Do Cost of Living Shocks Pass Through to Wages?

Justin Bloesch* Seung Joo Lee† Jacob P. Weber‡

December 20, 2023

Abstract

We develop a tractable, dynamic extension of Bloesch and Larsen (2023), in which firms post wages and workers search on the job, to investigate how wages respond to a pure cost of living shock, i.e., a shock that raises the price of households' consumption bundle without affecting the marginal product of labor. We show that this shock affects wages only to the extent that higher cost of living affects worker mobility decisions and therefore affects turnover costs for firms. We show further that in response to higher cost of living, neither inflation-indexed unemployment benefits that relatively improve the desirability of unemployment, nor increased frequency of on-the-job search in response to higher inflation, generate meaningful nominal wage growth. Our results imply that for economies like the modern United States, where on-the-job search and wage posting are common, there is little scope for supply shock-induced wage-price spirals fueled by workers' ability to command higher nominal wages in response to higher nominal prices.

*Department of Economics and ILR, Cornell University. Email: jb2722@cornell.edu
†Saïd Business School, University of Oxford. Email: seung.lee@sbs.ox.ac.uk
‡Federal Reserve Bank of New York. Email: jake.weber@ny.frb.org

We thank seminar participants at the Reserve Bank of Australia for helpful comments and discussion.

JEL Codes: E31, E52.
Keywords: Monopsony, Inflation, Cost of living shocks, On-the-job search.

1 Introduction

In the economic recovery following the COVID pandemic, economies throughout the world experienced both rapid price inflation and rapid nominal wage growth. This experience has generated interest in the relationship between price and wage growth and raised concerns among policymakers of a wage-price spiral. Current mainstream tools for analyzing the relationship between price inflation and wage growth assume wage setting mechanisms that are counterfactual for economies such as the United States, namely that wages are set unilaterally by unions that represent workers. In many advanced economies, union membership has declined dramatically, and evidence suggests that in the United States wage posting is the most common, if not dominant, method of wage determination.[1] In light of this evidence and the recent experience of inflation, we ask, *when firms set both prices and wages, through what mechanisms do workers' wages respond to shocks to cost of living, and how large is this response?*

To answer this, we extend the wage posting model in Bloesch and Larsen (2023) into a dynamic, stochastic general equilibrium (DSGE) environment where workers search on the job, and firms set wages trading off between higher wage costs and higher turnover costs. To introduce a pure cost of living shock, we assume that workers consume two goods: a labor-intensive services bundle (e.g., haircuts) and an endowment good (e.g., unprepared food or energy). Negative shocks to the quantity of the endowment good thus raise the price of workers' consumption basket without affecting the marginal product of labor, allowing us to study how a "pure" cost of living shock passes through to wages. This shock raises firms' optimal wage only to the extent that higher cost of living increases worker turnover, either by increasing the rate of job-to-job switching, or by making unemployment relatively more desirable such that workers are more likely to quit into unemployment and more difficult to recruit from unemployment. In our benchmark model where higher cost of living also lowers unemployed workers' purchasing power, we show that a higher price level has no effect on workers' mobility between employment and unemployment. Similarly, higher prices lowers real wages for all jobs evenly, so the cost-of-living shock also has no effect on the rate of employment-to-employment transitions either. Thus in our baseline case, higher cost of living has no effect on worker mobility, and therefore no effect on wages.

We consider two ways that the price level might affect worker flows: first, by inflation-indexing the value of unemployment benefits so that the relative value of unemployment improves when real wages fall, and second, that the probability of searching on the job rises when real wages fall, as shown empirically by Pilossoph and Ryngaert (2023) and explored in partial equilibrium by Pilossoph et al. (2023). In the first case where inflation lowers real wages and but not the real value of unemployment benefits, we find that a cost of living shock only min-

[1] See Hall and Krueger (2012); Lachowska et al. (2022); Di Addario et al. (2023).

imally incentivizes firms to raise wages. This is because when calibrating the model to match worker flows, quitting into unemployment is rarely attractive to workers, so a firm's main threat to retaining workers is poaching by other firms. This makes the value of unemployment largely irrelevant in the wage-posting decision, consistent with Jäger et al. (2020). Incorporating a quantitatively realistic amount of on-the-job search in the model thus significantly dampens the pass through of cost-of-living shocks to wages when the flow value of unemployment is invariant to cost of living.

We then consider how wages respond to cost of living shocks if workers' probability of searching on the job rises in response to higher inflation and lower expected real wages, finding only modest pass-through to wages. While a greater threat of worker separation incentivizes firms to raise wages, there is an important offsetting general equilibrium effect: a greater number of searchers lowers labor market tightness, making it easier for firms to replace departing workers. The net result is that the amount of pass-through remains small even under this modification.

Incorporating on-the-job search also allows the model to match a key stylized fact about the US labor market: that the rate of job-to-job transitions is a very good predictor of nominal wage growth, even for job stayers (Faberman and Justiniano (2015); Moscarini and Postel-Vinay (2017)). While prior research has modeled this relationship between job-to-job mobility and wage growth,[2] our setting provides a tractability advantage: if firms are identical and adjust prices and wages subject to Rotemberg (1982) pricing frictions, then our model features a symmetric equilibrium with a single wage alongside endogenous worker flows between firms (and unemployment). This outcome is compatible with on-the-job search due to the presence of idiosyncratic, worker-specific preference shocks over workplaces, so that workers will sometimes choose to switch jobs even when firms offer identical wages. We also develop a novel household block such that aggregate consumption remains governed by a standard Euler equation further, allowing our labor block to integrate easily with existing DSGE models.

Other recent studies have explored supply shocks and the response of wages. We differ from Lorenzoni and Werning (2023a,b) where workers set wages via unions and Gagliardone and Gertler (2023) where workers bargain and wages are rigid in real terms. Unlike these and other papers which study oil or other shocks which affect the marginal product of labor, we study a shock which only affects workers' cost of living and focus on understanding whether the pass-through of cost of living to wages amplifies inflationary shocks in the U.S. economy. Given this narrow focus, we also abstract from assuming *ad hoc* real wage rigidity, which mechanically induces pass through of cost of living to wages, noting that there is little evidence to suggest this type of indexation is widely used in the United States at present.[3] Similarly, while there is a long

[2]See e.g., Moscarini and Postel-Vinay (2016) and Birinci et al. (2022). Faccini and Melosi (2023) measure the effect of job-to-job mobility on price inflation.

[3]Historically, the evidence for the prevalence of cost of living adjustments (COLAs) comes from studies of large union contracts, which now cover a small share of U.S. employment; and even within unionized workers, the share

tradition of modelling nominal wage rigidity in New Keynesian models by assuming workers are unionized following the tractable approach in Erceg et al. (2000), we refrain from assuming that workers are unionized, noting that only 11.3% of U.S. workers were unionized as of 2022.[4] de la Barrera i Bardalet (2023) develops a similar model of labor market monopsony with on-the-job search and finds that increased monopsony power flattens the wage Phillips curve.

Our results suggest that in a setting such as the United States where few workers operate under collective bargaining agreements with cost of living adjustments, and where firms' wage setting decision reflects competition for already-employed rather than for unemployed workers, the ability for workers to reclaim real wages in response to supply shock that raises their cost of living is limited. There is thus little scope for supply shock-induced wage-price spirals fueled by workers' ability to command higher nominal wages in response to higher nominal prices.

Layout Section 2 presents stylized facts from U.S. data, demonstrating the tight correlation between job-to-job transitions and wage inflation that motivates our model's assumption of on-the-job search. Section 3 presents our dynamic New Keynesian model with on-the-job search and wage posting of firms. Section 4 then provides quantitative results, demonstrating first that monetary policy (demand) shocks allow the model to generate a tight correlation between wage growth and job-to-job transitions, and second that cost-of-living shocks feature limited pass through to wages. Section 5 concludes.[5]

2 US Wage Growth and Inflation

In this section, we document two stylized facts. First, the correlation at annual frequencies between headline inflation and wage growth was relatively weak prior to the COVID pandemic and recovery. Second, the correlation between wage growth and the quits rate has remained very strong continuously since the beginning of publishing the employment cost index series.

Figure 1 plots the relationship between US inflation measured by Consumer Price Index (CPI) and nominal wage growth, measured by the Employment Cost Index (ECI), showing how the correlation between these two series has changed over time. Figure 1 shows that at high frequencies, there is little correlation between price inflation and nominal wage growth. For example, 2011 was marked by a large increase in commodities prices, which contributed to price

covered by contracts which include COLAs has shrunk dramatically since the 1970s. See e.g., Christiano et al. (2016), footnote 4, for discussion.

[4]From the US Bureau of Labor Statistics: see https://www.epi.org/publication/unionization-2022/.

[5]Derivations and proofs are detailed in Appendix A: Appendix A.1 provides microfoundations for workers' problem with a preference for leisure; Appendix A.2 solves a firm's problem and derives wage and price Phillips curves; Appendix A.3 derives a linearized wage Phillips curve; Appendix A.4 derives the household's Euler equation under an unemployed benefit that is invariant with aggregate price. Lastly, Appendix B provides a 2-period version of our model, where we analytically prove our quantitative results.

inflation close to 4%, while nominal wage growth remained subdued below 2%. In 2014-2015, a big drop in commodities prices lowered headline inflation to 0%, and nominal wages continued growing at just above a 2% annualized pace. However, during the recovery from the COVID shock, wages and prices suddenly rose, roughly at the same time. CPI inflation peaked just below 9%, and wage growth rose to over 5% at its peak in early 2022. Since the peak of both series, both price inflation and wage growth have generally been falling.[6] Quantitatively, between 2002 and 2020, the correlation between 4 quarter growth in the CPI and ECI was only 0.32. Including the COVID period raises this correlation to 0.70.

Figure 2 shows the relationship between the quit rate from the Job Openings and Labor Turnover Survey (JOLTS) and the four quarter growth in the employment cost index. This figure shows that the time series result documented by, e.g., Faberman and Justiniano (2015) and Moscarini and Postel-Vinay (2017), that nominal wage growth is well predicted by job-to-job transitions, extends to the recent period of COVID shock and recovery. Note that while the figure plots the behavior of quits, most quits are job-to-job transitions, which is why we discuss Figure 2 as documenting the tight correlation between job-to-job transitions and wage inflation.[7]

This strong correlation hints that incorporating job-to-job transitions is important when writing down a model of wage growth over the business cycle. Indeed, as we will explain next, writing down a model which incorporates on-the-job search to capture this tight correlation will also imply that wage-price spirals are muted.

3 Model

To build intuition about how incorporating on-the-job search can mute the wage-price spiral in our setting, we first describe the problem of a firm posting wages in the presence of recruiting costs and on-the-job searches of workers. When deciding whether to raise wages, the firm trades off between a higher wage bill and lower turnover costs. Lower turnover costs come from the fact that the firm understands that a higher wage increases the probability that it recruits a particular searching worker (the recruiting rate) while also lowering the probability that incumbent workers leave (the separation rate). Since this firm's problem does not depend directly on the price level in partial equilibrium, increases in workers' cost of living can only affect wages through their effects on these recruiting or separation rates.[8]

[6] As of December of 2023.

[7] Quits include various labor market transitions: job-to-job transitions without a period of non-employment, job-to-job transitions with a period of non-employment, and voluntary quits into non-employment. Qiu (2022) shows finds that only 3% of workers transition from employment to non-participation each month (most of which appear voluntary) and Elsby et al. (2010) find that only 16% of workers who quit enter a period of unemployment.

[8] In general equilibrium, a negative shock to X_t will depress aggregate demand for Y_t, reducing workers' marginal revenue product and causing the firm to lower wages; this partially motivates our exploration of the quantitative GE model below. Note that this channel is quite distinct from the wage price spiral mechanism, which moves wages and

Figure 1: Wage Growth and Consumer Price Inflation

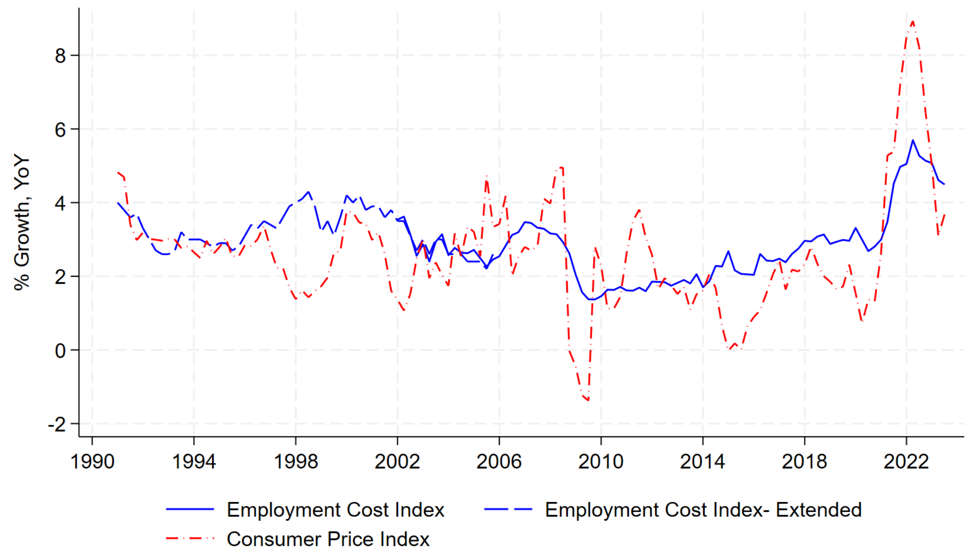
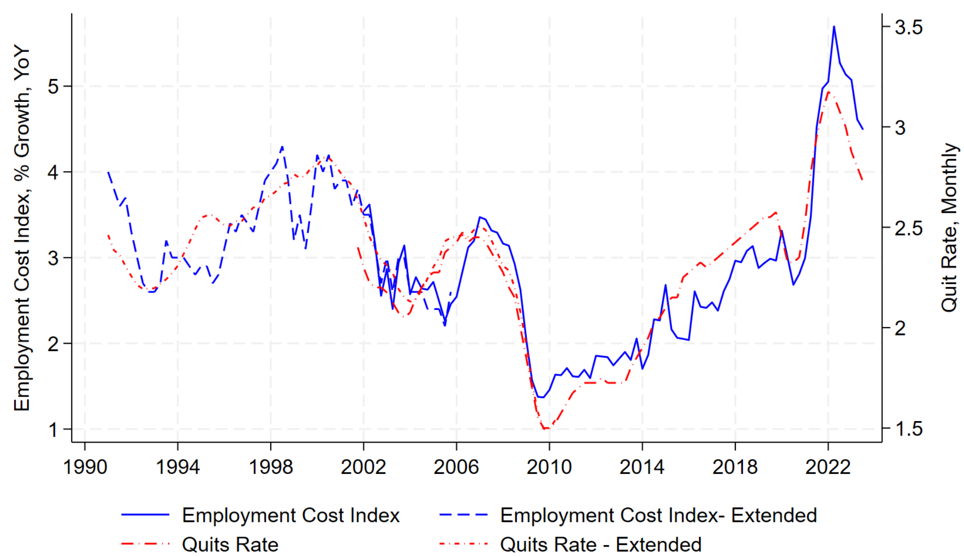


Figure 2: Wage Growth and Quits Rate



Notes: At high frequencies, there is relatively little correlation between price inflation and nominal wage growth (top figure) relative to the correlation between wage growth and the quits rate, which largely reflects job-to-job transitions (bottom figure).

We then describe the worker's problem, which determines the firms' recruiting and separation rates, and discuss how changes in the price level can relatively improve workers' outside option, and raise wages, if changes in the price level make unemployment more attractive. If this

prices in the same direction.

is the case, this can lead to pass through from cost-of-living to wages, as firms must now offer a higher wage to retain the same number of workers as before. However, these considerations are quantitatively small when (a) most workers already vastly prefer a job to unemployment and/or when (b) most searching workers already have a job, rendering the value of unemployment irrelevant when considering whether to accept a new job offer. And this channel need not exist at all if changes in the price level do not affect the desirability of unemployment, as we will show below.

Our analysis in Sections 3 and 4 is primarily based on our quantitative dynamic general equilibrium model, while we provide analytical results based on a simpler 2-period model in Appendix B.

Production and the firm There are two goods in the economy: an endowment good X_t and services Y_t. They are combined into an aggregate consumption good, C_t, according to

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

with corresponding aggregate price index

$$P_t^{1-\eta} = \left(\alpha_Y P_{y,t}^{1-\eta} + \alpha_X P_{x,t}^{1-\eta} \right)^{\frac{1}{1-\eta}}. \tag{2}$$

Workers are hired by firms to produce services Y_t, so that their real wage is determined by the nominal wage offered in that sector divided by the overall price level P_t. Our "pure" cost of living shock is thus a decline in the endowment good X_t which raises its price, $P_{x,t}$, and hence the price level P_t. This is a "pure" cost of living shock in the sense that it raises the cost of living for workers without affecting their marginal products, *unlike* an oil shock, for example, which affects both. The point of considering a shock of this sort is not to downplay the role or importance of oil shocks to many modern economies, but to highlight *how* these shocks propagate and question whether a "wage price spiral" amplifies their effects on the price level.

We now turn to the determination of the nominal wage. We assume that perfectly-competitive retailers bundle service types j according to a standard Dixit-Stiglitz production function with a associated ideal price index:

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

yielding product demand for variety j:

$$\frac{Y_t^j}{Y_t} = \left(\frac{P_{y,t}^j}{P_{y,t}}\right)^{-\epsilon}. \tag{3}$$

The firm produces with labor $Y_t^j = N_{jt}$. Firms set nominal wages W_{jt} each period, which is assumed to be the same for all workers in the firm, including new hires. Workers separate from the firm with probability $S(W_{jt})$ each period, with $S'(W_{jt}) < 0$: firms retain a higher share of workers each period by paying a higher wage. The firm can recruit workers by posting vacancies V_{jt}, and the probability that a vacancy successfully results in a hire is $R(W_{jt})$, with $R'(W_{jt}) > 0$.[9] The firm pays a convex, per-vacancy hiring cost, $c\left(\frac{V_{jt}}{N_{j,t-1}}\right)^{\chi}$, to post V_t vacancies, where $c > 0$ and $\chi \geq 0$. Finally, the firm is also subject to price and wage adjustment frictions à la Rotemberg (1982).

