Worker Beliefs About Outside Options

Simon Jäger
MIT

Christopher Roth
U Cologne

Nina Roussille
LSE

Benjamin Schoefer
UC Berkeley

Yale Macro Seminar
September 2022
What Do Workers Know About Their Outside Options?

Starting point:

- Across firms and jobs, large wage differences between similar workers
  - Slichter (1950); Abowd, Kramarz and Margolis (1999); Card, Heining and Kline (2013); Bonhomme, Holzheu, Lamadon, Manresa, Mogstad and Setzler (2020)

How can these differences persist in equilibrium?

- Compensating differentials
  - Rosen (1986)

- Heterogeneity in preferences
  - Card, Cardoso, Heining and Kline (2018); Berger, Herkenhoff and Mongey (2019); Lamadon, Mogstad and Setzler (2021)

- Search/switching costs

- Misperceptions
Our Paper: Workers’ Subjective vs. Objective Outside Options

We ask:

1. Do workers accurately perceive wage differences across firms?
2. How systematic are workers’ biases about outside options with other employers?
3. What are equilibrium consequences of misperceptions about outside options?
Our Paper: Workers’ Subjective vs. Objective Outside Options

- Representative survey of workers’ beliefs about their outside options
  - Integrated into German Socio-Economic Panel (GSOEP)
  - Linked to respondents’ administrative labor market data (IAB)

- Compare subjective beliefs with (proxies for) objective outside options
  - Wage changes of coworkers when they move out of the firm
  - External labor market: wages of workers in the same occupation

- Experiment (in separate, follow-up survey): information treatment about average wage of similar workers in respondent’s labor market cell
Our Paper: Preview of Main Results

- Workers have systematic misperceptions about outside options
  - Workers mistakenly believe outside options are similar to current employment conditions ("anchoring")
  - Workers, especially at low-paying firms, underestimate their outside options.

- Analyze equilibrium consequences of worker misperception in very simple labor market model
  Adopt and extend product market framework in Salop and Stiglitz (1977) to labor market and allow for misperceptions (anchoring)
  - Key insight: Misperceptions can be source of monopsony, wage markdowns, and labor market segmentation.
    Formalization of Robinson's (1933) insight
  - Evaluate model predictions in the data
Related Literature

**Reynolds (1951):** survey of 1,000 manual workers in New Haven labor market (1946-48)
- “Very few [workers] knew [...] how much they could expect to earn [at other plants]”
- Workers at low-paying firms underestimate wages elsewhere

Growing literature on **labor market expectations** (Faberman, Mueller, Şahin and Topa, 2017; DellaVigna, Lindner, Reizer and Schmieder, 2017; DellaVigna, Heining, Schmieder and Trenkle, 2020; Mueller, Spinnewijn and Topa, 2021)
- Survey data covering job-seekers’ beliefs about, e.g., **future wage offers** (Conlon, Pilossoph, Wiswall and Zafar, 2018) or **future job finding rates** (Spinnewijn, 2015; Mueller and Spinnewijn, 2021)
- Limited information even about **coworker wages** (Card, Mas, Moretti and Saez, 2012; Cullen and Perez-Truglia, 2018)

**Our paper:** direct measure of beliefs about outside options + comparisons to objective benchmarks in admin data + analysis of equilibrium consequences of misperceptions
Research Design: Subjective vs. Objective Outside Options

Microfoundation: Bayesian Learning Model
Research Design: Subjective vs. Objective Outside Options

![Graph showing the relationship between subjective and actual wage change at outside option. The graph has a line with a slope of 1 and an intercept of 0, indicating unbiased beliefs.](image-url)
Research Design: Subjective vs. Objective Outside Options

Microfoundation: Bayesian Learning Model
Research Design: Subjective vs. Objective Outside Options

Homogeneous underestimation
Slope = 1, intercept < 0

Subjective Wage Change at Outside Option vs. Actual Wage Change at Outside Option

Microfoundation: Bayesian Learning Model
Research Design: Subjective vs. Objective Outside Options

Heterogeneity: bias towards identical OOs
Slope < 1

Subjective Wage Change at Outside Option
Actual Wage Change at Outside Option

Microfoundation: Bayesian Learning Model
Research Design: Subjective vs. Objective Outside Options

Underestimation of wage increase
Underestimation of wage decrease

Subjective Wage Change at Outside Option
Actual Wage Change at Outside Option

Heterogeneity: bias towards identical OOs
Slope < 1

Microfoundation: Bayesian Learning Model
Research Design: Implementation

Actual Wage Change at Outside Option
Subjective Wage Change at Outside Option
Research Design: Beliefs

Worker belief about own wage change if forced to separate from current firm.
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?

If previous answer is not “Same pay”: What do you think: how much more/less would you earn in that new job? ⇒ Worker Belief about Outside Option

• Elicit measures of surplus, perceived frictions, and a series of other outside option measures, including:
  - Wage changes of coworkers who left the firm
  - Rank in within-occupation wage distribution
  - Median salary in occupation in external labor market

Integrate this Q + custom questionnaire into GSOEP (2019, 2020 waves) & link to administrative matched employer-employee data (SOEP-ADIAB)
German Socio-Economic Panel (GSOEP)

- Representative, probability-based sample of German population

- High quality: face-to-face or computer-aided telephone interviews

- We included our tailored survey module in the 2019 and 2020 waves of the GSOEP Innovation Sample

- 1,604 respondents, with panel structure across the two waves

- Link to administrative matched employer-employee data (SOEP-ADIAB)
  - SOEP respondents asked for consent for linkage
  - Match rate of 87% (based on names, gender, date of birth, and address)

Additional surveys: academic experts & additional survey for robustness checks
Validation I: Beliefs are Persistent

Slope: 0.29 (SE 0.03)
Validation II: Beliefs Predict Intentions to Search

Prob of Seeking New Job (%)

Belief: Own Wage Change

Uncontrolled, Slope: 50.057 (SE 14.674)
Controlling for Objective Benchmark, Slope: 51.532 (SE 14.884)

Reservation Wage Cut
Intentions to Bargain
Bargaining Magnitude
Robustness Checks: Beliefs

- Drop respondents who report "same pay"
- Elicit beliefs without "same pay" option
- Do not condition on staying in occupation
- Vary time horizon of search
- Vary reason for separation
Research Design: Objective Proxy

Mean log wage change of coworkers (2015-2019)
EUE moves (proxy for involuntary)
Two measurement error corrections: Empirical Bayes & IV
Additional proxy: Machine-learning prediction (in full data set) for EUE wage change
Coworker Wage Changes Correlated with Firm AKM Effect

Data, Slope: -.474 (SE .099)
Coworker Wage Changes Predictive of Past GSOEP Wage Changes

Slope: 1.047 (SE .068), N=1877

EB-Adjusted Mover Wage Changes
Research Design: Expert Prediction

Null: Unbiased Beliefs
Slope: 1

Expert Prediction
Slope: 0.708

Belief: Own Wage Change

Objective Benchmark: EB-Adjusted Mover Wage Changes
Results

Null: Unbiased Beliefs
Slope: 1
Expert Prediction
Slope: 0.708
Slope: 0.089

Belief: Own Wage Change

Objective Benchmark: EB-Adjusted Mover Wage Changes
Average Bias (Belief - Actual): -0.023 (SE 0.011)

Empirical Bayes Methodology
Results

Null: Unbiased Beliefs
Slope: 1
Expert Prediction
Slope: 0.708

Objective Benchmark: Mover Wage Changes

Average Bias (Belief - Actual): -0.023 (SE 0.011)

Empirical Bayes Slope: 0.089 (SE 0.045)
Split-Sample IV Slope: 0.049 (SE 0.061)
Unadjusted Slope: 0.024 (SE 0.013)
1. Alternative Set of Coworkers

