Inaccurate Beliefs and Cyclical Labor Market Dynamics

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- Long-standing questions in the macro labor market:
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- Also provides insights to:
  - Why is the job separations more cyclical for high-wage workers? Mueller (2017)
  - Why similar workers have drastically different transition patterns across employment states? Hall and Kudlyak (2019) Ahn et al. (2023) Gregory et al. (2025)

This Paper

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- DMP model with imperfect info
  - The distribution of worker beliefs are lagged and dispersed
  - Workers bargain for wages with firms based on their own beliefs
  - The distribution of worker beliefs affects firm's vacancy posting and layoffs

  - Better informed firms (share a common belief):
    - Bargain for wages, make hiring and layoff decisions according to their beliefs

Main Findings

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- Heterogeneous transition patterns
  - Differences in learning rate and persistence in biases $\Rightarrow$ Heterogeneity

Literature

- Survey evidence on beliefs and labor market decisions/outcomes: Campbell et al. (2007), Conlon et al. (2018), Mitra (2023), Balleer et al. (2024), Jäger et al. (2024)

  Contribution: New GE framework

- DMP models with information friction about aggregate productivity in GE:
  - Asymmetric beliefs about the aggregate: Menzio (2023), Morales-Jiménez (2022)
  - Biased beliefs about the aggregate: Mitra (2024), Bhandari et al. (2025)

  Contribution: Dispersion + endogenous separations + role of firm beliefs

- Other DMP models with imperfect info:
  - Firm's private information on match quality: Azariadis and Stiglitz (1983), Kennan (2010)
  - Worker's private information on types: Acharya and Wee (2020), Birinci et al. (2025)

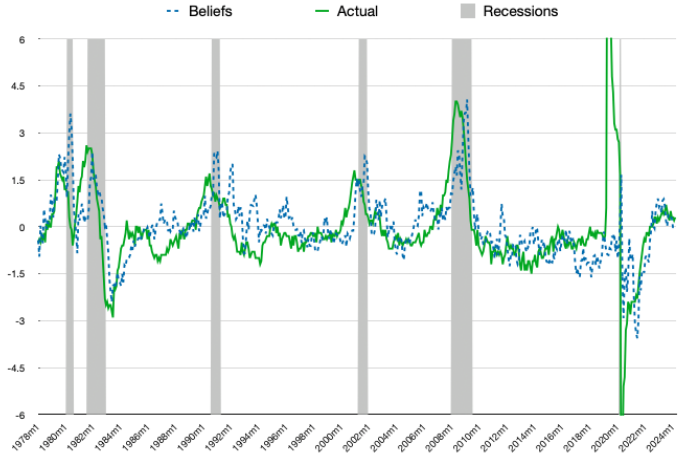
  Contribution: Belief formation on aggregate productivity disciplined by survey data

- Connect to the larger literature on amplification and persistence: Shimer (2005), Elsby and Michaels (2013), Ljungqvist and Sargent (1998), Marimon and Zilibotti (1999), Hornstein et al. (2007)...
  - Stick-wages: Hall (2005), Shimer (2010), Gertler and Trigari (2009), Gertler et al. (2020)...

Roadmap

- Motivation evidence from survey data
- DMP model with imperfect information
- Calibration
- Quantitative results about aggregate fluctuations
  - Amplification and persistence of aggregate shocks
  - Comovements of pre-displacement wage and unemployment rate
  - Heterogeneous transition patterns

Household beliefs lag the actual change in unemployment rate



Perceived and actual changes in unemployment rate (Both standardized). Source: MSC, FRED.

- Du et al. (2024) also documents a lag using SCE

Method

More Optimistic Workers have Higher Reservation Wage of Working

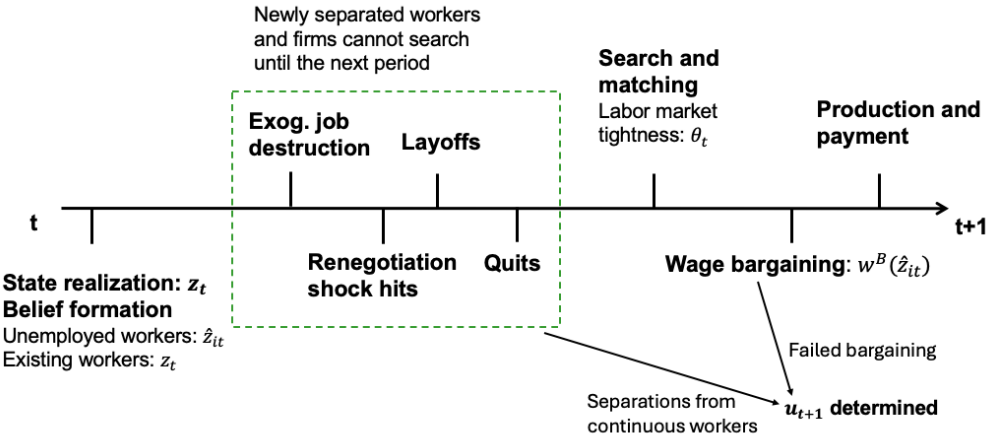
- Survey of Consumer Expectations: 2014m3–2023m7 Survey Questions and Regression equations
- Cross-section: Workers expecting higher job-finding rates set higher reservation wages
- Time series: Larger increases in unemployment expectations are associated with larger reductions in reservation wages

