncratic volatility, defined as the standard deviation of the residuals from the regressions of individual stock returns on Carhart's (1997) four-factor model (see, e.g., Ang et al., 2006). Specifically, we introduce a dummy variable that takes on value one if a stock exhibits above-median idiosyncratic volatility in a given month, and zero otherwise.[34] The results are in Table C.7, columns (1) and (2). Consistent with our considerations, we find that the results are robust to this

[31] We recognize the caveat that any measure of operating efficiency that is not included in Eqs. (6) and (7) will end up in the UWG rather than the JWG, although the latter is more preferable.

[32] This can be seen by replacing the wage gap (W_j/w_j) with the unjustified wage-gap in Case 3 in Appendix B.

[33] The negative association between unjustified wage-gaps and future operating performance may constitute an additional motive for trading also for pro-social investors. While this trading motive goes in the same direction as inequality aversion, it cannot explain the overbidding for firms with low unjustified wage-gaps.

[34] This specification allows us to achieve three goals at once. First, we directly compare two competing rankings of stocks, i.e., one based on the wage gap and the other on idiosyncratic volatility. Second, we are able to interpret the coefficient of the dummy-variable idiosyncratic-volatility as abnormal returns, just like the coefficient of the dummy-variable wage-gap. Third, we avoid any potential spurious correlation between stock returns and idiosyncratic volatility, as both represent functions of stock prices (see, e.g., Brennan et al. (1998) and references therein).

additional specification. The coefficient of the wage gap dummy is positive and significant, and its magnitude is similar to that from our previous set of estimates.

We also find that the incidence of penny stocks in our sample is rather low. Of the 17.1, 11.6, and 5.9 stocks that respectively compose the average low-wage-gap portfolio for the 30%, 20%, and 10% thresholds, 2.0, 2.1, and 2.9 stocks respectively trade at a price below €5, which represents the conventional threshold to identify penny stocks. Furthermore, we find that our Fama–MacBeth results are largely unchanged when excluding penny stocks from the analysis in Table C.7, columns (3) and (4). More generally, the returns on our portfolios of interest seem to exhibit a rather symmetric distribution (see Table 3, Panel B), which is unappealing to investors with lottery preferences. Altogether, these observations suggest that our results are unlikely to be driven by stocks with lottery-like features.

Among other potential patterns, our market-beta estimates allay the concern that the risk-adjusted returns on low-wage-gap stocks may be related to the low-beta anomaly (Frazzini and Pedersen, 2014), i.e., the tendency of high-beta stocks to earn low risk-adjusted returns. In our baseline regressions in Table 5, for example, the difference in market beta between high- and low-beta stocks is not significant in all specification except one (Panel A, column (3)), where high-wage-gap stocks actually exhibit a higher market beta. Then the negative abnormal returns of low-wage-gap stocks does not seem to be related to the low-beta anomaly.

4.5. Robustness checks

In the last part of the analysis, we re-estimate a number of alternative specifications for our time-series regressions. First, we start with a simple CAPM, rather than the four-factor model, to check whether the results are also present in simple regressions that exclude factor-mimicking portfolios. The results are in Table C.8. The estimates are similar to those from our baseline specification. Low-wage-gap stocks exhibit negative and significant abnormal returns, while high-wage-gap stocks are correctly priced. As a result, the long-minus-short portfolio exhibits a positive and significant alpha. Abnormal returns increase when considering larger wage gaps, and the results are similar when considering cash compensation.

Second, we acknowledge that the four-factor model actually leaves out other factors that are also known to affect returns. For this reason, we repeat the baseline regressions by including the liquidity factor from Pástor and Stambaugh (2003), or the investment and profitability factors from Fama and French (2015). Unfortunately, we can only use the U.S. version of these factors, as they are not available for Germany or Europe. Financial markets integration, however, allays the concern that the results might be spurious (see, e.g., Pástor and Veronesi, 2020).

In Table C.9, Panel A, we find that neither set of regressors alters any of the previous findings. In the regressions with the liquidity factor from Pástor and Stambaugh (2003), abnormal returns on the long-minus-short portfolios are positive and highly significant, and equal to 0.9%, 1.5%, and 1.6%, respectively, for the three thresholds introduced above, which addresses the concern that the return differential might represent a liquidity premium. The results are similar when introducing the investment and profitability factors from Fama and French (2015), with arbitrage returns equal to 1.0%, 1.6%, and 1.9%.

On the other hand, the mispricing of the wage gap might be driven by other well-known behavioral biases or preferences (i.e., different than inequality aversion). To address this point, we also consider the profitability factor from Novy-Marx (2013), and the management and performance factors from Stambaugh and Yuan's (2017) behavioral factor model. In Table C.9, Panel B, we find that abnormal returns on the long-minus-short portfolios are positive and significant, and equal to 0.7%, 1.0%, and 1.5%, respectively, with the Novy-Marx (2013) model, and equal to 0.9%, 1.4%, and 2.1%, respectively, with the Stambaugh and Yuan (2017) model. The results from our baseline regressions are then robust to these alternative factor models.

The 2005 German reform on executive compensation disclosure substantially improved the quality of the information on managerial pay. One concern, then, is that our sample period includes two different regulatory frameworks. To address this issue, re-estimate our baseline regressions in the post-reform subsample only, i.e., from year 2006. The results, reported in Table C.10, are similar. The arbitrage portfolios yield abnormal returns of 0.5%, 1.0%, and 2.2%, respectively, for the three progressive thresholds we consider. Note that the effect of this reform on stock prices is unclear ex-ante. On the one hand, the improvement in transparency likely enables inequality-averse agents to trade more aggressively. On the other hand, it may improve arbitrage forces. For this reason, we do not exploit it as a shock in our analysis.

5. Conclusion

Recent research shows that a high wage-gap between managers and workers identifies better-performing firms, but the stock market does not price this information. In this paper, we shed new light on this issue. First, we show that arbitrageurs seem to recognize the relevance of the wage gap, and correctly incorporate it in their evaluations. Second, we provide support to the idea that some investors exhibit an aversion to high pay-inequality, which leads to a lower cost of capital for low-wage-gap companies. In particular, the overpricing is driven by the economically-unjustified component of the wage gap, and confined to times of high income-inequality and low sentiment.

In our theoretical analysis, we model inequality aversion as a preference rather than a bias in expectations. The difference is mostly cosmetic, however, as the latter specification yields the same asset pricing predictions. That is, inequality-averse traders still bid up the prices of low-wage-gap firms, but do not recognize that such firms are actually less profitable. Unfortunately, we are not able to tease out the two mechanisms empirically due to data limitations.[35] However, evidence of an inequality-aversion

[35] A way to filter out expectations from preferences would be to look at analysts' earnings surprises, but this approach does not work for our German sample. Using IBES data, we find too little coverage for the firms in our data set to estimate our baseline regressions.

bias would still not necessarily rule out the preference channel. In light of our analysis, we find it easier to justify our findings using preferences rather than expectations. Interestingly, Pan et al. (2022) also come to a similar conclusion in their analysis of inequality-averse investors.

