Do Cost-of-Living Shocks Pass Through to Wages?[1]

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[1] The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

Do Cost of Living Shocks Pass Through to Wages?

During COVID, both inflation and nominal wage growth surged.

- **Question**: are wages responding to inflation, or reflect tight labor markets?
- Concern about 1970's style wage-price spiral:

  shock to specific sector → increased wage demands → generalized inflation

Sticky wage macro models: union wage setting (Erceg et al., 2000; Lorenzoni and Werning, 2023b) or ad-hoc real wage rigidity (Gagliardone and Gertler, 2023)

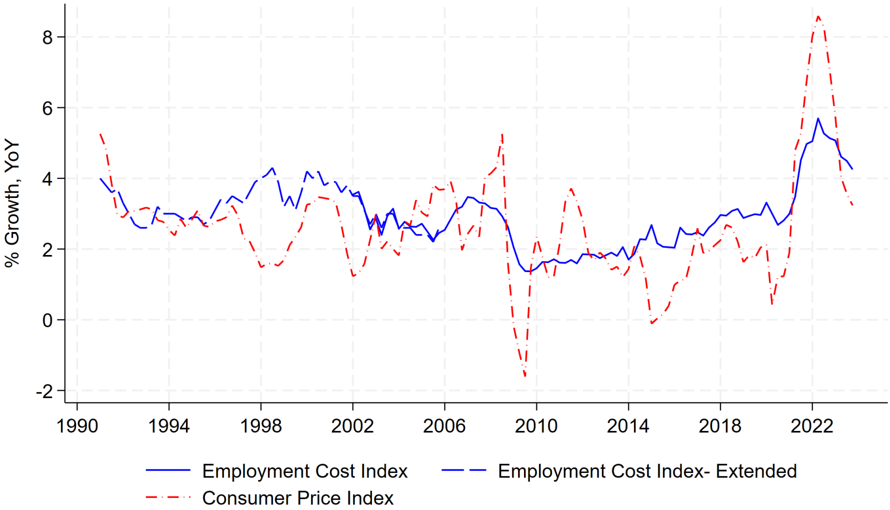
- Micro evidence: wage posting is dominant form of wage determination in the US. (Lachowska et al., 2022; Di Addario et al., 2023)

Big Question

If firms set wages, how do wages respond to shocks to cost-of-living?

- "Cost-of-living shock": raises price of consumption bundle, no direct effect on physical marginal product of labor.
- Example: labor intensive services (haircuts), endowment good (food).

Inflation and wage growth: weak correlation at high frequencies, both surge post-COVID



Wage Posting, OTJ Search: Weak Cost of Living → Wages

Firms set (post) wages (Lachowska et al., 2022; Di Addario et al., 2023), post vacancies.

- Optimal wage setting trades off wage costs and turnover costs.
- Cost of living affects wages only to the extent that recruiting or retaining workers is harder.

Workers search on the job, experience workplace preference shocks.

- Cost-of-living shocks affect relative value of working vs. nonemployment
  - Lower real wages → income & substitution effects.
  - Income stream from owning endowment goods: wealth effects.
- But: unemployment is rarely a credible threat.
  - Weak effect of benefit level on wages: (Jäger et al., 2020).
- Firms primarily concerned with job-to-job quits:

On-the-job search dramatically dampens pass-through!

Related Literature

Wage Posting and/or On-the-Job Search in DSGE Models: Moscarini and Postel-Vinay (2016, 2023); de la Barrera i Bardalet (2023)

- We develop a tractable model and focus on the implications for cost of living shocks

Supply shocks, inflation, and wage growth: Lorenzoni and Werning (2023a,b); Gagliardone and Gertler (2023); Pilossoph and Ryngaert (2023)

- General equilibrium, focus on wage posting consistent with microevidence.

Micro evidence

Our purpose: tractability

Idiosyncratic preference shocks → single wage in equilibrium.

Roadmap

1. Model
2. Cost of Living Shocks

Final Consumption Goods

Perfectly-competitive final good producers bundle services Y_t and endowment good X_t into final consumption:

$$C_t = \left(\alpha_Y^{\frac{1}{\eta}} Y_t^{\frac{\eta-1}{\eta}} + \alpha_X^{\frac{1}{\eta}} X_t^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}},$$

with price index:

$$P_t = \left(\alpha_Y P_{y,t}^{1-\eta} + \alpha_X P_{x,t}^{1-\eta} \right)^{\frac{1}{1-\eta}}$$

Endowment Good X_t and Services Production Y_t

X_t appears each period:

- Each (identical) household receives the same amount
- Competitively & flexibly priced.

Y_t built from intermediates Y_t^j by a perfectly-competitive retail firm:

$$
\begin{aligned}
Y_t &= \left(\int \left(Y_t^j\right)^{\frac{\epsilon-1}{\epsilon}} dj\right)^{\frac{\epsilon}{\epsilon-1}}, \\
P_{y,t} &= \left(\int \left(P_{y,t}^j\right)^{1-\epsilon} dj\right)^{\frac{1}{1-\epsilon}}.
\end{aligned}
$$

Households

Maximize the present discounted sum of members' utility,

$$\sum_{t=0}^{\infty} \left(\frac{1}{1+\rho} \right)^t \left[U_t \ln(C_t^u) + \int_0^{1-U_t} \ln\left(C_t(i, j(i))\right) di \right].$$

by choosing C_t^u (unemployment benefits) and linear tax/subsidy on employed workers, who consume all labor income:

$$C_t(i, j(i)) = \tau_t \frac{W_{j(i)t}}{P_t}$$

subject to the budget constraint

$$U_t C_t^u = \frac{D_t}{P_t} - \frac{B_t}{P_t} + \frac{(1+i_{t-1})B_{t-1}}{P_t} + (1-\tau_t) \int_0^{1-U_t} \frac{W_{j(i)t}}{P_t} di.$$

Consumption Sharing + Euler Equation

We assume an *ad hoc* consumption sharing rule

$$\frac{\bar{C}_t^e}{C_t^u} = \xi,$$

where $\xi \geqslant 1$ and $\bar{C}_t^e \equiv \frac{1}{1-U_t}\int_0^{1-U_t} C_t(i, j(i))di$ is the average consumption of employed (Chodorow-Reich and Karabarbounis, 2016).

