EQUILIBRIUM EFFECTS OF PAY TRANSPARENCY
IN A SIMPLr LABOR MARKET∗

Zoë B Cullen† and Bobak Pakzad-Hurson‡

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Public discourse on pay transparency has not focused on equilibrium effects: how greater transparency impacts hiring and bargaining. To study these effects, we combine a dynamic wage-bargaining model with data from online markets for low-skill, temporary jobs that differ in their level of transparency. Wages are more equal, but lower under transparency. Transparency increases hiring and employer profits, rising 27% in an online field experiment. A key intuition is high transparency commits employers to negotiating aggressively, because a highly paid worker’s salary affects negotiations with other workers. We discuss implications for the gender wage gap and employers’ endogenous transparency choices.

Keywords: Pay Transparency, Negotiation, Online Labor Market, Privacy, Wage Gap

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†Cullen: Harvard Business School, Rock Center, Soldiers Field, Boston, MA 02163, zcullen@hbs.edu
‡Pakzad-Hurson: Brown University, 64 Waterman Street, Providence RI 02912, bph@brown.edu
I. Introduction

Private information can have a large effect on the outcomes of negotiations, and in imperfectly competitive labor markets, it can lead to high levels of inequality (Manning, 2005). Pay transparency laws aim to increase workers’ knowledge of the pay of their peers to ensure “victims of pay discrimination can effectively challenge unequal pay” through negotiations, by informing them of their employer’s willingness to pay for labor (Phillips, 2009). But the equilibrium impacts of increasing transparency, namely how firms might change their hiring and wage-setting policies and how workers might adjust their bargaining strategies, are not well understood.\(^1\) Despite this, 13 states have passed laws preventing employers from punishing workers who discuss wages with coworkers (Siniscalco et al., 2017) and California now requires employers to provide the range of salaries it pays current workers to prospective employees (Pender, 2017). The level of transparency in alternative work arrangements and jobs arranged through online labor markets—engaging 7% of the US workforce (14 million people) (Robles and McGee, 2016)—is less regulated. Among the design choices that online labor platforms face is whether to make past contracts visible, and who can communicate with each other about pay.

Our paper tests the equilibrium impact of pay transparency policies on wage negotiations, hiring, and profits in the context of online labor markets. Because of the short duration of jobs, we can see transparency propagating through the market on an observable timeline and a level of detail about the wage negotiations between thousands of employers and workers that goes unrecorded in other settings. We combine a dynamic wage-bargaining model, administrative data from TaskRabbit, an online platform over which employers and workers negotiate temporary work contracts, and a field experiment involving online labor market participants. We find that higher transparency leads to more equal pay across workers, but lowers wages on average. Hiring increases for the typical employer, as do profits. As a guide to readers, Table I provides a roadmap for our theoretical and empirical results on each of these effects of transparency.

To introduce the mechanisms we study in this paper, consider an employer and a worker when they first bargain over a wage. Neither party knows the exact value of the relationship to the other. If pay is transparent within the firm, the employer reasons that if she pays a high wage to the worker, other workers may learn this information and use it in future negotiations.\(^2\) Therefore, the employer will bargain aggressively to drive the wage down, and

\(^1\)In a recent paper, Mas (2017, page 1718) states, “More work could also be done to investigate other effects of pay disclosure...and whether transparency changes the relative bargaining of workers and employers in wage setting.”

\(^2\)For example, Caldwell and Harmon (2019) present empirical evidence from Denmark that workers renegotiate their wages on the job after learning new wage information.
may decline to hire the worker at all if he asks for too high a wage. The worker similarly anticipates information spillovers; he expects to learn the wages of his peers quickly, and will then use the information of what the employer has paid others to renegotiate a higher wage for himself. Therefore, it is less important for the worker to secure a high wage in this initial negotiation, so he bargains more passively to ensure that he is hired.

We present a simple baseline model of dynamic wage negotiation in the presence of transparency, which we extend in many ways. A continuum of workers individually bargain for wages with a firm in continuous time. Bargaining takes the form of directed take-it-or-leave-it (TIOLI) offers from each worker to the firm. Once employed, workers are able to renegotiate with the firm at will. Whenever an offer is rejected, the worker making that offer is permanently unmatched with the firm and receives her heterogeneous, exogenous outside option.\(^3\)

Over time workers stochastically learn the wages of their peers. The arrival rate of wage information characterizes the level of transparency; with higher levels of transparency, wage information arrives more quickly. Workers learn the wages of coworkers immediately under full transparency, and workers never learn the wages of peers under full privacy. Workers do not know their value to the firm. Therefore, learning that an equally productive coworker is earning a higher wage reveals the firm’s private information to a worker.

In equilibrium, and regardless of the level of transparency, a worker will only choose to renegotiate her wage once she learns the pay of her peers. When she learns this information, she will (successfully) use it in renegotiations to raise her own wage to the highest wage she observes. Therefore, transparency causes an information externality, as one worker’s wage can affect the renegotiations of others.

Transparency affects the frequency of renegotiations, which alters bargaining power through two equilibrium effects: a demand effect and a supply effect. As transparency rises, the firm’s maximum willingness to pay for labor falls because a raise in pay for one worker is learned by others and used to renegotiate (demand effect).\(^4\) At the same time, workers make lower initial offers to increase their chances of getting a foot in the door because they know they will quickly learn about the wages of others and be able to renegotiate without risk (supply effect). These effects are present in static double auction models, first studied by Chatterjee and Samuelson (1983).\(^5\)

\(^3\)Farrell and Greig (2016) find that online labor platform users earn on average one-third of their total income on platform, leading to heterogeneous outside options based on earnings off the platform.

\(^4\)Another interpretation of the demand effect is that with increased transparency the firm becomes more concerned with the ratchet effect (Weitzman, 1980)–the firm mimics a lower productivity type to avoid workers discovering the true productivity of the firm and demanding a higher wage in future negotiations. For references to recent work on the ratchet effect, see Cardella and Depew (2018).

\(^5\)In their model, a buyer and a seller have private values for a particular good. Both agents simultaneously place bids, and if the bid of the buyer is higher than that of the seller, the two exchange the good at a price
frequently contain analogues of one of these effects, but not, to our knowledge, both. In the well-known chain store game, Kreps and Wilson (1982) and Milgrom and Roberts (1982) show that costly, predatory behavior against early competitors may be optimal in order to create a reputation favorable for later negotiations (demand effect). Kuhn and Gu (1998, 1999) show that unions optimally delay making contract offers to employers so that they can freeride on information gathered from the negotiations of others (supply effect). Our setting includes both of these effects, which cause simultaneous adjustment of bargaining strategies by workers and the firm in response to changes in transparency. This leads to novel equilibrium predictions:

Earnings are more equal with higher transparency, as workers renegotiate to a common wage. Because workers have heterogenous outside options, this implies worker surplus, the difference between earnings and outside option, is more dispersed with higher transparency.

Transparency increases the share of workers hired by the firm if and only if the firm’s value for labor is sufficiently low. Lower initial offers mean that a low-value firm can (and does) feasibly hire more workers, while a high-value firm will decline to hire workers with high wage offers to avoid information spillovers. This suggests that transparency mandates will be more effective at creating low-paying jobs within a particular industry. We also show more generally that either full privacy or full transparency minimizes the expected hiring rate, and we find the level of partial transparency that maximizes the expected hiring rate.

Pay transparency also changes the division of surplus between workers and the firm, leading to lower wages which benefit the firm at the workers’ expense. The demand effect that is a predetermined convex combination of the two bids. We show a connection between the equilibria of our dynamic bargaining model and the equilibria of the static double auction model using data from post-auction bargaining over used cars.

Gu and Kuhn (1998) show that an analogue of the demand effect may be present in this setting, although they do not consider both effects simultaneously.

Our model can be adapted to understand the effect of hiding or revealing previous worker wages. Between 2016 and 2018, 9 states and municipalities passed laws that prohibit employers from requesting past salary information of potential employees during the hiring process (Cain et al., 2018), while internet platforms have done the opposite—eLance and UpWork now both include accounts of past contract payments on worker profiles. Please see Section III.E and Appendix H for details.

Bewley (1999), Abowd et al. (1999), and, more recently, Song et al. (2019) show that wages within firms are compressed relative to the wages across firms. Our paper may provide a microfoundation for these findings: wages are compressed within firm because employees rebargain to a common wage upon learning the firm’s willingness to pay for labor through transparency.

The positive effect of transparency on hiring is perhaps surprising given results of related models. Brancaccio et al. (2017) and Hörner and Vieille (2009) study bargaining in markets with private information. Both find that transparency decreases (or prevents) the number of transactions.

Faminow and Benson (1987), Kühn and Vives (1995), Alæk et al. (1997), and Nilsson (1999) demonstrate instances in which price transparency among consumers can lead to increased prices (and firm profits) due to collusion in oligopolistic settings. This mirrors our finding that transparency increases firm profits, although our result is not due to collusion between competing firms.
allows the firm to commit to rejecting high wage offers to strengthen its bargaining position in renegotiations. Simultaneously, the supply effect causes workers to demand smaller markups over their outside options as transparency increases. The combination of these two forces shifts the de facto bargaining power to the firm. Under full transparency, workers learn the maximum wage the firm is willing to pay immediately upon matching with the firm. Each worker will either choose to work at this wage or take her outside option. Therefore, the equilibrium outcome under full transparency is the same as a monopsonistic firm posting a wage. Because of this, full transparency maximizes firm expected profits and minimizes worker surplus and wages (Myerson, 1981; Williams, 1987). However, raising transparency partially can benefit workers with low outside options, and we may expect support for transparency laws among these workers.

If instead the firm endogenously picks the level of transparency then this choice signals the firm’s value for labor, affecting how workers negotiate. This leads to a unique equilibrium outcome in which the firm pools on full transparency regardless of its value of labor. The cause of this is unraveling (Milgrom, 1981). If low-value firm types were to maintain pay privacy, they would earn zero profits, as workers would always offer more than the firm’s value for labor. Instead, any of these low-value firm types could deviate to full transparency, effectively posting a wage below its value to ensure positive profits. But this causes workers to raise their offers when they do not encounter full transparency, resulting in new “low-value firm types” that receive zero profits by maintaining pay privacy. This logic can be iteratively applied until the firm chooses full transparency for any value.

Back-end data from TaskRabbit allows us to study and verify these equilibrium effects in an environment uncomplicated by pecuniary benefits or career concerns. Most jobs on the platform are low-skill, standardized tasks that clear quickly through a worker-bidding assignment process. Jobs are typically carried out in person. Each accepted bid serves as a binding wage floor, but the employer can pay a bonus to any worker after the job is completed, allowing for the possibility of wage renegotiations on the job. We observe all transactions on the platform between 2010 and 2014, as well as job postings, worker bids, on-the-job bonuses, employer ratings of workers, and worker and employer demographics. While the platform itself is 10 years old, the employers using the platform range from older and more established firms, including approximately 10% of Fortune 500 companies, to household employers (comprising roughly one quarter of our sample).

The amount of pay transparency varies across jobs for reasons unrelated to the deliberate

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11Because of this equilibrium outcome, our theory unifies previous results from a variety of models (and our empirical evidence corroborates these findings). For example: Michelacci and Suarez (2006) show that bargaining leads to more dispersed wages (our Theorem 1); Ellingsen and Rosén (2003) find wage posting is more effective when reservation wages are low (an implication of our Theorem 2); Brenzel et al. (2013) suggest that bargaining may lead to higher average worker wages (our Theorem 3).
choice for pay transparency. We show there is partial transparency when coworkers are physically co-located while carrying out the task and can communicate about pay through word of mouth. Co-location can vary due to the nature of the job, even while all other aspects of the job remain the same. For example it may be necessary for two workers to distribute marketing materials in the same location or different locations depending on where clients are during a particular shift.

Our bargaining model has implications for the difference between the initial wage agreed to and the eventual wage negotiated under partial transparency, both of which we observe. First, workers should receive the same final wage as the highest earner if they renegotiate. Second, initial wage differences between coworkers should be uncorrelated with whether or not a worker negotiates a raise, because the arrival of information is uncorrelated with wage differences.\textsuperscript{12} Our data verify these claims. When workers are co-located and employers adjust final wages above the initial wages, final wages are nearly completely equal. Also, inequality between workers’ initial wages does not predict whether or not a worker renegotiates at all.

We rule out alternative mechanisms for the wage equalization patterns we observe, such as employer preference for equal wages and productivity spillovers between workers equalizing observable output. We also endogenize effort costs and embed worker social preferences into our model to study the psychological cost workers face after learning they are underpaid, which potentially leads to low morale and low effort (higher probability of leaving the job) (Akerlof and Yellen, 1990).\textsuperscript{13} As a result, proactive employers may raise and equalize the wages of workers in pay transparent environments. We model these morale concerns as in DellaVigna et al. (2016) and Breza et al. (2018), and find that nearly all specifications predict a relationship between the extent of inequality of coworker initial wages and the likelihood of wage equalization, which we do not observe in our data. Without the presence of a bargaining channel, only very extreme and discontinuous morale cost functions replicate our empirical findings of full wage equalization. Morale costs must be so severe that all workers quit the job (expend 0 effort) upon finding out they are paid even small amounts less than a peer. We produce evidence (described in Section VI) that documents a morale effect on effort, but not enough of one to explain the observed equalization patterns. Previous work (e.g. Breza et al. (2018); Charness and Kuhn (2007); Gächter and Thöni (2010)) also does not find the required extreme morale responses to explain the wage equalization we observe.

\textsuperscript{12}Cullen and Perez-Truglia (2019) document the diffusion of pay information. Knowledge about the pay of others, and ability to ask others about their pay, appears uncorrelated with relative pay.

\textsuperscript{13}Card et al. (2012), Mas (2017), Mas (2016), Perez-Truglia (2016), and Breza et al. (2018) conduct field and natural experiments on transparency, and document dissatisfaction upon learning of peers with higher pay. Charness and Kuhn (2007), Gächter and Thöni (2010), and Greiner et al. (2011) investigate similar claims in laboratory settings.
TaskRabbit data also allow us to study the endogenous choice of employers to select full transparency. In single-worker jobs, the employer can choose to be fully transparent in two ways: by publicly posting a price along with the job description, or by mentioning a wage in the text of a job descriptions. In line with our model, we show that employers who select full transparency transact at lower wages. The very same workers bid hourly wages 7.8% lower for work in the same job category when the job description mentions price expectation up front.

We also observe the market unraveling towards higher levels of pay transparency across all employers, as our theory predicts. TaskRabbit staggered its entry into metropolitan areas across the U.S., creating segregated markets of various levels of maturity. Across all markets, we observe a striking linear progression toward the use of transparent, posted wages month over month. For every month on the platform, the fraction of jobs using a transparent posted price increases by 1%. In line with our theory, lower income employers are most likely to switch to transparent posted prices. This trend is not explained by the changing composition or number of jobs on the platform. For comparison, over two-thirds of the broader U.S. workforce faced transparent posted wages in 2008 (Hall and Krueger, 2012), and more recent surveys of HR professionals suggest the trend toward voluntary pay transparency has picked up pace, particularly in the tech industry (Loudenback, 2017).^{14}

We run a field experiment to measure worker welfare, and to observe the division of surplus.^{15} Across all treatments, we hire 365 managers and 964 workers from an online labor market, Amazon Mechanical Turk, who are tasked with negotiating wages for, and carrying out, transcription services that take half a work day to complete on average. We elicit outside options from workers, and assign a budget to managers, who are the residual claimants of that budget after paying wages. We randomize transparency by restricting wage negotiations to either a common chat room or split chat room, where the only difference is whether coworkers can observe the negotiations with other workers. We document all interactions in these chat rooms, and we place no restrictions on the ways in which workers and managers can bargain.

Our field experiment results corroborate our theoretical findings and TaskRabbit analyses: pay is equalized when workers negotiate in a common chat room 100% of the time, compared to 60% of the time in private chat rooms. In the common chat room, manager profits are 27% higher, wages 7.4% lower, and hiring (the share of workers who reach an agreement with the employer) rises by more than 10%. Worker surplus is lower and more dispersed, both of which are predicted by our theory. Productivity levels are similar across

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^{14}According to LinkedIn’s Global Talent Trends 2019 report, just as many HR and hiring professionals say they are likely to start sharing salary ranges with employees within the next 5 years as currently self-report sharing in 2019 (Chanler et al., 2019).

^{15}Another motivation for the experiment is replicability. The experiment is automated, and can be replicated using our code in a matter of days.
the two groups.

We consider the effects of worker heterogeneity along gender lines. We find in our experi-
ment that women have outside options approximately 15% lower than those of men on
average. Bids for work reflect these differences. We find that the gender pay gap caused by
this difference in outside options is mitigated by higher levels of transparency. However, we
also find men are more likely to receive bonuses than women when there are communication
channels between workers on TaskRabbit. Guided by empirical evidence, we include com-
munication heterogeneity between genders into our model and show that partial transparency
can lead to very different arrival rates of wage information for men and women, potentially
increasing the gender pay gap. This finding may give pause to those who advocate commu-
nication about pay to mitigate the gender pay gap. Men’s communication advantage over
women would disappear under full transparency, and we show in our experimental data that
full transparency relatively benefits women by closing the gender gap.

The closest empirical literature to our paper focuses on publicly-mandated full trans-
parency of individual pay. Card et al. (2012) experimentally nudge some University of
California employees to visit a list of salaries published online and return to participants one
week later to find aggregate worker satisfaction falls, and self-reported job search rises. Mas
(2017) shows that top earners in municipal jobs experience a drop in nominal wages following
the public revelation of wages, which he attributes to public aversion to visibly exorbitant
salaries. Baker et al. (2019) use data from Canadian university employees to show that
mandated transparency leads to lower wages and a smaller gender wage gap, mirroring our
theoretical and empirical findings. Our analysis is based on a simpler labor market than in
these prior studies. There are at least two important features of our setting to consider when
determining where our results apply beyond the context of online labor markets. First, work
is short term and hence interpersonal comparisons in these short-lived relationships may not
be as influential. We measure the productivity loss when workers see each others wages but
are not allowed to renegotiate, a measure of the morale response to pay comparisons, and
find similar results in our experiment and longer-term work settings in Breza et al. (2018)
and Cullen and Perez-Truglia (2018). Second, workers complete more standard, low-skill
tasks than in the general population, and their relative productivities may be more easily

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16This is consistent with survey evidence that women are more private about wages than men (Goldfarb
and Tucker, 2011) and that women are less informed about the market value of labor than men (Babcock
and Laschever, 2003).

17Baker et al. (2019) and Bennedsen et al. (2018) find that gender wage gaps decrease with the adoption of
transparency policies. They also find that transparency decreases wage levels on average, which is consistent
with our findings on the effect of transparency on wages.

18Another literature focuses on public disclosure of executive compensation in private sector jobs (Faulk-
ender and Yang, 2013; Mas, 2016; Schmidt, 2012). Among the key mechanisms identified is the benchmarking
of executive pay against rival executives, and the fear of public backlash against extreme inequality.
observed. We extend our model to allow for unobserved productivity differences between
workers in Section VIII. While the equilibrium outcome under full transparency is not identi-
cal to a single posted wage, we show that the presence of unobserved productivity differences
does not change (quantitatively or qualitatively) the expected impact of pay transparency.
However we do not have an empirical analogue to test our predictions in a setting with highly
varied worker productivities.

Here we discuss some boundary conditions for our model. First, individual workers must
have some bargaining power. We show that our predictions extend to various bargaining
environments (Appendix F and our experiment) including a search model with multiple
firms and matching frictions (Appendix C). In each of these extensions, workers’ bargaining
power affects the magnitude of transparency’s impact, but not the direction of the effect.
Individual workers have no bargaining power in perfectly competitive labor markets in which
all agents are price takers, or markets where wages are determined by a third party, such as
a union or centralized clearinghouse. Our model does not extend to these settings. Second,
our predictions will not be valid for firms with values for labor exceeding all worker outside
options. We extend the model to these superstar firms and show theoretically and empirically
how the predictions change (see Appendix I for details).

The remainder of the paper is organized as follows. Section II lays out our model. Section
III presents our main theoretical findings. Section IV describes the TaskRabbit market and
contains empirical tests of our main findings using TaskRabbit data. Section V discusses our
field experiment and related findings. Section VI examines an alternative model based on
the fair wage-effort hypothesis and morale costs associated with pay transparency. Section
VII investigates heterogeneity of workers across gender lines, and the effects of transparency
on the gender pay gap. Section VIII extends our model and main results to settings in
which workers have heterogeneous, and unobservable productivity differences. Section IX
concludes. Omitted proofs, regression tables, and extensions are contained in the Appendix.

II. Model

II.A. Preliminaries

We propose and analyze a simple model of dynamic wage negotiations which mirrors the
bargaining process on TaskRabbit. The relative simplicity of TaskRabbit allows for many
generalizations and extensions of our model which preserve our main findings, as we discuss
in Sections VII and VIII, and Appendices C - F.

Time is continuous, and is indexed by $t \in \mathbb{R}_+$. There is a single firm in the economy.
At each time $t$, a mass of workers enters the market, and each existing worker exogenously
departs the market via a Poisson process with rate $\rho$. Each worker has a publicly observable type $\tau \in T$ where $T$ is some countable set. Let $v_\tau \sim F_\tau[0,1]$ be the productivity of type $\tau$ workers, which is known only to the firm. Each worker $i$ of type $\tau$ also has a private outside option $\theta_i \sim G_\tau[0,1]$, which is the flow payment $i$ receives when not matched to the firm. To simplify notation, we assume for the majority of the analysis that $|T| = 1$, that is, all workers are equally productive with productivity $v \sim F[0,1]$ and outside option distribution $G$. This simplification does not meaningfully impact our findings. We discuss the case in which workers are heterogeneously productive and can be misinformed about their productivities in Section VIII.

The firm has a constant returns to scale production function, and receives a flow surplus $v$ from each employed worker. All agents exponentially discount the future at rate $\delta$, are risk neutral, and seek to maximize discounted expected flow payments. We assume that $F$ and $G$ are twice continuously differentiable over the interior of their supports, with densities $f$ and $g$, respectively. We also assume agents have strictly increasing virtual reservation values, i.e. $\theta + \frac{G(\theta)}{g(\theta)}$ is strictly increasing in $\theta$ and $v - \frac{1-F(v)}{f(v)}$ is strictly increasing in $v$.

Before any workers arrive, the firm selects a maximum wage it is willing to pay $\bar{w}(v) \in [0,1]$. $\bar{w}$ is not immediately observed by workers. Workers bargain through a series of take-it-or-leave-it (TIOLI) offers to the firm. Each worker $i$ makes an initial offer $w_i^*(\theta_i) \in [0,1]$ to the firm at the first moment she is hired, and can elect to make further TIOLI offers at any point during her employment, potentially renegotiating infinitely often. Two things can happen when a worker $i$ makes a wage offer $w_{i,t}$ at time $t$. If $w_{i,t} \leq \bar{w}$ then $i$ receives a flow wage $w_{i,t}$ for all time periods $t' \geq t$ until she departs the market or attempts to renegotiate. If $w_{i,t} > \bar{w}$ then $i$ is permanently unmatched with the firm for all time periods $t' \geq t$ and consumes her outside option until she departs.

We model transparency as the random arrival of information about current wages. At time $t$ each matched worker observes the set of wages the firm pays to currently employed workers, $W_t$, according to an independent Poisson arrival process with (commonly known) rate $\lambda \in [0, \infty) \cup \{\infty\}$, where we take $\lambda = \infty$ to mean that the process arrives at every time $t$. For convenience, we assume that $W_t \equiv \bar{w}$ if the firm does not have any currently employed workers.

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19There is a known measurability issue with the assumption of a continuum of i.i.d. random variables (Judd, 1985). A solution is to assume that worker outside options are drawn “almost” i.i.d. in the sense of Sun (2006). This solves the measureability issue and has the intuitive and intended property that the distribution of realized outside options is given by the same function $G_\tau(\cdot)$.

20Clearly some bargaining friction must exist, or else workers could always ensure payments of $\bar{w}$ arbitrarily quickly by starting at wage 0, and continuously increasing offers until exceeding $\bar{w}$ and getting rejected, then renegotiating for exactly that amount. The current assumption adds a draconian friction, but one that fits our context—if initial wages are set through a bidding process (as in TaskRabbit), those who bid too high will be rejected without the ability to readjust the bid. In Appendix E we generalize the game to allow for smaller frictions in the rebargaining stage, and show that all of our results are unchanged in this setting.
workers.\footnote{Without this assumption, the first cohort of workers in the full transparency equilibrium face an openness issue of wanting to renegotiate wages at the earliest time $t > 0$. It is also possible to complicate the timing of the game to resolve this issue, but at the expense of clarity.} Therefore, higher $\lambda$ corresponds to more transparency.\footnote{Alternatively, if workers are not able to initiate renegotiation at will (e.g. workers have to wait for a scheduled performance review to renegotiate), $\lambda$ can be thought of as the rate at which workers both learn the wages of their peers and have the ability to renegotiate.}

The timing of the stage game is as follows at each time $t \geq 0$: 

1. New workers enter the market and are matched with the firm. 
2. Each matched worker $i$ learns $W_t$ independently with arrival rate $\lambda$. 
3. Workers bargain according to the TIOLI protocol laid out above. 
4. Existing workers depart independently at rate $\rho$. 

In Appendix C we expand our model to allow workers to search for work across multiple firms, and show that many results are robust to this extension. In Appendix D we allow the firm to accept or reject each offer individually as it arrives, instead of picking a single $\bar{w}$ at $t = 0$, and show that all results of this paper are unchanged under a selection of “Markov Perfect” equilibria. In Appendix E we allow the firm to reject worker renegotiation offers at cost but without permanently unmatching, and find an equilibrium of this game that mirrors that of the base model. In Appendix F we analyze alternative bargaining protocols, including one that allows for firm counteroffers, and show that our results are robust to these settings.

II.B. Equilibrium

We investigate pure strategy perfect Bayesian equilibria (PBE) of the game. We restrict our attention to equilibria satisfying the following conditions:

A1 $\bar{w}$ and $w^*_i$ are strictly increasing and continuous functions of $v$ and $\theta_i$, respectively.

A2 $0 \leq \bar{w} \leq v$ for all $v$. If $v \leq w^*_i$ for every worker $i$ according to equilibrium strategies then $\bar{w} = v$.

A3 $\theta_i \leq w^*_i \leq 1$ for all $i$. If there is no $v$ such that $\theta_i \leq \bar{w}$ according equilibrium strategies then $w^*_i = \theta_i$.

A4 At any time $t$, any worker $i$ who makes an offer $w_{i,t}$ that should have been rejected according to equilibrium strategies but is not, believes with probability 1 that $\bar{w} = w_{i,t}$ until observing the wages of others via the transparency process.
Along equilibrium path, if any worker $i$ renegotiates at time $t' > t$ then $w_{i,t'} > w_{i,t}$.

A1 limits our study to continuous equilibria, in which the highest wage the firm accepts ($\bar{w}$) and the initial wage offers of workers ($w_i^*$) are continuous functions of agents’ types. This removes equilibria in which workers and the firm pool on a predetermined wage from consideration. A2 and A3 restrict actions of agents who never match in equilibrium, because either the firm’s value for labor is too low or the worker’s outside option is too high. These assumptions rule out pathological equilibria in which, for example, $\bar{w} = 0$ for all $v$ and all workers choose $w_i^* = 1$.

A4 deals with histories that do not occur in equilibrium, and pins down off-equilibrium-path beliefs. If a worker makes an offer that is higher than the highest offer the firm is supposed to accept in equilibrium, yet the offer is accepted, the worker believes she is extremely lucky and is receiving the highest possible wage until she is presented with evidence to the contrary. These are the most favorable beliefs to the firm allowable in a PBE, so any equilibrium sustainable under A4 is sustainable for any off-path beliefs.

A5 rules out a multiplicity of essentially equivalent equilibria in which workers “renegotiate” infinitely often by offering the same wage over and over again.

As we will show, A1-4 only play a role in our analysis for partial transparency levels $\lambda \in (0, \infty)$. If one is only interested in comparing full privacy to full transparency, these assumptions are not necessary.

II.C. Renegotiation

We find that in equilibrium, workers renegotiate wages at most once.

**Proposition 1.** The set of equilibria is non-empty. In any equilibrium workers only renegotiate wages in the first instant they receive information about wages of coworkers. Upon renegotiating, workers offer and receive $\bar{w}$.

The key step in proving this result is showing that a worker does not learn exploitable information about $\bar{w}$ if her initial offer is accepted. Any worker strategy that says “offer $w$ when initially hired at time $t$ and offer $w' > w$ at time $t' > t$ if I have not learned the wages of my coworkers” is not optimal, because if offering $w'$ at time $t'$ improves the expected utility of the worker, she would be even better off offering $w'$ at time $t$.

Due to the continuum of workers entering the market at each time, in addition to our equilibrium selection criteria, workers trace out the set $[a, 1]$ for some $a > 0$ with their initial

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23Leininger et al. (1989) suggest similarities between the set of continuous equilibria and a set of discontinuous equilibria of a game similar to our own, and so we do not believe this to be a conceptually limiting constraint. We discuss this similarity in Section II.D.

24This reasoning is shared in Lazear (1986) and Tirole (2016).
offers at each time $t$. Therefore, the highest wage paid by the firm (assuming it hires a positive measure of workers) is $\bar{w}$ for all $t \geq 0$. As a result, the maximum wage that any worker observes upon information arrival is $\bar{w}$. The worker will then demand this amount from the firm.

II.D. Solving for equilibrium

An employed worker will receive $w_i^*$ for the periods she is employed before learning the wages of her peers, and $\bar{w}$ thereafter. Letting $\bar{F}(x) = P(\bar{w} \leq x)$, and $\bar{G}(x) = P(w_i^* \leq x)$, we show in Appendix B that each worker solves

$$w_i^* = \arg\max_{w_i} \int_0^1 \left((1 - \Lambda) w_i + \Lambda x - \theta_i\right) \bar{f}(x) dx$$

and the firm solves

$$\bar{w} = \arg\max_{w} \int_0^w \left(v - (1 - \Lambda) y - \Lambda w\right) \bar{g}(y) dy$$

where $\Lambda = \frac{\Lambda}{\rho + \delta + \lambda}$ for all $\lambda \in [0, \infty)$ and $\Lambda \equiv 1$ for $\lambda = \infty$. $\lambda$ is the arrival rate of information, and $\Lambda$ is the effective level of transparency.

With the exception of Section VII, we use $\Lambda$ to represent transparency in the rest of the paper. The reason is that this parameter encapsulates the relevant information from agents’ perspectives. A high rate of information arrival $\lambda$ will be unimportant to workers if the discount rate $\delta$ and/or departure rate $\rho$ are sufficiently higher than $\lambda$. $\lambda = \Lambda = 0$ corresponds to full privacy, while $\lambda = \infty$ and $\Lambda = 1$ correspond to full transparency. There are uncountably many combinations of parameters $\delta, \rho, \lambda$ that correspond to any $\Lambda \in (0, 1)$. However, fixing $\rho$ and $\delta$, there is a bijection between $\lambda$ and $\Lambda$ with higher $\lambda$ corresponding to higher $\Lambda$.

Equations 1 and 2 are the same objective functions as those in the well-known Chatterjee and Samuelson (1983) double auction in which a seller (worker) with a private value for a good ($\theta_i$) and a buyer (firm) with a private value for a good ($v$) submit sealed bids. If the bid of the buyer is at least as large as that of the seller, the good switches hands at a price set by a predetermined convex combination of the two bids (determined by $\Lambda$). Therefore, the equilibria of our model coincide with the equilibria of Chatterjee and Samuelson (1983), in which higher transparency shifts the average wage of employed workers toward the maximum wage set by the firm, $\bar{w}$. The first order conditions for workers and the firm are, respectively:
\[ w_i^* - \theta_i = (1 - \Lambda) \cdot \frac{1 - \bar{F}(w_i^*)}{f(w_i^*)} \]  
\[ v - \bar{w} = \Lambda \cdot \frac{G(\bar{w})}{g(\bar{w})} \]

The set of equilibria corresponds to solutions of the first order equations, and given the equilibrium strategy of the firm, workers have a unique best response, and vice versa (Satterthwaite and Williams, 1989).

The optimal bidding and wage-setting policies of workers and the firm, respectively, are interdependent for any level of partial transparency \( \Lambda \in (0, 1) \). Workers decide how aggressively to bid depending on how the firm sets \( \bar{w} \), while the firm sets \( \bar{w} \) as a function of how aggressively the workers bid. While there exists a unique equilibrium when \( \Lambda \in \{0, 1\} \), Satterthwaite and Williams (1989) show that there exists a continuum of equilibria satisfying Equations 3 and 4 for \( \Lambda \in (0, 1) \). This set lacks natural ordering, limiting the possibility for general claims about the entire set of equilibria. However, experimental evidence in Radner and Schotter (1989) suggests that equilibria in which \( w_i^* \) and \( \bar{w} \) are linear functions of \( \theta_i \) and \( v \), are focal and most likely to be played in practice. We produce similar evidence, shown in Figure I3. We use this evidence as our equilibrium selection criterion, and therefore, we focus our analysis on linear equilibria. To do so, we restrict attention to a two-parameter family of power law distributions of worker outside options and firm values, which we show admit a unique linear equilibrium.\textsuperscript{25} We then study the properties of this equilibrium, and analyze the effects of transparency. The class of distributions we study are:

\[ F(v) = 1 - (1 - v)^r, \quad r > 0 \]
\[ G(\theta) = \theta^s, \quad s > 0 \]

As \( r \) increases, \( v \) is on average lower and as \( s \) increases, \( \theta \) is on average higher. Therefore, increasing \( r \) or \( s \) reduces the average surplus from employment. We define a linear equilibrium below and show that distributions of this type admit a unique linear equilibrium. We note again that these distributional restrictions are unnecessary if one is only interested in comparing full transparency to full privacy.

\textsuperscript{25}The approach of making parametric assumptions to ensure linear equilibrium is common. One recent example on CEO pay is Edmans et al. (2012). Power law distributions are commonly observed in economic situations such as ours, including worker income and firm productivities. See Gabaix (2009, 2016) for details.
Definition 1. A linear equilibrium is a pure strategy perfect Bayesian equilibrium satisfying A1-5, where \( \bar{w} \) is a linear function of \( v \) whenever a positive mass of workers offers \( w^*_i \leq v \), and where \( w^*_i \) is a linear function of \( \theta_i \) whenever there is positive probability that \( \theta_i \leq \bar{w} \).

Proposition 2. For any pair of distributions within the family described in Equation 5 there exists a unique linear equilibrium.