Given this, the firm maximizes the present discounted value of profits, solving

$$\max_{\substack{\{P_{y,t}^j\},\{Y_t^j\},\\ \{N_{jt}\},\{W_{jt}\},\{V_t^j\}}} \sum_{t=0}^{\infty} \left(\frac{1}{1+\rho}\right)^t \left(P_{y,t}^j Y_t^j - W_{jt}N_{jt} - c\left(\frac{V_{jt}}{N_{j,t-1}}\right)^{\chi} V_{jt}W_t - \frac{\psi}{2}\left(\frac{P_{y,t}^j}{P_{y,t-1}^j} - 1\right)^2 Y_t^j P_{y,t}^j \right.$$
$$\left. - \frac{\psi^w}{2}\left(\frac{W_{jt}}{W_{j,t-1}} - 1\right)^2 W_{jt}N_{jt}\right) \tag{4}$$

subject to

$$N_{jt} = (1 - S(W_{jt}))N_{j,t-1} + V_{jt}R(W_{jt}) \tag{5}$$

and product demand equation (3). From inspecting equations (4) and (5), we can already see that the service sector firm chooses the wage (and other choice variables) taking as given the choices of other service sector firms (embodied in the price index and aggregate output of the service sector), parameters, and the separation and recruiting rates $S(\cdot)$ and $R(\cdot)$. The aggregate price level does not appear directly. Thus, in partial equilibrium, the *only* way that changes in the price level can impact the wage setting decision is through changes in $S(\cdot)$ and $R(\cdot)$, which are determined by the household side. This is crucial to understanding the general equilibrium results, where we will effectively fix nominal spending in the services sector at its steady state value; i.e., $P_{y,t}Y_t$ remains unchanged, given appropriate assumptions for monetary policy and household preferences, eliminating the aggregate demand effects from the shock X_t to effectively deliver a shock only to the aggregate price level P_t in (2).[10]

[9] Of course, the retention and separation functions $R(W_{jt})$ and $S(W_{jt})$ depend as well on wages set by other service firms, which will be microfounded in Section 3.1. Here, we intentionally simplify notations by writing $R(\cdot)$ and $S(\cdot)$ as functions of W_{jt} set by firm j.

[10] Choosing an elasticity of substitution of $\eta = 1$ and a fixed path (or Taylor rules that target the service inflation, i.e., inflation in $P_{y,t}$) for nominal interest rates in response to the X_t shock, combined with a standard Euler equation for aggregate consumption derived below, deliver this result. See Section 4 and Appendix B for details.

Wage Phillips curve To make this relationship between the separation and recruiting rates and the firm's choice of wage clearer, we derive a wage Phillips curve from the firm's first order conditions, assuming for the moment that a symmetric equilibrium exists.[11] Under this assumption, we can derive the wage Phillips curve to demonstrate that nominal wage growth is exclusively a function of other endogenous labor market variables: vacancies, employment, recruiting and separation rates, and recruiting and separation elasticities.

Denote $\varepsilon_{R,W}$ and $\varepsilon_{S,W}$ as the elasticities of the recruiting function $R(W_{jt})$ and the separation function $S(W_{jt})$ with respect to the wage. Then in any symmetric equilibrium where $W_{jt} = W_t$, $N_{jt} = N_t$, $V_{jt} = V_t$, $P_t^j = P_t$, $Y_t^j = Y_t$, the wage Phillips curve characterizing nominal wage growth curve is:

$$\begin{aligned}\psi^w \left(\Pi_t^w - 1\right) \Pi_t^w + 1 =& c(1+\chi)\left(\frac{V_t}{N_{t-1}}\right)^{\chi} \left(\frac{V_t}{N_t}\varepsilon_{R,W_t} + (-\varepsilon_{S,W_t})\frac{N_{t-1}}{N_t}\frac{S(W_t)}{R(W_t)}\right) \\ &+ \frac{1}{1+\rho}\psi^w \left(\Pi_{t+1}^w - 1\right)\left(\Pi_{t+1}^w\right)^2 \frac{N_{t+1}}{N_t}.\end{aligned} \tag{6}$$

Thus, in any symmetric equilibrium where firms solve an optimization problem of the form of (4), the wage Phillips curve will be a function of the current and expected future paths of the job vacancy rate V_t, employment N_t, the recruiting and separation rates $R(W_t)$ and $S(W_t)$, and their elasticities, denoted $\varepsilon_{R,W_t} > 0$ and $\varepsilon_{S,W_t} < 0$ following conventions in the monopsony literature; see e.g. Bloesch and Larsen (2023). Appendix A.2 derives the firm's first-order conditions in (4), including the price Phillips curve and wage Phillips curve (6).

To see how the quits (and the presence of monopsony power) affect aggregate wage behavior, we linearize the wage Phillips curve (6): for any variable x_t, let $\check{x}_t$ be the log deviation of x_t from steady state, $\check{x}_t \equiv \ln x_t - \ln x$, and suppress the dependence of the recruiting and separation rates on W_t.[12] Then, denoting $T_t \equiv \frac{V_t}{N_{t-1}}$, which is proportional to labor market tightness, we write the linearized wage Phillips curve as

$$\check{\Pi}_t^w = \frac{\kappa}{\psi^w}\left[\underbrace{\left(-\varepsilon_S + S(\varepsilon_R - \varepsilon_S)\right)}_{>0}\left(\check{S}_t - \check{R}_t\right) + \underbrace{\left(\varepsilon_R + (\chi - S)\left(\varepsilon_R - \varepsilon_S\right)\right)}_{>0}\check{T}_t + \left(\epsilon_R \check{\epsilon}_{R,t} - \epsilon_S \check{\epsilon}_{S,t}\right)\right] + \frac{1}{1+\rho}\check{\Pi}_{t+1}^w, \tag{7}$$

where $\kappa \equiv c(1+\chi)T^{\chi+1} > 0$; we can sign the coefficients assuming convexity parameter χ is not much smaller than steady state separations S, recalling both that the steady state separation rate S is quite small and that $\varepsilon_R > 0$ and $\varepsilon_S < 0$. From (7), we observe that wage Phillips curve implies (i) wage growth increases as labor market tightness, $\check{T}_t$, and quits, $\check{S}_t$, increase, (ii) wage growth

[11]Section 3.2 shows that there exists a symmetric equilibrium in this economy where all firms choices are the same.

[12]In practice, when we specify the household's problem, we will show that in our setting assuming a symmetric equilibrium implies that the aggregate wage does not affect the separation and recruiting rates, nor their elasticities. See equations (17) and (16) for equilibrium expressions for the recruiting and separation rates.

increases when recruiting rates $\check{R}_t$ fall; (iii) stronger monopsony, i.e., a lower $\varepsilon_R - \varepsilon_S$, flattens the wage Phillips curve, as documented in de la Barrera i Bardalet (2023). See Proposition 2 in Appendix A.3, which derives (7).

Note the absence of aggregate inflation, and that the recruiting and separation rates (and their elasticities) and tightness T_t are the only variables which are not firm choice variables. To the extent a change in the price level affects these objects, there can be pass through from cost of living shocks to wages. As we will show momentarily, the scope for such pass through is quantitatively small.

3.1 Households and Workers

This section derives the household and worker block of the model. We deviate from the standard assumption in the New Keynesian literature of perfect consumption insurance within the household by assuming that households only imperfectly insure the consumption of workers who are unemployed, consistent with evidence that unemployed workers consume less than employed workers (Chodorow-Reich and Karabarbounis, 2016). We assume that workers themselves choose whether to take a job, and workers make these decisions based on relative wages and consumption levels, in addition to idiosyncratic preference shocks. Workers' mobility decisions will aggregate up into the firms' recruiting and separation functions. Households smooth aggregate consumption within the household over time, yielding a standard Euler equation, making the labor block easy to integrate into a standard New Keynesian setting.

Frictional Markets Workers and firms match according to random search in a frictional market. As mentioned above, each firm j posts V_{jt} vacancies, and aggregate vacancies are $V_t = \int V_{jt} dj$. Each period, employed workers can search on the job with some constant, exogenous probability $\lambda_{EE} \in (0, 1)$, and unemployed workers can always search.[13] The unemployment rate is defined as U_t, so the total mass of searchers $\mathcal{S}_t$ is $\mathcal{S}_t = \lambda_{EE}(1 - U_t) + U_t$. Matching is random and follows a constant returns to scale matching function $M_t(V_t, \mathcal{S}_t)$. Labor market tightness is $\theta_t = V_t / \mathcal{S}_t$. The job finding rate for workers is $f(\theta_t) = \frac{M_t}{\mathcal{S}_t}$ is increasing in tightness θ_t, and the probability that a vacancy is matched with a worker $g(\theta_t) = \frac{M_t}{V_t}$ is a decreasing function of tightness θ. The share of searchers who are employed is $\phi_{E,t} = \lambda_{EE}(1 - U_t) / \mathcal{S}_t$, and the share of searchers who are unemployed is $\phi_{U,t} = 1 - \phi_{E,t} = U_t / \mathcal{S}_t$. We use

$$f(\theta_t) = \frac{\theta_t}{(1 + \theta_t^{\nu})^{\frac{1}{\nu}}}, \quad g(\theta_t) = \frac{1}{(1 + \theta_t^{\nu})^{\frac{1}{\nu}}},$$

[13] This simplifying assumption mechanically shuts down the possibility that on-the-job search intensity increases with the price level (Pilossoph and Ryngaert, 2023); Appendix 4.4 relaxes this assumption and shows that the scope for pass-through from cost-of-living shocks to wages remains small in our model even if workers search harder as prices rise.

with $\nu = 2$ following the literature.

Households A representative household has a unit mass $i \in [0,1]$ of members who can work. Households seek to maximize the discounted present value of its members' utility, which is log in consumption. Without loss of generality, assume that unemployed household members must each have the same consumption level, C_t^u.[14] Then letting $C_t(i,j)$ denote the consumption of worker i in state j, where j indicates the firm i is employed at, the households objective function becomes

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

The household is allowed to choose C_t^u (effectively, an unemployment benefit) and also a linear tax/subsidy on employed workers, who consume their income each period:

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

subject to the following budget constraint: letting D_t be nominal dividend payments from services firms (who profit from monopoly and monopsony power), B_t be nominal bond holdings in zero net supply paying nominal interest rate i_t, and letting $\bar{W}_t$ be the average wage of employed workers, the budget constraint is

$$U_t C_t^u = \frac{D_t}{P_t} - \frac{B_t}{P_t} + \frac{(1+i_{t-1,t})B_{t-1}}{P_t} + (1-\tau_t)(1-U_t)\frac{\bar{W}_t}{P_t}.$$

To make further progress in delivering a tractable model with a standard consumption Euler equation, we impose an *ad hoc* consumption rule within the household requiring that unemployed workers' consumption must be a *constant* fraction of employed workers' average consumption,

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

where $\xi \geq 1$. This rule allows us to capture the fact that the ratio of unemployed and employed consumption is relatively constant over the business cycle (Chodorow-Reich and Karabarbounis, 2016). Moreover, this consumption rule can be thought of as the result of a household facing an incentive-insurance tradeoff. By insuring unemployed workers less and making unemployment relatively worse (lower ξ), the household encourages workers to take jobs but takes consumption away from agents with higher marginal utility of consumption.

[14]This is not restrictive, as the household will always choose to equalize consumption across unemployed agents given diminishing marginal returns to consumption.

In a symmetric equilibrium where all firms set the same wage, and so $W_{jt} = W_t$, then the household's problem under these constraints simplifies to choosing aggregate consumption C_t and bond holdings B_t to maximize

$$\sum_{t=0}^{\infty} \left(\frac{1}{1+\rho}\right)^t \left[\ln\left(\frac{C_t}{(1-U_t)\xi + U_t}\right)\right]$$

subject to the simplified budget constraint

$$C_t = \frac{D_t}{P_t} - \frac{B_t}{P_t} + \frac{(1+i_{t-1,t})B_{t-1}}{P_t} + (1-U_t)W_t.$$

Optimization then yields the standard consumption Euler equation with log-utility given by:

$$C_t^{-1} = \frac{1}{1+\rho}\frac{1+i_{t,t+1}}{\Pi_{t+1}}C_{t+1}^{-1}. \tag{8}$$

Workers Workers get utility from consumption and an idiosyncratic preference draw ι. ι represents how much workers like their current job at firm j, which is redrawn every period and is i.i.d. Workers draw a similar preference shock each period during unemployment (note that the household does not take the idiosyncratic preference shocks into its own maximization). Workers are myopic[15] and consider their utility only one period at a time, which for worker i in state j is given by[16]

$$\mathcal{V}_t(i,j) = \ln\left(C_t(i,j)\right) + \iota_{ijt}.$$

Workers are allowed to search on the job with probability λ^{EE}, and conditional on searching, are matched with a vacancy with probability $f(\theta)$. Workers are allowed to consider unemployment with probability λ^{EU}. Consider a worker currently employed at firm j who successfully matches with firm k's vacancy. Define $s_{jk}(W_{jt}, W_{kt})$ as probability that the worker is poached from firm j to firm k is

$$s_{jk}(W_{jt}, W_{kt}) = \frac{\left(\tau\frac{W_{kt}}{P_t}\right)^\gamma}{\left(\tau\frac{W_{kt}}{P_t}\right)^\gamma + \left(\tau\frac{W_{jt}}{P_t}\right)^\gamma} = \frac{W_{kt}^\gamma}{W_{kt}^\gamma + W_{jt}^\gamma}, \tag{9}$$

[15] Even if we make a worker's problem dynamic as in Heise and Porzio (2023), it does not change our quantitative results. It is because the only way that changes in the price level impacts the wage setting decision is through changes in separation and recruiting functions $R(\cdot)$ and $S(\cdot)$, and we calibrate our free parameters to match the elasticities $\varepsilon_{R,W}$ and $\varepsilon_{S,W}$ of those two functions eventually. See Table 1.

[16] The absence of utility from leisure here, which may be greater in unemployment, can be viewed as a simplifying assumption: we can introduce leisure without changing the results provided that the elasticity of substitution between leisure and consumption is one. See Section 4.3 and accompanying Appendix A.1 for further discussion on how assuming a different elasticity affects the results.

which is decreasing in W_{jt}: if firm j pays a higher wage, workers are less likely to be poached. Notice also that the probability a worker switches jobs is only a function of the relative *nominal* wage. The worker takes as given the internal tax rate by the household τ and the price level P, both of which are unchanged regardless of which job the worker chooses.

Now consider a worker who is allowed to quit into unemployment. Let the average wage of employed workers in worker i's household be $\bar{W}_t$, which determines consumption in unemployment through $C_t^u = \frac{\bar{C}_t^e}{\xi} = \tau \frac{\bar{W}_t}{\xi P_t}$. The probability that a worker voluntarily quits into unemployment $s_{ju}(W_{jt})$ is

$$s_{ju}(W_{jt}) = \frac{\left(\frac{1}{\xi}\tau\frac{\bar{W}_t}{P_t}\right)^\gamma}{\left(\frac{1}{\xi}\tau\frac{\bar{W}_t}{P_t}\right)^\gamma + \left(\tau\frac{W_{jt}}{P_t}\right)^\gamma} = \frac{\left(\frac{\bar{W}_t}{\xi}\right)^\gamma}{\left(\frac{\bar{W}_t}{\xi}\right)^\gamma + W_{jt}^\gamma}, \tag{10}$$

which is decreasing in W_{jt} but does not depend on the price level P_t.

These individual transition probabilities aggregate up into the firm's separation rate $S(W_j)$: each period, a share of workers $s \in (0,1)$ exogenously separate while the remainder $(1-s)$ endogenously separate if they recieve an opportunity to take a job or exit to unemployment that they prefer to their current job. Recalling that $f(\theta_t)\lambda_{EE}$ denotes the probability that a particular employed worker is allowed to search on the job and matches to another firm, and that and λ_{EU} denote the probabilities that an employed worker is allowed to consider quitting into unemployment, the separation rate is written as

$$S(W_{jt}) = s + (1-s)\left(\lambda_{EE} f(\theta_t)\int s_{jk}(W_{jt}, W_{kt}) z(W_{kt}) dk + \lambda_{EU} s_{ju}(W_{jt})\right), \tag{11}$$

where $z(W_{kt})$ is a density function of outside posted wages. Note that $S(\cdot)$ is a decreasing function of W_{jt}, i.e. $S'(W_{jt}) < 0$, since all of it's components are decreasing in W_{jt}; in other words, the firm's separation rate falls as the wage rises.

Analogously to the individual separation probabilities, there are probabilities that a matched worker is recruited into the firm conditional on whether the worker is employed or unemployed. Consider a worker employed at firm k that encounters firm j's vacancy. The probability that firm j successfully poaches the worker $r(W_{jt}, W_{kt})$ is:

$$r_{kj}(W_{kt}, W_{jt}) = \frac{\left(\tau\frac{W_{jt}}{P_t}\right)^\gamma}{\left(\tau\frac{W_{kt}}{P_t}\right)^\gamma + \left(\tau\frac{W_{jt}}{P_t}\right)^\gamma} = \frac{W_{jt}^\gamma}{W_{kt}^\gamma + W_{jt}^\gamma}, \tag{12}$$

which is increasing in W_{jt} and is a function of relative wages.

Now consider an unemployed worker who is matched with firm j's vacancy. The probability that the worker takes the job with firm j is defined as $r_{uj}(W_{jt})$ and is equal to

$$r_{uj}(W_{jt}) = \frac{\left(\tau \frac{W_{jt}}{P_t}\right)^{\gamma}}{\left(\frac{1}{\xi}\tau \frac{\bar{W}_t}{P_t}\right)^{\gamma} + \left(\tau \frac{W_{jt}}{P_t}\right)^{\gamma}} = \frac{W_{jt}^{\gamma}}{\left(\frac{\bar{W}_t}{\xi}\right)^{\gamma} + W_{jt}^{\gamma}}, \tag{13}$$

which is increasing in W_{jt}.

We can use this to write firm j's recruiting rate, defined as the share of vacancies that successfully result in hiring a worker is the following. Recalling that $g(\theta_t)$ denotes the probability that a vacancy is matched with a worker, and that $\phi_{E,t}$ and $\phi_{U,t}$ denote the share of searchers who are employed and unemployed, respectively, we can write the recruiting rate as:

$$R(W_{jt}) = g(\theta_t)\left(\phi_{E,t}\int_k r_{kj}(W_{kt}, W_{jt})\omega(W_{kt})dk + \phi_{U,t} r_{uj}(W_{jt})\right). \tag{14}$$

where $\omega(W_{kt})$ is the distribution of wages that workers are currently employed at. The recruiting rate $R(W_{jt})$ is an increasing function because all of its components r_{kj} and r_{uj} are also increasing in W_{jt}. In other words, a higher wage improves the firms odds of recruiting workers through its vacancies.