(a) Same Education

(b) Same Occupation

Empirical Bayes Slope: .135 (SE .069)
Split-Sample IV Slope:  .082 (SE .086)
Unadjusted Slope:         .018 (SE .024)

Empirical Bayes Slope: .043 (SE .084)
Split-Sample IV Slope:  .017 (SE .085)
Unadjusted Slope:         -.012 (SE .028)

- Predict GSOEP respondents’ wage changes if they left their current firm, based on a rich set of covariates
- Estimate a Lasso model of log wage change of "involuntary" (EUE) movers

![Graph showing the relationship between belief in own wage change and objective benchmark of ML prediction. The raw slope is 0.095 (SE 0.021), N=519. Null hypothesis slope is 1.](image)
3a. Alternative Comparison: Coworkers’ Wage Changes if Moving Out

Null: Unbiased Beliefs
Slope: 1

Belief: Coworker Wage Change

Objective Benchmark: Mover Wage Changes

Empirical Bayes Slope: .125 (SE .047)
Split-Sample IV Slope: .098 (SE .048)
Unadjusted Slope: .052 (SE .018)
3b. Alt. Comparison: Own Rank in Occupation (Truth)

Red bars plot actual pay rank in occupation, calculated using admin ADIAB data and 4-digit occupation codes.
3b. Alt. Comparison: Own Rank in Occupation (Beliefs vs. Truth)

Red bars plot actual pay rank in occupation, calculated using GSOEP data and 4-digit occupation codes.
3b. Alt. Comparison: Own Rank in Occupation (Beliefs vs. Truth)

(a) Belief Distribution

(b) Belief vs Actual Rank

Red bars plot actual pay rank in occupation, calculated using GSOEP data and 4-digit occupation codes.

Question
Taking Stock: Comparing Subjective and Objective Outside Options

- Systematic misperceptions of own and coworker wage changes: “anchoring” beliefs about OO on current wage.

- Consistent with workers perceiving (relevant) external labor market to be more similar to current job/employer than it actually is – and using their current (jobs/employer’s) wage as a signal about the overall labor market.

  - Anchoring-and-adjustment heuristic (Kahneman and Tversky, 1974)

- **Natural question:** so would providing workers with information...
  - shift (correct) their beliefs?
  - change their labor market behavior?
Information Provision Experiment

- In GSOEP-IS sample: underpowered experiment (didn’t shift beliefs ⇒ no first stage?)

Results II

- New experiment: online survey of ≈ 3,000 German respondents in full-time employment

- Elicit beliefs about mean wage of observably similar peers
  - Workers of the same gender, age, education, labor market region, 5-digit occupation

- Information treatment: randomly provide 50% of respondents with the objective mean wage of similar worker

- Study effects on
  - beliefs about outside options
  - intended labor market behaviors
Information about the Wages of Workers with Similar Characteristics to You

You have estimated that other people with your characteristics earn **2800 dollars** 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 dollars** per month.
**Information about the Wages of Workers with Similar Characteristics to You**

You have estimated that other people with your characteristics earn **2800 dollars** 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 dollars** per month.
Information Treatment Screen

(a) Treatment Group

**Information about the Wages of Workers with Similar Characteristics to You**

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

![Bar chart showing average monthly earnings](chart1.png)

(b) Control Group

**Your Guess**

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

![Bar chart showing wages](chart2.png)
Validation Check: The Information Treatment Reduces the Estimation Error About Peer Salary
Validation Check: The Information Treatment Reduces the Estimation Error About Peer Salary

- Full Belief Updating
  - Slope = 0

- No Belief Updating
  - Slope = 1

Control Slope: .893 (SE .04)
Validation Check: The Information Treatment Reduces the Estimation Error About Peer Salary

**Graph Details:**
- **Trend Lines:**
  - **Treatment Slope:** 0.361 (SE 0.033)
  - **Control Slope:** 0.893 (SE 0.04)
- **Legend:**
  - **Full Belief Updating:** Slope = 0
  - **No Belief Updating:** Slope = 1

**Graph Axes:**
- **X-Axis:** Pre-Treatment Estimation Error (Peer Salary, %)
- **Y-Axis:** Post-Treatment Estimation Error (Peer Salary, %)
First Stage: Effects on Outside Option Beliefs
First Stage: Effects on Outside Option Beliefs

Control Slope: 0.045 (SE 0.022)
First Stage: Effects on Outside Option Beliefs

Post-Treatment Belief: Own Wage Change (%)

Pre-Treatment Estimation Error (Peer Salary, %)

Treatment Slope: \(-0.443\) (SE 0.025)

Control Slope: \(0.045\) (SE 0.022)
## Information Experiment: Main Results

<table>
<thead>
<tr>
<th></th>
<th>(1) Post-Treat Estimation Error</th>
<th>(2) Post-Treat Beliefs: Own Wage Change</th>
<th>(3) Intended Quit Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treated x Pre-Treat Estimation Error</strong></td>
<td>-0.528*** (0.051)</td>
<td>-0.451*** (0.034)</td>
<td></td>
</tr>
<tr>
<td><strong>Treated</strong></td>
<td>-1.644 (1.222)</td>
<td>4.199*** (0.732)</td>
<td></td>
</tr>
<tr>
<td><strong>Pre-Treat Estimation Error</strong></td>
<td>0.902*** (0.037)</td>
<td>0.025 (0.022)</td>
<td></td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>4.120*** (0.917)</td>
<td>4.066*** (0.499)</td>
<td></td>
</tr>
<tr>
<td><strong>Mean Dep. Var.</strong></td>
<td>-6.83</td>
<td>3.91</td>
<td></td>
</tr>
<tr>
<td><strong>Nb. obs</strong></td>
<td>3206</td>
<td>3206</td>
<td></td>
</tr>
<tr>
<td><strong>IV: Belief: % Wage Change at OO</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control Group Mean</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First-Stage F-Stat</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) Post-Treat Estimation Error</td>
<td>(2) Post-Treat Beliefs: Own Wage Change</td>
<td>(3) Intended Quit Probability</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------</td>
<td>----------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Treated × Pre-Treat Estimation Error</strong></td>
<td>-0.528*** (0.051)</td>
<td>-0.451*** (0.034)</td>
<td>-0.121*** (0.043)</td>
</tr>
<tr>
<td><strong>Treated</strong></td>
<td>-1.644 (1.222)</td>
<td>4.199*** (0.732)</td>
<td>1.152 (1.096)</td>
</tr>
<tr>
<td><strong>Pre-Treat Estimation Error</strong></td>
<td>0.902*** (0.037)</td>
<td>0.025 (0.022)</td>
<td>-0.036 (0.032)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>4.120*** (0.917)</td>
<td>4.066*** (0.499)</td>
<td>22.823*** (0.776)</td>
</tr>
<tr>
<td><strong>Mean Dep. Var.</strong></td>
<td>-6.83</td>
<td>3.91</td>
<td>24.06</td>
</tr>
<tr>
<td><strong>Nb. obs</strong></td>
<td>3206</td>
<td>3206</td>
<td>3206</td>
</tr>
</tbody>
</table>

**IV: Belief: % Wage Change at OO**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>0.269*** (0.078)</td>
</tr>
<tr>
<td><strong>Control Group Mean</strong></td>
<td>23.055</td>
</tr>
<tr>
<td><strong>First-Stage F-Stat</strong></td>
<td>171.515</td>
</tr>
</tbody>
</table>
Post-Treatment: Personal Outside Option Beliefs vs ML Predictions

![Graph showing Belief: Own Wage Change (%) vs ML Predicted Wage Change (%)]
Post-Treatment: Personal Outside Option Beliefs vs ML Predictions