II.E. Supply and Demand effects

Workers initially offer premia over their outside options, \( w^*_i - \theta_i \geq 0 \). Similarly, the firm sets a markdown below its value for labor, \( v - \bar{w} \geq 0 \). We show that both \( \bar{w} \) and \( w^*_i \) are decreasing in \( \Lambda \); with increased transparency the firm reduces the highest wage offer it accepts to avoid information spillovers across workers (which we call the demand effect), and workers make more conservative initial offers as they anticipate quickly, and risklessly renegotiating and receiving \( \bar{w} \) (which we call the supply effect). We graphically represent the demand and supply effects in Figure II as \( \Lambda \) increases, and the following proposition formalizes these arguments.

Proposition 3. \( \bar{w} \) and \( w^*_i \) are decreasing functions of \( \Lambda \). As \( \Lambda \to 0 \), \( \bar{w} \to v \) for all \( v \in [0,1] \). As \( \Lambda \to 1 \), \( w^*_i \to \theta_i \) for all \( \theta_i \in [0,1] \).

III. Main results - Effects of transparency on equilibrium

We analyze the equilibrium effects of increasing transparency along three dimensions: pay inequality, the hiring rate, and division of surplus.

III.A. Pay Inequality

Initial wages are more dispersed with higher transparency. Over time, wages are equalized as workers renegotiate to a common, higher wage. Ultimately expected earnings are more equal under transparency.

We compare the earnings of workers \( i \) and \( j \) who are hired in equilibrium under both of two transparency levels, \( \Lambda' < \Lambda'' \), so we do not confound employment effects of increasing transparency.\(^{26}\) For any two workers \( i \) and \( j \) with \( \theta_i > \theta_j \) who are hired under both \( \Lambda' \) and

\(^{26}\)The restriction that workers be hired under both transparency levels is necessary, as we show in Theorem 2, because increasing transparency can increase the hiring rate. A previously unemployed, high outside option worker may find employment only when transparency is increased. To make this point concrete, take some small \( \epsilon > 0 \) and consider increasing transparency from \( \Lambda' \) to \( \Lambda'' = \Lambda' + \epsilon \), such that more workers are employed in equilibrium under \( \Lambda'' \). In Appendix B we show that \( w^*_i \) and \( \bar{w} \) are continuous in \( \Lambda \) and so the expected earnings of any worker \( j \) hired under both transparency regimes is barely affected by an \( \epsilon \) increase in transparency. However, a worker \( i \) who over-negotiates at level \( \Lambda' \) receives her outside option \( \theta_i \) for her
there are two effects. First, the supply effect incentivizes workers to reduce initial wage offers. We find that in equilibrium, since $j$ has a lower outside option than $i$, $j$ reduces her initial offer more than $i$. Figure II shows that the relative impact of transparency on $w_i^*$ is smaller the larger $\theta_i$ is. Second, higher transparency decreases the expected time it takes before both workers renegotiate to $w^*$, reducing dispersion of their earnings as $\bar{w} - w_j^* > \bar{w} - w_i^*$. The first effect increases the initial wage gap between $i$ and $j$, however, the latter effect dominates in the long run, leading to more equalized expected earnings, regardless of $\delta$ and $\rho$. We document these two effects by plotting the expected difference in wages between workers $i$ and $j$ over time and for different levels of transparency in Figure III.

**Theorem 1.** Let $\theta_i > \theta_j$, $1 > \Lambda'' > \Lambda'$, and suppose workers $i$ and $j$ are both hired in equilibrium under $\Lambda'$ and $\Lambda''$.

1. The difference in initial offers $w_i^* - w_j^*$ is higher under $\Lambda''$ than $\Lambda'$, and
2. Let $T(\Lambda, v, \theta_k)$ be the equilibrium expected discounted total earnings of a worker $k$ with outside option $\theta_k$ under transparency level $\Lambda$ and firm value $v$ conditional on $k$ being employed at the firm. Then $T(\Lambda'', v, \theta_i) - T(\Lambda', v, \theta_i) > T(\Lambda', v, \theta_i) - T(\Lambda'', v, \theta_j)$ and $T(\Lambda'', v, \theta_i) - T(\Lambda'', v, \theta_j) \rightarrow 0$ as $\Lambda'' \rightarrow 1$.

Note that the first point in the above theorem does not apply to full transparency; there is a discontinuity because workers make their initial wage offers after seeing the wages of their coworkers. Therefore $w_i^* - w_j^* = 0$ and $T(\Lambda'', v, \theta_i) - T(\Lambda'', v, \theta_j) = 0$ when $\Lambda'' = 1$, so there is never wage dispersion among employed workers.

Pay equalization does not imply equalized worker surplus. We show workers offer premia that are decreasing in outside option, implying that more equal earnings caused by transparency result in greater inequality of worker surplus.

**Corollary 1.** Let $\theta_i > \theta_j$, $1 > \Lambda'' > \Lambda'$, and suppose workers $i$ and $j$ are both hired in equilibrium under $\Lambda'$ and $\Lambda''$.

1. The difference in initial surplus $(w_j^* - \theta_j) - (w_i^* - \theta_i)$ is smaller under $\Lambda''$ than $\Lambda'$ and
2. Let $S(\Lambda, v, \theta_k)$ be the equilibrium expected discounted total surplus of a worker $k$ with outside option $\theta_k$ under transparency level $\Lambda$ and firm value $v$ conditional on $k$ being employed at the firm. Then $S(\Lambda'', v, \theta_i) - S(\Lambda'', v, \theta_j) > S(\Lambda', v, \theta_i) - S(\Lambda', v, \theta_j)$, and $S(\Lambda'', v, \theta_i) - S(\Lambda'', v, \theta_j) \rightarrow \frac{\theta_i - \theta_j}{\rho + \delta}$ as $\Lambda'' \rightarrow 1$.

Entire duration in the market, while if she manages to find employment at the firm under $\Lambda''$ her average total earnings will be greater than, and bounded away from, $\theta_i$ (as she always asks for a premium $w_i^* - \theta_i > 0$). But note that $\theta_i > \theta_j$, so the total earnings of $i$ and $j$ are not equalized by increased transparency.
In sum, transparency decreases differences in expected pay across workers, but it also increases differences in expected worker surplus. We discuss these two notions of equalization in Section V.E.

III.B. Hiring Rate

Increasing transparency has competing effects on the hiring rate. Let $\bar{w}_\Lambda$ denote the maximum wage the firm pays and $w^*_i,\Lambda$ the initial offer of worker $i$ for transparency level $\Lambda$. When transparency increases from $\Lambda'$ to $\Lambda''$, the demand effect lowers the hiring rate. $\bar{w}_{\Lambda''} \leq \bar{w}_{\Lambda'}$ meaning that there are fewer workers with $\theta_i \leq \bar{w}_{\Lambda''}$ who are eligible for employment. The supply effect increases the hiring rate. $w^*_{i,\Lambda''} \leq w^*_{i,\Lambda'}$, for all $i$ so fewer workers over-negotiate by initially offering $w^*_{i,\Lambda''} > \bar{w}_{\Lambda'}$.

**Theorem 2.** The expected proportion of workers hired in equilibrium is concave in $\Lambda$ and maximized at

$$\Lambda^* = \frac{1 - \mathbb{E}(\theta)}{1 + \mathbb{E}(v) - \mathbb{E}(\theta)}$$

Moreover, the ex-post hiring rate is submodular in $v$ and $\Lambda$ for the set of firm types that hire a positive mass of workers.

An interior level of transparency maximizes the expected hiring rate. Due to the concavity of the expected hiring rate in $\Lambda$ either full privacy or full transparency is employment minimizing.

$\Lambda^*$ is decreasing in both $\mathbb{E}(v)$ and $\mathbb{E}(\theta)$.$^27$ As $\mathbb{E}(v)$ converges to 0 full transparency becomes close to employment maximizing, and as $\mathbb{E}(\theta)$ converges to 1 full privacy becomes close to employment maximizing. For intuition, we return to Proposition 3. As $\mathbb{E}(v)$ decreases, the firm’s markdown $v - \bar{w}$ is likely to be small regardless of $\Lambda$. Therefore, increasing transparency does not greatly reduce the number of workers with $\theta_i < \bar{w}$. But by increasing transparency, workers will shade down their initial offers $w^*_i$, reducing the number of workers who over-negotiate. Similarly, as $\mathbb{E}(\theta)$ increases, most workers offer small premia $w^*_i - \theta_i$ regardless of $\Lambda$. Increasing transparency has little effect on these premia, but instead discourages the firm from setting a large markdown.

Consider an increase in transparency from $\Lambda'$ to $\Lambda'' > \Lambda'$. The submodularity of the ex-post hiring rate in $v$ and $\Lambda$ means that the firm hires more workers under $\Lambda''$ than $\Lambda$ if and only if $v$ is below a particular threshold. It also implies that the value of $\Lambda$ that maximizes the ex-post hiring rate is weakly decreasing in $v$ (Topkis, 1998). These comparative statics

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$^27$The expected match surplus is $\mathbb{E}(v) - \mathbb{E}(\theta)$, so $\Lambda^* = \frac{1-\text{expected outside option}}{1+\text{expected match surplus}}.$
on ex-post hiring also hold for ex-post social surplus. In fact, the ex-post maximizer of the hiring rate also maximizes ex-post social surplus. Because each employed worker earns a wage weakly greater than her outside option, in equilibrium each employed worker increases social surplus by $v - \theta_i > 0$, implying that social surplus is strictly increasing in the hiring rate. Therefore, increasing transparency to $\Lambda''$ increases ex-post social surplus if and only if $v$ is below some threshold.

III.C. Division of Surplus

Increasing pay transparency increases the expected profits of the firm, decreases average worker surplus, and lowers average discounted wages. The demand effect causes the firm to limit its demand, similar to the pricing strategy of a monopsonist. Due to the information spillover caused by transparency, the firm can commit to reducing $\bar{w}$ as $\Lambda$ increases. This restricts the extensive margin of labor (the proportion of workers it hires) and increases the intensive margin (profit per worker hired). Simultaneously, the supply effect reduces worker initial offers, which similarly benefits the firm.

Although raising $\Lambda$ increases the rate at which workers receive wage $\bar{w}$, it lowers both $w_i^*$ and $\bar{w}$ in equilibrium. The overall effect is to shift de facto bargaining power to the firm, benefiting the firm at the expense of workers. For clear intuition, consider the extreme cases of full privacy ($\Lambda = 0$) and full transparency ($\Lambda = 1$). In the full privacy equilibrium, each worker makes a once-and-for-all offer to the firm as no worker ever renegotiates. Under full transparency, there are perfect information spillovers, and each worker learns the wages of others within the firm at the instant she is hired, before initial negotiations. Therefore, every employed worker will demand and receive exactly $\bar{w}$ for each period of her employment. This is equivalent to the firm making a once-and-for-all offer to workers. The main result of Myerson (1981) implies that each party prefers to be the one making the once-and-for-all offer to the other.

Theorem 3. The expected equilibrium profit of the firm is strictly increasing in $\Lambda$. The expected average equilibrium surplus of workers and expected average discounted wages conditional on employment are strictly decreasing in $\Lambda$.

This theorem takes expectations over firm and worker types. In particular, it does not imply that a move from full privacy to partial transparency improves profits for all firm types or decrease expected surplus for all worker types. Example 1 in the Appendix shows that a move from full transparency to partial transparency benefits high-value firm types, and a move from full privacy to partial transparency benefits low outside option workers.
III.D. Endogenous selection of transparency

Until now, we have been studying the effects of transparency from an ex-ante perspective, before the firm draws \( v \). This perspective is aligned with that of a government agency instituting pay transparency measures without detailed information about the value of labor to each firm. We next ask what transparency level firms choose with access to private information about \( v \).

We allow the firm to select \( \Lambda \) to maximize its profits immediately after seeing the draw of \( v \), and at the same time that it selects \( \bar{w} \). Workers observe only the choice of \( \Lambda \). We find that in equilibrium the firm selects full transparency regardless of its draw of \( v \).

Theorem 4. Suppose the firm selects \( \Lambda \) as a function of \( v \). There is an essentially unique equilibrium satisfying A1-5. In it, the firm selects \( \Lambda = 1 \) for all \( v \).

For intuition, suppose the firm can only select \( \Lambda \in \{0, 1\} \). We show that the firm cannot set \( \Lambda = 0 \) in equilibrium due to unraveling (Milgrom, 1981). Toward a contradiction, let \( v_L \) be the infimum value for which the firm selects \( \Lambda = 0 \). Then upon arriving at the firm, workers will infer that the firm’s value is at least \( v_L \), and so every worker will bid at least \( v_L \). As a result, when the value of the firm is \( v_L \) it will make 0 profits unless it deviates to selecting \( \Lambda = 1 \). But if this firm type deviates, there is a new “\( v_L \)”. Inductively there cannot be an equilibrium in which there is a positive measure of firm types playing \( \Lambda = 0 \). The equilibrium in which the firm selects \( \Lambda = 1 \) for all \( v \) can be supported with the off-path beliefs that a deviating firm has value \( v = 1 \) with probability 1. As \( \bar{w} = v \) when \( \Lambda = 0 \), a deviating firm will make zero profits.

Fixing \( \bar{w} \), higher transparency is better for every worker, so every worker has an incentive to seek out the wages of their coworkers to the highest possible degree. We have not formally modeled the choice of workers to “bury their heads in the sand” and ignore information about their coworker’s wages. Nevertheless, a richer model that allows each worker \( i \) to specify \( \Lambda_i \) such that the effective transparency to worker \( i \) is \( \min\{\Lambda_i, \Lambda\} \) will result in each worker \( i \) setting \( \Lambda_i \geq \Lambda \) because no single worker will affect the equilibrium payoff, and therefore actions, of the firm.

III.E. Worker wage history

Our model can be adapted to understand the effect of hiding or revealing previous worker wages. Suppose a worker receives a job offer from a different firm at each time \( t \) and can either accept the wage and complete the job at time \( t \) or consumer her outside option. In either case, the job finishes at time \( t \) and the game continues.

We formalize this model in Appendix II. We find that many of the effects we note in our base model mirrored in this setting, most prominently, that the revelation of previous
worker wages increases the bargaining position of the worker and increases her surplus at the expense of firms.

IV. Empirical Evidence from TaskRabbit

IV.A. Platform

We use an administrative dataset of temporary workers and employers, matched on an online labor platform, TaskRabbit, between January, 2009 and June 2014 to test our theoretical predictions. TaskRabbit differentiates itself from other online labor platforms by specializing in local jobs which account for 89% of jobs completed. The platform is active in 19 metropolitan areas across the U.S. during this period. The employers using the platform range from older and more established firms, including approximately 10% of Fortune 500 companies, to household employers (comprising roughly one quarter of our sample).

Our research concentrates on jobs that are posted as one-time tasks. Among the most common categories of jobs are deliveries, shopping, event staffing, and user testing. Employers can observe workers’ profiles, which include the number of prior jobs completed on the platform, a rating out of 5 stars, and a short bio. Previous worker wages are not shown.

IV.B. Bargaining Environment

Employers post a description of the task, details about the exact location, and a deadline for completion. Workers search through these postings and submit bids for tasks they are interested in completing. Alternatively, the employer can choose to post a take-it-or-leave-it (TIOLI) price, and the first worker to accept is matched. The platform charges employers different fees at different times, with a mean fee of approximately 20% of the final payments made to workers, including bonuses.

Employers can elect to increase wages through the platform once the job is completed. As jobs frequently involve face-to-face contact between employers and employees, this allows for the possibility of on-the-job wage bargaining.\footnote{TaskRabbit reserves the right to revoke user privileges should any activity suggest circumventing the online contract, or making payments off the platform. However, we do not rule out the possibility that working relationships continue off the platform. For robustness, we replicate results to exclude and include employers that never return to the site after their initial jobs are completed.}

At the time that a worker is assigned a job, the worker and employer enter a contract that can be cancelled by providing a reason to the platform. TaskRabbit has a three strike rule. After three cancellations, a user will not be permitted to use the site again. During the window between when the match is made and the job is complete, money is held in escrow and is released to workers by default after a predetermined deadline.
Once the job begins, several additional frictions make canceling costly for both parties. TaskRabbit is a spot market designed for urgent tasks. Conditional on completion, 97% of tasks are finished within three days of posting. Additionally, the rate of bids received slows considerably after posting. The median job receives 1 offer in the first hour, and 1 every 4 hours over the first day. Taken altogether, finding a replacement worker after the job begins would likely result in costly delays. Similarly, workers cannot costlessly transition to another job. Because these are short-term in-person tasks, travel costs are high relative to the final transaction price.

Employers have the opportunity to leave a public rating out of 5 stars for a hired worker. There is no reputation system for employers. With very few exceptions (less than 1% of the time), employers do not leave reviews lower than 4 stars, but they frequently decline to rate workers. Employers only observe worker average rating, not the number of declined reviews. We add to our performance measure “missing” reviews, based on prior research that missing reviews are skewed toward negative feedback.29

IV.C. Measuring Transparency

We measure pay transparency on TaskRabbit several ways. Our first measure is whether the job post itself includes a posted price publicly visible to all workers. The posted price can either be text embedded in a job description or a TIOLI price associated with the job posting format selected. We classify these as fully transparent jobs.

Our second measure is based on the physical proximity of workers in multi-worker jobs and the length of time they overlap in the same location, with longer co-location leading to higher transparency. For example, a retail branch might outsource the boxing of holiday gifts at the store (co-located workers), or outsource the distribution of catalogues in different neighborhoods (separated workers). We use the street address of a job to classify proximity and we supplement it with survey evidence. We hire approximately five thousand online workers to read through the detailed job descriptions and report key attributes, including how conducive the setting is to coworker communication and length of time together. Those surveyed expect workers to learn about each other’s bids 40% of the time when co-located (according to our administrative record of physical proximity), and only 7% of the time if the workers are physically separated.

29The literature on user generated content has identified a number biases and manipulation techniques that we can address using data about performance that the platform collects but is not visible to the users. Nosko and Tadelis (2015) show the “sound of silence,” or missing reviews, on eBay is skewed toward negative feedback. We show the share of missing reviews on TaskRabbit predicts whether an employer returns to the platform, TaskRabbit’s central measure of employer satisfaction, and the worker star-rating conditional on receiving a rating (Table A3 Col. 1 and Col. 2 respectively). The share of positive reviews a worker receives is correlated with ex-post pay, but not the ex-ante bid accepted (Table A4), suggesting that we are really detecting the performance that the employer observes on the job.
In Table I we summarize these transparency measures and how they are used in our empirical analysis. In Table II we compare worker-bids, worker-ratings and tasks on TaskRabbit across these transparency classifications. We restrict our main sample to categories of jobs which lend themselves to both multi-worker separated and co-located jobs (a minimum of 20% of each type), but we also show our results are not sensitive to this restriction. Panel (a) shows observable characteristics between multi-worker co-located jobs and multi-worker separated jobs are similar across a number of important dimensions such as the number of workers required, the dispersion and level of bids received and bids chosen. We also show that the dispersion in performance ratings are similar across job types. We explore whether co-located and separated tasks differ in their content using unsupervised natural language processing, which identified six differentiating topics in the job text. Across five of these topics, co-located job posts are statistically indistinguishable from separated job posts. Co-located job posts are more likely to use cordial language such as “would like,” “hoping,” and “would be great.” Panel (b) compares job postings that do and do not mention price in the text that workers read before placing a bid. We show balance across the six language topics identified using machine learning. We also show balance in the length of the job description. We find a large and significant difference in the submitted bids to job postings that do and do not mention price, a result we discuss in Section III. Panel (c) describes local market characteristics at the city-month level. The mean price for a job is $56 conditional on closing, and 46% of jobs close on average. In a randomly selected cross-section from the panel, the average age of a market is 17 months. On average, 43% of jobs are listed with a posted take-it-or-leave it price.

IV.D. Verifying Bargaining Assumptions

We do not directly observe renegotiations, nor is it ex-ante obvious what share of the bargaining power workers would have in any renegotiations. But our model with worker bargaining power has two clear empirical implications for the outcome of a re-bargaining process that are demonstrated empirically using TaskRabbit data in Table III.

**SF1:** In co-located jobs, initial inequality is uncorrelated with employers’ decisions to compress pay.

**SF2:** In co-located jobs, employers equalize wages if they compress pay at all.

Conditional on a worker receiving higher final pay than her initial bid, she receives final pay that is statistically no different than that of the highest accepted bidder (SF2) in the job. In Col. 4-6 of Table III we estimate the relationship between the amount that the worker bid below the highest bidder and the amount of the raise paid at the end of the job, conditional
on receiving a raise. In this and subsequent regressions, we index workers by $i$, employers by $j$ and jobs by $k$. We include job-specific fixed effects $\alpha_k$ and individual performance controls $X_i$ at the time of job $k$ in the equation below.

$$\text{Raise}(\% \text{ above bid} | \text{Raise} > 0)_{ik} = \beta_0 + \beta_1 \cdot (\text{Amt. under top bid (})_k + \phi \cdot X_i + \alpha_k + \epsilon_{ik}$$

A coefficient equal to 1 (on “Amt. under top bid (%)”) implies that the raise amount is equivalent to the initial gap between bids. We estimate a precise relationship statistically indistinguishable from 1. We include job-specific fixed effects in Col. 6 to isolate the impact of one coworkers’ bid on another’s final negotiation and show the result is not driven by job characteristics correlated with bid amounts.

At the same time, the difference in initial wages does not predict whether or not a worker receives any raise at all (SF1). In Col. 1-3 of Table III, we test if the amount the worker bids less than the highest accepted bid predicts whether the worker will receive a raise.

$$\text{Any Raise(Yes=1)}_{ik} = \beta_0 + \beta_1 \cdot (\text{Amt. under top bid (})_k + \phi \cdot X_i + \alpha_k + \epsilon_{ik}$$

A coefficient equal to 0 (on “Amt. under top bid %”) implies no conditional correlation between a worker’s bid and the probability of receiving a raise. We estimate a small effect that is statistically indistinguishable from 0. We include job-specific fixed effects in Col. 3 to isolate the impact of one coworkers’ bid on another’s final negotiation and show the result is not driven by job characteristics correlated with bid amounts.

In higher transparency, co-located settings 22% of workers receive pay that is higher than their bids, as opposed to 7% in lower transparency, physically separated work settings. We argue that renegotiation results exhibit a pattern that reveals co-worker communication about pay is the primary driver. While there are other candidate mechanisms, such as productivity spillovers when co-located or employer preferences for equity, they fall short of matching key facts.

Perceived productivity differences as the explanation for the wage equalization we observe requires that assessed performance of coworkers is less dispersed when workers are together. We do not find strong evidence that ratings employers give to workers are more dispersed or compressed when workers are co-located, detailed in Appendix A.2. More generally, there is a small and statistically insignificant correlation between bids and ratings. As a result, any systematic pattern of spillovers from high to low productivity types does not necessarily raise the performance of the low bidder or the pay of the low bidder per se.

Another potential channel is employer preferences for equity. As we show in Table A6,
the same employers who equalize pay when workers are co-located do not do so when they are separated. Employers may have a preference for equity only when workers are co-located. We collect survey evidence (Appendix J.1) of how likely workers are to talk to and ask about another worker’s pay on the job and find the frequency of renegotiation is positively correlated with the probability of communication even within co-located jobs. For example, when workers are hired to transcribe in an active courtroom, the likelihood that they talk to each other about pay is relatively small compared to those packing boxes alone together for a longer duration. The amount of time workers overlap in the same place, as well as how able they are to talk, are both predictive of exchanging information and of pay equalization. Therefore, employer preferences for equity seem less likely to be the driver of pay equalization relative to the importance of pay communication between coworkers and subsequent renegotiation.

In Section VI we analyze and describe the shortcomings of an alternative model in which worker preferences for equality drives wage equalization. In Section V we present results from our experiment in which we exogenously vary transparency and observe negotiations directly. Our experimental results are consistent with our findings from TaskRabbit.

IV.E. Wage Equalization

Theorem 1 states that increased transparency leads to equalization in the wages of employed workers. We present a visual depiction of wage equalization across two types of tasks, higher transparency jobs that require multiple workers to be situated together and lower transparency jobs that can be carried out separately.

Figure I shows the variance in wages for workers assigned to the same job on TaskRabbit. Each dot represents a multi-worker job. Observations that fall beneath the 45 degree line illustrate the tendency for employers to reduce the variance in ex-post payment relative to the variance of ex-ante bids. We do not expect full wage equalization because, as we illustrate in Table III, the workers who renegotiate are a subset of all workers, who learn about the bids of their coworkers on the job. In Appendix Table A6 we carry out a similar test at the level of individual bids with controls for worker performance and again find wage compression only when workers are physically co-located. We find that a 10% gap between a worker’s initial bid and that of the highest bidder results in a 4% raise in final pay for the low bidder.

We interpret coworkers’ bids as having a causal effect on each other’s final pay when co-located; as we show in Table II, observables between separated and co-located jobs are similar. Moreover, employers do not appear to select different types of workers as a function of co-location and workers do not appear to adjust their initial bidding strategy as a function of co-location with other workers. Workers may not anticipate multi-worker settings. They
Notes: Each observation summarizes the variance in pay among the workers that have been selected for multi-worker separated jobs (Panel a, N=184) and multi-worker co-located jobs (Panel b, N=386). The x-axis is the variance in the bids accepted for a job, in dollars. The y-axis is the variance in the final payout. An observation below the 45 degree line indicates that wages are compressed on the job, while an observation above the 45 degree line indicates that wages become dispersed on the job. Observations along the 45 degree line generally capture the decision of the employer not to raise the wage of any worker. Since initial bids are binding, the employer cannot pay less than the bid. Marketing, user-testing and delivery are among the most common task categories in Panel a. Packing and shipping, delivery, and event staffing are among the most common categories in Panel b. We fail to accept the null hypothesis that the slopes of these two plots, 0.96 (0.17) and 0.56 (0.08) are equal, P-value = 0.046.

IV.F. Profits

Theorem 3 predicts higher levels of transparency are associated with higher expected employer profits and lower wages. In TaskRabbit, we do not directly observe employer profits, but we can observe labor costs. We compare the difference in bids, sent from the same workers for similar jobs, in the case where the employer does mention the price of the job in the posting directly (high transparency) and the case where the employer does not mention the price in the posting (low transparency). In Table IV, Col. 1-3 we include worker fixed effects and compare the bids and final pay of the same worker as a function of whether the job posting contained any information about the expected price of the job before the bid was submitted. In Col. 3, we restrict the sample to only those employers who pay hourly wages (rather than a piece rate for the entire job), and include worker fixed effects, $\alpha_i$, and past performance evaluations $X_i$, as well as job category fixed effects $\omega_k$.

$$\{\log(Bid \text{ Amount})_{ik}, \log(Winner's \text{ Pay})_{ik}, \log(Winner's \text{ Hourly Pay})_{ik}\} = \beta_0 + \beta_1 \cdot transparent_{ik} + \phi \cdot X_i + \omega_k + \alpha_i + \epsilon_{ik}$$
When the employer mentions a price in the job description, hourly earnings are 7.8% lower, total pay is 13.6% lower, and bids are 9.6% lower.

IV.G. Endogenous Choice of Transparency

Theorem 4 states the market unravels toward full transparency in equilibrium. The intuition is that employers with low values for labor benefit the most from selecting transparency. Therefore, the choice of privacy signals to workers that the employer has a high value. This leads to higher bids, which induces more employers to prefer transparency. As marginal employers switch from choosing privacy to transparency, privacy signals an even higher valuation and attracts even higher bids, until all switch to full transparency.

We observe the predicted unraveling in TaskRabbit by studying segregated city-markets for local tasks. Among the 95% of jobs that require a single worker, an employer can choose full transparency through posting a price, or full privacy by soliciting private bids. Figure IV shows the share of transparent posted price jobs in each metropolitan area in June, 2014. Markets where TaskRabbit has been active for longer are associated with a higher proportion of transparent posted price jobs. Analyzing a balanced panel of city-months and adjusting for changes in job-category composition, Figure V shows that the proportion of transparent posted price jobs rises by 1% per month.31 As predicted by our theory, low-income employers are most likely to switch to using transparent posted prices, and the market-level move to transparency is not explained by the changing composition of jobs or size of the market (for more details, see Table A9).32

V. Empirical Evidence from a Field Experiment

We conduct a field experiment to further test our findings in a controlled environment. In our main treatments, we hire 262 managers and 655 workers from an online labor market, Amazon Mechanical Turk, who are tasked with negotiating wages for transcription services that take on average three hours to complete. This experiment is automated and can be replicated using our code in a matter of days. We randomize transparency by restricting wage negotiations to either a common chat room containing a manager and multiple workers, or separate each worker into a private chat room with the manager. We document all

31Our theory predicts immediate unraveling to full transparency, but observed unraveling in labor markets typically takes time, as discussed in Roth and Xing (1994). This dynamic is consistent with a richer, bounded rationality formulation of our model, a la Kandori et al. (1993), in which employers select a level of transparency (to post a price or to accept private bids) based on which scheme would have maximized their expected profits in the previous period.

32Einav et al. (2018) study a shift in eBay sales away from an auction format and toward posted prices. We discuss their model, its relation to our setting, and the differences between TaskRabbit and eBay in Appendix A.5.
interactions in these chat rooms, and we place no restrictions on the ways in which workers and managers can bargain. Common chatrooms introduce high transparency, more similar to the non-anonymous posted salaries of public sector employees or posted wage formulas\(^{33}\) than like the informal discussions of workers on-the-job in TaskRabbit (in line with this, we document more wage equalization in the common chatrooms than in co-located jobs on TaskRabbit).

We directly measure worker productivity, outside options, and employer profits. This allows us to explore additional notions of equality, such as parity in worker surplus. In Section VI we use this additional data to test the relative importance of social concerns surrounding pay transparency, and run a horse race between such a model and our re-bargaining model.

V.A. Procedure

Participants are recruited from Amazon’s Mechanical Turk between October 2016 and May 2017. Participants are assigned to either the role of worker or manager and informed that their participation is voluntary and part of an academic experiment. All participants are given the following instructions: managers and workers are tasked with negotiating a per-page rate for completing text-to-text transcription of US Census tables from the 1940s. If a worker and manager agree on a wage and the worker completes a page above a stated accuracy threshold, the worker receives the agreed upon wage. Each worker can complete up to 5 pages of transcription. Each manager is assigned to 3 workers and privately given a per-worker-page budget of $5. Managers are the residual claimant of this budget, after wages are paid, for completed work.

Before interacting, workers are shown a sample transcription page, and are asked to provide an estimate for how long it would take them to transcribe the page. We collect data about the minimum price a worker would accept to transcribe a similar page, and make it clear to workers that this information will not be shared with managers. Similarly to Becker et al. (1964), we make truth-telling a dominant strategy for workers. They are asked to make several selections between receiving $X for completing one transcription page, up to a maximum of 5 pages, or $9 for doing nothing. We vary X and randomly select one choice for 1 in 10 workers and give the worker their reward (either $9 or the opportunity to complete 5 additional pages at $X per page) after their initial assignment has been completed. We calculate a worker’s outside option using the lowest wage at which a worker is willing to transcribe a page and the time it takes that worker to transcribe a page.\(^{34}\)

We next ask workers to place a bid for completing each page of transcription, to be

\[^{33}\text{See, for example, https://open.buffer.com/salary-formula/ accessed 2/13/2019.}\]

\[^{34}\text{Letting } x_i \text{ represent the lowest wage at which } i \text{ is willing to complete the transcription, and } t_i \text{ the time it takes } i \text{ to transcribe a page, we calculate } i \text{'s outside option as } \theta_i = \frac{2x_i - 1}{9} - \frac{9}{5} \cdot t_i.\]
used in the pay negotiation. In some treatments arms this bid is binding and will be either accepted or rejected by managers, in other treatment arms the bid is a non-binding opening offer submitted to the manager. Managers then meet with workers to bargain over per-page pay in anonymous online chatrooms. No other communication occurs between participants. We place no restrictions on the way in which participants bargain, only that they indicate in the chatroom a final agreed upon wage. Upon finishing wage negotiations, we survey demographic information including education, gender, and age. Workers who agree to a wage with a manager have 48 hours to complete up to 5 pages of transcription.

V.B. Treatments

Our experiment has two treatment arms. One treatment is the public visibility of wage negotiations. Managers either negotiate wages with each worker in a private chat room, or the manager negotiates over a common, transparent chat room with all workers. The only difference between the private chat room and the transparency chat room is a division between chat forums allowing (or preventing) workers to observe all communication between coworkers and the manager. In both cases, the manager must confirm wages individually with each worker in the chat room. The second treatment arm introduces a constraint on the negotiation options for the manager. In one scenario the manager must accept all bids less than or equal to the budget, and in another, the manager can actively bargain with workers. The number of participants assigned to different treatments is displayed in Table V. Subject characteristics across transparent and non-transparent assignments are similar in terms of age, share female, and education, within both negotiable and non-negotiable treatment arms.

User interface differences across treatments are minimal as the multiple manager chat rooms in the privacy treatment all appear on one page side by side. For pictures of the interfaces, please see Appendix I. We describe an additional treatment arm involving 103 managers and 309 workers in Appendix I.

V.C. Administrative Details

We believe our experiment to be informative for understanding the effect of transparency at standard market wages. The $5 budget for managers was selected to approximate wages on Mechanical Turk in general. The distribution of worker hourly pay in our experiment has mean $4.14 and median $6.30. Mean and median hourly wages on the platform are $3.18 and $6.19, respectively (Hara et al., 2018). Moreover, the $5 budget matches “expected” wages in our experiment: $5 is the modal, and 46th percentile bid placed by workers (Figure I1).
The experiment is automated, and all interactions occur through a single web interface programmed in oTree (Chen et al., 2016). Transcription accuracy is calculated using the Levenshtein distance measure (Levenshtein, 1966), defined as the minimum number of single-character edits (substitutions, deletions, or insertions) necessary to change one string into another. Each submitted page with a Levenshtein distance from the original document of fewer than 5% of the total number of characters on the page meets our accuracy threshold. Participants were made aware of this threshold at the onset.

V.D. Example Transcript

Workers often use the wages of others when bargaining in the transparency treatment. Below, we provide a portion of one wage negotiation as an example.

Employee 1: Minimum is 3 for me
Manager: Yes, I will agree on 3, thank you
Employee 3: $4, I got puppy to feed
Manager: Employee 3, I will agree on 4.00
Employee 3: thank you very much
Employee 1: Well that’s bull I want 4 now
Manager: Employee 1, I will go up to 4.00 as well for you

V.E. Analysis and Main Findings

Wage and Surplus Equalization:

In what follows, we use the subscript $j$ to denote a manager, who is either assigned to a common chat room or a separate chat room (transparent $\in \{0, 1\}$). $X_i$ refers to age, college attainment, and gender of the worker. $S_j$ refers to a set of demographic controls, including the age, college attainment and gender of the manager as well average characteristics of workers eligible for hire by the manager. We run the following specifications to test the effect of transparency on equality:

$$\{Gini(Wages)_j, Gini(Hourly\ Pay)_j, Gini(Worker\ Surplus)_j\} = \beta_0 + \beta_1 \cdot \text{transparent}_j + \psi \cdot S_j + \epsilon_j$$

Wages are significantly equalized in the transparency treatment compared to the privacy treatment. Of the managers allowed to negotiate wages with worker, 100% pay common
wages to all workers in the pay transparent treatment, compared to only 60% of managers in
the private pay treatment. This further corroborates theoretical predictions SF1 and SF2.