3.2 Equilibrium

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

$$1 + i_t = \Pi_{Y,t}^{\phi_{\Pi}}(1+\rho)(1+\varepsilon_{i,t}). \tag{15}$$

A symmetric equilibrium consists of sequences of all endogenous prices and quantities satisfying the assumptions that: (1) identical firms choose identical sequences such that $W_{jt} = W_t$, $N_{jt} = N_t$, $V_{jt} = V_t$, $P_{jt}^{Y} = P_t^{Y}$, (2) workers and households maximize utility, (3) firms maximize profits, (4) product markets clear, and (5) labor market flows add up.

We linearize these necessary conditions in a symmetric equilibrium around a non-stochastic steady state, and solve for the unique solution in Dynare. While there is a unique, symmetric equilibrium (for our given parameter values) we cannot rule out and leave unexplored the possibility of non-symmetric equilibria where *ex ante* identical firms choose different wages. The fact that we have one wage in equilibrium, while still having worker flows between unemployment and various firms due to idiosyncratic shocks, buys us a highly tractable dynamic model with on-the-job search.

Discussion In our baseline setting, changes to the price level P_t have no effect on individual workers' transition probabilities, and as such have no effect on separation and recruiting rates S

and R. In a symmetric equilibrium, the expressions for these rates simplify to

$$S_t = s + (1-s)\left(\lambda_{EE} f(\theta_t)\frac{1}{2} + \lambda_{EU}\left(\frac{1}{1+\xi^{\gamma}}\right)\right) \tag{16}$$

$$R_t = g(\theta_t)\left(\phi_{E,t}\frac{1}{2} + \phi_{U,t}\left(\frac{\xi^{\gamma}}{1+\xi^{\gamma}}\right)\right). \tag{17}$$

where we can now drop the dependence on the aggregate wage from our notation for S and R. Recall that the reason for the absence of the price level P in the separation rate (16) is fundamentally that the price level is irrelevant to a worker considering choosing between two different nominal wage offers. Also driving this result is the fact that we have assumed the price level is irrelevant for workers considering choosing between working and *unemployment*. This is because the households social insurance scheme fixes the relative consumption of employed and unemployed workers at ξ, which naturally appears in equation (16) and (17) above: the higher real consumption in employment is on average, the more likely unemployed workers are to prefer that state. Note that relaxing the assumption that consumption ratio ξ is constant will not change the result about pass through: the issue is that it does not depend on the price level, P_t. Fixing unemployment benefits at some nominal level, for example, would still result in the relative attractiveness of employment and unemployment being insensitive to the price level by the same logic that applies to employed workers choosing between nominal wages at two different jobs.

As a result, we will also explore what happens when we modify the model to allow the relative attractiveness of unemployment to rise along with the price level: Section 4.3, considers a variation of the worker and household problem above where the value of unemployment is not affected by the aggregate price level (i.e., unemployment benefits are fixed in real terms) while the real wages of employed workers remain affected by the price level. We show that in this setting there is some pass through of cost of living shocks X_t to real wages: as the price level rises, unemployment with its promise of some fixed value of consumption becomes more attractive. However, this pass through is quantitatively small in a model with on-the-job search calibrated to U.S. data. Because most searchers already have a job, the value of unemployment is not relevant for their job-taking decision, so changes in the price level are irrelevant as well. And while quits to unemployment may rise, and the job-taking rate from unemployment may fall, these are quantitatively small margins, given that in steady state few workers quit into unemployment and almost all workers move from unemployment into employment when given a chance. Thus, realistically incorporating on-the-job search limits the pass through of cost of living shocks to wages, as the next section will demonstrate.

4 Monetary Policy and Cost of Living Shocks in General Equilibrium

The section presents the main results, in which we log linearize a calibrated version of the model above and present impulse response functions for the effects of both demand shocks (i.e., monetary policy shock) and shocks to the cost of living (i.e., a shock to endowment good X_t). We choose standard values for most parameters, but this is not possible for some of the parameters governing the labor search block of the model: Table 1 lists the model's calibrated parameters, some of which are chosen to target moments in the data given in Table 2.

We then show that, in response to an expansionary monetary policy shock which lowers the interest rate, both nominal wage growth and job-to-job quits rise in tandem. Thus, this simple, tractable on-the-job-search model proves capable of delivering a positive comovement between nominal wage growth and job-to-job quits, as seen in Figure 2. Turning to cost of living shocks, we show in our baseline model that nominal wage growth, and the labor market in general, is unaffected by cost of living shocks in general equilibrium. The intuition from the partial equilibrium analysis suggests that this result stems from the fact that the firm's recruiting and separation elasticities do not depend on changes in the price level. This is because the relative desirability of unemployment in our benchmark case is unaffected by the aggregate price level.

Accordingly, this section also explores relaxing this last assumption, analyzing the effects of a cost of living shock in an alternative version of the model in which the relative desirability of unemployment *rises* when the price level rises: in this version, instead of having the household allocate resources to ensure the relative consumption of both employed and unemployed workers is constant over the business cycle, we allow unemployed households to receive some quantity of the aggregate consumption bundle which is fixed in *real terms*. This benefit becomes more valuable, relative to receiving a given nominal wage through employment, when the price level of the aggregate consumption bundle is high.

In this variant, we find that cost-of-living shocks now pass through to wages. When workers suddenly prefer unemployment more, then firms offer higher wages to discourage their workers from quitting into unemployment. However, the effect is quantitatively small in our calibrated model, because the pass through is significantly muted by the presence of on the-job-search. Intuitively, if firms mainly set wages viewing their competition as other firms (both for recruiting new workers and retaining existing workers), then the desirability of unemployment barely matters for their choice of the optimal wage. Given that on-the-job search is a quantitatively significant feature of the U.S. labor market, we conclude that the pass through of cost of living increases to wages is, equivalently, quantitatively insignificant as an amplification channel for inflationary shocks.

Finally, we also demonstrate how allowing on-the-job search probability to rise with the price level, calibrated to findings in Pilossoph and Ryngaert (2023), affects our analysis. We find

Table 1: 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 probability	Match voluntary EU rate, Qiu (2022)
ξ	2	consumption ratio, e vs. u	See Notes below
s	.01	exogenous separation rate	Match JOLTS monthly separation Rate
γ	6	variance^{-1} of idiosyncratic preferences	Match $\varepsilon_{R,W} - \varepsilon_{S,W}$
ϵ	10	elasticity of substitution of services	
ψ	100	services price adjustment cost	
ψ^w	100	wage adjustment cost	
η	1	services/food elasticity of substitution	
α_X	.2	food share in CES Utility	
χ	1	convexity in vacancy posting costs	Bloesch and Larsen (2023)
c	1.2	Hiring cost shifter	target V, U
ρ	.004	Discount Rate	Monthly model

Table 2: Selected Model Moments and Data in Steady State

Targeted 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 minus separation elasticities	4.4	4.2	Bassier et al. (2022)

Notes: We calibrate the model to match labor market flows of the US economy during 2015-2019 to capture the approximately full employment conditions that existed prior to the COVID shock. Data on the unemployment rate and separation rate come from the Bureau of Labor Statistics (BLS) and the Job Openings and Labor Turnover Survey (JOLTS). We set $\xi = 2$, higher than in Chodorow-Reich and Karabarbounis (2016) but closer to what maximizes steady-state utility for the household in our setting; the results are largely insensitive to changing this parameter.

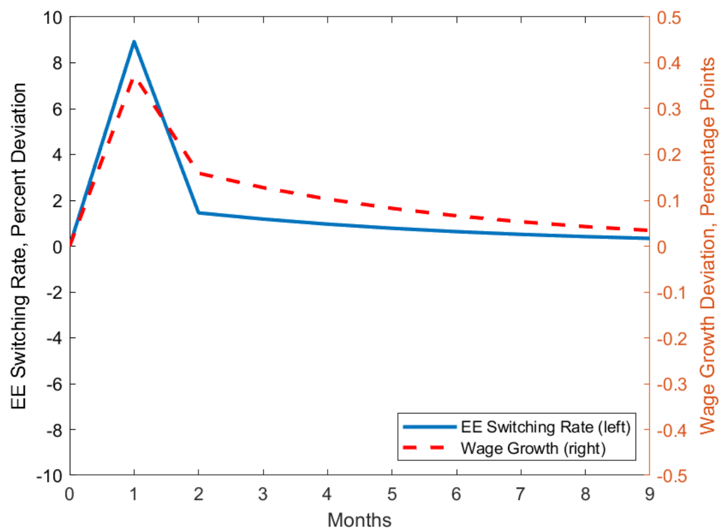
that assuming endogenous on-the-job search probability implies pass-through from cost-of-living shocks to wages in our setting, as firms raise wages to retain workers. However, we also highlight an offsetting general equilibrium effect: tightness falls with more workers searching, making it easier for firms to replace departing workers without raising wages. The net result is that the amount of pass-through remains small in our setting even under this modification.

4.1 Monetary Policy Shock

We first consider an expansionary monetary policy shock, subjecting the economy to a one period, 1 percent decrease in nominal interest rates, with a monthly persistence of 0.8. On impact, both nominal wage growth and employment-to-employment transitions increase. Lower nominal interest rates increase demand for consumption, which increases demand for labor. Firms post more vacancies, increasing opportunities for workers to find other jobs, which raises job-to-job transitions, while also increasing competition for workers, which raises wages. Appendix B.1 provides analytical results about employment-to-employment transitions and wage growth.

This result demonstrates that the model can rationalize comovements between quits and wage growth, documented in e.g., Faberman and Justiniano (2015); Moscarini and Postel-Vinay (2017), through demand shocks like monetary policy shocks.

Figure 3: Expansionary 1% Decrease in the Policy Rate

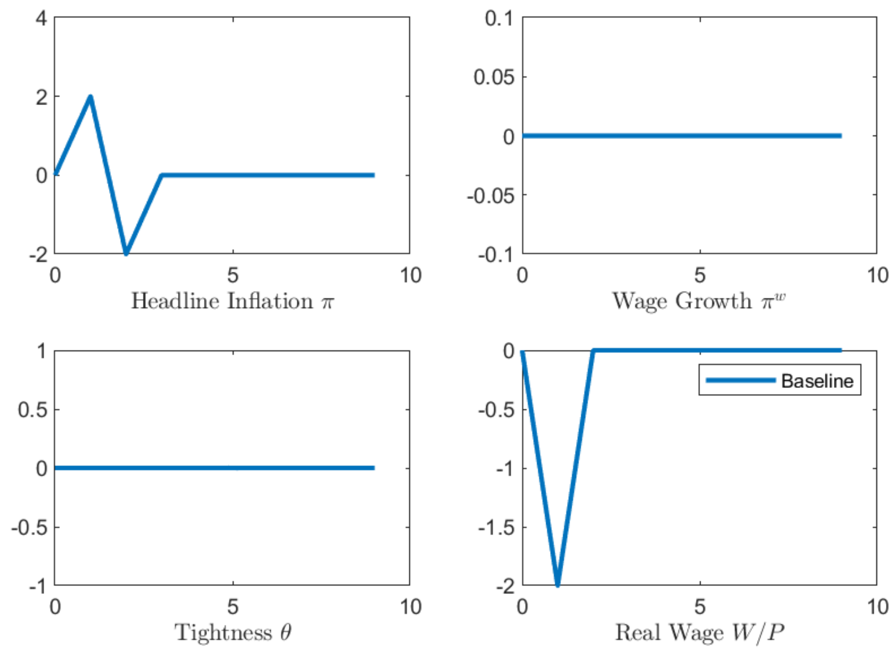


Notes: This figure plots the effects of a 1% decrease in nominal interest rates in our benchmark model. Both nominal wage growth and employment-to-employment transitions increase as lower nominal interest rates increase demand for consumption, which increases demand for labor. Firms post more vacancies, increasing opportunities for workers to find other jobs, which raises job-to-job transitions, while also increasing competition for workers, which raises wages. This result demonstrates that the model can rationalize comovements between quits and wage growth, documented in e.g., Faberman and Justiniano (2015); Moscarini and Postel-Vinay (2017), through demand shocks like monetary policy shocks.

4.2 Cost of Living Shocks

Next, we subject the economy to a 10% quantity shock of the endowment good X. Given the assumption of a unit elasticity between services and goods in final aggregation, i.e., $\eta = 1$, this implies a 10% relative price shock to good X and an increase in the overall price index P_t. Additionally, we assume that the central bank leaves nominal interest rates fixed: given the household's Euler equation (8) and that fact that $\eta = 1$ implies constant expenditure shares, this experiment effectively holds aggregate demand for services constant; see Appendix B for details, which works through this same experiment in a simplified two-period version of the model and provides analytical results. This setting allows us to isolate how firms' wage posting channel and on-the-job search of workers affect pass-through from cost-of-living shocks to wages.

Figure 4: Impulse Response to a 10% Negative Shock to Supply of Endowment Good X



Notes: This Figure presents the effects of a decreased supply of the endowment good X under a nominal interest rate peg. Given the assumption of a unit elasticity between services and goods in final aggregation, this implies a 10% relative price shock to good X and an increase in the overall price index P_t. Given the household's Euler equation and constant expenditure shares, the nominal interest rate peg experiment effectively holds aggregate demand for services constant (see Appendix B). Thus, workers marginal revenue product is unchanged by the shock. Since the shock also does not affect the relative attractiveness of unemployment and working, the recruiting and separation elasticities faced by firms are also unchanged as discussed in Section 4: the result is no change in vacancy posting, no change in tightness, and no change in the *nominal* wage, which causes *real* wages to fall as shown in the last panel.

Because the shock has no aggregate demand effects under this specification for preferences (i.e., log-preference and $\eta = 1$) and monetary policy, and only raises the price level, the intuition in the partial equilibrium analysis above can still be valid, and the prediction that wages will be unchanged by the shock is born out in Figure 4, which shows the response of headline inflation and nominal wage growth to the cost of living shock. Since the shock does not affect the relative attractiveness of unemployment and working, the recruiting and separation elasticities faced by firms are unchanged: there is no change in vacancy posting, no change in tightness, and no change in the *nominal* wage, which causes *real* wages to fall as shown in the last panel of Figure

4.

The following Section 4.3 considers the same experiment while relaxing the assumption that the relative desirability of unemployment and employment is held fixed by the household, allowing the relative desirability of unemployment to rise along with the price level, showing how on-the-job search mutes the pass-through from wages to prices.

4.3 Cost of Living Shocks with Inflation-Indexed Unemployment Benefits

The goal of this section is to alter the model so that the relative desirability of unemployment rises along with the price level for a given nominal wage. To do so, we now assume that households do not fix the ratio of consumption between employed and unemployed workers, but guarantees unemployed workers some inflation-indexed quantity of consumption, b. Thus, for a given nominal wage, an increase in the price level will raise the relative consumption of unemployed agents, making unemployment more desirable.

It is worth mentioning at this point that simply assuming workers derive some utility from leisure, as well as consumption, and that leisure utility is systematically higher while unemployed, does not necessarily mean that workers will value unemployment more when the price level is high: Appendix A.1 demonstrates that if leisure and consumption have an elasticity of substitution of one, then changes in the price level have no effect on the relative desirability of employment for a given nominal wage. Since goal of this section is to alter the model so that the relative desirability of unemployment rises along with the price level for a given nominal wage, we proceed by continuing to assume that workers value only consumption and the independently and identically distributed preference shock ι.

To see this, note that the probability that a worker separates from employment to unemployment is now

$$s_{ju}(W_{jt}) = \frac{b^\gamma}{\left(\frac{W_{jt}}{P_t}\right)^\gamma + b^\gamma}.$$

Note that the separation rate from employment to unemployment now depends on the price level: at a given nominal wage, higher prices unemployment attractive. Similarly, the new recruiting function from unemployment is

$$r_{uj}(W_{jt}) = \frac{\left(\frac{W_{jt}}{P_t}\right)^\gamma}{\left(\frac{W_{jt}}{P_t}\right)^\gamma + b^\gamma}.$$

Where now we can see that a higher price level makes recruiting from unemployment more difficult at a given nominal wage, by the same logic.

In a symmetric equilibrium, the separation and recruiting rates are

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

and

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

Unlike in equations (16) and (17), the price level does affect the recruiting and separation rates via the probability of quitting into unemployment and the probability of successfully recruiting unemployed workers.

We can solve this model given a choice for unemployment benefit b instead of ξ; we set $b = 0.4$ which results in a steady-state consumption ratio for employed to unemployed agents of 2, so that this moment is the same at the steady state as in the benchmark model with $\xi = 2$.[17] All the other model equations (i.e. the firm's problem and the Taylor rule) remain unchanged; Appendix A.4 shows how to derive an Euler equation in this setting which is identical to that used above, given appropriate assumptions on the representative household's optimization problem.

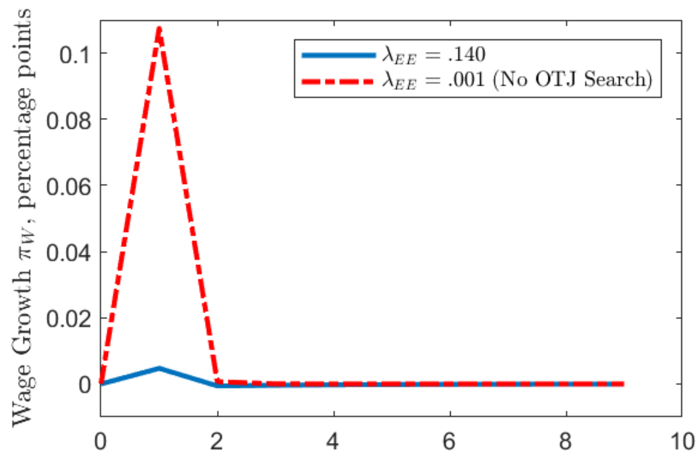
Result and the Role of λ_{EE} Having solved the log-linearized model, Figure 5 presents the impulse response function of wage growth in the model: in the solid blue line, which follows our benchmark calibration, we see that the effect on wage growth is quantitatively small. Intuitively, this is because the increase in the desirability of unemployment is not relevant to firms who quantitatively care mainly about the risk of losing workers to other firms, and recruiting workers on the job, than about quits to unemployment, which our baseline model assumes is rare as in U.S. data.