The literature on skill-biased technical change suggests that within-firm pay inequality is partly driven by innovation (see, e.g., Goldin and Katz, 2010; Tirole, 2017; Aghion et al., 2017). Also, company-level pay-inequality is positively associated with complexity, as measured by the number of hierarchical layers (Friedrich, 2022). As a result, low-wage-gap firms tend to be less innovative and less complex, and therefore comparatively easier to evaluate than high-wage-gap firms. These features lend further support to the inequality-aversion hypothesis. Investors are indeed able to evaluate low-wage-gap firms correctly, but reward them for their equitable compensation schemes.

A growing literature shows that investors care about non-monetary values, and exhibit various forms of pro-social preferences. One such preference is inequality aversion, as companies that disclose high pay-inequality between managers and workers are associated with negative announcement-returns (Pan et al., 2022). Our paper complements this result by adding a time-series dimension to the analysis. We show that inequality-averse preferences also affect long-run abnormal returns.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Appendix A. Firm's problem

Firms' first-order conditions

If contracting is efficient, the objective function can be expressed as:

$$\max_{e,L} \pi(e,L) = \theta(e)K^{1-\alpha}L^{\alpha} - w(e)L - W(e), \tag{A.1}$$

The first-order condition with respect to e is:

$$\frac{d\pi(e,L)}{de} = \frac{d\theta(e)}{de}K^{1-\alpha}L^{\alpha} - \frac{dw(e)}{de}L - \frac{dW(e)}{de} = 0 \tag{A.2}$$

Using the following elasticity definitions:

$$\epsilon_{\theta} \equiv \frac{\partial\theta(e)}{\partial e}\frac{e}{\theta(e)} > 0, \tag{A.3}$$

$$\epsilon_{W} \equiv \frac{\partial W(e)}{\partial e}\frac{e}{W(e)} > 0, \tag{A.4}$$

$$\epsilon_{w} \equiv \frac{\partial w(e)}{\partial e}\frac{e}{w(e)} < 0, \tag{A.5}$$

which we assume to be constant, then optimal managerial compensation is:

$$W\left(e^*\right) = \frac{\epsilon_{\theta} y(e^*,L) - \epsilon_{w} w(e^*)L}{\epsilon_{W}} \equiv \frac{\epsilon_{\theta} y(e^*,L) + |\epsilon_{w}| w(e^*)L}{\epsilon_{W}}, \tag{A.6}$$

where ϵ_{W} represents the price of managerial effort. The first-order condition with respect to labor is:

$$\frac{\partial\pi(e,L)}{\partial L} = \alpha L^{\alpha-1}\theta(e)K^{1-\alpha} - w(e) = 0, \tag{A.7}$$

which yields

$$L^* = \left(\frac{\alpha\theta(e^*)}{w(e^*)}\right)^{\frac{1}{1-\alpha}} K. \tag{A.8}$$

Optimal managerial compensation can then be expressed as

$$\begin{aligned} W\left(e^*\right) &= \frac{\epsilon_{\theta}}{\epsilon_{W}} \underbrace{\theta\left(e^*\right)\left(\frac{\alpha\theta\left(e^*\right)}{w\left(e^*\right)}\right)^{\frac{\alpha}{1-\alpha}} K}_{\equiv y(e^*,L^*)} + \frac{|\epsilon_{w}|}{\epsilon_{W}} \underbrace{w\left(e^*\right)\left(\frac{\alpha\theta\left(e^*\right)}{w\left(e^*\right)}\right)^{\frac{1}{1-\alpha}} K}_{\equiv w(e^*)L^*} \\ &= K\left(\theta\left(e^*\right)\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{w\left(e^*\right)}\right)^{\frac{\alpha}{1-\alpha}} \frac{\epsilon_{\theta} + |\epsilon_{w}|\alpha}{\epsilon_{W}}. \end{aligned} \tag{A.9}$$

In particular, the firm chooses the optimal level of effort e^* by trading off the cost of managerial effort (ϵ_W) with its benefits ($\epsilon_\theta, |\epsilon_w|$).

Using the two first-order conditions, the firm's profits can be expressed as:

$$\begin{aligned}\pi(e^*, L^*) &= \underbrace{\theta(e^*)\left(\frac{\alpha\theta(e^*)}{w(e^*)}\right)^{\frac{\alpha}{1-\alpha}} K}_{\equiv y(e^*,L^*)} - \underbrace{w(e^*)\left(\frac{\alpha\theta(e^*)}{w(e^*)}\right)^{\frac{1}{1-\alpha}} K}_{\equiv w(e^*)L^*} - \underbrace{K\left(\theta\left(e^*\right)\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{w\left(e^*\right)}\right)^{\frac{\alpha}{1-\alpha}}\frac{\epsilon_\theta + |\epsilon_w|\alpha}{\epsilon_W}}_{\equiv W(e^*)} \\ &= K\left(\theta\left(e^*\right)\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{w\left(e^*\right)}\right)^{\frac{\alpha}{1-\alpha}}\left(1-\alpha-\frac{\epsilon_\theta + |\epsilon_w|\alpha}{\epsilon_W}\right) \equiv \phi\left(e^*\right)K,\end{aligned} \tag{A.10}$$

where $\phi(e^*)$ represents the profits per euro invested. Note that $\phi(e^*) \geq 1$ for the project to be started.

The firm's profits and the manager's salary both increase with effort:

$$\frac{\partial\pi(e^*, L^*)}{\partial e} \equiv \frac{\partial W(e^*)}{\partial e} \propto \frac{1}{1-\alpha}\left(\frac{\theta(e)}{w(e)}\right)^{\frac{1}{1-\alpha}}\frac{w}{e}\left(\epsilon_\theta + \alpha|\epsilon_w|\right) > 0, \tag{A.11}$$

and so does the wage gap, defined as the ratio between the manager's compensation and workers' wages:

$$\frac{\partial W(e^*)/w(e^*)}{\partial e} \propto \frac{1}{1-\alpha}\left(\frac{\theta(e)}{w(e)}\right)^{\frac{1}{1-\alpha}}\frac{1}{e}(\epsilon_\theta + |\epsilon_w|) > 0. \tag{A.12}$$

Then high managerial effort leads to an increase in profitability, managerial compensation, and pay inequality with respect to rank-and-file workers.[36]

Appendix B. Investors' problem

Setup

After establishing that the wage gap is a signal for profitability, we consider three scenarios for the stock market. First, the wage gap is unobservable to all traders. Second, arbitrageurs observe the wage gap and correctly interpret it as a signal for managerial effort, while naive traders just neglect pay inequality. Third, both arbitrageurs and inequality-averse investors observe the wage gap, but the latter dislike high pay-inequality within firms. Specifically, they exhibit an inequality-aversion preference: their evaluation of low-wage-gap firms is higher than the evaluation of arbitrageurs, and vice versa for high-wage-gap firms. The proportion of naive or inequality-averse investors' capital in the economy is $\lambda \in [0, 1]$.

