

Worker Beliefs About Outside Options*

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Abstract

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.

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1 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).¹

In this paper, 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.² Our main benchmark draws on realized wage changes of respondents' coworkers who involuntary left their firm.³ 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 to isolate factors common to a firm's workforce. Our benchmark specification uses an Empirical Bayes shrinkage procedure of coworker wage changes, and we also provide robustness checks with split-sample IV measurement error correction. As a complement to the coworker-based benchmark, we employ a machine-learning prediction trained on

¹Robinson (1933), p.296, describes the sources of frictions in the labor market as follows: “There may be a certain number of workers in the immediate neighbourhood and to attract those from further afield it may be necessary to pay a wage equal to what they can earn near home plus their fares to and fro; or there may be workers attached to the firm by preference or custom and to attract others it may be necessary to pay a higher wage. *Or ignorance may prevent workers from moving from one to another in response to differences in the wages offered by the different firms.*”

²Identifying workers' outside options is notoriously challenging. See Lachowska (2016); Caldwell and Harmon (2019); Caldwell and Danieli (2022); Jäger et al. (2020); Schubert, Stansbury, and Taska (2023); Di Addario et al. (2022) for recent research on the impact of outside options on wages.

³The coworker-based benchmark builds on the evidence for substantial between-firm wage differentials (see, e.g., 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; Schmieder, von Wachter, and Heining, 2022; Lachowska, Mas, and Woodbury, 2020).

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 0.091 (SE 0.045) between predicted own wage changes and actual coworker wage changes. Similarly, we find slopes around 0.1 with the machine learning benchmark, and 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 not responsive to actual outside options. In line with anchoring of beliefs about outside options, we also 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 workers in low-wage firms that would, if given correct information, be more likely to 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 19th percentile of the firm AKM effect distribution, underestimate their outside option by about 10ppt. 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 their beliefs about their own outside options. We then document that this updating of beliefs causes them to adjust their job search and wage negotiation intentions. A 10ppt increase in beliefs about the wage at the outside option raises the probability of quitting the current job by 2.5ppt (SE 0.87). This estimate suggests that correcting the misperceptions of workers at the 19th percentile of the AKM firm effect distribution would cause about 2.5ppt—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 of current employers to form beliefs about outside options—and to decide whether to search.⁴ 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 when correcting their beliefs. Our simple model leaves for future work a quantitative decomposition into the misperceptions-based and standard sources.

Several pieces of evidence in the literature on worker beliefs are consistent with imper-

⁴This model is in the spirit of the product market model of Salop and Stiglitz (1977), which we adapt to the labor market and enrich with the possibility of biased beliefs about the external wage distribution in the form of anchoring.

fect knowledge about outside options and anchoring on current wages. First, unemployed job seekers anchor their reservation wages on their own pre-job-loss wage (Feldstein and Poterba, 1984; Krueger and Mueller, 2016; Le Barbanchon, Rathelot, and Roulet, 2019; Koenig, Manning, and Petrongolo, 2022), and update their expectations about job offers when receiving offers (Conlon et al., 2018).⁵ Second, workers appear to be imperfectly informed about the wage distribution within their own firm (Card et al., 2012; Cullen and Perez-Truglia, 2022, 2020; 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" (p. 84). Relative to the existing literature, our main contributions lie in directly measuring beliefs about outside options, in comparing these beliefs with objective benchmarks to document anchoring, in demonstrating that information about the external wage distribution changes workers' labor market beliefs and intended behavior, and in theoretically and empirically exploring equilibrium implications of anchoring.

Section 2 compares beliefs about outside options to objective benchmarks and documents anchoring. Section 3 provides correlational evidence on the labor market consequences of anchoring. Section 4 presents the information experiment. Section 5 sketches a simple equilibrium model with anchoring. Section 6 concludes.

2 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. We find that workers appear to anchor their beliefs about their outside option on their current jobs' wages, potentially using it as a signal about the external labor market. We document the associated misperceptions for a variety of measures.

⁵There is evidence that unemployed workers hold wrong beliefs about the duration of unemployment and update them insufficiently (Spinnewijn, 2015; Mueller, Spinnewijn, and Topa, 2021). See also Skandalis (2018); Altmann et al. (2018); Belot, Kircher, and Muller (2019); DellaVigna et al. (2017, 2022) and Abebe et al. (2021) for evidence on the role of beliefs and information among unemployed job seekers, and Mueller and Spinnewijn (2023) for a survey of the literature.

2.1 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 non-wage 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 paper, 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 1 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. It also plots several potential relationships between subjective and objective wage changes.

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

Over- or Under-Estimation Deviations from the accuracy benchmark can take two forms. Observations above the 45-degree line correspond to *overestimation*, i.e., 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, we would expect our observations to trace out a line parallel-shifted down from the full accuracy benchmark, sharing a slope of one.

Anchoring We highlight a specific violation of the benchmark of accurate beliefs that we dub *anchoring*: workers believe their outside option pays a wage closer to their current wage than it actually does, i.e., they *anchor* their belief about their outside option on the wage they receive at their current firm. Anchoring would manifest itself as a rotation of

the perfect accuracy benchmark around the origin, with slopes closer to zero indicating stronger anchoring.

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 rise 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. 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. Here, the model predicts a slope weakly below one, given by the relative (subjective) precision of the signal about the mean wage (the current wage) and of 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 or their colleagues' wage) without accounting for selection in what they observe (Enke, 2020; Frick, Iijima, and Ishii, 2022). Third, anchoring could also reflect sorting, e.g., of underestimators into low-wage firms.

2.2 Data: The German Socio-Economic Panel (SOEP) Merged to Matched Employer-Employee Data (IAB)

We first describe the German Socio-Economic Panel, including the questionnaire we integrated. We then describe the merge with administrative matched employer-employee data.

SOEP Innovation Sample To elicit beliefs about outside options and the wage distribution, we included a custom survey in the Innovation Sample of the German Socio-Economic Panel (SOEP-IS) in 2019 and 2020 (although our main analyses will 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, and 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 (and 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 non-response rates. Our module took on average 5 minutes. The full questionnaire is in Appendix G.1 (English translation) and Appendix G.2 (original German version).

Administrative Data on Objective Outside Option To construct objective benchmarks for workers' outside options, we rely on administrative matched employer-employee data. Our paper 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 (see Ruf et al., 2021, for an overview of the administrative data). 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.

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 1 describes the main analysis sample.

2.3 Beliefs about Outside Options

We first describe our strategy to elicit workers' beliefs about wage changes if forced to move to their outside options, and then our objective benchmarks.

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 3 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?

For respondents who did not choose "Same pay," we elicited the size of the expected increase/decrease.⁶ We then construct the percent wage change by dividing this wage change in EUR by the respondent's current wage.⁷

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).

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, Appendix Figure A.3 illustrates that there is significant within-respondent persistence in belief about their outside option, both in the short run within a survey (a slope of 0.982 (SE 0.018)) as well as in the medium run (across one year, using repeat respondents across the SOEP waves, with a slope of 0.290 (SE 0.028)).⁸ 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

⁶The brackets (in EUR) our respondents could choose from are given as follows: [0-50; 50-100; 100-200; 200-300; 300-400; 400-500; 500-750; 750-1000; 1000-1500; 1500-2000; 2000-3000; >3000]. We define the wage change in EUR that the respondent expects to experience at her outside option as the mid-point of each bracket (e.g., 25 for the [0-50] bracket) and 3500 for the >3000 bracket.

⁷Since our benchmarks will be based on log differences, we construct the log difference as the belief about the outside option wage level in logs (own wage plus wage change) minus the log of the own wage.

⁸The short-run statistic comes from an additional survey we present in Section 4 as part of the information experiment, and draws on the control group observations.

beliefs variables strongly correlate with questions on intended labor market behavior in the expected direction (see Section 3.1 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 Appendix E.1 for a detailed exposition of these robustness tests).⁹

Summary Statistics Figure 2 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% (-0.4%). The distribution is symmetric around zero, with a large mass at or close to zero. The 10th (90th) percentile is -14.5% (13.0%).

Beliefs About the Wage Distribution In addition to this measure of beliefs about outside options, we collected additional 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 2.7 when drawing on them.

2.4 Benchmark: Involuntary Moves of Coworkers

Specifying and quantifying workers’ outside options is notoriously challenging. We use plausible empirical proxies, and show robustness to several alternative measures of actual outside options.

Our first benchmark exploits systematic differences across firms in pay premia common to all workers (Abowd, Kramarz, and Margolis, 1999; Card, Mas, Moretti, and Saez, 2012). These wage differences may reflect amenities, firm size, rent sharing or other sources. For

⁹The different wordings we included in the robustness online survey were: eliciting the wage level at outside option rather than change relative to current wage; omitting the “same pay” category as a response option and forcing 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.

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. Since this benchmark does not perfectly predict wage changes, which also have idiosyncratic components, this particular test can be viewed as whether workers are aware of variation in outside options that is explained by their current employer and common to all workers.

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 specifically draw on plant closings): coworker moves to another employer that involve an intervening unemployment spell (see 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.

As not all involuntary moves involve unemployment, we expect this benchmark to be more negative, on average, compared to the population of all transitions.¹⁰ Our sample of worker moves spans the years from 2015 to 2019, the five years preceding and including the survey.¹¹ In a robustness check, we will 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

¹⁰We find an average percent wage change of 2% (approximated in terms of log differences) for the sample of involuntary moves and of 8% for all job transitions. This benchmark is, on average, slightly more positive than typical wage changes associated with job displacement in Germany (see, e.g., Schmieder, von Wachter, and Heining, 2022). Four potential sources are (i) the job displacement literature focuses on larger establishments with higher firm effects (Gathmann, Helm, and Schönberg, 2020) that would be associated with more negative wage changes (Schmieder, von Wachter, and Heining, 2022), whereas our sample includes smaller establishments too, (ii) the German labor market was very tight in the time period up to and including 2019, plausibly associated with smaller displacement effects (Schmieder, von Wachter, and Heining, 2022), (iii) our sample restriction to full-time to full-time moves, (iv) the job displacement literature typically focuses on high-tenured workers whereas our sample includes workers regardless of tenure.

¹¹We construct moves at the annual level, assigning each individual a main employer every year as in the AKM literature (as in Card et al., 2012).

from the time of the survey.

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 coworkers moves. As a complement to the EB approach, we apply a split-sample instrumental variables (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.¹²

Validation of 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 changes of involuntary movers out of that previous workplace in the 5 years preceding the SOEP respondent’s exit. Appendix Figure A.4 Panels (a) and (b) report a tightly estimated slope of about one, indicating that, at least in respondent’s past, wage changes of coworkers are highly predictive of the respondent’s own wage change. Second, Appendix Figure A.5 presents the first-stage relevant to the split-sample IV strategy, showing a slope coefficient of 0.441 (SE 0.121). 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.

Results Figure 3 Panel (a) is the empirical analog of the research design we plotted in Figure 1 and described in Section 2.1. The y-axis remains the same, that is respondents’

¹²Robustness checks with stricter or looser cutoffs yield similar results; the first stage loses strength with only two coworker moves.

belief about the wage change at their outside option, but the x-axis is now the actual wage changes of plausibly involuntary coworker movers. The binned scatterplot in Figure 3 Panel (a) presents both EB-shrunk observations (blue solid circles) and the unadjusted data points (yellow hollow triangles). To quantify the degree of anchoring, we estimate a linear regression slope. The EB-corrected slope is 0.091 (SE 0.045), that is, worker beliefs about their wage change when forced to leave are, on average, only 0.91ppt 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 1 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 0.023 (SE 0.013). This attenuated slope reflects spurious variation in the benchmark that would not carry over to the respondent, e.g., due to outliers or few observations among coworkers, issues the EB correction addresses. Finally, as a complement to the EB procedure, we also report the split-sample IV estimate, which yields a slope of 0.049 (SE 0.051). The slope is significantly different from one and the confidence interval includes the 0.091 slope estimate from our EB procedure.

2.5 Benchmark: Machine Learning Prediction

As an alternative benchmark, in Panel (b) of Figure 3 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 based on 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 2.3.

Methodology In our overall sample of involuntary (EUE) movers in the administrative data (omitting SOEP respondents), we estimate a Lasso model where the dependent variable is the log wage change of the mover. As predictors, we use individual- and firm-level covariates and their interactions.¹³ 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

¹³The 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 (1-digit), and interactions of age \times education and industry \times region.

gender, occupation, industry, and age \times education. The model based on a random training sample explains 40% of the variance in log wage changes in the remaining evaluation sample. Appendix D presents the full results of the prediction model, including out-of-sample performance and the partial R^2 values of selected covariates.

Results Panel (b) of Figure 3 reports results using this benchmark. We find quantitatively similar results to those using the wage changes of involuntary coworker movers, with a slope of 0.096 (SE 0.021).

2.6 Robustness Checks

Robustness to Different Benchmarks We implement a number of robustness checks, all summarized in Figure 4. First, this figure displays the slope coefficients from the main specification (Panel (a) of Figure 3) to provide a reference. Second, it shows a very similar slope coefficient when using all movers instead of only EU moves. Besides showing robustness to a broader mover definition, this specification serves as a bridge to subsequent robustness checks that rely on this population for sample size reasons to consider coworkers with similar observables. Third, it reports robustness to calculating mover wage changes using the median rather than the mean, or over a shorter horizon (2017 to 2019). Fourth, it reports analogous results if constructing the benchmark using all coworker moves (rather than restricting to plausibly involuntary, EU moves). Fifth, results are also robust to requiring at least 20 such coworker moves. Sixth, we restrict the sample of coworker movers to those that are similar to the SOEP respondent: within the same occupation, earnings quintile, age band, or education band. Some slopes are meaningfully higher (up to about 0.260 for similar income movers), but still far and statistically different from one. However, for those more granular cuts, the coworker-based design hits its limits, as we shrink the sample of movers to construct the benchmark; as a result, confidence intervals widen substantially. Seventh, Figure 4 reports robustness to dropping respondents selecting the “same wage” (zero wage change) option, suggesting that the qualitative-quantitative elicitation sequence does not drive the results and that rounding to zero does not explain the low slope. Finally, Figure 4 also shows that the slope for the ML benchmark remains virtually identical (0.102 (SE 0.023)) if trained only on the most recent EU wage changes from 2018-2019 instead of 2015-2019.

Robustness Survey Appendix Figure A.10 explores robustness to alternative question wording as elicited in a robustness survey fielded with a convenience sample. This survey data is not linked to administrative data, so we cannot check for biases; instead we compare the distribution of responses across different question wording. The robustness check is motivated by the literature documenting that the framing of questions can play an important role in shaping stated beliefs (Stantcheva, 2022; Haaland, Roth, and Wohlfart, 2023). In this survey, we randomly assigned respondents to either the original wording from our main survey or an alternative elicitation. Specifically, we elicited beliefs about the level of wages at the outside option using an open-ended question, we omitted the “same pay” category for the question about coworker beliefs, increased the search horizon to 12 months, specified an unexpected company closure as the context, and specified that the respondent does not have to search within their current occupation. Some of the alternative wordings, especially the omission of the “same pay” option, result in less compressed distributions of beliefs about outside options. Yet, all alternative wordings replicate our qualitative finding of median beliefs being close to zero, and strong clustering around zero subjective wage change. Moreover, most of the alternative wordings have virtually no effect. Moreover, in Appendix Figure A.10, we also show that a 5 EUR prediction incentive barely affect beliefs about the median pay in the occupation (for which we had an objective non-confidential benchmark).

2.7 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 our identification strategy.

As a first step to address such concerns, we also 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 4, we will further probe the anchoring interpretation in an information experiment.

Coworker Wage Changes First, we ask SOEP respondents about the wage changes experienced by typical coworkers moving out of their firm.¹⁴ For this belief, we can directly calculate 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 5 years—our previous outside option proxy, but looking at all moves instead of just involuntary ones. Figure 5 reports the same specification as Figure 3 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 graph) underestimate wage increases among movers (and vice versa). The empirical-Bayes-corrected slope is 0.125 (SE 0.047), a substantial departure from 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.

Rank Within Occupation We now draw on a question about workers’ subjective wage rank within their occupation, and compare this belief to their objective rank.¹⁵ The histogram in Figure 6 Panel (a) reports the distribution of respondents’ beliefs (blue solid bars) and the empirical objective benchmark (light red 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: 56% of respondents see themselves between the 40th and 60th percentiles. In the data, only 21% of workers actually rank in that interval. In the tails, only about 5% of workers believe that they rank in the top or bottom decile, rather than 17.9% in actuality.

To highlight anchoring, Panel (b) of Figure 6 provides a scatterplot of workers’ subjec-

¹⁴Specifically, we ask: “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 employer?” We then give respondents not answering “same pay” specific bins of average wage changes as before.

¹⁵The 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 6 hours per work day.

tive wage rank within their occupation against their objective rank. Rather than a slope of 1 that would be consistent with full accuracy, we find a slope of 0.159 (SE 0.033). That is, an increase in workers' actual wage rank by ten percentile ranks is accompanied by less than a two percentile increase in their perceived rank.

Median Wage in Occupation Finally, we elicit beliefs about the median wage (monthly salary) in a worker's occupation.¹⁶ Again, workers appear to anchor their beliefs about the median wage in their occupation on their current wage. In Appendix Figure A.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 (SE 0.042); that is, workers for whom the median is 10% higher than their current wage think that the median is in fact 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 worker's idiosyncratic outside options at other employers.

3 Labor Market 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 non-wage amenities: workers in low-wage jobs might be overly pessimistic about the external labor market, search less because of those misperceptions, and hence stay put in those jobs. In this section, we provide correlational evidence consistent with these two implications for respondents' intended labor market behavior and beliefs. We will probe the causality from anchoring to behavior in a follow-up information experiment in Section 4. We also formalize these

¹⁶The 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 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 corresponds to median monthly salaries for five-digit occupations (*KldB 2010*).

mechanisms in a simple labor market equilibrium model in Section 5.

3.1 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. Hence, a worker in a low-wage job that, due to anchoring, wrongly believes outside options to pay similarly to their current job are no more likely to search than a worker with similar outside options but accurate beliefs.

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. Additionally, 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 7 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 7 Panel (a) shows that a 10ppt increase in the belief of the wage change if moving to the outside option is associated with a 5.0ppt (SE 1.5) 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 7 as a control variable; Appendix Figure A.8 replicates the entire figure while instead controlling for the machine learning benchmark.

We find similar patterns for the other variables. Panels (b) through (d) of Figure 7 document a corresponding 2.8ppt (SE 0.6) decrease in the reservation wage cut to quit, a 7.4ppt (SE 2.0) increase in the probability to ask for a raise, and a 2.0ppt (SE 0.4) higher ask in such a negotiation, all for a 10ppt shift in the beliefs variable.

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 (but their misperceptions are not allocative in this scenario). In contrast to this view, Appendix Figure A.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.

3.2 Overly Pessimistic Workers Work in Low-Wage Jobs

We now 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.

Definition of High and Low Wage Firms: Firm AKM Effects To classify firms, we draw on Abowd, Kramarz, and Margolis (1999) (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, 2022).¹⁷

Results Figure 8 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 -0.477 (SE 0.100) between AKM effects and objective outside options, workers’ beliefs trace out a much

¹⁷We think of a firm’s AKM effect as a measure of its overall wage premium, while “average coworker wage changes” are a measure of an individual worker’s outside option. There are several differences between the two. First, AKM effects need not be representative of outside options (e.g., if most worker moves are between firms with a similar wage premium). Second, AKM effects are calculated from both *entries* and *exits* (while only exit-induced wage changes are relevant for a worker’s outside option). Third, our measure of coworker wage changes restricts to *involuntary* moves to proxy for outside options. Due to data availability reasons, the AKM effects were calculated for the period from 2010 to 2017. While our survey refers to 2019, we expect little attenuation due to the high persistence of firm effects (Lachowska et al., 2023).

flatter slope of -0.142 (SE 0.031). That is, objective outside options vary a lot across the AKM distribution, but beliefs remain relatively constant. Panel (b) of Figure 8 shows analogous patterns for beliefs about coworker wage changes.

Figure 8 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, while workers at high-wage firms hold more accurate beliefs.¹⁸ 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 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.

4 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 towards the benchmark. Second, the observed shift in beliefs provides an additional validation exercise both 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.

Information Treatment in SOEP-IS This online experiment refines a simple information treatment we had included in the 2019 wave of our 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

¹⁸When using the ML benchmark, we find similar underestimation in low-AKM firms, but instead find overestimation in high-AKM firms.

was not as salient and visual. We suspect that these limitations led to a weak first stage on outside options beliefs (an F-stat of about 2) and sizeable but imprecisely estimated (IV) effects on intended labor market behaviors. We report and discuss those results in Appendix F.3.

4.1 Sample for Information Experiment

To conduct a higher-powered information experiment with more tailored treatments, we collaborate with two survey companies, Bilendi and Dynata, that have been used in previous social science research (see, e.g., Alesina, Ferroni, and Stantcheva, 2021; Stantcheva, 2021; Alsan et al., 2022). Our data were collected in May, June, and July 2022 in Germany. These providers use opt-in panels, i.e., 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, Appendix Table A.4 shows similarity for several core descriptive statistics of our experimental sample compared to full-time employed respondents in the SOEP-IS sample.¹⁹ Appendix Table A.4 also shows balanced covariates across treatment and control groups. 2,448 respondents are in our analysis sample, with 1,203 and 1,245 in the treatment and control groups, respectively.

Inattention Screens To minimize concerns about inattention, only participants that pass two attention screeners are allowed to participate in our survey. 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, e.g. Peer et al., 2021).

4.2 Experimental Design

The survey was conducted online. Appendix G.4 prints the English translation of the survey. Appendix F provides additional details on the experiment. The analysis was

¹⁹Participation in our survey is restricted to respondents that are in full-time employment, that are not self-employed and that are not employed in the public sector.

pre-registered on the AsPredicted registry (<https://aspredicted.org/yg8p9.pdf>); see Appendix F.4.²⁰

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

Information Treatment Next, both groups are shown an additional screen, depicted in Figure 9. The main feature is a bar chart displaying each respondent's own wage as well as their previously stated belief about similar workers' wages.²¹ Compared to the control group (Panel (a)), the only difference for the treatment group (Panel (b)) is an additional bar depicting the *actual* wages of similar workers. This additional information constitutes the information treatment. (See 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 on the next page whether and by how much they over- or underestimated the wage of similar workers.

Post-Treatment Block After the treatment, we again measure beliefs about similar workers' wages, to gauge whether the information was internalized. We then again ask beliefs about the outside option, in order 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.

²⁰Our results reported below exclude the pilot we ran. Appendix Table A.3 replicates the results pooling the pilot and post-pilot data, which was our pre-specified collection plan to maximize statistical power.

²¹A short text accompanies these charts and describes their content. These screens are also preceded by a screen reminding the respondent of the list of characteristics they reported (gender, age, occupation, labor market region, education level).

4.3 Effects on Worker Beliefs

Identification Strategy: Exploiting Heterogeneity in Pre-Treatment Estimation Error

Figure 10 illustrates the effects of the information treatment on beliefs in binned scatter plots. The x-axis represents the worker-level *pre-treatment* 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 pre-treatment estimation error. The idea is that in response to information, respondents that initially underestimated the wage of similar workers (have negative errors) are expected to shift their belief about the wage of similar workers upward, compared to workers with initially positive errors. Importantly, these initial underestimators should also shift upward their belief about their *personal outside option*, as long as they consider the external wage distribution as informative about their personal outside option. We leverage this variation in an instrumental variable (IV) setup, instrumenting for beliefs about outside options with a treatment group indicator and its interaction with the continuous pre-treatment estimation error. Below, we illustrate the design graphically, focusing on belief updating.

Intervention Check Our first analysis investigates whether treated workers used the information to correct their beliefs about similar workers. We implement this test in Figure 10 Panel (a), which plots the post-treatment estimation error on the y-axis against the pre-treatment estimation error on the x-axis, separately for the control and treatment groups. For the control group, which did not receive the information, the binned scatter plot traces out a linear slope of nearly one (0.893, SE 0.040), implying substantial persistence. By contrast, for the treatment group, post-treatment estimation errors move substantially closer towards zero for all bins of pre-treatment estimation errors—indicating that the treated respondents used the information about the actual wage of similar workers to substantially correct their beliefs about this object. For the treatment group, the slope shrinks to 0.361 (SE 0.033), far below the persistence benchmark from the control group.

Updating of Outside Option Beliefs: De-Anchoring We now investigate 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 in a

setting in which workers do not have accurate beliefs about the external wage distribution, and hence anchor their beliefs about their outside options on their current wage.²² Panel (b) of Figure 10 reports this analysis. As in the intervention check, we sort workers, on the x-axis, by their pre-treatment errors regarding the wages of similar workers, but on the y-axis we now plot the post-treatment 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 0.045, SE 0.022).

For the treatment group, we would expect a substantially more *negative* slope: workers that initially underestimated the wage of similar workers should update positively about the external wage distribution and hence their outside option. Indeed, in the data, treated respondents that initially underestimated the wages of similar workers now increase their assessment about their personal outside option, and vice versa for overestimating respondents. The slope is -0.443 (SE 0.025), far lower than the flat slope of the control group. This evidence is consistent with respondents not having precise beliefs about the external wage distribution and hence 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 will form the basis of the first stage in our IV regression specification.

Reduction in Misperceptions about Outside Options: Machine Learning Benchmark
Did workers' beliefs about outside options become more accurate? To shed light on the accuracy of beliefs, we examine whether treated workers' beliefs shift towards the objective benchmark given by a ML prediction as in Section 2.5.²³ Figure 10 Panel (c) formalizes this test by mirroring Figure 3 from the descriptive analysis in our SOEP-IS sample, sorting workers based on the ML-predicted wage change. Again, a slope of 1 is a benchmark for accurate beliefs vis-a-vis this benchmark. Compared to the control group slope of 0.284 (SE 0.019), the slope for the treatment group increases substantially, to 0.539 (SE

²²This implication is formalized in our conceptual framework on anchoring in a Bayesian learning model in Appendix C.

²³That is, we estimate the ML model in the IAB administrative data among "involuntary" (i.e., EU) workplace switches between 2015 and 2019 but restrict the predictors to those we can collect in the survey (gender, age, education, tenure, labor market region, occupation, and establishment size, as well as their interactions).

0.019), in response to exposure to information about similar workers' wages.²⁴ In sum, this figure documents that treated workers *correct* their beliefs about their outside option. Additionally, this finding provides further validation of the ML benchmark used in the descriptive analysis.

Implications Our experimental evidence on belief updating has three 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 also provides an experimental validation of our measure of beliefs to begin with, and hence helps validate the findings from our descriptive analysis in the SOEP-IS survey in Section 2: 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.

Third, the experimental evidence helps assuage measurement-related concerns regarding the objective benchmark, specifically the machine learning benchmark from the descriptive analysis. The fact that the treatment group converges to the benchmark on the basis of a brief intervention rules out, e.g., that the wage changes underlying the benchmarks, among actual movers, may not carry over to the employed individuals at all.

4.4 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.