Table: Beliefs and Reservation Wages $log(w^r)$

	Exp job-finding rate			*Exp unemployment rate*		
	employed	*employed*	*unemployed*	*all*	*employed*	*non-employed*
	(1)	(2)	(3)	(4)	(5)	(6)
Beliefs	0.178***	0.102***	0.005*	-0.114**	-0.096*	-0.132
	(0.032)	(0.027)	(0.003)	(0.053)	(0.052)	(0.128)
Household income	✓		✓			
Worker income		✓				
Demographics	✓	✓	✓			
Worker FE				✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
Observations	19,035	18,989	802	28,318	19,049	8,231
R^2	0.215	0.364	0.133	0.485	0.514	0.419

DMP Model with Inaccurate Beliefs

Model: Timeline



Aggregate Productivity and Belief Formation

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- Heterogeneous worker beliefs: $\hat{z}_{it} = \hat{z}_t^w + \eta_{it}, \quad \eta_{it} \sim \mathcal{N}(0, \sigma_s^2) \quad \Rightarrow$ dispersion

$$\hat{z}_t^w = \hat{z}_{t-1}^w + \gamma^w \underbrace{(z_{t-1} - \hat{z}_{t-1}^w)}_{\text{forecast error}}, \quad 0 < \gamma^w < 1 \quad \Rightarrow \text{delay}$$

$\Rightarrow$ Distribution of worker beliefs $G_t \sim \mathcal{N}(\hat{z}_t^w, \sigma_s^2)$

(Perceived distribution of worker beliefs $\hat{G}_{it} \sim \mathcal{N}(\hat{z}_{it}, \sigma_s^2)$)

Strategic Considerations: Firms

- Workers and firms bargain $\Rightarrow$ beliefs about others' expectations affect decisions
- Assume firms observe the true productivity z_t and the actual distribution of current worker beliefs G_t $\Rightarrow$ relaxed later

  $\Rightarrow$ firms use z_t and G_t to compute

  - the expected distribution of future worker beliefs
  - workers' value functions: expected reservation wages, and bargaining wages
  - resulting labor market tightness and own reservation wage

Strategic Considerations: Workers

- Each worker believes their own info is accurate and that firms also use this belief in wage setting
- Worker i perceives that other workers' beliefs are distributed as $\hat{G}_{it}$, centered on $\hat{z}_{it}$

  $\Rightarrow$ worker i uses $\hat{z}_{it}$ and $\hat{G}_{it}$ to compute

  - the *perceived* value functions of firms, labor market tightness, job-finding rate, firms' reservation wage
  - own reservation wage and bargained wage

Value Functions: Firms

- Dist. of beliefs affect the value of a filled job and firm's vacancy posting incentives
- Value of a filled job:

$$J(z,w) = z - w + \beta(1-\delta)\mathbb{E}\Big[\lambda \underbrace{\mathbb{1}(w^r(z') < w)}_{\textit{Workers might quit}} \underbrace{max\{J(z',w), V(z')\}}_{\textit{Whether to layoff}} + (1-\lambda)\underbrace{J(z', w^B(z'))}_{\textit{Renegotiation}}\Big] \tag{1}$$

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- Value of vacancy and free entry condition:

$$V(z) = -\kappa + \beta \underbrace{\mathbb{E}q(\theta)\left\{\int_{\hat{z}_i} \max\{J(z', w^B(\hat{z}_i)), V(z')\} dG\right\}}_{\textit{Expected value of a new hire}} = 0 \tag{2}$$

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- Firm's acceptable wages:

$$\{w : w \leq \overline{w}^f(z) \quad \textit{and} \quad J(z, \overline{w}^f(z)) = 0\} \tag{3}$$

Perceived Value Functions: Workers

- Worker's belief affects their perceived job-finding rate and layoff prob.
- Perceived value of a filled job

$$J(\hat{z}, w) = \hat{z} - w + \beta(1-\delta)\hat{\mathbb{E}}\Big[\lambda \mathbb{1}(w^r(\hat{z}') < w) max\{J(z', w), V(z')\} + (1-\lambda)J(z', w^B(\hat{z}'))\Big] \tag{4}$$

- Perceived value of vacancy $\Rightarrow$ Perceived job-finding rate $f(\hat{\theta})$

$$V(\hat{z}) = -\kappa + \beta q(\hat{\theta})\hat{\mathbb{E}} \int_{\hat{z}_i} \max\{J(z', w^B(\hat{z}_i)), 0\} d\hat{G} = 0 \tag{5}$$

- Perceived reservation wage of the firm

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Perceived Value Functions: Workers

- Perceived strategies of the firm affects the worker's perceived value functions
- Worker's perceived value of working:

$$
\begin{aligned}
W(\hat{z}, w) = w + \beta \hat{\mathbb{E}} \Big\{ & \underbrace{\Big[\delta + (1-\delta)\lambda \mathbb{1}\big(w > \overline{w}^f(\hat{z}')\big)\Big] U(\hat{z}')}_{\textit{Involuntary separations}} \\
& + \underbrace{(1-\delta)\lambda \mathbb{1}\big(w < \overline{w}^f(\hat{z}')\big) \max\{W(\hat{z}', w), U(\hat{z}')\}}_{\textit{Quits}} \\
& + \underbrace{(1-\delta)(1-\lambda) W\big(\hat{z}', w^B(\hat{z}')\big)}_{\textit{Renegotiation}} \Big\}
\end{aligned} \tag{7}
$$

