

# Pay transparency: fairness and morale considerations in wage-setting policies

Master's thesis Economics of Management and Organisation

Lennart Cox

Erasmus University Rotterdam  
Erasmus School of Economics

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Student number: 400124

Supervisor: Prof. dr. Bauke Visser

Second assessor: Dr. Josse Delfgaauw

## Abstract

The emergence of pay transparency policies suggests an increased emphasis on fairness within the workplace. Nonetheless, the implications of pay transparency on pay structures and organizational performance remain unclear. This paper builds on the model of Fang and Moscarini (2005) to formalize employees' responses to pay information and to subsequently determine the firm's optimal wage policy and corresponding firm profits. In this extended model, the employees are offered a contingent wage contract and perform a simple task which they can either complete successfully or not. Only in case of success the employee is compensated. The firm's employees are concerned with their own individual payoff in addition to believing performance should be rewarded equally. Pay transparency serves as a self-evaluation mechanism to employees and influences their perceptions of fairness. This paper suggests that balancing employees' fairness perceptions, their confidence in their ability and the benefits of tailoring contracts determines the optimal wage policy of the firm.

## 1. Introduction

Recent amendments to the Dodd-Frank Wall Street Reform and Consumer Protection Act – which requires public companies to disclose the ratio of the compensation of its Chief Executive Officer (CEO) to the median compensation of its employees for the fiscal year 2017 and onwards – can be seen as concern from society regarding fairness in compensation. However, the increased demand for pay transparency is not limited to top management: states and cities in the US have increasingly disclosed worker salaries as part of sunshine initiatives and a memorandum by former president Barack Obama recommends requiring summary data on employee compensation by race and sex of federal contractors. On the other side of the Atlantic, Norway goes even as far as publishing its residents' tax returns online and Germany recently passed the 'Entgelttransparenzgesetz', which requires companies with more than two hundred employees to publish reports on equality and equal pay and, moreover, establishes an employee's individual right to information about colleagues' pay.<sup>1</sup>

Transparency in pay is predominantly present in the public sector and is often a response to societal concerns about pay discrimination and inequality. Some firms however opt to be transparent in their remuneration practices themselves. Buffer for instance, a company which designed the equivalently named social media management tool, publicly discloses all its employees' salaries on their website, in addition to the formula used to construct these compensation packages. Likewise, consulting firm Finext employs teams which are self-regulating, where individual salary increases require consent of the whole team. These policies serve a common purpose: reducing perceived unfairness in pay practices.

Collela, Paetzold, Zardkoohi and Wesson (2007) argue that pay transparency is imperative in experiencing fairness, with unfairness being associated with negative consequences such as lower productivity and product quality (Cowherd & Levine, 1992). Results from the 2010 IWPR/Rockefeller Survey of Economic Security however indicate that most employers are reluctant to disclose the remuneration of their employees, especially to be as radically transparent as Buffer or Finext are. Roughly half of the surveyed employees reported that they were either explicitly prohibited or strongly discouraged from discussing their compensation with colleagues (Hayes & Hartmann, 2011). Apparently, restricting the distribution of information is sometimes desired by employers. This brings

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<sup>1</sup> See <https://www.sec.gov/news/statement/reconsideration-of-pay-ratio-rule-implementation.html> for the SEC rule of CEO pay relative to the median worker, [https://ballotpedia.org/Public\\_employee\\_salary](https://ballotpedia.org/Public_employee_salary) for a detailed overview of states with employee salary databases, <https://obamawhitehouse.archives.gov/the-press-office/2016/01/29/fact-sheet-new-steps-advance-equal-pay-seventh-anniversary-lilly> for Obama's presidential memorandum (issued April 2014), <https://www.theguardian.com/money/blog/2016/apr/11/when-it-comes-to-tax-transparency-norway-leads-the-field> for an article on Norway publishing its residents tax returns online and see <https://www.welt.de/wirtschaft/article163144947/Das-Lohnvergleichsgesetz-gehört-in-die-Tonne.html> for some background on the German Pay Transparency Act.

us to question the following: Why does one firm prohibit the exchange of salary information whilst the other opts for complete transparency instead?

In recent years our understanding of how available information shapes preferences concerning inequality and redistribution has increased substantially (Cruces, Perez-Truglia, & Tetax, 2013; Kuziemko, Norton, Saez, & Stantcheva, 2015). Nevertheless, the relationship between transparency and pay structures has received considerably less attention. The implications of transparency on organizational performance remain unclear and thereby also the justification of why some firms may opt for secrecy instead. Transparency in pay potentially evokes a different response from society than it does from a firm's workforce, although these responses can generally not be segregated empirically.<sup>2</sup>

The internal costs of pay secrecy mainly comprise the sacrifice of employees' fairness judgements and the potential decrease in motivation due to a lack of self-evaluation (Colella, Paetzold, Zardkoohi, & Wesson, 2007). Fang and Moscarini (2005) have developed a theoretical framework that explains a firm's wage policy choice by capturing the latter. The firm is considered to be able to offer employees either different contracts or to offer them all the same contract. Observing different contracts indicates to employees that they are of different ability. The workforce updates its beliefs in their ability up or downwards in light of this information. The firm internalizes these considerations and may decide to offer each employee the same contract to prevent this updating. One of the key assumptions in this framework is that pay is transparent.

The purpose of this paper is to formalize the workforce's response to transparency and the organizational implications it has. This paper largely adopts the framework of Fang and Moscarini (2005) to describe the firm's wage policy choice. The prime adaptation is that the firm is considered to be able to strategically choose whether or not to distribute pay information. The underlying assumption is that perceiving unfairness increases the costs of exerting effort. Employees only receive compensation in case of 'high' performance. This particular wage contract is actually very common, since it allows the firm to tailor contracts to employees' ability. Moreover, it allows a reasonable incorporation of fairness: employees believe that similar performance should yield comparable rewards.

Besides managing employees' self-perceptions, this paper poses that the firm also needs to internalize the fairness considerations of its employees. The analysis shows that secretly offering employees the same contract is never optimal. Any of the other three considered policies is potentially optimal: the firm may either choose to publicly offer the same contract to everyone, to publicly differentiate between employees, or to secretly do the latter. Other kinds of social preferences, or

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<sup>2</sup> See for instance Mas (2016b), who argues that pay information is not necessarily distributed solely to employees. Hence, separately establishing the response of the firm's workforce, or society's, is virtually impossible.

privacy concerns, are not incorporated in the analysis, primarily because doing so is considered to yield an investigation too extensive for a single paper.

The structure of this paper is as follows. Section 2 summarizes the relevant literature on feelings of inequity within organizations and relates these to pay transparency. Thereafter, Section 3 describes the model of Fang and Moscarini (2005) in more detail as well as the fundamental adaptations implemented in this paper. Section 4 analyzes the model put forward in the previous section algebraically. Some numerical illustrations are provided in Section 5. Hereafter, Section 6 discusses some of the model's assumptions in addition to providing recommendations for further research. Lastly, Section 7 concludes.

## **2. Related literature**

This paper relates largely to the social psychology and economics literature. More specifically, this paper concerns the importance of social comparisons and feelings of inequity in pay structures and considers how these relate to transparency in remuneration practices.

### **2.1. Pay structures and social comparisons**

Lawler (1981) poses that pay structure design, specifically the dispersion (or compression) of pay, has critical implications for both strategy implementation and organizational performance. Nevertheless, conditions under which pay dispersion result in increased organizational performance remain unclear. Bishop (1987) identifies three core benefits of dispersed pay structures: they provide incentives for higher effort, they invoke a selection effect and they make it less likely that good performers leave the firm. Shaw, Gupta and Delery (2002) note that these arguments assume that dispersion occurs for legitimate reasons and that human capital is rewarded fairly; if this is not the case, dispersion in pay is unlikely to be effective. Moreover, Suchman (1995) notes the importance of moral legitimacy: the motivating aspects of pay dispersion are only effective when encompassed by legitimate or normatively accepted factors. When pay dispersion is perceived as being unjust, it can lead to effort reduction, retaliation and even sabotage (Skarlicki & Folger, 1997).

The adverse behavioral responses to wage differentials as described above fall broadly under what is known as 'distributive justice', which suggests that employees' assessments about fairness in pay potentially influence their behavior and performance. Individuals have the urge to evaluate their opinions and capabilities against a reference group, which consists of individuals who they consider to be similar to themselves (Festinger, 1954). This process of comparison also applies to social exchange relationships, with people believing that rewards should be distributed according to one's contributions. Individuals judge fairness by comparing how they are rewarded for their contribution compared to others (Adams, 1965; Crosby, 1984). The 'fair wage-effort hypothesis' even conceptualizes the notion that individuals reduce effort as a result of perceived unfairness (Akerlof & Yellen, 1990).

Interviews with wage-setters indeed suggest that perceptions of fairness play a major role in remuneration policies and that constructing a 'fair' policy is rather complicated (Blinder & Choi, 1990). Within organizations social comparisons may evoke feelings of inequity, where these feelings are linked to lower productivity, reduced group cohesion, lower product quality, decreased job satisfaction and ultimately increased employee turnover (Pfeffer & Langton, 1993; Cowherd & Levine, 1992; Dittrich & Carrell, 1979; Zenger, 1992). Moreover, social comparisons amongst employees are directly related to reduced effort: Cohn, Fehr, Herrmann and Schneider (2014) show that disproportionate wage cuts (in a team of two employees) lead to a significant decrease in performance of the employee who is relatively worse off compared to when both wages are cut equally.

Interestingly, social comparisons may not be limited to similar job positions. Cowherd and Levine (1992) find product quality to be positively associated with interclass pay equity, suggesting that smaller pay differentials between ranks correspond with increased product quality. Moreover, even CEOs may serve as a subject for social comparisons: Wade, O'Reilly III and Pollock (2006) establish that lower-level managers are more likely to depart when they are underpaid more (or overpaid less) than the CEO.

The process of comparing oneself with those who are classified as more able can partly be attributed to the concept of overconfidence. Overconfidence implies that one's subjective self-evaluation of ability is greater than his<sup>3</sup> actual ability, where this often manifests as an individual considering himself to be superior to others. This behavioral bias is for instance reflected in the 'above median effect': more than half of the individuals typically judge themselves to possess more desirable traits than fifty percent of the population. Probably the most prominent manifestation of this bias is reported by Svenson (1981), who found that 93% of American drivers rate themselves to be safer drivers than 50% of other drivers.

Kruger (1999) suggests that the presence of overconfidence depends on the nature of the task. People tend to be overconfident about their ability on tasks in which success is common, which they perform frequently or are familiar with. Meanwhile, they tend to be underconfident on tasks which they rarely ever perform or on tasks with increased difficulty (Moore & Kim, 2003; Moore, 2007).<sup>4</sup> Overconfidence in particular is argued to increase perceived inequity in wage comparison and thereby decreases the benefits of individual pay-for-performance contracts (Larkin, Pierce, & Gino, 2012).

In general, explicit incentive contracts<sup>5</sup> are argued to lose their efficacy once individuals possess social preferences. Social preferences (or interchangeably, other-regarding preferences) include any kind of interdependent preferences, where an individual's welfare then depends on the welfare of other

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<sup>3</sup> Where 'he' or 'his' is used in this paper, 'she' or 'her' is also implied.

<sup>4</sup> For a comprehensive overview of evidence of overconfidence see for instance Babcock and Loewenstein (1997) or Moore and Healy (2008); see Malmendier and Tate (2008) for a review which focuses on executives.

<sup>5</sup> In these contracts incentives are provided through contractual commitments, guaranteeing that an offered bonus is received if the targets are achieved. This is not the case with implicit incentives.

individuals. These preferences range from fairness to reciprocity. The decreased efficacy of explicit contracts manifests for instance by employees internalizing the externalities of their behavior on other individuals' welfare. This is particularly eminent when individuals work alongside friends (Bandiera, Barankay, & Rasul, 2005). Although less common, incentives may also be intensified when individuals possess social preferences. Social preferences and incentives may thus also be complements instead of substitutes in achieving greater performance (Bowles & Polania-Reyes, 2012).

While Milgrom and Roberts (1992) forthrightly state that other-regarding preferences (and thereby, social comparisons) constrain the use of any kind of incentive pay, incentives are mainly analyzed in the absence of such preferences. Since the turn of the century economists are increasing the use of social preferences in their theoretical frameworks. Two leading examples of such models include Rabin (1993) and Fehr and Schmidt (1999) with their views on respectively reciprocity and inequity aversion. Generally, models incorporating social preferences do so in two distinct ways (Englmaier & Wambach, 2010). Firstly, some frameworks cover agents' intentions, where these intentions determine how material payoffs are evaluated. These models usually intend to model reciprocal behavior. Conversely, models such as that of Fehr and Schmidt (1999) consider agents to solely care about the distribution of payoffs and not about underlying intentions. Moreover, they consider employees to respond asymmetrically to disadvantageous inequity and advantageous inequity. Whereas the first approach is more realistic, the latter approach is more tractable analytically.

Adhering to the latter, Englmaier and Wambach (2010) analyze incentive contracts in a moral hazard context assuming a single inequity averse agent, where 'inequity aversion' is thus conceptualized in terms of final allocations. In their setting, the agent's concern for fairness tends to initiate linear sharing rules between the principal and the agent. Fairness can then serve as an additional incentive instrument: the agent can either be rewarded for good performance by paying more or by pay being more equitable. Needless to say, the definition of 'inequity aversion' is pivotal here and, arguably, another definition is more applicable. Moreover, social comparisons occur between the agent and principal in their model. Though these may indeed occur, Bartling and von Siemens (2010) argue that comparisons with other agents are considerably more prevalent. Similarly though, envy generates a tendency to flat-wage contracts. Considering that empirical evidence shows that social comparisons are more pronounced within firms than among individuals who solely interact in market transactions, they argue that flat-wage contracts are more likely to be optimal in the first rather than the latter case.