Control Slope: 0.326 (SE 0.017)
Post-Treatment: Personal Outside Option Beliefs vs ML Predictions

Belief: Own Wage Change (%) vs ML Predicted Wage Change (%)

Treatment Slope: 0.626 (SE 0.019)

Control Slope: 0.326 (SE 0.017)
## Effects on Intended Labor Market Behaviors II

<table>
<thead>
<tr>
<th>Intended</th>
<th>(3) Intended Quit Probability</th>
<th>(4) Intended Search Probability</th>
<th>(5) Intended Negotiation Probability</th>
<th>(6) Intended Neg Magnitude (No Neg = 0)</th>
<th>(7) Reservation Wage Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated × Pre-Treat Estimation Error</td>
<td>-0.121***</td>
<td>-0.066</td>
<td>-0.187***</td>
<td>-0.029***</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.044)</td>
<td>(0.048)</td>
<td>(0.005)</td>
<td>(0.035)</td>
</tr>
<tr>
<td>Treated</td>
<td>1.152</td>
<td>2.499**</td>
<td>0.945</td>
<td>0.166</td>
<td>-2.718</td>
</tr>
<tr>
<td></td>
<td>(1.096)</td>
<td>(1.115)</td>
<td>(1.295)</td>
<td>(0.132)</td>
<td>(2.014)</td>
</tr>
<tr>
<td>Pre-Treat Estimation Error</td>
<td>-0.036</td>
<td>-0.056*</td>
<td>0.088**</td>
<td>0.007*</td>
<td>-0.028</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.030)</td>
<td>(0.034)</td>
<td>(0.004)</td>
<td>(0.033)</td>
</tr>
<tr>
<td></td>
<td>(0.776)</td>
<td>(0.768)</td>
<td>(0.923)</td>
<td>(0.092)</td>
<td>(1.998)</td>
</tr>
<tr>
<td>Mean Dep. Var.</td>
<td>24.06</td>
<td>26.08</td>
<td>39.66</td>
<td>7.08</td>
<td>10.36</td>
</tr>
<tr>
<td>Nb. obs</td>
<td>3,206</td>
<td>3,206</td>
<td>3,206</td>
<td>3,206</td>
<td>3,204</td>
</tr>
<tr>
<td>IV: Belief: % Wage Change at OO</td>
<td>0.269***</td>
<td>0.223***</td>
<td>0.382***</td>
<td>0.059***</td>
<td>-0.176</td>
</tr>
<tr>
<td></td>
<td>(0.078)</td>
<td>(0.079)</td>
<td>(0.092)</td>
<td>(0.010)</td>
<td>(0.167)</td>
</tr>
<tr>
<td></td>
<td>(0.725)</td>
<td>(0.734)</td>
<td>(0.856)</td>
<td>(0.090)</td>
<td>(1.557)</td>
</tr>
<tr>
<td>Control Group Mean</td>
<td>23.055</td>
<td>24.595</td>
<td>38.574</td>
<td>6.895</td>
<td>11.799</td>
</tr>
<tr>
<td>First-Stage F-Stat</td>
<td>171.515</td>
<td>171.515</td>
<td>171.515</td>
<td>171.515</td>
<td>170.520</td>
</tr>
</tbody>
</table>

### Over-Under Estimators
Equilibrium Consequences of Biases

- Now: equilibrium model
  - Anchoring gives rise to monopsony power

- Then: empirical evidence
  - Equilibrium sorting consistent with model predictions
  - Biases predict labor market behaviors
  - Calculate share of nonviable jobs if workers had correct beliefs
Equilibrium Consequences of Worker Misperceptions

- Old hypothesis (Robinson, 1933): Workers’ misperceptions may generate employer monopsony, and may help sustain wage markdowns and wage dispersion.

- Simple equilibrium model (adopt and extend product market framework of Salop and Stiglitz, 1977, to labor market and misperceptions (anchoring)):
  - Sophisticated and naive workers: experts and amateurs
  - Firms strategically set wages to maximize profits

- Largely graphical intuitions in slides; full paper has Full Model.
Standard Competitive Equilibrium

![Graph showing the relationship between wage (w) and labor input (l), with MPL (Marginal Product of Labor) and a point where w equals w* at l*]
Competitive Firm Size

\begin{equation}
\frac{L}{N} \quad w^* \quad \ell^*
\end{equation}
Low-Wage Firm Size

\[ w = MPL \]

\[ w^* \]

\[ (1 - \alpha) \frac{L}{N} \]

\[ \frac{L}{N} \]

\[ \ell_i \]

\[ \ell^* \]
High-Wage Firm Size

\[ w \]

\[ \ell_l \quad \ell^* \quad \ell_h \]

(1 - \alpha) \frac{L}{N} \quad \frac{L}{N} \quad (1 - \alpha + \frac{\alpha}{\beta}) \frac{L}{N}

\[ w^* \]

MPL
Wages in the High-Wage Sector

$$w$$ vs $$\ell$$

- Full Model

$$w^*$$

$$w_h$$

$$\ell_l$$

$$\ell^*$$

$$\ell_h$$

$$(1 - \alpha) \frac{L}{N}$$

$$\frac{L}{N}$$

$$(1 - \alpha + \frac{\alpha}{\beta}) \frac{L}{N}$$
Wages in the Low-Wage Sector

\[ w = MPL \]

\[ w^* = \frac{(1 - \alpha)}{N} \]

\[ w_h = \frac{L}{N} \]

\[ w_l = \frac{(1 - \alpha + \frac{\alpha}{\beta})}{N} \]

\( \ell \)

\( \ell^* \)

\( \ell_h \)
Wage Markdowns in the Low-Wage Sector

\[ w^* \]

\[ w_h \]

\[ w_l \]

\[ \ell_l \]

\[ \ell^* \]

\[ \ell_h \]

\[ (1 - \alpha) \frac{L}{N} \]

\[ \ell \]

\[ \frac{L}{N} \]

\[ (1 - \alpha + \frac{\alpha}{\beta}) \frac{L}{N} \]
Wage-Setting: Worker Beliefs and Reservation Wages

• Simple setup: amateurs’ priors are weighted avg of current wage and true max wage:

\[ \tilde{w}^{\text{max}} = \gamma \cdot w_j + (1 - \gamma) \cdot w^{\text{max}} \]

(1)

• \( \gamma \in [0, 1] \) guides the degree of anchoring

• Since true max wage is the competitive wage \( w^* \), optimal \( w' \) is:

\[ w_l = w^* - \frac{c_A}{1 - \gamma} \]

(2)

• Higher search costs or stronger anchoring push down \( w_l \)
Effects of Search Costs on Equilibrium

Effects of Search Costs, With and Without Anchoring

- Competitive Equilibrium without Anchoring ($\gamma = 0$)
- Segmented Equilibrium with Anchoring ($\gamma = 0.9$)
- Segmented Equilibrium without Anchoring ($\gamma = 0$)

Wages vs. Share of Low-wage Jobs

Search Cost ($c_A$)
Effects of Search Costs on Equilibrium

Effects of Search Costs, With and Without Anchoring

Competitive Equilibrium without Anchoring (γ = 0) → Segmented Equilibrium without Anchoring (γ = 0)

Segmented Equilibrium with Anchoring (γ = .9)

Search Cost (cA)

Wages

Share of Low-wage Jobs

Full Model
How Relevant Are Misperceptions for Labor Market Equilibrium?

Test model predictions and allocative consequences of misperceptions:

1. Model predicts sorting: naive workers concentrated in low-wage sector
2. Pessimism about outside options reduces search
3. Rational inattention: wrong beliefs inconsequential among workers who do not search
4. Calculation of share nonviable jobs if workers had correct beliefs
How Relevant Are Misperceptions for Labor Market Equilibrium?