We measure worker surplus as the agreed-to wage less the elicited reservation value. While
we observe significant equalization of wages under transparency, we observe amplification in
the dispersion of worker surplus, as predicted by Corollary 1.

On average, the Gini coefficient, a measure of inequality, for worker surplus nearly doubles
in the transparency treatment (Table VI, Col. 5-6). Dispersion in worker surplus arises from
the fact that workers submit bids for work that are approximately a fixed mark-up above
their outside option. When the employer equalizes wages, she grants more surplus to low
outside option workers, exacerbating surplus inequality.

These two findings suggest that transparency closes pay gaps caused by differences in
outside options, while simultaneously widening the gap between wage and outside option. If
workers’ outside options reflect external wages, then equalizing pay may offset disparities
in external opportunities. If the outside option reflects cost of effort, rising dispersion in
worker surplus reflects a shift of surplus towards those who (are fortunate to) have low effort
costs and away from those who have high effort costs. We find evidence that outside options
partially reflect cost of effort by eliciting the time it takes to complete a page of transcription.
When we convert the piece-rate contracts into an hourly wage, we do not find evidence of
hourly-wage equalization (Table VI, Col. 3-4).

**Hiring Rate:**

We define the hiring rate as the proportion of workers who agree on a wage with their
manager. Theorem 2 states that transparency increases hiring when the value of labor is
sufficiently low. The reason is that a worker will overbid for a job posted by a low-value
employer if wages are not transparent. The bid includes a premium above the outside option
which is optimal in expectation without knowledge of the value, but sub-optimal if the value
were known to be low.

This experiment provides a direct test of this prediction under an open bargaining pro-
ocol.

\[
Hired \text{ Worker (Yes=1)}_{ij} = \beta_0 + \beta_1 \cdot \text{transparent}_{ij} + \phi \cdot X_i + \psi \cdot S_j + \epsilon_{ij}
\]

We estimate a linear probability model of hiring under transparency versus privacy. We
include as controls the age, college attainment, and gender of the worker and manager, \(X_i\)
and \(S_j\) respectively, and allow for correlated errors at the level of the manager.\(^{35}\) Coefficient
\(\beta_1\) measures the increased likelihood that a manager hires a worker under pay transparency

\(^{35}\)Each manager and worker is assigned to only one job in our experiment.
compared to pay privacy. We show in Col. 1 of Table VII that the hiring rate rises by 10% when negotiations are held in the common chat forum as opposed to the private forum. We present additional empirical support for Theorem 2 in Appendices A and I.

**Profits:**

Theorem 3 predicts that profits will be higher and that wages will be lower under full transparency than under full privacy, because employers bargain more aggressively under full transparency. We run the following specifications with wages agreed to, wages agreed to for the subset of workers who completed at least one page of transcription at 95% accuracy, number of transcription pages completed within manager group (productivity), and overall manager profit as the dependent variables.\(^{36}\)

\[
\{\log(Wages|Hired)_{ij}, \log(Wages|Positive Payout)_{ij}\} = \beta_0 + \beta_1 \cdot transparent_{ij} + \phi \cdot X_i + \psi \cdot S_j + \epsilon_{ij}
\]

\[
\{\sinh^{-1}(Productivity)_j, \sinh^{-1}(Profit)_j\} = \beta_0 + \beta_1 \cdot transparent_{j} + \psi \cdot S_j + \epsilon_j
\]

In Table VII, we show that manager profits are 27% higher in the transparent group than the private group, and wages are 7.4% lower conditional on reaching an agreement.\(^{37}\) There is no statistical difference between productivity in the two groups; the point estimate for productivity is a 13% increase under transparency, with an equally large standard error. These findings are consistent with the theoretical intuition that the manager has a credible way to commit to a wage in a common chat room where employees can see her turn down bidders demanding more. Wages are even lower, by an additional 5.6%, under transparency among the subsample of workers who successfully complete at least one page of transcription. In Section VI and Appendix G we formally model endogenous effort, and provide a basis for this result.

\(^{36}\)We use the log transformation of wages as the dependent variable, allowing \(\beta_1\) to be interpreted as the elasticity of wages with respect to transparency. To accomodate 0 profit outcomes, we use the inverse hyperbolic sine of productivity and manager profit. The transformation \(\text{arcsinh}(x)\) down-weights treatment effects at small values, is linear for \(x\) close to 0 and approximates \(\log(2x)\) for \(x\) greater than 3. For an in-depth discussion about this transformation, see Kline et al. (2019) Appendix D, page 65.

\(^{37}\)There are at least two reasons why we do not expect these two numbers to be identical. First, transparency increases the hiring rate, mechanically implying higher profits without any effect on wages. Second, if wages are greater than $2.50+\epsilon$ for some positive \(\epsilon\) then decreasing the wage by no more than \(\epsilon\) will increase manager profit proportionally more than it decreases wages, because the wage is greater than half the total budget. Table VII, Col. 4 shows that the average wage in the private treatment is roughly $4.
VI. Effects of Social Concerns

We incorporate an additional channel, social concerns about relative pay, that is a prominent explanation in the literature for equalized wages in transparent environments. Several papers (Akerlof and Yellen, 1990; Breza et al., 2018; Card et al., 2012; Mas, 2017) argue that a worker exerts less effort upon learning she is underpaid relative to her peers. A proactive employer who observes the transparency process (or observes decreases in effort) may augment the wages of workers who learn they are underpaid in order to avoid low effort provision (Eliaz and Spiegler, 2013). We test the hypothesis that employers optimally equalize wages due to social concerns in this section. In Appendix G we extend the analysis to account for situations in which transparency can also increase the effort provision of certain workers.

VI.A. Endogenous Worker Effort

We build a model of bargaining under transparency that endogenizes worker effort. As before, workers make TIOLI offers \( w_{i,t} \) and observe the wages of their peers at rate \( \lambda \). Now each worker \( i \) also selects \( e_{i,t} \in [0, 1] \) which is the probability of successfully completing her time \( t \) duties and receiving her flow wages. All workers have an outside option normalized to 0 and have to pay a linear effort flow cost \( \theta_i \cdot e_{i,t} \). Each worker \( i \)'s expected flow payoff is \( (w_{i,t} - \theta_i) \cdot e_{i,t} \).\(^{38}\) We show that workers bargain in the same way as in the original game in equilibrium. Therefore, all of the results of the paper carry through when effort is endogenous.

**Proposition 4.** There is a unique linear equilibrium outcome of the endogenous worker effort game. In it all workers set \( e_{i,t} = 1 \) for all periods of employment. All other actions are the same along the equilibrium path as those in the equilibrium of the original game.

VI.B. Proactive Employer Model

We now remove workers’ ability to renegotiate in order to study employer decisions to raise wages to avoid effort reduction. Workers make a wage offer \( w_i^* \) when they are initially hired, and thereafter only choose effort. We include a morale cost to a worker for learning she is underpaid, modeled as in DellaVigna et al. (2016) and Breza et al. (2018). Workers face a higher cost to effort upon learning they are paid less than any peer, and this cost is non-decreasing in the effort the worker provides and the difference between her wages and that of her highest paid coworker.\(^{39}\) At each time \( t \) the firm can observe whether a worker

\(^{38}\)We could replace \( e_{i,t} \) with a productivity function \( z(e_{i,t}) \), where \( z(e) > 0 \) for all \( e > 0 \), \( z(0) = 0 \), and \( z(\cdot) \) has a unique global maximizer at 1 without altering the results of this section.

\(^{39}\)If we layer in the morale specification in this section and give the workers the ability to make TIOLI offers to the firm, then workers optimally request \( \bar{w} \) upon seeing peer wages. This means that on equilibrium
has received wage information and can elect to unilaterally increase her wage for all times \( t' \geq t \) to reduce the morale cost. We refer to this as the \textit{proactive employer model}.

Formally, let the morale cost be \( m(e_{i,t}, d) \in [0, 1] \) where \( d = \bar{w} - w_{i,t} \). We assume \( m(\cdot, \cdot) \) is non-decreasing in both arguments and that \( m(0, \cdot) = m(\cdot, 0) = 0 \). As before, worker \( i \)'s flow payoff is \((w_{i,t} - \theta_i) \cdot e_{i,t}\) prior to learning about the wages of her peers, so she will put in full effort in equilibrium. Upon seeing the wages of her coworkers and learning \( \bar{w} \), the worker’s flow payoff becomes \((w_{i,t} - \theta_i) \cdot e_{i,t} - m(e_{i,t}, d)\). Depending on \( m(e_{i,t}, d) \), the worker may optimally shirk. It is easy to see that the firm will increase the wage of a worker \( i \) at time \( t \) only if \( i \) learns the wages of her coworkers at time \( t \).

We now formally state conditions on the morale function for the proactive employer model to generate the same equilibrium outcome as that of our original model, and in particular, fit our key empirical findings of full pay equalization under transparency, both in TaskRabbit and our field experiment.

**Proposition 5.** Consider any equilibrium which satisfies regularity conditions \( A1-A4 \). The firm always sets \( w_{i,t} = \bar{w} \) for every worker \( i \) who learns \( \bar{w} \) at time \( t \) for all \( \Lambda \) if and only if \((w_{i,t} - \theta_i) \cdot e_{i,t} - m(e_{i,t}, d) \leq 0 \) for every \( e_{i,t} \in (0, 1] \) and every \( d \) occurring on equilibrium path.

Only large and discontinuous morale cost functions result in the same predictions as the bargaining model; unless social concerns reduce worker effort to 0 upon receiving even slightly less than \( \bar{w} \), the firm will not equalize the wages of all workers who observe peer wages. Intuitively, when transparency is low, firms make close to zero profit from their highest paid worker \((v - \bar{w} \approx 0)\) so even if a worker drastically reduces her effort, a proactive firm would still prefer to pay her less than \( \bar{w} \) unless she quits entirely upon learning she is underpaid.\(^{40}\)

We do find evidence that relative pay concerns lead to lower effort when a worker learns she is underpaid, but output declines with the extent of inequality.\(^{41}\) Average output is 26% path, workers will never pay the morale cost or put in low effort. Therefore, the presence of a morale cost does not affect the predictions of our bargaining model.

\(^{40}\)\textit{Fanning and Kloosterman (2017)} produce experimental evidence that social concerns in dynamic bargaining may lead to a Coasian result of full wage equalization; that is, if with positive probability each worker refuses to work for anything less than full wage equalization due to morale concerns, all other worker types will mimic this behavior, and the firm will (almost) immediately offer wages to workers that are (almost) equal. This type of model would have nearly identical predictions as our bargaining model. However, we note that we do not observe workers rejecting all wages which are bounded away from full equality in our data, as \textit{Fanning and Kloosterman (2017)} predict.

\(^{41}\)Robert Duvall refused to take part in The Godfather Part III stating, “if they paid Pacino twice what they paid me, that’s fine, but not three or four times, which is what they did” (http://www.imdb.com/name/nm0000380/bio accessed 11/7/2016). Similarly, in our experimental treatment in which managers must accept worker bids as final wages, one low-bidding worker remarked, “yeah, I won’t be working for less than a third of what others are getting for the same amount of work” before ending his participation.
lower in the transparent no negotiation treatment than the non-transparent no negotiation treatment. As we show in Figure VI, output is decreasing in the difference between a worker’s pay and that of her highest paid peer in a common chat room compared to separate chat rooms. The magnitude of productivity loss is in line with a field experiment in Breza et al. (2018) who find a 22% reduction in output among workers who learn each other’s salaries. Moreover, they also present a similar trend of a smooth decrease in output as inequality rises. In our data, effort reduction appears convex in the degree of inequality, implying morale concerns would make it profitable to raise wages more often when inequality is small, and to potentially only partially close the gap (rather than equalizing wages) in some cases.

Recalling our findings of full wage equalization, regardless of initial wage differences in both TaskRabbit data and our experiment, and in light of Proposition 5, reduced effort due to relative pay concerns does not unilaterally generate pay equalization for a profit maximizing employer. Our findings suggest that re-bargaining is an important mechanism equalizing wages in the transparent pay environments, even in the presence of morale concerns.

VII. Gender Differences and the Gender Pay Gap

We study the effects of differences between men and women along two dimensions, outside options and the spread of peer wage information. We extend our empirical and theoretical analyses to shed light on how transparency affects wage inequality when genders differ along these dimensions. We believe this to be an important avenue of inquiry as pay transparency is commonly cited as a way to close the gender wage gap.  

We elicit the outside option of workers in our experimental setting as discussed in Section V. We find that women have on average 14.6% lower outside options than men, and we show that increasing pay transparency can close a pay gap caused by differences in outside options (women bid 14.4% less than men).

To see this theoretically, let there be two types of workers, \( m \) (male) and \( f \) (female), such that \( qG_m(x) + (1-q)G_f(x) = G(x) \) for all \( x \in [0,1] \), where \( q \in [0,1] \) is the proportion of men in the market. The first, and simplest, result is an application of Theorem 1. Similarly to above, we denote the average equilibrium expected earnings of an employed worker of type \( \ell \in \{m,f\} \) as \( T(\Lambda,v,\theta_i,\ell) \).

**Corollary 2.** If \( G_m(\cdot) \) first-order stochastically dominates \( G_f(\cdot) \) then \( \frac{\mathbb{E}_{G_f[T(\Lambda,v,\theta_i,f)]}}{\mathbb{E}_{G_m[T(\Lambda,v,\theta_i,m)]}} \) converges monotonically to 1 as \( \Lambda \) converges to 1 for all \( v \).

\(^{42}\)For example, Hillary Clinton championed transparency during her presidential campaign. Her website reads, “As president, Hillary will: Work to close the pay gap...We should promote pay transparency across the economy and work to pass the Paycheck Fairness Act—a bill Hillary introduced as senator—to give women the tools they need to fight discrimination in the workforce.” https://www.hillaryclinton.com/issues/womens-rights-and-opportunity/, accessed 3/20/2018.
In words, this result says that the average earnings of employed women is rising relative to the average earnings of employed men as transparency increases, and reaching full transparency completely equalizes earnings. The proof of this result follows from Theorem 1. When $G_m(\cdot)$ first-order stochastically dominates $G_f(\cdot)$, it is possible to pair up every $f$-type worker with an $m$-type worker with a higher outside option. Formally, let $\mu : [0, 1] \to [0, 1]$ define for each $f$ type worker $i$ an $m$ type worker $j$ such that $\theta_j \geq \theta_i$ and $\mu(\theta_i) \neq \mu(\theta_{i'})$ for any $i \neq i'$. We know by Theorem 1 that $\frac{T(\Lambda, v, \theta_i)}{T(\Lambda, v, \theta_j)}$ converges monotonically to 1 in $\Lambda$, which implies that the average earnings of each gender also converges monotonically to 1 in $\Lambda$.

However, if transparency spreads through word of mouth, men’s and women’s differing propensities to gossip about wages may affect who receives what information, and hence who renegotiates. Empirically, we find evidence that a permissive communication environment affects men’s and women’s wages differently. In TaskRabbit, men receive raises above their initial bids more often than women on average when workers are co-located, and not when they are separated. In Col. 1-3 of Table VIII we regress receipt of any raise on the interaction between female and transparent (co-location).

\[
\text{Any Raise(Yes=1)}_{ik} = \beta_0 + \beta_1 \cdot \text{transparent}_{ik} + \beta_2 \cdot \text{female}_i + \beta_3 \cdot \text{female}_i \times \text{transparent}_{ik} + \epsilon_{ik}
\]

While co-location increases the likelihood of a raise for men by more than 14% across all specifications, for women the likelihood is statistically smaller than half this magnitude. This is demonstrated via statistically significant and negative estimates of $\beta_3$ in Cols. 1-3.

This finding suggests that either women communicate with their peers about pay less often than men, or that they are less likely to successfully renegotiate higher wages despite having similar information. Both possibilities are consistent with survey evidence in the literature.\textsuperscript{43} In our experimental setting, when men and women are shown the same information about wages, we do not see a wage gap in the final negotiations by men and women. Because of this, we only model differences in communication patterns between men and women. Other important gender differences in the negotiation process may exist, and are worth future study.

We make simple adjustments to the model to capture differences in rates of wage communication across genders. Let $\alpha_m > \alpha_f > 0$ be the rates at which men and women “speak about wages,” respectively. Let the arrival rate of information for a worker of gender

\textsuperscript{43}Babcock and Laschever (2003) find that women are less informed of the market value of their work than men and are less likely to negotiate. Hall and Krueger (2012) (Table 4) find that women are roughly half as likely as men to bargain for wages. Goldfarb and Tucker (2011) show that women are more private about their pay than men. In a survey we conduct presenting vignettes of TaskRabbit workers in a co-located job, participants (of both genders) believe men are more likely than women to ask and discover a coworker’s wage (Figure A1).
\( \ell \in \{m, f\} \) be \( \alpha_\ell \lambda \). Then

\[
\Lambda_\ell = \frac{\alpha_\ell \lambda}{\rho + \delta + \alpha_\ell \lambda}
\]

for \( \ell \in \{m, f\} \) and \( \lambda \in [0, \infty) \) \( (7) \)

This communication heterogeneity causes the de facto arrival rate of information of men to be greater than that of women, that is, \( \Lambda_m - \Lambda_f \geq 0 \) for all \( \lambda \). We plot \( \Lambda_m - \Lambda_f \) as a function of \( \lambda \) for arbitrary parameters in Figure VII. \( \Lambda_m - \Lambda_f \) is initially increasing but converges to 0.

**Proposition 6.** Let \( \lambda_c \) solve

\[
\frac{\alpha_m}{\alpha_f} = \left( \frac{\rho + \delta + \alpha_m \lambda}{\rho + \delta + \alpha_f \lambda} \right)^2,
\]

\( \Lambda_m - \Lambda_f \) is strictly increasing in \( \lambda \) for all \( \lambda < \lambda_c \) and strictly decreasing for all \( \lambda > \lambda_c \). As \( \lambda \to \infty \), \( \Lambda_m - \Lambda_f \to 0 \).

Compare the effects of moving from full privacy to some \( \lambda > 0 \). When \( \lambda \) is low, information transmission between workers rarely happens through word of mouth. If men are more likely to speak about wages, they disproportionately benefit from low levels of transparency. However, when \( \lambda \) is high, men gain less compared to women because all workers learn information quickly. In extreme cases of transparency \( (\lambda \to \infty) \) any communication advantage men have completely disappears. An important implication of our findings is that pay gossip between coworkers may exacerbate pay discrepancies, while full transparency may close the gender gap.

That the gender wage gap is closed by full transparency is supported by the fact that all managers in the transparency treatment of our experiment pay equal wages to all workers. We include Table IX to test additional theoretical predictions in our experimental data. We estimate the following three specifications

\[
\{\text{Hired Worker (Yes=1)}_{ij}, \log(\text{Wages|Hired})_{ij}, \log(\text{Wages|Positive Payout})_{ij}\} = \\
\beta_0 + \beta_1 \cdot \text{transparent}_{ij} + \beta_2 \cdot \text{female}_i + \beta_3 \cdot \text{female}_i \times \text{transparent}_{ij} + \phi \cdot X_i + \psi \cdot S_j + \epsilon_{ij}
\]

where worker and manager demographics are given by \( X_i \) and \( S_j \) respectively, and we allow for correlated errors at the level of the manager. Coefficient \( \beta_3 \) measures the differential effect of full transparency for women. Women experience, on average, higher rates of hiring (Col. 1) and higher wages (Col. 2-3) under transparency compared to men. These point estimates are approximately 50% larger for women than men, albeit with large standard errors. Our estimate for \( \beta_1 + \beta_3 \), which gives the effect of transparency among women only, is not statistically significant in Col. 2 (wages conditional on hiring). We interpret these findings as suggestive evidence for the theoretical modeling of this section which predicts that full transparency is, relatively speaking, more beneficial for women than men.
VIII. HETERGENEOUS AND UNKNOWN WORKER QUALITIES

Until now we have assumed that relative productivities are known by workers and the firm. This is based on our empirical setting in which many jobs consist of simple and standardized tasks, with binary performance outcomes. Here we discuss our findings in contexts where there may be significant heterogeneity in worker productivities, and where these differences are only observed by the firm.

We find that equilibrium expected wages, firm profit, and the hiring rate level under full transparency are unchanged from the base model when productivity differences are observed. Transparency does not fully equalize wages, due to different worker productivities. But, earnings between high-productivity workers and low-productivity workers are compressed relative to the case where productivity differences are observable.

Suppose there are two types of workers, with productivities $v$ and $V$, respectively. $v$ and $V$ are drawn independently from the same distribution. Each worker is equally likely to have productivity type $v$ or $V$. The firm knows each worker’s productivity type, but workers do not. To highlight mechanisms at play, we study the extreme case in which outside options are distributed independently of productivity so that workers do not receive a signal of their relative productivities. The firm initially sets two maximum wages, $\bar{W}_V$ and $\bar{W}_v$, and the rest of the game is as before.

Under full privacy, the equilibrium outcome mirrors that of the base model: $\bar{W}_v = v$ and $\bar{W}_V = V$, and workers make the same initial offers. Therefore, firm profits, the expected hiring rate, and wage dispersion are the same as before.

For tractability, we consider only the effects of full transparency. Upon meeting the firm, each worker sees the wages of other employed workers, and, in particular, will observe $\bar{W}_v$ and $\bar{W}_V$. Without loss of generality, we assume that $v < V$ so that $\bar{W}_v \leq \bar{W}_V$. Worker $i$ will offer $\bar{W}_v$ (and be employed with probability 1) if

$$W_v > \frac{1}{2} \bar{W}_v + \frac{1}{2} \theta_i$$

and she will offer $\bar{W}_V$ if $\bar{W}_V \geq \theta_i$ and

$$\bar{W}_v \leq \frac{1}{2} \bar{W}_v + \frac{1}{2} \theta_i$$

When a worker demands $\bar{W}_V$ the firm will reject her offer with probability $\frac{1}{2}$, which clearly reduces the hiring rate and firm profits compared to the baseline model where there is no uncertainty about worker productivity. On the other hand, low outside option, productivity $V$ workers will offer $\bar{W}_v$, meaning that the firm is able to hire some high productivity workers at low wages, increasing profits. We show that, because of this latter effect, the firm sets $\bar{W}_v$
Proposition 7. In equilibrium under full transparency, $\bar{W}_V = \bar{\bar{w}}(V)$ and $\bar{W}_v > \bar{\bar{w}}(v)$, where $\bar{\bar{w}}(\cdot)$ is the maximum wage the firm sets in the baseline model where productivity differences are observable.

In this setting, transparency leads to wage compression as opposed to complete wage equalization. All employed, low-productivity workers earn $\bar{W}_v$, as the firm rejects all such workers who demand more. Employed, high-productivity workers earn either $\bar{W}_v$ or $\bar{W}_V$. Since $\bar{W}_v > \bar{\bar{w}}(v)$, and $\bar{W}_V = \bar{\bar{w}}(V)$, the gap in pay between low- and high-productivity workers is smaller than in the base model. Interestingly, we show that the firm may set $\bar{W}_v > v$ when $v$ is sufficiently small, incurring a loss on low-productivity workers!

Because $\bar{W}_v > \bar{\bar{w}}(v)$, more low-productivity workers are hired than if productivity differences were observable. This completely offsets the reduction in the hiring rate caused by high outside option, low type workers requesting $\bar{W}_V$. The fact that the firm is able to secure low outside option, high productivity workers at wage $\bar{W}_v$ also offsets the profit loss caused by missing out on certain low quality workers.

Proposition 8. For any values $v$ and $V$, firm profit and the hiring rate are the same as in the baseline model with observable productivity differences.

This analysis shows that transparency has similar effects even when relative worker productivities are not known. These results hinge on the assumption that workers correctly estimate their chances of being a high productivity worker. Recent research has argued that some workers may be overconfident in their abilities compared to those of their peers (Hoffman and Burks, 2017). In our context, we can model worker confidence with parameter $\gamma$, which is the probability that each worker places on being type $V$ upon seeing the wages of her peers. $\gamma = \frac{1}{2}$ is as above, where workers are neither over nor underconfident. Higher levels of $\gamma$ represent more confidence.

Proposition 9. Firm profit under full transparency is decreasing in $\gamma$.

Unobservable worker productivities coupled with high levels of overconfidence may lead transparency to reduce profits and the hiring rate below full privacy levels. As workers become extremely overconfident, i.e. $\gamma$ converges to 1, the firm must either employ all workers at essentially the same wage, or only hire high productivity workers. Therefore, transparency may cause high turnover with high overconfidence.

IX. Conclusion

Pay transparency and norms about pay privacy have been in the political and popular spotlights, but their effect on wages, hiring, and profits are not well understood. Moreover,
federal and local pay-transparency regulations do not systematically address alternative work arrangements or online markets where platform design choices can dramatically affect transparency. We study the equilibrium effects of pay transparency in markets for short-term work by combining a dynamic bargaining model with an empirical analysis of panel data from an online labor platform, and an online field experiment. Our analysis of equilibrium wages, hiring rate, and profits under greater pay transparency reveals consequences that are counterintuitive and economically significant in a market for low-skill tasks.

We empirically assess the effects of transparency in our administrative and experimental settings. In both, pay transparency improves the negotiating position of the employer, which leads to wages that are 7-8% lower. Employer profits are even larger as transparency raises the hiring rate. Increasing transparency increases hiring at equilibrium wages by approximately 10% in our experiment. We also show that transparency equalizes wages while increasing dispersion in worker surplus by shifting surplus toward low outside option workers. We present relative worker surplus as an additional measure of fairness, which should be interpreted in light of what outside options represent. If outside options represent cost of effort, then more equal wages resulting from transparency shifts worker surplus toward workers most capable of completing the job. If outside options represent previous wages, then transparency lessens disparities in opportunity in other labor markets.

Our finding that pay transparency is profitable for employers appears at odds with the commonly cited statement that transparency is rare and that most firms rally against it (Hegewisch et al., 2011). One reason for this is the narrow framing of transparency in the popular debate. In this paper, we show that the equilibrium outcome under full transparency is equivalent to the firm optimally posting a wage. Redefining transparency to include not only pay discussions on the job but also the choice of the employer to be forthcoming about a posted price at the time of hiring implies that there is actually a high degree of transparency in the economy, and employers are actively selecting it. Hall and Krueger (2012) show that nearly three-fourths of workers face a very high degree of transparency. This share is higher among jobs with a high degree of standardization, such as entry-level jobs and occupation-certified roles, and these are precisely the jobs where learning the pay of a coworker is likely most informative in wage negotiations. Other studies place transparency within specific occupations at even higher levels.

Employers in favor of pay transparency during initial wage negotiations, need not always

44In their sample, two-thirds of employees faced posted wages. Of the remaining third who did not face a posted wage, 15% knew what their salary would be when they entered negotiations.
45Similarly, Caldwell and Harmon (2019) find that 70% of employees face posted wages and that higher-skilled and more specialized workers are much more likely to increase their wages through renegotiations.
46Niederle et al. (2006) consider entry-level jobs for gastroenterologists and find that 94% of employers pay common wages and “offers are not adjusted in response to outside offers and terms are not negotiable.”
be in favor of transparency. Posting a price is beneficial during the initial hiring process by strengthening the employer’s bargaining position, but renegotiations following on-the-job wage gossip directly lower employer profits. This may be especially true in firms that hire workers to do different types of jobs, as wage information across job types may convey little information about the employers, but potentially decreases morale. Employers may also be concerned with other factors, such as unfavorable press associated with wage disparities across jobs, or overaggressive negotiations by overconfident workers (as discussed in Section VIII). As a result, the public perception that employers discourage transparency could be in large part driven by their desire to prevent gossip after wages have been initially negotiated.

Similarly, while the average worker’s opportunities are worsened with greater transparency, partial transparency increases the pay of the lowest outside option employees (Section III.C). We also show that the employees of superstar firms benefit from greater transparency (Appendix I.1). These workers (or their advocates) may explain the public perception that employees demand greater transparency. Employees may also have additional reasons to seek transparency that have been outside the scope of our study. For example, knowledge of the pay of bosses can be informative about a worker’s career trajectory (Cullen and Perez-Truglia, 2018), or to make informed career investment decisions (Faleye et al., 2013).

As we discuss in Section III.E, our model can be adapted to evaluate recent laws prohibiting employers from asking workers their past wages during the interview process. Our framework reveals a parallel between full transparency and fully revealing workers’ past salary information. Verifiable past salary information strengthens the bargaining power of workers, by allowing workers to credibly commit to rejecting low wage offers. In equilibrium, all workers should voluntarily reveal previous wages due to unraveling. Revealed salary history may lead to a scarring effect of previous low wages. Future research will hopefully test the efficacy of these laws and more stringent laws that ban all past salary information.

We also discover through our analysis that the method of implementing transparency can be consequential. Some policies operate by protecting the rights of workers to discuss pay. We show that when pay information travels through gossip networks, encouraging pay discussions can exacerbate the gender pay gap because men and women may not access the same information at the same rate. In TaskRabbit we find evidence that transparency leads to more men renegotiating their wages than women, widening the gender pay gap. This may be an important consideration in how transparency policies are enacted.

References


## X. Tables and Figures

**TABLE I: Roadmap**

### Table I.A: Mapping Between Theory and Empirics

<table>
<thead>
<tr>
<th>Effect of transparency on:</th>
<th>Theoretical reference</th>
<th>Empirical reference</th>
<th>TaskRabbit or Experiment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Wage equality</td>
<td>Theorem 1</td>
<td>Tables III, VI; Figure I</td>
<td>Both</td>
</tr>
<tr>
<td>2 Worker surplus equality</td>
<td>Corollary 1</td>
<td>Table VI</td>
<td>Experiment</td>
</tr>
<tr>
<td>3 Hiring</td>
<td>Theorem 2</td>
<td>Table VII</td>
<td>Experiment</td>
</tr>
<tr>
<td>4 Profits/ average wages</td>
<td>Theorem 3</td>
<td>Tables IV, VII</td>
<td>Both</td>
</tr>
<tr>
<td>5 Endogenous choice of transparency/ unraveling</td>
<td>Theorem 4</td>
<td>Figures IV, V</td>
<td>TaskRabbit</td>
</tr>
<tr>
<td>6 Gender wage gap</td>
<td>Corollary 2; Proposition 6</td>
<td>Tables VIII, IX</td>
<td>Both</td>
</tr>
</tbody>
</table>

### Table I.B: Overview of Empirical Comparison Groups

<table>
<thead>
<tr>
<th>Comparison groups</th>
<th>Comparable along observables?</th>
<th>Exogenously determined?</th>
<th>Sample size (# jobs)</th>
<th>Additional information</th>
</tr>
</thead>
</table>
| 1 Multi-worker jobs that are co-located (same time and location) vs. separated (same time, different locations) (TaskRabbit) | Yes | Partially due to nature of work | 569 | Restricted to private auctions jobs, and job categories with minimum share 20% of both types of jobs (Tables III, VIII, Figure I).  

