WORKER BELIEFS ABOUT OUTSIDE OPTIONS*

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Standard labor market models assume that workers hold accurate beliefs about the external wage distribution, and hence their outside options with other employers. We test this assumption by comparing German workers' beliefs about outside options with objective benchmarks. First, we find that workers wrongly anchor their beliefs about outside options on their current wage: workers that would experience a 10% wage change if switching to their outside option only expect a 1% change. Second, workers in low-paying firms underestimate wages elsewhere. Third, in response to information about the wages of similar workers, respondents correct their beliefs about their outside options and change their job search and wage negotiation intentions. Finally, we analyze the consequences of anchoring in a simple equilibrium model. In the model, anchored beliefs keep overly pessimistic workers stuck in low-wage jobs, which gives rise to monopsony power and labor market segmentation. *JEL Codes:* J01, J31, J42, J64, D83.

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I. Introduction

Firms differ substantially in the wages they pay to similar workers (Slichter 1950; Abowd, Kramarz, and Margolis 1999; Card, Heining, and Kline 2013). In the tradition of Stigler (1961), standard models of the labor market assume that workers have accurate beliefs about the differences in wages across firms (including in bargaining and wage-posting models with search, as in Burdett and Mortensen 1998; Mortensen and Pissarides 1999; Cahuc, Postel-Vinay, and Robin 2006; Manning 2011; Hornstein, Krusell, and Violante 2011). While this fundamental assumption remains untested, its violation—in the form of worker misperceptions about the wage distribution—could lead to worker misallocation and act as a source of monopsony power (Robinson 1933).

In this article, we assess the accuracy of workers' beliefs about their outside options and explore consequences of potential misperceptions. To do so, we conduct a representative survey embedded in the German Socio-Economic Panel (SOEP), which asks each employed respondent about wages in the external labor market and the expected wage change that would accompany a switch to their next-best employer—their outside option. We compare these beliefs with proxies for actual outside options, which we construct using administrative matched employer-employee data.[1] Our main benchmark draws on realized wage changes of respondents' coworkers who involuntary left their firm.[2] To approximate involuntary moves, we draw on employer switches with at least a brief unemployment spell. We use several methods to address measurement error and isolate factors common to a firm's workforce. Our benchmark specification uses an empirical Bayes shrinkage procedure of coworker wage changes, and we provide robustness checks with a split-sample instrumental variables (IV) measurement error correction. As a complement to the coworker-based benchmark, we use a machine learning prediction trained

1. Identifying workers' outside options is notoriously challenging. See Lachowska (2016), Caldwell and Harmon (2019), Jäger et al. (2020), Caldwell and Danieli (2022), Di Addario et al. (2023), Jäger, Schoefer, and Zweimüller (2023) and Schubert, Stansbury, and Taska (2023) for recent research on the impact of outside options on wages.

2. The coworker-based benchmark builds on the evidence for substantial between-firm wage differentials (see Card et al. 2018; Bonhomme et al. 2023, for overviews of the literature), as well as the large and heterogeneous (across firms) wage effects of job loss (Jacobson, LaLonde, and Sullivan 1993; Lachowska, Mas, and Woodbury 2020; Schmieder, von Wachter, and Heining 2023).

on all involuntary separations in the administrative data to construct a benchmark that uses a richer set of predictors than the respondent's current firm.

In a stark rejection of the assumption of accurate beliefs, workers appear to anchor their beliefs about wages with other employers on their current wage: workers believe their outside option is much closer to their current wage than it actually is. Workers' expectations for their own wage change are tightly compressed around zero—even for workers in firms where coworkers systematically experience large wage changes upon leaving. We estimate a slope of 0.107 (std. err. 0.040) between predicted own wage changes and actual coworker wage changes. Similarly, we find slopes around 0.1 with the machine learning benchmark, and in a series of robustness checks. Anchoring also emerges with narrower definitions of coworker wage changes, for instance, focusing on coworkers with the same occupation or education level.

This slope between beliefs and actual outside options is far from the benchmark slope of one for accurate beliefs. It is closer to zero, as would emerge if workers' beliefs were anchored on their current wages and unresponsive to actual outside options. In line with anchoring, we find that respondents anchor beliefs about wage changes of coworkers who move out of the firm and the external wage distribution in their occupation, both of which we can directly compare to their empirical counterparts in the administrative data. Overall, our results are consistent with a model in which workers hold incorrect and imprecise beliefs about the statistical properties of the external wage distribution, and strongly rely on their current wage as a signal for their outside option.

These findings raise the possibility that workers' misperceptions may affect the allocation of workers to firms, and specifically keep some workers in low-wage firms that would, if given correct information, search and leave their employer. Indeed, we find that workers in low-wage firms (as proxied by Abowd, Kramarz, and Margolis 1999 (AKM) firm fixed effects) are too pessimistic about the labor market; for example, workers at the 24th percentile of the firm AKM effect distribution underestimate their outside option by about 10 percentage points. Similar patterns emerge for the external wage distribution: workers in low-wage firms underestimate the wage changes of coworkers moving to other firms and the median wage in their occupation, and overestimate their rank in their occupation's wage distribution. These patterns could plausibly be caused by misperceptions of outside

options as worker beliefs are correlated with intended search and bargaining behavior.

To causally identify the anchoring mechanism and explore its effects on labor market behavior, we implement an online information experiment in Germany. We provide a random subset of respondents with information about the average wage of workers with similar characteristics in the same labor market. We find that treated workers use this information to correct not only their beliefs about the wages of similar workers but also to adjust their beliefs about their own outside options. We document that this updating of beliefs causes them to adjust their job search and wage negotiation intentions. A 10 percentage point increase in beliefs about the wage at the outside option raises the probability of quitting the current job by 2.6 percentage points (std. err. 0.87). This estimate suggests that correcting the misperceptions of workers at the 24th percentile of the AKM firm effect distribution would cause about a 2.6 percentage point—or 11%—increase in quits out of those firms. We caution that this experiment implements a light-touch treatment and studies effects on planned behaviors declared at the end of the online survey. While our experiment thus leaves the question of longer-term effects to future research, the causal effects of the information treatment do point to misperceptions as a source of labor market imperfections.

To explore aggregate consequences of anchoring, we build a simple equilibrium model of the labor market that is consistent with our empirical findings. In the model, one worker type holds accurate beliefs. The other type exhibits anchoring: that worker type holds imprecise beliefs about the wage distribution, and hence uses wages paid by their own current employers to form beliefs about outside options—and decide whether to search. Workers with anchored beliefs therefore stay put in low-wage firms because they underestimate their outside options. Firms anticipate and can exploit these misperceptions. Anchoring acts as a source of labor market imperfections that the model would otherwise rationalize through standard search costs: anchoring can lead to unraveling of the competitive, single-wage equilibrium and give rise to a segmented labor market equilibrium with a high- and a low-wage sector. But it generates those patterns through an informational mechanism uniquely consistent with our empirical evidence and distinct from standard switching costs: workers who underestimate their outside options are concentrated in the

low-wage sector, and would update beliefs and switching behavior upon correcting their beliefs.

Several pieces of evidence in the literature on worker beliefs are consistent with imperfect knowledge about outside options and anchoring on current wages. First, unemployed job seekers set their reservation wages close to their own pre-job-loss wage (Feldstein and Poterba 1984; Krueger and Mueller 2016; Le Barbanchon, Rathelot, and Roulet 2019), hold wrong beliefs about the expected duration of unemployment (Spinnewijn 2015; Mueller, Spinnewijn, and Topa 2021; Mueller and Spinnewijn 2023), update their expectations about job offers when receiving offers (Conlon et al. 2018), and broaden their search horizon when informed about alternative occupations (Belot, Kircher, and Muller 2019). Second, workers appear to be imperfectly informed about the wage distribution in their own firm (Card et al. 2012; Cullen and Perez-Truglia 2022, 2023; Hvidberg, Kreiner, and Stantcheva 2023) or sector (Hvidberg, Kreiner, and Stantcheva 2023). Third, our findings are consistent with Reynolds's qualitative survey of about 1,000 manual workers in New Haven between 1946 and 1948, which documented that "very few [workers] knew…how much they could expect to earn per week [at other plants], or what the nonwage conditions of employment were like" (Reynolds 1951, 84). Relative to the existing literature, our main contributions lie in directly measuring beliefs about outside options, comparing these beliefs with objective benchmarks to document anchoring, demonstrating that information about the external wage distribution changes workers' labor market beliefs and intended behavior, and theoretically and empirically exploring equilibrium implications of anchoring.

Section II compares beliefs about outside options to objective benchmarks and documents anchoring. Section III provides correlational evidence on the labor market consequences of anchoring. Section IV presents the information experiment. Section V sketches a simple equilibrium model with anchoring. Section VI concludes.

II. Anchored Beliefs about Outside Options: Descriptive Evidence

In this section, we compare workers' beliefs about their outside options to proxies for their actual outside options. Workers appear to anchor their beliefs about their outside option on

their current jobs' wages, potentially using the latter as a signal about the external labor market. We document the associated misperceptions for a variety of measures.

II.A. Research Design and Hypotheses

Our goal is to assess the accuracy of workers' beliefs about the wage they would earn if forced to move to their outside option. Conceptually, we define an outside option as the job a worker would expect to obtain if their current job were to disappear. For instance, in a McCall (1970) search model, the wage at the outside option would correspond to the expected wage arising from jobs above the reservation wage. In a frictionless model with heterogeneity in nonwage amenities of a job (e.g., Rosen 1986; Card et al. 2018; Berger, Herkenhoff, and Mongey 2022; Lamadon, Mogstad, and Setzler 2022), the outside option would correspond to the second-best option in the worker's choice set. Hence, wages at the outside option can be larger or smaller than the worker's current wage.

Throughout the article, we cast the object of interest as the wage change (in percent) the worker would expect if forced to switch to the outside option.

Figure I illustrates our research design. The x-axis represents the objective wage change if forced to switch to the outside option, whereas the y-axis represents the subjective wage change, i.e., workers' beliefs.

1. *Accurate Beliefs.* The canonical benchmark of accurate beliefs about outside options would manifest itself as observations on the 45-degree line in Figure I. Virtually all search and matching models implicitly assume this accuracy benchmark (see Burdett and Mortensen 1998; Mortensen and Pissarides 1999).

2. *Over- or Underestimation.* Deviations from the accuracy benchmark can take two forms. Observations above the 45-degree line correspond to overestimation, that is, workers expect an unrealistically large wage gain. Conversely, observations below the 45-degree line would imply that workers underestimate wages elsewhere. For example, if workers systematically and homogeneously underestimate their outside options, observations will trace out a line parallel to but below the full accuracy benchmark, sharing a slope of one.

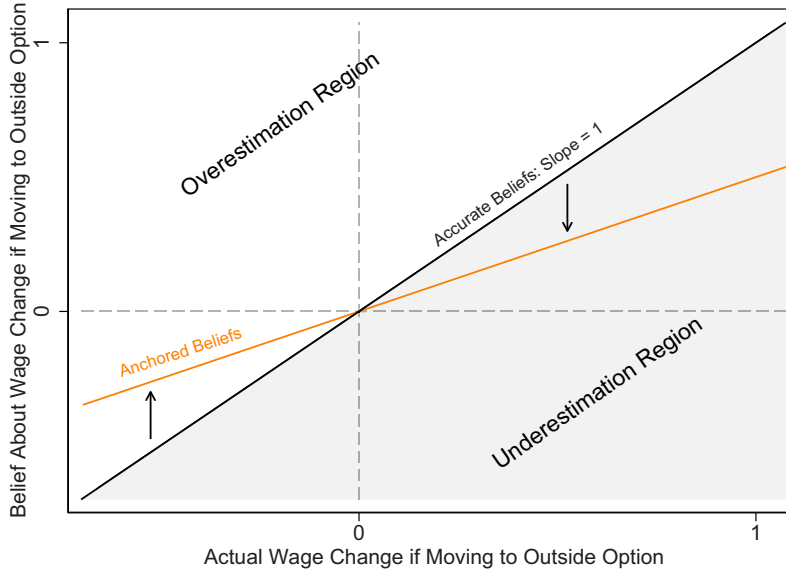


FIGURE I

Research Design

This figure illustrates our research design. The y-axis depicts beliefs about wage changes if moving to the outside option, and the x-axis shows actual wage changes if moving. The black line illustrates the baseline case where workers hold beliefs that are accurate. Workers above (below) that line overestimate (underestimate) their outside option. The gray line has a slope that is less than one, as would emerge if workers anchor their beliefs about their outside option on their current wages.