Itoh (2004) comprehensively analyzes the influence of both vertical and horizontal comparisons in a moral hazard context with inequity averse agents. Following Baron (1988), who notes that pay differences across job titles are more likely to be perceived as acceptable than within a single position, Itoh (2004) assumes that agents choose the most similar candidate for social comparisons when there are multiple reference candidates. He shows that, although there is no technological or stochastic

interdependence between agents, the principal can optimally exploit the agents' social preferences by designing an appropriate interdependent contract. More specifically, with social preferences, team contracts or relative performance contracts may become optimal.

As the above illustrates, the incorporation of fairness into moral hazard contexts mostly occurs through assuming that agents care about final allocations rather than intentions. Often, the concepts of inequality or inequity aversion and fairness are used interchangeably, where fairness is then defined as outcomes being equitable. The context in which fairness is defined is imperative, with Deutsch (1975) noting that equity rather than equality should be the dominant principle when economic productivity is the primary objective. Though the question "What exactly does an individual perceive as fair?" seems insoluble, 'an equal distribution of pay' is regularly unjustly assumed to be the answer.

## **2.2. Transparency or secrecy?**

While social comparisons have widely been recognized to influence the design of contracts by making contracts interdependent, this is largely untrue for the information required to make such comparisons. How can one accurately compare himself to similar others without information about these individuals? The complementary role transparency (or alternatively, secrecy) fulfills in social comparisons, and thereby also in the design of contracts, has received limited attention so far. Recent economics literature however start to recognize the implications of transparency.

Available information alters preferences about inequality and redistribution. Cruces, Perez-Truglia and Tetax (2013) find that, by means of an experimental design incorporated in a household survey, people who overestimated their relative position in the income distribution demand higher levels of redistribution when they are informed of their true ranking. In a similar fashion, Kuziemko, Norton, Saez and Stantcheva (2015) show that information about income inequality has the tendency to increase support for redistributive policies. Card, Mas, Moretti and Seaz (2012) show that this also applies to work settings. They find that learning about the pay of colleagues lowers job satisfaction. Specifically, they find an asymmetric response to distributing information. The fraction of below-median earners (in their pay unit and occupation) who think wages are set fairly decreases once they are provided access to information on their colleagues' wages, whilst the above-median earners report no change in their perception of fairness.

Larkin, Pierce and Gino (2012) argue that the effects of social comparisons on pay intensify once employees have more information about the pay of others. Nonetheless, the precise influence of transparency on pay remains unclear. Empirically speaking, this is mainly due to limited variation in transparency at the organizational level and the lack of pre-disclosure compensation data. Despite these hurdles our understanding of transparency has increased in the past decade.

Mas (2016b) shows that the disclosure of compensation of city managers leads to declines in the compensation of those same managers, even when compensation is in line with fundamentals. Especially those at the top of the wage distribution suffer from pay transparency. Furthermore, a substantial increase in separation rates is observed after disclosure. He concludes that salaries are cut because they appear excessive, which is consistent with the notion of inequality aversion in society. Nonetheless, employers internalizing employees' morale considerations may also explain the exhibited downward pressure on city managers' wages. The accuracy of this explanation however depends on how much the employees initially know about the compensation of their superiors, which is unfortunately unknown in this particular instance.

The disclosure of compensation however need not lead to declines in average compensation. Mas (2016a) examines the evolution of executive compensation before and after mandated disclosure. Though the 1934 Securities Exchange Act was intended to lower CEO compensation, it achieved the opposite. More specifically, average CEO compensation relative to that of the top of the non-CEO wage distribution increased. Simultaneously, the disclosure led to more compressed wages amongst CEOs. Essentially, the lower paid CEOs experienced salary increases whilst those at the top of the wage distribution neither experienced a decrease or increase in salary. This finding holds more generally for top executives in the private sector and indicates the enabling of favorable horizontal peer comparisons (Gartenberg & Wulf, 2017; Faulkender & Yang, 2013). Gipper (2016) notes that increases in compensation occur primarily amongst executives with shorter tenure, who are in position at smaller firms and who operate in industries which are characterized by higher variation in compensation levels.

As can be inferred from above, the relationship between transparency and pay has attracted increased academic interest. These academics devise profound ways to investigate this matter empirically.<sup>6</sup> The population for which the implications of disclosure are studied however mostly concern high-ranked officials such as CEOs and CFOs (Chief Financial Officers). Exceptionally, Pfeffer and Langton (1993) investigate the effects of wage inequality (and disclosure) amongst college and university faculties. They find that greater wage dispersion is associated with reduced satisfaction, decreased productivity and less collaboration. Interestingly, these adverse effects are less apparent in private colleges and universities, where colleagues' pay is less transparent. Conversely, Futrell and Jenkins (1978) show, using a before-after analysis (with control group), that moving from pay secrecy to transparency increases performance and job satisfaction amongst sales personnel. This may either

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<sup>6</sup> See for instance Gipper (2016), who uses the introduction of the Compensation Discussion and Analysis (CD&A) – which increased the disclosure requirements for companies with regard to compensation substantially – in order to compare managers' compensation at firms with and without disclosure in a difference-in-differences analysis.



be due to a more evident relationship between performance and pay, due to a reduction in perceived unfairness or a combination of both.

The costs of pay secrecy are generally classified in three categories, which are (1) the sacrifice of employees' fairness judgments and their perceptions of trust, (2) the potential decrease in motivation, partially because the lack of self-evaluation that obscures the link between performance and pay, and (3) the decreased efficacy of the labor market as employees will not move to their highest valued use. The three major benefits of pay secrecy are (1) the organizational control it offers, the protection of privacy it ensures (2) and (3) the decreased labor mobility. Nonetheless, the relevance of these costs and benefits varies between organizations and settings. This seems primarily related to individuals' needs and perceptions, although previous altercations with the employer are of significance as well (Colella, Paetzold, Zardkoohi, & Wesson, 2007).<sup>7</sup>

Arguably the most fickle aspect of pay secrecy (or, transparency) for organizations is managing employee's fairness judgments and their perceptions of trust. Organizational justice is generally regarded to comprise of three components, of which one, being distributive justice, has been discussed already. The other two components are procedural justice and interactional justice, where primarily the sub-category informational fairness of the latter component is of significance in matters of pay secrecy (Thibaut & Walker, 1975; Leventhal, 1980; Bies & Moag, 1986; Colquitt, 2001). Informational fairness relates to the adequacy of given clarifications in terms of their timeliness, specificity and truthfulness for why procedures were used in a particular manner or why outcomes are distributed as they are. The other component of interaction justice, interpersonal justice, refers to the perceived respect one receives. Lastly, procedural justice concerns the fairness in processes to allocate resources and resolve disagreements.

Some evidence from the lab suggests an intricate interaction between informational and distributive fairness. Greenberg (1993) performs a laboratory experiment to assess theft rates among employees who are faced with varying pay rates, in addition to different explanations for these established rates. The setup of the experiment is the following. Undergraduates were required to perform a task for five dollars. Afterwards, half of the participants were paid the promised five dollars and the others were informed they would only receive three dollars. Informational fairness was manipulated by varying the quality of the explanations for why the undergraduates would receive the specified amount. The experimenter then inattentively placed a handful of coins on a nearby desk, leaving the impression that he was unaware of the precise amount of money he provided. Undergraduates were instructed to take the amount of money they were supposed to be paid. The laboratory experiment yields two interesting

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<sup>7</sup> For a comprehensive overview of how these costs and benefits of pay secrecy may manifest see Colella, Paetzold, Zardkoohi and Wesson (2007).

results regarding the impact of fairness on undesired behavior. First of all, no difference in theft rates was observed for those who were equitably paid, regardless of the provided explanations. Intuitively however, the amount of theft was considerably higher among those who received the lower rate. However, this number reduced with higher levels of informational fairness. Combining these results suggests that informational fairness is primarily important once distributive fairness judgements are negative, with high quality explanations of observed pay discrepancies inhibiting undesired behavior.

Judgments concerning informational fairness are likely to be negative under pay secrecy as information is being withheld. According to the fairness heuristic, people are likely to base specific fairness judgments on their general impression of organizational fairness (Lind, 2001). Hence, judgements regarding the two other types of fairness may be expected to be negative as well. Besides judgments about procedural and distributive fairness being negative due to the fairness heuristic they may be expected to be negative anyhow in case of pay secrecy. A prerequisite of procedural justice to be perceived, according to Leventhal (1980), is that individuals feel that they have a voice in the process and that it involves characteristics such as consistency, accuracy and ethicality. The lack of information impedes employees in their evaluation of bias, restricts their voice and suggests that decision making in general may occur inaccurately, resulting in negative procedural fairness judgments (Colella, Paetzold, Zardkoohi, & Wesson, 2007). Negative judgements about distributive fairness may arise due to inaccurate estimates about referent others' earnings (Dornstein, 1989). Communication about pay is argued to mitigate these perceptions of pay inequity. More specifically, it is argued to increase employees' engagement and lead to an increased sense of empowerment, importance and more accurate feedback about one's own performance (Lawler, 1981; Day, 2012).

Fang and Moscarini (2005) show how credible communication about pay influences the behavior of employees. In doing so, they only consider how information alters beliefs, thereby ignoring potential organizational fairness concerns that may arise. They argue that transparent remuneration practices, in addition to a wage differentiation policy, invokes updating of the employees' beliefs about their own ability. The accuracy of this updating depends on how well the firm is able to sort employees by ability, by means of previous performance for instance. Observing that different contracts are offered lets employees infer the firm's beliefs about their respective ability, where employees are unaware of their own true ability. Subsequently, the 'morale' of those employees who the firm believes are of higher (lower) ability than they believe themselves is boosted (hurt). Pay transparency, accompanied by a wage differentiation policy, then essentially serves as a relative performance evaluation. According to Fang and Moscarini (2005), the choice for a (non-)differentiation policy then depends on, among others, the composition of the workforce and the discrepancy in beliefs, including the degree of overconfidence employees have in their own ability. Benabou and Tirole (2003) stress that the implications of overconfidence depend on whether ability and effort are complements or substitutes, with the latter

implying that an employee may reduce effort when he feels more confident in his abilities. This is primarily a concern when the payoff is of a ‘pass-fail’ nature. Although this may indeed be the case, the employee is motivated by a bonus set by the firm in the considered setting, where the firm will never incentivize the employee to exert less instead of more effort. Contrary to Fang and Moscarini (2005) pay transparency is not assumed. This is primarily due to the salience of pay secrecy in many organizations. Contracts are thus not considered to be observable to each employee by default. Then, besides preserving employees’ morale, social preferences may induce firms to be secretive about their chosen wage policy.

Though the research on pay transparency (or alternatively, secrecy) is inconclusive, organizations which include performance-pay in their pay structure seem to rely primarily on secrecy for its effective implementation (Perry, Engbers, & Jun, 2009). Bartling and von Siemens (2010) argue that, at first sight, this may largely be attributed to apparent envy increasing the costs of providing incentives: wage secrecy is argued to prevent social comparisons and thereby also the additional agency costs arising from them. Nonetheless, individuals are likely to form beliefs about the contracts of other agents without actual (accurate) information on their referent others anyhow. A policy of pay secrecy then leads to even higher agency costs of providing incentives if agents suffer from their beliefs as much as from actual observed wage discrepancies. Importantly, inequity based on beliefs is dissimilar to observed inequity and is therefore likely to be experienced differently as well. While it remains unclear what people dislike most of these two, the results of Kuziemko, Norton, Saez and Stantcheva (2015) and those of Card, Mas, Moretti and Seaz (2012) – which were both discussed in the beginning of this section – suggest that it is observed inequity which is particularly dissatisfying.

### 3. Model

The model of Fang and Moscarini (2005) is largely adopted to formalize the firm’s wage policy and the subsequent information distribution regarding it. The fundamental deviations of their model concern the assumption of pay being transparent and the absence of social preferences.

Consider a firm that employs a continuum of employees with unit mass for a single period. Employees differ in their ability  $a$  (or interchangeably, capacity or talent). For simplicity, the ability of an employee can either be ‘high’ or ‘low’,  $a \in \{a_L, a_H\}$ , with  $0 < a_L < a_H$ . Neither the employee nor the firm knows the true value of his ability and moreover, they may have different prior beliefs about  $a$ . The firm has an objective initial belief as to whether an employee has high ability, denoted by  $q_0$ . The employee’s ability types are assumed to be independent and therefore  $q_0$  (by the Law of Large Numbers, hereafter ‘LLN’) is also the proportion of high ability employees in the firm’s workforce. The employee has an initial belief  $p_0$  that he is of high ability. Initial beliefs are common knowledge, and when  $p_0$  and  $q_0$  are not equal the firm and employee agree to disagree.

Each employee is assumed to be able to produce two levels of output. Output  $Y$  may be either ‘low’ or ‘high’, where low output is normalized to  $0$  and high output equals  $y$ , with  $y > 0$ . The task the employees perform is thereby of a pass-fail nature. There are no productional interdependencies, that is the output of employee A is completely unaffected by that of employee B (and vice versa). To capture that high ability employees are more capable, they are more likely to have high output than low ability employees. If an employee exerts positive effort (denoted by  $e > 0$ ), the probability of achieving high output equals

$$P(Y = y|a_j, e) = \pi_j(e), j \in \{L, H\}$$

where  $\pi_j' > 0$ ,  $\pi_j'' < 0$  and satisfies  $\pi_j(0) = 0$ ,  $\lim_{m \rightarrow \infty} \pi_j(e) = \bar{\pi}_j \leq 1$ , and  $\pi_H(e) > \pi_L(e)$ ,  $\forall e > 0$ .

