# Why Do Workers Dislike Inflation? Wage Erosion and Conflict Costs

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# Introduction

# Why do Workers Dislike Inflation?

Prior work focus in real wage – do nominal wages keep up with prices? How fast?

[Kessel-Alchian '60, Fischer-Modigliani '78, Shiller '97]

This paper: ***how*** wages catch up with prices

- Workers must take **costly actions** ("**conflict**") to have wages keep up with prices

  [E.g. tough conversations with employers; union strike; soliciting offers from other firms]

- Conflict costs contribute to welfare costs of inflation
- Substantial welfare costs of inflation even if real wages do not fall much

# Paper outline: Accounting for costly actions



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2. **Conflict-cost model**: (random) menu-cost style model for wage setting–Calvo+:

   [Caballero–Engel '99, Nakamura–Steinsson '10, Alvarez et al. '16, Auclert et al. '21]

   - Workers consider costly conflict w/ firm to raise nominal wage [+ idiosyncratic shocks]

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   - Workers consider costly conflict w/ firm to raise nominal wage [+ idiosyncratic shocks]
3. **Main analytical result**: impact of inflation on worker welfare determined by **wage erosion**
   - Wage erosion: how inflation lowers real wages if conflict decision do not change
   - Wage catch-up after inflation from more frequent conflict doesn't raise welfare
     - On the margin: benefit of wage catch-up are offset by cost of conflict [envelope theorem]

# Paper outline: Are conflict costs quantitatively large?

4. **Key parameters:** (1) conflict cost and (2) inflation indexation in default wages – **survey evidence**
   1. Workers willing to sacrifice **1.75% of wages** to avoid conflict
   2. Close to no automatic indexation

5. **Quantify:** Explore inflation shocks within calibrated model
   - incorporating conflict **doubles** the overall **cost of inflation** to work for the post-Pandemic inflation

# Outline

1. Our Survey and Motivating Evidence
2. Conflict-Cost Model
3. Using Survey Evidence to Calibrate Key Parameters
4. Quantifying the Costs of Conflict
5. Application to Post-Pandemic Inflation

# Our Survey

# Our Survey

Designed and implemented own survey through **Prolific** from **Feb-March '24**:

- 3,000 prime-age, employed US workers
- **Representative** of the general population in terms of chosen **observable characteristics**
  - gender, education and political affiliation

Representation

**Survey part I [now]:** Qualitative evidence to motivate model

- Workers achieve wage growth through costly conflict with employers

Survey part II [later]: Quantitative evidence to discipline the model

# Motivating Evidence: Wage Growth, Inflation and Conflict

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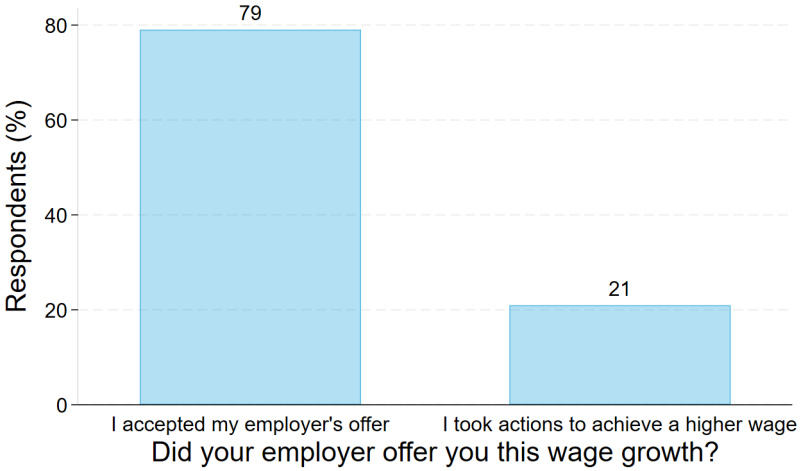
1. **Workers choose between accepting employer's default wage offer or conflict**
2. Conflict raises wages
3. Workers who did not conflict believe conflict could have raised wages
4. Inflation leads to conflict

# Workers Choose Employer Offer vs. Conflict to Raise Wage

Heterogeneity | By income




Note: actions include tough conversations with employers; union strike; soliciting other offers, etc.

actions

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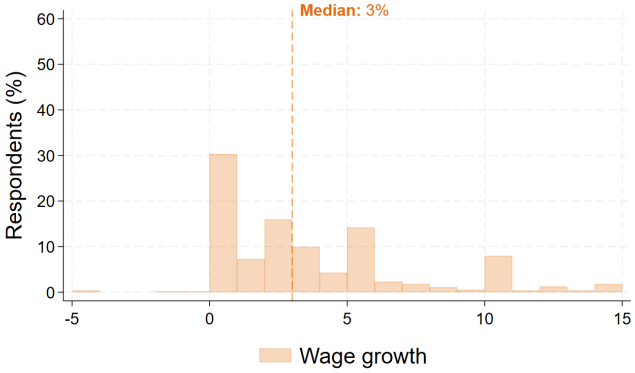
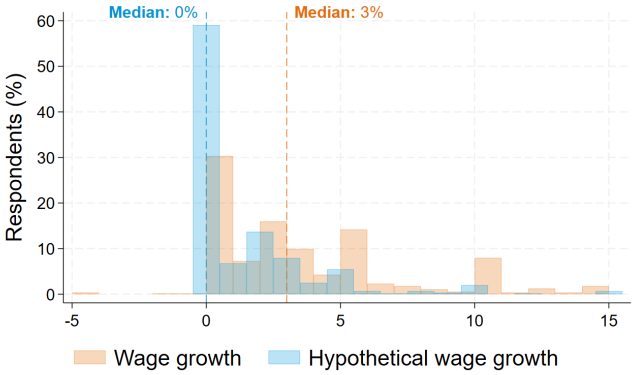
# Conflict Leads to Higher Wages...





# Conflict Leads to Higher Wages...

Within-individual | High wage workers




- Workers who conflict increased their wage relative to default employer offer.

# Motivating Evidence: Wage Growth, Inflation and Conflict

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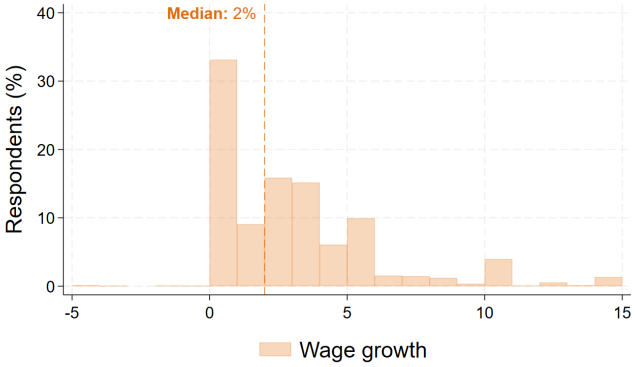
# Workers Sacrifice Wage Growth To Avoid Conflict



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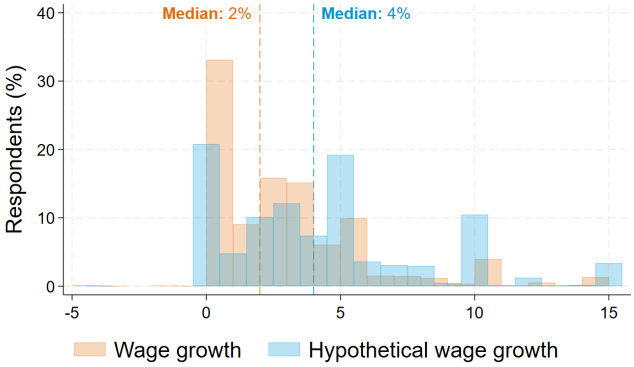


- Workers who do not conflict, report having sacrificed 2pp of wage growth

# Motivating Evidence: Wage Growth, Inflation and Conflict

Motivating evidence from survey:

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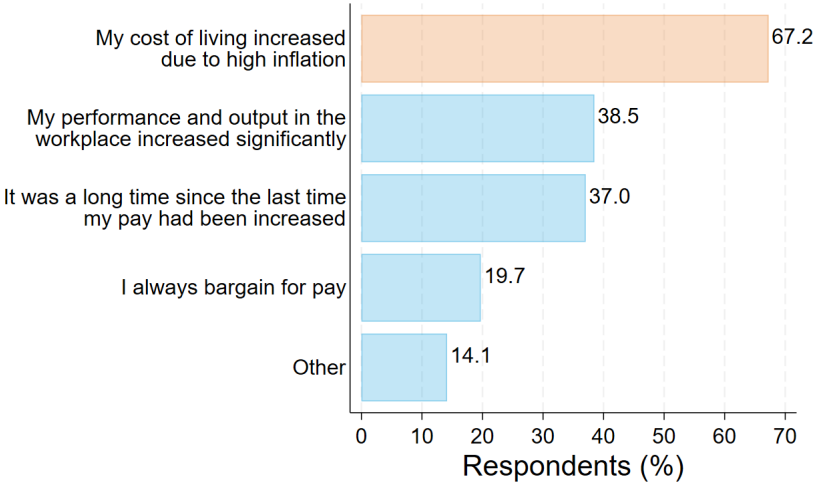
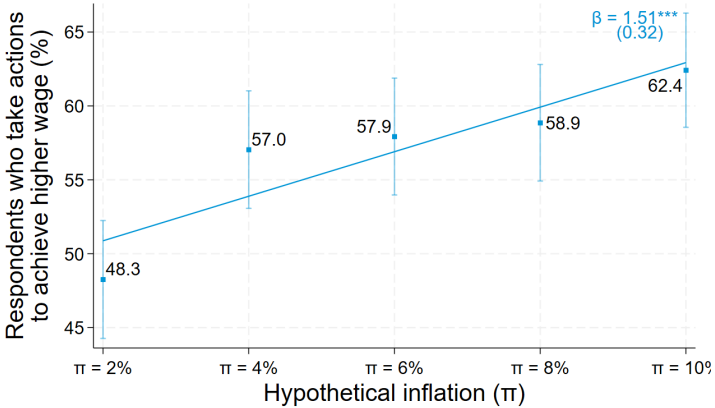
4. **Inflation leads to conflict**

# Inflation was the main motivation for conflict



# Inflation Increases the Probability of Conflict

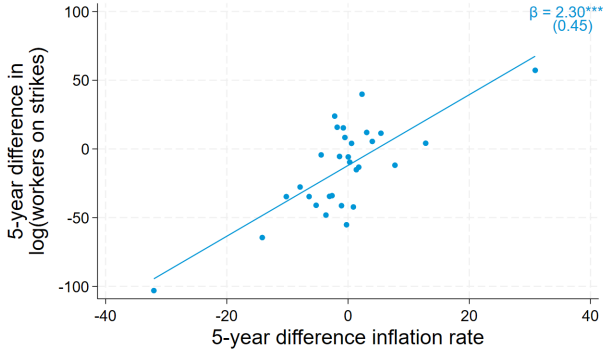



Q: consider a hypothetical situation, inflation is expected to be $x$% in next 12 months.

