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Overconfidence and gender gaps in career outcomes: insights from a promotion signaling model[a]

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Abstract

Gender differences in overconfidence are well documented in the empirical literature, but their impact on labor market outcomes remains underexplored. We provide new insights into how behavioral biases interact with career dynamics by presenting a theoretical analysis of how men's relatively higher overconfidence shapes gender differences in the labor market. Using a promotion-signaling model with competitive work incentives in which wages are endogenously determined, we show that overconfident workers exert more effort, are more likely to be promoted, and ultimately earn higher wages across job levels despite having lower expected ability conditional on promotion. The higher effort not only increases their chances of promotion, but also contributes to human capital accumulation through learning-by-doing, leading to higher productivity. However, overconfidence can be a double-edged sword: while it can lead to higher promotions and wages (serving as a "self-serving bias"), it also imposes higher effort costs and discourages peers, which can make it self-defeating in certain contexts.

Keywords: overconfidence, promotion, competition, gender gap, tournament, theory

JEL classification: C72, D91, J16, J24, M51, M52

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1 Introduction

Labor market outcomes for men and women have converged significantly in recent decades, driven by changes in cultural norms, family-friendly workplace policies, and more generous parental leave and childcare support. However, despite this progress, significant gender gaps persist, particularly in high-skill and high-wage occupations. While men and women with similar skills often start their careers with comparable earnings, significant gender gaps emerge over time (Noonan et al., 2005, Manning and Swaffield, 2008, Bertrand et al., 2010, Azmat and Ferrer, 2017). Economists point to several key contributors to these differences, including the demands of long hours, psychological traits related to competitive behavior, and the impact of child-rearing responsibilities (Goldin, 2014).[1]

In this study, we examine how overconfidence, which is often more prevalent among men, affects labor market outcomes under competitive work incentives. Extensive empirical research has consistently documented gender differences in overconfidence in a variety of settings (e.g., Camerer and Lovallo, 1999; Niederle and Vesterlund, 2007; Hoffman and Burks, 2020; Sarsons and Xu, 2021; Brilon et al., 2024). For example, Niederle and Vesterlund (2007) found that men were almost twice as likely as women to choose a competitive pay system, attributing this disparity to overconfidence and different preferences for competition. More recent findings by van Veldhuizen (2022) suggest that self-selection into competitive pay structures is primarily driven by overconfidence and risk aversion rather than an inherent preference for competition.[2]

To explore the labor market implications of overconfidence and its impact on gender equality, we embed overconfidence in a promotion-signaling model in which work effort simultaneously affects multiple labor market outcomes. Our focus is on competition for promotions, given their important role in driving individual wage growth (Baker et al., 1994b) and their prevalence as an incentive system in firms (Lazear and Rosen, 1981, Green and Stokey, 1983, Malcomson, 1984, Baker et al., 1994a,b, Prendergast, 1999, Bognanno, 2001, DeVaro, 2006, DeVaro et al., 2019).

The key feature of our model is that it accounts for the superior information that incumbent employers have about their workers and the reliance of outside firms on observable signals in hiring (Waldman, 1990, Acemoglu and Pischke, 1998). Thus, internal promotions signal workers' skills and influence wage offers from both current employers and outside firms (Wald-

[1] A growing body of literature points to behavioral differences between men and women in response to competitive environments. Studies have found that women are less likely than men to select into competitive economic environments and are more reluctant to accept performance-based pay (Gneezy et al., 2003, Niederle and Vesterlund, 2007, Croson and Gneezy, 2009). In addition, women tend to be less active in seeking promotions (Bosquet et al., 2019), negotiate lower salaries (Säve-Söderbergh, 2019), and are more likely to volunteer for tasks that contribute little to career advancement (Babcock et al., 2017). Conversely, certain roles and tasks associated with male stereotypes tend to attract men while discouraging women from pursuing such opportunities (Dreber et al., 2014, Flory et al., 2015, Flory et al., 2021). In addition, men are more likely to sabotage colleagues and compete aggressively against women (Dato and Nieken, 2014).

[2] In addition, Adamecz-Völgyi and Shure (2022) showed that male overconfidence accounts for between 5 and 11 percent of the gender employment gap in top positions. Overconfidence has also been found to be evolutionarily stable, serving motivational and ego-protective functions (Waldman 1994; Zimmermann 2020).

man, 1984). Such asymmetric learning and promotion signals have been extensively studied as drivers of labor market outcomes (Bernhardt, 1995, Zábojník and Bernhardt, 2001, Ghosh and Waldman, 2010, DeVaro and Waldman, 2012, Zábojník, 2012, Waldman, 2013, Gürtler and Gürtler, 2015, Waldman, 2016, DeVaro et al., 2018, Gürtler and Gürtler, 2019). Empirical evidence for the signaling role of promotions in wage determination is provided by DeVaro and Waldman (2012), Bognanno and Melero (2016), and Cassidy et al. (2016), with their relevance demonstrated by the exposure of promotion events on social media and hiring platforms.

Our contribution is to provide a theoretical analysis of the impact of overconfidence on early career human capital investments and later career outcomes in the context of job promotion competition. While the prior literature largely agrees that overconfidence leads to increased effort, our paper uniquely links overconfidence to a broader set of concurrent outcome gaps. These findings are consistent with empirical evidence showing lower promotion probabilities for women (leading to underrepresentation in senior corporate positions), wage differentials at the same hierarchical level, lower expected wages for women, gender differences in human capital investment, and skill differentials between promoted women and men. More broadly, our paper demonstrates how behavioral biases can be studied within a promotion signaling framework, with broader applications beyond this specific context.

We focus on two early career workers who make effort decisions that affect human capital accumulation, promotion probabilities, and subsequent wages. These effort decisions represent effective hours worked, which contribute to human capital development through learning-by-doing (De Grip et al., 2016, Stinebrickner et al., 2019, Caplin et al., 2022, James et al., 2022). Both workers have the same inherent ability distribution, but one worker (”he”) is *overconfident*, perceiving his ability as drawn from a superior distribution. Otherwise, the workers are identical, have the same preferences, and have the same ex ante promotion chances. Within each firm, there are two job levels: an entry-level position and a high-level (e.g., managerial) position. After gaining experience, one of the entry-level workers is promoted to the higher-level job. Productivity in the higher-level position is more important to the firm. The incumbent firm observes performance in the entry-level job, forms beliefs about the worker’s unobservable ability and effort, and uses these beliefs to predict productivity in the managerial job.

Our main results are as follows. First, we show that the equilibrium promotion rule is unbiased. It is in the firm’s best interest to promote the worker with the highest expected productivity, consistent with recent empirical evidence.[3] Second, we examine how overconfidence affects career investment. Intuitively, overconfidence could lead to either reduced or increased effort. On the one hand, a worker who perceives himself as highly capable may feel less need to exert effort, believing that his chances of promotion are already high. On the other hand, if effort and ability are complements (Bénabou and Tirole, 2002, Fang and Moscarini, 2005),

[3]For example, Azmat and Ferrer (2017) found that the gender gap in partnership status among lawyers becomes statistically insignificant once performance is accounted for, suggesting that promotion decisions are largely based on performance. Similarly, Bender et al. (2018) found that managerial human capital has a significant impact on firm productivity.

higher perceived ability could lead the overconfident worker to overestimate the marginal effect of effort, thus motivating increased effort. We show that in our model, it is the *marginal* probabilities that drive effort decisions. When effort and ability are complements, the overconfident worker always exerts more effort. However, when effort and ability are substitutes, both workers exert the same effort in equilibrium. This result is consistent with existing theory and empirical evidence (Chen and Schildberg-Hörisch, 2019, Bruhin et al., 2024).[4]

Finally, our third result focuses on the long-term implications of overconfident workers' increased effort. Higher effort leads to a higher probability of promotion and higher wages later in their careers, regardless of whether they are promoted. This simultaneously generates (gender) wage differentials across the hierarchy. Even though overconfident workers may have lower expected ability conditional on promotion, their increased effort results in greater transferable human capital, making them more productive overall. Thus, overconfident workers may either benefit from these dynamics, consistent with the concept of overconfidence as a "self-serving bias" (Bénabou and Tirole, 2002, Zimmermann, 2020), or suffer from the costs of excessive effort. The outcome depends on the interaction of these factors. Our findings are consistent with several gender differences highlighted in the empirical literature:

- At the beginning of their careers, men and women have equal earnings, but they diverge over time due to men's longer working hours and faster accumulation of work experience (Landers et al., 1996, Azmat and Ferrer, 2017, Goldin, 2014).

- Women have lower promotion rates than men and are underrepresented at higher levels of the corporate hierarchy (Goldin, 2014, Azmat and Ferrer, 2017, Cook et al., 2021).

- Controlling for job level, women have lower wages than men (Blau and Kahn, 2017).

- Women in higher corporate positions tend to have higher ability than their male counterparts (Heyman et al., 2020 notes that women "need higher skills to secure a managerial position" and refers to the "skill-biased glass ceiling effect", see also Campbell and Hahl, 2022, Keloharju et al., 2022).[5]

While overconfidence is not the only or most important explanation for gender gaps in the labor market, it remains a noteworthy psychological trait supported by recent empirical literature. Our approach takes overconfidence as a given and examines its impact on labor market outcomes when firms use competitive promotion incentives. Specifically, our results are derived under the assumption that overconfidence is the only distinguishing factor between

[4]Effort and ability are typically complementary (Bénabou and Tirole, 2002, Bénabou and Tirole, 2003, Fang and Moscarini, 2005). Bénabou and Tirole (2002) and Bénabou and Tirole (2003) argue that complementarity between ability and effort is a fundamental principle in social psychology, although they also acknowledge cases of substitutability, such as pass-fail rewards. We examine substitutes in Appendix A.4 and discuss the results in section 3.

[5]We are grateful to Joacim Tåg for pointing out that the working paper version Keloharju et al. (2016) reports in Table 2 that Swedish female CEOs have a higher share of university education than their male counterparts.

workers. They are equally productive (with identical ability distributions) and have the same effort costs and competitive preferences. As a result, we identify mechanisms that remain relevant even when all workers have equal chances of success and women do not "shy away from competition".

In the existing literature, only a few papers have theoretically examined the role of overconfidence in promotion competition. Fang and Moscarini (2005) consider a principal-agent setting with bonus payments and, similar to our model, examine the impact of overconfidence when effort and ability are complements. Deng et al. (2024) consider an employee's confidence in another employee's ability, along with the firm's confidence management and information disclosure policies. Santos-Pinto (2010, 2021), Santos-Pinto and Sekeris (2023) investigate the effects of overconfidence in tournaments where prizes (wages) are either exogenous or endogenous, but do not depend on the identity of the tournament winner. In contrast, our promotion signaling model allows wage offers to depend on the worker's identity, allowing us to explain the gender wage gap conditional on job level, a recurring empirical finding.

The structure of the paper is as follows. Section 2 describes the model, while Section 3 characterizes the equilibrium and presents our main results. Section 4 concludes the paper. The appendix contains derivations and proofs.

2 Model

We consider a competitive labor market with $n \geq 3$ identical firms. There are two periods, $t \in \{1, 2\}$, representing the early and late stages of workers' careers. In period 1, one of the firms (hereafter the *incumbent*) hires two workers, A and B. Each worker $i \in \{A, B\}$ produces output through a combination of ability Θ_i and effort e_i. Following, e.g., Holmström (1982), we assume symmetric uncertainty about ability, i.e., ability Θ_i is a random variable and its realization, denoted by θ_i, is not observable by any firm or worker (not even worker i). The ability of each worker is uniformly distributed on $[0, 1]$ with cdf F and pdf f:

$$f(x) = \begin{cases} 1 & x \in [0,1] \\ 0 & \text{else} \end{cases}, \qquad F(x) = \begin{cases} 0 & x < 0 \\ x & x \in [0,1] \\ 1 & x > 1 \end{cases}. \tag{1}$$

The key assumption of our model is that worker A is *overconfident*. Worker A overestimates his ability, believing that his ability is drawn from a 'better' distribution, denoted by cdf $\hat{F}$ and pdf $\hat{f}$, with overconfidence parameter $\gamma > 1$.[6] This probability distribution, which we call the *subjective* ability distribution of A, first-order stochastically dominates the actual ability

[6] Overestimating one's ability is referred to in the literature as *overoptimism* or *overestimation* (see, e.g., Moore and Healy, 2008).

distribution, giving greater weight to higher ability:

$$\hat{f}(x) = \begin{cases} \gamma x^{\gamma-1} & x \in [0,1] \\ 0 & \text{else,} \end{cases} \qquad \hat{F}(x) = \begin{cases} 0 & x < 0 \\ x^{\gamma} & x \in [0,1] \\ 1 & x > 1. \end{cases} \tag{2}$$

Note that larger values of the overconfidence parameter γ correspond to a greater degree of overconfidence, while as $\gamma \to 1$ the overconfidence becomes negligible and the subjective ability distribution coincides with the *objective* distribution F.

It is common knowledge that (only) worker A is overconfident, i.e., that A believes his ability to be drawn from distribution $\hat{F}$, whereas all other players assume that all abilities follow distribution F. This implies that all other players know that A is overconfident, while A knows that the other players disagree with his view of his ability distribution. This "agree to disagree" assumption of non-common priors allows us to solve the game in a tractable way. For a discussion of the non-common priors assumption, see, e.g., Savage (1954), Aumann (1976), Kyle and Wang (1997), Brunnermeier and Parker (2005), Fang and Moscarini (2005), Santos-Pinto (2010), and Deng et al. (2024). The common-knowledge assumption can be justified in several ways. For example, personality traits are typically revealed during job interviews, in confidential reference letters, or in informal hiring networks. Moreover, gender differences in overconfidence are empirically well-established.

There are two job levels within each firm: In period 1 (the early-career stage), workers are employed by the incumbent firm in the low-level job L, but one of them can move to the high-level job H by promotion.[7] Each worker i exerts an effort $e_i \geq e_{\min} > 0$ (where $e_{\min}$ is the minimum effort required to keep the current job) and produces an output equal to

$$y_{i1L} = c_L + d_L e_i \theta_i, \tag{3}$$

where c_L and d_L are strictly positive parameters characterizing the production technology of the low-level job.[8] A higher value of d_L implies a higher sensitivity of output to worker productivity. Effort and ability are assumed to be complements, reflected in the term $e_i\theta_i$. In Appendix A.4 we explore the case of substitutes.

The cost of effort is separable between periods and is given by $c(e_i)$ in period 1 and $c(e_{\min})$ in period 2, where $c'(e) > 0$, $c''(e) > 0$ for all $e > e_{\min}$, and $c'(e_{\min}) = 0$.[9] The cost function is assumed to be sufficiently steep given all other model parameters. This serves the purpose of

[7] We assume that the high-level job requires firm-specific human capital or skills. Therefore, newly-hired workers always work in the low-level job at each firm.

[8] The results would be qualitatively the same if we assigned different minimum efforts in both periods. It is important that the period-2 minimum effort is positive because, otherwise, the period-2 output would not be increasing in the worker's productivity.

[9] The cost of effort in the second period is mostly ignored in our analysis because it is constant.

ruling out that a worker is promoted with certainty.[10]

By working in period 1, workers acquire two forms of human capital. First, there is firm-specific human capital, characterized by the parameter S, which cannot be transferred to another firm.[11] Second, there is transferable human capital acquired through learning-by-doing, qe_i, which strictly increases with effort in period 1 and is preserved if the worker leaves the firm. The parameter $q > 0$ captures the relative importance of ability and human capital in determining period-2 productivity.