The employee is interested in maximizing his (perceived) expected utility. The employee is offered a contingent wage contract  $\{b\}$ , which consists in its entirety of a bonus  $b$  for achieving high output.<sup>8</sup> The firm decides for each individual whether to offer them a contract, and if so, the terms of this contract. The cost of exerting effort is independent of one’s ability (or morale) and is represented by  $C(e)$ , with  $C(e)$  being a strictly convex function with  $C(0) = 0$ . Following the standard assumptions of agency theory, effort is assumed to be unobservable to the firm whilst output is observable and, verifiable, by all parties, including (possibly) the court. The firm can therefore credibly commit to any contract it decides to offer.

The firm receives a private signal  $\theta_i \in \{L, H\}$  of each individual’s ability before initiating (or continuing) the relationship with each employee, which is either ‘high’ or ‘low’. This performance evaluation can be interpreted in several ways, where the interpretation of it arising from the onboarding process (e.g. interviews, assessments) is most suitable, though it can essentially be anything from which the firm can (imperfectly) infer an employee’s type. For simplicity, the signal is independently and identically drawn as follows

$$P(\theta_i = H|a = a_H) = P(\theta_i = L|a = a_L) = \mu$$

The informativeness of this signal, that is it correctly indicates one’s type, is represented by  $\mu$ , where  $\mu > \frac{1}{2}$  ensures that people who signal  $H$  ( $L$ ) are more likely to possess high (low) ability.<sup>9</sup> Importantly, an employee is not able to directly observe this signal. He may however infer  $\theta_i$  from the wage contracts

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<sup>8</sup> Fang and Moscarini (2005) use a two-tier wage contract in their model, which has a similar bonus scheme but includes a (non-negative) fixed component. The simplified wage contract in this paper is however considered to be sufficient in describing the matter of pay secrecy and fairness. Furthermore, such a contract is essentially equivalent to each employee receiving the same (minimum) fixed hourly wage and a varying bonus based on performance, which is not uncommon in real-world settings.

<sup>9</sup> Note that  $1 - \mu$  represents the probability that the signal wrongly indicates one’s type (e.g. an employee receives signal  $H$  whilst being  $a_L$ , then  $1 - \mu$  represents the probability of this occurring).

offered by the firm to different employees, though this only occurs if wage contracts are not identical and, moreover, if the firm decides to disclose contracts.

Herein lies the first fundamental difference from Fang and Moscarini (2005), who assume that contracts are observable to each employee anyhow. To the contrary, employees need not be aware of all contracts and hence may not infer their own ability, which is considerably more realistic due to the prominence of pay secrecy policies in organizations. More specifically, employees only infer their own ability if different contracts are offered and if, in addition, the firm chooses to be transparent in its remuneration practices. This assumption adds a unique dimension to the firm's problem, as the firm now has the choice to be secretive about its wage policy. Hereafter, 'pay secrecy' refers to the situation where the firm does not disclose all contracts and 'pay transparency' to the situation where the firm actually does disclose each employee's contract.

The firm uses each employee's signal  $\theta_i$  to update its beliefs about the ability of the employee in question. The updating of beliefs happens according to Bayes' rule, where  $q_\theta$  denotes the firm's posterior belief that an employee with signal  $\theta$  is of high ability. Then, the updated belief  $q_\theta$  equals

$$q_H = \frac{q_0\mu}{q_0\mu + (1 - q_0)(1 - \mu)}, \quad q_L = \frac{q_0(1 - \mu)}{q_0(1 - \mu) + (1 - q_0)\mu}$$

where  $q_H$  and  $q_L$  respectively denote the firm's posterior belief that the employee is of high ability after receiving signal  $H$  or  $L$ .

An employee does not directly observe his performance evaluation  $\theta_i$ , but he may infer it if he observes different contracts are offered to other employees (who have other performance evaluations). The updating of employees' beliefs can thus solely occur under pay transparency and when a differentiation wage policy is employed. Once these two conditions are satisfied, the employee forms a posterior belief  $p_\theta$  about his ability according to Bayes' rule, where  $p_\theta$  equals

$$p_H = \frac{p_0\mu}{p_0\mu + (1 - p_0)(1 - \mu)}, \quad p_L = \frac{p_0(1 - \mu)}{p_0(1 - \mu) + (1 - p_0)\mu}$$

where  $p_H$  and  $p_L$  denote the employee's posterior belief that he is of high ability after receiving signal  $H$  or  $L$ , respectively. Note that receiving a 'high' ('low') signal boosts (hurts) an employee's self-image, which, following Fang and Moscarini (2005), is described as the 'morale' of an employee. Employees' updated beliefs equal their priors if they are unable to observe that different contracts are offered.

The second fundamental deviation from Fang and Moscarini (2005) concerns the cost of effort function: employees care about fairness, where contracts are perceived as 'fair' if employees receive the same payoff for achieving the same output. Specifically, considering the inherent link between social comparisons and feelings of inequity within organisations, perceived unfairness is assumed to increase the costs of exerting (an additional unit of) effort.

Organizational fairness, as noted in Section 2.2, is generally considered to consist of three components, being distributive justice, procedural justice and interactional justice. In matters of pay secrecy, primarily the sub-category informational fairness is of significance. Individuals' perceptions of informational fairness are likely negative under pay secrecy since information is being withheld. According to the fairness heuristic, judgements regarding the other two types of fairness are then expected to be negative as well. The following impressions of (overall) organizational fairness are established. Firstly, employees perceive contracts to be fair if they are able to observe that contracts are identical. On the contrary, contracts are considered unfair if employees observe that the terms specified in the contract differ from those of their colleagues. Importantly, the firm cannot justify offering a different bonus for achieving the same performance. Informational fairness judgements are negative in case the firm opts for pay secrecy, primarily because no information is provided to them. Since employees are then unable to evaluate whether the terms specified in the contract are the same, the other two types of fairness judgements are negative as well following the fairness heuristic.

Summarizing, three general impressions of organizational fairness are considered. Following the results of Kuziemko, Norton, Saez and Stantcheva (2015) and those of Card, Mas, Moretti and Seaz (2012), who show in their own distinctive ways that learning about pay (differences) essentially increases fairness concerns, the costs of exerting effort are assumed to be higher in case an employee actually observes contracts specifying different terms rather than presuming this following negative informational fairness judgements. The common phrase 'ignorance is bliss' thus applies. Effort exertion is specified to be the least costly if contracts are observed to be fair.

The firm is interested in maximizing profits. In achieving its objective the firm has two instruments at its disposal. First, the firm can choose to adopt either a differentiation or a non-differentiation policy. Second, the firm can opt for pay transparency or secrecy. This results in four potential combinations the firm can make. For simplicity, the firm's decisions are assumed to occur before the employee accepts or declines the contract, implying that employees are perfectly aware of the state of the world beforehand. Importantly, the firm can credibly commit to any wage policy and information distribution before observing the employees' performance signals  $\theta_i$ . Otherwise, individuals would be able to infer their ability to some extent following wage equality or pay secrecy as well. This paper aims to establish under which conditions the firm finds it optimal to choose any of the four potential combinations.

The firm and its employees are risk-neutral. Without loss of generality, the outside options of the firm and the employee are assumed to be  $V_0 \geq 0$  and  $U_0 \geq 0$ , respectively. Importantly, an employee's outside option is irrespective of his ability.<sup>10</sup> Lastly, any kind of information the firm distributes is

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<sup>10</sup> This assumption is reasonable when the ability of individuals is in its entirety not general, otherwise high ability employees are then also more valuable to other firms, increasing their outside option.

verifiable (by the court) without charge, which, in particular, averts false information distribution. This is necessary as the firm may be incentivized to lie to its employees. The firm may, for instance, want employees to always believe contracts are fair, even though it offers them different contracts. The equilibria resulting from the distribution of such information are ignored.<sup>11</sup>

Putting together all the model's elements yields the following timing of events:

1. Nature draws  $a$ , with  $a \in \{a_L, a_H\}$ .
2. The firm decides whether to be secretive about the chosen wage policy or not. It can opt for either pay secrecy or transparency. Simultaneously, the firm (credibly) commits to either a differentiation or non-differentiation wage policy.
3. The firm hires a continuum of employees with unit mass and receives individual performance evaluations  $\theta_i \in \{L, H\}$ . For each individual, the firm decides whether to offer them a contract, and if so, the terms of this contract.
4. Each employee observes his own contract and, if the firm opts for transparency, all other contracts. Any combination involving either wage equality or pay secrecy contains no information about employees' ability.
5. Employees individually decide whether to accept employment and, if so, how much effort to exert, with the latter decision being unobservable to the firm.
6. The output of each employee is received by the firm and the firm compensates its employees as specified in the contract.

## 4. Analysis of the model

The analysis begins with characterizing the behavior of the employee, before analyzing the firm's problem for any given belief pair  $\{p, q\}$  regarding the employee's ability. Initially the firm is considered to decide separately whether to hire a single individual, before characterizing the more intricate firm problem of hiring a continuum of employees. Employees' beliefs and fairness perceptions vary with the available information at hand and affect their willingness to exert effort.<sup>12</sup>

### 4.1. The employee's problem

Assume the firm has chosen wage policy  $W$  and information distribution  $I$ . Suppose that an employee with morale  $p$  is offered a contingent wage contract  $\{b\}$  and solely receives compensation if he achieves

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<sup>11</sup> These equilibria refer to 'babbling equilibria' in game theory. In these type of equilibria, the firm communicates a message which is subsequently disregarded by the employees because it simply contains no information to them; they are aware that the communicated message is irrespective of their type and hence their strategy is independent of the information the firm communicates (Crutzen, Swank, & Visser, 2013).

<sup>12</sup> Without intending to replicate Fang and Moscarini's (2005) analysis, some sections are highly similar; this is especially true for the first two sections, where the problem of the employee and the firm are characterized.

high output, being the bonus  $b$ . The employee then decides either to accept employment, and if so, his optimal effort level  $e^*$ , or to decline the offer. At the moment the employee decides what to do, he is aware of whether there is secrecy or transparency. Employees who decide to decline the offer earn their outside option, denoted by  $U_0$  (with  $U_0 \geq 0$ ). Note that employees are risk-neutral. The decision-making process of the employee is (mathematically) represented by

$$\max \left\{ \max_{e \geq 0} \{ b[p\pi_H(e) + (1-p)\pi_L(e)] - C(e) \}, U_0 \right\}$$

where the inner maximization provides the perceived expected utility from accepting the offer and optimally exerting effort. Temporarily ignoring that  $e$  cannot be negative, the inner maximization problem is concave with the following first-order condition

$$b[p\pi'_H(e) + (1-p)\pi'_L(e)] = C'_{W,I}(e) \quad (1)$$

and yields a unique optimal effort level  $e^*_{W,I}(b, p)$ , where the subscript refers to the employee's fairness perceptions following the choices of the firm. The firm's wage policy  $W$  can either be to differentiate employees or to offer them a uniform contract, where  $D$  refers to the former ('differentiation') and  $E$  to the latter choice ('equality'). Then, the firm either informs (' $I$ ') its employees of the chosen wage policy or not, respectively denoted by  $T$  ('transparency') and  $S$  ('secrecy'). Recall that fairness in this framework concerns contracts specifying uniform terms, that is, in particular, the bonus  $b$  for achieving high output should be identical in each offered contract for employees to perceive fairness. Specifically, with regard to the cost of effort function, the following is assumed

**Assumption:**  $C'_{D,T}(e) > C'_{W,S}(e) > C'_{E,T}(e) > 0, \quad C''_{D,T}(e) \geq C''_{W,S}(e) \geq C''_{E,T}(e) > 0$

Respectively, the subscripts  $(D, T)$ ,  $(W, S)$  and  $(E, T)$  indicate that the employee observes unequal contract terms and perceives unfairness, cannot accurately judge fairness since he is uninformed about colleagues' contracts (following pay secrecy, irrespective of the employed wage policy  $W$ ) and, lastly, the employee actually observes identical contract terms and hence perceives fairness.

The firm is interested in maximizing profits, where (productional) value is only created if employees exert some positive amount of effort. Applying some algebra to the first order condition in (1) presented earlier shows that  $e^*_{W,I}(b, p) \geq 0$  if and only if

$$b[p\pi'_H(0) + (1-p)\pi'_L(0)] \geq C'_{W,I}(0)$$

which essentially states that it is optimal for the employee to exert effort when the marginal benefits of doing so are greater than its costs (at zero effort). The bonus thus must be sufficiently large to incentivize the firm's employees, where some rewriting of the above yields



$$b \geq \frac{C'_{W,I}(0)}{[p\pi'_H(0) + (1-p)\pi'_L(0)]} \equiv \underline{b}$$

where the above expression indicates that the bonus for achieving high output must be at least equal to  $\underline{b}$  for an employee with morale  $p$  to find it optimal to exert positive effort, that is the incentive compatibility constraint (ICC) of the employee is satisfied if and only if  $b \geq \underline{b}$ .

If the firm finds it suboptimal to provide such a bonus, the employee will not be hired (or alternatively, fired). The firm is only willing to offer an employee a bonus  $\underline{b}$  if it does not exceed the value of high output, that is  $y$ . When  $y$  is not larger than (or, at least equal to)  $\underline{b}$  the firm will make a loss by hiring an employee. Therefore, it is assumed that  $y > \underline{b}$ .