- 1% $\Delta\pi$ implies a 1.5% increase in conflict – **state-dependent conflict decisions**

# Inflation is Associated with Higher Union Activity






$$\Delta \log 100 \times (\text{workers involved in strikes})_{i,t,t-5} = \gamma_i + \lambda_t + \beta \Delta \pi_{i,t,t-5} + \varepsilon_{it},$$

International Labor Organization data, $1960 - 2020$

# Motivating Evidence: Wage Growth, Inflation and Conflict

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Next: incorporate these features in a **"menu-cost style" model of wage setting**

[Alvarez et al. '16; Nakamura et al. '18; Auclert et al. '24]

# Costs of Inflation in a Conflict-Cost Model

# Workers' Problem

A continuum of workers $i \in [0,1]$ balances **benefit of wage catch up** and **cost of conflict**

$$\max_{\{\mathscr{I}_{i,t}\}_{t=0}^{+\infty}} \mathbb{E}_0 \left[ \sum_{t \geq 0} \beta^t \left( \log c_{i,t} - \kappa_{i,t} \mathscr{I}_{i,t} \right) \right],$$

where $\mathscr{I}_{i,t} = 1$ if the worker takes costly actions to increase pay and 0 otherwise.

Now: hand-to-mouth $c_{i,t} = \frac{W_{i,t}}{P_t} = w_{i,t}$. [Paper: borrowing constraints.]

$\kappa_{i,t}$: i.i.d. "Calvo-plus" cost to increase pay [Nakamura–Steinsson '10; Auclert et al. '23]

$$\kappa_{i,t} = \begin{cases} \kappa & \text{with probability } 1-\lambda \\ 0 & \text{with probability } \lambda \end{cases}$$

**Reduced form cost** captures a variety of conflict actions

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where $\mathscr{I}_{i,t} = 1$ if the worker takes costly actions to increase pay and 0 otherwise.

Nominal wage ($\alpha$: steady state default nominal wage growth & $\gamma$: degree of indexation)

$$W_{i,t} = \begin{cases} W_{i,t-1} e^{\alpha + \gamma(\pi_t - \pi^{ss})} & \text{if } \mathscr{I}_{i,t} = 0 \\ P_t w^*_{i,t} & \text{if } \mathscr{I}_{i,t} = 1 \end{cases}$$

$\rightarrow$ some wage changes not associated with conflict [Not usually observable default vs. conflict]

Conflict-induced (real) wage $w^*_{i,t}$, keeps up w/ inflation & productivity

$$\log w^*_{i,t} = \log w^*_{i,t-1} + g + z_{i,t},$$

$z_{i,t} \in [-\overline{z}, \infty)$ is idiosyncratic productivity shock, $g$ is trend productivity growth.

# The Impact of Inflation Shocks on Worker Welfare and Wages

Start from a steady state with inflation $\pi^{ss} \geq 0$.

An unexpected $t = 0$ **inflation shock**, $\{\hat{\pi}_t\}_{t=0}^{+\infty} = \{\pi_t - \pi^{ss}\}_{t=0}^{+\infty}$. Perfect foresight after.

Study its impact on aggregate worker welfare

$$\mathscr{W} \equiv \int \mathbb{E}_0 \left[ \sum_{t=0}^{\infty} \beta^t \left\{ \log\left(c_{i,t}\right) - \kappa_{i,t} \mathscr{I}_{i,t} \right\} \right] di$$

and aggregate log real wages

$$\log w_t \equiv \int_0^1 \log\left(w_{i,t}\right) di.$$

# Model: Higher inflation increases share of conflict

**Proposition.**

*If $\gamma < 1$, then an* ***increase in inflation*** *at $t = 0$ leads to a* ***larger fraction*** *of workers engaging in* ***conflict*** *at $t = 0$.*

- State dependency: likelihood of conflict increases with inflation
- Unless default wages were fully indexed ($\gamma = 1$)

# The Impact of Inflation Shocks on Worker Wages

**Definition 1.**

The impact of inflation shocks on aggregate log real wage can be decomposed into

$$\hat{w}_t \equiv \log w_t - \log w^{ss} = \hat{w}_t^{\text{erosion}} + \hat{w}_t^{\text{catch-up}},$$

- **Wage erosion**: impact of inflation shocks holding conflict decision at steady state $\mathscr{I}_{i,t}^{ss}$

$$\hat{w}_t^{\text{erosion}} \equiv \int_0^1 \log \omega_t \left(\pi_t, \mathscr{I}_{i,t}^{ss}, h_{i,t}\right) di - \int_0^1 \log \omega_t \left(\pi^{ss}, \mathscr{I}_{i,t}^{ss}, h_{i,t}\right) di,$$

  where $\omega_t$ is wage given path of inflation $\pi_t$, conflict choices $\mathscr{I}_{i,t}$, & idio. conditions $h_{i,t}$.

- **Wage catch-up**: impact of inflation shocks through changes in conflict decision $\mathscr{I}_{i,t}$

$$\hat{w}_t^{\text{catch-up}} \equiv \int_0^1 \log \omega_t \left(\pi_t, \mathscr{I}_{i,t}, h_{i,t}\right) di - \int_0^1 \log \omega_t \left(\pi_t, \mathscr{I}_{i,t}^{ss}, h_{i,t}\right) di.$$

**Theorem.**

*The (first-order) impact of inflation shocks on worker welfare is given by* ***wage erosion***

$$\underbrace{\hat{\mathscr{W}}}_{\text{impact on worker welfare}} = \sum_{t=0}^{\infty} \beta^t \hat{w}_t^{\text{erosion}} = \underbrace{\sum_{t=0}^{\infty} \beta^t \hat{w}_t}_{\text{real wage response}} - \sum_{t=0}^{+\infty} \beta^t \hat{w}_t^{\text{catch-up}}.$$

Because the benefits of **wage catch-up** are offset by **costs of conflict**

$$\sum_{t=0}^{\infty} \beta^t \hat{w}_t^{\text{catch-up}} = \underbrace{\int \mathbb{E}_0 \left[ \sum_{t=0}^{\infty} \beta^t \kappa_{i,t} \left( \mathscr{I}_{i,t} - \mathscr{I}_{i,t}^{ss} \right) \right] di}_{\text{aggregate costs of inflation due to conflict}}.$$

[Milgrom-Segal '02 envelope theorem applied to discrete choice set]

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- The impact of inflation on **aggregate wage** $\sum_{t=0}^{\infty} \beta^t \hat{w}_t$ **does not measure** welfare
  - Even $\approx 0$, inflation could still be costly because wage catch-up comes from costly conflicts
  - Sufficient for welfare only w/ purely time-dependent wage setting ($\kappa \to \infty$)

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  - Even $\approx 0$, inflation could still be costly because wage catch-up comes from costly conflicts
  - Sufficient for welfare only w/ purely time-dependent wage setting ($\kappa \to \infty$)
- Conflict cost are **aggregate** deadweight loss, not just redistribution from workers to firms
- Extensions: (1) general distribution of $\kappa_{i,t}$; (2) Rotemberg quadratic costs; (3) $w_{i,t}^*$ impacted by inflation shocks; (4) other agg. shocks; (5) unemployment; (6) beyond hand-to-mouth

# What is wage erosion?

**Proposition.**

*Wage erosion is given by*

$$\hat{w}_t^{erosion} = -(1-\gamma)\sum_{k=0}^{t} \Phi_k^{ss}\hat{\pi}_{t-k} \quad \forall t \geq 0$$

*where* $\Phi_k^{ss} \equiv \int_0^1 \left(\Pi_{l=0}^{k}\left(1-\mathscr{I}_{i,t+l}^{ss}\right)\right) di$.

Two key terms impact wage erosion:

1. Indexation $\gamma$: lower $\gamma \implies$ higher costs of inflation
2. $\Phi_k^{ss}$ is prob. that employer's default wage **"survives"** without conflict for $k$ periods.
   - linked with the **frequency of conflict in steady-state**
   - lower $\lambda \implies$ higher $\Phi_k^{ss} \implies$ more wage erosion $\implies$ higher costs of inflation
   - higher $\kappa \implies$ higher $\Phi_k^{ss} \implies$ more wage erosion $\implies$ higher costs of inflation

# Using the Survey to Calibrate Key Model Parameters

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Use survey to directly inform **key parameters** governing the importance of conflict

1. **Estimate conflict costs**
   - utility cost of conflict $\kappa$
   - probability of free catch-up $\lambda$

2. Elicit how default wage varies with inflation
   - indexation $\gamma$
   - also, SS nominal wage growth $\alpha$

# Estimating Conflict Costs

- Elicit nominal wage growth workers believe they get **via costly actions**

$$\Delta W^{\text{conflict}} \equiv \log W^{*}_{i,t} - \log W_{i,t-1}$$

[$W^{*}_{i,t}$ : conflict-induced nominal wage]

*What pay growth in next 12 months do you think you would get if you do your best to increase pay using any strategies at your disposal, including the common strategies listed above?*

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*What pay growth in next 12 months do you think you would get if you do your best to increase pay using any strategies at your disposal, including the common strategies listed above?*

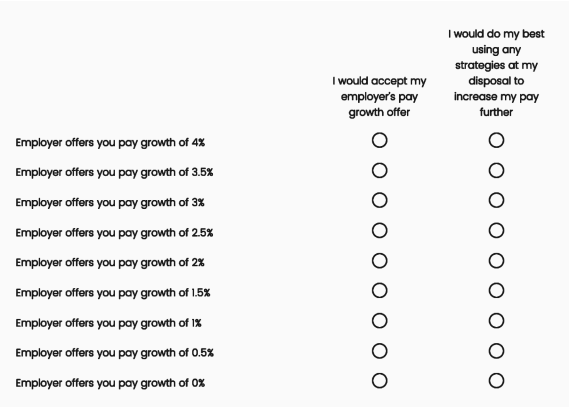
- Elicit nominal wage growth $\Delta W^{\text{indiff}}$ where workers are **indifferent** between
  - Accepting if offered by their employers vs taking costly actions
- Find the **conflict threshold** $x^{\text{conflict}}$:

$$x^{\text{conflict}} \equiv \Delta W^{\text{conflict}} - \Delta W^{\text{indiff}}$$

  - the fraction of wage that workers would sacrifice to avoid conflict

# Eliciting Costs of Conflict

Elicit $\Delta W^{\text{indiff}}$ via "multiple price list" standard in experimental economics [Jack et al. '22]



| | I would accept my employer's pay growth offer | I would do my best using any strategies at my disposal to increase my pay further |
|---|---|---|
| Employer offers you pay growth of 4% | ○ | ○ |
| Employer offers you pay growth of 3.5% | ○ | ○ |
| Employer offers you pay growth of 3% | ○ | ○ |
| Employer offers you pay growth of 2.5% | ○ | ○ |
| Employer offers you pay growth of 2% | ○ | ○ |
| Employer offers you pay growth of 1.5% | ○ | ○ |
| Employer offers you pay growth of 1% | ○ | ○ |
| Employer offers you pay growth of 0.5% | ○ | ○ |
| Employer offers you pay growth of 0% | ○ | ○ |

Consider a respondent who reports $\Delta W^{\text{conflict}} = 4\%$. They get a list of potential employer offers $\leq 4\%$.

