The Impact of Labor Market Matching Efficiency on Inflation Dynamics[*]

Salem Abo-Zaid[†] Brenda Samaniego de la Parra[‡] Xuguang Simon Sheng[§]

Abstract

The COVID-19 pandemic initially caused inflation to fall, then rose sharply to a 40-year high. Vacancies and labor market tightness strongly correlated with inflation rates in the United States and major European countries, with both measures dipping and then overshooting their pre-pandemic levels. To account for the joint dynamics of inflation and key labor market indicators, we propose a labor search-and-matching model augmented with shocks to both demand and labor matching efficiency. We show that demand shocks and fiscal policy alone cannot explain the inflation dynamics and the rise in tightness. While fiscal policy accelerates the recovery and the reversal of inflation, it fails to generate sustained inflationary pressure unless paired with structural labor market frictions. The model aligns with empirical patterns and offers a framework for understanding inflation dynamics with time-varying matching efficiency.

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[†]University of Maryland-Baltimore County. Contact information: 1000 Hilltop Circle, Baltimore, MD 21250, USA; Tel: 410-455-2498; Email: salem.abozaid@umbc.edu.

[‡]University of Notre Dame, Keough School of Global Affairs. Contact information: Jenkins Nanovic Hall, Notre Dame, IN 46556; Tel: Phone: 574-631-6212; Email: bsamanie@nd.edu.

[§]American University. Contact information: 4400 Massachusetts Ave., N.W., Washington, DC 20016, USA; Tel: (202) 885-3782; Fax: 202-885-3790; Email: sheng@american.edu.

1 Introduction

The COVID-19 pandemic spurred research on the drivers and dynamics of inflation in the presence of unprecedented demand and supply shocks. Despite a brief period of negative inflation at the outset of the pandemic in 2020, inflation in the United States then spiked and by 2022 exceeded historical values not seen since during the Great Inflation period (1965-1982). Job filling rates initially increased, then declined significantly and continued to be below their pre-pandemic levels. In this paper, we study the role of a negative shock to labor matching efficiency in driving inflation dynamics. We explore the evolution of price growth and its correlation with other key economic indicators under different assumptions of the underlying shocks during the onset of the pandemic. Understanding how different shocks propagate through the economy, and their implications for inflation is key for improving forecasting and policy making.

Inflation and labor market tightness (as measured by the vacancies-unemployment ratio) in the US exhibited a strong positive correlation from 2020 through 2023. During the early stages of the pandemic, vacancies decreased while unemployment rose, reducing labor market tightness and placing downward pressure on wages and prices. A concurrent shock to consumer demand, driven in part by lockdowns and heightened uncertainty, further impacted prices. As the labor market began to recover, vacancies surpassed pre-pandemic levels and unemployment declined, resulting in higher labor market tightness and upward pressure on nominal wages. This increase in wages was due to firms competing for job seekers to fill vacancies. Job finding probabilities then returned to pre-shock levels, while job filling probabilities remained significantly below pre-pandemic levels. Potentially reflecting these developments in the labor market, inflation started to rise beyond pre-pandemic levels. We observe a similarly strong correlation between labor market tightness and inflation in European OECD countries.

To explore the mechanisms behind these patterns and understand the role of matching efficiency on inflation dynamics, we propose a labor search and matching model with downward nominal wage rigidity. Within the context of this model, we evaluate the impact and propagation mechanisms behind two shocks stemming from the same event (i.e., the pandemic): a demand-side shock and a shock to matching efficiency in the labor market. The former shock reduces households' willingness to spend, while the later creates a friction in the matching process between job seekers and firms.

We use data from before the pandemic (i.e., 1983-2019) to estimate the model and forecast the impact of these shocks. We compare the resulting inflation dynamics under three scenarios in out-of-sample exercises: (i) when both shocks are simultaneous, (ii) when there is only a demand shock, and (iii) when there is only a matching efficiency shock. We show that, despite simulating the shocks to match the initial rise in the unemployment rate, the demand shock alone is insufficient to replicate the evolution of key economic indicators. In contrast, including a negative shock to matching efficiency is able to produce the rise in vacancies and swift recovery in tightness observed in the data.

The model successfully replicates the dynamics of inflation and its correlation with other key economic indicators. The negative demand shock drives dynamics during the initial stage of the pandemic, while the shock in matching efficiency enables the model to account for the dynamics of inflation during the recovery phase. Moreover, wage rigidity allows the model to justify the behavior of nominal wages that continued to rise throughout the pandemic. Without wage rigidity, nominal wages initially fall, mitigating the decline in labor, vacancies, and the subsequent rise in inflation in later periods.

During the pandemic, the US Congress implemented massive fiscal stimulus that arguably generated inflationary pressures.[1] We introduce government spending with a fiscal policy rule that responds to changes in output. Under such a fiscal policy, the rise in inflation during the early stages of the pandemic is significantly muted and temporary, while vacancies and tightness are unable to reach pre-pandemic levels even 30 quarters after the shock. Introducing fiscal policy makes the impact of the shock on economic activity muted, short-lived, and leads to a faster reversal of economic activity and inflation. The fiscal policies of 2020 become a less likely driver of inflation as its rise becomes more persistent. A change in matching efficiency is crucial to explain the behavior of key labor market indicators which in turn influenced inflation dynamics.

We further extend the model to include a labor force participation margin, which rationalizes the effect of changes in the labor force participation rate on inflation. The extended model also allows for the efficiency of the matching process to depend on the search and recruiting intensities. Allowing for variations in search intensity and recruiting intensity follows Leduc and Liu (2020),

[1] In response to the COVID-19 pandemic, the U.S. Congress passed multiple stimulus packages, including the Coronavirus Aid, Relief, and Economic Security (CARES) Act, which authorized over 2 trillion dollars in spending, and the American Rescue Plan Act, which allowed for nearly 2 trillion dollars in spending.

among others, who show that fluctuations in these intensities can help bridge the gap between the actual and model-predicted job-filling rate. Our empirical analysis shows that both search and recruiting intensities fell in the early stages of the pandemic. Recruiting intensity quickly recovered and exceeded its pre-pandemic level after nearly two quarters while search intensity continued to be below pre-pandemic levels. The model captures these dynamics well, showing that both intensities are crucial for replicating inflation patterns since the start of the pandemic. Additionally, our model better explains the co-movement of the inflation rate with various labor market variables from spring 2020 onward.

A substantial body of recent research highlights the central role of labor market tightness in driving post-pandemic inflation. Ball et al. (2022) and Dao et al. (2024) emphasize the importance of the vacancy-to-unemployment ratio as a key determinant of core inflation, pointing to a significant pass-through from tight labor conditions to persistent price increases. Benigno and Eggertsson (2023) develop a non-linear Phillips curve model, demonstrating that inflation becomes more sensitive to labor market slack as the economy tightens, intensifying wage-price pressures. Bernanke and Blanchard (2024) offer a more moderate view, suggesting that although tight labor markets have not been the dominant cause of the inflation surge, they exert a sustained influence on wage growth and inflation persistence. Chen et al. (2024), using regional wage microdata, find a significant lagged relationship between service sector wage growth and inflation, reinforcing the view that localized labor constraints have prolonged price pressures, especially in the services sector. Barnichon and Shapiro (2024) further confirm that the vacancy-to-unemployment ratio outperforms traditional slack measures like unemployment in forecasting inflation dynamics.

Inflationary pressures have also been heavily shaped by supply-side disruptions, particularly during the early stages of the pandemic, and by geopolitical events. Supply chain bottlenecks and constrained production capacity are widely cited as key drivers of headline inflation. Comin et al. (2023) argue that binding capacity constraints amplified the effects of monetary stimulus, shifting domestic and import price Phillips curves upward and exacerbating inflation. Shapiro (2024) provides further decomposition, showing that supply-driven inflation – closely linked to energy and food prices – spiked in early 2022, partly due to the Russian invasion of Ukraine. Crump et al. (2024) and Harding et al. (2023) also find that temporary supply-side factors contributed significantly to the inflation surge, with the latter modeling how inflation becomes more responsive to shocks under elevated pressure, producing steeper inflation responses when supply is restricted. These findings underscore that while demand rebounded quickly, the supply side of the economy remained inelastic and fragile, magnifying price increases during periods of high demand.

Beyond labor and supply factors, a range of other influences – especially fiscal policy and inflation expectations – played a critical role in shaping post-pandemic inflation dynamics. Bianchi et al. (2023) and Dynan and Elmendorf (2024) show that pandemic-era fiscal expansions, particularly when unfunded, significantly increased aggregate demand and contributed to overheating the economy. de Soyres et al. (2023) link generous fiscal transfers to increased household consumption, intensifying demand-side inflation. Meanwhile, the perception of the pandemic's economic impact evolved over time. Initially seen as a negative demand shock that suppressed inflation expectations, the pandemic was later understood to involve simultaneous demand and supply shocks (Hassan et al., 2023), leading to elevated inflation expectations (Meyer and Sheng, 2025).

In contrast to these studies, we demonstrate, quantitatively, that the state of the labor market can explain inflation dynamics even in the absence of other potentially important factors that drive inflation, such as supply chain disruptions, geopolitical tensions, and fiscal policy. The latter may generate a faster rise in inflation, but our results suggest that inflation was likely to rise anyway due to the tightness of the labor market. Furthermore, multiple years since the start of the pandemic, inflation has not yet returned to normal, despite fiscal policy and supply chains largely normalizing. The labor market remains tighter than usual, indicating that the state of the labor market may be contributing to persistent inflation.

In addition, this paper contributes to the broader literature on inflation dynamics by providing a novel structural interpretation of the Phillips Curve during the COVID-19 pandemic. In contrast to traditional specifications that rely on a linear relationship between inflation and the unemployment gap, our framework emphasizes the role of labor market tightness, captured by the vacancy-to-unemployment ratio, as a more relevant measure of slack. Moreover, the model incorporates key frictions, including downward nominal wage rigidity and time-varying matching efficiency, which endogenously generate inflation persistence. The interaction of these frictions implies a state-dependent Phillips Curve: inflation becomes more sensitive to labor market conditions as the economy tightens (even before employment fully recovers), consistent with recent empirical work. Our results show that while fiscal policy can influence the timing and magnitude of inflation, structural labor market features are central in driving the inflation-unemployment trade-off, especially during the recovery phase.

The remainder of the paper proceeds as follows. Section 2 describes the behavior of inflation and labor market variables for the U.S. and a group of OECD countries. Section 3 outlines the benchmark model. Section 4 describes the calibration of the model and presents numerical results. Section 5 discusses the implications for the Phillips curve. Section 6 concludes. Additional details on model estimation and extensions are relegated to the appendix.

2 Inflation and the Labor Market During the Pandemic

In this section, we provide evidence regarding the relationship between the inflation rate and key labor market data. While we show here only the CPI (including food and energy prices), in what follows we discuss other measures, such as the Personal Consumption Expenditure index. We also discuss the "core" inflation rate, which excludes food and energy prices. More analysis about these measures and their correlations with the labor market variables can be found in Section 4.

Figure 1 shows the behavior of the quarterly inflation rate, unemployment rate, vacancies, the labor market tightness (which is the vacancies-unemployment ratio), the job finding rate, the job filling rate and the wage inflation rate during the first three years of this inflation episode. All variables are expressed as percentage deviations from their average values in the final three months before the Covid-19 (December 2019-February 2020).

The inflation rate is positively correlated with vacancies and labor market tightness throughout the entire period. On the other hand, its correlation with the unemployment rate is negative. Furthermore, early in the pandemic, the job finding rate by job searchers declined, and then it started to gradually rebound. The job filling rate by firms, on the other hand, increased on impact, but declined significantly below its pre-shock level and continued to be lower than its initial level by roughly 33%. Its correlation with the inflation rate is clearly negative.

The nominal wage continued to rise throughout the pandemic. One explanation for the initial uptick is that, with rising unemployment, particularly among lower wage earners, the average nominal wage jumped. As the labor market began to recover, the growth in the nominal wage moderated. Then, with the rise in vacancies and labor market tightness, the nominal wage continued to rise; the tightness in the labor market may have caused an increase in wage growth.[2]

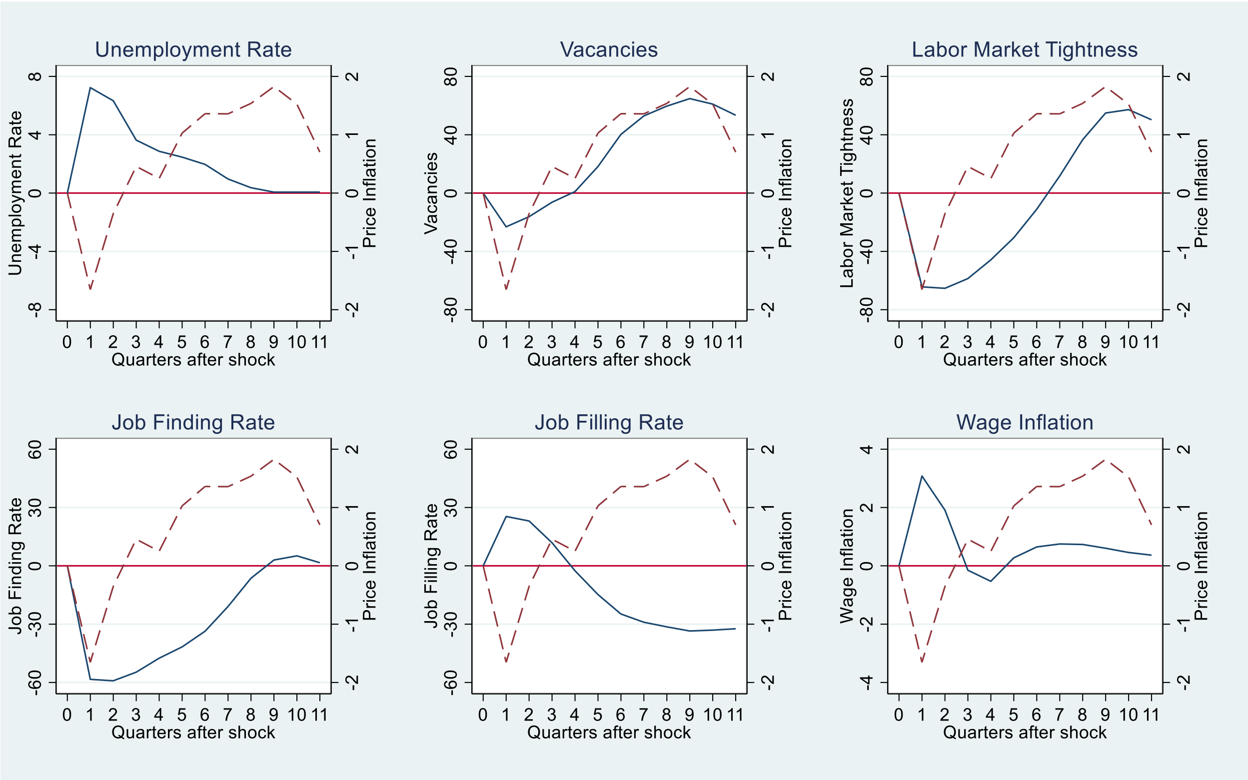

Figure 1: Price Inflation, Wage Inflation and Labor Market Variables

Note: Percentage deviations from the average level between December 2019-February 2020. Time zero indicates the last quarter before the shock. Price Inflation- the percentage change in the consumer price index for all urban consumers- all items in U.S., is plotted in the dashed line and measured in the right axis. Unemployment Rate- unemployment-labor force ratio. Vacancies- total unfilled job vacancies for the United States. Labor Market Tightness- the ratio of vacancies to unemployment. Job Finding Rate- ratio of hires (Total Nonfarm) to unemployment. Job Filling Rate- the job finding rate times the inverse of labor market tightness. Wage Inflation- the percentage change in the average hourly earnings of production and nonsupervisory employees, total private. The data are updated as of November 2022.

In Figure 2, we provide a similar analysis for a group of European OECD countries for which data have been readily available at the time of this writing. The positive correlation between the inflation rate and vacancies or labor market tightness seems to hold for all countries in our sample, most noticeably for Austria, Finland, Sweden, France, Poland and the U.K. On this basis, the

[2]Using Job Openings- Total Private for vacancies and Average Hourly Earnings of All Employees- Total Private for the nominal wage gives the same results. In addition, using Hires: Total Private to calculate the job finding rate gives the same results.

observations for the U.S. hold for other advanced nations. Interestingly, Poland and Portugal saw the biggest normalization in vacancies and labor market tightness, and they also experienced a clear drop in the inflation rates from their respective peaks.

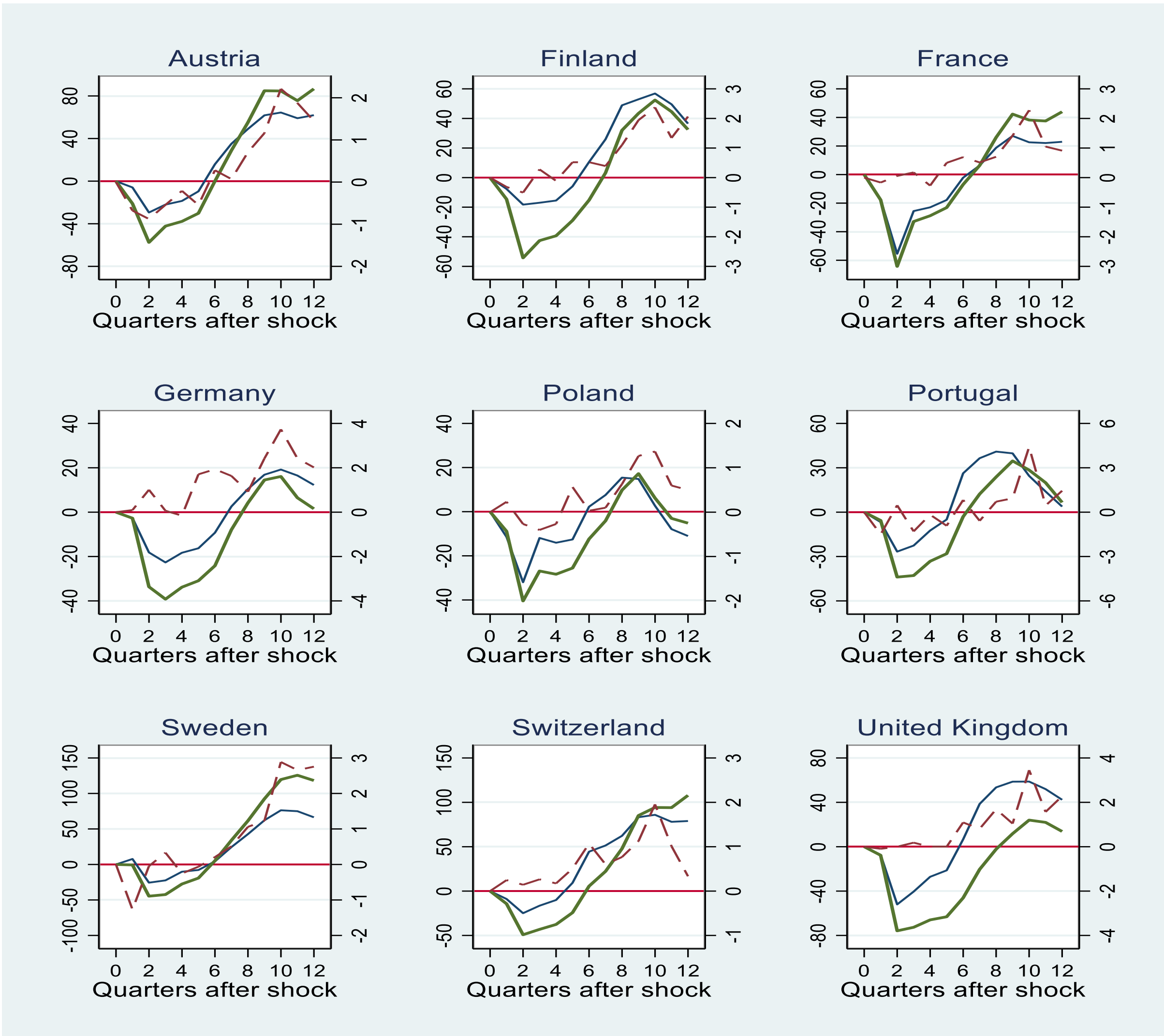

Figure 2: Price Inflation, Vacancies and Labor Market Tightness: OECD Countries

Note: Percentage deviations from pre-Covid levels. Solid blue line: vacancies (left axis). Solid green thick line: labor market tightness (left axis). Dashed maroon line: price inflation (right axis). Data source: OECD.