**Assumption:**  $y > \underline{b}$

Besides satisfying the ICC, the offered contract also needs to satisfy the employee's participation constraint (PC). That is, the utility of the employee when optimally exerting effort should exceed his outside option, otherwise he will not accept the contract. The employee will accept the contract and optimally exert effort  $e^*_{W,I}(b, p) \geq 0$  if and only if

$$b[p\pi_H(e^*_{W,I}(b, p)) + (1-p)\pi_L(e^*_{W,I}(b, p))] - C_F(e^*_{W,I}(b, p)) \geq U_0 \quad (2)$$

where the left-hand side of this inequality represents  $U_{W,I}(b, p)$ .

**Remark:** Given that the employee accepts the contingent wage contract  $\{b\}$ , he will always optimally exert effort  $e^*_{W,I}(b, p) \geq 0$ .

The employee can only earn a bonus if he exerts at least some effort. Since the employee does not (expect to) receive any kind of compensation without exerting effort, in addition to his outside option being  $U_0 \geq 0$ , he will never accept the contract if he is not willing to exert any effort. Hence, reversely, this means that the employee always optimally exerts effort  $e^*_{W,I}(b, p) \geq 0$  if he decides to accept the contract.

#### 4.2. The firm's problem when hiring a single employee

In this section, the firm's problem is analyzed in case it takes a rather *myopic* perspective in the design of contracts, that is it considers separately whether it wants to offer a contract to a single individual. The fairness perceptions of the employee are thereby considered to be given rather than influenceable by the firm's wage policy and information distribution.

The firm is interested in maximizing profits given posterior beliefs  $\{p, q\}$  about employees' ability, which is equivalent to maximizing the sum of (expected) net values created by the firm's employees. Posterior beliefs are updated according to Bayes' rule as specified in Section 3.

The (perceived) expected profit to the firm with belief  $q$  from offering a contingent wage contract with bonus  $b$  to a single employee with morale  $p$ , given that the employee accepts the contract and optimally exerts effort  $e_{W,I}^*(b, p) \geq 0$ , is represented by

$$V_{W,I}(b, p, q) = [q\pi_H(e_{W,I}^*(b, p)) + (1 - q)\pi_L(e_{W,I}^*(b, p))][y - b] \quad (3)$$

The evaluation of an employee's ability, that is  $\theta_i$ , is incorporated in the above function through  $q$  and, potentially, through  $p$ . Note that both  $q$  and  $p$  represent updated beliefs rather than initial beliefs.

The firm only wants to offer the employee a contract if doing so exceeds its outside option, that is

$$[q\pi_H(e_{W,I}^*(b, p)) + (1 - q)\pi_L(e_{W,I}^*(b, p))][y - b] \geq V_0 \quad (4)$$

Any contract that satisfies the participation constraints of both the employee and the firm is a *feasible* contract. The set of *feasible* contracts consist of all contracts the firm wants to offer which the employee would subsequently accept. Within this set of contracts, the firm devises a wage contract  $\{b\}$  such that  $V_{W,I}(b, p, q)$  is maximized. Given beliefs  $(p, q)$ , the firm's problem is then

$$\max_{b \geq \underline{b}} [q\pi_H(e_{W,I}^*(b, p)) + (1 - q)\pi_L(e_{W,I}^*(b, p))][y - b], \quad \text{s. t. (2), (4)} \quad (5)$$

which has a solution if the function is both continuous and bounded in the bonus  $b$ . Since the firm can guarantee itself its outside option  $V_0 \geq 0$ , it will never offer a contract where the bonus outweighs the value of high output ( $b > y$ ). Therefore, the firm's participation constraint bounds the values of the bonus  $b$ ; specifically,  $b \in [\underline{b}, y]$ . Additionally, both  $V_{W,I}(b, p, q)$  and  $U_{W,I}(b, p)$  are continuous in the bonus, implying that the firm's maximization problem in (5) has a solution. Subsequently, this solution can be compared to  $V_0$  to verify whether the firm actually wants to offer the employee this particular bonus.

**Lemma 1:** *The solution to the firm's problem in (5) exists.*

While Lemma 1 states that a solution to the firm's problem exists, this solution need not be unique. Specifically however, in order for the firm to be willing to offer different bonuses and for employee's fairness perceptions to be of significance, a unique bonus in terms of beliefs  $(p, q)$  is required. Otherwise, the optimal bonus the firm offers is irrespective of workforce characteristics and everyone is offered the same bonus, implying that fairness perceptions will always be favorable. Lemma 2 states that sufficient conditions for a unique optimal bonus in terms of beliefs  $(p, q)$  to exist is that the optimal effort allocation of the employee is concave in the bonus  $b$ .<sup>13</sup> The proof of Lemma 2 – in addition to the proofs of Lemma 3, Proposition 2 and Proposition 3 – are provided in Appendix 1.

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<sup>13</sup> Fang and Moscarini (2005) prove that this definitely holds in case  $C''' \geq 0$  and  $p\pi_H' + (1 - p)\pi_L'$  is log-concave. It is refrained from proving this and simply stressed that the analysis requires concavity of  $e^*$  in  $b$ .

**Lemma 2:** *Sufficient conditions for the inner maximization problem in (5) to have a unique solution  $b_{W,I}^*(p, q) \in (\underline{b}, y)$  is that the optimal amount of effort  $e^*$  is concave in the bonus  $b$ . This solution implicitly solves the following first-order condition:*

$$\begin{aligned} \frac{\delta V_{W,I}(b, p, q)}{\delta b} &= [y - b][q\pi'_H(e_{W,I}^*(b, p)) + (1 - q)\pi'_L(e_{W,I}^*(b, p))] \frac{\delta e_{W,I}^*(b, p)}{\delta b} \\ &\quad - [q\pi_H(e_{W,I}^*(b, p)) + (1 - q)\pi_L(e_{W,I}^*(b, p))] = 0 \end{aligned} \quad (6)$$

The firm solely wants to offer  $b_{W,I}^*(p, q)$  if doing so exceeds its outside option  $V_0$ . Likewise, the employee is only willing to accept this contract, and thereby to optimally exert effort  $e_{W,I}^*(b, p) \geq 0$ , if and only if  $U_{W,I}(b_{W,I}^*(p, q), p) \geq U_0$  holds. When the participation constraint of the firm is not satisfied, the firm will simply offer no contract to the employee. Matters become more interesting however when it is the employee's outside option that is not met. The firm may then decide to offer a higher bonus  $\bar{b}_{W,I}(p)$  which just satisfies the employee's participation constraint, thereby decreasing its own expected profit. Note though that the firm is only willing to do so if the following inequality is satisfied:

$$V_{W,I}(\bar{b}_{W,I}(p), p, q) \geq V_0 \quad (7)$$

where  $\bar{b}_{W,I}(p)$  is retrieved by solving

$$U_{W,I}(\bar{b}_{W,I}(p), p) = U_0 \quad (8)$$

The firm's problem in case it contemplates whether to hire a single employee can then be summarized in the following way:

**Proposition 1:** *Consider any posterior belief pair of the employee and the firm  $(p, q)$ . Suppose the firm decides whether to hire a single employee with fixed fairness perceptions. Consider contingent wage contracts  $\{b\}$  with potential bonuses  $b_{W,I}^*(p, q)$  and  $\bar{b}_{W,I}(p)$ . Then, three general equilibria exist:*

1. *If the contingent wage contract with bonus  $b_{W,I}^*(p, q)$  is feasible, that is  $b_{W,I}^*(p, q)$  satisfies both (2) and (3), it is offered to the employee and subsequently accepted;*
2. *If the contingent wage contract with bonus  $b_{W,I}^*(p, q)$  is not feasible, but  $\bar{b}_{W,I}(p)$  satisfies (7), then the wage contract with bonus  $\bar{b}_{W,I}(p)$  is offered to the employee and subsequently accepted;*
3. *In any other case, no contract is offered to the employee.*

#### 4.3. The firm's problem when hiring multiple employees

This section analyzes the firm's problem in case it is *holistic* in its contracting efforts. The firm then considers hiring a continuum of employees instead of only one, thereby recognizing how (not) observing different contracts may influence employees' beliefs and their perceptions of fairness.

Recall that the firm can construct four combinations with regard to its wage policy  $W$  and corresponding information distribution  $I$ , with  $W \in \{D, E\}$  and  $I \in \{T, S\}$ . Besides these options, the firm can decide to offer no contract at all, denoted by  $\emptyset$ .

The firm knows beforehand (by LLN), in each combination, that a fraction  $q_0$  is of high ability and that  $q_0\mu + (1 - q_0)(1 - \mu)$  of employees will receive a ‘high’ signal. Similar reasoning may be applied to the employees who are of low ability and to those who receive a ‘low’ signal. The firm is therefore able to probabilistically assess the total profits each option yields given its objective prior beliefs  $q_0$  about the workforce and informativeness  $\mu$  of the performance evaluation  $\theta$ . The firm is considered to be perfectly aware of the intricate relationship between its actions and employees’ fairness concerns.

**Secretive wage differentiation.** The firm decides to offer different contracts to its employees, without providing employees access to the contracts of their colleagues. Employees are considered to interpret the lack of information about the employed wage policy as a signal of organizational unfairness. The updating of employees’ beliefs is inhibited due to the lack of information and posteriors hence equal prior beliefs ( $p_0 = p$ ). The firm however still observes each employee’s performance evaluation and updates its beliefs accordingly.

The firm can offer a multitude of bonuses to achieve its objective. Since the firm is secretive about its wage policy, the morale of an employee is neither boosted or hurt by offering different bonuses. The firm’s maximization problem under a secretive wage-differentiation policy is equivalent to maximizing the perceived expected profit of a single individual given belief pair  $\{p_0, q_\theta\}$ , with  $\theta \in \{L, H\}$ , and fairness perceptions following  $(D, S)$ .

$$\max \left\{ \max_{b \in (\underline{b}, \bar{y})} \left\{ [q_0\mu + (1 - q_0)(1 - \mu)]V_{D,S}(b(p_0, q_H), p_0, q_H) \right\}, V_0 \right\} + [(1 - q_0)\mu + q_0(1 - \mu)]V_{D,S}(b(p_0, q_L), p_0, q_L)$$

Note that the inner maximization problem yields the firm’s expected profits under a secretive wage differentiation policy  $(D, S)$ , with the firm maximizing profits with respect to both  $b(p_0, q_H)$  and  $b(p_0, q_L)$ . The firm will offer contingent wage contracts with bonus  $b(p_0, q_\theta)$  in case doing so exceeds its outside option  $V_0$ .

Recall that the optimal bonus offered in equilibrium for a single individual, given belief pair  $(p, q)$ , hereafter denoted by  $\tilde{b}_{W,I}(p, q)$ , is provided in Proposition 1. Likewise,  $\tilde{V}_{W,I}(p, q)$  denotes the profits of a single individual by offering  $\tilde{b}_{W,I}(p, q)$ , given generic beliefs  $(p, q)$ . Since the firm can offer different contracts, Proposition 1 applies and the solution to the inner maximization problem is given by  $\tilde{b}_{W,S}(p_0, q_\theta)$ , with  $\theta \in \{L, H\}$ . Then, (maximum) expected profits following a secretive wage differentiation policy with contracts  $\tilde{b}_{D,S}(p_0, q_H)$  and  $\tilde{b}_{D,S}(p_0, q_L)$  equal  $\pi^{D,S}$ .

**Transparent wage differentiation.** The firm decides to offer different contracts to its employees and shares all contracts with them. Employees observe that different contracts are offered and, besides

inferring their own performance evaluation, perceive different bonuses for achieving the same performance to be unfair. This results in the employee judging organizational fairness as being unfair.

Similar as is the case when the firm secretly differentiates between employees the firm's maximization problem consists of different bonuses to be offered, with the optimal bonus for an employee being conditional on the performance evaluation  $\theta$  he receives. The two sole differences between the two combinations concern employees updating their beliefs and them actually experiencing unfairness rather than presuming its existence. Maximum expected profits are then achieved by offering contingent wage contracts  $\tilde{b}_{D,T}(p_\theta, q_\theta)$ , with  $\theta \in \{L, H\}$ , with profits equal to

$$\pi^{D,T} = [q_0\mu + (1 - q_0)(1 - \mu)]\tilde{V}_{D,T}(p_H, q_H) + [(1 - q_0)\mu + q_0(1 - \mu)]\tilde{V}_{D,T}(p_L, q_L)$$

**Secretive wage equality.** The firm decides to offer an identical contract to its employees but refrains from informing them of doing so. Hence, employees negatively assess informational fairness and presume some unfairness. They are unable to observe the contracts of their colleagues and posterior beliefs therefore equal prior beliefs. Since the firm opts for a non-differentiation policy it only offers a single contract, identical for each employee. The firm's problem is then

$$\max \left\{ \max_{b \in (\underline{b}, y)} \left\{ [q_0\mu + (1 - q_0)(1 - \mu)]V_{E,T}(b, p_0, q_H) \right\} + [(1 - q_0)\mu + q_0(1 - \mu)]V_{E,T}(b, p_0, q_L) \right\}, V_0 \right\}$$

where  $q_0\mu + (1 - q_0)(1 - \mu)$  of employees receive a 'high' signal and  $(1 - q_0)\mu + q_0(1 - \mu)$  a 'low' signal (by LLN). Note that, compared to the problem in case of secretive wage differentiation outlined earlier, the firm only maximizes the inner problem with regard to a single bonus  $b$ .