At the end of period 1, one worker is promoted to job H in the incumbent firm, and the other worker remains in job L. In period 2 (the late-career stage), workers choose the minimum effort, $e_{\min}$, since there are no further incentives in this two-period game. The promoted worker has a period-2 output equal to

$$y_{i2H} = c_H + (1 + S)d_H e_{\min}(\theta_i + qe_i), \tag{4}$$

where c_H and d_H are parameters characterizing the high-level job. The factor $\theta_i + qe_i$ is the period-2 *productivity* of worker i, which includes the human capital acquired through learning-by-doing in period 1.

The non-promoted worker has a period-2 output of

$$y_{i2L} = c_L + (1 + S)d_L e_{\min}(\theta_i + qe_i). \tag{5}$$

Following Waldman (1984) and others, we assume $c_H < c_L$ and $d_H > d_L$, implying that productivity is more important in the high-level job.[12]

The incumbent firm observes both workers' output in period 1 and promotes a worker to maximize its expected profit. Outside firms cannot observe individual output, but they can observe who has been promoted and use this information to update their assessments of workers' abilities. The external firms simultaneously make individual wage offers to all workers. The incumbent firm observes these offers and makes counteroffers. Workers accept (one of) the highest offers, maximizing their expected period-2 payoffs. Ties are broken randomly, except in the case where the period-1 employer is among the firms making the highest offer, in which case a worker remains with the initial employer. It is assumed that firm-specific human capital S is sufficiently high that, in equilibrium, no outside firm succeeds in hiring a worker away from the period-1 employer. Following the literature on promotion signaling (e.g., DeVaro and Waldman, 2012), we assume that there is a small exogenous probability τ that the incum-

[10] As the later analysis shows, this can be expressed as $|q(e_A^* - e_B^*)| < 1$, where e_A^* and e_B^* are the equilibrium efforts, and $q(e_A^* - e_B^*)$, consequently, is the difference in transferable human capital between the workers in equilibrium.

[11] The sole role of firm-specific human capital in our model (and in related models) is to provide an advantage for the incumbent that justifies matching all competitive wage offers from outside firms. Its exact modeling does not affect wage offers by external firms and thus wage setting in equilibrium. We model this form of human capital in a simple way. Making it dependent on effort would not change the results qualitatively.

[12] Baker et al. (1994b) argue that higher-level jobs are more sensitive to differences in ability.

bent mistakenly fails to make a counteroffer, which is independent of worker ability. This assumption ensures that outside firms poach workers with positive probability, implying that the highest equilibrium offer from an outside firm is equal to the worker's expected productivity.[13]

We further assume that external firms always assign workers to the low-level job L, regardless of whether the worker was assigned to job L or H by the incumbent firm.[14] If hired by an external firm, the output of worker i would be

$$\hat{y}_{i2L} = c_L + d_L e_{\min}(\theta_i + q e_i). \tag{6}$$

The incumbent firm makes a promotion decision based on expected profit maximization, taking into account the anticipated wage offers from outside firms that will be made in response to the promotion decision and that it will have to match to keep the workers.

The time structure is as follows: At the beginning of period 1, one of the firms hires both workers and assigns them to the low-level job. The two workers then choose their efforts to produce outputs in period 1. At the end of period 1, the incumbent firm observes these outputs and decides which worker to promote to the high-level job. The external firms observe the promotion decision and then make wage offers to the workers, to which the incumbent firms can respond. Finally, the workers decide which offer to accept and choose effort to produce period 2 outputs.

3 Equilibrium Characterization

We start by sketching the derivation of the equilibrium, and we provide additional details in the proof of Proposition 1 in Section A.2 of the Appendix. The game is solved by backwards induction. In $t = 2$, both workers $i \in \{A, B\}$ choose the minimum effort, $e_{\min}$, as there are no incentives to justify higher effort.

Denote the beliefs about period-1 efforts e_i by $\tilde{e}_i$. After period 1, the incumbent firm can observe worker i's output, y_{i1L}. Recalling (3), observed output and effort beliefs allow the firm to deduce the ability realization, which we denote as $\tilde{\theta}_i$. The deduced beliefs about ability are

$$\tilde{\theta}_A = \frac{y_{A1L} - c_L}{d_L \tilde{e}_A}, \quad \tilde{\theta}_B = \frac{y_{B1L} - c_L}{d_L \tilde{e}_B}. \tag{7}$$

We state the promotion rule as a function of the deduced ability levels $\tilde{\theta}_i$ rather than the ob-

[13]If this assumption were dropped, the same equilibrium would exist where the highest equilibrium offer from an outside firm equals the worker's expected productivity. However, the equilibrium would not be unique, and other outcomes of period-2 bargaining would be possible. Furthermore, the assumption that τ is independent of worker ability eliminates the strong winner's curse result that occurs in other asymmetric learning models with firm-specific human capital and counteroffers (e.g., Ghosh and Waldman, 2010, DeVaro and Waldman, 2012, Cassidy et al., 2016, and Waldman and Zax, 2016).

[14]All of our qualitative results would be the same if external firms always assigned workers to the high-level job H.

served output levels. The equilibrium promotion decision must be profit-maximizing and is based on both workers' expected period-2 productivity $\tilde{\theta}_i + q\tilde{e}_i$. Denote the set of deduced abilities $\tilde{\theta}_A$ and $\tilde{\theta}_B$ for which worker A will be promoted by T_A and the set of deduced abilities where B is promoted by T_B. Furthermore, denote the external firms' beliefs regarding T_A and T_B by $\tilde{T}_A$ and $\tilde{T}_B$, respectively.

We now consider the wages offered by the external firms. The outside firms can only observe the incumbent firm's promotion decision. Wage offers are therefore based on this observation, and on beliefs regarding the incumbent's promotion rule, and the period-1 efforts. We consider the wage offers made by a representative external firm. We assume the external firm offers worker i a wage rate of w_{i2}^P if worker i has been promoted and w_{i2}^{NP} otherwise. The "2" indicates period 2. Due to perfect (Bertrand) competition, the (highest bidding) external firms offer wages that are equal to their expected gross profit (recall (6)). As the firm-specific human capital S is assumed to be sufficiently large, the incumbent firm matches the external firms' wage offers (with probability $1-\tau$, i.e., unless the incumbent firm mistakenly fails to make a counteroffer).

We start by considering the case where worker A is promoted by the incumbent firm. In this case, the external wage offers are (where the expected value is from the point of view of the outside firm):

$$w_{A2}^P = c_L + d_L e_{\min}\left(E[\Theta_A|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in \tilde{T}_A] + q\tilde{e}_A\right), \tag{8}$$

$$w_{B2}^{NP} = c_L + d_L e_{\min}\left(E[\Theta_B|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in \tilde{T}_A] + q\tilde{e}_B\right). \tag{9}$$

If worker B is promoted, the wage offers by the external firm are

$$w_{A2}^{NP} = c_L + d_L e_{\min}\left(E[\Theta_A|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in \tilde{T}_B] + q\tilde{e}_A\right), \tag{10}$$

$$w_{B2}^{P} = c_L + d_L e_{\min}\left(E[\Theta_B|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in \tilde{T}_B] + q\tilde{e}_B\right). \tag{11}$$

We now turn to the incumbent firm's promotion decision at the end of period 1. Recall the period-2 outputs in the two job levels, (4) and (5). If the firm promotes worker A (and hence does not promote worker B), the incumbent's expected period-2 profit is

$$\begin{aligned}\pi^{(P,NP)} = (1-\tau)\Big(&c_H + (1+S)d_H e_{\min}(\tilde{\theta}_A + q\tilde{e}_A)) \\ &+ (c_L + (1+S)d_L e_{\min}(\tilde{\theta}_B + q\tilde{e}_B)) - (w_{A2}^P + w_{B2}^{NP})\Big).\end{aligned} \tag{12}$$

Similarly, if worker B is promoted, the firm's expected period-2 profit is

$$\begin{aligned}\pi^{(NP,P)} = (1-\tau)\Big(&(c_H + (1+S)d_H e_{\min}(\tilde{\theta}_B + q\tilde{e}_B)) \\ &+ (c_L + (1+S)d_L e_{\min}(\tilde{\theta}_A + q\tilde{e}_A)) - (w_{A2}^{NP} + w_{B2}^P)\Big).\end{aligned} \tag{13}$$

It follows that the firm promotes worker A if and only if

$$\pi^{(P,NP)} > \pi^{(NP,P)}$$
$$\iff (1+S)(d_H - d_L)e_{\min}(\tilde{\theta}_A + q\tilde{e}_A - (\tilde{\theta}_B + q\tilde{e}_B)) > w^P_{A2} + w^{NP}_{B2} - w^{NP}_{A2} - w^P_{B2}. \quad (14)$$

Recalling $d_H > d_L$, i.e., that job H is more responsive to period-2 productivity $\theta_i + qe_i$ than job L, the obvious candidate equilibrium promotion rule is that worker A is promoted if and only if $\tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B$. In order to prove that this is an equilibrium promotion rule, we focus attention on the RHS of (14).

Suppose, in equilibrium, worker A is indeed promoted iff $\tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B$. In equilibrium, outside firms correctly anticipate the promotion rule. Therefore, $\tilde{T}_A = T_A$ and $\tilde{T}_B = T_B$. Recalling the wage offers (8)–(11), the RHS of (14) is then equal to

$$\begin{aligned} d_L e_{\min} \Big(& E[\Theta_A|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in T_A] - E[\Theta_A|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in T_B] \\ & + E[\Theta_B|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in T_A] - E[\Theta_B|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in T_B] \Big). \end{aligned} \quad (15)$$

In the Appendix, Subsection A.2, we show that this expression is equal to zero, meaning that the absolute (period-2) wage premium of getting promoted is the same for both workers. This property is a result of the symmetry of the ability distributions around their means. It follows that $\pi^{(P,NP)} > \pi^{(NP,P)}$ is equivalent to $\tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B$, the candidate promotion rule. Therefore, this promotion rule is profit-maximizing and part of an equilibrium, i.e., the incumbent firm does not have an incentive to deviate from it.

The next step is to determine the two workers' period-1 effort choices. We start by considering worker A. In equilibrium, worker A anticipates to be promoted if and only if

$$\begin{aligned} & \tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B \\ \iff & \frac{y_{A1L} - c_L}{d_L \tilde{e}_A} + q\tilde{e}_A > \frac{y_{B1L} - c_L}{d_L \tilde{e}_B} + q\tilde{e}_B \\ \iff & \frac{(c_L + d_L e_A \theta_A) - c_L}{d_L \tilde{e}_A} + q\tilde{e}_A > \frac{(c_L + d_L e_B \theta_B) - c_L}{d_L \tilde{e}_B} + q\tilde{e}_B \\ \iff & \theta_B < \theta_A \frac{e_A \tilde{e}_B}{e_B \tilde{e}_A} + \frac{q(\tilde{e}_A - \tilde{e}_B)\tilde{e}_B}{e_B}. \end{aligned} \quad (16)$$

Worker A's *subjective* promotion probability (using pdf $\hat{f}$) can now be stated as

$$\hat{P}_A = \int_{-\infty}^{\infty} F\left(x \frac{e_A \tilde{e}_B}{e_B \tilde{e}_A} + \frac{q(\tilde{e}_A - \tilde{e}_B)\tilde{e}_B}{e_B} \right) \hat{f}(x)\, dx. \quad (17)$$

A's expected payoff can be expressed as

$$\hat{P}_A \times (\text{expected payoff given } P) + (1 - \hat{P}_A) \times (\text{expected payoff given } NP). \quad (18)$$

This can be restated as

$$\hat{P}_A d_L e_{\min}\Big(E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A > \tilde{\Theta}_B + q\tilde{e}_B] - E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B]\Big) \\ + c_L + d_L e_{\min}\left(E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A\right) - c(e_A). \tag{19}$$

Note that A's choice variable e_A appears only in the cost function and in the probability of winning $\hat{P}_A$, see (17). The reason is that wages only depend on beliefs regarding effort (not the actual effort choices). The overconfident worker A is aware of how the firms form expectations about A's ability (agree to disagree) and takes this into account in (19) above.

In equilibrium, beliefs about the efforts of both workers are correct, $\tilde{e}_i = e_i^*, i \in \{A, B\}$. As a consequence, beliefs about ability realizations are correct as well, $\tilde{\theta}_i = \theta_i$, which implies $\tilde{\Theta}_i = \Theta_i$. Thus, the first-order condition to worker A's decision problem, evaluated in equilibrium, is

$$c'(e_A^*) = d_L e_{\min} \left.\frac{\partial \hat{P}_A}{\partial e_A}\right|_{(e_A^*, e_B^*)} \Big(E[\Theta_A|\Theta_A + qe_A^* > \Theta_B + qe_B^*] \\ - E[\Theta_A|\Theta_A + qe_A^* < \Theta_B + qe_B^*]\Big). \tag{20}$$

Similarly, B's first-order condition (evaluated in equilibrium) can be stated as follows, expressing the difference in expected values in terms of Θ_A rather than Θ_B):

$$c'(e_B^*) = d_L e_{\min} \left.\frac{\partial P_B}{\partial e_B}\right|_{(e_A^*, e_B^*)} \Big(E[\Theta_A|\Theta_A + qe_A^* > \Theta_B + qe_B^*] \\ - E[\Theta_A|\Theta_A + qe_A^* < \Theta_B + qe_B^*]\Big). \tag{21}$$

In order to simplify notation, define $K := q(e_A^* - e_B^*)$. The above first-order conditions can be written as

$$c'(e_A^*)e_A^* = d_L e_{\min} \int_{-\infty}^{\infty} f\left(x + K\right) x \hat{f}\left(x\right) dx \cdot \Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big), \tag{22}$$

$$c'(e_B^*)e_B^* = d_L e_{\min} \int_{-\infty}^{\infty} f\left(x - K\right) x f\left(x\right) dx \cdot \Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big). \tag{23}$$

Using these two first-order conditions and our distributional assumptions, one can then show that $e_A^* > e_B^*$.

We summarize our findings in Proposition 1, describing the incumbent's equilibrium promotion rule as well as the central result that the overconfident worker A exerts more effort than worker B.

Proposition 1. *In equilibrium,*

(a) the worker with the higher period-2 productivity is promoted.

(b) the overconfident worker A exerts more effort in period 1 than worker B.

The intuition behind a) is that, in the absence of commitment power, the only credible promotion rule is one that maximizes the incumbent's expected period-2 profit, given the observed output of the two workers and the expected outside wage offers. This profit is equal to the output produced by the workers minus the wage payments. As the proof of Proposition 1 shows, outside firms offer the same wage premium to both workers upon promotion. This means that the sum of wages for the incumbent (which matches these offers) is constant and independent of who is promoted. This leaves output as the decisive criterion for the promotion decision. As can be seen in (4) and (5), output depends crucially on productivity $\theta_i + qe_i$. By the assumptions $c_H < c_L$ and $d_H > d_L$, promoting the worker with higher productivity is the profit-maximizing decision.

The intuition behind b) is as follows. Recall that the incumbent forms a belief $\tilde{\theta}_i$ about the ability of worker i, given by (7). This belief is independent of the ability distribution (overconfident or not), since it is a belief about ability *realization* derived from actual observed performance. Thus, the only way for a worker to affect the probability of promotion is to change output by changing effort. In equilibrium, $\tilde{e}_i$ is equal to the actual effort e_i chosen by worker i, and therefore $\tilde{\theta}_i$ is equal to the actual ability realization θ_i of worker i. Since effort and ability are complements in producing output, the overconfident worker A who overestimates his expected ability mistakenly believes that his effort is marginally more effective at increasing output than it actually is, motivating A to choose a higher effort. In turn, A's higher effort, and thus the probability of promotion, discourages player B by making a given effort e_B less effective for promotion.