3. *Anchoring.* We highlight a specific violation of the benchmark of accurate beliefs that we call anchoring: workers believe their outside option pays a wage closer to their current wage than it actually does; that is, they anchor their belief about their outside option on the current wage. Anchoring would manifest itself as a rotation of the perfect accuracy benchmark around the origin, with slopes closer to zero indicating stronger anchoring.

4. *Potential Sources of Anchoring.* We refer to anchoring simply to describe beliefs that are, on average, too close to the current wage rather than to describe a specific belief formation process. Such anchoring can arise from a variety of mechanisms. First, it can reflect Bayesian updating. The context would be imperfectly precise information about the statistical properties

of the wage distribution. Online Appendix C presents such a model, where workers do not know the mean of the (normally distributed) wage distribution and use the current wage as a signal about this mean. This model predicts a slope weakly below one, given by the subjective precision of the signal about the mean wage relative to the prior. Second, anchoring could also arise with non-Bayesian belief formation, for example anchoring in the sense of Tversky and Kahneman (1973). Anchoring would also arise in models of assortativity or selection neglect with individuals forming beliefs (e.g., about the external labor market) based on what they observe (e.g., their own wage) without accounting for selection in what they observe (Enke 2020; Frick, Iijima, and Ishii 2022). Third, anchoring could also reflect sorting, for example, of underestimators into low-wage firms.

II.B. Data: The SOEP Merged to Matched Employer-Employee Data

1. *SOEP Innovation Sample.* To elicit beliefs about outside options and the wage distribution, we included a custom survey in the Innovation Sample of the SOEP (SOEP-IS) in 2019 and 2020 (although our main analyses only draw on 2019 data). The SOEP-IS is a longitudinal study that surveys a representative sample of the German population on a wide range of topics once a year. The sample design and core fieldwork are identical to that of the SOEP-Core samples (see Richter and Schupp 2015; Zweck and Glemser 2020; Zweck and Rathje 2021 for details on sampling methods). Our questionnaire was fielded in the samples I1/IE, I2, and I5, and its members had been part of the panel since 2009/2012, 2012, and 2016, respectively.

The SOEP is a probability-based sample with high representativeness and response rates through multi-month recontact strategies. For our questionnaire, face-to-face interviews were conducted in private with each member of a household by trained interviewers (about 30% of interviews in the 2020 wave were conducted over the phone; Zweck and Rathje 2021). The face-to-face nature of the interviews results in higher quality of responses by allowing for clarifying questions and decreasing nonresponse rates. Our module took on average five minutes. The full questionnaire is in Online Appendix G.1 (English translation) and Online Appendix G.2 (original German version).

2. *Administrative Data on Objective Outside Option.* To construct objective benchmarks for workers' outside options, we rely on administrative matched employer-employee data. Our article is part of a project linking SOEP data and individual-level administrative labor market data from the Institute for Employment Research (IAB) from 1975 to 2019, containing rich information on earnings, occupations, and several other characteristics of all workers at an establishment. As part of the 2018 wave, SOEP respondents were asked for consent to link their SOEP data with IAB data. The linkage procedure used respondents' names, gender, date of birth, and address (see Antoni, Beckmannshagen, and Grabka 2023, for a detailed description). The match rate among consenters was 87.2%, leaving 558 individuals in our matched sample. We use the IAB data to construct proxies for outside options for the SOEP respondents, using wage changes of coworker movers and predictions based on a machine learning procedure, as well as the respondent's actual rank in the occupational wage distribution. We describe these outside option proxies below. We also draw on AKM firm effects to characterize heterogeneity between employers.

3. *Analysis Sample.* Our sample condition is full-time or part-time employment. Due to availability of the administrative data (which ends in 2019) and the potential shocks to outside options induced by the COVID-19 pandemic, we restrict our analyses to using data from 2019 only (except for measuring the persistence of beliefs about outside options and the external labor market, which also draws on 2020 data). We winsorize all unbounded continuous variables at 2%. Table I describes the main analysis sample.

II.C. Beliefs about Outside Options

1. *Beliefs about Own Wage Changes Following Involuntary Separation.* Our main question elicited employed respondents' expected wage change if forced to switch out of their current job: "Imagine that you were forced to leave your current job and that you had three months to find a job at another employer in the same occupation. Do you think that you would find a job that would offer you a higher overall pay, the same pay or a lower pay?"

TABLE I

SUMMARY STATISTICS (SOEP-IAB SAMPLE)

	Mean	Std. Dev.	P10	P25	Median	P75	P90	Share 0	*N*
Panel A: Demographics and labor market characteristics									
Age in years	44.6	11.4	29.0	35.0	45.0	55.0	60.0	0.000	514
Wage (€ per year)	39,222	21,168	16,644	24,000	35,100	48,000	69,600	0.000	514
Tenure in years	11.2	10.8	0.0	2.0	7.0	18.0	29.0	0.101	514
Share of women	0.482	0.500	0.000	0.000	0.000	1.000	1.000	0.518	514
Full-time employed	0.718	0.450	0.000	0.000	1.000	1.000	1.000	0.282	514
Part-time employed	0.272	0.446	0.000	0.000	0.000	1.000	1.000	0.728	514
Panel B: Beliefs									
Own wage change as % of wage	−1.2	11.0	−15.0	−7.4	0.0	0.0	12.2	0.406	498
Coworker wage change as % of wage	1.3	10.3	−13.4	0.0	0.0	7.2	16.1	0.397	499
Own wage rank in the same occupation	51.8	18.1	30.0	45.0	50.0	60.0	75.0	0.000	504
Median wage in occupation (€ per year)	41,219	18,508	22,800	28,800	36,000	48,000	66,000	0.000	492
Panel C: Estimation errors									
Belief (own wage change) versus coworker wage changes (%)	−6.3	33.7	−50.4	−23.0	−3.4	13.9	34.0	0.006	329
Belief (coworker wage change) versus coworker wage changes (%)	−4.5	32.6	−47.5	−18.9	0.0	14.6	32.7	0.006	334
Belief (median wage) versus actual median wage (%)	−4.6	27.6	−35.7	−23.3	−7.0	9.6	28.1	0.000	405
Belief (own wage rank in occupation) minus actual wage rank (percentage points/rank)	1.5	29.4	−37.5	−17.5	2.5	22.5	37.5	0.008	397
Belief (own wage change) versus ML prediction (%)	5.5	28.7	−34.3	−9.6	9.8	24.9	37.7	0.000	417

Notes: This table reports summary statistics for our analysis sample, a match of the 2019 SOEP respondents in our questionnaire and the IAB data. Panel A reports demographic and labor market characteristics. Panel B reports summary statistics of labor market beliefs. "Own wage change as % of wage" is calculated based on responses to a question about respondents' expected wage change if forced to leave their job relative to their current wage. "Coworker wage change as % of wage" is calculated based on responses to a question about the wage change experienced by a typical coworker leaving their job. Both percentage shares are approximated by log differences. "Own wage rank in the same occupation" is based on a question asking respondents about the fraction of other workers who receive a lower wage. Panel C reports estimation errors, which are defined as the respective belief minus an objective benchmark: logs for the belief about own outside option and the belief about coworker wage change, rank units for the wage percentile, and percent for the belief about the median wage. For the estimation error of the respondents' own outside option, we follow the sample definitions of Figure III, Panel A and Figure IV. In this table, all continuous variables are winsorized at the 2% level.

For respondents who did not choose "Same pay," we elicited the size of the expected increase/decrease.[3] We construct the belief about the wage change as the belief about the outside option wage level in logs (own wage plus wage change) minus the log of the own wage (since the benchmarks will be estimated in log differences).

Our baseline formulation results from consultation and iteration with the survey provider and recognizes several real-world features of the empirical setting (job search, mandatory advance notice; we also relax the occupation restriction).

2. *Validation and Measurement Error.* We validate the belief measure and investigate and address measurement error in several ways. First, our main specification uses beliefs as an outcome variable, so that classical measurement error therein does not lead to attenuation bias. Second, Online Appendix Figure B.3 illustrates that there is significant within-respondent persistence in beliefs about their outside option in the short run within a survey (a slope of 0.980; std. err. 0.017) as well as in the medium run (across one year, using repeat respondents across the SOEP waves, with a slope of 0.290; std. err. 0.028). (This short-run statistic comes from an additional survey we present in Section IV as part of the information experiment and draws on the control group observations.) The absence of perfect persistence over a year may reflect aggregate (e.g., pandemic) or idiosyncratic shifts in outside options or transitory measurement error in the variables. Third, the belief variables strongly correlate with questions on intended labor market behavior in the expected direction (see Section III.A for the full discussion). Fourth, to account for framing effects, we compare distributions from different elicitations and find that they are similar across many alternative question wordings (see Online Appendix E.2 for a detailed exposition of these robustness tests).[4]

3. The brackets (in euros) our respondents could choose from are given as follows: [0–50; 50–100; 100–200; 200–300; 300–400; 400–500; 500–750; 750–1,000; 1,000–1,500; 1,500–2,000; 2,000–3,000; > 3,000]. We define the wage change in euros that the respondent expects to experience at her outside option as the midpoint of each bracket (e.g., 25 for the [0–50] bracket) and 3,500 for the >3,000 bracket.

4. The different wordings we included in the robustness online survey were eliciting the wage level at the outside option rather than the change relative to the current wage, omitting the "same pay" category as a response option and forcing

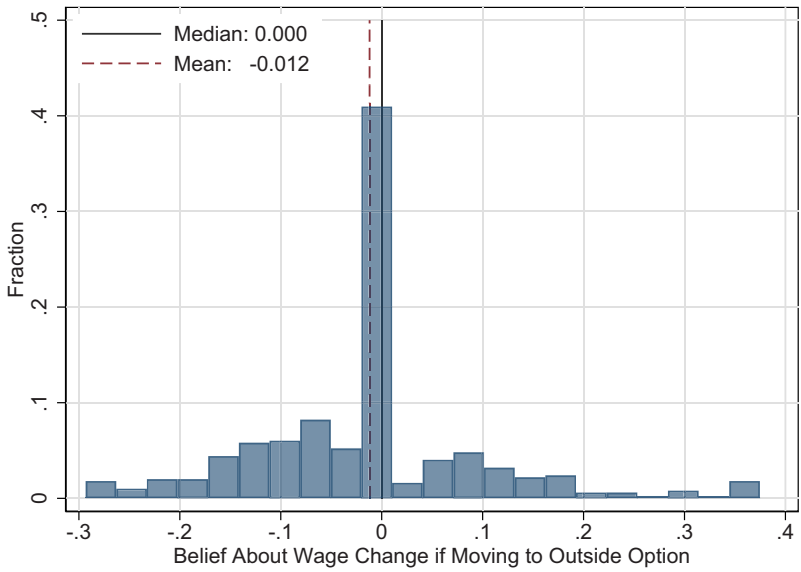


FIGURE II

Distribution of Beliefs about Wage Change if Moving to Outside Option

This figure presents a histogram of workers' beliefs about their own wage change when forced to leave their job as a percent of workers' current wages (approximated by the log difference). The data are winsorized at the 2% level. The data stems from the 2019 wave of the German Socio-Economic Panel (see Table I for summary statistics). The sample size is 498.

3. *Summary Statistics.* Figure II reports the summary statistics of our main outcome variable: the difference between a worker's current wage and their expected wage if they were forced to leave their job (i.e., the wage at their outside option), divided by their current wage. The median (mean) wage difference at the subjective outside option is 0% (−1.2%). The distribution is symmetric around zero, with a large mass at or close to zero. The 10th (90th) percentile is −15.0% (12.2%).

4. *Beliefs about the Wage Distribution.* In addition to the measure of beliefs about outside options, we collected additional

respondents to enter a percent wage change (for beliefs about coworker wage changes), varying the duration to find a new job between 3 and 12 months, specifying an unexpected company closure as the cause of the separation, or not specifying that the respondent has to search within their current occupation.

questions regarding beliefs about the external wage distribution. We select those questions to refer to variables plausibly relevant to the respondent's outside option but for which we can more directly and precisely construct objective benchmarks. Those variables are beliefs about (i) wage changes of coworkers leaving the respondent's current employer, (ii) the respondent's rank in the wage distribution of their occupation, and (iii) the median wage in the respondent's occupation. We describe these additional questions in Section II.F when drawing on them.

II.D. Benchmark: Involuntary Moves of Coworkers

Specifying and quantifying workers' outside options is notoriously challenging. We propose plausible empirical proxies for these outside options and show robustness to alternative measures.

Our first benchmark exploits systematic differences across firms in pay premia common to all workers (Abowd, Kramarz, and Margolis 1999; Card et al. 2012). These wage differences may reflect amenities, firm size, rent sharing, or other sources. For our purpose, we isolate the systematic differences in wage changes workers experience when switching from their current employer, which result from the difference between the current employer's pay premium and the pay premium at the next employer. Because this benchmark does not perfectly predict wage changes, which also have idiosyncratic components, this particular analysis can be viewed as testing whether workers are aware of variation in outside options that is explained by their current employer and common to all workers.