IV Specification An instrumental variable (IV) regression permits us to estimate the causal effect of the information treatment on labor market behavior through the channel of shifting workers' beliefs. For this question, the endogenous variable is workers' beliefs

²⁴The control slope may be larger due to the more limited covariates we can use in the machine learning benchmark, implying that the set of predictors used may be more attended to, while the variation explained falls.

about their outside option. The instrument is the treatment indicator and its interaction with the initial estimation error, exploiting the heterogeneity in estimation error described above and plotted in Figure 10 Panel (b). Formally, we estimate the following model with 2SLS:

$$\begin{aligned} OO_i^{\text{Post}} &= \beta_0 + \beta_1 \text{EstError}_i^{\text{Pre}} + \beta_2 \text{Treated}_i + \beta_3 \text{Treated}_i \times \text{EstError}_i^{\text{Pre}} + \epsilon_i & (2: \text{1st Stage}) \\ Y_i^{\text{Post}} &= \delta_0 + \delta_1 \text{EstError}_i^{\text{Pre}} + \delta_2 \widehat{OO}_i^{\text{Post}} + \nu_i. & (3: \text{2nd Stage}) \end{aligned}$$

We denote variables by pre- and post-treatment timing. OO_i^{Post} denotes individual i 's post-treatment 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. Both the first stage and the second stage also control for the estimation error.

In our 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 10 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 hence exploits the difference in the estimated linear models plotted in Figure 10 Panel (b).

Our 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 post-treatment, i.e., outcome Y_i^{post} ?

Recap: Intervention Check Table 2 Column (1) presents the regression estimates corresponding to the intervention check depicted in Figure 10 Panel (a), i.e., the effect of the treatment on the post-treatment estimation error about beliefs about the wages of similar workers, $\text{EstError}_i^{\text{Post}}$. While the specification mirrors the first stage Equation (2: 1st Stage), it is an intermediate step as it does *not* yet study the endogenous variable (i.e., beliefs about 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 -0.532 (SE 0.058). That is, treated workers that initially underestimated the mean wage in their labor market cell by 10ppt reduce their estimation error by 5.3ppt.

First-Stage: Updating About Personal Outside Option Column (2) of Table 2 reports the first stage estimates, i.e., Equation (2: 1st Stage) with post-treatment beliefs about own wage changes, OO_i^{Post} , as the dependent variable. We estimate a β_3 of -0.488 (SE 0.040). That is, workers that initially underestimated similar workers' wages by 10ppt upward-adjust their belief about their own wage change if moving to the outside option by 4.9ppt.

IV: Causal Effects on Labor Market Behavior Columns (3) to (8) of Table 2 report on the causal effects on labor market behaviors: respondents' expected probability to quit, to look for a new job over the next 12 months and to ask for a wage raise and its size, and the reservation wage cut for quitting. The top panel reports the reduced form effects while the bottom panel reports the IV estimates. We will 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.²⁵

To provide a quantitative benchmark for the effect sizes, we report the implied effects for a 10ppt increase in beliefs about wages at the outside option. This shift in beliefs would correspond to the belief change associated with a full belief correction for workers employed at firms at the 19th percentile of the AKM firm effect distribution (Figure 8).

For the quit probability (Column (3)), we estimate an IV coefficient of 0.248 (SE 0.087), which implies that a 10ppt increase in respondents' beliefs about wages at their outside option would cause a 2.5ppt 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 0.209 (SE 0.088) IV effect, comparable in magnitude to the quit effect. That is, a 10ppt increase in beliefs translates into a 2.1ppt increase in the job search probability or an 8% increase relative to the control group mean.

Columns (5) through (7) report effects on intended wage negotiations. A 10ppt increase in beliefs about wages at the outside option causes a 3.7ppt (SE 1.0) increase in the probability to negotiate a wage increase, and a 1 to 1.2ppt 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.

Lastly, we estimate non-significant reduced-form and IV effects close to zero on the

²⁵While we interpret our IV effects to work only through the channel of beliefs about wages, it is possible that, due to a correlation of amenities and wages, respondents may also update about non-wage aspects of jobs, which in turn may drive some of the shifts in behavior.

reservation wage cut in Column (8).

Experimenter Demand Effects As with information provision experiments in general, one concern is that participants may adjust their responses to align with researchers' expectations (Haaland, Roth, and Wohlfart, 2023), in our case, the effect of information on worker beliefs and on labor market behavior. To address this concern, we examine the potential importance of these effects by asking respondents to state their beliefs about the study's hypothesis using an open-ended question. This data was hand-coded by a team of research assistants. We find that respondents have relatively crude and dispersed beliefs about the study's hypothesis. Only a small fraction of respondents correctly guess that the hypothesis relates to the effects of worker beliefs about outside options and labor market behavior (7%), while a relatively large fraction of respondents either express not knowing the hypothesis of interest (31%) or provide relatively generic guesses (e.g., that the hypothesis is related to wages (19%) or worker beliefs (14%)). Consistent with the small share of correct guesses, treatment effects are almost identical when we restrict our main specification to respondents who do not correctly guess the hypothesis of the experiment (see Appendix Table A.8). This finding is consistent with previous research, which suggests that demand effects may not have a significant quantitative impact (De Quidt, Haushofer, and Roth, 2018).

Implications First, the additional results on labor market behaviors establish a causal interpretation *from* beliefs *to* intended behavior. The correlational evidence in Figure 3 discussed in Section 3.1 had left open the possibility of reverse causality or an underlying third factor. Or, inherently immobile workers may 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 markets 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, e.g., those building on search costs, workers hold accurate beliefs about the statistical properties of the external wage distribution. In such models, providing information about, e.g., 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. Below, in Section 5, 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 8, we documented that workers at the bottom of the firm wage distribution (the 19th percentile of the AKM firm effect distribution) on average underestimate the wages at their outside option by about 10ppt. Our experiment suggests that correcting those misperceptions would cause about a 2.5ppt—or 11%—increase in quits out of those firms. A simple back-of-the-envelope calculation implies that this increase in quits would shrink the size of those low-wage firms significantly, by about 11%.²⁶

5 Equilibrium Implications of Anchored Beliefs: A Simple Model

We now 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 2 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 3.1 and 4. Third, the empirical sorting of most pessimistic workers into low-paying firms (documented in Section 3.2) emerges as an equilibrium outcome in our model: workers that stay put in low-wage firms are those that wrongly believe that 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 thus are a monopsony source distinct from the standard frictions existing models draw on to generate these outcomes,

²⁶This back of the envelope calculation draws on a simple wage posting model in which a firm hires $H(w)$ workers per period, which depends on the posted wage w , and its workers quit at rate $s(w)$. The steady-state firm size is given by $L(w) = H(w)/s(w)$. Here, an 11% increase in separations shrinks firm size by 11%. At least four caveats apply. First, not all separations are voluntary quits, so the actual impact on overall separations and hence firm size would be lower. Second, working in the other direction, hiring will arguably also fall in low-wage firms if workers more accurately perceive their outside options. Third, this micro calculation ignores equilibrium effects. Fourth, our estimate of the quit effect stems from one cross-section, whereas the calculation assumes a persistent effect on quits.

such as idiosyncratic tastes among workers for firm-specific amenities (Card, Cardoso, Heining, and Kline, 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.²⁷

Our model is a conceptual and qualitative treatment of these issues, and we leave a quantitatively realistic description of the empirical labor market for future research, along with a decomposition of monopsony power and wage dispersion into anchoring rather than conventional sources.

5.1 Preview of Assumptions, Mechanisms, and Implications

In our model, firms set wages competing for imperfectly informed 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 largely costless, a competitive equilibrium with a single wage emerges. Worker search makes paying a lower wage unprofitable, 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: the higher the search cost, the lower the reservation wage of those workers, and hence the more profitable it is to pay a wage below the competitive wage; firms trade off the benefits from lower wages and the cost by losing workers not subject to the search cost.²⁸ Crucially, workers’ beliefs about the competitive wage (the outside option) determine their reservation wages, hence

²⁷Similarly, 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).

²⁸This aspect of our model can be read as taking the spirit of the Salop and Stiglitz (1977) model of monopolistic competition in product markets and adapting it to the labor market, as well as augmenting it to feature biased beliefs of workers. The Salop and Stiglitz (1977) model is a model of monopolistic competition in the product market with frictions featuring two types of consumers, who differ only in the cost of information gathering. Depending on the level of the search costs, a two-price equilibrium can emerge. Consumers have accurate beliefs in Salop and Stiglitz (1977), lacking knowledge of which specific firms charge which specific prices but correctly understanding the statistics of the price distribution. Like the Salop and Stiglitz (1977) model, ours features workers subject to two different information acquisition cost levels, which govern their decision to search. But, in our model, misperceptions may also affect the decision to search by determining workers’ reservation wages. Employers take advantage of potential misperceptions in setting wages. Moreover, our model is a labor market model with aggregate labor supply and demand curves rather than a product market model, which changes several key intuitions (e.g., a competitive equilibrium emerges for standard Walrasian reasons, and the production function is entirely standard). Our leading example takes the firm count as given and sidesteps free entry.

the wage deviating firms optimally set, and hence the degree of wage dispersion, wage mark-downs 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 options—consistent with the evidence in Section 5. Misperceptions in the form of anchoring on the current wage act similarly to a search cost in aggravating wage mark-downs, wage dispersion, misallocation, and the size of the low-wage sector.

5.2 Setup

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.

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 policy w_j . After arriving in their initial firm, each worker decides whether to search for a new job or stay put in their initial job.

Workers can pay a cost c_τ to gather complete information about the labor market. Informed workers can switch to their outside option, in this case a job at the highest paying firm. (When there are multiple firms paying the highest wage, we assume 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, i.e., $c_E = 0$. The remaining share $1 - \alpha$ of workers 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, i.e., the difference between their current wage and their belief about the highest wage, denoted $\tilde{w}^{\max}(w_j, w_{-j})$. Amateurs search if:

$$\tilde{w}^{\max}(w_j, w_{-j}) - w_j > c_A. \quad (4)$$

The dependence of \tilde{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).

Beliefs We specify beliefs in a simple parametric form that nests accurate beliefs as well as misperceptions—specifically the kind of anchoring our empirical evidence reveals. (Appendix C presents an updating model.) Specifically, a worker earning wage w_j perceives the highest wage to be a weighted average of the actual highest wage and the worker's current wage.

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

Here, $\gamma \in [0, 1]$ captures the degree of anchoring on the current wage. $\gamma = 0$ implies that beliefs are insensitive to w_j , while $\gamma = 1$ implies full anchoring. Beliefs are accurate if $\gamma = \delta = 0$.

That γ captures the degree of anchoring as in our empirical framework can be seen by reformulating the expression in wage changes (to the outside option, here, the highest wage):

$$\tilde{w}^{\max} - w_j = \delta + (1 - \gamma) \cdot (w^{\max} - w_j). \quad (6)$$

Our theoretical framework remains qualitative.²⁹ Below, we consider the case of $\delta = 0$ to isolate the role of anchoring ($\delta = 0$ is quite consistent with our empirical findings).

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 $\ell(w_j | \mathbf{w}_{-j})$ 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 \mathbf{w}_{-j} , firm j 's profits are

$$\pi(w_j | \mathbf{w}_{-j}) = \ell(w_j | \mathbf{w}_{-j})^\eta - w_j \ell(w_j | \mathbf{w}_{-j}). \quad (7)$$

²⁹Our empirical specification as percent would simply set δ in percent of the current wage. Hence, 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 γ by $\frac{1}{1-\alpha}$ to recover γ .

Firm count N is fixed for exposition, so equilibrium profits are positive.³⁰

5.3 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 neoclassical 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 of firms, that the marginal product of labor equal the wage:

$$\eta(\ell^*)^{\eta-1} = w^*. \quad (8)$$

Standard Walrasian arguments apply: firms would be unwilling to hire this amount of workers at higher wages (it would be profitable to lay some off) and the market would not clear, hence the wage falls to this level to obtain full employment; similarly, a lower wage is not an equilibrium as some firms could then profitably poach workers by offering slightly higher wages.

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

$$N \cdot \ell^* = L \quad (9)$$

$$\Leftrightarrow \ell^* = \frac{L}{N}. \quad (10)$$

5.4 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. The optimal lower wage such a deviant would pay depends on information costs c , the share of amateur workers $1 - \alpha$, and—our main focus—their beliefs about their outside option, \tilde{w}^{\max} .

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

³⁰Every firm count N could be rationalized by an upfront entry cost (e.g., for entrepreneurial effort) that will equal ex-post equilibrium profits, which depend on N .

deviation requires wage below w^* but high enough to retain a firm's stock of amateur workers. (We assume that indifferent amateurs stay put.) The reservation wage of amateurs to not become informed (and hence leave the deviant) is given by Equation (4), and depends on both beliefs and search costs:

$$w^r(w_j, \mathbf{w}_{-j}, c_A) = \tilde{w}^{\max}(w_j, \mathbf{w}_{-j}) - c_A. \quad (11)$$

The most profitable deviation is therefore to exactly pay the reservation wage, $w' = w^r(w', \mathbf{w}^*, c_A)$. Using the specification of worker beliefs in Equation (6) and maintaining $\delta = 0$ gives:

$$w' = w^* - \frac{c_A}{1 - \gamma}. \quad (12)$$

For intuition, consider $\gamma = 0$, i.e., accurate beliefs. Here, the deviant's wage pushes the amateur worker to their reservation wage, which is entirely given by the search cost c_A . Now consider the role of anchored beliefs, i.e., $\gamma > 0$. 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 (12).

Deviants' profits also depend on scale; since a deviant keeps its amateur workers only, its employment is:

$$\ell(w') = (1 - \alpha) \frac{L}{N}. \quad (13)$$

Together with the optimal wage deviation given by Equation (12), we can write deviant profit as

$$\pi(w') = \left((1 - \alpha) \frac{L}{N} \right)^\eta - \left(w^* - \frac{c_A}{1 - \gamma} \right) (1 - \alpha) \frac{L}{N}. \quad (14)$$

The competitive equilibrium obtains when deviation is unprofitable, i.e., when employing

ℓ^* workers at wage w^* yields higher profits than the best deviation $\pi(w')$:

$$\left(\frac{L}{N}\right)^\eta - \eta\left(\frac{L}{N}\right)^\eta > \left((1-\alpha)\frac{L}{N}\right)^\eta - \left(\eta\left(\frac{L}{N}\right)^{\eta-1} - \frac{c_A}{1-\gamma}\right)(1-\alpha)\frac{L}{N} \quad (15)$$

$$\frac{c_A}{1-\gamma} < \frac{1-\alpha\eta-(1-\alpha)^\eta}{1-\alpha}\left(\frac{N}{L}\right)^{1-\eta}. \quad (16)$$

Higher search costs c_A tip the economy away from the competitive equilibrium (holding the share of amateurs $1-\alpha$ fixed). Misperceptions, the degree of anchoring γ , play the same role—consistent with the hypothesis by Robinson (1933) we cited in Footnote 1. Below, we characterize the alternative, segmented equilibrium which arises when Condition (16) does not hold.

5.5 Segmented (Two-Wage) Equilibrium

When information costs or anchoring are sufficiently large to violate Condition (16), a two-wage, or segmented, labor market equilibrium takes its place, with a high wage sector and a low wage sector. Misperceptions, the degree of anchoring γ , support this segmentation.

The logic of the two-wage equilibrium differs qualitatively from the competitive one. As Condition (16) is violated, some firms find it profitable to deviate to a low wage w_l . As more firms begin to deviate, more experts flock to the remaining high wage firms. In equilibrium, the share of firms paying the high wage, denoted β , adjusts so that firms in each sector are equally profitable.³¹

Firm Size and Turnover by Wage Low wage firms lose their expert workers (who costlessly move to high-wage firms), but retain their amateur workers. Since high wage firms employ their original amateur workers and all expert workers (those initially placed in the high-wage firm plus those separating from the low-wage firms, spread equally across the

³¹Because there are only two types of workers, there can be no alternative non-competitive equilibria with more than two wages. Any firm that pays a wage $w \in (w_l, w_h)$ would employ the same number of workers as firms 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.

high-wage firms), the equilibrium employment levels for low- and high-wage firms are:

$$\ell_l = (1 - \alpha) \frac{L}{N} \quad (17)$$

$$\ell_h = \left(1 - \alpha + \frac{\alpha}{\beta}\right) \frac{L}{N}. \quad (18)$$

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

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 unit of labor is an informed, expert worker, whose ability to search costlessly prevents firms from marking down wages relative to marginal product, much as in the competitive equilibrium above. Any higher wage leads to excess labor supply, and any lower wage entails losing expert workers. This observation, together with firm-level employment from Equation (18) implies

$$w_h = \eta \left(\left(1 - \alpha + \frac{\alpha}{\beta}\right) \frac{L}{N} \right)^{\eta-1}. \quad (19)$$

This equation clarifies that 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 .

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^*):

$$w_l = w_h - \frac{c_A}{1 - \gamma}. \quad (20)$$

Plugging in the high-wage sector's wage w_h from Equation (19) gives the level of the low wage.

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 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.

Concretely, profits in the low-wage and high-wage sectors are:

$$\pi(w_l) = \left((1 - \alpha) \frac{L}{N} \right)^\eta - w_l (1 - \alpha) \frac{L}{N} \quad (21)$$

$$\pi(w_h) = \left(\left(1 - \alpha + \frac{\alpha}{\beta} \right) \frac{L}{N} \right)^\eta - w_h \left(1 - \alpha + \frac{\alpha}{\beta} \right) \frac{L}{N}. \quad (22)$$

Profit equalization then implies

$$\pi(w_l) = \pi(w_h) \quad (23)$$

$$\Leftrightarrow 1 - \eta = \left(\frac{1 - \alpha}{1 - \alpha + \frac{\alpha}{\beta}} \right)^\eta \left[\frac{c_A (1 - \alpha)^{1-\eta}}{1 - \gamma} \left(\frac{L}{N} \right)^{1-\eta} + 1 \right] - \eta \left(\frac{1 - \alpha}{1 - \alpha + \frac{\alpha}{\beta}} \right), \quad (24)$$

which implicitly gives β as a function of model parameters. In fact, this equation has a solution whenever Condition (16) is violated, i.e., a competitive single-wage equilibrium cannot obtain.

With β in hand, the share of jobs (rather than firms) in the low wage sector is given by:

$$\begin{aligned} S_l &= \frac{(1 - \beta)\ell_l}{\beta\ell_h} \\ &= \frac{1 - \beta}{\alpha/(1 - \alpha) + \beta}. \end{aligned} \quad (25)$$

5.6 Misperceptions in the Low-Wage Sector and Monopsony

In Figure 11 and Appendix Figure A.9, we illustrate the role of anchoring in amplifying labor market segmentation. The figures plot the share of workers in the low-wage sector as well as the wages paid in each sector.

Figure 11 does so 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 the degree of anchoring, γ .

There exists a threshold level γ^* after which the equilibrium becomes segmented, for a given set of other parameters η , c_A , and α , defined in the profitable-deviation Condition (16). 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 (20).

5.7 The Interaction of Standard Frictions and Misperceptions

The left-hand side of Condition (16) clarifies an important insight: in generating labor market segmentation and monopsonistic behavior by firms, misperceptions, γ , require some search costs, c_A (otherwise no worker stays put and misinformed), and search costs c_A are amplified by misperceptions (which facilitate firms' gouging of immobile workers). In fact, there is a direct relationship between c_A and γ on the left-hand side of the condition.

Appendix Figure A.9 illustrates the labor market patterns as in Figure 11, but as a function of amateurs' search cost c_A , for two economies: a no-anchoring economy ($\gamma = 0$), where workers have accurate beliefs about the wage distribution, and for an anchored economy that mimics, loosely, a very large degree of anchoring as in our data ($\gamma \approx 0.9$). In both cases, there is a cutoff level of c_A before which the economy is competitive, and above which it is segmented, again given by the Condition (16).

However, the cutoff value of the search cost c_A required to tilt the economy falls dramatically, by 90%, when $\gamma = 0.9$. 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 when seeking to explain the amount of wage dispersion.

6 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 that 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. The information treatment increases the accuracy of worker beliefs and affects intended labor market behaviors. 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 paper 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.

Our findings suggest anchoring and misperceptions about the wage distribution as a source of labor market imperfections. While 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. A focus on misperceptions also points to distinct policy remedies, such as pay transparency mandates, and opens up new avenues through which labor market institutions, e.g., minimum wages, may operate. In particular, the experimental evidence suggests that even providing wage information about fine-grained labor market cells, rather than coworker wages (which may be harder to find or disclose), can serve as an effective tool to debias 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, 2020). On the employer side, Ellison and Wolitzky (2012) describe a model in which oligopsonistic firms may have an incentive to obfuscate their prices (wages). Relatedly, a large literature in behavioral industrial organization documents and analyzes the con-

sequences 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).

References

- Abebe, Girum, A Stefano Caria, Marcel Fafchamps, Paolo Falco, Simon Franklin, and Simon Quinn. 2021. "Anonymity or Distance? Job Search and Labour Market Exclusion in a Growing African City." *Review of Economic Studies* 88 (3):1279–1310.
- Abowd, John, Francis Kramarz, and David Margolis. 1999. "High Wage Workers and High Wage Firms." *Econometrica* 67 (2):251–333.
- Alesina, Alberto, Matteo F Ferroni, and Stefanie Stantcheva. 2021. "Perceptions of Racial Gaps, their Causes, and Ways to Reduce Them." *NBER Working Paper* .
- Alsan, Marcella, Luca Braghieri, Sarah Eichmeyer, Minjeong Joyce Kim, Stefanie Stantcheva, and David Y Yang. 2022. "Civil Liberties in Times of Crisis." *American Economic Journal: Applied Economics* forthcoming.
- Altmann, Steffen, Armin Falk, Simon Jäger, and Florian Zimmermann. 2018. "Learning about Job Search: A Field Experiment with Job Seekers in Germany." *Journal of Public Economics* 164:33–49.
- Altonji, Joseph and Charles Pierret. 2001. "Employer Learning and Statistical Discrimination." *The Quarterly Journal of Economics* 116 (1):313–350.
- Antoni, Manfred, Mattis Beckmannshagen, and Markus M. Grabka. 2023. "SOEP Survey Data Linked to Administrative Data of the IAB (SOEP-ADIAB 7520)." *FDZ-Datenreport, Nuremberg* .
- Bassier, Ihsaan, Arindrajit Dube, and Suresh Naidu. 2022. "Monopsony in Movers the Elasticity of Labor Supply to Firm Wage Policies." *Journal of Human Resources* 57 (S):S50–S86.
- Belot, Michele, Philipp Kircher, and Paul Muller. 2019. "Providing Advice to Jobseekers at Low Cost: An Experimental Study on Online Advice." *Review of Economic Studies* 86 (4):1411–1447.

- Berger, David, Kyle Herkenhoff, and Simon Mongey. 2022. "Labor Market Power." *American Economic Review* 112 (4):1147–93.
- Bonhomme, Stéphane, Kerstin Holzheu, Thibaut Lamadon, Elena Manresa, Magne Mogstad, and Bradley Setzler. 2023. "How Much Should We Trust Estimates of Firm Effects and Worker Sorting?" *Journal of Labor Economics* 41 (2):000–000.
- Burdett, Kenneth and Dale Mortensen. 1998. "Wage Differentials, Employer Size, and Unemployment." *International Economic Review* 39 (2):257–273.
- Cahuc, Pierre, Fabien Postel-Vinay, and Jean-Marc Robin. 2006. "Wage Bargaining with On-the-Job Search: Theory and Evidence." *Econometrica* 74 (2):323–364.
- Caldwell, Sydnee and Oren Danieli. 2022. "Outside Options in the Labor Market." *Working Paper*.
- Caldwell, Sydnee and Nikolaj Harmon. 2019. "Outside Options, Wages, and Bargaining: Evidence from Coworker Networks." *Working Paper*.
- Card, David, Ana Rute Cardoso, Jörg Heining, and Patrick Kline. 2018. "Firms and Labor Market Inequality: Evidence and Some Theory." *Journal of Labor Economics* 36 (S1):S13–S70.
- Card, David, Jörg Heining, and Patrick Kline. 2013. "Workplace Heterogeneity and the Rise of West German Wage Inequality." *The Quarterly Journal of Economics* 128 (3):967–1015.
- Card, David, Alexandre Mas, Enrico Moretti, and Emmanuel Saez. 2012. "Inequality at Work: The Effect of Peer Salaries on Job Satisfaction." *American Economic Review* 102 (6):2981–3003.
- Chandra, Amitabh, Amy Finkelstein, Adam Sacarny, and Chad Syverson. 2016. "Health Care Exceptionalism? Performance and Allocation in the US Health Care Sector." *American Economic Review* 106 (8):2110–44.
- Conlon, John, Laura Pilossoph, Matthew Wiswall, and Basit Zafar. 2018. "Labor Market Search With Imperfect Information and Learning." *NBER Working Paper*.
- Cullen, Zoë and Ricardo Perez-Truglia. 2020. "The Salary Taboo: Privacy Norms and the Diffusion of Information." *NBER Working Paper*.
- . 2022. "How Much Does Your Boss Make? The Effects of Salary Comparisons." *Journal of Political Economy* 130 (3):766–822.
- Cullen, Zoe B, Shengwu Li, and Ricardo Perez-Truglia. 2023. "What's My Employee Worth? The Effects of Salary Benchmarking." *NBER Working Paper*.

- De Quidt, Jonathan, Johannes Haushofer, and Christopher Roth. 2018. "Measuring and Bounding Experimenter Demand." *American Economic Review* 108 (11):3266–3302.
- DellaVigna, Stefano, Jörg Heining, Johannes F Schmieder, and Simon Trenkle. 2022. "Evidence on job search models from a survey of unemployed workers in germany." *The Quarterly Journal of Economics* 137 (2):1181–1232.
- DellaVigna, Stefano, Attila Lindner, Balázs Reizer, and Johannes Schmieder. 2017. "Reference-Dependent Job Search: Evidence from Hungary." *The Quarterly Journal of Economics* 132 (4):1969–2018.
- Di Addario, Sabrina, Patrick Kline, Raffaele Saggio, and Mikkel Sølvsten. 2022. "It Ain't Where You're From, It's Where You're At: Hiring Origins, Firm Heterogeneity, and Wages." *Journal of Econometrics* 233 (2):340–374.
- Drenik, Andres, Simon Jäger, Pascuel Plotkin, and Benjamin Schoefer. 2023. "Paying Outsourced Labor: Direct Evidence From Linked Temp Agency-Worker-Client Data." *Review of Economics and Statistics* 105 (1):206–216.
- Ellison, Glenn. 2006. "Bounded Rationality in Industrial Organization." In *Advances in Economics and Econometrics: Theory and Applications*, edited by R. Blundell, W. Newey, and T. Persson. Cambridge University Press.
- Ellison, Glenn and Alexander Wolitzky. 2012. "A Search Cost Model of Obfuscation." *The RAND Journal of Economics* 43 (3):417–441.
- Enke, Benjamin. 2020. "What You See Is All There Is." *The Quarterly Journal of Economics* 135 (3):1363–1398.
- Faberman, R Jason, Andreas I Mueller, Aysegül Şahin, and Giorgio Topa. 2022. "Job Search Behavior Among the Employed and Non-Employed." *Econometrica* 90 (4):1743–1779.
- Farber, Henry and Robert Gibbons. 1996. "Learning and Wage Dynamics." *The Quarterly Journal of Economics* 111 (4):1007–1047.
- Feldstein, Martin and James Poterba. 1984. "Unemployment Insurance and Reservation Wages." *Journal of Public Economics* 23 (1-2):141–167.
- Frick, Mira, Ryota Iijima, and Yuhta Ishii. 2022. "Dispersed Behavior and Perceptions in Assortative Societies." *American Economic Review* 112 (9):3063–3105.
- Gathmann, Christina, Ines Helm, and Uta Schönberg. 2020. "Spillover Effects of Mass Layoffs." *Journal of the European Economic Association* 18 (1):427–468.
- Gibbons, Robert and Lawrence Katz. 1992. "Does unmeasured ability explain inter-industry wage differentials?" *Review of Economic Studies* 59 (3):515–535.