In a symmetric equilibrium with $W_{jt} = W_t$, household optimality requires

$$(C_t)^{-1} = \frac{1}{1+\rho}(1 + r_{t,t+1})(C_{t+1})^{-1}.$$

Workers' Discrete-Choice Problem 1/2

Timing:

1. At start of period t, firms post wages W_{jt} and vacancies V_{jt}
2. Fraction s of workers are exogenously separated.
3. Total searchers includes some employed workers and all the unemployed:

$$\mathcal{S}_t \equiv \lambda_{EE}(1 - U_{t-1}) + U_{t-1}$$

4. Matches happen; workers choose to accept offers and/or quit: with
   - $V_t \equiv \int_0^1 V_{jt} dj$, $\theta_t \equiv \frac{V_t}{\mathcal{S}_t}$.

   The probability that:
   - Searching worker meets a firm's vacancy:

$$f(\theta_t) = \frac{M(V_t, \mathcal{S}_t)}{\mathcal{S}_t}$$

   - Searching firms meet a worker:

$$g(\theta_t) = \frac{M(V_t, \mathcal{S})}{V_t}$$

   - Employed worker can consider quitting to unemployment: $\lambda_{EU} \in (0, 1)$
5. N_t is determined; production happens.

Workers' Discrete-Choice Problem 2/2

Each worker i is **myopic**, making choices to maximize

$$\mathcal{V}_t(i,j) = \underbrace{\ln(C_t(i,j(i)))}_{=\begin{cases} \ln\left(\frac{\tau_t}{P_t} W_{j(i)t}\right), \text{ if employed} \\ \ln\left(\frac{\tau_t}{P_t} \frac{\bar{W}_t}{\xi}\right), \text{ if unemployed} \end{cases}} + \underbrace{\iota_{ijt}}_{\text{Matching taste}}$$

Where ι_{ijt} is Type-1 extreme value with scale parameter γ^{-1} over workplaces drawn each period

Individual Recruiting and Separation Probabilities

The probability a vacancy attracts a matched searcher $r()$ is

$$\underbrace{r_{kj}(W_{kt}, W_{jt})}_{\substack{\text{Probability } j \text{ poaches} \\ \text{matched worker from } k}} = \frac{W_{jt}^{\gamma}}{W_{kt}^{\gamma} + W_{jt}^{\gamma}}, \qquad \underbrace{r_{uj}\left(\frac{\bar{W}_t}{\xi}, W_{jt}\right)}_{\substack{\text{Probability } j \text{ recruits} \\ \text{matched unemployed worker}}} = \frac{W_{jt}^{\gamma}}{\left(\frac{\bar{W}_t}{\xi}\right)^{\gamma} + W_{jt}^{\gamma}},$$

where recall $C_t(i,j) = \frac{\tau_t}{P_t} W_{jt}$ and $C_t^u = \frac{\tau_t}{P_t} \frac{\bar{W}_t}{\xi}$.

Similarly, separation probabilities $s()$ for a worker matching with an outside job or considering unemployment:

$$\underbrace{s_{jk}\left(W_{jt}, W_{kt}\right)}_{\substack{\text{Probability } j \text{ loses} \\ \text{worker matched to } k}} = \frac{W_{kt}^{\gamma}}{W_{kt}^{\gamma} + W_{jt}^{\gamma}}, \qquad \underbrace{s_{ju}\left(W_{jt}, \frac{\bar{W}_t}{\xi}\right)}_{\substack{\text{Probability } j \text{ loses} \\ \text{worker to unemployment}}} = \frac{\left(\frac{\bar{W}_t}{\xi}\right)^{\gamma}}{\left(\frac{\bar{W}_t}{\xi}\right)^{\gamma} + W_{jt}^{\gamma}},$$

These determine firm j's recruiting and separation rates, $R(W_{jt})$ and $S(W_{jt})$.

Firm's Recruiting and Separation Rates

Define the probability a matched worker is employed or unemployed:

$$\phi_{E,t} \equiv \frac{\lambda_{EE}(1 - U_{t-1})}{\mathcal{S}_t}$$

$$\phi_{U,t} \equiv \frac{U_{t-1}}{\mathcal{S}_t} = 1 - \phi_{E,t}$$

In a symmetric equilibrium where $W_{jt} = W_t \ \forall j$, $R(\cdot)_t$ and $S(\cdot)_t$ becomes

$$\begin{aligned} R_t &= g(\theta_t)\left(\phi_{E,t}\frac{1}{2} + \phi_{U,t}\left(\frac{\xi^\gamma}{1+\xi^\gamma}\right)\right) \\ S_t &= s + (1-s)\left(\lambda_{EE} f(\theta_t)\frac{1}{2} + \lambda_{EU}\left(\frac{1}{1+\xi^\gamma}\right)\right) \end{aligned}$$

Intermediate Services Firms

Firm j maximizes profits facing to Rotemberg (1982) style adjustment costs:

$$\max_{\substack{\{P^j_{y,t}\},\{Y^j_t\},\\ \{N_{jt}\},\{W_{jt}\},\{V^j_t\}}} \sum_{t=0}^{\infty} \left(\frac{1}{1+\rho}\right)^t \left(P^j_{y,t} Y^j_t - W_{jt} N_{jt} - c \left(\frac{V_{jt}}{N_{j,t-1}}\right)^{\chi} V_{jt} W_t \right.$$

$$\left. - \frac{\psi}{2} \left(\frac{P^j_{y,t}}{P^j_{y,t-1}} - 1\right)^2 Y^j_t P^j_{y,t} - \frac{\psi^w}{2} \left(\frac{W_{jt}}{W_{j,t-1}} - 1\right)^2 W_{jt} N_{jt} \right)$$

subject to the law of motion on employment:

$$N_{jt} = (1 - S(W_{jt})) N_{j,t-1} + R(W_{jt}) V_{jt}.$$

Service firms produce using only labor

$$Y^j_t = N_{jt}$$

with demand from a retail firm

$$\frac{Y^j_t}{Y_t} = \left(\frac{P^j_{y,t}}{P_{y,t}}\right)^{-\epsilon}.$$

Closing the Model & Equilibrium

We close the model with a simple Taylor rule, with a potentially persistent policy shock $\varepsilon_{i,t}$:

$$\ln(1 + i_t) = \phi_\Pi \ln(\Pi_{Y,t}) + \log(1 + \varepsilon_{i,t})$$

A symmetric equilibrium consists of sequences of all endogenous prices and quantities such that:

1. Firms choose identical sequences such that $W_{jt} = W_t$, $N_{jt} = N_t$, $V_{jt} = V_t$, $P^j_{yt} = P_{y,t}$, for all t,
2. Workers and households maximize utility,
3. Firms maximize profits,
4. Product markets clear,
5. Labor market flows add up.