In what follows we propose a model that can account for the empirical regularities. Given the relatively rapid decline in the unemployment rate, our focus shifts to vacancies and labor market tightness, as the higher-than-usual tightness reflects an elevated number of vacancies. To fix ideas, the benchmark model in Section 3 assumes that the fall in the efficiency of the matching process and labor force participation rate are exogenous. In the Appendix C, we present an extended version of the model that allows for endogenous participation in the labor force as well as endogenous changes in the efficiency of matching.

3 The Model

The economy is populated by households, monopolistically-competitive firms that produce differentiated products and a monetary authority. Hiring labor by firms is subject to search and matching frictions as in Pissarides (2000). Each firm faces an asymmetric adjustment cost function for nominal wages, which implies that the costs of reducing nominal wages are higher compared to increasing them by the same magnitude. Changing prices by each firm is subject to a direct resource cost.

3.1 Households

The economy is populated by a representative household which consists of family members of measure one. Each period t, a household member can be either employed or unemployed and searching for a job. Employed individuals are of measure n_t and the unemployed individuals are of measure u_t, where $u_t = 1 - n_t$. As in Merz (1995) and Andolfatto (1996), all household members have the same consumption due to the assumptions of consumption insurance. The disutility of work is the same for all employed individuals, and income during non-employment is homogenous across all non-employed individuals. Then, the household's problem is to maximize:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[e_t u(c_t) - n_t v(h_t) \right], \tag{1}$$

with $\beta < 1$ being the standard subjective discount factor, $\mathbb{E}_0$ is the expectation operator, c_t is consumption, h_t denotes hours per worker, $u(c_t)$ is the period utility function of consumption and $v(h_t)$ is the period disutility from supplying labor. These functions satisfy the usual properties: $\frac{\partial u(\cdot)}{\partial c} > 0$, $\frac{\partial^2 u(\cdot)}{\partial c^2} < 0$, $\frac{\partial v(\cdot)}{\partial h} > 0$ and $\frac{\partial^2 v(\cdot)}{\partial h^2} > 0$. The variable e_t is a demand (preference) shifter, which we discuss in detail later.

As standard in New Keynesian models, consumption (c_t) is a Dixit-Stiglitz aggregator of differentiated products ($c_{j,t}$) produced by monopolistically-competitive firms:

$$c_t = \left(\int_0^1 c_{j,t}^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}}, \tag{2}$$

where $\varepsilon > 1$ is the elasticity of substitution between two varieties of final goods. In line with standard Dixit-Stiglitz based New Keynesian models, the optimal allocation of expenditures on each variety is given by:

$$c_{j,t} = \left(\frac{P_{j,t}}{P_t} \right)^{-\varepsilon} c_t, \tag{3}$$

where $P_t = \left(\int_0^1 {P_{j,t}}^{1-\varepsilon} dj \right)^{\frac{1}{1-\varepsilon}}$ is the Dixit-Stiglitz price index that results from cost minimization.

Maximization is subject to the sequence of budget constraints of the form:

$$c_t + \frac{B_t}{P_t} = \frac{n_t h_t W_t}{P_t} + (1 - n_t)s + \frac{R_{t-1} B_{t-1}}{P_t} + \frac{T_t}{P_t} + \frac{\Theta_t}{P_t}, \tag{4}$$

where s stands for the outside option (e.g. unemployment benefits), W_t is the nominal wage, B_t denotes nominal bonds, R_t is the nominal gross interest rate on bonds, P_t is the aggregate price level, T_t is net nominal transfers and Θ_t denotes nominal profits from the ownership of firms.

Household's choices of c_t and B_t give the standard Euler equation:

$$e_t u_{c,t} = \beta R_t E_t \left(\frac{e_{t+1} u_{c,t+1}}{\pi_{t+1}^p} \right), \tag{5}$$

where $\pi_t^p = \frac{P_t}{P_{t-1}}$ is the gross price inflation rate and $e_t u_{c,t}$ is the marginal utility of consumption.

3.2 The Production Sector

There is a continuum of measure one of monopolistically-competitive firms. Each firm j hires labor as the only input and produces a differentiated product $y_{j,t}$ using the following technology:

$$y_{j,t} = z_t n_{j,t} f(h_{j,t}), \tag{6}$$

with z_t denoting aggregate productivity (which is common to all firms), $n_{j,t}$ is employment at firm j and $h_{j,t}$ denotes hours per worker at the firm. The pricing of a firm is subject to a quadratic adjustment cost as in Rotemberg (1982), expressed in units of the final good.

Hiring workers by each firm is subject to search and matching frictions. Each period, firms post vacancies and meet unemployed workers searching for jobs. The cost of posting a vacancy v is γ. Matches between unemployed individuals, u_t, and vacancies, v_t, are determined by the following constant return-to-scale matching function:

$$m(u_t, v_t) = \mu d_t u_t^{\zeta} v_t^{1-\zeta}, \tag{7}$$

where ζ is the elasticity of matches with respect to unemployment, μ is a scaling parameter and d_t measures the efficiency of the matching process. The shock acts as a friction and reduces the efficiency of the matching process. In what follows, we assume that d_t responds to this shock.

Labor market tightness is defined as the ratio of vacancies to unemployment:

$$\theta_t = \frac{v_t}{u_t}. \tag{8}$$

The probability of the firm to fill a job is $q(\theta_t) = \frac{m(v_t,u_t)}{v_t}$, and the job finding rate is $p(\theta_t) = \frac{m(v_t,u_t)}{u_t}$. Other things being equal, the job filling rate decreases in labor market tightness, while the job finding rate increases in labor market tightness. Changes in the efficiency of the matching process, however, break the direct link between labor market tightness, on one hand, and the job filling and finding rates, on the other hand. As such, with a time-varying efficiency of matching, the correlation between job finding and job filling rates is not unambiguously negative.

Nominal wages and hours per worker are determined by Nash bargaining between workers and firms. Adjusting nominal wages is costly, and the cost of adjusting the nominal wage of one worker by firm j is given by the following Linear-Exponential (*Linex*) function:

$$\Phi_{j,t}^{W} = \frac{\phi^w}{\psi^2}\left(\exp[-\psi(\frac{W_{j,t}}{W_{j,t-1}} - \overline{\pi}^w)] + \psi(\frac{W_{j,t}}{W_{j,t-1}} - \overline{\pi}^w) - 1\right) \tag{9}$$

with ϕ^w being the adjustment cost parameter of nominal wages, ψ the degree of asymmetry in wage adjustment and $\overline{\pi}^w$ the steady-state wage inflation rate. For positive values of ψ, the cost of cutting the nominal wage by a certain magnitude is higher than the cost of increasing the nominal wage by the same magnitude. Also, as ψ approaches zero, this function approaches the quadratic adjustment cost function and hence it enables comparison with the case of symmetric adjustment cost function. In the other extreme, as ψ approaches infinity, this adjustment cost function becomes L-shaped, and therefore, nominal wages cannot fall. Nominal wages are determined via Nash bargaining and, following Arseneau and Chugh (2008), we assume the incidence of the adjustment cost falls on firms.

Employment at each firm evolves according to the following law of motion:

$$n_{j,t+1} = (1-\rho)\left(n_{j,t} + m(v_{j,t}, u_t)\right), \tag{10}$$

with ρ denoting the separation rate from a match. This formulation assumes that a match formed at time t starts to produce at time *t+1* if it survives exogenous separation.

The adjustment cost of prices is given by:

$$\Phi^P_{j,t} = \frac{\phi^p}{2}\left(\frac{P_{j,t}}{P_{j,t-1}} - \overline{\pi}^p\right)^2 \tag{11}$$

with ϕ^p being the adjustment cost parameter and $\overline{\pi}^p$ the steady-state price inflation rate.

A firm j chooses its price, vacancies and next-period employment to maximize the expected present discounted stream of profits:

$$E_0 \sum_{t=0}^{\infty} \frac{\beta^t e_t u_{c,t}}{e_0 u_{c,0}} \left\{ \frac{P_{j,t}}{P_t} y_{j,t} - n_{j,t} w_{j,t} h_{j,t} - \gamma v_{j,t} - \Phi^W_{j,t} n_{j,t} - \Phi^P_{j,t} y_t \right\}, \tag{12}$$

subject to the sequence of laws of motion of employment:

$$n_{j,t+1} = (1-\rho)(n_{j,t} + v_{j,t} q(\theta_t)), \tag{13}$$

and the downward-sloping demand function for its product:

$$z_t n_{j,t} f(h_{j,t}) = \left[\frac{P_{j,t}}{P_t}\right]^{-\varepsilon} y_t. \tag{14}$$

Since households own the firms, future profits of the firms are discounted by the stochastic discount factor of households. We assume symmetry across workers (they supply the same number of hours) and firms (they choose the same amount of employment and vacancies), and hence we suppress the index j in what follows. Then, combining the first-order conditions with respect to n_{t+1} and v_t yields:

$$\frac{\gamma}{q(\theta_t)} = \beta(1-\rho)E_t\left\{\left(\frac{e_{t+1}u_{c,t+1}}{e_t u_{c,t}}\right)\left[mc_{t+1}z_{t+1}f(h_{t+1}) - w_{t+1}h_{t+1} - \Phi^W_{t+1} + \frac{\gamma}{q(\theta_{t+1})}\right]\right\}, \tag{15}$$

where $w_t(=\frac{W_t}{P_t})$ is the real wage and mc_t is the Lagrange multiplier on the output constraint (14). This multiplier measures the contribution of one additional unit of output to the revenue of the firm, and, in equilibrium, it equals the real marginal cost of the firm.

Equation (15) is the Job Creation (JC) condition (or Free-Entry condition), and it states that, in equilibrium, the firm equates the vacancy-creation cost to the expected present discounted value of profits from the match. As the term in brackets makes clear, the flow profit to a firm from a match equals output net of wage payments and the costs of adjusting wages.

In a symmetric equilibrium, in which all firms set the same price, Rotemberg pricing gives the standard forward-looking price Phillips curve:

$$1 - \phi^p(\pi^p_t - \overline{\pi}^p)\pi^p_t + \beta\phi^p E_t\left[\left(\frac{e_{t+1}u_{c,t+1}}{e_t u_{c,t}}\right)(\pi^p_{t+1} - \overline{\pi}^p)\pi^p_{t+1}\frac{y_{t+1}}{y_t}\right] = \varepsilon(1 - mc_t). \tag{16}$$

This equation suggests that the current price inflation rate is a function of expected price inflation rate and current real marginal cost. The role of downward nominal wage rigidity in driving inflation is better seen by substituting, using the time (*t-1*) version of equation (15), for the real marginal cost mc_t in equation (16). The adjustment cost of nominal wages increases the marginal cost of the firm and in turn, leads to an increase in inflation. In this context, wage rigidity acts as an endogenous cost-push shock.

3.3 Nash Bargaining

As is typical in the literature, wage payments and hours per employed individual are determined by a Nash bargaining between firms and individuals. Firms and workers then split the surplus of a match according to their bargaining powers. Because of the monetary nature of our model and nominal wage rigidity, we follow Gertler et al. (2009), Arseneau and Chugh (2008) and Thomas

(2008) by assuming that bargaining is over nominal wages W_t rather than real wages w_t.

Bargaining over nominal wages gives the following condition that characterizes the real wage setting:

$$\frac{\omega_t}{1-\omega_t}\left[mc_t z_t f(h_t) - w_t h_t - \Phi_t^W + \frac{\gamma}{q(\theta_t)}\right] = w_t h_t - \frac{v(h_t)}{u_{c,t}} - s + E_t\left[\frac{\omega_{t+1}}{1-\omega_{t+1}}\left(\frac{\gamma}{q(\theta_t)} - \gamma\theta_t\right)\right], \quad (17)$$

where η denotes the share of workers in the match surplus (which is also their deterministic steady state bargaining power), $\omega_t = \frac{\eta}{\eta+(1-\eta)\frac{\Delta_t^F}{\Delta_t^W}}$ is the *effective* bargaining power of workers, Δ_t^F is the marginal change in the value of a filled job and Δ_t^W is the marginal change in the value of being employed as the nominal wage varies. The wage adjustment cost thus drives a wedge between the effective bargaining power and the ex-ante bargaining power of workers.

Similarly, bargaining over hours per employed individual gives the following condition:

$$\frac{\Gamma_t}{1-\Gamma_t}\left[mc_t z_t f(h_t) - w_t h_t - \Phi_t^W + \frac{\gamma}{q(\theta_t)}\right] = w_t h_t - \frac{v(h_t)}{u_{c,t}} - s + E_t\left[\frac{\Gamma_{t+1}}{1-\Gamma_{t+1}}\left(\frac{\gamma}{q(\theta_t)} - \gamma\theta_t\right)\right], \quad (18)$$

where $\Gamma_t = \frac{\eta}{\eta+(1-\eta)\frac{\delta_t^F}{\delta_t^W}}$ is the effective bargaining power of workers in hours determination, δ_t^F and δ_t^W are, respectively, the marginal changes in the values of a filled job and being employed as hours per employed individual vary.

Conditions (17) and (18) suggest that the current real wage is affected by the outside option of workers (unemployment benefits), the disutility of work, the cost of adjusting nominal wages and the continuation value of being employed. As standard in this class of models, the real wage is increasing in the value of the outside option and disutility of work, as workers need higher real wages to compensate them for the disutility of work and the forgone outside option. Finally, when nominal wages are fully flexible (or fully stabilized), we have $\omega_t = \eta$.[3]

3.4 The Shocks

The demand (preference) shifter evolves according to the following rule:

$$\ln\left(\frac{e_t}{\bar{e}}\right) = \rho_s \ln\left(\frac{e_{t-1}}{\bar{e}}\right) + q_e \iota_t \quad (19)$$

[3]The use of the term "effective bargaining power" in a model with wage stickiness follows Gertler et al. (2009) who assume staggered multi-period wage contracting in a labor search and matching model.

where ρ_s is the persistence of the shock, $\iota_t \sim \mathcal{N}(0, \sigma_\iota^2)$, $q_e > 0$ and $\bar{e} = 1$.

The efficiency of the matching process is given by:

$$\ln\left(\frac{d_t}{\bar{d}}\right) = \rho_s \ln\left(\frac{d_{t-1}}{\bar{d}}\right) + q_d \iota_{t-1} \tag{20}$$

with $q_d > 0$ and $\bar{d} = 1$. We assume that the effect on matching has a one period (a quarter) lag. In the appendix, we show that this assumption is not central to our main findings with respect to the dynamics of inflation. We further assume that the same event affects the demand side of the economy and the labor market, but allow for the shocks impact on the demand side and on labor market matching efficiency, as measured by q_d and q_e, to differ.

3.5 Market Clearing and Monetary Policy

Bonds are in zero net supply ($b_t = 0$). In addition, in equilibrium, the resource constraint of the economy holds:

$$n_t z_t h_t^\alpha = c_t + \gamma v_t + \frac{\phi^w}{\psi^2}\left(\exp[-\psi(\pi_t^w - \bar{\pi}^w)] + \psi(\pi_t^w - \bar{\pi}^w) - 1\right) n_t + \frac{\phi^p}{2}\left(\pi_t - \bar{\pi}^p\right)^2 n_t z_t h_t^\alpha, \tag{21}$$

and the labor market clears:

$$u_t = 1 - n_t. \tag{22}$$

Real wage growth evolves according to:

$$\frac{w_t}{w_{t-1}} = \frac{\pi_t^w}{\pi_t^p}. \tag{23}$$

Condition (23) is typically introduced in models with sticky price and sticky nominal wages. This identity does not hold trivially under sticky nominal wages and sticky prices, and hence it should be added to the equilibrium conditions of the private sector in order to tie the path of real wages to the paths of nominal wages and prices.[4]

Finally, monetary policy is governed by a Taylor-type rule whereby the nominal interest rate responds to deviations of inflation and output from their steady-state values:

$$\ln\left(\frac{R_t}{\bar{R}}\right) = \rho_\pi \ln\left(\frac{\pi_t^p}{\bar{\pi}^p}\right) + \rho_y \ln\left(\frac{y_t}{\bar{y}}\right) \tag{24}$$

[4]This constraint also appears in the studies of Erceg et al. (2000) and Chugh (2006), among others.

with $\overline{y}$ being the steady-state value of output, and $\rho_\pi > 1$ and $\rho_y > 0$ being the coefficients of inflation and output.

3.6 The Private-Sector Equilibrium

Definition 1: given the exogenous process $\{z_t\}$, the private-sector equilibrium is a sequence of allocations $\{c_t, d_t, e_t, h_t, n_t, u_t, v_t, \theta_t, mc_t, w_t, \pi_t^p, \pi_t^w, R_t\}$ that satisfy the equilibrium conditions (5), (8), (13) and (15)-(18) and (19)-(24).

4 Numerical Analysis

We first describe the functional form and the parameterization of the model and then present the model-based numerical results.

4.1 Calibration

We assume the following period utility functions of consumption and disutility of hours:

$$u(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma} \tag{25}$$

$$v(h_t) = \chi \frac{h_t^{1+\vartheta}}{1+\vartheta}, \tag{26}$$

where σ is the curvature parameter of the period utility function of consumption, τ is the curvature parameter of the period utility function of real money, χ is scaling parameter and ϑ is the inverse of the intertemporal elasticity of substitution of labor.

Output per worker has diminishing returns in hours per worker, as follows:

$$f(h_t) = h_t^\alpha, \tag{27}$$

with α being the elasticity of output with respect to hours per worker.

4.2 Parameterization

The time unit is a quarter. Table 1 presents a summary of the parameter values. We divide the parameters of the model into two groups. The first group includes parameters for which we use standard values. To this end, we set α based on National Income and Product Accounts (NIPA) data. The exogenous separation rate ρ is in line with the literature, as in Davis et al. (1996). The value of ε implies a net steady state markup of 10 percent. The steady state value of inflation ($\bar{\pi}^p$) is set so that the annual inflation rate is 2%, which is consistent with the pre-shock inflation rates. For condition (23) to be satisfied at the steady state, we set $\bar{\pi}^w = \bar{\pi}^p$. The parameter χ is calibrated so that the deterministic steady state value of h is 0.3.

As is standard in the literature, the benchmark calibration of the model assumes that the Hosios (1990) condition holds, and hence the Nash bargaining power of workers equals the contribution of an unemployed individual to the match (i.e. $\eta = \zeta$). As shown in Hosios (1990), this condition guarantees the efficiency of the matching process. We set the size of the shocks (q_e and q_d) to jointly match the rise in the unemployment rate at the onset of the pandemic. Furthermore, the persistence of the shocks ρ_s is consistent with the effects of the Covid-19 shock being in place for 20 quarters. For robustness, we also consider smaller values of ρ_s (0.50 or 0).