To shed light on the role of the complementarity assumption, we have analyzed the case where effort and ability are substitutes, see Appendix Subsection A.4. Under this assumption, the effort of the two workers is equal, since the structure of the workers' first-order conditions resembles that of a standard heterogeneous-player contest, see Bastani et al. (2022). From this analysis, we can conclude that the complementarity assumption, interacting with overconfidence, drives the higher effort of the overconfident worker. We can also see that the promotion rule is the same under both production technologies: the more productive worker is promoted.

Our second and main result concerns the differences in outcomes between the two workers. These are a direct consequence of the higher effort exerted by the overconfident worker A.

Proposition 2. *In equilibrium, compared to worker B, the overconfident worker A*

(a) is promoted with a higher probability.

(b) receives a higher period-2 wage conditional on the job level.

(c) receives a higher expected period-2 wage.

(d) has a lower expected ability conditional on promotion.

(e) acquires more transferable human capital through learning-by-doing.

Proof. See Appendix Subsection A.3. □

In order to understand these results, we provide a brief discussion:

Part (a) is easy to see: Given that worker A exerts more effort than B, while the ability of both workers is drawn from the same distribution, the promotion rule that in equilibrium compares the productivity of $\theta_A + qe_A$ and $\theta_B + qe_B$ will select A more often.

Part (b) is the result of two opposing effects. Outside firms only care about and pay for a worker's productivity $\theta_i + qe_i^*$. Due to the higher effort, the transferable human capital of A, qe_A^*, exceeds that of worker B, while, see part (d), the conditional expected ability of B, θ_B, exceeds that of A. We prove that the overall effect is unambiguously in favor of A.

Part (c) follows directly from the combination of a higher probability of promotion, part (a), with higher wages conditional on promotion, part (b).

To understand part (d), recall that the promotion rule compares productivity $\theta_A + qe_A$ with $\theta_B + qe_B$, and selects the more productive worker. Thus, for worker B to be promoted, it must hold that $\theta_B > \theta_A + q\left(e_A - e_B\right)$. This means that B's ability must exceed both A's ability and A's advantage due to the higher effort. In contrast, the promotion of A requires $\theta_A > \theta_B - q\left(e_A - e_B\right)$, meaning that A can be promoted even if θ_A is slightly below θ_B. Overall, this makes it more difficult for B to be promoted than for A, which means that a promoted B tends to have greater ability than a promoted A.

Part e) follows directly from the fact that effort is higher for the overconfident worker.

We present two numerical examples that illustrate all of our key results. Consider the following parameters:

$$\gamma = 2, c_L = 2,\ c_H = 1,\ d_L = 1,\ d_H = 2,\ c(e) = \frac{(e - e_{\min})^2}{2},\ e_{\min} = \frac{1}{5},\ q = 2.$$

In the first example, shown in Table 1, the expected utility of worker A exceeds that of worker B, and it is also higher than it would be in a game in which neither worker is overconfident (see Appendix Subsection A.6 for a discussion of the game without overconfidence). Thus, in this example, overconfidence is a self-serving bias.

Table 1: Numerical Example, $q = 2$.

	worker A	worker B
Equilibrium effort	0.324	0.308
Promotion probability	0.532	0.468
Effort cost	0.008	0.006
Expected period-2 wage offer if promoted	2.261	2.259
Expected period-2 wage offer if not promoted	2.194	2.192
Expected utility	2.222	2.217
Expected ability conditional on promotion	0.656	0.677
Expected productivity conditional on promotion	1.305	1.294
A's subjective promotion probability	0.698	
A's subjective expected utility	2.233	

Now we change $q = 2$ to $q = 1/2$, which makes human capital formation less sensitive to effort, thus reducing the advantage of A due to higher effort. All other parameters remain unchanged. The results in Table 2 show that the expected utility of B now exceeds that of A. Overconfidence becomes self-defeating, as A's expected utility is now lower than it would be in a game without overconfidence.

Table 2: Numerical Example, $q = 1/2$.

	worker A	worker B
Equilibrium effort	0.330	0.308
Promotion probability	0.511	0.489
Effort cost	0.009	0.006
Expected period-2 wage offer if promoted	2.166	2.165
Expected period-2 wage offer if not promoted	2.099	2.098
Expected utility	2.124	2.125
Expected ability conditional on promotion	0.663	0.670
Expected productivity conditional on promotion	0.828	0.824
A's subjective promotion probability	0.678	
A's subjective expected utility	2.136	

4 Concluding Remarks

Recent literature addressing the "last chapter" of gender inequality in the labor market has highlighted the role of how firms reward long, inflexible hours, as well as the influence of psychological traits and non-cognitive skills on competitive behavior (Goldin, 2014). In this paper, we analyzed how male overconfidence, combined with competitive workplace incentives, affects gender equality in the labor market. Our analysis was framed using a promotion-signaling model in which wages are endogenously determined by market forces.

The gender differences in labor market outcomes that emerge from our framework are driven by the increased effort of overconfident workers. In the context of our model, this implies that policies aimed at limiting working hours could help mitigate the effects of overconfidence, potentially reducing the gender gap in career progression and wages. However, implementing limits on working hours can be challenging, especially in highly skilled occupations where it may not be in the interest of firms or easily enforceable. Despite these challenges, many modern labor markets have regulations that limit working hours. For example, Sweden's Working Time Act (*arbetstidslag*) explicitly aims to protect workers from excessive working hours by limiting daily, weekly and annual working time.

In addition to regulation, firm-level policies can also influence worker confidence. Deng et al. (2024) provides a theoretical analysis of a firm's optimal information disclosure policy when managing overconfident or underconfident workers, and identifies when de-biasing efforts are beneficial or detrimental to firm performance. As reviewed in Hügelschäfer and Achtziger (2014), empirical studies have shown mixed results regarding the success of interventions aimed at addressing overconfidence. For example, Grossman and Owens (2012) found that overconfidence is often resistant to intervention, while Chen and Schildberg-Hörisch (2019) demonstrated that providing workers with information about their abilities can effectively reduce overconfidence-driven effort.

Our model has several limitations that provide directions for future research. First, we focused on competition for promotions among workers with similar educational backgrounds. While relevant (e.g., Azmat and Ferrer, 2017), this perspective does not capture how overconfidence in the labor market might influence choices related to educational pathways or occupations that expose individuals to competitive wages—a factor identified by Blau and Kahn (2017) as key to explaining the remaining gender gap. Second, for reasons of analytical tractability, we did not examine the interplay between risk aversion and different levels of confidence, which may have important implications for career outcomes. Third, we did not consider the impact of childcare responsibilities, an important driver of gender gaps in the labor market. Fourth, we assumed that all work effort is productive, whereas in reality workers often divide their effort between productive tasks and rent-seeking activities. Finally, while our analysis found instances where overconfidence can harm workers' welfare, there may be broader costs of overconfidence that our model does not capture, such as productivity losses due to overestimating one's abilities or taking on unrealistic projects. We hope that these questions will inspire further research to deepen our understanding of how behavioral biases contribute to persistent gender inequalities and how policy can be used to address these gaps.

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A Proofs and derivations

A.1 Lemmas

We start by proving a set of lemmas to be used in the proofs of our main results. Throughout the appendix, we make use of the random variables Θ_A and Θ_B that are assumed to be uniformly distributed on $[0,1]$ with the following pdf and cdf

$$f(x) = \begin{cases} 1 & x \in [0,1] \\ 0 & \text{else} \end{cases}, \qquad F(x) = \begin{cases} 0 & x < 0 \\ x & x \in [0,1] \\ 1 & x > 1 \end{cases}. \tag{A1}$$

We also make use of the random variable $\hat{\Theta}_A$ with support $[0,1]$ and the following pdf and cdf, where $\gamma > 1$.

$$\hat{f}(x) = \begin{cases} \gamma x^{\gamma-1} & x \in [0,1] \\ 0 & \text{else,} \end{cases} \qquad \hat{F}(x) = \begin{cases} 0 & x < 0 \\ x^{\gamma} & x \in [0,1] \\ 1 & x > 1. \end{cases} \tag{A2}$$

The following lemma computes probabilities that will later be shown to be the equilibrium subjective, resp. objective, promotion probabilities of worker A (case (a), resp. (b)), and the (objective) promotion probability of worker B (case (c)).

Lemma 1. *For a constant $K \in (0,1)$, we have the following probabilities.*

$$(a) \qquad \hat{P}(\hat{\Theta}_A + K > \Theta_B) := \int_{-\infty}^{\infty} F(x+K)\,\hat{f}(x)\,dx = 1 - \frac{(1-K)^{\gamma+1}}{\gamma+1} \tag{A3}$$

$$(b) \qquad P(\Theta_A + K > \Theta_B) := \int_{-\infty}^{\infty} F(x+K)\,f(x)\,dx = \frac{1}{2}\left(1 + 2K - K^2\right) \tag{A4}$$

$$(c) \qquad P(\Theta_A + K < \Theta_B) := \int_{-\infty}^{\infty} F(x-K)\,f(x)\,dx = \frac{1}{2}(1-K)^2. \tag{A5}$$

Proof of Lemma 1. (a)

$$
\begin{aligned}
\int_{-\infty}^{\infty} F\left(x+K\right)\hat{f}\left(x\right)dx &= \gamma \int_{0}^{1} F\left(x+K\right)x^{\gamma-1}dx \\
&= \gamma\left(\int_{0}^{1-K}\left(x^{\gamma}+Kx^{\gamma-1}\right)dx+\int_{1-K}^{1}x^{\gamma-1}dx\right) \\
&= \gamma\left(\frac{1}{\gamma+1}\left(1-K\right)^{\gamma+1}+\frac{K}{\gamma}\left(1-K\right)^{\gamma}+\frac{1}{\gamma}-\frac{1}{\gamma}\left(1-K\right)^{\gamma}\right) \\
&= 1+\gamma\left(\frac{1}{\gamma+1}\left(1-K\right)^{\gamma+1}-\frac{\left(1-K\right)^{\gamma}}{\gamma}\left(1-K\right)\right) \\
&= 1+\left(1-K\right)^{\gamma+1}\left(\frac{\gamma}{\gamma+1}-1\right) \\
&= 1-\frac{\left(1-K\right)^{\gamma+1}}{\gamma+1}.
\end{aligned}
\tag{A6}
$$

(b)

$$
\begin{aligned}
\int_{-\infty}^{\infty} F(x+K)f(x)dx &= \int_{0}^{1} F(x+K)dx \\
&= \int_{0}^{1-K}(x+K)dx+\int_{1-K}^{1}1dx \\
&= \frac{1}{2}(1+2K-K^2).
\end{aligned}
\tag{A7}
$$

(c) This can be computed directly from (b):

$$
\begin{aligned}
P(\Theta_A+K<\Theta_B) &= 1-P(\Theta_A+K>\Theta_B) \\
&= 1-\frac{1}{2}(1+2K-K^2) \\
&= \frac{1}{2}(1-2K+K^2).
\end{aligned}
\tag{A8}
$$

□

Lemma 2. *For any constant $K \in (0,1)$, we have*

$$(a) \qquad E[\Theta_A|\Theta_A+K>\Theta_B] = \frac{2+3K-3K^2+K^3}{3(1+2K-K^2)}, \tag{A9}$$

$$(b) \qquad E[\Theta_A|\Theta_A+K<\Theta_B] = \frac{1-K}{3}, \tag{A10}$$

$$(c) \qquad E[\Theta_A|\Theta_A+K>\Theta_B]-E[\Theta_A|\Theta_A+K<\Theta_B] = \frac{1+2K}{3(1+2K-K^2)}, \tag{A11}$$

$$(d) \qquad E[\Theta_B|\Theta_A+K>\Theta_B] = \frac{1+3K-K^3}{3(1+2K-K^2)}, \tag{A12}$$

$$(e) \qquad E[\Theta_B|\Theta_A+K<\Theta_B] = \frac{2+K}{3}. \tag{A13}$$

Proof of Lemma 2. (a) As both random variables are uniformly distributed on $[0,1]$ and $P(\Theta_B < \Theta_A + K) = \frac{1}{2}(1+2K-K^2)$, as shown in (A4), we obtain

$$\begin{aligned}
E[\Theta_A|\,\Theta_A+K>\Theta_B] &= E[\Theta_A|\,\Theta_A>\Theta_B-K] \\
&= \frac{\int_0^1\int_{\max\{y-K,0\}}^1 x dx dy}{\frac{1}{2}(1+2K-K^2)} \\
&= \frac{\int_K^1\int_{y-K}^1 x dx dy + \int_0^K\int_0^1 x dx dy}{\frac{1}{2}(1+2K-K^2)} \\
&= \frac{\frac{1}{2}\int_K^1 (1-y^2+2Ky-K^2)\,dy + \frac{1}{2}\int_0^K dy}{\frac{1}{2}(1+2K-K^2)} \\
&= \frac{3\left(-\frac{1}{3}(1-K^3)+K(1-K^2)+(1-K^2)(1-K)\right)+3K}{3+6K-3K^2} \\
&= \frac{2+3K-3K^2+K^3}{3+6K-3K^2} \\
&= \frac{K((K-3)K+3)+2}{3-3(K-2)K}.
\end{aligned}$$

(b) As $P\left(\Theta_B > \Theta_A + K\right) = \frac{1}{2}(1-K)^2$, as shown in (A5), we obtain

$$
\begin{aligned}
E\left[\Theta_A \middle| \Theta_A + K < \Theta_B\right] &= E\left[\Theta_A \middle| \Theta_A < \Theta_B - K\right] \\
&= \frac{\int_K^1 \int_0^{y-K} x dx dy}{\frac{1}{2}(1-K)^2} \\
&= \frac{\frac{1}{2}\int_K^1 (y-K)^2 dy}{\frac{1}{2}(1-K)^2} \\
&= \frac{\frac{1}{3}\left(1-K^3\right) - K\left(1-K^2\right) + K^2\left(1-K\right)}{\left(1-K\right)^2} \\
&= \frac{1 - K^3 - 3K + 3K^2}{3\left(1-K\right)^2} \\
&= \frac{\left(1-K\right)^3}{3\left(1-K\right)^2} \\
&= \frac{1-K}{3}.
\end{aligned}
$$

(c) It directly follows that

$$
\begin{aligned}
&E\left[\Theta_A \middle| \Theta_A + K > \Theta_B\right] - E\left[\Theta_A \middle| \Theta_A < \Theta_B - K\right] \\
&= \frac{2 + 3K - 3K^2 + K^3}{3 + 6K - 3K^2} - \frac{1-K}{3} \\
&= \frac{2 + 3K - 3K^2 + K^3 - (1-K)\left(1 + 2K - K^2\right)}{3 + 6K - 3K^2} \\
&= \frac{1 + 2K}{3(1 + 2K - K^2)}.
\end{aligned}
$$