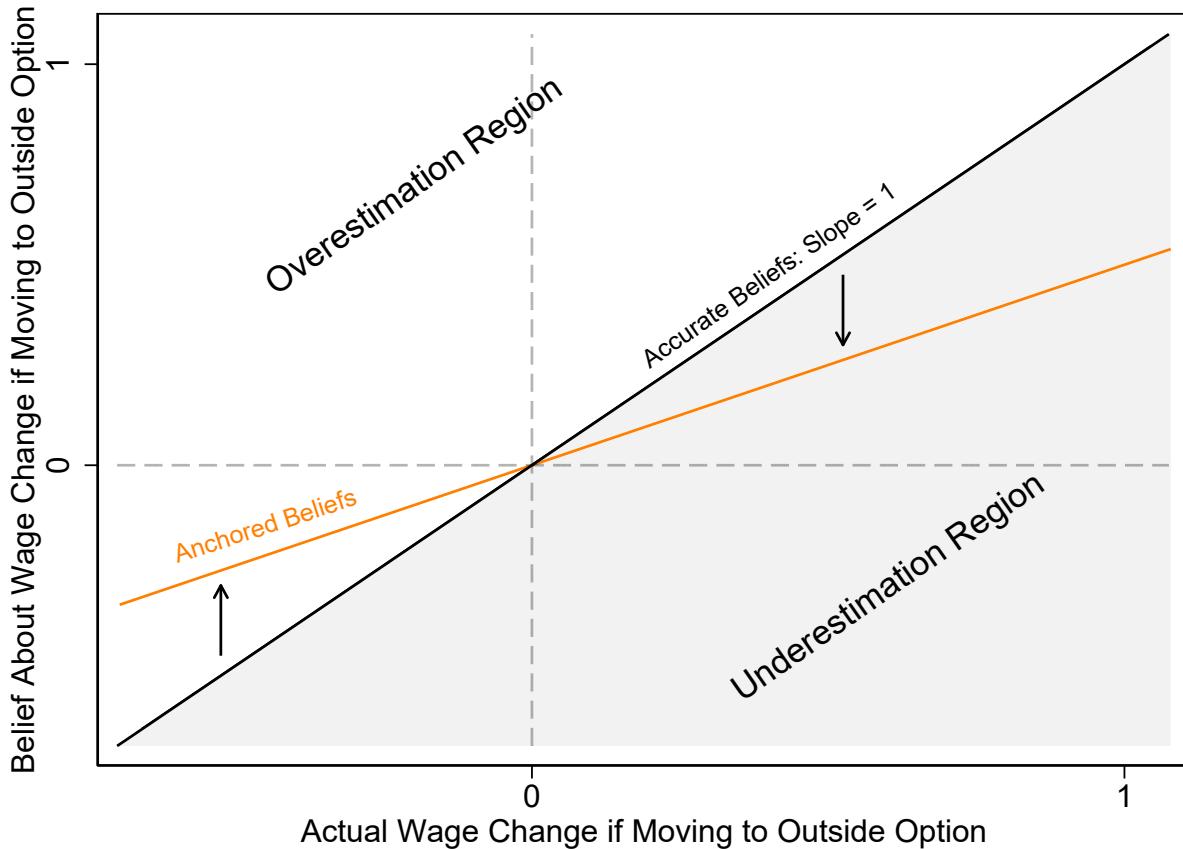
- Grubb, Michael. 2015. "Failing to Choose the Best Price: Theory, Evidence, and Policy." *Review of Industrial Organization* 47 (3):303–340.
- Haaland, Ingar, Christopher Roth, and Johannes Wohlfart. 2023. "Designing Information Provision Experiments." *Journal of Economic Literature* 61 (1):3–40.
- Heidhues, Paul and Botond Kőszegi. 2018. "Behavioral Industrial Organization." *Handbook of Behavioral Economics: Applications and Foundations* 1:517–612.
- Hornstein, Andreas, Per Krusell, and Giovanni Violante. 2011. "Frictional Wage Dispersion in Search Models: A Quantitative Assessment." *American Economic Review* 101 (7):2873–98.
- Hvidberg, Kristoffer, Claus Kreiner, and Stefanie Stantcheva. 2023. "Social Position and Fairness Views." *Review of Economic Studies* forthcoming.
- Jacobson, Louis, Robert LaLonde, and Daniel Sullivan. 1993. "Earnings Losses of Displaced Workers." *American Economic Review* 83 (4):685–709.
- Jäger, Simon, Benjamin Schoefer, Samuel Young, and Josef Zweimüller. 2020. "Wages and the Value of Nonemployment." *The Quarterly Journal of Economics* 135 (4):1905–1963.
- Koenig, Felix, Alan Manning, and Barbara Petrongolo. 2022. "Reservation Wages and the Wage Flexibility Puzzle." *Working Paper*.
- Krueger, Alan and Andreas Mueller. 2016. "A Contribution to the Empirics of Reservation Wages." *American Economic Journal: Economic Policy* 8 (1):142–179.
- Krueger, Alan and Lawrence Summers. 1988. "Efficiency Wages and the Inter-industry Wage Structure." *Econometrica: Journal of the Econometric Society* 56 (2):259–293.
- Lachowska, Marta. 2016. "Outside Options and Wages: What Can We Learn from Subjective Assessments?" *Empirical Economics* 52 (1):79–121.
- Lachowska, Marta, Alexandre Mas, Raffaele Saggio, and Stephen A Woodbury. 2023. "Do firm effects drift? Evidence from Washington administrative data." *Journal of Econometrics* 233 (2):375–395.
- Lachowska, Marta, Alexandre Mas, and Stephen Woodbury. 2020. "Sources of Displaced Workers' Long-Term Earnings Losses." *American Economic Review* 110 (10):3231–66.
- Lamadon, Thibaut, Magne Mogstad, and Bradley Setzler. 2022. "Imperfect Competition, Compensating Differentials and Rent Sharing in the US Labor Market." *American Economic Review* 112 (1):169–212.
- Le Barbanchon, Thomas, Roland Rathelot, and Alexandra Roulet. 2019. "Unemployment Insurance and Reservation Wages: Evidence from Administrative Data." *Journal of Public Economics* 171 (1):1–17.

- Manning, Alan. 2011. "Imperfect Competition in the Labor Market." In *Handbook of Labor Economics*, vol. 4. Elsevier, 973–1041.
- Matějka, Filip and Alisdair McKay. 2015. "Rational Inattention to Discrete Choices: A New Foundation for the Multinomial Logit Model." *American Economic Review* 105 (1):272–98.
- McCall, John Joseph. 1970. "Economics of Information and Job Search." *The Quarterly Journal of Economics* 84 (1):113–126.
- Morris, Carl. 1983. "Parametric Empirical Bayes Inference: Theory and Applications." *Journal of the American Statistical Association* 78 (381):47–55.
- Mortensen, Dale and Christopher Pissarides. 1999. "New Developments in Models of Search in the Labor Market." *Handbook of Labor Economics* 3B:2567–2627.
- Mueller, Andreas and Johannes Spinnewijn. 2023. "Expectations Data, Labor Market and Job Search." *Handbook of Economic Expectations* Chapter 22:677–713.
- Mueller, Andreas, Johannes Spinnewijn, and Giorgio Topa. 2021. "Job Seekers' Perceptions and Employment Prospects: Heterogeneity, Duration Dependence, and Bias." *American Economic Review* 111 (1):324–63.
- Peer, Eyal, David Rothschild, Andrew Gordon, Zak Evernden, and Ekaterina Damer. 2021. "Data Quality of Platforms and Panels for Online Behavioral Research." *Behavior Research Methods* 54:1643–1662.
- Reynolds, Lloyd. 1951. *The Structure of Labor Markets: Wages and Labor Mobility in Theory and Practice*. Westport, Conn: Greenwood Press.
- Richter, David and Jürgen Schupp. 2015. "The SOEP Innovation Sample (SOEP IS)." *Schmollers Jahrbuch: Journal of Applied Social Science Studies/Zeitschrift für Wirtschafts- und Sozialwissenschaften* 135 (3):389–400.
- Robinson, Joan. 1933. *The Economics of Imperfect Competition*. Macmillan.
- Rosen, Sherwin. 1986. "The Theory of Equalizing Differences." *Handbook of Labor Economics* 1:641–692.
- Ruf, Kevin, Lisa Schmidlein, Stefan Seth, Heiko Stüber, Matthias Umkehrer et al. 2021. "Linked Employer-Employee Data from the IAB: LIAB Longitudinal Model (LIAB LM) 1975-2019." *FDZ-Datenreport*.
- Salop, Steven and Joseph Stiglitz. 1977. "Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion." *Review of Economic Studies* 44 (3):493–510.
- Schmieder, Johannes, Till von Wachter, and Jörg Heining. 2022. "The Costs of Job Displacement over the Business Cycle and its Sources: Evidence from Germany." *NBER Working Paper*.

- Schubert, Gregor, Anna Stansbury, and Bledi Taska. 2023. "Employer Concentration and Outside Options." *Working Paper*.
- Skandalis, Daphné. 2018. "Breaking News: Information About Firms' Hiring Needs Affects the Direction of Job Search." *Working Paper*.
- Slichter, Sumner. 1950. "Notes on the Structure of Wages." *Review of Economics and Statistics* 32 (1):80–91.
- Spinnewijn, Johannes. 2015. "Unemployed but Optimistic: Optimal Insurance Design with Biased Beliefs." *Journal of the European Economic Association* 13 (1):130–167.
- Stantcheva, Stefanie. 2021. "Understanding Tax Policy: How Do People Reason?" *The Quarterly Journal of Economics* 136 (4):2309–2369.
- . 2022. "How to Run Surveys: A Guide to Creating Your Own Identifying Variation and Revealing the Invisible." *NBER Working Paper*.
- Stigler, George. 1961. "The Economics of Information." *Journal of Political Economy* 69 (3):213–225.
- Townsend, Wilbur. 2017. "ELASTICREGRESS: Stata Module to Perform Elastic Net Regression, Lasso Regression, Ridge Regression." *Statistical Software Components*.
- Tversky, Amos and Daniel Kahneman. 1973. "Availability: A Heuristic for Judging Frequency and Probability." *Cognitive Psychology* 5 (2):207–232.
- Zweck, Bettina and Axel Glemser. 2020. "SOEP-IS 2019: Survey Report on the 2019 SOEP Innovation Sample." *SOEP Survey Papers*.
- Zweck, Bettina and Martin Rathje. 2021. "SOEP-IS 2020: Survey Report on the 2020 SOEP Innovation Sample." *SOEP Survey Papers*.

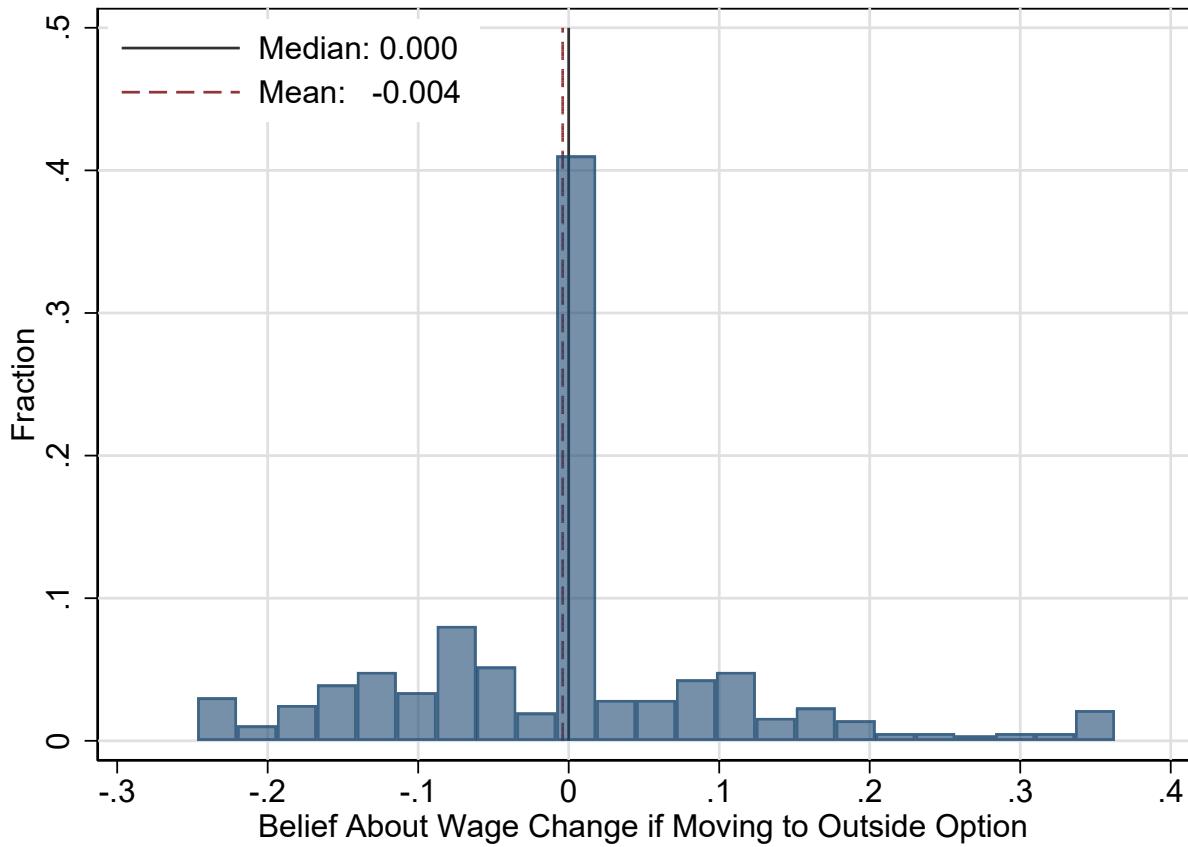
Figures

Figure 1: Research Design



Note: This figure illustrates our research design. The y-axis depicts beliefs about wage changes if moving to the outside option, while 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 orange line has a slope that is less than 1, as would emerge if workers anchor their beliefs about their outside option on their current wages.

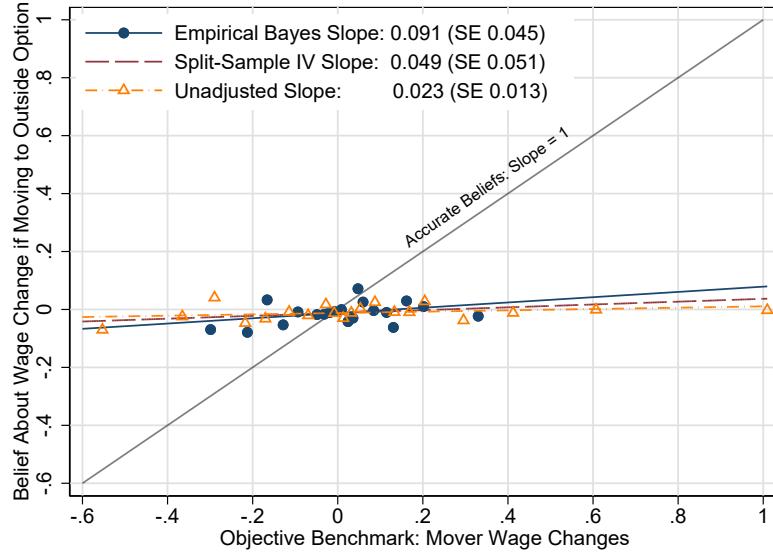
Figure 2: Distribution of Beliefs About Wage Change if Moving to Outside Option



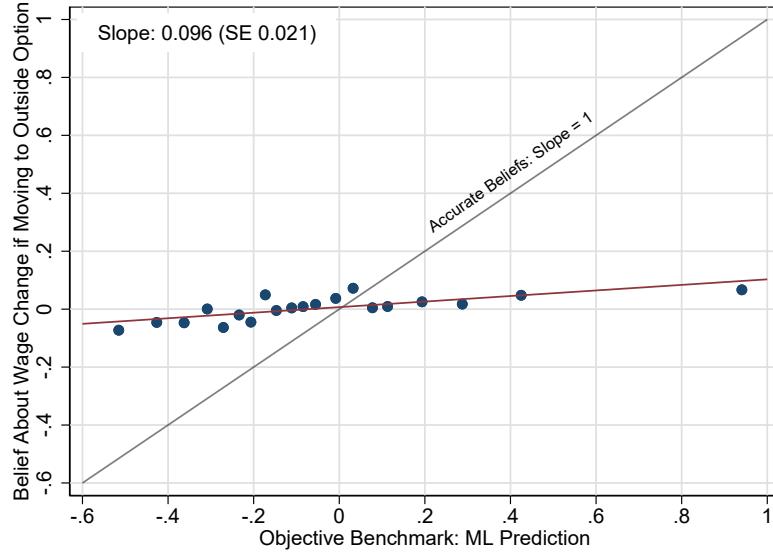
Note: This figure presents a histogram of workers' beliefs about their own wage change when forced to leave their job as a percent of workers' current wages (approximated by the log difference). The data are winsorized at the 2% level. The data stems from the 2019 wave of the German Socio-Economic Panel (see Table 1 for summary statistics). The sample size is 558.

Figure 3: Beliefs About Wage Change if Moving to Outside Option vs. Objective Benchmarks

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

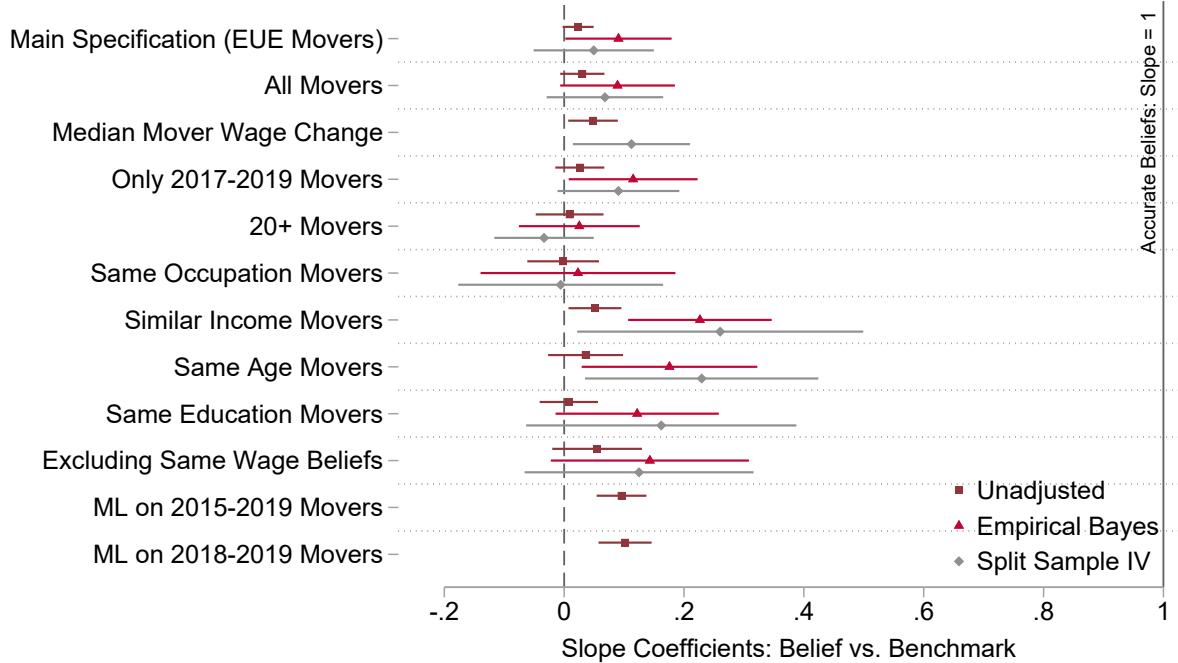


(b) Benchmark: Machine Learning Prediction



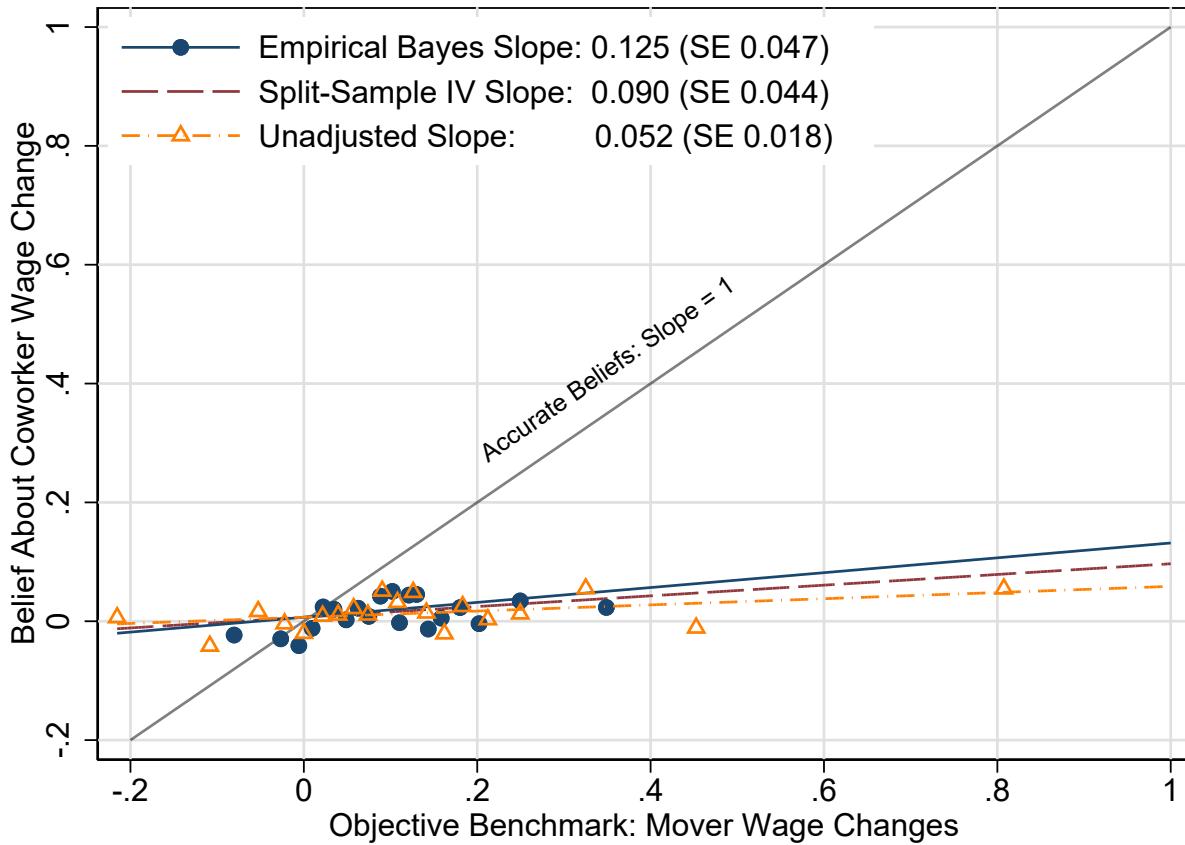
Note: This figure presents binned scatter plots of SOEP 2019 respondents' beliefs about their own wage change if forced to leave their firm against two objective benchmarks for the actual wage changes they would experience. In Panel (a), the benchmark is the mean log wage changes experienced by workers who left the SOEP respondent's firm in the past 5 years (between 2015 and 2019). We restrict to movers working full-time both 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 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 Appendix D. The sample size in Panel (a) is 355 observations for the unadjusted line, and 232 observations for the Empirical Bayes line, and 149 for the split-sample IV line. The sample size in Panel (b) is 519 observations.

Figure 4: Robustness to Alternative Specifications



Note: This figure reports the slope coefficients between outside option beliefs and an objective benchmark, varying the definition of the benchmark. For all specifications except the ones relying on machine learning, we report the unadjusted slope coefficient as well as estimates based on Empirical Bayes and split sample IV corrections. The main specification reports the specifications from Figure 3 Panel (a) which relies on EU moves. All other specifications except for the ones involving machine learning benchmarks instead use *all* coworker moves. We consider the following alternative benchmarks (from top to bottom): all coworker movers (instead of only EU moves); median (instead of mean) coworker wage changes; restricting coworker wage changes to the years 2017 to 2019; restricting to SOEP respondents with at least 20 coworker movers; restricting to movers in the same occupation as the SOEP respondent who remain within the same occupation when moving ; restricting to movers in the same wage quintile (wage quintiles are calculated in the overall labor market dataset); restricting to movers within the same age category (age categories are <20, 20-29, 30-39, 40-49, 50-59, 60-69, 70+); restricting to movers within the same education category (education categories are no education, vocational training, university degree, or missing education); restricting to SOEP respondents who do not answer “same wage” to the question about what wage they would earn at their outside option. Finally, the machine learning (ML) benchmarks compare the belief about the outside option against the same ML algorithm as in Figure 3 Panel (b), which is based on EU moves between 2015 to 2019; as a robustness check, we add a specification trained on EU moves from 2018 to 2019.

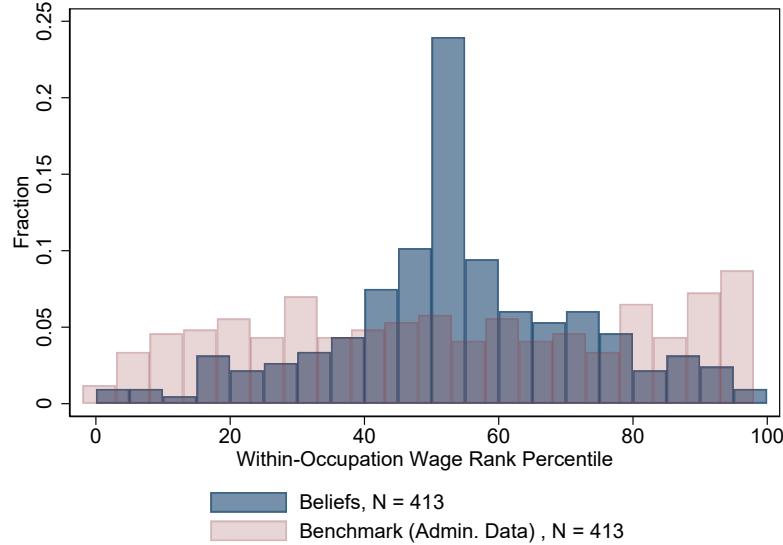
Figure 5: Beliefs About Mover Wage Changes vs. Actual Mover Wage Changes



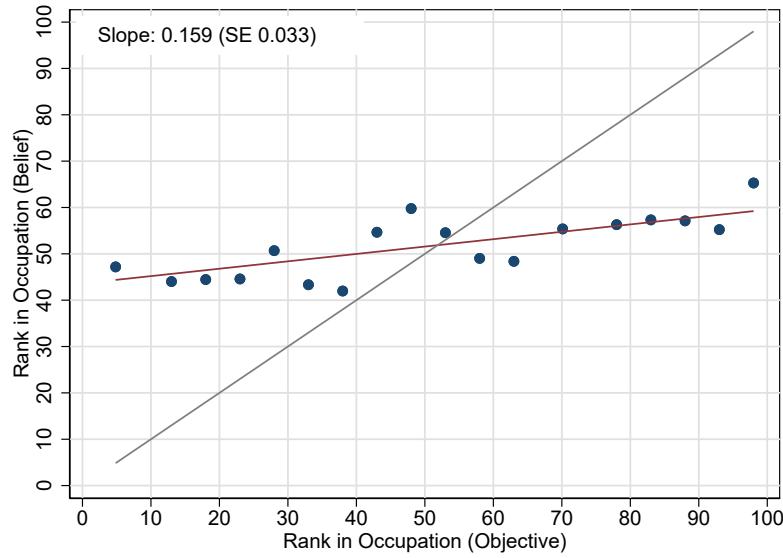
Note: This figure presents binned scatter plots of SOEP 2019 respondents' beliefs about the typical wage change of coworkers who leave their firm, against the actual wage changes of coworkers who left their firm between 2015 and 2019. It is analogous to Figure 3 Panel (a), except that the y-axis reports 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 involuntary ones only, consistent with this survey question). The sample size is 549 observations for the unadjusted line, and 502 for the Empirical Bayes line, and 431 split-sample IV line.

