The Search Cost of Inflation

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PRELIMINARY

Abstract

What are the costs of inflation in the labor market? When wages are set nominally, inflation leads to reduced purchasing power, which prompts workers to search for other jobs to regain it; this search is costly. We quantify these costs in a model of on-the-job search with nominal rigidities, where search effort responds endogenously to inflation. Relative to a flexible wage counterfactual, inflation erodes the value of a match to a worker through real wage losses and larger search costs. The real wage loss is absorbed as a benefit to firms, whereas the cost of search is a net aggregate cost of inflation.

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1 Introduction

What is the cost of inflation? In the New Keynesian model, inflation creates dispersion in the price of identical goods distorting relative price signals and leading to inefficient allocations, but the empirical evidence for these costs is limited (Nakamura et al. 2018). Workers' dislike of inflation due to a perceived loss of purchasing power is another potential cost proposed by Shiller 1997 and considered again more recently (Stancheva 2024, Pilossoph and Ryngaert 2023, Hajdini et al. 2022, Jain, Kostyshyna, and Zhang 2022). In Pilossoph and Ryngaert 2023, we argued that workers respond to such losses with one-the-job search. This paper shows that search costs constitute the primary aggregate cost of inflation in the labor market.

We propose a model of on-the-job search with price level shocks in which nominal wages are negotiated at the start of a match. Because of two-sided lack of commitment, the nominal wage is fixed for the duration of the match unless either party has a credible threat which induces the nominal wage to change. oThis implies that, conditional on the nominal wage being fixed, real wages move in response to movements in the price level. Wages are renegotiated between an employer and employee when (i) the worker gets an outside offer which allows them to bargain up the wage at their current firm, or (ii) inflation induces a large enough reduction in the worker's purchasing power that the net value to the worker is negative. We allow workers to respond to inflation by endogenizing their search decision to the price level. Inflationary shocks accelerate the rate of job-to-job transitions in this economy because they speed the arrival rate of offers.

We then consider the value of an employment match to both worker and firm. When wages are nominally rigid, inflation reduces the value of the match to workers relative to the case where wages are flexible. This reduction has two components: a lower real wage and increased search costs. The value of a match to a firm increases when the real wage decreases, so the net loss comes from the increased search cost rather than from lost purchasing power.

1.1 Related Literature

Faccini and Melosi 2023 and Karahan et al. 2017 show that the on-the-job search rate and the rate of job-to-job transitions predict future inflation. Given that on-the-job search effectively generates nominal wage growth at the aggregate level, workers may rationally view search for new work as a way to obtain a nominal raise for themselves. On-the-job search generates wage increases in two ways. A worker can accept an outside offer that dominates her current position or use outside offers to obtain a counteroffer at her current job. In the second case, she remains in the same position but at a higher wage. Pilossoph and Ryngaert 2023 show that higher inflation expectations and realizations are associated with on-the-job search and job-to-job transitions and proposes a model in which workers perceive that offered wages adjust more readily with inflation than existing wages adjust. In this case, expected and realized inflation facilitate raises primarily via labor market transitions. The current paper endogenizes job search to the current price level to study the effects of realized inflation on job-to-job transitions and wage growth for job stayers.

Moscarini and Postel-Vinay 2022 highlight the importance of understanding the origins of nominal wage changes: job-to-job transitions or counteroffers to prevent the poaching of employees. The former, they argue, result from the reallocation of employees from less-productive jobs to more-productive jobs. These raises are not inflationary because firms realize productivity gains that offset the higher wages they pay. Offers that prompt renegotiation at the current firm are inflationary marginal cost shocks for the firms as they must pay a worker more even as productivity remains unchanged or lose that worker. Importantly, Moscarini and Postel-Vinay 2022 assume an exogenous arrival rate of offers. Faccini and Melosi 2023 allow the arrival rate of offers to change with the rate of on-the-job search and show that an increase in the rate of job-to-job transitions is theoretically consistent with wage pressure as it provides a measure of the competition between firms for workers. We allow for the endogenous response of on-the-job search to inflation, showing that inflationary shocks will increase both job-to-job transitions and counteroffers simultaneously and suggesting a potential mechanism for so-called wage-price spirals in which prices and wages increase in response to one another (Blanchard 1986).