Investor i is risk-neutral and trades in a stock market from Hong and Sraer (2013). To incorporate inequality-averse preferences, we assume that agents dislike a large difference in pay between managers and workers (Dur and Glazer, 2008). As a result, they hold a more favorable view of firms that pay low wage-gaps. The objective function is then:

$$\max_{n_{ij}} \; u_0 = n_{ij}\left(E_i(\pi_j) - p_j - \alpha max\left(\frac{W_j}{w_j} - \upsilon, 0\right) + \beta max\left(\upsilon - \frac{W_j}{w_j}, 0\right)\right) - \frac{1}{2}\frac{n_{ij}^2}{\gamma}, \tag{B.1}$$

where n_{ij} is the number of shares traded by an investor of type i in stock j, W_j is CEO pay, w_j is workers' pay, $E_i(\pi_j)$ is investor i's subjective evaluation of the stock's cash flow, p_j is the price of stock j, υ is the reference point of inequality-averse investors, $\alpha \geq 0$ and $\beta \geq 0$ are parameters that capture the degree to which inequality-averse investors dislike high inequality and like low inequality, respectively, and γ captures transaction costs.[37] For arbitrageurs and naive traders there is no inequality-aversion preference, i.e., $\alpha = \beta = 0$. The discount rate is set to zero, without loss of generality.

The intuition behind parameters α and β is that some individuals tend to consider relative payoffs in their evaluations (see, e.g., Loewenstein et al., 1989). For example, Rabin (1993) shows that people have a strong impulse to reward those who are fair, and punish those who are not. In turn, the perception of kindness or hostility depends on the equitability of the payoff distribution induced by the action.

The definition of reference point υ is ultimately an empirical question. In Bolton and Ockenfels (2000), for example, it is defined as an average calculated over all the individuals that belong in the same group. Here we follow the same approach, and set the reference point equal to the unconditional average of the wage gap.

[36] This result also holds also when we relax the assumption $\epsilon_w < 0$, namely, if the firm hires workers in a perfectly competitive labor market ($\epsilon_w = 0$), or if managerial effort actually increases workers' wages ($\epsilon_w > 0$), but the manager brings comparatively more value to the firm ($\epsilon_\theta > \epsilon_w$).

[37] A type of transaction cost that is characterized by such a convex function is the bid–ask spread, as larger trades are typically associated with more unfavorable price movements.

Equilibrium prices

The first-order condition yields the following demand function for investor i in stock j:

$$n_{ij}^{*} = \gamma\left(E_i(\pi_j) - p_j - \alpha max\left(\frac{W_j}{w_j} - v, 0\right) + \beta max\left(v - \frac{W_j}{w_j}, 0\right)\right). \tag{B.2}$$

In what follows, we refer to firms that exhibit $W_j/w_j > v$ as high-wage-gap firms, and those with $W_j/w_j \leq v$ as low-wage-gap firms. Given supply equal to q for all stocks, the market clearing condition for high-wage-gap stocks is:

$$\begin{cases} q = (1-\lambda)\gamma\phi K + \lambda\gamma\phi K & \text{(Case 1)} \\ q = (1-\lambda)\gamma\phi(\bar{e})K + \lambda\gamma\phi K & \text{(Case 2)} \\ q = (1-\lambda)\gamma\phi(\bar{e})K + \lambda\gamma\left(\phi K - \alpha\left(\frac{W_j}{w_j} - v\right)\right) & \text{(Case 3),} \end{cases} \tag{B.3}$$

where ϕ represents investors' estimate of the firm's profitability when effort is not observed, which implies $\phi(\bar{e}) > \phi > \phi(\underline{e})$. Then the unconstrained equilibrium price is:

$$p_u^{*}(\bar{e}) = \begin{cases} \phi K - \frac{q}{\gamma} & \text{(Case 1)} \\ \phi(\bar{e})K - \lambda(\phi(\bar{e}) - \phi)K - \frac{q}{\gamma} & \text{(Case 2)} \\ \phi(\bar{e})K - \lambda\alpha\left(\frac{W_j}{w_j} - v\right) - \frac{q}{\gamma} & \text{(Case 3).} \end{cases} \tag{B.4}$$

On the other hand, the market clearing condition for low-wage-gap stocks is:

$$\begin{cases} q = (1-\lambda)\gamma\phi K + \lambda\gamma\phi K & \text{(Case 1)} \\ q = (1-\lambda)\gamma\phi(\underline{e})K + \lambda\gamma\phi K & \text{(Case 2)} \\ q = (1-\lambda)\gamma\phi(\underline{e})K + \lambda\gamma\left(\phi K + \beta\left(v - \frac{W_j}{w_j}\right)\right) & \text{(Case 3),} \end{cases} \tag{B.5}$$

which yields the following unconstrained equilibrium price:

$$p^{*}(\underline{e}) = \begin{cases} \phi K - \frac{q}{\gamma} & \text{(Case 1)} \\ \phi(\underline{e})K + \lambda(\phi - \phi(\underline{e}))K - \frac{q}{\gamma} & \text{(Case 2)} \\ \phi(\underline{e})K + \lambda\beta\left(v - \frac{W_j}{w_j}\right) - \frac{q}{\gamma} & \text{(Case 3).} \end{cases} \tag{B.6}$$

Short-sales constraints are binding for naive or inequality-averse investors, because their evaluations of high-wage-gap stocks lie below the unconstrained equilibrium price (due to $\phi(\bar{e}) - \phi > 0$ for naive investors, and $\frac{W_j}{w_j} - v > 0$ for inequality-averse traders). Taking this into account, the constrained equilibrium price for high-wage-gap stocks can be expressed as:

$$p_c^{*}(\bar{e}) = \begin{cases} \phi K - \frac{q}{\gamma} & \text{(Case 1)} \\ \phi(\bar{e})K - \frac{q}{\gamma} & \text{(Cases 2 and 3).} \end{cases} \tag{B.7}$$

