Asymmetric Employer Information, Promotions, and the Wage Policy of Firms

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This paper provides evidence that inefficient promotion strategies and large wage increases upon promotion may both arise as a consequence of asymmetric employer information. We present a simple model that illustrates how both phenomena may jointly arise due to the information revealing character of promotions. Using experimental labor markets, we demonstrate that asymmetric employer information is a causal factor for both inefficient promotions and large wage increases upon promotion. Moreover, our data are consistent with the idea that the channel through which asymmetric employer information affects personnel policies is the information revealing character of promotions.

JEL classification: D82; J3; M5.

Keywords: invisible workers; poaching; promotion-as-signal hypothesis.
1. Introduction

Ever since the seminal contributions by Akerlof (1976) and Spence (1973), economists came to recognize that asymmetric information in labor markets is a major determinant of employers’ personnel policies and an important source of inefficient market outcomes. Several pieces of empirical evidence document that asymmetric information across employers is prevalent (Gibbons and Katz, 1991; Schönberg, 2007; Pinkston, 2009). These information asymmetries have been shown to simultaneously affect two important features of personnel policies—allocation of workers to jobs and optimal wage schemes (Waldman, 1984; Milgrom and Oster, 1987). Specifically, under asymmetric information, an employer optimally decides not to assign all workers to their output-maximizing jobs; i.e., promotion rules are inefficient. Moreover, a job promotion is accompanied by a substantial wage increase at the moment the worker climbs the hierarchical ladder. While a number of empirical contributions are in line with these implications (Baker, Gibbs, and Holmström, 1994a,b; McCue, 1996; Bognanno, 2001; DeVaro and Waldman, 2012), there is no direct evidence for asymmetric employer information to be a causal factor for the empirical findings.

Our paper attempts to fill this gap by providing evidence that asymmetric information across employers is a causal factor for the application of inefficient promotion rules and large wage increases upon promotions. To derive precise testable implications, we present a streamlined version of the model in Waldman (1984) that incorporates two forms of information asymmetries across employers. First, we consider the case that a worker’s actual ability is known only to his current employer. Alternative employers, on the other hand, only observe the promotion decision of the worker’s current employer. Second, based on Milgrom and Oster (1987), we allow for the possibility that a worker remains invisible for the external labor market as long as he is not promoted. Our theoretical analysis reiterates the arguments by Waldman (1984) and Milgrom and Oster (1987) and shows that either informational friction on its own induces inefficiently few promotions and large wage increases upon promotion. Essentially, these results are rooted in the fact that alternative employers offer substantially higher wages for promoted workers than for non-promoted workers under both forms of asymmetric information. Under invisibility of non-promoted workers, this follows immediately from the fact that alternative employers can poach the worker only if he was promoted by his current employer. For the case of the worker’s ability being known only to his current employer, alternative employers offer higher wages to promoted workers as they recognize a promotion as a signal of high ability. Hence, in both cases the current employer herself has to offer a substantially higher wage after promoting a worker to prevent the worker from being poached. Taking this into account, the current employer optimally decides not to promote a worker that gener-
ates only slightly higher output if being promoted to save on wage costs.\footnote{Building on Waldman (1984), Golan (2005) shows that efficiency with regard to promotions is restored if the worker’s current employer can make a final counter wage offer after the worker received the wage offers from alternative employers. According to Waldman and Zax (2014), however, the inefficiency regarding promotion decisions may become drastic—in the sense of not even the ablest worker being promoted—even when the current employer can make counter offers if a worker’s productivity depends on his ability on all jobs that he can be assigned to.} Furthermore, we show that, compared to either form of asymmetric information in isolation, combining both forms aggravates the inefficiency of promotion strategies and leads to an even larger wage increase upon promotion.

Based on these theoretical predictions, the main part of the paper tests the causal impact of asymmetric information across employers on personnel policies. For this purpose, we conduct a laboratory experiment that allows us to exogenously vary the degree of information asymmetry. As a workhorse, we use a simple choice paradigm in which three firms compete for one worker. One of the firms is the worker’s current employer, whereas the two other firms are alternative employers representing the outside labor market. First, the current employer decides whether to assign the worker to a basic job, where ability has only little impact on output, or to promote the worker to a higher hierarchy level, where output depends stronger on ability. Thereafter, firms can submit wage offers and the (non-strategic) worker accepts the highest wage offer. Once the worker has accepted the wage offer of one of the firms, he generates output for that firm, where the worker’s productivity is determined jointly by his ability, his job assignment, and his specific human capital.

We implement four different treatment conditions. As a benchmark, we consider a baseline treatment with symmetric information, where the worker is visible for all alternative employers irrespective of the job assignment at his current employer and the worker’s ability is known not only to his current employer but also to the alternative employers. Compared to this treatment, we introduce two different forms of informational friction. First, we study a treatment featuring asymmetric employer information with respect to ability. Here, the worker’s actual ability is known only to his current employer but unknown to alternative employers, who only observe the worker’s current job assignment. Second, we study a treatment featuring asymmetric information with respect to the worker’s existence. Specifically, we allow for the current employer to keep the worker invisible for alternative employers by not promoting him. Finally, we analyze the interaction of the two informational frictions in a treatment where the worker becomes visible for alternative employers only after a promotion, but his ability nevertheless remains unknown to them.

We start our empirical analysis by investigating the idea that, given the worker’s ability is known only to his current employer, alternative employers perceive promotions as a signal of high ability. We find that in both treatments that feature unknown worker ability
for alternative employers, the expectation held by alternative employers with regard to the
worker’s ability is significantly higher if the worker is promoted by his current employer.
Importantly, this difference in expected abilities is reflected in the alternative employers’
voice setting behavior: poaching offers for promoted workers turn out to be significantly
higher than those for non-promoted workers. This finding delivers strong empirical sup-
port for the so-called promotion-as-signal hypothesis, i.e., for alternative employers using
promotions as a signal of high ability if the worker’s actual ability is unknown to them.
This idea, which first was stated in the seminal paper by Waldman (1984), is at the core
of a series of theoretical contributions that analyze how the signaling role of promotions
affects labor market outcomes. Specifically, it is shown that the signaling role of pro-
motions can account for fast-track promotions, the Peter principle, and salary increases
following demotions (Bernhardt, 1995), explains the use of up-or-out contracts in jobs
where firm-specific human capital is of little importance (Ghosh and Waldman, 2010),
and constrains the design of rank-order promotion tournaments (Bernhardt and Zábojník,
2001; Zábojník, 2012; DeVaro and Kauhanen, Forthcoming; Gürtler and Gürtler, Forth-
coming, 2015).2

In the next step, we use the exogenous variation across treatments to analyze the causal
impact of asymmetric information on the efficiency of promotion strategies. In the bench-
mark treatment with symmetric information promotion strategies of current employers in
our experiment turn out to be efficient. Rendering the informational distribution between
firms asymmetric, be it with respect to the worker’s ability or existence, significantly
distorts current employers’ promotion strategies. In fact, current employers promote
inefficiently few workers in the treatments with either form of asymmetric information
compared to the case of symmetric information. Not surprisingly, promotion strategies
become even more inefficient if both informational frictions jointly prevail. As Waldman
(1984), Waldman and Zax (2014), and Milgrom and Oster (1987) hypothesized, asym-
metric information is thus a direct source of inefficient personnel policies. In particular,
the resulting inefficient allocation of talent within a firm may be detrimental for the output
of every single firm and may lead to severe welfare costs.

Thereafter, we investigate the influence of promotions on wages. It is one of the most
persistent findings in the empirical labor market literature that promotions are directly
accompanied by large wage increases even when controlling for the worker’s human cap-
ital (Baker, Gibbs, and Holmström, 1994a,b; McCue, 1996; Bognanno, 2001). In the-
ory there are two particularly plausible explanations for this phenomenon. First, firms
may use large winner prizes in promotion tournaments to incentivize workers (Lazear
and Rosen, 1981).3 Second, asymmetric information may force employers to pay higher

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2See Waldman (2013) for a recent overview.

3While there is—to the best of our knowledge—no causal evidence how asymmetric employer information
affects promotion and wage policies, the implications of tournament theory for personnel policies have
wages to promoted workers because of labor market competition for the workers’ services (Waldman, 1984; Milgrom and Oster, 1987). Our experiment exogenously varies whether asymmetric information is in place, which allows to delineate its direct impact on wage increases upon promotion. We find that wage increases due to promotions are in fact not present in our benchmark treatment with symmetric information. In contrast, if information is asymmetrically distributed, there are large wage increases upon promotion. For both informational frictions under consideration, promoted workers earn significantly more than non-promoted workers even when controlling for the workers’ ability. Moreover, our data suggest that this result arises because alternative employers use promotions as a signal of high ability, which they incorporate into their wage setting. As current employers correctly anticipate this behavior, the outside labor market forces them to pay a higher wage to a promoted worker irrespective of the worker’s actual ability.

Finally, we analyze the impact of asymmetric information on firms’ profits. Compared to symmetric information, theory predicts the current employer’s profits to be higher when alternative employers can poach a worker of observable ability only after a promotion, because of a drastic saving of wage costs if the worker is not promoted. If, on the other hand, the worker’s ability is unknown to alternative employers but the worker can always be poached, theory predicts the current employer’s profits to be lower because the allocative inefficiency dominates any potential savings in wage costs. The experimental data are in line with both predictions. Furthermore, theory predicts zero profits for alternative employers in all treatments as the current employer always has the highest willingness to pay for the worker’s services because of his specific human capital. Strikingly, however, in the experiment alternative employers make negative profits on average. A possible explanation is that market firms might fall victim to some kind of winner’s curse, a well-known phenomenon from auctions for items of unknown value. Using the exogenous variation across our treatments, we show that unknown ability reinforces the negative profits by the alternative employers, which is indeed reminiscent of the winner’s curse.

The results of our experiment complement the emerging literature that empirically investigates asymmetric employer learning in labor markets. In their classic study, Gibbons and Katz (1991) argue that workers should have higher talent on average if they are fired because of a plant closing rather than being laid off, such that workers fired in a plant closing should have higher wages and shorter unemployment duration after the displacement than laid-off workers. Using data from the Current Population Survey, support is found for these theoretical predictions. According to Schönberg (2007), asymmetric employer learning has been extensively tested; see, e.g., Harbring and Irlenbusch (2008), Eriksson, Teyssier, and Villeval (2009), Harbring and Irlenbusch (2011), and Altmann, Falk, and Wibral (2012); for a comprehensive survey, see Dechenaux, Kovenock, and Sheremeta (Forthcoming).