Table 1: Parameter Values

Parameter	Description	No FP	With FP
β	Households' utility discount factor	0.99	0.99
σ	Consumption curvature parameter	2.13	2.19
ϑ	Inverse labor supply elasticity	2.25	2.26
α	Elasticity of output with respect to hours per worker	2/3	2/3
ε	Elasticity of substitution between products	11.00	11.00
$\bar{\pi}^p$	Steady-state gross price inflation rate	1.005	1.005
ρ_π	Response of the interest rate to inflation	1.50	1.50
ρ_y	Response of the interest rate to output	0.49	0.50
q_e	Demand shock	0.93	0.90
q_d	Shock to efficiency of matching	7.27	7.40
ρ_s	Persistence of the shock	0.95	0.95
ζ	Contribution of an unemployed individual to a match	0.40	0.40
ϕ^p	Price rigidity	29.73	30.26
ϕ^w	Wage rigidity	79.35	78.75
ψ	Asymmetry parameter of wage rigidity	2362.51	2427.23
ρ_g	Persistence of government spending		0.90
ρ_{gy}	Response of government spending to output		1.19

Note: This table summarizes the values of the parameters in the benchmark analyses. $\bar{\pi}^w = \bar{\pi}^p$ and $\eta = \zeta$. Productivity: $z_t = 1$ for all t. See Appendix A for more details.

For the second group of parameters, we use Bayesian estimation. The details of the estimation procedure, prior values and posterior values can be found in Appendix A. The main parameters in this group include $\phi^p, \phi^w, \psi, q_d$ and q_e, for which we do not have previous estimates. We also estimate the Taylor-rule parameters using this procedure and they tend to be consistent with previous estimates.

Our estimation makes use of U.S. data for the period 1983:Q1-2019:Q4. Therefore, we do not include the pandemic episode in the estimation. The rationale behind this choice is to show that a model that is estimated using pre-shock data can predict the dynamics of inflation and labor market variables once a shock, such as the one that we describe in this paper, hits the economy. We then set the standard deviation of the shock to match the rise in the unemployment rate during the first quarter of the pandemic. That would be the only target that we match since March 2020. We also note that the sample period since the start of the Covid-19 pandemic is relatively short, which limits our ability to rely solely on this period for estimation.[5] Finally, for downward nominal wage rigidity to remain operative, we solve the model using a second-order approximation (as linearization eliminates the asymmetry in wage adjustment).

4.3 Impulse Responses- Benchmark Results

We now discuss the impulse response functions that are obtained from solving the full non-linear model. The core simulation in the benchmark model considers a shock that simultaneously reduces household demand and the efficiency with which firms and workers form job matches. This shock replicates the economic conditions observed in the wake of the COVID-19 outbreak, which saw both a collapse in consumer activity and major disruptions to the labor market.

Figure 3 shows the responses of key macroeconomic aggregates to a shock that reduces demand and the efficiency in the matching process. Immediately following the shock, employment, vacancies and output drop, while unemployment rises. The combination of a fall in vacancies and a rise in unemployment triggers a fall in labor market tightness. Initially, the job finding rate falls while job filling rate rises. Job seekers find it harder to get hired, while firms initially experience a temporary increase in the job filling rate due to the rise in available workers. However, the continued deterioration in matching efficiency soon causes the job filling rate to fall well below its pre-pandemic level while the job finding rate remains under pre-shock levels.[6]

[5] In the Appendix, we present results based on data that also includes the pandemic period (1983:Q1-2022:Q4)

[6] In standard search and matching models, the job finding rate and the job filling rate are negatively related. This inverse relationship can break down when matching efficiency is endogenous. As a result, when matching efficiency is endogenous, these two variables can move in the same direction. This underscores the importance of modeling matching frictions to replicate observed labor market dynamics.

Owing to downward nominal wage rigidity, the nominal wage remains elevated above its steady-state level following the shock. In the immediate aftermath, the inflation rate declines, driven by a contraction in demand and a weakened labor market. Then, as vacancies and labor market tightness begin to recover and then exceed their pre-shock levels, starting around the third quarter after the shock, inflation rebounds and eventually exceeds its steady-state value. The real wage initially rises due to the decline in inflation and wage stickiness, but it then falls as inflation increases and wage growth moderates. These simulated dynamics closely mirror the empirical trends observed during the pandemic recovery, as shown earlier in the paper. Notably, the model captures the seemingly paradoxical situation in which inflation rises even though the labor market has not fully recovered. This outcome is driven by the persistent inefficiency in job matching and the inability of nominal wages to adjust downward.[7]

The results implied by our model are mostly consistent with the data that are presented in Figure 1. The rise in inflation happens while the labor market has not fully recovered, which is also consistent with U.S. data. As such, the model with labor search and matching, augmented with shocks to demand and the efficiency of the matching process, can successfully replicate the observed dynamics of the inflation rate in the United States since Spring 2020. Note also that, in the early stages of the recovery from the pandemic-induced recession, labor and output recovered quickly, and then the recovery slowed. Our model-based results account for this observation too.

We now turn to the results under two distinct scenarios: one in which the economy is subjected solely to a demand-side shock, and another in which the shock pertains exclusively to the efficiency of the matching process in the labor market. These scenarios are depicted in Figure 3, which plots the impulse responses of key variables following each type of shock.

In the case of a pure demand shock, the dynamics of all main variables exhibit a monotonic adjustment pattern after the initial impact. As illustrated in Figure 3, a contraction in demand causes a sharp decline in vacancies, a rise in unemployment, and a corresponding fall in labor market tightness. The inflation rate also declines, followed by a modest and gradual rebound. Crucially, however, neither vacancies nor inflation overshoot their respective steady-state values at any point during the adjustment path. This is inconsistent with the empirical patterns documented earlier

[7] The behavior of the time-varying effective bargaining power of workers ω_t following the shock is highly similar to that of the real wage: it rises on impact and then falls. In addition, in the model simulations, the correlation coefficient between the real wage and the bargaining power exceeds 90%.

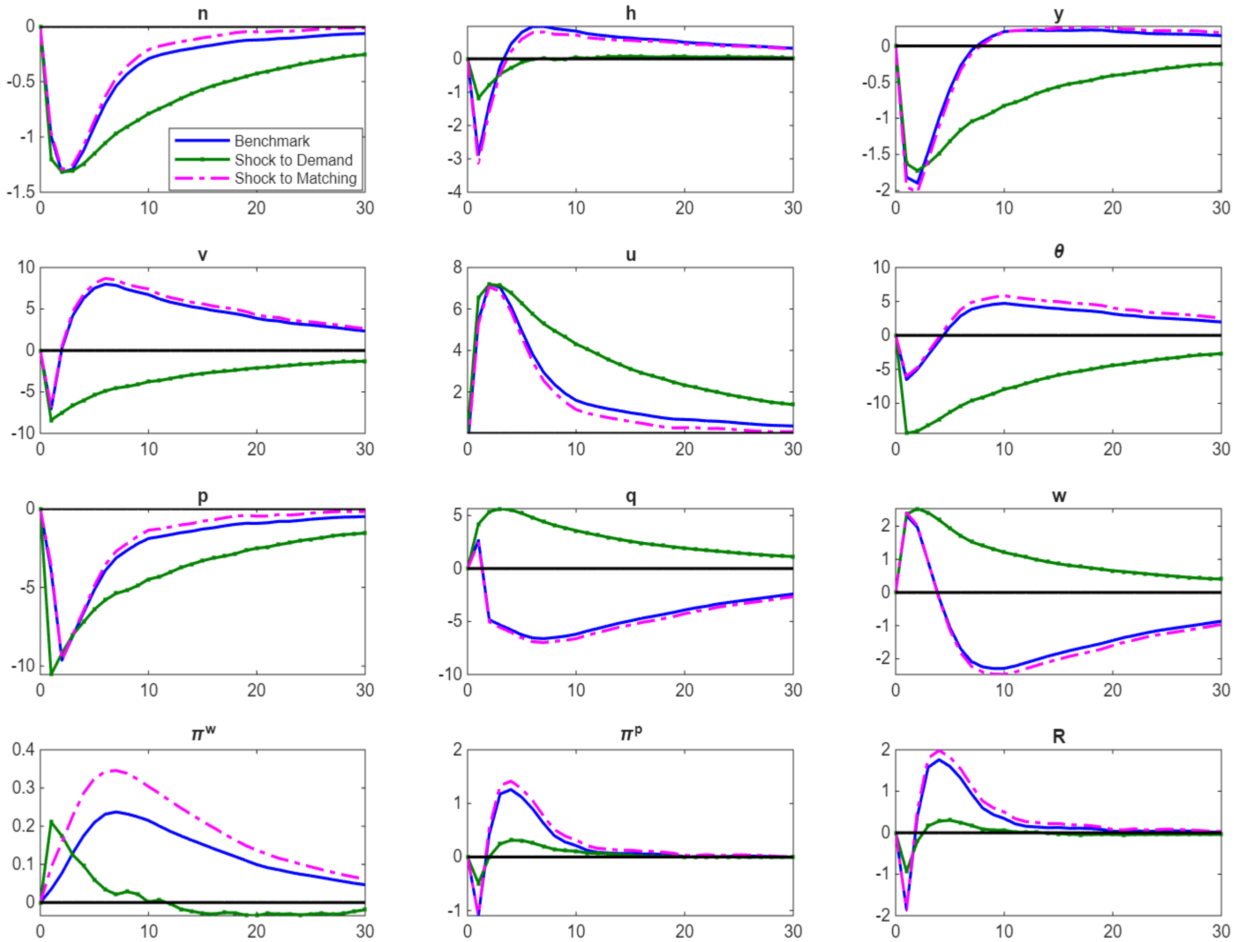

Figure 3: Impulse responses- Benchmark Analysis

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. These results are obtained from solving the benchmark model with both supply-side and demand-side effects using a second-order approximation. "Shock to Demand": the model with a demand-side effect only ($q_d = 0$). "Shock to Matching": the model with only a shock to the efficiency of the matching process ($q_e = 0$). "Benchmark": the model with both shocks. n: employment, h: hours per employed individual, y: output, v: vacancies, u: unemployment, θ: labor market tightness, p: job finding rate, q: job filling rate, w: real wage, π^w: wage inflation, π^p: price inflation, R: nominal interest rate.

in the paper (e.g., in Figure 1), where inflation and labor market tightness exhibit pronounced rebounds following the COVID-19 shock. In the demand shock scenario, the model generates insufficient inflationary pressure and subdued labor market recovery, failing to replicate the non-monotonic patterns seen in the data.

By contrast, the response to a matching efficiency shock, shown in Figure 3, captures many of the features observed in the data. Following a negative shock to matching efficiency, the number of successful matches falls, which depresses employment and reduces aggregate labor input. This in turn lowers aggregate demand, leading to a decline in inflation in the short run. However, as the labor market adjusts, vacancies and tightness rebound sharply – exceeding their steady-state levels

– and the inflation rate also overshoots before gradually stabilizing. These dynamics are much more consistent with empirical evidence, especially the recovery of inflation and tightness documented after the initial phase of the pandemic.

Importantly, the inflation overshoot observed in the matching shock scenario is not mechanically imposed; rather, it emerges endogenously from the interaction between labor market frictions and wage rigidity. The reduction in match efficiency initially limits job creation, but as firms seek to fill open positions in a tighter labor market, wage pressures build, contributing to the eventual rise in inflation. This mechanism provides a plausible explanation for the observed inflation dynamics in the post-shock period and suggests that shocks to the structure of the labor market, rather than aggregate demand alone, may play a pivotal role in driving inflationary outcomes.

4.4 Wage Rigidity Matters

This subsection investigates the importance of nominal wage rigidity within the model. When wages are fully flexible, i.e., when the wage adjustment cost parameter ϕ^w is set to zero, the dynamics of the nominal wage deviate significantly from observed data. As shown in Figure 4, the nominal wage declines immediately in response to the shock, a pattern that contrasts sharply with its relatively stable or elevated behavior in the aftermath of the COVID-19 pandemic. This flexibility allows some of the labor market adjustment to occur through wage reductions rather than through declines in employment or vacancies. As a result, the contraction in vacancies and output is considerably muted relative to the benchmark model with wage rigidity. Vacancies exhibit only a slight initial decline and begin to rebound after just one quarter. However, labor market tightness remains persistently below its pre-shock level, which is at odds with empirical evidence. The dynamics of the job finding and job filling rates are also affected. Both rates decline initially before gradually returning toward their steady-state values. Notably, the initial behavior of the job filling rate is inconsistent with the data and with the results produced by the baseline model that incorporates nominal wage rigidity.

Inflation dynamics under flexible wages resemble those of the benchmark model, but with an earlier reversal and a substantially smaller overshoot. The muted inflation response in the absence of wage rigidity is in line with existing literature that identifies downward nominal wage rigidity as a key determinant of inflation persistence (see, for instance, Kim and Ruge-Murcia (2009);

Abo-Zaid (2013)). In models with downward nominal wage rigidity, inflation tends to rise more in response to negative shocks, facilitating real wage adjustment in the absence of nominal wage cuts. Removing this rigidity weakens the inflationary response and diminishes the model's ability to replicate observed inflation patterns.

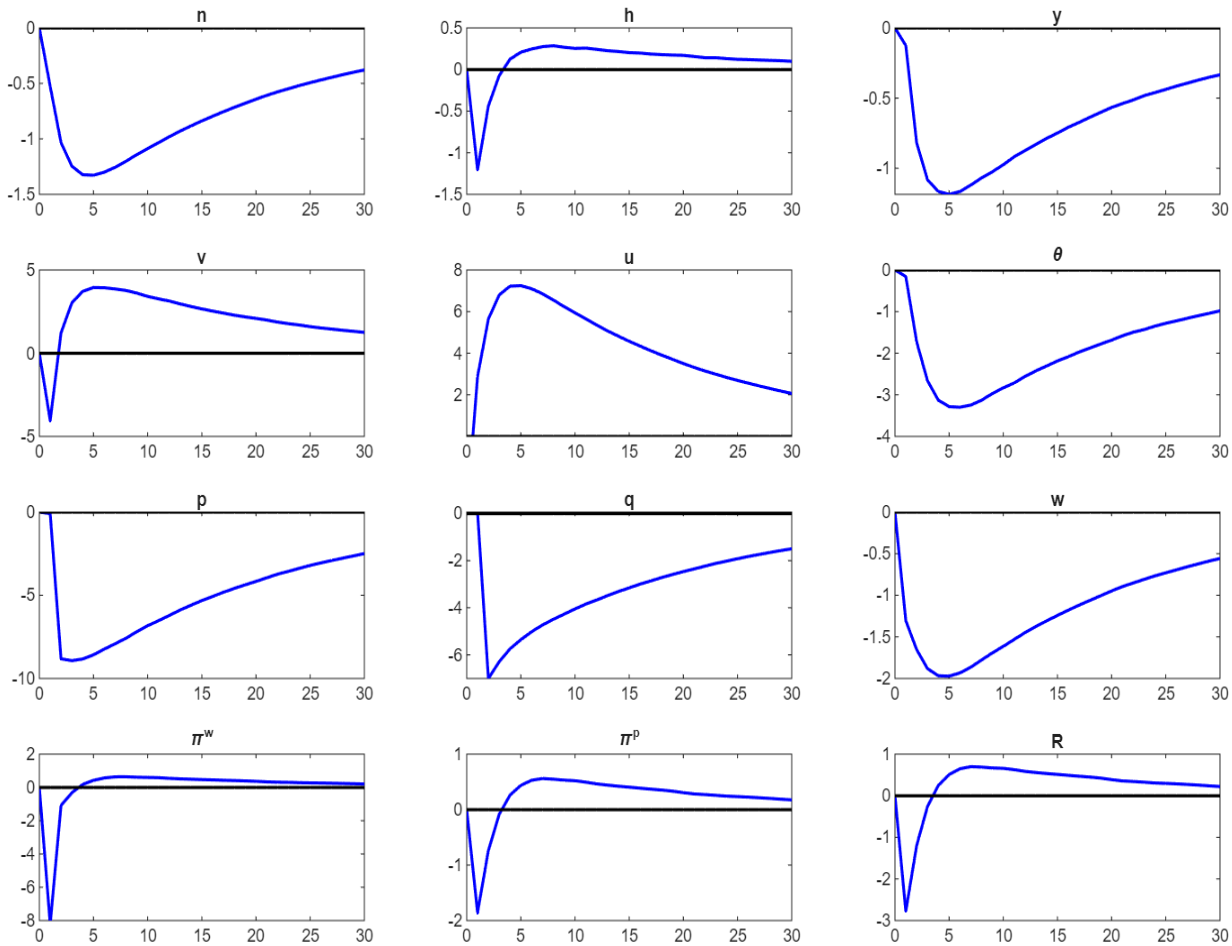

Figure 4: Impulse Responses- The Model With Flexible Wages

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. The results of the model with a demand-side effect, supply-side effect and flexible wages ($\phi^w = 0$). n: employment, h: hours per employed individual, y: output, v: vacancies, u: unemployment, θ: labor market tightness, p: job finding rate, q: job filling rate, w: real wage, π^w: wage inflation, π^p: price inflation, R: nominal interest rate.

Omitting wage rigidity thus reduces the model's explanatory power for the empirical patterns that are described in Section 2, particularly regarding labor market tightness and the persistence of inflation. A key insight from this analysis is that the rise in wage inflation since early 2020 likely played a central role in shaping the post-pandemic inflation path. Supporting this view, recent work by Kiley (2023) employs a time-varying distributed lag model of prices and wages to estimate trend inflation. The study finds that wages have become increasingly informative in explaining inflation dynamics, with their relative importance in trend inflation estimation by 2022 returning to levels last seen in the 1980s.

4.5 The Role of Fiscal Policy

In this subsection, we introduce government spending in the model. Specifically, we let government spending (g_t) respond to changes to output, acting as an "automatic stabilizer":

$$\ln\left(\frac{g_t}{\overline{g}}\right) = \rho_g \ln\left(\frac{g_{t-1}}{\overline{g}}\right) - (1-\rho_g)\rho_{gy} \ln\left(\frac{y_t}{\overline{y}}\right), \tag{28}$$

with $\overline{g}$ being the steady-state value of government spending, $\rho_{gy} > 0$ and $\rho_g > 0$ being the coefficient of output and the persistence of government spending, respectively. The government budget constraint is given by:

$$g_t + \frac{R_{t-1}b_{t-1}}{\pi_t^p} = b_t + T_t \tag{29}$$

where we assume that the additional spending is financed via borrowing only (i.e. net transfers T_t are kept fixed). In addition, the resource constraint is modified as follows:

$$y_t = c_t + \gamma v_t + \frac{\phi^w}{\psi^2}\left(\exp[-\psi(\pi_t^w - 1)] + \psi(\pi_t^w - 1) - 1\right) n_t + \frac{\phi^p}{2}\left(\pi_t - 1\right)^2 y_t + g_t. \tag{30}$$

Figure 5 compares the dynamic responses of key macroeconomic variables under two model specifications: the benchmark model (which includes wage rigidity, a shock to demand and a shock to matching efficiency, but no fiscal support) and an augmented version of the model that incorporates a government spending response following the shock (with and without a shock to matching efficiency). This allows us to assess the role of fiscal policy in shaping the recovery path of inflation and labor market indicators.

In the absence of a shock to the efficiency of matching (labelled "FP, Constant d"), the model is unable to replicate the behavior of inflation after the initial fall; the inflation rate barely surpasses its initial level and quickly reverts to its baseline. Moreover, the trajectories of key labor market variables, including vacancies and labor market tightness, diverge from empirical observations. Consequently, incorporating a shock to matching efficiency is essential to accurately replicate the dynamic behavior of inflation and related labor market variables.