Figure 6: Beliefs About Own Wage Rank in Occupation

(a) Histogram of Own Wage Rank in Occupation (Beliefs and Objective Benchmark)



(b) Beliefs About Wage Rank in Occupation Against Objective Benchmark



Note: 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 4-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 of the panels is 413.

Figure 7: Intended Labor Market Behavior and Beliefs about Outside Options

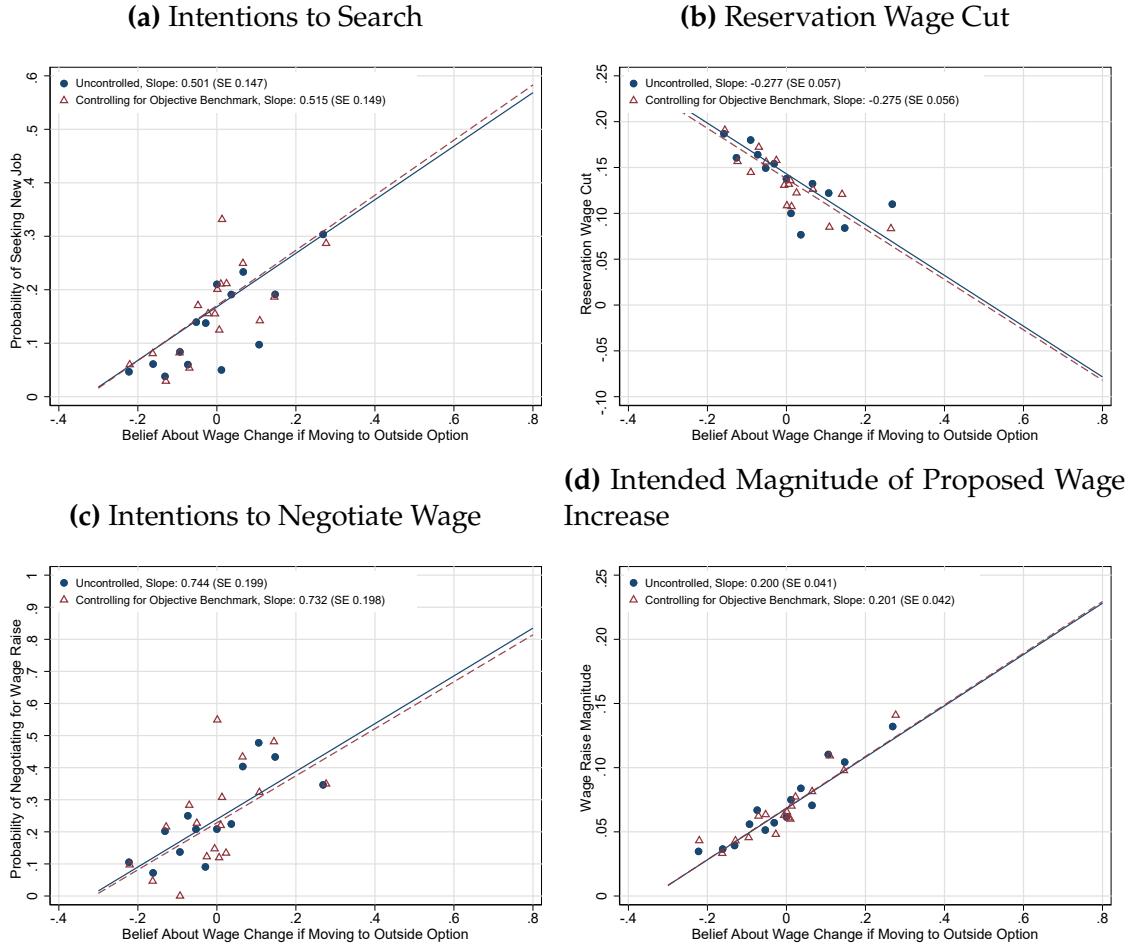
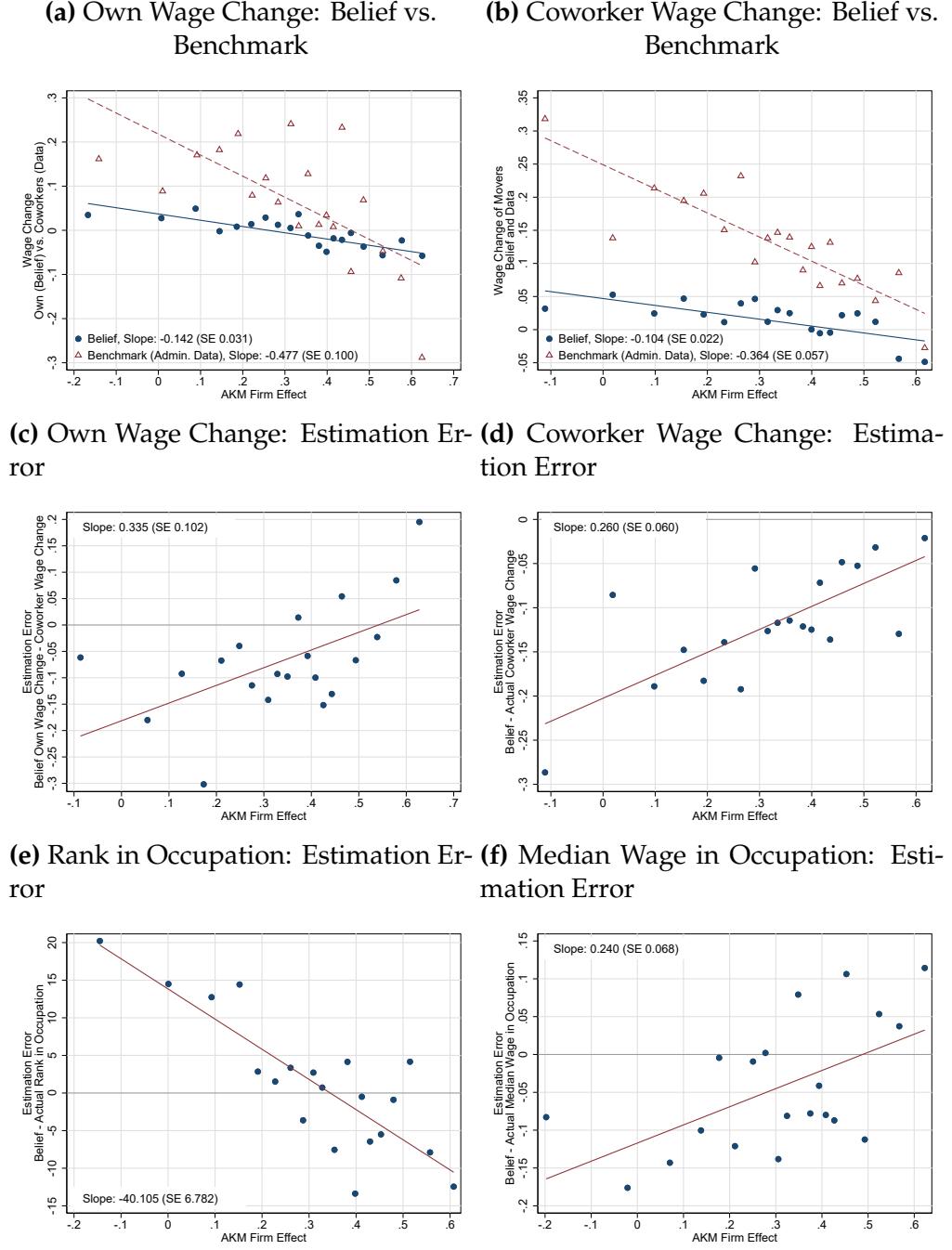
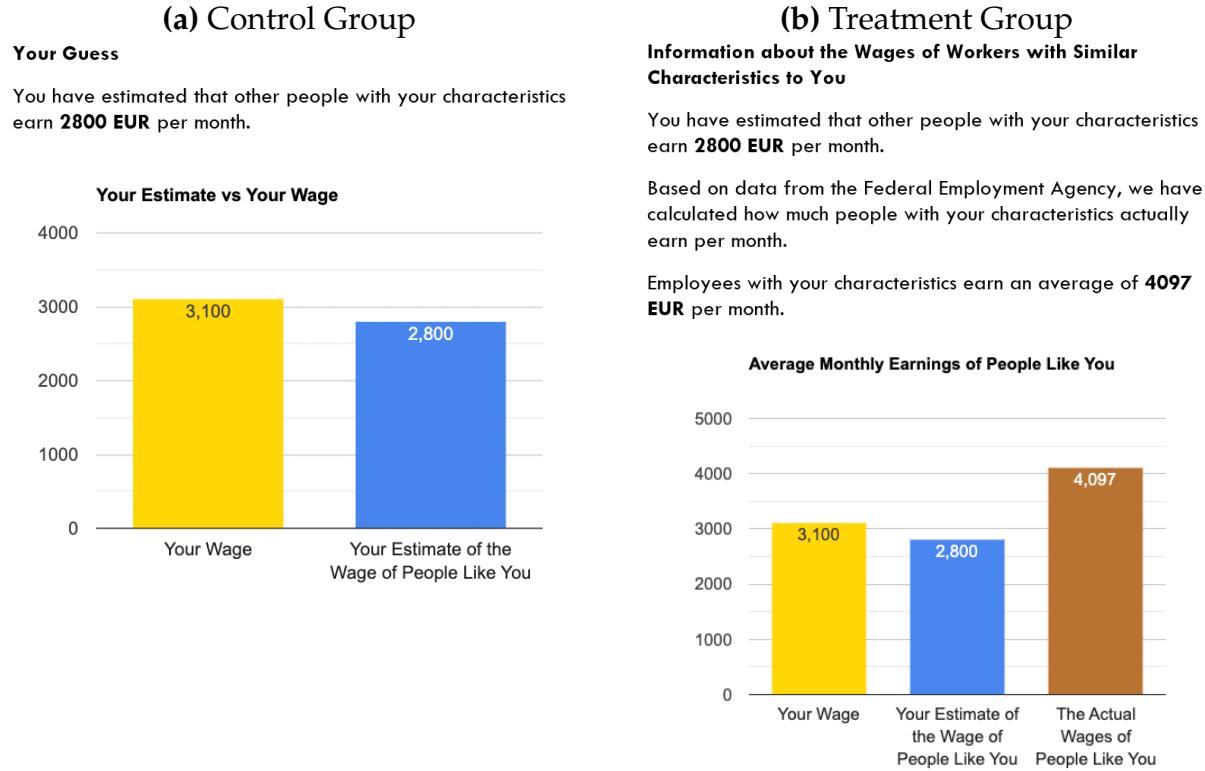


Figure 8: Beliefs and Misperceptions Across the Firm Wage Distribution



Note: 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, while Panel (b) presents beliefs about coworker wage changes and actual wage changes of involuntary movers. The Panels (c) to (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 1 Panel C for summary statistics of the estimation errors. The sample sizes are 355, 547, 355, 547, 407 and 409 in Panels (a) to (f).

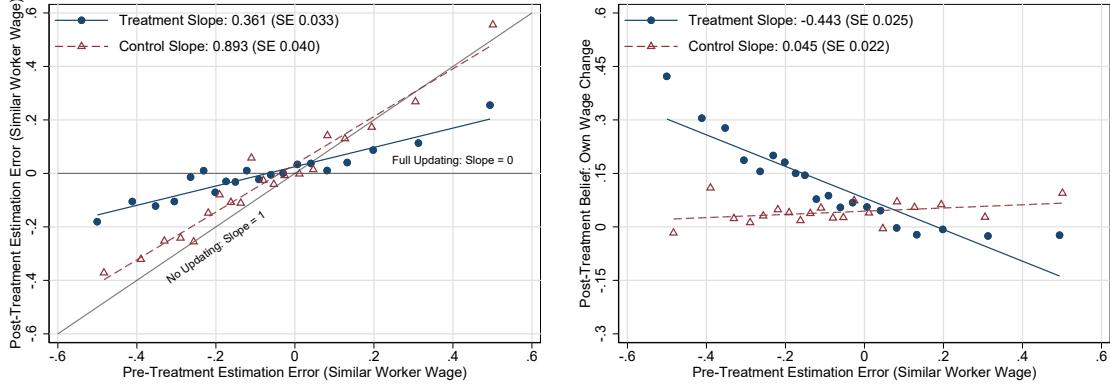
Figure 9: Experiment: Information Treatment Screen



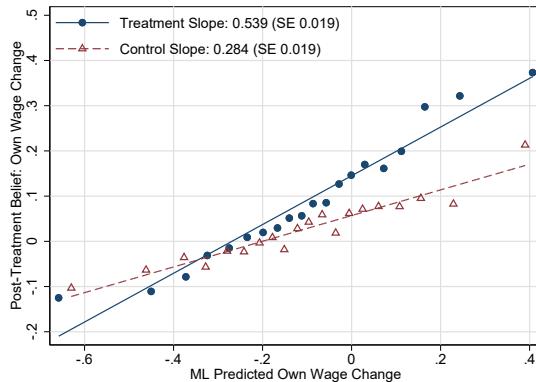
Note: These panels display (a translated version of) the information screen for a respondent with the same characteristics, in either the control (Panel (a)) or the treatment group (Panel (b)). The respondent reports a monthly wage of 3,100 EUR and estimates that other people with their characteristics earn 2,800 EUR 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, additionally the actual average wage is displayed (see Section 4 for details on its calculation).

Figure 10: Effects of Information Treatment

(a) Intervention Check: Beliefs about Wages **(b) First Stage: Beliefs about Outside Option of Similar Workers**

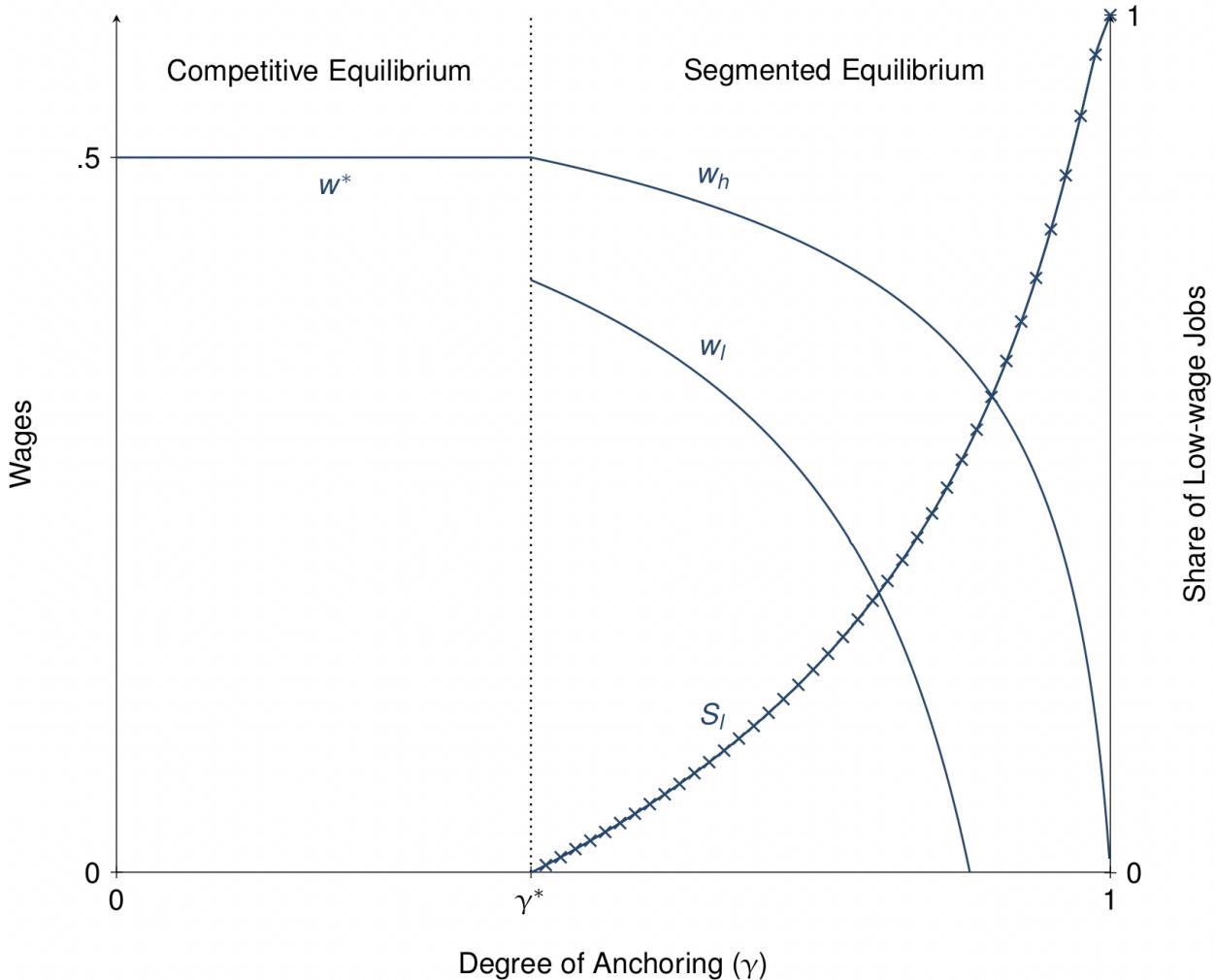


(c) Beliefs About Outside Option vs. Machine Learning Prediction



Note: 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 4 for details on its calculation). As an intervention check, Panel (a) plots the post-treatment estimation error about that wage against the pre-treatment 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 pre-treatment estimation error. Panel (c) plots beliefs about their outside option (wage change) against an objective benchmark, calculated from a machine learning prediction (see Appendix Figure A.7 for the pre-treatment analog). The sample size for all panels is 2,448.

Figure 11: Equilibrium Implications of Anchoring



Note: 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 $c_A = .05$, decreasing returns $\eta = 1/2$, share of amateur workers $\alpha = 1/2$, and the number of workers per firm $L/N = 1$. See Appendix Figure A.9 for the analogous figure illustrating the effects of information costs on equilibrium outcomes, with or without anchoring.

Tables

Table 1: Summary Statistics (SOEP-IAB Sample)

	Mean	SD	P10	P25	Median	P75	P90	Share 0	N
Panel A: Demographics and Labor Market Characteristics									
Age in Years	44.4	11.2	29.0	35.0	45.0	54.0	59.0	0.000	558
Wage (in EUR, per Year)	38,479	20,853	15,600	24,000	34,800	46,800	67,200	0.000	558
Tenure in Years	10.4	10.6	0.0	2.0	7.0	17.0	28.0	0.143	558
Share of Women	0.502	0.500	0.000	0.000	1.000	1.000	1.000	0.498	558
Full-time Employed	0.715	0.452	0.000	0.000	1.000	1.000	1.000	0.285	558
Part-time Employed	0.280	0.449	0.000	0.000	0.000	1.000	1.000	0.720	558
Panel B: Beliefs									
Own Wage Change as % of Wage	-0.4	11.2	-14.5	-6.7	0.0	1.2	13.0	0.403	558
Coworker Wage Change as % of Wage	1.6	10.1	-13.4	0.0	0.0	7.2	14.0	0.404	540
Own Wage Rank in Same Occupation	51.1	18.1	25.0	45.0	50.0	60.0	75.0	0.000	548
Median Wage in Occupation (in EUR, per Year)	40,730	18,291	21,600	27,600	36,000	48,000	66,000	0.000	534
Panel C: Estimation Errors									
Belief (Own Wage Change) Versus Coworker Wage Changes (%)	-6.9	35.1	-51.7	-22.3	-2.7	13.8	34.0	0.000	355
Belief (Coworker Wage Change) Versus Coworker Wage Changes (%)	-11.9	22.8	-40.5	-21.5	-9.0	2.1	12.2	0.000	549
Belief (Median Wage) Versus Actual Median Wage (%)	-5.3	26.9	-35.2	-23.4	-7.0	7.7	27.2	0.000	441
Belief (Own Wage Rank in Occupation) Minus Actual Wage Rank (ppt/rank)	2.4	29.1	-37.5	-17.5	2.5	22.5	40.0	0.000	453
Belief (Own Wage Change) Versus ML Prediction (%)	5.1	29.0	-33.3	-10.1	10.0	24.8	36.9	0.000	519

Note: 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 3 Panel (a) and Figure 5. In this table, all continuous variables are winsorized at the 2% level.

Table 2: Information Experiment

	(1) Post-Treat Estimation Error	(2) Belief About Outside Option (Wage Change)	(3) Intended Quit Probability	(4) Intended Search Probability	(5) Intended Negotiation Probability	(6) Intended Neg. Magnitude (No Neg. = 0)	(7) Intended Neg. Magnitude (No Neg. = Msg.)	(8) Reservation Wage Cut
Treated × Pre-Treat Estimation Error	-0.532*** (0.058)	-0.488*** (0.040)	-0.139*** (0.052)	-0.086 (0.053)	-0.202*** (0.059)	-0.048*** (0.009)	-0.060*** (0.009)	-0.002 (0.016)
Treated	-0.009 (0.014)	0.036*** (0.008)	0.001 (0.013)	0.015 (0.013)	0.005 (0.015)	0.004* (0.002)	0.004* (0.002)	-0.002 (0.004)
Pre-Treat Estimation Error	0.893*** (0.043)	0.045* (0.026)	-0.021 (0.039)	-0.033 (0.038)	0.100** (0.043)	0.019*** (0.006)	0.020*** (0.006)	0.005 (0.012)
Constant	0.034*** (0.010)	0.044*** (0.006)	0.231*** (0.009)	0.246*** (0.009)	0.394*** (0.011)	0.057*** (0.001)	0.072*** (0.001)	0.090*** (0.003)
IV: Endogenous Variable: Belief About Outside Option (Wage Change)			0.248*** (0.087)	0.209** (0.088)	0.374*** (0.103)	0.100*** (0.015)	0.118*** (0.015)	-0.006 (0.024)
Constant			0.216*** (0.008)	0.240*** (0.008)	0.373*** (0.010)	0.053*** (0.001)	0.065*** (0.002)	0.089*** (0.002)
Control Group Mean	-0.031	0.041	0.233	0.248	0.387	0.056	0.071	0.089
First-Stage F-Stat			149.105	149.105	149.105	149.105	127.718	147.932
N	2,448	2,448	2,448	2,448	2,448	2,448	1,954	2,447

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Note: This table reports results of the information experiment in a 2022 online survey. It reports regressions of each outcome variable on the respondent's pre-treatment estimation error about the mean wage of similar workers (in logs), a treatment indicator, and an interaction between the treatment indicator and pre-treatment estimation error. We also report IV specifications, using respondents' beliefs about their outside option as the endogenous variable (see Section 4.4 for details on the IV specification). In Column (1), the outcome is a post-treatment version of the estimation error, i.e., beliefs about wages of similar workers. In Column (2) the outcome is the respondent's post-treatment 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.

Online Appendix: Worker Beliefs about Outside Options

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A Appendix Tables

Table A.1: Overview of Data Collections

Data collection	Sample	Timing
SOEP IS Wave 1 (N=1,068)	In-person interviews with full-time and part-time employed workers in Germany as part of SOEP-IS	2019, September – December
SOEP IS Wave 2 (N=828)	In-person and telephone interviews with full-time and part-time employed workers in Germany as part of SOEP-IS	2020, September – December
Robustness Survey (N=902)	Online surveys with full-time and part-time employed workers in Germany with Dynata	2021, July
Information Provision Experiment (N=2,448, with pilot N=3,206)	Online surveys with full-time employed workers in Germany with Dynata and Bilendi	2022, May – July

Table A.2: Characteristics of SOEP Respondents vs. "Involuntary" Coworker Movers vs. Other Coworkers

Variable	Mean SOEP	Mean Movers	Mean Nonmovers	SOEP vs. Movers	SOEP vs. Nonmovers
Log Wage	4.373	4.286	4.228	0.112	0.011
Age in Years	40.720	35.668	37.310	0.000	0.000
Tenure in Years	6.522	3.427	2.059	0.000	0.000
Share of Women	0.409	0.294	0.308	0.002	0.007
No Qualifications	0.061	0.165	0.095	0.000	0.059
Vocational Qualification	0.459	0.423	0.486	0.361	0.487
University Qualification	0.224	0.148	0.157	0.020	0.036
Missing Qualifications	0.257	0.264	0.262	0.830	0.878
Agriculture & Forestry	0.009	0.017	0.012	0.382	0.750
Mining, Industry, & Manufacturing	0.257	0.284	0.266	0.459	0.805
Construction & Infrastructure	0.043	0.034	0.035	0.587	0.617
Academic & Technical	0.061	0.062	0.044	0.955	0.352
Transportation, Logistics, & Cleaning	0.180	0.180	0.208	0.978	0.418
Sales	0.074	0.074	0.090	0.991	0.480
Managerial	0.152	0.169	0.176	0.588	0.434
Medical, Childcare, & Educational	0.185	0.142	0.140	0.188	0.167
Marketing, Artistic, & Athletic	0.039	0.038	0.031	0.939	0.588

↳ Note: This table relies on the same sample definition as our preferred Empirical Bayes bias correction in Figure 3 Panel (a). The sample size of the SOEP-mover column is 232. This table compares the characteristics of SOEP respondents to the characteristics of their coworkers who moved "involuntarily" out of their firm sometime between 2015 and 2019 and the characteristics of their other coworkers. The first three columns present the means of each variable for the SOEP respondents, the movers, and the non-movers of the same firm as the SOEP respondents. The columns "SOEP vs. Movers" and "SOEP vs. Nonmovers" report the p-value obtained from either a t-test or a proportion test comparing the two groups. In this table, all continuous variables are winsorized at the 2% level.