2 Posted price vs. private auction jobs (TaskRabbit) | Noii | No | >50k | Table VII, Fig. IV, V.  

3 Price mentioned in job description vs. price not mentioned (TaskRabbit) | Yesiii | No | >50k | Restricted to private auction jobs. Sub-sample of > 20,000 with hourly wage prices only (Table IV). |

4 Common public chat forums vs. private chat forums (Field experiment) | Yes | Yes | 262 | Negotiable treatment arms used for Tables VI, VII, IV (101 managers). Non-negotiable treatment arms used in Fig. VI (161 managers). |

Notes: (i) Replication of Table III results with all categories included can be found in Table A11. (ii) See Table A10 for further details about differences between private auctions and posted price jobs. (iii) See Table II for more details. Small differences are statistically significant due to the large sample size.
and the first worker to accept the price will be assigned to the job. Price is the total amount transacted for the job, including the platform fee.

started in 2008 until June 2014. posted price refers to jobs assigned where the employer chooses a price that is publicly posted on the platform, active in the city. Vacancy-fill rate is the share of posted job positions that are matched to a worker during the time period, since the platform

<table>
<thead>
<tr>
<th>Market age (months)</th>
<th>N</th>
<th>Mean</th>
<th>Stand. Dev.</th>
<th>25th Perc.</th>
<th>75th Perc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>417</td>
<td>16.6</td>
<td>12.2</td>
<td>6.1</td>
<td>26.1</td>
<td></td>
</tr>
</tbody>
</table>

Price ($) 417 56.1 8.69 52.0 61.0

Initial bids received ($) 48.9 52.4 -1.59 469 930
Amount below max bid (%) 0.38 0.32 1.13 469 930
Number hired 2.56 2.54 0.16 184 386
Received bids (Gini) 0.19 0.20 0.255 184 386
Chosen bids (Gini) 0.08 0.07 1.53 184 386
Positive ratings (Gini) 0.31 0.29 1.10 184 386
Length of description 732 756 -0.72 184 386
LDA 1 (%) (eg. “would like,” “hoping,” “would be great”) 1.06 3.61 -2.37 184 386
LDA 2 (%) (eg. “give feedback,” “product review”) 3.25 2.02 0.87 184 386
LDA 3 (%) (eg. “assistance,” “shopping,” searching”) 5.29 6.61 -0.94 184 386
LDA 4 (%) (eg. “planning,” “evening”) 6.60 7.52 -0.82 184 386
LDA 5 (%) (eg. “moving,” “pickup,” “delivery”) 8.55 8.70 -0.14 184 386
LDA 6 (%) (eg. “documents,” “photos”) 3.20 3.46 -0.18 184 386

(b) “Price Mention” refers to the presence of text in the job description that indicates a range for acceptable bids. Initial bids are submitted after reading the job post with or without price mentions and we consider initial bids as an outcome of interest in Table IV. Observation counts

<table>
<thead>
<tr>
<th>City markets</th>
<th>N</th>
<th>Mean</th>
<th>Stand. Dev.</th>
<th>25th Perc.</th>
<th>75th Perc.</th>
</tr>
</thead>
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<tr>
<td>Share posted price</td>
<td>417</td>
<td>0.43</td>
<td>0.10</td>
<td>0.37</td>
<td>0.46</td>
</tr>
<tr>
<td>Market age (months)</td>
<td>417</td>
<td>16.6</td>
<td>12.2</td>
<td>6.1</td>
<td>26.1</td>
</tr>
<tr>
<td>Price ($)</td>
<td>417</td>
<td>56.1</td>
<td>8.69</td>
<td>52.0</td>
<td>61.0</td>
</tr>
</tbody>
</table>

(c) City-month level summary statistics about the 19 active cities of TaskRabbit. Market age is the number of months since Task Rabbit became active in the city. Vacancy-fill rate is the share of posted job positions that are matched to a worker during the time period, since the platform started in 2008 until June 2014. posted price refers to jobs assigned where the employer chooses a price that is publicly posted on the platform, and the first worker to accept the price will be assigned to the job. Price is the total amount transacted for the job, including the platform fee.
<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{\beta}_1 ) Amt. under top bid (%)</td>
<td>0.0105</td>
<td>0.0257</td>
<td>0.0294</td>
<td>0.883***</td>
<td>0.958***</td>
<td>0.947***</td>
</tr>
<tr>
<td></td>
<td>[0.0181]</td>
<td>[0.0192]</td>
<td>[0.0193]</td>
<td>[0.105]</td>
<td>[0.0740]</td>
<td>[0.0791]</td>
</tr>
<tr>
<td>Years experience</td>
<td>0.0191</td>
<td>0.0436**</td>
<td>-0.126</td>
<td>0.0334</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0369]</td>
<td>[0.0215]</td>
<td>[0.112]</td>
<td>[0.0527]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective percent positive overall</td>
<td>0.000788</td>
<td>-0.00100</td>
<td>-0.0120</td>
<td>0.084</td>
<td>0.0326</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0108]</td>
<td>[0.00570]</td>
<td>[0.0278]</td>
<td>[0.0243]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective percent positive in cat.</td>
<td>0.0349</td>
<td>-0.0120</td>
<td>0.0482</td>
<td>-0.0632</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0312]</td>
<td>[0.0240]</td>
<td>[0.0703]</td>
<td>[0.100]</td>
<td></td>
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<tr>
<td>No. reviews</td>
<td>-0.0135</td>
<td>-0.00474</td>
<td>0.0453</td>
<td>0.0215</td>
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<td></td>
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<tr>
<td></td>
<td>[0.00899]</td>
<td>[0.00609]</td>
<td>[0.0302]</td>
<td>[0.0176]</td>
<td></td>
<td></td>
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<tr>
<td>No. reviews cat.</td>
<td>0.0792</td>
<td>-0.00761</td>
<td>-0.375**</td>
<td>-0.0614</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0546]</td>
<td>[0.0390]</td>
<td>[0.170]</td>
<td>[0.144]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean rating</td>
<td>-0.000217</td>
<td>0.0130</td>
<td>-0.0306</td>
<td>0.0145</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0169]</td>
<td>[0.0103]</td>
<td>[0.0479]</td>
<td>[0.0399]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean rating in category</td>
<td>0.000598</td>
<td>-0.00112</td>
<td>0.0271</td>
<td>-0.0216</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0131]</td>
<td>[0.00863]</td>
<td>[0.0360]</td>
<td>[0.0262]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. workers (log)</td>
<td>-0.128***</td>
<td>-0.00728</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0293]</td>
<td>[0.197]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean bid (log)</td>
<td>0.0138</td>
<td>-0.171</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0304]</td>
<td>[0.176]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.215***</td>
<td>0.234*</td>
<td>0.206***</td>
<td>0.267***</td>
<td>0.934</td>
<td>0.333</td>
</tr>
<tr>
<td></td>
<td>[0.0256]</td>
<td>[0.129]</td>
<td>[0.0467]</td>
<td>[0.0625]</td>
<td>[0.761]</td>
<td>[0.201]</td>
</tr>
</tbody>
</table>

> 1 hour overlap | ✓ | ✓ | ✓ | ✓ | ✓ |
Job-specific FE | ✓ | ✓ | ✓ |

P-value Test: \( H_0 : \beta_1 = 1 \) | 0.267 | 0.570 | 0.509 |
Mean Dep. Var. | 0.22 | 0.22 | 0.22 | 0.43 | 0.44 | 0.46 |
SE Dep. Var. | 0.41 | 0.41 | 0.41 | 0.38 | 0.41 | 0.42 |
Observations | 930 | 708 | 708 | 203 | 154 | 116 |
Clusters Jobs | 390 | 299 | 299 | 123 | 92 | 54 |
Clusters Workers | 627 | 481 | 481 | 165 | 130 | 96 |
Clusters Employers | 293 | 237 | 237 | 117 | 88 | 52 |
\( R^2 \) | 0.001 | 0.047 | 0.839 | 0.665 | 0.730 | 0.963 |

Notes: Each model is estimated by OLS. Col. 1-3 are linear probability models. An observation is an accepted worker-bid for jobs with co-located workers. Our main sample is restricted to job categories with at least 20% of each of separated and co-located multi-worker jobs, however results are robust to looking across all categories with co-located jobs (see Appendix Table A11). The dependent variable equals one if the particular worker earns more than their agreed to bid, and 0 otherwise. Following theoretical predictions SF1 and SF2, Col. 4-6 are restricted to those workers that receive a raise (final pay higher than their agreed-to bid). The dependent variable is the size of the raise, as percent above bid. The primary explanatory variable, amount below maximum bid, is equal to \( \frac{(bid_{max} - bid_i)}{bid_i} \) for person \( i \). Reviews are in units of 1000. “> 1 hour overlap” is equal to 1 if the survey response to the question “How many hours is it necessary for workers to overlap in the same place at the same time in order to complete this job?” is greater than 1 hour on average. Singleton observations are dropped when job fixed effects are added. Standard errors are three-way clustered at the level of the job, worker, and employer.
### TABLE IV: LOWER WAGES UNDER TRANSPARENCY, TASKRABBIT

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>All Bids (log $)</th>
<th>Winners’ Pay (log $)</th>
<th>Winners’ Hourly Pay (log hourly wages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent (Job mentions price)</td>
<td>-0.0959*** [0.0136]</td>
<td>-0.136*** [0.0142]</td>
<td>-0.0778*** [0.0281]</td>
</tr>
<tr>
<td>Exp. on platform (Days)</td>
<td>0.378** [0.175]</td>
<td>0.493*** [0.123]</td>
<td>1.048*** [0.393]</td>
</tr>
<tr>
<td>No. ratings in category</td>
<td>-0.991*** [0.0859]</td>
<td>-0.512*** [0.172]</td>
<td>1.921*** [0.308]</td>
</tr>
<tr>
<td>No. ratings overall</td>
<td>1.656*** [0.0546]</td>
<td>1.694*** [0.123]</td>
<td>0.361 [0.400]</td>
</tr>
<tr>
<td>Mean rating in category</td>
<td>0.0476*** [0.00733]</td>
<td>0.0792*** [0.0199]</td>
<td>0.0230 [0.0363]</td>
</tr>
<tr>
<td>Mean rating overall</td>
<td>-0.00385 [0.0114]</td>
<td>-0.0168 [0.0330]</td>
<td>-0.0591 [0.0796]</td>
</tr>
</tbody>
</table>

| Category FE | ✓ | ✓ | ✓ |
| Worker FE | ✓ | ✓ | ✓ |

| Mean Dep. Var. | 3.37 | 3.69 | 3.02 |
| SE Dep. Var. | 0.946 | 0.854 | 0.624 |
| Observations | >100k | >100k | >20k |
| $R^2$ | 0.277 | 0.381 | 0.607 |

Notes: Each model is estimated by OLS. An observation is a worker-bid on TaskRabbit. The dependent variable is the log bid in Col. 1, and log final pay in Col. 2 and 3. In Col. 3 we restrict our attention to the sample of jobs that solicit hourly wage bids rather than piece rate. The independent variable, transparent, is an indicator equal to one if there is any mention of price in the job post. Only job posts that accept private bids are included in these regressions. Platform tenure is measured in days. Performance covariates include the square of all ratings covariates. Two-way clustered standard errors at the worker and employer level are in square brackets. We do not reveal observation counts for aggregate activity on the platform at the request of TaskRabbit.
<table>
<thead>
<tr>
<th></th>
<th>Negotiable Treatments</th>
<th></th>
<th>Non-negotiable Treatments</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Transparent</td>
<td>Transparent</td>
<td>T-Statistic</td>
<td>Not Transparent</td>
</tr>
<tr>
<td></td>
<td>(mean)</td>
<td>(mean)</td>
<td>(diff)</td>
<td>(mean)</td>
</tr>
<tr>
<td>Workers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>37</td>
<td>37</td>
<td>0.02</td>
<td>34</td>
</tr>
<tr>
<td>Share female</td>
<td>0.55</td>
<td>0.58</td>
<td>-0.34</td>
<td>0.46</td>
</tr>
<tr>
<td>Share w/ at least some college</td>
<td>0.97</td>
<td>0.94</td>
<td>1.12</td>
<td>0.92</td>
</tr>
<tr>
<td>N</td>
<td>174</td>
<td>129</td>
<td></td>
<td>183</td>
</tr>
<tr>
<td>Managers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>37</td>
<td>38</td>
<td>-0.68</td>
<td>36</td>
</tr>
<tr>
<td>Share female</td>
<td>0.57</td>
<td>0.68</td>
<td>-1.04</td>
<td>0.52</td>
</tr>
<tr>
<td>Share w/ at least some college</td>
<td>0.92</td>
<td>0.87</td>
<td>0.88</td>
<td>0.95</td>
</tr>
<tr>
<td>N</td>
<td>58</td>
<td>43</td>
<td></td>
<td>88</td>
</tr>
</tbody>
</table>

Notes: The leftmost three columns describe the sample assigned to negotiate in either a split or common chat room. The rightmost three columns describe the sample who were not allowed to renegotiate after placing the initial bid. The “diff” columns report the t-statistic of a test of the null hypothesis that the difference in means between Col. 1 and Col. 2 is 0 (Col. 3), or between Col. 4 and Col. 5 is 0 (Col. 6). We report the total number of participants in our analysis as the observation count, however we ask demographic characteristics after all interactions are complete and give the option to opt out of any particular question. Hence for our regressions we impute missing values using the average of all non-missing values. In this table we only compute means and statistical tests using non-missing values. Up to 11% of managers, and 37% of workers opted out of answering a particular demographic characteristic.
<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>Wages (Gini)</th>
<th>Hourly Wage (Gini)</th>
<th>Worker Surplus (Gini)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent (Public chat)</td>
<td>-0.0237***</td>
<td>-0.0211***</td>
<td>0.0784*</td>
</tr>
<tr>
<td></td>
<td>[0.00721]</td>
<td>[0.00570]</td>
<td>[0.0383]</td>
</tr>
<tr>
<td>Manager Some College</td>
<td>0.0335**</td>
<td>0.158</td>
<td>0.0730</td>
</tr>
<tr>
<td></td>
<td>[0.0167]</td>
<td>[0.0965]</td>
<td>[0.0953]</td>
</tr>
<tr>
<td>Manager Age</td>
<td>-0.000522</td>
<td>0.00167</td>
<td>0.000961</td>
</tr>
<tr>
<td></td>
<td>[0.000460]</td>
<td>[0.00230]</td>
<td>[0.00193]</td>
</tr>
<tr>
<td>Manager Female</td>
<td>-0.000686</td>
<td>-0.0492</td>
<td>0.0488</td>
</tr>
<tr>
<td></td>
<td>[0.00892]</td>
<td>[0.0459]</td>
<td>[0.0488]</td>
</tr>
<tr>
<td>Age (Worker Avg.)</td>
<td>-0.000275</td>
<td>-0.00265</td>
<td>-0.00380</td>
</tr>
<tr>
<td></td>
<td>[0.000474]</td>
<td>[0.00328]</td>
<td>[0.00279]</td>
</tr>
<tr>
<td>Some College (Worker Avg.)</td>
<td>-0.0963**</td>
<td>-0.323</td>
<td>-0.0814</td>
</tr>
<tr>
<td></td>
<td>[0.0477]</td>
<td>[0.266]</td>
<td>[0.247]</td>
</tr>
<tr>
<td>Female (Worker Avg.)</td>
<td>-0.0243</td>
<td>0.0966</td>
<td>-0.150*</td>
</tr>
<tr>
<td></td>
<td>[0.0190]</td>
<td>[0.0826]</td>
<td>[0.0867]</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0237***</td>
<td>0.128***</td>
<td>0.147***</td>
</tr>
<tr>
<td></td>
<td>[0.00721]</td>
<td>[0.0419]</td>
<td>[0.0222]</td>
</tr>
</tbody>
</table>

Notes: Each model is estimated by OLS. An observation is a manager. Data is from the sample assigned to treatment groups where workers were allowed to negotiate with the manager. For participants who opted not to report certain demographics, we impute the missing value using the average of the non-missing values and include an indicator variable equal to 1 if the value has been imputed. The dependent variable in Col. 1-2 is the dispersion in final wages agreed-to between the worker and manager. The dependent variable in Col. 3-4 is dispersion in expected hourly wage, defined as the per page wage agreed to divided by the estimated time to complete each page. The dependent variable in Col. 5-6 is dispersion in worker surplus, defined as the difference between the per page rate agreed to and the outside option. Since the Gini coefficient is only defined if more than one worker is hired by the manager, we exclude from this table employers who hire one or zero workers. We also exclude workers with inconsistent responses to the Becker-DeGroot-Marschak (BDM) outside option elicitation method. Covariates with “worker avg.” refer to the mean demographic characteristic for all workers assigned to a particular manager. Robust standard errors are displayed in square brackets.
<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent (Public chat)</td>
<td>0.106**</td>
<td>-0.0740*</td>
<td>-0.130***</td>
<td>0.136</td>
<td>0.271**</td>
</tr>
<tr>
<td></td>
<td>[0.0485]</td>
<td>[0.0396]</td>
<td>[0.0476]</td>
<td>[0.133]</td>
<td>[0.106]</td>
</tr>
<tr>
<td>Worker Some College</td>
<td>-0.121</td>
<td>0.123</td>
<td>0.242**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.194]</td>
<td>[0.104]</td>
<td>[0.106]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker Age</td>
<td>-0.00518</td>
<td>0.00274**</td>
<td>-0.00366*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.00338]</td>
<td>[0.00131]</td>
<td>[0.00212]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker Female</td>
<td>0.0470</td>
<td>-0.0718</td>
<td>0.0513</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0736]</td>
<td>[0.0466]</td>
<td>[0.0550]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager Some College</td>
<td>0.0896</td>
<td>0.0745</td>
<td>0.281**</td>
<td>-0.298</td>
<td>-0.242</td>
</tr>
<tr>
<td></td>
<td>[0.106]</td>
<td>[0.1000]</td>
<td>[0.123]</td>
<td>[0.270]</td>
<td>[0.249]</td>
</tr>
<tr>
<td>Manager Age</td>
<td>0.00507*</td>
<td>0.00179</td>
<td>-0.00275</td>
<td>0.0186***</td>
<td>0.0154***</td>
</tr>
<tr>
<td></td>
<td>[0.00292]</td>
<td>[0.00201]</td>
<td>[0.00240]</td>
<td>[0.00701]</td>
<td>[0.00556]</td>
</tr>
<tr>
<td>Manager Female</td>
<td>-0.106</td>
<td>-0.0483</td>
<td>0.0142</td>
<td>-0.212</td>
<td>-0.207*</td>
</tr>
<tr>
<td></td>
<td>[0.0672]</td>
<td>[0.0522]</td>
<td>[0.0581]</td>
<td>[0.163]</td>
<td>[0.124]</td>
</tr>
<tr>
<td>Age (Worker Avg.)</td>
<td>-0.00537</td>
<td>-0.00370</td>
<td>0.00167</td>
<td>-0.0141</td>
<td>-0.00759</td>
</tr>
<tr>
<td></td>
<td>[0.00437]</td>
<td>[0.00319]</td>
<td>[0.00414]</td>
<td>[0.0107]</td>
<td>[0.00623]</td>
</tr>
<tr>
<td>Some College (Worker Avg.)</td>
<td>-0.169</td>
<td>-0.225</td>
<td>-0.574</td>
<td>-0.206</td>
<td>-0.184</td>
</tr>
<tr>
<td></td>
<td>[0.209]</td>
<td>[0.252]</td>
<td>[0.349]</td>
<td>[0.691]</td>
<td>[0.489]</td>
</tr>
<tr>
<td>Female (Worker Avg.)</td>
<td>-0.00532</td>
<td>0.271***</td>
<td>0.0486</td>
<td>0.160</td>
<td>0.0179</td>
</tr>
<tr>
<td></td>
<td>[0.103]</td>
<td>[0.0918]</td>
<td>[0.108]</td>
<td>[0.259]</td>
<td>[0.179]</td>
</tr>
<tr>
<td>Constant</td>
<td>0.866***</td>
<td>1.397***</td>
<td>1.681***</td>
<td>0.901</td>
<td>0.402</td>
</tr>
<tr>
<td></td>
<td>[0.220]</td>
<td>[0.180]</td>
<td>[0.230]</td>
<td>[0.691]</td>
<td>[0.554]</td>
</tr>
</tbody>
</table>

| Mean Dep. Var.               | 0.525                    | 4.276                    | 4.377                    | 0.603                    | 0.271                    |
| Observations                 | 303                      | 159                      | 57                       | 101                      | 101                      |
| Clusters                     | 101                      | 84                       | 49                       | 101                      | 101                      |
| \( R^2 \)                    | 0.273                    | 0.135                    | 0.370                    | 0.117                    | 0.212                    |

Notes: Col. 1-5 are estimated using ordinary least squares. Data is from the sample assigned to treatment groups where workers were allowed to negotiate with the manager. For participants who opted not to report certain demographics, we impute the missing value using the average of the non-missing values and include an indicator variable equal to 1 if the value has been imputed. An observation is a worker (Col. 1-3) or manager (Col. 4-5). The dependent variables (moving left to right) are hiring (equal to 1 if the worker and manager agree on a wage and 0 otherwise), log wage agreed to with the manager, log wage agreed to with the manager conditional on receiving a payout by submitting at least one page at 95% accuracy, inverse hyperbolic sine of total pages completed by workers assigned to a manager, and inverse hyperbolic sine of profits a manager earns. We use inverse hyperbolic sine transformation to accommodate 0 outcomes. This transformation down-weights treatment effects at small values, is linear for x close to 0 and approximates \( \log(2x) \) for x greater than 3 (for more details see Kline et al. (2019) Appendix D, page 65). Covariates with “worker avg.” refer to the mean demographic characteristic for all workers assigned to a particular manager. Clustered standard errors at the manager level are in square brackets.
### TABLE VIII: Gender gap in likelihood of raise rises with partial transparency, TaskRabbit

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent (Co-located)</td>
<td>0.196***</td>
<td>0.182***</td>
<td>0.143***</td>
</tr>
<tr>
<td>Female</td>
<td>0.00688</td>
<td>0.0340</td>
<td>0.0800**</td>
</tr>
<tr>
<td>Transparent × Female</td>
<td>-0.143***</td>
<td>-0.110**</td>
<td>-0.0973*</td>
</tr>
<tr>
<td>Years experience</td>
<td>0.0253</td>
<td>0.0265</td>
<td></td>
</tr>
<tr>
<td>Effective percent positive overall</td>
<td>-0.00270</td>
<td>-0.00117</td>
<td></td>
</tr>
<tr>
<td>Effective percent positive in cat.</td>
<td>0.0220</td>
<td>0.00752</td>
<td></td>
</tr>
<tr>
<td>No. reviews</td>
<td>-0.0109*</td>
<td>-0.0128*</td>
<td></td>
</tr>
<tr>
<td>No. reviews in cat.</td>
<td>0.0389*</td>
<td>0.0268</td>
<td></td>
</tr>
<tr>
<td>Mean rating</td>
<td>-0.00411</td>
<td>-0.00454</td>
<td></td>
</tr>
<tr>
<td>Mean rating in category</td>
<td>0.00179</td>
<td>-0.000510</td>
<td></td>
</tr>
<tr>
<td>No. workers (log)</td>
<td>-0.0885***</td>
<td>-0.0713**</td>
<td></td>
</tr>
<tr>
<td>Mean bid (log)</td>
<td>0.00575</td>
<td>-0.0329</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.0788***</td>
<td>0.125</td>
<td>0.284**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1 hour overlap</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Category FE</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Mean Dep. Var.</td>
<td>0.18</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>SE Dep. Var.</td>
<td>0.38</td>
<td>0.38</td>
<td>0.38</td>
</tr>
<tr>
<td>Observations</td>
<td>1342</td>
<td>1083</td>
<td>1083</td>
</tr>
<tr>
<td>Clusters Jobs</td>
<td>570</td>
<td>462</td>
<td>462</td>
</tr>
<tr>
<td>Clusters Workers</td>
<td>874</td>
<td>718</td>
<td>718</td>
</tr>
<tr>
<td>Clusters Employers</td>
<td>381</td>
<td>324</td>
<td>324</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.051</td>
<td>0.067</td>
<td>0.113</td>
</tr>
</tbody>
</table>

Notes: Each model is estimated by OLS. An observation is a worker-bid in a multi-worker job on TaskRabbit using a private auction. The sample is restricted to those with self-reported gender information (96% of workers). All specifications are linear probability models, and are restricted to categories with (at least 20%) separated and co-located jobs. The dependent variable equals 1 if the particular worker earns more than their initial bid, and 0 otherwise. “> 1 hour overlap” is equal to 1 if the survey response to the question “How many hours is it necessary for workers to overlap in the same place at the same time in order to complete this job?” is greater than 1 hour on average. Standard errors are three-way clustered at the level of the job, worker, and employer.
TABLE IX: GENDER GAP UNDER FULL TRANSPARENCY, EXPERIMENT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_1$ Transparent (Public Chat)</td>
<td>0.109</td>
<td>-0.124**</td>
<td>-0.195**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.114]</td>
<td>[0.0593]</td>
<td>[0.0807]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_2$ Female</td>
<td>0.00866</td>
<td>-0.0115</td>
<td>0.0277</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0872]</td>
<td>[0.0454]</td>
<td>[0.0553]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_3$ Transparent × Female</td>
<td>0.0695</td>
<td>0.0696</td>
<td>0.0794</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.134]</td>
<td>[0.0750]</td>
<td>[0.0946]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker Some College</td>
<td>-0.133</td>
<td>0.0329</td>
<td>0.251**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.241]</td>
<td>[0.131]</td>
<td>[0.114]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker Age</td>
<td>-0.00554</td>
<td>0.00183</td>
<td>-0.00368</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.00402]</td>
<td>[0.00164]</td>
<td>[0.00240]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager Some College</td>
<td>-0.0121</td>
<td>0.0779</td>
<td>0.287**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.149]</td>
<td>[0.157]</td>
<td>[0.123]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager Age</td>
<td>0.00838*</td>
<td>-0.00147</td>
<td>-0.00258</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.00431]</td>
<td>[0.00236]</td>
<td>[0.00295]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager Female</td>
<td>-0.142*</td>
<td>0.0621</td>
<td>0.0176</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0769]</td>
<td>[0.0453]</td>
<td>[0.0580]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (Worker Avg.)</td>
<td>-0.00566</td>
<td>0.00207</td>
<td>0.00231</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.00772]</td>
<td>[0.00511]</td>
<td>[0.00584]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some College (Worker Avg.)</td>
<td>-0.0697</td>
<td>0.0781</td>
<td>-0.564</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.366]</td>
<td>[0.452]</td>
<td>[0.382]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.775***</td>
<td>1.204***</td>
<td>1.677***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.280]</td>
<td>[0.295]</td>
<td>[0.281]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Mean Dep. Var.     | 0.412 | 1.446 | 4.323         |
| $\beta_1 + \beta_3$ | 0.179 | -0.0543 | -0.116       |
| SE($\beta_1 + \beta_3$) | 0.0786 | 0.0660 | 0.0647       |
| P-value test: $H_0 : \beta_1 + \beta_3 = 0$ | 0.0251 | 0.414 | 0.0801       |
| Observations       | 194   | 80    | 48            |
| Clusters           | 95    | 59    | 42            |
| $R^2$              | 0.175 | 0.152 | 0.384         |

Notes: Col. 1-3 are estimated using ordinary least squares. Data is from the treatment groups where workers were allowed to negotiate with the manager. An observation is a worker. To test the interaction between gender and our transparency treatment, we drop all observations where the participant chose not to report gender, rather than allow for imputed missing values as in our main sample. The dependent variables (moving left to right) are hiring (equal to 1 if the worker and manager agree on a wage and 0 otherwise), log wage agreed to with the manager, and log wage agreed to with the manager conditional on receiving a payout by submitting at least one page at 95% accuracy. Clustered standard errors at the manager level are in square brackets.
Figure II: Effects of increasing $\Lambda$ on worker and firm strategies

Notes: (a) By Equation 3, worker $i$ picks an initial wage offer $w^*_i$ that equals $\frac{w-\theta_i}{1-\Lambda}$ (the black, upward sloping line) and $\frac{1-F(w)}{f(w)}$ (the orange, downward sloping line). (b) The demand effect of increasing $\Lambda$ from 0 to $\frac{3}{4}$ reduces $\bar{w}$ for each $v$, shifting $\frac{1-F(w)}{f(w)}$ to the left. (c) The supply effect of increasing $\Lambda$ from 0 to $\frac{3}{4}$ increases the slope of the function $\frac{w-\theta_i}{1-\Lambda}$. (d) The supply and income effects combine to reduce the initial wage offer of worker $i$ to $w^*_i$ when $\Lambda$ increases.
Figure III: Expected difference in equilibrium wages $T$ periods after entering the market

Notes: Figure III shows the expected difference in the wage of two workers, $i$ and $j$. $T$ periods after each has entered the market when $\theta_i > \theta_j$. The dashed (black) curve represents this difference when $\Lambda = \frac{1}{2}$, $\rho + \delta = 1$, $r = s = 1$, and the solid (orange) curve represents this difference when $\Lambda = \frac{1}{3}$, $\rho + \delta = 1$, $r = s = 1$. Although the dashed curve is initially above the solid one, the two curves satisfy a single-crossing condition in $t$.

Figure IV: Posted price by city

Notes: Figure IV plots the age of each TaskRabbit market (horizontal axis) and the proportion of posted price jobs in each market (vertical axis) at the end of our data sample in June, 2014. TaskRabbit entered Boston in 2008 nearly one year before the start of our data sample. In our analysis we treat the Boston market as if it started at the same date as our data sample, but in reality, there are many months that we do not observe. Boston was where the company was founded and the technology evolved considerably during the first year when it was only available in one city. “Virtual” refers to tasks that are completed by workers online.
Notes: Figure V is a binscatter plot of a balanced panel of 9 local markets active for longer than a year and each city-month is an observation. The bin-means are adjusted for city-level fixed effects, total size of market (measured by the number of job listings), and the share of job postings in each of the 8 largest categories. To address the small number of clusters, we report the p-value after wild cluster bootstrapping, drawing from the six-point Webb distribution, 1 million bootstrap samples. For details, see Roodman et al. (2018) and references therein. We also include Appendix Table A9, a full table of regression results with a more complete set of controls and observations.
**Figure VI: Productivity consequences of transparency when pay is non-negotiable**

![Graph showing relative output by wage gap for non-negotiable, transparent vs. private wages.](image)

Notes: We plot OLS coefficients and robust standard errors from regressing the number of pages completed on the interaction between co-worker bid differences (amt. below highest bid) and an indicator equal to one if co-workers are in a transparent common chat, 0 otherwise. We only include the treatment group that was not allowed to renegotiate, so initial bids were equal to the final pay (conditional on satisfying the manager’s budget). We group the ‘amount from highest bidder’ accepted into three bins: exactly equal, between 0 and $1 difference, and $1 upwards. The data include 205 workers who bid less than or equal to the $5 budget.

**Figure VII: Difference in de facto arrival rate of wage info between genders as a function of $\lambda$**

![Graph showing difference in de facto arrival rate.](image)

Notes: Figure VII plots $\lambda$ against the difference in the de facto rate of information arrival between men and women. This difference is initially increasing in $\lambda$, but after a single peak, it decreases toward 0. Parameters used: $\alpha_m = 2$, $\alpha_f = 1$, $\rho + \delta = 1$. 
A. Data Appendix

A.1. Hiring Results, TaskRabbit

TaskRabbit administrative data includes both job posts that are successfully matched with a worker and those that go unmatched, offering us a measure of unmet labor demand.\textsuperscript{47} We refer to hiring rate, in the context of TaskRabbit, as the proportion of posted positions which are ever filled.

Our model of transparency illuminates an important reason for vacancies: a worker may overbid for a job posted by a low-value employer if wages are not transparent. The bid includes a premium above the outside option which is optimal in expectation without knowledge of $v$, but sub-optimal if $v$ were known to be low. As a result, we expect low-value employers’ positions to be vacant more often, and we also expect low-value employers to increase hiring under higher transparency relative to high-value employers (Theorem 2).

We use annual earnings of household employers as a proxy for willingness to pay. One reason to favor this measure is that, from a survey of employers conducted by TaskRabbit, the most common alternative to using TaskRabbit to complete a task is to do it oneself. Using money as measure of the opportunity cost of time, higher income employers are more likely to have higher time costs (i.e. leisure is a normal good). We run the following specification,

\[ \text{Hire (yes=1)}_{ij} = \beta_0 + \beta_1 \text{(low value)}_j + \beta_2 \text{(transparent)}_{ij} + \beta_3 \text{(low value x transparent)}_{ij} + \epsilon_{ij} \]

This model and data are suited to testing the prediction that transparency is more beneficial for hiring when the employer has a lower value (Theorem 2).

\[ H_0 : \beta_3 = 0 \]

We find that below-median earners in each city are slightly less likely to fill their jobs. Col. 1-3 of Table A1 shows employers are 2\% less likely to fill their positions. Conditional on choosing posted price, below-median earners gain the greatest boost to their vacancy fill rates. Our preferred specification, Col. 3 of Table A1, shows low-value employers gain a relative boost of 4\% more than other employers when they choose to publicly post a price for their jobs.

\textsuperscript{47}Cullen and Farronato (2016) find TaskRabbit to be a slack labor market with highly elastic labor supply, supporting the notion that unfilled tasks reduce total work completed by workers and their wages on platform.
TABLE A1: Effect of Transparency on Hiring by Value of Labor, TaskRabbit

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>Hired worker (yes = 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_3$ Low Value $\times$ Transparent</td>
<td>(Employer inc.) (Posted price)</td>
</tr>
<tr>
<td></td>
<td>0.0203 0.0229* 0.0409**</td>
</tr>
<tr>
<td></td>
<td>[0.0139] [0.0128] [0.0200]</td>
</tr>
<tr>
<td>$\hat{\beta}_1$ Low Value</td>
<td>-0.0210* -0.0172* -0.0187</td>
</tr>
<tr>
<td></td>
<td>[0.0114] [0.0101] [0.0140]</td>
</tr>
<tr>
<td>$\hat{\beta}_2$ Transparent</td>
<td>0.170*** 0.132*** 0.143***</td>
</tr>
<tr>
<td></td>
<td>[0.0112] [0.0103] [0.0164]</td>
</tr>
</tbody>
</table>

Employer Char. ✓ ✓
Category FE ✓ ✓
City FE, Month FE, Mkt. Age ✓

Mean Dep. Var. 0.650 0.650 0.650
Observations >20k >20k >20k
Clusters >5k >5k >5k
$R^2$ 0.0352 0.0664 0.0745

Notes: Each model is a linear probability model estimated by OLS. An observation is a job posting on TaskRabbit. The sample is restricted to jobs posted by household employers with observable earnings. The dependent variable is equal to 1 if the job posting is matched to a worker before it expires on TaskRabbit. The primary explanatory variable, lower value, is an indicator equal to 1 if the employer earns less than the median earning household on the platform in each city. We mask the number of observations at the request of TaskRabbit. Standard errors in all columns are clustered at the level of the employer.

The choice of full transparency is endogenous in this context. The employers who choose transparent posted prices tend to be lower income households (which is also consistent with consistent with Theorem 2). See Table A2. Our theory predicts selection of low-income employers into transparent job postings downward biases the results of Table A1. Nevertheless, transparency serves to relatively increase the hiring for low-value employers despite negative selection of low-value employers into transparency.
### TABLE A2: ENDENOUS SELECTION OF TRANSPARENT PRICING, TaskRabbit

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employer chooses transparency (public posted price, yes =1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employer Lower Income</td>
<td>0.0622**</td>
<td>0.0641**</td>
<td>0.0456*</td>
<td>0.0452*</td>
<td>0.0579*</td>
</tr>
<tr>
<td></td>
<td>[0.0269]</td>
<td>[0.0272]</td>
<td>[0.0270]</td>
<td>[0.0270]</td>
<td>[0.0329]</td>
</tr>
<tr>
<td>Employer Age</td>
<td>-0.00147***</td>
<td>-0.000511</td>
<td>-0.000536</td>
<td>-0.00109</td>
<td>-0.00109</td>
</tr>
<tr>
<td></td>
<td>[0.000557]</td>
<td>[0.000524]</td>
<td>[0.000528]</td>
<td>[0.000672]</td>
<td></td>
</tr>
<tr>
<td>Empl. Gender (Fem = 1)</td>
<td>-0.0130</td>
<td>-0.00901</td>
<td>-0.00921</td>
<td>-0.0144</td>
<td>-0.0144</td>
</tr>
<tr>
<td></td>
<td>[0.0148]</td>
<td>[0.0130]</td>
<td>[0.0129]</td>
<td>[0.0163]</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.323***</td>
<td>0.390***</td>
<td>0.221***</td>
<td>0.256***</td>
<td>0.215***</td>
</tr>
<tr>
<td></td>
<td>[0.0259]</td>
<td>[0.0359]</td>
<td>[0.0538]</td>
<td>[0.0602]</td>
<td>[0.0720]</td>
</tr>
<tr>
<td>Category FE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>City FE, Month FE, Mkt. Age</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Exclude 1st time users</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: All columns are linear probability models estimated by OLS. An observation is a job post on TaskRabbit. The sample is restricted to jobs posted by household employers with observable earnings. The dependent variable is equal to 1 if the employer chose to post the job using a transparent (public) posted price, and 0 if the employer chooses to accept private bids. The primary explanatory variable, low income, is an indicator equal to 1 if the employer earns less than the median earning household in each city. Standard errors are clustered at the level of the employer. Observation numbers are intentionally obscured at the request of TaskRabbit.

### A.2. Tests of alternative explanations for wage equalization

#### Wage compression

In this section we assess mechanisms other than communication about pay per se that could explain the wage equalization we observe when workers are co-located. Chief among them are productivity spillovers, either observed or perceived. Under a pay-for-performance framework, an employer may assign more compressed wages to workers if their performance converges or if the employer cannot attribute the output to individual workers.

Perceived productivity differences, as the explanation for the wage compression we observe, requires that (1) employers compensate workers according to their on-the-job assessed performance and (2) assessed performance of co-workers is less dispersed or compressed when workers are together.