Perceived Value Functions: Workers

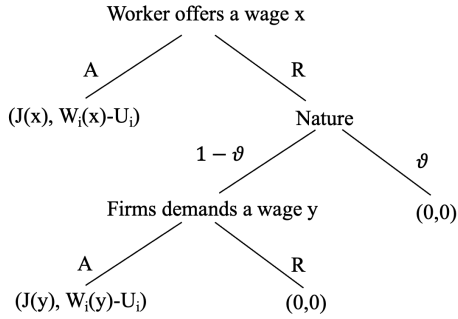
- Value of unemployment:

$$(8) \quad U(\hat{z}) = b + \beta \hat{\mathbb{E}} \left\{ f(\hat{\theta}) W\left(\hat{z}', w^B(\hat{z})\right) + (1 - f(\hat{\theta}'))U(\hat{z}') \right\}$$

- Worker's perceived value functions determine
  - The range of acceptable wages:

$$(9) \quad \left\{ w : w \geq \underline{w}^r(\hat{z}) \quad \textit{and} \quad W\left(\hat{z}, \underline{w}^r(\hat{z})\right) = U(\hat{z}) \right\}$$

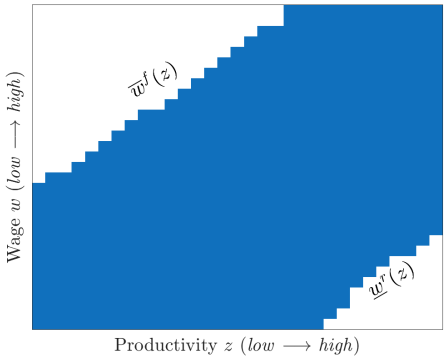
Model: Wage Bargaining Game



- Worker makes the first offer: giving firms $1-\vartheta$ of the *percieved* matching surplus, *thinking* that the firm will always accept
- Firms accept if it's below its reservation wage
- Otherwise, the match is dissolved

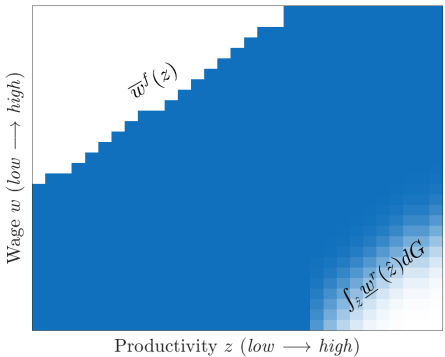
Steady State Rejection Probability: Full Info

- Wage rigidities + two-sided lack of commitment $\Rightarrow$ endogenous separations
  - Firms lay off workers when the true state is low and current wage is high
  - Workers quit the job when their belief is high and current wage is low
  - All bargaining result in matches



Steady State Rejection Probability: Noisy Beliefs

- Noisy beliefs create a region with nonzero probability of failed negotiation



Model Mechanism

- Amplification: Lagged worker beliefs $\Rightarrow$ slow adjustment for wages of new hires $\Rightarrow$ larger volatility in job creation

- Persistence: Firm learning $\Rightarrow$ dampened and sluggish response in all variables

- Firms hire high-wage workers, knowing they can fire them later
- Dispersion in beliefs $\Rightarrow$ wage dispersion $\Rightarrow \uparrow$ separations of high wage workers in recessions

  $\Rightarrow$ Shift in the composition of unemployment

  $\Rightarrow$ Heterogeneity

Calibration

Calibration: Belief Parameters

- MSC 1978m1-2020m2

- Cross-sectional dispersion in beliefs
  - Calibrate σ_s to match time-average of $\sigma_u = \frac{1}{T}\sum_t \tilde{\sigma}_t = 0.2$ in data

- Worker's learning rate
  - Calibrate learning rate γ^w to match learning rate in data (0.093)

Reg results

(10) $UNEMPL_t^e = \beta_1 UNEMPL_{t-1} + \beta_2 UNEMPL_{t-1}^e + \epsilon_t$

Parameters

	Description	Value	Source
ρ	Persistence of z	0.983	GHT
σ_z	Standard Deviation of z	0.007	GHT
β	Discount factor	0.997	GHT (3% interest)
λ	Renegotiation frequency	11/12	GHT (every 4 quarters)
α	Matching elasticity to v	0.5	Blanco et al. (2024)
ϑ	Bargaining power of the worker	0.6	within the range

- GHT = Gertler et al. (2020)

	Description	Value	Target	Moment
δ	Exog job destruction rate	0.018	Unemploy. rate = 6.1%	6.1%
b	Unemp benefit	0.650	0.7 of median state productivity	0.65
A	Matching efficiency	0.328	Job finding rate = 27.7%	27.8%
κ	Cost of vacancy posting	0.289	Labor market tightness = 0.720	0.719
σ_s	Std. dev. of beliefs	0.019	MSC $\sigma_u = 0.20$	0.199
γ^w	Learning rate of HH	0.085	MSC $\beta^1 = 0.093$	0.095

Quantitative Results

- Aggregate fluctuations
- Cyclical job separations
- Distributional consequences