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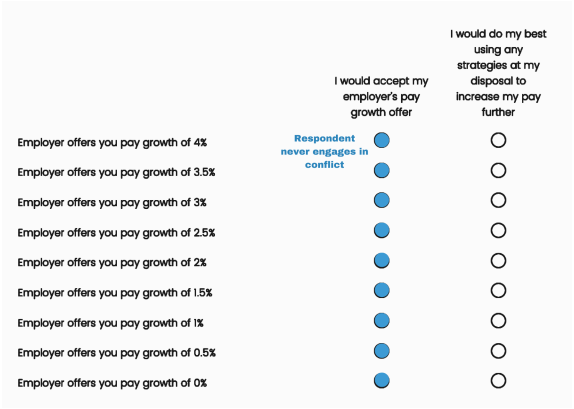


Always accept employer offers & never conflict $\Longrightarrow$ high conflict cost.

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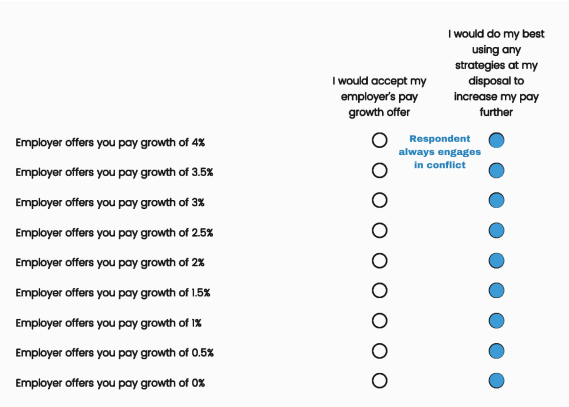


Never accept employer offers & always conflict $\Longrightarrow$ zero conflict cost.

# Eliciting Costs of Conflict

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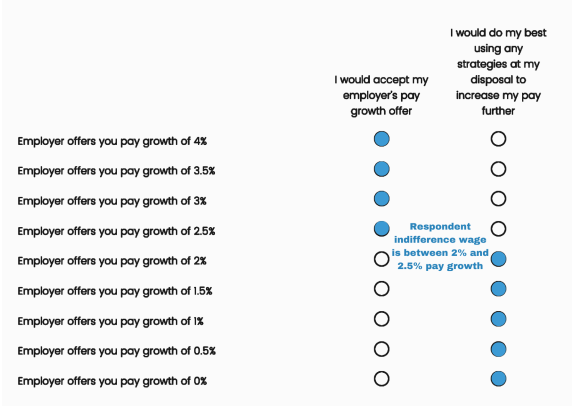
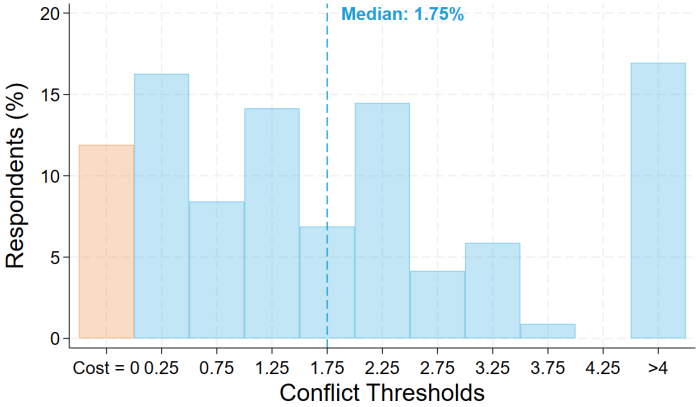



Let $\Delta W^{\text{indiff}}$ denote lowest nominal wage growth where workers accept employers' offer, then:

$$x^{\text{conflict}} \in \left[\Delta W^{\text{conflict}} - \Delta W^{\text{indiff}},\ \Delta W^{\text{conflict}} - \Delta W^{\text{indiff}} + 0.5\right].$$

# Conflict Costs

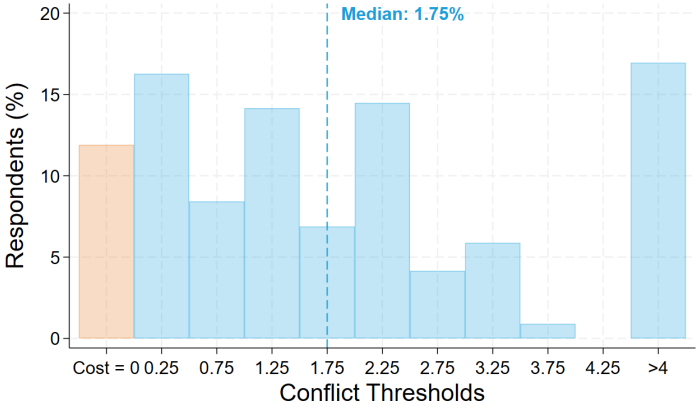





- Direct evidence on **conflict costs**: $\kappa_{i,t} = 0$ *with prob.* $\lambda$ *and* $\kappa_{i,t} = \kappa$ *otherwise*
  - $\lambda = 0.029$ (quarterly) to match share of people who would always conflict
  - Internally calibrate $\kappa$ so conflict threshold is equal to $x^{\text{conflict}} = 1.75\%$

Calibrating $\kappa$ | Union Dues

# Conflict Costs




- **Validation exercises**:
  1. **Lower conflict costs** predict **higher likelihood** of having taken **actions** in 2023 — Here
  2. **Lower conflict costs** predict **less wage sacrificed** from **not** taking **actions** in 2023 — Here

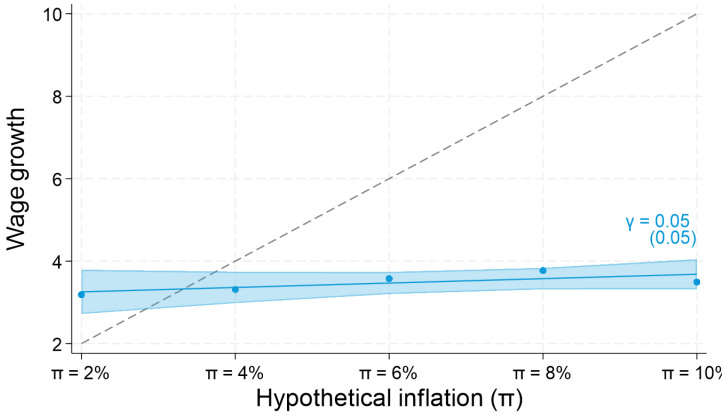
# Elicit Conflict Costs with the Survey

Use survey to directly inform **key parameters** governing the importance of conflict

1. Elicit conflict costs
   - utility cost of conflict $\kappa$
   - probability of free catch-up $\lambda$

2. **Elicit how default wage varies with inflation**
   - indexation $\gamma$
   - also, SS nominal wage growth $\alpha$

# Indexation: Perceived Nominal Wage Growth without Conflict




- Evidence on **default wages + indexation**: $W_{i,t}^{default} = W_{i,t-1} e^{\alpha + \gamma(\pi_t - \pi^{ss})}$
- Indexation: $\Delta\pi = 1\%$ then $\Delta \log W_{i,t}^{\text{default}} = 0.05\% \Rightarrow \gamma = 0.05$
  - Intercept: with $\pi^{ss} = 2\%$, 3% default wage annual growth $\Rightarrow \alpha = 0.81\%$ quarterly

# Empirical Takeaway

1. **Significant cost of conflict** $x^{\text{conflict}} = 1.75\%$ of wages and $\lambda = 0.029$
2. **Almost no indexation**: 1 p.p. inflation $\Rightarrow \sim 0$ in employer-offered nominal wage growth

# Quantifying the Costs of Inflation: The Importance of Conflict

# Calibration - Quarterly Frequency

| | *Description* | *Value* | *Target* |
|---|---|---|---|
| $\beta$ | Discount factor | 0.99 | Standard |
| $\kappa$ | Conflict cost | 8.14% | Own survey<br>such that $\underline{x}^{ss} = -1.75\%$ |
| $\lambda$ | Probability of free catchup | 2.87% | Own survey |
| $g$ | Trend real wage growth | 0.76% | ASEC-CPS<br>3.02% annual real wage growth |
| $\alpha$ | Default nom. wage growth, zero inflation | 0.81% | Own survey |
| $\gamma$ | Indexation of default nominal wage | 0.05 | Own survey |
| $\pi^{ss}$ | Steady state inflation | 0.5% | 2% annual inflation |
| $z_{i,t}$ | Idios. shocks $z_{i,t} + \mu \sim \text{Gamma}(a, b)$ | $(0.14, 0.03)$ | $\mathbb{E}[z_{i,t}] = 0$<br>48% yearly share of conflict |

# Quantifying the Aggregate Costs of Inflation Due to Conflict

Solve for first-order responses to inflation shocks $\{\hat{\pi}_t\}_{t\geq 0}$, starting from steady state

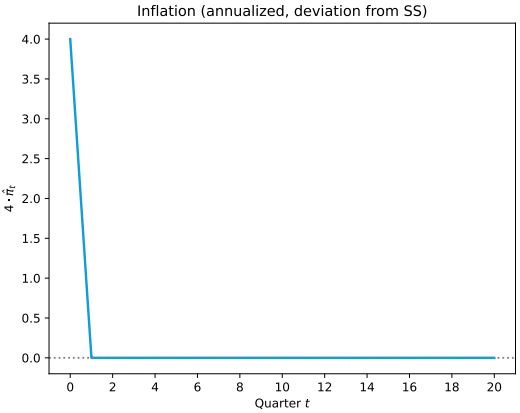
- Using **SSJ** methods [Auclert-Bardóczy-Rognlie-Straub '21, Auclert-Rigato-Rognlie-Straub '24]

Evaluate welfare costs of inflation shocks to workers

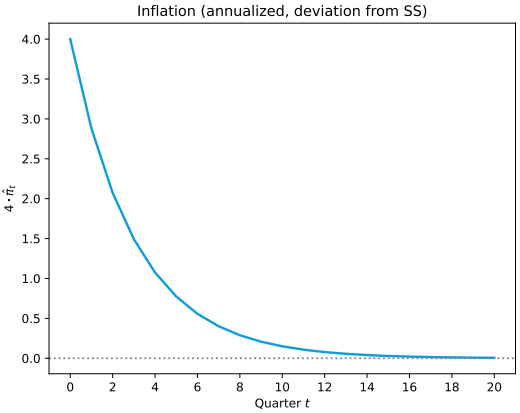
$$\hat{\mathscr{W}} = \sum_{t=0}^{\infty} \beta^t \hat{w}_t^{\text{erosion}} = \underbrace{\sum_{t=0}^{\infty} \beta^t \hat{w}_t}_{\text{aggregate wage response}} - \underbrace{\sum_{t=0}^{\infty} \beta^t \hat{w}_t^{\text{catch-up}}}_{\substack{\text{aggregate costs of} \\ \text{inflation due to conflict}}},$$