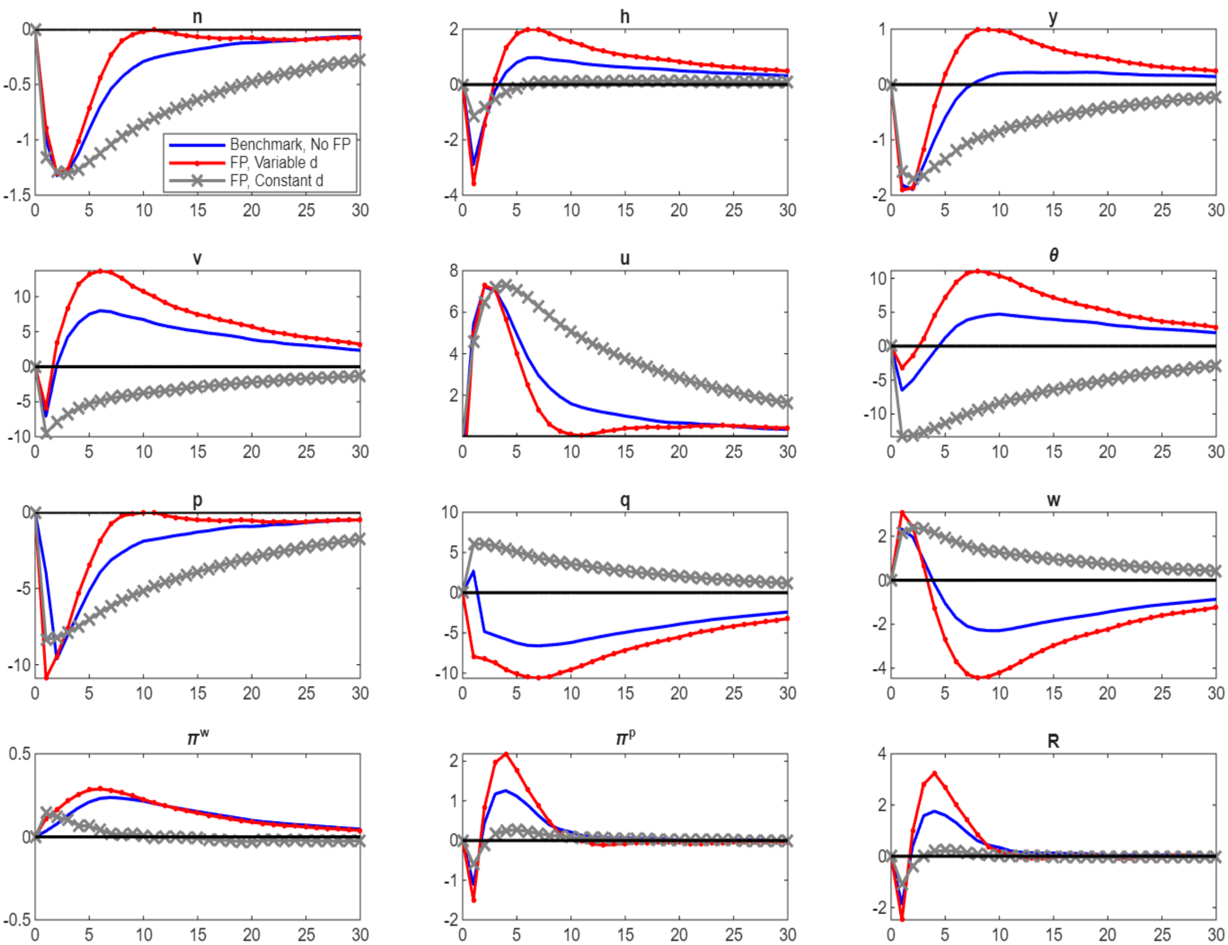

Figure 5: Impulse Responses- The Benchmark vs. the Model With Government Spending

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. The results of the model with government spending compared to the benchmark model. "Benchmark, No FP": the model with a demand-side effect, supply-side effect, but no fiscal policy. "FP, Variable d": the model with a demand-side effect, supply-side effect and fiscal policy. "FP, Constant d": the model with fiscal policy and demand side effect, but no supply-side effect. n: employment, h: hours per employed individual, y: output, v: vacancies, u: unemployment, θ: labor market tightness, p: job finding rate, q: job filling rate, w: real wage, π^w: wage inflation, π^p: price inflation, R: nominal interest rate.

That said, coupled with the shock to matching efficiency, fiscal policy matters for the dynamics of the economy (the specification "FP, Variable d" in Figure 5). The increase in government spending following the shock renders the output decline transient. Furthermore, it accelerates the reversal of the inflation rate and results in a higher inflation rate compared to the benchmark model that excludes fiscal policy. While the benchmark model without fiscal interventions better captures the dynamics of some variables during the initial phase, the model that includes fiscal policy provides a more accurate explanation of the behavior of other variables during the later stages of the pandemic.

For instance, the recovery of unemployment and the job-finding rate occur within approximately ten quarters, aligning well with the empirical data that are discussed in Section 2.

Under fiscal policy, the elevated inflation rate persists for a shorter duration, reverting to its initial level after approximately twelve quarters. This pattern may reflect a return to pre-shock government spending levels. In other words, given that inflation in the model is sensitive to the path of fiscal policy, the subsequent reduction in government spending following its initial rise contributes to a more rapid decline in inflation.

4.6 Model Fit: Short-run Dynamics

We now turn to comparing the model-based behavior of inflation to its counterpart in the data. While the goal of the model is not to fit the exact dynamics of inflation, we perform this model fit exercise to assess the role that demand shocks, matching efficiency shocks, fiscal policy, and wage rigidity each separately play on the model's ability to qualitatively generate the observed inflation patterns.

In the left panel of Figure 6, we plot the results from the benchmark model with both the demand and the shock to matching efficiency. The right panel adds fiscal policy to the benchmark model. We also include four inflation measures (headline CPI, core CPI, headline PCE, and core PCE) highlighting that the overall pattern is common across the various concepts. Each plot represents the deviation of the inflation rate from its initial value, referred to as "excess inflation," on a quarterly basis. The initial value is defined as the average inflation rate during the last three months before the Covid-19 pandemic (December 2019 - February 2020).

The analysis highlights that the model can capture the initial decline and subsequent rise in inflation. The benchmark model overshoots the increase and overstates the speed of the recovery, even more so when fiscal stimulus is added. In this sense, we note that fiscal policy does not appear to be essential to explain the inflation dynamics during the initial months of the pandemic. Overall, the success of the model in accounting for the behavior of inflation since the beginning of the pandemic is noteworthy, especially considering that the model is calibrated based on pre-pandemic data. Moreover, in Appendix Figure C.5 we show that allowing matching efficiency to vary based on endogenous job search and recruiting intensity, with underlying shocks to job seekers' search costs and firms' recruiting decisions, substantially improves the model's ability to replicate the tapered rise in inflation and slower recovery.

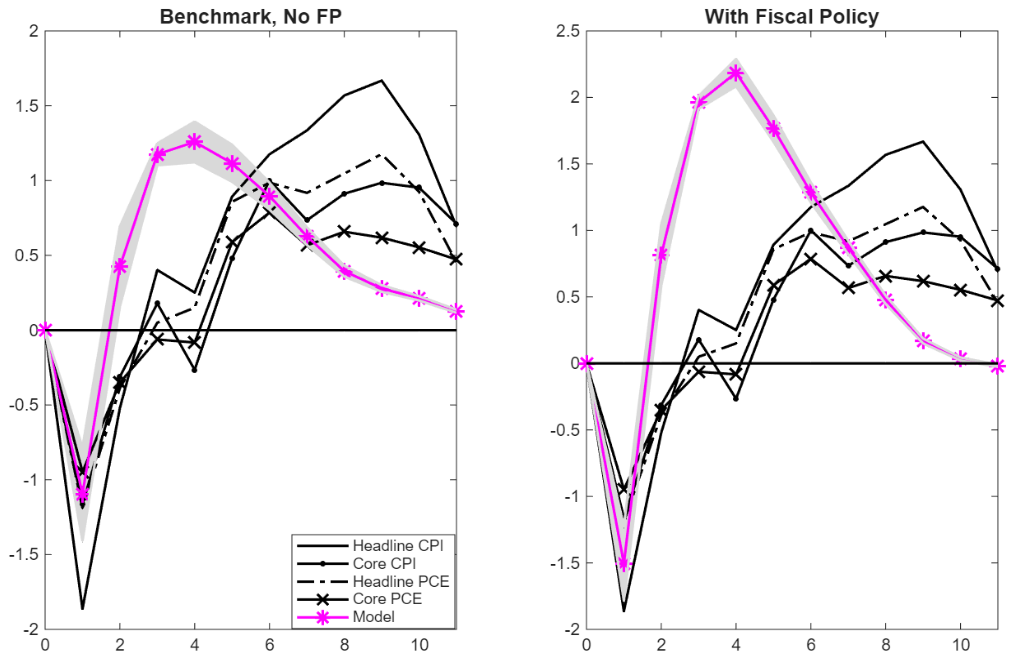

Figure 6: Excess Inflation Rate: Model vs. Data

Note: Data vs. model-based inflation rates (Quarterly). Model: Percentage deviations from the deterministic steady state. Data: percentage deviations from pre-Covid levels. Left panel: the model without fiscal policy. Right Panel: the model with fiscal policy. Shaded areas: 90% confidence intervals around the model-based impulse response functions.

We next explore the model-implied correlations between the inflation rate and key labor market variables, and how they compare to the empirical correlation using data from 2020 to 2023. The first notable pattern in Table 2 is the strong, positive correlation between labor market tightness and vacancies with inflation. This finding aligns with the results reported in Ball et al. (2022), confirming the importance of labor market tightness to capture the relevant measure of slack for price-setting dynamics and hence in understanding inflation dynamics. Further, it is important to note that the job filling rate consistently correlates negatively with inflation. This inverse relationship is intuitive: when the labor market is tight and firms have difficulty filling vacancies (i.e., a lower job filling rate), they face higher marginal hiring costs, which can feed into upward price pressures. This reinforces the view that labor market frictions, rather than just employment levels, play a central role in inflation dynamics.

The second half of the table displays the pairwise correlation coefficients implied across various versions of the model. From this section of the table, we highlight three results. First, vacancies and inflation are strongly and positively correlated in all versions of the model with wage rigidity, and quantitatively reflect their empirical counterparts. Second, while the benchmark model generates the positive correlation between job finding rates and inflation, the strength is much attenuated relative to the data unless fiscal policy is added or matching efficiency is kept constant. Combined with Figure 6, we take this result as consistent with fiscal policy being a necessary, yet not sufficient, shock to explain the dynamics of inflation during the pandemic. Third, we highlight the consistently negative correlation between job filling rate and inflation across the various model specifications.

Table 2: Correlations of Labor Market Variables with Inflation

Measure	Wage inflation	Vacancies	Labor market tightness	Job finding rate	Job filling rate
Headline CPI	0.4168	0.7648	0.6108	0.5909	-0.7276
Core CPI	0.3414	0.7791	0.6469	0.6265	-0.7348
Headline PCE	0.5953	0.7740	0.6106	0.5880	-0.7662
Core PCE	0.5651	0.7602	0.6005	0.5771	-0.7678
Benchmark, No FP	0.6962	0.6921	0.2441	0.0815	-0.3076
FP, Variable d	0.4943	0.7060	0.3069	0.2156	-0.2556
FP, Constant d	0.4335	0.7233	0.3965	0.3872	-0.3599
Flexible Wage	0.6217	-0.0023	-0.5007	-0.3982	-0.0363

Note: Correlation coefficients of labor market variables with the inflation rates, data vs. model. “Benchmark, NP”: the model with a demand-side shock, a shock to matching efficiency, but no fiscal policy. “FP, Variable d”: the model with a demand-side shock, a shock to matching efficiency and fiscal policy. “FP, Constant d”: the model with a demand-side shock, fiscal policy, but no shock to matching efficiency. “Flexible Wages”: the model with a demand-side shock, a shock to matching efficiency, but no fiscal policy and flexible nominal wages.

4.7 Robustness Analysis

We briefly discuss the results of a few robustness checks (the full results are shown in Appendix B). First, we present the results when the shock to the efficiency of matching is introduced with no lag (Appendix B.1). The impulse responses show that the core qualitative features of the model remain intact. Employment, output, and vacancies all experience an initial decline, reflecting a fall in demand and an immediate contraction in labor market activity. Over time, these variables recover gradually, consistent with the slow repair of labor market frictions. Inflation, importantly, exhibits a notable initial dip followed by a persistent and substantial rise, mirroring the dynamics in the benchmark model. This rise is more delayed than in standard New Keynesian models, but consistent with real-world data from the pandemic recovery period. The inflation trajectory reinforces the idea that persistent labor market tightness, driven by reduced matching efficiency and compounded by nominal wage rigidity, keeps real marginal costs elevated over time, pushing inflation upwards. It also confirms that the mechanism underlying inflation persistence is not reliant on a delayed transmission of the matching shock.

Next, we examine the impact of the shock persistence (ρ_s) on the dynamics of inflation (Appendix B.2). When the shock is less persistent, the declines in output, employment, and vacancies are milder and the recovery in labor market activity is faster. However, a key insight from the figure is that even when the shock is assumed to be less persistent, inflation still displays considerable persistence. This occurs despite a faster recovery in output and labor market variables. The result highlights the model's structural feature: persistent inflation can emerge not only from long-lived shocks, but also from short-lived disruptions interacting with nominal wage rigidity and labor market frictions. This reinforces the idea that inflation dynamics are shaped not only by the shock's duration, but also by the economy's structural inability to reallocate labor efficiently in the short run.

Third, we re-estimate the model using data spanning the period 1983:Q1-2022:Q4 and find that this modification has a very negligible effect on the results (Appendix B.3). Inflation behaves as in the benchmark model, which supports our key findings. In fact, the results under this scenario are highly similar to what we report in Figure 3.

Fourth, the early stages of the pandemic saw an unusal rise in job separations, with the separation rate nearly doubling compared to its pre-Covid level. The separation rate returned to its pre-Covid level after one quarter. We let the separation rate be endogenous (Appendix B.4). When separations are endogenized, firms gain an additional margin of adjustment. Following a negative shock, they increase separations, which deepens the initial drop in employment but also reduces the pressure to rapidly post vacancies during the recovery. As a result, the surge in vacancy posting is more modest, and tightness ($\theta = v/u$) rises more gradually. With higher endogenous separations early on, unemployment also rises more, dampening tightness further. Therefore, the reduced reliance on vacancy posting as the sole adjustment channel smooths the labor market response, explaining why the overshoot in both vacancies and tightness is less pronounced in this version of the model. Consequently, less overshooting in vacancies and tightness translates into more moderate and less persistent inflation, even though the overall employment path is similar. The inclusion of endogenous separations effectively dampens the inflation response by smoothing out labor market reallocation pressures, making the model's inflation dynamics more stable following a shock. That said, despite these quantitative differences, the main insight about inflation persistence does not change: inflation remains elevated for an extended period due to the continued presence of nominal wage rigidity and lingering labor market frictions. Endogenous separations simply alter the channels through which these frictions manifest, without overturning the core mechanism itself.

Next, we explore an alternative fiscal approach wherein the government provides transfers rather than increasing direct spending (Appendix B.5). The results show that transfers generate only a modest and short-lived increase in inflation, similar to the government spending scenario. Importantly, there is no overshooting of vacancies or labor market tightness in this specification. The recovery in labor market indicators is smoother, and tightness remains below its initial level for an extended period. This behavior reflects the fact that, although transfers support consumption and demand, they do not stimulate hiring incentives or labor market matching to the same extent. Overall, the figure confirms that fiscal policy alone – whether via transfers or spending – is insufficient to replicate the magnitude and persistence of post-pandemic inflation. The inflationary dynamics seen in the data emerge primarily through the interaction of fiscal support with persistent matching frictions and downward nominal wage rigidity.

Finally, in Appendix C we extend the benchmark model to allow for endogenous search intensity and recruitment intensity. In particular, in this extended model we assume that job seekers endure a negative utility cost to job search and that firms can choose the intensity of their search too, but face an adjustment cost when doing so. The main findings regarding inflation dynamics are qualitatively similar to those in the benchmark model; in fact, the model fit is substantially improved.

The robustness checks reinforce the central insight of the paper: persistent inflation following a large shock cannot be explained by transitory demand factors or fiscal policy alone. Whether the shock to matching efficiency is assumed to be immediate or lagged, more or less persistent, or whether fiscal policy is implemented through government spending or transfers, the model consistently shows that labor market features, particularly reduced matching efficiency and nominal wage rigidity, are essential to generating sustained inflation. Moreover, while introducing mechanisms such as endogenous separations alters the dynamics of vacancies and tightness and weakens the response of inflation, it does not eliminate inflation persistence. Across all specifications, the absence of significant overshooting in labor market tightness under certain conditions further emphasizes that tightness and wage rigidity, not the sheer scale of fiscal support, drive the inflationary response. These results underscore the robustness of the core mechanism of the model and highlight the importance of incorporating labor market frictions into macroeconomic models of inflation.

5 Implications for the Phillips Curve

The analyses of the paper provide a structural interpretation of the Phillips curve within a dynamic labor market framework characterized by search frictions, downward nominal wage rigidity, and fiscal policy interventions. Together, these elements offer a more nuanced view of the inflation-unemployment relationship, deviating from the standard formulation by highlighting persistence and amplification mechanisms that arise under certain labor market conditions.

The benchmark model accounts for the empirical co-movement between inflation and labor market tightness observed during the COVID-19 pandemic. It captures an initial decline in inflation following a negative demand shock and a delayed inflationary response resulting from a deterioration in the efficiency of the matching process between firms and job seekers. Crucially, as the labor market becomes increasingly tight, reflected in rising vacancies and falling unemployment, inflation begins to accelerate, even though output and employment have *not* fully recovered. Put differently, the overshooting of inflation occurs even with a negative employment gap, which is consistent with the data. This behavior suggests that inflation becomes more responsive to labor market tightness during the recovery phase, consistent with recent empirical findings by Benigno and Eggertsson (2023).

This interpretation is reinforced by the empirical evidence in Table 2, which suggests that inflationary pressures are more tightly linked to firm-side conditions, particularly hiring frictions and matching dynamics, than to worker-side indicators alone. The structure of the model and empirical consistency suggest that labor market tightness, rather than slack in the traditional sense, is the more relevant metric for understanding recent inflation dynamics.

Downward nominal wage rigidity plays a central role in amplifying and sustaining inflation in the aftermath of the shock. In a setting without wage rigidity, nominal wages adjust downward when demand falls, helping to stabilize real marginal costs and mitigate inflationary pressures. In contrast, when wages are sticky, firms are constrained in their ability to reduce nominal compensation, leaving real marginal costs elevated for a longer period. This contributes to persistent inflation even as economic activity and employment begin to recover. From the perspective of the Phillips curve, wage rigidity introduces an endogenous cost-push mechanism that intensifies inflationary pressures. This helps explain the sharp and prolonged rise in inflation following the pandemic shock, despite only a partial recovery in the labor market. As such, the slope and persistence of the inflation response are directly shaped by structural wage dynamics, especially when labor markets are tight.

Fiscal expansions, modeled as automatic stabilizers that respond to falling output, help shorten the depth and duration of the initial recession. From the standpoint of the inflation-unemployment relationship, such stimulus reduces slack more quickly and brings forward the inflation rebound. However, simulations indicate that fiscal policy alone cannot account for the observed persistence or magnitude of inflation unless it operates in conjunction with supply-side frictions like reduced matching efficiency and wage rigidity. These frictions are necessary to sustain elevated marginal costs and inflationary pressures beyond the immediate effects of demand support.

Table 2 also highlights how different model specifications generate varying correlations between inflation and key labor market variables, shedding light on each model's ability to replicate real-world inflation dynamics. This variation in correlation structures across model versions suggests that the shape and behavior of the Phillips curve are sensitive to the underlying model assumptions. Specifically, models that include matching efficiency shocks better capture the dynamics of inflation observed in the data, while those that rely solely on demand-side policies fail to reproduce key empirical regularities.