This paper contributes to the literature on estimating and explaining the passthrough of price inflation to wage inflation. Hajdini et al. 2022, Jain, Kostyshyna, and Zhang 2022, and Buchheim, Link, and Möhrle 2023 find evidence that the perceived passthrough of inflation to wage growth is low. Pilossoph and Ryngaert 2023 provide evidence that this prompts employed workers to search and potentially speed the arrival of negotiations. Buchheim, Link, and Möhrle 2023 show that - among German workers and firms - expected passthrough increases when workers and firms anticipate negotiations to take place. Higher inflation expectations do not, however, increase the likelihood that German workers ascribe to entering into negotiations. The current paper combines nominal wage rigidity and endogenous search effort to evaluate the mechanisms of passthrough of realized inflation to wage growth.

Our paper also fits with a set of papers studying post-pandemic labor market dynamics. Bagga et al. 2023 considers the effect of work-from-home amenities in the labor market transitions of workers. Autor, Dube, and McGrew 2023 shows a compression in the aggregate wage distribution in the post-pandemic years and argues that a on-the-job search lead to a tightening labor market reallocated workers - particularly younger and less educated workers - up the frictional wage distribution. This finding is consistent with that of Pilossoph and Ryngaert 2023 that expected inflation, ceterus paribus, increases labor market tightness by prompting on-the-job search and that wage growth from this mechanism comes primarily via job-to-job transitions. In this paper, we propose a model of endogenous search that has predictions for both job-to-job transitions and on-the-job raises prompted by outside offers.

From a more theoretical perspective, our paper takes the canonical wage negotiation frameworks from the search literature (Postel-Vinay and Robin 2002, Cahuc, Postel-Vinay, and Robin 2006, Lise and Robin 2017,Jarosch 2023), which are developed in real terms, and explicitly adds nominal wage rigidity. Blanco et al. 2022 similarly think about a search framework with nominal rigidities, but do not consider search on-the-job or the wage renegotiation mechanism. As highlighted in Moscarini and Postel-Vinay 2017, this is an important channel for thinking about wage-price spirals, as wage increases on the job are considered cost-push shocks at the firm level.

2 Model

We now outline a model of search on- and off-the-job where there is a unit mass of firms, each with a vacancy, indexed by their productivity $y \in (0, \bar{y})$. The distribution of vacancies across firms y, denoted by $v(y, \Omega)$, is exogenous, and allowed to depend on the aggregate state of the economy Ω, to be specified below.[1]

Workers are homogeneous, infinitely lived, and of measure one, with linear preferences over a single final consumption good given by $u(c) = c$ whose price is p_t, which we take to be exogenous. The aggregate state of the economy Ω is given by the joint (exogenous) dynamics of aggregate productivity z_t and the price level p_t. z_t is stochastic and changes according to the Markov transition probability $T_z(z, z')$. The price level is also assumed to be stochastic and changes according to a Markov transition probability $T_p(p, p')$. Finally, all agents discount the future at rate β.

The model closely follows Lise and Robin 2017, with three main differences: (i) there is no worker heterogeneity (a simplification), (2) vacancies are exogenous as in Jarosch 2023, (also a simplification), and more importantly (3) firms and workers bargain over current real wages, but *nominal* wages are rigid; this implies that movements in the price level and productivity will endogenously move the share of surplus going to the worker and the firm. Wages are only renegotiated when either party has a credible threat.

[1]In the model we outline below, it is straightforward to introduce endogenous vacancy creation. However, the vacancy creation decision becomes a function of the distribution of workers across firms and the unemployment rate once we endogenize search effort, which substantially increases the computational burden of the model. We therefore assume vacancies are exogenous from the outset.