To illustrate the importance of on-the-job search in delivering this result, we also estimate the impulse response function in the version of the model without on-the-job search, where the probability of being allowed to search on the job λ_{EE} is nearly zero, given by the red dashed line, finding that the response of wages is considerably larger. When λ_{EE} is low, firms' main concern when deciding wages becomes attracting unemployed workers into employment and discouraging quits to unemployment since unemployment is more attractive. Thus, firms raise

[17] Recall from the discussion in Table 1 that this calibrated consumption ratio of 2:1 is higher than in Chodorow-Reich and Karabarbounis (2016) but closer to what maximizes steady-state utility for the household. While the benchmark model results are insensitive to changing ξ, modifying the model to allow for pass-through from cost of living shocks to wages as we do here means changes in b matter: lowering b might raise or reduce the pass-through of cost of living to wages depending on λ_{EE}, but does not affect the result that on-the-job search mutes this pass-through; see Appendix B.2 for analytical characterizations. Quantitatively, changes in b do not affect the level of pass-through much.

wage more aggressively in response to a cost-of-living shock.[18]

Figure 5: Impulse Response with Inflation-Indexed Unemployment Benefits



Notes: This Figure presents the effects of a decreased supply of the endowment good X under a nominal interest rate peg, as in Figure 4, in a variant of the benchmark model where increased cost of living raises the desirability of unemployment described in Section 4.3. While there is now some pass through from the cost of living shock to wages, on-the-job search significantly dampens this result, as can be seen by comparing the results in calibrations where the on-the-job serach probability, λ_{EE} is calibrated to match U.S. data (the solid blue line) to a calibration where workers are almost never allowed to search on the job (the dashed red line).

4.4 Cost of Living Shocks With Variable On-the-Job Search Intensity

Our baseline model features an exogenous, constant on-the-job search probability of λ_{EE}, which we calibrate to match U.S. data. However, it is possible that employed workers may respond to a higher price level by searching more intensely, and Pilossoph and Ryngaert (2023) provide evidence that this is indeed the case.

Motivated by their findings, we solve a version of the model where λ_{EE} is assumed to rise along with inflation according to a reduced form, *ad hoc* relationship calibrated to match the results in Pilossoph and Ryngaert (2023). Specifically, we assume:

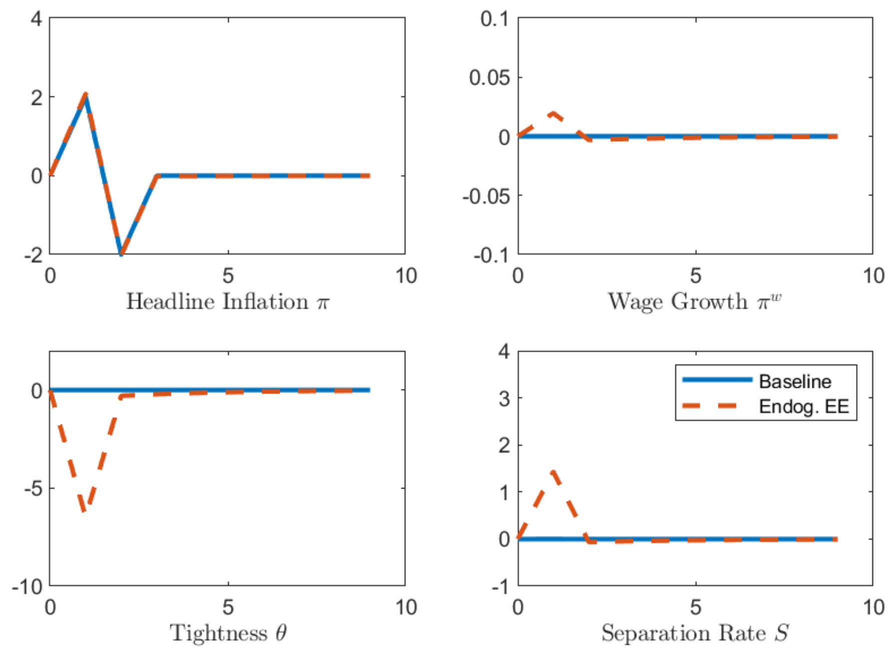
$$\lambda_{EE,t} = \lambda_{EE,0} \left(\frac{W_t}{P_t} \right)^{-m}$$

where $\lambda_{EE,0}$ is chosen to target the same steady-state value for λ_{EE} as in the benchmark model, and $m = 4$ to match the fact that Pilossoph and Ryngaert (2023) find that in response to a one percentage point increase in inflation expectations (and thus a 1% decline in expect real wages),

[18] Appendix B demonstrates this result analytically in a simplified 2-period version of the quantitative model.

the probability that an employed worker searches on the job rises by 0.57 percentage points.[19] With a share of 14.9% of employed workers typically searching, this represents a (0.0057/0.149) $\approx$ 4 percent increase in search probability, yielding an elasticity of search probability with respect to expected real wages of -4.

Figure 6: Impulse Response with Endogenous On-the-Job Search



Notes: This figure presents the effects of a decreased supply of the endowment good X under a nominal interest rate peg, i.e. the same experiment as in Figure 4, but comparing the benchmark case (solid blue line) to the case described in Section 4.4 where the job-to-job search probability increases along with the price level (dashed red line). In this second model, as on-the-job search rises, separations rise, inducing firms to raise wages to retain workers. But at the same time, tightness θ_t falls due to the increasing number of searchers, pushing firms to lower wages. The net effect is the modest increase in wages in the top right panel, so that overall there is very little pass-through from wages to prices even when the probability of on-the-job search rises in response to lower real wages. Note that the axes are in percent deviations, so the axis for wage growth is comparable to Figure 5.

We then revisit the response in the model to a shock to the quantity of the endowment good X. Note that here, there are two contrasting effects of allowing for endogenous on-the-job search probability. In response to the inflationary shock, workers search more which induces firms to raise wages in order to retain workers (more searchers means more workers find jobs they prefer to their current job, due to the idiosyncratic preference shocks over workplaces). However, as separation rates rise, so do recruiting rates: with more searchers, tightness falls, meaning that

[19]See equation (3) and accompanying Table 3 of Pilossoph and Ryngaert (2023).

firms can afford to lower wages and still recruit the same number of workers are before. Figure 6 plots the impulse responses of headline inflation, wage growth, labor market tightness, and the separation rate to the shock to the quantity of endowment good X. We can see the net effect of the shock an extremely limited pass-through from cost-of-living to wages: separations and wage growth rise, pushing firms to want to raise wages, but on the other side tightness θ_t falls due to the increasing number of searchers, pushing firms to want to lower wages.

5 Conclusion

This paper develops a tractable, dynamic extension of Bloesch and Larsen (2023), in which firms post wages and workers search on the job, to investigate the effect on wages of a pure cost of living shock, i.e., a shock that raises the price of households' consumption bundle without affecting the marginal product of labor. In the model, if an increase in the cost of living makes unemployment more attractive, firms are forced to raise wages to retain workers, theoretically delivering some pass through from cost of living to wages.

Incorporating on-the-job search in this model allows it to capture a key feature of US wage growth: that job-to-job transitions closely track nominal wage growth over the business cycle. At the same time, we show quantitatively that allowing workers to search on-the-job in the model dramatically weakens this channel by making competition for already-employed workers the primary force in wage determination. Allowing for an endogenous on-the-job search probability that responds to the value of real wages generates only modest nominal wage increases in response to higher cost of living, as greater search activity lowers labor market tightness in general equilibrium and decreases the incentive for firms to raise wages.

Our results suggest that in a setting such as the United States where few workers operate under collective bargaining agreements with cost of living adjustments, and where firms post wages and on-the-job search is common, the ability for workers to reclaim real wages in response to supply shocks is limited. While this paper explored a one sector model where workers were myopic, the results suggest that there is little ability for inflation to propagate into sectors unaffected by adverse supply shocks, and that higher worker inflation expectations will also barely matter for firm wage setting. In short, there seems to be little scope for supply shock-induced wage-price spirals fueled by workers demanding higher nominal wages in response to higher nominal prices.

References

Addario, Sabrina Di, Patrick Kline, Raffaele Saggio, and Mikkel Sølvsten, "It Ain't Where You're From, It's Where You're At: Hiring Origins, Firm Heterogeneity, and Wages," *Journal of*

Econometrics, 2023, *233* (2), 340–374.

Bassier, Ihsaan, Arindrajit Dube, and Suresh Naidu, "Monopsony in Movers: The Elasticity of Labor Supply to Firm Wage Policies," *Journal of Human Resources*, 2022, *57* (S), S50–s86.

Birinci, Serdar, Fatih Karahan, Yusuf Mercan, and Kurt See, "Labor Market Shocks and Monetary Policy," *FRB St. Louis Working Paper*, 2022, (2022-16).

Bloesch, Justin and Birthe Larsen, "When do Firms Profit from Wage Setting Power?," 2023. Working Paper.

_ **and Jacob Weber**, "Congestion in Onboarding Workers and Sticky R&D," *Available at SSRN 4465590*, 2023.

Chodorow-Reich, Gabriel and Loukas Karabarbounis, "The Cyclicality of the Opportunity Cost of Employment," *Journal of Political Economy*, 2016, *124* (6), 1563–1618.

Christiano, Lawrence J, Martin S Eichenbaum, and Mathias Trabandt, "Unemployment and business cycles," *Econometrica*, 2016, *84* (4), 1523–1569.

de la Barrera i Bardalet, Marc, "Monopsony in New Keynesian Models," 2023. Working Paper.

Elsby, Michael W, Bart Hobijn, and Aysegul Sahin, "The Labor Market in the Great Recession," Technical Report, National Bureau of Economic Research 2010.

Erceg, Christopher J, Dale W Henderson, and Andrew T Levin, "Optimal monetary policy with staggered wage and price contracts," *Journal of monetary Economics*, 2000, *46* (2), 281–313.

Faberman, R Jason and Alejandro Justiniano, "Job Switching and Wage Growth," *Chicago Fed Letter*, 2015.

Faccini, Renato and Leonardo Melosi, "Job-to-job Mobility and Inflation," *The Review of Economics and Statistics*, 2023, pp. 1–45.

Gagliardone, Luca and Mark Gertler, "Oil Prices, Monetary Policy and Inflation Surges," 2023. NBER Working Paper 31263.

Hall, Robert E and Alan B Krueger, "Evidence on the Incidence of Wage Posting, Wage Bargaining, and On-the-Job Search," *American Economic Journal: Macroeconomics*, 2012, *4* (4), 56–67.

Heise, Sebastian and Tommaso Porzio, "Labor Misallocation Across Firms and Regions†," 2023. Working Paper.

Jäger, Simon, Benjamin Schoefer, Samuel Young, and Josef Zweimüller, "Wages and the Value of Nonemployment," *The Quarterly Journal of Economics*, 2020, *135* (4), 1905–1963.

Lachowska, Marta, Alexandre Mas, Raffaele Saggio, and Stephen A Woodbury, "Wage Posting or Wage Bargaining? A Test using Dual Jobholders," *Journal of Labor Economics*, 2022, *40* (S1), S469–S493.

Lorenzoni, Guido and Iván Werning, "Inflation is conflict," Technical Report, National Bureau of Economic Research 2023.

_ and _ , "Wage-Price Spirals," Technical Report, National Bureau of Economic Research 2023.

Moscarini, Giuseppe and Fabien Postel-Vinay, "Wage Posting and Business Cycles," *American Economic Review*, 2016, *106* (5), 208–213.

_ and _ , "The Relative Power of Employment-to-Employment Reallocation and Unemployment Exits in Predicting Wage Growth," *American Economic Review*, 2017, *107* (5), 364–368.

Pilossoph, Laura and Jane M. Ryngaert, "Job Search, Wages, and Inflation," *Working Paper*, 2023.

_ , Jane M Ryngaert, and Jesse Wedewer, "Job Search, Raises, and Inflation," 2023. Working Paper.

Qiu, Xincheng, "Vacant Jobs," 2022. Working Paper.

Rotemberg, Julio J., "Sticky Prices in the United States," *Journal of Political Economy*, 1982, *90* (6), 1187–1211.

A Derivations and Proofs

A.1 Worker's Problem with Utility From Leisure

This section reviews the worker's problem in Bloesch and Larsen (2023) used in the main text, deriving the probability a worker chooses a particular job j over outside offer k or unemployment. We then show that allowing for utility from leisure, as well as consumption, will not generally overturn the result that the price level does not affect the worker's optimal choice unless the elasticity of substitution between leisure and consumption is different from one.

Discrete choice with Type-1 extreme value preference draws Suppose worker i in state j (which could be working at firm j, for example), gets utility $\mathcal{U}(ijt)$ plus a draw ι_{ijt} that is distributed type-1 extreme value:

$$\mathcal{V}(ijt) = \mathcal{U}(ijt) + \iota_{ijt}$$

Let ι_{ijt} have variance $1/\gamma$. Then given options two states j and k, the probability that the worker chooses j is

$$\frac{\exp(\gamma\mathcal{U}(ijt))}{\exp\left(\gamma\mathcal{U}(ijt)\right) + \exp\left(\gamma\mathcal{U}(ikt)\right)}.$$

Suppose now that utility $\mathcal{U}$ is a function of log consumption: $\mathcal{U}(ijt) = ln(C(ijt))$. This is the case in the main text. Then the probability of choosing j is

$$\frac{C(ijt)^\gamma}{C(ijt)^\gamma + C(ikt)^\gamma}.$$

Case with a more general utility function Consider now the more general form

$$\mathcal{V}(ijt) = ln\Big(U\left(C(ijt), \ell(ijt)\right)\Big) + \iota_{ijt}$$

where ℓ_{ijt} is the leisure i gets in state j at time t, which nests the above case. For simplicity, denote utility while unemployed by $U\left(C(iut), \ell(iut)\right)$, and while employed by $U\left(C(iet), \ell(iet)\right)$; then the probability of an unemployed worker taking a job when matched is now:

$$\frac{1}{1 + \left(\frac{U(C(iut),\ell(iut))}{U(C(iet),\ell(iet))}\right)^\gamma} \tag{A.1}$$

Proposition 1 *In partial equilibrium (i.e. holding all other equilibrium prices and quantities fixed) the probability that an unemployed worker takes a job in our general setting, (A.1), is invariant to changes in the price level P_t if and only if $\frac{\partial}{\partial P_t}\frac{U(C(iut),\ell(iut))}{U(C(iet),\ell(iet))} = 0$.*

CES preference To make progress, consider the case with CES preferences: $U = \left(aC^{\frac{\rho-1}{\rho}} + (1-a)\ell^{\frac{\rho-1}{\rho}}\right)^{\frac{\rho}{\rho-1}}$ where ρ is the elasticity of substitution. First write $U(C,\ell) = U(I/P,\ell)$, imposing that $C = I/P$ for both types, who differ only in the nominal spending ability I (i.e. I_e for employed and I_u for unemployed)[1] Noting constant returns to scale (CRS) yields

$$\frac{U\left(\frac{I(iut)}{P},\ell(iut)\right)}{U\left(\frac{I(iet)}{P},\ell(iet)\right)} = \frac{U\left(I(iut),P\ell(iut)\right)}{U\left(I(iet),P\ell(iet)\right)},$$

and using the property of CES functions: $\frac{\partial}{\partial P}U(I,P\ell) = (1-a)U(\cdot)^{\frac{1}{\rho}}(P\ell)^{-\frac{1}{\rho}}l$, we can show:

$$\frac{\partial}{\partial P_t}\frac{U\left(\frac{I(iut)}{P_t},\ell(iut)\right)}{U\left(\frac{I(iet)}{P_t},\ell(iet)\right)} = \frac{(1-a)P_t^{\frac{1}{\rho}}}{U(I(iet),P_t\ell(iet))} \cdot \left[U(I(iut),P_t\ell(iut))^{\frac{1}{\rho}}\ell(iut)^{1-\frac{1}{\rho}} - U(I(iet),P_t\ell(iet))^{\frac{1}{\rho}}\ell(iet)^{1-\frac{1}{\rho}}\frac{U(I(iut),P_t\ell(iut))}{U(I(iet),P_t\ell(iet))}\right]$$

which becomes 0 when $\rho \to 1$, i.e. the Cobb-Douglas case. Therefore, under the unit elasticity of substitution between consumption and leisure, Proposition 1 still holds.

A.2 Firm's Problem and Derivation of the wage Phillips curve in (6)

The firm's problem is:[2]

$$\max_{\substack{\{P^j_{y,t}\},\{N_{jt}\}\\ \{W_{jt}\},\{V_{j,t}\}}} \sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^t \left(P^j_{y,t}Y^j_t - W_{jt}N_{jt} - c\left(\frac{V_{j,t}}{N_{j,t-1}}\right)^{\chi}V_{j,t}W_t - \frac{\psi}{2}\left(\frac{P^j_{y,t}}{P^j_{y,t-1}}-1\right)^2 Y^j_t P^j_{y,t} - \frac{\psi^w}{2}\left(\frac{W_{jt}}{W_{j,t-1}}-1\right)^2 W_{jt}N_{jt}\right) \tag{A.2}$$

subject to

$$N_{jt} = (1-S(W_{jt}))N_{j,t-1} + R(W_{jt})V_{j,t}. \tag{A.3}$$

We will have that physical output is produced with labor with the linear production: $Y^j_t = A^j_t N_{jt}$, and Dixit-Stiglitz demand, so $\frac{Y^j_t}{Y_t} = \left(\frac{P^j_{y,t}}{P_{y,t}}\right)^{-\epsilon}$, hence $N_{jt} = \left(\frac{P^j_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^j_t}$ with $\epsilon > 1$. The Lagrangian

[1] Here, the result does not depend on the case where we impose a tax-and-transfer scheme to keep $I_e/I_u = C_e/C_u$ constant over the business cycle as in Section 3.1.