- Test model predictions and allocative consequences of misperceptions:
  1. Model predicts sorting: uninformed (amateur) workers concentrated in low-wage sector
Beliefs vs Coworker Wage Changes by AKM Firm Effect

The graph shows the relationship between Beliefs About Coworkers and Wage Change Own (Belief) vs Coworkers (Data). The data points are plotted as squares, and a dashed line represents the regression line with a slope of -0.474 (SE 0.099). The x-axis represents the AKM Firm Effect, and the y-axis represents the Wage Change Own (Belief) vs Coworkers (Data).
Beliefs vs Coworker Wage Changes by AKM Firm Effect

Beliefs About Coworkers
Errors (Own Wage Change) by AKM Firm Effect

Slope: .335 (SE .102), N=355

Beliefs About Coworkers
Errors (Rank in Occupation) by AKM Firm Effect

Slope: \(-40.927\) (SE 7.048), N=407

Estimation Error

\(\text{Belief} - \text{Actual Rank in Occupation}\)

AKM Firm Effect

Slope: \(-40.927\) (SE 7.048), N=407
Errors (Median Salary in Occupation) by AKM Firm Effect

Slope: 0.222 (SE 0.078), N=475

Estimation Error (Belief - Actual Wage in Occupation)

AKM Firm Effect:

Slope: 0.222 (SE 0.078), N=475
How Relevant Are Misperceptions for Labor Market Equilibrium?

• Test model predictions and allocative consequences of misperceptions:

  1. Model predicts sorting: naive workers concentrated in low-wage sector

  2. Pessimism about outside options reduces search
Beliefs About Outside Options Predict Behavior

- Prob of Seeking New Job (%)
- Belief: Own Wage Change
  - Uncontrolled, Slope: 50.057 (SE 14.674)
  - Controlling for Objective Benchmark, Slope: 51.532 (SE 14.884)
Beliefs about Outside Options Predict Behavior

(a) Reservation Wage Cut
(b) Search for New Job
(c) Negotiate for Higher Pay

Intentions on Mover Wage Changes
Effects of Information Treatment

[See previous slides]
How Relevant Are Misperceptions for Labor Market Equilibrium?

- Test model predictions and allocative consequences of misperceptions:
  1. Model predicts sorting: naive workers concentrated in low-wage sector
  2. Pessimism about outside options reduces search
  3. Rational inattention: wrong beliefs inconsequential among workers who do not search
How Relevant Are Misperceptions for Labor Market Equilibrium?

- Test model predictions and allocative consequences of misperceptions:
  1. Model predicts sorting: naive workers concentrated in low-wage sector
  2. Pessimism about outside options reduces search
  3. Rational inattention: wrong beliefs inconsequential among workers who do not search
  4. Calculation of share nonviable jobs if workers had correct beliefs
Recalculate surplus: replace subjective wage component with coworker mover wage change (average in AKM ventile) or ML prediction for wage change, keep non-wage component fixed. ▶ Full Methodology
Recalculate surplus: replace subjective wage component with coworker mover wage change (average in AKM ventile) or ML prediction for wage change, keep non-wage component fixed.

Full Methodology
Conclusion

1. Do workers accurately perceive wage differences across firms?
   - No: workers underestimate wage differences across firms
   - Workers anchor beliefs about external labor market on current employer

2. How systematic are workers’ biases about outside options with other employers?
   - Workers, especially at low-paying firms, underestimate their outside options.
   - Targeted wage information improves accuracy of workers’ beliefs and leads them to shift their planned behavior

3. What are equilibrium consequences of misperception about outside options?
   - Monopsony and wage markdowns
   - Labor market segmentation with high- and low-wage sector
Worker Beliefs About Outside Options

Simon Jäger
MIT

Christopher Roth
U Cologne

Nina Roussille
LSE

Benjamin Schoefer
UC Berkeley

Yale Macro Seminar
September 2022
Our Paper: Main Results

• Workers have systematic misperceptions about outside options
  ▪ Workers mistakenly believe outside options are similar to current employment conditions (anchoring)
  ▪ Workers, especially at low-paying firms, underestimate their outside options.

• Targeted wage information improves accuracy of workers’ beliefs and leads them to shift their planned behavior

• Analyze equilibrium consequences of worker misperception in very simple labor market model
  
  Adopt and extend product market framework in Salop and Stiglitz (1977) to labor market and allow for misperceptions (anchoring)
  
  ▪ Key insight: Misperceptions can be source of monopsony, wage markdowns, and labor market segmentation.
    
    Formalization of Robinson’s (1933) insight

  ▪ Evaluate model predictions in the data
Biased Beliefs Among All Subgroups

(a) Tenure

(b) Coworker Turnover

(b) Confidence

Split workers by whether above/below median of heterogeneity variable.


References III


Robinson, Joan, *The Economics of Imperfect Competition*, Macmillan, 1933.


Appendix
### GSOEP-IS - Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>43.93</td>
<td>44.00</td>
<td>1604</td>
</tr>
<tr>
<td>Years of Education</td>
<td>13.15</td>
<td>12.00</td>
<td>1517</td>
</tr>
<tr>
<td>Salary</td>
<td>40998</td>
<td>34800</td>
<td>1604</td>
</tr>
<tr>
<td>Tenure</td>
<td>10.85</td>
<td>7.00</td>
<td>1604</td>
</tr>
<tr>
<td>Female</td>
<td>0.47</td>
<td>0.00</td>
<td>1604</td>
</tr>
<tr>
<td>Full-time Employed</td>
<td>0.72</td>
<td>1.00</td>
<td>1604</td>
</tr>
<tr>
<td>Part-time Employed</td>
<td>0.28</td>
<td>0.00</td>
<td>1604</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Obs.</td>
</tr>
<tr>
<td>---------------</td>
<td>-------</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>Age</td>
<td>43.89</td>
<td>45.00</td>
<td>516</td>
</tr>
<tr>
<td>Salary</td>
<td>37978</td>
<td>34710</td>
<td>516</td>
</tr>
<tr>
<td>Tenure</td>
<td>10.19</td>
<td>6.00</td>
<td>516</td>
</tr>
<tr>
<td>Female</td>
<td>0.50</td>
<td>1.00</td>
<td>516</td>
</tr>
<tr>
<td>Full-time Employed</td>
<td>0.70</td>
<td>1.00</td>
<td>516</td>
</tr>
<tr>
<td>Part-time Employed</td>
<td>0.30</td>
<td>0.00</td>
<td>516</td>
</tr>
</tbody>
</table>
## Main Specification in GSOEP

<table>
<thead>
<tr>
<th></th>
<th>(1) Own Wage Change Beliefs</th>
<th>(2) Intended Search Probability</th>
<th>(3) Intended Negotiation Probability</th>
<th>(4) Intended Neg Magnitude (No Neg = 0)</th>
<th>(5) Intended Neg Magnitude (No Neg = Msg)</th>
<th>(6) Reservation Wage Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treated × Estimation Error</strong></td>
<td>-0.016 (0.018)</td>
<td>0.018 (0.024)</td>
<td>0.019 (0.035)</td>
<td>-0.002 (0.018)</td>
<td>0.001 (0.002)</td>
<td>0.001 (0.002)</td>
</tr>
<tr>
<td><strong>Treated</strong></td>
<td>0.666 (0.779)</td>
<td>1.828 (2.087)</td>
<td>-0.548 (2.590)</td>
<td>-0.457 (0.864)</td>
<td>0.070 (0.108)</td>
<td>0.066 (0.103)</td>
</tr>
<tr>
<td><strong>Estimation Error (%)</strong></td>
<td>0.016 (0.017)</td>
<td>-0.027 (0.023)</td>
<td>-0.025 (0.033)</td>
<td>0.001 (0.018)</td>
<td>-0.000 (0.002)</td>
<td>-0.000 (0.002)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>-1.638*** (0.555)</td>
<td>14.317*** (1.451)</td>
<td>23.401*** (1.949)</td>
<td>14.655*** (0.626)</td>
<td>3.188*** (0.079)</td>
<td>3.311*** (0.074)</td>
</tr>
<tr>
<td><strong>Nb. obs</strong></td>
<td>997</td>
<td>994</td>
<td>991</td>
<td>909</td>
<td>997</td>
<td>961</td>
</tr>
</tbody>
</table>

* Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
## Expert Survey - Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Respondents: Female</td>
<td>21.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>Share of Respondents: Professor</td>
<td>47.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>Share of Respondents: Associate Professor</td>
<td>17.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>Share of Respondents: Assistant Professor / Lecturer</td>
<td>24.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>Share of Respondents: US based</td>
<td>61.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>Share of Respondents: Germany based</td>
<td>16.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>Share of Respondents: UK based</td>
<td>9.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>151</td>
</tr>
<tr>
<td>Age</td>
<td>42.82</td>
<td>40</td>
<td>9.59</td>
<td>27</td>
<td>80</td>
<td>149</td>
</tr>
<tr>
<td>h – index</td>
<td>22.12</td>
<td>21.92</td>
<td>22.32</td>
<td>0</td>
<td>118</td>
<td>151</td>
</tr>
</tbody>
</table>
Beliefs About Own Wage Change (Percent)

Mean: -0.26
Median: 0.00
Experts' mean: -0.72
Experts' median: 0.0

Beliefs: Own Wage Change

Fraction

Mean: -0.26
Median: 0.00

Beliefs: Own Wage Change

Mean: -0.26
Median: 0.00

Back
Beliefs About Own Wage Change (Euros)

Mean: -525.75
Median: 0.00
Persistence of Beliefs (Euros)

Slope: 0.46 (SE 0.04)
Robustness

In July 2021 we fielded a robustness survey which demonstrates robustness of beliefs to:

- **Elicitation format** (change vs. level elicitation)
- Conditioning on **staying in the same occupation**
- Different **time horizons** of search (3 months vs 12 months)
- Different **framing** of reason for separation (general framing vs. layoff)
- **Prediction incentives** for beliefs about median wage in own occupation
- **Elicitation of min pay raise** at another firm to quit, rather than pay cut at current firm

In May 2021, conducted a survey with **German HR managers** to shed light on the firm-sides.
Imagine you are forced to leave your current job and had [3 / 12 months] to find a job with another employer [in the same occupation].
In the job with another employer, how much would you receive per month as gross employment income in Euro? ___ Euro
[Reminder: Your current gross monthly income is ___ Euro.]
How confident are you in your previous estimate? (very certain, certain, uncertain, very uncertain)
Robustness to Elicitation Format II: No "Same Pay" Option

- Same Pay Option + Categorical Elicitation
- No Same Pay Option + Open Elicitation

Belief: Coworker Wage Change
Robustness to Occupation-Specific Search

The graph illustrates the cumulative probability distribution of beliefs regarding one's own wage change, conditioning and not conditioning on occupation. The x-axis represents the belief in one's own wage change, while the y-axis shows the cumulative probability.

- **Conditioning on Occupation**: The line with squares indicates the cumulative probability when conditioning on occupation.
- **Not Conditioning on Occupation**: The dashed line with circles shows the cumulative probability without conditioning on occupation.

The graph compares how differentiating between occupation affects the perceived probability of wage changes.
Robustness to Time Horizon of Search

Cumulative Probability

Belief: Own Wage Change

3 Months to Find a New Job
12 Months to Find a New Job

Back to question in main slides
Robustness to Framing of Reason for Separation

- **General Framing**
- **Firm Closure Framing**

Belief: Own Wage Change

Cumulative Probability

Back to question in main slides
Robustness to Prediction Incentives

Cumulative Probability

-2000 -1000 0 1000 2000 3000

Biases in Beliefs in Euro

Elicitation Without Incentive
Elicitation With Incentive

Back to question in main slides
Robustness to Reservation Wage Elicitation: Cut vs Raise

![Graph showing the relationship between minimum wage cut at the current firm to quit and minimum wage raise at another firm to quit. The slope is 0.507 (SE 0.059) with N=1,537.]
Beliefs Predict Reservation Wage Cuts

- Uncontrolled, Slope: -27.688 (SE 5.677)
- Controlling for Objective Benchmark Slope: -27.474 (SE 5.646)
Beliefs Predict Intentions to Bargain

Belief: Own Wage Change
Uncontrolled, Slope: 74.448 (SE 19.885)
Controlling for Objective Benchmark, Slope: 73.237 (SE 19.816)
Beliefs Predict Intended Magnitude of Negotiation

Pay Rise Magnitude (%) vs. Belief: Own Wage Change

- Uncontrolled, Slope: 19.994 (SE 4.122)
- Controlling for Objective Benchmark, Slope: 20.101 (SE 4.167)
Robustness: No "Same Pay" Option

Cumulative Probability vs. Belief: Coworker Wage Change

- Same Pay Option + Categorical Elicitation
- No Same Pay Option + Open Elicitation

Belief: Coworker Wage Change

Cumulative Probability

Back
Robustness: Don’t Condition on Staying in Occupation
Robustness: Vary Time Horizon of Search

Belief: Own Wage Change

- 3 Months to Find a New Job
- 12 Months to Find a New Job

Cumulative Probability
Robustness: Vary Reason for Separation

![Graph showing cumulative probability against belief of own wage change with two framing conditions: General Framing and Firm Closure Framing. The graph illustrates how different framing influences the belief distribution.](image-url)
Bayesian Model with Normal Learning

- \( N \) firms
- Worker’s prior beliefs about wages are given by
  \[
  w_j | \theta \sim N(\theta, 1/\pi) \quad \forall j
  \]
  \[
  \theta \sim N(\mu, 1/\tau).
  \]
- Worker employed at firm \( j \) observes the wage \( w_j \) and updates her beliefs about \( \theta \) according to Bayes rule:
  \[
  \theta | w_j \sim N\left(\frac{w_j \pi + \mu \tau}{\pi + \tau}, \frac{\pi + \tau}{\pi + \tau}\right),
  \]
  \[\Rightarrow\] Posterior belief about \( \theta \) will be increasing in the current wage \( w_j \) (as long as some uncertainty over \( \theta \) and finite variance of wages)
Formation of Worker’s Posterior About Wages at Other firms

We use Bayes’ Rule to write the employed worker’s joint posterior:

\[ f(w_k, \theta|w_j) = \frac{f(w_j|w_k, \theta)f(w_k|\theta)f(\theta)}{f(w_j)} \]

\[ = \frac{f(w_j|\theta)f(w_k|\theta)f(\theta)}{f(w_j)} \quad \text{by cond. ind.} \]  

(6)

(7)

The marginal posterior for \( \theta \) is given by integrating over the wage \( w_k \):

\[ f(\theta|w_j) \propto \int f(w_j|\theta)f(w_k|\theta)f(\theta)dw_k \quad \int f(w_k|\theta)dw_k = 1 \]

\[ = f(w_j|\theta)f(\theta) \]

\[ = \phi(\theta; w_j, \pi)\phi(\theta; \mu, \tau) \quad \text{by sym. of Normal distr.} \]

(8)

(9)

(10)

Utilizing product characteristics of normal distributions, gives:

\[ \theta|w_j \sim N \left( \frac{w_j\pi + \mu\tau}{\pi + \tau}, \pi + \tau \right) \]