1. *Identifying Involuntary Moves: EUE Moves.* We proceed in two steps. First, we attempt to identify plausibly involuntary coworker moves as proxies for the outside option (our survey supposed the worker "was forced to leave [their] current job"). To do so, we select employment-unemployment-employment (EUE) moves (in the spirit of Gibbons and Katz 1992, who draw on plant closings): coworker moves to another employer that involve an intervening unemployment spell (see Online Appendix Table A.2 for summary statistics and comparisons to our sample of respondents). Specifically, we require unemployment insurance receipt beginning within 12 weeks of leaving the original employer and before joining another employer, as German unemployment law

offers unemployment insurance after voluntary separations, but only after a 12-week waiting period (§159 *Sozialgesetzbuch* III). We also require full-time work at their original and new employers.

Because not all involuntary moves involve unemployment, we expect this benchmark to be more negative, on average, compared with the population of all transitions.[5] Our sample of worker moves spans 2015 to 2019, the five years preceding and including the survey. We construct moves at the annual level, assigning each individual a main employer every year (as in Card et al. 2012). In a robustness check, we also consider all coworker moves (rather than involuntary moves only), and restrict the sample to comparable coworkers, to larger firms, to the median rather than mean coworker wage change, and to less distant time horizons from the time of the survey.

2. *Isolating the Systematic Component.* As a second step of our two-step procedure, we isolate the variation in coworker wage changes that is systematic—and hence would apply to the SOEP respondent too if switching to the outside option. Our goal is to strip out spurious variation that would plague raw averages of mean wage changes—which would combine the common component (which we aim to isolate), and the average of idiosyncratic terms (due to match- or worker-specific factors). Our main strategy is an empirical Bayes (EB) correction (Morris 1983; Chandra et al. 2016). This strategy essentially "shrinks" imprecisely estimated averages to the sample mean. For the EB strategy, the sample is firms with at least two coworker moves. As a complement to the EB approach, we apply a split-sample IV strategy (as in Drenik et al. 2023). This strategy partitions each firm's movers into two random samples and uses one sample's wage change as an instrument for the other sample's wage change. Standard IV methods can then be used to isolate the relationship with an outcome variable (in our case, beliefs). For the IV strategy, we choose a cutoff of four coworker moves, so that we have at least two observations in each partition.[6]

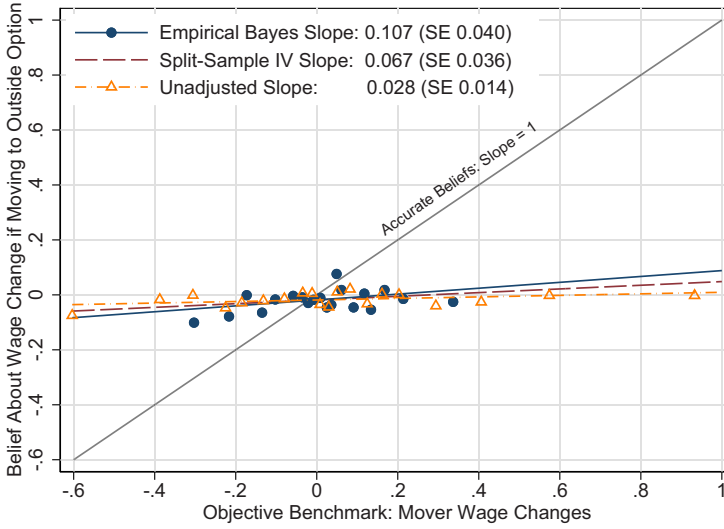
5. We find an average wage change of 2% (8%) for involuntary (all) moves. This average is slightly more positive than that of displaced workers (see Schmieder, von Wachter, and Heining 2023). The gap may be due to that literature's focus on mass layoffs of higher-tenured workers from larger establishments.

6. Robustness checks with stricter or looser cutoffs yield similar results; the first stage loses strength with only two coworker moves.

3. *Validation of the Benchmark.* We present two validations illustrating the relevance of coworker wage changes for predicting actual wage changes. First, we track the labor market history of our SOEP sample in the administrative panel data and regress their wage change when leaving previous workplaces against an EB-corrected mean log wage change of involuntary movers out of that previous workplace in the five years before the SOEP respondent's exit. Online Appendix Figure B.4, Panels (a) and (b) report a tightly estimated slope of about one, indicating that at least in a respondent's past, wage changes of coworkers are highly predictive of the respondent's own wage change. Second, Online Appendix Figure B.5 presents the first stage relevant to the split-sample IV strategy, showing a slope coefficient of 0.616 (std. err. 0.079). This slope also indicates that a lot of the variation in coworker wage changes is spurious, showing up as significant attenuation bias in a naive, unadjusted OLS strategy—which our two strategies overcome.

4. *Results.* Figure III, Panel A is the empirical analog of the research design we plotted in Figure I and described in Section II.A. The y-axis remains the same, that is, respondents' belief about the wage change at their outside option, but the x-axis is now the actual wage change of plausibly involuntary coworker movers. The binned scatterplot in Figure III, Panel A presents both EB-shrunk observations (solid circles) and the unadjusted data points (hollow triangles). To quantify the degree of anchoring, we estimate a linear regression slope. The EB-corrected slope is 0.107 (std. err. 0.040), that is, worker beliefs about their wage change when forced to leave are, on average, only 1.07 percentage points higher in a firm where they are predicted to experience a 10% wage increase, compared to a firm with a zero predicted wage change. This slope is far below the benchmark of one and indicates substantial underestimation of outside options at firms with large positive wage changes (and vice versa). As expected, the raw relationship without measurement error correction is quantitatively starker with an even lower slope of 0.028 (std. err. 0.014). This attenuated slope reflects spurious variation in the benchmark that would not carry over to the respondent, for example, due to outliers or few observations among coworkers, issues the EB correction addresses. Finally, we also report the split-sample IV estimate, which yields a slope of 0.067 (std. err. 0.036).

(A) Benchmark: Wage Changes of Coworkers Involuntarily Leaving Firm



(B) Benchmark: Machine Learning Prediction

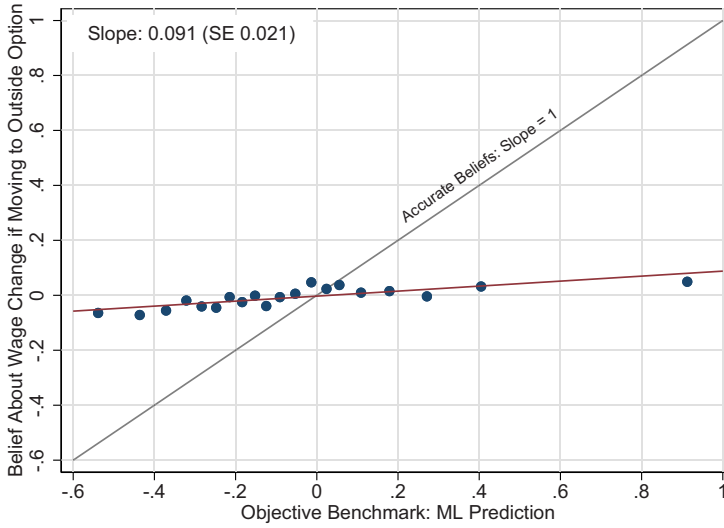


FIGURE III

Beliefs About Wage Change if Moving to the Outside Option versus Objective Benchmarks

FIGURE III

(*Continued*) This figure presents binned scatter plots of SOEP 2019 respondents' beliefs about their own wage change if forced to leave their firm against two objective benchmarks for the actual wage changes they would experience. In Panel A, the benchmark is the mean log wage changes experienced by workers who left the SOEP respondent's firm in the past five years (between 2015 and 2019). We restrict to movers working full-time before and after the move and to movers who experience an intermediate unemployment spell before finding their next job, to narrow our attention to "involuntary" separations. In Panel B, the benchmark is based on machine learning for the wage changes that SOEP respondents would experience if leaving their firm, with a model trained on the universe of "involuntary" moves in the German labor market ("involuntary" defined as above). The machine learning methodology is fully described in Online Appendix D. The sample size in Panel A is 310 observations for the unadjusted line, 206 observations for the empirical Bayes line, and 132 for the split-sample IV line. The sample size in Panel B is 419 observations.

The slope is significantly different from one, and the confidence interval includes the 0.107 slope estimate from our EB procedure.

II.E. Robustness Checks

1. *Machine Learning Benchmark.* As an alternative benchmark, we draw on a machine learning model to predict SOEP respondents' wage changes at their outside option, based on a broader sample of movers rather than only on coworkers in the same establishment. This approach allows us to predict wage changes using a rich set of covariates to address potential concerns about differences in characteristics between our respondents and their coworkers who experienced an involuntary move, the proxy we used in Section II.C.

In our overall sample of involuntary (EUE) movers in the administrative data (omitting SOEP respondents), we estimate a Lasso model, which mitigates concerns about overfitting. In the model, the dependent variable is the log wage change of the mover. As predictors, we use individual- and firm-level covariates and their interactions.[7] Calculations of partial R^2 values indicate that the key covariates are the mover's wage at their initial firm, initial firm's AKM effect, and gender, occupation, industry, and age $\times$ education. The model based on a random training sample explains 43% of the variance in log wage changes in

7. The covariates are workers' own wage at the initial firm, the firm effect of the initial firm, age (cubic), gender, tenure (cubic), education categories, size of initial firm, separation rate of initial firm, standard deviation of wages at initial firm, employment growth at initial firm, industry (NACE level 1), state (16), occupation (one-digit), and interactions of age $\times$ education and industry $\times$ region.

the remaining evaluation sample. Online Appendix D presents the full results of the prediction model, including out-of-sample performance and the partial R^2 values of selected covariates.

Figure III, Panel B reports results using this benchmark. We find quantitatively similar results to those using the wage changes of involuntary coworker movers, with a slope of 0.091 (std. err. 0.021).

2. *Robustness to Different Specifications.* We implement a number of robustness checks, such as changing the set of mover wage changes used to construct the benchmark, omitting respondents who selected the "same wage" (zero wage change) option, or changing the training set for the ML benchmark. Online Appendix E.1 confirms the robustness of our results, with all coefficients far below one.

3. *Robustness Survey.* We explore robustness to alternative question wording as elicited in a robustness survey fielded with a convenience sample (not matched to administrative data) and report results in Online Appendix E.2.

II.F. Beliefs about Directly Observable Benchmarks: Coworker Moves and Wages in the Occupation

Even though we draw on a rich set of covariates to construct benchmarks, unobserved differences between movers and respondents may constitute a threat to identification.

As a first step to address such concerns, we check for anchoring patterns in beliefs about other statistics concerning the wage distribution that are plausibly relevant for outside options and whose accuracy we can assess directly: coworkers' wage changes when moving, respondents' position in the occupational wage ladder, and the median wage in their occupation. In Section IV, we further probe the anchoring interpretation in an information experiment.

1. *Coworker Wage Changes.* First, we ask SOEP respondents about the wage changes experienced by typical coworkers moving out of their firm.[8] For this belief, we can directly calculate

8. The exact question was: "Think of the typical employee with work experience that switches from your current employer to another employer. Would this employee receive a lower, higher or the same pay compared to his previous

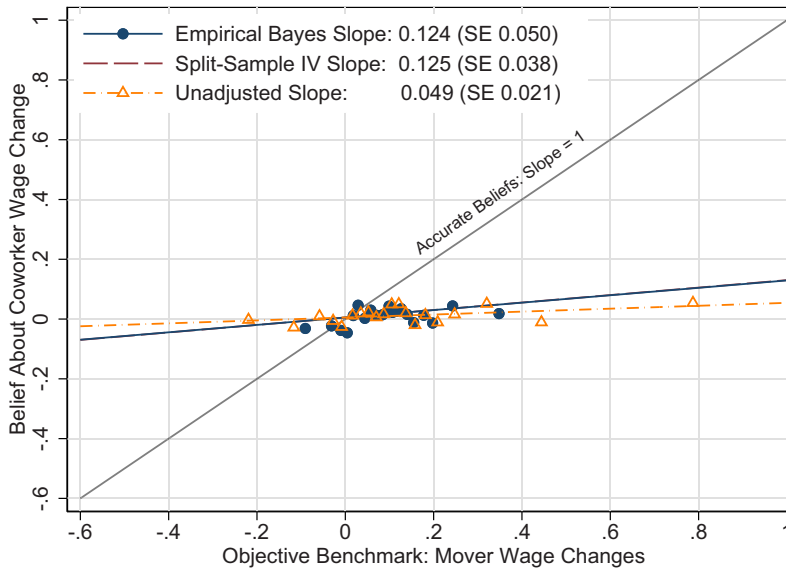


FIGURE IV

Beliefs about Mover Wage Changes versus Actual Mover Wage Changes

This figure presents binned scatter plots of SOEP 2019 respondents' beliefs about the typical wage change of coworkers who leave their firm, against the actual wage changes of coworkers who left their firm between 2015 and 2019. It is analogous to Figure III, Panel A, except that the *y*-axis reports beliefs about the typical wage change of coworkers (irrespective of whether voluntary or involuntary), and the *x*-axis is the corresponding objective benchmark (but now calculated from all coworker moves rather than involuntary ones only, consistent with this survey question). The sample size is 473 observations for the unadjusted line, 442 for the empirical Bayes line, and 382 for the split-sample IV line.

the benchmark in the matched survey-administrative data by looking at the wage changes of all movers leaving the SOEP respondent's firm in the past five years—our previous outside option proxy, but looking at all moves instead of just involuntary ones. Figure IV reports the same specification as Figure III, Panel A, but with SOEP respondents' beliefs about coworker wage changes as the *y*-axis variable and the mean log wage change of all coworker movers as the *x*-axis variable.