2.1 Meeting Technology

At the beginning of every period, there are u_{t-1} unemployed workers and $h_{t-1}(y)$ employed workers at firms of type y, where the adding up constraint on the labor force implies:

$$u_{t-1} + \int h_{t-1}(y)\, dy = 1$$

The exogenous components of the aggregate state of the economy then change from $\Omega_{t-1} = (z_{t-1}, p_{t-1})$ to $\Omega_t = (z_t, p_t)$. As in Lise and Robin 2017 and Lentz, Lise, and Robin 2016, separations and meetings between searching workers and vacant jobs occur sequentially after the change in the aggregate state: first, separations occur and then searching workers may draw a new offer.

Letting u_{t+} and $h_{t+}(y)$ denote the stock of unemployed workers and employed workers employed at firms y right after both the state changes and separations occur, the number of effective searchers L_t is then:

$$L_t = u_{t+} + s \int h_{t+}(y)\, dy,$$

where s represents the exogenous search effort of employed workers relative to unemployed workers.

Let $\lambda(\Omega)$ denote the exogenous probability that an unemployed searcher meets a vacant job, and $s\lambda(\Omega)$ denote the exogenous probability an employed searcher contacts a job opening when the state is Ω. Later, we will endogenize search decisions so that s will be a decision variable for each worker.[2]

2.2 The Value of Unemployment

Let $U(\Omega)$ denote the value of unemployment and let $M(y, \Omega)$ denote the joint value of a worker matched with a firm of type y when the state is Ω. The difference between the match value $S(y, \Omega) = M(y, \Omega) - U(\Omega)$ is the match surplus, and only positive surplus matches will form. When a firm meets an unemployed worker, the firm receives the full surplus of the match. Assuming a worker earns $b(\Omega) = \frac{p \cdot b(z)}{p} = b(z)$ in unemployment, the value of unemployment can be written as:

$$\begin{aligned} U(\Omega) =& b(z) + \beta E_{\Omega'|\Omega}\left[\left(1 - \lambda(\Omega') \int_{y \in S(\Omega')^+} v(y, \Omega')\, dy\right) U(z')\right. \\ &+ \lambda(\Omega') \int_{y \in S(\Omega)^+} U(\Omega')\, v(y, \Omega')\, dy \\ =& b(z) + \beta E_{\Omega'|\Omega}\left[U(\Omega')\right] \end{aligned} \tag{1}$$

[2]When search effort is exogenous, one could allow for endogenous vacancy creation without complicating the computation of the model. When search effort is endogenous, the surplus function will depend on the XX...

Since we assume that benefits are indexed to the price level, $U(\cdot)$ is independent of the price level.[3]

2.3 Match Value $M(y,z)$ and Match Surplus $S(y,\Omega)$

Firms with individual productivity y produce $f(z,y)$ units of the final good when aggregate productivity is z when matched with a worker. They sell this at price p, and the numeraire in the economy is the final good, so $f(z,y)$ is real output. At the beginning of the next period, after the aggregate state changes, the firm and worker will only remain together if surplus remains positive, or if $M(y,\Omega') \geq U(\Omega')$. If the match remains intact, we allow for the match to exogenously dissolve with probability δ so that overall, the match is destroyed with probability:

$$\mathbf{1}\{M(y,\Omega') < U(\Omega')\} + \delta \mathbf{1}\{M(y,\Omega') \geq U(\Omega')\}$$

If the job is indeed destroyed, the job disappears and the worker receives their unemployment value, so that the joint value of the match in the case of destruction is simply the value of unemployment.

The probability that the match continues is:

$$1 - [\mathbf{1}\{M(y,\Omega') < U(\Omega')\} + \delta \mathbf{1}\{M(y,\Omega') \geq U(\Omega')\}] = (1-\delta)\mathbf{1}\{M(y,\Omega') \geq U(\Omega')\}$$