(11)
Empirical Bayes Methodology

- Firm $j$'s mean coworker wage change $\hat{\Delta}_j$ is the firm’s "true" leaver wage change parameter $\Delta_j$ plus random error:

$$\hat{\Delta}_j = \Delta_j + \varepsilon_j$$

(12)

$$\hat{\Delta}_j | \Delta_j, \sigma_j^2 \sim N(\Delta_j, \sigma_j^2)$$

(13)

- Suppose we know underlying distribution of leaver wage change parameters:

$$\Delta_j \sim N(\bar{\Delta}, \sigma^2)$$

(14)

- Idea: shrink $\Delta_j$ towards $\bar{\Delta}$ to reduce influence of $\varepsilon_j$ on regression results

---

1Reference: Chandra, Finkelstein, Sacarny, and Syverson (2016), "ebayes.ado" by Adam Sacarny
Empirical Bayes Methodology

- Posterior distribution of $\Delta_j$ given observed mean $\hat{\Delta}_j$ and population parameters $\bar{\Delta}, \sigma^2$ is:

$$\Delta_j|\hat{\Delta}_j, \bar{\Delta}, \sigma^2 \sim N(\Delta_j^{EB}, \sigma_j^2(1 - b_j))$$ (15)

where:

$$b_j = \frac{\sigma_j^2}{\sigma_j^2 + \sigma^2}$$ (16)

$$\Delta_j^{EB} = (1 - b_j)\hat{\Delta}_j + b_j\bar{\Delta}$$ (17)

- $\Delta_j^{EB}$ is the posterior expected value of $\Delta_j$, and is a weighted average of the observed mean and true population mean, weighted by relative variances of observed mean and population distribution.

---

2Reference: Chandra, Finkelstein, Sacarny, and Syverson (2016), "ebayes.ado" by Adam Sacarny
Empirical Bayes Methodology

- How to estimate $\Delta^\text{EB}_j$?
- Estimate $\sigma_j^2$ using within-firm variance of mover wage changes (requires restricting to firms with $\geq 2$ movers)
- Estimate $\bar{\Delta}$ and $\sigma^2$ using an iterative procedure on population distribution of $\hat{\Delta}$
- Details in Appendix C of Chandra, Finkelstein, Sacarny, and Syverson (2016)

Reference: Chandra, Finkelstein, Sacarny, and Syverson (2016), "ebayes.ado" by Adam Sacarny
Lasso Methodology I

• Take universe of transitions between main employment spells, involving an intermediate unemployment spell, in Germany between 2015 and 2019 (excluding GSOEP respondents)

• Lasso regression
  ■ Dependent variable: log wage change associated with transition
  ■ Independent variables: worker and origin-firm covariates

• Use selected variables and estimated coefficients to generate predicted wage changes for GSOEP respondents
Lasso Methodology II

Included covariates, in descending order of partial R-squared values:

- Wage at initial firm
- Age × education dummies
- Occupation (1-digit) at initial firm
- Industry × region dummies
- Gender
- Initial firm’s AKM effect
- Age, tenure, education, and firm size, turnover, employment growth, wage dispersion, region, industry

No covariates end up excluded
Coworker Moves: Split-Sample First-Stage

Slope: .224 (SE .116), N=232

Actual Wage Change of Movers (50% Random Sample A)

Actual Wage Change of Movers (50% Random Sample B)

Slope: .224 (SE .116), N=232

Back to Main Exhibit  Back to Beliefs About Coworkers
Subjective Outside Options: Median Coworker Wage Change

Belief: Own Wage Change

Objective Benchmark: Mover Wage Changes

Split-Sample IV Slope: \(0.035 \text{ (SE } 0.048)\)

Unadjusted Slope: \(0.024 \text{ (SE } 0.014)\)
Subjective Outside Options: Different Time Horizon (2017-2019)

![Graph showing Belief: Own Wage Change vs. Objective Benchmark: Mover Wage Changes with different slopes: Empirical Bayes Slope: 0.102 (SE 0.073), Split-Sample IV Slope: 0.046 (SE 0.167), Unadjusted Slope: 0.021 (SE 0.016).]
Belief: Own Wage Change

Objective Benchmark: Mover Wage Changes

Empirical Bayes Slope: 0.025 (SE 0.051)
Split-Sample IV Slope: 0.015 (SE 0.034)
Unadjusted Slope: 0.009 (SE 0.029)
20+ Coworker Moves (Coworker Wage Change)

![Graph showing Belief: Coworker Wage Change and Objective Benchmark: Mover Wage Changes with slopes and standard errors.](image)
Excluding "Same Wage" Responses (Own Wage Change)

- Belief: Own Wage Change

Objective Benchmark: Mover Wage Changes

Empirical Bayes Slope: 0.143 (SE 0.084)

Split-Sample IV Slope: 0.16 (SE 0.082)

Unadjusted Slope: 0.055 (SE 0.038)
Excluding "Same Wage" Responses (Own Wage Change)

Belief: Own Wage Change

Objective Benchmark: Mover Wage Changes

Empirical Bayes Slope: .143 (SE .084)
Split-Sample IV Slope:  .16 (SE .082)
Unadjusted Slope:         .055 (SE .038)
Excluding "Same Wage" Responses (Mover Wage Change)

Belief: Coworker Wage Change

Objective Benchmark: Mover Wage Changes

Empirical Bayes Slope: 0.138 (SE 0.057)
Split-Sample IV Slope: 0.125 (SE 0.056)
Unadjusted Slope: 0.057 (SE 0.026)
Own Wage Change 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 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?

- 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 Euros
- Between 50 and 100 Euros
- Between 100 and 200 Euros
- ...
- Between 2000 and 3000 Euros
- More than 3000 Euros
Alternative Set of Coworkers II

(a) Same Age

(b) Same Income

- Empirical Bayes Slope: .176 (SE .074)
- Split-Sample IV Slope: .104 (SE .08)
- Unadjusted Slope: .036 (SE .032)

- Empirical Bayes Slope: .278 (SE .062)
- Split-Sample IV Slope: .25 (SE .089)
- Unadjusted Slope: .059 (SE .022)
Involuntary Move Wage Changes By AKM Firm Effect (Beliefs and Data)

Belief, Slope: -0.142 (SE 0.031)
Data, Slope: -0.477 (SE 0.1)
Beliefs About Coworkers: Median Coworker Wage Change

- Belief: Coworker Wage Change
  - Objective Benchmark: Mover Wage Changes
    - Split-Sample IV Slope: 0.14 (SE 0.045)
    - Unadjusted Slope: 0.084 (SE 0.018)
Beliefs About Coworkers: Different Time Horizon (2017-2019)

Belief: Coworker Wage Change

Objective Benchmark: Mover Wage Changes

Empirical Bayes Slope: .144 (SE .049)

Split-Sample IV Slope:  .135 (SE .061)

Unadjusted Slope:         .039 (SE .018)
Own Wage Rank Question

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...

- Lower pay _ %
- Same pay _ %
- Higher pay _ %

(Please note: these numbers need to add up to 100%)
Median Salary Question

- 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 Euro)?
- 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.
Beliefs vs Actual Coworker Wage Changes by AKM Firm Effect

![Graph showing the relationship between AKM Firm Effect and Wage Change of Movers. The graph includes data points and a trend line. The slope of the trend line is -0.271 with a standard error of 0.066.](image-url)
Beliefs vs Actual Coworker Wage Changes by AKM Firm Effect

Data, Slope: -.271 (SE .066)
Belief, Slope: -.105 (SE .034)
Errors (Coworker Wage Change) by AKM Firm Effect

Slope: .26 (SE .06), N=547

Estimation Error (Belief - Actual Coworker Wage Change)
Survey Measure of Worker Surplus

• Definition: the worker surplus is the percent wage cut that makes the worker indifferent between her current firm and her second best option

• Measure Worker Rent $c_i^*$ as follows:

  Imagine that your current employer were to 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 $c_i^*$.