(d) As both random variables are uniformly distributed on $[0,1]$ and $P\left(\Theta_B < \Theta_A + K\right) = \frac{1}{2}(1 + 2K - K^2)$, as shown in (A4), we obtain

$$
\begin{aligned}
E\left[\Theta_B \middle| \Theta_B < \Theta_A + K\right] &= \frac{\int_0^1 \int_0^{\min\{1, y+K\}} x dx dy}{\frac{1}{2}(1 + 2K - K^2)} \\
&= \frac{\int_0^{1-K} \int_0^{y+K} x dx dy + \int_{1-K}^1 \int_0^1 x dx dy}{\frac{1}{2}(1 + 2K - K^2)} \\
&= \frac{\frac{1}{2}\int_0^{1-K} \left(y^2 + 2Ky + K^2\right) dy + \frac{1}{2}\int_{1-K}^1 dy}{\frac{1}{2}(1 + 2K - K^2)} \\
&= \frac{\frac{1}{2}\left(\frac{1}{3}\left(1-K\right)^3 + K\left(1-K\right)^2 + K^2\left(1-K\right)\right) + \frac{K}{2}}{\frac{1}{2}(1 + 2K - K^2)} \\
&= \frac{1 + 3K - K^3}{3(1 + 2K - K^2)}.
\end{aligned}
$$

(e) As $P\left(\Theta_B > \Theta_A + K\right) = \frac{1}{2}(1 - 2K + K^2)$, as shown in (A5), we obtain

$$\begin{aligned}
E\left[\Theta_B \middle| \Theta_B > \Theta_A + K\right] &= \frac{\int_0^{1-K}\int_{y+K}^{1} x dx dy}{\frac{1}{2}(1-2K+K^2)} \\
&= \frac{\frac{1}{2}\int_0^{1-K}\left(1 - y^2 - 2Ky - K^2\right) dy}{\frac{1}{2}(1-2K+K^2)} \\
&= \frac{1 - K - \frac{1}{3}\left(1-K\right)^3 - K\left(1-K\right)^2 - K^2\left(1-K\right)}{1-2K+K^2} \\
&= \frac{2 - 3K + K^3}{3\left(1-K\right)^2} \\
&= \frac{\left(2+K\right)\left(1-K\right)^2}{3\left(1-K\right)^2} \\
&= \frac{2+K}{3}.
\end{aligned}$$

□

Lemma 3. *For a constant $K \in (-1, 1)$, and f and $\hat{f}$ defined in (A1) and (A2), we have*

$$(a) \qquad \int_{-\infty}^{\infty} f(x+K)x\hat{f}(x)dx = \begin{cases} \frac{\gamma}{1+\gamma}(1 + K(-K)^{\gamma}) & -1 < K \leq 0 \\ \frac{\gamma}{1+\gamma}(1-K)^{1+\gamma} & 0 < K < 1, \end{cases} \tag{A14}$$

$$(b) \qquad \int_{-\infty}^{\infty} f(x-K)xf(x)dx = \begin{cases} \frac{1}{2}(1+K)^2 & -1 < K \leq 0 \\ \frac{1}{2}(1-K^2) & 0 < K < 1. \end{cases} \tag{A15}$$

Proof of Lemma 3. (a)

$$\begin{aligned}
\int_{-\infty}^{\infty} f\left(x+K\right)x\hat{f}\left(x\right)dx &= \begin{cases} \gamma\int_{-K}^{1} x^{\gamma}dx & -1 < K \leq 0 \\ \gamma\int_0^{1-K} x^{\gamma}dx & 0 < K < 1, \end{cases} \\
&= \begin{cases} \frac{\gamma}{\gamma+1}\left(1 + K(-K)^{\gamma}\right) & -1 < K \leq 0 \\ \frac{\gamma}{\gamma+1}\left(1-K\right)^{\gamma+1} & 0 < K < 1. \end{cases}
\end{aligned}$$

(b)

$$\begin{aligned}
\int_{-\infty}^{\infty} f\left(x-K\right)xf\left(x\right)dx &= \begin{cases} \int_0^{1+K} xdx & -1 < K \leq 0 \\ \int_K^1 xdx & 0 < K < 1, \end{cases} \\
&= \begin{cases} \frac{1}{2}(1+K)^2 & -1 < K \leq 0 \\ \frac{1}{2}\left(1-K^2\right) & 0 < K < 1. \end{cases}
\end{aligned}$$

□

Lemma 4. *For any* $e_A, e_A^* > 0$*,* $\gamma > 1$*, and* $K \in (0,1)$ *we have*

$$(a) \qquad \int_{-\infty}^{\infty} F\left(x\frac{e_A}{e_A^*}+K\right)\hat{f}(x)\,dx = \begin{cases} \frac{\gamma}{1+\gamma}\frac{e_A}{e_A^*}+K & \frac{e_A}{e_A^*}+K \leq 1 \\ 1-\frac{(1-K)^{1+\gamma}}{1+\gamma}\left(\frac{e_A^*}{e_A}\right)^{\gamma} & \frac{e_A}{e_A^*}+K > 1, \end{cases} \tag{A16}$$

$$(b) \qquad \frac{\partial}{\partial e_A}\left(\int_{-\infty}^{\infty} F\left(x\frac{e_A}{e_A^*}+K\right)\hat{f}(x)\,dx\right) = \begin{cases} \frac{\gamma}{(1+\gamma)e_A^*} & \frac{e_A}{e_A^*}+K \leq 1 \\ \frac{(1-K)^{1+\gamma}}{e_A}\frac{\gamma}{1+\gamma}\left(\frac{e_A^*}{e_A}\right)^{\gamma} & \frac{e_A}{e_A^*}+K > 1, \end{cases} \tag{A17}$$

$$(c) \qquad \frac{\partial^2}{(\partial e_A)^2}\left(\int_{-\infty}^{\infty} F\left(x\frac{e_A}{e_A^*}+K\right)\hat{f}(x)\,dx\right) = \begin{cases} 0 & \frac{e_A}{e_A^*}+K \leq 1 \\ -\frac{\gamma(1-K)^{1+\gamma}}{e_A^2}\left(\frac{e_A^*}{e_A}\right)^{\gamma} & \frac{e_A}{e_A^*}+K > 1. \end{cases} \tag{A18}$$

Proof of Lemma 4. (a) We want to determine

$$\int_{-\infty}^{\infty} F\left(x\frac{e_A}{e_A^*}+K\right)\hat{f}(x)\,dx = \int_0^1 F\left(x\frac{e_A}{e_A^*}+K\right)\gamma x^{\gamma-1}dx.$$

Consider the term $F\left(x\frac{e_A}{e_A^*}+K\right)$ on the RHS of the above, and note that the argument is strictly positive. If $\frac{e_A}{e_A^*}+K \leq 1$, then $F\left(x\frac{e_A}{e_A^*}+K\right) = x\frac{e_A}{e_A^*}+K$, whereas if $\frac{e_A}{e_A^*}+K > 1$, then

$$F\left(x\frac{e_A}{e_A^*}+K\right) = \begin{cases} x\frac{e_A}{e_A^*}+K & x \leq (1-K)\frac{e_A^*}{e_A} \\ 1 & x > (1-K)\frac{e_A^*}{e_A}. \end{cases}$$

Therefore,

$$\begin{aligned} \int_{-\infty}^{\infty} F\left(x\frac{e_A}{e_A^*}+K\right)\hat{f}(x)\,dx &= \gamma\int_0^1 x^{\gamma-1}F\left(x\frac{e_A}{e_A^*}+K\right)dx \\ &= \begin{cases} \gamma\int_0^1 x^{\gamma-1}\left(x\frac{e_A}{e_A^*}+K\right)dx & \frac{e_A}{e_A^*}+K \leq 1 \\ \gamma\int_0^{(1-K)\frac{e_A^*}{e_A}} x^{\gamma-1}\left(x\frac{e_A}{e_A^*}+K\right)dx + \gamma\int_{(1-K)\frac{e_A^*}{e_A}}^1 x^{\gamma-1}dx & \frac{e_A}{e_A^*}+K > 1. \end{cases} \end{aligned}$$

It is straightforward to compute

$$\gamma\int_0^1 x^{\gamma-1}\left(x\frac{e_A}{e_A^*}+K\right)dx=\gamma\int_0^1 x^{\gamma}\frac{e_A}{e_A^*}+x^{\gamma-1}Kdx=\frac{\gamma}{1+\gamma}\frac{e_A}{e_A^*}+K,$$

$$\gamma\int_0^{(1-K)\frac{e_A^*}{e_A}} x^{\gamma-1}\left(x\frac{e_A}{e_A^*}+K\right)dx=\gamma\int_0^{(1-K)\frac{e_A^*}{e_A}} x^{\gamma}\frac{e_A}{e_A^*}+x^{\gamma-1}Kdx$$
$$=\frac{\gamma}{1+\gamma}\left((1-K)\frac{e_A^*}{e_A}\right)^{\gamma+1}\frac{e_A}{e_A^*}+\left((1-K)\frac{e_A^*}{e_A}\right)^{\gamma}K,$$

$$\gamma\int_{(1-K)\frac{e_A^*}{e_A}}^1 x^{\gamma-1}dx=1-\left((1-K)\frac{e_A^*}{e_A}\right)^{\gamma}.$$

The first result corresponds to the first case in the lemma. Adding the last two expressions and simplifying, we get the second case

$$\begin{aligned}&\gamma\int_0^{(1-K)\frac{e_A^*}{e_A}} x^{\gamma-1}\left(x\frac{e_A}{e_A^*}+K\right)dx+\gamma\int_{(1-K)\frac{e_A^*}{e_A}}^1 x^{\gamma-1}dx\\&=\frac{\gamma}{1+\gamma}\left((1-K)\frac{e_A^*}{e_A}\right)^{\gamma+1}\frac{e_A}{e_A^*}+\left((1-K)\frac{e_A^*}{e_A}\right)^{\gamma}K+1-\left((1-K)\frac{e_A^*}{e_A}\right)^{\gamma}\\&=1+\frac{\gamma}{1+\gamma}(1-K)^{\gamma+1}\left(\frac{e_A^*}{e_A}\right)^{\gamma}-(1-K)^{\gamma}\left(\frac{e_A^*}{e_A}\right)^{\gamma}(1-K)\\&=1-\frac{(1-K)^{1+\gamma}}{1+\gamma}\left(\frac{e_A^*}{e_A}\right)^{\gamma}.\end{aligned}\tag{A19}$$

(b) and (c): The first and second derivatives can be computed straightforwardly from (a). □

Lemma 5. *For any* $e_B, e_B^*>0$ *and* $K\in(0,1)$*, we have*

$$(a)\qquad \int_{-\infty}^{\infty}F\left(x\frac{e_B}{e_B^*}-K\right)f(x)dx=\begin{cases}0 & \frac{e_B}{e_B^*}\le K\\ \frac{\left(e_B-Ke_B^*\right)^2}{2e_B^*e_B} & K<\frac{e_B}{e_B^*}\le 1+K\\ 1-(1+2K)\frac{e_B^*}{2e_B} & \frac{e_B}{e_B^*}>1+K,\end{cases}\tag{A20}$$

$$(b)\qquad \frac{\partial}{\partial e_B}\left(\int_{-\infty}^{\infty}F\left(x\frac{e_B}{e_B^*}-K\right)f(x)dx\right)=\begin{cases}0 & \frac{e_B}{e_B^*}\le K\\ \frac{1}{2e_B^*}-\frac{e_B^*K^2}{2e_B^2} & K<\frac{e_B}{e_B^*}\le 1+K\\ (1+2K)\frac{e_B^*}{2e_B^2} & \frac{e_B}{e_B^*}>1+K,\end{cases}\tag{A21}$$

$$(c)\qquad \frac{\partial^2}{(\partial e_B)^2}\left(\int_{-\infty}^{\infty}F\left(x\frac{e_B}{e_B^*}-K\right)f(x)dx\right)=\begin{cases}0 & \frac{e_B}{e_B^*}\le K\\ \frac{e_B^*K^2}{e_B^3} & K<\frac{e_B}{e_B^*}\le 1+K\\ -(1+2K)\frac{e_B^*}{e_B^3} & \frac{e_B}{e_B^*}>1+K.\end{cases}\tag{A22}$$

Proof of Lemma 5.

(a) We want to determine

$$\int_{-\infty}^{\infty} F\left(x\frac{e_B}{e_B^*}-K\right) f(x)\, dx = \int_0^1 F\left(x\frac{e_B}{e_B^*}-K\right) dx.$$

We distinguish three cases: i) $\frac{e_B}{e_B^*} \leq K$, ii) $K < \frac{e_B}{e_B^*} \leq 1+K$, iii) $\frac{e_B}{e_B^*} > 1+K$. In case i), the argument of F is nonpositive, and we have

$$\int_0^1 F\left(x\frac{e_B}{e_B^*}-K\right) dx = \int_0^1 0dx = 0.$$

In case ii), we have

$$\begin{aligned}
\int_0^1 F\left(x\frac{e_B}{e_B^*}-K\right) dx &= \int_0^{K\frac{e_B^*}{e_B}} 0dx + \int_{K\frac{e_B^*}{e_B}}^1 \left(x\frac{e_B}{e_B^*}-K\right) dx \\
&= \left(\frac{e_B}{2e_B^*}x^2 - Kx\right)_{K\frac{e_B^*}{e_B}}^1 \\
&= \frac{e_B}{2e_B^*} - K - \frac{e_B}{2e_B^*}\left(K\frac{e_B^*}{e_B}\right)^2 + K^2\frac{e_B^*}{e_B} \\
&= \frac{\left(e_B - Ke_B^*\right)^2}{2e_B^* e_B}.
\end{aligned}$$

In case iii), we have

$$\begin{aligned}
\int_0^1 F\left(x\frac{e_B}{e_B^*}-K\right) dx &= \int_0^{K\frac{e_B^*}{e_B}} 0dx + \int_{K\frac{e_B^*}{e_B}}^{(1+K)\frac{e_B^*}{e_B}} \left(x\frac{e_B}{e_B^*}-K\right) dx + \int_{(1+K)\frac{e_B^*}{e_B}}^1 1dx \\
&= \left(\frac{e_B}{2e_B^*}x^2 - Kx\right)_{K\frac{e_B^*}{e_B}}^{(1+K)\frac{e_B^*}{e_B}} + 1 - (1+K)\frac{e_B^*}{e_B} \\
&= \left(1+2K+K^2\right)\frac{e_B^*}{2e_B} - \frac{K^2}{2}\frac{e_B^*}{e_B} + 1 - (1+2K)\frac{e_B^*}{e_B} \\
&= 1 - (1+2K)\frac{e_B^*}{2e_B} \\
&= \frac{2e_B - (1+2K)\,e_B^*}{2e_B}.
\end{aligned}$$

(b) and (c): The first and second derivatives can be computed straightforwardly from (a).

□

A.2 Proof of Proposition 1

The game is solved by backward induction. The period-2 wages have already been determined in the main body. The first thing we show here is that the RHS of (14), given by

$$\begin{aligned} d_L e_{\min} \Big(& E[\Theta_A|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in T_A] - E[\Theta_A|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in T_B] \\ & + E[\Theta_B|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in T_A] - E[\Theta_B|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in T_B] \Big), \end{aligned} \tag{A23}$$

is equal to zero.