In this event, the worker draws a new offer with probability $s\lambda(\Omega')$ and it will come from a job of type y' with probability $v(y',\Omega')$. In terms of wage setting, we assume that firms engage in Bertrand competition (Postel-Vinay and Robin 2002) so that the worker ultimately gets a value equal to the second highest bid. There are thus two cases to consider in terms of a mobility decision. First, suppose that the surplus at the poaching firm is larger than at the incumbent firm, $S(y',\Omega') > S(y,\Omega')$. In this case, the worker moves to firm y' and receives a net value equal to the surplus at firm y. Second, suppose the opposite; then the worker stays with the incumbent employer and earns net value equal to the minimum between $S(y',\Omega')$ and the worker's implied current net value given his/her current nominal wage and the current price level. Since either of these alternatives plus the value of unemployment are a share of the current match surplus, the joint value of the match is $M(y,\Omega')$ in both cases. Therefore, we can write the value of the current match as follows:

$$M(y,\Omega) = f(z,y) + \beta E_{\Omega'|\Omega}[U(\Omega') + (1-\delta)\mathbf{1}\{M(y,\Omega') \geq U(\Omega')\}[M(y,\Omega') - U(\Omega')]]$$

[3] If real benefits depended on the price level, then the value would be $U(\Omega)$.

Combining this with the value of unemployment, we can write match surplus as:

$$S(y,\Omega) = f(z,y) - b(z) + \beta(1-\delta) E_{\Omega'|\Omega}\left[\max\left\{S(y,\Omega'),0\right\}\right] \tag{2}$$

Given this surplus function, we can now explicitly define the stock of unemployed and employed workers at a firm y after the realization of the new shock which moves the aggregate state to Ω' and separations occur as:

$$h_{t+}(y) = (1-\delta)\,\mathbf{1}\left\{S(y,\Omega') \geq 0\right\} h_t(y) \quad \text{and}$$

$$u_{t+} = 1 - \int h_{t+}(y)\,dy$$

2.4 Nominal Wage Contracting

Employment contracts are fixed *nominal* wage contracts which the employer commits to for the duration of the match unless both parties agree to renegotiate the terms. Since employers can fire workers and workers can always quit, renegotiation will take place when (i) the nominal wage is such that the real wage delivers negative net value to the firm, (ii) the nominal wage is such that the real wage delivers negative net value to the worker, or (iii), the nominal wage delivers net value to the worker which is lower than the net value the worker can receive at a poaching firm.

Consider a worker currently employed at firm y when the state is Ω who is receiving a nominal wage of w. Let y_l denote the worker's negotiation benchmark (the firm who they last had an offer from which allowed them to negotiate their wage, including the possibility of unemployment) and let z_l and p_l denote the productivity and price level at the time when the negotiation last occurred. Their value at date t is:

$$\begin{aligned}
W(y,p,y_l,p_l,z,z_l) = {} & \frac{w(y,p,y_l,p_l,z,z_l)}{p} + \beta E_{\Omega'|\Omega}\left[U(\Omega')\right] \\
& + \beta(1-\delta) E_{\Omega'|\Omega}\Bigg\{ \mathbf{1}\left\{S(y,\Omega') \geq 0\right\} s(\Omega')\lambda(\Omega') \Bigg(\\
& \int_x v(x,\Omega')\,\mathbf{1}\left\{S(x,\Omega') > S(y,\Omega')\right\} S(y,\Omega')\,dx + \\
& \int_x v(x,\Omega')\,\mathbf{1}\left\{\tilde{\sigma}_{t+}S(y,\Omega') < S(x,\Omega') \leq S(y,\Omega')\right\} S(x,\Omega')\,dx + \\
& \int_x v(x,\Omega')\,\mathbf{1}\left\{S(x,\Omega') \leq \tilde{\sigma}_{t+}S(y,\Omega') \leq S(y,\Omega')\right\} \tilde{\sigma}_{t+}S(y,\Omega')\,dx \Bigg) \Bigg\} \\
& + \beta(1-\delta) E_{\Omega'|\Omega}\left[\mathbf{1}\left\{S(y,\Omega') \geq 0\right\}\left(1 - s(\Omega')\lambda(\Omega')\right) \tilde{\sigma}_{t+}S(y,\Omega')\,dx\right]
\end{aligned} \tag{3}$$

where

$$\tilde{\sigma}_{t+} = \begin{cases} \frac{W(y,p',y_l,p_l,z',z_l)-U(\Omega')}{S(y,\Omega')} & 0 \leq W(y,p',y_l,p_l,z',z_l) - U(\Omega') \leq S_{t+1}(y,\Omega') \\ 0 & W(y,p',y_l,p_l,z',z_l) - U(\Omega') < 0 \\ 1 & S(y,\Omega') < W(y,p',y_l,p_l,z',z_l) - U(\Omega') \end{cases}$$