These observations are echoed by Figure 7, which presents the labor market tightness and inflation rate generated by numerous simulations of the model, alongside the corresponding U.S. labor market tightness and core inflation rates. The model, whether with or without fiscal policy, produces a labor market tightness and inflation locus that aligns with the observed data, conditional on accounting for a shock to the efficiency of matching. Once the efficiency of matching is assumed to be constant (labeled "FP, Constant d"), the correlation between inflation and tightness becomes weaker and non-monotonic (certainly non-linear), even when fiscal policy is activated. The model with flexible wages also produces weaker correlations, underscoring the importance of wage rigidity in this setup. It should be noted, though, that the model with constant efficiency of matching performs the worst among all versions, thus highlighting the centrality of a shock to matching in this paper.

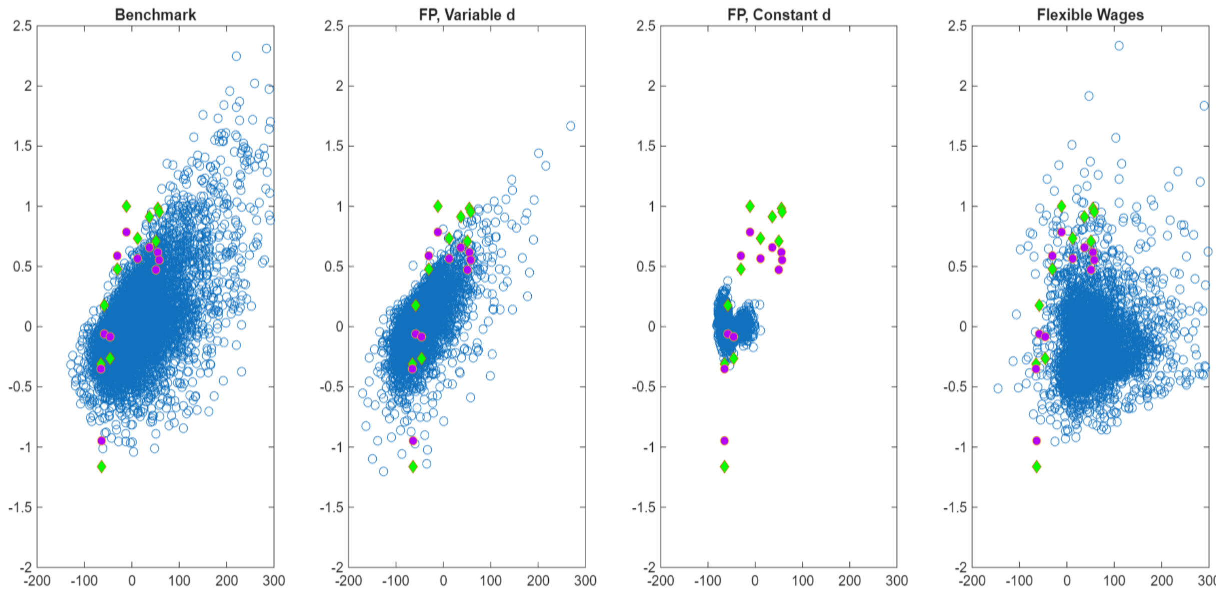

Figure 7: Inflation Rate vs. Labor Market Tightness

Note: Data vs. model-based inflation rates vs. labor-market tightness. Model: Percentage deviations from the deterministic steady state. Data: percentage deviations from pre-Covid levels (Quarterly). Green diamond: CPI-based core inflation rates. Purple filled circle: PCE index-based core inflation rate. "Benchmark, NP": the model with a demand-side shock, a shock to matching efficiency, but no fiscal policy. "FP, Variable d": the model with a demand-side shock, a shock to matching efficiency and fiscal policy. "FP, Constant d": the model with a demand-side shock, fiscal policy, but no shock to matching efficiency. "Flexible Wages": the model with a demand-side shock, a shock to matching efficiency, but no fiscal policy and flexible nominal wages.

Together, the analysis depicts a generalized, state-dependent (and potentially non-linear) Phillips curve framework in which inflation is shaped not only by labor market slack, but also by wage rigidity, matching efficiency and fiscal policy. The findings challenge the traditional view of a stable, one-dimensional Phillips curve by showing that the sensitivity of inflation to labor market conditions varies depending on the structural features of the economy. In particular, price inflation becomes more responsive to labor market tightness when nominal rigidities are binding and matching frictions are elevated. The model, thus, provides a compelling account of inflation dynamics by integrating modern labor market theory with the classical inflation-unemployment tradeoff.

6 Conclusions

This paper investigates the post-pandemic inflation surge through the lens of a labor search and matching model that incorporates demand shocks, time-varying matching efficiency, and downward nominal wage rigidity. Our proposed labor search and matching model incorporates a shock that affects economic activity and the inflation rate through the demand side and labor market matching. In the aftermath of a negative shock, we observe a decline in labor, vacancies, and the inflation rate. In the short term, this shock acts as a negative demand disturbance, leading to reduced economic activity and inflation. However, as time progresses, the shock to matching in the labor market becomes more pronounced, causing inflation to exceed its pre-shock levels. As such, the dynamics of the inflation rate closely resemble those of vacancies and labor market tightness.

The model demonstrates that shocks affecting the efficiency of the matching process play a role in generating persistent inflation, even in the absence of continued fiscal expansion. Wage rigidity further amplifies this effect by constraining the ability of firms to adjust real wages downward, thereby raising real marginal costs and sustaining upward pressure on prices. These structural features, rather than short-lived demand disturbances, explain the persistence and magnitude of inflation in the aftermath of the initial pandemic shock.

Our analysis also shows that while fiscal policy contributed to a faster recovery in output and employment, it was not sufficient to produce sustained inflationary pressure on its own. Fiscal stimulus influenced the timing and intensity of the inflation response, but the prolonged elevation of inflation required the interaction of policy with underlying labor market frictions. The results suggest that fiscal measures and labor market dynamics jointly determine the inflation trajectory, but structural labor market conditions are the dominant driver over the medium term. Therefore, our findings indicate that even in the absence of expansionary fiscal policy, the shocks to the labor market would have eventually led to a similar outcome in terms of inflation, albeit with a delay of 2-3 quarters. This highlights the significance of labor market shocks as a driving force behind inflation dynamics, suggesting that fiscal policy's role in inflation behavior should be understood within the broader context of labor market conditions.

References

Abo-Zaid, S. (2013). Optimal monetary policy and downward nominal wage rigidity in frictional labor markets. *Journal of Economic Dynamics & Control 37*, 345–364.

Andolfatto, D. (1996). Business cycles and labor-market search. *American Economic Review 86*(1), 112–132.

Arseneau, D. M. and S. K. Chugh (2008). Optimal fiscal and monetary policy with costly wage bargaining. *Journal of Monetary Economics 55*(8), 1401–1414.

Ball, L. M., D. Leigh, and P. Mishra (2022). Understanding U.S. inflation during the COVID era. *Brookings Papers on Economic Activity*, 1–54.

Barnichon, R. and A. H. Shapiro (2024). Phillips meets Beveridge. *Journal of Monetary Economics 148*(103660).

Benigno, P. and G. B. Eggertsson (2023). It's baaack: The surge in inflation in the 2020s and the return of the non-linear Phillips curve. *NBER Working Paper 31197*.

Bernanke, B. and O. Blanchard (2024). What caused the U.S. pandemic-era inflation? *American Economic Journal: Macroeconomics, forthcoming*.

Bianchi, F., R. Faccini, and L. Melosi (2023). A fiscal theory of persistent inflation. *Quarterly Journal of Economics 138*, 2127–2179.

Chen, S., D. Igan, D. Lee, and P. Mishra (2024). Inflation and labor markets: A bottom-up view. *Ashoka Economics Discussion Papers 127*.

Chugh, S. K. (2006). Optimal fiscal and monetary policy with sticky wages and sticky prices. *Review of Economics Dynamics 9*(4), 683–714.

Comin, D. A., R. C. Johnson, and C. J. Jones (2023). Supply chain constraints and inflation. *NBER Working Paper 31179*.

Crump, R. K., S. Eusepi, M. Giannoni, and A. Şahin (2024). The unemployment-inflation trade-off revisited: The Phillips curve in COVID times. *Journal of Monetary Economics 145*(103580).

Dao, M. C., P.-O. Gourinchas, D. Leigh, and P. Mishra (2024). Understanding the international rise and fall of inflation since 2020. *Journal of Monetary Economics 148*(103658).

Davis, S. (2011). Comments on "job search, emotional well-being, and job finding in a period of mass unemployment: Evidence from high-frequency longitudinal data" by Alan b. Krueger and Andreas Mueller. *Brookings Papers on Economic Activity 41*, 58–70.

Davis, S., J. Faberman, and J. Haltiwanger (2023). The establishment-level behavior of vacancies and hiring. *Federal Reserve Bank of St. Louis Review 105*, 21–50.

Davis, S. J., J. C. Haltwanger, and S. Schuh (1996). Job creation and destruction. *MIT Press, Cambridge*.

de Soyres, F., A. M. Santacreu, and H. Young (2023). Demand-supply imbalance during the

COVID-19 pandemic: The role of fiscal policy. *Federal Reserve Bank of St. Louis Review 105*, 21–50.

Dynan, K. E. and D. W. Elmendorf (2024). Fiscal policy and the pandemic-era surge in US inflation: Lessons for the future. *Peterson Institute for International Economics Working Paper 24-22*.

Erceg, C. J., D. W. Henderson, and A. T. Levin (2000). Optimal monetary policy with staggered wage and price contracts. *Journal of Monetary Economics 46*(2), 281–313.

Gertler, M., L. Sala, and A. Trigari (2009). An estimated monetary DSGE model with unemployment and staggered nominal wage bargaining. *Journal of Money, Credit & Banking 40*(8), 1713–1764.

Harding, M., J. Lindé, and M. Trabandt (2023). Understanding post-COVID inflation dynamics. *Journal of Monetary Economics 140*, S101–S118.

Hassan, T. A., S. Hollander, L. van Lent, and A. Tahoun (2023). Firm-level exposure to epidemic diseases: Covid-19, SARS, and H1N1. *Review of Financial Studies 36*, 4919–4964.

Hosios, A. J. (1990). On the efficiency of matching and related models of search and unemployment. *Review of Economic Studies 57*(2), 279–298.

Kiley, M. T. (2023). The role of wages in trend inflation: Back to the 1980s? *Finance and Economics Discussion Series No. 2023-022*.

Kim, J. and F. Ruge-Murcia (2009). How much inflation is necessary to grease the wheels. *Journal of Monetary Economics 56*(3), 365–377.

Krause, M. U. and T. A. Lubik (2007). The (ir)relevance of real wage rigidity in the new keynesian model with search frictions. *Journal of Monetary Economics 54*(3), 706–727.

Leduc, S. and Z. Liu (2020). The weak job recovery in a macro model of search and recruiting intensity. *American Economic Journal: Macroeconomics 12*, 310–343.

Merz, M. (1995). Search in the labor market and the real business cycle. *Journal of Monetary Economics 36*(2), 269–300.

Meyer, B. H. and X. S. Sheng (2025). Unit cost expectations: Firms' perspectives on inflation. *European Economic Review 174*(104955), 1–22.

Pissarides, C. A. (2000). Equilibrium unemployment theory. *MIT Press, Cambridge*.

Rotemberg, J. J. (1982). Monopolistic price adjustment and aggregate output. *Review of Economic Studies 49*(4), 517–531.

Shapiro, A. H. (2024). Decomposing supply and demand driven inflation. *Journal of Money, Credit and Banking, forthcoming*.

Thomas, C. (2008). Search and matching frictions and optimal monetary policy. *Journal of Monetary Economics 55*(5), 936–956.

A Bayesian Estimation

The Bayesian estimation procedure proceeds as follows: 1) We use the observed data to estimate the model. 2) We calculate parameter values, means and standard deviations of shocks using Bayesian estimation. The posterior distribution is obtained using the Metropolis-Hastings algorithm. 3) We use these parameter values to simulate the model.

Since our model has only one shock, we can only use one observed variable. to improve the estimation, we expand the model by including more observed variables. Since we maintain that the number of observed variables equals the number of shocks in the model, the shock structure is enlarged by allowing for potential measurement errors. As observed variables, we use the growth rates of GDP, real wage, employment and consumption, we follows:

$$
\begin{aligned}
g_y &= y_t/y_{t-1} + \varepsilon_{y,t} \\
g_w &= w_t/w_{t-1} + \varepsilon_{w,t} \\
g_n &= n_t/n_{t-1} + \varepsilon_{n,t} \\
g_c &= c_t/c_{t-1} + \varepsilon_{c,t}
\end{aligned}
$$

We use the following data series:

- y_t: Real Gross Domestic Product, Billions of Chained 2012 Dollars, Seasonally Adjusted Annual Rate

- w_t: Nonfarm Business Sector: Real Hourly Compensation for All Employed Persons, Index 2012=100, Seasonally Adjusted.

- n_t: All Employees, Total Nonfarm, Thousands of Persons, Seasonally Adjusted.

- c_t: Real Personal Consumption Expenditures, Billions of Chained 2012 Dollars, Seasonally Adjusted Annual Rate.

All data are quarterly and obtained from the FRED database of the Federal Reserve Bank of St. Louis.

Table A.1: Bayesian Estimation Results- Benchmark, No Fiscal Policy

	Prior Distribution			Posterior Distribution	
Parameter	Density	Mean	Std. Dev.	Mean	Std. Dev.
β	Beta	0.99	0.01	0.9919	0.0003
σ	Normal	2.00	0.10	2.1274	0.0539
ϑ	Normal	2.00	0.10	2.2548	0.0079
ρ_π	Normal	1.50	0.10	1.4973	0.0047
ρ_y	Normal	0.50	0.01	0.4941	0.0051
ϕ^π	Normal	20.00	2.00	29.7257	0.5342
ϕ^w	Normal	80.00	2.00	79.3519	4.5812
ψ	Normal	2500	200.00	2362.5102	105.4704
q_d	Normal	8.00	0.20	7.2676	0.0282
q_e	Normal	1.00	0.05	0.9292	0.0314

Notes: The posterior distribution is obtained using the Metropolis-Hastings algorithm. Results for the benchmark model with demand-side shock and a shock to the efficiency of the matching process. No fiscal policy.

Table A.2: Bayesian Estimation Results- With Fiscal Policy

	Prior Distribution			Posterior Distribution	
Parameter	Density	Mean	Std. Dev.	Mean	Std. Dev.
β	Beta	0.99	0.01	0.9924	0.0003
σ	Normal	2.00	0.10	2.1907	0.0260
ϑ	Normal	2.00	0.10	2.2642	0.0332
ρ_π	Normal	1.50	0.10	1.4972	0.0061
ρ_y	Normal	0.50	0.01	0.4993	0.0023
ϕ^π	Normal	20.00	2.00	30.2587	0.3480
ϕ^w	Normal	80.00	2.00	78.7537	2.4056
ψ	Normal	2500	200.00	2427.2297	76.4722
q_d	Normal	8.00	0.20	7.3997	0.0436
q_e	Normal	1.00	0.05	0.8997	0.0062
ρ_g	Normal	0.90	0.01	0.9007	0.0017
ρ_{gy}	Normal	1.30	0.20	1.1911	0.1735

Notes: The posterior distribution is obtained using the Metropolis-Hastings algorithm. Results for the benchmark with demand-side shock, a shock to the efficiency of the matching process and fiscal policy.

B Robustness Analysis

B.1 The Model With No Lags

We discuss the case when the supply-side effect is introduced without a lag. We consider two options: in the first, the coefficients of the demand effect and the shock to the matching efficieny are equal $q_d = q_e$, while in the second, we allow them to differ. As Figure B.1 shows, this model largely accounts for the observed behavior of inflation and other variables.

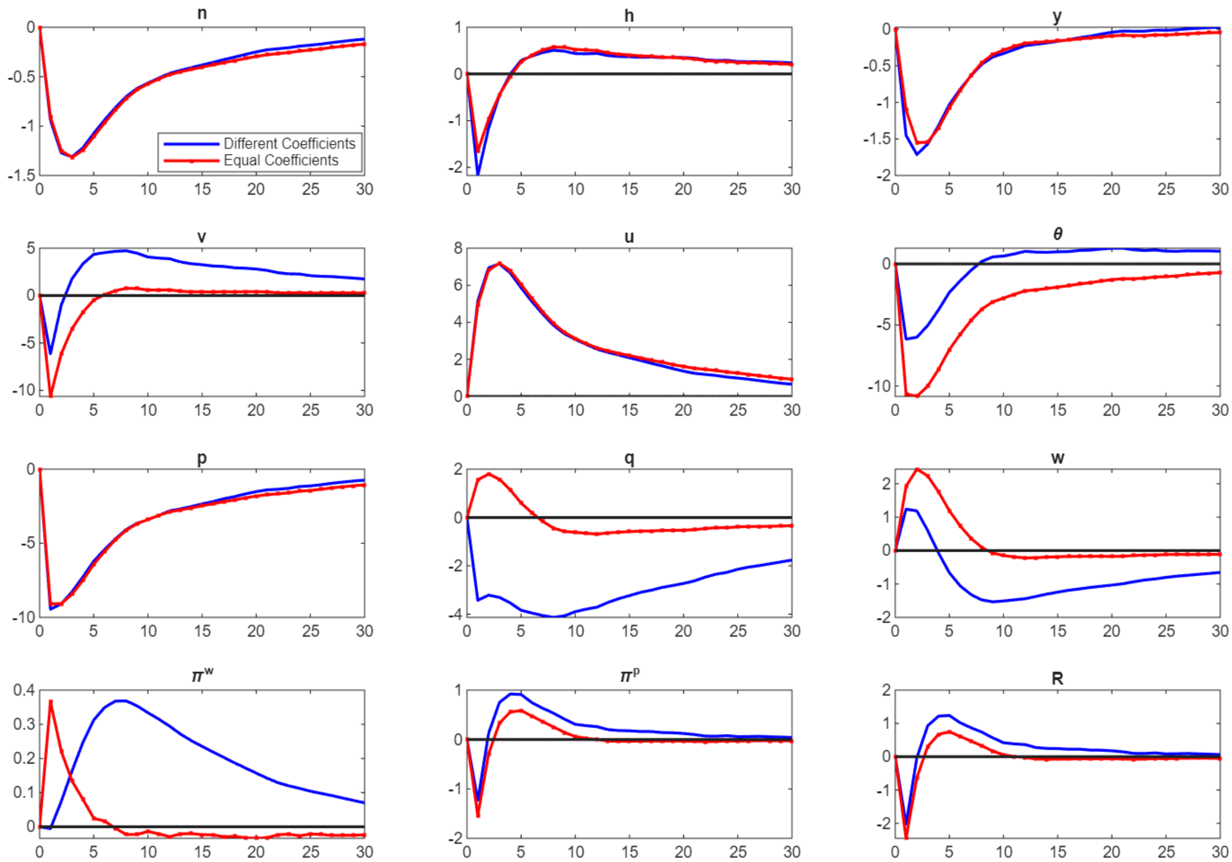

Figure B.1: Impulse Responses- The Model With No Lags

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. The results of the model with no lags on the supply side. "Different Coefficients": $q_d \neq q_e$. "Equal Coefficients": $q_d = q_e$. No fiscal policy.

However, there are two main differences compared to the benchmark model. First, the reversal happens sooner, roughly 1-2 quarters after the initial fall. Second, in the model with equal coeffients, labor market tightness and vacancies fall on impact, but do not exceed their initial levels, which contradicts the data. When the coefficients are allowed to differ, we observe an over-shooting of vacancies and labor market tightness, as well as inflation. On this basis, the benchmark model that allows for differentiated strengths of the two effects is moderately preferred.