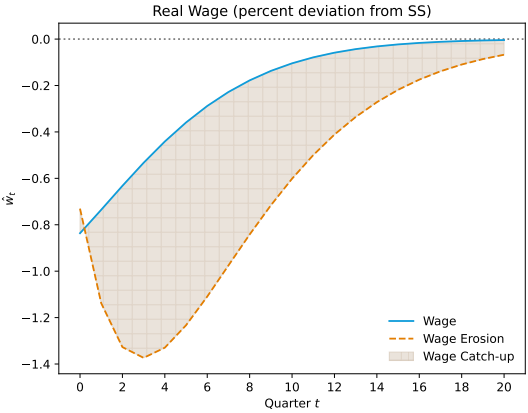
1. Transitory inflation shocks: $\hat{\pi}_0 > 0$ and $\hat{\pi}_t = 0$ for $t \geq 1$
2. Persistent inflation shocks: $\hat{\pi}_t = \rho^t \varepsilon$, with $\rho = 0.72$

# Wage Dynamics in Transitory Inflation Shocks




# Wage Dynamics in Persistent Inflation Shocks



# Welfare Decomposition

| | Overall Welfare Change | Real Wage Response | Aggregate Costs of Inflation due to Conflict |
|---|---|---|---|
| **Transitory inflation** | −0.95% | −0.22% | −0.73% |
| **Persistent inflation** | −3.31% | −1.16% | −2.15% |

**Note**: Welfare units = % of 1-year consumption

- **Costs of inflation** incorporating conflict **more than double** costs via falling real wages

# Quantitative robustness

**Question:** how affected are the results by changes in important parameters?

- Different level of indexation of default wages $\gamma$ Here
- Different probability of free catch-up $\lambda$ Here
- Different cost of costly conflict $\kappa$ Here
- GE determination of employment and wages (inflation greases wheels of labor market) Here

# Conflict and the Costs of the Post Pandemic Inflation

# Conflict and the Costs of the Post Pandemic Inflation

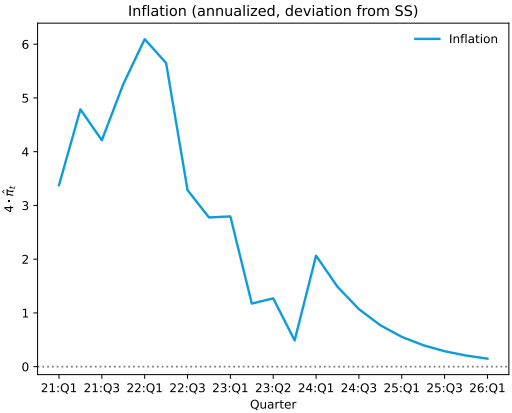
**Goal:** explore contribution of conflict to recent inflation angst

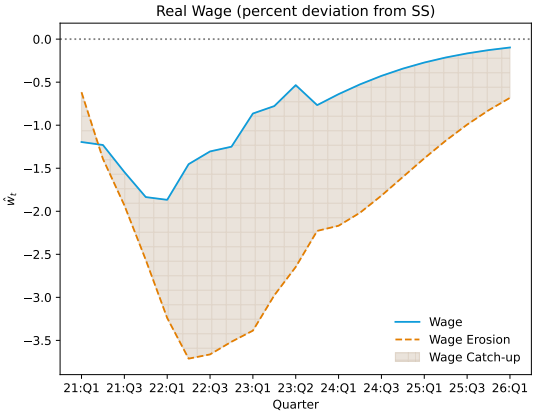
Feed **inflation between Jan. '21 and Dec. '23** [Extrapolate using historical persistence]

Solve the model under two alternative assumptions:

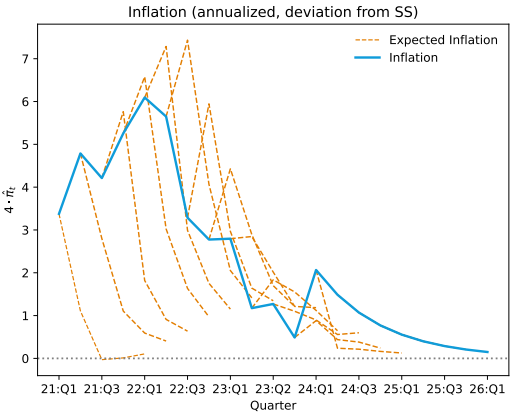
1. Perfect Foresight
2. Using Observed Expectations from Surveys How? [similar to Bardóczy-Guerreiro '23]
   - Observed expectations: SCE + SPF
     - SCE gives expectations over next 12 months
     - Use term structure of SPF to extrapolate to quarterly inflation forecasts
   - Assess welfare with ex-post realized outcomes

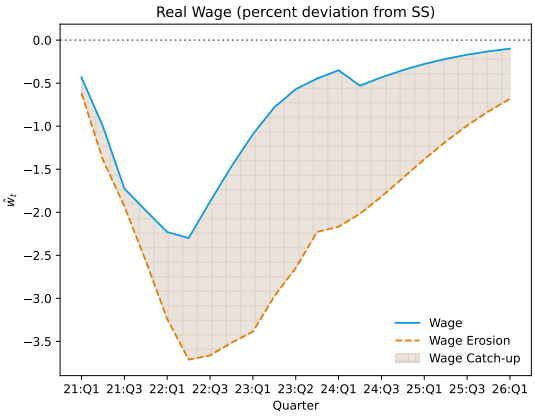
# Wage Dynamics in Post-Pandemic Inflation – Perfect Foresight



# Wage Dynamics in Post-Pandemic Inflation – Observed Expectations




No Foresight | Sticky Expectations

# Welfare Decomposition of the Post-Pandemic Inflation

| | Overall Welfare Change | Real Wage Response | Aggregate Costs of Inflation due to Conflict |
|---|---|---|---|
| **Perfect foresight** | −10.91% | −4.21% | −6.70% |
| **Observed Expectations** | −10.91% | −4.45% | −6.46% |

**Note**: Welfare units = % of 1-year consumption

- **Costs of inflation** incorporating conflict **more than double** costs via falling real wages

# Conclusion

# Conclusion

Workers incur **conflict costs** to have nominal wages keep up with inflation

Survey: workers willing to sacrifice 1.75% of wages to avoid costly conflict

We capture conflict in a menu-cost style model applied to wage setting

Incorporating conflict costs **more than doubles** costs of inflation to workers.

- Conflict is an important contributor to the dislike of inflation

**Broader agenda**: a realistic and tractable approach to introduce **state-dependent wage setting**

- In progress: firms' costs in adjusting wages away from default – Why don't firm cut wages?

# Thank you!

# Literature

**Inflation and Conflict.** [Lorenzoni & Werning '23 a,b]

- **This paper:** related but distinct notion of conflict—costly actions by workers raises wages
- Our focus is the **welfare costs of inflation**, theirs is the causes of inflation

**Costs of inflation.** [Baily '56; Friedman '77; Fischer & Modigliani '78; Imrohoroglu '92; Lucas '00; Burstein & Hellwig '08; Alvarez et al '16; Nakamura et al '18; Binetti et al '24]

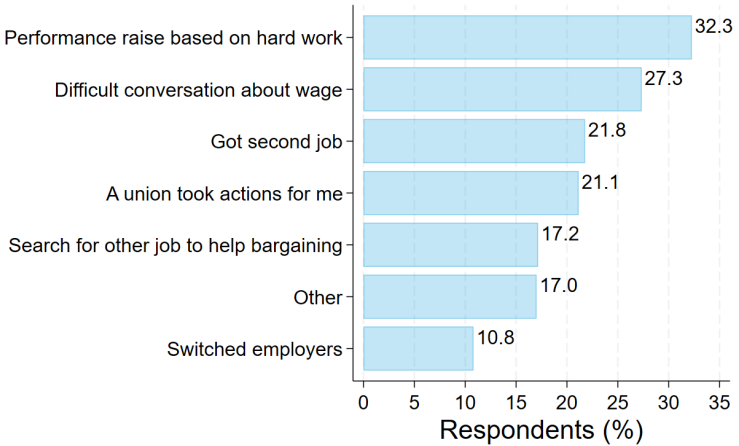
- **Previous:** inflation costs from range of mechanisms
  [e.g. shoe leather costs, menu costs, relative price distortions, inflation volatility, tax distortions]
- **This paper:** new + significant costs of inflation via labor markets

**Costs of inflation via labor market.** [Shiller '97; Hadjini et al '22; Pilossoph & Ryngaert '23; Del Canto et al '23; Ferreira et al '23; Pallotti et al '23; Stantcheva '24; Afrouzi et al. '24; Pilossoph et al '24]

- **This paper:** real wage growth misses costs of inflation in labor market due to conflict

# What are the Costly Actions?

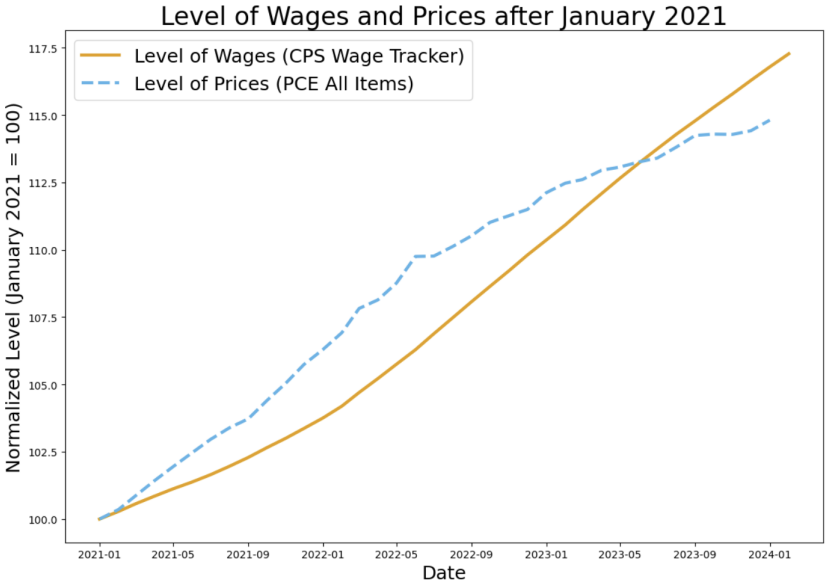
Back




Takeway: Workers engage in a **diverse set of costly actions**

# Wages and prices in the post-Pandemic inflation

Back



# Sample Representation 1/3

Back

**Table 3:** Distributions in Survey Sample vs. Population

| | Survey | US population |
|---|---|---|
| Male | 0.52 | 0.52 |
| Female | 0.48 | 0.48 |
| | | |
| Secondary education (e.g. GED/GCSE) | 0.02 | 0.02 |
| High school diploma/A-levels | 0.37 | 0.39 |
| Technical/community college | 0.12 | 0.11 |
| Undergraduate degree (BA/BSc/other) | 0.32 | 0.30 |
| Graduate degree (MA/MSc/MPhil/other) | 0.14 | 0.13 |
| Doctorate degree (PhD/other) | 0.04 | 0.04 |
| | | |
| Democrat | 0.28 | 0.28 |
| Republican | 0.26 | 0.26 |
| Independent | 0.33 | 0.33 |
| None | 0.07 | 0.07 |
| Other party | 0.06 | 0.06 |
| | | |
| 22-29 years old | 0.24 | 0.20 |
| 30-39 years old | 0.38 | 0.29 |
| 40-49 years old | 0.21 | 0.26 |
| 50-60 years old | 0.16 | 0.26 |