We find similar anchoring patterns. Respondents in firms where coworkers fare well when leaving (i.e., on the right of the

employer?" We give respondents not answering "same pay" specific bins of average wage changes as before.

graph) underestimate wage increases among movers (and vice versa). The empirical Bayes corrected slope is 0.124 (std. err. 0.050), substantially below the unbiased slope of one; we also find a similar slope using a split-sample IV strategy. The slope is even lower for the unadjusted specification, which may be the right design if the respondent interprets the typical coworker as the average past mover.

2. *Rank within Occupation.* We draw on a question about workers' subjective wage rank within their occupation and compare this belief to their objective rank.[9] The histogram in Figure V, Panel A reports the distribution of respondents' beliefs (darker-shaded bars) and the empirical objective benchmark (lighter-shaded bars).

Once again, we find evidence consistent with workers anchoring their beliefs about the external labor market on the wages of their current employer. In sharp contrast with the nearly uniform empirical distribution (validating the representativeness of the SOEP sample), the beliefs follow a bell-shaped distribution: 51% of respondents see themselves between the 40th and 60th percentiles. In the data, only 20% of workers actually rank in that interval. In the tails, only about 4% of workers believe that they rank in the top or bottom decile, rather than 18% in actuality.

To highlight anchoring, Figure V, Panel B provides a scatterplot of workers' subjective wage rank in their occupation against their objective rank. Rather than a slope of 1 that would be consistent with full accuracy, we find a slope of 0.162 (std. err. 0.034). That is, an increase in workers' actual wage rank by 10 percentile ranks is accompanied by less than a 2 percentile increase in their perceived rank.

3. *Median Wage in Occupation.* Finally, we elicit beliefs about the median wage (monthly salary) in a worker's occupation.[10] Again, workers appear to anchor their beliefs about

9. The exact question was: "Think of all employees in Germany that work in the same occupation as you, but work at a different employer. What do you think: what percent of these employees receive a [lower pay/same pay/higher pay]?" The objective rank is calculated from the administrative data, at the four-digit occupation level (*Berufsuntergruppe*) using workers' daily wage and a lower bound of minimum wage earnings at six hours per work day.

10. The exact question was: "Think of all employees in Germany that are full-time employed and work in the same occupation as you. What do you think is

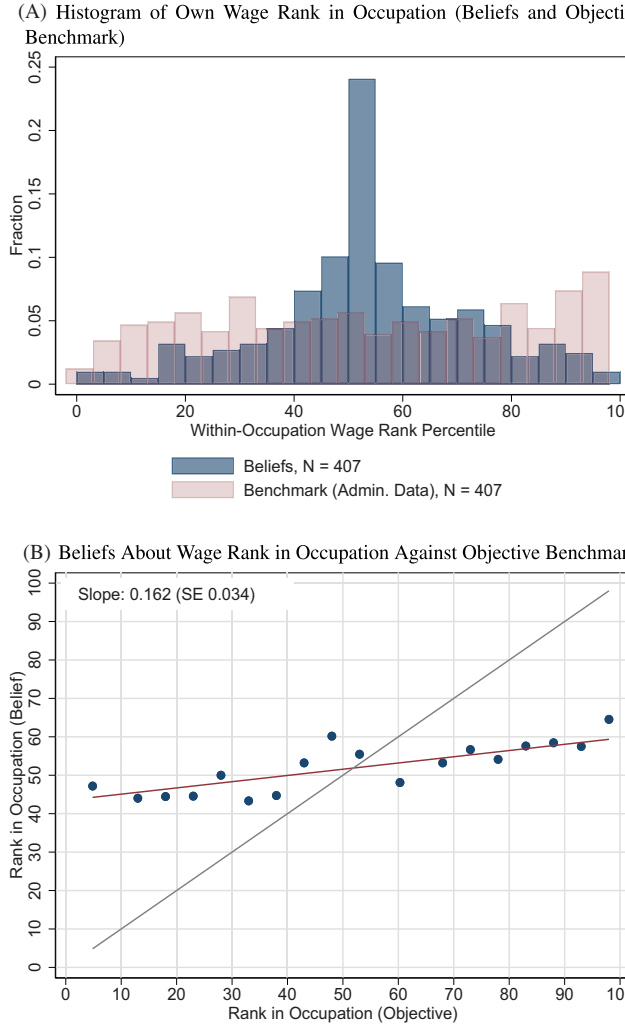


FIGURE V

Beliefs About Own Wage Rank in Occupation

This figure tests the accuracy of 2019 SOEP respondents' beliefs about their wage rank within their occupation (compared to workers in other firms). Panel A shows a histogram of beliefs as well as the actual ranks of our respondents (the latter calculated at the four-digit occupation level in our administrative data sample in 2019). Panel B shows a binned scatter plot of beliefs against actual rank, along with a regression line. The sample size in each panel is 407.

the median wage in their occupation on their current wage. In Online Appendix Figure B.6, we plot workers' residualized beliefs about the median wage in their occupation against the residualized actual median wage in their occupation. Residuals are obtained by separately regressing beliefs about median wage in the occupation and actual median wage in the occupation on own wages. We find a slope of 0.471 (std. err. 0.042); that is, workers for whom the median is 10% higher than their current wage think that the median is only 4.7% higher than their wage. This result is consistent with anchoring also for more easily observable features of the external wage distribution, with the higher slope for this variable perhaps pointing to more accurate beliefs for occupation-level wage variation compared to workers' idiosyncratic outside options at other employers.

III. Implications of Anchoring: Descriptive Evidence

The evidence for anchoring raises the possibility that misperceptions play a role in the otherwise puzzling prevalence of wage dispersion and willingness of workers to stay put in low-wage jobs, besides conventional search costs or nonwage amenities: workers in low-wage jobs might be overly pessimistic about the external labor market, search less because of those misperceptions, and thus stay put in those jobs. We provide correlational evidence consistent with these two implications for respondents' intended labor market behavior and beliefs. We probe the causality from anchoring to behavior in a follow-up information experiment in Section IV. We also formalize these mechanisms in a simple labor market equilibrium model in Section V.

III.A. Anchoring Distorts Behavior: Correlational Evidence

We find that workers' beliefs—even when controlling for objective benchmarks—strongly predict their intentions to quit, search for a new job, and negotiate their wage.

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the typical monthly pay of these employees before taxes (in EUR)?" To benchmark these beliefs, we use wage information based on a reference date of December 31, 2018, provided to us by the Federal Employment Agency's Statistics Group based on the universe of full-time employment subject to social security and which corresponds to median monthly salaries for five-digit occupations (KldB 2010).

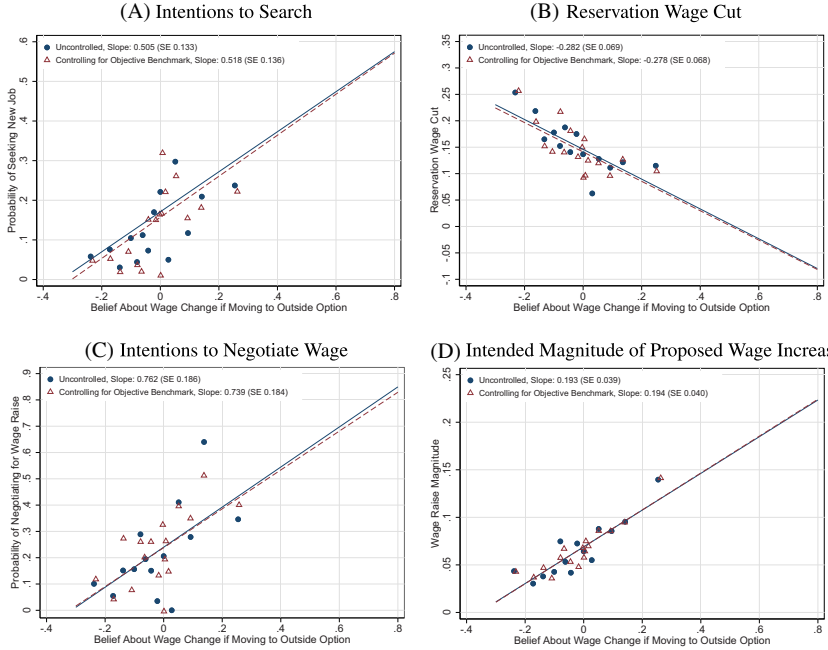


FIGURE VI

Intended Labor Market Behavior and Beliefs about Outside Options

The figure presents binned scatter plots of respondents' intended labor market behaviors against their beliefs about their own wage change if forced to leave their firm. The variables are the probability of searching for a new job in the next 12 months (Panel A), the minimum pay cut at their current job that would induce them to quit (Panel B), the probability of asking for a wage raise in the next 12 months (Panel C), and the magnitude of the raise one would suggest in a salary negotiation (Panel D). We report two specifications: without controls (solid circles and solid regression line) and with coworker wage changes as a control (hollow triangles and dashed regression line), the objective benchmark for the wage change they would experience. The sample sizes are 310, 291, 310, and 306 in Panels A–D, respectively.

1. *Intended Labor Market Behaviors.* Our SOEP-IS module asks respondents about the probability that they will look for a new job at a different company over the next 12 months, and about the reservation pay cut at their current job that would induce them to quit. In addition, we draw on questions about wage bargaining, the probability that a respondent will ask their boss for a wage raise over the next 12 months, and its magnitude.

Figure VI shows that respondents' beliefs about their outside options are strongly predictive of these stated labor market

behaviors, while controlling for their objective outside options does not change this strong relationship.

Figure VI, Panel A shows that a 10 percentage point increase in the belief of the wage change if moving to the outside option is associated with a 5.1 percentage point (std. err. 1.3) increase in the stated probability of looking for a new job. This relationship barely changes when controlling for objective benchmarks. This figure uses wage changes of coworker movers in Figure VI as a control variable; Online Appendix Figure B.7 replicates the entire figure while instead controlling for the machine learning benchmark.

We find similar patterns for the other variables. Figure VI, Panels B–D document a corresponding 2.8 percentage point (std. err. 0.7) decrease in the reservation wage cut to quit, a 7.6 percentage point (std. err. 1.9) increase in the probability to ask for a raise, and a 1.9 percentage point (std. err. 0.4) higher ask in such a negotiation, all for a 10 percentage point shift in the beliefs variable.

2. *Do Only Non-searchers Anchor?* The misperceptions would be irrelevant if workers only search sporadically and exogenously, and are then well-informed, while only non-searchers exhibit anchoring (whose misperceptions are not allocative in this scenario). In contrast to this view, Online Appendix Figure B.2 documents that workers who are more likely to search or are plausibly more exposed to external labor market information—proxied for with shorter than median tenure (hence, recent search) or in firms with higher than median turnover (hence, frequent search)—also exhibit anchoring. This figure more broadly illustrates that there is relatively little heterogeneity in the extent of misperceptions by demographic variables, such as education, age, and gender.

III.B. Overly Pessimistic Workers Work in Low-Wage Jobs

We check for the key implication of anchoring distorting search behavior: workers with more pessimistic beliefs about their outside option will sort into and be more likely to remain in low-wage jobs. Indeed, we find that low-wage firms are disproportionately staffed by workers that underestimate their outside options—and a variety of related moments of the external wage distribution. Besides providing a misperception-based rationale of wage dispersion and staying in low-wage jobs, the evidence is

also consistent with workers using their current job as a signal about the overall wage distribution.