We linearize these necessary conditions around a non-stochastic steady state, and solve for the unique solution in e.g. Dynare.

Symmetric Equilibrium: Key Equations

Aggregate demand obeys standard Euler equation:

$$(C_t)^{-1} = \frac{1}{1+\rho}(1 + r_{t,t+1})(C_{t+1})^{-1}$$

Wage Inflation follows the wage Phillips curve

$$\psi^w \left(\Pi_t^w - 1\right)\Pi_t^w + 1 = c(1+\chi)\left(\frac{V_t}{N_{t-1}}\right)^{\chi}\left[\frac{V_t}{N_t}\underbrace{\varepsilon_{R,W_t}}_{>0} + (-\underbrace{\varepsilon_{S,W_t}}_{<0})\frac{N_{t-1}}{N_t}\frac{S_t}{R_t}\right]$$
$$+\frac{1}{1+\rho}\psi^w\left(\Pi_{t+1}^w - 1\right)\left(\Pi_{t+1}^w\right)^2\frac{N_{t+1}}{N_t}.$$

$\varepsilon_{R,W} - \varepsilon_{S,W}$: measure of degree of labor market competition in dynamic monopsony models. Micro evidence Log-linear version

Parameters in the Monthly Benchmark New Keynesian Model

Parameter	Value	Meaning	Reason
λ_{EE}	.14	OTJ search probability	Match EE rates
λ_{EU}	.30	Opportunity to quit	Match voluntary EU rate, Qiu (2022)
ξ	2	Consumption ratio: C_t^e/C_t^u	See text
s	.01	Exogenous separation rate	Match JOLTS separations
γ	6	Variance^{-1} of pref. shock	Match $\varepsilon_{R,W} - \varepsilon_{S,W}$
ϵ	10	EOS of intermediates Y_{jt}	
ψ	100	Price adjustment cost	
ψ^w	100	Wage adjustment cost	
η	1	EOS of Y_t vs. X_t	
α_X	.2	X_t's share in C_t	
χ	1	Convexity of vacancy costs	Bloesch and Larsen (2023)
c	30	Hiring cost shifter	Targeting U
ρ	.004	Discount Rate	Monthly model

Selected Model Moments and Data in Steady State

Moment	Meaning	Model	Data	Source
U	Unemployment rate	.044	.044	BLS
S	Monthly separation rate	.036	.036	JOLTS
$\varepsilon_{R,W} - \varepsilon_{S,W}$	Recruiting-Separation Elasticity	4.4	4.2	Bassier et al. (2022)

Pass-Through in Our Baseline Model

$$\ln W_t - \ln W_{t-1} = \beta_Q \check{Q}_t + \beta_U \check{U}_{t-1} + \frac{1}{1+\rho}\check{\Pi}^w_{t+1} \quad (1)$$

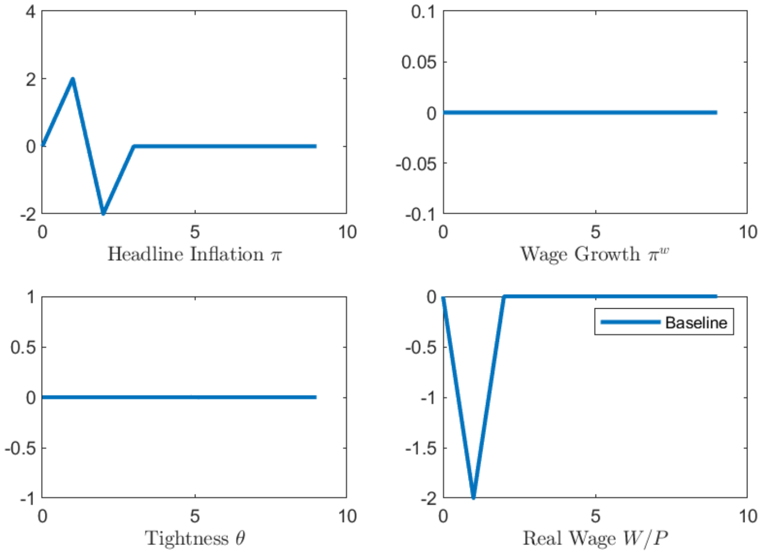
Thought Experiment (Cost of Living Shock)

-10% shock to X_t raises the price level, but monetary policy stabilizes employment, i.e., $\check{N}_t = 0$

- Pass through in our model is zero because there is no effect of the price level on the relative value of non-employment
  - Stabilizing the labor market stabilizes the right hand side of (1).

- This is different from a model where unions set wages, or neo-classical labor supply: depending on the strength of income, substitution, and wealth effects, wages can go up or down in response to this shock
  - For standard macro calibrations, a higher price level makes workers want to work less, so wages must rise to stabilize N_t