Business Cycle Summary Statistics

	p	u	f	s	θ
Panel A: Data					
Standard Deviation	0.010	0.103	0.053	0.067	0.229
Quarterly Autocorrelation	0.746	0.934	0.871	0.773	0.936
Panel B: Full Info					
Standard Deviation	0.014	0.025	0.020	0.012	0.041
Quarterly Autocorrelation	0.727	0.795	0.719	0.505	0.719
Panel C: HH Learning					
Standard Deviation					
Quarterly Autocorrelation					
Panel D: HH Learning + Dispersion					
Standard Deviation					
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Panel E: HH Learning + Dispersion + Firm Learning					
Standard Deviation					
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Standard Deviation	0.014	0.115	0.139	0.020	0.279
Quarterly Autocorrelation	0.727	0.785	0.626	0.374	0.627
Panel E: HH Learning + Dispersion + Firm Learning					
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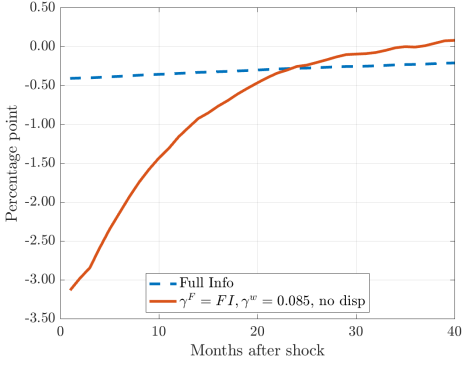
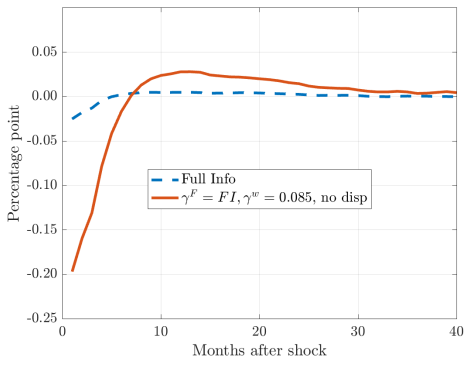
Panel E: HH Learning + Dispersion + Firm Learning ($\gamma^F = 0.5$)					
Standard Deviation	0.014	0.092	0.110	0.015	0.219
Quarterly Autocorrelation	0.727	0.814	0.705	0.505	0.705

IRF: Belief Asymmetry Amplifies the Volatility in Job Creation

- Sluggish adjustment for household beliefs generates sticky wages for new hires
  $\Rightarrow$ further reduce firm's vacancy posting incentives
- Larger drop in job-finding rate and job creation



Job-finding probability



New hires

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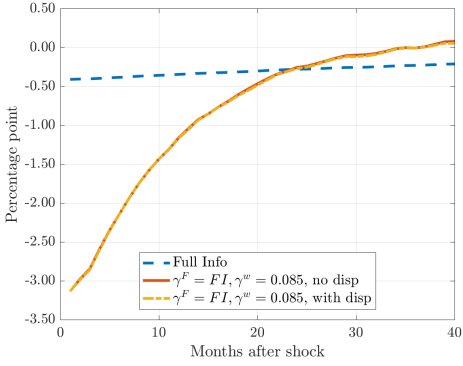

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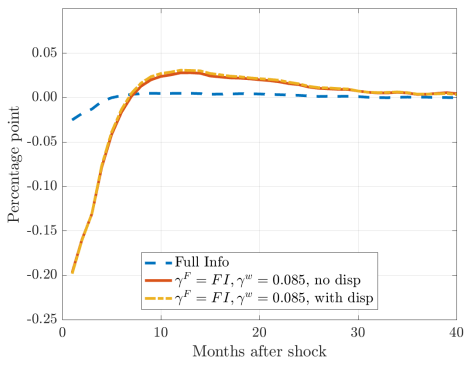

New hires

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Model with firm learning

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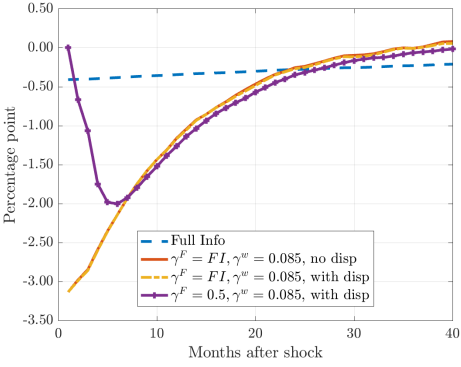

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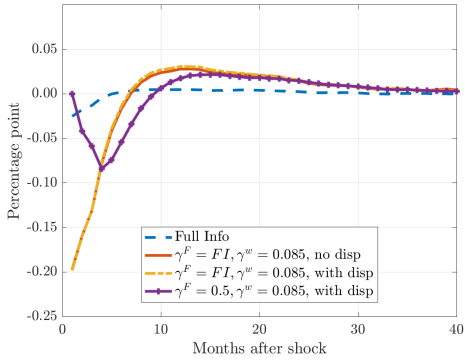

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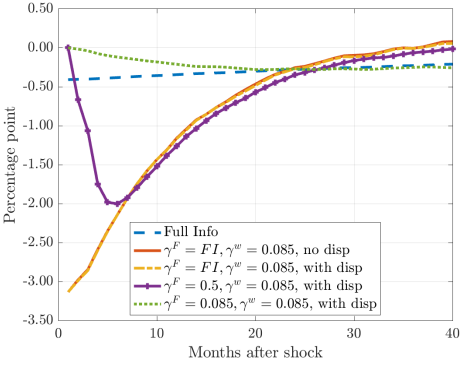