# Sample Representation 2/3

Back

**Table 3:** Distributions in Survey Sample vs. Population

| | Survey | US population |
|---|---|---|
| Full-Time | 0.83 | 0.83 |
| Part-Time | 0.17 | 0.17 |
| | | |
| For-profit company | 0.80 | 0.77 |
| Not-for-profit corporation | 0.09 | 0.07 |
| State government | 0.03 | 0.06 |
| Federal government | 0.02 | 0.03 |
| Local government | 0.04 | 0.07 |
| Other employer | 0.01 | |
| | | |
| White | 0.68 | 0.75 |
| Black | 0.12 | 0.14 |
| Asian | 0.08 | 0.07 |
| Mixed | 0.08 | 0.02 |
| Other | 0.04 | 0.02 |
| Not reported | 0.00 | |

# Sample Representation 3/3

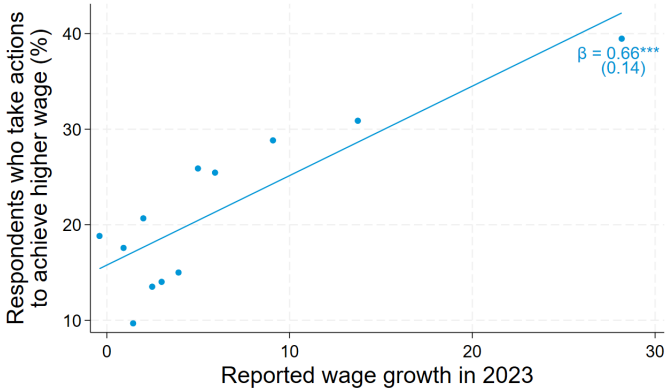
Back

**Table 3:** Distributions in Survey Sample vs. Population

| | Survey | US population |
|---|---|---|
| Covered by a union | 0.11 | 0.13 |
| Not part of a union | 0.81 | 0.87 |
| Not reported | 0.08 | |
| | | |
| Income | | |
| $0-$19,999 | 0.12 | 0.12 |
| $20,000-$39,999 | 0.24 | 0.22 |
| $40,000-$69,999 | 0.34 | 0.31 |
| $70,000-$99,999 | 0.17 | 0.16 |
| $100,000-$124,999 | 0.06 | 0.08 |
| $125,000+ | 0.07 | 0.11 |

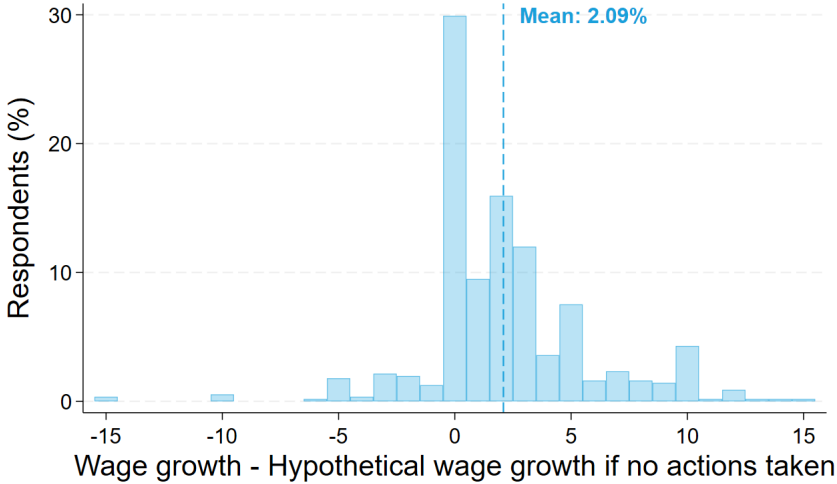
# Workers with higher wage growth were more likely to have taken costly actions

Back



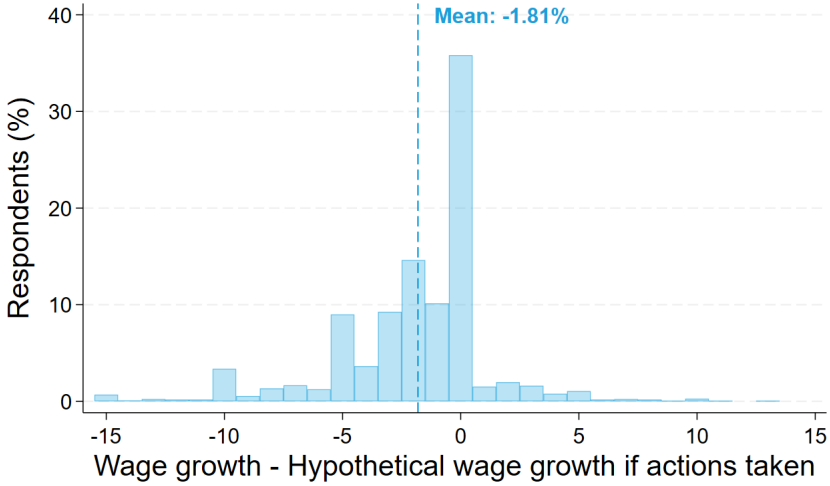
# Conflict Leads to Higher Wages: Within-individual

Back



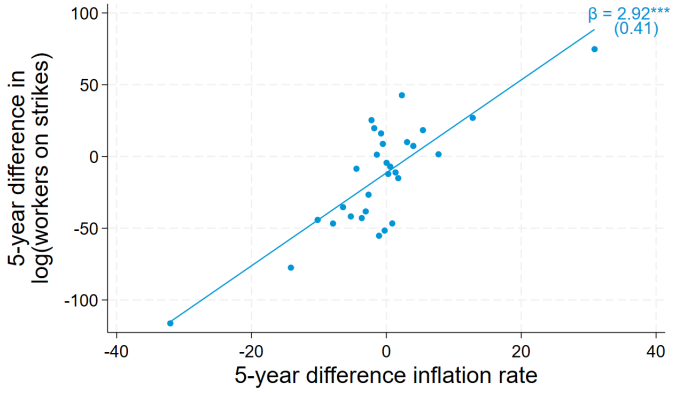
# Workers sacrifice wage growth not to conflict: Within-individual

Back



# Evidence from Unions

Back




$$\Delta \log(\text{workers involved in strikes}) * 100_{i,t,t-5} = \beta \Delta \pi_{i,t,t-5} + \varepsilon_{it}$$ [1]

[1] Note: Standard errors are clustered at the country level.

# Union Dues

Return

- Service Employees International Union (≈1.9 million members): 1.7% of the member's gross monthly salary for time in regular pay status.
- International Brotherhood of Teamsters (≈1.4 million members): if you make $15 an hour, your dues are ≈1.5% of income.
- United Auto Workers (≈990k members): two hours pay per month for full time members and 1.15% of straight-time hourly pay for part time and per diem members.
- National Education Association (≈ 3 million members): National dues are $15 per year. For Chicago, to be a member costs from $745.20 to $1,242.00 a year.

# Evidence from Unions: Specification

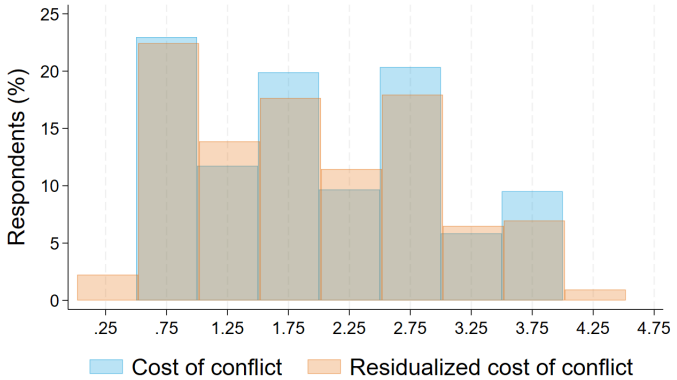
Back

$$\Delta \log(\text{workers involved in strikes}) * 100_{i,t,t-5} = \gamma_i + \lambda_t + \beta \Delta \pi_{i,t,t-5} + \varepsilon_{it}$$

- The dependent variable is the 5-year long log difference of "Workers involved in strikes and lockouts", sourced from the International Labour Organization, multiplied by 100 for ease of interpretation.
- As independent variable, we employ he 5-year long difference of headline inflation, sourced by the World Bank, trimmed at 2.5% on each tail.
- Country and year fixed effects are included.
- Observations are unweights.
- Standard errors are clustered at the country level only.
- The data availability per year depends on the country. The analysis includes 78 countries, between 1969 to 2022: Algeria, Australia, Austria, Bangladesh, Barbados, Belgium, Botswana, Brazil, Burundi, Cameroon, Canada, Chile, Colombia, Costa Rica, Cyprus, Denmark, Ecuador, Egypt, Arab Rep., El Salvador, Estonia, Fiji, Finland, France, Germany, Ghana, Greece, Guatemala, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Korea, Rep., Latvia, Lithuania, Malaysia, Malta, Mauritius, Mexico, Morocco, Myanmar, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, San Marino, Slovak Republic, South Africa, Spain, Sri Lanka, Suriname, Sweden, Switzerland, Thailand, Trinidad and Tobago, Tunisia, Turkiye, Uganda, Ukraine, United Kingdom, United States, and Uruguay.

# Conflict Costs vs Residualized Conflict Costs

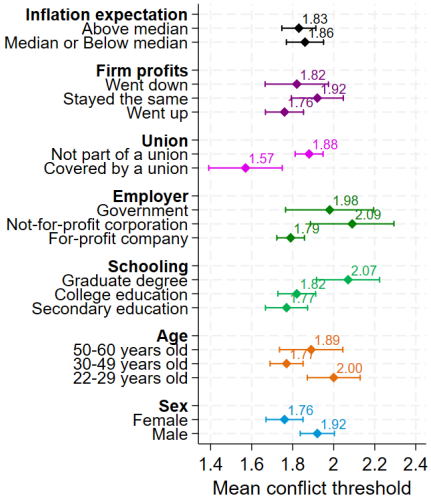
Back




[2] Note: Respondents who never and always engage in conflict have been excluded from the figure and the calculation of the residualized cost of conflict. The residualized cost of conflict has been generated by regressing cost of conflict on dummy variables for the categories of age, education, income and union coverage. The categories excluded were 30-49 years old, income of [100k-125k), graduate education and non-union coverage.