1. *Definition of High- and Low-Wage Firms: Firm AKM Effects.* To classify firms, we draw on AKM firm effects, a standard measure of firm-specific pay premia; firms with low AKM effects are considered "low-wage" firms, and vice versa for firms with high AKM effects. Importantly, AKM firm effects reflect wages net of worker fixed effects and Mincerian controls, so they serve as a composition-adjusted measure of firms' wages. As described in the introduction, the large empirical dispersion in AKM firm effects is the key illustration of the departure from the law of one price per skill. In Germany, firm AKM effects are an increasingly important determinant of earnings (Card, Heining, and Kline 2013), and are a powerful predictor of wage changes after forced displacement (Schmieder, von Wachter, and Heining 2023). For data availability reasons, the AKM effects were calculated for the period from 2010 to 2017, but AKM firm effects appear highly persistent (Lachowska et al. 2023).

2. *Results.* Figure VII, Panel A plots workers' beliefs about outside options and objective outside options (as proxied by involuntary coworker moves) against AKM firm effects. While there is a strong linear relationship with a regression slope of −0.525 (std. err. 0.101) between AKM effects and objective outside options, workers' beliefs trace out a much flatter slope of −0.157 (std. err. 0.037). That is, objective outside options vary a lot across the AKM distribution, but beliefs remain relatively constant. Panel B shows analogous patterns for beliefs about coworker wage changes.

Figure VII, Panel C presents the misperceptions depicted in Panel A in the form of estimation errors: the vertical difference between beliefs and the objective benchmark. The figure shows that workers in low-wage firms strongly underestimate their outside options, and workers at high-wage firms hold more accurate beliefs.[11] Panel D shows analogous patterns for estimation error of coworker wage changes complementing Panel B. Panel E shows similar patterns for the estimation error about the rank in the

11. When using the ML benchmark, we find similar underestimation in low-AKM firms, but instead find overestimation in high-AKM firms.

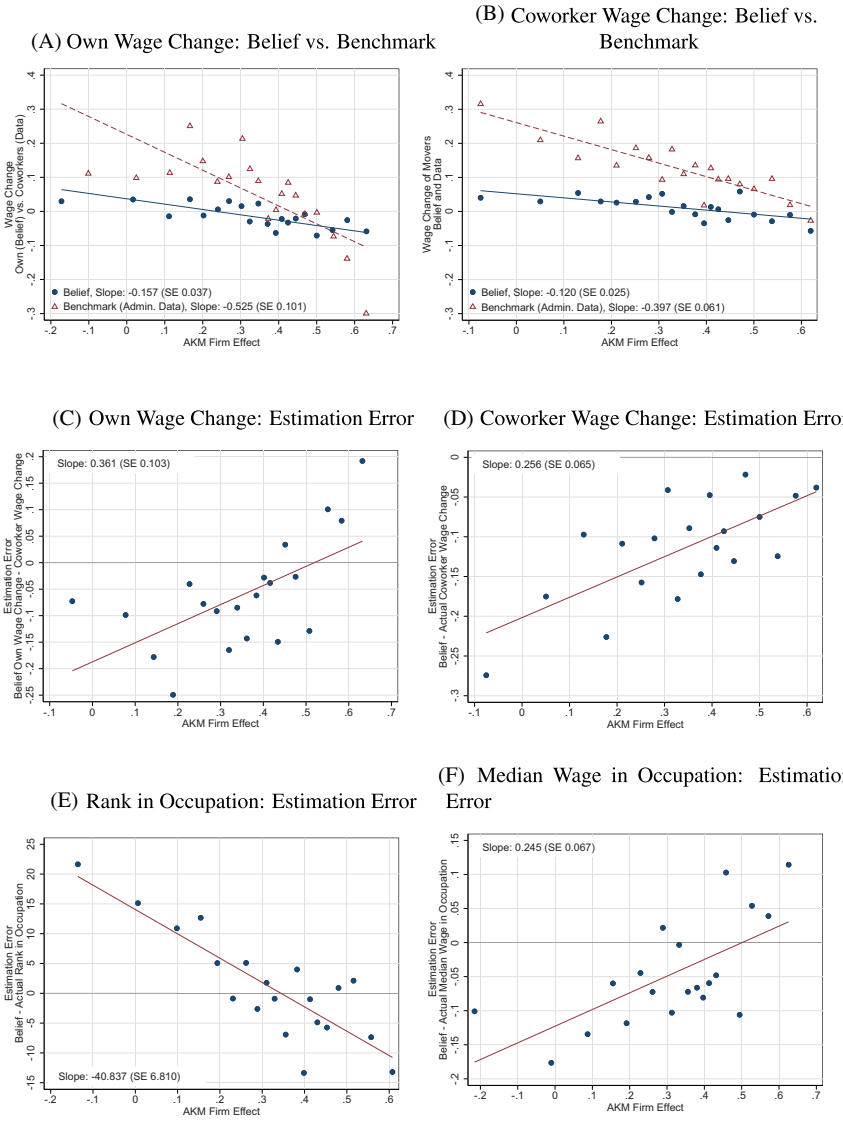


FIGURE VII

Beliefs and Misperceptions across the Firm Wage Distribution

Panels A and B present binned scatter plots of beliefs about outside options and objective benchmarks for outside options against firm AKM effects, as a measure of composition-adjusted firm wage premia. Panel A presents beliefs about own wage changes and actual wage changes of involuntary movers, and Panel B

FIGURE VII

(*Continued*) presents beliefs about coworker wage changes and actual wage changes of involuntary movers. Panels C–F present binned scatter plots of misperception measures against firm AKM effects. Estimation errors are defined as the belief minus the objective benchmark: logs in Panels C and D, rank units in Panel E, and percent in Panel F. See Table I, Panel C for summary statistics of the estimation errors. The sample sizes are 310, 471, 310, 471, 405, and 413 in Panels A–F.

occupational wage distribution, which is positive for workers in low-wage firms (i.e., they underestimate their rank) and closer to zero for workers in high-wage firms. Panel F shows similar patterns for the estimation error about the median wage in the occupation.

IV. EXPERIMENTAL EVIDENCE FROM AN INFORMATION TREATMENT

To identify causal effects and address remaining measurement concerns (such as unobserved ability and endogenous mobility as in Gibbons and Katz 1992), we complement our descriptive analysis with an online experiment. We provide workers with information relevant for their outside option: the wage of similar workers in their narrow labor market cell. First, this experiment confirms the informational frictions underlying anchoring: while workers initially anchor their beliefs about outside options on their own wage, they shift their beliefs in response to the information toward the benchmark. Second, the observed shift in beliefs provides an additional validation exercise for the belief measures and imputed objective benchmarks from the descriptive analysis. Third, we find that treated respondents adjust their intended labor market behaviors, which provides causal evidence that misperceptions distort labor market behaviors, rather than just reflecting search costs or rational inattention.

1. *Information Treatment in SOEP-IS.* This online experiment refines a simple information treatment we had included in the 2019 SOEP-IS survey. There, legal and technical challenges had restricted us to a relatively coarse labor market information treatment, the national median wage in the occupation, and the information treatment was not as salient and visual. We suspect that these limitations led to a weak first stage on outside

options beliefs (an F-statistic of 1.7) and imprecisely estimated (IV) effects on intended labor market behaviors. We report and discuss those results in Online Appendix F.3.

IV.A. Sample for the Information Experiment

To conduct a higher-powered information experiment with more tailored treatments, we collaborated with two survey companies, Bilendi and Dynata. Our data were collected in May, June, and July 2022 in Germany. These providers use opt-in panels, that is, respondents sign up to participate in opinion surveys in exchange for money or reward points. The providers recruit participants through ads posted in online stores and on social media. While the survey companies tap into a large pool of heterogeneous respondents, the resulting samples are, in principle, less representative than samples from probability-based surveys such as the one we used for the main descriptive evidence. However, Online Appendix Table A.4 shows similarity for several core descriptive statistics of our experimental sample compared with full-time employed respondents in the SOEP-IS sample. (Participation in our survey is restricted to respondents that are in full-time employment, not self-employed, and not employed in the public sector.) Online Appendix Table A.4 also shows balanced covariates across treatment and control groups: 2,468 respondents are in our analysis sample, with 1,211 and 1,257 in the treatment and control groups, respectively.

1. *Inattention Screens.* To minimize concerns about inattention, only participants who pass two attention screeners are allowed to participate in our survey. Online Appendix F provides additional details on the sample definition and inclusion criteria. In this survey, about 27% of respondents do not pass the attention check, consistent with the literature on inattention in online surveys (see Peer et al. 2021).

IV.B. Experimental Design

The survey was conducted online. Online Appendix G.4 shows the English translation of the survey. Online Appendix F provides additional details on the experiment. The analysis was preregistered on the AsPredicted registry (https://aspredicted.org/yg8p9.pdf); see Online Appendix F.4. (Our

results reported below exclude a pilot; Online Appendix Table A.3 replicates the results pooling pilot and post-pilot data, which was our prespecified collection plan to maximize statistical power.)

1. *Pretreatment Block.* First, we replicate our SOEP-IS question about outside options (the expected monthly pretax wage if forced to leave one's current job and find a new job within three months). Second, we ask respondents' beliefs about the mean of the pretax wage of full-time workers with similar characteristics (same occupation, gender, age, labor market region, and education). As an incentive, respondents receive a €1 bonus if their estimate is within €100 of the true value (which we calculated based on administrative data, as we discuss below).

2. *Information Treatment.* Next, both groups are shown an additional screen, depicted in Figure VIII. The main feature is a bar chart displaying each respondent's wage and their previously stated belief about similar workers' wages. A short text accompanies these charts and describes their content. These screens are also preceded by a screen reminding the respondent of the list of own characteristics they reported (gender, age, occupation, labor market region, education level). Compared with the control group (Panel A), the treatment group (Panel B) sees an additional bar depicting the actual wages of similar workers. (See Online Appendix F for details on the prediction model based on administrative data that we use to compute the information on actual wages.) To increase engagement with that information treatment and as an intervention check, we ask the treatment group whether and by how much they over- or underestimated the wage of similar workers.

3. *Posttreatment Block.* After the treatment, we again measure beliefs about similar workers' wages to gauge whether the information was internalized. We again ask beliefs about the outside option to check on treatment effects. Finally, we ask both groups about their intended labor market behaviors, as well as a free-form question in which respondents guess our hypothesis (which few respondents appear to do, limiting concerns about experimenter demand effects, see Online Appendix F.1).

(A) Control Group (B) Treatment Group

FIGURE VIII

Experiment: Information Treatment Screen

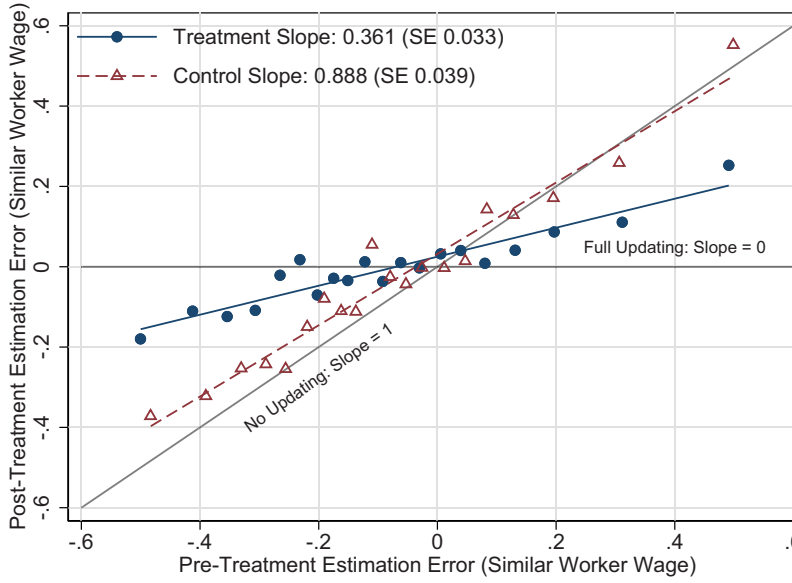
These panels display (a translated version of) the information screen for a hypothetical respondent with the same characteristics in either the control (Panel A) or the treatment group (Panel B). The respondent reports a monthly wage of €3,100 and estimates that other people with their characteristics earn €2,800 a month on average. These screens are preceded by a screen reminding the respondent of the list of characteristics they reported (gender, age, occupation, labor market region, education level, and so on) to explicitly identify the characteristics being held fixed. For the treatment group, the actual average wage is also displayed (see Section IV and Online Appendix F for details on its calculation).