See Waldman (2011) for a recent survey of this empirical literature and a comprehensive discussion of to what extent competing theoretical models can explain empirical regularities in internal labor markets.
ric employer learning leads to hard-to-observe variables (e.g., ability) having a stronger and easy-to-observe variables (e.g., schooling) having a weaker impact on wage offers of better informed current employers as compared to those of alternative employers. This prediction is confirmed for college graduates with data from the National Longitudinal Survey of Youth. While the aforementioned contributions provide general support for asymmetric employer learning in labor markets, our paper empirically validates the implications of asymmetric employer learning for firms’ personnel policies. In particular, we identify inefficient promotion rules and large wage increases upon promotion as a direct consequence of asymmetric employer learning.

Our paper is intimately related to the analysis provided by DeVaro and Waldman (2012), who extend the theoretical framework of the promotion-as-signal hypothesis by assuming that workers vary in terms of publicly observed schooling levels. Theoretically, a worker with higher schooling level has higher expected ability. As a consequence, a promotion is a weaker signal of ability for workers with higher schooling levels such that their wage increase upon promotion is less pronounced and their first promotion decision less distorted. Using panel data on the personnel records for managerial workers in the financial service industry, DeVaro and Waldman (2012) find evidence that an increase in the education level from a bachelor to a master degree indeed increases the probability of a first promotion and decreases the wage jump upon promotion. This analysis proves that real-world personnel records are in line with the implications of the promotion-as-signal hypothesis, thereby it complements our approach by indicating that our results are also valid outside the laboratory setting. In contrast to the field study by DeVaro and Waldman (2012), our approach allows to exogenously vary the degree of informational asymmetry while keeping everything else constant, which is only possible in an experimental labor market. In consequence, our results show that asymmetric employer information in fact causes the inefficient promotions and large wage increases as implied by the promotion-as-signal hypothesis. As such, our analysis also lends support to the arguments put forth in DeVaro and Waldman (2012) by asserting that they indeed identify a causal effect of education on promotion and wage policies.

Our paper is organized as follows. Section 2 presents a simple labor market model upon which our experiment is based. This model is analyzed in Section 3. Section 4 discusses our experimental design. After deriving behavioral predictions in Section 5, experimental results are discussed in Section 6. We conclude in Section 7.

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5 Based on data from the National Longitudinal Survey of Youth, Pinkston (2009) argues that much of what is seen as evidence for public learning over labor market experience is actually consistent with private employer learning within spells of continuous employment.

6 For a general overview of the advantages of labor market experiments, see Falk and Fehr (2003).
2. The Model

This section provides a theoretical framework to show how asymmetric information across employers impacts personnel policies. We consider the following labor market model inspired by Waldman (1984) and Milgrom and Oster (1987).\footnote{For the main building blocks of our model see also Ghosh and Waldman (2010), DeVaro and Waldman (2012), and Waldman and Zax (2014).} There are $n > 2$ firms that produce an identical output, the price of which is normalized to 1. At date 0, firm 1 employs a single worker whose ability is given by $A \in [0, \bar{A}]$ with $0 < \bar{A}$, whereas the other firms do not employ any worker. In the following, we refer to firm 1 as the the “current employer” and to firms $2, \ldots, n$ as “market firms” (because they represent the outside labor market). The worker’s ability is uniformly distributed, i.e., $A \sim U[0, \bar{A}]$.

<table>
<thead>
<tr>
<th>Job 0</th>
<th>Job 1</th>
</tr>
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<tbody>
<tr>
<td>Firm 1</td>
<td>$(1 + s)(d_0 + c_0A)$</td>
</tr>
<tr>
<td>Firm $i \neq 1$</td>
<td>$d_1 + c_1A$</td>
</tr>
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Table 1: Worker’s output depending on his ability, employer, and job assignment.

The current employer, firm 1, can assign the worker to either job 0 on a low hierarchy level or job 1 on a higher hierarchy level. Output on job $j \in \{0, 1\}$ is described by $(1 + s)(d_j + c_jA)$ with $d_0 > d_1 \geq 0$ and $c_1 > c_0 \geq 0$. Job 0 thus represents a more basic task, whereas job 1 corresponds to a managerial position the output of which depends on ability more strongly. In this sense, assigning the worker to job 1 can be thought of the current employer promoting the worker to a position with greater responsibility. In contrast to the current employer, the market firms $2, \ldots, n$ are assumed to only have a managerial position—i.e., a type 1 job—to fill.\footnote{Our qualitative results will not change if the market firms also have a basic job to fill. We opted for this version to keep the setting of the following experimental test as understandable for the subjects as possible.} The worker’s output depending on his ability, his job assignment, and his employer is summarized in Table 1. We assume $s > 0$, such that, given the managerial job assignment, the worker generates higher output for his current employer firm 1 than for one of the market firms. This may, for example, be due to specific human capital that the worker accumulated during the prior cooperation and which will be lost if he switches employers. To avoid situations in which the worker is either always or never promoted, we assume that the impact of specific human capital is neither too strong nor too weak and that the marginal productivity of ability is not too low on job 0 compared to job 1.
Assumption 1.
(i) \( \frac{c_1 A}{d_1} > s > \frac{d_0 + c_0 A}{(c_1 - c_0)A - (d_0 - d_1)} \),
(ii) \( 3c_0 \geq c_1 \).

The worker’s reservation wage equals zero and he experiences no disutility from exerting effort. Ceteris paribus, the worker is indifferent between both job assignments and employers, such that he only cares about the wage he receives.

Regarding the job assignment and wage setting process, we consider the following sequence of events. First, at date 1, the current employer observes the worker’s ability \( A \) and, thereafter, assigns the worker to job \( j \in \{0, 1\} \). If indifferent between job assignments, the current employer is assumed to promote the worker to job 1.

At date 2, the market firms receive information about the worker, and firms make their wage offers. We analyze two different informational frictions at this stage. First, we borrow the so-called “invisibility hypothesis” from Milgrom and Oster (1987) and allow for the possibility that the worker is only visible to market firms if the current employer promotes the worker to the managerial position. Second, following Waldman (1984), we allow for the possibility that only the current employer knows the worker’s true ability, whereas all other firms only know the distribution from which the worker’s ability is drawn. Taken together this leaves us with four different scenarios:

(I) **Known Ability and Visibility (ka-vis):**
The market firms see the current employer’s job assignment and know the worker’s ability. All \( n \) firms, i.e., the current employer and the market firms, compete for the worker by simultaneously offering wages \( w_1, \ldots, w_n \).

(II) **Unknown Ability and Visibility (ua-vis):**
The sequence of events is identical to that of Scenario I, with the exception that the market firms do not know the worker’s ability.

(III) **Known Ability and Invisibility (ka-invis):**
If the current employer promotes the worker to job 1, the worker becomes visible for all firms such that the same sequence as in Scenario I applies. If, on the other hand, the current employer assigns the worker to job 0, the worker remains invisible for the market firms and only the current employer’s wage offer \( w_1 \) is relevant for the worker.

(IV) **Unknown Ability and Invisibility (ua-invis):**
The sequence of events is identical to that of Scenario III, with the exception that the market firms do not know the worker’s ability.
Next to being poached by one of the market firms, we assume that the worker might leave his current employer for totally exogenous reasons.\(^9\) Formally, with some small probability \(\gamma\) the worker leaves the current employer for exogenous reasons that do not depend on ability or job assignment.\(^{10}\) In this case, the current employer cannot win the worker back and only the wage offers \(w_2, \ldots, w_n\) become relevant for the worker. For the case of invisibility, we assume that if a worker that was assigned to job 0 leaves for exogenous reasons, market firms have access to the same information as if the worker had been visible from the start. Specifically, in Scenario III the worker’s ability and job assignment become visible for the market firms, whereas in Scenario IV only the worker’s job assignment becomes visible. With probability \(1 - \gamma\), however, the worker does not leave for exogenous reasons and stays with the current employer if poaching by the market firms is unsuccessful.

At **date 3**, the worker accepts the highest relevant wage offer. If \(w_1\) is the highest wage offer, the worker is assumed to stay with his current employer, even if one of the market firms offers the same wage. If \(w_i > w_1\) for at least one market firm \(i \neq 1\), the worker will switch to firm \(i\) with the highest offer \(w_i\); if there are several market firms that offer the highest wage, the worker will pick one of them at random.

The current employer’s profit from hiring the worker is \(\pi_1 = (1 + s)(d_j + c_jA) - w_1\), where \(j \in \{0, 1\}\) corresponds to the job assignment chosen by the current employer. The profit of market firm \(i \neq 1\) from successfully poaching the worker is \(\pi_i = d_1 + c_1A - w_i\). Any firm that does not employ the worker makes zero profits.

As a benchmark, consider an efficient promotion decision of the current employer. Promoting the worker is efficient if he generates (weakly) higher output on job 1 than on job 0 or, equivalently, if the worker’s ability (weakly) exceeds

\[
A^* = \frac{d_0 - d_1}{c_1 - c_0}.
\]

We assume that efficiency requires not to promote the least talented worker and to promote the most talented worker.

**Assumption 2.** \(A^* \in (0, \bar{A})\).

### 3. Equilibrium Analysis

In case of known ability (Scenarios I and III), each firm’s information set is a singleton and the appropriate solution concept is subgame-perfect Nash equilibrium (SPNE). In

\(^9\)In practice, we can imagine a situation where the worker wants a fresh start at a new employer because there was a falling-out with his superior or his co-workers.

\(^{10}\)The assumption of \(\gamma\) being small but positive is made to avoid multiplicity of equilibria. In the equilibrium analysis, however, we consider the limit case where \(\gamma\) tends to zero.
case of unknown ability (Scenarios II and IV), on the other hand, whenever the market firms submit wage offers to the worker, they do not know the worker’s ability. Here, we use the solution concept of (weak) perfect Bayesian equilibrium (PBE). In the following, we consider a situation in which the probability of the worker leaving his current employer for exogenous reasons, $\gamma$, is equal to zero, which is also implemented in our laboratory experiment. In general, there may exist multiple equilibria in this situation. To derive qualitative predictions for the laboratory experiment, however, we consider the unique equilibrium that is compatible with the idea that there is an infinitesimally small probability that the worker-firm relationship ceases due to random mistakes of subjects in the lab. Technically, we thus consider the equilibrium that emerges for $\gamma \to 0$. All our results qualitatively also hold for the case of $\gamma$ being small but strictly positive.