Subtracting (case by case), we obtain Proposition 2. The price differential between high- and low-wage-gap stocks is:

$$p_c^{*}(\bar{e}) - p^{*}(\underline{e}) = \begin{cases} 0 & \text{(Case 1)} \\ (\phi(\bar{e}) - \phi)K + (1-\lambda)(\phi - \phi(\underline{e}))K & \text{(Case 2)} \\ (\phi(\bar{e}) - \phi(\underline{e}))K - \lambda\beta\left(v - \frac{W_j}{w_j}\right) & \text{(Case 3).} \end{cases} \tag{B.8}$$

Returns

Following Chen et al. (2002), we define returns as the difference between fundamental value and market price. We first derive Proposition 1a. For high-wage-gap stocks, abnormal returns are positive if the wage gap is unobservable, and zero otherwise, due to binding short-sales constraints:

$$r_c^{*}(\bar{e}) = \begin{cases} \frac{q}{\gamma} + (\phi(\bar{e}) - \phi)K & \text{(Case 1)} \\ \frac{q}{\gamma} & \text{(Cases 2 and 3).} \end{cases} \tag{B.9}$$

Then, we derive Proposition 1b. For low-wage-gap stocks, short-sales constraints are never binding, and then abnormal returns are always negative:

$$r^{*}(\underline{e}) = \begin{cases} \frac{q}{\gamma} - (\phi - \phi(\underline{e}))K & \text{(Case 1)} \\ \frac{q}{\gamma} - \lambda(\phi - \phi(\underline{e}))K & \text{(Case 2)} \\ \frac{q}{\gamma} - \lambda\beta\left(v - \frac{W_j}{w_j}\right) & \text{(Case 3).} \end{cases} \tag{B.10}$$

As a result, we obtain Proposition 1c. Stocks with high wage-gaps outperform stocks with low wage-gaps:

$$r_c^{*}(\bar{e}) - r^{*}(\underline{e}) = \begin{cases} (\phi(\bar{e}) - \phi(\underline{e}))K & \text{(Case 1)} \\ \lambda(\phi - \phi(\underline{e}))K & \text{(Case 2)} \\ \lambda\beta\left(v - \frac{W_j}{w_j}\right) & \text{(Case 3).} \end{cases} \tag{B.11}$$

Finally, we derive Corollary 1, as the return differential between high- and low-wage-gap stocks (case 3) increases with the difference in wage gaps, the proportion of inequality-averse investors in the market, and the inequality-aversion preference.

Appendix C. Additional tables

Table C.1
CEO–workers wage gap and firm performance.

Panel A. Unadjusted ROA, firm and year fixed-effects				
	Total pay		Cash pay	
	(1)	(2)	(3)	(4)
Wage gap	0.026**	0.026**	0.029**	0.029**
	2.15	2.08	2.27	2.20
Employees		−0.015		−0.014
		−0.55		−0.52
Constant	0.057	0.209	0.041	0.186
	0.78	0.71	0.58	0.59
Fixed-effects: Firm and year	Y	Y	Y	Y
Clustering: Firm and year	Y	Y	Y	Y
Adj. R-squared	0.725	0.725	0.726	0.726
Observations	552	552	552	552
Panel B. Unadjusted ROA, Lerner index breakdown				
	Total pay		Cash pay	
	(1)	(2)	(3)	(4)
	High margin	Low margin	High margin	Low margin
Wage gap	0.003	0.017	0.007	0.030**
	0.27	0.91	0.51	2.06
Employees	−0.005	0.017	−0.005	0.014
	−0.77	1.34	−0.86	1.22
Constant	0.109**	−0.180	0.103**	−0.191*
	2.62	−1.66	2.57	−1.73
Fixed-effects: Year	Y	Y	Y	Y
Clustering: Firm	Y	Y	Y	Y
Adj. R-squared	0.017	0.107	0.023	0.125
Observations	272	309	272	309
Panel C. Industry-adjusted ROA				
	Total pay		Cash pay	
	(1)	(2)	(3)	(4)
Wage gap	0.028**	0.019	0.037***	0.031***
	2.29	1.45	2.73	2.72
Employees		0.008		0.006
		0.86		0.66
Constant	−0.107**	−0.152*	−0.134**	−0.164*
	−1.99	−1.74	−2.34	−1.82
Fixed-effects: Year	Y	Y	Y	Y
Clustering: Firm	Y	Y	Y	Y
Adj. R-squared	0.044	0.055	0.073	0.077
Observations	552	552	552	552
Panel D. CEO–workers wage gap				
	Total pay	Cash pay	Fixed pay	
	(1)	(2)	(3)	
ROA (−1)	1.247	1.043	−0.065	
	1.37	1.17	−0.10	
ROA (−2)	−0.488	−0.204	−0.573	
	−0.79	−0.33	−1.09	
ROA (−3)	0.698	0.721	0.763	
	1.22	1.32	1.53	
ROA (−4)	0.747	0.833	0.884	
	1.19	1.38	1.65	

(*continued on next page*)

Table C.1 (*continued*).

Constant	3.859***	3.634***	2.939***
	31.04	32.16	27.94
Fixed-effects: Year	Y	Y	Y
Clustering: Firm	Y	Y	Y
Adj. R-squared	0.027	0.035	0.008
Observations	406	406	406

Panel regressions of firms' return on assets (ROA), defined as EBITDA divided by total assets, on the wage gap between CEO and workers, lagged one year and expressed in logs, and the logarithm of the firm's employees. CEO compensation is measured either as total annual pay, including cash and stocks, or cash only. Workers' pay is measured as the annual wage paid in establishments that are located in the same state as the firm's headquarters, calculated as a weighted average across establishments, where the weights are represented by the number of employees in each establishment. In Panel B, we split the sample into firms that belong in industries with a low or high degree of competition, defined as those whose Lerner index takes on above- and below-median values, respectively. In Panel C, we consider industry-adjusted ROA, constructed by subtracting the industry median across all firms in Amadeus in the same two-digit SIC industry and year. In Panel D, we estimate panel regressions of the log wage gap between CEO and workers and several lags of ROA. Company-level accounting and stock market data are from Worldscope and Datastream, CEO compensation data are from the companies' annual reports, workers' data are from the German Federal Employment Agency. Observations are annual, and the sample period is from 2002 to 2011. The numbers below the coefficients are t statistics, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.2
CEO–workers wage gap: Annual rebalancing.