IV.C. Effects on Worker Beliefs

1. *Identification Strategy: Exploiting Heterogeneity in Pretreatment Estimation Error.* Figure IX illustrates the effects of the information treatment on beliefs in binned scatter plots. The x-axis represents the worker-level pretreatment estimation error regarding the wage level of similar workers. This estimation error is calculated as the difference between the respondent's belief about similar workers' wages and the truth, divided by the truth to express this difference in percentage terms.

Throughout the analysis of the experiment, we fix this sorting of individuals along their pretreatment estimation error. The idea is that in response to information, respondents that initially

(A) Intervention Check: Beliefs about Wages of Similar Workers



(B) First Stage: Beliefs about Outside Option

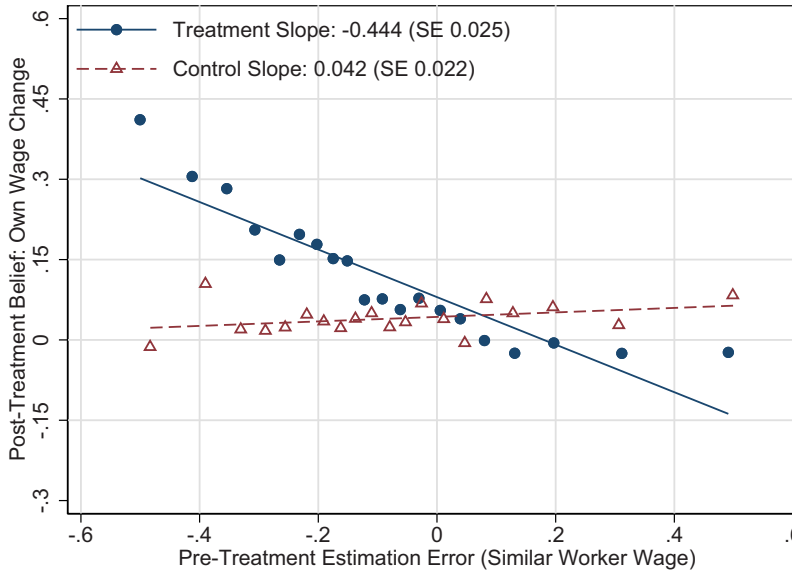


FIGURE IX

Effects of Information Treatment

FIGURE IX

(*Continued*) The figure presents binned scatter plots using data from our 2022 information experiment, in which the treatment group received information in the form of the average wage of workers with similar characteristics from the same labor market (see Section IV for details on its calculation). As an intervention check, Panel A plots the posttreatment estimation error about that wage against the pretreatment one, separately for the treatment and control groups. The estimation error is defined as the percentage difference between beliefs and the actual wage. Panel B plots participants' beliefs about their outside option (wage change) against the pretreatment estimation error.

underestimated the wage of similar workers (have negative errors) should shift their belief about the wage of similar workers upward, compared with workers with initially positive errors. Importantly, these initial underestimators should also increase their belief about their personal outside option, as long as they consider the external wage distribution as informative for themselves. We leverage this variation in an IV setup, instrumenting for beliefs about outside options with a treatment group indicator and its interaction with the continuous pretreatment estimation error. Below, we illustrate the design graphically, focusing on belief updating.

2. *Intervention Check.* We investigate whether treated workers used the information to correct their beliefs about similar workers. We implement this test in Figure IX, Panel A, which plots the posttreatment estimation error on the y-axis against the pretreatment estimation error on the x-axis, separately for the control and treatment groups. For the control group, the binned scatter plot traces out a linear slope of nearly 1 (0.888, std. err. 0.039), implying substantial persistence. By contrast, the treatment group slope shrinks to 0.361 (std. err. 0.033), far below the persistence benchmark from the control group. Posttreatment estimation errors move substantially closer to zero for all bins of pretreatment estimation errors—indicating that treated respondents used the information about the actual wage of similar workers to substantially correct their beliefs about this object.

3. *Updating of Outside Option Beliefs: De-Anchoring.* We now check whether treated respondents used the information about the wages of similar workers to update their belief about their own outside option. This response would be expected if workers do not have accurate beliefs about the external wage distribution and thus anchor their beliefs about their outside

options on their current wage. We formalize this implication in a Bayesian learning model in Online Appendix C. Figure IX, Panel B reports this analysis. As in the intervention check, we sort workers, on the x-axis, by their pretreatment errors regarding the wages of similar workers, but on the y-axis we now plot the posttreatment belief about their own outside option (i.e., the associated wage change).

The scatter plot for the control group again illustrates the benchmark of no updating. A priori, for the control group, there is no natural relationship between misperceptions about similar workers' wages and one's belief about wage changes. In the data, we find an essentially flat relationship (a slope of 0.042, std. err. 0.022).

For the treatment group, we would expect a substantially more negative slope: workers who initially underestimated the wage of similar workers should update positively about the external wage distribution and hence their outside option. Indeed, we document a substantially negative slope, −0.444 (std. err. 0.025), for the treatment group: treated respondents that initially underestimated the wages of similar workers now increase their assessment about their personal outside option, and vice versa for overestimators. This evidence is consistent with respondents not having precise beliefs about the external wage distribution and anchoring their beliefs on their current wage—and updating their belief about their outside option in response to information about the external labor market. This relationship forms the basis of the first stage in our IV regression specification.

4. *Implications.* Our experimental evidence on belief updating has two implications. First, it establishes causal evidence on anchoring: respondents change their beliefs about outside options away from their current wage when exposed to information about the external wage distribution. Therefore, their initial beliefs were imprecise and too close to their current wage.

Second, this finding provides an experimental validation of our measure of beliefs to begin with and helps validate the findings from our descriptive analysis in the SOEP-IS survey in Section II: if one worried that respondents largely report noise as their subjective outside option, one would have expected a zero effect of information on this measure (a similar slope between treatment and control groups). The strong shift induced by information hence rejects at least the most extreme version of this concern.

IV.D. Effects on Intended Labor Market Behavior

We now study the causal effects of shifting worker beliefs on their intended labor market behavior (mirroring those in the correlational analysis): probability to quit, to look for a new job, to ask for a wage raise and its size, and the reservation wage cut required for the respondent to quit the current job.

1. *IV Specification.* An IV regression allows us to estimate the causal effect of the information treatment on labor market behavior through the channel of shifting workers' beliefs. The endogenous variable is workers' beliefs about their outside option. The instrument is the treatment indicator and its interaction with the initial estimation error, exploiting the heterogeneity in the estimation error described above and plotted in Figure IX, Panel B. Formally, we estimate the following model with 2SLS:

$$\begin{aligned}(1\text{: 1st Stage}) \quad OO_i^{\text{Post}} = {} & \beta_0 + \beta_1 \text{EstError}_i^{\text{Pre}} \\ & + \beta_2 \text{Treated}_i + \beta_3 \text{Treated}_i \times \text{EstError}_i^{\text{Pre}} + \epsilon_i\end{aligned}$$

$$(2\text{: 2nd Stage}) \quad Y_i^{\text{Post}} = \delta_0 + \delta_1 \text{EstError}_i^{\text{Pre}} + \delta_2 \widehat{OO}_i^{\text{Post}} + \nu_i.$$

We denote variables by pre- and posttreatment timing. OO_i^{Post} denotes individual i's posttreatment beliefs about outside options. $\text{EstError}_i^{\text{Pre}}$ is the percent estimation error about similar workers' wages. Treated_i is an indicator for the treatment group. The first and the second stage also control for the estimation error.

In the first stage, the coefficient β_3 captures the effect of the information treatment on outside option beliefs as a function of respondents' initial estimation error, corresponding to the difference in the slopes in Figure IX, Panel B. A negative value of β_3 means that initial overestimators updated downward (and vice versa for underestimators). A level shift would be captured by the baseline treatment effect β_2. Our first stage exploits the difference in the estimated linear models plotted in Figure IX, Panel B.

The second stage estimates the effects of outside option beliefs as instrumented by the treatment indicator and its parametric interaction with the estimation error, on intended labor market behavior. The second-stage coefficient δ_2 answers our

question of interest: how much does a percentage point shift in beliefs about a workers' outside option causally shift workers' intended labor market behavior elicited posttreatment, that is, outcome Y_i^{post}?

2. *Recap: Intervention Check.* Table II, column (1) presents the regression estimates corresponding to the intervention check depicted in Figure IX, Panel A, that is, the effect of the treatment on the posttreatment estimation error about beliefs about the wages of similar workers, $\text{EstError}_i^{\text{Post}}$. Although the specification mirrors the first-stage equation (1), it is an intermediate step as it does not yet study the endogenous variable (i.e., beliefs about the outside option). A benchmark of $\beta_3 = -1$ would correspond to an updating of the estimation errors to zero, on average, for each initial error group. We estimate a substantial coefficient of -0.527 (std. err. 0.057). That is, treated workers that initially underestimated the mean wage in their labor market cell by 10 percentage points reduce their estimation error by 5.3 percentage points.

3. *First Stage: Updating about Personal Outside Option.* Table II, column (2) reports the first-stage estimates, equation (1), with posttreatment beliefs about own wage changes, OO_i^{Post}, as the dependent variable. We estimate a β_3 of -0.486 (std. err. 0.039). That is, workers that initially underestimated similar workers' wages by 10 percentage points raise their belief about their own wage change if moving to the outside option by 4.9 percentage points.

4. *IV: Causal Effects on Labor Market Behavior.* Table II, columns (3)–(8) report on the causal effects on labor market behaviors: respondents' expected probability to quit, look for a new job over the next 12 months, ask for a wage raise and its size, and the reservation wage cut for quitting. The top panel reports the reduced-form effects and the bottom panel reports the IV estimates. We focus on the bottom panel, as these effects quantify the changes in intended labor market behaviors due to shifts in beliefs about outside options induced by our information treatment.

To provide a quantitative benchmark for the effect sizes, we report the implied effects for a 10 percentage point increase in beliefs about wages at the outside option. This shift in beliefs would correspond to the belief change associated with a full belief

TABLE II

INFORMATION EXPERIMENT

	Post-treat estimation error (1)	Belief about outside option (wage change) (2)	Intended quit probability (3)	Intended search probability (4)	Intended negotiation probability (5)	Intended neg magnitude (no neg = 0) (6)	Intended neg magnitude (no neg = msg) (7)	Reservation wage cut (8)
Treated × pre-treat estimation error	−0.527***	−0.486***	−0.142***	−0.086	−0.208***	−0.048***	−0.060***	0.000
	(0.057)	(0.039)	(0.052)	(0.053)	(0.059)	(0.009)	(0.009)	(0.016)
Treated	−0.008	0.037***	0.003	0.017	0.007	0.004*	0.004*	−0.003
	(0.014)	(0.008)	(0.013)	(0.013)	(0.015)	(0.002)	(0.002)	(0.004)
Pre-treat estimation error	0.888***	0.042	−0.021	−0.034	0.102**	0.019***	0.019***	0.004
	(0.043)	(0.026)	(0.039)	(0.037)	(0.043)	(0.006)	(0.006)	(0.012)
Constant	0.032***	0.043***	0.230***	0.244***	0.392***	0.057***	0.072***	0.090***
	(0.010)	(0.006)	(0.009)	(0.009)	(0.011)	(0.001)	(0.001)	(0.003)
IV: Endogenous variable:			0.261***	0.217**	0.395***	0.100***	0.117***	−0.012
Belief about outside option (wage change)			(0.087)	(0.088)	(0.103)	(0.015)	(0.015)	(0.024)
Constant			0.215***	0.239***	0.371***	0.053***	0.066***	0.090***
			(0.008)	(0.008)	(0.010)	(0.001)	(0.002)	(0.002)
Control group mean	−0.078	0.040	0.231	0.247	0.385	0.056	0.071	0.090
First-stage F-stat.			150.511	150.511	150.511	150.511	129.722	150.511
N	2,468	2,468	2,468	2,468	2,468	2,468	1,969	2,468

Notes: This table reports results of the information experiment in a 2022 online survey. It reports regressions of each outcome variable on the respondent's pretreatment estimation error about the mean wage of similar workers (in logs), a treatment indicator, and an interaction between the treatment indicator and pretreatment estimation error. We also report IV specifications, using respondents' beliefs about their outside option as the endogenous variable (see Section IV.D for details on the IV specification). In column (1), the outcome is a posttreatment version of the estimation error, that is, beliefs about wages of similar workers. In column (2) the outcome is the respondent's posttreatment belief about the wage change at their outside option. Columns (3)–(8) report results on intended labor market behaviors: probability of quitting, probability of finding another job, probability of negotiating for a raise, the expected magnitude of the raise asked (with no negotiations planned coded as a zero-magnitude raise or as missing), and the reservation wage cut as a percent of their current wage. *** $p < .01$, ** $p < .05$, * $p < .10$.

correction for workers employed at firms at the 24th percentile of the AKM firm effect distribution (Figure VII).