3.1. Scenario I: Known Ability and Visibility (ka-vis)

The market firms can submit wage offers to the worker irrespective of the current employer’s job assignment and they know the worker’s ability. The Bertrand nature of wage competition drives the wage offers of at least two of the market firms up to their maximum willingness to pay for the worker’s services—irrespective of the wage offer submitted by the current employer—which equals the worker’s output on job 1 without any specific human capital. Note that the maximum wage offer of the market firms thus is linearly increasing in the worker’s actual ability. The current employer’s best reply is to just match this offer whenever the worker is more valuable to her than to any market firm. Anticipating this wage setting behavior, by promoting the worker efficiently, the current employer not only ensures that her own maximum willingness to pay for the worker’s services exceeds that of the market firms, but also maximizes the worker’s output.\(^{11}\)

**Proposition 1.** Suppose $\gamma \to 0$. In Scenario I, in any SPNE the worker is promoted to the managerial job 1 if and only if $A \geq A^* =: A^+_\text{ka,vis}$, the worker stays with the current employer, and her wage offer is $w_{\text{ka,vis}} = d_1 + c_1 A$.

3.2. Scenario II: Unknown Ability and Visibility (ua-vis)

While the market firms can submit wage offers to the worker irrespective of the current employer’s job assignment, they no longer know the worker’s ability but only observe the current employer’s job assignment. Nevertheless, the Bertrand nature of wage competition drives at least two of the market firms to bid their maximum willingness to pay, which corresponds to the worker’s expected output conditional on the current employer’s job assignment. Again, the current employer’s best reply is to just match this maximum offer.

\(^{11}\)All proofs are relegated to the appendix.
whenever the worker’s actual value for her is higher than the worker’s expected value for any market firm.

The equilibrium then displays the following properties. First, as specific human capital makes the worker more valuable for the current employer than for the market firms, the worker stays with his current employer. Second, the current employer uses a cut-off promotion rule, i.e., if a worker of a particular ability is promoted, then a worker of even higher ability is also promoted. Third, with the wage offers of the market firms conditioning only on the current employer’s job assignment, her equilibrium wage offer does not depend on the worker’s actual ability but only on the job assignment as well. Finally, the promotion cut-off (in terms of the worker’s ability) is inefficiently high.

Intuitively, given the cut-off rule played by the current employer in equilibrium, the market firms expect the worker to be of higher average ability in case he is assigned to job 1 rather than to job 0. In consequence, a promotion triggers higher wage offers by the market firms and the current employer has to offer a considerably higher wage to retain a promoted worker than to retain a non-promoted worker. The wage increase brought forth by a promotion, however, is not worthwhile for the current employer to incur if the worker is only slightly more valuable on job 1 than on job 0, which is why a worker whose ability is only slightly above $A^*$ is not promoted in equilibrium.

**Proposition 2.** Suppose $\gamma \to 0$. In Scenario II, in any PBE the worker is promoted to the managerial position if and only if $A \geq A^+_{ua,vis}$ where

$$A^+_{ua,vis} := A^* + \frac{c_1}{c_1 - c_0} \frac{\bar{A}}{2(1 + s)} \in (A^*, \bar{A}),$$

the worker stays with the current employer, and her wage offer is

$$w_{ua,vis} = \begin{cases} 
  d_1 + c_1 A^+_{ua,vis} & \text{if } A < A^+_{ua,vis} \\
  d_1 + c_1 \frac{A^+_{ua,vis} + \bar{A}}{2} & \text{if } A \geq A^+_{ua,vis} 
\end{cases}.$$

### 3.3. Scenario III: Known Ability and Invisibility (ka-invis)

In contrast to Scenario I, if the current employer assigns the worker to job 0, the worker will be invisible for the market firms. In that case, the current employer avoids any wage competition and can offer a zero retention wage. If, however, the current employer assigns the worker to job 1, poaching by the market firms becomes possible and the same rationale as for Scenario I will apply. In particular, the current employer will offer a retention wage that exactly matches the worker’s value for the market firms. Thus, the worker realizes a considerable wage jump when being promoted to job 1. Anticipating this wage setting behavior, the current employer’s optimal promotion cut-off is again inefficiently high.

Intuitively, for workers of moderate ability, the current employer is willing to sacrifice
productive efficiency for the sake of cutting back on the worker’s wage by avoiding a wage competition with the market firms.

**Proposition 3.** Suppose $\gamma \to 0$. In Scenario III, in any SPNE the worker is promoted to the managerial job 1 if and only if $A \geq A^{+}_{\text{ka,invis}}$, where

$$A^{+}_{\text{ka,invis}} := \frac{(1 + s)d_0 - sd_1}{sc_1 - (1 + s)c_0} \in (A^*, \bar{A}),$$

the worker stays with the current employer, and her wage offer is

$$w_{\text{ka,invis}} = \begin{cases} 0 & \text{if } A < A^{+}_{\text{ka,invis}} \\ d_1 + c_1A & \text{if } A \geq A^{+}_{\text{ka,invis}}. \end{cases}$$

### 3.4. Scenario IV: Unknown Ability and Invisibility (ua-invis)

The market firms do not know the worker’s actual ability and they can try to poach the worker only after he has become visible. With the informational frictions of Scenarios II and III combined, optimal job assignment and wage setting also combines the equilibrium features of these cases. If the current employer assigns the worker to job 0, the optimal wage offer is zero. If the current employer assigns the worker to job 1, her retention wage will match the market firms’ expected value of the worker conditional on being promoted and does not depend on the worker’s actual ability. Finally, in equilibrium, the promotion cut-off is inefficiently high.

**Proposition 4.** Suppose $\gamma \to 0$. In Scenario IV, in any PBE the worker is promoted to the managerial position if and only if $A \geq A^{+}_{\text{ua,invis}}$, where

$$A^{+}_{\text{ua,invis}} := \frac{s(d_0 - d_1) + d_0 + \frac{c_1A}{2}}{s(c_1 - c_0) - c_0 + \frac{c_1}{2}},$$

the worker stays with the current employer, and her wage offer is

$$w_{\text{ua,invis}} = \begin{cases} 0 & \text{if } A < A^{+}_{\text{ua,invis}} \\ d_1 + c_1A^{+}_{\text{ua,invis}} + \bar{A} & \text{if } A \geq A^{+}_{\text{ua,invis}}. \end{cases}$$

According to Propositions 2 and 3, each informational friction in isolation, either unknown ability or invisibility, leads to the current employer implementing an inefficiently strict promotion cut-off. As the following result shows, if both informational frictions prevail simultaneously, this inefficiency is further aggravated. Furthermore, the different informational scenarios also feature different equilibrium wages for the worker. Without an informational friction, the worker’s equilibrium wage increases linearly in his ability and there is no upward discontinuity in the wage schedule upon promotion. Thus, the most able worker type that is not promoted basically receives the same wage as the least able worker type that is promoted. However, in the three other scenarios, where at least
one informational friction prevails, a promotion *induces* a large wage increase. In particular, all worker types that are not promoted earn the same wage, irrespectively of their ability. As soon as ability reaches the promotion cut-off, however, there is a discontinuous upward jump in the wage schedule as a consequence of the promotion. Hence, workers that are promoted earn substantially more than workers that are not promoted even if they have almost the same ability.

**Corollary 1.** Suppose $\gamma \to 0$.

(i) Promotions are efficient under symmetric information. The equilibrium promotion cut-off is increasing in the number of informational frictions, i.e., $A^* = A_{ka,\text{vis}}^+ < A_{ka,\text{invis}}^+ < A_{ua,\text{invis}}^+$ and $A^* = A_{ka,\text{vis}}^+ < A_{ua,\text{vis}}^+ < A_{ua,\text{invis}}^+$.

(ii) A (large) wage increase upon promotion prevails if and only if at least one informational friction exists. The wage increase upon promotion is larger in Scenario IV than in Scenarios II and III.

In order to analyze the impact of asymmetric employer information on firms’ profits, we compare the ex ante profits across Scenarios I to III, i.e., expected profits before nature determines the worker’s ability. Contrary to their effects on the optimal promotion cut-off and the wage jump upon promotion, the effects of the two forms of asymmetric employer information on the current employer’s expected profits go in opposite directions. Consider invisibility of the worker on the basic job first. Compared to a labor market with symmetric employer information, invisibility increases the current employers’ expected profits as ex post poaching offers remain unchanged but invisibility can be used to save wage costs. Next, compare unknown worker ability to symmetric employer information. While the current employers’ expected wage offers do not differ in both scenarios, unknown worker ability leads to inefficient promotion decisions, which decrease output and thereby the current employers’ expected profits.\(^{12}\) Finally, as the worker in equilibrium remains with his current employer, market firms make zero expected profits.

**Corollary 2.** Suppose $\gamma \to 0$. Compared to symmetric employer information (Scenario I), the current employer’s expected profits decrease under unknown worker ability (Scenario II) and increase under invisibility of the worker on job 0 (Scenario III). The market firms’ expected profits are zero in any scenario.

4. EXPERIMENTAL DESIGN

In the experiment, we examine the key comparative statics of our theoretical framework regarding the impact of informational asymmetries on labor market competition and promotion strategies. Specifically, we consider two distinct treatment dimensions. First, we

\(^{12}\)The effect on profits from combining both informational frictions, however, is ambiguous as both individual effects work into opposite directions.
exogenously vary whether a worker’s ability is known to all firms or only for the current employer. Second, we vary whether non-promoted workers are visible to the labor market.

4.1. The Game

We use a simple choice paradigm to implement these treatment conditions. At the beginning of the game, groups of three players are formed. There is one current employer and two market firms competing for one worker. The worker is not represented by a player in the lab but always accepts the highest wage offer. In consequence, our experimental setup—in line with the theoretical arguments—abstracts from any potential concerns for prosocial behavior in the employer-worker relationship or limited attention of the worker. While we do not consider these concerns unimportant, this setup enables us to identify the pure effect of asymmetric information on employers’ personnel strategies. All firms have an endowment of 150 points. Their production technologies are given by the parameter constellation in Table 2. Hence, for ability $A$ of the worker, the value of the output for the current employer on job 0 is given by $95 + 10A$ points while it is $30A$ points after a promotion. Likewise, the output of the market firms is given by $12A$ points.