Pass Through in Our Baseline Model is Zero



Monetary policy shock   Results if λ_{EE} is endogenous

If Unemployment Gets More Attractive When Prices Rise

Alter the model

Assumption: household insures unemployed members against inflation, but not employed members

$$C_t(i, j(i)) = \frac{W_{j(i)t}}{P_t}(1 + \tau_t)$$

$$C_t^U = b(1 + \tau_t).$$

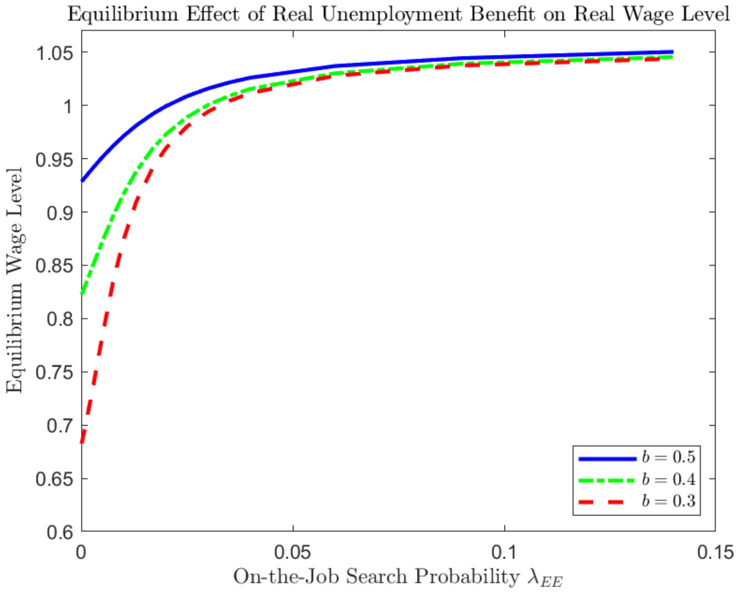
In a symmetric equilibrium, the separation and recruiting rates become

$$R_t = g(\theta_t)\left(\phi_{E,t}\frac{1}{2} + \phi_{U,t}\frac{\left(\frac{W_t}{P_t}\right)^\gamma}{\left(\frac{W_t}{P_t}\right)^\gamma + b^\gamma}\right)$$

$$S_t = s + (1 - s)\left(\lambda_{EE} f(\theta_t)\frac{1}{2} + \lambda_{EU}\frac{b^\gamma}{\left(\frac{W_t}{P_t}\right)^\gamma + b^\gamma}\right),$$

When $P_t \uparrow$, unemployment becomes more attractive for a given W_t: firms must raise wages to retain workers. Model details

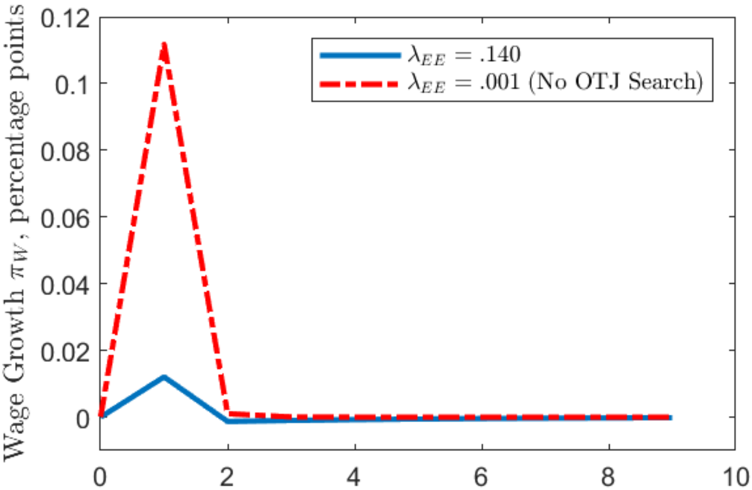
OTJ Search Kills Effect of Unemployment Benefit on Wages



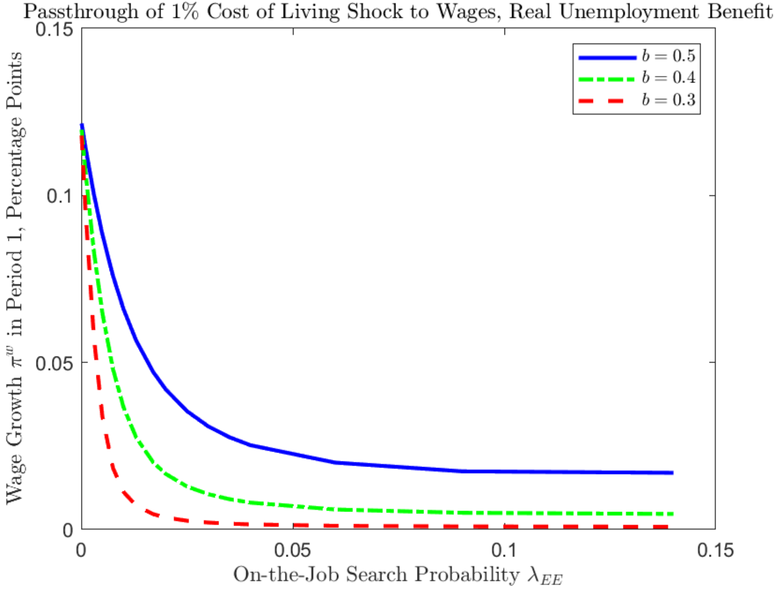
On-the-Job Search Dramatically Dampens Pass-through

Thought Experiment (Cost of Living Shock)

1 Period, 10% drop in quantity of endowment good X_t



On-the-Job Search Dramatically Dampens Pass-through II



Conclusion

We develop a tractable New Keynesian model with wage-posting firms and on-the-job search consistent with a range of micro evidence.

- Wage posting → wage setting trades off wage costs vs. turnover costs.

- Wage growth is mostly driven by quits, not unemployment.

- On-the-job search dramatically dampens pass-through of cost of living shocks to wages.

- Bernanke & Blanchard (2024): "catch-up" effect, the tendency of workers to press for compensation for earlier unexpected price increases, appears limited in practice, with the estimated coefficient on the catch-up variable in the wage equation close to zero in most countries.

- Some macro evidence Empirics

Implication: COVID-era surge in wage growth will revert as labor market tightness reverts

Thank you very much!
(Appendix)

Micro Evidence

Model consistent with a range of micro evidence:

1. Well-identified evidence on the sensitivity of recruiting and quitting to changes in wages (recruiting & separations elasticities) estimated in monopsony literature: e.g., Manning (2011); Azar et al. (2021); Datta (2023).

2. Wage growth predicted by job-to-job transitions: e.g., Faberman & Justiniano (2015); Moscarini & Postel-Vinay (2016); Karahan et al. (2017).