Panel A						
30% threshold	Total wage gap			Cash wage gap		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	−0.001	−0.009**	0.008**	0.001	−0.008**	0.009***
	−0.18	−2.26	2.34	0.44	−2.24	2.91
MKT	0.998***	0.814***	0.184***	0.936***	0.798***	0.137**
	9.59	6.60	3.62	8.54	6.45	2.07
SMB	−0.767**	0.192	−0.960**	−0.815**	0.189	−1.004**
	−2.08	0.65	−2.23	−2.23	0.67	−2.38
HML	−0.393*	−0.249	−0.144	−0.355	−0.237	−0.118
	−1.91	−0.72	−0.60	−1.61	−0.70	−0.61
UMD	−0.260*	−0.379**	0.119**	−0.309**	−0.388**	0.079
	−1.96	−2.46	2.19	−2.54	−2.46	0.99
Adj. R-squared	0.692	0.576	0.176	0.693	0.572	0.180
Observations	120	120	120	120	120	120
Panel B						
30% threshold	Total wage gap			Cash wage gap		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.001	−0.012***	0.013***	0.003	−0.010**	0.012**
	0.26	−2.96	2.81	0.48	−2.28	2.43
MKT	1.060***	0.831***	0.230**	1.056***	0.826***	0.230**
	6.32	6.03	2.41	5.97	6.29	2.19
SMB	−1.444**	0.368	−1.812***	−1.331**	0.211	−1.543**
	−2.25	1.29	−2.82	−1.97	0.67	−2.06
HML	−0.831**	−0.406	−0.425	−0.934**	−0.354	−0.580*
	−2.35	−1.10	−1.60	−2.52	−0.95	−1.91
UMD	−0.452**	−0.407***	−0.045	−0.389*	−0.441***	0.052
	−2.16	−2.77	−0.47	−1.65	−3.25	0.40
Adj. R-squared	0.594	0.529	0.268	0.558	0.532	0.189
Observations	120	120	120	120	120	120
Panel C						
30% threshold	Total wage gap			Cash wage gap		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.002	−0.016***	0.018***	−0.001	−0.017***	0.016***
	0.62	−3.60	6.48	−0.27	−2.78	4.11
MKT	0.703***	0.712***	−0.009	0.800***	0.537***	0.263***
	7.74	4.64	−0.05	9.96	5.93	3.35
SMB	−0.582***	0.775**	−1.357***	−0.300*	0.591*	−0.891**
	−3.60	2.36	−3.80	−1.76	1.69	−2.32

(*continued on next page*)

Table C.2 (*continued*).

HML	0.363	0.270	0.093	0.252	0.472	−0.220
	1.47	0.78	0.35	1.18	1.17	−0.64
UMD	−0.185	−0.238***	0.053	−0.220*	−0.297***	0.077
	−1.49	−2.60	0.57	−1.90	−2.78	0.95
Adj. R-squared	0.571	0.376	0.112	0.600	0.304	0.068
Observations	108	108	108	108	108	108

Carhart's (1997) four-factor model regressions of equal-weighted returns on a portfolio of stocks with high inequality between CEO and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 5), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). Pay inequality is defined as the difference in earnings between CEO and workers. CEO compensation is calculated as the overall annual pay, including cash and stocks, in columns (1–3), and as cash pay in columns (4–6). Workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each year. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% (Panel A), 20% (Panel B), and 10% (Panel C) of the distribution. Company-level stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Observations are monthly, and the sample period is from January 2002 to December 2011. Heteroskedasticity and autocorrelation-robust *t*-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.3
Managers–workers wage gap: Four-factor model regressions.

Panel A						
30% threshold	Monthly rebalancing			Annual rebalancing		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.003	−0.008**	0.011***	0.001	−0.008**	0.009**
	0.59	−2.07	2.62	0.30	−2.02	2.15
MKT	1.085***	0.749***	0.335**	1.107***	0.810***	0.297**
	6.39	7.41	2.46	6.80	7.67	2.41
SMB	−1.316**	0.29	−1.606***	−1.200**	0.351	−1.551**
	−2.39	1.18	−2.98	−2.04	1.42	−2.54
HML	−0.744**	0.063	−0.806***	−0.689*	−0.131	−0.559**
	−1.97	0.22	−3.63	−1.89	−0.50	−2.36
UMD	−0.387**	−0.292**	−0.095	−0.459***	−0.328***	−0.131
	−2.34	−2.35	−1.10	−3.06	−3.10	−1.45
Adj. R-squared	0.661	0.563	0.373	0.673	0.601	0.333
Observations	120	120	120	120	120	120
Panel B						
30% threshold	Monthly rebalancing			Annual rebalancing		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.001	−0.015***	0.012**	−0.001	−0.010**	0.010*
	0.26	−2.59	2.28	−0.12	−2.37	1.87
MKT	1.138***	0.780***	0.358***	1.128***	0.815***	0.312***
	6.91	5.14	3.38	6.88	5.64	3.14
SMB	−1.452**	0.305	−1.758***	−1.318**	0.336	−1.653**
	−2.35	0.90	−2.69	−1.99	1.12	−2.36
HML	−0.726**	−0.351	−0.375	−0.743**	−0.370	−0.373
	−2.09	−0.91	−1.60	−2.12	−0.97	−1.38
UMD	−0.454**	−0.411**	−0.043	−0.455**	−0.433***	−0.023
	−2.43	−2.46	−0.42	−2.27	−2.94	−0.22
Adj. R-squared	0.628	0.488	0.286	0.603	0.517	0.245
Observations	120	120	120	120	120	120
Panel C						
30% threshold	Monthly rebalancing			Annual rebalancing		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.006*	−0.020***	0.026***	0.002	−0.019***	0.021***
	1.78	−4.10	7.63	0.48	−4.55	5.88
MKT	0.710***	0.738***	−0.028	0.705***	0.649***	0.056
	7.83	4.77	−0.13	9.20	5.04	0.35

(*continued on next page*)

Table C.3 (*continued*).

SMB	−0.724***	0.851***	−1.575***	−0.551***	0.866***	−1.416***
	−4.89	3.04	−5.40	−2.84	3.67	−5.26
HML	0.389	−0.387	0.777*	0.477**	0.021	0.457
	1.49	−1.02	1.86	2.19	0.06	1.16
UMD	−0.206*	−0.270**	0.064	−0.225*	−0.112	−0.114
	−1.77	−2.12	0.61	−1.94	−0.98	−0.64
Adj. R-squared	0.586	0.362	0.156	0.590	0.354	0.163
Observations	108	108	108	108	108	108

Carhart's (1997) four-factor model regressions of equal-weighted returns on a portfolio of stocks with high inequality between managers and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 5), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). Pay inequality is defined as the difference in earnings between managers and workers. Managerial compensation is calculated as the overall annual pay, including cash and stocks. Workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month in columns (1–3), and at the beginning of each year in columns (4–6). We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% (Panel A), 20% (Panel B), and 10% (Panel C) of the distribution. Company-level stock market data is from Worldscope and Datastream, managerial compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Observations are monthly, and the sample period is from January 2002 to December 2011. Heteroskedasticity and autocorrelation-robust t-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.4
Fama–MacBeth regressions: CEO–workers wage gap as a continuous variable.