For the quit probability (column (3)), we estimate an IV coefficient of 0.261 (std. err. 0.087), which implies that a 10 percentage point increase in respondents' beliefs about wages at their outside option would cause a 2.6 percentage point increase in their quit probability (or an 11% increase relative to the control group mean of 0.233).

For the probability of job search (column (4)), we estimate a 0.217 (std. err. 0.088) IV effect, comparable to the quit effect. That is, a 10 percentage point increase in beliefs translates into a 2.2 percentage point increase in the job search probability or a 10% increase relative to the control group mean.

Columns (5) through (7) report effects on intended wage negotiations. A 10 percentage point increase in beliefs about wages at the outside option causes a 4.0 percentage point (std. err. 1.0) increase in the probability to negotiate a wage increase, and a 1 to 1.2 percentage point increase in the requested wage increase, depending on whether we count zero negotiation probability observations as asking for a zero wage increase or as missing.

Last, we estimate nonsignificant reduced-form and IV effects close to zero on the reservation wage cut in column (8).

5. *Implications.* First, the additional results on labor market behaviors establish a causal interpretation from beliefs to intended behavior. The correlational evidence in Figure III had left open the possibility of reverse causality or an underlying third factor. Inherently immobile workers may also just not gather information out of rational inattention, may not encounter such information, or underestimate their outside option to reduce cognitive dissonance. Our experimental evidence rules out this view as a complete explanation of our main descriptive evidence on anchoring and misperceptions.

Second, more broadly, our experimental evidence supports a class of models of the labor market in which anchoring and misperceptions about the external wage distribution play a role in the labor market phenomena that motivated our study. In standard models, for example, those building on search costs, workers hold accurate beliefs about the statistical properties of the external wage distribution. In such models, providing information about, say, mean wages in the labor market would hence not affect behavior (or lead to an updating of beliefs). Of

course, our evidence is not inconsistent with an important role of search costs. In Section V, we present a model that features both search costs and anchoring to display their independent effects and their interaction.

Third, the IV estimates of the causal effect of beliefs on intended labor market behavior suggest room for quantitatively significant consequences of the misperceptions we document. For instance, in Figure VII, we documented that workers at the bottom of the firm wage distribution (the 24th percentile of the AKM firm effect distribution) underestimate the wages at their outside option by about 10 percentage points. Our experiment suggests that correcting those misperceptions would cause about a 2.6 percentage point—or 11%—increase in quits out of those firms.

For quantitative intuition, this increase in quits could shrink the size of those low-wage firms significantly, by about 11%. This number is implied by a back-of-the-envelope calculation that draws on a simple wage-posting model in which a firm hires $H(w)$ workers per period and its workers quit at rate $s(w)$ so that steady-state firm size is given by $L(w) = \frac{H(w)}{s(w)}$.

V. Equilibrium Implications of Anchoring: A Simple Model

We propose a simple equilibrium model that organizes the three key facts we have demonstrated and highlights the potential equilibrium consequences of workers' anchored beliefs. First, the model replicates the anchoring patterns documented in Section II as workers (potentially) use their current job as a signal about the competitive wage. Second, in our model, workers' beliefs drive their search behavior and specifically their reservation wage, consistent with the correlational and causal evidence in Sections III.A and IV. Third, the empirical sorting of the most pessimistic workers into low-paying firms (documented in Section III.B) emerges as an equilibrium outcome: workers that stay put in low-wage firms are those that wrongly believe that the external wage is lower than it actually is, a fact that firms exploit in setting wages.

Hence, workers' misperceptions about outside options generate wage dispersion and a departure from the competitive equilibrium. Misperceptions are a monopsony source distinct from the standard frictions existing models draw on to generate

these outcomes, such as idiosyncratic tastes among workers for firm-specific amenities (Card et al. 2018), or search or mobility frictions (Burdett and Mortensen 1998). In those search models, as in all models in the tradition of Stigler (1961), workers have unbiased beliefs about the wage distribution in the external labor market.[12]

V.A. Preview of Assumptions, Mechanisms, and Implications

In our model, firms set wages competing for workers who may misperceive the wage distribution. Specifically, workers form beliefs about their outside option based on the wage at their current employer—generating the kind of anchoring we document in the data. When search is costless, a competitive equilibrium with a single wage emerges, as firms deviating from the competitive wage cannot hire any workers. However, when search is costly for a substantial share of workers, firms can mark down wages, trading off the benefits from lower wages and the cost of losing workers not subject to the search cost. At a high level, our model can therefore be viewed as adapting the Salop and Stiglitz (1977) model of monopolistic competition in product markets (which features two types of consumers with different information acquisition costs) to the labor market (e.g., with standard labor demand and supply curves) and augmenting it to allow for biased beliefs. Crucially, workers' beliefs about the competitive wage (the outside option) determine their reservation wages. This, in turn, governs the wage that deviating firms optimally set, and hence the degree of wage dispersion, wage markdowns, and the size of the low-wage sector. A segmented, or dual, labor market emerges, with a competitive high-wage sector and a low-wage sector in which low-wage firms employ uninformed workers who underestimate their outside option—consistent with the evidence in Section III.B. Misperceptions in the form of anchoring on the current wage act similarly to a search cost in aggravating wage markdowns, wage dispersion, misallocation, and the size of the low-wage sector.

12. Similarly, even a standard rational inattention model taken to the labor market would not generate anchoring as it would assume accurate and precise beliefs about the wage distribution, even though the underlying noisy signals about specific jobs' wages (rather than the overall wage distribution) can generate market power (as in the product market model of Matějka and McKay 2015).

V.B. Setup

1. *Environment.* The timing of our model is as follows. First, N homogeneous firms enter the labor market and decide what wage to post. We take the firm count N as given. Second, L workers are randomly assigned to firms and supply labor inelastically (but may switch firms), learn the wage w_j paid by their initial firm j, and potentially update their beliefs about the external wage distribution. Third, workers choose whether to stay at their current firm, or pay an information acquisition cost c (which differs across otherwise homogeneous workers) to perfectly learn the wages paid by other firms and move to the highest-paying firm, which pays $w^{\max}$. Finally, production occurs and wages are paid.

2. *Workers and Search.* Each of L risk-neutral workers is initially randomly assigned to one of N firms. A worker assigned to firm j observes its wage w_j, and decides whether to search for a new job or stay put in their initial job.

Workers can pay a cost c_τ to gather full information about the labor market. Informed workers can switch to their outside option, in this case to the highest-paying firm. If multiple firms pay the highest wage, searchers distribute themselves equally among them. A share α of workers are experts ($\tau = E$): they can learn about the labor market at no cost, $c_E = 0$. The remaining share $1 - \alpha$ are amateurs ($\tau = A$), facing a positive cost $c_A > 0$.

Experts always become informed and move to the highest-paying firm. Amateurs' information decision depends on their belief about the benefit of searching, that is, the difference between their current wage and their belief about the highest wage, denoted $\widetilde{w}^{\max}(w_j, \boldsymbol{w}_{-j})$. Amateurs search if:

$$\widetilde{w}^{\max}(w_j, \boldsymbol{w}_{-j}) - w_j > c_A. \tag{3}$$

The dependence of $\widetilde{w}^{\max}$ on w_j captures the fact that workers' own wage can influence their belief about other wages on offer in the market (even if amateurs do not accurately perceive that wage), including the anchoring we document (or belief updating more broadly).

3. *Beliefs.* We specify beliefs in a simple form that nests accurate beliefs and misperceptions—in particular, the kind of anchoring that our evidence reveals. (Online Appendix C presents an updating model.) Specifically, a worker at a firm paying wage w_j perceives the highest wage to be a weighted average of the

actual highest wage and the worker's current wage:

$$\widetilde{w}^{\max} = \delta + \gamma \cdot w_j + (1 - \gamma) \cdot w^{\max}. \tag{4}$$

Beliefs are accurate if $\gamma = \delta = 0$. δ is an intercept. $\gamma \in [0, 1]$ captures the degree of anchoring on the current wage. For $\gamma = 0$, beliefs are insensitive to w_j; $\gamma = 1$ implies full anchoring. Expressing beliefs and the outside option (highest wage) relative to the current wage highlights the link to our estimating equation in the research design:[13]

$$\widetilde{w}^{\max} - w_j = \delta + (1 - \gamma) \cdot (w^{\max} - w_j). \tag{5}$$

Our theoretical framework remains qualitative. Below, we consider the case of $\delta = 0$ to isolate the role of anchoring ($\delta = 0$ is quite consistent with our empirical findings).

4. *Firms and Wage Setting.* Firms produce a homogeneous good using a decreasing-returns production function $f(\ell) = \ell(w)^{\eta}$, with decreasing-returns parameter $\eta \in (0, 1]$. A firm's employment $\ell(w_j|\boldsymbol{w}_{-j})$ depends on the wage it pays along with those paid by other firms; the shape of this firm-specific labor supply curve will govern firms' wage setting. Given its own wage w_j and the external wage structure of other firms $\boldsymbol{w}_{-j}$, firm j's profits are

$$\pi(w_j|\boldsymbol{w}_{-j}) = \ell(w_j|\boldsymbol{w}_{-j})^{\eta} - w_j \ell(w_j|\boldsymbol{w}_{-j}). \tag{6}$$

Firm count N is fixed for exposition, so equilibrium profits are positive.

V.C. Competitive (Single-Wage) Equilibrium

Expert workers, who become informed at no cost, support a competitive equilibrium. Intuitively, if their share is $\alpha = 1$, the model follows the standard competitive equilibrium logic: aggregate labor supply is inelastic, and labor demand is downward sloping (with fixed N given $\eta < 1$). The competitive wage w^* then clears the market subject to the standard profit-maximizing condition that the marginal product of labor equal the wage:

$$\eta(\ell^*)^{\eta - 1} = w^*. \tag{7}$$

13. Our empirical specification (in percent) would simply set δ in percent of the current wage. Thus, estimating our empirical model in this setting recovers a regression coefficient that identifies $1 - \gamma$ in the sample of amateurs in an equilibrium where they do not become informed; a pooled regression across types will require scaling up the resulting coefficient by $\frac{1}{1-\alpha}$ to recover γ.

Moreover, labor market clearing pins down equilibrium firm size ℓ^* (with labor optimally spread equally across the N homogeneous, decreasing-returns firms):

$$N \cdot \ell^* = L \Leftrightarrow \ell^* = \frac{L}{N}. \tag{8}$$

V.D. Conditions for Competitive Equilibrium

A competitive equilibrium obtains if and only if no individual firm wants to deviate from paying the competitive wage w^*. Deviating to a higher wage $w' > w^*$ is surely unprofitable. This leaves $w' < w^*$ as the only feasible strategy. By offering a lower wage, a deviant firm immediately loses its expert workers. If its amateur workers also search, employment and profits fall to zero. Hence, a profitable deviation requires a wage below w^* but high enough to retain a firm's stock of amateur workers (we assume that indifferent amateurs stay put). The most profitable deviation is therefore to exactly pay the amateur's reservation wage to not become informed, $w^r(w_j, \boldsymbol{w}_{-j}, c_A)$, which is defined by condition (3) holding with equality. Using $w' = w^r(w', \boldsymbol{w}^*, c_A)$, the specification of worker beliefs in equation (5) and maintaining $\delta = 0$ gives:

$$w' = w^* - \frac{c_A}{1-\gamma}. \tag{9}$$

For intuition, consider $\gamma = 0$, accurate beliefs. Here, the deviant's wage pushes the amateur to their reservation wage, determined by search cost c_A. Now consider the role of anchored beliefs, $\gamma > 0$. The search cost c_A again enables the deviant to mark down the wage while retaining amateur workers. However, anchoring implies that workers facing a marked-down wage become endogenously more pessimistic about the benefits of search. This further depresses workers' reservation wage, as reflected in equation (9).