3. Wages unresponsive to flow benefit of unemployment (Jäger et al., 2020)

4. Wage posting more common than bargaining: current firm wage effects > past wage effects: e.g., Addario et al. (2021)

Back to related literature Back to equilibrium conditions

Simpler, Log-Linear Wage Phillips Curves: Go back

Leveraging the full structure of the model this simplifies to:

$$\check{\Pi}^w_t = \phi_V \check{V}_t + \phi_U \check{U}_{t-1} + \frac{1}{1+\rho}\check{\Pi}^w_{t+1} \tag{2}$$

With $\phi_V > 0$ and $\phi_U < 0$; our baseline calibration implies ϕ_V is much larger than ϕ_U in magnitude Comparative statics with λ_{EE}

Let $Q_t \equiv S_t - s$, and rewrite (2) as

$$\check{\Pi}^w_t = \beta_Q \check{Q}_t + \beta_U \check{U}_{t-1} + \frac{1}{1+\rho}\check{\Pi}^w_{t+1} \tag{3}$$

With $\beta_Q > 0$ and β_U positive or negative, depending on the calibration

Wage Growth v.s. Labor Market Data, 1990Q4-2023 Go back

$$\ln W_t - \ln W_{t-1} = \hat{\beta}_0 + \hat{\beta}_Q \ln Q_t + \hat{\beta}_U \ln U_{t-1} + \varepsilon_t.$$

VARIABLES	(1) ECI	(2) ECI	(3) ECI	(4) ECI	(5) ECI
$\ln U_t$	-0.0055***	0.0003	0.0017		
	(0.0009)	(0.0011)	(0.0012)		
$\ln Q_t$		0.0116***	0.0119***	0.0116***	0.0116***
		(0.0020)	(0.0020)	(0.0024)	(0.0016)
$\ln U_t - \ln U_t^*$				0.0003	
				(0.0013)	
$\ln U_{t-1}$					0.0003
					(0.0008)
Observations	135	135	119	135	135

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Comparing Model to Data

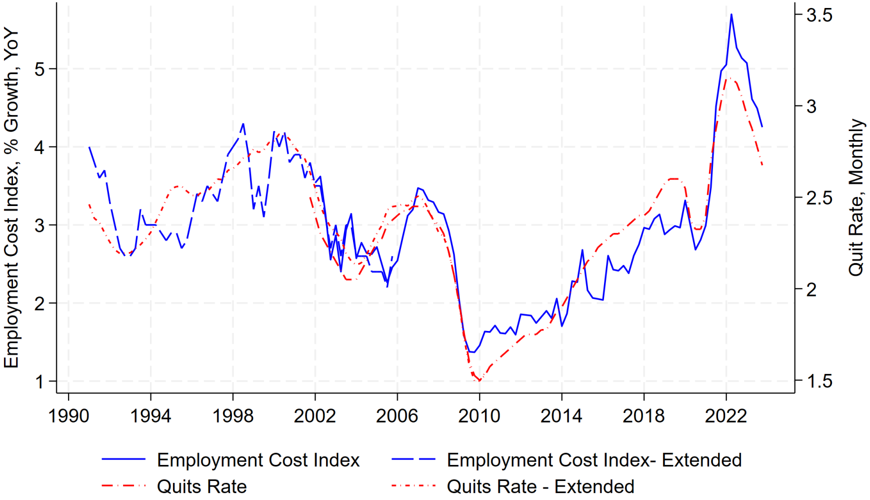
Go back

$$\check{\Pi}^w_t = \beta_Q \check{Q}_t + \beta_U \check{U}_{t-1} + \frac{1}{1+\rho}\check{\Pi}^w_{t+1}$$

Source	β_Q	β_U
Baseline Model: $\chi = 1$	0.0246	0.0009
Baseline Model: $\chi = 0$	0.0213	-0.0011
OLS using ECI 1990-Present	0.0116***	0.0003
	(0.0016)	(0.0008)

Standard errors in parentheses (Newey-West; 4 lags)
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

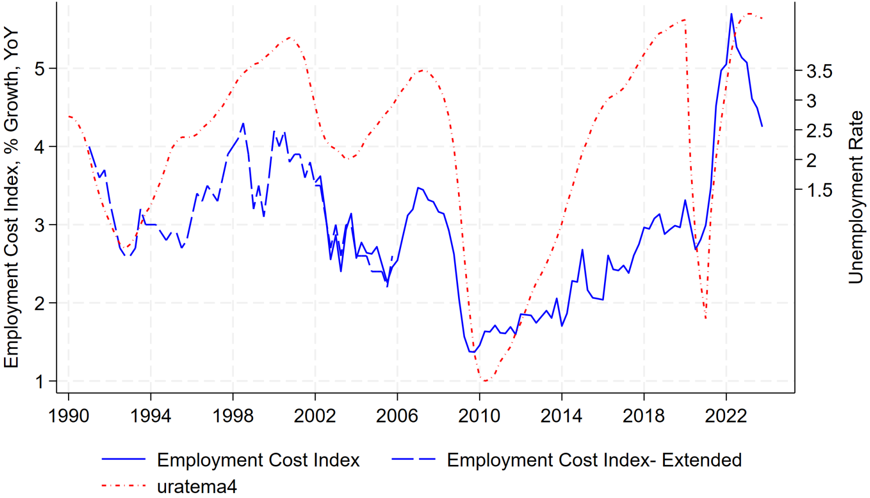
Quits Rate Captures Labor Market "Tightness" Go back



Extends results by, e.g., Faberman and Justiniano (2015) and Moscarini and Postel-Vinay (2017), through COVID shock and recovery.