[2] Note that we assume that vacancy costs are denominated in labor; see Bloesch and Weber (2023) for microfoundations. We also use the aggregate wage W_t rather than the firm-specific wage W_{jt} to simplify the firm's wage setting problem and its interpretation.

then can be written as:

$$
\begin{aligned}
\mathcal{L} = \sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^{t} \Bigg(& (P^{j}_{y,t})^{1-\epsilon}\left(P_{y,t}\right)^{\epsilon} Y_t - W_{jt}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^{j}_{t}} - c\left(V_{j,t}\right)^{1+\chi}\left(\frac{P^{j}_{y,t-1}}{P_{y,t-1}}\right)^{\epsilon\chi}\left(\frac{Y_{t-1}}{A^{j}_{t-1}}\right)^{-\chi} W_t \\
& - \frac{\psi}{2}\left(\frac{P^{j}_{y,t}}{P^{j}_{y,t-1}}-1\right)^{2}\left(P^{j}_{y,t}\right)^{1-\epsilon}\left(P_t\right)^{\epsilon} Y_t - \frac{\psi^{w}}{2}\left(\frac{W_{jt}}{W_{j,t-1}}-1\right)^{2} W_{jt}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^{j}_{t}} \\
& + \lambda^{j}_{t}\left[-\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^{j}_{t}} + V_{j,t}R(W_{jt}) + (1-S(W_{jt}))\left(\frac{P^{j}_{y,t-1}}{P_{y,t-1}}\right)^{-\epsilon}\frac{Y_{t-1}}{A^{j}_{t-1}}\right]\Bigg).
\end{aligned}
$$

The first order conditions are:

$$
\begin{aligned}
\mathcal{L}_{W_{jt}} = & -\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^{j}_{t}} + \lambda^{j}_{t}\left(V_{j,t}R'(W_{jt}) - S'(W_{jt})\left(\frac{P^{j}_{y,t-1}}{P_{y,t-1}}\right)^{-\epsilon}\frac{Y_{t-1}}{A^{j}_{t-1}}\right) - \frac{\psi^{w}}{2}\left(\frac{W_{jt}}{W_{j,t-1}}-1\right)^{2}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^{j}_{t}} \\
& - \psi^{w}\left(\frac{W^{j}_{t}}{W_{j,t-1}}-1\right)\frac{1}{W_{j,t-1}} W_t N_{jt} + \frac{1}{1+\rho}\psi^{w}\left(\frac{W_{j,t+1}}{W_{jt}}-1\right)\frac{W^{j}_{t+1}}{(W_{jt})^{2}} W_{j,t+1}N_{j,t+1} = 0. \quad \text{(A.4)}
\end{aligned}
$$

and

$$
\mathcal{L}_{V_{j,t}} = -c(1+\chi)(V_{j,t})^{\chi}\left(\frac{P^{j}_{y,t-1}}{P_{y,t-1}}\right)^{\epsilon\chi}\left(\frac{Y_{t-1}}{A^{j}_{t-1}}\right)^{-\chi} W_t + \lambda^{j}_{t}R(W_{jt}) = 0. \quad \text{(A.5)}
$$

$$
\begin{aligned}
\mathcal{L}_{P^{j}_{y,t}} = & (1-\epsilon)\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon} Y_t + \epsilon W_{jt}\left(P^{j}_{y,t}\right)^{-1}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^{j}_{t}} - \frac{c\epsilon}{1+\rho}\chi\left(V_{j,t+1}\right)^{1+\chi}\left(P^{j}_{y,t}\right)^{-1}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{\epsilon\chi}\left(\frac{Y_t}{A^{j}_{t}}\right)^{-\chi} W_{t+1} \\
& - \psi\left(\frac{P^{j}_{y,t}}{P^{j}_{y,t-1}}-1\right)\frac{1}{P^{j}_{y,t-1}}(P^{j}_{y,t})^{1-\epsilon}P^{\epsilon}_{y,t}Y_t - (1-\epsilon)\frac{\psi}{2}\left(\frac{P^{j}_{y,t}}{P^{j}_{y,t-1}}-1\right)^{2}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon} Y_t \\
& + \frac{1}{1+\rho}\psi\left(\frac{P^{j}_{t+1}}{P^{j}_{t}}-1\right)\frac{P^{j}_{t+1}}{\left(P^{j}_{y,t}\right)^{2}}\left(P^{j}_{t+1}\right)^{1-\epsilon} P^{\epsilon}_{t+1}Y_{t+1} \\
& + \epsilon\frac{\psi^{w}}{2}\left(\frac{W_{jt}}{W_{j,t-1}}-1\right)^{2}\frac{W_{jt}}{P_{y,t}}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon-1}\frac{Y_t}{A^{j}_{t}} \\
& + \lambda^{j}_{t}\epsilon\left(P^{j}_{y,t}\right)^{-1}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^{j}_{t}} - \frac{1}{1+\rho}\lambda^{j}_{t+1}\epsilon(1-S(W_{j,t+1}))(P^{j}_{y,t})^{-1}\left(\frac{P^{j}_{y,t}}{P_{y,t}}\right)^{-\epsilon}\frac{Y_t}{A^{j}_{t}} = 0.
\end{aligned}
$$

(A.6)

Equilibrium We focus on one particular equilibrium where $P^j_{y,t} = P_{y,t}$, $V_{j,t} = V_t$, $W_{jt} = W_t$, $A^j_t = A_t \; \forall j$. Then we can summarize the above equations as follows:

<u>**FOC on Wages in (A.4)**</u>:

$$-N_t + \lambda_t \left(V_t R'(W_t) - N_{t-1} S'(W_t)\right) - \psi^w (\Pi^w_t - 1)\Pi^w_t N_t - \frac{\psi^w}{2} \underbrace{(\Pi^w_t - 1)^2 N_t}_{\simeq 0}$$
$$+ \frac{1}{1+\rho} \psi^w \left(\Pi^w_{t+1} - 1\right) \left(\Pi^w_{t+1}\right)^2 N_{t+1} = 0,$$

where we define the aggregate wage inflation $\Pi^w_t = \frac{W_t}{W_{t-1}}$ and approximate with $(\Pi^w_t - 1)^2 \simeq 0$. Multiplying the second term by $\frac{W_t}{W_t} \frac{P_{y,t}}{P_{y,t}}$ yields:

$$-N_t + \frac{\lambda_t}{P_{y,t}} \left(\frac{W_t}{P_{y,t}}\right)^{-1} \left(V_t R'(W_t) W_t - N_{t-1} S'(W_t) W_t\right) - \psi^w \left(\Pi^w_t - 1\right) \Pi^w_t N_t + \frac{1}{1+\rho} \psi^w \left(\Pi^w_{t+1} - 1\right) \left(\Pi^w_{t+1}\right)^2 N_{t+1} = 0 \tag{A.7}$$

This is important so that we have the real wage and real Lagrange multiplier, i.e., $\frac{\lambda_t}{P_{y,t}}$ in our equilibrium equations

<u>**FOC on vacancies in (A.5)**</u>:

$$-c(1+\chi) V^\chi_t \left(\frac{Y_{t-1}}{A_{t-1}}\right)^{-\chi} W_t + \lambda_t R(W_t) = 0.$$

Dividing both sides by the price level gives and replacing $\frac{Y_{t-1}}{A_{t-1}} = N_{t-1}$:

$$-c(1+\chi) \left(\frac{V_t}{N_{t-1}}\right)^\chi \frac{W_t}{P_{y,t}} + \frac{\lambda_t}{P_{y,t}} R(W_t) = 0. \tag{A.8}$$

Plugging in (A.8) into (A.7) and rearranging gives:

$$N_t + \psi^w \left(\Pi^w_t - 1\right) \Pi^w_t N_t = c(1+\chi) \left(\frac{V_t}{N_{t-1}}\right)^\chi \frac{1}{R(W_t)} \left(V_t R'(W_t) W_t - N_{t-1} S'(W_t) W_t\right)$$
$$+ \frac{1}{1+\rho} \psi^w \left(\Pi^w_{t+1} - 1\right) (\Pi^w_{t+1})^2 N_{t+1}$$
$$= c(1+\chi) \left(\frac{V_t}{N_{t-1}}\right)^\chi \left(V_t \underbrace{\frac{R'(W_t) W_t}{R(W_t)}}_{\equiv \varepsilon_{R,W_t}} - N_{t-1} \frac{S(W_t)}{R(W_t)} \underbrace{\frac{S'(W_t) W_t}{S(W_t)}}_{\equiv \varepsilon_{S,W_t}} \right)$$
$$+ \frac{1}{1+\rho} \psi^w \left(\Pi^w_{t+1} - 1\right) (\Pi^w_{t+1})^2 N_{t+1}.$$

Dividing by N_t in both sides, we obtain

$$\psi^w \left(\Pi_t^w - 1\right) \Pi_t^w + 1 = c(1+\chi) \left(\frac{V_t}{N_{t-1}}\right)^\chi \left(\frac{V_t}{N_t}\varepsilon_{R,W_t} - \frac{N_{t-1}}{N_t}\frac{S(W_t)}{R(W_t)}\varepsilon_{S,W_t}\right) + \frac{1}{1+\rho}\psi^w \left(\Pi_{t+1}^w - 1\right) \left(\Pi_{t+1}^w\right)^2 \frac{N_{t+1}}{N_t}, \tag{A.9}$$

which is the wage Phillips curve in our model.

<u>**FOC on pricing in (A.6)**</u>:

$$\begin{aligned}
(1-\epsilon)&+\epsilon\frac{W_t}{P_{y,t}}A_t^{-1} - \frac{1}{1+\rho}c\epsilon\chi\left(V_{t+1}\right)^{1+\chi}\frac{P_{y,t+1}}{P_{y,t}}\frac{W_{t+1}}{P_{y,t+1}}Y_t^{-1-\chi}A_t^\chi + \epsilon\frac{\psi^w}{2}\underbrace{\left(\Pi_t^w-1\right)^2}_{\simeq 0}\frac{W_t}{P_{y,t}}N_t \\
&-\psi\left(\frac{P_{y,t}}{P_{y,t-1}}-1\right)\frac{P_{y,t}}{P_{y,t-1}} - (1-\epsilon)\frac{\psi}{2}\underbrace{\left(\frac{P_{y,t}}{P_{y,t-1}}-1\right)^2}_{\simeq 0} + \frac{1}{1+\rho}\psi\left(\frac{P_{y,t+1}}{P_{y,t}}-1\right)\left(\frac{P_{y,t+1}}{P_{y,t}}\right)^2\frac{Y_{t+1}}{Y_t} \\
&+\frac{\lambda_t}{P_{y,t}}\epsilon A_t^{-1} - \frac{1}{1+\rho}\frac{\lambda_{t+1}}{P_{y,t+1}}\frac{P_{y,t+1}}{P_{y,t}}\epsilon(1-S(W_{t+1}))A_t^{-1} = 0,
\end{aligned} \tag{A.10}$$

where we use $(\frac{P_{y,t+1}}{P_{y,t}}-1)^2 \approx 0$ as above. If we define the service inflation $\frac{P_{y,t}}{P_{y,t-1}} = \Pi_{Y,t}$, (A.10) can be written as

$$\begin{aligned}
(1-\epsilon) &+ \epsilon\frac{W_t}{P_{y,t}}A_t^{-1} - \frac{1}{1+\rho}c\epsilon\chi\left(\frac{V_{t+1}}{N_t}\right)^{1+\chi}\Pi_{Y,t+1}A_t^{-1}\frac{W_{t+1}}{P_{y,t+1}} - \psi(\Pi_{Y,t}-1)\Pi_{Y,t} \\
&+\frac{1}{1+\rho}\psi\left(\Pi_{Y,t+1}-1\right)\left(\Pi_{Y,t+1}\right)^2\frac{Y_{t+1}}{Y_t} + \frac{\lambda_t}{P_{y,t}}\epsilon A_t^{-1} - \frac{1}{1+\rho}\frac{\lambda_{t+1}}{P_{yt+1}}\Pi_{Y,t+1}\epsilon(1-S(W_{t+1}))A_t^{-1} = 0.
\end{aligned}$$

Dividing both sides by $-\epsilon$ yields:

$$\begin{aligned}
\frac{\epsilon-1}{\epsilon} &- \frac{W_t}{P_{y,t}}A_t^{-1} + \frac{1}{1+\rho}c\chi\left(\frac{V_{t+1}}{N_t}\right)^{1+\chi}\Pi_{Y,t+1}A_t^{-1}\frac{W_{t+1}}{P_{y,t+1}} + \frac{\psi}{\epsilon}(\Pi_{Y,t}-1)\Pi_{Y,t} \\
&-\frac{1}{1+\rho}\frac{\psi}{\epsilon}(\Pi_{Y,t+1}-1)\Pi_{Y,t+1}^2\frac{Y_{t+1}}{Y_t} - \frac{\lambda_t}{P_{y,t}}A_t^{-1} + \frac{1}{1+\rho}\frac{\lambda_{t+1}}{P_{y,t+1}}\Pi_{Y,t+1}(1-S(W_{t+1}))A_t^{-1} = 0.
\end{aligned}$$

Further rearranging gives:

$$\begin{aligned}
\frac{\psi}{\epsilon}(\Pi_{Y,t}-1)\Pi_{Y,t} + \frac{\epsilon-1}{\epsilon} =& \frac{W_t}{P_{y,t}}A_t^{-1} + \frac{1}{1+\rho}\frac{\psi}{\epsilon}(\Pi_{Y,t+1}-1)\Pi_{Y,t+1}^2\frac{Y_{t+1}}{Y_t} \\
&+ A_t^{-1}\left(-\frac{c\chi}{1+\rho}\left(\frac{V_{t+1}}{N_t}\right)^{1+\chi}\Pi_{Y,t+1}\frac{W_{t+1}}{P_{y,t+1}} + \frac{\lambda_t}{P_{y,t}} - \frac{1}{1+\rho}\frac{\lambda_{t+1}}{P_{y,t+1}}\Pi_{Y,t+1}(1-S(W_{t+1}))\right).
\end{aligned}$$

Multiplying both sides again by Y_t with $\frac{Y_t}{A_t} = N_t$ gives:

$$\frac{\psi}{\epsilon}(\Pi_{Y,t}-1)\Pi_{Y,t}Y_t+\frac{\epsilon-1}{\epsilon}Y_t=\frac{W_t}{P_{y,t}}N_t+\frac{1}{1+\rho}\frac{\psi}{\epsilon}(\Pi_{Y,t+1}-1)\Pi_{Y,t+1}^2Y_{t+1}$$
$$+N_t\left(\frac{-c\chi}{1+\rho}\left(\frac{V_{t+1}}{N_t}\right)^{1+\chi}\Pi_{Y,t+1}\frac{W_{t+1}}{P_{y,t+1}}+\frac{\lambda_t}{P_{y,t}}-\frac{1}{1+\rho}\frac{\lambda_{t+1}}{P_{y,t+1}}\Pi_{Y,t+1}(1-S(W_{t+1}))\right) \tag{A.11}$$

which is our price Phillips curve.

A.3 Linearized wage Phillips curve

A Log-Linear wage Phillips curve We log-linearize the wage Phillips curve in (6), except we leave in the second order term, $\frac{\psi^w}{2}\left(\Pi_t^w-1\right)^2$, which we dropped when we derive (6).

$$\frac{\psi^w}{2}\left(\Pi_t^w-1\right)^2+\psi^w\left(\Pi_t^w-1\right)\Pi_t^w+1=c(1+\chi)\left(\frac{V_t}{N_{t-1}}\right)^{\chi}\left(\frac{V_t}{N_t}\varepsilon_{R,W_t}-\frac{N_{t-1}}{N_t}\frac{S(W_t)}{R(W_t)}\varepsilon_{S,W_t}\right)$$
$$+\frac{1}{1+\rho}\psi^w\left(\Pi_{t+1}^w-1\right)\left(\Pi_{t+1}^w\right)^2\frac{N_{t+1}}{N_t}. \tag{A.12}$$

It is worth pointing out that equation (A.12) would hold even if we added other factors of production (e.g., we could have Cobb-Douglass production with capital or some other inputs including oil), and is unaffected by the presence of price rigidities (e.g., if we had flexible or price rigidity à la Rotemberg (1982), (A.12) would be the same).

To ease interpretation, we rewrite this using $T_t\equiv\frac{V_t}{N_{t-1}}$ and $g_t\equiv\frac{N_t}{N_{t-1}}$:

$$0=\frac{\psi^w}{2}\left(\Pi_t^w-1\right)^2+\psi^w\left(\Pi_t^w-1\right)\Pi_t^w+1-c(1+\chi)T_t{}^{\chi}g_t{}^{-1}\left(T_t\varepsilon_{R,W_t}-\frac{S(W_t)}{R(W_t)}\varepsilon_{S,W_t}\right)$$
$$-\frac{1}{1+\rho}\psi^w\left(\Pi_{t+1}^w-1\right)\left(\Pi_{t+1}^w\right)^2g_{t+1}. \tag{A.13}$$

We can suppress the dependence of $S(\cdot)$ and $R(\cdot)$ on W_t (since we know that in equilibrium, S_t and R_t are not functions of the aggregate wage W_t): we rewrite (A.13) as:

$$0=F\left(\ln(\Pi_t^w),\ln(\Pi_{t+1}^w),\ln(S_t),\ln(R_t),\ln(\epsilon_{R,t}),\ln(\epsilon_{S,t}),\ln(T_t),\ln(g_t),\ln(g_{t+1})\right),$$

and take a linear approximation around a zero wage-inflation steady state with variables $\ln(\Pi_t^w)$, $\ln(\Pi_{t+1}^w)$, $\ln(S_t)$, $\ln(R_t)$, $\ln(\epsilon_{R,t})$, $\ln(\epsilon_{S,t})$, $\ln(T_t)$, $\ln(g_t)$, and $\ln(g_{t+1})$. We first calculate derivatives of $F(\cdot)$ with respect to each variable as follows:

$$
\begin{aligned}
F_{\ln(\Pi_t^w)} &= \psi^w \Pi_t^w \left(2(\Pi_t^w - 1) + \Pi_t^w\right) \\
F_{\ln(\Pi_{t+1}^w)} &= -\frac{\psi^w g_{t+1}}{1+\rho} \left(\Pi_{t+1}^w (\Pi_{t+1}^w)^2 + (\Pi_{t+1}^w - 1) 2\Pi_{t+1}^w\right) \\
F_{\ln(S_t)} &= c(1+\chi) T_t^\chi g_t^{-1} \frac{S_t}{R_t} \epsilon_{S,t} \\
F_{\ln(R_t)} &= -c(1+\chi) T_t^\chi g_t^{-1} \frac{S_t}{R_t} \epsilon_{S,t} \\
F_{\ln(\epsilon_{R,t})} &= -c(1+\chi) T_t^{\chi+1} g_t^{-1} \epsilon_{R,t} \\
F_{\ln(\epsilon_{S,t})} &= c(1+\chi) T_t^\chi g_t^{-1} \frac{S_t}{R_t} \epsilon_{S,t} \\
F_{ln(T_t)} &= -c(1+\chi) g_t^{-1} \left((1+\chi) T_t^{\chi+1} \epsilon_{R,t} - \chi T_t^\chi \frac{S_t}{R_t} \epsilon_{S,t} \right) \\
F_{\ln(g_t)} &= c(1+\chi) T_t^\chi g_t^{-1} \left(T_t \epsilon_{R,t} - \frac{S_t}{R_t} \epsilon_{S,t} \right) \\
F_{\ln(g_{t+1})} &= -\frac{1}{1+\rho} \psi^w \left(\Pi_{t+1}^w - 1\right) (\Pi_{t+1}^w)^2 g_{t+1},
\end{aligned}
$$

which at the steady state with zero wage inflation can be written as

$$
\begin{aligned}
F_{\ln(\Pi_t^w)} &= \psi^w \\
F_{\ln(\Pi_{t+1}^w)} &= -\frac{\psi^w}{1+\rho} g \\
F_{\ln(S_t)} &= c(1+\chi) T^\chi g^{-1} \frac{S}{R} \epsilon_S = c(1+\chi) \frac{T^{\chi+1}}{g} \epsilon_S \\
F_{\ln(R_t)} &= -c(1+\chi) T^\chi g^{-1} \frac{S_t}{R_t} \epsilon_{S,t} = -c(1+\chi) \frac{T^{\chi+1}}{g} \epsilon_S \\
F_{\ln(\epsilon_{R,t})} &= -c(1+\chi) \frac{T^{\chi+1}}{g} \epsilon_R \\
F_{\ln(\epsilon_{S,t})} &= c(1+\chi) \frac{T^{\chi+1}}{g} \epsilon_S \\
F_{ln(T_t)} &= -c(1+\chi) \frac{T^{\chi+1}}{g} \left((1+\chi)\epsilon_R - \chi \epsilon_S\right) \\
F_{\ln(g_t)} &= c(1+\chi) \frac{T^{\chi+1}}{g} (\epsilon_R - \epsilon_S) > 0 \\
F_{\ln(g_{t+1})} &= 0
\end{aligned}
$$

where we made use of the fact that $T = \frac{V}{N} = \frac{S}{R}$ in steady state, which we obtain from (A.3). We can see that the assumption above that $\frac{\psi^w}{2} \left(\Pi_t^w - 1\right)^2 \approx 0$ is correct in the sense that it drops out in our first-order approximation. We also find that in a zero inflation steady-state, there is no role for expectations of future employment growth in our first-order approximation.