B.2 Lower Persistence of the Shock

Figure B.2 presents the benchmark results together with the results that we obtain when the persistence of the shock ρ_s is reduced to 0.50 ("moderate persistence"), and to zero. Generally speaking, the results confirm that the model can replicate the dynamics of inflation even with no persistence or with moderate persistence of the shock. The initial fall in the inflation rate is largely similar in all cases, but the model with no persistence shows quicker reversal of inflation, peaking rapidly after the rebound. Interestingly, even in this case, the inflation rate remains persistent, returning to its initial level nearly 10 quarters after the initial shock. With $\rho_s = 0.50$, inflation is more persistent and returns to its initial level nearly 12 quarters after the shock. The persistence of the inflation rates, thus, does not solely reflect the persistence of the shock.

With no to moderate persistence of the shock, other variables mostly behave similarly to what we observe in the benchmark analysis, but the return to the initial state occurs faster. Furthermore, the benchmark model performs better in replicating the dynamics of the wage inflation, hence the

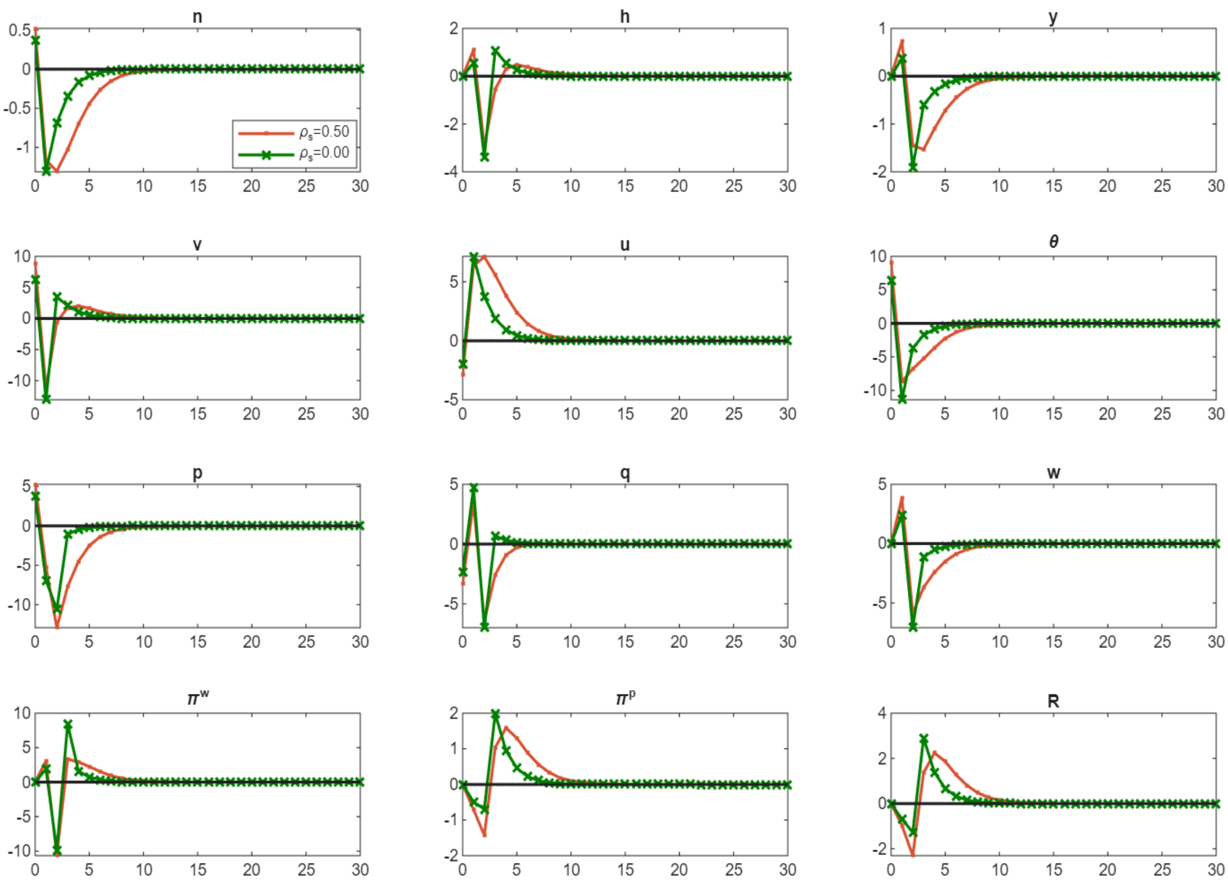

Figure B.2: Impulse responses- Changing the persistence of the shock

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. "Benchmark"- the model with $\rho_s = 0.95$.

B.3 Including the Pandemic Period

We present the estimation results and impulse responses when the estimation sample is extended to include the period of the pandemic. Specifically, we re-estimate the model using data for 1983:Q1-2022:Q4. Table B.1 reports the estimated parameter values and Figure B.3 shows the corresponding results. Both the parameter values and the impulse responses are similar to the benchmark results, partly reflecting the fact that the pandemic period constitutes only three years out of 40.

Table B.1: Bayesian Estimation Results- 1983:Q1-2022:Q4

	Prior Distribution			Posterior Distribution	
Parameter	Density	Mean	Std. Dev.	Mean	Std. Dev.
β	Beta	0.99	0.01	0.9921	0.0001
σ	Normal	2.00	0.10	2.1417	0.0755
ϑ	Normal	2.00	0.10	2.2576	0.0046
ρ_π	Normal	1.50	0.10	1.4949	0.0021
ρ_y	Normal	0.50	0.01	0.4943	0.0054
ϕ^π	Normal	20.00	2.00	29.6683	0.7586
ϕ^w	Normal	80.00	2.00	82.7465	0.2119
ψ	Normal	2500	200.00	2406.7812	119.7289
q_d	Normal	8.00	0.20	7.4652	0.0412
q_e	Normal	1.00	0.05	0.9131	0.0126

Notes: The posterior distribution is obtained using the Metropolis-Hastings algorithm. Results for the benchmark model with demand-side shock and a shock to the efficiency of the matching process. Sample period: 1983:Q1-2022:Q4. No fiscal policy.

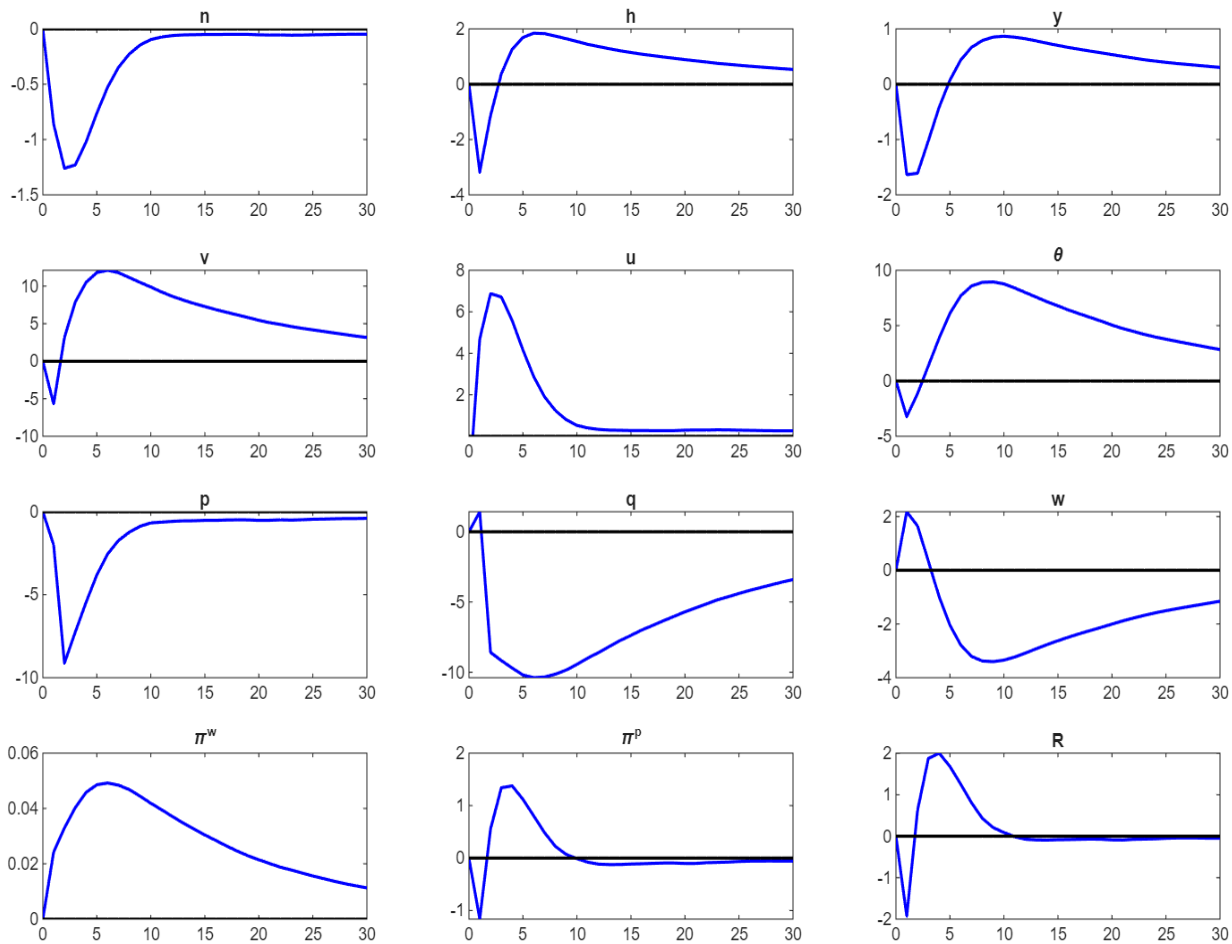

Figure B.3: Impulse Responses- Accounting for the pandemic period

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. The results of the model with estimation that includes the pandemic period (1983:Q1-2022:Q4).

B.4 Endogenous Separations

The early stages of the pandemic saw an unusal rise in job separations, followed by a return to its pre-Covid level after one quarter. In this subsection, we let the separation rate be endogenous. To this end, we conduct two experiments. First, the separation rate follows an ad-hoc rule and rises for one quarter as observed in the data. Specifically, the separation rate evolves according to the following rule:

$$\ln\left(\frac{\rho_t}{\bar{\rho}}\right) = \rho_\rho \ln\left(\frac{\rho_{t-1}}{\bar{\rho}}\right) + q_\rho \iota_t \tag{B.1}$$

This specification has the advantage of both capturing the rise in the separation rate in the spring of 2020 and the subsequent quick return to the initial level. The behavior of all relevant variables continues to be qualitatively similar to what we observe in the benchmark analysis (Figure B.4). The inflation rate initially falls and then rises as in the data, and its return to the steady-state is gradual.

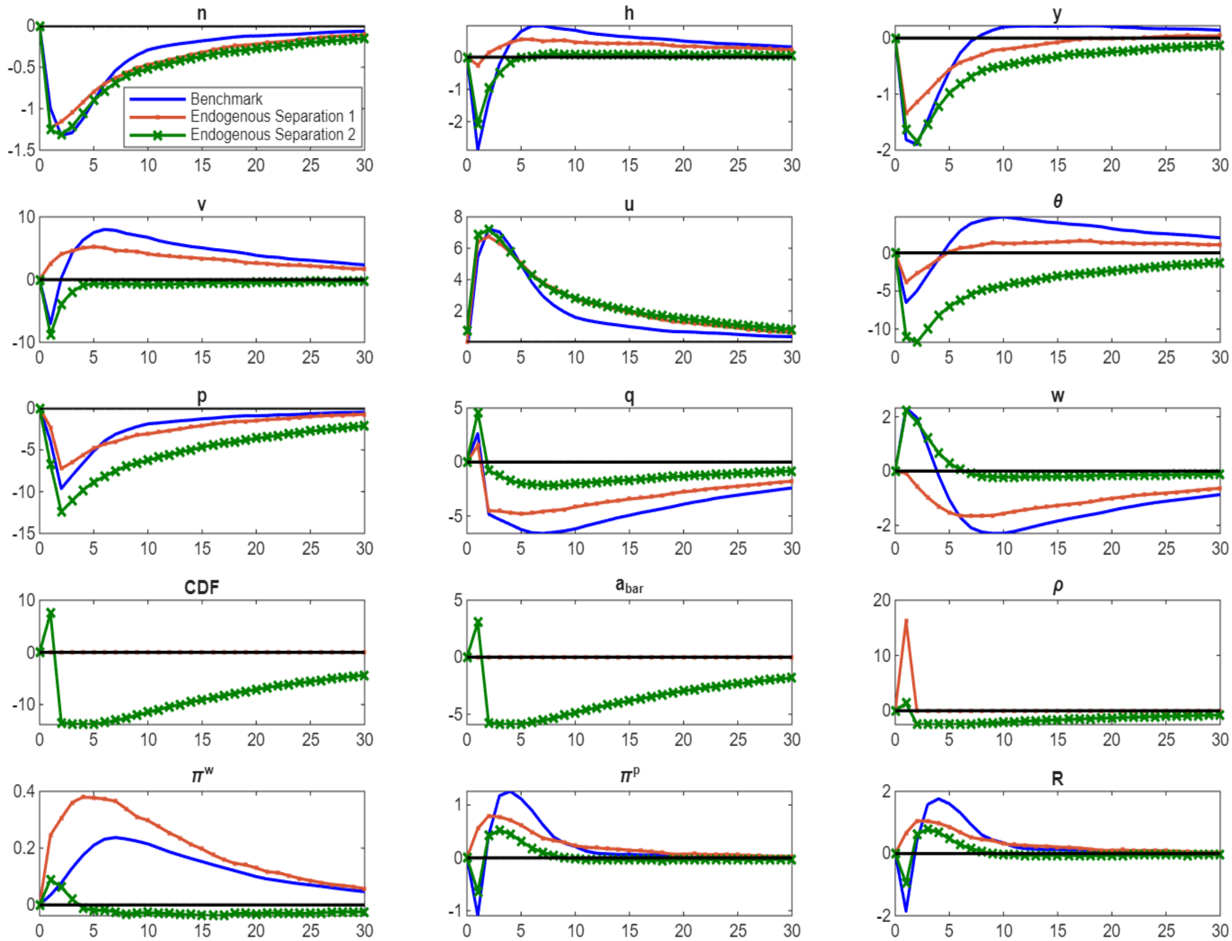

Figure B.4: Impulse responses- Endogenous Separations

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. These results are obtained from solving the benchmark model with both supply-side and demand-side effects using a second-order approximation. n: employment, h: hours per employed individual, y: output, v: vacancies, u: unemployment, θ: labor market tightness, p: job finding rate, q: job filling rate, w: real wage, CDF: the cumulative distribution of the idiosyncratic productivity, a_{bar}: the level of idiosyncratic productivity under which separation occurs, ρ: the endogenous separation rate, π^w: wage inflation, π^p: price inflation, R: nominal interest rate. End. Separations 1: the model with an ad-hoc rule as in Equation (B.1). End. Separations 2: The model with Micro-founded separation as in Krause and Lubik (2007).

Second, we introduce endogenous separation as in Krause and Lubik (2007), among others. The idea is that firms are subject to idiosyncratic shocks, and separation occurs if the productivity of a match falls under a certain threshold. In this regard, one interpretation would be that an unusual drop in productivity has caused a higher than usual separation rate in 2020.

Specifically, there is a continuum of jobs within the firm. Jobs differs in their productivity, with $a_{j,i,t}$ denoting the productivity of job i at firm j at time t. Jobs are drawn from a time-invariant distribution with a cumulative distribution of $F(a)$ and density $f(a)$. If the idiosyncratic productivity of job i is lower than a certain threshold $\tilde{a}_{j,t}$, then the job is not profitable, and it is thus destroyed. Separation then takes places. Workers may also separate for other reasons, leading to an exogenous separation rate of ρ^x. Then, total separations are given by: $\rho_{j,t} = \rho^x + (1-\rho^x)F(\tilde{a}_{j,t})$.

Output at firm j is given by:

$$y_{j,i,t} = z_t H(\tilde{a}_{j,t}) f(h_{j,t}) \tag{B.2}$$

with $H(\tilde{a}_{j,t}) = \int_{\tilde{a}_{j,t}}^{\infty} a \frac{f(a)}{1-F(\tilde{a}_{j,t})} da$ being the expected value of a conditional on $a > \tilde{a}_{j,t}$.

The relevant conditions are then modified to account for this specification. For example, the job creation condition becomes (after imposing symmetry among firms):

$$\frac{\gamma}{q_t} = \beta(1-\rho_t)E_t\left\{\left(\frac{e_{t+1}u_{c,t+1}}{e_t u_{c,t}}\right)\left[mc_{t+1}z_{t+1}H(\tilde{a}_{t+1})f(h_{t+1}) - w_{t+1}h_{t+1} - \Phi^W_{t+1} + \frac{\gamma}{q_{t+1}}\right]\right\}. \tag{B.3}$$

Inflation behaves as in the benchmark model, which supports our key findings (Figure B.4). However, in this setting, the peak of inflation is smaller relative to the benchmark model. In addition, the behavior of vacancies and labor market tightness in the second stage is not consistent with the data.

B.5 A Change in Transfers

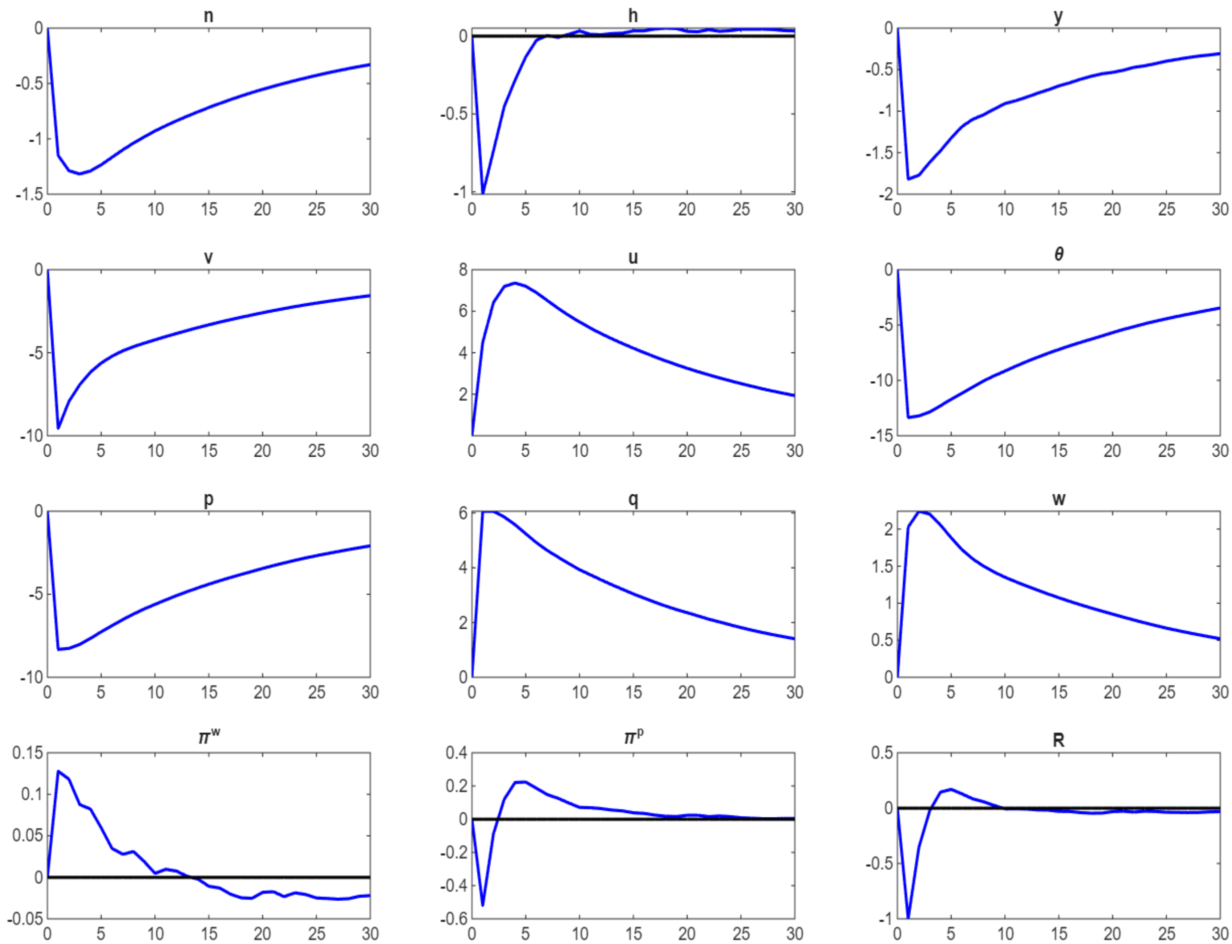

Figure B.5: Impulse Responses- The Model With Transfers.