Dep. variable: Returns	Total pay (1)	Cash pay (2)
Wage gap	0.007	0.007
	1.26	1.08
Book-to-market (−1)	−0.012	−0.012
	−0.72	−0.69
Dividend yield (−1)	−0.004	−0.004
	−0.96	−1.07
CumRet (2,3)	0.009	0.022
	0.44	1.41
CumRet (4,6)	0.012	0.022
	0.51	0.79
CumRet (7,12)	0.040***	0.026
	3.97	1.6
Size (−1)	−0.004	−0.005
	−0.83	−0.87
Stock price (−2)	−0.004	−0.003
	−1.14	−0.86
Trading volume (−2)	−0.001	−0.001
	−0.65	−0.35
Constant	0.01	0.014
	0.39	0.46
R-squared	0.384	0.383
Observations	4677	4677

Fama–MacBeth regressions from Brennan et al. (1998) of returns on German stocks on the firm's wage gap at the beginning of the month, and a vector of firm characteristics that includes: the log of the book-to-market ratio (calculated each July and held constant through the following June), the ratio of dividends in the previous fiscal year to market value at calendar year-end (calculated each July and held constant through the following June), the log of cumulative returns over months $t-3$ through $t-2$, months $t-6$ through $t-4$, and months $t-12$ through $t-7$, size (defined as the log of market capitalization at the end of month $t-2$), the log of the dollar volume of trading in the stock in month $t-2$, and the log of the stock price at the end of month $t-2$. CEO compensation is measured as total pay in column (1), and cash pay in column (2). Workers' pay is measured as the annual wage paid in establishments that are located in the same state as the firm's headquarters, calculated as a weighted average across establishments, where the weights are represented by the number of employees in each establishment. Company-level stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Observations are monthly, and the sample period is from January 2002 to December 2011. The numbers below the coefficients are t statistics, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.5
CEO–workers wage gap: Value-weighted returns.

30% threshold	Total wage gap			Cash wage gap		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	0.006	0.002	0.004	0.006	0.000	0.006
	1.30	0.69	0.80	1.34	0.10	1.29
MKT	0.886***	0.614***	0.272**	0.829***	0.714***	0.115
	4.35	5.07	2.53	3.68	7.57	0.68
SMB	−1.700***	−0.178	−1.522***	−1.779***	−0.089	−1.690***
	−3.14	−0.73	−3.40	−3.20	−0.51	−3.67
HML	−0.489	−0.013	−0.476**	−0.416	−0.121	−0.296
	−1.22	−0.04	−2.43	−0.95	−0.47	−1.05
UMD	−0.420*	−0.332**	−0.088	−0.426*	−0.335**	−0.091
	−1.86	−2.06	−1.03	−1.85	−2.31	−0.85
Adj. R-squared	0.567	0.506	0.322	0.543	0.560	0.280
Observations	120	120	120	120	120	120

Carhart's (1997) four-factor model regressions of value-weighted returns on a portfolio of stocks with high inequality between CEO and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 5), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). Pay inequality is defined as the difference in earnings between CEO and workers. CEO compensation is calculated as the overall annual pay, including cash and stocks, in columns (1–3), and as cash pay in columns (4–6). Workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% of the distribution. Company-level stock market data are from Worldscope and Datastream, CEO compensation data are from the companies' annual reports, and workers' data are from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Observations are monthly, and the sample period is from January 2002 to December 2011. Heteroskedasticity and autocorrelation-robust *t*-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.6
CEO–workers wage gap, income inequality, and valuations: Sample breakdown.

Panel A. High wage-gap						
Dep. variable: Tobin's q	Total pay			Cash pay		
	(1)	(2)	(3)	(4)	(5)	(6)
Wage gap	0.599	0.682	0.989*	−0.272	−0.145	0.940*
	0.87	0.86	1.91	−0.20	−0.12	1.98
Employees		−0.940*	−0.942*		−0.922*	−0.910*
		−1.80	−1.81		−1.92	−1.97
Wage gap x Inequality (d)			−0.386			−1.392
			−0.85			−1.21
Constant	−1.175	8.528	8.423	2.825	12.162	11.686
	−0.39	1.42	1.42	0.46	1.35	1.39
Year FE	Y	Y	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R-squared	0.034	0.161	0.159	0.025	0.146	0.153
Observations	260	260	260	260	260	260
Panel B. Low wage-gap						
Dep. variable: Tobin's q	Total pay			Cash pay		
	(1)	(2)	(3)	(4)	(5)	(6)
Wage gap	−0.122	−0.024	0.065	−0.207	−0.129	−0.049
	−0.84	−0.14	0.35	−1.56	−0.85	−0.27
Employees		−0.082	−0.085		−0.062	−0.064
		−1.06	−1.10		−0.84	−0.86
Wage gap x Inequality (d)			−0.106			−0.095
			−0.67			−0.56
Constant	1.418***	1.809***	1.788***	1.658***	1.950***	1.930***
	2.69	2.97	2.95	3.37	3.22	3.21

(*continued on next page*)

Table C.6 (*continued*).

Year FE	Y	Y	Y	Y	Y	Y
Clustering	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R-squared	0.024	0.028	0.024	0.030	0.030	0.027
Observations	265	265	265	265	265	265

Panel regressions of firms' Tobin's q, defined as enterprise value (debt plus market value of equity) divided by book value (debt plus book value of equity), on the wage gap between CEO and workers, lagged one year and expressed in logs, the logarithm of the firm's employees, and an interaction term between the wage gap and a dummy that takes on value one if income inequality, defined as the top 1% fiscal income share in Germany, has increased over a given year, and zero otherwise. CEO compensation is measured as total annual pay, including cash and stocks, in columns (1) to (3), and as cash only in columns (4) to (6). Workers' pay is measured as the annual wage paid in establishments that are located in the same state as the firm's headquarters, calculated as a weighted average across establishments, where the weights are represented by the number of employees in each establishment. In Panels A and B, we only consider firms with above- and below-median wage gaps, respectively. All specifications include year fixed-effects, and standard errors are clustered by firm. Company-level accounting and stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, workers' data is from the German Federal Employment Agency, and income inequality data is from the World Inequality Database. Observations are monthly. The sample period is from 2002 to 2011. The numbers below the coefficients are t statistics, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.7
CEO–workers wage gap, Fama–MacBeth regressions: iVol and penny stocks.