Cf. Mui and Schoefer (2021) reservation wage change to/from nonemployment
Intentions on Mover Wage Changes

(a) Reservation Wage Cut
- Uncontrolled, Slope: -1.629 (SE 1.6)
- Controlling for Belief, Slope: -1.142 (SE 1.517)

(b) Search for New Job
- Uncontrolled, Slope: -5.224 (SE 4.162)
- Controlling for Belief, Slope: -6.398 (SE 4.192)

(b) Negotiate for Higher Pay
- Uncontrolled, Slope: 6.84 (SE 5.049)
- Controlling for Belief, Slope: 5.134 (SE 4.918)
Persistence of Worker Surplus

Worker Surplus in 2020 (Flow, as % of Salary)

Worker Surplus in 2019 (Flow, as % of Salary)

slope: 0.3590 (0.0545)
Worker Surplus Predict Lower Actual Separations

Switched employer over the last 12 months

Worker Rent (Flow, as % of Salary)

slope: -0.0014 (0.0006)
Reasons for Not Switching Employers

- Job Security
- Atmosphere
- Schedule
- Colleagues
- Location
- Dislike Change
- Obligation
- Fear New Job
- Difficulty to Find New Job
- Other Reasons

The bar charts show the fraction of people who cite each reason for not switching employers.
Coworker Wage Change Question

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 50% and 75%
- More than 75%
Setting

- $N$ firms, each initially endowed with $\frac{L}{N}$ workers
- Produce a homogeneous good with DRS production function:

\[ f(\ell) = \ell^{\eta} \quad (\eta \in (0, 1]) \]

- Normal competitive equilibrium:
  - Wages equal MPL
  \[ w^* = \eta \left( \frac{L}{N} \right)^{\eta - 1} \quad (18) \]
  - Firms earn positive profits (no free entry)
Timing

1. Firms enter labor market endowed with their workers, post a wage

2. Workers learn their firm’s wage, choose whether to search (costly) and move to higher (highest) paying firm
   - Share $\alpha$ of experts: costless search and accurate beliefs
   - Share $(1 - \alpha)$ of amateurs: search costs $c_A$ and anchored prior beliefs

3. Production occurs
Suppose a competitive equilibrium.

A firm has two options:

- Pay competitive wage $w^*$, retain all workers, earn profits:
  \[
  \pi_j = \left( \frac{L}{N} \right)^\eta - w^* \frac{L}{N}
  \]

- Deviate: pay lower wage $w' < w^*$, retain only amateurs, earn profits:
  \[
  \pi_j = \left( (1 - \alpha) \frac{L}{N} \right)^\eta - w' (1 - \alpha) \frac{L}{N}
  \]

Tradeoff: paying lower wage leads to

- $\pi \uparrow$ due to reduced wages ($w' < w^*$)
- $\pi \downarrow$ due to reduced scale $(1 - \alpha)$
Wage-Setting: Reservation Wages

- What is the optimal choice of lower wage \( w' \), conditional on deviating from competitive wage?

- Optimal \( w' \) is the lowest wage that still retains amateur workers

- Amateurs search (and hence leave) if perceived benefits of search exceed costs:

\[
\tilde{w}_{\text{max}}(w_j, w_{-j}) - w_j > c_A
\]  

\[\Rightarrow\] Optimal \( w' = w_l \) pushes amateur workers to reservation wage:

\[
\tilde{w}_{\text{max}}(w_l, w_{-j}) - w_l = c_A
\]
Wage-Setting: Worker Beliefs and Reservation Wages

- Simple setup: amateurs’ priors are weighted avg of current wage and true max wage:
  \[ \tilde{w}^{\text{max}} = \gamma \cdot w_j + (1 - \gamma) \cdot w^{\text{max}} \]  
  (23)

- \( \gamma \in [0, 1] \) guides the degree of anchoring

- Since true max wage is the competitive wage \( w^* \), optimal \( w' \) is:
  \[ w_l = w^* - \frac{c_A}{1 - \gamma} \]  
  (24)

- Higher search costs or stronger anchoring push down \( w_l \)
Solving for the Equilibrium

- Profits in the competitive equilibrium:

\[
\pi^{\text{competitive}} = \left( \frac{L}{N} \right)^{\eta} - \eta \left( \frac{L}{N} \right)^{\eta}
\]  

(25)

- Profits when deviating:

\[
\pi^{\text{deviating}} = \left( (1 - \alpha) \frac{L}{N} \right)^{\eta} - \left( \eta \left( \frac{L}{N} \right)^{\eta-1} - \frac{c_A}{1 - \gamma} \right) \left( 1 - \alpha \right) \frac{L}{N}
\]  

(26)
Equilibrium Consequences of Worker Misperceptions

- Presence of amateur workers with anchored beliefs can lead to shift from competitive equilibrium to segmented labor market with high- and low-wage sector
  - Search costs and anchoring amplify each other
- Comparative statics: more anchoring leads to
  - Lower wages in low-wage sector
  - Larger low-wage sector
First Possibility: Competitive (One-Wage) Equilibrium

- If $\pi^{\text{competitive}} > \pi^{\text{deviating}}$, deviating is unprofitable and we get a normal competitive-wage equilibrium.

- This occurs if:

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

(27)

- i.e., if search costs $c_A$ are low, anchoring $\gamma$ is weak, or the share of experts $\alpha$ is high.
Second Possibility: Segmented Equilibrium

- Either competitive equilibrium or a segmented, two-wage equilibrium

- If $\pi^{\text{competitive}} < \pi^{\text{deviating}}$, some firms deviate and pay low wage $w_l$

- Deviating firms increase their profits (by assumption)

- Non-deviating pay high wage $w_h$, and firms absorb the experts from deviating firms, increasing their size and hence their profits

- Deviations continue until profits in deviating and non-deviating firms are equal:

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

where $\beta$ is the share of high-wage (non-deviating) firms
Employment Levels in the Segmented Equilibrium

- High-wage sector employs all experts and all "lucky" amateurs
- High-wage firms are large:
  \[ \ell_h = (1 - \alpha + \frac{\alpha}{\beta}) \frac{L}{N} \]  
  (29)
- Low-wage sector employers all "unlucky" amateurs
- Low-wage firms are small:
  \[ \ell_l = (1 - \alpha) \frac{L}{N} \]  
  (30)
- Turnover in the low-wage sector is higher (experts leave low-wage firms), consistent with reality
Wage Levels in the Segmented Equilibrium

- High-wage firms pay wages equal to MPL at $\ell_h$

$$w_h = \eta \left( \left( 1 - \alpha + \frac{\alpha}{\beta} \right) \frac{L}{N} \right)^{\eta-1} \tag{31}$$

- Low-wage firms pay the reservation wage preventing amateurs from searching

$$w_l = w_h - \frac{c_A}{1 - \gamma} \tag{32}$$
The Size of the Low-Wage Sector

- Low-wage sector employs all amateurs born into low-wage firms

⇒ Number of workers in low-wage sector depends on share of firms, $1 - \beta$, that are low-wage, and share of workers, $1 - \alpha$, that are amateurs

- $\beta$ pinned down by equal-profit condition

$$
\left((1 - \alpha) \frac{L}{N}\right)^\eta - w_l (1 - \alpha) \frac{L}{N} = \left((1 - \alpha + \frac{\alpha}{\beta}) \frac{L}{N}\right)^\eta - w_h \left(1 - \alpha + \frac{\alpha}{\beta}\right) \frac{L}{N} \quad (33)
$$

- Given $\beta$, share of jobs that are low-wage is

$$
S_l = \frac{1 - \beta}{\alpha / (1 - \alpha) + \beta} \quad (34)
$$
Share of Nonviable Jobs if Workers Had Correct Beliefs

• How consequential are these misperceptions?