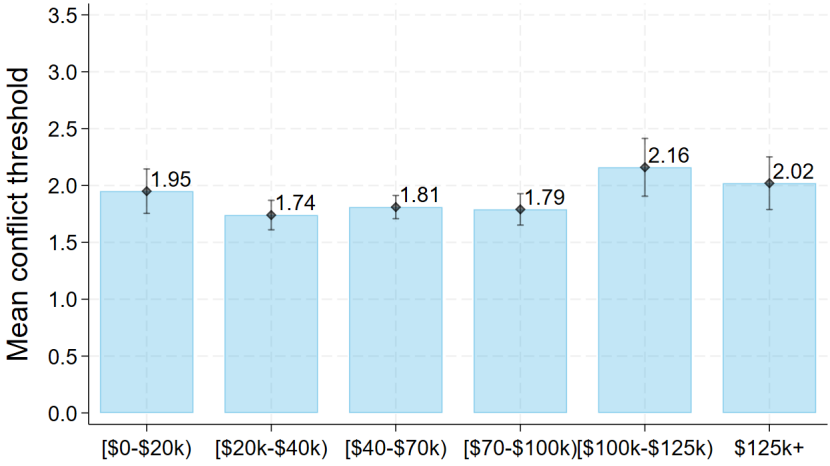
# Heterogeneity: Conflict Costs

Back



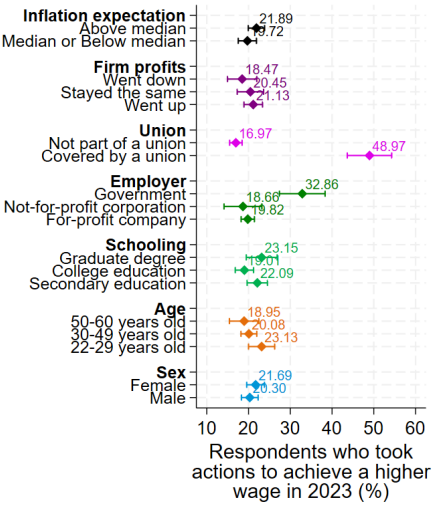
# Heterogeneity: Conflict Costs, by income

Back



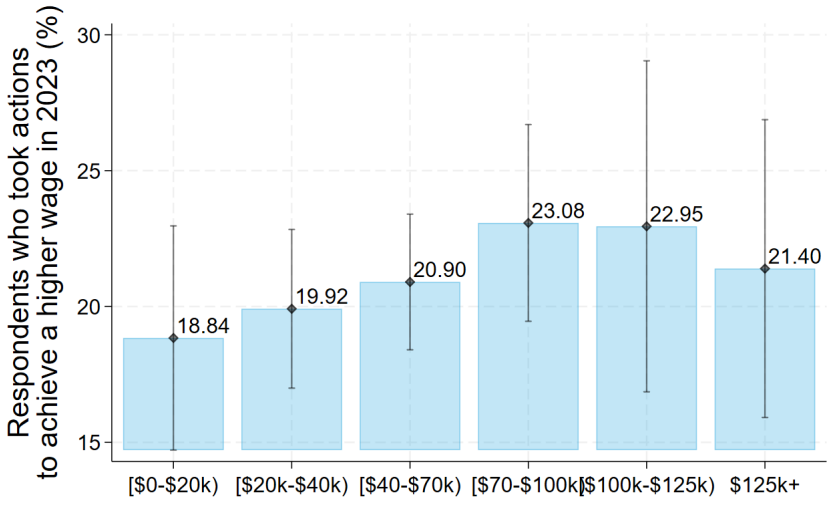
# Heterogeneity: Respondents engaging in conflict in 2023

Back



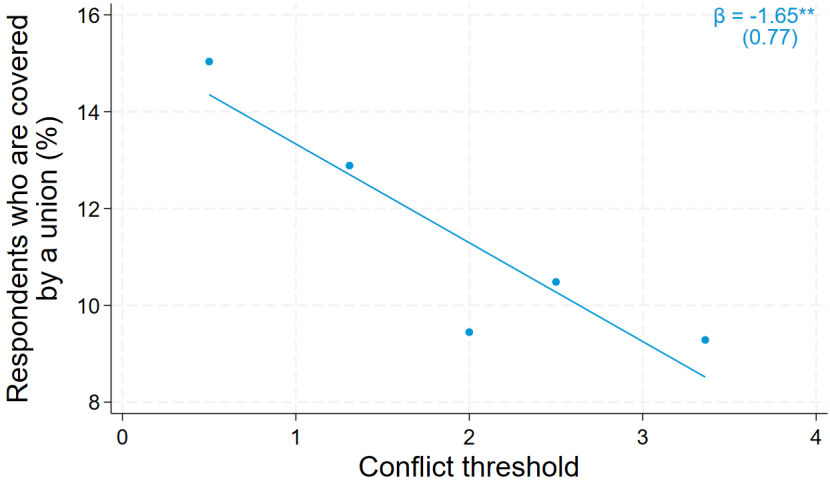
# Heterogeneity: Respondents engaging in conflict in 2023, by income

Back



# Union members have lower cost of conflict

Back



# Calibrating $\kappa$

Back

**Lemma.**

*Let $v^{ss}(x)$ denote worker's value as a function of end-of-period wage gap $x$*

$$v^{ss}(x) \equiv \max\left\{x + \beta \mathbb{E}\left[\max\left\{v^{ss}(0) - \kappa', v^{ss}\left(x'\right)\right\}\right]\right\}$$

*where $x \equiv \log\left(w_{i,t}/w^*_{i,t}\right)$ denotes the wage gap. Then,*

$$v^{ss}\left(-x^{conflict}\right) = v^{ss}(0) - \kappa.$$

- Measured conflict threshold is directly informative of $\kappa$.

# Extensions

Back

- **Conflict-induced real wages affected by inflation shocks**

$$\hat{\mathscr{W}} \approx \sum_{t=0}^{\infty} \beta^t \hat{w}_t^{\text{erosion}} \quad \& \quad \hat{w}_t^{\text{erosion}} \approx -(1-\gamma) \sum_{s=0}^{t} \Phi_{t-s}^{ss} \hat{\pi}_s + \sum_{s=0}^{t} \left(1 - \Phi_{t-s}^{ss}\right) \hat{g}_{w,s}, \tag{1}$$

  - $g_{w,s} \equiv \log\left(w_s^* / w_{s-1}^*\right)$ is growth of agg. conflict-induced wages & hats are dev. from SS.
  - $\hat{w}_t^{\text{erosion}}$ still captures the impact of inflation shocks if conflict decisions are hold at SS level
  - $\hat{g}_{w,s}$ increases $\hat{w}_t^{\text{erosion}}$ only if workers conflict between $s$ & $t$, with prob. $1 - \Phi_{t-s}^{ss}$

- Allowing **other aggregate shocks** (e.g., changing productivity growth $g_t$)

$$\hat{\mathscr{W}} \approx \sum_{t=0}^{\infty} \beta^t \hat{w}_t^{\text{erosion}} \quad \& \quad \hat{w}_t^{\text{erosion}} \approx -(1-\gamma) \sum_{s=0}^{t} \Phi_{t-s}^{ss} \hat{\pi}_s + \sum_{s=0}^{t} \left[1 - (1-\gamma_g)\, \Phi_{t-s}^{ss}\right] \hat{g}_s.$$

  - Wage erosion and "conflict costs" relevant for the welfare costs of other shocks

Back

- **Beyond** log-utility or **hand-to-mouth** consumers (e.g., standard borrowing constraints)

$$\hat{\mathscr{W}} \approx \sum_{t=0}^{\infty} \beta^t \left[ \int_0^1 u'\left(c_{i,t}^{ss}\right) w_{i,t}^{ss} di \right] \int_0^1 \frac{u'\left(c_{i,t}^{ss}\right) w_{i,t}^{ss}}{\int_0^1 u'\left(c_{i,t}^{ss}\right) w_{i,t}^{ss} di} \hat{w}_{i,t}^{\text{erosion}} di$$

- **Allowing conflict costs to scale with wage gains from conflict.**
  - Akin to Rotemberg, worker who chooses $w_{i,t}$ incurs a utility cost of $\frac{\kappa}{2}\left(\log w_{i,t} - \log w_{i,t}^{\text{d}}\right)^2$
  - Impact of inflation shocks on aggregate worker welfare is still given by

$$\hat{\mathscr{W}} \approx \sum_{t=0}^{\infty} \beta^t \hat{w}_t^{\text{erosion}} \approx -(1-\gamma) \sum_{s=0}^{\infty} \beta^s \sum_{k=0}^{\infty} \beta^k \hat{\pi}_s$$

  - $\hat{w}_t^{\text{erosion}}$ : the impact of inflation shocks if intensity of the conflict $\log w_{i,t} - \log w_{i,t}^{\text{d}}$ is at SS

# Milgrom & Segal '02: Envelope Theorems for Arbitrary Choice Sets

Back

- Let $X$ be an **arbitrary** non-empty set and $f : X \times [0,1] \to \mathbb{R}$ be a real-valued function.
- Let $V(\theta)$ be the optimal value as a function of $\theta$ and let $X^*(\theta)$ be the set of maximizers.

$$V(\theta) := \sup_{x \in X} f(x,\theta), \ \forall \theta \in [0,1] \quad \text{and} \quad X^*(\theta) := \{x \in X | f(x,\theta) = V(\theta)\}$$

**Theorem.**

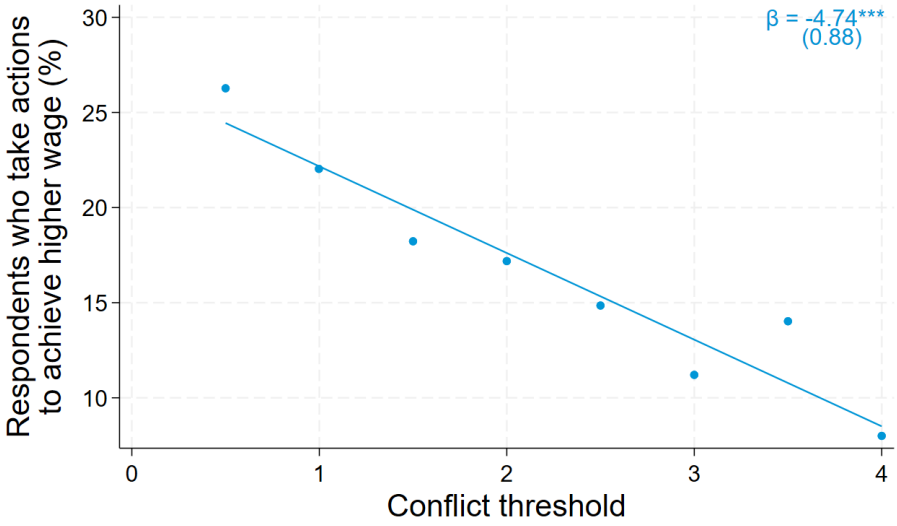
*If $f(x,\cdot)$ is differentiable in $\theta \in [0,1]$ for all $x \in X$ and $X^*(\theta) \neq \emptyset$ for all $\theta \in [0,1]$, then for any selection of $x^*$ of $X^*$,*

$$V(\theta) = V(0) + \int_0^\theta \frac{\partial f(x^*(z),z)}{\partial \theta} dz \quad \forall \theta \in [0,1] \quad \textit{and} \quad V'(\theta) = \frac{\partial f(x^*(\theta),\theta)}{\partial \theta} \quad \textit{a.s.}$$