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. The results of the model with transfers and a demand-side effect only ($q_d = 0$). In this version of the model, the government raises transfers (T_t) without changing government spending (g_t).

C Extended Model with Labor Force Participation, Search Intensity and Recruiting Intensity

The baseline model assumes matching efficiency is exogenously varying across time. Arguably, this variation is driven by changes in job seekers' search intensity and firms' recruiting intensity.[8] We extend the model to decompose the impact of shocks in each of these search dimensions.

Let $s_{v,t}$ and $s_{u,t}$ be the endogenous firms' recruiting and job seekers' search intensities, respectively. The matching function is now given by:

$$m(u_t, v_t, s_{u,t}, s_{v,t}) = \mu(u_t s_{u,t})^{\zeta}.(v_t s_{v,t})^{1-\zeta}. \tag{C.1}$$

The efficiency of the matching process can then be written as a function of search intensity and recruiting intensity, $d_t = s_{u,t}^{\zeta} s_{v,t}^{1-\zeta}$. Decomposing the efficiency of matching into search and recruiting intensities allows us to disentangle the distinct roles of firm and household choices in generating the observed dynamics of vacancies, labor market tightness, inflation, and other macroeconomic aggregates.

To measure recruiting intensity, we follow Davis et al. (2023). For search intensity, we use $d_t = s_{u,t}^{\zeta} s_{v,t}^{1-\zeta}$. Finally, we calculate matching efficiency as a residual: $d_t = m_t / \mu u_t^{\zeta} v_t^{1-\zeta}$. As such, d_t accounts for variations in matches that do not result from changes in unemployment or vacancies. Figure C.1 presents the dynamics of the labor force participation rate, search and recruiting intensities, and matching process efficiency in the US.

The participation rate declined by nearly 2% at the beginning of the Covid-19 crisis before gradually recovering. At the end of 2022, it stood at nearly 1% below its pre-shock level. Search and recruiting intensity, as well as the efficiency of the matching process, declined on impact. However, while recruiting intensity quickly recovered and exceeded its pre-shock level, search intensity and matching efficiency continued to linger, remaining clearly below pre-Covid levels at the end of 2022. The gap between the intensity at which firms try to hire and the intensity at which individuals try to search for jobs has widened since the start of 2020. Note also the strong correlation between recruiting intensity and the inflation rate since the beginning of the Covid-19 crisis.

C.1 Households

Each period t, an individual can be employed, unemployed or out of the labor force, so that $lf_t = n_t + u_t$, with lf_t being the labor force. The household chooses employment (n_t), unemployment

[8] Prior literature explores the role of endogenous search intensity and recruiting intensity ion matching efficiency. For example, Leduc and Liu (2020) show that fluctuations search and recruiting, driven by productivity and discount factor shocks, can help bridge the gap between the empirical and the model-predicted job-filling rate.

Figure C.1: Price Inflation, Labor Force Participation, Search Intensity and Recruiting Intensity

Note: Percentage deviations from the average level between December 2019-February 2020. Time zero indicates the last quarter before the shock. Price Inflation- the percentage change in the consumer price index for all urban consumers- all items in U.S., as plotted in the dashed line and measured in the right axis. Labor Force Participation Rate: Percent, Seasonally Adjusted. Efficiency of the Matching Process: obtained as a residual from the matching function. Recruiting Intensity: obtained from Davis et al. (2023). Search Intensity: obtained from the definition of the efficiency of the matching process and the recruiting intensity.

(u_t) and search intensity for work ($s_{u,t}$). Leisure (non-labor market activity) time of the household is then given by $l_t = 1 - n_t h_t - u_t s_{u,t}$. Both working or searching for a job reduce the household's leisure time and have a utility cost. The household's problem is to maximize:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[e_t u(c_t) - a_t [n_t v(h_t) + u_t k(s_{u,t})] \right], \tag{C.2}$$

subject to:

$$c_t + \frac{B_t}{P_t} = \frac{n_t h_t W_t}{P_t} + u_t s + \frac{R_{t-1} B_{t-1}}{P_t} + \frac{T_t}{P_t} + \frac{\Theta_t}{P_t}, \tag{C.3}$$

$$n_t = (1-\rho)\left(n_{t-1} + p_t u_t\right), \tag{C.4}$$

where $k(s_{u,t})$ is period t's job search disutility, and it satisfies $\frac{\partial k(\cdot)}{\partial s_u} > 0$ and $\frac{\partial^2 k(\cdot)}{\partial s_u^2} > 0$. As before, e_t is the demand shock while a_t is a shock to the desire of households to be engaged in the labor market (akin to a labor supply shock). The pandemic increased the utility cost of participating in the labor market (working or searching for employment) thus decreasing labor force participation rate and search intensity.

Optimization with respect to bonds, consumption, employment, unemployment and search intensity give:

$$\lambda_t = \beta R_t E_t \left(\frac{\lambda_{t+1}}{\pi^p_{t+1}} \right) \tag{C.5}$$

$$a_t k(s_{u,t}) = s\lambda_t + (1-\rho)p_t\,\mathbb{E}_t \left[\lambda_t w_t h_t - a_t v(h_t) + \beta \frac{a_{t+1}k(s_{u,t+1}) - s\lambda_{t+1}}{p_{t+1}} \right] \tag{C.6}$$

$$u_t a_t k'(s_{u,t}) = (1-\rho)p_t\,\mathbb{E}_t \left[\lambda_t w_t h_t - a_t v(h_t) + \beta \frac{u_{t+1}a_{t+1}k'(s_{u,t+1})}{p_{t+1}} \right] \tag{C.7}$$

with $\lambda_t = e_t u_{c,t}$ being the marginal utility of consumption. Condition (C.5) is the Euler Equation. Condition (C.6) governs the labor force participation, and it is obtained from combining the first-order condition with respect to labor and unemployment. It states that, at the optimum, the households equates the expected marginal cost of one additional searching member to the expected marginal benefit. The former includes the disutility of search (e.g. in the form of forgone leisure).

With probability p_t, the search effort is successful. Then, the expected marginal benefit would include, if the matching survives separation, the value of labor income net of disuility of work as well as future employment relationship by the household member (a household member who remains employed next period does not have to search again, thus saving on net potential searching costs). Condition (C.7) describes the choice of search intensity; the left-hand side describes the increases in the disutility of raising the search intensity multiplied by the number of searching members. If the search is successful and the match survives separation, the marginal benefit is labor income net of the disutility of working as well as the continuation value (the search disutility that is saved next period if employment continues).

The disutility function of households of raising search intensity is given by:

$$k(s_{u,t}) = \chi_u \frac{s_{u,t}^{1+\kappa}}{1+\kappa} \tag{C.8}$$

with $\kappa, \chi_u > 0$. The disutility function of raising the search effort is convex, similar to the disutility function of raising the number of hours worked.

C.2 Firms

A firm j can adjust its recruiting intensity $s_{v,j,t}$, but adjusting intensity entails a resource cost:

$$\Phi^S_{j,t}(s_{v,j,t}) = \frac{\phi^s}{2} \left(s_{v,j,t} - \overline{s_v} \right)^2 \tag{C.9}$$

with ϕ^s being the adjustment cost parameter and $\overline{s_v}$ the steady-state value of the recruiting intensity. The firm then chooses its price, vacancies, recruiting intensity, and next-period employment to maximize:

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{r_t \lambda_t}{r_0 \lambda_0} \left\{ \frac{P_{j,t}}{P_t} y_{j,t} - n_{j,t} w_{j,t} h_{j,t} - \gamma v_{j,t} - \Phi^S_{j,t} v_{j,t} - \Phi^W_{j,t} n_{j,t} - \Phi^P_{j,t} y_t \right\}, \tag{C.10}$$

subject to:

$$n_{j,t} = (1-\rho)(n_{j,t-1} + q_t v_{j,t}), \tag{C.11}$$

$$z_t n_{j,t} f(h_{j,t}) = \left[\frac{P_{j,t}}{P_t} \right]^{-\varepsilon} y_t. \tag{C.12}$$

Here, r_t is a shock that, among others, affects the firm's decisions on labor and posting vacancies. This shock captures changes in firms' hiring, recruiting intensity, and vacancy postings since the start of the pandemic, separately from the change in decisions driven by demand shocks.

Optimization and imposing symmetry across firms yield the modified job creation condition, the condition that governs the choice of recruiting intensity, and the Phillips Curve:

$$\frac{\gamma + \Phi^S_t}{q_t} = (1-\rho) \left\{ mc_t z_t f(h_t) - w_t h_t - \Phi^W_t + \beta E_t \left(\frac{r_{t+1} \lambda_{t+1}}{r_t \lambda_t} \right) \left(\frac{\gamma + \Phi^S_{t+1}}{q_{t+1}} \right) \right\}, \tag{C.13}$$

$$\frac{\Phi^{S'}(s_{v,t})}{q_t} = (1-\rho) \left\{ mc_t z_t f(h_t) - w_t h_t - \Phi^W_t + \beta E_t \left(\frac{r_{t+1} \lambda_{t+1}}{r_t \lambda_t} \right) \left(\frac{\Phi^{S'}(s_{v,t+1})}{q_{t+1}} \right) \right\}, \tag{C.14}$$

$$1 - \phi^p (\pi^p_t - \overline{\pi}^p) \pi^p_t + \beta \phi^p E_t \left[\left(\frac{r_{t+1} \lambda_{t+1}}{r_t \lambda_t} \right) (\pi^p_{t+1} - \overline{\pi}^p) \pi^p_{t+1} \frac{y_{t+1}}{y_t} \right] = \varepsilon (1 - mc_t). \tag{C.15}$$

The job creation condition is modified to account for the cost of adjusting the recruiting intensity. In equilibrium, the firm equates the vacancy-creation cost and the cost of changing recruiting intensity to the expected present discounted value of profits from the match. Raising the recruiting intensity raises the likelihood of filling a vacancy, and if the match survives separation, it yields a future steam revenues net of wage costs and the cost of adjusting nominal wages as well as saves on future costs of raising recruiting intensity.

Note that at the individual firm's level, the vacancy fill rate is $q_{j,t} = s_{v,j,t} m_t / v_t s_{v,t}$, thus implying $q_{j,t}/q_t = s_{v,j,t}/s_{v,t}$. The likelihood that a firm j with intensity $s_{v,j,t}$ fills a vacancy relative to the market-wide probability depends on its intensity relative to the economy-wide intensity (all economy-wide quantities are taken as given by the firm). In a symmetric equilibrium: $q_{j,t} = q_t$. Similarly, for a member i of the household, we obtain $p_{i,t}/p_t = s_{u,i,t}/s_{u,t}$, which becomes one in a symmetric equilibrium.

C.3 The Shocks

The demand (preference) shifter evolves according to the following rule:

$$\ln\left(\frac{e_t}{\overline{e}}\right) = \rho_s \ln\left(\frac{e_{t-1}}{\overline{e}}\right) + q_e \iota_t \tag{C.16}$$

The shock to the desire to engage in the labor market:

$$\ln\left(\frac{a_t}{\overline{a}}\right) = \rho_s \ln\left(\frac{a_{t-1}}{\overline{a}}\right) + q_a \iota_t \tag{C.17}$$

The shock to firms' desire to hire and post vacancies:

$$\ln\left(\frac{r_t}{\overline{r}}\right) = \rho_s \ln\left(\frac{r_{t-1}}{\overline{r}}\right) - q_r \iota_t \tag{C.18}$$

where ρ_s is the persistence of the shock, $\iota_t \sim \mathcal{N}(0, \sigma_\iota^2)$, $q_a, q_e, q_r > 0$ and $\overline{a} = \overline{e} = \overline{r} = 1$.

C.4 Market Clearing

In equilibrium, the labor force (lf_t) is given by:

$$lf_t = n_t + u_t, \tag{C.19}$$

and $1 - lf_t$ measures the fraction of individuals who are out of the labor force.

The resource constraint of the economy:

$$y_t = c_t + \gamma v_t + \Phi_t^S v_t + \Phi_t^W n_t + \Phi_t^P y_t. \tag{C.20}$$

When fiscal policy is introduced, the resource constraint is adjusted accordingly.

C.5 Parameterization

Table C.1 presents the parameter values that we use with the model with endogenous labor force participation, search intensity and recruiting intensity (Figure C.2 in the text).

Table C.1: Values of the Parameters- Model with Endogenous Labor Force Participation

Parameter	Description	No FP	With FP
β	Households' utility discount factor	0.99	0.99
σ	Consumption curvature parameter	2.00	2.00
ϑ	Inverse labor supply elasticity	2.00	2.00
α	Elasticity of output with respect to hours per worker	2/3	2/3
ε	Elasticity of substitution between products	11.00	11.00
$\overline{\pi}^p$	Steady-state gross price inflation rate	1.005	1.005
ρ_π	Response of the interest rate to inflation	1.51	1.50
ρ_y	Response of the interest rate to output	0.51	0.51
q_e	Demand shock	0.67	0.31
q_a	Labor supply shock	6.22	6.39
q_r	Labor demand shock	1.21	0.60
ρ_s	Persistence of the shock	0.95	0.95
ζ	Contribution of an unemployed individual to a match	0.40	0.40
ϕ^p	Price rigidity	23.80	24.95
ϕ^w	Wage rigidity	79.07	81.44
ψ	Asymmetry parameter of wage rigidity	2605.34	2580.33
κ_u	Disutility of search curvature parameter	8.1147	7.74
ϕ^s	Adjustment cost of recruiting intensity parameter	0.11	0.10
ρ_g	Persistence of government spending		0.91
ρ_{gy}	Response of government spending to output		1.74

Note: This table summarizes the values of the parameters in the benchmark analyses. $\overline{\pi}^w = \overline{\pi}^p$ and $\eta = \zeta$. Productivity: $z_t = 1$ for all t. Part of the parameter values are based on Bayesian estimation.

We also consider fiscal policy as characterized by equation (28).

C.6 Numerical Results

Figure C.2 summarizes the main numerical findings where we consider three cases: the modified model without fiscal policy (labeled "Benchmark, No FP"), with fiscal policy (labeled "FP, Variable s_u & s_v"), and the model with endogenous labor force participation but constant searching intensity and recruiting intensity (labeled "FP, Constant s_u & s_v").

Consider the first case (i.e., the modified model without fiscal policy). The desire to work initially falls following the shock, which is reflected in a fall in the labor force, employment, hours, and search intensity. In addition, recruiting intensity and vacancy postings decline on impact. The job finding rate, output and inflation rate fall too. As the economy recovers, vacancies, recruiting intensity, and labor market tightness start to rebound and later exceed their initial values. Interestingly, the recovery of output is faster than the (slow) recovery of labor force participation, which is in line with the data. Wage inflation rises and then slowly reverts back to its initial level. The inflation rate and the nominal interest rate fall on impact, but rebound after 2-3 quarters and later exceed their initial values.

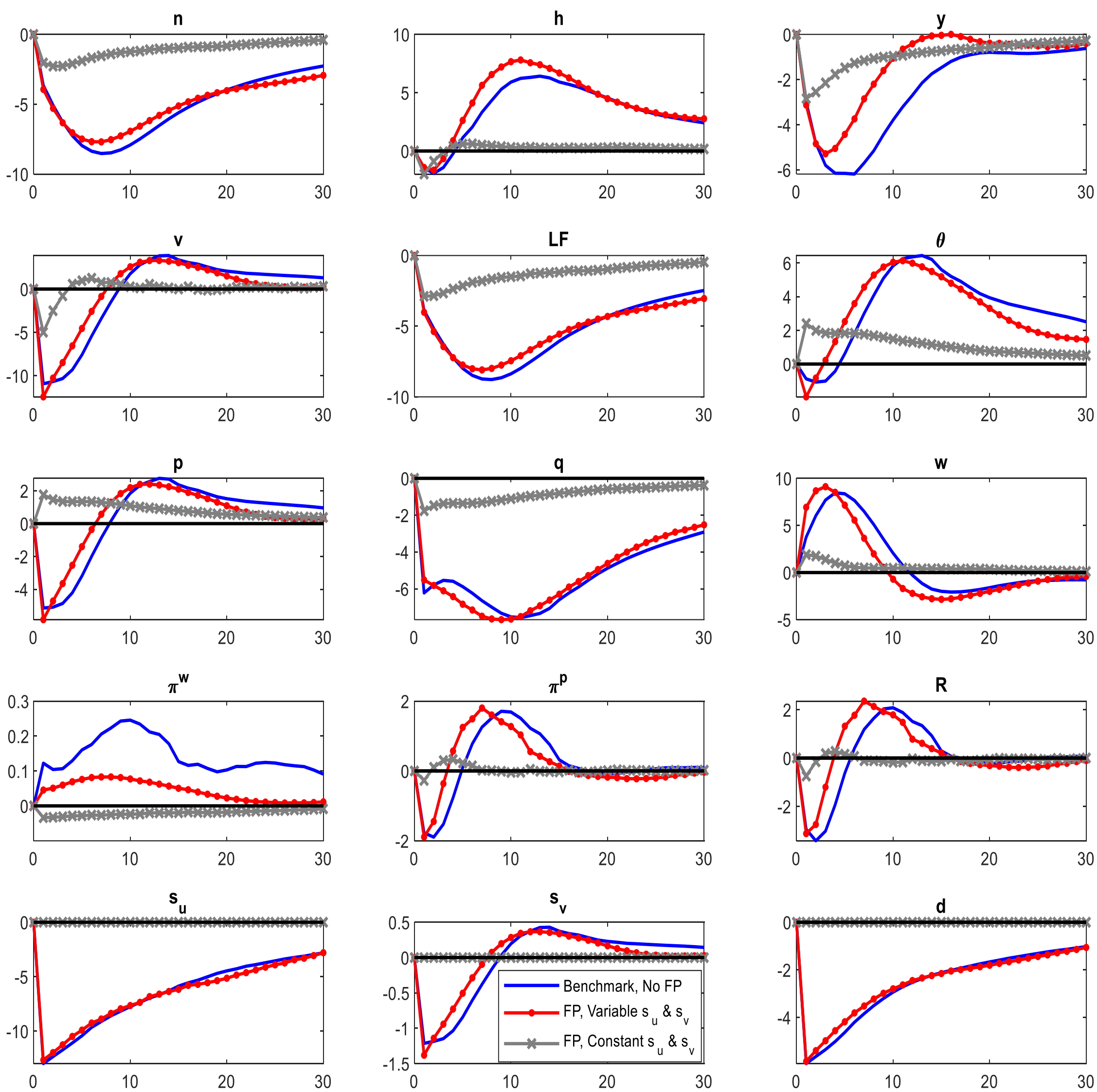

Figure C.2: Impulse Responses- The Model with Endogenous Labor Force Participation, Search Intensity and Recruiting Intensity

Note: Model-based impulse responses- the model with endogenous labor force participation. Percentage deviations from the deterministic steady state. "Benchmark, No FP": the model with search intensity and recruiting intensity but no fiscal policy. "FP, Variable s_u&s_v": the model with search intensity and recruiting intensity and fiscal policy. "FP, Constant s_u&s_v": the model with fiscal policy, fixed search intensity and recruiting intensity. n: employment, h: hours per employed individual, y: output, v: vacancies, LF: labor force participation rate, θ: labor market tightness, p: job finding rate, q: job filling rate, w_t: real wage, π^w: wage inflation, π^p: price inflation, R: nominal interest rate, s_u: search intensity, s_v: recruiting intensity, d: efficiency of the search process.