Deviants' profits also depend on scale, given by their amateur employment only:

$$\ell(w') = (1-\alpha)\frac{L}{N}. \tag{10}$$

Given the deviants' scale and optimal wage in equations (9) and (10), their profit is:

$$\pi(w') = \left((1-\alpha)\frac{L}{N}\right)^{\eta} - \left(w^* - \frac{c_A}{1-\gamma}\right)(1-\alpha)\frac{L}{N}. \tag{11}$$

The competitive equilibrium obtains when deviation is unprofitable, that is, when employing ℓ^* workers at wage w^* yields higher profits than the best deviation $\pi(w')$:

$$\left(\frac{L}{N}\right)^{\eta} - \eta\left(\frac{L}{N}\right)^{\eta} > \left((1-\alpha)\frac{L}{N}\right)^{\eta} - \left(\eta\left(\frac{L}{N}\right)^{\eta-1} - \frac{c_A}{1-\gamma}\right)(1-\alpha)\frac{L}{N} \tag{12}$$

$$\Leftrightarrow \frac{c_A}{1-\gamma} < \frac{1-\alpha\eta-(1-\alpha)^{\eta}}{1-\alpha}\left(\frac{N}{L}\right)^{1-\eta}. \tag{13}$$

V.E. Segmented (Two-Wage) Equilibrium

When search costs c_A or the degree of anchoring γ are sufficiently large to violate condition (13) (holding the amateur share fixed), a two-wage, or segmented, labor market equilibrium emerges. As condition (13) is violated, some firms find it profitable to deviate to a low wage w_l. As more firms deviate, more experts flock to the remaining high-wage firms. The equilibrium share of high-wage firms, denoted β, requires equal profits in both sectors. (Because there are only two types of workers, there can be no alternative noncompetitive equilibria with more than two wages. A firm paying any wage $w \in (w_l, w_h)$ would employ the same number of workers as if paying w_l but earn lower profits. Paying more than w_h means lower profits than paying w_h, which, we explain below, equals the MPL at high-wage firms.)

1. *Firm Size and Turnover by Wage.* Low-wage firms lose their expert workers (who costlessly move to high-wage firms), but retain their amateurs. High-wage firms employ their original amateurs and all experts (those initially placed in the high-wage firm plus those separating from the low-wage firms, spread equally across the high-wage firms). Hence, the equilibrium employment levels for low- and high-wage firms are:

$$\ell_l = (1-\alpha)\frac{L}{N} \qquad \ell_h = \left(1-\alpha+\frac{\alpha}{\beta}\right)\frac{L}{N}. \tag{14}$$

That is, the model features more turnover in the low-wage sector, consistent with evidence that workers in low-paying industries or firms search and quit more (Krueger and Summers 1988; Bassier, Dube, and Naidu 2022; Faberman et al. 2022; Drenik et al. 2023).

2. *The Wage in the High-Wage Sector.* Within the high-wage sector, a sectoral competitive equilibrium emerges: the sector's wage w_h equals the MPL at employment ℓ_h. The reason is that high-wage firms' marginal labor unit is an informed, expert worker, with costless search. Hence, the high wage, given firm-level employment from equation (14), is

$$w_h = \eta \left(\left(1 - \alpha + \frac{\alpha}{\beta} \right) \frac{L}{N} \right)^{\eta - 1}. \tag{15}$$

The more firms are in the low-wage sector (i.e., the lower β), the more experts separate from that sector, search, and get spread across the β high-wage firms, pushing down their marginal product and hence the wage they pay, w_h.

3. *The Wage in the Low-Wage Sector.* By contrast, non-competitive forces shape the low-wage sector. Here, as in the discussion of deviation from the competitive equilibrium above, firms simply pay the reservation wage that fulfills workers' participation constraints (now against a maximum wage of w_h rather than w^*):

$$w_l = w_h - \frac{c_A}{1 - \gamma}. \tag{16}$$

Plugging in the high wage w_h from equation (15) gives the level of the low wage.

4. *The Size of the Low-Wage Sector.* The equilibrium conditions remain conditional on the share of high-wage firms, β. We pin down β through an indifference condition: the marginal firm—due to ex ante homogeneity, each individual firm—must be indifferent between entering as a low- or as a high-wage firm, trading off wage savings against loss in scale. Intuitively, β governs the relative profitability of high-wage firms by affecting the number of searching workers that each high-wage firm stands to gain from the low-wage sector. The more firms enter the low-wage sector, the more (expert) workers flow into the high-wage sector, scaling up production at each high-wage firm, and raising profits there.[14] With β in hand from the equal-profit condition, the share

14. Concretely, profits in the low-wage and high-wage sectors are $\pi(w_l) = ((1-\alpha)\frac{L}{N})^{\eta} - w_l(1-\alpha)\frac{L}{N}$ and $\pi(w_h) = ((1-\alpha+\frac{\alpha}{\beta})\frac{L}{N})^{\eta} - w_h(1-\alpha+\frac{\alpha}{\beta})\frac{L}{N}$. Profit equalization, $\pi(w_l) = \pi(w_h)$, then implies $1 - \eta = (\frac{1-\alpha}{1-\alpha+\frac{\alpha}{\beta}})^{\eta}[\frac{c_A(1-\alpha)^{1-\eta}}{1-\gamma}(\frac{L}{N})^{1-\eta} +$

of jobs (rather than firms) in the low-wage sector is given by:

$$S_l = \frac{(1-\beta)\ell_l}{\beta \ell_h} = \frac{1-\beta}{\frac{\alpha}{1-\alpha}+\beta}. \tag{17}$$

V.F. Misperceptions in the Low-Wage Sector and Monopsony

Figure X illustrates the role of anchoring in amplifying labor market segmentation. It plots the share of workers in the low-wage sector as well as the wages paid in each sector as a function of the degree of anchoring, γ. For low γ, the competitive labor market equilibrium obtains. Here, misperceptions are irrelevant: the competitive equilibrium is sustained by the subset of expert workers, who are informed and discipline firms' ability to take advantage of amateurs. However, the higher γ, the larger the temptation to deviate and rip off amateur workers with a lower wage, as their reservation wage falls in γ.

There exists a threshold level γ^* above which the equilibrium becomes segmented, for a given set of other parameters η, c_A, and α, defined in the profitable-deviation condition (13). For higher values of γ, a two-wage, segmented equilibrium emerges. The share of workers in the low-wage sector becomes positive. As γ rises, more firms choose to pay a low wage (β falls) and each high-wage firm gains a larger number of experts exiting the low-wage sector as a result. The high wage then falls to match the declining marginal product of labor. The low wage declines more rapidly, however, with the gap between the high and low wage increasing in γ according to equation (16).

V.G. The Interaction of Standard Frictions and Misperceptions

The left-hand side of condition (13) clarifies an important interaction between search costs c_A and misperceptions γ in generating labor market segmentation and monopsony: misperceptions require some search costs (otherwise no worker stays put and misinformed), and search costs are amplified by misperceptions (which facilitate firms' gouging of immobile workers). Illustrating this interaction, Online Appendix Figure B.8 replicates Figure X but as a function of amateurs' search cost c_A, for

1] $- \eta(\frac{1-\alpha}{1-\alpha+\frac{\alpha}{\beta}})$, which implicitly gives β as a function of model parameters. In fact, this equation has a solution whenever condition (13) is violated (that is, a competitive single-wage equilibrium cannot obtain).

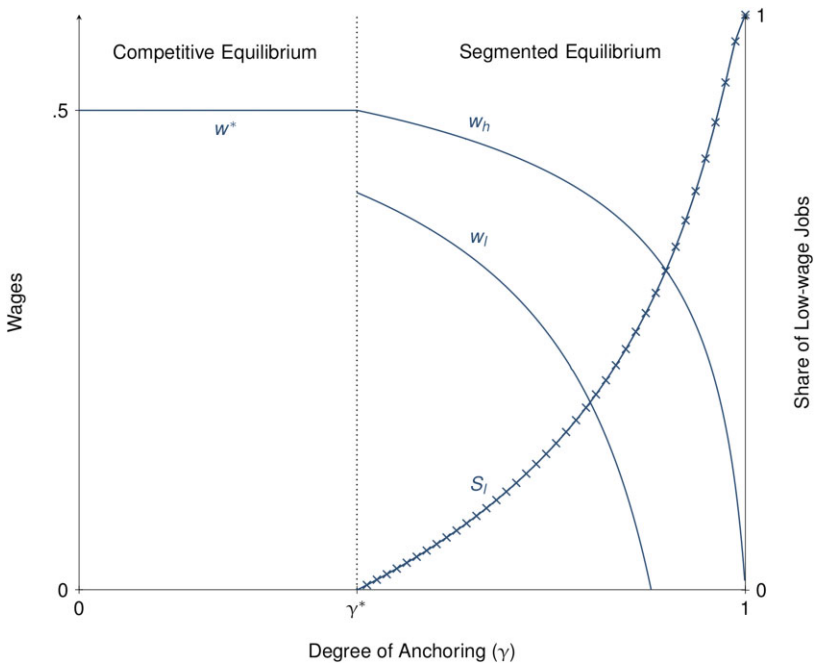


FIGURE X

Equilibrium Implications of Anchoring

The figure plots equilibrium wages and the share of low-wage jobs as a function of the degree of anchoring (i.e., the weight workers put on their current wage when forming beliefs about their outside option). The dotted vertical line marks the cutoff value of anchoring that induces a switch from a competitive to a segmented labor market, with a high- and low-wage sector. The other parameters are set as follows: search cost $c_A = 0.05$, decreasing returns $\eta = \frac{1}{2}$, share of amateur workers $\alpha = \frac{1}{2}$, and the number of workers per firm $\frac{L}{N} = 1$. See Online Appendix Figure B.8 for the analogous figure illustrating the effects of information costs on equilibrium outcomes, with or without anchoring.

two economies: a no-anchoring economy ($\gamma = 0$) and an anchored one ($\gamma = 0.9$). In both cases, there is a cutoff level of c_A for segmentation given by condition (13). However, this cutoff falls dramatically, by 90%, for $\gamma = 0.9$ rather than $\gamma = 0$. Hence, in our model economy, an economist ignoring anchoring and estimating a model with standard search/information costs c only, would dramatically overestimate the level of c_A required to explain the amount of wage dispersion.

VI. Conclusion

We have measured workers' beliefs about wages at their outside options and compared them with proxies for their objective outside options. Workers believe that wages at their outside option are much closer to their current wage than they actually are. These beliefs, in turn, are correlated with intended labor market behaviors, even after controlling for proxies of actual outside options. Objectively low-paying firms employ workers who systematically underestimate their outside options. To causally examine the role of information frictions, we conduct an experiment in which we inform some respondents about the average wage of similar workers. Treated workers use the information not only to correct their beliefs about the wages of similar workers, but also to revise their beliefs about their own outside options. This updating of beliefs leads them to adjust their job search and wage negotiation intentions. Using an equilibrium model, we show that such anchoring of beliefs about outside options can give employers monopsony power and lead to labor market segmentation with a high- and a low-wage sector.

Our findings suggest anchoring and misperceptions about the wage distribution as a source of labor market imperfections. Although such a misperception-based friction may result in similar phenomena (such as finitely elastic labor supply curves) as conventional frictions, it has distinctive predictions. For instance, in standard models with amenity differentiation or search frictions, workers are assumed to have perfect information about the wage distribution, their position therein, and hence their outside options; in those models, giving workers accurate information about the statistical properties of the wage distribution would change neither beliefs nor behavior. Both predictions are rejected by our evidence. While our article seeks to establish its distinct role, it leaves a quantification of the relative contribution of anchoring to labor market imperfections, besides and in tandem with conventional sources such as search costs or preference heterogeneity for specific employers, to future research.

The presence of misperceptions also gives rise to distinct policy remedies, such as pay transparency mandates. Consistent with our findings, a growing body of evidence suggests that increases in between-firm pay transparency can redirect worker flows to higher-wage employers (Cullen 2023). Besides pay transparency mandates, other labor market institutions (e.g.,

minimum wages or sectoral bargaining) may also reduce misperceptions. Our experimental evidence suggests that providing wage information about fine-grained labor market cells could serve as a promising tool to debias workers' beliefs about outside options.

Why might the biases we document persist? On the worker side, perhaps privacy norms keep workers from sharing their wage information (Cullen and Perez-Truglia 2023). On the employer side, firms may avoid advertising high entry wages (e.g., in the presence of fairness concerns between colleagues; Dube, Giuliano, and Leonard 2019) to avoid antagonizing some incumbent workers or generating wage pressure. Ellison and Wolitzky (2012) describe a model in which oligopsonistic firms may have an incentive to obfuscate their prices (in our case, wages). Relatedly, a large literature in behavioral industrial organization documents and analyzes the consequences of consumers persistently misperceiving prices and often failing to choose the best option (see Ellison 2006; Grubb 2015; Heidhues and Kőszegi 2018, for overviews). Our evidence for similar patterns among workers choosing between firms raises the possibility that broader lessons from behavioral industrial organization may carry over to labor markets and highlights the importance of work investigating the extent to which firms may exploit workers' biases or may themselves be subject to imperfect information (Cullen, Li, and Perez-Truglia 2023).

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SUPPLEMENTARY MATERIAL

An Online Appendix for this article can be found at *The Quarterly Journal of Economics* online.

DATA AVAILABILITY

The code underlying this article is available in the Harvard Dataverse, https://doi.org/10.7910/DVN/DCSR0N (Jäger et al. 2024).

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