<table>
<thead>
<tr>
<th>Model Parameter</th>
<th>$s$</th>
<th>$d_0$</th>
<th>$d_1$</th>
<th>$c_0$</th>
<th>$c_1$</th>
<th>$\gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental value</td>
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<td>38</td>
<td>0</td>
<td>4</td>
<td>12</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2: Parameter values for the experiment

The sequence of the game is as follows. First, the worker’s ability is randomly drawn from the set \{0, 1, \ldots, 19, 20\}, where each realization is equally likely. Afterward the current employer gets to know the worker’s ability and decides about whether to promote the worker. To be able to observe promotion strategies, we apply the strategy method at this stage. Hence, the current employer decides whether or not to promote the worker for every possible realization of ability $A$. Once the promotion decision is implemented, the two other players, who represent the market firms, are informed about the promotion decision and, depending on the treatment, also about the worker’s ability. In the last step, all players that are eligible can post a wage offer to the worker. The player with

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13 All subjects know that workers are not represented by another subject and that workers always choose the highest wage offer.

14 Considering the parameter values, one concern could be that the large impact of specific human capital ($s = 1.5$) discourages market firms in the experiment, leading to zero wage offers. As we will outline in Section 6, however, this is not the case.

15 The wage offer is restricted to values between 0 and 250 points, such that no player gets negative earnings at the end of the experiment (each player’s initial endowment is 150 points and the show up fee amounts
the highest wage offer obtains the worker.\textsuperscript{16} This player’s payoff is given by the initial endowment plus the value of the worker’s output on the offered job minus her wage offer. The other players’ payoff is equal to the initial endowment. At the end of each period, every player is informed about all wage offers in the group, the worker’s actual ability, and the own payoff.

4.2. Treatments

We implement four treatment conditions, reflecting the scenarios discussed in Section 2. Across treatments we exogenously vary the informational setting of the labor market. In the baseline treatment \textit{ka-vis}, actual worker ability is \textit{known} by all players. Moreover, the worker is also \textit{visible} to all firms irrespective of the promotion decision of the current employer such that all firms can post a wage offer at the end of each round. As a consequence, there are no informational frictions in this case.

In our second treatment, \textit{ua-vis}, worker ability is \textit{unknown} to the market firms. In this case, market firms only obtain information about the current employer’s promotion decision. Nevertheless, the worker is \textit{visible} to all firms irrespective of the promotion decision of the current employer. One crucial aspect of the promotion-as-signal hypothesis is how market firms’ beliefs are shaped by the promotion decision of the current employer. Therefore, we implement an incentivized elicitation of beliefs about worker ability for market firms in this treatment. The elicitation takes place before market firms are informed about the current employer’s promotion decision. Every market firm states a point estimate on $A$ for both possible job assignments, i.e., for the case that the worker is promoted and for the case that the worker is not promoted. The belief $\hat{A}$ stated for the effectively implemented promotion decision of the current employer becomes relevant for the payoff of a market firm, being given by $200 - 10 \times |\hat{A} - A|$ points.

Our third treatment, the \textit{ka-invis} treatment, differs from the baseline treatment only in the fact that the worker remains \textit{invisible} to the market firms when not being promoted. Hence, market firms are not able to make a wage offer if the current employer has decided not to promote the worker. If the worker is promoted and becomes visible for the market firms, however, they also \textit{know} his ability.

Finally, in the \textit{ua-invis} treatment, the two informational frictions from the \textit{ua-vis} and \textit{ka-invis} treatments are in place at the same time. Hence, market firms do not know the worker’s ability and are not able to make a wage offer if the current employer has decided not to promote the worker. As in the \textit{ua-vis} treatment, we implement an incentivized

\textsuperscript{16}Whenever the current employer’s wage offer is among the highest wage offers, she obtains the worker. If both market firms make identical wage offers which strictly exceed the current employer’s wage offer, a random draw determines which market firm obtains the worker.
elicitation of the market firms’ beliefs regarding the worker’s ability.

4.3. Procedures

The experiment was conducted in the BonnEconLab at the University of Bonn. We used z-tree as programming language (Fischbacher, 2007) and the online recruiting system hroot (Bock, Baetge, and Nicklisch, 2014). Overall, we conducted eight sessions of the experiment, two for each treatment. In a session, 24 subjects interacted for three trial rounds and 15 payoff relevant rounds, in each of which they played the game described in section 4.1. Subjects within one session were randomly assigned to four matching groups with six participants each. In each round, three players within one matching group were randomly grouped to play the game described above. Moreover, roles were also randomly assigned within each of these groups in every period. This procedure yields eight independent observations per treatment for the non-parametric tests reported below. We chose to use a neutral framing in the instructions. For example, value-ladden terms like "worker", "employer", "promotion", or "poaching" were not used. Before each session started, the players completed a short quiz to check their understanding of the instructions, and they had the opportunity to ask clarifying questions.\footnote{As additional controls, after the experiment we elicited each subject’s risk attitude, cognitive reflection score, and competitiveness.} We did not allow communication among the players. At the end of each session, one round was randomly selected to determine the subjects’ payoffs. The points earned by a subject in this round were converted to Euros according to 20 points = 1 Euro. Overall, sessions lasted about 100 minutes, and subjects earned 19.35 Euros on average (approx. 21.3 USD) including a show up fee of five Euros.

5. Behavioral Predictions

The experimental design described in the previous section allows us to identify the causal impact of informational asymmetries on labor market wage competition and firms’ promotion policies. We present our hypotheses and empirical results in four steps. First, we analyze whether under unknown ability firms recognize promotions as a signal of ability. For this purpose, we analyze how promotions affect the beliefs that market firms hold about the worker’s ability, and how these beliefs, in turn, influence their wage offers. Second, we investigate how the anticipated wage offers of the market firms feed back into the current employer’s decision to promote the worker. Third, we analyze how promotions affect wages. Fourth, we consider profits of current employers and market firms.

**Hypothesis 1.A.** In case of unknown worker ability, market firms associate higher ability with promoted workers than with non-promoted workers. If, in addition, workers are
infrared on the basic job, expected ability of both promoted and non-promoted workers is higher compared to the case in which the worker is visible on both jobs.

These differences in market firms’ beliefs about promoted and non-promoted workers’ ability directly follow from the optimal personnel policy of current employers. As current employers are hypothesized to promote the most able workers, market firms associate higher expected ability with promoted workers. If workers are additionally invisible on the basic job, current employers choose an even higher promotion cut-off (see Corollary 1). As a consequence, only workers with very high ability are promoted. This induces the market firms to associate higher expected ability with both jobs. The differences in market firms’ beliefs depending on the current employer’s job assignment should directly influence their wage offers as stated in Hypothesis 1.B.

**Hypothesis 1.B.** In case of unknown worker ability, all firms offer higher wages to promoted workers than to non-promoted workers. If, in addition, workers are invisible on the basic job, the wage offers to promoted workers further increase.

Higher expected ability directly translates into market firms’ higher willingness to pay and thus to higher wage offers. Hence, wage offers for promoted workers should be higher than for non-promoted workers (see Propositions 1 and 2). Moreover, wage offers for promoted workers are even higher in the case of invisibility. The current employers, who want to retain the worker, should anticipate this behavior of market firms so that we expect to find the same wage effects of informational asymmetries for current employers as for market firms (see Propositions 2 and 4).

Regarding the promotion decision, current employers face the following trade-off under asymmetric information. On the one hand, they should promote efficiently to maximize output. On the other hand, they anticipate that promotion would result in higher wage costs. As a consequence, current employers adopt a cut-off promotion rule featuring inefficiently few promotions. According to Corollary 1 (i), the optimal promotion cut-offs can be ranked because each additional informational friction leads to a further wage increase. This observation yields Hypothesis 2.

**Hypothesis 2.** The current employers promote according to a cut-off rule. The promotion cut-off is efficient under symmetric information and increasing in the number of frictions, i.e., $A^* = A^+_{ka,vis} < A^+_{ka,invis} < A^+_{ua,invis}$ and $A^* = A^+_{ka,vis} < A^+_{ua,vis} < A^+_{ua,invis}$.

Next, consider how the workers’ wages should depend on their ability. If a worker’s ability is known to the market firms and the worker is visible, the current employers’ retention wages will depend on ability but not on the fact whether the worker has been promoted or not. Consequently, we should observe a wage schedule that linearly increases in the worker’s ability without any discontinuity. In case of unknown ability,
the current employers’ retention wages should only depend on the promotion decision. Hence, we would expect an upward discontinuity in the wage schedule such that a promoted worker earns substantially more than a non-promoted worker even if they have almost the same ability. If the worker is only visible on the managerial job 1, the wage schedule again should display an upward discontinuity. Intuitively, the current employers offer zero wages to non-promoted workers, who remain invisible and cannot be poached, whereas promotion makes the worker visible and leads to poaching, which requires the retention wages to be strictly positive. If both forms of asymmetric information prevail at the same time, the promotion-as-signal effect and the visibility effect will reinforce each other so that promotion leads to an even larger wage jump (see Corollary 1 (ii)).

**Hypothesis 3.** Asymmetric employer information causes a discontinuous increase in the worker’s wage schedule upon promotion. This wage jump is largest when both informational frictions jointly prevail. If, in contrast, employer information is symmetric, there is no discontinuous wage increase upon promotion.

Finally, we consider firms’ profits. Theory predicts each informational friction in isolation to have an unambiguous effect on the current employers’ profits: unknown worker ability should decrease profits, whereas invisibility of the worker on the basic job should increase profits. Furthermore, market firms should make zero profits as workers should remain with their current employer in each scenario (see Corollary 2).

**Hypothesis 4.** Profits of the current employers are higher in ka-invis than in ka-vis and lower in ua-vis than in ka-vis. Profits of market firms are zero in all treatments.

6. **Results**

This section provides the experimental test of the hypotheses for behavioral differences across treatments due to informational asymmetries.

6.1. The Signaling Character of Promotions

If only the current employer knows the worker’s ability, the market firms have to rely on the observable promotion decision of the current employer to form beliefs about the unknown ability. We start by testing whether market firms indeed associate higher abilities with those workers that have been promoted than with workers that have not been promoted (Hypothesis 1.A).

Figure 1 depicts the average belief that market firms associate with a worker depending on the observed promotion decision for the case of unknown ability. Importantly, in both treatments ua-vis and ua-invis market firms associate a clearly higher ability with promoted workers than with workers that are not promoted (Wilcoxon rank-sum test (WRT),
Figure 1: Market firms’ expectations about workers’ ability for ua-vis and ua-invis depending on whether the worker was promoted or not.