That is, they earn a nominal wage equal to w which is divided by the current price level to be expressed in real terms. The first line of Equation **??** is the expected value the worker receives conditional on a separation. The second line is the value the worker gets when poached by a firm, which is equal to the current full match surplus. The third line is what the worker receives if they are not poached, but can use the outside offer to bid up their current nominal wage. In that scenario, when the aggregate state moves from Ω to Ω', the worker's nominal wage does not move, so they would be a receiving a share $\frac{W\left(y,p^{prime},y_l,p_l,z',z_l\right)}{S(y,\Omega')}$ of match surplus. The fourth line is the case where the outside offer does not affect the worker's options, but the nominal wage may adjust because the aggregate shocks are such that a surplus boundary is hit. The last line is the case where the worker does not receive an offer.

2.5 Labor Market Flows

Unemployment and employment flows will follow:

$$u_{t+1} = u_{t+} \left(1 - \lambda(\Omega_t) \int v(y,\Omega_t) \mathbf{1}\{S(y,\Omega_t)\} dy\right)$$

$$\begin{aligned} h_{t+1}(y) = {} & h_{t+}(y) \left(1 - s(\Omega_t) \lambda(\Omega_t) \int v(y',\Omega_t) \mathbf{1}\{S(y',\Omega_t) > S(y,\Omega_t)\} dy'\right) \\ & + \int h_{t+}(y') s(\Omega_t) \lambda(\Omega_t) v(y',\Omega_t) \mathbf{1}\{S_t(y,\Omega_t) > S_t(y',\Omega_t)\} dy' + \\ & + u_{t+} \lambda(\Omega_t) v(y',\Omega_t) \mathbf{1}\{S_t(y,\Omega_t) > 0\} \end{aligned}$$

2.6 Model Solution

The model can be solved in the following steps:

1. For a given home production function $b(\Omega)$ and output functions $f(z,y)$ discount rate β, exogenous separation probability δ, the distribution of vacancies for all states $v(y,\Omega)$, the meeting rates for all states $\lambda(\Omega)$, exogenous search intensities for all states $s(\Omega)$, and stochastic transition matrices for z and p, $T(z,z')$ and $T_p(p,p')$, solve for the surplus function $S(y,\Omega)$ as the unique solution to Equation 2. This implies a solution for $U(\Omega)$

and $M(y, \Omega)$.

2. Given some initial values for u_0 and $h_0(y)$, a sequence of stochastic productivity shocks $\{z_t\}_{t=0}^{T}$ and price level realizations $\{p_t\}_{t=0}^{T}$ imply a unique path for the unemployment rate, and the distribution of employed workers across firms:

$$\{u_t, h_t(y)\}_{t=0}^{T}$$

3. Given the path for the above objects, we can now turn to the dynamics of wages. To solve for wages, given some initial $\{z_0, p_0, u_0, h_0(y)\}$:[4]

   (a) Construct a grid of wage outcomes, $w^j(y, p, y_l, p_l, z, z_l)$, where j refers to the iteration of the solution algorithm.

   (b) Guess an initial value function for $W(y, p, y_l, p_l, z, z_l)$.

   (c) Construct $\sigma(y, p, y_l, p_l, z, z_l)$, the implied share of surplus the nominal wage $w^j(\cdot)$ generates for the worker.

   (d) Iterate on $W(y, p, y_l, p_l, z, z_l)$ using Equation 3 until convergence.