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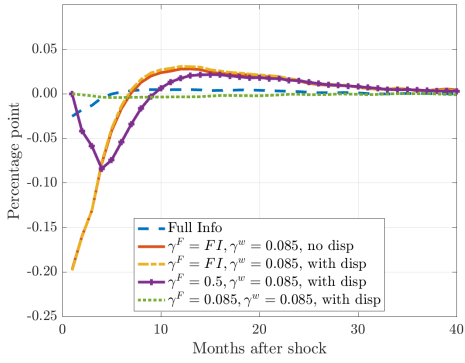
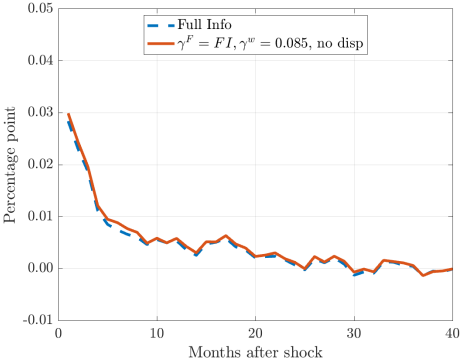


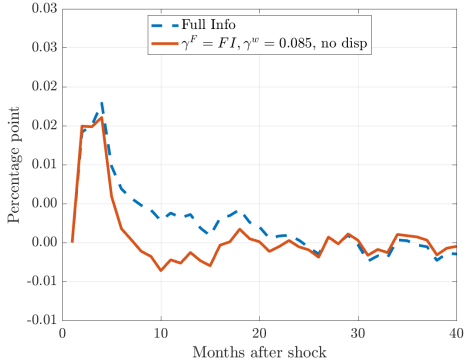
New hires

IRF: Dispersion in Beliefs Amplifies the Response in Separations

- Larger belief dispersion generates larger layoffs
- Firm learning dampens this result



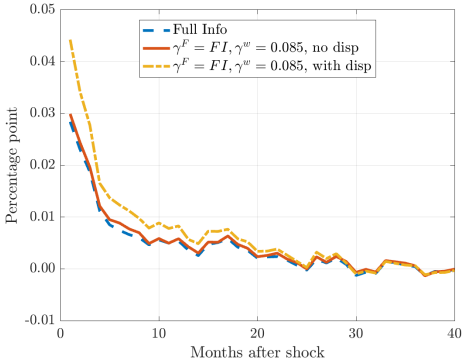
Layoffs



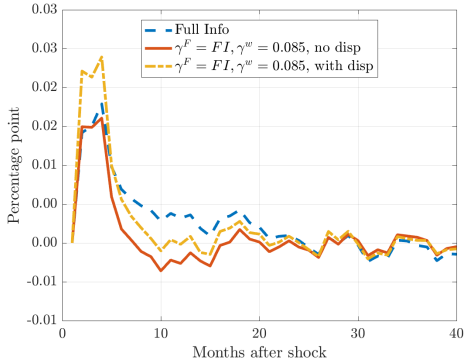
Job Separations

IRF: Dispersion in Beliefs Amplifies the Response in Separations

- More workers are hired closed to firm's layoff threshold
- The pool of unemployment shifts towards high-wage workers during recessions (Mueller (2017)



Layoffs



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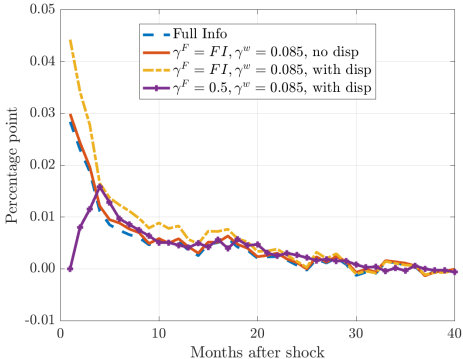

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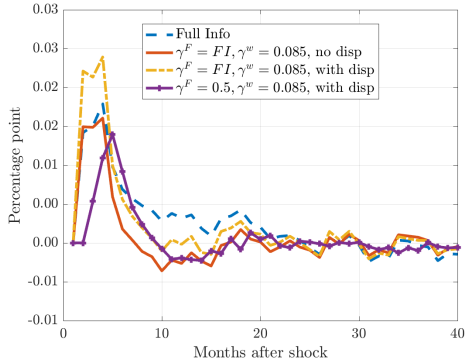

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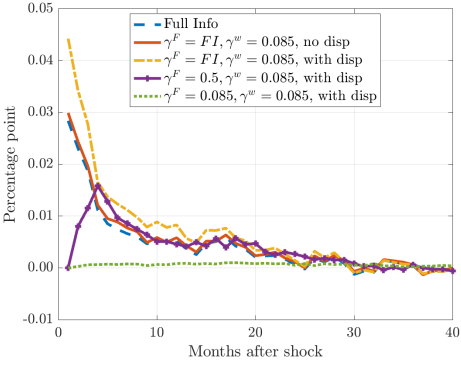