The firm's inner maximization problem above can be simplified to the following

$$\max_{b \in (\underline{b}, y)} [q_0\pi_H(e_{E,T}^*(b, p_0)) + (1 - q_0)\pi_L(e_{E,T}^*(b, p_0))][y - b]$$

Note that the firm's problem is then identical to that in (5), with beliefs  $(p_0, q_0)$  and average fairness perceptions following secrecy. The firm hires a continuum of employees with unit mass, hence Proposition 1 applies and the firm earns (expected) profits equal to  $\pi^{E,S} = \tilde{V}_{E,S}(p_0, q_0)$  following a policy of secretive wage equality  $(E, S)$ . Importantly, note that an employee's performance evaluation  $\theta_i$  is irrelevant following this particular combination.

**Transparent wage equality.** The firm decides to offer an identical contract to its employees and informs them of doing so. Hence, employees, following the assumption of verifying distributed pay information being costless, perceive organizational fairness. They are however unable to infer their own performance evaluation and thus cannot update their beliefs about their ability. The firm opts for a non-differentiation policy and thus solely offers a single (identical) contract. The firm's problem is then identical to the one characterized in the previous section, except for the employees' perceptions of fairness. When wage equality is observed, employees perceive contracts to be fair. Without

unnecessarily iterating the discussion of the previous section, maximum expected profits are achieved by offering contingent wage contracts  $\tilde{b}_{E,T}(p_0, q_0)$  and equal  $\pi^{E,T} = \tilde{V}_{E,T}(p_0, q_0)$ .

#### 4.4. Wage equality: transparency or secrecy?

This section compares the choice between transparency and secrecy given that the firm opts for a non-differentiation wage policy. In both information policies, the firm either offers a contract with bonus  $b$  or decides to offer no contract at all ( $\emptyset$ ). Since offering no contract following a wage equality policy yields the firm's outside option  $V_0$ , irrespective of whether the firm opts for secrecy or transparency, this possibility is excluded.<sup>14</sup>

Recall that  $\pi^{E,S}$  and  $\pi^{E,T}$  denote the firm's expected profits following a policy of wage equality with a corresponding information policy of secrecy or transparency. Note that the firm's privately observed performance evaluation  $\theta$  is irrelevant in both information policies. Importantly, the only difference between the expected profits concern employees' fairness perceptions, with employees presuming unfairness following secrecy and perceiving fairness following transparency.

**Proposition 2:** *Suppose the firm opts for a policy of wage equality. Then, for any belief pair  $(p, q)$ , being transparent yields the firm higher profits than being secretive.*

Proposition 2 establishes the inferiority of being secretive compared to being transparent after having adopted a non-differentiation wage policy. Since it is assumed that exerting effort is more costly when employees presume unfairness rather than while they observe actual fairness, this statement is far from surprising. It follows that, if the firm prefers to offer the same exact contract to all its employees rather than not, the firm will *always* inform its employees of doing so.

#### 4.5. Wage differentiation: transparency or secrecy?

This section compares the choice between secrecy and transparency is analyzed given a wage differentiation policy. The firm either offers contracts conditional on the employee's performance evaluation or decides to offer no contract to (at least some) employees. Optimal bonuses differ with the employee's morale and their perceptions of fairness. Furthermore, since the firm now has the option to offer one group of employees a contract while not hiring the remaining employees, offering no contract  $\emptyset$  does not necessarily yield the same profits in each information policy. For instance, it may be beneficial to offer employees with a 'high' performance evaluation a contract while not offering a contract to those with a 'low' evaluation. Therefore, contrary to the analysis of information policy choice following wage equality, the optimal contract  $\tilde{b}_{W,I}(p, q)$  may include offering  $\emptyset$ .

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<sup>14</sup> Note that this argument does not apply following a policy of wage differentiation, since the firm can then decide to offer one particular group a contract while not hiring the remaining individuals.

Recall that  $\pi^{D,S}$  and  $\pi^{D,T}$  denote the firm's expected profits following a policy of wage differentiation with a corresponding information policy of secrecy or transparency. The differences between the two information policies concern employees' fairness perceptions and their morale. Employees update their beliefs in case all contracts are disclosed and, additionally, are observed to differ. Note that employees still infer their own performance evaluation in case the firm offers a contract to one particular group while not hiring the remaining individuals. Employees presume unfairness following secrecy and experience it following transparency.

The firm, dissimilar to its choice following a policy of wage equality, does not solely prefer one of the information policies over the other in case it offers different contracts. Specifically, the difference in the firm's profits between the two information policies can be decomposed into three components. These components are the *fairness effect*, the *morale gain effect* and the *morale loss effect*, where the latter two are highly similar to the morale effects Fang and Moscarini (2005) identify.

So, the difference between the firm's profits following transparency and secrecy, and thereby the effect of disclosure, equals

$$\begin{aligned} \pi^{D,T} - \pi^{D,S} = & \left[ \begin{array}{l} \text{fairness effect} \\ [q_0\mu + (1 - q_0)(1 - \mu)][\tilde{V}_{D,T}(p_H, q_H) - \tilde{V}_{D,S}(p_H, q_H)] \\ + [(1 - q_0)\mu + q_0(1 - \mu)][\tilde{V}_{D,T}(p_L, q_L) - \tilde{V}_{D,S}(p_L, q_L)] \end{array} \right] + \quad (9) \\ & \left[ \begin{array}{l} \text{morale gain effect} \\ [q_0\mu + (1 - q_0)(1 - \mu)][\tilde{V}_{D,S}(p_H, q_H) - \tilde{V}_{D,S}(p_0, q_H)] \end{array} \right] + \\ & \left[ \begin{array}{l} \text{morale loss effect} \\ [(1 - q_0)\mu + q_0(1 - \mu)][\tilde{V}_{D,S}(p_L, q_L) - \tilde{V}_{D,S}(p_0, q_L)] \end{array} \right] \end{aligned}$$

The first component concerns the effect on profits of changing fairness perceptions, without affecting an employee's morale. This effect is also obtained while evaluating a transparent wage differentiation policy with and without social preferences, and should be interpreted as such. Importantly, note that a similar effect exists following wage equality, which causes transparency's dominance over secrecy in that particular instance (see Proposition 2). The latter two components concern the morale effects of disclosure. This effect is separated from the change in profits resulting from the worse fairness perceptions. Generally speaking, in case effort and ability are complements, the morale gain effect is positive and the morale loss effect negative. Fang and Moscarini (2005) thus rightly state that a tradeoff exists, albeit they ignore employee's fairness perceptions in their model.

**Proposition 3:** *For any posterior beliefs  $q_0 \in (0,1)$ , the firm's expected profits are higher following a secretive wage differentiation policy than when it transparently differentiates employees:*

1. *When the employee's prior beliefs approaches its extremes, being either  $p_0 \rightarrow 0$  or  $p_0 \rightarrow 1$ ;*

2. Or, if  $p_0 = q_0$ , if and only if  $\tilde{V}_{D,S}(p, p)$  is concave in  $p$ .

The second statement of Proposition 3 is neglected since it is rather technical and not particularly informative. The first statement essentially states that the less updating of beliefs occurs, the more likely it is that preserving employee's fairness perceptions by secretively differentiating rather than transparently is to be preferred. Section 5 illustrates this tradeoff for some specific belief pairs.

#### 4.6. Wage equality or differentiation?

Before deciding whether or not to initiate transparency the firm needs to decide whether it wants to offer individual contracts, and if so, the terms of these contracts. Recall that Proposition 2 establishes that a wage equality policy is evidently followed up by the firm disclosing all employee's contracts. Such a generalization is however unfeasible following a wage differentiation policy. Hence, the firm's wage policy choice cannot be analyzed without considering its subsequent information policy choice.

**Transparent wage equality versus transparent wage differentiation.** Transparency is a given and the evaluation of the two wage policies is essentially identical to the one performed by Fang and Moscarini (2005) perform. The difference in profits between the two wage policies decomposed into four separate categories:

$$\begin{aligned}
 \pi^{D,T} - \pi^{E,T} = & \left[ \begin{array}{l} \text{fairness effect} \\ [q_0\mu + (1 - q_0)(1 - \mu)][\tilde{V}_{D,T}(p_H, q_H) - \tilde{V}_{E,T}(p_H, q_H)] \\ + [(1 - q_0)\mu + q_0(1 - \mu)][\tilde{V}_{D,T}(p_L, q_L) - \tilde{V}_{E,T}(p_L, q_L)] \end{array} \right] + \quad (10) \\
 & \begin{array}{l} \text{morale gain effect} \\ [q_0\mu + (1 - q_0)(1 - \mu)][\tilde{V}_{E,T}(p_H, q_H) - \tilde{V}_{E,T}(p_0, q_H)] + \\ \text{morale loss effect} \\ [(1 - q_0)\mu + q_0(1 - \mu)][\tilde{V}_{E,T}(p_L, q_L) - \tilde{V}_{E,T}(p_0, q_L)] + \\ \text{sorting effect} \\ \left[ \begin{array}{l} [q_0\mu + (1 - q_0)(1 - \mu)][\tilde{V}_{E,T}(p_0, q_H) - \tilde{V}_{E,T}(p_0, q_0)] \\ + [(1 - q_0)\mu + q_0(1 - \mu)][\tilde{V}_{E,T}(p_0, q_L) - \tilde{V}_{E,T}(p_0, q_0)] \end{array} \right] \end{array}
 \end{aligned}$$

The first component denotes, likewise as the previously established fairness effect, the effect on profits from employees possessing social preferences rather than not. Since the fairness effect is negative, it represents the loss in profits resulting from employees perceiving unfairness instead of fairness following a transparent wage differentiation policy. A similar interpretation applied earlier in (9), although the magnitude of the fairness effect is evidently larger when a transparent wage differentiation policy is compared to a policy of wage equality rather than to a policy of secretive wage differentiation. The morale gain and loss effect concern how the disclosure of varying contracts alters employees' self-evaluation. This effect is evaluated with the corresponding fairness perceptions in the reference category, with employees perceiving fairness following a policy of transparent wage equality. Recall that



the signs of these two effects are each other's inverse. The *sorting effect* represents the informational value of the received performance evaluation. Specifically, it denotes the increase in profits from being able to modify employees' contracts to their corresponding performance evaluation without affecting their morale. Note that, with these particular combinations of wage and information policies, this effect is only artificial. The sorting effect is relative to the fairness perceptions following a transparent wage equality policy, implying that it considers the firm to be able to preserve employee's favorable fairness perceptions while simultaneously tailoring employees' contracts.

**Lemma 3:** *Consider any prior beliefs  $q_0 \in (0,1)$  and equilibria contracts  $\tilde{b}_{D,T}(p_0, q_j)$ , with  $j \in \{0, L, H\}$ . The sorting effect is then strictly positive in case the optimal contract  $b_{D,T}^*(p_0, q_j)$  satisfies the employee's participation constraint and equals zero in any other case.*

Recall that the firm solely receives *informative* performance evaluations. Intuitively, receiving such information is always valuable since it allows a decision-maker to make more informed choices. In this particular instance, the received performance evaluation allows the firm to differentiate between employees and tailor incentives to employees' capabilities. The sorting effect solely equals zero, for any prior beliefs  $q_0 \in (0,1)$ , in case the firm either believes all employees possess low (high) ability, the optimal contract  $b_{D,T}^*(p_0, q_j)$  violates the employee's participation constraint while  $\bar{b}_{D,T}(p)$  satisfies the firm's participation constraint or, thirdly, when no contracts are offered to any of the individuals.

Since the fairness effect in (10) is always negative (by Proposition 2) and the sorting effect is strictly positive for any prior beliefs  $q_0 \in (0,1)$  by Lemma 3, a tradeoff evidently exists. Irrespective of the employed policy, the net morale effect equals zero when the employee has extreme prior beliefs (see Proposition 3). However, the net morale effect's sign is ambiguous in any other case. These statements result in the following generalizations:

**Proposition 4:** *In case both the firm's and the employees' prior beliefs approach their extremes simultaneously, being any combination of  $(p_0, q_0)$  with  $p_0 \in \{0,1\}$  and  $q_0 \in \{0,1\}$ , the firm's expected profits are higher following a transparent wage equality policy than those of a transparent wage differentiation policy.*

Note that the opposing signs of the fairness and sorting effect inhibit any further generalizations than the ones made in Proposition 4, with the net morale effect tipping the odds either in favor of a transparent wage equality or in favor of a differentiation policy. In case the employees have extreme beliefs they will not update their beliefs and the fairness effect simply opposes the sorting effect.

**Transparent wage equality versus secretive wage differentiation.** Being able to secretly differentiate between employees provides the firm with the opportunity to modify employees' contracts to their corresponding performance evaluation without, importantly, altering their beliefs in

their own ability. Doing so however comes at the cost of worse fairness perceptions. Decomposing the difference in profits between the two wage policies yields

$$\pi^{D,S} - \pi^{E,T} = \begin{array}{c} \text{fairness effect} \\ \left[ \begin{array}{l} [q_0\mu + (1 - q_0)(1 - \mu)][\tilde{V}_{D,S}(p_0, q_H) - \tilde{V}_{E,T}(p_0, q_H)] \\ + [(1 - q_0)\mu + q_0(1 - \mu)][\tilde{V}_{D,S}(p_0, q_L) - \tilde{V}_{E,T}(p_0, q_L)] \end{array} \right] + \end{array} \quad (11)$$

$$\begin{array}{c} \text{sorting effect} \\ \left[ \begin{array}{l} [q_0\mu + (1 - q_0)(1 - \mu)][\tilde{V}_{E,T}(p_0, q_H) - \tilde{V}_{E,T}(p_0, q_0)] \\ + [(1 - q_0)\mu + q_0(1 - \mu)][\tilde{V}_{E,T}(p_0, q_L) - \tilde{V}_{E,T}(p_0, q_0)] \end{array} \right] \end{array}$$

The interpretation of the established fairness effect is comparable to the one identified previously, with fairness perceptions following a transparent wage equality policy being the reference category. Contrary to the previously established fairness effects however, employees' posterior beliefs equal their prior beliefs. This is because employees are unable to update their beliefs following a secretive wage differentiation policy, whereas the previously analyzed policy of wage differentiation accompanied by transparency allowed employees to infer their own performance evaluation. Since the updating of employees' beliefs does not occur in a secretive wage differentiation policy, the morale gain and loss effect are both non-existent. The gain in profits of being able to tailor employees' contracts to their corresponding performance evaluation is less artificial than before, since the firm can actually offer different contracts without altering the morale of its employees. Nonetheless, the sorting effect considers employees favorable fairness perceptions to be preserved, which is actually not the case. This change in fairness perceptions is precisely what the first component captures.