Let the magenta terms above be collected as $\kappa \equiv c(1+\chi)\frac{T^{\chi+1}}{g}$. Then the first order approximation of $F(\cdot)$ around its steady state is given by[3]

$$0 = \psi^w \check{\Pi}_t^w - \frac{\psi^w g}{1+\rho}\check{\Pi}_{t+1}^w + \kappa\epsilon_S\left(\check{S}_t - \check{R}_t\right) + \kappa\left(\epsilon_S \check{\epsilon}_{S,t} - \epsilon_R \check{\epsilon}_{R,t}\right) + \kappa(\chi\epsilon_S - (1+\chi)\epsilon_R)\check{T}_t + \kappa(\epsilon_R - \epsilon_S)\check{g}_t,$$

which we can rewrite as

$$\check{\Pi}_t^w = \underbrace{-\frac{\kappa(\epsilon_R - \epsilon_S)}{\psi^w}\check{g}_t}_{\text{Employment Growth}} + \underbrace{\frac{g}{1+\rho}\check{\Pi}_{t+1}^w}_{\text{Expectations}} \underbrace{- \frac{\kappa\epsilon_S}{\psi^w}\left(\check{S}_t - \check{R}_t\right) - \frac{\kappa}{\psi^w}\left(\epsilon_S \check{\epsilon}_{S,t} - \epsilon_R \check{\epsilon}_{R,t}\right) - \frac{\kappa(\chi\epsilon_S - (1+\chi)\epsilon_R)}{\psi^w}\check{T}_t}_{\text{Three Labor Market ``Tightness'' Terms}} \tag{A.14}$$

Note that the law of motion for employment in (A.3) that the firm faces implies:

$$g_t = (1 - S_t) + R_t T_t \tag{A.15}$$

Log linearizing (A.15) yields:

$$\frac{1}{S}\check{g}_t = \check{R}_t + \check{T}_t - \check{S}_t,$$

which leads to

$$\check{S}_t - \check{R}_t = \check{T}_t - \frac{1}{S}\check{g}_t \tag{A.16}$$

Plugging (A.16) into the log-linear wage Phillips curve in (A.14) and assuming $g_{=1}$, we obtain

$$\check{\Pi}_t^w = \underbrace{\frac{\kappa\left(-\epsilon_R + \frac{1+S}{S}\epsilon_S\right)}{\psi^w}\check{g}_t}_{\text{Employment Growth}} + \underbrace{\frac{\kappa}{\psi^w}\left(\epsilon_R \check{\epsilon}_{R,t} - \epsilon_S \check{\epsilon}_{S,t}\right) + \frac{\kappa(1+\chi)(\epsilon_R - \epsilon_S)}{\psi^w}\check{T}_t}_{\text{Two Labor Market ``Tightness'' Terms}} + \underbrace{\frac{1}{1+\rho}\check{\Pi}_{t+1}^w}_{\text{Expectations}}. \tag{A.17}$$

where $\kappa \equiv c(1+\chi)T^{\chi+1}$. From (A.17), we observe that stronger monopsony, i.e., a lower $\varepsilon_R - \varepsilon_S$, flattens the wage Phillips curve, which is documented in de la Barrera i Bardalet (2023) as well. We summarize this in the following Proposition 2.

Proposition 2 *The wage Phillips curve in (A.17) becomes flatter as the recruiting elasticity net of the separation elasticity, $\varepsilon_R - \varepsilon_S$, falls.*

Deriving equation (7) Plugging (A.15) into (A.14) yields:

[3] We let $\check{X}_t \equiv \ln X_t - \ln X$ for any X_t. If $X_t < 0$, then we let $\check{X}_t \equiv \frac{X_t - X}{X}$.

$$\check{\Pi}^w_t = \frac{\kappa}{\psi^w}\left(-S\left(\varepsilon_R-\varepsilon_S\right)\left(\check{T}_t+\check{R}_t-\check{S}_t\right)-\varepsilon_S\left(\check{S}_t-\check{R}_t\right)+\left(\varepsilon_R\check{\varepsilon}_{R,t}-\varepsilon_S\check{\varepsilon}_{S,t}\right)+\left(\varepsilon_R+\chi\left(\varepsilon_R-\varepsilon_S\right)\right)\check{T}_t\right) + \frac{1}{1+\rho}\check{\Pi}^w_{t+1}, \tag{A.18}$$

which derives (7).

A.4 Euler Equation With Fixed Real Unemployment Benefits

This section shows how the assumptions made in Section 4.3 can be made consistent with the standard Euler equation as before given appropriate assumptions on how the household reallocates consumption. Recall the goal in 4.3 was to modify the model so that the desirability of unemployment varied with the price level; here, we show one way to make that model consistent with the Euler Equation used throughout the main text.

Suppose that when unemployed, household members are guaranteed some quantity b of real consumption goods and receive no other income (e.g., some nominal unemployment benefit perfectly indexed to inflation). When employed, they receive a nominal wage W_t. The household takes b, market wages W_t, and the price level P_t as given, but can smooth all members consumption by choosing a proportional "top-up" each period, multiplying each type of worker's income by $1+\tau_t$. This yields consumption levels

$$C^u_t = b(1+\tau_t)$$
$$C^e_t = \frac{W_t}{P_t}(1+\tau_t),$$

and total consumption

$$C_t = U_t b(1+\tau_t) + (1-U_t)\frac{W_t}{P_t}(1+\tau_t). \tag{A.19}$$

Making the top-up proportional and identical in both states implies that as the household smooths consumption, it does not affect the relative attractiveness of unemployment and employment: the $1+\tau$ terms cancel out separation and recruiting probabilities from unemployment ($s_{ju}(W_{jt})$ and $r_{uj}(W_{jt})$) presented in Section 4.3.

Continuing on to derive the Euler equation, the household maximizes

$$\begin{aligned}
&\sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^t (U_t \ln(C_t^u) + (1-U_t)\ln(C_t^e)) \\
=&\sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^t \left(U_t \ln(b(1+\tau_t)) + (1-U_t)\ln(\frac{W_t}{P_t}(1+\tau_t))\right) \\
=&\sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^t \left(U_t \ln(b) + (1-U_t)\ln(\frac{W_t}{P_t})) + \ln(1+\tau_t)\right).
\end{aligned}$$

The household's budget constraint can be written as:

$$(1+\tau_t)\left(U_t b + (1-U_t)\frac{W_t}{P_t}\right) + \frac{B_t}{P_t} = \frac{D_t}{P_t} + (1-U_t)\frac{W_t}{P_t} + \frac{(1+i_{t-1,t})B_{t-1}}{P_t}.$$

The household Lagrangian is given by:

$$\begin{aligned}
\mathcal{L} = \sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^t \Bigg(&U_t \ln(b) + (1-U_t)\ln\left(\frac{W_t}{P_t}\right) + \ln(1+\tau_t) \\
&+ \lambda_t \left[-(1+\tau_t)\left(U_t b + (1-U_t)\frac{W_t}{P_t}\right) - \frac{B_t}{P_t} + \frac{D_t}{P_t} + \frac{(1+i_{t-1,t})B_{t-1}}{P_t}\right]\Bigg).
\end{aligned}$$

The household's only choice variables are τ_t and B_t. The first order conditions are

$$\mathcal{L}_{\tau_t} : \frac{1}{1+\tau_t} = \lambda_t \left(U_t b + (1-U_t)\frac{W_t}{P_t}\right),$$

$$\mathcal{L}_{B_t} : \frac{\lambda_t}{P_t} = \left(\frac{1}{1+\rho}\right)\lambda_{t+1}\frac{(1+i_{t,t+1})B_t}{P_{t+1}}.$$

Plugging in the expression for aggregate consumption in equation (A.19) into the first order condition on τ_t yields the standard Euler equation used in the main text:

$$C_t^{-1} = \frac{1}{1+\rho}\frac{1+i_{t,t+1}}{\pi_{t,t+1}}C_{t+1}^{-1}.$$

B A Simpler Two-Period Model

In this section, we build a simple two-period general equilibrium model that illustrates the following two features in a sharper way:

1. When the employed and unemployed share consumption risks according to $\frac{C_t^e}{C_t^u} = \xi$, i.e., the unemployed receives the consumption expenditure that is ξ^{-1} times that of employed workers, the cost of living shock does not affect wage and labor market outcomes in general.

2. When the unemployed benefit b_t is in real terms, which workers compare with real wage $\frac{W_t}{P_t}$ in deciding whether to join the workforce or not, a cost of living shock generates a positive wage response. This wage response becomes more muted as λ_{EE}, the on-the-job search probability, increases.

We consider 3 different points in time: $t = 0, 1, 2$. At $t = 0$, the economy is at its steady-state: the number of employed is $\bar{N}$, that of unemployed is $\bar{U} = 1 - \bar{N}$. At $t = 2$, the economy gets back to the steady state, regardless of what happens at the interim period, $t = 1$.

Demand block The policy rate is given by $i_t = \rho$ for $t = 0, 1$ (i.e., pegged) so the households' Euler equation under log-preference implies the intertemporal equalization of consumption expenditures, given by

$$P_0 C_0 = P_1 C_1 = P_2 C_2, \tag{B.1}$$

where P_t is the price aggregator (of endowment good X_t and service good Y_t which is produced by firms) at time t, and C_t is the corresponding consumption aggregator. Under the unit elasticity of substitution between goods X_t and Y_t, i.e., $\eta = 1$ in our dynamic general equilibrium model, the households' expenditures on X_t and Y_t goods become equal, implying

$$P_{X,t} X_t = P_{Y,t} Y_t = \frac{1}{2} P_t C_t \tag{B.2}$$

for all $t = 0, 1, 2$. From (B.1) and (B.2), we obtain:

$$P_{Y,0} Y_0 = P_{Y,1} Y_1 = P_{Y,2} Y_2 \tag{B.3}$$

in equilibrium. We further assume the full price rigidity for the service good sector for tractability purposes: $P_{Y,0} = P_{Y,1} = P_{Y,2} = \bar{P}_Y$,[4] which implies $Y_0 = Y_1 = Y_2 = \bar{Y}$ where $\bar{Y}$ is the steady-state level of service output. Therefore, the service output Y_1 at the interim period $t = 1$ is always at the steady state level $\bar{Y}$, regardless of shocks realized at $t = 1$. It is because the economy

[4]We will characterize the flexible price case later as a separate case.

is demand-determined, and the household always insures their perfect consumption smoothing under pegged monetary policy.

Firm's problem Firm i, with its production function $Y_t^i = N_t^i$,[5]. solves the following optimization at $t = 1$, with its number of workers $N_0 = \bar{N}$ inherited from the previous period:

$$J(\bar{N}) = \max_{V_1^i . W_1^i} \bar{P}_Y N_1^i - W_1^i N_1^i - \kappa(W_1) \cdot V_1^i + \frac{1}{1+\rho} J(N_1^i) \tag{B.4}$$

subject to

$$N_1^i = \bar{N} = (1 - S(W_1^i | W_1))\bar{N} + R(W_1^i | W_1) V_1^i, \tag{B.5}$$

where $\kappa(W_1)V_1^i$ is a vacancy-creation cost, where $\kappa(W_1)$ is a function of aggregate wage W_1. We will later consider two cases: $\kappa(W_1) = \kappa$ (i.e., constant) and $\kappa(W_1) = \kappa W_1$ (i.e., linear function). $S(W_1^i|W_1)$ and $R(W_1^i|W_1)$ are separation and retaining probabilities, respectively, that depend on the firm's individual wage W_1^i and the aggregate wage W_1. We will use the same functional form as in our dynamic general equilibrium model. Note that in (B.4), we do not incorporate nominal wage rigidities for now. Note that due to demand-determined nature, $N_1 = \bar{N}$ is taken as given by each firm.

Solving (B.4) and (B.5) with μ_1^i as the Lagrange multiplier to (B.5) yields the followings:

- For vacancy V_1^i:

$$\mu_1^i = \frac{\kappa(W_1)}{R(W_1^i|W_1)} \tag{B.6}$$

  which implies: the value of each worker is equal to the expected cost of hiring the worker. The creation of one vacancy costs $\kappa(W_1)$ but each vacancy is filled with probability $R(W_1^i|W_1)$. This interpretation is provided in de la Barrera i Bardalet (2023) as well.

- Wage W_1^i:

$$\begin{aligned} N_1^i &= \frac{\kappa(W_1)}{R(W_1^i|W_1)} \left[R'(W_1^i|W_1) V_1^i - S'(W_1^i|W_1)\bar{N} \right] \\ &= \frac{\kappa(W_1)}{R(W_1^i|W_1)} \left[\frac{R(W_1^i|W_1)}{W_1^i} \underbrace{\frac{R'(W_1^i|W_1)W_1^i}{R(W_1^i|W_1)}}_{=\varepsilon_{R,1}} V_1^i - \underbrace{\frac{S'(W_1^i|W_1)W_1^i}{S(W_1^i|W_1)}}_{=\varepsilon_{S,1}} \cdot \frac{S(W_1^i|W_1)}{W_1^i} \bar{N} \right] \end{aligned} \tag{B.7}$$

which becomes

$$N_1^i = \frac{\kappa(W_1)}{W_1^i} \left[\varepsilon_{R,1} \cdot V_1^i - \varepsilon_{S,1} \cdot \frac{S(W_1^i|W_1)}{R(W_1^i|W_1)} \bar{N} \right]. \tag{B.8}$$

[5] With production function $Y_t^i = N_t^i$, from (B.3), we obtain that $N_0 = N_1 = N_2 = \bar{N}$.

Envelope condition:

$$J'(\bar{N}) = (1 - S(W_1^i|W_1))\mu_1^i = (1 - S(W_1^i|W_1))\frac{\kappa(W_1)}{R(W_1^i|W_1)}. \tag{B.9}$$

Later, we will impose the equilibrium condition: $W_1^i = W_1$ and $N_1^i = N_1 = \bar{N}$.

Search and matching process For now, we use the same functional forms for $R(W_1^i|W_1)$ and $S(W_1^i|W_1)$ as in our dynamic general equilibrium model in Section 3.1. As we stated, we assume employed and unemployed share consumption risks according to $\frac{C_t^e}{C_t^u} = \xi$. Therefore, under the equilibrium condition with equal decisions across firms, i.e., $W_1^i = W_1$, $N_1^i = N_1$, $V_1^i = V_1$, the following definitions can be introduced:

- Labor market tightness θ_1:

$$\theta_1 = \frac{V_1}{\lambda_{EE}\bar{N} + 1 - \bar{N}} \tag{B.10}$$

  where λ_{EE} is the on-the-job search intensity, and we use $N_0 = \bar{N}$.

- Retaining probability $R(W_1^i = W_1|W_1)$:

$$R(W_1|W_1) = g(\theta_1)\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right) \tag{B.11}$$

  where $\phi_{E,1}$ and $\phi_{U,1} \equiv 1 - \phi_{E,1}$ are fractions of employed (i.e., on-the-job searchers) and unemployed among job seekers, given by

$$\phi_{E,1} = \frac{\lambda_{EE}\bar{N}}{\lambda_{EE}\bar{N} + 1 - \bar{N}}. \tag{B.12}$$

- Separation probability $S(W_1^i = W_1|W_1)$:

$$S(W_1|W_1) = \frac{1}{2}\lambda_{EE}f(\theta_1) + \frac{1}{1+\xi^\gamma}\lambda_{EU} \tag{B.13}$$

  where we assume zero automatic separation (i.e., $s = 0$ in our dynamic general equilibrium model), and λ_{EU} is the exogenous job-quitting probability.

- Elasticity $\varepsilon_{R,1}$ and $\varepsilon_{S,1}$: from (B.11) and (B.13), we obtain

$$\varepsilon_{R,1} = \gamma \cdot \left(\frac{\frac{1}{4}\phi_{E,1} + \phi_{U,1}\left(\frac{\xi^\gamma}{(1+\xi^\gamma)^2}\right)}{\frac{1}{2}\phi_{E,1} + \left(\frac{\xi^\gamma}{1+\xi^\gamma}\right)\phi_{U,1}}\right) \simeq \gamma \cdot \left(\frac{\frac{1}{4}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + \left(\frac{\xi^\gamma}{1+\xi^\gamma}\right)\phi_{U,1}}\right), \tag{B.14}$$

and

$$\varepsilon_{S,1} = -\gamma \cdot \left(\frac{f(\theta_1)\lambda_{EE}\frac{1}{4} + \lambda_{EU}\frac{\xi^r}{(1+\xi^r)^2}}{0.5\lambda_{EE}f(\theta_1) + \left(\frac{1}{1+\xi^\gamma}\right)\lambda_{EU}} \right) \simeq -\frac{\gamma}{2}. \tag{B.15}$$

where we approximate $\frac{\lambda_{EU}}{1+\xi^\gamma} \simeq 0$ and $\frac{\phi_{U,1}\xi^\gamma}{(1+\xi^\gamma)^2} \simeq 0$, which hold well under our calibration. In (B.14), our approximation is based on that the effect of higher wages in making currently unemployed people choose to work at a firm is small compared with the effect on attracting on-the-job searchers from other firms.