Dep. variable: Returns	(1)	(2)	(3)	(4)
30% threshold	Total pay	Cash pay	Total pay	Cash pay
Wage gap (d)	0.013**	0.010**	0.019***	0.013**
	2.28	2.23	3.02	2.46
iVol (d)	−0.002	−0.005	−0.006	−0.004
	−0.39	−0.89	−0.72	−0.66
Book-to-market (−1)	0.012	−0.008	0.027	0.032
	0.34	−0.34	0.81	0.94
Dividend yield (−1)	−0.007*	−0.006	−0.005	−0.007*
	−1.91	−1.49	−1.17	−1.91
CumRet (−2,−3)	0.044	0.004	0.070**	0.041
	1.50	0.15	2.21	1.49
CumRet (−4,−6)	0.038*	0.032	0.043**	0.029
	1.90	1.15	2.03	1.10
CumRet (−7,−12)	0.030**	0.046***	0.025	0.038**
	2.15	3.72	1.30	2.40
Size (−2)	−0.001	0.002	−0.002	0.000
	−0.19	0.46	−0.48	−0.10
Stock price (−2)	−0.003	−0.002	−0.008	−0.008*
	−0.83	−0.51	−1.57	−1.85
Trading volume (−2)	−0.003	−0.005	−0.003	−0.004
	−1.21	−1.37	−1.03	−1.30
Constant	−0.039	−0.042	−0.026	−0.050
	−1.27	−1.14	−0.79	−1.41
Penny stocks	Y	Y	N	N
R-squared	0.596	0.581	0.597	0.593
Observations	2722	2718	2673	2670

Fama–MacBeth regressions from Brennan et al. (1998) of returns on German stocks on a dummy-variable wage-gap that takes on value one if firm i's wage gap is among the top 30% at the beginning of the month, an idiosyncratic volatility dummy (iVol (d)), defined as a dummy variable that takes on value one if idiosyncratic volatility, defined as the standard deviation of the residuals from the regressions of individual stock returns on the Carhart (1997) four-factor model, is above its median value at the beginning of the month, and a vector of firm characteristics, which includes: the log of the book-to-market ratio (calculated each July and held constant through the following June), the ratio of dividends in the previous fiscal year to market value at calendar year-end (calculated each July and held constant through the following June), the log of cumulative returns over months $t-3$ through $t-2$, months $t-6$ through $t-4$, and months $t-12$ through $t-7$, size (defined as the log of market capitalization at the end of month $t-2$), the log of the dollar volume of trading in the stock in month $t-2$, and the log of the stock price at the end of month $t-2$. In all specifications, we exclude the middle 40% wage-gap stocks. CEO compensation is measured as total pay in columns (1) and (3), and cash pay in columns (2) and (4). Workers' pay is measured as the annual wage paid in establishments that are located in the same state as the firm's headquarters, calculated as a weighted average across establishments, where the weights are represented by the number of employees in each establishment. In columns (3) and (4), we exclude penny stocks, defined as stocks whose price is below the €5 threshold. The average number of penny stocks is 2.0 among high-wage-gap stocks, and 2.9 among low-wage-gap stocks. Company-level stock market data is from Worldscope and Datastream, CEO compensation data is from the companies' annual reports, and workers' data is from the German Federal Employment Agency. Observations are monthly, and the sample period is from January 2002 to December 2011. The numbers below the coefficients are t statistics, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.8
CEO–workers wage gap: CAPM regressions.

Panel A						
30% threshold	Total wage gap			Cash wage gap		
	(1)	(2)	(3)	(4)	(5)	(6)
	R30 high	R30 low	R30 high–low	R30 high	R30 low	R30 high–low
Alpha	−0.004	−0.012***	0.008**	−0.004	−0.012***	0.008**
	−1.42	−2.66	2.39	−1.35	−2.68	2.00
MKT	1.019***	0.904***	0.115	0.985***	0.899***	0.085
	5.21	5.98	1.02	4.91	5.71	0.66
Adj. R-squared	0.618	0.546	0.014	0.604	0.534	0.003
Observations	120	120	120	120	120	120
Panel B						
20% threshold	Total wage gap			Cash wage gap		
	(1)	(2)	(3)	(4)	(5)	(6)
	R20 high	R20 low	R20 high–low	R20 high	R20 low	R20 high–low
Alpha	−0.005	−0.016***	0.011**	−0.005	−0.016***	0.011*
	−0.99	−3.20	2.10	−0.82	−2.83	1.83
MKT	1.115***	0.945***	0.17	1.094***	0.954***	0.14
	3.51	5.09	0.70	3.40	5.30	0.58
Adj. R-squared	0.439	0.487	0.009	0.43	0.494	0.004
Observations	120	120	120	120	120	120
Panel C						
10% threshold	Total wage gap			Cash wage gap		
	(1)	(2)	(3)	(4)	(5)	(6)
	R10 high	R10 low	R10 high–low	R10 high	R10 low	R10 high–low
Alpha	0.002	−0.015**	0.018***	0.004	−0.015*	0.018***
	1.15	−2.39	2.79	1.15	−1.89	2.62
MKT	0.738***	0.974***	−0.235	0.659***	0.838***	−0.180
	7.76	4.32	−0.94	5.85	4.66	−1.02
Adj. R-squared	0.548	0.350	0.020	0.408	0.285	0.013
Observations	108	108	108	108	108	108

CAPM regressions of equal-weighted returns on a portfolio of stocks with high inequality between CEO and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 5), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). Pay inequality is defined as the difference in earnings between CEO and workers. CEO compensation is calculated as the overall annual pay, including cash and stocks, in columns (1–3), and as cash pay in columns (4–6). Workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% (Panel A), 20% (Panel B), and 10% (Panel C) of the distribution. Company-level stock market data are from Worldscope and Datastream, CEO compensation data are from the companies' annual reports, and workers' data are from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Observations are monthly, and the sample period is from January 2002 to December 2011. Heteroskedasticity and autocorrelation-robust *t*-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.9
CEO–workers wage gap: Alternative factor models.