We write our random variables as $\Theta_i = \mu + \varepsilon_i$ and note that $\mu = \frac{1}{2}$ while ε_A and ε_B are random variables with mean zero that are identically, independently, and symmetrically distributed on $\left[-\frac{1}{2}, \frac{1}{2}\right]$. Using this definition and the candidate promotion rule, the preceding expression can be written as

$$\begin{aligned} d_L e_{\min} \Bigg(& \overbrace{E[\varepsilon_A|\tilde{\varepsilon}_A + q\tilde{e}_A > \tilde{\varepsilon}_B + q\tilde{e}_B] - E[\varepsilon_A|\tilde{\varepsilon}_A + q\tilde{e}_A < \tilde{\varepsilon}_B + q\tilde{e}_B]}^{=:\alpha} \\ & + \underbrace{E[\varepsilon_B|\tilde{\varepsilon}_A + q\tilde{e}_A > \tilde{\varepsilon}_B + q\tilde{e}_B] - E[\varepsilon_B|\tilde{\varepsilon}_A + q\tilde{e}_A < \tilde{\varepsilon}_B + q\tilde{e}_B]}_{=:\beta} \Bigg). \end{aligned} \tag{A24}$$

In the following, we show that $\beta = -\alpha$. Consider expression β. As ε_A and ε_B are identically, independently, and symmetrically distributed with mean zero, the variables ε_A and $-\varepsilon_B$ as well as $-\varepsilon_A$ and ε_B are i.i.d. Therefore, we can replace ε_A by $-\varepsilon_B$ (and vice versa) everywhere in β. Moreover, in equilibrium, beliefs about efforts $\tilde{e}_A$ and $\tilde{e}_B$ are correct, i.e., the distributions of $\tilde{\varepsilon}_A$ (resp. $\tilde{\varepsilon}_B$) and ε_A (resp. ε_B) are the same. We can therefore also replace $\tilde{\varepsilon}_A$ by $-\tilde{\varepsilon}_B$ and vice versa. We obtain

$$\begin{aligned} \beta &= E[-\varepsilon_A| - \tilde{\varepsilon}_B + q\tilde{e}_A > -\tilde{\varepsilon}_A + q\tilde{e}_B] - E[-\varepsilon_A| - \tilde{\varepsilon}_B + q\tilde{e}_A < -\tilde{\varepsilon}_A + q\tilde{e}_B] \\ &= -\left(E[\varepsilon_A| - \tilde{\varepsilon}_B + q\tilde{e}_A > -\tilde{\varepsilon}_A + q\tilde{e}_B] - E[\varepsilon_A| - \tilde{\varepsilon}_B + q\tilde{e}_A < -\tilde{\varepsilon}_A + q\tilde{e}_B]\right) \\ &= -\left(E[\varepsilon_A|\tilde{\varepsilon}_A + q\tilde{e}_A > \tilde{\varepsilon}_B + q\tilde{e}_B] - E[\varepsilon_A|\tilde{\varepsilon}_A + q\tilde{e}_A < \tilde{\varepsilon}_B + q\tilde{e}_B]\right) \\ &= -\alpha. \end{aligned} \tag{A25}$$

It follows that the RHS of (14) is equal to zero, $w_{A2}^P + w_{B2}^{NP} - w_{A2}^{NP} - w_{B2}^P = 0$, which can equivalently be expressed as

$$w_{A2}^P - w_{A2}^{NP} = w_{B2}^P - w_{B2}^{NP}, \tag{A26}$$

which means that the absolute (period 2) wage premium of getting promoted is the same for both workers. This property is a result of the symmetry of the ability distributions around their means.

With the RHS of (14) being equal to zero, we see that $\pi^{(P,NP)} > \pi^{(NP,P)}$ is equivalent to $\tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B$, the candidate promotion rule. Therefore, this promotion rule is profit-maximizing and part of an equilibrium, i.e., the incumbent firm does not have an incentive to deviate from it.

The next step is to determine the two workers' period-1 effort choices. We start by considering worker A. In equilibrium, worker A anticipates to be promoted if and only if (below we replace output y_{A1L} by actual output which is a function of actual effort e_A that is chosen by the workers)

$$\begin{aligned}
& \tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B \\
\iff & \frac{y_{A1L} - c_L}{d_L\tilde{e}_A} + q\tilde{e}_A > \frac{y_{B1L} - c_L}{d_L\tilde{e}_B} + q\tilde{e}_B \\
\iff & \frac{(c_L + d_L e_A \theta_A) - c_L}{d_L\tilde{e}_A} + q\tilde{e}_A > \frac{(c_L + d_L e_B \theta_B) - c_L}{d_L\tilde{e}_B} + q\tilde{e}_B \\
\iff & \frac{e_A\theta_A}{\tilde{e}_A} + q\tilde{e}_A > \frac{e_B\theta_B}{\tilde{e}_B} + q\tilde{e}_B \\
\iff & \theta_B < \theta_A \frac{e_A\tilde{e}_B}{e_B\tilde{e}_A} + \frac{q(\tilde{e}_A - \tilde{e}_B)\tilde{e}_B}{e_B}.
\end{aligned} \tag{A27}$$

Worker A's *subjective* promotion probability (using pdf $\hat{f}$) can now be stated as

$$\hat{P}_A = \int_{-\infty}^{\infty} F\left(x\frac{e_A\tilde{e}_B}{e_B\tilde{e}_A} + \frac{q(\tilde{e}_A - \tilde{e}_B)\tilde{e}_B}{e_B}\right)\hat{f}(x)\,dx. \tag{A28}$$

We continue the analysis supposing that efforts and beliefs imply that $\hat{P}_A \in (0,1)$, in line with our assumption that none of the workers is promoted with certainty.

Differentiating with respect to A's choice variable e_A, we obtain

$$\frac{\partial \hat{P}_A}{\partial e_A} = \int_{-\infty}^{\infty} f\left(x\frac{e_A\tilde{e}_B}{e_B\tilde{e}_A} + \frac{q(\tilde{e}_A - \tilde{e}_B)\tilde{e}_B}{e_B}\right)\left(x\frac{\tilde{e}_B}{e_B\tilde{e}_A}\right)\hat{f}(x)\,dx. \tag{A29}$$

Denote equilibrium efforts by e_A^* and e_B^*. As beliefs regarding efforts are confirmed in equilibrium, $e_A = \tilde{e}_A = e_A^*$ and $e_B = \tilde{e}_B = e_B^*$, the latter expression simplifies to

$$\left.\frac{\partial \hat{P}_A}{\partial e_A}\right|_{(e_A^*, e_B^*)} = \int_{-\infty}^{\infty} f\left(x + q(e_A^* - e_B^*)\right)\frac{x}{e_A^*}\hat{f}(x)\,dx. \tag{A30}$$

We now turn to A's problem of maximizing expected payoff, which, in general terms, can be expressed as

$$\hat{P}_A \times (\text{expected payoff given } P) + (1 - \hat{P}_A) \times (\text{expected payoff given } NP). \tag{A31}$$

This equals

$$
\begin{aligned}
&\hat{P}_A w^P_{A2} + \left(1 - \hat{P}_A\right) w^{NP}_{A2} - c(e_A) \\
&= \hat{P}_A \left(w^P_{A2} - w^{NP}_{A2}\right) + w^{NP}_{A2} - c(e_A) \\
&= \hat{P}_A \Big(\Big[c_L + d_L e_{\min} \Big(E[\Theta_A | \tilde{\Theta}_A + q\tilde{e}_A > \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A \Big)\Big] \\
&\qquad - \Big[c_L + d_L e_{\min} \Big(E[\Theta_A | \tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A \Big)\Big] \Big) \\
&\qquad + \Big[c_L + d_L e_{\min} \Big(E[\Theta_A | \tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A \Big)\Big] - c(e_A) \\
&= \hat{P}_A d_L e_{\min} \Big(E[\Theta_A | \tilde{\Theta}_A + q\tilde{e}_A > \tilde{\Theta}_B + q\tilde{e}_B] - E[\Theta_A | \tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B] \Big) \\
&\qquad + c_L + d_L e_{\min} \Big(E[\Theta_A | \tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A \Big) - c(e_A).
\end{aligned}
\tag{A32}
$$

Note that A's choice variable e_A appears only in the cost function and in the probability of winning $\hat{P}_A$, see (A28). The reason is that wages only depend on beliefs regarding effort (not the actual effort choices). The overconfident worker A is aware of how the firms form expectations about A's ability (agree to disagree) and takes this into account in (A32) above. In equilibrium, beliefs about the efforts of both workers are correct, $\tilde{e}_i = e^*_i$, $i \in \{A, B\}$. As a consequence, beliefs about ability realizations are correct, $\tilde{\theta}_i = \theta_i$, which implies $\tilde{\Theta}_i = \Theta_i$. Thus, the first-order condition to worker A's decision problem, evaluated in equilibrium, is

$$
\begin{aligned}
c'(e^*_A) = d_L e_{\min} \left.\frac{\partial \hat{P}_A}{\partial e_A}\right|_{(e^*_A, e^*_B)} &\Big(E[\Theta_A | \Theta_A + q e^*_A > \Theta_B + q e^*_B] \\
&\qquad - E[\Theta_A | \Theta_A + q e^*_A < \Theta_B + q e^*_B] \Big).
\end{aligned}
\tag{A33}
$$

By symmetry, we have for worker B, where the pdf f replaces $\hat{f}$,

$$
P_B = \int_{-\infty}^{\infty} F\left(x \frac{e_B \tilde{e}_A}{e_A \tilde{e}_B} + \frac{q(\tilde{e}_B - \tilde{e}_A)\tilde{e}_A}{e_A} \right) f(x)\, dx, \tag{A34}
$$

$$
\left.\frac{\partial P_B}{\partial e_B}\right|_{(e^*_A, e^*_B)} = \int_{-\infty}^{\infty} f\left(x - q(e^*_A - e^*_B)\right) \frac{x}{e^*_B} f(x)\, dx. \tag{A35}
$$

Using similar steps as above, B's first-order condition (evaluated in equilibrium) can be derived as follows (exploiting (A26), expressing the difference in expected values in terms of Θ_A rather than Θ_B):

$$
\begin{aligned}
c'(e^*_B) = d_L e_{\min} \left.\frac{\partial P_B}{\partial e_B}\right|_{(e^*_A, e^*_B)} &\Big(E[\Theta_A | \Theta_A + q e^*_A > \Theta_B + q e^*_B] \\
&\qquad - E[\Theta_A | \Theta_A + q e^*_A < \Theta_B + q e^*_B] \Big).
\end{aligned}
\tag{A36}
$$

In order to simplify notation, define $K := q(e_A^* - e_B^*)$.[15] The above first-order conditions can be written as

$$c'(e_A^*)e_A^* = d_L e_{\min} \int_{-\infty}^{\infty} f(x+K)\, x \hat{f}(x)\, dx \\ \Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big), \tag{A37}$$

$$c'(e_B^*)e_B^* = d_L e_{\min} \int_{-\infty}^{\infty} f(x-K)\, x f(x)\, dx \\ \Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big). \tag{A38}$$

In the following, we prove that $e_A^* > e_B^*$. Recall that, by assumption, $K \in (-1, 1)$. By contradiction, assume that $e_A^* \leq e_B^*$, which is equivalent to $K \in (-1, 0]$. For this case, the two integrals above are given in Lemma 3. We now demonstrate that, for $K \in (-1, 0]$,

$$\int_{-\infty}^{\infty} f(x+K)\, x \hat{f}(x)\, dx > \int_{-\infty}^{\infty} f(x-K)\, x f(x)\, dx \\ \iff \frac{\gamma}{1+\gamma}(1 + K(-K)^{\gamma}) > \frac{1}{2}(1+K)^2 \tag{A39}$$

is true. First consider the case $K = 0$. Then the inequality simplifies to $\frac{\gamma}{1+\gamma} > \frac{1}{2} \Leftrightarrow 2\gamma > 1 + \gamma \Leftrightarrow \gamma > 1$, which is always fulfilled. Now consider the case $K \in (-1, 0)$. The above observation that $\frac{\gamma}{1+\gamma} > \frac{1}{2}$ implies that we only need to show that

$$\begin{aligned} & 1 + K(-K)^{\gamma} > (1+K)^2 \\ \Leftrightarrow\ & 1 + K(-K)^{\gamma} > 1 + 2K + K^2 \\ \Leftrightarrow\ & K(-K)^{\gamma} > 2K + K^2 \\ \Leftrightarrow\ & (-K)^{\gamma} < 2 + K. \end{aligned}$$

Notice that $(-K)^{\gamma} < 1$, while $2 + K > 1$, so inequality (A39) is fulfilled for all $K \in (-1, 0]$. Thus, the RHS of (A37) would be larger than the RHS of (A38), which implies that the LHS of (A37) is larger than the LHS of (A38). As $c'(x)x$ is increasing in x, the latter contradicts $e_A^* \leq e_B^*$. Therefore, $e_A^* \leq e_B^*$ is not a solution to the pair of first-order conditions. Therefore, if there is an equilibrium that is characterized by the first-order conditions, it must satisfy $e_A^* > e_B^*$.

Having established that $e_A^* > e_B^*$, implying that $K \in (0, 1)$, in the following, we rewrite these conditions, inserting our distributional assumptions.
First, applying Lemma 3 for $K \in (0, 1)$, we can write the equilibrium marginal promotion

[15] In the paper, we assume that, given all other model parameters, the cost function is sufficiently convex such that the equilibrium difference in transferable human capital between the workers is less than one, $|q(e_A^* - e_B^*)| < 1$. This assumption ensures that both workers are promoted with a positive probability.

probabilities as

$$
\begin{aligned}
\left.\frac{\partial \hat{P}_A}{\partial e_A}\right|_{(e_A^*, e_B^*)} &= \frac{1}{e_A^*}\int_{-\infty}^{\infty} f(x+K)\, x \hat{f}(x)\, dx = \frac{1}{e_A^*}\frac{\gamma(1-K)^{\gamma+1}}{\gamma+1}, \\
\left.\frac{\partial P_B}{\partial e_B}\right|_{(e_A^*, e_B^*)} &= \frac{1}{e_B^*}\int_{-\infty}^{\infty} f(x-K)\, x f(x)\, dx = \frac{1}{e_B^*}\frac{1-K^2}{2}.
\end{aligned}
\tag{A40}
$$

Second, Lemma 2 part (c) provides the difference of conditional expectations,

$$
\Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big) = \frac{1+2K}{3(1+2K-K^2)}. \tag{A41}
$$

This allows us to write (A33) and (A36) as

$$
\begin{aligned}
c'(e_A^*)e_A^* &= d_L e_{\min}\frac{\gamma(1-K)^{\gamma+1}}{3(\gamma+1)}\frac{1+2K}{1+2K-K^2}, \\
c'(e_B^*)e_B^* &= d_L e_{\min}\frac{1}{6}(1-K^2)\frac{1+2K}{1+2K-K^2}.
\end{aligned}
\tag{A42}
$$

Recall that K is a function of the equilibrium efforts, which means that we can only implicitly characterize equilibrium efforts.

A.2.1 Second order conditions

We continue with deriving sufficient second-order conditions such that (A42) indeed characterizes an equilibrium. For this, we look at each worker's expected deviation payoff, i.e., worker i's payoff as a function of e_i given that the other worker, j, plays the above Nash equilibrium candidate effort e_j^*, and given that all beliefs are also equal to the above two candidate efforts (e_A^*, e_B^*).