Equilibrium characterization Since every firm i chooses the same decisions in equilibrium, i.e., $W_1^i = W_1$, $V_1^i = V_1$, and $N_1^i = N_1 = \bar{N}$, from (B.11) and (B.13), we obtain

$$\begin{aligned} \frac{S(W_1|W_1)\bar{N}}{R(W_1|W_1)} &= \frac{\frac{1}{2}\lambda_{EE}\underbrace{f(\theta_1)}_{=\theta_1 g(\theta_1)}\bar{N} + \frac{1}{1+\xi^\gamma}\lambda_{EU}\bar{N}}{g(\theta_1)\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right)} \\ &= \frac{\frac{1}{2}\phi_{E,1}g(\theta_1)V_1 + \frac{1}{1+\xi^\gamma}\lambda_{EU}\bar{N}}{g(\theta_1)\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right)}. \end{aligned} \tag{B.16}$$

We then plug in (B.14), (B.15), and (B.16) to (B.8) to obtain

$$\bar{N} = N_1 = \frac{\kappa(W_1)}{W_1}\left\{ \underbrace{V_1\left[\gamma\left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}}\right)\right]}_{\equiv\varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\frac{1}{1+\xi^\gamma}\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right)g(\theta_1)}}_{\equiv\varepsilon_{21}} \right\}, \tag{B.17}$$

where $\varepsilon_{11} + \varepsilon_{21}$ in (B.17) becomes the 'effective' labor supply elasticity each firm faces. ε_{11} is about the elasticity due to those who are on-the-job search: an increase in wage attracts more on-the-job searchers from other firms and reduce the endogenous separation of current workers, and given other variables, this effect becomes more pronounced with higher measure of on-the-job searchers among job seekers, i.e., higher $\phi_{E,1}$ (thereby decrease in $\phi_{U,1}$). Eventually in equilibrium, every firm sets the same wage: $W_1^i = W_1$ for $\forall i$.

ε_{21} is the elasticity attributed to those who quit their jobs to be unemployed: a higher wage deters workers from going to be unemployed. The proportion of those who exit the labor market becomes smaller under a bigger and more competitive job market with higher λ_{EE}, i.e., higher λ_{EE} lowers ε_{21} and raises ε_{11}.

From (B.5), (B.11), and (B.13), we obtain the labor dynamics as follows:

$$
\begin{aligned}
\bar{N} = N_1 &= \left[1 - \left(\frac{1}{2}\lambda_{EE} \underbrace{f(\theta_1)}_{=\theta_1 g(\theta_1)} + \frac{1}{1+\xi^\gamma}\lambda_{EU}\right)\right]\bar{N} + g(\theta_1)\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right)V_1 \\
&= \bar{N} - \bar{N}\frac{1}{1+\xi^\gamma}\lambda_{EU} + g(\theta_1)V_1\left[\left\{\cancel{\frac{1}{2}\phi_{E,1}} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right\} - \left\{\cancel{\frac{1}{2}\phi_{E,1}}\right\}\right] \\
&= \bar{N} - \bar{N}\frac{1}{1+\xi^\gamma}\lambda_{EU} + g(\theta_1)V_1\frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1},
\end{aligned}
\tag{B.18}
$$

which implies

$$
\frac{\bar{N}\frac{1}{1+\xi^\gamma}\lambda_{EU}}{\lambda_{EE}\bar{N} + 1 - \bar{N}} = f(\theta_1)\frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}. \tag{B.19}
$$

Equations (B.17) and (B.19) constitute our equilibrium, with the condition $N_1 = Y_1 = \bar{N}$. We can theoretically elicit equilibrium W_1 and V_1 from those two equations.

Cost-of-living shock We assume that the endowment good X_t drops from its steady state level $\bar{X}$ to $X_1 < \bar{X}$ at $t = 1$ in an unanticipated manner, and see how the business cycle variables adjust at $t = 1$. From (B.17) and (B.19), a sudden drop in X_1 from $\bar{X}$ does not affect the equilibrium levels of V_1 and W_1, and from the household's Euler equation (B.3), $N_1 = \bar{N}$ remains the same. From (B.2), the only change is the price of endowment good X_t, and $P_{X,1}$ rises satisfying $P_{X,1}X_1 = \bar{P_X}\bar{X}$. The following Proposition 3 summarizes this finding.

Proposition 3 *A cost-of-living shock, i.e., a sudden drop in X_1 from $\bar{X}$, does not affect equilibrium labor market outcomes: $N_1 = \bar{N}$, W_1, and V_1. The price $P_{X,1}$ of endowment good X_1 rises so that the expenditure stays the same, i.e., $P_{X,1}X_1 = \bar{P_X}\bar{X}$.*

Flexible price case The result in Proposition 3 holds even if firms set their prices fully flexibly. As in our dynamig general equilibrium model, we assume firms are in monopolistic competition, represented by Dixit-Stiglitz aggregator with elasticity of substitution ϵ. Then

$$
Y_1^i = Y_1\left(\frac{P_{Y,1}^i}{P_{Y,1}}\right)^{-\epsilon}. \tag{B.20}
$$

Each firm i solves instead the following problem:

$$
J(\bar{N}) = \max_{P_{Y,1}^i, N_1^i, V_1^i, W_1^i} P_{Y,1}^i N_1^i - W_1^i N_1^i - \kappa(W_1)\cdot V_1^i + \frac{1}{1+\rho}J(N_1^i) \tag{B.21}
$$

subject to (B.20) and

$$
N_1^i = (1 - S(W_1^i|W_1))\bar{N} + R(W_1^i|W_1)V_1^i. \tag{B.22}
$$

The solution to (B.21), with $W_1^i = W_1$, will be given by

$$
\begin{aligned}
P_{Y,1}^i = P_{Y,1} &= \frac{\epsilon}{\epsilon-1}\left(W_1 + \frac{\kappa(W_1)}{R(W_1|W_1)} - \frac{1}{1+\rho}J'(N_1^i)\right) \\
&= \frac{\epsilon}{\epsilon-1}\left(W_1 + \frac{\kappa(W_1)}{R(W_1|W_1)} - \frac{1}{1+\rho}(1-S(W_2|W_2))\frac{\kappa(W_2)}{R(W_2|W_2)}\right)
\end{aligned} \tag{B.23}
$$

where $W_2 = \bar{W}$ as the economy gets back to its steady state at $t = 2$. The term $\frac{\kappa(W_1)}{R(W_1|W_1)}$ is a cost of hiring through additional vacancy. If a firm hires at $t = 1$, it can reduce hiring at $t = 2$ by one. The last term $\frac{1}{1+\rho}(1-S(W_2|W_2))\frac{\kappa(W_2)}{R(W_2|W_2)}$ represents this reduction in future hiring costs.[6]

From (B.3), (B.17), and (B.23), we obtain

$$
\begin{aligned}
\underbrace{P_{Y,0}}_{=\bar{P}_Y}\bar{Y} = P_{Y,1}Y_1 =& \frac{\epsilon}{\epsilon-1}\left[W_1 + \frac{\kappa(W_1)}{R(W_1|W_1)} - \frac{1}{1+\rho}(1-S(W_2|W_2))\frac{\kappa(W_2)}{R(W_2|W_2)}\right] \\
&\cdot \frac{\kappa(W_1)}{W_1}\left\{\underbrace{V_1\left[\gamma\left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}}\right)\right]}_{\equiv \varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\frac{1}{1+\xi^\gamma}\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right)g(\theta_1)}}_{\equiv \varepsilon_{21}}\right\},
\end{aligned} \tag{B.24}
$$

which, with (B.19), constitute the flexible price equilibrium. Since (B.19) and (B.24) do not depend on X_1 or $P_{X,1}$, a cost-of-living shock, i.e., reduction in X_1 from $\bar{X}$, does not affect the labor market equilibrium outcome as in the rigid price case.

Corollary 1 *Even if the price-setting of firms is fully flexible, a cost-of-living shock, i.e., a sudden drop in X_1 from $\bar{X}$, does not affect the equilibrium labor market outcomes: $N_1 = \bar{N}$, W_1, and V_1. The price $P_{X,1}$ of endowment good X_1 rises so that the expenditure stays the same, i.e., $P_{X,1}X_1 = \bar{P}_X\bar{X}$.*

B.1 Quits rate and wage growth under demand shocks

In this section, we show analytically that a positive demand shock generates positive responses in both on-the-job switching rate $\frac{1}{2}\lambda_{EE}f(\theta_1)$[7] and wage growth. As $f(\cdot)$ is increasing, it is equivalent to a positive correlation between market tightness θ_1 and wage growth under a demand shock.

We define a positive demand shock that raises N_1 from $\bar{N}$, e.g., a reduction in the policy rate at $t = 1$ will result in a consumption boom, thereby leading to firms' higher labor demand level

[6] The decomposition of marginal costs in equation (B.23) is similarly given in de la Barrera i Bardalet (2023).

[7] Quits rate includes those who voluntarily quit to unemployed as well, which is a small margin compared to the on-the-job switching part.

at $t = 1$. We start from our equilibrium conditions: instead of $\bar{N}$, we use $N_1 > \bar{N}$ there:

$$\bar{N} < N_1 = \frac{\kappa(W_1)}{W_1} \left\{ \underbrace{V_1 \left[\gamma \left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}} \right) \right]}_{\equiv \varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\frac{1}{1+\xi^\gamma}\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right) g(\theta_1)}}_{\equiv \varepsilon_{21}} \right\}, \tag{B.25}$$

and

$$\bar{N} < N_1 = \bar{N} - \bar{N}\frac{1}{1+\xi^\gamma}\lambda_{EU} + g(\theta_1)V_1\frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}. \tag{B.26}$$

We divide into two cases according to different functional forms of $\kappa(W_1)$: (i) $\kappa(W_1) = \kappa$ (i.e., constant), and (ii) $\kappa(W_1) = \kappa W_1$ (i.e., linear) with nominal wage rigidity.

Case 1: $\kappa(W_1) = \kappa$ In this case, (B.25) becomes:

$$\bar{N} < N_1 = \frac{\kappa}{W_1} \left\{ \underbrace{V_1 \left[\gamma \left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}} \right) \right]}_{\equiv \varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\frac{1}{1+\xi^\gamma}\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right) g(\theta_1)}}_{\equiv \varepsilon_{21}} \right\}. \tag{B.27}$$

In order to get a sharper results, we log-linearize (B.26) and obtain[8]

$$0 < \check{N}_1 = \frac{1}{1+\xi^\gamma}\lambda_{EU} \left(\underbrace{\frac{g'(\bar{\theta}_1)\bar{\theta}_1}{g(\bar{\theta}_1)}}_{\equiv -\varepsilon_{g,\theta}} \check{\theta}_1 + \check{\theta}_1 \right) = \frac{1}{1+\xi^\gamma}\lambda_{EU} \left(1 - \underbrace{\varepsilon_{g,\theta}}_{<1} \right) \check{\theta}_1, \tag{B.28}$$

where we assume the firm's matching elasticity $\varepsilon_{g,\theta} \geq 0$ of $g(\theta_1)$ is less than 1, which holds under various specification.[9] Therefore, from (B.28), $\check{\theta}_1 > 0$ when $\check{N}_1 > 0$, i.e., labor market gets tighter at $t = 1$. We then log-linearize (B.27) and use (B.28) to obtain

$$\underbrace{\frac{1}{1+\xi^\gamma}\lambda_{EU} \left(1 - \underbrace{\varepsilon_{g,\theta}}_{<1} \right) \check{\theta}_1}_{=\check{N}_1} + \check{W}_1 = \left[\frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11} + \bar{\varepsilon}_{21}} + \frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11} + \bar{\varepsilon}_{21}}\varepsilon_{g,\theta} \right] \check{\theta}_1. \tag{B.29}$$

Since $\frac{1}{1+\xi^\gamma}\lambda_{EU}$ is small under our calibration, $\check{\theta}_1 > 0$ from (B.28) implies $\check{W}_1 > 0$ in (B.29). Thus, we generate a positive correlation between movements in wage and market tightness (on-

[8] We use $\check{\theta}_1 = \check{V}_1$ as θ_1 and V_1 are proportional and $\lambda_{EE}\bar{N} + 1 - \bar{N}$ is constant.

[9] Since $f(\theta_1) = \theta_1 g(\theta_1)$, $\varepsilon_{f,\theta} \equiv \frac{g'(\bar{\theta}_1)\bar{\theta}_1}{g(\bar{\theta}_1)} = 1 - \varepsilon_{g,\theta} > 0$ under our specification, as $f(\theta_1)$ is increasing in θ_1.

the-job switching rate), which is summarized in the following Proposition 4.

Proposition 4 *When $\kappa(W_1) = \kappa$, i.e., $\kappa(W_1)$ is a constant function, both market tightness θ_1 (on-the-job switching rate $0.5\lambda_{EE} f(\theta_1)$) and wage W_1 rises in response to a positive demand shock.*

Case 2: $\kappa(W_1) = \kappa W_1$ with nominal wage stickiness Now we assume $\kappa(W_1) = \kappa W_1$ (i.e., linear function) but incorporate nominal wage rigidity à la Rotemberg (1982). Firm i solves:

$$J(\bar{N}) = \max_{V_1^i, W_1^i} \bar{P}_Y N_1^i - W_1^i N_1^i - \underbrace{\kappa(W_1)}_{\equiv \kappa W_1} \cdot V_1^i - \underbrace{\frac{\psi^W}{2}\left(\frac{W_1^i}{\bar{W}} - 1\right)^2 \bar{W} N_1^i}_{\text{Wage changing cost}} + \frac{1}{1+\rho} J(N_1^i) \tag{B.30}$$

subject to

$$N_1^i = (1 - S(W_1^i | W_1))\bar{N} + R(W_1^i | W_1) V_1^i. \tag{B.31}$$

Solving (B.30) subject to (B.31) with $W_1^i = W_1$ and $N_1^i = N_1$ yields

$$N_1 \left(1 + \psi^W \frac{W_1 - \bar{W}}{\bar{W}}\right) = \frac{\kappa \cancel{W_1}}{\cancel{W_1}} \left\{ \underbrace{V_1 \left[\gamma \left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + \frac{\xi\gamma}{1+\xi\gamma}\phi_{U,1}}\right)\right]}_{\equiv \varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\left(\frac{1}{1+\xi\gamma}\right)\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + \frac{\xi\gamma}{1+\xi\gamma}\phi_{U,1}\right) g(\theta_1)}}_{\equiv \varepsilon_{21}} \right\}, \tag{B.32}$$

We log-linearize (B.32) and use (B.28) to obtain

$$\frac{1}{1+\xi\gamma}\lambda_{EU} \left(1 - \underbrace{\varepsilon_{g,\theta}}_{<1}\right) \check{\theta}_1 + \psi^W \check{W}_1 = \left[\frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11} + \bar{\varepsilon}_{21}} + \frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11} + \bar{\varepsilon}_{21}} \varepsilon_{g,\theta}\right] \check{\theta}_1. \tag{B.33}$$

Since $\frac{1}{1+\xi\gamma}\lambda_{EU}$ is small under our calibration, $\check{\theta}_1 > 0$ from (B.28) implies $\check{W}_1 > 0$ in (B.33) as well. Thus, we generate a positive correlation between movements in wage and market tightness (on-the-job switching rate), which is summarized in the following Proposition 5. Finally, note that **Case 2** (which is the case in our dynamic stochastic general equilibrium model in Section 3, with $\chi = 0$) generate similar results to **Case 1**, where $\kappa(\cdot)$ is a constant function.

Proposition 5 *When $\kappa(W_1) = \kappa W_1$ and firms face nomial wage rigidities à la Rotemberg (1982), both market tightness θ_1 (on-the-job switching rate $0.5\lambda_{EE} f(\theta_1)$) and wage W_1 rises in response to a positive demand shock.*

Therefore, our simple model generates the results in Section 4.1.

B.2 With real benefits of unemployment

In this section, we assume that unemployed workers some inflation-indexed quantity of consumption b_1 at $t = 1$ as we do in Section 4.3. In those cases, all the equilibrium conditions above, i.e., (B.10), (B.11), (B.12), (B.13), (B.14), (B.15), (B.17), (B.19), hold, with

$$c(P_1, W_1) \equiv \frac{\left(\frac{W_1}{P_1}\right)^\gamma}{b_1^\gamma + \left(\frac{W_1}{P_1}\right)^\gamma}.$$

in the position of $\frac{\xi^\gamma}{1+\xi^\gamma}$. Here b_1 is the consumption-equivalent during unemployment, which an unemployed person compares with real wage $\frac{W_1}{P_1}$ in deciding whether to be back at work.

Note that $c(P_1, W_1)$ is increasing in W_1 and decreasing in P_1, where P_1 is total price aggregator of endowment good X_1 and service good Y_1. Under the rigid service prices, i.e., $P_{Y,1} = \bar{P}$, a cost-of-living shock as described above increases P_1 and lower $c(P_1, W_1)$. We ask how the economy's responses to a cost-of-living shock under this specification would differ from the above case where $c(P_1, W_1) \equiv \frac{\xi^\gamma}{1+\xi^\gamma}$. Intuitively, a rise in cost-of-living reduces the relative attractiveness of working compared with being unemployed, resulting in a lower $c(P_1, W_1)$. The equilibrium will be represented by

$$\frac{\bar{N}\left(1 - c(P_1, W_1)\right)\lambda_{EU}}{\lambda_{EE}\bar{N} + 1 - \bar{N}} = f(\theta_1)c(P_1, W_1)\phi_{U,1}. \tag{B.34}$$

and

$$\bar{N} = N_1 = \frac{\kappa(W_1)}{W_1}\left\{\underbrace{V_1\left[\gamma\left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + c(P_1, W_1)\phi_{U,1}}\right)\right]}_{\equiv\varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\left(1 - c(P_1, W_1)\right)\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + c(P_1, W_1)\phi_{U,1}\right)g(\theta_1)}}_{\equiv\varepsilon_{21}}\right\}, \tag{B.35}$$

where we use the fact that output (and labor) remains at the steady state level due to households' perfect consumption smoothing. We assume that at the steady state, $c(\bar{P}_1, \bar{W}_1) = \bar{c} = \frac{\xi^\gamma}{1+\xi^\gamma}$.