Panel A						
	R30 high–low		R20 high–low		R10 high–low	
	(1)	(2)	(3)	(4)	(5)	(6)
Alpha	0.009***	0.010***	0.015***	0.016***	0.016***	0.019***
	3.10	3.65	2.91	3.83	2.68	4.24
Pástor and Stambaugh (2003)	Y	N	Y	N	Y	N
Fama and French (2015)	N	Y	N	Y	N	Y
Adj. R-squared	0.218	0.214	0.263	0.272	0.152	0.115
Observations	120	120	120	120	108	108
Panel B						
	R30 high–low		R20 high–low		R10 high–low	
	(1)	(2)	(3)	(4)	(5)	(6)
Alpha	0.007**	0.009***	0.010*	0.014***	0.015**	0.021***
	2.14	4.14	1.71	4.23	2.00	4.90
Novy-Marx (2013)	Y	N	Y	N	Y	N
Stambaugh and Yuan (2017)	N	Y	N	Y	N	Y
Adj. R-squared	0.016	0.221	0.043	0.263	0.037	0.129
Observations	120	120	120	120	108	108

Factor model regressions of equal-weighted returns on a portfolio with a long position in stocks with high pay-inequality between CEO and workers, and a short position in a portfolio of stocks for which such inequality is low. In Panel A, columns (1), (3), and (5), we consider Carhart's (1997) European four-factor model from Kenneth French's website and augment it with the U.S. liquidity factor from Pástor and Stambaugh (2003), while in columns (2), (4), and (6), we consider the European three-factor model from Kenneth French's website, and augment it with the U.S. investment and profitability factors from Fama and French (2015). In Panel B, columns (1), (3), and (5), we consider the European market, book-to-market, and momentum factors from Kenneth French's website, and add the U.S. profitability factor from Novy-Marx (2013), while in columns (2), (4), and (6), we consider the European market and size factors from Kenneth French's website, and add the U.S. management and performance factors from Stambaugh and Yuan (2017). Pay inequality is defined as the difference in earnings between CEO and workers. CEO compensation is calculated as the overall annual pay, including cash and stocks, while workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% (columns 1–2), 20% (columns 3–4), and 10% (columns 5–6) of the distribution. Company-level stock market data are from Worldscope and Datastream, CEO compensation data are from the companies' annual reports, and workers' data are from the German Federal Employment Agency. Observations are monthly, and the sample period is from January 2002 to December 2011. Heteroskedasticity and autocorrelation-robust t-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.10
CEO–workers wage gap: Post-reform subsample.

Panel A						
30% threshold	Total wage gap			Cash wage gap		
	(1) R30 high	(2) R30 low	(3) R30 high–low	(4) R30 high	(5) R30 low	(6) R30 high–low
Alpha	−0.002	−0.008**	0.005***	−0.002	−0.009**	0.007**
	−0.88	−2.13	3.22	−0.92	−2.11	2.03
MKT	0.789***	0.637***	0.152	0.742***	0.612***	0.130
	11.75	6.32	1.52	12.75	5.71	1.07
SMB	−0.401***	0.359	−0.760***	−0.334**	0.286	−0.621***
	−2.93	1.23	−2.85	−2.56	1.06	−3.38
HML	0.045	0.362	−0.317*	0.151	0.340	−0.188
	0.24	1.26	−1.65	0.90	1.21	−1.26
UMD	−0.053	−0.155**	0.101	−0.022	−0.201**	0.179*
	−0.55	−2.04	1.26	−0.21	−2.34	1.72
Adj. R-squared	0.743	0.644	0.173	0.740	0.628	0.135
Observations	72	72	72	72	72	72
Panel B						
20% threshold	Total wage gap			Cash wage gap		
	(1) R20 high	(2) R20 low	(3) R20 high–low	(4) R20 high	(5) R20 low	(6) R20 high–low
Alpha	−0.002	−0.011***	0.010***	0.000	−0.015***	0.015***
	−0.88	−3.16	3.61	0.25	−3.03	3.51
MKT	0.754***	0.645***	0.109	0.724***	0.667***	0.057
	13.68	4.14	0.69	11.86	4.48	0.34
SMB	−0.668***	0.387	−1.054***	−0.454***	0.216	−0.670***
	−3.95	1.24	−5.38	−2.74	0.73	−3.26
HML	0.118	0.304	−0.186	0.079	0.299	−0.220
	0.74	0.83	−0.68	0.42	0.87	−0.97
UMD	−0.056	−0.232**	0.177	−0.077	−0.191**	0.114
	−0.49	−2.55	1.47	−0.62	−2.08	0.81
Adj. R-squared	0.762	0.567	0.185	0.747	0.546	0.05
Observations	72	72	72	72	72	72
Panel C						
10% threshold	Total wage gap			Cash wage gap		
	(1) R10 high	(2) R10 low	(3) R10 high–low	(4) R10 high	(5) R10 low	(6) R30 high–low
Alpha	0.001	−0.021***	0.022***	−0.002	−0.020***	0.018***
	0.44	−6.44	7.22	−1.05	−3.15	3.02
MKT	0.582***	0.761***	−0.180	0.573***	0.488***	0.085
	5.83	3.59	−0.61	6.13	5.13	0.49
SMB	−0.695***	0.513*	−1.207***	−0.756***	0.277	−1.033***
	−4.03	1.82	−4.60	−3.37	0.79	−5.15
HML	0.456**	0.041	0.414	0.167	0.436	−0.269
	2.05	0.11	1.13	0.59	1.13	−1.02
UMD	−0.040	−0.248**	0.208	0.080	−0.375***	0.455***
	−0.30	−2.50	1.27	0.58	−3.46	4.17
Adj. R-squared	0.643	0.473	0.133	0.565	0.431	0.209
Observations	72	72	72	72	72	72

Carhart's (1997) four-factor model regressions of equal-weighted returns on a portfolio of stocks with high inequality between CEO and workers' pay (columns 1 and 4), a portfolio of stocks for which such inequality is low (columns 2 and 5), and a portfolio with a long position in high-inequality stocks and a short position in low-inequality stocks (columns 3 and 6). The regressions are estimated during the period that followed the recent German reform on executive compensation disclosure. Before the reform, listed companies only had to report the aggregate pay of their key corporate executives. Since corporations were not keen on providing information on individual managers' pay, the Federal Government of Germany passed a regulation effective 2006 that made such disclosure mandatory. Pay inequality is defined as the difference in earnings between CEO and workers. CEO compensation is measured as total pay in columns (1) to (3), and cash pay in columns (4) to (6). Workers' pay is measured as the average annual wage paid in establishments that are located in the same state as the firm's headquarters, weighted by the number of employees in each establishment. To construct our test portfolios, we rank all stocks in pay inequality quantiles and rebalance them at the beginning of each month. We define high- and low-wage-gap stocks, respectively, as the stocks that lie at the top and the bottom 30% (Panel A), 20% (Panel B), and 10% (Panel C) of the distribution. Company-level stock market data are from Worldscope and Datastream, CEO compensation data are from the companies' annual reports, and workers' data are from the German Federal Employment Agency. Factor-mimicking portfolios are from Kenneth French's website and refer to Europe. Observations are monthly, and the sample period is from January 2006 to December 2011. Heteroskedasticity and autocorrelation-robust t-statistics are below the coefficients, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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