Table A.3: Information Experiment: Pooling Pilot and Post-Pilot

	(1) Post-Treat Estimation Error	(2) Belief About Outside Option (Wage Change)	(3) Intended Quit Probability	(4) Intended Search Probability	(5) Intended Negotiation Probability	(6) Intended Neg. Magnitude (No Neg. = 0)	(7) Intended Neg. Magnitude (No Neg. = Msg.)	(8) Reservation Wage Cut
Treated × Pre-Treat Estimation Error	-0.528*** (0.051)	-0.451*** (0.034)	-0.121*** (0.043)	-0.066 (0.044)	-0.187*** (0.048)	-0.037*** (0.007)	-0.046*** (0.007)	-0.002 (0.013)
Treated	-0.016 (0.012)	0.042*** (0.007)	0.012 (0.011)	0.025** (0.011)	0.009 (0.013)	0.004** (0.002)	0.005*** (0.002)	-0.003 (0.003)
Pre-Treat Estimation Error	0.902*** (0.037)	0.025 (0.022)	-0.036 (0.032)	-0.056* (0.030)	0.088** (0.034)	0.013*** (0.005)	0.010** (0.005)	0.008 (0.009)
Constant	0.041*** (0.009)	0.041*** (0.005)	0.228*** (0.008)	0.242*** (0.008)	0.391*** (0.009)	0.053*** (0.001)	0.066*** (0.001)	0.089*** (0.002)
IV: Endogenous Variable: Belief About Outside Option (Wage Change)			0.269*** (0.078)	0.223*** (0.079)	0.382*** (0.092)	0.084*** (0.013)	0.105*** (0.013)	-0.007 (0.021)
Constant			0.217*** (0.007)	0.241*** (0.007)	0.373*** (0.009)	0.050*** (0.001)	0.061*** (0.001)	0.088*** (0.002)
Control Group Mean	-0.017	0.039	0.231	0.246	0.386	0.053	0.066	0.089
First-Stage F-Stat			171.515	171.515	171.515	171.515	144.359	170.520
N	3,206	3,206	3,206	3,206	3,206	3,206	2,566	3,204

• Note: This table replicates Table 2 using the pre-specified sample (pooling pilot and post-pilot). See Table 2 for additional information.

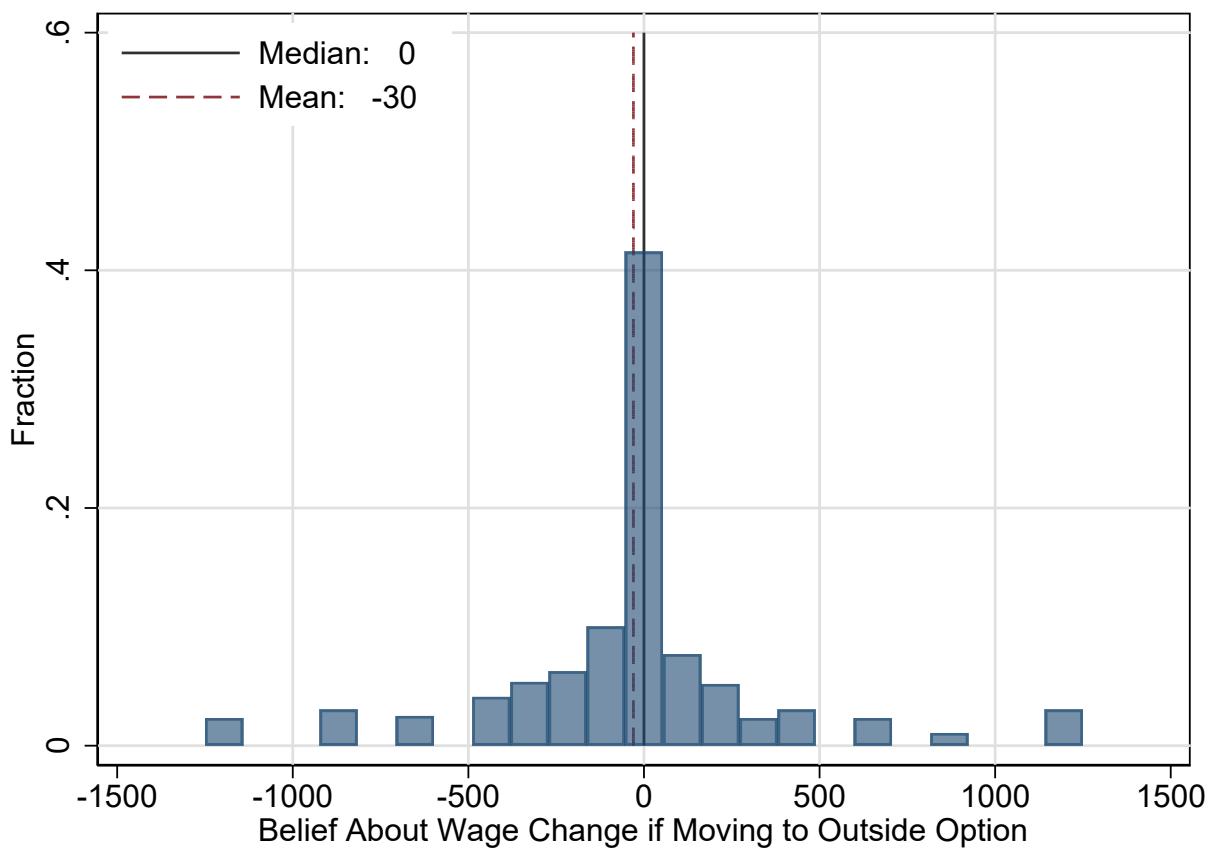
Table A.4: Balance in Online Experiment Groups

	SOEP-IAB Mean	SOEP-IAB Mean FT	Online Survey Mean	Online Control Mean	Online Treatment Mean
General Stats					
Number of Respondents	558	399	2,448	1,245	1,203
Share of Women	0.502	0.346	0.411	0.410	0.412
Age in Years	44.4	44.5	44.7	44.4	45.0
Pre-Tax Wage (in EUR, per Month)	3,206	3,732	3,885	3,892	3,877
Tenure in Years	10.4	10.7	15.0	15.0	15.0
Full-time Employed	0.715	1.000	1.000	1.000	1.000
Beliefs					
Pretreatment Beliefs: Wage Change (in %)	0.270	-0.046	0.038	0.037	0.039

Note: This table compares characteristics in the SOEP-IAB sample and in the online experiment. Columns (1) and (2), respectively, show demographic characteristics of the SOEP-IAB sample, restricting to full-time in Column (2). Columns (3) to (5) use the same sample as in Table 2 and report characteristics over control and treated groups. In this table, all continuous variables are winsorized at the 2% level.

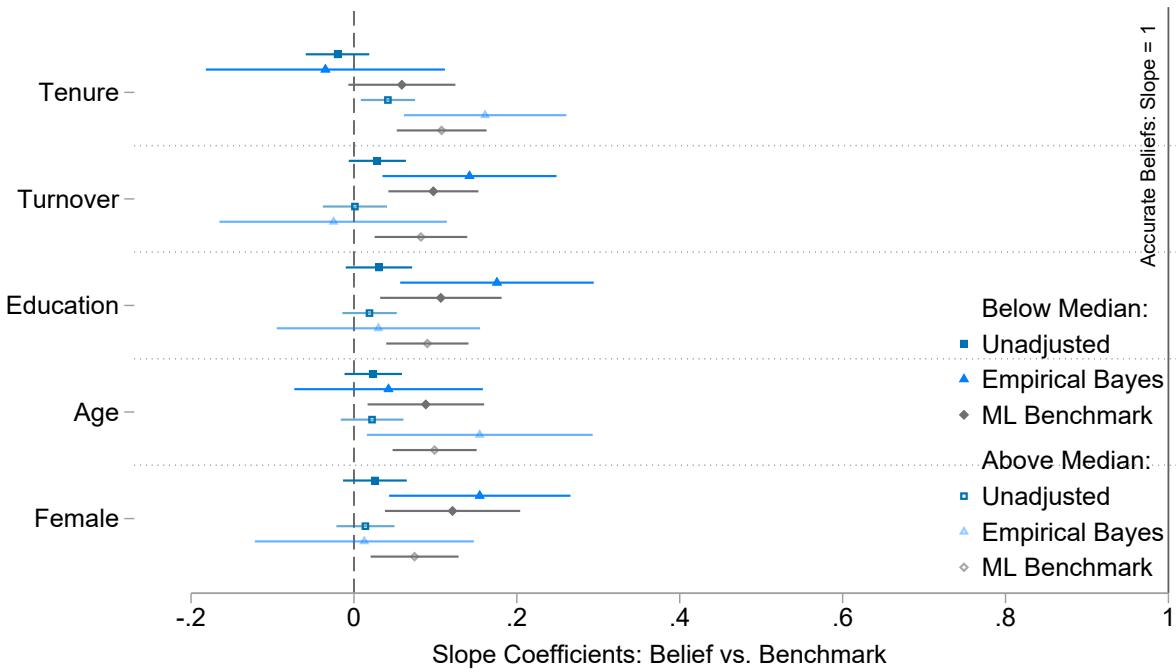
B Appendix Figures

Figure A.1: Distributions of Beliefs About Own Wage Change in EUR



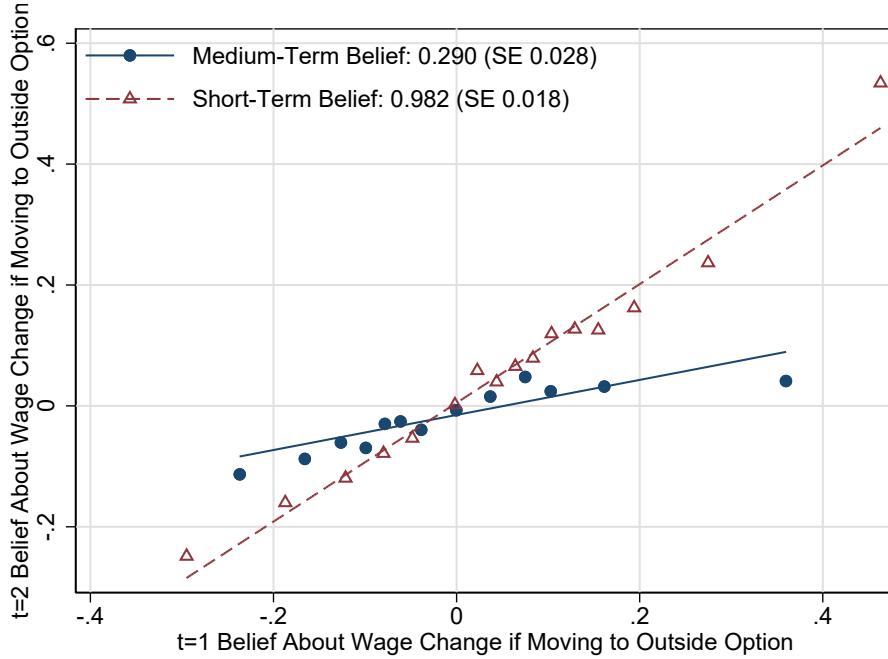
Note: This figure replicates Figure 2, but presents beliefs in absolute monetary amounts (EUR) instead of percent changes. This variable is not winsorized as it is bounded (unlike beliefs about own wage change in percent (i.e., divided by own wage)).

Figure A.2: Heterogeneity by Covariates



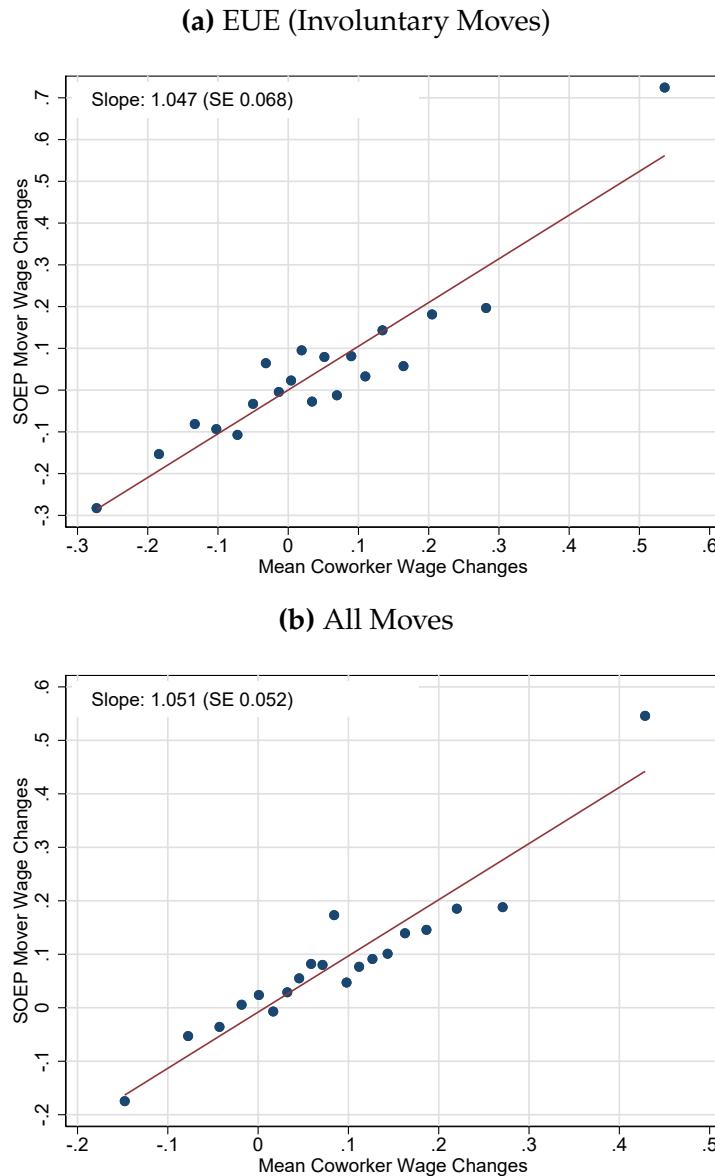
Note: This figure reports the slope coefficients between outside option beliefs and an objective benchmark using subsamples used in Figure 3, cutting the sample by median of tenure, of the annual coworker separation rate (turnover), of education in years, and of age in years, and by gender.

Figure A.3: Persistence of Belief About Outside Option



Note: This figure documents the persistence of respondent's belief over two different timelines. The medium-term belief draws on the panel dimension of the SOEP and regresses the beliefs about outside options in 2020 ($t=2$) on beliefs in 2019 ($t=1$) using only respondents who did not change their job between the panel waves. The short-term belief was calculated within the control group of the information experiment who received the same question twice in the time-span of a few minutes within the same survey. All measures are in percent of the respondent's own wage. The sample sizes are 650 and 1,245 in the SOEP and control group of the information experiment, respectively.

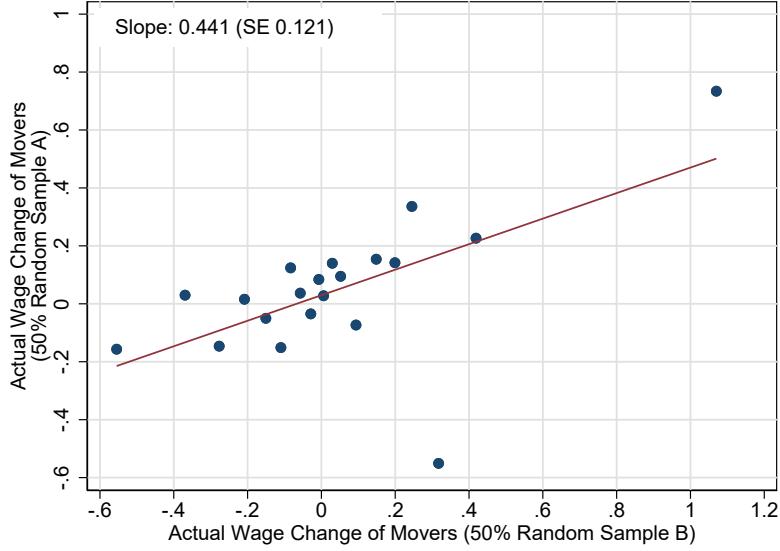
Figure A.4: Predictiveness of Mover Wage Changes for SOEP Sample



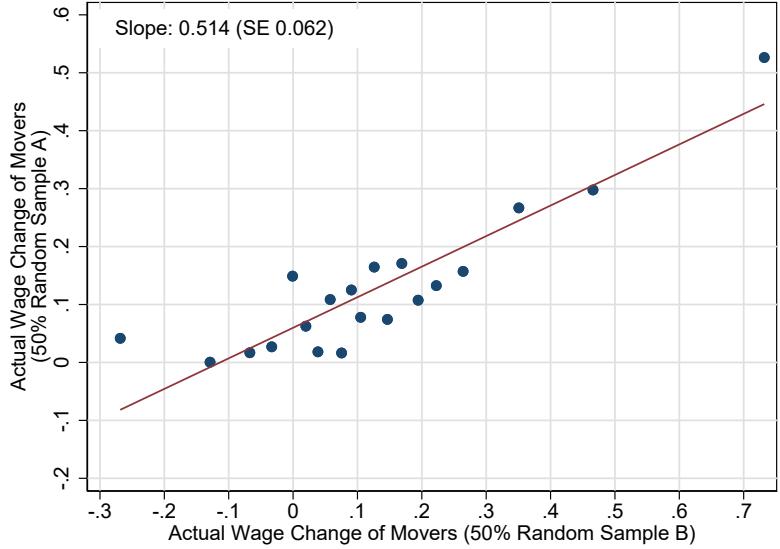
Note: This figure tests the predictiveness of past coworker mover wage changes for the wage changes that SOEP respondents experienced when leaving those workplaces by tracking SOEP respondents back to their previous workplace. Specifically, it plots the SOEP respondent's wage change when leaving this workplace against an Empirical Bayes correction of coworker wage changes (computed as the mean wage change of coworkers who left this workplace in the 5 years preceding the SOEP respondent's exit). Panel (a) restricts to EUE moves (both SOEP and coworker) to approximate "involuntary" moves, and Panel (b) considers all moves. The sample sizes are 1,877 for Panel (a) and 4,349 for Panel (b).

Figure A.5: Split Sample IV First Stage

(a) EUE (Involuntary Moves)

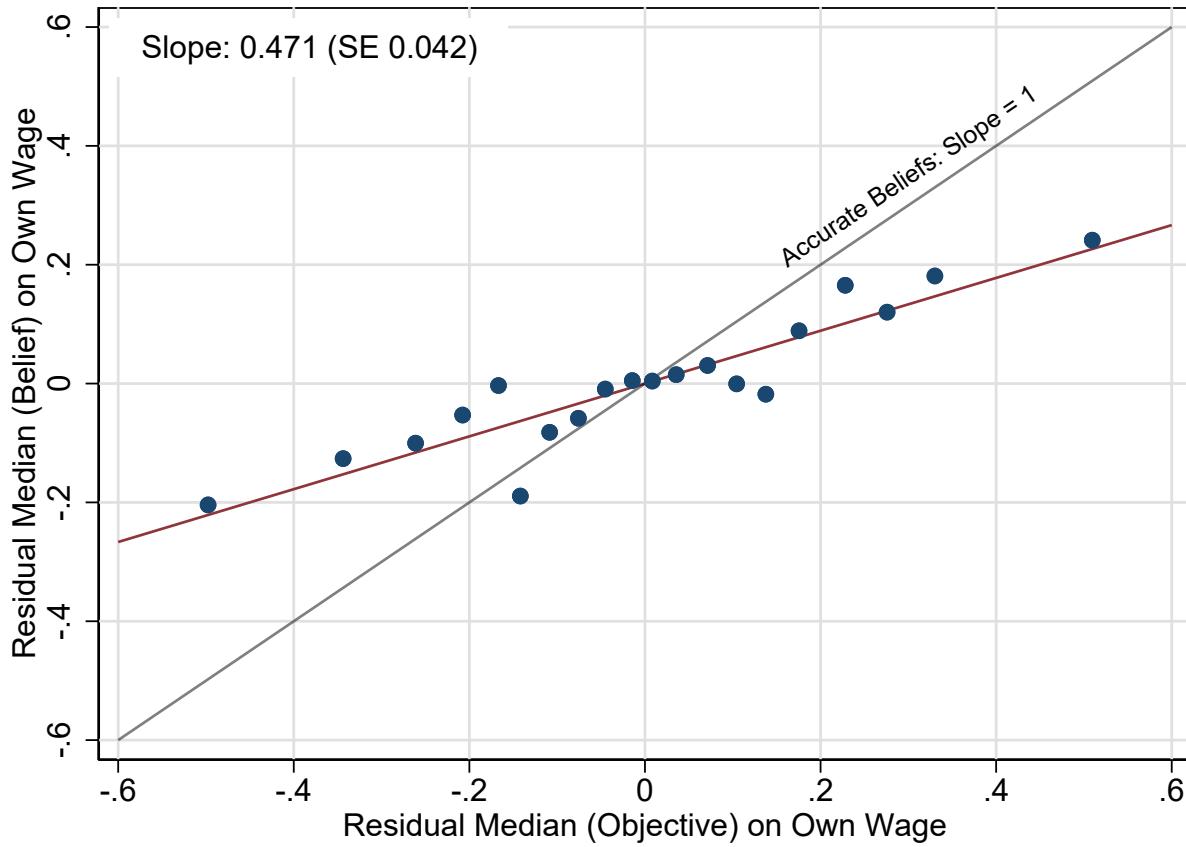


(b) All Moves



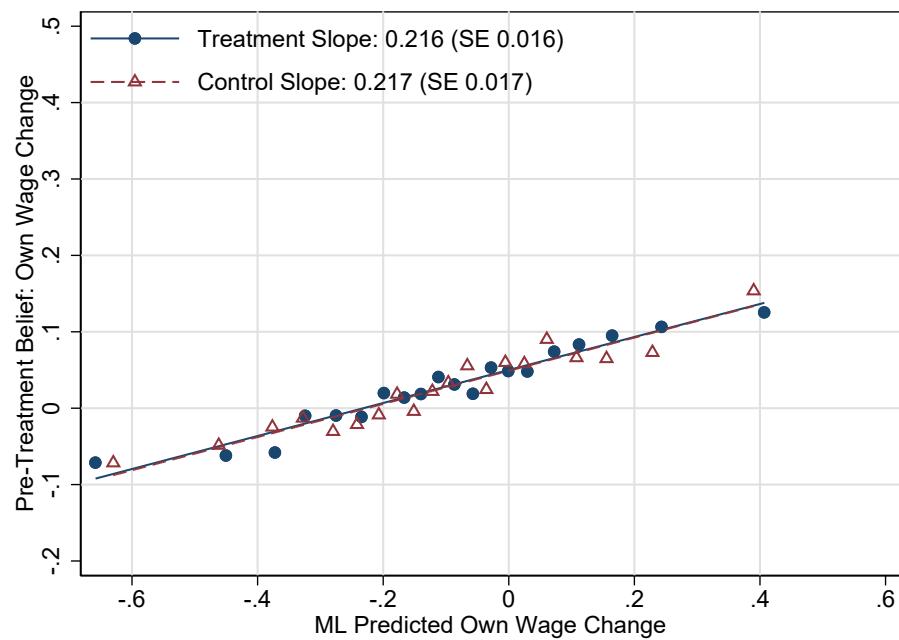
Note: The figure displays binned scatter plots of the first stages of the split-sample IV procedures we use to correct for errors in measurement of coworker wage changes. The estimated coefficients and standard errors from the second stages are reported in Figure 3 Panel (a) and Figure 5 as the dashed red lines. The procedures split each worker's set of coworker movers into two 50% random samples; these panels scatterplot their mean wage changes across the two random samples by firm. Panel (a) does so for EUE movers (corresponding to Figure 3 Panel (a)), and Panel (b) does so all movers (corresponding to Figure 5). The sample size in Panel (a) is 149, the sample size in Panel (b) is 403.

Figure A.6: Beliefs About Median Wage in Occupation



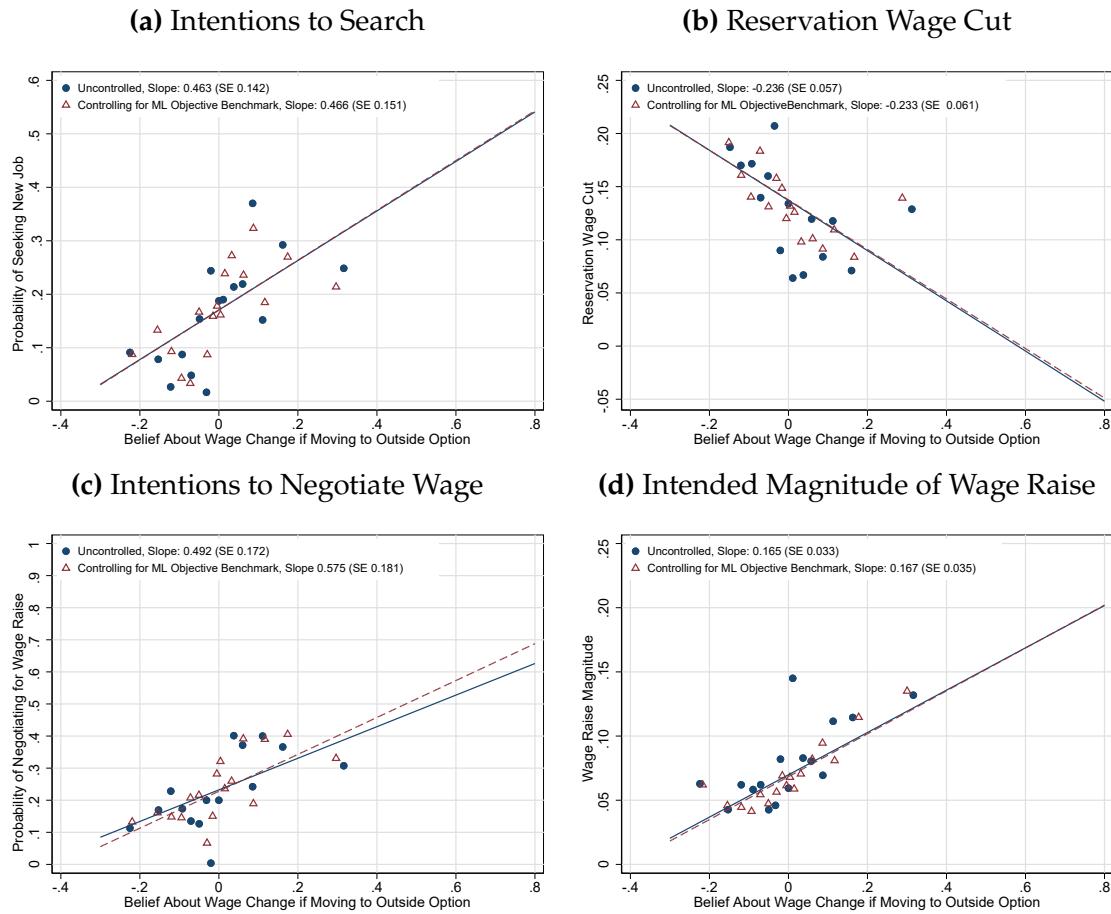
Note: This figure shows a binned scatterplot of the residuals of beliefs about median wage in the occupation (y-axis) and residuals of the actual median wage in the occupation. Residuals are obtained by separately regressing beliefs about median wage in the occupation and actual median wage in the occupation on own wages. We only include the full-time employed workers from our 2019 SOEP questionnaire. The sample size is 650.