Start with worker A's problem. The overconfident A's subjective probability of winning as a function of e_A, evaluated at firms' candidate equilibrium beliefs and worker B's candidate equilibrium effort, $\tilde{e}_A = e_A^*, \tilde{e}_B = e_B = e_B^*$, is

$$
\begin{aligned}
\left.\hat{P}_A\right|_{\tilde{e}_A = e_A^*, \tilde{e}_B = e_B = e_B^*} &= \left.\int_{-\infty}^{\infty} F\left(x\frac{e_A \tilde{e}_B}{e_B \tilde{e}_A} + \frac{q(\tilde{e}_A - \tilde{e}_B)\tilde{e}_B}{e_B}\right)\hat{f}(x)\, dx\right|_{\tilde{e}_A = e_A^*, \tilde{e}_B = e_B = e_B^*} \\
&= \int_{-\infty}^{\infty} F\left(x\frac{e_A}{e_A^*} + q(e_A^* - e_B^*)\right)\hat{f}(x)\, dx.
\end{aligned}
\tag{A43}
$$

Recall A's expected payoff in the last line of (A32), which we also evaluate at $\tilde{e}_A = e_A^*$,

$\tilde{e}_B = e_B = e_B^*$, $\tilde{\theta}_i = \theta_i$, again using $K := q(e_A^* - e_B^*)$ to get

$$\int_{-\infty}^{\infty} F\left(x\frac{e_A}{e_A^*} + K\right) \hat{f}(x)\, dx\, d_L e_{\min}\Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big)$$
$$+ c_L + d_L e_{\min}\left(E[\Theta_A|\Theta_A + K < \Theta_B] + q e_A^*\right) - c(e_A), \tag{A44}$$

where only the integral and the cost term depend on A's choice variable e_A. The integral is multiplied by a positive constant, recall (A41). Lemma 4 derives the first and second derivatives of the above integral. The integral is (once) continuously differentiable. As the second derivative of the integral is either zero or negative, while the cost function is convex, we conclude that $e_A = e_A^*$ is a best response for worker A.

We repeat similar steps for worker B. Start with the winning probability:

$$\begin{aligned} P_B|_{e_A=\tilde{e}_A=e_A^*,\tilde{e}_B=e_B^*} &= \int_{-\infty}^{\infty} F\left(x\frac{e_B\tilde{e}_A}{e_A\tilde{e}_B} + \frac{q(\tilde{e}_B - \tilde{e}_A)\tilde{e}_A}{e_A}\right) f(x)\, dx\Bigg|_{e_A=\tilde{e}_A=e_A^*,\tilde{e}_B=e_B^*} \\ &= \int_{-\infty}^{\infty} F\left(x\frac{e_B}{e_B^*} - q(e_A^* - e_B^*)\right) f(x)\, dx. \end{aligned} \tag{A45}$$

The payoff of worker B evaluated at the equilibrium candidate and beliefs is:

$$\int_{-\infty}^{\infty} F\left(x\frac{e_B}{e_B^*} - K\right) f(x)\, dx\, d_L e_{\min}\Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big)$$
$$+ c_L + d_L e_{\min}\left(E[\Theta_B|\Theta_A + K > \Theta_B] + q e_B^*\right) - c(e_B). \tag{A46}$$

Similar to worker A's problem, only the integral and the cost term depend on the choice variable e_B. The integral is multiplied by a positive constant, recall (A41). Lemma 5 derives the first and second derivatives of the above integral. The integral is (once) continuously differentiable. Note that, in contrast to worker A's problem, the second derivative of the integral can be positive, while the cost function is convex. We conclude that $e_B = e_B^*$ is a best response for worker B only if suitable parameters are identified. In the numerical examples that we provide, the second-order conditions are satisfied.

A.3 Proof of Proposition 2

(a) **Worker A is promoted with a higher probability.**

According to the equilibrium promotion rule, A is promoted if and only if (using the notation $K := q(e_A^* - e_B^*)$)

$$\theta_A + q e_A^* > \theta_B + q e_B^* \iff \theta_B < \theta_A + K. \tag{A47}$$

The probability of that event is denoted by $P(\Theta_A + K > \Theta_B)$ and is given by (A4). The probability that worker B is promoted is denoted by $P(\Theta_A + K < \Theta_B)$ and is given by (A5). We have that

$$\begin{aligned} P(\Theta_A + K > \Theta_B) &= \int_{-\infty}^{\infty} F(x+K) f(x) dx \\ &> \int_{-\infty}^{\infty} F(x) f(x) dx = \frac{1}{2}, \end{aligned} \tag{A48}$$

since $e_A^* > e_B^*$ and $K > 0$. Thus, the probability of A being promoted is larger than $\frac{1}{2}$, implying that worker B's promotion probability is less than $\frac{1}{2}$.

(b) **Worker A receives a higher period-2 wage than worker B.**

Recall (8)–(11), and insert the equilibrium promotion rule $\theta_A + qe_A^* > \theta_B + qe_B^*$. The two workers' period-2 wages for both feasible promotion events are

$$w_{A2}^{NP} = c_L + d_L e_{\min} \left(E\left[\Theta_A \middle| \Theta_A + qe_A^* < \Theta_B + qe_B^*\right] + qe_A^* \right), \tag{A49}$$

$$w_{A2}^{P} = c_L + d_L e_{\min} \left(E\left[\Theta_A \middle| \Theta_A + qe_A^* > \Theta_B + qe_B^*\right] + qe_A^* \right), \tag{A50}$$

$$w_{B2}^{NP} = c_L + d_L e_{\min} \left(E\left[\Theta_B \middle| \Theta_B + qe_B^* < \Theta_A + qe_A^*\right] + qe_B^* \right), \tag{A51}$$

$$w_{B2}^{P} = c_L + d_L e_{\min} \left(E\left[\Theta_B \middle| \Theta_B + qe_B^* > \Theta_A + qe_A^*\right] + qe_B^* \right). \tag{A52}$$

We need to show that both $w_{A2}^{NP} > w_{B2}^{NP}$ and $w_{A2}^{P} > w_{B2}^{P}$. Note that $w_{A2}^{NP} > w_{B2}^{NP}$ is equivalent to

$$q(e_A^* - e_B^*) + E\left[\Theta_A \middle| \Theta_A + qe_A^* < \Theta_B + qe_B^*\right] > E\left[\Theta_B \middle| \Theta_B + qe_B^* < \Theta_A + qe_A^*\right]$$

Denoting $K := q(e_A^* - e_B^*) \in (0,1)$, and inserting two conditional expectations computed in Lemma 2, cases (b) and (d), this simplifies to

$$\begin{aligned} & K + E[\Theta_A | \Theta_A + K < \Theta_B] > E[\Theta_B | \Theta_A + K > \Theta_B] \\ \iff \quad & K + \frac{1-K}{3} > \frac{1 + 3K - K^3}{3(1 + 2K - K^2)} \\ \iff \quad & 1 + 2K > \frac{1 + 3K - K^3}{1 + 2K - K^2} \\ \iff \quad & K + 3K^2 - K^3 > 0. \end{aligned} \tag{A53}$$

Since $K \in (0,1)$ and thus $K > K^3$, this always holds. Thus, $w_{A2}^{NP} > w_{B2}^{NP}$. By (A26), this implies $w_{A2}^{P} > w_{B2}^{P}$.

(c) **Worker A receives a higher expected period-2 wage.**

The expected period-2 wages for both workers are

$$P_A(w^P_{A2} - w^{NP}_{A2}) + w^{NP}_{A2} \tag{A54}$$
$$P_B(w^P_{B2} - w^{NP}_{B2}) + w^{NP}_{B2} \tag{A55}$$

The proof follows directly from parts (a) and (b), i.e., a larger promotion probability, $P_A > P_B$, combined with A receiving a larger wage than B if not promoted, $w^{NP}_{A2} > w^{NP}_{B2}$. By (A26), the differences in parentheses are equal.

(d) **Upon promotion, in expectation, worker A's ability is smaller than worker B's.**

Recall that in the event of promotion, worker A's ability θ_A satisfies

$$\begin{aligned} &\theta_A + qe^*_A > \theta_B + qe^*_B \\ \iff &\theta_A > \theta_B - q(e^*_A - e^*_B). \end{aligned} \tag{A56}$$

The expected value of Θ_A in this event is found in part (a) of Lemma 2, for $K = q(e^*_A - e^*_B) \in (0, 1)$. For worker B's promotion event,

$$\begin{aligned} &\theta_A + qe^*_A < \theta_B + qe^*_B \\ \iff &\theta_B > \theta_A + q(e^*_A - e^*_B), \end{aligned} \tag{A57}$$

the relevant expected value is found in part (e) of Lemma 2, again for $K = q(e^*_A - e^*_B) \in (0, 1)$. The expected values in part (a) and (e) can be written as

$$\begin{aligned} (a) \quad & E[\Theta_A | \Theta_A > \Theta_B - K] \\ (e) \quad & E[\Theta_B | \Theta_B > \Theta_A + K]. \end{aligned} \tag{A58}$$

Obviously, $E[\Theta_A|\Theta_A > \Theta_B - K] < E[\Theta_B|\Theta_B > \Theta_A + K]$, as Θ_A and Θ_B are i.i.d. and $K > 0$. This can of course also be confirmed by comparing the respective expressions.

(e) **Worker A has larger transferable human capital.**

This follows directly from $e^*_A > e^*_B$, which implies larger human capital for A, $qe^*_A > qe^*_B$.

A.4 Perfect Substitutes

Here we assume that effort e_i and ability θ_i are perfect substitutes, rather than complements. Below we present a backwards-induction proof showing that both workers will have the same effort in equilibrium. The proof is very similar to the proof of Proposition 1 but is kept much shorter.

In period 1 (the early career stage), each worker produces an output equal to

$$y_{i1L} = c_L + d_L(e_i + \theta_i). \tag{A59}$$

At the end of period 1, one worker is promoted to job H in the incumbent firm and has a period-2 output equal to

$$y_{i2H} = c_H + (1+S)d_H(e_{\min} + \theta_i + qe_i). \tag{A60}$$

The other worker remains in job L and has a period-2 output of

$$y_{i2L} = c_L + (1+S)d_L(e_{\min} + \theta_i + qe_i). \tag{A61}$$

If hired by an external firm, the output of worker i would be

$$\hat{y}_{i2L} = c_L + d_L(e_{\min} + \theta_i + qe_i). \tag{A62}$$

After period 1, the incumbent firm can observe worker i's output, y_{i1L}. Recalling (A59), observed output and effort beliefs allow the firm to deduce the ability realization, which we denote as $\tilde{\theta}_i$ and which in equilibrium is equal to the actual ability realization θ_i. The deduced beliefs about ability are

$$\tilde{\theta}_A = \frac{y_{A1L} - c_L}{d_L} - \tilde{e}_A, \quad \tilde{\theta}_B = \frac{y_{B1L} - c_L}{d_L} - \tilde{e}_B. \tag{A63}$$

We state the promotion rule as a function of the deduced ability levels $\tilde{\theta}_i$ rather than the observed output levels. The equilibrium promotion decision must be profit-maximizing and is based on both workers' expected period-2 productivity $\tilde{\theta}_i + q\tilde{e}_i$. Denote the set of deduced abilities $\tilde{\theta}_A$ and $\tilde{\theta}_B$ for which worker A will be promoted by T_A and the set of deduced abilities where B is promoted by T_B.Furthermore, denote the external firms' beliefs regarding T_A and T_B by $\tilde{T}_A$ and $\tilde{T}_B$, respectively.
We now consider the wages offered by the external firms. If worker A is promoted by the incumbent firm, the external wage offers are (where the expected value is from the point of view of the outside firm):

$$w_{A2}^{P} = c_L + d_L\left(e_{\min} + E[\Theta_A|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in \tilde{T}_A] + q\tilde{e}_A\right), \tag{A64}$$

$$w_{B2}^{NP} = c_L + d_L\left(e_{\min} + E[\Theta_B|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in \tilde{T}_A] + q\tilde{e}_B\right). \tag{A65}$$

If worker B is promoted, the wage offers by the external firm are

$$w_{A2}^{NP} = c_L + d_L\left(e_{\min} + E[\Theta_A|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in \tilde{T}_B] + q\tilde{e}_A\right), \tag{A66}$$

$$w_{B2}^{P} = c_L + d_L\left(e_{\min} + E[\Theta_B|(\tilde{\Theta}_A, \tilde{\Theta}_B) \in \tilde{T}_B] + q\tilde{e}_B\right). \tag{A67}$$

We now turn to the incumbent firm's promotion decision at the end of period 1. Recall the period-2 outputs in the two job levels, (A61) and (A60). If the firm promotes worker A (and hence does not promote worker B), the incumbent's expected period-2 profit is

$$\pi^{(P,NP)} = (1-\tau)\Big((c_H + (1+S)d_H(e_{\min} + \tilde{\theta}_A + q\tilde{e}_A)) \\ + (c_L + (1+S)d_L(e_{\min} + \tilde{\theta}_B + q\tilde{e}_B)) - (w^P_{A2} + w^{NP}_{B2})\Big) \tag{A68}$$

Similarly, if worker B is promoted, the firm's expected period-2 profit is

$$\pi^{(NP,P)} = (1-\tau)\Big((c_H + (1+S)d_H(e_{\min} + \tilde{\theta}_B + q\tilde{e}_B)) \\ + (c_L + (1+S)d_L(e_{\min} + \tilde{\theta}_A + q\tilde{e}_A)) - (w^{NP}_{A2} + w^P_{B2})\Big). \tag{A69}$$

It follows that the firm promotes worker A if and only if

$$\pi^{(P,NP)} > \pi^{(NP,P)} \iff (1+S)(d_H - d_L)(\tilde{\theta}_A + q\tilde{e}_A - (\tilde{\theta}_B + q\tilde{e}_B)) > w^P_{A2} + w^{NP}_{B2} - w^{NP}_{A2} - w^P_{B2}. \tag{A70}$$

The obvious candidate equilibrium promotion rule is that worker A is promoted if and only if $\tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B$. In order to prove that this is an equilibrium promotion rule, we focus attention on the RHS of (A70). Suppose, in equilibrium, worker A is indeed promoted iff $\tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B$. In equilibrium, outside firms correctly anticipate the promotion rule. Therefore, $\tilde{T}_A = T_A$ and $\tilde{T}_B = T_B$. Recalling the wage offers (A64)–(A67), the RHS of (A70) is then equal to

$$d_L\left(E[\Theta_A|(\tilde{\Theta}_A,\tilde{\Theta}_B) \in T_A] - E[\Theta_A|(\tilde{\Theta}_A,\tilde{\Theta}_B) \in T_B] \\ +E[\Theta_B|(\tilde{\Theta}_A,\tilde{\Theta}_B) \in T_A] - E[\Theta_B|(\tilde{\Theta}_A,\tilde{\Theta}_B) \in T_B]\right). \tag{A71}$$

In the proof of Proposition 1, we have demonstrated that the expression in parentheses above is equal to zero.

With the RHS of (A70) being equal to zero, we see that $\pi^{(P,NP)} > \pi^{(NP,P)}$ is equivalent to $\tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B$, the candidate promotion rule. Therefore, this promotion rule is profit-maximizing and part of an equilibrium, i.e., the incumbent firm does not have an incentive to deviate from it.