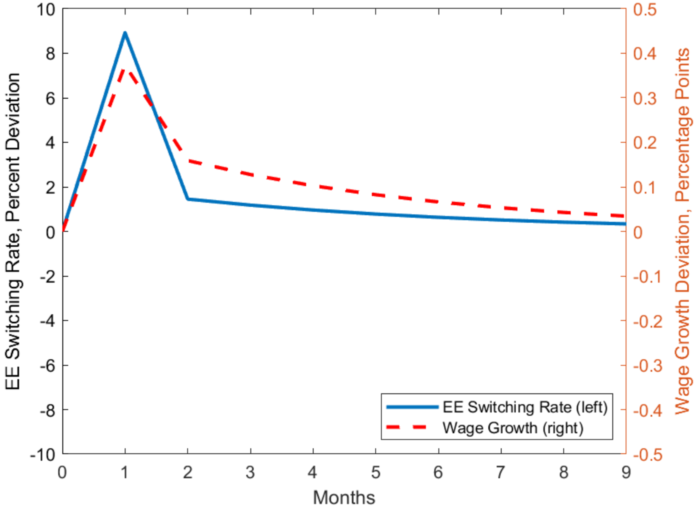
Unemployment: Less So

Go back



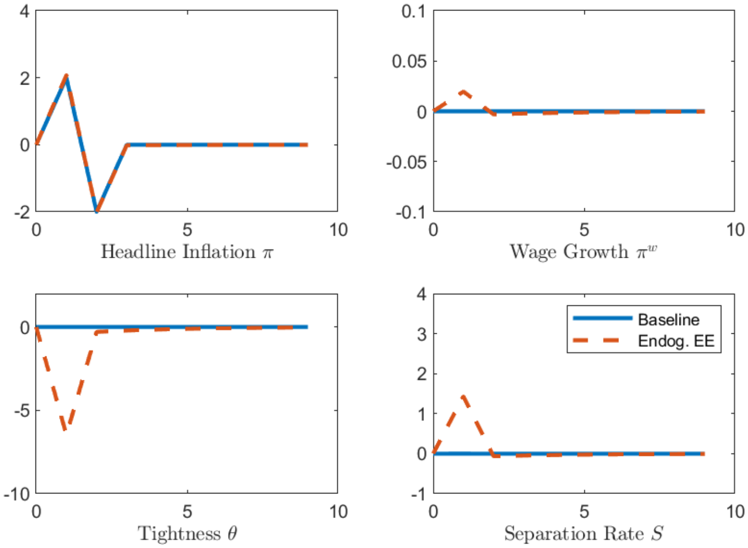
Expansionary 1% Decrease in the Policy Rate

Go back



Endogenous labor search intensity

Go back



Baseline model, but now assuming: $\lambda_{EE,t} = \lambda_{EE,0} \left(\frac{W_t}{P_t} \right)^{-m}$

Households Go back

Maximize the present discounted sum of members' utility,

$$\sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^{t}\left[U_t \ln(C_t^u) + \int_0^{1-U_t} \ln\left(C_t(i,j(i))\right) di\right]. \tag{4}$$

Assumption: household insures unemployed members against inflation, but not employed members

$$C_t(i,j(i)) = \frac{W_{j(i)t}}{P_t}(1+\tau_t)$$
$$C_t^U = b(1+\tau_t).$$

Households choose bonds $\{B_t\}$, "top-up" $\{\tau_t\}$ to maximize (4) subject to the budget constraint:

$$U_t b(1+\tau_t) + (1-U_t)\frac{W_t}{P_t}(\cancel{1}+\tau_t) + \frac{B_t}{P_t} = \frac{D_t}{P_t} + \frac{(1+i_{t-1})B_{t-1}}{P_t} + \cancel{\int_0^{1-U_t} \frac{W_{j(i)t}}{P_t} di}.$$

In a symmetric equilibrium with $W_{jt} = W_t$, household optimality requires

$$(C_t)^{-1} = \frac{1}{1+\rho}(1+r_{t,t+1})(C_{t+1})^{-1}$$

Workers' Discrete-Choice Problem 1/2 Go back

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4. Matches happen; workers choose to accept offers and/or quit: with
    - $V_t \equiv \int_0^1 V_{jt} dj$, $\theta_t \equiv \frac{V_t}{\mathcal{S}_t}$.

   The probability that:
    - Searching worker meets a firm's vacancy:

$$f(\theta_t) = \frac{M(V_t, \mathcal{S}_t)}{\mathcal{S}_t}$$

    - Searching firms meet a worker:

$$g(\theta_t) = \frac{M(V_t, \mathcal{S})}{V_t}$$

    - Employed worker can consider quitting to unemployment: $\lambda_{EU} \in (0, 1)$
5. N_t is determined; production happens.

Workers' Discrete-Choice Problem 2/2 Go back

Each worker i is **myopic**, making choices to maximize

$$\mathcal{V}_t(i,j) = \underbrace{\ln(C_t(i,j(i)))}_{=\begin{cases}\ln\left(\frac{W_t}{P_t}(1+\tau_t)\right), \text{ if employed} \\ \ln\left(b(1+\tau_t)\right), \text{ if unemployed}\end{cases}} + \underbrace{\iota_{ijt}}_{\text{Matching taste}}$$

Where ι_{ijt} is Type-1 extreme value with scale parameter γ^{-1} over workplaces drawn each period

Individual Recruiting and Separation Probabilities Go back

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where recall $C_t(i,j) = \frac{W_{jt}}{P_t}(1+\tau_t)$ and $C_t^u = b(1+\tau_t)$

Similarly, separation probabilities for a worker matching with an outside job or considering unemployment:

$$\underbrace{s_{jk}\left(W_{jt}, W_{kt}\right)}_{\substack{\text{Probability } j \text{ loses} \\ \text{worker matched to } k}} = \frac{W_{kt}^{\gamma}}{W_{kt}^{\gamma} + W_{jt}^{\gamma}}, \qquad \underbrace{s_{ju}\left(\frac{W_{jt}}{P_t}, b\right)}_{\substack{\text{Probability } j \text{ loses} \\ \text{worker to unemployment}}} = \frac{b^{\gamma}}{b^{\gamma} + \left(\frac{W_{jt}}{P_t}\right)^{\gamma}},$$

Firm's Recruiting and Separation Rates Go back

Define the probability a matched worker is employed or unemployed:

$$\phi_{E,t} \equiv \frac{\lambda_{EE}(1 - U_{t-1})}{\lambda_{EE}(1 - U_{t-1}) + U_{t-1}}$$

$$\phi_{U,t} = 1 - \phi_{E,t}.$$

Firm's Recruiting and Separation Rates Go back

Define the probability a matched worker is employed or unemployed:

$$\phi_{E,t} \equiv \frac{\lambda_{EE}(1-U_{t-1})}{\lambda_{EE}(1-U_{t-1})+U_{t-1}}$$
$$\phi_{U,t} = 1-\phi_{E,t}.$$