We find evidence that a component of pay reflects on-the-job performance using a measure of performance constructed from back-end administrative data (effective percent positive score (EPP), detailed in Nosko and Tadelis (2015)). However, we do not find empirical evidence to support (2). Performance measures are no more dispersed or compressed when
workers are co-located. In Table A5, the dependent variable is the dispersion of ratings given to workers at the conclusion of the job, expressed as the Gini coefficient. An indicator variable of whether these workers operate together or separately, including an interaction between ex-ante dispersion in the performance (effective percent positive lifetime rating) and co-location, adds minimal explanatory power for the final dispersion of ratings for a job. Without evidence that employer evaluations (or ex-post ratings) converge among workers when they are together, it is unlikely that perceived productivity drives the wage compression we observe.

More generally, there is a small and statistically insignificant correlation between bids and productivity. Theoretically, the relationship is ambiguous as well, a high productivity type might have both lower costs of effort and higher opportunity costs. While our private measures of individual productivity on TaskRabbit are strong predictors of real outcomes (eg. return customers, Table A3) they do not explain much of the variance in bids and market wages, which are determined in the absence of information about life-time effective percent positive scores (Table A4 Col.1). As a result, any systematic pattern of spillovers does not necessarily raise the performance of the low bidder or the pay of the low bidder per se. In other words, a model of positive spillovers where the most productive worker pulls up the performance of the least productive worker, would not imply that the lowest bidder improves performance per se and hence compressed performance pay. When we can observe productivity directly in our field experiment we find a small and insignificant relationship between output and bids.

Another potential channel consistent with the pattern of compression that we observe is employer preferences for equity specifically when workers are co-located (and not when they are separated). We collect survey evidence (Appendix J.1) of how likely workers are to talk to and ask about another worker’s pay on-the-job, among the co-located jobs, and find significant variation (mean 40%, variance 24%) as a function of the extent of collaboration required, amount of noise and other activity in the environment, and length of time together. The frequency of renegotiation and compression is correlated with the probability of communication even within co-located jobs.
TABLE A3: HIDDEN ADMINISTRATIVE MEASURE OF WORKER QUALITY (EPP) PREDICTS EMPLOYER SATISFACTION, TaskRabbit

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employer returns</td>
<td>Employer returns</td>
<td>Positive rating</td>
</tr>
<tr>
<td>EPP (Effect Percent Positive Rating)</td>
<td>1.591***</td>
<td>5.858***</td>
</tr>
<tr>
<td></td>
<td>[6.154]</td>
<td>[20.19]</td>
</tr>
<tr>
<td>Ex-Ante mean rating</td>
<td>0.955**</td>
<td>0.876***</td>
</tr>
<tr>
<td></td>
<td>[-2.456]</td>
<td>[-5.611]</td>
</tr>
<tr>
<td>Prior # closed offers</td>
<td>1.075***</td>
<td>0.857***</td>
</tr>
<tr>
<td></td>
<td>[6.562]</td>
<td>[-11.72]</td>
</tr>
<tr>
<td>Constant</td>
<td>0.168</td>
<td>1.035</td>
</tr>
<tr>
<td></td>
<td>[-1.156]</td>
<td>[0.0261]</td>
</tr>
<tr>
<td>Category FE</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Worker characteristics</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Job Characteristics</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Observations</td>
<td>&gt; 100k</td>
<td>&gt; 100k</td>
</tr>
</tbody>
</table>

Exponentiated coefficients; t statistics in brackets

Notes: Each model is estimated using maximum likelihood assuming extreme value type-1 distributed errors (logistic regression). An observation is a matched worker-job in TaskRabbit. In Col. 1 the dependent variable equals 1 if the employer returns to the platform after the job is completed, giving her the option to rate the worker. The dependent variable in Col. 2 is equal to 1 if the worker receives a positive review after the job is complete, 0 otherwise. Positive review is defined as either a 4 or 5 on the 5 star scale. Standard errors are clustered at the job level. T-statistics are reported in brackets beneath the point estimate. Job characteristic controls include category fixed effects and proxies for transparency of the job requirements, including the length of description and frequency of posts in same category. We also include the number of bidders (log) and equipment requirements.
## TABLE A4: Worker quality measure (EPP) predicts ex-post pay but not ex-ante pay, TaskRabbit

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dep Var:</strong></td>
<td>Bid (log)</td>
<td>Raise (%)</td>
</tr>
<tr>
<td>Ex-ante EPP</td>
<td>0.00960</td>
<td>0.0771*</td>
</tr>
<tr>
<td></td>
<td>[0.0461]</td>
<td>[0.0431]</td>
</tr>
<tr>
<td>Entry Month FE</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Category FE</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Worker characteristics</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Job Characteristics</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Mean Dep. Var.</strong></td>
<td>3.63</td>
<td>0.129</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>&gt;100k</td>
<td>&gt;100k</td>
</tr>
<tr>
<td><strong>$R^2$</strong></td>
<td>0.238</td>
<td>0.00583</td>
</tr>
</tbody>
</table>

Notes: All models are estimated by OLS. An observation is the bid from a worker assigned to a job on TaskRabbit. The dependent variable is the log bid in Col. 1 and percentage raise above the initial bid in Col. 2. Standard errors are clustered at the level of the worker.
TABLE A5: Dispersion in Perceived Worker Performance, TaskRabbit

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>Final Worker Performance Ratings (Gini)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>$\hat{\beta}_1$ Transparent</td>
<td>-0.00671</td>
</tr>
<tr>
<td>(Co-located)</td>
<td>(0.0377)</td>
</tr>
<tr>
<td>$\hat{\beta}_2$ Ex-ante EPP (Gini)</td>
<td>0.454***</td>
</tr>
<tr>
<td></td>
<td>(0.123)</td>
</tr>
<tr>
<td>$\hat{\beta}_3$ Transparent × EPP (Gini)</td>
<td>-0.0704</td>
</tr>
<tr>
<td></td>
<td>(0.155)</td>
</tr>
<tr>
<td>No. workers (log)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.127***</td>
</tr>
<tr>
<td></td>
<td>(0.0484)</td>
</tr>
<tr>
<td>Mean bid (log)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0408*</td>
</tr>
<tr>
<td></td>
<td>(0.0212)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.225***</td>
</tr>
<tr>
<td></td>
<td>(0.0340)</td>
</tr>
</tbody>
</table>

Category FE ✓ ✓
Duration > 1hr ✓

Mean Dep. Var. 0.30 0.30 0.30
SE Dep. Var. 0.28 0.28 0.28
$\hat{\beta}_1 + \hat{\beta}_3$ -0.077 -0.099 -0.131
SE($\hat{\beta}_1 + \hat{\beta}_3$) 0.134 0.117 0.128
Observations 658 658 531
Clusters Employers 421 421 356
$R^2$ 0.046 0.122 0.126

Notes: Each model is estimated by OLS. An observation is a multi-worker job in TaskRabbit within our main sample. The dependent variable is the dispersion in ratings received after work is completed, measured by a Gini coefficient. Ex-ante ratings are measured as the share of positive ratings at the time of hire. Standard errors are clustered at the employer level.
A.3. Pay Spillovers (Compression) at Worker-Bid Level with Performance Controls

In this section we estimate the causal impact of a co-worker’s private bid amount on one’s own final pay. The specification is another way of measuring compression, and we do so at the level of an individual worker-bid, which allows for additional controls for the perceived performance of a worker. The dependent variable is the raise a worker receives, as a percent above the initially agreed to bid. The key explanatory variable is relative bid distance, specifically the amount below the highest bidder accepted the initial bid is in percentage terms.

We run the specification in the following equation. Each accepted bid placed by worker i is one observation. The subscript k refers to the job and j to the employer. We include employer fixed effects in our analysis, $\alpha_j$, and characteristics of the task itself, job category fixed effects $\alpha_k$. The dependent variable is the difference between ex-post payment and ex-ante bid, $\Delta y_{ijk}$, expressed as a percentage raise above i’s initial bid. The difference between i’s initial bid and that of the highest selected bidder is also expressed as the percentage above i’s initial bid, (Amt. under top bid (%)). We interact difference between bids with an indicator for whether workers are separated on the job.

$$\Delta y_{ijk} = \beta_0 + \beta_1 (\text{Amt. under top bid (%)} \cdot \text{transparent}_{ik}) + \beta_2 (\text{Amt. under top bid (%)} \cdot \text{transparent}_{ik} \times \text{transparent}_{ik}) + \phi \cdot X_i + \alpha_j + \alpha_k + \epsilon_{ijk}$$

These results can be seen in Table A6. Among the workers in co-located jobs hired by employers who return to the platform after the job is complete (as required to actively adjust pay) we find an additional 10% gap between a worker’s initial bid and that of the highest bidder will result in a 4% increase in final pay on average. The effect of the difference between co-worker bids on the final pay when workers are separated physically cannot be statistically distinguished from 0. Col. 4 demonstrates this finding is robust within employer.

---

48 We are confident that there is negligible measurement error in the bids, and are therefore comfortable normalizing both the dependent and independent variables by the initial bid.
### TABLE A6: Worker-Bid Level Pay Compression, TaskRabbit

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>Final Pay (% over bid)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \beta_1 \text{ Amt. under top bid (%)} )</td>
<td></td>
<td>0.436**</td>
<td>0.440**</td>
<td>0.440**</td>
<td>0.368**</td>
<td>0.596***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.182]</td>
<td>[0.183]</td>
<td>[0.183]</td>
<td>[0.171]</td>
<td>[0.197]</td>
</tr>
<tr>
<td>( \beta_2 \text{ Separate} \times \text{ Amt. under top bid (%)} )</td>
<td></td>
<td>-0.443**</td>
<td>-0.444**</td>
<td>-0.444**</td>
<td>-0.363**</td>
<td>-0.565***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.182]</td>
<td>[0.185]</td>
<td>[0.185]</td>
<td>[0.171]</td>
<td>[0.196]</td>
</tr>
<tr>
<td>( \beta_3 \text{ Virtual} \times \text{ Amt. under top bid (%)} )</td>
<td></td>
<td>-0.350*</td>
<td>-0.338*</td>
<td>-0.338*</td>
<td>-0.249</td>
<td>-0.476**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.195]</td>
<td>[0.195]</td>
<td>[0.195]</td>
<td>[0.188]</td>
<td>[0.213]</td>
</tr>
<tr>
<td>Separate</td>
<td></td>
<td>0.0143</td>
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<td>0.0559</td>
<td>0.0509</td>
<td>-0.0110</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0561]</td>
<td>[0.0572]</td>
<td>[0.0572]</td>
<td>[0.0899]</td>
<td>[0.114]</td>
</tr>
<tr>
<td>Virtual</td>
<td></td>
<td>-0.00742</td>
<td>0.0601</td>
<td>0.0601</td>
<td>-0.142</td>
<td>-0.305</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0685]</td>
<td>[0.115]</td>
<td>[0.115]</td>
<td>[0.141]</td>
<td>[0.231]</td>
</tr>
<tr>
<td>Years experience</td>
<td></td>
<td>0.0118</td>
<td>0.0118</td>
<td>0.0240</td>
<td>0.0128</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0230]</td>
<td>[0.0230]</td>
<td>[0.0275]</td>
<td>[0.0277]</td>
<td></td>
</tr>
<tr>
<td>No. workers (log)</td>
<td></td>
<td>-0.118***</td>
<td>-0.118***</td>
<td>-0.0815</td>
<td>-0.0957</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0448]</td>
<td>[0.0448]</td>
<td>[0.0606]</td>
<td>[0.0621]</td>
<td></td>
</tr>
<tr>
<td>Mean bid (log)</td>
<td></td>
<td>-0.0341</td>
<td>-0.0341</td>
<td>-0.165</td>
<td>-0.176</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0447]</td>
<td>[0.0447]</td>
<td>[0.104]</td>
<td>[0.120]</td>
<td></td>
</tr>
<tr>
<td>Effective percent positive overall</td>
<td></td>
<td>0.00490</td>
<td>0.00490</td>
<td>-0.00756</td>
<td>-0.00725</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0119]</td>
<td>[0.0119]</td>
<td>[0.00942]</td>
<td>[0.00913]</td>
<td></td>
</tr>
<tr>
<td>Effective percent positive in cat.</td>
<td></td>
<td>0.000149</td>
<td>0.000149</td>
<td>0.00299</td>
<td>0.00502</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0110]</td>
<td>[0.0110]</td>
<td>[0.00942]</td>
<td>[0.0104]</td>
<td></td>
</tr>
<tr>
<td>No. reviews</td>
<td></td>
<td>-0.00859</td>
<td>-0.00859</td>
<td>-0.00958</td>
<td>-0.00326</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.00873]</td>
<td>[0.00873]</td>
<td>[0.0107]</td>
<td>[0.0124]</td>
<td></td>
</tr>
<tr>
<td>No. reviews cat.</td>
<td></td>
<td>0.000706</td>
<td>0.000706</td>
<td>-0.0394</td>
<td>-0.0579</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0611]</td>
<td>[0.0611]</td>
<td>[0.0644]</td>
<td>[0.125]</td>
<td></td>
</tr>
<tr>
<td>Mean rating</td>
<td></td>
<td>0.000374</td>
<td>0.000374</td>
<td>0.00955</td>
<td>0.00372</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.00840]</td>
<td>[0.00840]</td>
<td>[0.00842]</td>
<td>[0.0112]</td>
<td></td>
</tr>
<tr>
<td>Mean rating in category</td>
<td></td>
<td>0.00890*</td>
<td>0.00890*</td>
<td>0.00568</td>
<td>0.00533</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.00525]</td>
<td>[0.00525]</td>
<td>[0.00545]</td>
<td>[0.00550]</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>0.0335</td>
<td>0.0868</td>
<td>0.0868</td>
<td>0.720*</td>
<td>0.855*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.0537]</td>
<td>[0.194]</td>
<td>[0.194]</td>
<td>[0.413]</td>
<td>[0.453]</td>
</tr>
</tbody>
</table>

| Performance w/in Cat.                           | ✓ | ✓ | ✓ | ✓ | ✓ |
| Category FE                                     | ✓ | ✓ | ✓ | ✓ | ✓ |
| Employer FE                                     | ✓ | ✓ | ✓ | ✓ | ✓ |
| Job FE                                          | ✓ | ✓ | ✓ | ✓ | ✓ |

P-value Test: \( H_0 : \beta_1 = -\beta_2 \) 0.245 0.642 0.642 0.713 0.240
P-value Test: \( H_0 : \beta_1 = -\beta_3 \) 0.209 0.165 0.165 0.141 0.141

Mean Dep. Var. 0.10 0.10 0.10 0.10 0.10
SE Dep. Var. 0.26 0.26 0.26 0.26 0.26
Observations 1,345 1,345 1,345 1,345 1,345
R^2 0.241 0.273 0.273 0.578 0.643

Notes: Each model is estimated by OLS. An observation is an accepted worker-bid for a multi-worker job on TaskRabbit. We restrict the sample to employers who ever re-visit the platform (required to enter a rating or adjust pay). The dependent variable is the size of the raise, as percent above the worker’s initial bid. The primary explanatory variable, amount under the maximum bid, is equal to \( \frac{\text{bid}_{\text{max}} - \text{bid}_i}{\text{bid}_i} \) for person \( i \). Separate refers to jobs that are local but where workers are separated physically. Virtual refers to jobs carried out entirely online. We have added virtual jobs to our main sample but we have also excluded employers who do not return to the platform after a job to either rate workers or confirm completion, a common occurrence in virtual jobs. “Performance w/in Cat.” refers to the inclusion of the covariates capturing overall performance on the platform, replicated within each category. Because virtual jobs are, on average, much lower paying jobs, we expect some additional compression in the presence of efficiency wage incentives and minimum wage norms. Standard errors are three-way clustered at the level of the job, worker, and employer.
A.4. Strategic bidding, worker selection, and unanticipated transparency

For a causal interpretation of the effect of co-location on ex-post relative wages in our TaskRabbit population, we must show the composition of workers is similar across settings as are worker bids. Prima facie evidence supports these assumptions. Multi-worker tasks comprise fewer than 5% of posted jobs and workers are often unaware that more than one vacancy exists even when it does. Additionally, employers rarely have more offers that the number necessary to complete a multi-worker job. Here we offer more empirical tests.

We observe that the mean and dispersion of bids received are similar across job settings. We also find that dispersion in selected offers is no different across setting. Irrespective of work setting, employers select bids that exhibit roughly one-third of the dispersion of offers received.

As another test of our assumptions that workers, in this particular environment, do not bid strategically in anticipation of learning pay, we split a sample of co-located jobs by whether or not the employer explicitly mentions that the tasks require multiple people (e.g. “we need two people to load boxes” vs “load boxes between 12-2p”). 35% of job postings for co-located, multi-worker jobs do not reveal to workers that there are other workers on the job. In these jobs, workers are unlikely to be able to anticipate transparency. We find almost all worker characteristics are not statistically different (Table A7) with the exception of a 7 share point different in the gender of the applicants. Table A8 shows we cannot reject that bids are similar among those bidding on postings that do and do not reveal multiple workers are required. However, we may not have the specification or power required to detect many forms of strategic bidding.
TABLE A7: COMPARISON OF WORKER CHARACTERISTICS FOR JOB POSTINGS THAT DO OR DO NOT MENTION MULTIPLE WORKERS REQUIRED, TaskRabbit

<table>
<thead>
<tr>
<th>Applicant Characteristics</th>
<th>(1) No</th>
<th>(2) Yes</th>
<th>(3) T-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years experience</td>
<td>0.44</td>
<td>0.46</td>
<td>-0.84</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.49</td>
<td>0.42</td>
<td>3.73</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Effective percent positive overall</td>
<td>33.03</td>
<td>38.09</td>
<td>-1.32</td>
</tr>
<tr>
<td></td>
<td>(3.10)</td>
<td>(2.24)</td>
<td></td>
</tr>
<tr>
<td>Prior # closed jobs</td>
<td>0.64</td>
<td>0.71</td>
<td>-1.59</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.03)</td>
<td></td>
</tr>
<tr>
<td>Mean rating (=0 if none)</td>
<td>4.21</td>
<td>4.28</td>
<td>-1.06</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.03)</td>
<td></td>
</tr>
<tr>
<td>No rating (=1 if none)</td>
<td>0.14</td>
<td>0.12</td>
<td>1.27</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td># Applicants</td>
<td>1,086</td>
<td>2,133</td>
<td></td>
</tr>
<tr>
<td># Jobs</td>
<td>131</td>
<td>240</td>
<td></td>
</tr>
</tbody>
</table>

Notes: An observation is a worker-bid. We selected a random sample of multi-worker, co-located jobs for Mechanical Turk workers to read through and manually classify. Results are similar if workers only enter a comparison group once, as a unique worker who bids at least once in the comparison group.
TABLE A8: Job postings that mention multiple workers required receive similar bids, TaskRabbit

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Mention</td>
<td>0.0282</td>
<td>0.0296</td>
<td>0.0380</td>
<td>0.0404</td>
<td>0.0276</td>
</tr>
<tr>
<td></td>
<td>[0.0616]</td>
<td>[0.0620]</td>
<td>[0.0424]</td>
<td>[0.0427]</td>
<td>[0.0606]</td>
</tr>
<tr>
<td>No. workers (log)</td>
<td>-0.0189</td>
<td>0.0397</td>
<td>0.0443</td>
<td>0.00869</td>
<td>0.0880</td>
</tr>
<tr>
<td></td>
<td>[0.0860]</td>
<td>[0.0625]</td>
<td>[0.0618]</td>
<td>[0.0783]</td>
<td></td>
</tr>
<tr>
<td>Duration (hours)</td>
<td>0.0721***</td>
<td>0.0722***</td>
<td>0.0638***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0188]</td>
<td>[0.0189]</td>
<td>[0.0173]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years experience</td>
<td>0.131***</td>
<td></td>
<td>2.618</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0217]</td>
<td></td>
<td>[2.004]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>-0.0936***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0237]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective percent positive overall</td>
<td>0.0000831</td>
<td></td>
<td>-0.0000509</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.000140]</td>
<td></td>
<td>[0.000222]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior # closed jobs</td>
<td>-0.00399</td>
<td>-0.0162</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0174]</td>
<td></td>
<td>[0.0353]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. reviews</td>
<td>-0.00377</td>
<td>0.0115</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.00977]</td>
<td></td>
<td>[0.0361]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean rating</td>
<td>-0.0443</td>
<td>-0.292</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0543]</td>
<td></td>
<td>[0.216]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No rating</td>
<td>-0.183</td>
<td>-1.372</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.276]</td>
<td></td>
<td>[1.082]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>3.962***</td>
<td>3.974***</td>
<td>4.068***</td>
<td>3.875***</td>
<td>8.148***</td>
</tr>
<tr>
<td></td>
<td>[0.0676]</td>
<td>[0.0840]</td>
<td>[0.122]</td>
<td>[0.366]</td>
<td>[2.358]</td>
</tr>
</tbody>
</table>

Performance measures w/in Cat. ✓ ✓
Category FE ✓ ✓
Worker FE ✓

Mean Outcome 3.96 3.96 3.96 3.96 3.96
Std. Dev. Outcome 0.71 0.71 0.71 0.71 0.71
Observations 3.219 3.219 3.219 3.219 3.219
Clusters 371 371 371 371 371
\(R^2\) 0.078 0.078 0.252 0.273 0.790

Notes: All models are estimated using OLS. The dependent variable is the log bid of bids received. We selected a random sample of multi-worker, co-located jobs for Mechanical Turk workers to read through and manually classify. The key explanatory variable “any mention” is equal to 1 if readers of the job description report multiple workers are required to complete the job, and 0 otherwise. “No. workers” refers to the actual number of workers that the employer requested directly to the platform (whether or not it is mentioned in the job description), so that the platform knows not to close the job until the number is reached or the post expires. Performance measures also include overall (in addition to category) measures of ratings and prior experience. Standard errors are clustered at the level of the job.
A.5. Market Unraveling

We find evidence that TaskRabbit markets unravel toward the use of posted price by more employers in Section IV.G, which supports the finding of Theorem 4.

We discuss possible alternative explanations for this market trend toward posted price, and why we do not believe these to be plausible explanations of our observations.

One alternative explanation for this trend is that employers initially accept bids to learn about workers’ outside options and in subsequent tasks use a posted price. We do not believe this to be a convincing explanation for this observation because employers are short-lived in TaskRabbit. Over half of employers only post a single task on the platform, and only 10% post more than 6 tasks in their lifetime on the platform. Nearly 80% of employers who participate in the platform do not experiment, that is, they use either posted price or bid acceptance for all of their tasks. The pattern of a linear move toward posted prices, therefore, seems unlikely to be due to experimentation.

Another alternative is put forth by Einav et al. (2018). They find that eBay’s auction format became much less used than its posted price format between 2003 and 2009. They argue that this is primarily driven by a change in user preferences. In 2003 there were not many exciting internet alternatives, and so buyers preferred the fun associated with bidding in auctions. But by 2009 with the advent of Web 2.0 websites like youtube.com and facebook.com, there were better avenues for entertainment on the internet. Could a similar phenomenon be occurring in TaskRabbit? Again, we do not believe so. Our data sample (albeit for a different service) begins around the time that the sample of Einav et al. (2018) ends, certainly after the popularization of Web 2.0 and plenty of entertainment websites. Second, our time horizon is relatively short compared to theirs, and we observe a large move toward posted prices. Only a drastic change in preferences over a short period of time could explain this. Third, TaskRabbit staggers entry into different markets, and therefore, we observe wide variance in market age. Despite this, we observe a strong linear trend toward posted price in markets of different ages. This is on display in Figure IV. Fourth, and perhaps most convincing, the “fun” workers can have through static bidding on TaskRabbit is more limited than on eBay–workers are unable to track their bids and update their offers over time in response to others. Although changing preferences cannot completely be ruled out in TaskRabbit data, a mechanism such as Einav et al.’s does not seem likely to lead to the move toward posted price in TaskRabbit.

Finally, there is potential for the types of jobs to change as the platform matures in each city, particularly toward standardized tasks that may lend themselves to a universal price on and off the platform, and hence a posted price. Empirically we do not see a trend toward standardization - if anything the platform launched in several cities with a strong association with one or two key tasks, especially deliveries, but over time the platform diversified somewhat. We include in our regression controls for the composition of tasks in each marketplace. Our findings are robust to the inclusion of variation in the share of top categories posted in each marketplace (Col. 2 Table A9), although our estimates lessen in significance after accounting for the small number of clusters by applying wild cluster bootstrapping.
TABLE A9: SHARE OF JOBS WITH POSTED PRICE, TASKRABBIT

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>Proportion of Jobs with Posted Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market age (months)</td>
<td>0.0110*** 0.0133** 0.0120*** 0.0140**</td>
</tr>
<tr>
<td>[0.0000196] [0.00500] [0.00102] [0.00511]</td>
<td></td>
</tr>
<tr>
<td>Number of posts per month</td>
<td>0.00000761 0.00000754</td>
</tr>
<tr>
<td>[0.00000731] [0.00000728]</td>
<td></td>
</tr>
<tr>
<td>City FE, Month FE</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Category job-share control</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Observations</td>
<td>417 417 417 417</td>
</tr>
<tr>
<td>P-Value-Wild-Bootstrap</td>
<td>0.132 0.213 0.113 0.206</td>
</tr>
<tr>
<td>Clusters</td>
<td>19 19 19 19</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.668 0.668 0.671 0.671</td>
</tr>
</tbody>
</table>

Notes: Each model is estimated by OLS. An observation is a city-month in TaskRabbit. The dependent variable is the proportion of tasks that use the transparent posted price scheme. Market size is measured as the number of job posts. Category share is measured by the share of job posts that fall into the top three categories at the month-city level. Standard errors, and significance stars, from OLS are clustered at the city level and displayed in square brackets below the point estimates. To address the small number of clusters, we also report p-values after wild cluster bootstrapping, drawing from the six-point Webb distribution, 1 million bootstrap samples.
**Figure A1: Expectations of Learning Co-worker Pay on-the-Job**

Notes: This figure is a kernel density constructed from 5,000 responses from online workers who read through job descriptions on TaskRabbit and answered questions about the likelihood that two co-workers would compare notes about their pay after meeting for the first time on-the-job. We randomized whether the description of the task involved two strangers meeting on the job with female names or male names. “Female co-workers” refers to a vignette with two people named Samantha and Alexis, and “male co-workers” refers to a vignette with two people names Sam and Alex.
Figure A2: Distribution of Jobs Across Job Category, by Price Mention

Notes: Along the X-axis categories are ordered according to the mean hourly wage across all jobs posted within the category with hourly contract. The y-axis is the percentage of jobs, which either do or do not have a price mention in the job description, which are posted in each category. The difference in hourly wages at the category level is $3 (28 vs. 31) and statistically significant (T-statistic equal to 3.0). The statistical test Epps-Singleton (E-S) rejects the two underlying independent samples are identical.
<table>
<thead>
<tr>
<th></th>
<th>Posted Price (mean)</th>
<th>Priv. Auction (mean)</th>
<th>T-Stat (Public−Auct.)</th>
<th>Acct. Bids (or Tasks) (48% (41%) posted)</th>
<th>Acct. Bids (or Tasks) (48% (41%) posted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial wages ($)</td>
<td>40.72</td>
<td>64.08</td>
<td>-122.64</td>
<td>&gt;50,000</td>
<td>&gt;50,000</td>
</tr>
<tr>
<td>Length of Task Description</td>
<td>798</td>
<td>736</td>
<td>18.90</td>
<td>&gt;50,000</td>
<td>&gt;50,000</td>
</tr>
<tr>
<td>LDA 1 (%)(eg. “would like,” “hoping”)</td>
<td>2.69</td>
<td>2.64</td>
<td>0.45</td>
<td>&gt;50,000</td>
<td>&gt;50,000</td>
</tr>
<tr>
<td>LDA 2 (%)(eg. “feedback,” “review”)</td>
<td>3.28</td>
<td>3.13</td>
<td>1.09</td>
<td>&gt;50,000</td>
<td>&gt;50,000</td>
</tr>
<tr>
<td>LDA 3 (%)(eg. “assistance,” “shopping”)</td>
<td>10.69</td>
<td>10.41</td>
<td>1.88</td>
<td>&gt;50,000</td>
<td>&gt;50,000</td>
</tr>
<tr>
<td>LDA 4 (%)(eg. “planning,” “evening”)</td>
<td>4.96</td>
<td>4.96</td>
<td>-0.07</td>
<td>&gt;50,000</td>
<td>&gt;50,000</td>
</tr>
<tr>
<td>LDA 5 (%)(eg. “moving,” “pickup”)</td>
<td>6.63</td>
<td>6.92</td>
<td>-2.45</td>
<td>&gt;50,000</td>
<td>&gt;50,000</td>
</tr>
<tr>
<td>LDA 6 (%)(eg. “documents,” “photos”)</td>
<td>8.39</td>
<td>8.45</td>
<td>-0.79</td>
<td>&gt;50,000</td>
<td>&gt;50,000</td>
</tr>
</tbody>
</table>

Notes: Summary statistics of all jobs. Observation numbers are intentionally obscured at the request of TaskRabbit. LDA (Latent Dirichlet Allocation) text components are included to compare the content of job descriptions. LDA is an unsupervised bag-of-words machine learning method. The algorithm assumes every document contains a mixture of topics and every topic is a mixture of words. Topics are assumed to have a Dirichlet prior, which intuitively means that each job description is likely to only contain a small set of topics and each topic frequently uses a small set of words. Words can belong to multiple topics and LDA estimates the probability that a particular word belongs to a particular topic. Using the probabilities that given words belong to given topics in combination with the Dirichlet priors, it is then possible to construct the probabilities that each document contains each topic.
**Figure A3: TaskRabbit Online Interface for Workers**

(a) Panel (a) displays a list of job postings that a worker can see. Panel (b) gives the details posted by the employer about one of the jobs from the job listings page. Screenshots taken on December 14th, 2013. Faces and identifiable information have been intentionally blurred. A similar figure appears in Cullen and Farronato (2016).
### TABLE A11: Bonuses Among Co-located Workers*, TaskRabbit

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>Any Raise (Yes = 1)</th>
<th>Raise (% Above Bid)</th>
<th>Any Raise</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$\beta_1$ Amt. under top bid (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0106</td>
<td>0.0123</td>
<td>0.0234*</td>
</tr>
<tr>
<td></td>
<td>[0.0114]</td>
<td>[0.0113]</td>
<td>[0.0128]</td>
</tr>
<tr>
<td>Years experience</td>
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<td>0.0229*</td>
<td>-0.113</td>
</tr>
<tr>
<td></td>
<td>[0.0250]</td>
<td>[0.0132]</td>
<td>[0.0817]</td>
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<tr>
<td>Effective percent positive overall</td>
<td>0.00276</td>
<td>-0.00685</td>
<td>0.0429</td>
</tr>
<tr>
<td></td>
<td>[0.00711]</td>
<td>[0.00455]</td>
<td>[0.0301]</td>
</tr>
<tr>
<td>Effective percent positive in cat.</td>
<td>0.0295*</td>
<td>-0.0112</td>
<td>-0.0620</td>
</tr>
<tr>
<td></td>
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<td>[0.0139]</td>
<td>[0.0784]</td>
</tr>
<tr>
<td>No. reviews</td>
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<td>0.00120</td>
<td>0.0299</td>
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<tr>
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<tr>
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<td>-0.304*</td>
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<td>[0.172]</td>
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<tr>
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<td>0.0161**</td>
<td>-0.198</td>
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<tr>
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<td>[0.0108]</td>
<td>[0.00736]</td>
<td>[0.184]</td>
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<tr>
<td>Mean rating in category</td>
<td>0.00415</td>
<td>0.00632</td>
<td>0.0293</td>
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<tr>
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<td>[0.0103]</td>
<td>[0.00524]</td>
<td>[0.0290]</td>
</tr>
<tr>
<td>No. workers (log)</td>
<td>-0.102***</td>
<td>-0.190*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0167]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean bid (log)</td>
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<td>-0.360**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0246]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.205***</td>
<td>0.0532</td>
<td>0.200</td>
</tr>
<tr>
<td></td>
<td>[0.0237]</td>
<td>[0.0948]</td>
<td>[0.174]</td>
</tr>
</tbody>
</table>

| > 1 hour overlap | ✓ | ✓ | ✓ | ✓ | ✓ |
| Job-specific FE | ✓ | ✓ | ✓ | ✓ | ✓ |

P-value Test: $H_0$: $\beta_1 = 1$

| Mean Dep. Var. | 0.21 | 0.20 | 0.20 | 0.41 | 0.42 | 0.40 |
| SE Dep. Var. | 0.41 | 0.40 | 0.40 | 0.39 | 0.40 | 0.38 |
| Observations | 1,997 | 1,661 | 1,605 | 417 | 326 | 249 |
| Clusters Jobs | 790 | 656 | 656 | 245 | 187 | 110 |
| Clusters Workers | 1156 | 967 | 967 | 335 | 269 | 208 |
| Clusters Employers | 482 | 406 | 406 | 208 | 157 | 89 |
| $R^2$ | 0.001 | 0.043 | 0.827 | 0.429 | 0.564 | 0.941 |

Notes: Each model is estimated by OLS. Col. 1 through 3 are linear probability models. An observation is an accepted worker-bid for jobs with co-located workers. All co-located jobs across all categories are included, not just the sample of jobs from overlapping categories used in the main body of the paper. The dependent variable equals one if the particular worker earns more than their agreed to bid, and 0 otherwise. Col. 4 through 6 are restricted to those workers that do receive more than their bid. The dependent variable is the size of the raise, as percent above bid. The primary explanatory variable, amount below maximum bid, is equal to \((\text{bid}_{\text{max}} - \text{bid}_i)/\text{bid}_i\) for person \(i\). Col. 3 and Col. 6 include fixed effects for each job. Reviews are in units of 1000. Standard errors are three-way clustered at the level of the job, worker, and employer.
B. Omitted proofs

Proof of Proposition 1:

It is easy to see that for all times \( t \geq 0 \) there exists at least one worker earning \( \bar{w} \). Therefore, conditional on receiving wage information, every worker will offer the highest wage visible which equals \( \bar{w} \). It remains to prove that in equilibrium no worker will ever renegotiate without the arrival of wage information. Without loss of generality, let an arbitrary worker enter the market at \( t = 0 \) and (in an abuse of notation) let \( \omega_t \) denote the wage the worker offers at time \( t \) in the absence of arrival of wage information on equilibrium path. If the worker does not renegotiate between times \( t' \) and \( t'' \) then let \( \omega_t = \omega_{t'} \) for all \( t \in [t', t''] \). On equilibrium path satisfying A1-A5, an optimal sequence \( \omega^* \equiv \{\omega_t^*\}_{t \geq 0} \) is a non-decreasing sequence bounded above by 1, since the firm will never set \( \bar{w} > 1 \). Therefore, conditional on receiving wage information, every worker will offer the highest wage visible which equals \( \bar{w} \).