Figure A.7: Pre-Treatment: Personal Outside Option Beliefs vs. ML Predictions



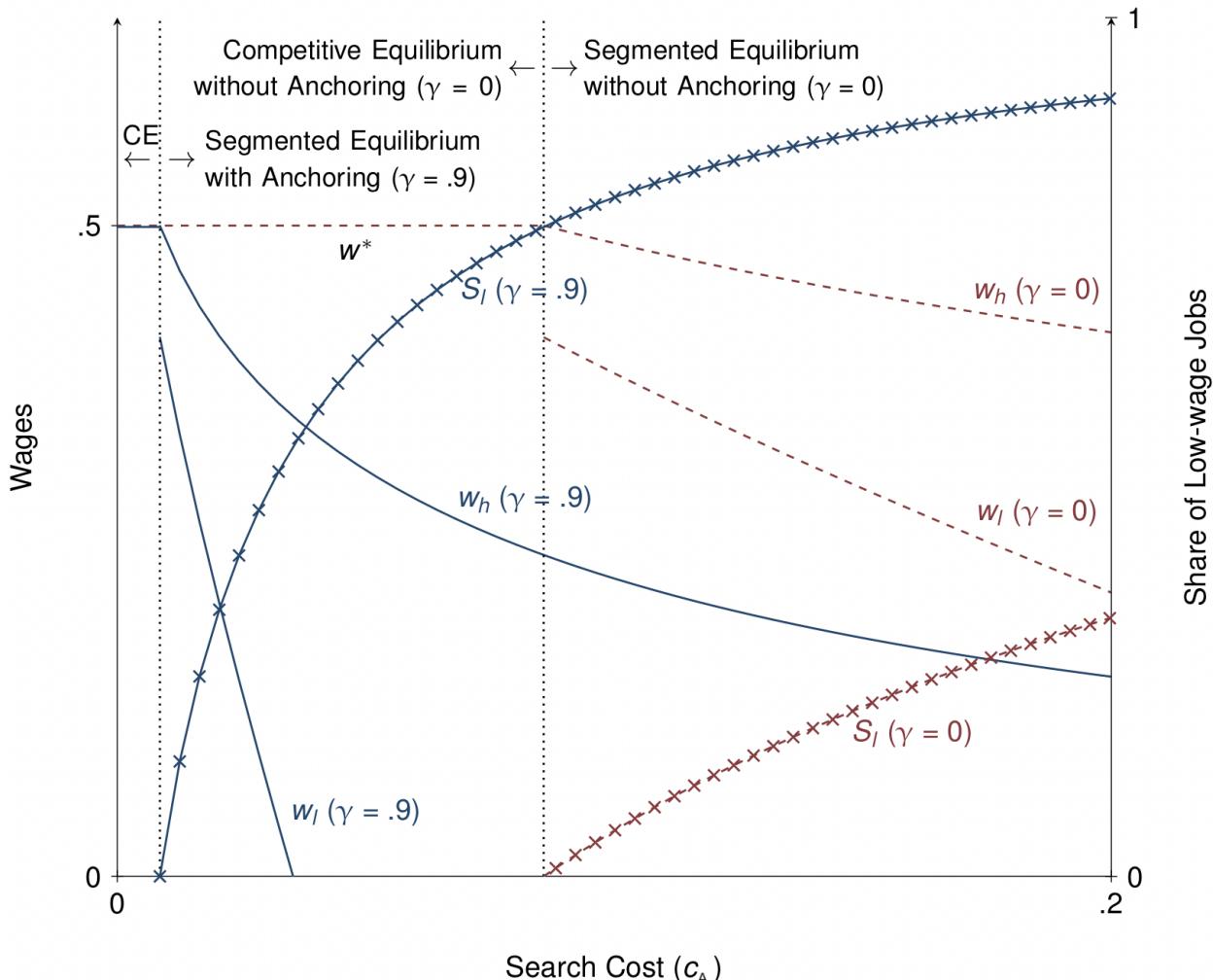
Note: This figure uses data from our 2022 information experiment. It shows a binned scatterplot between the pre-treatment beliefs about wage own changes and the machine learning prediction of wage change for our survey respondents. The sample size is 2,448.

Figure A.8: Worker Beliefs, Machine Learning Prediction, and Intentions to Search, Bargain, or Quit



Note: This figure replicates Figure 7 but uses the benchmark from the machine learning (ML) prediction as a control. See Figure 7 for additional information. The sample sizes are 515, 484, 516, and 506 in Panels (a) to (d) respectively.

Figure A.9: Equilibrium Implications of Information Costs, With and Without Anchoring



Note: The figure plots the same outcomes as Figure 11 (equilibrium wages and the share of low-wage jobs), but does so as a function of the search cost c_A , without anchoring ($\gamma = 0$, dashed red lines), and with anchoring ($\gamma = 0.9$, solid navy lines). The dotted vertical line marks the cutoff value of search costs that induces a switch from a competitive to a segmented labor market, with a high and low wage sector. The other parameters are decreasing returns $\eta = 1/2$, share of amateur workers $\alpha = 1/2$, and the number of workers per firm $L/N = 1$.

C Conceptual Framework: Anchoring in a Learning Model

In this section, we offer a simple model of belief formation that gives one potential way to interpret our patterns structurally. Our model assumptions depart from standard search models in that workers do not know the shape of the wage distribution and therefore have to form beliefs about it using as a signal the wage they receive at their current employer. We embed our analysis in a normal learning model, which has a long tradition in labor economics for *employer* learning about worker productivity (Farber and Gibbons, 1996; Altonji and Pierret, 2001). We derive an expression for workers' subjective beliefs about the expected wage change when moving to the outside option. This expression consists of a linear function of their objective wage premium, with the addition of two potential misperceptions.

C.1 Model

Environment There are N firms, with firm wage policies given by a normal distribution $N(\theta, 1/\pi)$ with mean θ and precision (inverse variance) π . Workers do not know these firm wage policies, instead they hold a subjective prior over θ given by $N(\mu, 1/\tau)$, while π is common knowledge. Wages are independent conditional on θ . In summary, the worker's beliefs about wages at firm j are given by

$$w_j | \theta \sim N(\theta, 1/\pi) \quad \forall j \in N \tag{A1}$$

$$\theta \sim N(\mu, 1/\tau) \tag{A2}$$

Belief Formation A worker hired by firm j observes the wage w_j . This provides a costless signal about the wage distribution. We first want to understand how the worker's posterior expectation about θ changes as a function of w_j , i.e., $\theta|w_j$. Bayesian updating implies:

$$\theta|w_j \sim N\left(\frac{w_j\pi + \mu\tau}{\pi + \tau}, \frac{1}{\pi + \tau}\right). \tag{A3}$$

Intuitively, the posterior mean of $\theta|w_j$ is a precision-weighted average of the prior mean μ and the received wage w_j . So long as w_j is informative about wages, i.e. π is non-zero, the

posterior belief about θ will be increasing in the received wage w_j . Footnote 1 elaborates.¹ Similarly, Bayesian updating about wages at another firm k implies:²

$$w_k|w_j \sim N\left(\frac{w_j\pi + \mu\tau}{\pi + \tau}, \frac{2\pi + \tau}{\pi(\pi + \tau)}\right). \quad (\text{A4})$$

¹To see this, note that the marginal posterior for θ is given by integrating over the wage w_k :

$$\begin{aligned} f(\theta|w_j) &= \int f(w_k, \theta|w_j) dw_k \\ &\propto \int f(w_j|\theta) f(w_k|\theta) f(\theta) dw_k \\ &= f(w_j|\theta) f(\theta) \int f(w_k|\theta) dw_k \\ &= f(w_j|\theta) f(\theta) \\ &= \phi(w_j; \theta, 1/\pi) \phi(\theta; \mu, 1/\tau) \\ &= \phi(\theta; w_j, 1/\pi) \phi(\theta; \mu, 1/\tau) \end{aligned}$$

where the last step follows from symmetry of the normal distribution. We next rely on the fact that the product of two normal pdfs is proportional to a normal pdf whose mean is a precision weighted average of the original means, and whose precision is equal to the sum of the original precisions. Specifically,

$$\phi(x; \mu_1, \tau_1) \phi(x; \mu_2, \tau_2) = \underbrace{\phi(\mu_1; \mu_2, \tau_1^{-1} + \tau_2^{-1})}_{\text{constant w.r.t. } x} \phi\left(x; \frac{\mu_1\tau_1 + \mu_2\tau_2}{\tau_1 + \tau_2}, \frac{1}{\tau_1 + \tau_2}\right).$$

Applying this to $f(\theta|w_j)$ implies:

$$\theta|w_j \sim N\left(\frac{w_j\pi + \mu\tau}{\pi + \tau}, \frac{1}{\pi + \tau}\right).$$

²To see this, note that we can write the marginal over w_k (for $k \neq j$) as:

$$\begin{aligned} f(w_k|w_j) &= \int f(w_k, \theta|w_j) d\theta = \int f(w_k|\theta) f(\theta|w_j) d\theta \\ &= \int \phi(w_k; \theta, 1/\pi) \phi\left(\theta; \frac{w_j\pi + \mu\tau}{\pi + \tau}, \frac{1}{\pi + \tau}\right) d\theta \\ &= \int \phi(\theta; w_k, \pi) \phi\left(\theta; \frac{w_j\pi + \mu\tau}{\pi + \tau}, \frac{1}{\pi + \tau}\right) d\theta \\ &= \phi\left(w_k; \frac{w_j\pi + \mu\tau}{\pi + \tau}, \frac{2\pi + \tau}{\pi(\pi + \tau)}\right) \int \phi(\theta; \cdot, \cdot) d\theta \\ &= \phi\left(w_k; \frac{w_j\pi + \mu\tau}{\pi + \tau}, \frac{2\pi + \tau}{\pi(\pi + \tau)}\right), \\ \Leftrightarrow w_k|w_j &\sim N\left(\frac{w_j\pi + \mu\tau}{\pi + \tau}, \frac{2\pi + \tau}{\pi(\pi + \tau)}\right). \end{aligned}$$

Since the conditional belief in Equation (A1) is a normal distribution centered at θ , the posterior belief about w_k is centered at the same point as the posterior belief about θ . Therefore, so long as $\pi > 0$, the posterior mean of $w_k|w_j$ is increasing in w_j : workers earning higher wages will have more optimistic posteriors about wages at other firms. However, the w_k posterior is less precise than the θ posterior whenever there is dispersion in wages, i.e., π is finite. Indeed:

$$\frac{\pi(\pi + \tau)}{2\pi + \tau} < \pi + \tau \quad (\text{A5})$$

Intuitively, this is because the posterior $w_k|w_j$ incorporates both uncertainty in θ and uncertainty in the wage conditional on θ .

Belief About Outside Options Our empirical design elicits a worker's subjective expectation about the wage change accompanying an involuntary move to their outside option. The essence of our research design is that workers form expectations about their outside option on the basis of their beliefs about the wage distribution. In the current setup, workers form beliefs about the expected wage. To formalize the link between the wage change in our model and our empirical design, suppose that, with probability x , the worker finds a job paying the same wage as their current employer; with (complementary) probability $1 - x$ the worker takes a random draw from the wage distribution, and hence in expectation receives the average expected wage. As a result, the wage change the worker would experience if transitioning to their outside option is given by:

$$\Delta_j = (1 - x)(\mu_j^0 - w_j), \quad (\text{A6})$$

where μ_j^0 is the average wage at other firms, that is $\mu_j^0 = \frac{1}{N} \sum_{k \neq j} w_k$. Assuming x is common knowledge, the worker's subjective *belief* about the wage difference, $\tilde{\Delta}_j$, is given by:

$$\begin{aligned} \tilde{\Delta}_j &= (1 - x)(E_j[w_k|w_j] - w_j) \\ &= (1 - x)\left(\frac{w_j\pi + \mu\tau}{\pi + \tau} - w_j\right) \end{aligned} \quad (\text{A7})$$

where we get Equation (A7) by replacing $E_j[w_k|w_j]$ with the mean of the distribution of $w_k|w_j$ from Equation (A4).

Biased Belief About Outside Options In order to measure potential biases in beliefs about outside options, we need to compare the worker's subjective belief about their outside option with an objective benchmark. Our empirical strategy to measure this objective benchmark is described in Section 2.4. Here, we assume that we have access to the true wage change the worker would experience at their outside option. The worker's

bias is then defined as the difference between the worker's subjective wage change and the true wage:

$$B_j = \tilde{\Delta}_j - \Delta_j \quad (\text{A8})$$

$$= (1 - x) \left(\frac{\pi w_j + \tau \mu}{\pi + \tau} - \mu_j^0 \right), \quad (\text{A9})$$

where Equation (A9) is obtained by replacing Δ_j using Equation (A6) and $\tilde{\Delta}_j$ using Equation (A7).

It follows that workers will underestimate outside options, i.e., $B_j < 0$, if:

$$w_j < \mu_j^0 + \frac{\tau}{\pi}(\mu_j^0 - \mu) \quad (\text{A10})$$

The direction of the inequality reflects the fact that workers paid lower wages are led to believe the external wage distribution is less favorable. The cutoff wage at which workers start to underestimate outside options relative to the truth depends on the prior mean μ . The lower the prior mean relative to the empirical average, the more workers will underestimate, and vice versa. In the special case when priors are correctly centered, $\mu = \mu_j^0$, Equation (A10) reduces to $w_j > \mu_j^0$: Workers with above average wages will overestimate wages at their outside options, and those with below average wages will underestimate wages at their outside options. Further, the impact of the relative precision of the signal $\frac{\pi}{\tau}$ depends on the sign of $\mu_j^0 - \mu$. Intuitively, the relative precision of the signal governs the anchoring to priors relative to the adjustment to current wage: if the prior is below the true mean and anchoring is strong (i.e. τ is high relative to π), a high w_j is needed for the adjustment to lead to overestimation of outside options. Conversely, if the prior is above the true mean and anchoring is strong, a low w_j is needed for the adjustment to lead to underestimation of outside options.

C.2 Correspondence to Empirical Strategy

Equations (A6) and (A7) allow us to express the coefficient in the regression of subjective beliefs ($\tilde{\Delta}_j$) on objective beliefs (Δ_j) in terms of the model parameters:

$$\tilde{\Delta}_j = \alpha + \beta \Delta_j + \epsilon_j \quad (\text{A11})$$

Slope β The coefficient of interest can then be written as:

$$\begin{aligned}
\beta &= \frac{\text{Cov}(\tilde{\Delta}_j, \Delta_j)}{\text{Var}(\Delta_j)} \\
&= (1-x)^2 \frac{\text{Cov}\left(\left(\frac{w_j \pi + \mu \tau}{\pi + \tau} - w_j\right), (\mu_j^0 - w_j)\right)}{\text{Var}(\Delta_j)} \\
&= (1-x)^2 \frac{\tau}{\pi + \tau} \frac{\text{Cov}((\mu - w_j), (\mu_j^0 - w_j))}{\text{Var}(\Delta_j)} \\
&= (1-x)^2 \frac{\tau}{\pi + \tau} \frac{(1-(N-1)^{-1})\text{Var}(w_j)}{\text{Var}(\Delta_j)} \\
&= \frac{N-2}{N-1} \frac{\tau}{\pi + \tau},
\end{aligned} \tag{A12}$$

where the last line follows from the fact that $\text{Var}(\Delta_j) = (1-x)^2 \text{Var}(w_j)$.³ When N is large,

$$\beta \approx \frac{\tau}{\pi + \tau}. \tag{A13}$$

When θ is uninformative about wages, i.e., when wage dispersion is high and π is low relative to τ , current wages do not generate differential posterior over- or under-estimation and the slope approaches one. Meanwhile, when θ and wages are tightly linked (π is high relative to τ), overall sentiment about the wage distribution is highly sensitive to the current wage. Workers underestimate the magnitude of wage changes, leading to a lower β .

Intercept α The intercept is the subjective wage change for a worker at the average firm ($w_j = \mu_j^0$), and is given by

$$\begin{aligned}
\alpha &= \bar{\tilde{\Delta}}_j - \beta \bar{\Delta}_j \\
&= (1-x) \left(\frac{\bar{w} \pi + \mu \tau}{\pi + \tau} - \bar{w} \right) - \frac{\tau}{\pi + \tau} (1-x) (\mu_j^0 - \bar{w}) \\
&= \frac{\tau}{\pi + \tau} (1-x) (\mu - \mu_j^0),
\end{aligned} \tag{A14}$$

where \bar{w} is the sample mean of w_j , which may differ from μ_j^0 when the SOEP sample is not perfectly representative. Equation (A14) shows that the intercept is proportional to

³The coefficient $\frac{N-2}{N-1}$ arises due to the mechanical negative correlation between w_j and μ_j^0 . This attenuates the positive correlation between subjective and objective wage changes.

the difference between the posterior and population means $\mu - \mu_j^0$. When this difference is non-zero, the intercept induces a homogenous shift in subjective wage changes.

D Machine Learning Prediction

In this appendix, we describe the methodology used to produce our machine learning wage change predictions.

We begin by taking the universe of annual employment spells between 2015 and 2019 in the IAB data. For each person, we narrow down to that person’s “main spell” within each year by taking the spell with the highest earnings that year. A “firm-to-firm transition” is defined as a case where person i ’s main spell is in firm j_1 during year t and in firm $j_2 \neq j_1$ in year $t + 1$. Using this definition, we restrict our attention to the full set of firm-to-firm transitions occurring between 2015 and 2019 in which the person worked full-time both at their origin firm and their destination firm, and experienced an intermediate spell of unemployment insurance receipt beginning within 12 weeks after the termination of the original job. We omit firm-to-firm transitions corresponding to SOEP respondents.

For each firm-to-firm transition, we calculate the log wage change associated with that transition as the difference between the log daily earnings associated with firm j_2 in year $t + 1$ minus the log daily earnings associated with firm j_1 in year $t + 1$. We also calculate a comprehensive set of covariates for the person-transition observation, with all covariates calculated during the person’s last spell at the origin firm—so firm-level characteristics are characteristics of the *origin* firm, and age, education, etc., are calculated during the last spell at that firm. The full set of covariates is listed in Appendix Table A.5.

We then run a lasso regression at the person-transition level where the dependent variable is the log wage change associated with the transition and the independent variables are the covariates listed in Appendix Table A.5. We use the Stata command `elasticregress` (Townsend, 2017), as the administrative data environment we worked in did not have newer versions of Stata with built-in machine learning packages.

Once the lasso regression selects a set of covariates and estimates coefficients for them, we use those covariates and coefficients to generate a predicted wage change for each SOEP respondent. We do this by matching the SOEP respondent IDs into the 2019 administrative IAB data and calculating the values of each covariate for the SOEP respondents using the IAB data.

The lasso regression selects all of the covariates we include, with the exception of some of the dummies within the sets of region/industry dummies and interactions. Appendix Table A.5 presents estimated coefficients, and partial R^2 values, for each selected coefficient. Partial R^2 values are calculated by regressing the “transition wage change” variable on the relevant covariate, with all of the other covariates partialled out; the R^2 value from this regression is the relevant covariate’s partial R^2 value.

We test the fit of the lasso model by estimating the model on a randomly selected 50% sample of firm-to-firm transitions, using the estimated coefficients to generate predictions for the remaining 50% of observations, and then regressing the true wage changes for those observations on the predicted wage changes. This latter “evaluation” regression results in a coefficient of 1.017 (SE 0.006) on the “predicted wage change” dependent variable and an R^2 value of 0.40.

Table A.5: Machine Learning Predictors

Variable	Description	Included?	Coefficient	Partial R^2
Wage	Mover's Log Wage at Initial Firm.	Y	-0.647	0.232
Firm Effect	AKM Fixed Effect of Initial Firm.	Y	0.192	0.003
Age in Years	Cubic in Mover's Age (Linear Coef. Reported).	Y	0.008	0.000
Tenure in Years	Cubic in Mover's Number of Years Spent at Initial Firm (Linear Coef. Reported).	Y	0.008	0.001
Gender	Female Dummy.	Y	-0.075	0.008
Firm Size	Cubic in Number of Employees at Initial Firm (Coef. on Cubic, the Only Included Dummy, Reported).	Y	0.000	0.001
Turnover	Annual Separation Rate at Initial Firm.	Y	0.060	0.001
Wage Dispersion	SD of Wages at Initial Firm.	Y	0.073	0.001
Employment Growth	Annual Growth Rate in Number of Employees at Initial Firm.	Y	0.037	0.000
Education	Dummies for: No Education, Vocational Education, University Education, Omitted = Missing Education. Coef. on "University" Reported, the Other Two Are Very Close to Zero.	Y	0.312	0.000
Region	16 <i>Bundesländer</i> (German States).	Y	NA	0.000
Occupation	1-Digit Occupation Categories.	Y	NA	0.023
Industry	NACE Level 1 Codes.	Y	NA	0.000
Industry × Region	Industry Dummies Interacted with Region Dummies.	Y	NA	0.013
Age × Education	Cubic in Age Interacted With Education Dummies.	Y	NA	0.062

E Additional Results

E.1 Robustness: Survey with Alternative Elicitations

To verify that our main descriptive results are not driven by the particular wording of our survey questions, we examine robustness to alternative wordings by running an online survey using a sample of 902 workers broadly representative of the German population in full-time and part-time employment in terms of age, wage, education, gender and region (see Appendix Table A.6). The data collection took place in July 2021 and was conducted with Dynata, a professional survey company frequently used in the social sciences (Haaland, Roth, and Wohlfart, 2023).

Sample Definition and Data Quality In what follows, we describe how the dataset from the robustness survey was cleaned. We only consider respondents who completed all of our survey questions. Out of 1,173 respondents who qualified for and started our study, 179 (or 15%) did not complete the full survey, which is a common attrition rate in online surveys. This leaves us with a sample of 994 respondents.

At the start of the survey, we elicited people's pre-tax earnings using both a question with categorical responses and open-ended responses. We exclude 69 respondents who gave inconsistent or implausible responses (monthly wage larger than 25,000 EUR or lower than 170 EUR) to the initial wage questions, which may be a reflection of inattention in online surveys. Moreover, we asked all of our respondents about their outside option in case of a job loss, and removed those that either state that their outside option pays less than 100 EUR monthly wage or more than 25,000 EUR monthly wage (23 respondents). This leaves us with a sample of 902 respondents. All of our results from the robustness survey are robust to including these 92 dropped respondents. The median response time in the survey is approximately 10 minutes.

Winsorization Some of our response scales more naturally give rise to outliers than others. Since we want to compare responses across response scales, we winsorize our outcomes to make our comparisons less sensitive to outliers:

- For the question on outside options, we winsorize responses at a 3500 wage increase or decrease (as this is the maximum implied by our categorical response scale). This affects 4 responses.
- For the question on coworker wage changes, we winsorize responses at a 62.5% wage increase or decrease (as this is in practice the maximum categorical response scale chosen by respondents). This affects 13 responses.
- For all of our variables on wage changes as a fraction of wage, based on the question on outside options, we further winsorize responses at -100% and +100% of wage. This affects 8 responses for our "generally framed" main outside option question and 11 responses for the outside option question framed in terms of a mass layoff.

Results Our online survey confirms qualitative robustness to the following alternative question wordings: eliciting the wage level at outside option rather than change relative to current wage; omitting the “same pay” category as a response option and forcing respondents to enter a percentage wage change; varying the duration to find a new job between 3 and 12 months; specifying that an unexpected company closure is what forces the respondent to find a new job; specifying that the respondent has to search within their current occupation; not specifying that the belief about own wage rank is conditional on occupation; and adding 5-EUR prediction incentives for the question about median pay in one’s occupation.

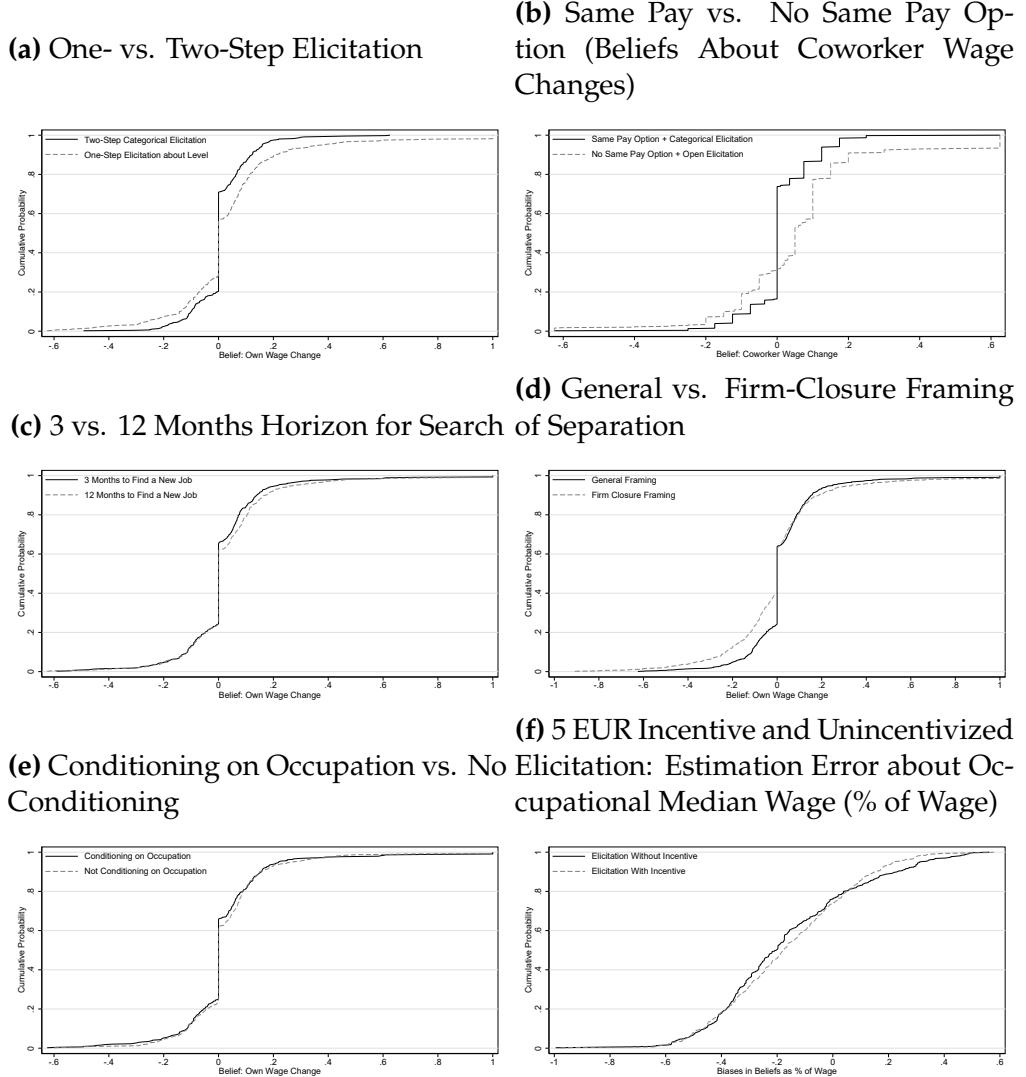
Results are reported in Appendix Figures A.10. Some of the alternative wordings, especially the omission of the “same pay” option, result in less compressed distributions of beliefs about outside options, though all alternative wordings replicate our qualitative finding of strong clustering around zero subjective wage change, and most of the alternative wordings have virtually no effect.