The next step is to determine the two workers' period-1 effort choices. We start by considering worker A. In equilibrium, worker A anticipates to be promoted if and only if (below we replace output y_{A1L} by actual output which is a function of actual effort e_A that is chosen by the workers)

$$\begin{aligned}
&\tilde{\theta}_A + q\tilde{e}_A > \tilde{\theta}_B + q\tilde{e}_B \\
\Longleftrightarrow\ & \frac{y_{A1L} - c_L}{d_L} - \tilde{e}_A + q\tilde{e}_A > \frac{y_{B1L} - c_L}{d_L} - \tilde{e}_B + q\tilde{e}_B \\
\Longleftrightarrow\ & \frac{(c_L + d_L(e_A + \theta_A)) - c_L}{d_L} - (1-q)\tilde{e}_A > \frac{(c_L + d_L(e_B + \theta_B)) - c_L}{d_L} - (1-q)\tilde{e}_B \\
\Longleftrightarrow\ & e_A + \theta_A - (1-q)\tilde{e}_A > e_B + \theta_B - (1-q)\tilde{e}_B \\
\Longleftrightarrow\ & \theta_B < \theta_A + e_A - e_B - (1-q)(\tilde{e}_A - \tilde{e}_B).
\end{aligned} \tag{A72}$$

Worker A's *subjective* promotion probability (using pdf $\hat{f}$) can now be stated as

$$\hat{P}_A = \int_{-\infty}^{\infty} F\left(x + e_A - e_B - (1-q)(\tilde{e}_A - \tilde{e}_B)\right) \hat{f}\left(x\right) dx. \tag{A73}$$

We continue the analysis supposing that efforts and beliefs imply that $\hat{P}_A \in (0,1)$, in line with our assumption that none of the workers is promoted with certainty.
Differentiating with respect to A's choice variable e_A, we obtain

$$\frac{\partial \hat{P}_A}{\partial e_A} = \int_{-\infty}^{\infty} f\left(x + e_A - e_B - (1-q)(\tilde{e}_A - \tilde{e}_B)\right) \hat{f}\left(x\right) dx. \tag{A74}$$

Denote equilibrium efforts by e_A^* and e_B^*. As beliefs regarding efforts are confirmed in equilibrium, $e_A = \tilde{e}_A = e_A^*$ and $e_B = \tilde{e}_B = e_B^*$, the latter expression simplifies to

$$\left.\frac{\partial \hat{P}_A}{\partial e_A}\right|_{(e_A^*, e_B^*)} = \int_{-\infty}^{\infty} f\left(x + q(e_A^* - e_B^*)\right) \hat{f}\left(x\right) dx. \tag{A75}$$

We now turn to A's problem of maximizing expected payoff, which, in general terms, can be expressed as

$$\hat{P}_A \times (\text{expected payoff given } P) + (1 - \hat{P}_A) \times (\text{expected payoff given } NP). \tag{A76}$$

This equals

$$\begin{aligned}
&\hat{P}_A w_{A2}^P + \left(1-\hat{P}_A\right) w_{A2}^{NP} - c(e_A) \\
&= \hat{P}_A \left(w_{A2}^P - w_{A2}^{NP}\right) + w_{A2}^{NP} - c(e_A) \\
&= \hat{P}_A \Big(\Big[c_L + d_L \Big(e_{\min} + E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A > \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A\Big)\Big] \\
&\qquad - \Big[c_L + d_L \Big(e_{\min} + E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A\Big)\Big] \Big) \\
&\qquad + \Big[c_L + d_L \Big(e_{\min} + E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A\Big)\Big] - c(e_A) \\
&= \hat{P}_A d_L \Big(E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A > \tilde{\Theta}_B + q\tilde{e}_B] - E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B]\Big) \\
&\qquad + c_L + d_L \Big(e_{\min} + E[\Theta_A|\tilde{\Theta}_A + q\tilde{e}_A < \tilde{\Theta}_B + q\tilde{e}_B] + q\tilde{e}_A\Big) - c(e_A).
\end{aligned} \tag{A77}$$

Note that A's choice variable e_A appears only in the cost function and in the probability of winning $\hat{P}_A$, see (A73). The reason is that wages only depend on beliefs regarding effort (not the actual effort choices). The overconfident worker A is aware of how the firms form expectations about A's ability (agree to disagree) and takes this into account in (A77) above. In equilibrium, beliefs about the efforts of both workers are correct, $\tilde{e}_i = e_i^*$, $i \in \{A, B\}$. As a consequence, beliefs about ability realizations are correct, $\tilde{\theta}_i = \theta_i$, which implies $\tilde{\Theta}_i = \Theta_i$. Thus, the first-order condition to worker A's decision problem, evaluated in equilibrium, is

$$\begin{aligned}
c'(e_A^*) = d_L \left.\frac{\partial \hat{P}_A}{\partial e_A}\right|_{(e_A^*, e_B^*)} &\Big(E[\Theta_A|\Theta_A + qe_A^* > \Theta_B + qe_B^*] \\
&\qquad - E[\Theta_A|\Theta_A + qe_A^* < \Theta_B + qe_B^*]\Big).
\end{aligned} \tag{A78}$$

By symmetry, we have for worker B, where the pdf f replaces $\hat{f}$,

$$P_B = \int_{-\infty}^{\infty} F\left(x + e_B - e_A - (1-q)(\tilde{e}_B - \tilde{e}_A)\right) f(x)\, dx, \tag{A79}$$

$$\left.\frac{\partial P_B}{\partial e_B}\right|_{(e_A^*, e_B^*)} = \int_{-\infty}^{\infty} f\left(x + q(e_B^* - e_A^*)\right) f(x)\, dx. \tag{A80}$$

Using similar steps as above, B's first-order condition (evaluated in equilibrium) can be derived as follows (expressing the difference in expected values in terms of Θ_A rather than Θ_B):

$$\begin{aligned}
c'(e_B^*) = d_L \left.\frac{\partial P_B}{\partial e_B}\right|_{(e_A^*, e_B^*)} &\Big(E[\Theta_A|\Theta_A + qe_A^* > \Theta_B + qe_B^*] \\
&\qquad - E[\Theta_A|\Theta_A + qe_A^* < \Theta_B + qe_B^*]\Big).
\end{aligned} \tag{A81}$$

Using $K = q(e_A^* - e_B^*)$, the above first-order conditions can be written as

$$c'(e_A^*) = d_L \int_{-\infty}^{\infty} f(x+K)\,\hat{f}(x)\,dx \\ \Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big), \tag{A82}$$

$$c'(e_B^*) = d_L \int_{-\infty}^{\infty} f(x-K)\,f(x)\,dx \\ \Big(E[\Theta_A|\Theta_A + K > \Theta_B] - E[\Theta_A|\Theta_A + K < \Theta_B]\Big). \tag{A83}$$

We solve the two integrals, assuming $K \in (-1, 1)$:

$$\int_{-\infty}^{\infty} f(x+K)\,\hat{f}(x)\,dx = \begin{cases} \int_0^{1-K} \gamma x^{\gamma-1}dx & K \geq 0 \\ \int_{-K}^{1} \gamma x^{\gamma-1}dx & K < 0 \end{cases} = \begin{cases} (1-K)^\gamma & K \geq 0 \\ 1-(-K)^\gamma & K < 0. \end{cases} \tag{A84}$$

$$\int_{-\infty}^{\infty} f(x-K)\,f(x)\,dx = \begin{cases} \int_K^1 dx & K \geq 0 \\ \int_0^{1+K} dx & K < 0 \end{cases} = \begin{cases} 1-K & K \geq 0 \\ 1+K & K < 0. \end{cases} \tag{A85}$$

In the following, we prove that $e_A^* = e_B^*$ is the only equilibrium candidate that can be derived from the first-order conditions above ((A82) and (A83)). Inserting $e_A^* = e_B^*$ in the two first-order conditions ((A82) and (A83)), we get $K = 0$ and the two integrals both have value 1, such that both the left-hand sides and the right-hand sides of (A82) and (A83) are equal to each other, confirming that $e_A^* = e_B^*$ is a solution of the first-order conditions.
Now consider $e_A^* > e_B^*$. This implies $K \in (0, 1)$, and it would require that the right-hand side of (A82) is larger than the right-hand-side of (A83). This is equivalent to requiring $(1-K)^\gamma > 1 - K$, but this is violated as $\gamma > 1$ and $K \in (0, 1)$.
Now consider $e_A^* < e_B^*$. This implies $K \in (-1, 0)$, and it would require that the right-hand side of (A82) is less than the right-hand-side of (A83). This is equivalent to requiring $1 - (-K)^\gamma < 1 + K$, but this is again violated as $\gamma > 1$ and $K \in (-1, 0)$.

A.5 Period-1 Wages

In this section we analyze period-1 wage payments w_{A1}^* and w_{B1}^*. In period 1, the incumbent expects a net profit from worker A equal to

$$c_L + d_L E[\Theta_A]\,e_A^* - w_{A1}^* \\ = c_L + \frac{d_L}{2} e_A^* - w_{A1}^*, \tag{A86}$$

and from worker B equal to

$$\begin{aligned} & c_L + d_L E\left[\Theta_B\right] e_B^* - w_{B1}^* \\ & = c_L + \frac{d_L}{2} e_B^* - w_{B1}^* . \end{aligned} \tag{A87}$$

We assume that, due to a competitive labor market, the incumbent expects zero total net profit from both periods. Thus, in order to determine w_{A1}^* and w_{B1}^* we need to derive the total expected net profit from each worker over both periods.
We continue with deriving the incumbent's expected output in period 2 (recalling that the workers stay at the incumbent firm with probability $1-\tau$). The expected output from worker A is (recalling (12) and (13))

$$\begin{aligned} & (1-\tau)\Big(P\left(\Theta_A + qe_A^* > \Theta_B + qe_B^*\right)\left(c_H + (1+S)\, d_H e_{\min} E\left[\Theta_A + qe_A^* \middle| \Theta_A + qe_A^* > \Theta_B + qe_B^*\right]\right) \\ & + P\left(\Theta_A + qe_A^* < \Theta_B + qe_B^*\right)\left(c_L + (1+S)\, d_L e_{\min} E\left[\Theta_A + qe_A^* \middle| \Theta_A + qe_A^* < \Theta_B + qe_B^*\right]\right)\Big). \end{aligned} \tag{A88}$$

Similarly, for worker B we have

$$\begin{aligned} & (1-\tau)\Big(P\left(\Theta_A + qe_A^* > \Theta_B + qe_B^*\right)\left(c_L + (1+S)\, d_L e_{\min} E\left[\Theta_B + qe_B^* \middle| \Theta_A + qe_A^* > \Theta_B + qe_B^*\right]\right) \\ & + P\left(\Theta_A + qe_A^* < \Theta_B + qe_B^*\right)\left(c_H + (1+S)\, d_H e_{\min} E\left[\Theta_B + qe_B^* \middle| \Theta_A + qe_A^* < \Theta_B + qe_B^*\right]\right)\Big). \end{aligned} \tag{A89}$$

As a final ingredient of the incumbent's total profit, consider the expected wage payment to each worker in the second period, recalling (A49)–(A52). For worker A this is

$$\begin{aligned} & (1-\tau)\Big(c_L + d_L e_{\min}\Big(P\left(\Theta_A + qe_A^* > \Theta_B + qe_B^*\right)\left(E\left[\Theta_A \middle| \Theta_A + qe_A^* > \Theta_B + qe_B^*\right] + qe_A^*\right) \\ & + P\left(\Theta_A + qe_A^* < \Theta_B + qe_B^*\right)\left(E\left[\Theta_A \middle| \Theta_A + qe_A^* < \Theta_B + qe_B^*\right] + qe_A^*\right)\Big)\Big), \end{aligned} \tag{A90}$$

where

$$\begin{aligned} & P\left(\Theta_A + qe_A^* > \Theta_B + qe_B^*\right) E\left[\Theta_A \middle| \Theta_A + qe_A^* > \Theta_B + qe_B^*\right] \\ & + P\left(\Theta_A + qe_A^* < \Theta_B + qe_B^*\right) E\left[\Theta_A \middle| \Theta_A + qe_A^* < \Theta_B + qe_B^*\right] = \frac{1}{2}. \end{aligned} \tag{A91}$$

The latter follows from the law of total expectation and can easily be verified using the results in Lemmas 1 and 2. So the expected wage payment simplifies to

$$(1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + qe_A^*\right)\right). \tag{A92}$$

Similarly, the incumbent's expected period-2 wage payment to worker B is

$$(1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e_B^*\right)\right). \tag{A93}$$

Combining the above results (A86), (A88), and (A92), the incumbent's total expected net profit (output minus wages) from worker A is

$$\begin{aligned}
&c_L + \frac{d_L}{2} e_A^* - w_{A1}^* - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e_A^*\right)\right) + (1-\tau)\cdot \\
&\Big(P\left(\Theta_A + q e_A^* > \Theta_B + q e_B^*\right)\left(c_H + (1+S)\, d_H e_{\min} E\left[\Theta_A + q e_A^* \middle|\, \Theta_A + q e_A^* > \Theta_B + q e_B^*\right]\right) \\
&+ P\left(\Theta_A + q e_A^* < \Theta_B + q e_B^*\right)\left(c_L + (1+S)\, d_L e_{\min} E\left[\Theta_A + q e_A^* \middle|\, \Theta_A + q e_A^* < \Theta_B + q e_B^*\right]\right)\Big).
\end{aligned} \tag{A94}$$

If we impose a zero-profit condition on worker A, then the incumbent needs to pay worker A a period-1 wage of

$$\begin{aligned}
w_{A1}^* = {} & c_L + \frac{d_L}{2} e_A^* - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e_A^*\right)\right) + (1-\tau)\cdot \\
&\Big(P\left(\Theta_A + q e_A^* > \Theta_B + q e_B^*\right)\left(c_H + (1+S)\, d_H e_{\min} E\left[\Theta_A + q e_A^* \middle|\, \Theta_A + q e_A^* > \Theta_B + q e_B^*\right]\right) \\
&+ P\left(\Theta_A + q e_A^* < \Theta_B + q e_B^*\right)\left(c_L + (1+S)\, d_L e_{\min} E\left[\Theta_A + q e_A^* \middle|\, \Theta_A + q e_A^* < \Theta_B + q e_B^*\right]\right)\Big).
\end{aligned} \tag{A95}$$

Denoting $K := q(e_A^* - q_B^*)$, we can write this as

$$\begin{aligned}
w_{A1}^* = {} & c_L + \frac{d_L}{2} e_A^* - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e_A^*\right)\right) + (1-\tau)\cdot \\
&\Big(P\left(\Theta_A + K > \Theta_B\right)\left(c_H + (1+S)\, d_H e_{\min}(E\left[\Theta_A \middle|\, \Theta_A + K > \Theta_B\right] + q e_A^*)\right) \\
&+ P\left(\Theta_A + K < \Theta_B\right)\left(c_L + (1+S)\, d_L e_{\min}(E\left[\Theta_A \middle|\, \Theta_A + K < \Theta_B\right] + q e_A^*)\right)\Big).
\end{aligned} \tag{A96}$$

Recall the promotion probabilities (A4) and (A5). Furthermore, insert conditional expectations developed in Lemma 2 to write the above as

$$\begin{aligned}
w_{A1}^* = {} & c_L + \frac{d_L}{2} e_A^* - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e_A^*\right)\right) + (1-\tau)\cdot \\
&\left(\frac{1}{2}(1+2K-K^2)\left(c_H + (1+S)\, d_H e_{\min}\left(\frac{2+3K-3K^2+K^3}{3(1+2K-K^2)} + q e_A^*\right)\right)\right. \\
&\left.+\frac{1}{2}(1-2K+K^2)\left(c_L + (1+S)\, d_L e_{\min}\left(\frac{1-K}{3} + q e_A^*\right)\right)\right).
\end{aligned} \tag{A97}$$

Similarly, collecting (A87), (A89), and (A93), worker B's period-1 wage would have to be

$$\begin{aligned} w_{B1}^* = c_L + \frac{d_L}{2} e_B^* - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e_B^*\right)\right) + (1-\tau)\cdot \\ \Big(P\left(\Theta_A + q e_A^* > \Theta_B + q e_B^*\right)\left(c_L + (1+S)\, d_L e_{\min} E\left[\Theta_B + q e_B^* \middle| \Theta_A + q e_A^* > \Theta_B + q e_B^*\right]\right) \\ + P\left(\Theta_A + q e_A^* < \Theta_B + q e_B^*\right)\left(c_H + (1+S)\, d_H e_{\min} E\left[\Theta_B + q e_B^* \middle| \Theta_A + q e_A^* < \Theta_B + q e_B^*\right]\right)\Big). \end{aligned} \tag{A98}$$

Denoting $K := q(e_A^* - q_B^*)$, we can write this as

$$\begin{aligned} w_{B1}^* = c_L + \frac{d_L}{2} e_B^* - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e_B^*\right)\right) + (1-\tau)\cdot \\ \Big(P\left(\Theta_A + K > \Theta_B\right)\left(c_L + (1+S)\, d_L e_{\min}(E\left[\Theta_B \middle| \Theta_A + K > \Theta_B\right] + q e_B^*)\right) \\ + P\left(\Theta_A + K < \Theta_B\right)\left(c_H + (1+S)\, d_H e_{\min}(E\left[\Theta_B \middle| \Theta_A + K < \Theta_B\right] + q e_B^*)\right)\Big). \end{aligned} \tag{A99}$$

Recall the promotion probabilities (A4) and (A5). Furthermore, insert conditional expectations developed in Lemma 2 to write the above as

$$\begin{aligned} w_{B1}^* = c_L + \frac{d_L}{2} e_B^* - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e_B^*\right)\right) + (1-\tau)\cdot \\ \left(\frac{1}{2}(1+2K-K^2)\left(c_L + (1+S)\, d_L e_{\min}\left(\frac{1+3K-K^3}{3(1+2K-K^2)} + q e_B^*\right)\right)\right. \\ \left. + \frac{1}{2}(1-2K+K^2)\left(c_H + (1+S)\, d_H e_{\min}\left(\frac{2+K}{3} + q e_B^*\right)\right)\right). \end{aligned} \tag{A100}$$

Thus, (A97) and (A100) define the equilibrium period-1 wages w_{A1}^* and w_{B1}^* that are obtained if we impose a zero profit condition on each worker.