Proof of Lemma: Take some \( t_1 > 0 \) and consider a sequence \( \omega' \) that equals \( \omega^*_{t_2} \) for all \( t \geq 0 \). Both \( U(\omega', t) \) and \( U(\omega^*, t) \) are clearly continuous in \( t \). Since \( u(\omega^*|t) > 0 \) for all \( t \) by assumption, then there are two possibilities. First, there exists a unique \( t_1 > t_2 \) such that \( U(\omega', t_1) = U(\omega^*, t_1) \), with \( U(\omega', t) < U(\omega^*, t) \) for all \( t > t_1 \), in which case we have found the sought after \( t_1 \) for the specified \( t_2 \). Second, it could be that \( U(\omega', t) > U(\omega^*, t) \) for all \( t > 0 \), in which case \( \omega^* \) is not an optimal sequence. 

Lemma 1. For any optimal sequence \( \omega^* \) there exists a sequence \( \hat{\omega}(t_1) \) satisfying the required conditions.

Proof of Lemma: Take some \( t_2 > 0 \) and consider a sequence \( \omega' \) that equals \( \omega^*_{t_2} \) for all \( t \geq 0 \). Both \( U(\omega', t) \) and \( U(\omega^*, t) \) are clearly continuous in \( t \). Since \( u(\omega^*|t) > 0 \) for all \( t \) by assumption, then there are two possibilities. First, there exists a unique \( t_1 > t_2 \) such that \( U(\omega', t_1) = U(\omega^*, t_1) \), with \( U(\omega', t) < U(\omega^*, t) \) for all \( t > t_1 \), in which case we have found the sought after \( t_1 \) for the specified \( t_2 \). Second, it could be that \( U(\omega', t) > U(\omega^*, t) \) for all \( t > 0 \), in which case \( \omega^* \) is not an optimal sequence.
As $\hat{\omega}(t_1) = \hat{\omega}(t_1)$ for all $t \leq t_2$, $U(\hat{\omega}(t_1), t) = U(\hat{\omega}(t_1), t)$ for all $t \leq t_2$. Since $u(\omega^*|t) > 0$ for all $t$, $U(\hat{\omega}(t_1), t) > U(\hat{\omega}(t_1), t)$ for all $t > t_2$. Therefore, $u(\hat{\omega}(t_1)) > u(\hat{\omega}(t_1)) = u(\omega^*)$, which contradicts the optimality of sequence $\omega^*$.

**Figure B1: Sequences used in proof**

(a)  

(b)  

(c)  

Notes: This figure shows the construction of sequences to prove the desired result. Panel (a) shows the conjectured optimal sequence $\omega^*$. Panel (b) shows $\hat{\omega}(t_1)$, a sequence that is constant before time $t_1$ and gives the same utility as $\omega^*$ (sequence $\omega^*$ is plotted with dotted lines for comparison). Panel (c) shows sequence $\tilde{\omega}(t_1)$ which equals the pointwise maximum of $\omega^*$ and $\hat{\omega}(t_1)$. Since utility is increasing along $\omega^*$ by assumption, $\tilde{\omega}(t_1)$ yields higher expected worker utility than the other sequences.

By the above logic, WLOG we restrict ourselves to worker strategies that never renegotiate wage along equilibrium path without the arrival of wage information. Letting
\( \hat{F}(x) = P(\bar{w} \leq x) \), for all \( \lambda < \infty \) worker \( i \) negotiates at the first moment she is hired to solve:

\[
    w_i^* \in \arg\max_{w_i} \left( \frac{w_i}{\rho + \delta + \lambda} + \frac{\lambda}{\rho + \delta + \lambda} \frac{\mathbb{E}(\bar{w}|\bar{w} \geq w_i)}{\delta + \rho} \right) (1 - \hat{F}(w_i)) + \frac{\theta_i}{\delta + \rho} \hat{F}(w_i) \tag{10}
\]

where the first term represents the expected discounted wage the worker receives, given the arrival rate of information, if matched with the firm. The second term represents the lifetime earnings of the worker if she exceeds \( \bar{w} \) and instead consumes her outside option for her lifetime. When \( \lambda = \infty \), the pricing scheme is a posted price in which all workers can elect to make an offer \( w_i^* = \bar{w} \) or unmatch with the firm.

In a series of steps, we modify the objective function without affecting the maximizer. For \( \lambda \in [0, \infty) \)

\[
    \begin{align*}
    w_i^* &\in \arg\max_{w_i} \left( \frac{w_i}{\rho + \delta + \lambda} + \frac{\lambda}{\rho + \delta + \lambda} \frac{\mathbb{E}(\bar{w}|\bar{w} \geq w_i)}{\delta + \rho} \right) (1 - \hat{F}(w_i)) + \frac{\theta_i}{\delta + \rho} \hat{F}(w_i) \\
    \iff w_i^* &\in \arg\max_{w_i} \left( \frac{w_i}{\rho + \delta + \lambda} + \frac{\lambda}{\rho + \delta + \lambda} \mathbb{E}(\bar{w}|\bar{w} \geq w) \right) (1 - \hat{F}(w_i)) + \theta_i \hat{F}(w_i) \\
    \iff w_i^* &\in \arg\max_{w_i} \left( \frac{w_i}{\rho + \delta + \lambda} + \frac{\lambda}{\rho + \delta + \lambda} \mathbb{E}(\bar{w}|\bar{w} \geq w_i) - \theta_i \right) (1 - \hat{F}(w_i)) \\
    \iff w_i^* &\in \arg\max_{w_i} \int_{w_i}^{1} ((1 - \Lambda) w_i + \Lambda x - \theta_i) \hat{f}(x) dx 
\end{align*}
\]

where \( \Lambda = \frac{\lambda}{\rho + \delta + \lambda} \). When \( \lambda = \infty \), the scheme is equivalent to a posted price in which \( \Lambda = 1 \) (workers receive \( \bar{w} \) if they remain at the firm). Therefore, for any \( \rho, \delta > 0 \) there is a bijection between \( \lambda \) and \( \Lambda \) with higher \( \Lambda \) corresponding to more transparency.

For \( \lambda < \infty \) the firm solves:

\[
\bar{w} \in \arg\max_{w} \int_{0}^{w} (v - y) \tilde{g}(y) dy + \tilde{G}(w) \frac{\lambda}{\rho + \delta + \lambda} \frac{1}{\rho + \delta + \lambda} (v - w) \tag{12}
\]

where \( \tilde{G}(x) = P(w_i^* \leq x) \). The first term gives the total discounted profits made by the firm given the arrival rate of information and the second term is the profit made from workers after renegotiating their wages to \( \bar{w} \) over the rest of their lifetimes in the firm. When \( \lambda = \infty \) the firm will hire every worker \( i \) with \( \theta_i \leq \bar{w} \) at a constant wage \( \bar{w} \). We can similarly manipulate the objective as with the worker problem:

\[
\bar{w} \in \arg\max_{w} \int_{0}^{w} (v - (1 - \Lambda) y - \Lambda w) \tilde{g}(y) dy \tag{13}
\]

These manipulations collapse the set of equilibria of our problem into that of the well-known Chatterjee and Samuelson (1983) double auction in which a seller (worker) with a private value for a good (\( \theta_i \)) and a buyer (firm) with a private value for a good \( (v) \) submit sealed bids. If the bid of the buyer is at least as large as that of the seller, the
good switches hands at a price set be a predetermined convex combination of the two bids (determined by $\Lambda$). The first order conditions for workers and the firm are, respectively:

$$w^*_i - \theta_i = (1 - \Lambda) \frac{1 - F(w^*_i)}{f(w^*_i)} \tag{14}$$

$$v - \bar{w} = \Lambda \frac{\bar{G}(\bar{w})}{\bar{g}(\bar{w})} \tag{15}$$

We know from Satterthwaite and Williams (1989) that the set of equilibria corresponds to solutions of the first order equations, and that the set of solutions to these equations, and therefore equilibria, is non-empty. Furthermore, given the equilibrium strategies of the firm (workers), workers (the firm) have a unique best response.

It now remains to consider the case in which $u(\omega^*|t) = 0$ for some $t > 0$. Let $\hat{t} = \inf_{t \geq 0} \{t|u(\omega^*|t) = 0\}$. We can create a new sequence $\omega^{**}$ such that

$$\omega^{**}_t = \begin{cases} \omega_t^* & t \in [0, \hat{t}) \\ \omega^*_\hat{t} & t > \hat{t} \end{cases} \tag{16}$$

Since $u(\omega^*|\hat{t}) = 0$, $\omega^{**}$ is also an optimal sequence. If $\hat{t} > 0$ then replacing $\omega^*$ with $\omega^{**}$ in the earlier parts of this proof gives the desired result. If however, $\hat{t} = 0$, we must take a different approach. Since $u(\omega^*|t) \geq 0$ for all $t \geq 0$, it must be the case that $u(\omega^*|t) = 0$ for all $t \geq 0$, i.e. that the worker is indifferent between ever renegotiating. Similarly to above, we can construct a sequence $\hat{\omega}(t_1)$ that is constant over the first $t_2$ periods and ex-ante payoff equivalent to $\omega^*$. But since $u(\omega^*|t) = 0$ for all $t$ then it must also be optimal to never renegotiate from $\hat{\omega}(t_1) = \omega^{*\hat{t}}$. In other words, this says that the agent is indifferent between initially asking for $\omega^*_0$ or $\omega^{*\hat{t}}$ and never renegotiating, and moreover, both such sequences are optimal. But the right hand side of Equation 14 is strictly decreasing in the initial offer, meaning there cannot be two optimal constant sequences. Contradiction.

**Proof of Proposition 2:**

Let $\bar{w} = \beta(v)$ and let $w^*_i = \gamma(\theta)$ and assume that a linear equilibrium exists. Workers are hired at initial wages in some range $[a, h]$ where $0 \leq a \leq h \leq 1$. By the linearity hypothesis, it must be the case that

$$\bar{w} = \begin{cases} v & 0 \leq v < a \\ a + \frac{h-a}{1-a}(v-a) & a \leq v \leq 1 \end{cases} \tag{17}$$

$$w^*_i = \begin{cases} a + \frac{h-a}{h} \theta_i & 0 \leq \theta_i \leq h \\ \theta_i & h < \theta_i \leq 1 \end{cases}$$

Furthermore, by definition $\bar{F}(x) = P(\beta(v) \leq x) = F(\beta^{-1}(x))$, and similarly $\bar{G}(x) = G(\gamma^{-1}(x))$. Inverting the functions in Equation 17 and plugging in to the distributions in
Equation 5 yields

$$\bar{F}(x) = 1 - \left(1 - a + \frac{(x-a)(1-a)}{h-a}\right)^r \quad a \leq x \leq h$$  \hspace{1cm} (18)

$$\bar{G}(x) = \left(\frac{(x-a)h}{h-a}\right)^s$$

Equations 3 and 4 give another set of equations for $\gamma^{-1}(\cdot)$ and $\beta^{-1}(\cdot)$. Plugging these into the distributions in Equation 5 yields

$$\bar{F}(x) = 1 - \frac{1 - x - a}{\frac{1 - x - a}{f(x)}}^r \quad a \leq x \leq h$$  \hspace{1cm} (19)

$$\bar{G}(x) = \left(x - \frac{1 - F(x)}{f(x)}\right)^s$$

Solving Equations 18 and 19 simultaneously results in a unique solution in which

$$a = \frac{(1 - \Lambda)s}{(s + \Lambda)r + (1 - \Lambda)s}$$

$$h = \frac{(1 - \Lambda)s + rs}{(s + \Lambda)r + (1 - \Lambda)s}$$  \hspace{1cm} (20)

As $\bar{w}$ and $w_i^*$ are pinned down by $a$ and $h$ due to linearity, there is a unique linear equilibrium.

Proof of Proposition 3:

We first show $\bar{w}$ is strictly decreasing in $\Lambda$ for all $v \in [a, 1]$. Using Equations 17 and 20, we see that

$$\bar{w} = a + \frac{s}{s + \Lambda}(v - a) \quad \text{for all } v \in [a, 1]$$  \hspace{1cm} (21)

Differentiating with respect to $\Lambda$ yields

$$\frac{\partial \bar{w}}{\partial \Lambda} = \frac{\partial a}{\partial \Lambda} \left(1 - \frac{s}{s + \Lambda}\right) - \frac{s}{(s + \Lambda)^2}(v - a)$$  \hspace{1cm} (22)

Noting that $\frac{s}{s + \Lambda} \in (0, 1]$ and that from Equation 20

$$\frac{\partial a}{\partial \Lambda} \text{ sign} = -r(s + 1) < 0$$  \hspace{1cm} (23)

implies that $\frac{\partial \bar{w}}{\partial \Lambda} < 0$ for all $v \in [a, 1]$. From Equation 18 we see that $\frac{\bar{G}(x)}{g(x)} = \frac{x-a}{s}$ for all $x \in [a, h]$. Therefore, from Equation 4 we see that $\bar{w} \to v$ for all $v \in [0, 1]$ as $\Lambda \to 0$.

By virtue of the fact that $\bar{w}$ is decreasing in $\Lambda$, it must also be the case that $h$ is decreasing in $\Lambda$. (It is possible to directly verify this by computing $\frac{\partial h}{\partial \Lambda}$.)

From Equation 18 we calculate
\[ \frac{1-F(x)}{f(x)} = \frac{h-x}{r} \] for all \( x \in [a, h] \). Since \( h \) is decreasing in \( \Lambda \), \( \frac{1-F(x)}{f(x)} \) is also decreasing in \( \Lambda \) over this range. Therefore, from Equation 3 we see that \( w^*_i \) is strictly decreasing for \( \theta_i \in [0, h] \), and \( w^*_i \to \theta_i \) for all \( \theta_i \in [0,1] \) as \( \Lambda \to 1 \).

Proof of Theorem 1:

1. For all \( \theta_k < h \) we have from Equation 17 that \( w^*_k = a + \frac{h-a}{h} \theta_k \). Therefore, for any relevant workers \( i \) and \( j \), we have that \( w^*_i - w^*_k = \frac{h-a}{h} (\theta_i - \theta_j) \). From Equation 20 we see that the derivative of this function is increasing in \( \Lambda \), completing the claim.

2. Recall from Equation 11 that the expected lifetime earnings of a worker with outside option \( \theta_i \) is \( T(\Lambda, v, \theta_i) = (1-\Lambda) w^*_i + \Lambda \bar{w} - \theta_i \). A sufficient condition for \( T(\cdot, v, \theta_i) - T(\cdot, v, \theta_j) \) being strictly decreasing in \( \Lambda \) is that \( \frac{\partial^2 T(\Lambda, v, \theta)}{\partial \theta \partial \Lambda} < 0 \) for all \( \Lambda, \theta \in [0,1) \) and all \( v \in [0,1] \). From Equations 11 and 17 we see that

\[
\frac{\partial^2 T(\Lambda, v, \theta)}{\partial \theta \partial \Lambda} = \frac{\partial(1-\Lambda)\frac{h-a}{h}}{\partial \Lambda}
\]

From Equation 20 we see that

\[
\frac{\partial(1-\Lambda)\frac{h-a}{h}}{\partial \Lambda} = \frac{\partial(1-\Lambda)\frac{r}{r+1-\Lambda}}{\partial \Lambda} = \frac{-r}{r+1-\Lambda}
\]

Since \( \Lambda, r > 0 \) we see that \( \frac{\partial^2 T(\Lambda, v, \theta)}{\partial \theta \partial \Lambda} < 0 \) as desired. To show that \( T(\cdot, v, \theta_i) - T(\cdot, v, \theta_j) \to 0 \) in \( \Lambda \), we note that \( T(\cdot, v, \theta_i) = (1-\Lambda) w^*_i + \Lambda \bar{w} \). Since \( w^*_i \) is bounded below by \( \theta_i \) then \( T(\cdot, v, \theta_i) \) converges to \( \bar{w}(\Lambda) \) for any \( \theta_i \).

Proof of Theorem 2:

1. To see the equilibrium hiring rate of the firm, we calculate the probability that a worker is hired by the firm ex-ante. Let \( E(r, s, \Lambda) \) be the expected equilibrium hiring rate in a market with distribution parameters \( r \) and \( s \) and transparency \( \Lambda \). Then

\[
E(r, s, \Lambda) \equiv \int_0^h \Pr \left( \bar{w} \geq w^*_i(\theta) \right) g(\theta) d\theta
\]

\[
= \int_0^h \Pr \left( v \geq a + \frac{1-a}{h} \theta \right) g(\theta) d\theta
\]

\[
= s \cdot (1-a)^r \int_0^h \left( 1 + \frac{1}{r} \theta \right)^r \theta^{s-1} d\theta
\]

\[
= (1-a)^r \frac{h^s \Gamma(r+1) \Gamma(s+1)}{\Gamma(r+s+1)}
\]
where the first equality comes from substituting in Equation 17, the second equality comes from substituting in the distribution of outside options from Equation 5 and the third from \( \Gamma(x) \equiv \int_{0}^{\infty} y^{x-1} e^{-y} dy \). As we see, transparency affects the hiring rate through changing \( a \) and \( h \). We know from Equation 26 that

\[
\arg\max_{\Lambda} \mathbb{E}(r, s, \Lambda) = \arg\max_{\Lambda} (1 - a)^{r} h^{s}
\]  

Substituting in from Equation 20 and taking the first order condition with respect to \( \Lambda \) yields

\[
\Lambda^{\ast} = \frac{r + 1}{r + s + 2}
\]

It remains to show that the maximization problem in Equation 27 is concave in \( \Lambda \) over \([0,1]\). Taking the first order condition of Equation 27 we see that

\[
\frac{\partial (1 - a)^{r} h^{s}}{\partial \Lambda} = \frac{- r^{2} s^{2} (1 - a)^{r-1} h^{r-1} (r(\Lambda - 1) + (2 + s)\Lambda - 1)}{(s + r - \Lambda + r\Lambda)^{3}}
\]

From this, since \( r, s > 0 \) and \( a < 1 \) we see that the first order condition in Equation 28 holds. Substituting in from Equation 5 gives us the particular form of \( \Lambda^{\ast} \) in the theorem. We further can calculate

\[
\frac{\partial^{2} (1 - a)^{r} h^{s}}{\partial \Lambda^{2}} \overset{\text{sign}}{=} - r s h^{s} (1 - a)^{r - 1} \left( s^{2} (r^{2} + r (2 - \Lambda^{2}) + (1 - \Lambda^{2}))
\right.
\]

\[
- r \Lambda \left( r^{2} (2 - \Lambda) + 2 r (\Lambda^{2} - 3\Lambda + 2) + (4\Lambda^{2} - 5\Lambda + 2) \right)
\]

\[
- s^{2} \left( r^{3} + r^{2} \left( - 2\Lambda^{2} + 2\Lambda + 2 \right) + r \left( - 2\Lambda^{2} + 4\Lambda + 1 \right) + 2\Lambda \left( 1 - \Lambda^{2} \right) \right)
\]

\[
- s \left( r^{3} \left( - \Lambda^{2} + 2\Lambda + 1 \right) + r^{2} \left( 3 - 2\Lambda^{2} \right) \right)
\]

\[
- s \left( r^{2} (6\Lambda^{2} - 6\Lambda + 3) + (- 4\Lambda^{3} + 7\Lambda^{2} - 4\Lambda + 1) \right)
\]

A sufficient condition for \( \frac{\partial^{2} (1 - a)^{r} h^{s}}{\partial \Lambda^{2}} < 0 \) for all \( \Lambda \in (0,1) \) is that each of the polynomial terms involving \( \Lambda \) be strictly positive for \( \Lambda \in (0,1) \). It is easy to check each of these polynomials separately to see that this sufficient condition is indeed satisfied. Therefore, extreme point \( \Lambda^{\ast} \) is the global maximizer of expected employment.

2. In equilibrium, there is an outside option cutoff for employment \( \theta^{\ast} \) such that all workers with outside options weakly less than \( \theta^{\ast} \) negotiate wages that are acceptable to the firm. Then the hiring rate is equal to \( G'(\theta^{\ast}) \). Noting that a worker \( i \) with outside option \( \theta^{\ast} \) sets \( w_{i}^{\ast} = \bar{w} \) it must be the case that \( G'(\theta^{\ast}) = \bar{G}(\bar{w}) \). From Equations 17 and 18 it is the case that for all \( v \geq a \)

\[
\bar{G}(\bar{w}) = \left( \frac{h}{1 - a} (v - a) \right)^{a}
\]  

26
We can use a monotonic transformation of $\bar{G}(\bar{w})$ to complete the claim, that is, we show submodularity of $\frac{h}{1-a}(v-a)$ in $v$ and $\Lambda$.

$$\frac{\partial \frac{h}{1-a}(v-a)}{\partial v} = \frac{h}{1-a} = \frac{(1-\Lambda)s + rs}{(s+\Lambda)r}$$

(31)

Which is clearly decreasing in $\Lambda$. Therefore, $\bar{G}(\bar{w})$ is submodular in $v$ and $\Lambda$ for a firm of type $v \geq a(\Lambda)$.

$\blacksquare$

**Proof of Theorem 3:**

We show that the expected equilibrium profit of the firm is strictly increasing in $\Lambda$. That the expected equilibrium profit of an arbitrary worker is strictly decreasing in $\Lambda$ follows a similar calculation. We invoke the law of iterated expectations by first finding the firm’s profit for a particular draw $v > a$ which we denote by $\pi(v, \Lambda)$.

$$\pi(v, \Lambda) = \int_a^{\bar{w}} (v - (1-\Lambda)y - \Lambda \bar{w}) \bar{g}(y)dy$$

$$= \int_a^{\bar{w}} (v - (1-\Lambda)y - \Lambda \bar{w}) s \left( \frac{h}{h-a} \right)^s (y-a)^{s-1}dy$$

$$= \frac{(\bar{w} - a)^s}{s+1} \left( \frac{h}{h-a} \right)^s (a(\Lambda - 1) - \bar{w}(\Lambda + s) + sv + v)$$

(32)

where the second equality comes by using Equation 18. The ex-ante expected profit of the firm can be expressed as $\pi(\Lambda) = \int_a^1 \pi(v, \Lambda) f(v)dv$. A tedious, but straightforward calculation shows that $\frac{\partial \pi(\Lambda)}{\partial \Lambda} > 0$ for all $r, s > 0$ as desired.

The proof that expected discounted wages are decreasing in $\Lambda$ follows from Theorem 2 and the earlier part of the current proof. Let $\Lambda^*$ be the expected employment maximizing level of transparency as defined in Equation 6. From Theorem 2 we know that the expected hiring rate is increasing in $\Lambda$ on $[0, \Lambda^*]$ and we have just shown that expected worker surplus is decreasing in $\Lambda$ on $[0, \Lambda^*]$. Therefore, it must be the case that expected discounted wages, conditional on employment, must be decreasing in $\Lambda$ on $[0, \Lambda^*]$. Similarly, from Theorem 2 we know that the expected hiring rate is decreasing in $\Lambda$ on $[\Lambda^*, 1]$ and we have just shown that firm surplus is increasing in $\Lambda$ on $[\Lambda^*, 1]$. Therefore, it must be the case that expected discounted wages, conditional on employment, must be decreasing in $\Lambda$ on $[\Lambda^*, 1]$. Combining these two arguments, we see that expected discounted wages, conditional on employment, are decreasing in $\Lambda$ on $[0, 1]$, as desired.

$\blacksquare$
EXAMPLE 1. Increasing transparency does not increase profits for all firm types:

Let \( v = 1 \) and let \( \mathbb{E}(\theta) = \mathbb{E}(v) = \frac{1}{2} \). This implies that \( r = s = 1 \). We can calculate the profit \( \pi(v, \Lambda) \) of the firm using Equation 32. We see that \( \pi(1, 1) = \frac{1}{4} \) while \( \pi(1, \frac{1}{2}) = \frac{9}{32} \).

Notice that by symmetry of our model, this example implies that increasing transparency can strictly increase the expected earnings of workers with very low outside options.

Proof of Theorem 4:

To see that the desired equilibrium in which all firm types select \( \Lambda = 1 \) exists, suppose each worker \( i \) believes \( \bar{w} = 1 \) if any other \( \Lambda \) is observed. The optimal response to these beliefs is to set \( w_i^* = 1 \) for all \( i \), meaning that the firm will make zero profits if it deviates.

We begin the proof of uniqueness with a lemma.

LEMMA 2. In equilibrium no two firm types select the same level of transparency \( \Lambda < 1 \).

Proof of Lemma: Toward a contradiction, suppose two distinct firm types \( v \) and \( v' \) both select the same \( \Lambda < 1 \) in equilibrium. Let \( V(\Lambda) \) denote the set of firm types that select \( \Lambda \) according to equilibrium strategies, and let \( v_L(\Lambda) = \inf V(\Lambda) \). Upon observing \( \Lambda \), no worker \( i \) will set her initial offer \( w_i^* < \bar{w}(v_L(\Lambda)) \). We show that there exists some \( \epsilon > 0 \) such that workers with \( \theta_i \in [\bar{w}(v_L(\Lambda)) - \epsilon, \bar{w}(v_L(\Lambda))] \) will set \( w_i^* > \bar{w}(v_L(\Lambda)) \). Therefore firm type (arbitrarily close to) \( v_L(\Lambda) \) has a profitable deviation to set \( \Lambda = 1 \) and keeping the same maximum wage, \( \bar{w}(v_L(\Lambda)) \), and hiring all workers with \( \theta_i \leq \bar{w}(v_L(\Lambda)) \) at wage \( \bar{w}(v_L(\Lambda)) \). We show this for two exhaustive cases.

1. \( \inf \{ V(\Lambda) \setminus \{ v_L(\Lambda) \} \} = v_L(\Lambda) \). Following Equation 3, each worker \( i \) will set \( w_i^* \geq \bar{w}(v_L) \) to solve

\[
    w_i^* - \theta_i = (1 - \Lambda) \frac{1 - F(w_i^* | v \in V(\Lambda))}{f(w_i^* | v \in V(\Lambda))}
\]  

(33)

Given our continuity and full support assumptions on \( F(\cdot) \), that \( \Lambda < 1 \), and the premise of this case, there exists \( \Delta > 0 \) such that for all \( \delta < \Delta \), the RHS of Equation 33 is bounded away from zero. So as \( \theta_i \to \bar{w}(v_L(\Lambda)) \) from the left, it cannot be the case that \( w_i^* \neq \bar{w}(v_L(\Lambda)) \), as this would fail to satisfy Equation 33. Therefore, the firm fails to hire a positive mass of workers with \( \theta_i \leq \bar{w}(v_L(\Lambda)) \) that it could hire by deviating to \( \Lambda = 1 \).

2. \( \inf \{ V(\Lambda) \setminus \{ v_L(\Lambda) \} \} = v_2 > v_L(\Lambda) \). Each worker who observes transparency level \( \Lambda \) in equilibrium prescribes some probability \( p > 0 \) that \( \bar{w} \geq \bar{w}(v_2) \). Suppose worker \( i \) places initial offer \( \bar{w}(v_2) \) instead of \( \bar{w}(v_L(\Lambda)) \). From the fourth line of Equation 11 we see that a worker loses flow surplus \( \Lambda(\bar{w}(v_L(\Lambda)) - \theta_i)(1 - p) \) if she offers \( w_i' \) instead of \( w_i^* \). On the other hand, she gains flow surplus \( (1 - \Lambda)(\bar{w}(v_2) - \bar{w}(v_L(\Lambda)))p \). As \( \theta_i \to \bar{w}(v_L(\Lambda)) \), the expected gain outweighs the expected loss for any \( \Lambda < 1 \).
Therefore, workers with outside options sufficiently close to \( \bar{w}(v_L(\Lambda)) \) will offer strictly more than \( \bar{w}(v_L(\Lambda)) \). Therefore, the firm fails to hire a positive mass of workers with \( \theta_i \leq \bar{w}(v_L(\Lambda)) \) that it could hire by deviating to \( \Lambda = 1 \).

To complete the proof of the theorem, suppose for contradiction that some firm type \( v_1 < 1 \) selects some \( \Lambda^1 < 1 \) and sets \( \bar{w} = w_1 \). By assumption \( A2 \) then worker \( i \) who observes \( \Lambda \) in equilibrium offers

\[
\begin{align*}
  w_i^* &= \begin{cases} 
    w_1 & \theta_i \leq w_1 \\
    \theta_i & \theta_i > w_1 
  \end{cases}
\end{align*}
\]

(34)

Consider any firm type \( v_2 > v_1 \), that sets \( \bar{w} = w_2 \). In equilibrium, as above, worker \( i \) offers

\[
\begin{align*}
  w_i^* &= \begin{cases} 
    w_2 & \theta_i \leq w_2 \\
    \theta_i & \theta_i > w_2 
  \end{cases}
\end{align*}
\]

(35)

Now suppose that firm type \( v_2 \) deviates and selects transparency level \( \Lambda^1 \) and keeps \( \bar{w} = w_2 \). Instead of receiving offers as in Equation 35 it receives offers as in Equation 34. By assumption \( A4 \) firm type \( v_2 \) matches with all the same workers as it did according to the prescribed strategies, but pays lower wages. Contradiction with the premise that any firm type \( v_1 < 1 \) selects some \( \Lambda^1 < 1 \).

Proof of Proposition 4:

Suppressing time and worker indices, suppose a worker has negotiated a flow wage of \( w \). Then in addition to her other choices, she must choose \( e \) to solve \( \max_{e \in [0,1]} w \cdot e - \theta \cdot e \). For any \( w \geq \theta \) the maximizer is \( e = 1 \) (if \( w = \theta \) any \( e \in [0,1] \) is a maximizer and we select \( e = 1 \) in this case, although, as we see, in equilibrium this will only affect a zero measure set of workers). Therefore, when \( w \geq \theta \) the equilibrium flow utility to the worker is \( w - \theta \), as in the initial model. But by \( A1 \) a worker would never agree to a wage \( w < \theta \). So in equilibrium, \( e = 1 \) and payoffs are the same as the original model. It is easy to see that given this, all other equilibrium choices will be unchanged.

Proof of Proposition 5:

Let \( D \) be the largest wage gap arising on equilibrium path, that is, \( D = \bar{w} - w^*(0) \).

\( \Leftarrow \) If \( w \cdot e - \theta \cdot e - m(e,d) \leq 0 \) for any \( e \in [0,1] \) and any \( d < D \) then as soon as any worker learns \( \bar{w} \) the firm can either choose to increase her wage to \( \bar{w} \) and receive flow profits \( v - \bar{w} \geq 0 \) or receive flow profits of 0 otherwise from the worker who will put in zero effort. It is easy to see that given this, all other equilibrium choices will be unchanged.
Clearly it cannot be the case that \( m(e, d) = 0 \) for some \( d \in (0, D] \), or else the firm would never fully equalize wages. Suppose for contradiction that \( w \cdot e - \theta \cdot e - m(e, d) = \epsilon > 0 \) for some \( e \in (0, 1] \) and \( d \in (0, D] \). Let \( e^*(d, w_i^*) \) be the optimal effort selected by worker \( i \) upon learning \( \bar{w} \) when receiving wage \( w_i^* \). Note that since \( m(e, d) \) is non-decreasing in \( d \), \( e^*(d, w_i^*) \) is non-increasing in \( d \). The firm must solve

\[
\max_{0 \leq d \leq \bar{w} - w_i^*} e^*(d, w_i^*)(v - \bar{w} + d) \tag{36}
\]

The premise that the firm immediately sets \( i \)'s wage to \( w_{i,t} = \bar{w} \) if \( i \) learns \( \bar{w} \) at time \( t \) implies that \( d = 0 \) is optimal, inducing \( e = 1 \). This implies that

\[
v - \bar{w} \geq e^*(d, w_i^*)(v - \bar{w} + d) \quad \forall d \in (0, D] \tag{37}
\]

which holds if and only if

\[
v - \bar{w} \geq d \cdot \frac{e^*(d, w_i^*)}{1 - e^*(d, w_i^*)} \quad \forall d \in (0, D] \tag{38}
\]

We need to show that Equation 38 cannot hold for all \( \Lambda \). By sending \( \Lambda \rightarrow 0 \), the LHS of Equation 38 converges to 0, while by assumption there exists some \( d \) such that for all \( d' \in (0, D] \), the RHS is bounded away from 0. Contradiction.

\[\Box\]

**Proof of Proposition 6:**

Taking the first order condition of \( \Lambda_m - \Lambda_f \) with respect to \( \lambda \) yields

\[
\frac{\alpha_m}{\alpha_f} = \frac{(\rho + \delta + \alpha_m \lambda)^2}{(\rho + \delta + \alpha_f \lambda)^2} \tag{39}
\]

The LHS of Equation 39 is constant in \( \lambda \) while the RHS is increasing in \( \lambda \) as \( \alpha_m > \alpha_f \). Therefore, there is a unique solution \( \lambda_c \) to this first order equation and thus a unique interior extreme point. As \( \Lambda_m - \Lambda_f > 0 \) for all \( \lambda \in (0, \infty) \) and it is continuously differentiable over this domain, the fact that \( \Lambda_m - \Lambda_f = 0 \) for \( \lambda \in (0, \infty) \) it must be that \( \lambda_c \) is a maximizer, and that \( \Lambda_m - \Lambda_f \) is single-peaked.

\[\Box\]

**Proof of Proposition 7**

We have already explained that workers with \( 2\bar{W}_v + \bar{W}_V > \theta_i \) will offer a wage of \( \bar{W}_v \), and those with \( \bar{W}_V \geq \theta_i \geq 2\bar{W}_v + \bar{W}_V \) will offer a wage of \( \bar{W}_V \). Therefore, the firm maximizes:
\[ \left( \frac{1}{2} v + \frac{1}{2} V - \bar{W}_v \right) \max\{0, G(2\bar{W}_v + \bar{W}_V)\} + \frac{1}{2} (V - \bar{W}_v) \left[ G(\bar{W}_v) - \max\{0, G(2\bar{W}_v + \bar{W}_V)\} \right] \]

\tag{40}

We solve this maximization problem under the assumption that \( G(2\bar{W}_v + \bar{W}_V) > 0 \) and later verify that this is true for the given solution. From Equation 5 we know that \( G(x) = x^s \) over the region we are considering.