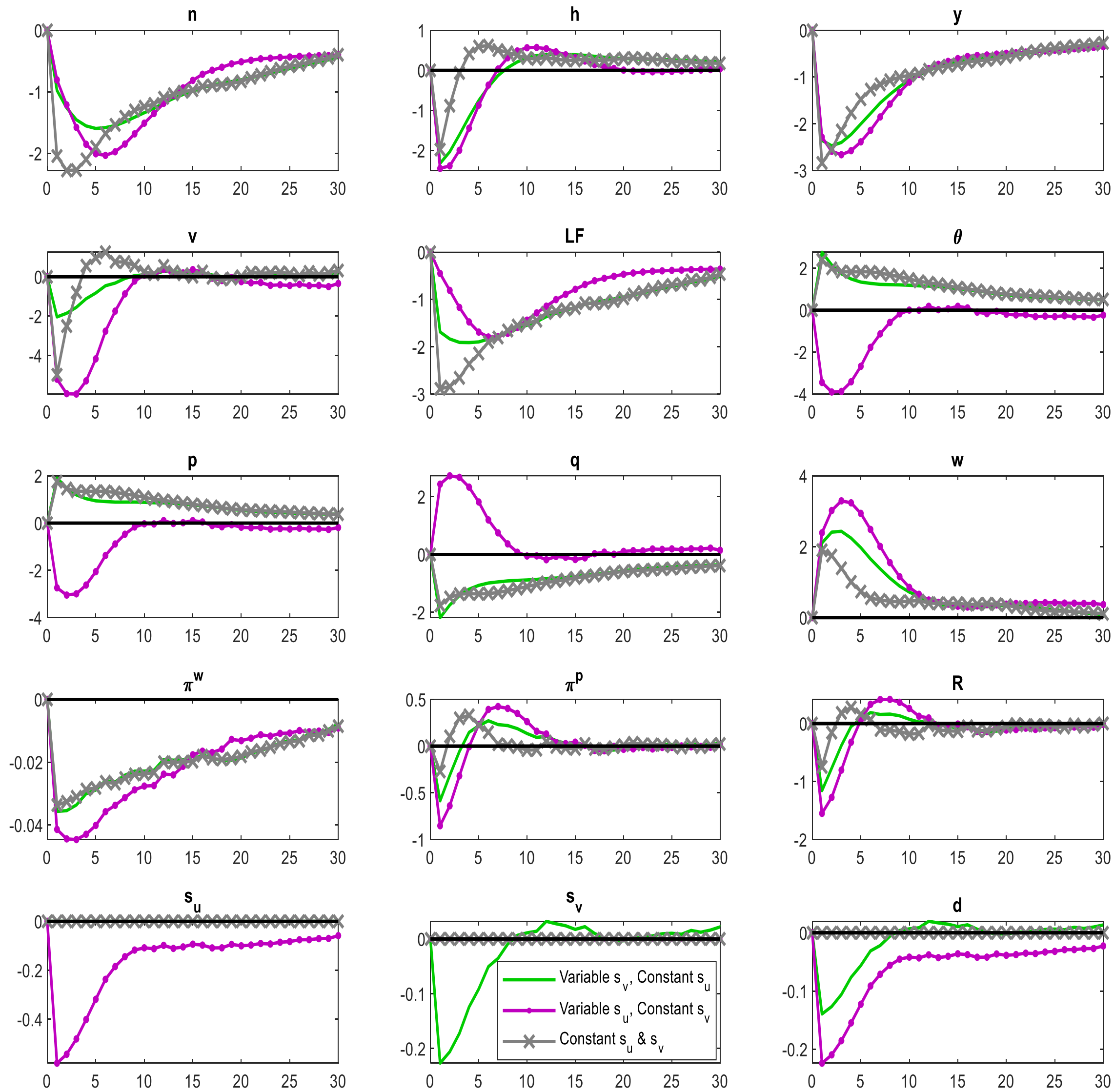

Figure C.3: Impulse Responses- The Model with Endogenous Labor Force Participation, Search Intensity and Recruiting Intensity

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. "Variable s_v, Constant s_u": the model with fiscal policy, fixed search intensity and variable recruiting intensity. "Variable s_u, Constant s_v": the model with fiscal policy, variable search intensity and fixed recruiting intensity. "Constant s_u & s_v": the model with fiscal policy, fixed search intensity and fixed recruiting intensity. n: employment, h: hours per employed individual, y: output, v: vacancies, LF: labor force participation rate, θ: labor market tightness, p: job finding rate, q: job filling rate, w_t: real wage, π^w: wage inflation, π^p: price inflation, R: nominal interest rate, s_u: search intensity, s_v: recruiting intensity, d: efficiency of the search process.

When fiscal policy is introduced, we observe very similar patterns, including the behavior of the inflation rate. Fiscal policy, however, leads to faster reversal (e.g., in output, vacancies, and labor market tightness) as well as to higher inflation in the first two years following the shock. The extended model thus indicates the potential role that fiscal policy played in inflation dynamics: the rise in prices, after an initial decline, occured at a faster rate than it otherwise would. Starting in the third year after the shock, inflation begins to moderate and gradually declines, eventually returning to its initial value.

Turning to the third case, without exogenous shocks to search and recruiting intensity, the fall in inflation is muted, and the reversal happens quickly. The rise in inflation above its initial value is small and short-lived. The dynamics of the job finding rate and labor market tightness are at odds with the data. Therefore, while fiscal policy alone can lead to the observed rise in inflation, it impact is less persistent and does not align with the observed correlation in key labor market indicators. We posit that a concurrent shock to the efficiency of the matching process was at play and helps explain inflation dynamics later in the pandemic. Indeed, over longer horizons, the fall matching efficiency is associated with a higher and more persistent inflation rate.

To further elaborate on the importance of search and recruiting intensities for the behavior of the inflation rate, we compare the model with a variable search intensity but constant recruiting intensity to the model with a variable recruiting intensity but constant search intensity, and to the model where both intensities are constant. Three points emerge in Figure C.3. First, fixing either search or recruiting intensity leads to a smaller response of inflation rate (compared to the model with variable search and recruiting intensities in Figure C.2). Second, a time-varying search intensity better replicates the behavior of labor market variables during the early stage of the pandemic, but variation in recruiting intensity becomes more important during the later stage. Third, the weakest response of the inflation rate is observed when both intensities are fully fixed.

Finally, we present the results when the economy is only subject to a fiscal policy shock. Fiscal policy is governed by the following exogenous rule:

$$\ln\left(\frac{g_t}{\bar{g}}\right) = \rho_g \ln\left(\frac{g_{t-1}}{\bar{g}}\right) + \varepsilon_{g,t} \tag{C.21}$$

We consider two cases. First, the economy is subject to fiscal policy shock but not a demand shock ($q_e = 0$). Second, the economy is subject to both shocks. Figure C.4 summarizes the results.

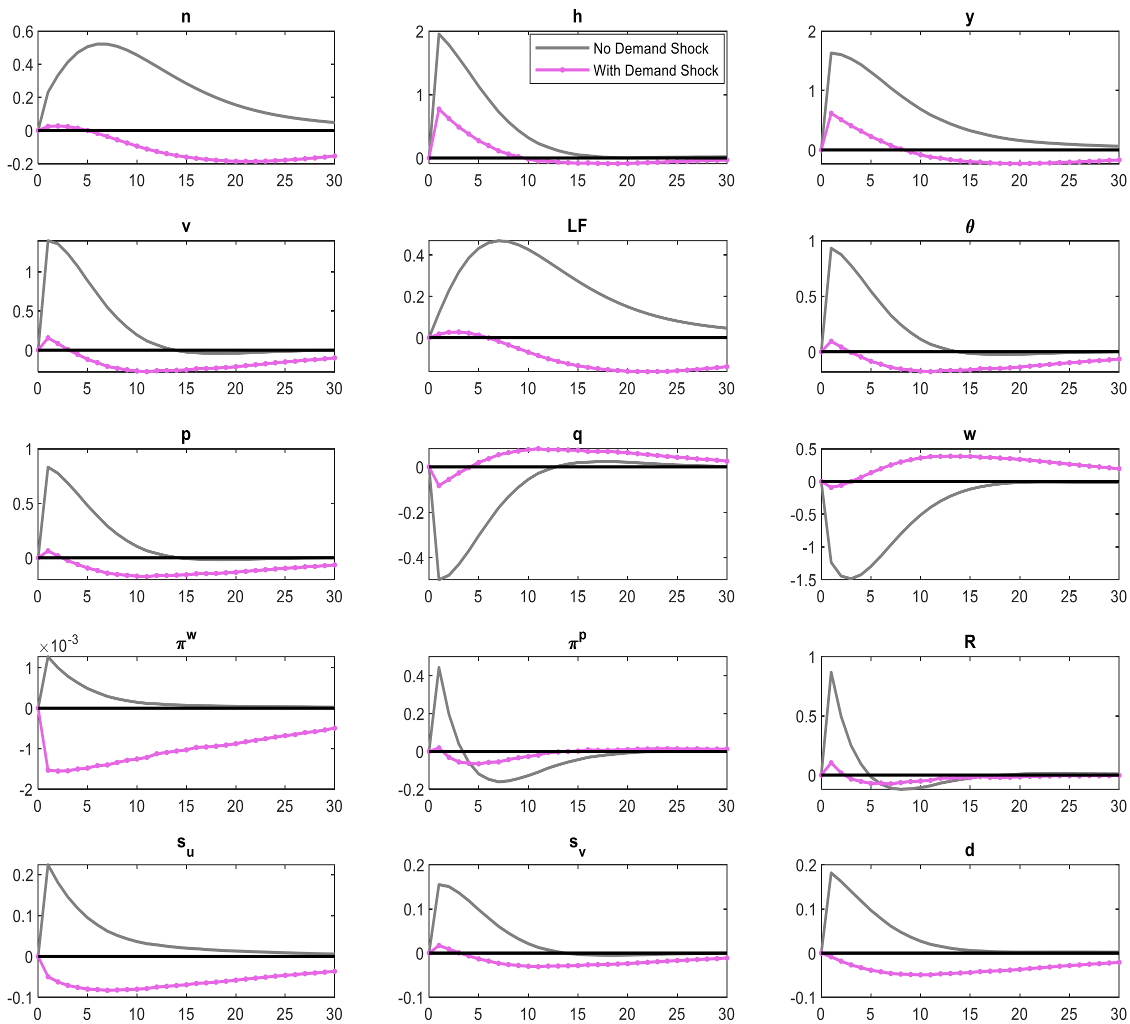

Figure C.4: Impulse Responses- The Model with Endogenous Labor Force Participation, Search Intensity, Recruiting Intensity and Exogenous Fiscal Policy Shock

Note: Model-based impulse responses. Percentage deviations from the deterministic steady state. "Variable s_v, Constant s_u": the model with fiscal policy, fixed search intensity and variable recruiting intensity. "Variable s_u, Constant s_v": the model with fiscal policy, variable search intensity and fixed recruiting intensity. "Constant s_u & s_v": the model with fiscal policy, fixed search intensity and fixed recruiting intensity. n: employment, h: hours per employed individual, y: output, v: vacancies, LF: labor force participation rate, θ: labor market tightness, p: job finding rate, q: job filling rate, w_t: real wage, π^w: wage inflation, π^p: price inflation, R: nominal interest rate, s_u: search intensity, s_v: recruiting intensity, d: efficiency of the search process. "No Demand Shock"- the model with $q_e = 0$.

While inflation does rise on impact, the response of most other variables is at odds with their empirical counterparts at the onset of the Covid-19 pandemic.

C.7 Model Fit: Short-Run Dynamics

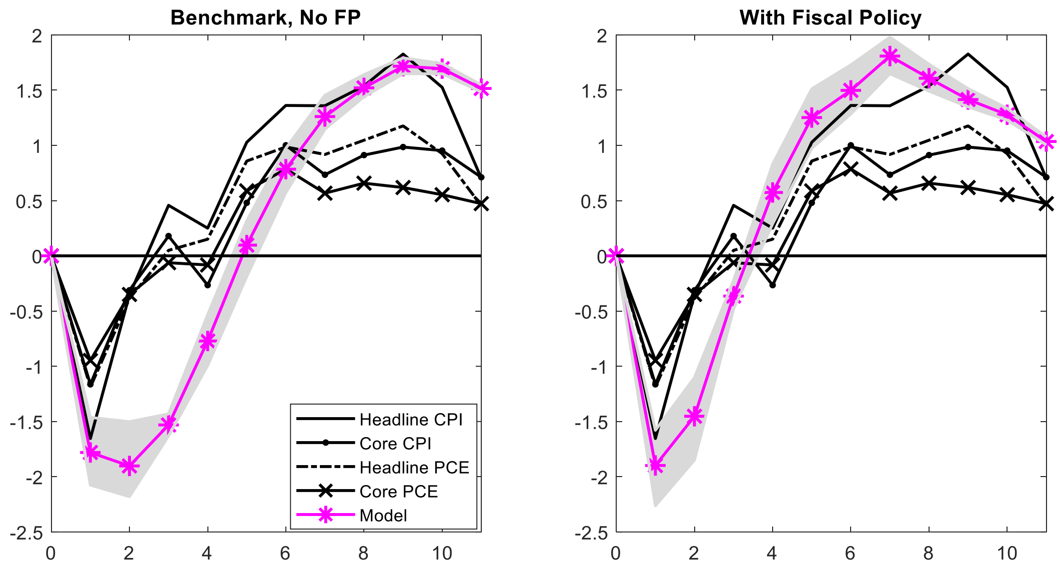

Figure C.5: Excess Inflation Rate: Model vs. Data

Note: Data vs. model-based inflation rates (Quarterly). Model: Percentage deviations from the deterministic steady state. Data: percentage deviations from pre-Covid levels. Left panel: the model without fiscal policy. Right Panel: the model with fiscal policy. Shaded areas: 90% confidence intervals around the model-based impulse response functions.

C.8 Model Fit: Correlations and Long-Run Dynamics

Table C.2: Correlations of Labor Market Variables with Inflation

Measure	Wage inflation	Vacancies	Labor market tightness	Job finding rate	Job filling rate
Headline CPI	0.4168	0.7648	0.6108	0.5909	-0.7276
Core CPI	0.3414	0.7791	0.6469	0.6265	-0.7348
Headline PCE	0.5953	0.7740	0.6106	0.5880	-0.7662
Core PCE	0.5651	0.7602	0.6005	0.5771	-0.7678
Benchmark, No FP	0.4297	0.6289	0.6876	0.6937	-0.5514
FP, Variable d	0.3474	0.6628	0.6974	0.7131	-0.6885
FP, Constant d	0.4286	0.8302	-0.3380	-0.3568	0.4032
Flexible Wage	0.3518	0.1645	0.0938	0.2593	0.2547

Note: Correlation coefficients of labor market variables with the inflation rates, data vs. model. "Benchmark, NP": the model with a demand-side shock, a shock to matching efficiency, but no fiscal policy. "FP, Variable d": the model with a demand-side shock, a shock to matching efficiency and fiscal policy. "FP, Constant d": the model with a demand-side shock, fiscal policy, but no shock to matching efficiency. "Flexible Wages": the model with a demand-side shock, a shock to matching efficiency, but no fiscal policy and flexible nominal wages.

C.9 Search Intensity: Alternative Approach

In this subsection, we present an alternative approach to estimating search intensity, which follows Davis (2011). The latter relates the intensity of search to the (average) duration of unemployment: $s_{u,t} = \alpha_1 - \alpha_2 Duration_t$. Leduc and Liu (2020) used a similar approach, but the median of unemployment duration replacing the mean of duration. In Figure C.6, we show the implied search intensity using both the mean and the median, with the values of α_1 and α_2 being obtained from Davis (2011). Throughout the majority of the time since the start of the pandemic, this measure points to the same phenomenon that we identify in the text- reduced search intensity for work following the Covid-19 shock.

This measure, however, suggests higher search intensity in the early stages of the pandemic, which is unreasonable. This occurs for the following reason: prior to March 2020, there have been nearly 6 million unemployed in the U.S. The number of unemployed rose to nearly 23 million in April 2020. Therefore, nearly three quarters of all unemployed in April 2020 were newly unemployed, which reduced the mean and the median duration of unemployment, particularly the former. As this measure negatively depends on the mean/median duration of unemployment, it shows more intensive search for work.

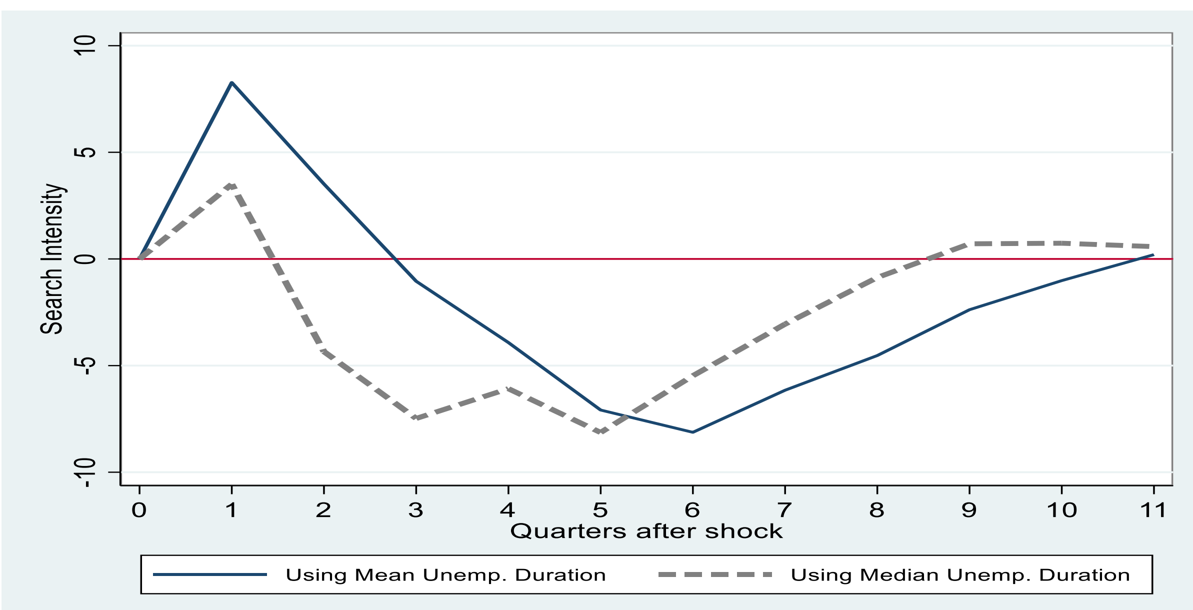

Figure C.6: Search Intensity- Alternative Approach

Note: calculating the search intensity following Davis (2011) and Leduc and Liu (2020). We use: $\alpha_1 = 122.30$ and $\alpha_2 = 0.90$.