**Proposition 5:** *The firm's expected profits are higher following a transparent wage equality policy than those following a secretive wage differentiation policy for any prior beliefs  $p_0$  if the firm has extreme prior beliefs  $q_0$ .*

The above proposition simply follows from the sorting effect being positive for any intermediary firm beliefs, that is for any  $q_0 \in (0,1)$ , and the fairness effect always being negative. Intuitively, in case the performance evaluation contains no information the firm prefers to preserve the employees' fairness concerns. In any other case, a tradeoff between the two policies evidently exists.

**Optimal policy choice.** Combining Proposition 4 and 5, it follows that the firm will opt for a transparent wage equality policy if the firm has extreme beliefs. In any other case, a potential tradeoff exists between the three policies. The magnitude and interpretation of the fairness, morale and sorting effects varies with each comparison. The conjunction of these effects is illustrated in Section 5.

## 5. Numerical analysis

The previous sections analyzed the model algebraically, which proved to be possible only for some extreme cases and combinations. In this section, the cost of effort and production function are quantitatively specified and numerical analysis is used to illustrate the different tradeoffs the firm faces. Numerical analysis is concerned with creating, analyzing and implementing algorithms to approximate numerical solutions to mathematical problems. The software package MATLAB is used to perform these approximations. The focus of the subsequent numerical analysis concerns the implications of the two main deviations from Fang and Moscarini's (2005) model, being the introduction of social preferences and pay transparency not being a given.

The same probability function of achieving high output is used as in Fang and Moscarini (2005), being  $\pi_j(e) = 1 - \exp[-a_j e]$ . This is primarily done so since this probability function is one of the few functions, that ensures that the firm has an incentive to tailor bonuses to one's capabilities. Note that it satisfies all the necessary conditions:  $\pi_j(0) = 0$ ,  $\pi_j' > 0$  and  $\pi_j'' < 0$ , besides ensuring that  $p\pi_H' + (1-p)\pi_L'$  is log-concave. The assumptions regarding the cost of effort function are much less restrictive, with its general form having to satisfy:  $C(0) = 0$ ,  $C' > 0$ ,  $C'' > 0$  and  $C''' \geq 0$ . Additionally, the costs of effort must increase when the employee's fairness perceptions become worse. A simple polynomial  $C(e) = \gamma e^2$  suffices to satisfy all these conditions, where  $\gamma > 0$  captures the employee's fairness concerns. For simplicity, the maximum value of  $\gamma$  is limited to 1. Corresponding with the particular fairness perceptions,  $0 < \gamma_{E,T} < \gamma_{W,S} < \gamma_{D,T} \leq 1$  then holds.

To be able to demonstrate the effect of fairness and pay transparency by way of numerical analysis, the value of a number of parameters needs to be fixed. For this section,  $a_H = 2$  and  $a_L = 1$ . Furthermore, the firm's prior beliefs  $q_0$  equal 0.5 and the informativeness of the performance evaluation is initially set at  $\mu = 0.75$ , which is hereafter referred to as being 'moderately' informative. Additionally, we fix the firm's and employees' outside options at 0, that is  $U_0 = 0$  and  $V_0 = 0$ . The value of 'high' output is set at  $y = 6$ .

### 5.1. Illustrating the impact of employee's fairness concerns

This section evaluates the impact of social preferences for some posterior belief pairs, with  $q = 0.50$ . Three belief pairs are discussed, one where the firm and its employees agree on their priors ( $p = 0.50$ ), one where employees are overconfident ( $p > 0.50$ ), and, additionally, the case where employees are underconfident ( $p < 0.50$ ). While the effect's sign is pretty straightforward with all of these belief pairs, its magnitude is of significance in relation to the other effects and thereby also for the firm's wage and information policy choice. Specifically, regarding the latter two belief pairs,  $p = 0.25$  and  $p = 0.75$ . The performance signal  $\theta$  is ignored in the evaluation of the fairness effect.

Figure 1 illustrates how the optimal effort allocation  $e^*$  and the corresponding optimal bonus  $b^*$  change with  $\gamma$ . Moreover, the bottom figure illustrates for the specified belief pairs how the firm's maximum profits  $V^*$  of a single employee vary with fairness concerns  $\gamma$ . The figure shows that the optimal effort allocation decreases with one's concern for fairness while the optimal bonus is a concave function in  $\gamma$ . Combining the two figures shows how the firm's maximum individual profits  $V^*$  decrease with increasing concerns for fairness, given the earlier specified parametric values. The figure shows that  $V^*$  is convex in  $\gamma$ , implying that the fairness effect is larger for small values of  $\gamma$ . Interestingly, an interaction between the employee's fairness concerns and his beliefs relative to those of the firm is observed in the bottom figure, introducing the tradeoff between fairness and morale considerations.

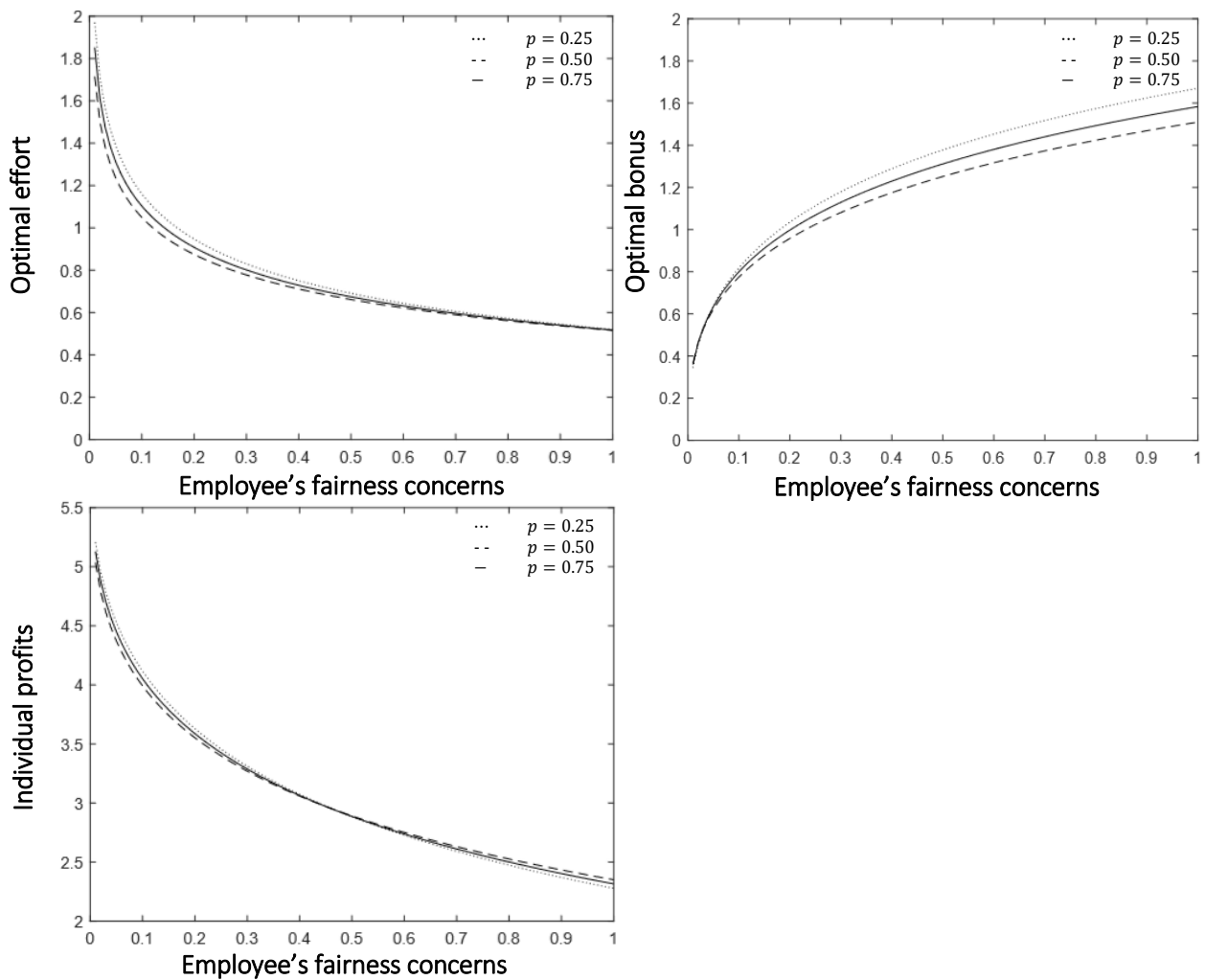


Figure 1: Graphical illustration of the relationship between the optimal effort, optimal bonus and individual profits with employee's fairness concerns. The firm's belief equals  $q = 0.50$  in each figure. Other parameter values are set at  $a_H = 2$ ,  $a_L = 1$  and  $y = 6$ .

Remember however that Figure 1 does not allow a separation of the updating of beliefs and the fairness effect. Not only may employees update their beliefs according to the potential disclosure of contracts, the firm always updates its beliefs while in this example we have simply fixed the firm's

posterior beliefs to equal 0.50. Moreover, the magnitude of the fairness effect not only depends on the relative values of  $\gamma_{E,T}$ ,  $\gamma_{W,S}$  and  $\gamma_{D,T}$  but also on their absolute values.

## 5.2. Internalizing fairness, managing confidence and sorting strategically

This section evaluates the profits resulting from the varying policies and compares the underlying mechanisms behind their differences. Following the analysis in Section 4, secretive wage equality is ignored in this comparison due to its inferiority compared to the other policies (see Proposition 2). Unfortunately, the outlined policies cannot be effectively compared without assigning numerical values to  $\gamma_{E,T}$ ,  $\gamma_{W,S}$  and  $\gamma_{D,T}$ . Considering Section 5.1, changing these values obviously impacts the illustrations about to follow. Other specific fairness perceptions invoke different actions and behavior: introducing fairness goes beyond simply stating that employees care, it also concerns *how* they care.

Employees' fairness concerns are set at  $\gamma_{E,T} = 0.96$ ,  $\gamma_{W,S} = 0.97$  and  $\gamma_{D,T} = 0.98$ .<sup>15</sup> The firm's prior beliefs  $q_0$  equal 0.50 and the performance signal is moderately informative ( $\mu = 0.75$ ). The firm's and employees' outside options equal 0, that is  $U_0 = 0$  and  $V_0 = 0$ . 'High' output is valued at  $y = 6$ .

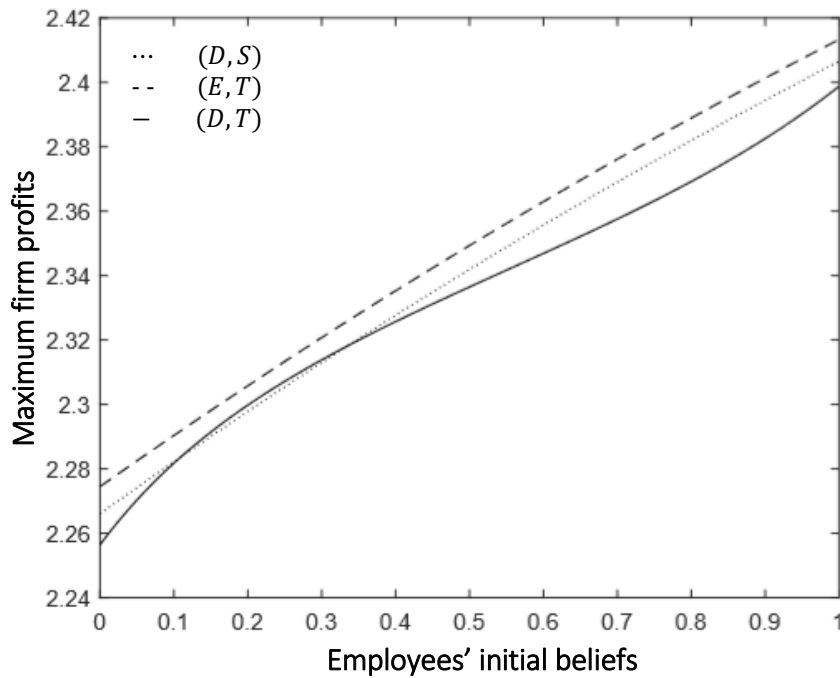


Figure 2: Firm profits resulting from transparent wage differentiation, secretive wage differentiation and transparent wage equality given various initial beliefs. Parameter values are set at  $q_0 = 0.50$ ,  $a_H = 2$ ,  $a_L = 1$ ,  $y = 6$ ,  $\mu = 0.75$ ,  $\gamma_{E,T} = 0.96$ ,  $\gamma_{W,S} = 0.97$  and  $\gamma_B = 0.98$ .