- For us, for each worker $i$, $\theta \leftrightarrow \{d\pi_t\}_{t=0}^{+\infty}$ & $x \leftrightarrow \left\{\mathscr{I}_{i,t}\right\}_{t=0}^{+\infty}$ (conflict choice, $\mathscr{I}_{i,t} \in \{0,1\}$)
- The envelope theorem holds a.s. at the worker level, and everywhere at the aggregate level

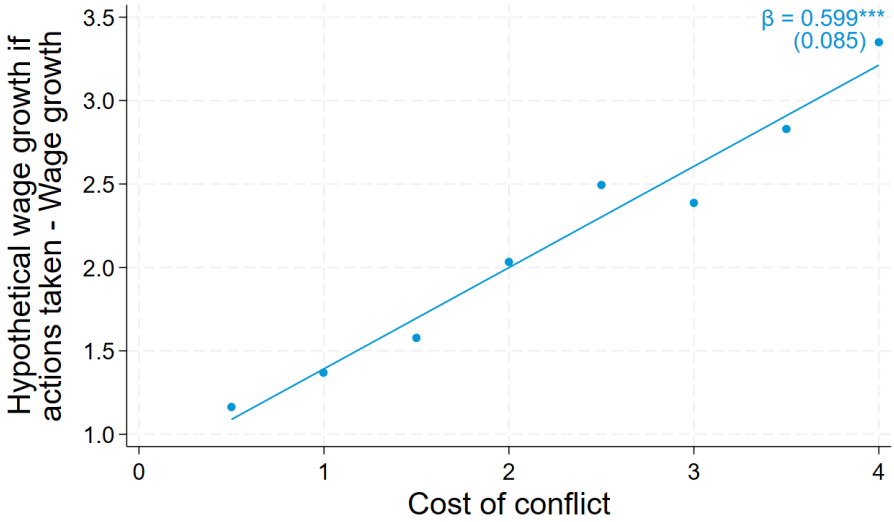
# Lower Conflict Costs Predict Costly Actions

Back Union



# Lower Conflict Costs Predict Lower Sacrifice from Not Taking Actions

Back



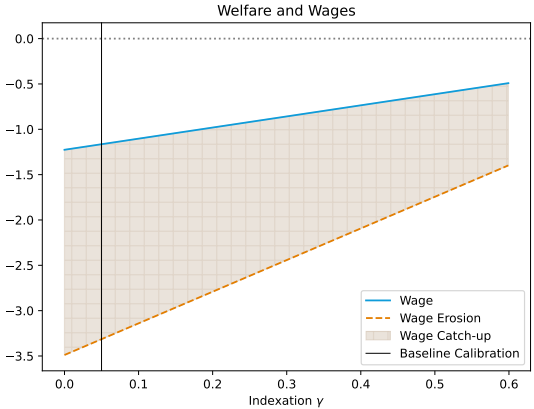
# GE Calibration

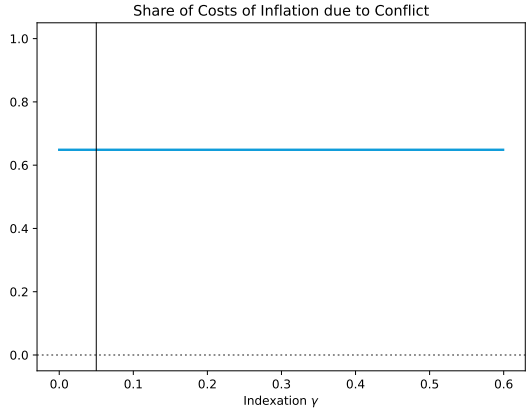
Back

- Separation at a quarterly rate $s = 0.1$ (Shimer, 05)
- Flow value of unemployment to $\phi = 0.5$ (Chodorow-Reich & Karabounis, 16)
- Vacancy filling rate $q(\theta_t) = \Psi \theta_t^{-\eta}$ where $\eta = 0.7$ (Shimer, 05) & $\Psi = 0.6789$ ($U^{SS} = 5.5\%$)
- $c_v = 0.0695$ s.t. PV of vacancy posting costs, $c_v / q(\theta^{ss}) = 0.1 w^{*,ss}$ (Silva and Toledo, 09)
- $\psi_E = 1$ (Gertler, Huckfeldt, & Trigari, 20; Hazell and Taska, 24)

# Robustness: Indexation Parameter $\gamma$

Back




**Note**: Based on persistent inflation.

Transitory

# Robustness: Indexation Parameter $\gamma$

Back

**Proposition 2.**

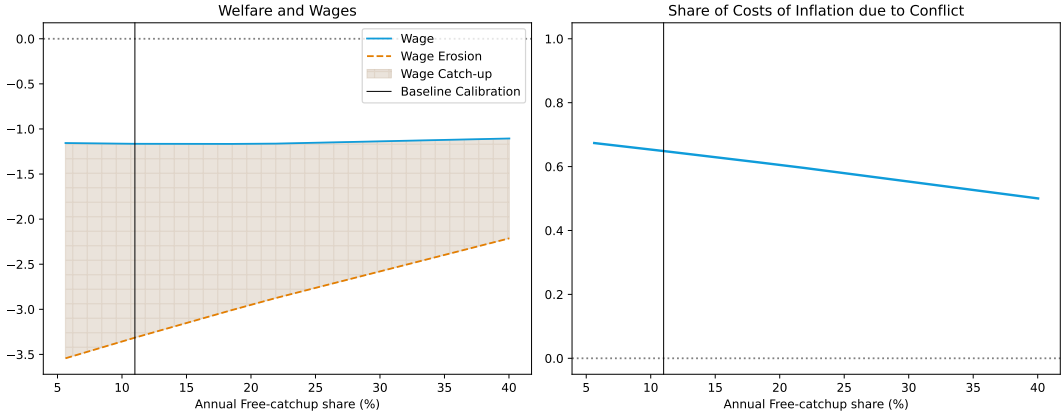
*The ratio of aggregate costs of inflation due to conflict to its overall costs is* ***invariant to the degree of indexation of default wage*** $\gamma \in [0,1)$.

Intuition:

- All matters is *inflation net-of-indexation* $\hat{\pi}_t^{net} \equiv (1-\gamma)\,\hat{\pi}_t$.
- So, both overall welfare loss and the aggregate costs due to conflict scale proportionally with $1-\gamma$.