$p < 0.01$ for ua-vis, $p < 0.01$ for ua-invis).\(^{18}\) Hence, in our experiment market firms well understand that promotions serve as a signal about the ability of the worker.

As stated in Hypothesis 1.A, our theoretical framework provides a second prediction with respect to beliefs: additional informational advantages of the current employer due to invisibility of the worker on the basic job 0 should induce market firms to form higher beliefs about the ability of workers on both jobs. As can be seen from Figure 1, for either type of job, market firms indeed expect higher worker ability under invisibility than under visibility ($p < 0.01$, WRT for ua-vis vs. ua-invis for promoted as well as non-promoted workers). Overall, the beliefs of market firms strongly depend on the promotion decision by the current employer, which supports Hypothesis 1.A.

Next, we investigate if the described differences in the market firms’ beliefs regarding the worker’s ability are also reflected in their wage offers (Hypothesis 1.B). The left panel of Figure 2 shows the average wage offers made by market firms for the two treatments with unknown worker ability. In fact, market firms internalize the signaling character of promotions and offer higher wages for promoted workers than for non-promoted workers. The difference in wages is highly significant ($p < 0.01$, WRT for ua-vis). If invisibility is added to unknown ability, we see that market firms associate even higher abilities with promoted workers. As a consequence, wage offers for promoted workers should further increase due to invisibility, which is confirmed by our data ($p < 0.01$, WRT for ua-invis vs. ua-vis).

As market firms internalize the signaling effect of promotions when making their wage offers, so should the current employer. She should anticipate higher poaching wages if she decides to promote a worker and therefore offer higher wages to promoted workers.

\(^{18}\)Unless stated otherwise, we report tests based on matching-group averages.
Average wage offers of market firms (left panel) and current employers (right panel) in treatments with unknown ability

Figure 2: Average wage offers of market firms (left panel) and current employers (right panel) in treatments with unknown ability

herself. The right panel of Figure 2 illustrates the current employers’ wage offers for the two treatments with unknown worker ability. The wage offers to promoted workers are significantly higher than to non-promoted workers ($p < 0.01$, WRT for $ua-vis$). Moreover, current employers also anticipate the even higher poaching wages for promoted workers if workers are invisible on the basic job, and match these in advance such that wages offered to promoted workers are higher in $ua-invis$ than in $ua-vis$ ($p = 0.016$, WRT).

In summary, wage offers of the market firms and the current employer perfectly match the qualitative predictions of the model as stated in Hypothesis 1.B. Hence, our data lend support to the idea that market firms recognize promotions as a signal of ability, which was first suggested by Waldman (1984) and applied in a series of subsequent papers (see, among others, Ricart-I-Costa, 1988; Bernhardt, 1995; Bernhardt and Zábojník, 2001; Golan, 2005; Waldman and Zax, 2014; Waldman, 2014).

6.2. The Impact of Asymmetric Information on Promotions

Having analyzed how wages of current employers and market firms depend on the promotion decision, we will now analyze how anticipated wages affect the promotion decisions of current employers in our experiment. As we applied the strategy method to elicit promotion decisions, we are able to directly check whether current employers use a cut-off rule when deciding about promotions. It turns out that over all treatments more than 95% of all promotion decisions were implemented by a cut-off rule. Hence, almost all observations confirm the first part of Hypothesis 2. For the remaining analysis, we neglect those observations that are not characterized by a cut-off rule.

The second part of Hypothesis 2 states that asymmetric employer information is a causal factor for inefficient promotion decisions of current employers. Figure 3 displays the average promotion cut-offs over treatments. In the baseline treatment $ka-vis$ the average promotion cut-off is 5.12, which is not statistically different from the efficient cut-off $A^* = 5$ (t-test, $p = 0.201$ standard errors account for potential clustering at the matching
group level). This picture changes strongly as soon as there is some form of asymmetric employer information. First, we analyze the pure effect of unknown worker ability on promotion strategies. Recall that, in this case, market firms offer significantly higher wages after having received the signal of a promotion (see Figure 2). Current employers anticipate this wage gap and incorporate it in their promotion strategy. As a result, promotion cut-offs in *ua-vis* are significantly higher than in *ka-vis* (*p* = 0.018, WRT). This finding provides evidence for the central claim in the promotion-as-signal literature that asymmetric employer information with regard to worker ability is a causal factor for firms adopting inefficient promotion strategies (Waldman, 1984; DeVaro and Waldman, 2012; Waldman and Zax, 2014).

Next, we turn to the impact of invisibility on promotion strategies. Current employers anticipate that they have to pay higher wages for promoted workers than for non-promoted workers. In consequence, they decide not to promote ability types that are only slightly more productive on job 1 than on job 0 and thereby choose significantly higher promotion cut-offs in *ka-invis* than in *ka-vis* (*p* < 0.01, WRT). We conclude that our experiment also supports the notion that invisibility induces inefficiently few promotions as argued in Milgrom and Oster (1987).

For the last part of Hypothesis 2, we investigate if the two informational frictions—invisibility and unknown ability—aggravate or attenuate each other. Reconsidering Figure 3, we find that the average cut-off in *ua-invis* is the highest among all treatments. In fact, the increase in the cut-off from *ua-vis* to *ua-invis* is also highly significant (*p* < 0.01, WRT). Although the average cut-off in *ua-invis* is also higher than the average cut-off in *ka-invis*, this difference turns out to be insignificant (*p* = 0.294, WRT).

Overall, the findings with respect to promotion strategies resonate very well with our predictions. First, the vast majority of current employers adopt a cut-off strategy. Sec-

![Figure 3: The average promotion cut-offs across treatments](image-url)
ond, both types of informational friction induce inefficient promotion policies by current employers. Third, when both types of informational friction are jointly present, the distortion in promotion decisions tends to be even stronger than in cases where only one informational friction prevails.

6.3. The Impact of Asymmetric Information on Wage Policies

Empirical studies have shown that promotions are associated with large wage increases even when controlling for differences in human capital and other worker characteristics (Baker, Gibbs, and Holmström, 1994a,b; McCue, 1996; Bognanno, 2001). Following this insight, there has been an ongoing discussion why firms reward exactly those workers that are promoted. One very plausible explanation for this phenomenon is given by the job-promotion literature about asymmetric employer information based on Waldman (1984) and Milgrom and Oster (1987). In this section, we provide evidence for asymmetric employer information being a causal factor of large wage increases upon promotion.

As implied by Hypothesis 4, we expect that symmetric information leads to wages depending only on the worker’s ability but not on the current employer’s promotion decision itself. In particular, the worker’s wage should be linearly increasing in his ability without any discontinuity due to a promotion. In contrast, asymmetric information is hypothesized to cause a wage jump—i.e., an upward discontinuity of the wage schedule—upon promotion. In consequence, promoted workers earn substantially more than non-promoted workers even if they have (almost) the same ability.

To provide a first overview of the data, Figure 4 displays the current employers’ wage offers for promoted and non-promoted workers across treatments. The graph in the upper left panel shows that under symmetric employer information (ka-vis) there is a smooth transition from the wage offered to non-promoted workers to the wage offered to promoted workers. In the three treatments with asymmetric information, in contrast, promotions themselves seem to affect wages. In particular, promoted workers tend to earn higher wages than their non-promoted counterparts even if they have identical ability.

As already suggested by Figure 4, we indeed find asymmetric employer information to be a causal factor for wage increases upon promotion. Table 3 reports the results from an OLS regression with wages being the dependent variable. To account for the fact that the current employer promotes only the most able types, we control for the ability of the worker. For the results of each column (2)-(5), we pool the data of two treatments that differ from each other only in the presence of one particular informational friction.

Considering the case of symmetric information first, column (1) of Table 3 reveals that the promotion decision itself does not have a significant effect on wages in ka-vis. To investigate how unknown ability changes this picture, we pool the data of the treatments featuring visibility (ka-vis and ua-vis). Moreover, we add a dummy variable for unknown
Figure 4: Wage offers of current employers contingent on promotion decision and ability across treatments. Fitted values are obtained from an OLS regression of wages on ability.

ability and allow for an interaction with the promotion decision. According to Hypothesis 3 this interaction term should have a positive coefficient indicating that unknown worker ability causes a wage jump upon promotion. In fact, as reflected by the significant and positive coefficient of this interaction term in column (2) of Table 3, the direct effect of promotions on wages is significantly stronger in \( ua-vis \) than in \( ka-vis \). Hence, asymmetric information with regard to ability causes a substantial wage increase upon promotion. The same is true for asymmetric information in form of invisibility. As indicated by the positive and significant coefficient of the interaction term in column (4) of Table 3, in comparison to \( ka-vis \), there is a large and significant wage increase due to promotions in \( ka-invis \). In summary, the decision to promote a worker does not affect the current employer’s wage offer if employer information is symmetric. Asymmetric employer information, however, causes a wage increase upon promotion, which confirms the first and last part of Hypothesis 3.

Regarding the second part of Hypothesis 3, we additionally analyze columns (3) and (5) of Table 3. Here, we study the effect of adding a second informational friction to either unknown ability or invisibility. We find a positive and significant coefficient of the interaction term between invisibility and promotion on wage offers in column (5) but not between unknown ability and promotion in column (3). If invisibility on the basic job is
Table 3: Determinants of current employers’ wage offer. OLS estimates; reported standard errors (in parentheses) account for potential clustering on the matching-group level. Promotion is equal to one if the worker is promoted and zero otherwise. Unknown Ability (ua) and Invisibility (invis) are equal to one for the treatments with the respective informational friction and zero otherwise. Columns (1)-(5) report estimates for ka-vis, both vis treatments, both invis treatments, both ka treatments, and both ua treatments, respectively.

<table>
<thead>
<tr>
<th></th>
<th>ka-vis</th>
<th>ka-vis</th>
<th>ka-invis</th>
<th>ka-vis</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
<td>Ability</td>
<td>11.968***</td>
<td>11.968***</td>
<td>3.166***</td>
<td>11.968***</td>
<td>5.922***</td>
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<tr>
<td></td>
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<td>(0.508)</td>
<td>(0.392)</td>
<td>(0.508)</td>
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<td>Promotion</td>
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<td>3.447</td>
<td>157.884***</td>
<td>3.447</td>
<td>40.251**</td>
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</tr>
<tr>
<td></td>
<td>(3.411)</td>
<td>(6.860)</td>
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<tr>
<td>ua × Ability</td>
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<td>0.243</td>
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<td>(1.153)</td>
<td>(1.123)</td>
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<tr>
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<td>−14.246</td>
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<td>(0.642)</td>
<td>(1.476)</td>
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<td>invis × Promotion</td>
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<td>103.387***</td>
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<td>(2.076)</td>
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N 234 457 456 466 447
R² .883 .795 .889 .899 .82

added to a situation where market firms do not know worker ability, the wage increase upon promotion becomes significantly larger. The reverse, however, is not supported by the data, i.e., for the case of invisibility, worker ability being private information of the current employer has no additional impact on the effect of promotions on wages.