We divide into three cases according to different functional forms of $\kappa(W_1)$: (i) $\kappa(W_1) = \kappa \cdot W_1$ (i.e., linear); (ii) $\kappa(W_1) = \kappa$ (i.e., constant), and (iii) whether we introduce nominal wage rigidity.

Case 1: $\kappa(W_1) = \kappa \cdot W_1$ In this case, (B.35) becomes:

$$\bar{N} = \kappa\left\{\underbrace{V_1\left[\gamma\left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + c(P_1, W_1)\phi_{U,1}}\right)\right]}_{\equiv\varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\left(1 - c(P_1, W_1)\right)\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + c(P_1, W_1)\phi_{U,1}\right)g(\theta_1)}}_{\equiv\varepsilon_{21}}\right\}. \tag{B.36}$$

Since (B.34) and (B.36) constitute the equilibrium, an increase in P_1 will lead to an increase in

W_1 so that $c(P_1, W_1) = \bar{c}$. Then other labor market variables, e.g., V_1, remain the same. Therefore, in this case, wage rises to compensate higher costs of living so that real wage stays constant, and real wage rigidity naturally arises as optimal decisions of firms.

Proposition 6 ($\kappa(W_1) = \kappa \cdot W_1$) *A rise in cost-of-living is exactly compensated by the same rate of increase in wage in equilibrium, and labor market equilibrium outcomes remain the same. The result does not depend on λ_{EE}, the on-the-job search intensity. Therefore, real wage rigidity naturally arises as optimal decisions of firms.*

Case 2: $\kappa(W_1) = \kappa$ In this case, (B.35) becomes

$$\bar{N} = \frac{\kappa}{W_1}\left\{\underbrace{V_1\left[\gamma\left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + c(P_1, W_1)\phi_{U,1}}\right)\right]}_{\equiv\varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\left(1 - c(P_1, W_1)\right)\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + c(P_1, W_1)\phi_{U,1}\right) g(\theta_1)}}_{\equiv\varepsilon_{21}}\right\}. \tag{B.37}$$

If, as in the above case, W_1 rises at the same rate as P_1 so that $c(P_1, W_1)$ does not change, then (B.37) is not satisfied as its left hand side becomes smaller than $\bar{N}$. Thus, we can infer that in this case, the wage response would be generically smaller than the price increase. In order to obtain sharper results, we log-linearize (B.34) and obtain

$$-\frac{\bar{c}}{1-\bar{c}}\check{c} = \underbrace{\frac{f'(\bar{\theta}_1)\bar{\theta}_1}{f(\bar{\theta}_1)}}_{\equiv\varepsilon_{f,\theta}}\check{\theta}_1 + \check{c} \tag{B.38}$$

with

$$\check{c} = \frac{\bar{c}_P\bar{P}_1}{\bar{c}}\check{P}_1 + \frac{\bar{c}_W\bar{W}_1}{\bar{c}}\check{W}_1. \tag{B.39}$$

Equations (B.38) and (B.39) yield

$$\check{\theta}_1 = -\frac{1}{(1-\bar{c})\varepsilon_{f,\theta}}\left(\frac{\bar{c}_P\bar{P}_1}{\bar{c}}\check{P}_1 + \frac{\bar{c}_W\bar{W}_1}{\bar{c}}\check{W}_1\right). \tag{B.40}$$

We also log-linearize (B.37) and obtain[10]

$$0 = -\check{W}_1 + \frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}}\left[\check{\theta}_1 - \frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}}\check{c}\right] + \frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}}\left[-\frac{\bar{c}}{1-\bar{c}}\check{c} - \frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}}\check{c} - \underbrace{\frac{g'(\bar{\theta}_1)\bar{\theta}_1}{g(\bar{\theta}_1)}}_{\equiv\varepsilon_{g,\theta}>0}\check{\theta}_1\right]. \tag{B.41}$$

[10]Again, we use $\check{\theta}_1 = \check{V}_1$ as θ_1 and V_1 are proportional and $\lambda_{EE}\bar{N} + 1 - \bar{N}$ is constant.

Therefore, from (B.40) and (B.41), we obtain

$$\check{W}_1 \left[1 + \left\{ \frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \left(\frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}} + \frac{1}{(1-\bar{c})\varepsilon_{f,\theta}} \right) + \frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \left(\frac{\bar{c}}{1-\bar{c}} + \frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}} + \frac{\varepsilon_{g,\theta}}{(1-\bar{c})\varepsilon_{f,\theta}} \right) \right\} \frac{\bar{c}_W \bar{W}_1}{\bar{c}} \right]$$
$$= \left\{ \frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \left(\frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}} + \frac{1}{(1-\bar{c})\varepsilon_{f,\theta}} \right) + \frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \left(\frac{\bar{c}}{1-\bar{c}} + \frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}} + \frac{\varepsilon_{g,\theta}}{(1-\bar{c})\varepsilon_{f,\theta}} \right) \right\} \left(-\frac{\bar{c}_P \bar{P}_1}{\bar{c}} \right) \check{P}_1.$$

If we define

$$\begin{aligned} d_W &\equiv \frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \left(\frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}} + \frac{1}{(1-\bar{c})\varepsilon_{f,\theta}} \right) + \frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \left(\frac{\bar{c}}{1-\bar{c}} + \frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}} + \frac{\varepsilon_{g,\theta}}{(1-\bar{c})\varepsilon_{f,\theta}} \right) \\ &= \underbrace{\frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}}}_{\equiv d_{W,1}} + \underbrace{\frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \frac{1}{(1-\bar{c})\varepsilon_{f,\theta}} + \frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \left(\frac{\bar{c}}{1-\bar{c}} + \frac{\varepsilon_{g,\theta}}{(1-\bar{c})\varepsilon_{f,\theta}} \right)}_{\equiv d_{W,2}} > 0 \end{aligned} \tag{B.42}$$

then because at the steady state we have[11]

$$\frac{\bar{c}_W \bar{W}_1}{\bar{c}} = -\frac{\bar{c}_P \bar{P}_1}{\bar{c}} = \frac{\gamma}{1+\xi^\gamma} = \gamma(1-\bar{c}),$$

the wage response $\check{W}_1$ is given by

$$\check{W}_1 = \frac{d_W}{\frac{1}{\gamma(1-\bar{c})} + d_W} \check{P}_1 < \check{P}_1, \tag{B.43}$$

which is increasing in d_W. From (B.39) and (B.43), $\check{\theta}_1 > 0$ follows, i.e., labor market becomes tighter. This result is summarized in the following Proposition 7.

Proposition 7 *When $\kappa(W_1) = \kappa$, i.e., $\kappa(W_1)$ is a constant function, wage rises in response to a cost-of-living shock, but the rate of wage increase is lower than that of price aggregator, i.e., $\check{W}_1 < \check{P}_1$. As a result, labor market becomes tighter, i.e., $\check{\theta}_1 > 0$.*

Role of on-the-job search intensity λ_{EE} At the steady state, $\frac{1}{1+\xi^\gamma}\lambda_{EU} \simeq 0$ under our calibration, and $\frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \simeq 0$ with $\frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \simeq 1$. Then from (B.42),

$$d_W \simeq \underbrace{\frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1}+\bar{c}\phi_{U,1}}}_{\equiv d_{W,1}} + \underbrace{\frac{1}{(1-\bar{c})\varepsilon_{f,\theta}}}_{\equiv d_{W,2}},$$

which is decreasing in λ_{EE} as $\phi_{E,1}$ falls and $\phi_{U,1}$ increases. Therefore, we can see from (B.43) that wage rises less under higher λ_{EE}. This result is summarized by the next Proposition 8.

[11]We assume that at the steady state, $c(\bar{P}_1, \bar{W}_1) = \bar{c} = \frac{\xi^\gamma}{1+\xi^\gamma}$.

Proposition 8 *Equilibrium wage rises less in response to a cost-of-living shock, under higher on-the-job search intensity* λ_{EE}.

Case 3: $\kappa(W_1) = \kappa W_1$ **with nominal wage stickiness** Now we go back to the first **Case 1** where $\kappa(W_1)$ is linear in W_1, but incorporate nominal wage rigidity à la Rotemberg (1982). Firm i solves:

$$J(\bar{N}) = \max_{V_1^i, W_1^i} \bar{P}_Y N_1^i - W_1^i N_1^i - \underbrace{\kappa(W_1)}_{\equiv \kappa W_1} \cdot V_1^i - \underbrace{\frac{\psi^W}{2}\left(\frac{W_1^i}{\bar{W}} - 1\right)^2 \bar{W} N_1^i}_{\text{Wage changing cost}} + \frac{1}{1+\rho} J(N_1^i) \tag{B.44}$$

subject to

$$N_1^i = (1 - S(W_1^i|W_1))\bar{N} + R(W_1^i|W_1)V_1^i. \tag{B.45}$$

Solving (B.44) subject to (B.45) with $W_1^i = W_1$ and $N_1^i = \bar{N}$ yields

$$\bar{N}\left(1 + \psi^W \frac{W_1 - \bar{W}}{\bar{W}}\right) = \frac{\kappa \cancel{W_1}}{\cancel{W_1}} \left\{ \underbrace{V_1 \left[\gamma \left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + c(P_1, W_1)\phi_{U,1}}\right)\right]}_{\equiv \varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\left(1 - c(P_1, W_1)\right) \lambda_{EU} \bar{N}}{\left(\frac{1}{2}\phi_{E,1} + c(P_1, W_1)\phi_{U,1}\right) g(\theta_1)}}_{\equiv \varepsilon_{21}} \right\}, \tag{B.46}$$

which in log-linear form becomes

$$\psi^W \check{W}_1 = \frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11} + \bar{\varepsilon}_{21}} \left[\check{\theta}_1 - \frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1} + \bar{c}\phi_{U,1}} \check{c}\right] + \frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11} + \bar{\varepsilon}_{21}} \left[-\frac{\bar{c}}{1 - \bar{c}}\check{c} - \frac{\bar{c}\phi_{U,1}}{\frac{1}{2}\phi_{E,1} + \bar{c}\phi_{U,1}}\check{c} - \underbrace{\frac{g'(\bar{\theta}_1)\bar{\theta}_1}{g(\bar{\theta}_1)}}_{\equiv \varepsilon_{g,\theta}} \check{\theta}_1\right]. \tag{B.47}$$

With (B.40) and (B.47), in equilibrium, the equilibrium wage response $\check{W}_1$ to cost-of-living shock $\check{P}_1$ is given by

$$\check{W}_1 = \frac{d_W}{\psi^W \frac{1}{\gamma(1-\bar{c})} + d_W} \check{P}_1 < \check{P}_1, \tag{B.48}$$

and Propositions 7 and 8 holds as well in this case. Again, note that **Case 3** (which is the case in our dynamic stochastic general equilibrium model in Section 3, with $\chi = 0$) generate similar results to **Case 2**, where $\kappa(\cdot)$ is a constant function.

B.3 Variable On-the-Job Search Intensity

Following Section 4.4, we now assume that on-the-job probability λ_{EE} at $t = 1$ is following

$$\lambda_{EE}(P_1, W_1) \equiv \bar{\lambda}_{EE} \left(\frac{\bar{W}_1}{\bar{P}_1}\right)^m \left(\frac{W_1}{P_1}\right)^{-m} \tag{B.49}$$

with $m = 4$. A cost-of-living shock raises $\lambda_{EE,1}$. Now from

$$\phi_{E,1} = \frac{\lambda_{EE}\bar{N}}{\lambda_{EE}\bar{N} + 1 - \bar{N}}, \ \ \phi_{U,1} = \frac{1 - \bar{N}}{\lambda_{EE}\bar{N} + 1 - \bar{N}}, \ \ \theta_1 = \frac{V_1}{\lambda_{EE}\bar{N} + 1 - \bar{N}}, \tag{B.50}$$

we see higher $\lambda_{EE,1}$ raises $\phi_{E,1}$ and lowers $\phi_{U,1}$, i.e., more of job seekers are on-the-job searchers. We start from the equilibrium conditions with $\kappa(W_1) = \kappa$:[12]

$$N_1 = \frac{\kappa}{W_1} \left\{ \underbrace{\underbrace{\left(\lambda_{EE}\bar{N} + 1 - \bar{N}\right) \theta_1}_{=V_1} \left[\gamma \left(\frac{\frac{1}{2}\phi_{E,1}}{\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}} \right) \right]}_{\equiv \varepsilon_{11}} + \underbrace{\frac{\frac{\gamma}{2}\frac{1}{1+\xi^\gamma}\lambda_{EU}\bar{N}}{\left(\frac{1}{2}\phi_{E,1} + \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1}\right) g(\theta_1)}}_{\equiv \varepsilon_{21}} \right\}, \tag{B.51}$$

and

$$\begin{aligned} N_1 &= \bar{N} - \bar{N}\frac{1}{1+\xi^\gamma}\lambda_{EU} + g(\theta_1) V_1 \frac{\xi^\gamma}{1+\xi^\gamma}\phi_{U,1} \\ &= \bar{N} - \bar{N}\frac{1}{1+\xi^\gamma}\lambda_{EU} + f(\theta_1) \frac{\xi^\gamma}{1+\xi^\gamma}\left(1 - \bar{N}\right). \end{aligned} \tag{B.52}$$

Price stickiness In contrast to Appendices B.1 and B.2 where we assume fully rigid prices, we assume a flexible form of price stickiness: in contrast to increase in W_1, service price $P_{Y,1}$ increases to some degree. More specifically, we assume $\check{P}_{Y,1} = d_P \check{W}_1$, with $d_P > 0$, where $\check{P}_{Y,1}$ and $\check{W}_1$ are log-deviations from the steady state levels. $d_P = 0$ corresponds to rigid prices.

Since $P_{Y,1}N_1 = \bar{P}_Y\bar{Y}$ holds due to the household's equal expenditure under pegged monetary policy, we know

$$\check{N}_1 = -\check{P}_{Y,1} = -d_P\check{W}_1 = \frac{1}{1+\xi^\gamma}\lambda_{EU} \underbrace{\varepsilon_{f,\theta}}_{>0} \check{\theta}_1 \tag{B.53}$$

where the last equality is derived from (B.52). From (B.53), we can see that if we have $\check{W}_1 > 0$ in equilibrium in response to a cost-of-living shock, i.e., $\check{P}_1 > 0$, then we need to have $\check{\theta}_1 < 0$, i.e., labor market becomes less tight. With lower θ_1, wage $\check{W}_1$ rises less in response to $\check{P}_1 > 0$ in (B.51), as θ_1 appears in ε_{11} and $g(\theta_1)$ is decreasing in θ_1: less tight labor market means that firms need not raise wage as much to attract job seekers and potential leavers.

By log-linearizing (B.50), we obtain

$$\check{\phi}_{E,1} = \bar{\phi}_{U,1}\check{\lambda}_{EE}, \ \ \check{\phi}_{U,1} = -\bar{\phi}_{E,1}\check{\lambda}_{EE} \tag{B.54}$$

with $\check{\lambda}_{EE} = -m\left(\check{W}_1 - \check{P}_1\right)$. Linearizing (B.51) yields:

[12] From Appendices B.1 and B.2, we know that $\kappa(W_1) = \kappa$ (i.e., constant) generates similar results to our specification in Section 3 of $\kappa(W_1) = \kappa W_1$ (i.e., linear) with nominal wage stickiness.

$$\check{N}_1 = -\check{W}_1 + \frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}}\left[\bar{\phi}_{E,1}\check{\lambda}_{EE} + \check{\theta}_1 + (1-\chi)\check{\lambda}_{EE}\right] - \frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}}\left[\chi\check{\phi}_{E,1} + (1-\chi)\check{\phi}_{U,1} - \varepsilon_{g,\theta}\check{\theta}_1\right], \tag{B.55}$$

where

$$\chi \equiv \frac{\frac{1}{2}\bar{\phi}_{E,1}}{\frac{1}{2}\bar{\phi}_{E,1} + \frac{\xi^{\gamma}}{1+\xi^{\gamma}}\bar{\phi}_{U,1}}.$$

Combining (B.53), (B.54), and (B.55) with $\check{\lambda}_{EE} = -m(\check{W}_1 - \check{P}_1)$ and approximating $\frac{\bar{\varepsilon}_{21}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \simeq 0$ with $\frac{\bar{\varepsilon}_{11}}{\bar{\varepsilon}_{11}+\bar{\varepsilon}_{21}} \simeq 1$ as before, we obtain

$$\check{W}_1 = \frac{m\left(\bar{\phi}_{EE} + 1 - \chi\right)}{1 - d_P + m\left(\bar{\phi}_{EE} + 1 - \chi\right) + \dfrac{d_P}{\dfrac{\lambda_{EU}}{1+\xi^{\gamma}}\varepsilon_{f,\theta}}}\check{P}_1 > 0. \tag{B.56}$$

Interpretation Under fully rigid prices, i.e., $d_P = 0$, then we would have

$$\check{W}_1 = \frac{m\left(\bar{\phi}_{EE} + 1 - \chi\right)}{1 + m\left(\bar{\phi}_{EE} + 1 - \chi\right)}\check{P}_1 > 0.$$

with $\check{\theta}_1 = 0$: no change in tightness. When employees engage in intensified on-the-job searches, firms offer more vacancies so that labor market tightness θ_1 remains the same: it is because under fully rigid prices, labor demand remains unchanged in response to a cost-of-living shock.

Under sticky prices following (B.53), $\check{\theta}_1 < 0$ and $\check{W}_1 > 0$ hold from (B.56). In equilibrium, firms raise service price in response to a cost-of-living shock, leading to lower service and labor demand. Since workers have higher intensity of on-the-job search, it reduces the market tightness θ_1. It in turn lowers the incentive of firms to raise wage to attract job seekers, resulting in muted wage responses: this effect is represented by $\frac{d_P}{\frac{\lambda_{EU}}{1+\xi^{\gamma}}\varepsilon_{f,\theta}}$.

On the other hand, a lower labor demand implies the marginal cost of wage increase in terms of wage bills (e.g., $ increase in wage implies all workers, new hires and incumbents, benefit from it) is lower from each firm's perspective, and raises firms' incentive to raise wage: this effect is represented by d_P term in (B.56). In effect, the first effect dominates the second effect,[13] and we have muted wage increase under endogenous on-the-job search intensity following (B.49).

[13] Remember $\frac{\lambda_{EU}}{1+\xi^{\gamma}}$ is small.