# Robustness: Prob. of Free Wage Catch-up $\lambda$

Back

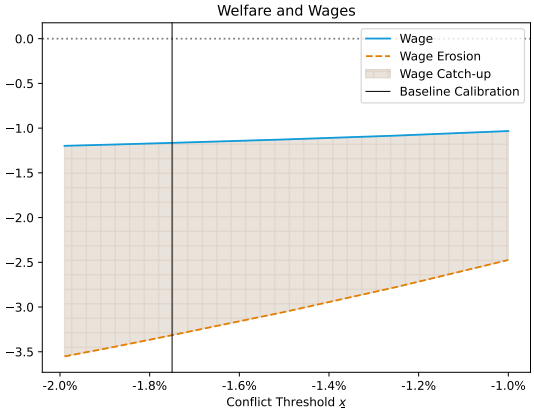


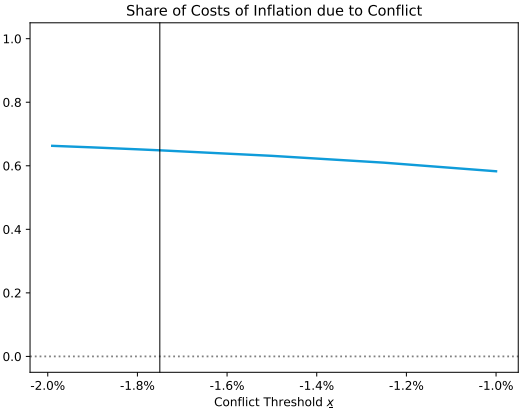

**Note**: Based on persistent inflation.

Transitory

# Robustness: Conflict Costs $\kappa$

Back



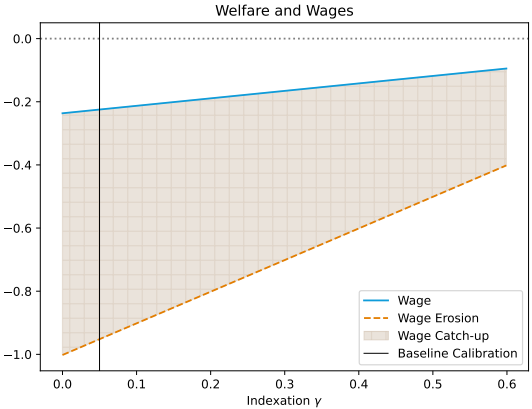



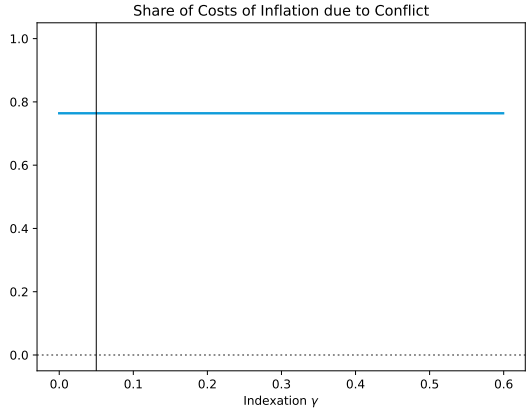

**Note**: Based on persistent inflation.

Transitory

# Robustness: Indexation Parameter $\gamma$

Back



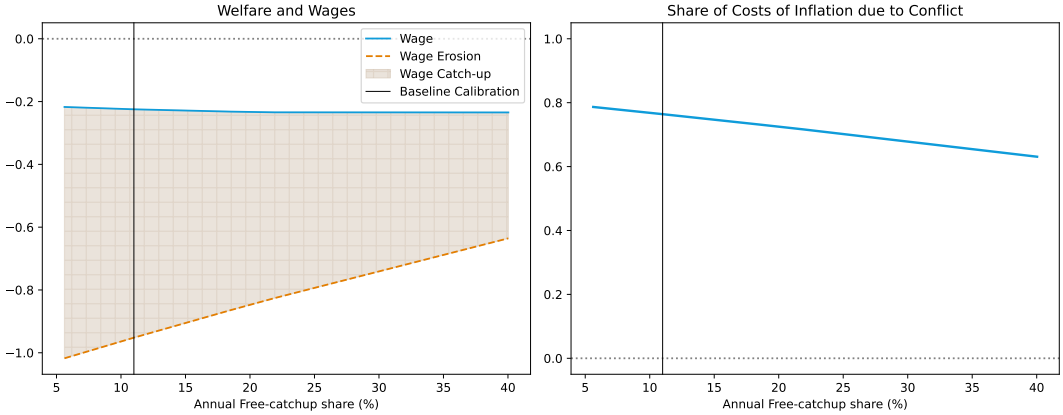




**Note**: Based on transitory inflation.

Persistent

# Robustness: Prob. of Free Wage Catch-up $\lambda$

Back

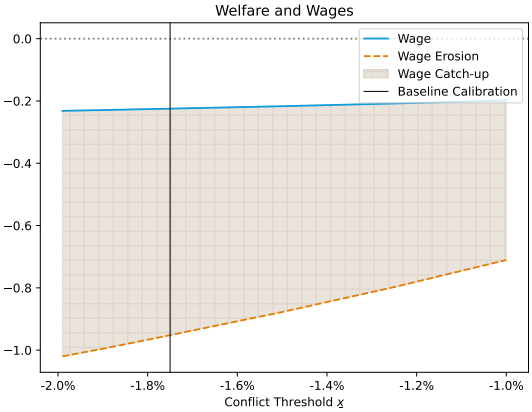


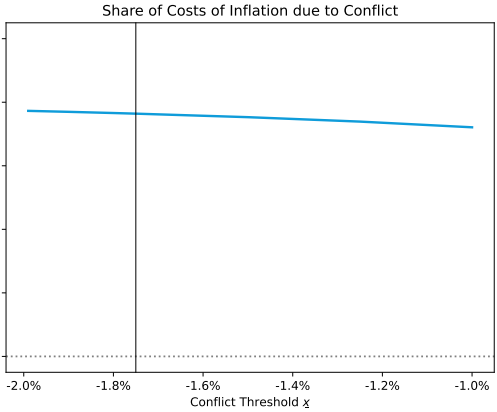

**Note**: Based on transitory inflation.

Persistent

# Robustness: Conflict Costs $\kappa$

Back




**Note**: Based on persistent inflation.

Persistent

# Employment and Wages in General Equilibrium

Back

- Inflation can impact worker welfare through **employment rates & conflict-induced real wages**
  - "Inflation greases the wheels of the labor market" in GE
  - How does it affect the importance of the conflict channel?

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- Model overview:
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  - Employment $E_t$ depends on random matching between unemployed & vacancies
  - Conflict-induced wage increases with $E_t$: $\hat{w}_t^* = \psi_E \hat{E}_t$ [Blanchard-Gali '10, Christiano et al. '16]

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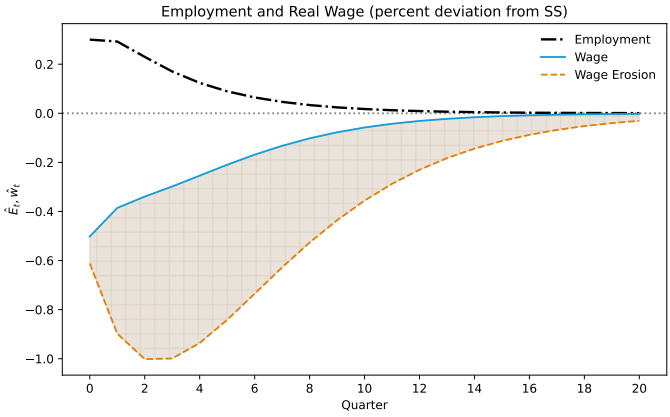
- Impact of inflation shocks on worker welfare

details

$$\hat{\mathscr{W}} = \sum_{t=0}^{\infty} \beta^t \left( \underbrace{E^{ss} \cdot \hat{w}_t}_{\text{employed}} + \underbrace{(1 - E^{ss}) \cdot \hat{w}_t^*}_{\text{unemployed}} + \underbrace{\hat{E}_t \left[ \log(w^{ss}) - \log(\phi w^{*,ss}) \right]}_{\text{employment rates}} \right) - \underbrace{\hat{\varkappa}}_{\text{Agg. Cost Conflict}} .$$

# Employment and Wages in General Equilibrium for 21-23 Inflation

calibration Back

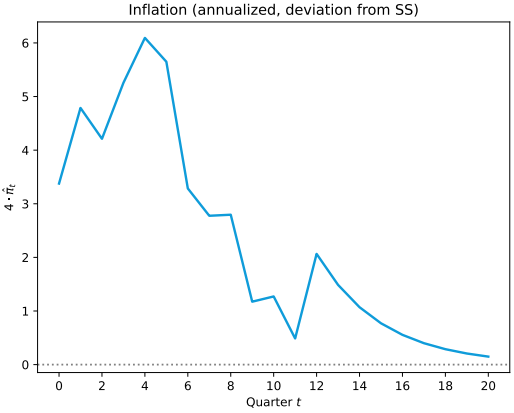


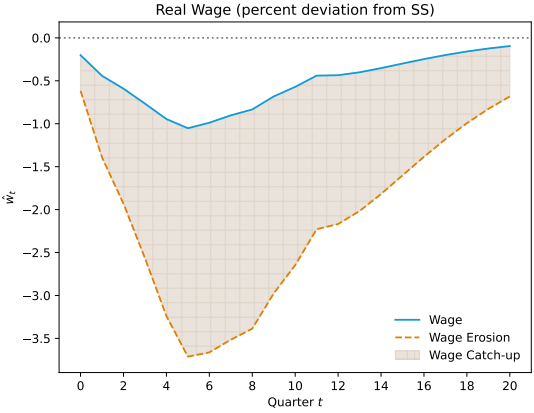

Aggregate costs of inflation due to conflict remain **significant**

- Overall welfare losses are 2.31%, of which 1.92% are aggregate costs of conflict.

# 2021-23 Inflation (No Foresight Limit)

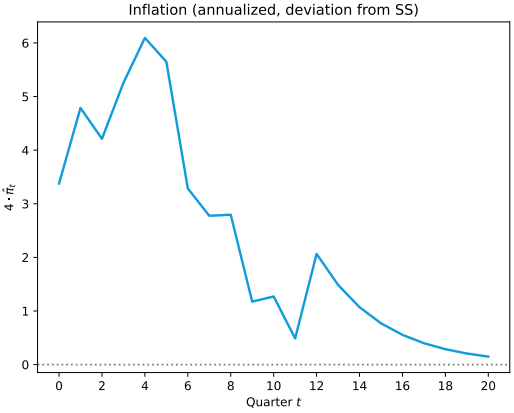
Back

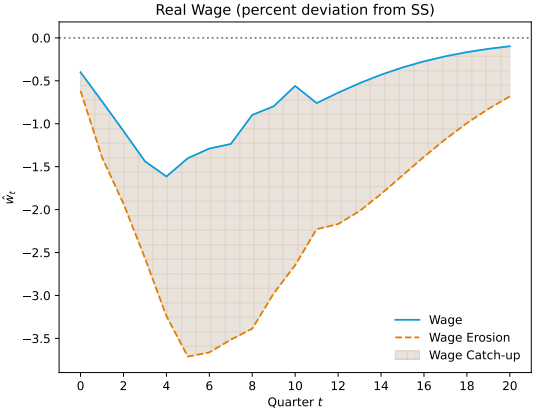


# 2021-23 Inflation (Sticky Expectations)

Back



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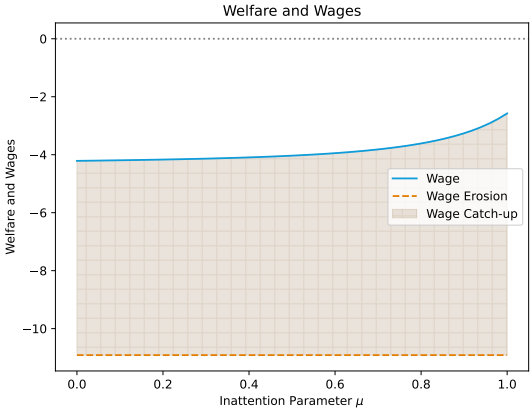


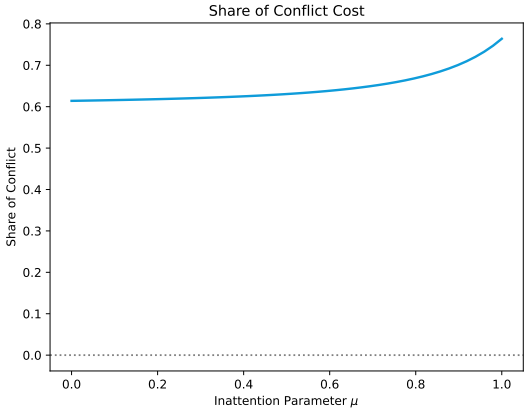

# Sequence-space solution method with FIRE and beyond

Back

Need to **characterize** $1^{\text{st}}$ **order response** wage.

[Auclert–Rognlie–Straub (2018), Auclert–Bardoczy–Rognlie–Straub (2020)]

With perfect foresight:

$$\hat{\boldsymbol{w}} = \mathscr{J}^{w,\pi} \cdot \hat{\boldsymbol{\pi}}.$$

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**Goal:** find response of consumption but under more general beliefs.

**Difficulty:** beliefs are a *sequence of sequences* $\{E_t[\hat{\pi}]\}_t$.

- Consumption is a function of all sequences. Can we easily characterize Jacobians?

There is a **natural link** between FIRE-Jacobians and *BR-J*acobians.

[Auclert–Rognlie–Straub (2020), Bardoczy-Guerreiro (2023)]

# Sequence-space solution method with general beliefs

Back

**Proposition.**

*For given beliefs, the first-order response of group g consumption is given by:*

$$\hat{\boldsymbol{w}} = \underbrace{\mathscr{J}^{w,\pi} \cdot \overline{E}_0[\hat{\pi}]}_{\text{Response to Initial Forecast}} + \underbrace{\sum_{t \geq 1} \mathscr{R}_t^{w,\pi} \cdot \left(\overline{E}_t[\hat{\pi}] - \overline{E}_{t-1}[\hat{\pi}]\right)}_{\text{Response to time-t Forecast-Revision}}$$

*where the* ***forecast-revision Jacobians*** *are given by:*

$$\mathscr{R}_t^{w,\pi} \equiv \begin{bmatrix} 0 & 0_h' \\ 0_h & \mathscr{J}^{w,\pi} \end{bmatrix}.$$