Recruiting rate is

$$R(W_{jt}) = g(\theta_t)\left[\phi_{E,t}\int_k r_{kj}(W_{kt},W_{jt})\omega(W_{kt})dW_{kt} + \phi_{U,t}r_{uj}\left(b,\frac{W_{jt}}{P_t}\right)\right],$$

with $\omega(W_k)$ some density of wages that search workers currently earn, with an analogous definition for the separation rate $S(W_j)$.

$$S(W_{jt}) = s + (1-s)\left[\lambda_{EE}f(\theta_t)\int_k s_{jk}(W_{jt},W_{kt})z(W_{kt})dW_{kt} + \lambda_{EU}s_{ju}\left(\frac{W_{jt}}{P_t},b\right)\right]$$

with $z(W_{kt})$ endogenous density of outside posted wages

Firm's Recruiting and Separation Rates

Go back

Define the probability a matched worker is employed or unemployed:

$$\phi_{E,t} \equiv \frac{\lambda_{EE}(1-U_{t-1})}{\lambda_{EE}(1-U_{t-1})+U_{t-1}}$$
$$\phi_{U,t} = 1-\phi_{E,t}.$$

In a symmetric equilibrium where $W_{jt}=W_t\ \forall j$, $R(\cdot)_t$ and $S(\cdot)_t$ becomes

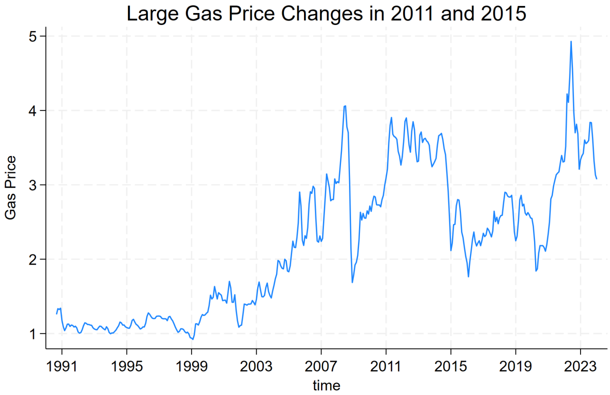
$$R_t = g(\theta_t)\left(\phi_{E,t}\frac{1}{2}+\phi_{U,t}\frac{\left(\frac{W_t}{P_t}\right)^{\gamma}}{\left(\frac{W_t}{P_t}\right)^{\gamma}+b^{\gamma}}\right)$$
$$S_t = s+(1-s)\left(\lambda_{EE}f(\theta_t)\frac{1}{2}+\lambda_{EU}\frac{b^{\gamma}}{\left(\frac{W_t}{P_t}\right)^{\gamma}+b^{\gamma}}\right).$$

New Calibration with b Go back

Parameter	Value	Meaning	Reason
λ_{EE}	.14	OTJ search probability	Match EE rates
λ_{EU}	.30	Opportunity to quit	Match voluntary EU rate, Qiu (2022)
b	0.45	Unemployment Benefit	Target U
s	.01	Exogenous separation rate	Match JOLTS separations
γ	6	T1EV scale parameter	Match $\varepsilon_{R,W} - \varepsilon_{S,W}$
ϵ	10	EOS of intermediates Y_{jt}	
ψ	100	Price adjustment cost	
ψ^w	100	Wage adjustment cost	
η	1	EOS of Y_t vs. X_t	
α_X	.2	X_t's share in C_t	
χ	1	Convexity of vacancy costs	Bloesch and Larsen (2023)
c	30	Hiring cost shifter	Targeting U, S
ρ	.004	Discount Rate	Monthly model

Selected Model Moments and Data in Steady State

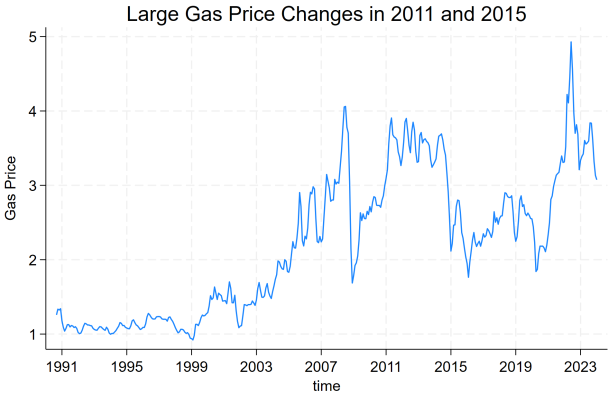
Moment	Meaning	Model	Data	Source
U	Unemployment rate	.044	.044	BLS
S	Monthly separation rate	.03	.036	JOLTS
$\varepsilon_{R,W} - \varepsilon_{S,W}$	Recruiting-Separation Elasticity	4.0	4.2	Bassier et al. (2022)



Share of annual wages spent on gasoline in state j

$$share_j = \frac{vmt_{2010,j}}{\underbrace{20}_{\text{20 miles per gallon}}} \times \$2 \times \frac{1}{\overline{statehourlywage}_{2010} \times 2000}.$$

Go back



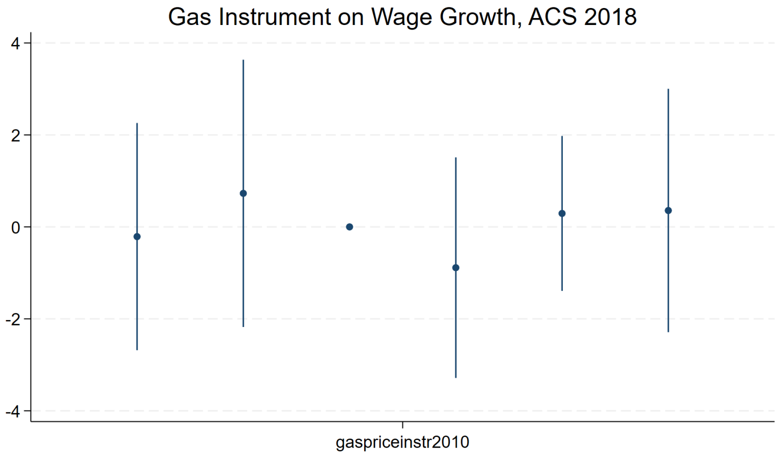
Shift: % change in national gas prices, $\%\Delta P_t^g$. The shift share instrument is