The first-order conditions for \( \bar{W}_V \) and \( \bar{w}_v \), respectively, are:

\[ \frac{s}{2} (V - \bar{W}_V) (\bar{W}_V^{s-1} + (2\bar{W}_v + \bar{W}_V)^{s-1}) - \left( \frac{1}{2} (v + V) - \bar{W}_v \right) s (2\bar{W}_v + \bar{W}_V)^{s-1} - \frac{1}{2} (\bar{W}_V^{s-1} - (2\bar{W}_v + \bar{W}_V)^s) = 0 \]

and

\[ 2s \left( \frac{1}{2} v + \frac{1}{2} V - \bar{W}_v \right) (2\bar{W}_v + \bar{W}_V)^{s-1} - (2\bar{W}_v + \bar{W}_V)^s - s \left( V - \bar{W}_V \right) (2\bar{W}_v + \bar{W}_V)^{s-1} = 0 \]

Solving these equations simultaneously yields

\[ \bar{W}_v = \frac{1}{2} s \left( \frac{v + V}{1 + s} \right) \]

\[ \bar{W}_V = \frac{Vs}{1 + s} \]

\tag{41}

We make note of three points. First, \( 2\bar{W}_v > \bar{W}_V \) which validates our decision to drop the “max” term from the objective function. Second, the second-derivative test can be shown to verify the above solution as a maximizer of firm surplus. Third, as we point out in the main body, for any \( V \) and \( s \), as \( v \) becomes sufficiently small \( \bar{W}_v > v \).

\[ \blacksquare \]

**Proof of Proposition 8**

To calculate the profit when workers cannot observe their productivity type, we plug the solutions from Equation 41 into Equation 40. From Equation 21 we know that \( \bar{w}(v) = \frac{sv}{1 + s} \). Therefore, firm profit when workers can observe their productivity types for the same draws of \( V \) and \( v \) is \( \frac{1}{2}(v - \frac{sv}{1 + s})(\frac{sv}{1 + s})^s + \frac{1}{2}(V - \frac{sv}{1 + s})(\frac{sv}{1 + s})^s \). Canceling terms reveals that these two profit values are identical.

Similarly, we can calculate the difference in the hiring rate between the two schemes:

\[ (2\bar{W}_v + \bar{W}_V)^s + \frac{1}{2} (\bar{W}_V)^s - (2\bar{W}_v + \bar{W}_V)^s - \frac{1}{2} \left( \frac{sv}{1 + s} \right)^s - \frac{1}{2} \left( \frac{sv}{1 + s} \right)^s = 0 \]

\[ \blacksquare \]
Let \( \bar{W}_V^\gamma \) and \( \bar{W}_v^\gamma \) represent the maximum acceptable wage for type \( V \) and type \( v \) workers, respectively, when workers place \( \gamma \) weight on being type \( V \) upon observing the wage profile within the firm. Compare profits under \( \gamma < \gamma' \). Then firm profit must be higher under \( \gamma \) because the firm could set \( \bar{W}_V = \bar{W}_V^{\gamma'} \) and \( \bar{W}_v = \bar{W}_v^{\gamma'} \) and have more workers select to offer \( \bar{W}_v \) than \( \bar{W}_V \) than under \( \gamma' \), increasing profits. Therefore, the maximizing values \( \bar{W}_V^\gamma \) and \( \bar{W}_v^\gamma \) must give no lower profit.

Theoretical Appendix

C. Multiple firms

In this section, we embed our analysis of pay transparency into a search model by including multiple firms, and show that many of the insights of the main model carry over to this setting. For tractability, we study only the cases of full privacy and full transparency. Let \( \mathcal{N} = \{1, 2, ..., N\} \) be the set of firms, each with a value for labor \( v^n \) drawn iid from distribution \( F \). As before, workers have outside options drawn iid from distribution \( G \). Workers negotiate with firms in a predetermined order without the possibility of returning to an earlier firm. Without loss of generality, we assume that workers first meet with firm 1, then firm 2, and so on.

If a firm rejects a worker’s offer the two are ineligible to match at any point in the future, and the worker (instantly) moves to the next firm in the sequence. Although we do not do so for simplicity of exposition, it is possible to embed a search friction in this formulation without affecting the qualitative findings. A worker whose offer is rejected by firm \( N \) becomes unemployed for her duration in the market and consumes her outside option. Workers continue to expire at rate \( \rho \) at which time they leave the market. A worker whose offer is accepted by firm \( n < N \) is replaced with a worker of identical outside option who moves on to firm \( n + 1 \) as if her offer had been rejected at firm \( n \).

Each firm \( n \) selects a maximum wage it is willing to pay for a worker \( \bar{w}^n(v^n) \in [0, 1] \), where the choice of \( \bar{w}^n \) is not immediately observed by workers. As before, each worker bargains for wages by making TIOLI offers to firms at any point during her employment, potentially renegotiating infinitely often. Workers who at anytime offer a wage greater than

49 Each time a worker’s offer is rejected, we could instead make the worker unable to meet with subsequent firms with probability \( \zeta \in (0, 1) \). Similarly to the relation between \( \lambda \) and \( \Lambda \) in the main body of the paper, the equilibrium consequences of this probabilistic search friction are identical to a friction which governs the (average) length of time it takes for a worker to find the next firm; in this context \( \zeta \) close to 0 corresponds to near-instant discovery of the next firm, while \( \zeta \) close to 1 corresponds to near-infinite time required to discover the next firm. Including such a search friction does not meaningfully change the remainder of the analysis.

50 This assumption is made for tractability as this “cloning” greatly simplifies equilibrium characterization in our context, and is frequently adopted in the search literature (see, for example, Burdett and Coles (1999), Bloch and Ryder (2000), and Chade (2006)). This assumption may be even more defensible in a setting like TaskRabbit, in which jobs are short-term, and therefore, we can interpret a “cloned” worker as merely a worker who has completed a given task and is not eligible to re-complete it.
\( \bar{w}^n \) to firm \( n \) are permanently unmatched with the firm. Let \( W^n_t \) denote the set of wages firm \( n \) is paying to its employed workers, where \( W^n_0 = \{ \bar{w}^n \} \). We model transparency as a random arrival process; at time \( t \), workers matched to firm \( n \) observe \( W^n_t \) according to an independent Poisson arrival process with rate \( \lambda \in \{0, \infty\} \), where we take \( \lambda = \infty \) to mean that the process arrives whenever a worker first matches with a firm, and at every instant while she is employed.

The timing of the stage game is as follows at each time \( t \geq 0 \):

1. **Entry:** New workers enter the market. Initialize \( m = 1 \), and \( \ell_i = 1 \) for each new worker.

2. **Search and Bargaining:**

   (a) Unmatched workers match with firm \( m \) if \( \ell_i = m \).

   (b) Each matched worker \( i \) learns \( W^m_t \) independently with arrival rate \( \lambda \).

   (c) Newly entering workers must bargain with the firm and any existing, matched worker can initiate bargaining. Any worker \( i \) who engages in bargaining makes a TIOI offer \( w^m_{i,t} \in [0, 1] \) to firm \( m \). If \( w^m_{i,t} \leq \bar{w}^m \) then firm \( m \) pays \( i \) a flow wage \( w^m_{i,t} \) until \( i \) departs or attempts to renegotiate. If \( w^m_{i,t} > \bar{w}^m \) then worker \( i \) becomes unmatched.

   (d) For any \( i \) such that \( w^m_{i,t} > \bar{w}^m \) increase \( \ell_i \) by 1.

   (e) If \( m < N \), for all \( i \) such that \( w^m_{i,t} \leq \bar{w}^m \), create a new worker \( j \) with \( \theta_j = \theta_i \) and \( \ell_j = \ell_i + 1 \), increase \( m \) by 1 and repeat Step 2.

3. **Exit:** Existing workers depart at rate \( \rho \).

**C.1. Equilibrium**

We work backward to solve for the unique equilibrium. Workers meeting firm \( N \) face the same decision as workers in the base model: they face a firm with value \( v^N \) drawn from distribution \( F \) and are among an incoming cohort with outside options determined by distribution \( G \). We know from Equations 3 and 4 that under full privacy each worker \( i \) will offer firm \( N \) an initial amount \( w^N_i \) solving

\[
\frac{1 - F(w^N_i)}{f(w^N_i)} = w^N_i - \theta_i
\]

and firm \( N \) will set \( \bar{w}^N = v^N \). Workers will not attempt to renegotiate. Under full transparency, \( N \) will set \( \bar{w}^N \) to solve

\[
\frac{G(\bar{w}^N)}{g(\bar{w}^N)} = v^N - \bar{w}^N
\]
and worker $i$ will be employed at flow wage equal to $\bar{w}^N$ if and only if $\bar{w}^N \geq \theta_i$. Denote by $\theta_i^{n,\lambda}$ the expected equilibrium lifetime utility (under transparency level $\lambda$) of a worker with outside option $\theta_i$ immediately upon matching with firm $n$ (before making an offer or learning wages through the transparency process), and denote by $G^{n,\lambda}$ the distribution of $\theta_i^{n,\lambda}$. Then, when facing firm $N-1$, workers face will face the same decision but with $\theta_i$ replaced with $\theta_i^{N,\lambda}$, and firm $N-1$ will face the same decision as firm $N$ but with distribution $G$ replaced with $G^{N,\lambda}$. Inducting up toward the first firm, we can characterize the equilibrium actions of agents as the following:

$\lambda = 0$:

**Workers:**

$$w^n_i - \theta^{n+1,0}_i = \frac{1 - F(w^n_i)}{f(w^n_i)} \text{ for } n < N$$  \hspace{1cm} (42)

**Firms:**

$$v^n = \bar{w}^n \text{ for } n \leq N.$$  \hspace{1cm} (43)

$\lambda = \infty$:

**Workers:**

$$w^n_i = \bar{w}^n \mathbf{1}_{\{\bar{w}^n \geq \theta^{n+1,\infty}_i\}} \text{ for } n < N$$  \hspace{1cm} (44)

**Firms:**

$$v^n - \bar{w}^n = \frac{G^{n+1,0}(\bar{w}^n)}{g^{n+1,0}(\bar{w}^n)} \text{ for } n < N$$  \hspace{1cm} (45)

As $\theta_i$ is constant over time, $\theta_i^{n,\lambda}$ is a non-increasing sequence, and strictly decreasing for workers with $\theta_i < 1$. Therefore, $\frac{G^{n,\lambda}}{g^{n,\lambda}}(x)$ is non-increasing in $n$. In words, workers’ outside options, which include the option value of bargaining with future firms, decreases as they move along the sequence of firms. Realizing this, under full transparency, earlier firms accept higher wages to incentivize workers to accept their offers rather than wait to meet future firms. We now provide results that are similar to the theorems in the main text.

**Proposition 10.** *The expected average utility of workers is higher in equilibrium with $\lambda = 0$ than $\lambda = \infty$. The expected utility of firms is higher in equilibrium with $\lambda = \infty$ than $\lambda = 0$.*

**Proof:**

We prove this result for workers, and the converse for firms is similar. By Myerson (1981) the expected utility of any worker who reaches firm $N$ is higher under $\lambda = 0$ than $\lambda = \infty$. Therefore, $\theta_i^{N,0} > \theta_i^{N,\infty}$ for all $\theta_i$. When meeting firm $N-1$, worker $\theta_i$ is in expectation better off setting offering $\bar{w}_i^{N-1}$ solving
\[ \tilde{w}_i^{N-1} - \bar{w}_i^{N-1} = \frac{1 - F(\tilde{w}_i^{N-1})}{f(\tilde{w}_i^{N-1})} \] (46)

than receiving the equilibrium offer under full transparency by the same Myerson (1981) argument. That worker \( i \) is able to offer \( \tilde{w}_i^{N-1} \) but instead chooses \( w_i^{N-1} \) that solves Equation 42 indicates that worker \( i \) is better off in expectation by revealed preference under full privacy. By induction, we see that worker \( i \) is better off at every firm she meets under full privacy.

Below are three analogues of the remaining theorems in the body of the paper. The proofs are omitted as the logic follows the proofs of the main theorems.

**Proposition 11.** When \( \lambda = \infty \) there is no wage dispersion between workers at the same firm in equilibrium.

**Proposition 12.** The ex-post employment maximizing level of transparency is weakly decreasing in \( v \).

**Proposition 13.** When each firm can select \( \lambda \in \{0, \infty\} \) as a function of \( v \) there is an essentially unique equilibrium outcome. In equilibrium, each firm selects \( \lambda = \infty \) for all \( v > 0 \).

One additional consideration is whether wages are transparent to workers outside the firm. In the above model, workers learn the wages of only their coworkers. If they learned the wages of all workers in the market—for example, if a transparency mandate caused all salaries to be posted online—then the results would change depending on whether or not there is a search friction, defined as a probability \( \zeta \in (0, 1) \) of a worker being unable to meet with subsequent firms after a wage-offer rejection.

Suppose the vector \((v_1, ..., v_N)\) is known to all firms before they (simultaneously) set their maximum acceptable wages. With no search friction (\( \zeta = 0 \), as we discuss above), firms under transparency will effectively Bertrand compete for workers. In equilibrium, all employed workers will seek out the highest value firm and receive pay \( w^* = \max\{v(2), \tilde{w}(v(1))\} \)—either the value of the second highest firm, or the equilibrium wage the firm would pay if it had value \( v(1) \) in the base game. Workers without outside options higher than this value will remain unemployed. With a search friction \( \zeta \in (0, 1) \), firms which do not have the highest value set higher wages \( \bar{w} \) to disincentivize workers from targeting higher-value firms. In the extreme case of \( \zeta = 1 \), no worker will ever leave a profitable employment opportunity to seek out a higher wage elsewhere, and so the model collapses to the base model we study in the main body of the paper.

**D. Firm Acceptance or Rejection of Each Offer**

We introduce the game as one in which the firm selects a single \( \tilde{w} \) and is bound to that for all time. More realistically, the firm may be able to accept offers on a case-by-case basis. In this section, we show that generalizing the game and restricting our attention to a class of time consistent equilibria does not change the analysis.
Amendments to the timing of the stage game are straightforward. Instead of selecting $\bar{w}$ at $t = 0$, the firm selects “accept” or “reject” for each offer as it receives it. By accepting, the firm is locked in to paying the agreed upon wage until the worker departs or makes another offer, and if the firm rejects, then the worker is ineligible to work at the firm.

As we are interested in the effect of transparency on wage negotiation, learning about the wages of others must convey information about the wage a worker can request. Intuitively, we want to use an equilibrium refinement like Markov perfection, as this includes subgame perfection (so that the firm cannot make non-credible threats of refusing to accept certain wage offers) and time consistency (seeing the wage of a higher paid co-worker means that a worker knows she can receive that wage if she offers it to the firm). Unfortunately, Markov perfect equilibria are not well-defined in our setting.\(^{51}\) Formally, we study equilibria satisfying $A_0$, $A_1$-$3$, $A_4'$, and $A_5$. We define $A_0$ and $A_4'$ below.

$A_0$ The firm selects some function $\bar{w}(v)$, and accepts all offers $w_{i,t} \leq \bar{w}$ for any worker $i$ and any time $t$, and rejects all others.

$A_4'$ Let $w_t^{\sup}$ be the highest wage paid by the firm at time $t$ if the worker observes wages at time $t$, and 0 otherwise. Off path, each worker $i$ believes with probability 1 that the firm will accept any offer she makes that is no more than $\max\{w_t^*, w_t^{\sup}\}$ and will reject all greater offers.

$A_0$ restricts attention to firm strategies that set a maximum wage $\bar{w}$ that is constant across workers and over time within worker. This assumption that the firm’s strategy is time-consistent within worker is a Markovian restriction; a firm can condition its acceptance strategy on $v$, previous offers made by the worker, and the history of the game. Note however, that given the constant inflow and outflow of workers, the only payoff relevant factor determining the state of the game from the firm’s point of view is $v$. Furthermore, this Markovian assumption is necessary to understand the effects of pay transparency and worker bargaining. Because each worker is infinitesimally small, without any restriction, the firm could essentially negate pay transparency by refusing to renegotiate with workers. For example, the firm could play a strategy that defines some $\bar{w}_{i,t}(v)$, which is the maximum wage it will accept from each $i$ at time $t$. The firm could set $\bar{w}_{i,t} = v$ and $\bar{w}_{i,t'} = w_t^*$ for all $t' > t$, which corresponds to the “full privacy” world of $\lambda = 0$ we present later. Without this restriction, it is also possible to construct “sun spot” equilibria in which $\bar{w}_t(v)$ is a step function in $t$, that is at some time $t'$ the firm’s maximum willingness to pay jumps upward.

The restriction that the maximum accepted offer is equal across workers is motivated by the assumption that the firm cannot wage discriminate against workers as it does not observe outside options.\(^{52}\) As we have limited our study to equilibria in which the firm’s

\(^{51}\)Watson (2017) discusses some issues of equilibrium refinement in games with infinite action spaces.

\(^{52}\)Massachusetts recently passed a law prohibiting firms from asking potential employees their current salaries during job interviews (http://www.nytimes.com/2016/08/03/business/dealbook/wage-gap-massachusetts-law-salary-history.html accessed 11/7/2016) and employers often have little information on workers’ outside options in online labor markets such as TaskRabbit. Even if firms are able to observe demographic factors associated with high or low outside options (perhaps such as gender), and would optimally set a different maximum wage for these groups, any such strategy would be in violation of the Equal Pay Act of 1963, opening up the firm to litigation. Therefore, the analysis would be unchanged if instead the firm could observe the demographics of workers but could not select separate wage policies for different groups.
willingness to pay is constant over time within worker, if the firm had a different willingness to pay across workers, it would imply that the firm has a different willingness to pay for two workers $i$ and $j$ at the moment each of these workers enters the market. Due to lack of information about outside options, the firm cannot discriminate in this fashion over a positive measure set of workers in equilibrium. We formally include the assumption that the maximum accepted offer is equal across workers here to rule out equilibria which vary only upon a measure zero set of workers.

$A4'$ is a special case of $A4$ and states that off path, conditional on learning the wages of co-workers, workers believe they can receive no more than $\bar{w}_i^{\text{sup}}$ and will not be rejected if they offer $w_i^{t}\sup$. In other words, workers believe that even off path the firm plays a time consistent strategy as in $A0$. Such beliefs are potentially reasonable in the presence of equal pay laws.

All of the results in the paper go through under this expanded game if we restrict attention to equilibria satisfying the above conditions. Indeed, all of the results until those in Section III.D go through if we relax off path beliefs in $A4'$ to workers believing that with probability 1 that any offer weakly less than $w_i^{t}\sup$ will be accepted. Nevertheless, this relaxed version of $A4'$ can create an additional equilibrium outcome in the game with endogenous firm selection of transparency in which all firm types pool on $\Lambda = 0$. Further details are available from the authors upon request.

**E. Dynamic Rebargaining with Low Frictions**

We study the game introduced in Appendix D with the following adjustment: any renegotiation offer a worker makes at any time $t$ that the firm rejects results in the worker consuming her outside option for $\Delta$ periods and the firm receiving no utility from that worker for $\Delta$ periods. At time $t + \Delta$, the worker must make a renegotiation offer to the firm. This process continues, with $\Delta$ periods of loss of employment in between rejected renegotiation offers until the firm accepts an offer or the worker exogenously departs. This extension captures the notion that rejection of the initial offer terminates communication between worker and firm (as in TaskRabbit, where rejection of a worker’s bid results in the pair never meeting) whereas failed renegotiation attempts on the job are costly but do not result in immediate firing. We show that the equilibrium outcome studied in the body of the paper is an equilibrium outcome of the game with low rebargaining frictions.

**Proposition 14.** For all $\Delta > 0$ and all $\Lambda$ there exists an equilibrium of the dynamic rebargaining with low frictions model that has the same outcome for all agents as the equilibrium of the base model.

**Proof:**

We construct equilibrium strategies that will support the given outcome. First, we consider the case of $\Lambda < 1$. The firm accepts the initial offer $w_i^*$ of any worker $i$ if and only if $w_i^* \leq \bar{w}$. The firm accepts a renegotiation offer $w_{i,t} > w_i^*$ from worker $i$ at time $t$ if and only if $w_{i,t} = \bar{w}$. Each worker $i$ only renegotiates at time $t'$ when she first learns $\bar{w}$ through the transparency process, and offers $w_{i,t'} = \bar{w}$. If $i$ ever makes a renegotiation offer before observing the transparency process and the offer is accepted, the worker believes that $v = 1$ and
she offers $\bar{w}(1)$ at every opportunity until she learns that actual $\bar{w}$ through the transparency process. If $i$ ever makes a renegotiation offer before observing the transparency process and the offer is rejected, she believes with probability 1 that $\bar{w} = w^*_i$ and she will offer $w^*_i$ at every opportunity until she learns the actual $\bar{w}$ through the transparency process.

Let us discuss how the off-path beliefs and actions support the equilibrium outcome. Suppose a worker $i$ whose initial offer has been accepted by the firm makes a renegotiation offer $w_{i,t} > w^*_i$ where $w_{i,t} \neq \bar{w}$. From $i$’s point of view, the probability of guessing the exact value of $\bar{w}$ given acceptance of her initial offer is 0, due to the continuum of values $\bar{w}$ can take. Therefore, according to equilibrium strategies, she will be unwilling to make an uninformed offer as she will lose $\Delta$ periods of surplus with no possibility of gain.

Similarly, when the firm sees an offer $w_{i,t} \neq \bar{w}$ it believes with probability 1 that $i$ has not yet seen the wages of other workers. Furthermore, the firm believes that if the current offer is rejected, $i$ will offer $w^*_i$ in $\Delta$ periods assuming she does not learn the wages of her peers in that time. If instead the firm accepts the offer, which happens with zero probability according to equilibrium strategies, we let the worker believe $v = 1$, meaning she will immediately offer $\bar{w}(1)$ and continue to do so, even if the firm rejects these offers (until she learns the wages of her peers). As $\bar{w}(1)$ is strictly more than almost any firm type is willing to pay, nearly every firm type will strictly prefer to reject this offer, given these beliefs. Therefore, the firm will not have a profitable deviation, unless $v = 1$.

As a result, and given that the ex-ante probability of $v = 1$ is zero, workers will never attempt to renegotiate without observing the transparency process, and the equilibrium outcome is as in the base model.

In the case that $\Lambda = 1$ the firm’s strategy is to accept any renegotiation offer $w_{i,t} \leq \bar{w}$ at any time $t$ from any worker $i$. Given this, workers have no incentive to attempt renegotiation as they learn $\bar{w}$ on equilibrium path before their initial negotiations, and they offer exactly this amount.

\section*{F. Extensions of Bargaining Protocol}

In this section, we discuss alternative bargaining protocols that generate qualitatively similar findings as the TIOLI bargaining scheme studied in the body of the paper. The first two cases consider situations in which workers are not able to rebargain as effectively as in the base model, either by being unable to capture the entire difference between their initial offers and $\bar{w}$, or sometimes being unable to rebargain. There is an injection between the equilibria of these games and the game studied in the body of the paper, in which the additional bargaining friction results in de facto lower levels of transparency. The third extension shifts the bargaining power from the workers to the firm probabilistically, giving the firm the ability to propose wages to a fraction of workers.\footnote{We show that the equilibrium outcome for workers receiving wage offers is independent of the level of transparency, and the equilibrium outcome for workers proposing wages is identical in this extended game to that.}

\footnote{This extension is similar to a modeling choice in Halac (2012) which changes the effective bargaining power of two parties by varying the probability of each agent making a TIOLI offer.}
of the original game. Therefore, transparency has the same equilibrium effects in this game, just affecting a smaller portion of the workers. The final extension allows employers to make a counteroffer. When workers initiate bargaining and can commit to a wage below which they will walk away, firms make counteroffers that, in equilibrium, target this walk-away wage. We show that workers make high offers in the first round, and anticipate receiving a counteroffer that is equal to the TIOLI offer they make in equilibrium in the original game. This leads to the same equilibrium outcome.

F.1. Workers can only re-bargain for part of surplus

There are a number of possibilities as to why workers may not be able to fully close the gap between their initial wage and \( \bar{w} \).

1. This could arise from a game in which workers and firm engage in alternating offer bargaining with disagreement amounts set to \( w^*_i \).

2. It could even occur under a worker TIOLI offer scheme under a “non-Markovian” (i.e. does not satisfy condition A0 in Section D) equilibrium in which the firm’s strategy is equilibrium is to reject re-bargaining offers that request more than a fixed proportion of the difference between a worker’s initial bid and \( \bar{w} \).

Formally, suppose that the firm selects \( \bar{w} \) which is the maximum wage it accepts from any worker in the initial period a worker is hired. At any subsequent period, the firm rejects any renegotiation offer from \( i \) strictly greater than \( w^*_i + \alpha (\bar{w} - w^*_i) \) where \( \alpha < 1 \).

Proposition 15. The (unique) linear equilibrium of the game in which workers can only re-bargain for a fraction of the difference between \( \bar{w} \) and \( w^*_i \) and transparency level \( \Lambda < 1 \) is equivalent to that of the original game with transparency level \( \alpha \Lambda \).

Proof:

For any \( \alpha \) the equilibrium outcome of this game is clearly equivalent to that of the original game when \( \lambda = \infty \) (\( \Lambda = 1 \)). When \( \lambda < \infty \), following the same logic as the main case, workers negotiate at most twice in equilibrium, once when they are first hired, and once when they learn \( \bar{w} \) through the transparency process. Letting \( \bar{F}(x) = P(\bar{w} \leq x) \), worker \( i \) negotiates at the first moment she is hired to:

\[
\arg\max_{w^*_i} \left( \frac{w^*_i}{\rho + \delta + \lambda} + \frac{\lambda}{\rho + \delta + \lambda} \cdot \frac{1}{\delta + \rho} [w^*_i + \alpha (\mathbb{E}(\bar{w}|\bar{w} \geq w^*_i) - w^*_i)] \right) (1 - \bar{F}(w^*_i)) + \frac{\theta_i}{\delta + \rho} \bar{F}(w^*_i)
\]

where the first term represents the weighted (by \( \lambda \)) expected wage the worker receives if matched with the firm, and the second term represents the lifetime earnings of the worker if she exceeds \( \bar{w} \) and instead consumes her outside option for her lifetime.

As before, we modify the objective function without affecting the maximizer, and show that this is equivalent to solving:

\[
\arg\max_{w^*_i} \int_{w^*_i}^{1} ((1 - \Lambda) w^*_i + \Lambda (w^*_i + \alpha (x - w^*_i)) - \theta_i) \bar{f}(x)dx
\]

\[
= \arg\max_{w^*_i} \int_{w^*_i}^{1} ((1 - \alpha \Lambda) w^*_i + \alpha \Lambda x - \theta_i) \bar{f}(x)dx
\]
where \( \Lambda = \frac{\lambda}{\rho + \delta + \lambda} \) for all \( \lambda \in [0, \infty) \). In equilibrium, the firm sets \( \bar{w}(v) \) to solve

\[
\arg\max_{\bar{w}} \int_0^\infty \frac{(v - y) \bar{g}(y) dy}{\rho + \delta + \lambda} + \bar{G}(\bar{w}) \frac{\lambda}{\rho + \delta + \lambda} \left( \frac{1}{\rho + \delta + \lambda} \left( v - \left[ \int_0^\infty \bar{y} \bar{g}(y) dy + \alpha \left( \bar{w} - \int_0^\infty \bar{y} \bar{g}(y) dy \right) \right] \right) \]
\]

where \( \bar{G}(x) = P(w_i^* \leq x) \). The first term gives the total discounted profits made by the firm before the workers experience an event (seeing the wage profile or perishing) and the second term is the profit made from workers after renegotiating their wages to the maximum allowable level over the rest of their lifetimes in the firm. We can similarly manipulate the objective as with the worker problem:

\[
\arg\max_{\bar{w}} \int_0^\infty (v - (1 - \alpha \Lambda) y - \alpha \Lambda \bar{w}) \bar{g}(y) dy
\]

Comparing Equations 48 and 50 to Equations 1 and 2, respectively, completes the proof.

The results presented in the body of the paper go through in this setting with minor notational changes. The only significant difference is Theorem 2. When \( \alpha \) is sufficiently small, the employment maximizing level of transparency may no longer be in the interior. It is possible to show that there exists \( \epsilon > 0 \) such that for all \( \alpha < \epsilon \) full transparency maximizes expected employment if and only if full transparency yields higher expected employment than full privacy. Intuitively, when \( \alpha \) is small, workers are unable to effectively rebargain, creating the possibility that full transparency (which requires no rebargaining in equilibrium) maximizes employment.

F.2. Workers are probabilistically able to rebargain

Now suppose that each worker is able to rebargain with probability \( \alpha \) after the first moment she is matched with the firm. Workers who are able to rebargain can take the same actions as in the standard game, while the \( 1 - \alpha \) fraction of workers who cannot rebargain can take no further strategic actions after specifying \( w_i^* \). Workers do not ex-ante know which type they are, and only realize their type after they make the initial offer to the firm (simultaneously with acceptance or rejection of offer).

**Proposition 16.** The (unique) linear equilibrium of the game in which each worker can independently rebargain with probability \( \alpha \in [0, 1) \) and transparency level \( \Lambda < 1 \) is equivalent to that of the original game with transparency level \( \alpha \Lambda \).

**Proof:**

Similar to the proof of Proposition 15.
Just as with the extension in Appendix F.1, the results from the body of the paper go through with appropriate modification to Theorem 2.

F.3. Two types of workers, receivers and proposers

For this case, suppose that some known fraction of workers are receivers (we can think of these as workers who are bad at bargaining) who are unable to make wage offers to the firm and receive a wage offer from the firm when they are first hired. If a receiver accept the offer, she is locked in to working at the specified wage until she perishes. If she rejects, she is permanently unmatched from the firm. The remaining workers operate as before, and make TIOLI offers (potentially infinitely often) to the firm upon matching. The type of each worker is independent of $\theta_i$, and is known to both the worker and the firm.

**Proposition 17.** The (unique) linear equilibrium of the game in which some fraction of workers are receivers and others are proposers is as follows:

1. The firm offers all receivers an initial wage of $\bar{w}$ which is the same as $\bar{w}$ in the original game with $\Lambda = 1$,
2. The (unique) linear equilibrium outcome for proposers with transparency level $\Lambda$ is equivalent to that of the original game with transparency $\Lambda$.

**Proof:**

1. This point follows immediately from the fact that the worker type (proposer or receiver) is independent of $\theta_i$ and that $\theta_i$ is privately known by each worker.

2. As $\bar{w}$ is the optimal posted price wage, the firm cannot maximize profits if it sets $\bar{w} < \bar{w}$. Therefore, when any proposer receives wage information through the transparency process, in equilibrium she will learn $\bar{w} \geq \bar{w}$ and will successfully demand a flow wage of $\bar{w}$. Therefore, a proposer’s information is not affected by the presence of receivers, and the unique linear equilibrium choices of firm, $\bar{w}$, and proposer, $w^*_i$, are unchanged from the base model.

F.4. Bargaining with a counteroffer

Suppose that instead of making TIOLI offers, anytime bargaining occurs workers make the first offer, and (privately) commit to a minimum acceptable wage. In response, the firm can either unmatch with the worker or make a counteroffer as a function of the initial worker offer. If the counteroffer is strictly less than the minimum acceptable wage, then the worker and firm unmatch. Otherwise, the counteroffer is accepted by the worker, who can then initiate rebargaining at any point in the future. As before, unmatching results in no further contact between the worker and the firm. The timing of the bargaining stage is formalized below for any time $t$ that any worker $i$ and the firm renegotiate.

1. $i$ makes a first offer $w^1_{i,t}$ and simultaneously picks a minimum acceptable bid $w^{\text{min}}_{i,t} \leq w^1_{i,t}$.
2. The firm observes only $w_{i,t}^1$ and elects to either terminate negotiations or make a counteroffer $w_{i,t}^2$.

3. If the firm makes a counteroffer and $w_{i,t}^{\text{min}} < w_{i,t}^2$, or if the firm elects to terminate negotiations, then $i$ and the firm unmatch and $i$ consumes her outside option until she exogenously departs the market. If the firm makes a counteroffer and $w_{i,t}^{\text{min}} \geq w_{i,t}^2$, then the firm employs $i$ at a flow wage of $w_{i,t}^2$ until $i$ departs or attempts to renegotiate.

Note that if we restrict $w_{i,t}^1 = w_{i,t}^{\text{min}}$ for all $i$ and $t$, then the firm cannot make a meaningful counteroffer, and essentially can either accept $w_{i,t}^1$ as is or unmatch with the worker. This is the same choice that the firm makes in Appendix D. We argue that there is an equilibrium in which $w_{i,t}^1 = w_{i,t}^{\text{min}}$ whose outcome is identical to that of the base game we study. Moreover, we show that there is an equilibrium whose outcome matches that of our base game anytime $w_{i,t}^{\text{min}}$ is a continuous function of $w_{i,t}^1$, and the ratio of $w_{i,t}^{\text{min}}$ and $w_{i,t}^1$ is bounded away from 0 for all $i$ and $t$.

**Proposition 18.** Suppose there exists $\epsilon \in (0,1]$ such that for $\epsilon$ and any $i$ and $t$ $w_{i,t}^{\text{min}}$ is a continuous function of $w_{i,t}^1$ and $w_{i,t}^{\text{min}} \geq \epsilon \cdot w_{i,t}^1$. Then there is an equilibrium outcome of the bargaining with counteroffer game that matches the equilibrium outcome of the base game.

**Proof:**

To construct such an equilibrium, let $w_{i,t}^{\text{min}} = w_{i,t}$, the wage that worker $i$ asks for at time $t$ in the initial game. Upon receiving an offer, the firm either rejects if the expected realization of $w_{i,t}^{\text{min}}$ upon observing $w_{i,t}^1$ and equilibrium strategies is greater than $\bar{w}$ (where $\bar{w}$ is the maximum wage the firm accepts in the initial game), and otherwise sets $w_{i,t}^2$ equal to her expectation of $w_{i,t}^{\text{min}}$. We need to show that for any $i$ and $t$ and any $x \in [0,1]$ there is some $w_{i,t}^1$ such that $w_{i,t}^{\text{min}}(w_{i,t}^1) = x$. If this holds, then no party has an incentive to deviate: the worker can achieve any relevant minimum acceptable value in a negotiation by specifying the correct initial ask, and the firm will either reject the negotiations or make the least acceptable counteroffer, which is then accepted. If the firm deviates by making a more aggressive counteroffer, then it unmatches with the worker. Similarly, a worker who tries to set a higher minimum wage will unmatch with the firm. Let the firm believe that any offer $w_{i,t}^1$ that does not occur on equilibrium path results in $w_{i,t}^{\text{min}} = 0 = w_{i,t}^2$. Then the worker does not want to deviate and offer an unexpected initial wage.