• Back-of-the-envelope calculation: calculate share of jobs that would not be viable if workers had accurate beliefs
Share of Nonviable Jobs with Corrected Beliefs

• How many jobs would not be viable at current wages if workers had correct beliefs?

• Draw on survey measure of subjective overall worker surplus:

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 X%.

• Decompose overall subjective surplus into subjective wage component and nonwage component:

$$ \tilde{S}_i = \tilde{W}_i + \tilde{A}_i $$

Worker Surplus = Wage Component from OO Question + Residual "Amenity" Component
Subjective Worker Surplus (Flow, as % of Salary)

Mean: 14.23  
Median: 10.00
Share of Nonviable Jobs with Corrected Beliefs

- Decompose overall subjective surplus into nonwage component and subjective wage component:

\[
\tilde{S}_i = \tilde{W}_i + \tilde{A}_i.
\]

- Worker Surplus
- Wage Component from OO Question
- Residual "Amenity" Component

- Calculate corrected surplus by replacing subjective wage component with objective OO proxy:

\[
S_i = \tilde{S}_i + \left( \tilde{W}_i - \tilde{W}_i \right)
\]

- Worker Surplus: Corrected
- Worker Surplus: Belief
- Wage Change: Objective Benchmark
- Wage Change: Belief

- OO proxy: mean coworker wage change in AKM ventile, or machine learning prediction
## GSOEP Information Treatment First Stage

<table>
<thead>
<tr>
<th></th>
<th>(1) Own Wage Change Beliefs</th>
<th>(2) Intended Search Probability</th>
<th>(3) Intended Negotiation Probability</th>
<th>(4) Intended Neg Magnitude (No Neg = 0)</th>
<th>(5) Intended Neg Magnitude (No Neg = Msg)</th>
<th>(6) Reservation Wage Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated × <strong>Underestimate</strong></td>
<td>0.921</td>
<td>1.101</td>
<td>0.063</td>
<td>-1.145</td>
<td>-0.062</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>(0.983)</td>
<td>(2.766)</td>
<td>(3.280)</td>
<td>(1.245)</td>
<td>(0.145)</td>
<td>(0.139)</td>
</tr>
<tr>
<td>Treated × <strong>Overestimate</strong></td>
<td>0.470</td>
<td>3.182</td>
<td>-0.070</td>
<td>0.619</td>
<td>0.214</td>
<td>0.102</td>
</tr>
<tr>
<td></td>
<td>(1.265)</td>
<td>(3.199)</td>
<td>(4.139)</td>
<td>(1.143)</td>
<td>(0.167)</td>
<td>(0.158)</td>
</tr>
<tr>
<td><strong>Overestimate</strong></td>
<td>0.686</td>
<td>-0.092</td>
<td>2.695</td>
<td>-1.370</td>
<td>-0.142</td>
<td>-0.061</td>
</tr>
<tr>
<td></td>
<td>(1.141)</td>
<td>(2.897)</td>
<td>(3.897)</td>
<td>(1.216)</td>
<td>(0.162)</td>
<td>(0.151)</td>
</tr>
<tr>
<td></td>
<td>(0.710)</td>
<td>(1.982)</td>
<td>(2.545)</td>
<td>(0.936)</td>
<td>(0.108)</td>
<td>(0.101)</td>
</tr>
<tr>
<td><strong>Nb. obs</strong></td>
<td>1,003</td>
<td>1,000</td>
<td>995</td>
<td>915</td>
<td>1,003</td>
<td>966</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01
## Average Treatment Effect by Under- and Overestimators

<table>
<thead>
<tr>
<th></th>
<th>(1) Post-Treat Estimation Error</th>
<th>(2) Post-Treat Beliefs: Own Wage Change</th>
<th>(3) Intended Quit Probability</th>
<th>(4) Intended Search Probability</th>
<th>(5) Intended Negotiation Magnitude (No Neg = 0)</th>
<th>(6) Reservation Wage Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treated × Underestimate</strong></td>
<td>9.166***</td>
<td>13.936***</td>
<td>4.051***</td>
<td>3.955***</td>
<td>5.787***</td>
<td>0.835***</td>
</tr>
<tr>
<td></td>
<td>(1.350)</td>
<td>(0.971)</td>
<td>(1.348)</td>
<td>(1.354)</td>
<td>(1.542)</td>
<td>(0.166)</td>
</tr>
<tr>
<td><strong>Treated × Overestimate</strong></td>
<td>-13.064***</td>
<td>-4.544***</td>
<td>-1.610</td>
<td>1.330</td>
<td>-4.373**</td>
<td>-0.497**</td>
</tr>
<tr>
<td></td>
<td>(2.229)</td>
<td>(1.155)</td>
<td>(1.764)</td>
<td>(1.800)</td>
<td>(2.108)</td>
<td>(0.206)</td>
</tr>
<tr>
<td><strong>Overestimate</strong></td>
<td>36.354***</td>
<td>1.331</td>
<td>-1.383</td>
<td>-2.759*</td>
<td>3.661*</td>
<td>0.263</td>
</tr>
<tr>
<td></td>
<td>(2.032)</td>
<td>(1.014)</td>
<td>(1.577)</td>
<td>(1.566)</td>
<td>(1.869)</td>
<td>(0.186)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>-14.370***</td>
<td>3.441***</td>
<td>23.538***</td>
<td>25.560***</td>
<td>37.294***</td>
<td>6.803***</td>
</tr>
<tr>
<td></td>
<td>(1.036)</td>
<td>(0.566)</td>
<td>(0.934)</td>
<td>(0.942)</td>
<td>(1.077)</td>
<td>(0.107)</td>
</tr>
</tbody>
</table>

### Control for Pre-Treatment Belief

<table>
<thead>
<tr>
<th>Pre-Treatment Mean: Underestimate</th>
<th>-21.35</th>
<th>3.63</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Treatment Mean: Overestimate</td>
<td>20.11</td>
<td>4.34</td>
</tr>
<tr>
<td>Nb. obs</td>
<td>3,206</td>
<td>3,206</td>
</tr>
</tbody>
</table>

### IV: Belief: % Wage Change at OO

<table>
<thead>
<tr>
<th></th>
<th>0.000</th>
<th>0.000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.119)</td>
<td>(0.121)</td>
</tr>
<tr>
<td>Constant</td>
<td>22.485***</td>
<td>25.07***</td>
</tr>
<tr>
<td></td>
<td>(1.139)</td>
<td>(1.159)</td>
</tr>
<tr>
<td>Control Group Mean</td>
<td>23.055</td>
<td>24.595</td>
</tr>
<tr>
<td>First-Stage F-Stat</td>
<td>139.593</td>
<td>139.593</td>
</tr>
</tbody>
</table>

### Control Group Mean

<table>
<thead>
<tr>
<th></th>
<th>23.055</th>
<th>24.595</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.119)</td>
<td>(0.121)</td>
</tr>
<tr>
<td>Control Group Mean</td>
<td>22.485***</td>
<td>25.07***</td>
</tr>
<tr>
<td>First-Stage F-Stat</td>
<td>(1.139)</td>
<td>(1.159)</td>
</tr>
</tbody>
</table>

### First-Stage F-Stat

<table>
<thead>
<tr>
<th></th>
<th>139.593</th>
<th>139.593</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.119)</td>
<td>(0.121)</td>
</tr>
<tr>
<td>Control Group Mean</td>
<td>22.485***</td>
<td>25.07***</td>
</tr>
<tr>
<td>First-Stage F-Stat</td>
<td>(1.139)</td>
<td>(1.159)</td>
</tr>
</tbody>
</table>

---

**Back**