Overall, we conclude that asymmetric information is a causal factor for wage increases upon promotion. Furthermore, an increase in the informational gap between the parties tends to (weakly) increase the wage jump following a promotion.
6.4. Firm Profits and the Winner’s Curse

Finally, we consider how the impact of informational asymmetries on personnel policies feeds back into the overall profits of firms. The left panel of Figure 5 shows the average profits of current employers across treatments. Unknown worker ability is hypothesized to have a detrimental effect on profits due to inefficient promotion strategies (see Hypothesis 4). Although average profits are smaller in the case of unknown ability, this effect turns out to be insignificant ($p = 0.753$, WRT for ka-vis vs. ua-vis). In contrast to unknown ability, invisibility is predicted to increase profits compared to a situation without informational friction because current employers can save on wages for non-promoted workers. The data corroborate this effect as profits of current employers are higher in ka-invis than in ka-vis ($p < 0.01$, WRT). In total, the evidence for the consequences of asymmetric information on profits is mixed: while unknown ability seems to have at most a weak negative effect on profits, invisibility leads to a clear increase in profits.

Next, we turn to the profits of market firms. As a worker is more valuable to his current employer than to the market firms because of specific human capital, theory predicts the current employer to match any poaching wage offers made by market firms. In consequence, profits of market firms should be zero in all treatments. Our data, however, suggest that profits of market firms are unequal to zero over all treatments (t-test, $p < 0.01$, standard errors account for potential clustering at the matching group level). As a matter of fact, market firms on average realize negative profits in all treatments (see the right panel of Figure 5). One possible explanation for the negative profits is that market firms might fall victim to some kind of winner’s curse.\footnote{The winner’s curse is known from auctions for items of unknown value: the successful bidder might have to admit ex post that he was only selected as the winner because he was the most (over-)optimistic bidder with respect to the value of the good. See Perri (1995) on the winner’s curse in the labor market.} The exogenous variation across our treatments allows us to directly test whether the winner’s curse is a causal factor for

![Figure 5: Average profits of current employers (left panel) and market firms (right panel) across treatments.](image-url)
the negative profits for market firms. If this is the case, profits should decrease as a consequence of unknown worker ability and thus unknown worker value. In fact, we find that profits in *ua-vis* are significantly lower than in *ka-vis* (*p* = 0.036, WRT).\(^20\) While profits are also lower in *ua-invis* than in *ka-invis*, this effect is not significant (*p* = 0.753, WRT).\(^21\) Overall, with profits being negative and significantly different from zero in all treatments, asymmetric information cannot fully explain the negative profits by market firms. Still, it reinforces negative profits of market firms which is in line with the idea that they suffer from a winner’s curse.

### 7. Conclusion

In this paper, we provide evidence that asymmetric employer information is a causal factor for inefficient promotion rules and large wage increases upon promotion. Using a simple theoretical framework that combines elements of Waldman (1984) and Milgrom and Oster (1987), we show that both phenomena may jointly arise due to an information revealing character of promotions under asymmetric employer information. The data from testing the implications of the theoretical model in a controlled lab experiment are consistent with the idea that the signaling role of promotions is in fact the driving force behind inefficient promotion rules and large wage increases upon promotion.

In our experiment, we test the effect of asymmetric employer information on two fundamental aspects of personnel policies—promotion decisions and wage offers. Building on the seminal work by Waldman (1984), asymmetric employer information has been hypothesized to also account for fast-track promotions, the Peter principle, and salary increases following demotions (Bernhardt, 1995) as well as the use of up-or-out contracts (Ghosh and Waldman, 2010). Furthermore, a sizable theoretical literature examines the constraints that the signaling role of promotions imposes on the design of rank-order promotion tournaments (Bernhardt and Zábojník, 2001; Zábojník, 2012; DeVaro and Kauhanen, Forthcoming; Gürtler and Gürtler, Forthcoming, 2015). A very interesting step for future research would be to provide direct evidence for whether the signaling role of promotions indeed is a causal factor also for these more complex implications.

Our setup also lends itself to investigate how social preferences interact with asymmetric information in shaping employers’ personnel strategies. In general, experimental evidence has documented the important role of reciprocity and fairness in employment

\(^{20}\) Interestingly, current employers choose a cut-off promotion rule in 268 cases in *ua-vis*. In 81 of these cases, market firms successfully poach the worker and in 68 of the cases realize negative profits.

\(^{21}\) For the case of invisibility, we only take profits after a promotion into account. Otherwise, market firms incur zero profits by definition. In consequence, the number of observations within each matching group is very limited for this analysis (We have overall 17 profit observations in *ka-invis* and 23 profit observations in *ua-invis* for market firms).
relationships (Fehr and Falk, 1999; Fehr and Gächter, 2000; Fehr and Falk, 2002; Brown, Falk, and Fehr, 2004; Altmann, Falk, Grunewald, and Huffman, 2014). While we deliberately eliminated this channel in our experiment to delineate the pure effect of asymmetric information, it would be straightforward to assign the role of the worker to a subject in the lab. In a second step this extension could also integrate workers’ effort choices into the picture. One might expect that reciprocal employers offer higher wages as retention premium compared to the employers in our experiment, who do not face a real individual as a worker. If this wage premium differs across the basic job and a managerial position, it may also alter the firms’ promotion decisions.

In contrast to our theoretical prediction, in our experiment workers are not always retained by their current employer despite the presence of specific human capital. Our findings therefore suggest that asymmetric employer information may be detrimental for welfare not only because of inefficient allocation of talent to jobs within a firm, but also because of inefficient allocation of workers across firms. As a consequence, measures that work against asymmetric information may be desirable from a welfare perspective. For example, general labor market certificates that can be obtained by employees from a third party (e.g., universities, chambers of industry and commerce) can serve as an important instrument to mitigate asymmetric information and its detrimental impact. These certificates can document a clear minimum norm of occupational skills and, in addition, might work as a credible signal in the notion of Spence (1973). Thus, the labor market certificates reveal valuable information about the ability of an employee and allow successful job applications of employees even if their current employer tries to hide them by assignment to some invisible staff positions or withholding promotion.

REFERENCES


APPENDIX

A. PROOFS OF PROPOSITIONS AND LEMMAS

Proof of Proposition 1. Denote the job assignment of firm 1 by $j_1 \in \{0, 1\}$. We prove the proposition in two steps. First, we show that in any wage-setting subgame at date 2, i.e., for any combination of ability $A \in [0, \bar{A}]$ and job assignment, we have $w_i(A) = d_1 + c_1 A$ for some firm $i = 2, \ldots, n$ and $w_i(A) \leq d_1 + c_1 A$ for all firms $i = 2, \ldots, n$. Second, we show that in the subgame-perfect equilibrium of the entire game firm 1 always retains the worker and promotes efficiently, i.e., $j_1(A) = 1$ if and only if $A \geq A^*$. 

Step 1: Note that in any wage-setting subgame, the wage offer of firm $i = 2, \ldots, n$ does not depend on the job assignment of firm 1 since the worker’s ability is publicly observable. For any ability $A \in [0, \bar{A}]$, let $\bar{w}(A) = \max\{w_2(A), \ldots, w_n(A)\}$. As the worker leaves firm 1 with probability $\gamma > 0$ for exogenous reasons, each firm $i = 2, \ldots, n$ that offers $w_i(A) = \bar{w}(A)$ obtains the worker with strictly positive probability. Hence, in equilibrium, we must have $\bar{w}(A) \leq d_1 + c_1 A$, for otherwise a firm offering $\bar{w}(A)$
would make strictly negative expected profits and could profitably deviate to offering a zero wage. Furthermore, for any ability \( A \in [0, \bar{A}] \) at least one firm \( i = 2, \ldots, n \) offers \( w_i(A) = d_1 + c_1 A \). Otherwise, if \( \bar{w}(A) < d_1 + c_1 A \), the alternative employer with the lowest wage offer, say, firm \( k \) with \( w_k(A) = \min\{w_2(A), \ldots, w_n(A)\} \) could strictly increase its expected profit by deviating to \( \bar{w}(A) + \varepsilon \) with \( \varepsilon \searrow 0 \). More precisely, if \( w_k(A) < \bar{w}(A) \), firm \( k \) generates zero profit. By deviating firm \( k \) obtains the worker with strictly positive probability and earns a strictly positive expected profit. If all alternative employers offer identical wages so that \( w_k(A) = \bar{w}(A) \), firm \( k \) discretely increases the probability to obtain the worker by only a marginal increase in the offered wage, yielding a larger expected profit.