Table A.6: Summary Statistics: Robustness Survey

	Mean	SD	P25	Median	P75	N
Panel A: Demographics and Labor Market Characteristics						
East	0.201	0.401	0.000	0.000	0.000	902
University Degree	0.360	0.480	0.000	0.000	1.000	902
Age in Years	48.7	11.8	40.0	51.0	58.0	902
Female	0.442	0.497	0.000	0.000	1.000	902
Gross Monthly Wage	3,567	2,098	2,280	3,200	4,450	902
Full-time Employed	0.776	0.417	1.000	1.000	1.000	902
Panel B: Beliefs						
Own Wage Change: Firm Closure Framing	-0.003	0.232	-0.091	0.000	0.062	902
Own Wage Change: Two-Step Categorical Elicitation	0.011	0.100	0.000	0.000	0.043	461
Own Wage Change: One-Step Elicitation About Level	0.037	0.217	-0.036	0.000	0.091	441
Own Wage Change: Conditioning on Occupation	0.020	0.175	-0.001	0.000	0.061	439
Own Wage Change: Not Conditioning on Occupation	0.027	0.162	0.000	0.000	0.076	463
Own Wage Change: 3 Months to Find a Job	0.017	0.161	0.000	0.000	0.060	457
Own Wage Change: 12 Months to Find a Job	0.031	0.175	0.000	0.000	0.083	445
Wage Change of Coworkers: Same Pay Option + Categorical Elicitation	0.062	0.210	-0.050	0.050	0.100	441
Wage Change of Coworkers: No Same Pay Option + Open Elicitation	0.010	0.090	0.000	0.000	0.035	461

Note: This table reports summary statistics from the robustness survey conducted in July 2021. “Own Wage Change: Firm Closure Framing” is the subjective wage change for an alternative framing, which explicitly states that the separation is due to an unexpected company closure. “Own Wage Change: Two-Step Categorical Elicitation” replicates the SOEP main elicitation. “Own Wage Change: One-Step Elicitation About Level” alternatively constructs the wage change from a direct question about the wage level at the outside option. “Own Wage Change: Conditioning on Occupation” features a restriction for the new job to be in the same occupation. “Own Wage Change as % of Wage: Not Conditioning on Occupation” does not restrict the new job to be in the same occupation. “Own Wage Change as % of Wage: 3 Months to Find a Job” posits a 3-month time horizon to find a new job. “Own Wage Change: 12 Months to Find a Job” extends this window to 12 months. “Wage Change of Coworkers: Same Pay Option + Categorical Elicitation” is the belief about coworkers wage changes for the main elicitation (which we employed in our main surveys from SOEP). “Wage Change of Coworkers: No Same Pay Option + Categorical Elicitation” is the belief about coworkers wage changes for an alternative elicitation which did not offer the “same pay” option and was open-ended in the second step of the elicitation.

Figure A.10: Robustness of Beliefs About Outside Option to Various Design Features



Note: Panel (a) reports the cumulative distribution function (cdf) of beliefs about outside options (wage change) separately for the elicitation which we employed in our main surveys from SOEP and an alternative elicitation which directly elicited beliefs in one step. Panel (b) reports cdfs of beliefs about coworkers' wage changes separately for the main elicitation and an alternative elicitation which did not offer the "same pay" option and was open-ended in the second step of the elicitation. Panel (c) reports the cdf separately for a 3 month and 12 month time horizon to find a new job. Panel (d) compares the cdf to that elicited in an alternative framing, which explicitly states that the separation is due to an unexpected firm closure. Panel (e) reports the cdf separately for elicitations conditioning on workers staying in the same occupation or not. Panel (f) reports on the cdf of estimation errors about the median pay (in percent of wage) in one's occupation separately for respondents in the 5 EUR incentive group and the no-incentive elicitation group.

F Information Provision Experiment

Ethical Considerations In this section, we briefly discuss relevant ethical considerations in the context of our experiment for which we received ethics approval from the University of Cologne and which was deemed exempt by MIT. Providing respondents with information about their outside options raises several ethical questions: could the information we provide our respondents with be misleading for them? Might they misunderstand the information provided?

We aimed to minimize ethical concerns in a number of ways. First, we offered respondents in the control group to receive information about outside options at the end of the survey. A large fraction (80%) of respondents chose to receive the information suggesting a large demand for the information. Second, we provided all of our respondents with a debrief clarifying some details on how we calculated the data on outside options. We also cautioned our respondents to consider that those were average values and that those averages shroud important heterogeneities. Thereby, we wanted to minimize the risk of respondents misinterpreting the provided information.

Sample Definition and Data Quality 9,225 respondents started the survey. Below, we describe, step-by-step, the sample size reductions for each data cleaning step.

- Initially, 9,225 were eligible to take the survey.
- 188 (2%) do not consent. 9,037 remain.
- 763 (8% out of the remaining sample) report an IP address's duplicates. 8,274 remain.
- 249 (3%) ID duplicates are dropped. 8,025 unique individuals remain.
- 1,330 (17%) fail the first attention check and are removed from the sample. 6,695 remain.
- 961 (14%) not full-time employed are removed. 5,734 remain.
- 470 civil servants, and 373 are self-employed (15%) are removed. 4,891 remain.
- We removed 636 individuals that reported that the occupations shown to them did not describe their occupation reasonably well. This represented 13% of that remaining sample. 4,255 remain.
- 514 (12%) respondents who did not finish the survey were removed. 3,741 remain.
- We drop individuals with implausible earnings reports. Across the four earning variables in EUR (pre-tax wage, pre-treatment outside option, belief about mean wage of similar workers, post-treatment outside option), 260 (7%) gave a response that is either invalid (e.g., a range like "3000-5000") or a wage that is < 20% or > 300% the mean wage in their observable cell. After this screen, 3,481 remain in sample.

- Finally, from the respondents left, we removed those who failed the occupation attention check (re-selecting the occupation they selected earlier, from a list of 10 occupations). 275 individuals were dropped in this final screen, which represents 8% of the remaining sample. 3,206 respondents remain.
- Of these 3,206 respondents, 758 come from the a pilot. In the pooled sample, 1,567 are treated and 1,639 are controls. In the post-pilot sample of 2,448 respondents, 1,203 are treated and 1,245 are controls.

Table A.7: Descriptive Statistics in Experiment

	Mean	SD	P10	Median	P90	Control (Mean)	Treatment (Mean)	P-Value
General Stats								
Number of Respondents	2,448					1,245	1,203	
Share of Women	0.411					0.410	0.412	0.893
Age in Years	44.7	10.4	31.0	45.0	59.0	44.4	45.0	0.155
Pre-Tax Wage (in EUR, per Month)	3,885	1,660	2,200	3,500	6,000	3,892	3,877	0.827
No Qualifications	0.019					0.018	0.020	0.790
Vocational Qualification	0.603					0.606	0.599	0.720
University Qualification	0.378					0.375	0.381	0.775
Share in Nordrhein-Westfalen	0.493					0.489	0.496	0.725
Share in Bavaria	0.201					0.210	0.192	0.277
Share in Baden-Wuerttemberg	0.137					0.136	0.138	0.872
Job Specific Stats								
Wage according to CBA	0.112					0.112	0.113	0.912
Weekly Working Hours	38.388	4.030	33.000	38.000	43.000	38.423	38.352	0.664
Size of Employer	4,535	16,346	20	260	6,000	4,014	5,074	0.109
Tenure in Years	15.004	9.817	5.000	13.000	30.000	15.039	14.968	0.857
Number of Previous Employer	6.967	2.436	4.000	7.000	10.000	6.916	7.019	0.297
Number of Wage Investigations	1.344	2.465	0.000	0.000	4.000	1.544	1.136	0.000
Experiment Specific Stats								
Average Bias (in Euro)	-365.650	1,001.761	-1,657.000	-381.500	920.000	-353.908	-377.801	0.555
Average Bias (in %)	-0.078	0.238	-0.374	-0.103	0.251	-0.073	-0.082	0.372
Pretreatment Beliefs: Wage Change (in Euro)	91.845	583.570	-532.000	0.000	750.000	91.339	92.369	0.965
Pretreatment Beliefs: Wage Change (in %)	0.038	0.153	-0.143	0.000	0.212	0.037	0.039	0.731

Note: This Table reports data from the information provision experiment conducted between May and July 2022. The p-values are obtained from a two-sided hypothesis test with a H0 of no difference in mean (proportion) between control and treatment group. We compare the group means (proportion) of the continuous (dummy) variables with a t-test (proportions test).

Calculation of Wages of Similar Worker in Same Local Labor Market To calculate the average wages of observably similar workers, we draw on the German administrative data for 2019 and run a regression of log daily wages on a female dummy, 5-digit occupation dummies, labor market region dummies, education dummies, an age cubic, and education interacted with the age cubic. We extract the coefficients from the administrative data environment and program them into our survey. Our survey uses those coefficients to predict the mean wage of workers with the respondent's covariates. Since the predictions are from 2019, we inflation-adjust using mean nominal wage growth between 2019 and the end of 2021. To test the validity of this technique, we run our "prediction" methodology on 2017 wage data and generate inflation-adjusted predictions for 2019, then regress actual 2019 wages on predicted 2019 wages in the administrative data. This results in a regression coefficient of 0.96.

F.1 Beliefs About the Study Hypothesis

Design At the end of the experiment, respondents were asked the following open-ended question: “Which hypothesis do you think the researchers try to test with this survey?”

Coding Manual Based on hand-coding of 200 responses, we came up with a coding scheme to capture the most predominant beliefs about the study purpose.

- **The Causal Effect of Information/Beliefs:** People correctly guessing the study’s hypothesis about the relationship between beliefs and labor market intentions, i.e., that respondents’ intended labor market behaviors are affected by the information provided in the experiment. Example responses: “Whether workers switch employers because of wages.”; “whether people think they earn more wages when they are shown a supposed average wage, and how much money can influence them to stay with a company or not”; “Knowing or not knowing the general average wage of our job changes the subjective perception of the value of our job.”
- **Beliefs:** Responses mentioning beliefs about the labor market or beliefs about wages about similar workers. Example responses: “Subjective beliefs about the labor market”; “You are trying to find out how each respondent assesses their wage compared to similar other people.”
- **Wages:** Responses mentioning wages or wage comparisons. Example response: “The extent to which the wage affects my job”; “wage comparisons.”
- **Labor Market:** Generic responses about labor market behaviors. Example response: “Willingness to switch.”
- **Attention:** responses indicating that the study tries to test respondent’s attention. Example response: “Cognitive abilities, concentration, attention.”; “How attentively people read surveys.”
- **Junk:** Nonsensical responses.
- **Don’t Know:** People expressing that they don’t know. Example response: “I don’t know.”
- **Other:** Responses that do not fit into any of these categories.

Results Only a small fraction of respondents correctly guess that we are interested in the causal effect of information and beliefs (7%), while a relatively large fraction of respondents express not knowing the hypothesis of interest (31%). Most of the other responses reveal that respondents do not have very precise hypotheses about the study. 7% think that the study hypothesis concerns labor markets, 5% think that the study tries to test people’s attention, 19% think that the study is about understanding wages in the labor market,

14% think that the study is about understanding labor market perceptions. Only 2% of responses fall into the junk category, indicating a high data quality. 14% of responses cannot be classified in any of these categories.

Table A.8: Information Experiment: Respondents not Guessing the Hypothesis

	(1) Post-Treat Estimation Error	(2) Belief About Outside Option (Wage Change)	(3) Intended Quit Probability	(4) Intended Search Probability	(5) Intended Negotiation Probability	(6) Intended Neg. Magnitude (No Neg. = 0)	(7) Intended Neg. Magnitude (No Neg. = Msg.)	(8) Reservation Wage Cut
Treated × Pre-Treat Estimation Error	-0.520*** (0.061)	-0.480*** (0.041)	-0.124** (0.054)	-0.091* (0.055)	-0.187*** (0.061)	-0.044*** (0.009)	-0.058*** (0.010)	-0.006 (0.017)
Treated	-0.008 (0.015)	0.033*** (0.009)	0.003 (0.013)	0.016 (0.014)	0.008 (0.016)	0.004** (0.002)	0.004* (0.002)	-0.003 (0.004)
Pre-Treat Estimation Error	0.892*** (0.046)	0.044 (0.027)	-0.024 (0.040)	-0.028 (0.039)	0.095** (0.044)	0.017*** (0.006)	0.018*** (0.006)	0.007 (0.012)
Constant	0.035*** (0.011)	0.045*** (0.006)	0.228*** (0.010)	0.245*** (0.009)	0.388*** (0.011)	0.057*** (0.001)	0.072*** (0.002)	0.091*** (0.003)
IV: Endogenous Variable: Belief About Outside Option (Wage Change)			0.237** (0.092)	0.229** (0.094)	0.372*** (0.109)	0.097*** (0.016)	0.117*** (0.016)	-0.001 (0.026)
Constant			0.215*** (0.009)	0.239*** (0.009)	0.369*** (0.010)	0.053*** (0.001)	0.066*** (0.002)	0.090*** (0.002)
Control Group Mean	-0.025	0.042	0.230	0.247	0.381	0.056	0.071	0.091
First-Stage F-Stat			129.674	129.674	129.674	129.674	112.822	128.538
N	2,267	2,267	2,267	2,267	2,267	2,267	1,814	2,266

Note: This table replicates Table 2 for the subsample of respondents who did not correctly guess the hypothesis of the experiment. We only collected this data on hypothesis guessing in the post-pilot sample.

F.2 Discussion: Revealed-Preference Outcomes

A challenge in this literature may be that it is hard to shift beliefs persistently and thereby affect longer-run behavior. We have experimented with studying realized revealed-preference outcomes rather than planned behaviors as outcomes, specifically studying WTP for vouchers for job search help (consultation about application material preparation) and wage negotiation training. In pilots, we did not find significant effects on those outcomes, and aborted because of logistical and financial complications associated with this outcome. One explanation for this null result could be that debiasing underestimators (overestimators) may lead them to update that job search is easy (hard), and hence make help with applications less (more) useful; similarly, our information treatment may facilitate wage negotiations itself, reducing rather than increasing the WTP for negotiations training.

F.3 Comparison to SOEP-IS Information Experiment

We had planned a simple information treatment in the SOEP-IS, informing workers about their outside options in the 2019 wave of our survey. Due to legal and technical challenges we were only able to give information about the median wage in the occupation (but not about the other, more granular benchmarks that are plausibly stronger signals informing the worker's own outside option). The survey randomly chose 50% of respondents to receive accurate information about the median wage in their occupation after they reported their belief. Our core descriptive beliefs about coworker wage changes after a switch, median wage in occupation, and perceived wage rank were all elicited before the information intervention. We aimed to study effects on beliefs about outside options and intended search and bargaining behavior.

Appendix Table A.9 shows results from the information treatment, leveraging the same empirical strategy as in Section 4. The table shows marginally significant treatment effects in the expected direction for post-treatment beliefs about wage changes: treated workers that initially underestimated the median wage in their occupation upward-adjust their expected wage at the next-best employer, while the reverse holds for overestimators. However, we detect non-significant effects on intended bargaining or job search behaviors, with positive coefficients.⁴

One interpretation is that the mild information treatment may not have sufficiently shifted respondents' beliefs about the external labor market to also ignite behavioral change, or that the national wage median may not give actionable information for labor market behavior.

We also calculate the implied IV coefficients of a second-stage specification where we regress job search or negotiation intentions on beliefs about the personal outside option (instrumented with the error in beliefs about the median wage in the occupation interacted with treatment status as well as the treatment indicator). As the bottom two rows show,

⁴We also do not find any realized effects of the 2019-wave treatment on 2020-wave outcomes such as wage growth.

the point estimates are comparable in magnitude to the OLS results, but more noisily estimated.

We interpret these results to be consistent with the results of our main information experiment conducted in 2022. However, the SOEP-IS experiment is under-powered to detect plausible effect sizes: the IV coefficients would have very wide standard errors as would be expected with a weak first stage (F -statistic of ~ 2).

The weaker effects in the SOEP-IS experiments can likely be explained by the following two factors, which likely contributed to the weak effects on post-treatment beliefs about own wage changes:

1. To shift outside options, we provided respondents with the **national median wage** in their occupation, rather than more targeted information matching participants' characteristics.
2. We could only briefly report the numeric information about the median wage, rather than, e.g., visualizing the information.

As a result, our main SOEP results pool treated and control groups.

Table A.9: SOEP Information Experiment

	(1) Post-Treat: Outside Option (Wage Change)	(2) Intended Search Probability	(3) Intended Negotiation Probability	(4) Intended Neg. Magnitude (No Neg. = 0)	(5) Intended Neg. Magnitude (No Neg. = Msg.)	(6) Reservation Wage Cut
Treated × Pre-Treat Estimation Error	-0.028* (0.017)	0.017 (0.025)	0.003 (0.035)	0.001 (0.002)	0.001 (0.002)	0.006 (0.018)
Treated	0.005 (0.008)	0.015 (0.019)	-0.017 (0.023)	0.000 (0.001)	-0.000 (0.001)	-0.011 (0.008)
Pre-Treat Estimation Error	0.023 (0.016)	-0.033 (0.024)	-0.012 (0.033)	-0.000 (0.002)	-0.000 (0.002)	-0.006 (0.018)
Constant	-0.011** (0.006)	0.151*** (0.013)	0.230*** (0.017)	0.033*** (0.001)	0.034*** (0.001)	0.150*** (0.006)
IV: Endogenous Variable:		-0.125	-0.566	-0.013	-0.019	-0.498
Belief About Outside Option (Wage Change)			(0.997)	(1.360)	(0.069)	(0.653)
Constant		0.158*** (0.013)	0.215*** (0.016)	0.033*** (0.001)	0.034*** (0.001)	0.140*** (0.007)
Control Group Mean	-0.008	0.155	0.225	0.033	0.034	0.150
First-Stage F-Stat		1.991	1.970	1.985	2.069	1.985
N	1,186	1,181	1,182	1,186	1,167	1,186

Note: This table reports results following the strategy from Table 2 for the 2019 information treatment about the median wage in the occupation, which we had integrated in the SOEP-IS.

F.4 Pre-Registration

Worker Beliefs about Outside Options (#101803)

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1) Have any data been collected for this study already?

It's complicated. We have already collected some data but explain in Question 8 why readers may consider this a valid pre-registration nevertheless.

2) What's the main question being asked or hypothesis being tested in this study?

Providing respondents with information about the wages of similar workers affects their beliefs about their personal outside options and, as a result, their intended labor market behaviors.

3) Describe the key dependent variable(s) specifying how they will be measured.

1) Beliefs about peer salaries (as percent of own salary); 2) Bias about peer salaries (as percent of true peer salary); 3) Beliefs personal outside options (in percent difference from current wage); 4) Intended quit probability (in percent); 5) Intended search probability (in percent); 6) Intended negotiation probability (in percent); 7) Intended negotiation magnitude (measured on a Likert scale and setting no negotiation as zero); 8) Intended negotiation magnitude (measured on a Likert scale and setting no negotiation as missing).

4) How many and which conditions will participants be assigned to?

Two treatment conditions.

Treatment group: Receives information about the wages of similar workers before the main outcomes are measured.

Control group: Does not receive information about the wages of similar workers before the main outcomes are measured.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

We estimate the following specification with OLS:

$$Y_i = \alpha + \beta_1 \text{EstimationError}_i + \beta_2 \text{InformationTreatment}_i + \gamma \text{InformationTreatment}_i \times \text{EstimationError}_i + \epsilon_i$$

Y_i is the outcome(s) of interest, listed in our response to question 3

$\text{InformationTreatment}_i$ takes value 1 for respondents in the treatment group that receives information about the wages of similar workers before the main outcomes are measured and value zero otherwise.

EstimationError_i is the difference between respondent i's pre-treatment belief about the wages of similar workers and the benchmark value we calculate based on administrative data.

The coefficient of interest is γ , which measures the effect of the information treatment as a function of respondents' initial estimation error.

We will also re-estimate the above equation replacing EstimationError_i with Overestimator_i a dummy variable taking value 1 for respondents that overestimate the wages of similar workers.

We also report results based on IV specifications. The endogenous independent variable is the post-treatment belief about the personal outside option (in percent difference from current wage). The IV specification regresses intended labor market behaviors on post-treatment personal outside option beliefs, instrumented with an interaction between $\text{InformationTreatment}_i$ and EstimationError_i .

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

We only include participants in our study that pass a basic attention screener at the start of the survey and that give consistent responses to a question eliciting the respondent's occupation.

We exclude respondents who, for any of the following questions -- (i) own wage, (ii) wwn outside option (both pre and post treatment) or (iii) Belief about peer wage -- give a response that is <20% or >300% the mean wage of observably similar peers.

7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

We plan to recruit 3000 to 4000 full-time employed workers that are not self-employed, do not work for the public sector and live and work in Germany. We conduct this recruitment with the survey provider Bilendi (previously Respondi). The exact number of participants will depend on the exact response rate of panelists invited to our study. Our target sample size is based on the provider's best estimate. We hope to complete the whole collection in July 2022.

8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

We collected some pilot data ($n=1,117$) already with Dynata and Bilendi (previously Respondi), which we plan to pool with the pre-registered data collection as a way to increase statistical power. Yet, we will transparently show our results separately for the pilot and the pre-registered collection in an Appendix.

G Questionnaires

G.1 Questionnaire: Innovation Sample (2019 Wave)

Beliefs About Ranking in the Wage Distribution 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 those employees receive a

(Please note: these numbers need to add up to 100%).

lower pay ____%

same pay ____%

higher pay ____%

Beliefs About Ranking in Terms of Non-Pecuniary Benefits We will now ask you a question about your working conditions. By working conditions we mean: work climate, relationship to colleagues, flexibility regarding work hours and work place, educational opportunities and family-friendly work conditions. Important: do not include the pay in your considerations.

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 those employees have....

(Please note: these numbers need to add up to 100%).

worse working conditions ____%

similar working conditions ____%

better working conditions ____%

Beliefs About Firm Pay Think of the typical employee with work experience that switches from another employer to your employer. Would this employee receive a lower, higher or the same pay compared to his previous employer?

- Higher pay
- Same pay
- Lower pay

[Asked only if previous answer is not "Same pay"] How much lower/higher would the monthly pay before taxes of this employee be (in percent) after the switch compared to his/her prior employer?

Between 0% and 2%

Between 2% and 5%

Between 5% and 10%

Between 10% and 15%

Between 15% and 20%

Between 20% and 30%
Between 30% and 50%
Between 50% and 75%
More than 75% (in data normalized to 87.5%)

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 employer?

- Higher pay
- Same pay
- Lower pay

[Asked only if previous answer is not "Same pay"] How much lower/higher would the monthly pay before taxes of this employee be (in percent) after the switch compared to his/her prior employer? Between 0% and 2%

Between 2% and 5%
Between 5% and 10%
Between 10% and 15%
Between 15% and 20%
Between 20% and 30%
Between 30% and 50%
Between 50% and 75%
More than 75% (in data normalized to 87.5%)

Beliefs About Median Wage Within Occupation Think of all employees in Germany that are full-time employed and work in the same occupation as you. What do you think is the typical monthly pay of those employees before taxes (in EUR)?

Here, we refer to the "typical" monthly earnings as the median monthly earnings, i.e. the earnings that the average full-time employee earns in their job, so that half of the full-time employees earn more in their job and the other half less than this earnings in the occupation according to the 2010 occupation classification.

How confident are you about this estimate? (Very unsure; unsure; neither unsure nor sure; sure; very sure)

Information Treatment You think the typical monthly pay of full-time employees in Germany that work in the same occupation [ParticipantOccupation] as you is Y dollars. According to official statistics of the Federal Employment Agency, we calculated the monthly wage of such employees. The typical monthly pay in your occupation is X EUR.

Intended Labor Market Behaviors We now have a series of questions about your labor market behavior.

Over the next 12 months, what is the probability that you will look for a new job at a different company? (scale 0 to 100)

Over the next 12 months, what is the probability that you will ask your boss for a wage raise? (scale 0 to 100)

[Asked even if previous answer is 0] Imagine that you negotiated your wage with your boss for the next year. Which wage raise would you suggest to your boss?

Between 0-2%

Between 2-5%

Between 5-10%

Between 10-15%

More than 15% (in data normalized to 17.5%)

Reservation Wage 1 Imagine that you considered switching to a different employer. What do you think: how much more would your current employer be willing to pay you to prevent that you switch to a different employer?

My current employer would be willing to pay me up to ___% more to prevent that I switch to a different employer.

Outside Offer Imagine that you received a job offer with a 30% higher wage from another employer and that the job is otherwise identical to your current job. Do you think you could use this outside offer in your wage negotiations with your current employer? (Y/N)

Frictions for Switching to Better-Paying Employer You told us that you think that X% of employees in Germany that are employed at a different employer, but work in the same occupation as you receive a higher wage. What are the main reasons for why you are currently (still) employed at your current employer even though other employers may offer you a higher wage?

- I would not want to lose the colleagues of my current employer.
- I do not like change.
- I would not want to learn the ropes in a new job.
- I like the working environment at my current employer.
- I like the regulation of working hours at my current employer.

- I have a very safe job at my current employer. If I start at a different company the risk of losing the job would be higher.
- I feel obliged to stay with my current employer.
- I would have difficulties finding a job that would pay a higher wage.
- I would have to move to another city or region for this.
- Other _____

Reservation Wage 2 Imagine that your current employer permanently cut wages. This wage cut results from a change of the CEO in the company and is independent of the economic conditions in your industry. At which wage cut would you quit your job within one year?

I would quit my job if my current employer cut wages by more than ____%.

Reservation Wage 3 Imagine that you received a job offer from a different employer in your labor market region that would provide you with a comparable work environment. What wage would this other employer have to offer to you to ensure that you would leave your current employer?

This other employer would have to offer me a ____% higher wage for me to leave my current employer.

Posterior About Outside Option: Point Belief Imagine that you were forced to leave your current job and that you had 3 months to find a job at another employer in the same occupation.⁵ Do you think that you would find a job that would offer you a higher overall pay, the same pay or a lower pay?

- Higher pay
- Same pay
- Lower pay

[Asked only if previous answer is not "Same pay"] What do you think: how much more/less would you earn in that new job?

Between 0 and 50 EUR

Between 50 and 100 EUR

⁵The original German version of this question used the following wording in German. “Stellen Sie sich vor, Sie müssten Ihre derzeitige Stelle kündigen und hätten drei Monate Zeit, eine Stelle bei einem anderen Arbeitgeber im selben Beruf zu finden.” In German it is clear that the separation that workers should imagine is exogenous.

Between 100 and 200 EUR
Between 200 and 300 EUR
Between 300 and 400 EUR
Between 400 and 500 EUR
Between 500 and 750 EUR
Between 750 and 1000 EUR
Between 1000 and 1500 EUR
Between 1500 and 2000 EUR
Between 2000 and 3000 EUR
More than 3000 EUR (in data normalized to 3500 EUR)

Posterior About Outside Option: Probabilistic Belief What do you think is the likelihood that you would earn...

- more than in your current job ____%
- as much as in your current job ____%
- less in your current job. ____%

(Please note: these numbers need to add up to 100%).

G.2 Questionnaire: Original German Version

Beliefs About Ranking in the Wage Distribution Denken Sie an alle Erwerbstäigen in Deutschland, die bei einem anderen Arbeitgeber beschäftigt sind, aber im gleichen Beruf wie Sie arbeiten.