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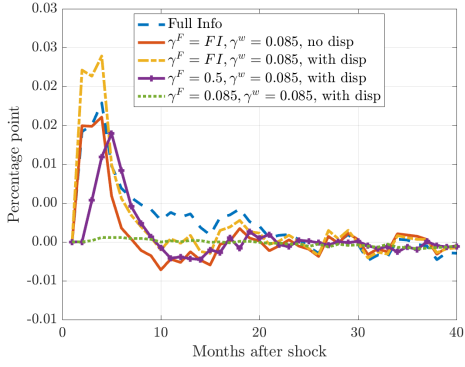
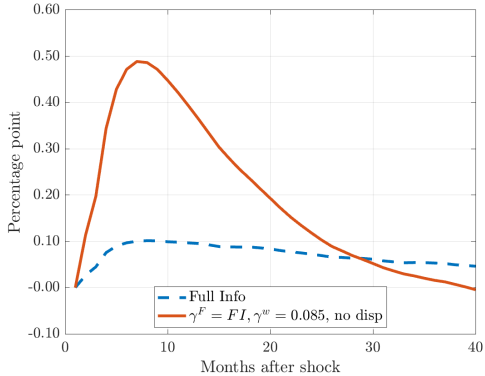


Job Separations

IRF: Belief Asymmetry and Dispersion Generates Larger volatility in Uunemployment Rate

- Asymmetry $\Rightarrow$ Larger drop in job-finding rate $\Rightarrow$ smaller outflows
- Dispersion $\Rightarrow$ Larger layoffs $\Rightarrow$ larger inflows
- Firm learning $\Rightarrow$ dampens volatility and generates more persistence



Unemployment rate

IRF: Belief Asymmetry and Dispersion Generates Larger volatility in Uunemployment Rate

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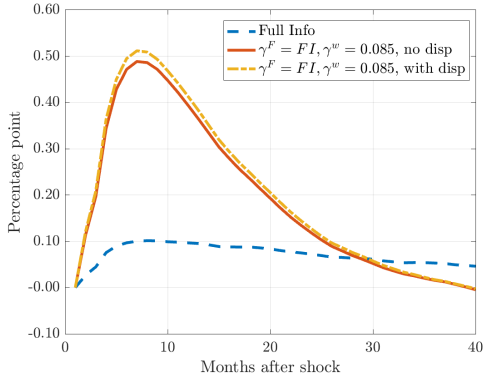
- Dispersion $\Rightarrow$ Larger layoffs and unsuccessful renegotiations $\Rightarrow$ larger inflows



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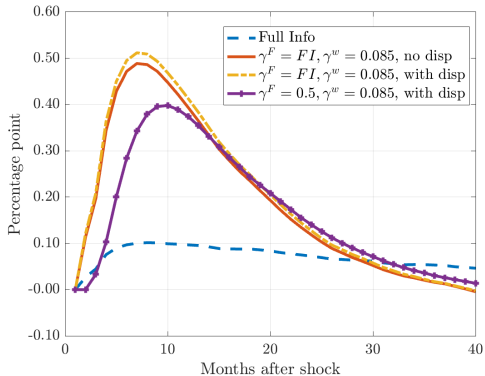

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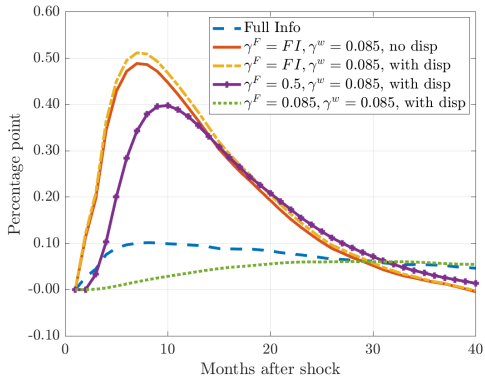
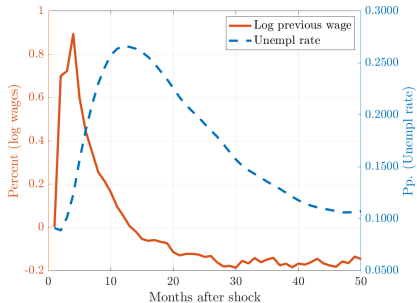


Unemployment rate

High-wage workers face more cyclical separations

- Mueller (2017): Comovements of pre-displacement wage and unemployment rate
- Driven by higher cyclicality of job separations among high-wage workers; similar job-finding rates

CPS evidence



Comovements of pre-displacement wage and unemployment rate

Distributional Consequences of Inaccurate Beliefs

- Empirical Observation: Heterogeneous transition patterns across workers (Gregory et al. (2025), Hall and Kudlyak (2019), Ahn et al. (2023))
- Differences in learning rate or persistence in biases can partially explain this
- Two types of workers with different learning rates

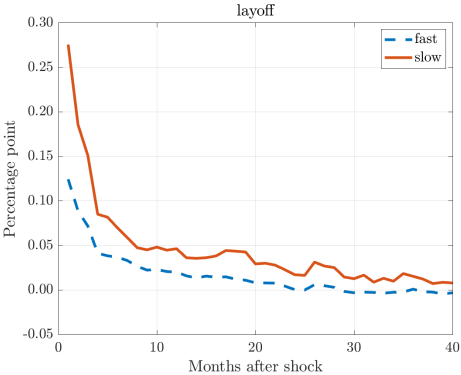
$$(11)\quad \hat{z}_{it}^{fast} = \hat{z}_{t-1}^{fast} + \gamma^{fast}(z_{t-1} - \hat{z}_{t-1}^{fast}) + \eta_{it}$$

$$(12)\quad \hat{z}_{it}^{slow} = \hat{z}_{t-1}^{slow} + \gamma^{slow}(z_{t-1} - \hat{z}_{t-1}^{slow}) + \eta_{it}$$