**Step 2:** Given job assignment \( j_1 \in \{0, 1\} \) and \( \bar{w}(A) = d_1 + c_1 A \), firm 1 prefers to retain the worker if and only if \( (1 + s)(d_{j_1} + c_{j_1} A) \geq \bar{w}(A) \), in which case firm 1’s best response is to offer \( \bar{w}(A) \). Otherwise, firm 1 prefers not to retain the worker and its best response is to offer \( w_1(A) \in [0, \bar{w}(A)) \). Hence, firm 1 will offer \( w_1(A) = \bar{w}(A) \) if either \( j_1 = 1 \) or \( j_1 = 0 \) and \( A[c_1 - (1 + s)c_0] \leq d_0(1 + s) - d_1 \), which results in nonnegative expected profits for firm 1 equal to \( E[\pi_1] = (1 - \gamma)s(d_1 + c_1 A) \) or \( E[\pi_1] = (1 - \gamma)(1 + s)(d_0 + c_0 A) - (d_1 + c_1 A) \), respectively. If \( j_1 = 0 \) and \( A[c_1 - (1 + s)c_0] > d_0(1 + s) - d_1 \), firm 1 offers \( w_1(A) \in [0, \bar{w}(A)) \), which results in expected profits equal to zero. However, as the worker is more productive at firm 1, for any \( A \in [0, \bar{A}] \) firm 1 can choose a job assignment such that she makes positive profits given wage \( \bar{w}(A) = d_1 + c_1 A \). Hence, in equilibrium firm 1 always retains the worker and offers wage \( w_1(A) = \bar{w}(A) \). Given our tie-breaking rule for promotion, a comparison of expected profits reveals that firm 1’s promotion policy is efficient and the worker is promoted to job \( j = 1 \) if and only if \( A \geq A^* \). □

**Proof of Proposition 2.** Let \( w_1(A, j), w_2(j), \ldots, w_n(j) \) denote the wages offered by firms \( 1, \ldots, n \) in equilibrium after firm 1 assigned a worker of ability \( A \in [0, \bar{A}] \) to job \( j \in \{0, 1\} \). Furthermore, define

\[
\mathcal{A}^1 = \mathcal{A}^1(w_1(A, j), w_2(j), \ldots, w_n(j)) := \{ A \in [0, \bar{A}] \mid w_1(A, j) \geq \max\{w_2(j), \ldots, w_n(j)\} \} \quad (A.1)
\]

and

\[
\mathcal{A}^j = \mathcal{A}^j(w_1(A, j), w_2(j), \ldots, w_n(j)) := \{ A \in [0, \bar{A}] \mid w_1(A, j) < \max\{w_2(j), \ldots, w_n(j)\} \} , \quad (A.2)
\]

where the sets \( \mathcal{A}^0, \mathcal{A}^0, \mathcal{A}^1, \mathcal{A}^1 \) represent a partition of the set \([0, \bar{A}]\). Finally, let \( P(A) = \text{prob}(A \in A) \) for \( A \subseteq [0, \bar{A}] \). Armed with these pieces of notation, we establish the result in a series of seven steps.
**Step 1:** \( A^1_\varnothing = \emptyset \).

Suppose, in contradiction, that \( A^1_\varnothing \neq \emptyset \), i.e., there exist ability types that firm 1 promotes to job \( j = 1 \) and for which firm 1 is outbid in the wage competition. Regarding the equilibrium wage offer by firm \( i = 2, \ldots, n \), we must have

\[
\begin{align*}
  w_i(1) & \leq \frac{P(A^1_\varnothing)}{P(A^1_\varnothing) + \gamma P(A^1)}(d_1 + c_1E[A|A \in A^1_\varnothing]) \\
 & \quad + \frac{\gamma P(A^1)}{P(A^1_\varnothing) + \gamma P(A^1)}(d_1 + c_1E[A|A \in A^1]) =: a(A^1, A^1_\varnothing),
\end{align*}
\]

for otherwise one of firms \( 2, \ldots, n \) makes strictly negative expected profits. Consider ability type \( A' \in A^1_\varnothing \) with \( A' \geq E[A|A \in A^1_\varnothing] \). As

\[
\lim_{\gamma \downarrow 0}(1 + s)[d_1 + c_1A'] - a(A^1, A^1_\varnothing) = (1 + s)[d_1 + c_1A'] - (d_1 + c_1E[A|A \in A^1_\varnothing]) > 0,
\]

for \( \gamma \downarrow 0 \) it is strictly profitable for firm 1 to deviate by offering \( \tilde{w}_1 = a(A^1_\varnothing, A^1) \) to ability type \( A' \) and retain this ability type. Thus, \( A^1_\varnothing \neq \emptyset \) is not compatible with equilibrium. \( \perp \)

**Step 2:** \( A^1 \neq \emptyset \).

Suppose, in contradiction, that \( A^1 = \emptyset \). By Step 1, this implies that firm 1 assigns all ability types \( A \in [0, \bar{A}] \) to job \( j = 0 \). No firm \( i = 2, \ldots, n \) will ever offer more than \( d_1 + c_1\bar{A} \). As Assumptions 1(i) and 2 imply that

\[
s(d_1 + c_1\bar{A}) > \max \left\{ (1 + s)(d_0 + c_0\bar{A}) - \max\{w_2(0), \ldots, w_n(0)\}, 0 \right\},
\]

firm 1 can strictly profitably deviate to promoting ability type \( \bar{A} \) to job \( j = 1 \) and offering \( \tilde{w}_1 = d_1 + c_1\bar{A} \). \( \perp \)

**Step 3:** If \( A' \in A^1 \), then \( A'' \in A^1 \) for all \( A'' > A' \).

Suppose, in contradiction, that \( A' \in A^1 \) and \( A'' \notin A^1 \) for \( 0 \leq A' < A'' \leq \bar{A} \). First, suppose that \( A'' \in A^0_\varnothing \). As ability type \( A' \) is retained by firm 1, we must have \( (1 + s)(d_1 + c_1A') - w_1(A', 1) \geq 0 \), for otherwise firm 1 could profitably deviate by making a zero wage offer to ability type \( A' \). With \( A'' > A' \), we have \( (1 + s)(d_1 + c_1A'') - w_1(A', 1) > 0 \), such that firm 1 could strictly profitably deviate by assigning ability type \( A'' \) to job \( j = 1 \) and retaining him by offering \( w_1(A', 1) \). Next, suppose that \( A'' \in A^0 \). For firm 1 not to have a profitable deviation, the following two conditions must hold:

\[
\begin{align*}
  (1 + s)(d_1 + c_1A') - w_1(A', 1) & \geq (1 + s)(d_0 + c_0A') - w_1(A'', 0) \quad \text{(A.6)} \\
  (1 + s)(d_1 + c_1A'') - w_1(A', 1) & \leq (1 + s)(d_0 + c_0A'') - w_1(A'', 0). \quad \text{(A.7)}
\end{align*}
\]

A necessary condition for (A.6) and (A.7) to be jointly satisfied, however, is \( A' \geq A'' \)—a contradiction. \( \perp \)
Steps 2 and 3 together imply that \( A^1 \) is an interval with \( \tilde{A} \) as maximum. We proceed by characterizing \( A^0 \) and \( A_\emptyset^0 \) in a similar fashion.

**Step 4: If \( A' \in A^0 \), then \( A'' \in A^0 \) for all \( A'' > A' \) with \( A'' \notin A^1 \).**

Suppose in contradiction that \( A' \in A^0 \) and \( A'' \in A_\emptyset^0 \) with \( 0 \leq A' < A'' < \tilde{A} \). For firm 1 not to have a profitable deviation, the following two conditions must hold:

\[
(1 + s)(d_0 + c_0 A') - w_1(A', 0) \geq 0 \tag{A.8}
\]
\[
(1 + s)(d_0 + c_0 A'') - w_1(A', 0) \leq 0. \tag{A.9}
\]

A necessary condition for (A.8) and (A.9) to be jointly satisfied, however, is \( A' \geq A'' \)—a contradiction. \( \Box \)

Thus, also the sets \( A^0 \) and \( A_\emptyset^0 \) are intervals.

**Step 5: \( A^1 \neq [0, \tilde{A}] \).**

Suppose, in contradiction, that \( A^0 = A_\emptyset^0 = \emptyset \). The Bertrand nature of wage competition dictates that \( \max\{w_2(1), \ldots, w_n(1)\} = d_1 + c_1 \tilde{A}/2 \). Then firm 1 makes negative expected profits with the lowest ability type \( A = 0 \) if

\[
(1 + s)d_1 - \left( d_1 + c_1 \frac{A}{2} \right) < 0, \tag{A.10}
\]

which holds by Assumption 1(i). Thus, firm 1 would have a profitable deviation. \( \Box \)

**Step 6: \( A^0 \neq \emptyset \) and \( A_\emptyset^0 \neq \emptyset \).**

First, suppose, in contradiction, that in equilibrium \( A^1, A^0, A_\emptyset^0 \neq \emptyset \). The Bertrand nature of wage competition dictates that \( w_1(A', 0) < \max\{w_2(0), \ldots, w_n(0)\} = \alpha(A^0, A_\emptyset^0) = w_1(A'', 0) \) for \( A' \in A_\emptyset^0 \) and \( A'' \in A^0 \), such that firms 2, \ldots, \( n \) make zero expected profits.

By Step 4, we know that \( A' < A'' \). As \( \lim_{\gamma \searrow 0} \alpha(A^0, A_\emptyset^0) = d_1 + c_1 E[A|A \in A_\emptyset^0] \), for \( \gamma \searrow 0 \) firm \( i \) with \( w_i(0) = \min\{w_2(0), \ldots, w_n(0)\} \) has a strictly profitable deviation: when offering \( \tilde{w}_i(0) = d_1 + c_1 E[A|A \in A_\emptyset^0] + \varepsilon \) for \( \varepsilon \searrow 0 \), firm \( i \) obtains a worker of ability type \( \bar{A} \in A^0 \cup A_\emptyset^0 \) for sure and makes expected profits of \( P(A^0) c_1 (E[A|A \in A^0] - E[A|A \in A_\emptyset^0]) - P(A^0 \cup A_\emptyset^0) \varepsilon > 0 \).

Next, suppose, in contradiction, that \( A^0 = \emptyset \) and \( A_\emptyset^0 \neq \emptyset \). Regarding the lowest ability type which is promoted, say \( A = \tilde{A} \), firm 1 has to be indifferent between assigning (and not retaining) this ability type to job \( j = 0 \) or assigning (and retaining) this ability type to job \( j = 1 \). Given our tie-breaking rule for promotion, from the previous steps it then follows that \( A_\emptyset^0 = [0, \tilde{A}] \) and \( A^1 = [\tilde{A}, \tilde{A}] \). The Bertrand nature of wage competition requires \( w_1(A', 0) < \max\{w_2(0), \ldots, w_n(0)\} = d_1 + c_1 \frac{\tilde{A}}{2} \) for \( A' \in A_\emptyset^0 \) and \( \max\{w_2(1), \ldots, w_n(1)\} = d_1 + c_1 \frac{\tilde{A} + \tilde{A}}{2} = w_1(A'', 1) \) for \( A'' \in A^1 \) and we must have

\[
(1 + s)[d_1 + c_1 \tilde{A}] = d_1 + c_1 \frac{\tilde{A} + \tilde{A}}{2} \iff \tilde{A} = \frac{c_1 \frac{\tilde{A}}{2} - sd_1}{c_1(\frac{1}{2} + s)}, \tag{A.11}
\]
where $\tilde{A} > 0$ by Assumption 1(i). Furthermore, firm 1 must not have an incentive to deviate by assigning ability type $A = \tilde{A}$ to job $j = 0$ and retain that ability type by offering $\tilde{w}_1 = d_1 + c_1 \frac{\tilde{A}}{2}$. Hence, as $(1 + s)c_0 - \frac{c_1}{2} > 0$ because of Assumptions 1 and 2,

$$(1 + s)(d_0 + c_0 \tilde{A}) - d_1 - c_1 \frac{\tilde{A}}{2} \leq 0 \iff \tilde{A} \leq \frac{d_1 - (1 + s)d_0}{(1 + s)c_0 - \frac{c_1}{2}}. \quad \text{(A.12)}$$

With the right-hand side of (A.12) being strictly negative, conditions (A.11) and (A.12) cannot be jointly satisfied—a contradiction. ||

Step 7: $A^0 = [0, A^+_{ua,vis}]$ and $A^1 = [A^+_{ua,vis}, \tilde{A}]$ with $A^+_{ua,vis} = A^* + \frac{c_1}{c_1 - c_0} \frac{\tilde{A}}{2(1 + s)}$.