Was glauben Sie: Wie viel Prozent dieser Erwerbstäigen haben...
(Bitte beachten Sie: die Zahlen müssen sich auf 100% aufsummieren).
einen niedrigeren Lohn als Sie __%
einen ähnlichen Lohn wie Sie __%
einen höheren Lohn als Sie __%

Beliefs About Ranking in Terms of Non-Pecuniary Benefits Wir stellen Ihnen nun eine Frage zu Ihrem Arbeitsumfeld. Mit Arbeitsumfeld meinen wir die folgenden Dinge: Arbeitsklima, Verhältnis zu Kollegen, Flexibilität bezüglich Arbeitszeiten und Arbeitsort, Möglichkeiten für Fortbildungen und familienfreundliche Arbeitsbedingungen. Wichtig: Das Gehalt bitten wir Sie hier jedoch nicht einzubeziehen. Denken Sie an alle Erwerbstäigen in Deutschland, die bei einem anderen Arbeitgeber beschäftigt sind, aber im gleichen Beruf wie Sie arbeiten. Was glauben Sie: Wie viel Prozent dieser Erwerbstäigen arbeiten bei einem Arbeitgeber, der...

(Bitte beachten Sie: die Zahlen müssen sich auf 100% aufsummieren).
ein schlechteres Arbeitsumfeld bietet als Ihr Arbeitgeber __%
ein ähnliches Arbeitsumfeld bietet wie Ihr Arbeitgeber __%
ein besseres Arbeitsumfeld bietet als Ihr Arbeitgeber __%

Beliefs About Firm Pay Denken Sie an einen typischen Erwerbstäigen, der mit Berufserfahrung von einem anderen Arbeitgeber zu Ihrem Arbeitgeber wechselt. Würde dieser Erwerbstäige nach dem Stellenwechseln bei Ihrem Arbeitgeber im Durchschnitt einen niedrigeren, höheren oder den gleichen Lohn erhalten als bei seinem vorherigen Arbeitgeber?

- Einen niedrigeren Lohn
- Den gleichen Lohn
- Einen höheren Lohn
- Keine Angabe

[Asked only if previous answer is not "Den gleichen Lohn"] Wie viel niedriger / höher wäre der monatliche Bruttolohn (d.h. vor Steuerabzug) dieses Erwerbstäigen nach dem Stellenwechsel im Vergleich zu seinem vorherigen Arbeitgeber im Durchschnitt in Prozent?
Zwischen 0% und 2%

Zwischen 2% und 5%
Zwischen 5% und 10%
Zwischen 10% und 15%
Zwischen 15% und 20%
Zwischen 20% und 30%
Zwischen 30% und 50%
Zwischen 50% und 75%
Mehr als 75% [in data normalized to 87.5%]

Denken Sie an den typischen Erwerbstätigen, der von Ihrem Arbeitgeber zu einem anderen Arbeitgeber wechselt. Würde dieser Erwerbstätige bei seinem nächsten Arbeitgeber im Durchschnitt einen niedrigeren, höheren oder den gleichen Lohn erhalten?

- Einen niedrigeren Lohn
- Den gleichen Lohn
- Einen höheren Lohn

[Asked only if previous answer is not "Den gleichen Lohn"] Wie viel niedriger/ höher wäre der monatliche Bruttolohn (d.h. vor Steuerabzug) im Durchschnitt in Prozent beim neuen Arbeitgeber? Zwischen 0% und 2%

Zwischen 2% und 5%
Zwischen 5% und 10%
Zwischen 10% und 15%
Zwischen 15% und 20%
Zwischen 20% und 30%
Zwischen 30% und 50%
Zwischen 50% und 75%
Mehr als 75% [in data normalized to 87.5%]

Beliefs About Median Wage Within Occupation Denken Sie an alle Erwerbstätigen in Deutschland, die im gleichen Beruf wie Sie arbeiten. Was, glauben Sie, ist der typische Monatsverdienst von Vollzeitbeschäftigen in Ihrem Beruf vor Steuerabzug (in EUR)?

Wie sicher sind Sie sich mit Ihrer vorherigen Schätzung? (Sehr unsicher; unsicher; weder unsicher noch sicher; sicher; sehr sicher)

Information Treatment Sie glauben, dass der typische Monatsverdienst von Vollzeiterwerbstätigen in Deutschland, die im gleichen Beruf wie Sie arbeiten, [participant's belief] EUR sind. Basierend auf offiziellen Statistiken der Bundesagentur für Arbeit haben wir berechnet, wie hoch der typische Monatsverdienst tatsächlich ist. Vor Steuern beträgt der typische Monatsverdienst in Ihrem Beruf [true amount] EUR.

Intended Labor Market Behaviors In den folgenden Fragen schätzen Sie die Wahrscheinlichkeit ein, dass ein bestimmtes Ereignis in der Zukunft eintreten wird. Ihre Antworten können zwischen 0% und 100% liegen, wobei 0% bedeutet, dass etwas definitiv nicht passieren wird, und 100% bedeutet, dass es absolut sicher ist.

Zum Beispiel eine Prozentangabe wie...

- ...2% oder 5% bedeutet, dass etwas sehr unwahrscheinlich ist.
- ...18% bedeutet, dass etwas unwahrscheinlich ist.
- ...47% oder 52% heißt, dass etwas mit ziemlich gleicher Chance eintreten wird oder nicht.
- ...83% heißt, dass etwas wahrscheinlich ist.
- ...95% oder 98% heißt, dass etwas fast sicher ist.

Wie wahrscheinlich ist es, dass Sie in den nächsten 12 Monaten einen anderen Job bei einem anderen Unternehmen suchen werden? Bitte geben Sie die Wahrscheinlichkeit in Prozent an.

Wie wahrscheinlich ist es, dass Sie Ihren Chef in den nächsten 12 Monaten nach einer Gehaltserhöhung fragen werden? Bitte geben Sie die Wahrscheinlichkeit in Prozent an.

[Asked even if previous answer is 0] Stellen Sie sich vor, dass Sie mit Ihrem Chef Ihr Gehalt für das nächste Kalenderjahr verhandeln. Welche Gehaltserhöhung würden Sie vorschlagen?
Keine Gehaltserhöhung
Gehaltserhöhung zwischen 0% und 2%
Gehaltserhöhung zwischen 2% und 5%.
Gehaltserhöhung zwischen 5% und 10%.
Gehaltserhöhung zwischen 10% und 15%.
Gehaltserhöhung von mehr als 15%. [in data normalized to 17.5%]

Reservation Wage 1 Stellen Sie sich vor, Sie überlegen sich, die Stelle zu wechseln. Was glauben Sie: wieviel mehr wäre Ihr derzeitiger Arbeitgeber bereit, Ihnen zu zahlen, damit Sie nicht die Stelle wechseln?

Mein derzeitiger Arbeitgeber wäre bereit, mir bis zu ___% mehr zu zahlen, um mich von dem Wechsel abzuhalten.

Outside Offer Stellen Sie sich vor Sie erhielten ein Angebot mit einer deutlich höheren Bezahlung von einem anderen Arbeitgeber, und die Stelle ist Ihrer derzeitigen sonst praktisch identisch. Könnten Sie dieses Angebot in Gehaltsverhandlungen mit Ihrem Arbeitgeber nutzen, um ein höheres Gehalt auszuhandeln?(Ja/Nein)

Frictions for Switching to Better-Paying Employer Sie haben uns gesagt, dass [XX]% der Erwerbstätigen in Deutschland, die bei einem anderen Arbeitgeber beschäftigt sind,

aber im gleichen Beruf wie Sie arbeiten, ein höheres Gehalt als Sie erhalten.

Was sind die Hauptgründe, warum Sie zurzeit (noch) bei Ihrem derzeitigen Arbeitgeber beschäftigt sind, obwohl andere Arbeitgeber Ihnen gegebenenfalls ein höheres Gehalt zahlen würden?

- Ich will meine Kollegen bei meinem derzeitigen Arbeitgeber nicht verlieren.
- Ich mag keine Veränderungen.
- Ich will mich nicht in einen neuen Job einarbeiten.
- Ich mag das Betriebsklima bei meinem derzeitigen Arbeitgeber.
- Ich mag die Arbeitszeitregelung bei meinem derzeitigen Arbeitgeber.
- Ich habe bei meinem derzeitigen Arbeitgeber eine sichere Stelle. Wenn ich bei einer Firma neu anfange, ist das Risiko, die Stelle wieder zu verlieren, größer.
- Ich fühle mich meinem derzeitigen Arbeitgeber gegenüber verpflichtet zu bleiben.
- Ich würde bei den anderen Arbeitgebern, die ein höheres Gehalt zahlen würden, nur sehr schwer eine Stelle finden.
- Ich müsste hierfür in eine andere Stadt oder Region ziehen.
- Andere _____

Reservation Wage 2 Stellen Sie sich vor, dass bei Ihrem derzeitigen Arbeitgeber die Löhne dauerhaft gekürzt werden. Die Lohnkürzung ist die Folge eines Wechsels in der Unternehmensführung und unabhängig von der wirtschaftlichen Entwicklung in Ihrer Branche. Ab welcher Lohnsenkung würden Sie Ihre Stelle innerhalb eines Jahres kündigen?

Ich würde kündigen, wenn bei meinem derzeitigen Arbeitgeber die Löhne um mehr als ___ % gesenkt werden würden.

Reservation Wage 3 Stellen Sie sich vor Sie erhielten ein Angebot von einem anderen Arbeitgeber in Ihrer Arbeitsmarktregion, der Ihnen ein vergleichbares Arbeitsumfeld wie Ihr derzeitiger Arbeitgeber bieten würde. Bezogen auf Ihr monatliches Bruttogehalt: wie viel % müsste Ihnen dieser Arbeitgeber mehr zahlen, damit Sie Ihren derzeitigen Arbeitgeber verlassen würden?

Dieser Arbeitgeber müsste mir ___ % im Monat mehr Bruttogehalt zahlen, damit ich meinen derzeitigen Arbeitgeber verlassen würde.

Posterior Personal Outside Option: Point Belief Stellen Sie sich vor, Sie müssten Ihre derzeitige Stelle kündigen und hätten drei Monate Zeit, eine Stelle bei einem anderen Arbeitgeber im selben Beruf zu finden. Glauben Sie, dass Sie im Schnitt monatlich brutto mehr oder weniger verdienen würden als in Ihrem jetzigen Job?

- Mehr als in Ihrem jetzigen Job
- Gleich viel wie in Ihrem jetzigen Job
- Weniger als in Ihrem jetzigen Job

[Asked only if previous answer is not "Same pay"] Was glauben Sie: wie viel mehr / weniger würden Sie wahrscheinlich monatlich brutto verdienen als in Ihrem jetzigen Job?
Zwischen 0 und 50 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 50 und 100 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 100 und 200 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 200 und 300 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 300 und 400 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 400 und 500 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 500 und 750 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 750 und 1000 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 1000 und 1500 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 1500 und 2000 EUR mehr / weniger verdienen als in meinem jetzigen Job
Zwischen 2000 und 3000 EUR mehr verdienen als in meinem jetzigen Job
Mehr als 3000 EUR mehr verdienen als in meinem jetzigen Job [in data normalized to 3500 EUR]

Posterior About Outside Option: Probabilistic Belief Was ist die Wahrscheinlichkeit, dass Sie...

(Bitte beachten Sie: die Zahlen müssen sich auf 100% aufsummieren).

- mehr verdienen als in Ihrem jetzigen Job ____%
- gleich viel verdienen wie in Ihrem jetzigen Job ____%
- weniger verdienen als in Ihrem jetzigen Job ____%

G.3 Questionnaire: Robustness Check Survey (July 2021)

Belief About Outside Option: SOEP Elicitation (50% of sample) Imagine that you were forced to leave your current job and that you had 3 months⁶ to find a job at another employer in the same occupation.⁷ Do you think that you would find a job that would offer you a higher overall pay, the same pay or a lower pay?

- Higher pay
- Same pay
- Lower pay

[Asked only if previous answer is not "Same pay"] What do you think: how much more/less would you earn in that new job?

- Between 0 and 50 EUR
- Between 50 and 100 EUR
- Between 100 and 200 EUR
- Between 200 and 300 EUR
- Between 300 and 400 EUR
- Between 400 and 500 EUR
- Between 500 and 750 EUR
- Between 750 and 1000 EUR
- Between 1000 and 1500 EUR
- Between 1500 and 2000 EUR
- Between 2000 and 3000 EUR
- More than 3000 EUR (in data normalized to 3500 EUR)

How confident are you in your previous estimate? (very certain, certain, uncertain, very uncertain)

Belief About Outside Option: Alternative Elicitation (50% of Sample) Imagine you were forced to leave your current job and had 3 months⁸ to find a job with another employer in the same occupation.⁹

In the job with another employer, how much would you receive per month as gross employment income in EUR? ____ EUR

[Only if randomised to "reminder treatment"] Reminder: Your current gross monthly income is [amount answered before] EUR.

How confident are you in your previous estimate? (very certain, certain, uncertain, very uncertain)

⁶For 50% of respondents the time horizon is instead 12 months.

⁷For 50% of respondents the instructions do not condition on occupation and are instead given as follows: [...] months to find a job at another employer.

⁸For 50% of respondents the time horizon is instead 12 months.

⁹For 50% of respondents the instructions do not condition on occupation and are instead given as follows: [...] months to find a job at another employer.

Beliefs Coworker Wage Changes: SOEP Elicitation (50% of Sample) Think of the typical employee with work experience that switches from another employer to your employer. Would this employee receive a lower, higher or the same pay compared to his previous employer?

- Higher pay
- Same pay
- Lower pay

[Asked only if previous answer is not "Same pay"] How much lower/higher would the monthly pay before taxes of this employee be (in percent) after the switch compared to his/her prior employer?

Between 0% and 2%

Between 2% and 5%

Between 5% and 10%

Between 10% and 15%

Between 15% and 20%

Between 20% and 30%

Between 30% and 50%

Between 50% and 75%

More than 75% (in data normalized to 87.5%)

Think of the typical employee that switches from your current employer to another employer. Would this employee receive a lower, higher or the same pay compared to his previous employer?

- Higher pay
- Same pay
- Lower pay

[Asked only if previous answer is not "Same pay"] How much lower/higher would the monthly pay before taxes of this employee be (in percent) after the switch compared to his/her prior employer?

Between 0% and 2%

Between 2% and 5%

Between 5% and 10%

Between 10% and 15%

Between 15% and 20%

Between 20% and 30%

Between 30% and 50%

Between 50% and 75%

More than 75% (in data normalized to 87.5%)

Beliefs Coworker Wage Changes: Alternative Elicitation (50% of Sample) Consider a typical employed person with work experience who switches from another employer to your employer. After switching jobs, would this worker receive, on average, a lower or higher wage at your employer than at her previous employer?

- a higher wage
- a lower wage

How much lower / higher would this worker's gross monthly wage (i.e., before taxes) be, on average, as a percentage, after the job change compared to her previous employer? ____%

Consider a typical employed person with work experience who switches from your employer to another employer. After switching jobs, would this worker receive, on average, a lower or higher wage at another employer than at your employer?

- a higher wage
- a lower wage

How much lower / higher would this worker's gross monthly wage (i.e., before taxes) be, on average, as a percentage, after the job change compared to her previous employer? ____%

Reservation Wage 1 Imagine that your current employer permanently cut wages. This wage cut results from a change of the CEO in the company and is independent of the economic conditions in your industry. At which wage cut would you quit your job within one year? ____%

Reservation Wage 2 Imagine that you considered switching to a different employer. What do you think: how much more would your current employer be willing to pay you to prevent that you switch to a different employer? ____%

Reservation Wage 3 Imagine that your current employer laid you off because your company closes unexpectedly. The company closing is independent of the economic development in your industry. How many months would you expect to remain unemployed until you found a new job? ____ months

Outside Option in Response to Mass Layoff Imagine that your current employer laid you off because your company closed unexpectedly and you had to find a job with another employer within 3 months.

In the job with another employer, how much would you receive monthly as gross employment income in EUR? EUR

General Beliefs About Outside Option 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 do you think these other workers earn on average per month before taxes (in EUR)?

[Only if randomised to “incentive treatment” (50% of respondents] If your estimate does not differ from the actual value by more than 5%, then you will receive a bonus of 5 EUR in panel points.

 EUR

Beliefs About Ranking in the Wage Distribution Think of all employees in Germany that work in the same occupation as you, but work at a different employer.¹⁰ What do you think: what percent of those employees receive a

(Please note: these numbers need to add up to 100%).

lower pay %

same pay %

higher pay %

¹⁰50% of our respondents were instead shown the following introductory sentence to this question without conditioning on occupation: Think of all employees in Germany that work that work at a different employer.

G.4 Questionnaire: Information Provision Experiment (May-July 2022)

First Attention Check The next question addresses the following problem. In surveys like this one, there are sometimes participants who don't read the questions carefully and just "click" through the questionnaire quickly. As a result, there are many random answers that falsify the results of the study. In order to show that you read our questions carefully, we ask you to indicate 333 as the answer to the next question.

What's your favorite number? __

Demographics Which of the following categories best describes you?

Full-time employed

Part-time employed

Unemployed

I am a student

I am retired

Housewife/houseman

Are you a civil servant? Yes/No

Are you self-employed? Yes/No

What device are you taking this survey on? [Desktop or Laptop/Tablet/Mobile]

How old are you (in years)?

What is your sex? male/female

Where do you work?

Federal state: [dropdown]

District: [dropdown]

This means that you are assigned to the following labor market region:

What is your highest professional qualification?

No completed education

Vocational training

University or technical college degree

Occupation Now we're going to ask you a few questions about your occupation.

What occupation do you work in? [open-text]

Which of the following categories best describes your professional activity? [drop-down]

Which of the following categories best describes your professional activity? Please enter your activity using the keyboard.[search interface with drop-down]

If you cannot find a suitable occupation in this list, we ask you to return to the previous pages, where you can answer the questions about the occupational area and the occupational category again. If you made a mistake in the professional field, you may then be able to find a more suitable job.

How appropriately does the job you have chosen describe your actual job?

Very suitable

Suitable

Not suitable

Not at all suitable

Wage Income How high is your current monthly gross income from work in EUR before taxes? ___ EUR

Beliefs About Personal Outside Option Imagine that you were forced to leave your current job and that you had 3 months to find a job at another employer.

In the job with another employer, how much would you receive per month as gross employment income in EUR? ___ EUR

Beliefs About the Wages of Similar Workers Imagine people who are very similar to you in some characteristics relevant to the job market.

Imagine people who...

work in your occupation (XXX)

are also employed full-time

are also [male/female]

have your age (XXX)

work in your labor market region (XXX)

and have your highest educational level (XXX)

Below we ask you questions about what people with your characteristics earn.

Based on data from the Federal Employment Agency, we calculated how much people with your characteristics actually earn on average gross per month. If your estimate is within 100 EUR of the actual value, you will receive a bonus of 1 EUR in panel points.

What do you think: how much do people with your characteristics earn on average monthly gross (in EUR)? EUR

Please explain how you arrived at this estimate. [text-box below]

How confident are you in your previous estimate? (very certain, certain, uncertain, very uncertain)

Control Group

Your Guess

You have estimated that other people with your characteristics earn **2800 euros** per month.



Treatment Group

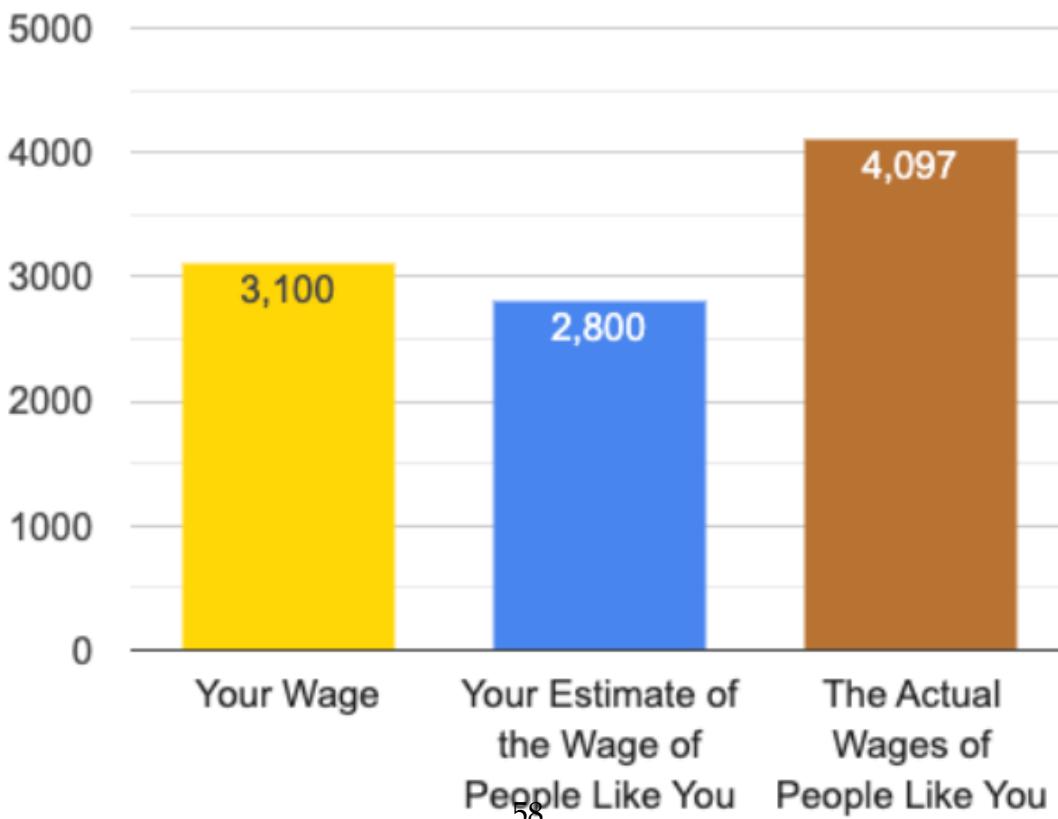
Information about the Wages of Workers with Similar Characteristics to You

You have estimated that other people with your characteristics earn **2800 euros** per month.

Based on data from the Federal Employment Agency, we have calculated how much people with your characteristics actually earn per month.

Employees with your characteristics earn an average of **4097 euros** per month.

Average Monthly Earnings of People Like You



Did you underestimate or overestimate the pay of people with your characteristics?

I underestimated the wages of people with my characteristics.

I overestimated the wages of people with my characteristics.

Your estimate of the wages of people with your characteristics: XXX EUR Actual wages of people with your characteristics: XXX EUR

By how many EUR did you [underestimate/overestimate] the wages of people with your characteristics? ___ EUR

Main Outcomes

We now have a series of questions about your labor market behavior.

Post-Treatment Beliefs About Wages of Similar Workers Based on data from the Federal Employment Agency, we have calculated what employees with your characteristics actually earn on average gross per month.

What do you think: do employees with your characteristics earn more or less than you on average?

More

Less

What do you think: How much [more/less] do employees with your characteristics earn on average compared to you (in EUR, gross)?

___ EUR

Post-Treatment Beliefs About Personal Outside Option We're going to ask you the same question we asked a few minutes ago. You may have changed your assessment because you had a little more time to think about the question.

Imagine that you were forced to leave your current job and that you had 3 months to find a job at another employer.

In the job with another employer, how much would you receive per month as gross employment income in EUR? ___ EUR

Probability of Looking for a New Job Over the next 12 months, what is the probability that you will look for a new job at a different company? (scale 0 to 100)

Probability of Asking for a Raise Over the next 12 months, what is the probability that you will ask your boss for a wage raise? (scale 0 to 100)

[Asked even if previous answer is 0] Imagine that you negotiated your wage with your boss for the next year. Which wage raise would you suggest to your boss?

0 %

Between 0-1%

Between 1-2%

Between 2-5%

Between 5-10%

Between 10-15%

Between 15-20%

More than 20% (in data normalized to 25%)

No negotiations planned

Reservation Wage Cut Imagine that your current employer permanently cut wages. This wage cut results from a change of the CEO in the company and is independent of the economic conditions in your industry. At which wage cut would you quit your job within one year?

I would quit my job if my current employer cut wages by more than ____%.

Quit Probability If your pay stays the same, how likely are you to quit your current job in the next 12 months? Please indicate the probability in percent.

How likely are you to quit your current job in the next 12 months if your wage decreases by 10% compared to your current wage? Please indicate the probability in percent.

How likely are you to quit your current job in the next 12 months if your wage increases by 10% compared to your current wage? Please indicate the probability in percent.

Additional Characteristics

Second Attention Check The next question addresses the following problem. In surveys like this one, there are sometimes participants who don't read the questions carefully and just "click" through the questionnaire quickly. As a result, there are many random answers that falsify the results of the study. To show that you are reading our questions carefully, we ask that you answer "Very interested" and "Not at all interested" for the next question.

Very interested

Interested

Somewhat interested

Almost not interested

Not at all interested

In the 12 months prior to taking this survey, how often did you look for information about wages from other employers? (Never, once, twice, three times, four times, five times, between 5 and 10 times, more than 10 times)

Imagine you had to find out about other potential employers you could work for. How exhausting would you find it to find out about other potential employers? [Very exhausting, Exhausting, Not exhausting, Not at all exhausting.]

Imagine you had to find out about other potential employers you could work for. How difficult would it be for you to find the relevant information? [Very difficult, difficult, not difficult, not difficult at all]

Are you paid according to a collective bargaining agreement (CBA)? [Yes/No]

How many hours do you work per week? [drop-down list]

Approximately how many employees work in your current company? [open-entry]

How many years have you worked for your current employer? [drop-down list]

How many times have you changed employers in total in your life? [drop-down list]
In which industry do you work? [drop-down list]

Occupation Elicitation The next question addresses the following problem again. In surveys like this one, there are sometimes participants who don't read the questions carefully and just "click" through the questionnaire quickly. As a result, there are many random answers that falsify the results of the study. That's why we ask you to enter the profession below again that you entered a few minutes ago. [List of occupations where one of the occupations corresponds to the occupation the respondent chose at the start of the survey]

Research Hypothesis Guess What hypothesis do you think the researchers are trying to test with this survey? [open text box]

Information Demand (Control Group Only)

Information about wages of employees with their characteristics

A few minutes ago you estimated that other people with your characteristics earn an average of XXX EUR gross per month.

Based on data from the Federal Employment Agency, we calculated how much people with your characteristics actually earn gross per month.

Would you like to receive information about the real wages of employees with your characteristics? Yes/No

[if Yes is selected] Information about wages of employees with your characteristics

Employees with your characteristics actually earn an average of XXXX EUR gross per month.

Debrief

More background information

In this study, you received information about the wages of workers with your characteristics. Below we give you a few details on how we calculated the wages.

To calculate the average wages of similar workers, we use German administrative data for 2019. We estimate a model that accounts for the following variables: gender, occupation, labor market region, education, age, and employment status. Using the model parameters, we then calculate the average wages of employees with your characteristics. As the forecasts are from 2019, we perform an inflation adjustment using average nominal wage growth between 2019 and July 2022.

Further sources: On the following link you can get additional information about salaries of employees with your characteristics: https://www.destatis.de/DE/Service/Statistik-Visualisiert/Gehaltsvergleich/_inhalt.html.

Important: The information regarding wages refers to average wages. These average wages mask a large heterogeneity between individuals. Therefore, the information should be interpreted with caution.