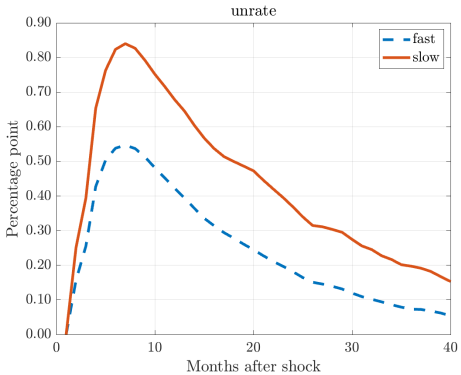
- $\gamma^{slow} = 0.02$, $\gamma^{fast} = 0.20$

Diff. in Learning Rates Helps Explain Heterog. Transition Patterns

- Slow updating workers are relatively more optimistic at the beginning of the recession
  $\Rightarrow$ Hired at higher wages $\Rightarrow$ Higher layoff rates and Unemployment rate Persistent biases



Layoffs



Unemployment rate

Conclusion

- Theory about how systematic biases and idiosyncratic noise in beliefs about the aggregate affects labor market fluctuations and heterogeneous transition patterns

- Future work:
  - Interaction of noisy beliefs about aggregate, worker private info, and misperception of employers
  - Implications for job acceptance, search/on-the-job search, future separation risks

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Belief Parameters: Michigan Survey of Consumers

- Construct $\tilde{\mu}_t$, following Mankiw et al. (2003):
  - *"How about people out of work during the coming 12 months — do you think that there will be more unemployment than now, about the same, or less?"*
  - *"more unemployment," "less unemployment," "no change,", "don't know."*
- Assumptions:
  - $E(\Delta \tilde{u}_{it})$ follows $N(\tilde{\mu}_t, \tilde{\sigma}_t^2)$.
  - Interpret "no change" as a small change within a threshold c.
- Back out $\tilde{\mu}_t$ and $\tilde{\sigma}_t$ from *%more unemployment* and *%less unemployment*

$$(13)\quad \%Up = 1 - F\left(\frac{-c - \tilde{\mu}_t}{\tilde{\sigma}_t}\right) \qquad \%Down = F\left(\frac{c - \tilde{\mu}_t}{\tilde{\sigma}_t}\right)$$

- Higher $\tilde{\mu}_t$: more pessimism
- Higher $\tilde{\sigma}_t$: more dispersion in beliefs Figure 1

Firm Learning Rate

Calibration

	1978m1-2020m2 (1)	1978m1-2024m3 (2)
β_1	0.093***	0.144***
	(0.019)	(0.018)
β_2	0.887***	0.849***
	(0.018)	(0.018)
R^2	0.857	0.846

Regression about Reservation Wages

Reg Results

- *Q4: What do you think is the percent chance that 12 months from now the unemployment rate in the U.S. will be higher than it is now?*
- For employed *Q22: Suppose you were to lose your main job this month. What do you think is the percent chance that within the following 3 months, you will find a job that you will accept, considering the pay and type of work?*
- For unemployed workers *Q17: What do you think is the percent chance that within the coming 12 months, you will find a job that you will accept, considering the pay and type of work?*
- For unemployed workers *Q18: And looking at the more immediate future, what do you think is the percent chance that within the coming 3 months, you will find a job that you will accept, considering the pay and type of work?*
- *RW2: Suppose someone offered you a job today in a line of work that you would consider. What is the lowest wage or salary you would accept (BEFORE taxes and other deductions) for this job?*

$$\log(\textit{res wage})_{it} = \alpha_0 + \alpha_1 \textit{Belief}_{it} + X_{it} + \epsilon_{it} \tag{14}$$

Business Cycle Summary Statistics

	p	u	f	s	θ
Panel A: Data					
Standard Deviation	0.010	0.103	0.053	0.067	0.229
Quarterly Autocorrelation	0.746	0.934	0.871	0.773	0.936
Panel E: HH Learning + Dispersion + Firm Learning ($\gamma^F = 0.2$)					
Standard Deviation	0.014	0.064	0.066	0.017	0.132
Quarterly Autocorrelation	0.727	0.849	0.769	0.378	0.769
Panel F: HH Learning + Dispersion + Firm Learning ($\gamma^F = 0.3$)					
Standard Deviation	0.014	0.085	0.088	0.025	0.176
Quarterly Autocorrelation	0.727	0.833	0.758	0.324	0.758
Panel G: HH Learning + Dispersion + Firm Learning ($\gamma^F = 0.4$)					
Standard Deviation	0.014	0.098	0.101	0.031	0.202
Quarterly Autocorrelation	0.727	0.818	0.731	0.272	0.731