Regarding the lowest ability type which is promoted, say $A = A^+_{ua,vis}$, firm 1 has to be indifferent between assigning (and retaining) this ability type to job $j = 0$ or assigning (and retaining) this ability type to job $j = 1$. Given our tie-breaking rule for promotion, from the previous steps it then follows that $A^0 = [0, A^+_{ua,vis}]$ and $A^1 = [A^+_{ua,vis}, \tilde{A}]$.

The Bertrand nature of wage competition implies that

$$\max\{w_2(0), \ldots, w_n(0)\} = d_1 + c_1 \frac{A^+_{ua,vis}}{2} = w_1(A', 0) \text{ for } A' \in A^0 \text{ and } \max\{w_2(1), \ldots, w_n(1)\} = d_1 + c_1 \frac{A^+_{ua,vis} + \tilde{A}}{2} = w_1(A', 1) \text{ for } A' \in A^1.$$ Hence, we must have

$$(1 + s)(d_1 + c_1 A^+_{ua,vis}) - \left( d_1 + c_1 \frac{A^+_{ua,vis} + \tilde{A}}{2} \right) = (1 + s)(d_0 + c_0 A^+_{ua,vis}) - \left( d_1 + c_1 \frac{A^+_{ua,vis}}{2} \right) \quad \text{(A.13)}$$

or, equivalently,

$$A^+_{ua,vis} = A^* + \frac{c_1}{c_1 - c_0} \frac{\tilde{A}}{2(1 + s)}. \quad \text{(A.14)}$$

$A^+_{ua,vis} < \tilde{A}$ is ensured by Assumptions 1(i) and 2. Obviously, $A^+_{ua,vis} > A^*$. ||

Finally, note that

$$s > \frac{d_1 + c_1 \frac{\tilde{A}}{2}}{d_0 + c_0} - 1. \quad \text{(A.15)}$$

is a sufficient condition for firm 1 making nonnegative expected profits with the lowest ability type.

**Proof of Proposition 3.** If firm 1 promotes the worker to job $j = 1$, the worker will become visible and his ability publicly observable immediately after the job assignment. In analogy to the corresponding arguments in the proof of Proposition 1, firm 1 wins the wage competition if and only if $w_1(A) \geq d_1 + c_1 A$. As the worker is more productive at firm 1 than at firms $2, \ldots, n$, following assignment to job $j = 1$, firm 1 will
always retain the worker by offering \( w_1(A) = d_1 + c_1 A \), which results in expected profits
\[ E[\pi_1] = (1 - \gamma)s(d_1 + c_1 A). \]
If firm 1 assigns the worker to job \( j = 0 \), the worker remains invisible for firms 2, \ldots, \( n \), unless he leaves firm 1 for exogenous reasons. In the former case firms 2, \ldots, \( n \) cannot compete for the worker’s services, whereas in the latter case firm 1 cannot win the worker back no matter what. Hence, firm 1 offers \( w_1 = 0 \) and generates an expected profit equal to
\[ E[\pi_1] = (1 - \gamma)(1 + s)(d_0 + c_0 A). \]
Comparison of profits reveals that firm 1 promotes the worker to job \( j = 1 \) if and only if
\[ A \geq \frac{s(d_0 - d_1) + d_0}{s(c_1 - c_0) - c_0} : = A_{ka,invis}^+, \]
where \( A_{ka,invis}^+ > A^* \) is obvious and \( A_{ka,invis}^+ < A \) holds by Assumption 1(i) and 2. 

**Proof of Proposition 4.** The proof follows the same steps as the proof of Proposition 2. Note, however, that for the case of invisibility \( \mathcal{A}_0^0 = \emptyset \) by assumption and firm 1 will optimally offer \( w_1(A, 0) = 0 \) for all ability types \( A \in \mathcal{A}_0^0 \). Steps 1 and 3 hold for identical reasons. Step 2 is also true for the case of invisibility since (A.5) holds for \( \max\{w_2(0), \ldots, w_n(0)\} = 0 \) by Assumptions 1(i) and 2. Step 4 follows in a trivial way as \( \mathcal{A}_0^0 = \emptyset \). Step 5 is again identical to the case of visibility and directly implies Step 6.

For Step 7 the calculations change slightly.

**Step 7 (invis):** \( \mathcal{A}_0 = [0, A_{ua,invis}^+] \) and \( \mathcal{A}_1 = [A_{ua,invis}^+, \bar{A}] \) with \( A_{ua,invis}^+ = (s(d_0 - d_1) + d_0 + \frac{A}{2} \bar{A}) \). The fact that \( \mathcal{A}_0^0 \) and \( \mathcal{A}_1^1 \) are intervals follows from the previous steps. The Bertrand nature of wage competition implies that
\[ \max\{w_2(0), \ldots, w_n(0)\} = d_1 + c_1 A_{ua,invis}^+ \bar{A} \]
and
\[ \max\{w_2(1), \ldots, w_n(1)\} = d_1 + c_1 A_{ua,invis}^+ \bar{A} = w_1(A'', 1) \text{ for } A'' \in \mathcal{A}_1^1. \]
At the same time \( w_1(A', 0) = 0 \) for all \( A' \in \mathcal{A}_1^1 \). In equilibrium, firm 1 has to be indifferent between assigning a worker of ability \( A_{ua,invis}^+ \) to job \( j = 0 \) or job \( j = 1 \). Hence, we must have
\[ (1 + s)(d_1 + c_1 A_{ua,invis}^+) - \left( d_1 + c_1 A_{ua,invis}^+ \frac{A}{2} \right) = (1 + s)(d_0 + c_0 A_{ua,invis}^+) \] (A.16)
or, equivalently,
\[ A_{ua,invis}^+ = \frac{s(d_0 - d_1) + d_0 + \frac{A}{2} \bar{A}}{s(c_1 - c_0) - c_0 + \frac{c_1}{2}}. \] (A.17)

The lower bound for \( s \) given by Assumption 1(i), together with Assumption 2, implies that the denominator of \( A_{ua,invis}^+ \) is always strictly positive. Analogously,
\[ A_{ua,invis}^+ - A^* = \frac{(d_0 + d_1) c_1 - 2d_1 c_0 + (c_1 - c_0) \bar{A}c_1}{2 (c_1 - c_0) (s (c_1 - c_0) - c_0 + \frac{c_1}{2})} \]
is strictly positive. Thus \( A_{ua,invis}^+ > A^* \). \( \square \)

\[ ^{22} \text{Note that Assumptions 1(i) and 2 imply that the denominator is positive.} \]
Proof of Corollary 1. It has been shown that $A_{ua,vis}^+$ and $A_{ka,invis}^+$ are larger than $A^*$. It is left to show that $A_{ua,vis}^+ > \max\{A_{ua,vis}^+, A_{ka,invis}^+\}$. First we show that $A_{ua,vis}^+ > A_{ua,vis}^+$, that is:

\[
\frac{2(1+s)(d_0-d_1)+2d_1+c_1\bar{A}}{2(1+s)(c_1-c_0)-c_1} > \frac{2(1+s)(d_0-d_1)+c_1\bar{A}}{2(1+s)(c_1-c_0)}
\]

This is clearly the case as the denominator of the right hand side is smaller and the numerator is larger than the ones of the left hand side.

Next we show that $A_{ua,vis}^+ > A_{ka,invis}^+$ also holds. That is:

\[
\frac{(1+s)d_0-sd_1+c\bar{A}}{sc_1-(1+s)c_0+c\overline{A}} > \frac{(1+s)d_0-sd_1}{sc_1-(1+s)c_0} \iff \bar{A} > \frac{(1+s)d_0-sd_1}{sc_1-(1+s)c_0} \iff \bar{A} > A_{ka,invis}^+,
\]

which is true.

Proof of Corollary 2. In Scenario I, expected wage payments of the current employer amount to $E[d_1 + c_1A] = d_1 + c_1\bar{A}$. The expected wage payments in Scenario II are given by

\[
P\left(A < A_{ua,vis}^+\right) \left(d_1 + c_1\frac{A_{ua,vis}^+}{2}\right) + P\left(A \geq A_{ua,vis}^+\right) \left(d_1 + c_1\frac{A_{ua,vis}^+ + \bar{A}}{2}\right)
\]

\[
= \frac{A_{ua,vis}^+}{\bar{A}} \left(d_1 + c_1\frac{A_{ua,vis}^+}{2}\right) + \left(1 - \frac{A_{ua,vis}^+}{\bar{A}}\right) \left(d_1 + c_1\frac{A_{ua,vis}^+ + \bar{A}}{2}\right)
\]

\[
= d_1 + \frac{\bar{A}}{2}c_1.
\]

As, due to inefficient promotion, the current employer’s expected output is lower in Scenario II than in Scenario I, her expected profits will be lower if the worker’s ability is unknown to the market firms compared to a situation with symmetric information.

In Scenarios I and III, the expected wage offers of the market firms are identical, because in both scenarios the market firms perfectly know the worker’s ability. Thus, in Scenario III, the current employer could mimic her optimal personnel policy from Scenario I. However, as Proposition 3 shows, the current employer strictly prefers not to promote efficiently, because the first-order advantage of zero wage costs dominates the second-order disadvantage of inefficient job assignment for worker abilities that are slightly higher than $A^*$. In consequence, expected profits of the current employer are larger in Scenario III than in Scenario I.

As, in equilibrium, the worker always stays with his current employer, the expected profits of the market firms will be zero in each of the four scenarios.