<sup>15</sup> These values are primarily chosen since the discrepancy in profits between the different policies is larger for small values of  $\gamma$ .

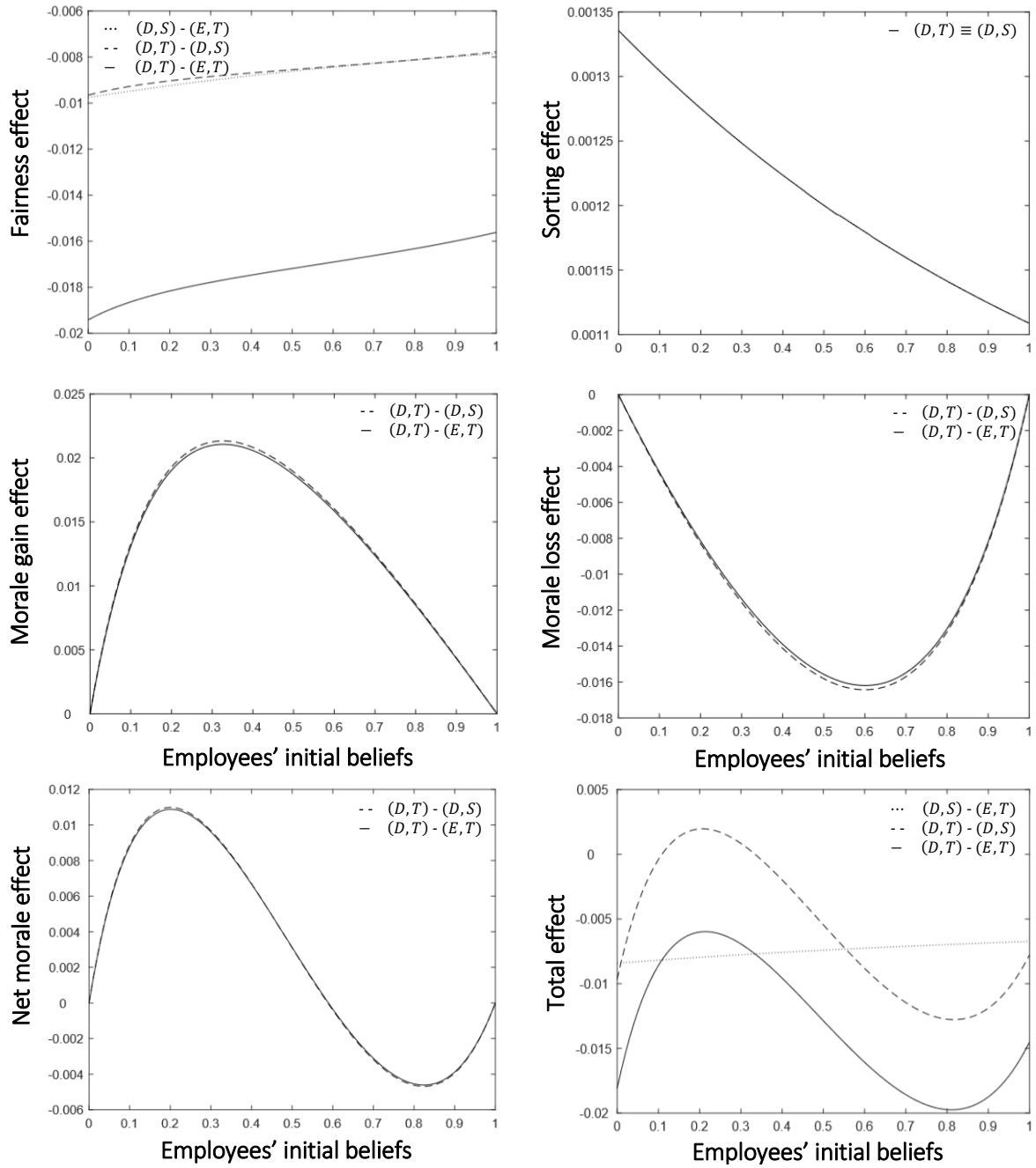


Figure 3: Disentangling the tradeoffs between the policies as shown in Figure 2. Parameter values are  $q_0 = 0.50$ ,  $a_H = 2$ ,  $a_L = 1$ ,  $y = 6$ ,  $\mu = 0.75$ ,  $\gamma_{E,T} = 0.96$ ,  $\gamma_{W,S} = 0.97$  and  $\gamma_{D,T} = 0.98$

Figure 2 shows the profits of the three considered wage policies, while Figure 3 depicts the underlying fairness, sorting and morale effects. Given the specified parametric values, transparent wage equality is superior to the other policies for any prior beliefs of the employee. This is primarily due to the significance of the fairness effect, even though high values of  $\gamma$  were chosen. Preserving employees' favorable fairness perceptions appears to be extremely valuable, inducing the firm to opt for a transparent wage equality policy. The stable difference in profits following transparent wage equality and secretive wage differentiation results from the insignificance of the sorting effect compared to the

fairness effect, with the (negative) fairness effect being roughly ten times the sorting effect. Figure 3 shows that this also applies for the morale effects, causing the superiority of a transparent wage equality policy over a transparent wage differentiation policy. Conclusively, tradeoffs will be more apparent when fairness effects are smaller than in the presented example, and any of the three considered policies may then still be potentially optimal.

Nonetheless, a tradeoff between a transparent and secretive wage differentiation policy exists, which is driven by the fairness and morale effects. Figure 3 shows that the (net) morale effect of differentiating transparently rather than secretly dominates the fairness effect for some low initial beliefs, roughly for initial beliefs  $q_0$  larger than 0.1 and smaller than 0.3. Note that the magnitude of the sorting effect is also substantially smaller than that of the morale effects (again given the specified parametric values). Figure 3 shows that the morale effects only differ slightly dependent on the policy to which the transparent differentiation policy is compared to: the (net) morale effects are larger when the secretive wage differentiation policy serves as the reference category. Lastly, the figures indicate that publicly differentiating becomes more appealing when employees care less about organizational fairness.

## 6. Discussion

In this section some model assumptions and alternative settings are discussed. Additionally, some recommendations for further research are offered.

### 6.1. Testable implications and validating the model

The model put forward in this paper is yet to be tested empirically.<sup>16</sup> This primarily concerns the importance of social preferences in wage-setting policies and in the decision to be transparent about the employed policy. A common obstacle to validating the model is the complexity of the matter and the general lack of suitable datasets. Nonetheless, some of the implications suggested by the model may however be verified in practice.

One potentially testable implication of the model is that transparent wage differentiation is more common when social preferences are not apparent. This however only concerns unjustifiable differentiation, such as rewarding the same performance differently. Comparing the wage policies of firms in a culture where fairness is (extremely) important with a culture in which this is not the case could validate this prediction. Note that the use of 'justifiable' is already culturally colored.

Another testable implication concerns the prevalence of wage differentiation in case one's performance cannot easily be compared, obscuring the relationship between wage and performance.

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<sup>16</sup>The same applies for the model presented by Fang and Moscarini (2005).

Fairness judgements are thereby much less precise and potentially less relevant. This can for instance be investigated by comparing wage policies of firms offering intellectual services with those performing simple and measurable manufacturing tasks.

Thirdly, the model suggests that transparently differentiating rather than secretly differentiating is more common for firms that have a workforce that lack confidence in their own ability (see Section 5). Contingent on employees' social preferences, transparent differentiation is then also preferred over wage equality. This can potentially be validated by targeting firms with employees that lack confidence to observe whether these firms are more inclined to boost the morale of their employees by transparently differentiating them.

Lastly, it can be tested whether firms indeed never combine wage equality and pay secrecy. The model starkly predicts that this never occurs, yet employees' potential privacy concerns may induce firms to not share sensitive pay information. Data is required regarding the firms' wage policy choice after imposing secrecy however, which is usually problematic. In general, a deeper understanding of employees' social preferences in a workforce setting is required to validate the model. This includes all the three components of organizational fairness, being distributive fairness, procedural fairness and interactional fairness.

## **6.2. Alternative social preferences**

In this paper, the cost of effort function is considered to be convex in employees' fairness perceptions. Implicitly, the optimal amount of effort then decreases with one's concern for fairness, and thereby also the firm's maximum expected profits. Fairness perceptions are assumed to gradually become worse when employees are not provided with sufficient information to evaluate the fairness of contracts or, increasingly worse, when they are provided with such information and observe that the terms specified in the contracts are dissimilar.

While such a generalization may uphold for most individuals Fehr and Schmidt (1999) suggest that people generally have an asymmetrical response to inequity. In particular, employees who experience less attractive contract terms are likely less willing to exert effort than their counterparts. Although the fairness effect remains, its impact varies once employees respond asymmetrically to unequal contract terms. While this would complicate the model, the outlined framework can still be applied. This can for instance be done by letting fairness perceptions depend on the contract terms. Alternatively, Rabin (1993) poses that employees may also reciprocate favorable contract terms, implying a lower impact of the negative fairness effect. The analyzed framework can also incorporate reciprocity.

The model disregards potential privacy concerns, which are usually regarded as being one of the main considerations in withholding pay information (Colella, Paetzold, Zardkoohi, & Wesson, 2007). Privacy concerns can be captured in the model by varying the degree to which employees care about



fairness. The positive effect of disclosing fair compensation then becomes smaller and the negative effect of publicly differentiating becomes larger. Applying the framework to the matter of disadvantageous inequity, suppose that employees with favorable contract terms have favorable fairness perceptions instead of poor fairness perceptions; informational fairness judgments remain the same, where a non-transparent firm thus invokes presumptions of unfairness. In this hypothetical situation the firm then needs to consider which group of employees, in terms of their ability and morale, is exposed to less attractive contract terms. Assuming that this generally is the less-productive group of employees, exposing differentials in bonuses then becomes more attractive. The opposite applies however when the group which faces worse contract terms has high productivity. The firm's understanding of employees' fairness perceptions is thus vital to its policy choice.

For simplicity, fairness is described in discrete terms rather than in a continuum. In other words, employees simply care whether contract terms are different while ignoring the extent to which this applies. Incorporating a continuous scale for fairness is more likely to resemble actual preferences, although doing so complicates the analysis by enhancing the interdependencies in wage contracts.

### **6.3. Intermediate transparency levels**

Besides pay transparency and secrecy, there may be some intermediary levels of transparency that are particularly interesting to investigate. For instance, transparency concerning employees' salary scale is not uncommon in organizations, even in academia. This provides individuals with a less precise benchmark against which they can evaluate their compensation. Having a higher salary indicates better qualifications, but is less informative than observing the salaries of everyone within the same salary scale. Likewise as observing higher salaries of colleagues, a low position on the scale is likely experienced as being unfair (Rowley, 1996). Note that sharing an employee's salary scale also yields some kind of performance evaluation, although it is much less informative. By sharing information about pay, informational fairness perceptions can be enhanced. Nevertheless, the exploration of alternative transparency levels is considered to be a valuable extension.

### **6.4. External forces**

The decision to share information about internal pay ratios and policies is likely not only influenced by employees' fairness considerations but also by society's perception of fair compensation. Positions that are extremely visible, such as the top management of a large firm, are regularly placed under scrutiny; Mas (2016b) for instance shows that salaries of city managers are primarily cut because they appear excessive rather than actually being so.

The performed analysis disregards such external pressure on wage policies, yet most of the examples in the introduction to this paper (e.g. the amendments to the Dodd-Frank Wall Street Reform

and Consumer Protection Act) seem to be driven largely by forces other than the firm's workforce. The model put forward in this paper could however be extended by introducing a pricing mechanism that relies on the firm's internal pay policy and the information it distributes regarding it.

More generally, analyzing multiple firms would allow for a more dynamic analysis of employee behavior. One of the limitations of the model is that the external labor market is mostly disregarded. Self-selection of employees with regard to the firm's policy choice cannot occur and ability is unlikely to be entirely firm-specific. Specifically the former is extremely interesting, since individuals may value transparency heterogeneously. Lastly, analyzing the recruitment of employees with a workforce and policy already in place – especially if these have a higher outside option – further emphasizes the importance of employees' social preferences and available information.

## 7. Concluding remarks

The purpose of this paper is to formalize the workforce's response to pay transparency incorporating employees' fairness concerns. The implications of these responses on optimal wage-setting are investigated. This paper thereby explores an alternative explanation for why firms impose pay secrecy guidelines that goes beyond preserving employees' confidence.

If anything, this paper shows that a firm's wage policy choice is extremely complicated. The firm hires multiple employees and hence needs to consider the interdependencies in contracts. Importantly, the firm is considered to have an incentive to strategically differentiate between employees based on the received performance signals. Such strategic differentiation, if done publicly, reveals employees their individual performance evaluations and may either hurt or boost their morale. Besides managing employees' morale, the firm strategically distributes information to preserve employees' fairness perceptions.

The analyzed framework is comprehensive in the sense that it captures the main considerations in choosing between pay transparency and secrecy. More importantly, this paper is the first to formalize this strategic use of pay information in relation to employees' fairness perceptions. Fairness concerns are introduced by increasing the cost of exerting effort with unfairness, which intuitively results in lower individual profits for the firm. While employees realize that offering different bonuses is done for some particular reason, they believe that achieving the same performance should be rewarded similarly.