Main results

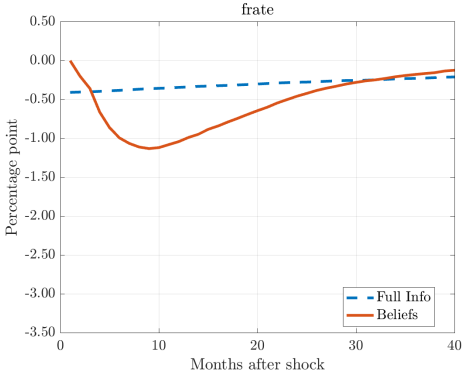
Learning for Firms

Main

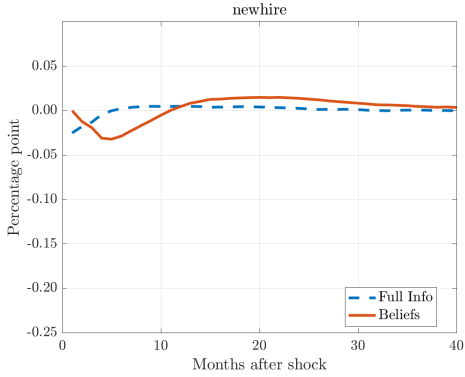
- Adaptive learning for firms: $\hat{z}_t^f = \hat{z}_{t-1}^f + \gamma^f \underbrace{(z_{t-1} - \hat{z}_{t-1}^f)}_{\text{forecast error}}, \quad \gamma^f > \gamma^w \quad \Rightarrow$ delay
- Motivation evidence: firms have more accurate and less dispersed information relative to households (Mitman et al. (2022))
- Same as before, firm observe the current distribution of worker beliefs
- Firm use $\hat{z}^f$ to update the distribution of worker beliefs in the next period

- Firms make hiring and layoff decisions based on their belief:
  - Delayed response in labor market tightness, job-finding rate and layoffs
  - Smaller belief asymmetry between workers and firms
    $\Rightarrow$ dampens the aggregate volatility

Firm Learning IRFs



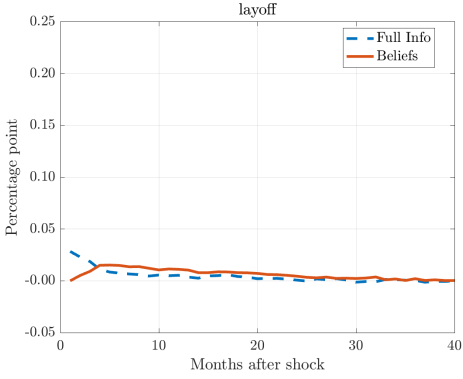
Job-finding rate



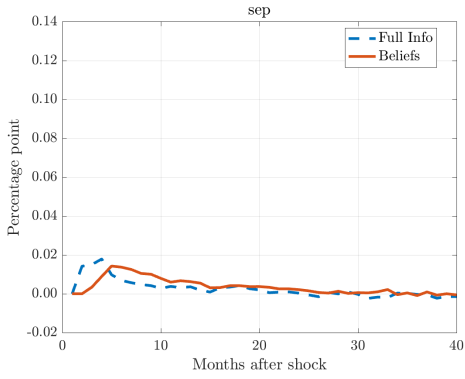
New hires

Main

Firm Learning IRFs



Layoffs



Separations

Main

Mueller 2017: Evidence from CPS

Main

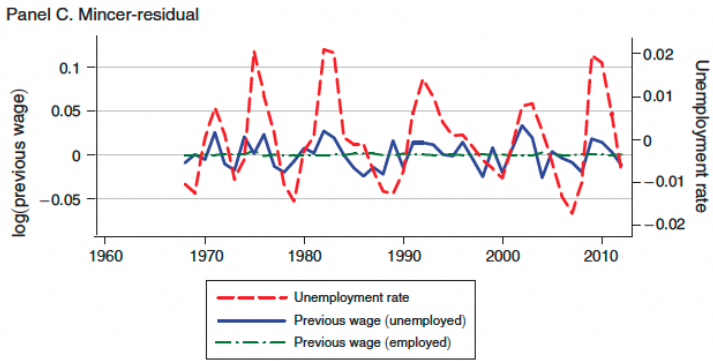


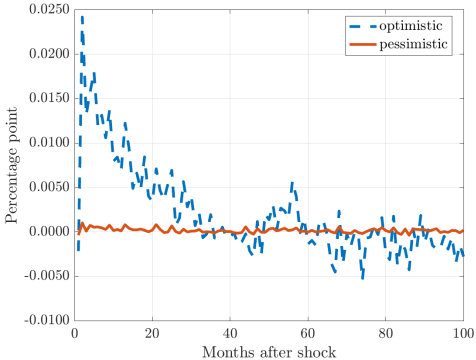
FIGURE 4. AVERAGE WAGE FROM PREVIOUS YEAR BY EMPLOYMENT STATUS IN THE CPS MARCH SUPPLEMENT, 1962–2012

Persistent biases

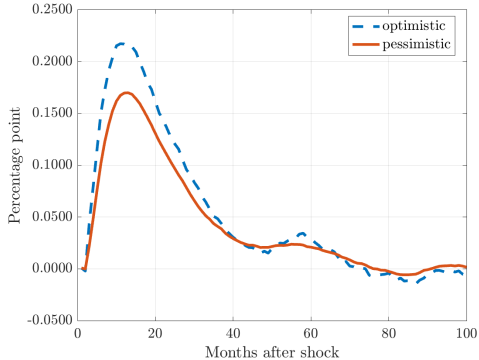
- Layoffs are concentrated on the optimistic workers with higher wages

Main

$$\hat{z}_{it}^{o} = (1-\gamma^{w})\hat{z}_{t-1}^{w} + \gamma^{w} z_{t-1} + \zeta^{o} + \eta_{it} \qquad \hat{z}_{it}^{p} = (1-\gamma^{w})\hat{z}_{t-1}^{w} + \gamma^{w} z_{t-1} + \zeta^{p} + \eta_{it}$$



Layoffs



Unemployment rate