$$gasinst_{jt} = share_j \times \%\Delta P_t^g .$$

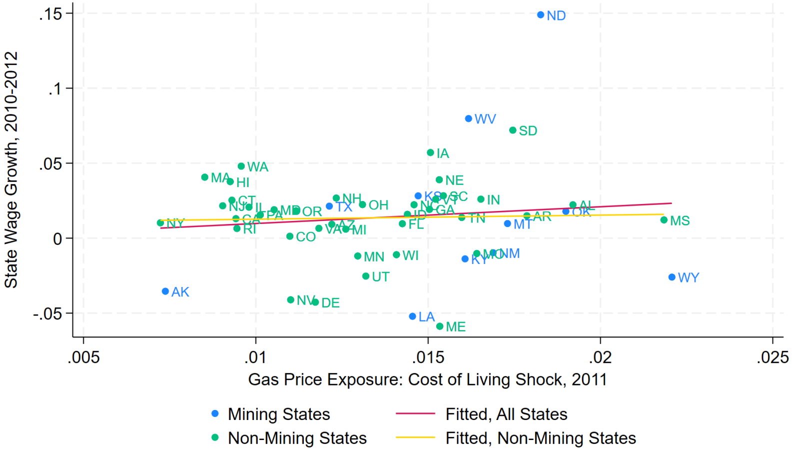
Estimate:

$$\log W_{j,t+s} - \log W_{j,t-1} = \alpha_s + \beta_s \times gasinst_{jt} + e_{jt} \tag{5}$$

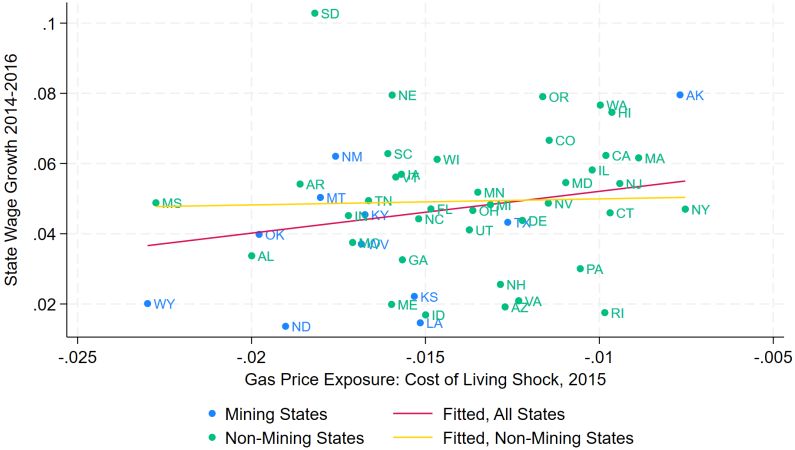
Go back


Gas Instrument on Wage Growth, ACS 2018
4
2
0
-2
-4
gaspriceinstr2010

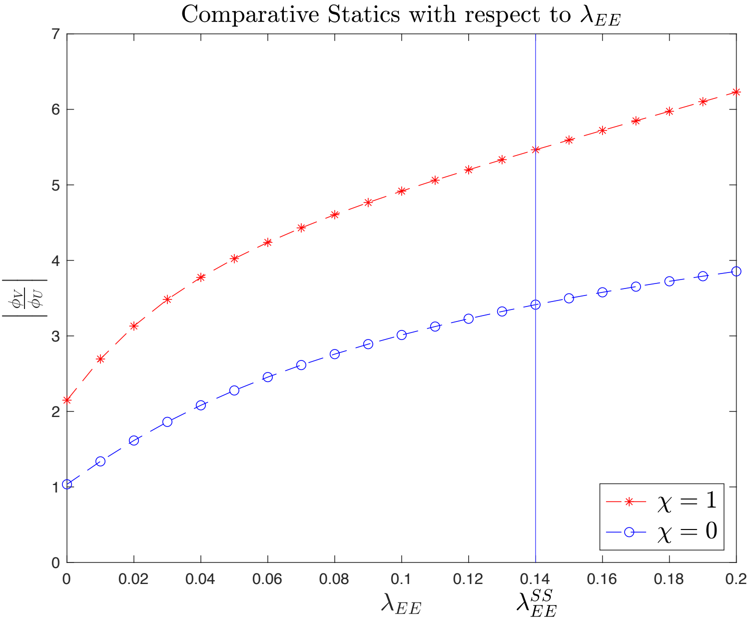
Go back


State Wage Growth, 2010-2012
Gas Price Exposure: Cost of Living Shock, 2011
.15
.1
.05
0
-.05
.005
.01
.015
.02
.025
ND
WV
SD
IA
WA
MA
HI
NE
CT
NJ
IL
MD
OR
TX
NH
OH
KS
SC
VT
NC
GA
IN
AL
OK
ID
PA
CA
NY
RI
AZ
VA
MI
FL
TN
AR
MT
MS
CO
MN
WI
KY
MO
NM
UT
WY
AK
NV
DE
LA
ME
Mining States
Non-Mining States
Fitted, All States
Fitted, Non-Mining States

Go back


State Wage Growth 2014-2016
Gas Price Exposure: Cost of Living Shock, 2015
.1
.08
.06
.04
.02
-.025
-.02
-.015
-.01
-.005
SD
NE
OR
WA
HI
AK
CO
NM
SC
WI
CA
MA
IL
AR
IA
VT
MD
NJ
MS
MT
TN
MN
MI
NV
NY
FL
OH
CT
IN
KY
NC
TX
DE
OK
UT
MO
WV
AL
GA
PA
NH
KS
WY
ME
AZ
VA
RI
ID
LA
ND
Mining States
Non-Mining States
Fitted, All States
Fitted, Non-Mining States

Go back



Comparative Statics with respect to λ_{EE}
$\left|\frac{\phi_V}{\phi_U}\right|$
0
1
2
3
4
5
6
7
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
λ_{EE}
λ_{EE}^{SS}
$\chi = 1$
$\chi = 0$

Go back

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