The analysis shows that secretly offering identical contracts is never optimal. This paper has however disregarded privacy concerns, which may invalidate this statement if employees care sufficiently more about privacy than about fairness. Regarding the other policies, any policy is potentially optimal. Three major considerations are characterized for opting between transparency or secrecy and wage differentiation or equality. First of all, the firm desires to strategically sort employees to their highest value use by tailoring their incentives to their ability. The second and third considerations

concern the strategic use of information. The firm is aware that withholding information induces negative fairness perceptions. On the other hand, showing the employees that they are rewarded differently in case of achieving similar performance is hypothesized to be even more worrisome. Lastly, employees update their beliefs about their own ability, contemplating the rationale behind this differentiation. In practice, the feeling of unfairness and the updating of beliefs are likely to be intertwined: observing differences in pay holds some informational value, yet this differentiation is not fully understood and thus yields a sense of unfairness.

This paper numerically illustrates that the larger employees' fairness concerns are, the less publicly differentiating employees is desired. This however solely applies for differentiation that is perceived as being unfair. In settings in which performance is continuous rather than discrete, differentiation is more appropriate: (absolute) bonuses may then differ, but the underlying performance is easier to measure and justify. The understanding of employees' fairness concerns is essential for the firm to devise the optimal wage policy. The apparent dominance of a transparent wage equality policy suggests that the fairness effect may be overestimated in the numerical illustrations. Interviews with wage-setters can potentially shed light on this possibility. Most importantly however, a deeper understanding of individuals' social preferences is required, specifically regarding the presumption of unfairness following pay secrecy and actually experiencing unfairness following pay transparency. Presumably, social preferences are influenced by cultural aspects and ethics, and may even be individual-specific. Nonetheless, our current understanding of how individuals experience pay secrecy is limited, definitely with regard to the preconception that ignorance is bliss.

Although academic interest has increased in recent years, our understanding of pay transparency is still limited. This is particularly true for how pay transparency affects fairness perceptions. Further empirical research can clarify how fairness and pay transparency relate within organizations. Natural experiments, with the intervention being the implementation of a pay transparency policy by the government, may be the most suitable to examine the organizational implications of transparency. Theoretical advancements may focus on intermediate transparency levels and the significance of privacy concerns. The recent emergence of pay transparency policies suggests an increased emphasis on fairness within the workplace. However, organizations rewarding fairly and being able to publicly justify their policies have nothing to worry from the movement towards transparency.

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## Appendix 1: Omitted proofs

### Proof Lemma 2:

Differentiating the first-order derivative in (6) w.r.t.  $b$  yields, with some simplification,<sup>17</sup>

$$V'' = [y - b]\{[q\pi'_H + (1 - q)\pi'_L]e^{*''} + [q\pi''_H + (1 - q)\pi''_L]e^{*'}e^{*'}\} - 2[q\pi'_H + (1 - q)\pi'_L]e^{*'}$$

Following Lemma 1, the firm's maximization problem is bounded in the bonus  $b$ , with  $b \in [\underline{b}, y]$  implying that  $(y - b) \geq 0$ . Then, by assumption,  $\pi'_j > 0$  and  $\pi''_j < 0$  imply that  $V'' < 0$  if and only if  $e^{*'} \geq 0$  and  $e^{*''} < 0$ . Thus, the firm's inner maximization problem has a unique solution if and only if  $e^*$  is concave in  $b$ . Moreover, note that the extremes  $\underline{b}$  and  $y$  do not solve (6). This follows from  $V' > 0$  when the lowest feasible bonus is offered and  $V' < 0$  when the bonus equals  $y$ , implying that these feasible bonuses will never be offered.

Rewriting the first-order condition of the employee and implicitly differentiating w.r.t.  $b$  yields

$$e^{*'} = \frac{[p\pi'_H + (1 - p)\pi'_L]}{C'' - b[p\pi''_H + (1 - p)\pi''_L]}$$

where  $C''$  denotes the second derivative w.r.t.  $m$  (given fairness perceptions  $F$ ). Note that  $e^{*'}$  is always larger than zero since  $C'' > 0$ ,  $\pi'_j > 0$  and  $\pi''_j < 0$  hold by assumption, implying that the first condition of concavity is definitely satisfied. The second condition of concavity, being that  $e^{*''} < 0$  for any  $b$ , is not necessarily satisfied. Note that differentiating  $e^*$  w.r.t.  $b$  once more yields

$$e^{*''} = \frac{[p\pi''_H + (1 - p)\pi''_L]e^{*'}}{C'' - b[p\pi''_H + (1 - p)\pi''_L]} - \left( \frac{[p\pi'_H + (1 - p)\pi'_L]}{C'' - b[p\pi''_H + (1 - p)\pi''_L]} \right) \left( \frac{[C''' - b[p\pi'''_H + (1 - p)\pi'''_L]]e^{*'} - [p\pi''_H + (1 - p)\pi''_L]}{C'' - b[p\pi''_H + (1 - p)\pi''_L]} \right)$$

where the common denominator is always positive since  $C'' > 0$  and  $\pi''_j < 0$ . Whether  $e^{*''}$  is subsequently negative depends on the specifications of  $C'''$  and  $p\pi'''_H + (1 - p)\pi'''_L$ . ■

### Proof Lemma 3:

The sorting effect is concerned with the difference between profits when the firm has either updated its beliefs or not. Note that the sorting effect concerns employees' fairness perceptions being favorable, with them having posterior beliefs  $p_0$ . The firm can, following performance evaluations  $\theta$ , either decide to ignore the received information and offer each employee the same contract or can decide to offer

<sup>17</sup> Importantly,  $e^*_{w,i}(\cdot)$ ,  $V_{w,i}(\cdot)$  and  $\pi_j(\cdot)$  abbreviates  $e^*$ ,  $V$  and  $\pi_j$ , in the following proof. Also,  $V''$  denotes the second derivative w.r.t.  $b$ ,  $\pi'_j$  ( $\pi''_j$ ) the first-order (second-order) derivative w.r.t.  $e$  and  $e^{*'}$  ( $e^{*''}$ ) the first-order (second-order) derivative w.r.t.  $b$  (given particular fairness perceptions, whose subscript is temporarily ignored). This notation applies in a similar manner to higher-order derivatives.

them separating contracts. The firm's and employees' participation constraints are temporarily ignored below in proving that the sorting effect is strictly positive, implying that maximum profits are achieved by offering  $b_{E,T}^*(p_0, q_j)$ .

Beliefs are updated according to Bayes' rule and the profits resulting from (publicly) offering the same contract to each employee can thus be rewritten in the following way

$$\begin{aligned} \tilde{V}_{E,T}(p_0, q_0) = & \\ & [q_0\mu + (1 - q_0)(1 - \mu)] \left[ \begin{array}{l} q_H\pi_H \left( e_{E,T}^*(b_{E,T}^*(p_0, q_0), p_0) \right) \\ + (1 - q_H)\pi_L \left( e_{E,T}^*(b_{E,T}^*(p_0, q_0), p_0) \right) \end{array} \right] [y - b_{E,T}^*(p_0, q_0)] \\ & + [(1 - q_0)\mu + q_0(1 - \mu)] \left[ \begin{array}{l} q_L\pi_H \left( e_{E,T}^*(b_{E,T}^*(p_0, q_0), p_0) \right) \\ + (1 - q_L)\pi_L \left( e_{E,T}^*(b_{E,T}^*(p_0, q_0), p_0) \right) \end{array} \right] [y - b_{E,T}^*(p_0, q_0)] \end{aligned}$$

Likewise, the firm's profits can be derived when the firm is able to differentiate employees while, hypothetically, preserving their favorable fairness perceptions. The firm's profits then equal

$$\begin{aligned} & [q_0\mu + (1 - q_0)(1 - \mu)] \left[ \begin{array}{l} q_H\pi_H \left( e_{E,T}^*(b_{E,T}^*(p_0, q_H), p_0) \right) \\ + (1 - q_H)\pi_L \left( e_{E,T}^*(b_{E,T}^*(p_0, q_H), p_0) \right) \end{array} \right] [y - b_{E,T}^*(p_0, q_H)] \\ & + [(1 - q_0)\mu + q_0(1 - \mu)] \left[ \begin{array}{l} q_L\pi_H \left( e_{E,T}^*(b_{E,T}^*(p_0, q_L), p_0) \right) \\ + (1 - q_L)\pi_L \left( e_{E,T}^*(b_{E,T}^*(p_0, q_L), p_0) \right) \end{array} \right] [y - b_{E,T}^*(p_0, q_L)] \\ & = [q_0\mu + (1 - q_0)(1 - \mu)]\tilde{V}_{E,T}(p_0, q_H) + [(1 - q_0)\mu + q_0(1 - \mu)]\tilde{V}_{E,T}(p_0, q_L) \end{aligned}$$

Importantly, the firm's maximization problem is different in the two instances and so are (potentially) their respective solutions. The firm is still able to opt for a similar contract when it decides to offer multiple contracts (conditional on performance evaluation  $\theta$ ), that is  $b_{E,T}^*(p_0, q_0)$  may equal  $b_{E,T}^*(p_0, q_\theta)$ , and the sorting effect is therefore never negative.

The sorting effect is even positive in most instances since the firm's maximization problem is non-linear in the bonus  $b$ , implying that a different optimal bonus exists for combinations of  $(p, q)$ . By a revealed preference argument and Bayesian updating of beliefs, the profits of the firm increase with beliefs  $q$ . This argument is conditional on the participation constraints of the firm and its employees. In case the firm has extreme prior beliefs, being that it initially either believes the population consists solely of high ability employees or alternatively that there are only employees who are of low ability, the sorting effect also equals zero. ■



**Proof Proposition 2:**

Suppose the firm opts for wage equality with pay transparency. Then, the employee perceives actual fairness with corresponding first-order condition

$$b[p\pi'_H(e) + (1-p)\pi'_L(e)] = C'_{E,T}(e)$$

yielding a unique optimal effort level  $e^*_{E,T}(b, p)$ . Entering this optimal effort level in the first-order condition of the employee when he possesses different fairness perceptions, specifically that he presumes some unfairness, yields

$$b[p\pi'_H(e^*_{E,T}(b, p)) + (1-p)\pi'_L(e^*_{E,T}(b, p))] < C'_{W,S}(e)$$

by assumption, since it is explicitly assumed that  $C'_B(e) > C'_{W,S}(e) > C'_{E,T}(e) > 0$  holds. Moreover, because  $\pi''_j < 0$  and  $C''_{W,I} > 0$ , increasing  $e$  beyond  $e^*_{E,T}(b, p)$  will only further increase the discrepancy between the marginal costs and benefits of effort. Rather, decreasing  $e$  sufficiently to  $e^*_A(b, p)$  yields

$$b[p\pi'_H(e^*_{W,S}(b, p)) + (1-p)\pi'_L(e^*_{W,S}(b, p))] = C'_A(e)$$

It then follows that  $e^*_{E,T}(b, p) > e^*_{W,S}(b, p)$  holds for all feasible bonuses  $b$  and morale  $p$ . Note that the incentive compatibility constraint of the employee is considered to be satisfied, irrespective of the employee's fairness perceptions, that is  $e^*_F(b, p) \geq 0$ . Recall that the incentive compatibility is always satisfied when the participation constraint is in the described setting. Following the assumptions regarding the cost of effort function, it follows that  $e^*_{E,T}(b, p) > e^*_{W,S}(b, p) > e^*_{D,T}(b, p) \geq 0$ .

Applying some simple algebra to the firm's problem in (5) shows that profits following wage equality with transparency then always exceed those of secrecy, since the probability of achieving high output increases with effort and profits increase with the likelihood of high output. Then, transparency yields the firm strictly higher profits than secrecy does. ■

**Proof Proposition 3:**

Recall from Proposition 2 that worse fairness perceptions, ceteris paribus, result in lower expected profits, conditional on offering at least a single contract being optimal. The fairness effect established in (9) is therefore always negative, whereas the morale effects have opposing signs.

The first statement then simply follows from the Bayesian updating of beliefs. That is, if each employee either firmly believes that he is of high or low ability, prior beliefs equal posterior beliefs, irrespective of performance evaluation  $\theta$ . The morale of the firm's employees is thus neither boosted or hurt, resulting in an overall morale effect equal to zero.

The second statement indicates sufficient conditions for the (net) morale effect to be non-positive, resulting in, since the fairness effect is always negative, higher profits following a secretive wage differentiation policy rather than a transparent one. In case the firm and its employees agree on their

priors, that is  $p_0 = q_0$ , the updating of beliefs occurs identically and yields the same posteriors. The net morale effect is then represented by

$$\left[ \begin{aligned} & [q_0\mu + (1 - q_0)(1 - \mu)] [\tilde{V}_{D,S}(p_H, p_H) - \tilde{V}_{D,S}(p_0, p_H)] \\ & + [(1 - q_0)\mu + q_0(1 - \mu)] [\tilde{V}_{D,S}(p_L, p_L) - \tilde{V}_{D,S}(p_0, p_L)] \end{aligned} \right]$$

Note that the above expression must be smaller, or equal to, zero in order for the firm to prefer secrecy over transparency. Although the first statement establishes that this definitely holds in case the employees have extreme priors, this is untrue for any of the intermediary values of  $p_0$ . The employees' and the firm's prior beliefs can be written as a linear function of their posteriors, with respective weights of  $p_H$  and  $p_L$  equal to  $[q_0\mu + (1 - q_0)(1 - \mu)]$  and  $[(1 - q_0)\mu + q_0(1 - \mu)]$ . Importantly, by definition,  $p_0$  and  $q_0$  are then convex combinations of both  $p_H$  and  $p_L$  since these weights sum to one and are non-negative. Then, by the definition of concavity, it follows that the net morale effect is smaller than, or equal to, zero in case  $\tilde{V}_{W,S}(p, p)$  is concave in  $p$ . ■