As an alternative, suppose the workers receive the same wages in period 1, based on a zero-profit condition for the incumbent firm as a whole, rather than individual workers. Then each worker receives one half of the sum of wages computed above, i.e., one half of the sum of

(A97) and (A100). This sum of wages is

$$
\begin{aligned}
w^*_{A1} + w^*_{B1} = {} & c_L + \frac{d_L}{2} e^*_A - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e^*_A\right)\right) + (1-\tau)\cdot \\
& \left(\frac{1}{2}(1+2K-K^2)\left(c_H + (1+S)\, d_H e_{\min}\left(\frac{2+3K-3K^2+K^3}{3(1+2K-K^2)} + q e^*_A\right)\right)\right. \\
& \left. + \frac{1}{2}(1-2K+K^2)\left(c_L + (1+S)\, d_L e_{\min}\left(\frac{1-K}{3} + q e^*_A\right)\right)\right) \\
& + c_L + \frac{d_L}{2} e^*_B - (1-\tau)\left(c_L + d_L e_{\min}\left(\frac{1}{2} + q e^*_B\right)\right) + (1-\tau)\cdot \\
& \left(\frac{1}{2}(1+2K-K^2)\left(c_L + (1+S)\, d_L e_{\min}\left(\frac{1+3K-K^3}{3(1+2K-K^2)} + q e^*_B\right)\right)\right. \\
& \left. + \frac{1}{2}(1-2K+K^2)\left(c_H + (1+S)\, d_H e_{\min}\left(\frac{2+K}{3} + q e^*_B\right)\right)\right) \\
= {} & (1+\tau)c_L + (1-\tau)c_H + \frac{d_L}{2}(e^*_A + e^*_B) - (1-\tau) d_L e_{\min}(1 + q(e^*_A + e^*_B)) \\
& + (1-\tau)\,(1+S) e_{\min}\left(\frac{1}{2}(1+2K-K^2) d_H\left(\frac{2+3K-3K^2+K^3}{3(1+2K-K^2)} + q e^*_A\right)\right. \\
& \left. + \frac{1}{2}(1-2K+K^2)\, d_L\left(\frac{1-K}{3} + q e^*_A\right)\right) \\
& + (1-\tau)\,(1+S) e_{\min}\left(\frac{1}{2}(1+2K-K^2) d_L\left(\frac{1+3K-K^3}{3(1+2K-K^2)} + q e^*_B\right)\right. \\
& \left. + \frac{1}{2}(1-2K+K^2) d_H\left(\frac{2+K}{3} + q e^*_B\right)\right).
\end{aligned}
\tag{A101}
$$

This can be simplified to

$$
\begin{aligned}
w^*_{A1} + w^*_{B1} &= (1+\tau)c_L + (1-\tau)c_H + \frac{d_L}{2}(e^*_A + e^*_B) - (1-\tau)d_L e_{\min}(1 + q(e^*_A + e^*_B)) \\
&\quad + (1-\tau)\,(1+S)e_{\min}\frac{1}{2}\Bigg((1+2K-K^2)d_H\left(\frac{2+3K-3K^2+K^3}{3(1+2K-K^2)}\right) \\
&\quad + (1-2K+K^2)d_L\left(\frac{1-K}{3}\right) \\
&\quad + (1+2K-K^2)d_L\left(\frac{1+3K-K^3}{3(1+2K-K^2)}\right) + (1-2K+K^2)d_H\left(\frac{2+K}{3}\right) \\
&\quad + (1+2K-K^2)q(d_H e^*_A + d_L e^*_B) + (1-2K+K^2)q(d_L e^*_A + d_H e^*_B)\Bigg) \\
&= (1+\tau)c_L + (1-\tau)c_H + \frac{d_L}{2}\left(e^*_A + e^*_B\right) - (1-\tau)d_L e_{\min}(1 + q(e^*_A + e^*_B)) \\
&\quad + (1-\tau)\,(1+S)e_{\min}\frac{1}{2}\Bigg(\frac{1}{3}\left(d_L(2+3K^2-2K^3) + d_H(4-3K^2+2K^3)\right) \\
&\quad + (1+2K-K^2)q(d_H e^*_A + d_L e^*_B) + (1-2K+K^2)q(d_L e^*_A + d_H e^*_B)\Bigg).
\end{aligned}
\tag{A102}
$$

Each worker receives one half of this sum, implying that the incumbent makes a profit from one of the workers, and a loss from the other, with zero profit in total.

A.6 Worker B has a lower effort due to the presence of overconfident worker A (Comparison with a symmetric game)

Consider the benchmark case where the firm hires two "B" workers (who are not overconfident), with ability drawn from the Uniform distribution on $[0,1]$, as in the main model.
Denote the *symmetric* equilibrium candidate effort by $\hat{e}_B$. From the main model, recall the probability of winning of a worker of type B as a function of the worker's choice variable, denoted here by e_B, evaluated at firms' candidate equilibrium beliefs $\hat{e}_B$ and assuming that the other worker plays the candidate equilibrium effort $\hat{e}_B$.
Recall the marginal promotion probability of worker B in the main model, (A35), and now evaluate at $\hat{e}_B$ for both workers

$$
\begin{aligned}
\left.\frac{\partial P_B}{\partial e_B}\right|_{(\hat{e}_B,\hat{e}_B)} &= \int_{-\infty}^{\infty} f(x)\,\frac{x}{\hat{e}_B} f(x)\,dx \\
&= \frac{1}{\hat{e}_B}\int_0^1 x\,dx \\
&= \frac{1}{2\hat{e}_B}.
\end{aligned}
\tag{A103}
$$

Furthermore, recall worker B's first-order condition, (A36), and again evaluate at effort $\hat{e}_B$ for both workers to get

$$
\begin{aligned}
c'(\hat{e}_B) &= d_L e_{\min} \left.\frac{\partial P_B}{\partial e_B}\right|_{(\hat{e}_B,\hat{e}_B)} \Big(E[\Theta_A|\Theta_A > \Theta_B] - E[\Theta_A|\Theta_A < \Theta_B]\Big) \\
&= d_L e_{\min} \frac{1}{2\hat{e}_B}\left(\frac{2}{3} - \frac{1}{3}\right) \\
\iff \quad c'(\hat{e}_B)\hat{e}_B &= d_L e_{\min}\frac{1}{6}.
\end{aligned}
\tag{A104}
$$

The last line of (A104) characterizes the symmetric equilibrium effort that is obtained in a game between two workers in the absence of overconfidence.

Now compare this with worker B's equilibrium first-order condition in the main game, the second line of (A42). As the LHS in both expressions is increasing in effort, the worker has a larger effort in the symmetric game if the two RHS satisfy

$$
\begin{aligned}
d_L e_{\min}\frac{1}{6} &> d_L e_{\min}\frac{1}{6}(1-K^2)\frac{1+2K}{1+2K-K^2} \\
\iff 1 &> (1-K^2)\frac{1+2K}{1+2K-K^2}.
\end{aligned}
\tag{A105}
$$

For our $K \in (0,1)$, we can multiply by $1+2K-K^2 > 0$ and simplify to get $2K^3 > 0$ which is true. Thus, worker B competing with the overconfident worker A in the main game has a lower effort than B would have in a symmetric game with another B-worker.

We mention that the second-order condition for the symmetric game holds. The second derivative of the promotion probability is either zero or negative.

Now look at the expected utility of a worker in this symmetric game.

We start from (A46) and evaluate at $\hat{e}_B = e_B = e_B^*$ and $K = 0$, then insert the promotion probability from Lemma 1 (which also holds for $K = 0$) as well as results (c) and (d) of Lemma 2 (which also holds for $K = 0$) to simplify as follows.

$$
\begin{aligned}
&\int_{-\infty}^{\infty} F(x)\, f(x)\, dx\; d_L e_{\min}\Big(E[\Theta_A|\Theta_A > \Theta_B] - E[\Theta_A|\Theta_A < \Theta_B]\Big) \\
&\qquad + c_L + d_L e_{\min}\left(E[\Theta_B|\Theta_A > \Theta_B] + q\hat{e}_B\right) - c(\hat{e}_B) \\
&= \frac{1}{2} d_L e_{\min}\left(\frac{2}{3} - \frac{1}{3}\right) + c_L + d_L e_{\min}\left(\frac{1}{3} + q\hat{e}_B\right) - c(\hat{e}_B) \\
&= c_L + d_L e_{\min}\left(\frac{1}{2} + q\hat{e}_B\right) - c(\hat{e}_B).
\end{aligned}
\tag{A106}
$$

This is the same function of effort as (A109) below (B's payoff in the main game) only with a larger effort.

A.7 Expected worker payoffs

Here we start from the point in the game where workers choose effort for period 1, and wages for period 1 are sunk. We also ignore the workers' effort cost $c(e_{\min})$ in period 2.

Consider worker A, who has a subjective as well as an objective expected payoff. Start with the objective payoff. Recall (A44), but use f instead of $\hat{f}$ and evaluate at $e_A = e_A^*$. Then insert the objective promotion probability from Lemma 1, as well as results (c) and (b) of Lemma 2, to simplify as follows.

$$\begin{aligned}
&\int_{-\infty}^{\infty} F(x+K) f(x)\, dx\, d_L e_{\min}\Big(E[\Theta_A|\Theta_A+K>\Theta_B]-E[\Theta_A|\Theta_A+K<\Theta_B]\Big)\\
&\qquad + c_L + d_L e_{\min}\left(E[\Theta_A|\Theta_A+K<\Theta_B]+qe_A^*\right)-c(e_A^*)\\
&=\frac{1}{2}\left(1+2K-K^2\right)\, d_L e_{\min}\left(\frac{1+2K}{3(1+2K-K^2)}\right)+c_L+d_L e_{\min}\left(\frac{1-K}{3}+qe_A^*\right)-c(e_A^*)\\
&=d_L e_{\min}\left(\frac{1}{6}\frac{(1+2K-K^2)\,(1+2K)}{(1+2K-K^2)}+\frac{1-K}{3}\right)+c_L+d_L e_{\min} q e_A^*-c(e_A^*)\\
&=c_L+d_L e_{\min}\left(\frac{1}{2}+qe_A^*\right)-c(e_A^*).
\end{aligned} \tag{A107}$$

Now turn to the subjective payoff. Replace the objective by the subjective promotion probability from Lemma 1 above, while the rest remains unchanged, and rewrite as follows.

$$\begin{aligned}
&\int_{-\infty}^{\infty} F(x+K) \hat{f}(x)\, dx\, d_L e_{\min}\Big(E[\Theta_A|\Theta_A+K>\Theta_B]-E[\Theta_A|\Theta_A+K<\Theta_B]\Big)\\
&\qquad + c_L + d_L e_{\min}\left(E[\Theta_A|\Theta_A+K<\Theta_B]+qe_A^*\right)-c(e_A^*)\\
&=\left(1-\frac{(1-K)^{\gamma+1}}{\gamma+1}\right)\, d_L e_{\min}\left(\frac{1+2K}{3(1+2K-K^2)}\right)+c_L+d_L e_{\min}\left(\frac{1-K}{3}+qe_A^*\right)-c(e_A^*)\\
&=c_L+d_L e_{\min}\left(\left(1-\frac{(1-K)^{\gamma+1}}{\gamma+1}\right)\frac{1+2K}{3(1+2K-K^2)}+\frac{1-K}{3}+qe_A^*\right)-c(e_A^*).
\end{aligned} \tag{A108}$$

Obviously, this must be larger than (A107), i.e., the first term in parenthesis is positive. This is because the only difference between (A107) and (A108) is the promotion probability, which is larger in (A108), due to $\hat{f}$ instead of f.

For worker B we start from (A46) and evaluate at $e_B = e_B^*$, then insert the promotion probability from Lemma 1 as well as results (c) and (d) of Lemma 2 to simplify as follows.

$$\begin{aligned}
&\int_{-\infty}^{\infty} F\left(x-K\right) f\left(x\right) dx \, d_L e_{\min}\Big(E[\Theta_A|\Theta_A+K>\Theta_B]-E[\Theta_A|\Theta_A+K<\Theta_B]\Big) \\
&\qquad + c_L + d_L e_{\min}\left(E[\Theta_B|\Theta_A+K>\Theta_B]+qe_B^*\right) - c(e_B^*) \\
&= \frac{1}{2}\left(1-2K+K^2\right)\, d_L e_{\min}\left(\frac{1+2K}{3(1+2K-K^2)}\right) + c_L + d_L e_{\min}\left(\frac{1+3K-K^3}{3(1+2K-K^2)}+qe_B^*\right) - c(e_B^*) \\
&= c_L + d_L e_{\min}\frac{1}{6}\left(\frac{(1-2K+K^2)(1+2K)+2(1+3K-K^3)}{(1+2K-K^2)}\right) + d_L e_{\min} q e_B^* - c(e_B^*) \\
&= c_L + d_L e_{\min}\frac{1}{6}\left(\frac{3(1+2K-K^2)}{(1+2K-K^2)}\right) + d_L e_{\min} q e_B^* - c(e_B^*) \\
&= c_L + d_L e_{\min}\left(\frac{1}{2}+qe_B^*\right) - c(e_B^*).
\end{aligned} \tag{A109}$$

Summarizing, the objective expected payoffs are

$$\begin{aligned}
&c_L + d_L e_{\min}\left(\frac{1}{2}+qe_A^*\right) - c(e_A^*) \\
&c_L + d_L e_{\min}\left(\frac{1}{2}+qe_B^*\right) - c(e_B^*).
\end{aligned} \tag{A110}$$

Comparing these two expressions, it is clearly conceivable that worker B's payoff can be higher or lower than worker A's. Numerical examples confirm that both situations are consistent with equilibrium.