Therefore, we show that any $x \in [0,1]$ is achievable, as described above. By assumption $w_{i,t}^{\text{min}} \leq w_{i,t}^1$ and $w_{i,t}^{\text{min}} \geq \epsilon \cdot w_{i,t}^1$. The second inequality requires that $w_{i,t}^{\text{min}}$ is non-negative and the first requires that if $w_{i,t}^1 = 0$ then $w_{i,t}^{\text{min}}$ is non-positive. Therefore, if $w_{i,t}^1 = 0$ then $w_{i,t}^{\text{min}} = 0$. Furthermore, by assumption $w_{i,t}^{\text{min}} \geq \epsilon \cdot w_{i,t}^1$ so if $w_{i,t}^1 = \frac{1}{\epsilon}$ then $w_{i,t}^{\text{min}} \geq 1$. Therefore, since $w_{i,t}^{\text{min}}$ is a continuous function, the intermediate value theorem implies that any $x \in [0,1]$ is achievable for all $i$ and $t$ by some initial offer $w_{i,t}^1 \in [0,\frac{1}{\epsilon}]$. ■
G. Endogenous Effort and Transparency

This section mirrors Section VI and extends the analysis to allow for situations in which transparency can increase effort provision. Proofs are omitted, as the logic is similar.

These results give a theoretical basis for the finding in Table VII that low outside option workers are relatively more productive under transparency.

As before, workers make TIOLI offers $w_{i,t}$ and observe the wages of their peers at rate $\lambda$. Now each worker $i$ also selects $e_{i,t} \in [0, 1]$. All workers have an outside option normalized to 0 and have to pay an effort flow cost $\theta_i$. Each worker $i$’s expected flow payoff is $(w_{i,t} - \theta_i) \cdot z(e_{i,t})$ where $z(\cdot)$ is a function governing productivity. We assume that $z(e) > 0$ for all $e \in (0, 1]$, $z(0) = 0$, and $z(\cdot)$ has a unique global maximizer at some $\mu^* > 0$. We use this objective function for workers to provide a baseline effect of transparency in the presence of endogenous effort when workers have the ability to bargain. We show that workers bargain in the same way as in the original game in equilibrium. Therefore, all of the results of the paper carry through when effort is endogenous.

**Proposition 19.** There is a unique linear equilibrium outcome of the endogenous worker effort game. In it all employed workers set $e_{i,t} = \mu^*$ for all periods of employment. All other actions are the same along the equilibrium path as those in the equilibrium of the original game.

G.1. Proactive Employer Model

We now remove workers’ ability to renegotiate in order to study employer decisions to raise wages to avoid effort reduction. Workers make a wage offer $w^*_i$ when they are initially hired, and thereafter only choose effort. We include a morale cost to a worker for learning she is underpaid. Workers face a higher cost to effort upon learning they are paid less than any peer, and this cost is non-decreasing in the effort the worker provides and the difference between her wages and that of her highest paid coworker. Transparency may have additional heterogenous impacts on workers depending on their surplus. A worker who observes the wages of others may have increased morale if they realize they are enjoying more benefits from employment than their peers. At each time $t$ the firm can observe whether a worker has received wage information and can elect to unilaterally increase her wage for all times $t' \geq t$ to reduce the morale cost. We refer to this as the proactive employer model.

Formally, let the morale cost be given by $m(d, u, e_{i,t}) \in [0, 1]$ where $d = \bar{w} - w_{i,t}$ and $d = w_{i,t} - \theta_i$. We assume $m(\cdot, u, \cdot)$ is non-decreasing in its first argument and non-increasing in its second. We also assume that $m(\cdot, \cdot, 0) = 0$, indicating that workers who do not work face zero cost, and, following the literature, that $m(d, u, e) > 0$ for any $\{d, u, e\}$ with $d > 0$ and $e > 0$, meaning that wage inequality always lowers worker morale. As before, worker $i$’s flow payoff is $(w_{i,t} - \theta_i) \cdot z(e_{i,t})$ prior to learning about the wages of her peers, so she will put in effort level $\mu^*$ in equilibrium. Upon seeing the wages of her co-workers and learning $\bar{w}$, the worker’s flow payoff becomes $(w_{i,t} - \theta_i) \cdot z(e_{i,t}) - m(d, u, e_{i,t})$. Depending on $m(d, u, e_{i,t})$, the worker may optimally shirk or increase effort. It is easy to see that the firm will increase the wage of a worker $i$ at time $t$ only if $i$ learns the wages of her co-workers at time $t$.

We now formally state conditions on the morale function for the proactive employer model to generate a similar equilibrium outcome as that of our original model, and in particular,
fit our key empirical findings of full pay equalization under transparency.

**Proposition 20.** Consider any equilibrium which satisfies regularity conditions A1-A4. The firm always sets \( w_{i,t} = \bar{w} \) for each worker \( i \) who learns \( \bar{w} \) at time \( t \) for all \( \Lambda \) if and only if \( (w_{i,t} - \theta_i) \cdot z(e_{i,t}) - m(d, u, e_{i,t}) \leq 0 \) for every \( \{d, u, e_{i,t}\} \) occurring on equilibrium path.

As before, only large and discontinuous morale cost functions result in the same predictions as the bargaining model; unless social concerns reduce worker effort to 0 upon receiving even slightly less than \( \bar{w} \), the firm will not equalize the wages of all workers who observe peer wages. Therefore, the proactive employer model does not support our empirical findings without adding a bargaining channel.

As we document in Table VII, there does appear to be an equilibrium effort response to transparency. We find that low outside option workers are relatively more productive under high transparency, and high outside option workers are relatively less productive (this is implied by Col. 4 which finds no statistically significant impact of transparency on overall productivity).

The equilibrium impact of transparency can additionally support this finding: let \( \partial_{\theta} m(0, u, \mu^*) \) be positive for sufficiently high \( u \) and negative otherwise. Furthermore, this also (qualitatively) preserves the impact of full transparency on the other outcomes of interest. Assuming symmetric impacts on productivity, i.e. overall productivity doesn’t change compared to the baseline model but is weighted toward low outside option workers, firm profit will be relatively higher, as will hiring. Transparency will again equalize wages.

**H. Transparency of Worker History**

Between 2016 and 2018, 9 states and municipalities passed laws that prohibit employers from requesting past salary information of potential employees during the hiring process (Cain et al., 2018). On the other hand, internet labor platforms have moved in the opposite direction: eLance and UpWork now include explicit accounts of each worker’s past contract payments and hours worked visible to all users. What are the equilibrium effects of disclosing previous worker wage history to potential employers?

Ruling out the ability of workers to learn the wages of others within the firm (i.e. assuming \( \Lambda = 0 \)) the equilibrium effects of this form of transparency depends crucially on who has the bargaining power. If workers have bargaining power (they are the ones making TIOLI offers), then from a pure bargaining perspective, publicizing previous wages plays no role in equilibrium outcomes—workers demand a wage that the firm accepts if and only if it is below \( v \). Indeed, if tasks are standardized, workers may not be able to price discriminate, leading to uniform offers over time, generating constant wages overtime anyway.

If the firm makes TIOI offers, the policy of exposing past worker salaries affects outcomes in equilibrium. Consider a model in which a worker meets with a new firm at each time \( t \). As before, we assume that the value of each firm, \( v_t \) and the outside option of the worker, \( \theta \) are distributed according to distributions with strictly increasing virtual values, i.e. \( v + \frac{F(v)}{f(v)} \) is strictly increasing in \( v \) and \( \theta - \frac{1-C(\theta)}{g(\theta)} \) is strictly increasing in \( \theta \). If the worker accepts an offer \( w_t \) at time \( t \), she receives a flow payoff of \( w_t - \theta \), and otherwise receives a flow payoff of \( \theta \). Without a visible work history, the worker will accept any wage weakly above \( \theta \), and
each firm will make a monopsonistic TIOLI offer. If instead work histories are observable, the worker can commit to accepting offers only above a threshold $\bar{w}$, set monopolistically.

The notation above, especially $\bar{w}$, is particularly chosen to mirror that in the main body of our paper exactly because, by flipping both the side of the market over which there is transparency and the side of the market with the bargaining power, our theoretical results are also flipped: transparency increases expected wages and worker surplus while decreasing firm profits. This suggests platforms that provide worker history are improving worker outcomes.

Of course, there are institutional features of traditional labor markets that may lead to negative effects of transparency to workers. Due to the relative infrequency of taking a new job in traditional labor markets, a worker—for example, a recent graduate with debt—may be unable to commit to rejecting an offer that pays above her outside option. Therefore, a low wage early on may follow her and, having revealed information about her outside option, will never receive higher wages in future jobs.

Nevertheless, even if transparency of previous wages has negative effects on (some) workers, we have reason to believe laws prohibiting employers from asking about pay history will be ineffective. Since receiving previous high wages indicates a high outside option, workers with the highest wages will find it in their interests to disclose their work history to new potential employers. The unraveling logic of Theorem 4 holds, and all workers should voluntarily reveal their previous wages in equilibrium. Indeed, workers even have an easy, credible way to do so—by bringing a copy of a recent paycheck to wage negotiations for a new job. This suggests bans on worker wage histories may have larger effects in online labor markets where communication between workers and employers is limited (Barach and Horton, 2017).
I. Experimental Appendix

**Figure I1: Distribution of Bids in Experiment**

Notes: Figure I1 plots the distribution of the lowest 95% of bids in our experiment. The median bid is $6, and the modal bid is $5.

I.1. Superstar Firms

We expect very different effects of transparency when a firm’s value is exceptionally high, higher than outside options of workers. The intuition is that as the value rises, the firm chooses a ceiling wage that allows it to hire all workers, under transparency and privacy. Hence the only effect of transparency is to bring the wage of lower bidders up, rather than to push the ceiling wage for everyone down. In other words, the demand effect no longer plays a role in the bargaining outcome.

Theoretically, we investigate the effect of a move from full secrecy to full transparency on a “superstar” firm with value $v > 1$. We study this experimentally by raising the budget of the manager to $9, which is the 85th percentile of opening worker bids and above the highest outside option value we elicited.

**Theory:** Workers’ outside options continue to be drawn on a distribution with support $[0, 1]$ while a superstar firm has value $v > 1$. Moreover, workers’ beliefs about the firm’s value are misspecified, and they continue to believe $v \sim F[0, 1]$. As before, workers successfully
renegotiate to the highest wage they observe at the firm in equilibrium. We make these assumptions on the distribution for clarity of expositing, but the qualitative results presented below will also hold for a firm with sufficiently high $v$, when drawn from a (correctly anticipated) distribution $F$ with full support over the positive reals, with finite mean.

In contrast to Theorem 2, transparency has a clear, non-positive effect on employment for a superstar firm. When $\Lambda = 0$ the firm hires all workers, but the firm may set $\bar{w} < 1$ when $\Lambda = 1$ to avoid information spillovers. From Equation 15, $\bar{w}$ is non-decreasing in $v$ when $\Lambda = 1$, so the difference in hiring between privacy and transparency is shrinking in $v$.

**Proposition 21.** A superstar firm hires fewer workers in equilibrium when $\Lambda = 1$ than when $\Lambda = 0$. Moreover, the ex-post hiring rate is supermodular in $v > 1$ and $\Lambda$.

This supermodularity stands in contrast to the submodular impact of transparency and $v$ on hiring for a non-superstar firm (Theorem 2).

Transparency can also increase wages and decrease profits for a superstar firm, the opposite of the predictions for a firm with value $v \leq 1$. The supermodularity of employment in transparency and $v > 1$ implies that the employment effect of transparency becomes small for sufficiently large $v$. This implies that the highest wage paid under transparency and private are approximately equal for sufficiently large $v$. Therefore, the demand effect dominates in this case: transparency equalizes the pay of all workers to that of the highest wage worker, increasing average wages and decreasing profits.

**Proposition 22.** Profits (average wages) are submodular (supermodular) in $v$ and $\Lambda$ for a superstar firm. There exists $v^* \geq 1$ such that profits are lower and wages are higher when $\Lambda = 1$ than when $\Lambda = 0$ for all $v > v^*$.

Consider the increase in profit for a private firm as its value increases from $v > 1$ to $v + \Delta$ for some small $\Delta > 0$. Since $v > 1$, it hires all workers in both cases, so its profits increase by $\Delta$ per worker. That is, the firm’s profit is $(v - 1)G(1) = v - 1$. The same exercise for a transparent firm yields an increase in profit of approximately $\Delta \cdot G(\bar{w})$. This is because the profit is $(v - \bar{w})G(\bar{w})$ and the derivative with respect to $v$ is $G(\bar{w})$ by the envelope theorem.

Figure 12 depicts the equilibrium effects of transparency on the maximum wage and profit for a superstar firm when $r = s = 1$ so that $F = U[0,1]$ and $G = U[0,1]$. Panel (a) plots $w^m \equiv \min\{1, \bar{w}\}$ as a function of $v$ under privacy and transparency. For a superstar firm, the fraction of the workers hired is equivalent to $w^m$. Under privacy, a superstar firm sets $w^m = 1$ for all $v > 1$. Under transparency, the firm hires strictly fewer workers for all $v \in (1,2)$. Panel (b) plots firm profit as a function of $v$ under privacy and transparency. For the given parameterization, a superstar firm derives lower profit under transparency than privacy for any $v > 1$. For any $v \in (1,2)$ profit is increasing faster under privacy than transparency. Above the threshold at which a transparent firm hires all workers ($v = 2$) the firm’s profit increases at the same rate under both transparency and privacy.
Figure I2: Effects of transparency on max wage and profit for superstar firms

Panel (a) plots $w^o \equiv \min\{1, \bar{w}\}$ as a function of $v$ under privacy and transparency. Panel (b) plots firm profit as a function of $v$ under privacy and transparency. These functions are calculated using Equations 11, 13-15, 18, and 20.

Notes: Figure I2 depicts the equilibrium effects of transparency on the maximum wage and profit for a superstar firm when $r = s = 1$ so that $F = U[0, 1]$ and $G = U[0, 1]$. Panel (a) plots $w^o \equiv \min\{1, \bar{w}\}$ as a function of $v$ under privacy and transparency. Panel (b) plots firm profit as a function of $v$ under privacy and transparency. These functions are calculated using Equations 11, 13-15, 18, and 20.

**Additional Treatments, Experiment**

We run an additional treatment arm to our experiment to test our predictions on superstar firms. In these treatments, managers are given a budget of $9. This budget nearly doubles that in our main treatment arms. As shown in Figure I1, this amount is at the 85th percentile of worker bids.\(^{54}\)

Again, transparency is varied in the $9$ treatments by holding negotiations in a common versus separated chatroom. 309 workers interact with 103 managers, and the observable characteristics of these subjects are similar those of subjects in the main treatment arms of the experiment. Table I1 presents demographics of the treatment groups.

\(^{54}\)There is a long right tail of bids, meaning that it would not be feasible to set a budget that exceeds all bids. As we discuss in the theoretical analysis of superstar firms, assuming an unbounded support of potential firm values and bids, our conclusions will hold for a sufficiently large value. The evidence we show below is consistent with $9$ being “sufficiently large.”
<table>
<thead>
<tr>
<th></th>
<th>Not Transparent</th>
<th>Transparent</th>
<th>T-Statistic (diff)</th>
<th>T-Statistic $9-$5 Not Transparent</th>
<th>T-Statistic $9-$5 Transparent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Workers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>35</td>
<td>36</td>
<td>-0.98</td>
<td>1.63</td>
<td>0.55</td>
</tr>
<tr>
<td>Share female</td>
<td>0.51</td>
<td>0.40</td>
<td>1.90</td>
<td>0.67</td>
<td>2.56</td>
</tr>
<tr>
<td>Share w/ at least some college</td>
<td>0.91</td>
<td>0.91</td>
<td>-0.03</td>
<td>2.12</td>
<td>0.81</td>
</tr>
<tr>
<td>N</td>
<td>168</td>
<td>141</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Managers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>37</td>
<td>34</td>
<td>1.03</td>
<td>0.11</td>
<td>1.66</td>
</tr>
<tr>
<td>Share female</td>
<td>0.57</td>
<td>0.49</td>
<td>0.78</td>
<td>-0.03</td>
<td>1.71</td>
</tr>
<tr>
<td>Share w/ at least some college</td>
<td>0.96</td>
<td>0.96</td>
<td>0.13</td>
<td>-0.79</td>
<td>-1.42</td>
</tr>
<tr>
<td>N</td>
<td>56</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: This table describes the sample assigned to negotiate in either a split or common chat room with a $9 manager budget. The first two columns describe the demographic characteristics of Not Transparent and Transparent groups, respectively. The last three columns report the t-statistic of a test of the null hypothesis that the difference in means between Col. 1 and Col. 2 is 0 (Col. 3), the difference between Col. 1 and the Not Transparent $5 negotiable treatment (Table V, Col. 1) is 0 (Col. 4), and the difference between Col. 1 and the Transparent $5 negotiable treatment (Table V, Col. 2) is 0 (Col. 5). We report the total number of participants in our analysis as the observation count, however we ask demographic characteristics after all interactions are complete and give the option to opt out of any particular question. Hence for our regressions we impute missing values using the average of all non-missing values. In this table we only compute means and statistical tests using non-missing values. Up to 11% of managers, and 37% of workers opted out of answering a particular demographic characteristic.
Table I2 provides evidence for our claims on superstar firms. We run the following specifications to test the differential impacts of transparency. Demographic controls have been suppressed. Outcomes, $y_{ij}$, include a binary outcome for hiring, log wages agreed-to by worker $i$ and manager $j$, log wages conditional on completing at least one page of transcription. We also estimate total pages completed within group, and manager profits, $y_j$.

$$y_{ij} = \beta_0 + \beta_1 \cdot \text{transparent}_ij + \epsilon_{ij} \quad (51)$$

Each of these specifications allows us to test the null hypotheses that transparency has no effect on the outcome for high-value employers $H_0 : \beta_1 = 0$

We also present diff-in-diff estimates coming from specification the following specification.

$$y_{ij} = \delta_0 + \delta_1 \cdot \text{transparent}_ij + \delta_2 \text{high value}_j + \delta_3 \text{high value}_j \times \text{transparent}_ij + \epsilon_{ij} \quad (52)$$

This allows us to test the null hypothesis that transparency affects the outcome measures the same for superstar firms as “regular firms” $H'_0 : \delta_3 = 0$

Our theoretical predictions in Propositions 21 and 22 indicate that we expect $\hat{\delta}_3 > 0$ for the wages outcome, $\hat{\delta}_3 < 0$ and $\hat{\beta}_1 < 0$ for the hiring outcome, and $\hat{\delta}_3 < 0$ for the profits outcome. The evidence in the following table supports all of these predictions, although the estimate for $\beta_1$ for the hiring outcome is not statistically significant.$^{55}$

---

$^{55}$One aberration worth noting is that nearly twice as many people submitted transcriptions in the $5 treatment compared to the $9 treatment, despite higher wages. While this does not contradict any model prediction, we also do not have a simple explanation for the different rates of submission. We did not find differences in negotiation effort as measured by the number of chat messages exchanged, or different wait times at each stage of the experiment.
### TABLE I2: PROFITS, WAGES, AND HIRING FOR A SUPERSTAR FIRM, EXPERIMENT

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hiring (yes =1)</td>
<td>Wages</td>
<td>Hire (log $)</td>
<td>Wages</td>
<td>+ Payout (log $)</td>
</tr>
<tr>
<td>$\hat{\beta}_1$ Transparent</td>
<td>-0.0353</td>
<td>0.0620</td>
<td>0.0165</td>
<td>0.00435</td>
<td>0.0247</td>
</tr>
<tr>
<td>(Public Chat)</td>
<td>[0.0723]</td>
<td>[0.0603]</td>
<td>[0.145]</td>
<td>[0.0344]</td>
<td>[0.0584]</td>
</tr>
<tr>
<td>Worker Some College</td>
<td>-0.0185</td>
<td>-0.0678</td>
<td>-0.397</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0722]</td>
<td>[0.100]</td>
<td>[0.284]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker Age</td>
<td>-0.00521**</td>
<td>-0.00202</td>
<td>-0.000214</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.00250]</td>
<td>[0.00273]</td>
<td>[0.00689]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker Female</td>
<td>0.119*</td>
<td>0.0611</td>
<td>0.144</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.0600]</td>
<td>[0.0464]</td>
<td>[0.124]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager Some College</td>
<td>-0.185</td>
<td>-0.243***</td>
<td>-0.643***</td>
<td>-0.0433</td>
<td>0.198**</td>
</tr>
<tr>
<td></td>
<td>[0.119]</td>
<td>[0.0624]</td>
<td>[0.0341]</td>
<td>[0.0995]</td>
<td>[0.0804]</td>
</tr>
<tr>
<td>Manager Age</td>
<td>0.000226</td>
<td>-0.00310</td>
<td>0.00148</td>
<td>0.00496**</td>
<td>0.00686*</td>
</tr>
<tr>
<td></td>
<td>[0.00387]</td>
<td>[0.00325]</td>
<td>[0.00688]</td>
<td>[0.00212]</td>
<td>[0.00398]</td>
</tr>
<tr>
<td>Manager Female</td>
<td>0.0912</td>
<td>0.0311</td>
<td>0.0194</td>
<td>-0.00912</td>
<td>-0.0215</td>
</tr>
<tr>
<td></td>
<td>[0.0795]</td>
<td>[0.0700]</td>
<td>[0.165]</td>
<td>[0.0397]</td>
<td>[0.0735]</td>
</tr>
<tr>
<td>Age (Worker Avg.)</td>
<td>0.00252</td>
<td>0.00174</td>
<td>-0.00613</td>
<td>-0.00444</td>
<td>-0.00661</td>
</tr>
<tr>
<td></td>
<td>[0.00796]</td>
<td>[0.00735]</td>
<td>[0.0141]</td>
<td>[0.00270]</td>
<td>[0.00415]</td>
</tr>
<tr>
<td>Some College (Worker Avg.)</td>
<td>0.165</td>
<td>-0.0226</td>
<td>1.318</td>
<td>-0.0236</td>
<td>-0.0836</td>
</tr>
<tr>
<td></td>
<td>[0.259]</td>
<td>[0.207]</td>
<td>[0.774]</td>
<td>[0.107]</td>
<td>[0.201]</td>
</tr>
<tr>
<td>Female (Worker Avg.)</td>
<td>-0.136</td>
<td>-0.320*</td>
<td>-0.262</td>
<td>-0.136**</td>
<td>-0.170</td>
</tr>
<tr>
<td></td>
<td>[0.153]</td>
<td>[0.164]</td>
<td>[0.355]</td>
<td>[0.0668]</td>
<td>[0.109]</td>
</tr>
<tr>
<td>Constant</td>
<td>0.722**</td>
<td>2.286***</td>
<td>1.814**</td>
<td>0.218</td>
<td>0.107</td>
</tr>
<tr>
<td></td>
<td>[0.325]</td>
<td>[0.193]</td>
<td>[0.655]</td>
<td>[0.162]</td>
<td>[0.234]</td>
</tr>
<tr>
<td>Observations</td>
<td>309</td>
<td>169</td>
<td>29</td>
<td>103</td>
<td>103</td>
</tr>
<tr>
<td>Mean Dep. Var.</td>
<td>0.547</td>
<td>6.172</td>
<td>6.838</td>
<td>0.0971</td>
<td>0.137</td>
</tr>
<tr>
<td>$\hat{\delta}_3$ Diff-in-Diff (transp. effect $9 - $5$)</td>
<td>-0.157*</td>
<td>0.141*</td>
<td>0.140</td>
<td>-0.129</td>
<td>-0.253**</td>
</tr>
<tr>
<td></td>
<td>[0.0927]</td>
<td>[0.0738]</td>
<td>[0.119]</td>
<td>[0.138]</td>
<td>[0.122]</td>
</tr>
<tr>
<td>Clusters</td>
<td>103</td>
<td>77</td>
<td>25</td>
<td>103</td>
<td>103</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.177</td>
<td>0.104</td>
<td>0.336</td>
<td>0.121</td>
<td>0.0873</td>
</tr>
</tbody>
</table>

Notes: We estimate the specifications in Equation 51. Col. 1-5 use ordinary least squares. Data is from the sample assigned to treatment groups where workers were allowed to negotiate with managers who have $9 budgets. An observation is a worker (Col. 1-3) or manager (Col. 4-5). For participants who opted not to report certain demographics, we impute the missing value using the average of the non-missing values and include an indicator variable equal to 1 if the value has been imputed. The dependent variables (moving left to right) are hiring (equal to 1 if the worker and manager agree on a wage and 0 otherwise), log wages conditional on agreeing to a wage with the manager, log wage agreed to with the manager conditional on receiving a payout by submitting at least one page at 95% accuracy, inverse hyperbolic sine of total pages completed by workers assigned to a manager, and inverse hyperbolic sine of profits a manager earns. We use inverse hyperbolic sine transformation to accommodate 0 outcomes. This transformation down-weights treatment effects at small values, is linear for x close to 0 and approximates log(2x) for x greater than 3 (for more details see Kline et al. (2019) Appendix D, page 65). Covariates with “worker avg.” refer to the mean demographic characteristic for all workers assigned to a particular manager. We present diff-in-diff estimates of $\delta_3$ from Equation 52. Clustered standard errors at the manager level are in square brackets.
Figure I3: Bids as function of Willingness to Accept

Notes: Each panel plots the outside option of a participant (horizontal axis) as measured by our BDM procedure against the participant’s bid on the job for completion of a page of transcription (vertical axis), both at a minimum accuracy of 95%. In the first panel, we fit the data to a best linear fit of outside option, and in the second, we display the quadratic function that best fits the data.

I.2. Interface

Here, we show the experimental interface for workers and managers in our experiment. We show the following treatment: $9 manager budget per page, per worker; common chatroom (pay transparency); managers and workers are able to negotiate pay. Other treatments are similar, with changes on Page 5 of these instructions as described in the main text. Note that we did not actually complete any of the transcription task for the purposes of this illustration, and so the accuracy on “Page 13, Workers” is calculated at 0.0% for all pages.
Introduction

There are 4 people simultaneously assigned to this group. You will either manage or carry out a transcription task. Those who successfully complete this task earn over $10 on average, some earn more than $20.

First, we’ll ask you some questions. Then you will interact with other participants. Please do this first part promptly so other participants do not have to wait for you. But read questions carefully because you will not be able to return to your answers after proceeding to the next page.

The transcription part, for the bonus, can be done any time in the next 48 hours.
# Example of Transcription Work

## Transcription Example

<table>
<thead>
<tr>
<th>Text Image</th>
<th>1,096</th>
<th>9</th>
<th>581</th>
<th>156</th>
<th>8</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>727</td>
<td>1</td>
<td>428</td>
<td>95</td>
<td>6</td>
<td>7</td>
<td>-</td>
</tr>
</tbody>
</table>

**Transcription:**

1,096 9,581,156,8,7
5. . .
35 . . . .
727 1,428,55,6,7

Now look at the sample page below. How many minutes do you think it would take you to transcribe the page below? This information will not affect your eligibility for a bonus in any way.

**How many minutes?**

[0] Next

## Sample Page:

<table>
<thead>
<tr>
<th>587,797</th>
<th>115,974</th>
<th>129,897</th>
<th>189,429</th>
<th>248,937</th>
<th>9,129</th>
<th>129</th>
<th>72</th>
<th>51</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>117,980</td>
<td>32,135</td>
<td>40,180</td>
<td>20,133</td>
<td>20,132</td>
<td>1,161</td>
<td>2,757</td>
<td>41</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>185,196</td>
<td>39,365</td>
<td>25,135</td>
<td>20,131</td>
<td>20,132</td>
<td>1,161</td>
<td>2,757</td>
<td>41</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>207,235</td>
<td>25,135</td>
<td>25,135</td>
<td>20,131</td>
<td>20,132</td>
<td>1,161</td>
<td>2,757</td>
<td>41</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>140</td>
<td>120</td>
<td>80</td>
<td>60</td>
<td>40</td>
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<td>10</td>
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<td>400</td>
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<tr>
<td>200</td>
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<td>20</td>
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<tr>
<td>200</td>
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<td>10</td>
<td>5</td>
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<td>1</td>
</tr>
<tr>
<td>50</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>600</td>
<td>700</td>
<td>800</td>
<td>900</td>
</tr>
</tbody>
</table>
Cash Preferences

Below you are presented with 5 scenarios. In each you will be given the choice between being paid for completing a page of transcription at 95% accuracy within 48 hours, or receiving $9 without having to do any transcription, also 48 hours from now.

If you are one of 20 survey respondents selected at random, we will randomly select one of your choices and enact it. You should answer honestly, because one of your choices might happen. (Note, information on this page will be kept private from all participants.)

Which would you prefer?
- $15, for 5 pages transcribed ($3 per page, 95% accuracy)
- $9, no transcription required

Which would you prefer?
- $20, for 5 pages transcribed ($4 per page, 95% accuracy)
- $9, no transcription required

Which would you prefer?
- $25, for 5 pages transcribed ($5 per page, 95% accuracy)
- $9, no transcription required

Which would you prefer?
- $30, for 5 pages transcribed ($6 per page, 95% accuracy)
- $9, no transcription required

Which would you prefer?
- $35, for 5 pages transcribed ($7 per page, 95% accuracy)
- $9, no transcription required

Next
Bid for Work

Now tell us your single page bid (the price for ONE page) to do up to 6 pages just like the example (with 55% accuracy).

The manager will start with this information to negotiate a price for your services.

How much is your bid price per single page?

$  

Next
Employee 1 - Chat Room

Everyone is here. You, 2 other employees, and a manager.

Your initial bid to the manager was 0 for each page. The manager is here to discuss it with you. You must agree to a price in order to submit the transcription work for a bonus. It is okay to disagree and exit. You will still be paid for the HIT.

<table>
<thead>
<tr>
<th>Employee 2</th>
<th>Sample text 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee 3</td>
<td>Sample text 3</td>
</tr>
<tr>
<td>Employee 1 (Me)</td>
<td>Sample text 1</td>
</tr>
<tr>
<td>Manager</td>
<td>Sample text M</td>
</tr>
</tbody>
</table>

If there is a discrepancy between what you enter and what the manager enters, then you will not receive a bonus for work completed. Please make sure you agree!

What is the confirmed per-page price you will be paid?

$ 

☐ Check here if you cannot reach a deal.

You and the manager must agree on your per-page price before you proceed! If your work does not achieve at least 95% accuracy, you will not be paid for that page. Selecting Done will end your chat session, you cannot come back.

Done
Manager - Chat Room
You are the Manager. Please chat with the 3 employees below. They should be there now.

You have a maximum budget of $9 per page. The employees were not aware of your budget when they bid. Your job is to negotiate a wage for each employee. Wages can be the same or different for different employees. You can negotiate however you want. If, and only if, you and the employee agree to a wage will the budget be split between you accordingly.

After this chat, employees will be taken to a screen to transcribe scanned pages, which will be checked for accuracy. For each page completed above 95% accuracy, they will receive their bid and you will receive the difference between $9 and the wage you agreed with that worker. If the work is not submitted, or does not achieve at least 95% accuracy, no one will be paid for that page. For example, if you agree to $6 per page for all three workers, who then complete the work, you will be paid: ($9 - $6) x (3 people) x (5 pages each) = $45

You do not have to come to agreements with all employees. You will still profit from the wage arrangements you make with the other workers, and you will still be paid for the HIT. You cannot agree to a wage above the $9 budget.

Chat Room:

| Employee 2 | Sample text 2 |
| Employee 3 | Sample text 3 |
| Employee 1 | Sample text 1 |
| Manager (Me) | Sample text M |

Enter the per-page amounts here.

**Employee 1** bid 0 for each page.
What wage did you and Employee 1 agree to? If the number you agreed is not higher than $9, enter it here.

$0

☐ Check here if no deal reached with Employee 1.

**Employee 2** bid 0 for each page.
What wage did you and Employee 2 agree to? If the number you agreed is not higher than $9, enter it here.

$0

☐ Check here if no deal reached with Employee 2.

**Employee 3** bid 0 for each page.
What wage did you and Employee 3 agree to? If the number you agreed is not higher than $9, enter it here.

$0

☐ Check here if no deal reached with Employee 3.

If there is a discrepancy between what you enter and what the employee enters, then neither party will receive any additional bonus for work completed. Please make sure you confirm!

You will receive any payment owed via an MTurk Bonus

Done
*Separated chatroom interface, Managers*

<table>
<thead>
<tr>
<th>Employee 1</th>
<th>Sample message 1</th>
<th>Employee 2</th>
<th>Sample message 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager (Me)</td>
<td>Sample message to</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Employee 1
Employee 1

Send | Send | Send
Survey

Enter your year of birth:

What is your gender?
please select

Next
Notes: We do not include two variables in our analyses: previous experience and daily household income. Half the participants chose not to answer these questions.
Transcription task 1/5

You will be shown 5 pages of transcription, one on each screen. When you click next, your transcription of the first page will be submitted and you will be presented with a fresh link to a second page of transcription and a blank text box, and so on until the fifth page. After you submit the fifth page we ask a few basic demographic questions and give you a code to submit your HIT.

Please transcribe the numbers from the table in the image into the box below.

You will be paid $5.00 for this page if you submit work that is at least 95% accurate, and if $5.00 matches the price the manager confirms. Thank you!

Click here to open image for transcription (opens in new tab or window)

You should only enter the NUMBERS from the table, none of the row or column headings. (No words)

Next

Do not click until you have finished the transcription!

Hint: if you prefer to work in a different format such as an Excel spreadsheet, simply export to csv (comma separated delimiter) copy and paste results here.

Do not complete this transcription if you did not actively AGREE with the manager about the per-page price.
## Summary

<table>
<thead>
<tr>
<th>Transcription #</th>
<th>Length of assigned text</th>
<th>Length of text entered</th>
<th>Levenshtein distance</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1232</td>
<td>0</td>
<td>1232</td>
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<tr>
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<td>524</td>
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<tr>
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</tr>
<tr>
<td>5</td>
<td>888</td>
<td>0</td>
<td>888</td>
<td>0.0 %</td>
</tr>
</tbody>
</table>

You transcribed 0 pages better than 95% accuracy.
Your agreed price per page was $5.00
Therefore your bonus is $0.00
Thank You

You're done, thank you. Click next to complete the HIT.

Next
J. Survey materials

J.1. Survey about job descriptions

We present individual job descriptions to approximately 5,000 Mechanical Turk workers to read between 1 and 10 descriptions and answer the following questions.

Instructions:

The following survey is for research purposes and will be used to understand interactions during short-term work arranged online.

Please read the job description(s) and describe the nature of the job by answering short questions. If the job description does not clearly indicate the answer to the question, please provide your best guess based on the information available to you.

When we ask how likely it is that something will occur, please use a scale of 0 through 10. A value of 0 means they definitely will not. A value of 1 means the odds are 1 in 10. In other words, if the job were carried out 10 times, the event would most likely occur on one of those occasions. A value of 10 means that it would happen every time.

[Insert job description]

1. How many people are being requested for this job?

2. How many hours will each worker be required to work in order to complete this job? (please provide the average duration if multiple workers are required)

3. How many hours is it necessary for workers to overlap in the same place at the same time in order to complete this job?

4. How likely is it that workers will talk to each other on the job?

5. How likely is it that any one worker will learn what another worker is being paid for the same job?