   (e) Given the updated value $W(y, p, y_l, p_l, z, z_l)$, we can solve for wages for those coming out of unemployment which must satisfy $W(y, p, \emptyset, p, z, z) - U(p, z) = 0 \quad \forall p, z$.[5] We can also solve for wages for any worker transitioning from one firm y to another (equal or higher surplus firm) y' when the state is Ω as $W(y', p, y, p, z, z) - U(z) = S(y, z) \quad \forall p, z$. As $W(y', p, y, p, z, z) = \frac{w(y', p, y, p, z, z)}{p} + W_{cont}(y', p, y, p, z, z)$, $w(y', p, y, p, z, z) = p * (U(z) + S(y) - W_{cont}(y', p, y, p, z, z))$

   (f) In cases where $p \neq p_l, z \neq z_l$, $w(y', p, y, p_l, z, z_l) = p_l * (U(z_l) + S(y, z_l) - W_{cont}(y', p, y, p, z, z))$ with the restriction that $\max_{y, y_l, z_l, p_l}(w(y', p, y, p_l, z, z_l)) = p * (U(z) + S(y, z) - W_{cont}(y', p, y, p, z, z)))$ and $\min_{y, y_l, z_l, p_l}(w(y', p, y, p_l, z, z_l) = p * (U(z) - W_{cont}(y', p, y, p, z, z)))$. This says that aggregate shocks z, p may force a renegotiation of the wage contract in the following two cases: (1) absent renegotiation, the contracted wage would result in the employer laying off the worker (2) absent renegotiation, the contracted wage would result in the worker quitting into unemployment.

   (g) Given this new wage grid, return to (c) and repeat steps (c)-(d) until convergence.

[4]The easiest is to begin with everyone in unemployment, so that the surplus shares are irrelevant.
[5]The $\emptyset$ notation refers to the state of unemployment.

2.7 Equilibrium Policies

When search effort is exogenous, our model offers three key mechanisms that allow the nominal wages of an employed worker to adjust in response to an inflationary shock: (1) the worker may make a job-to-job transition to a more productive firm, (2) the worker may renegotiate her wage after the arrival of a job offer from another firm, staying at the same employer, or (3) if her wages are sufficiently low in *real* terms, the worker may renegotiate her wage using the value of unemployment as her outside option. In the case where search effort is passive, only (2) and (3) are responsive to inflation, as changes in the price level do not influence contact rates, but instead influence the share of surplus going to the worker, which determines the likelihood of renegotiation, whether from a job offer or from unemployment. Finally, the key assumption underlying the operation of these mechanisms is that wages are flexible upon negotiation but that renegotiation only occurs when it is of mutual interest, a standard feature of the framework of Postel-Vinay and Robin 2002 that we extend to an environment where wage contracting occurs over nominal values.

Before turning to a simulation of the economy in response to a price level shock, we first show some general features of the model. Figure 1a displays the likelihood of a currently employed worker at a firm one rung below the top of the job ladder receiving a wage adjustment in the presence of a sudden inflationary shock. This illustrates that in the case where search effort is passive, the job-to-job transition rate is not influenced by inflation. This is founded upon two key features of the model: (1) the decision rule explaining such moves is based on comparing the *real* match value of two employers (2) offer arrival rates are independent of the price level when search effort is passive. Figure 1a also illustrates that the likelihood of a job offer resulting in renegotiation responds to changes in the price level, as inflation reduces the share of the *real* value of surplus received by the worker and this determines whether an outside offer may be used to bid wages up. Figure 1b, depicting the likelihood of renegotiation for workers employed at the same firm with varying negotiation benchmarks, illustrates that, importantly, this fact does not apply to all workers. For workers receiving no share of net surplus of the job, *any* outside offer will result in renegotiation. Instead, for this set of workers, wage contracts are adjusted with the price level based on the outside option of unemployment.

As wage contracts are rigid in the presence of inflation without a credible outside option forcing renegotiation, this has a clear implication: the wage of a worker receiving a positive share of surplus will be unresponsive to changes in the price level up to the point where their share of surplus falls to 0, which forces an increase in their wage as displayed in Figure 2a. As a different interpretation of the same fact, the *real* value of employment of a worker $W(y, y_l, p, p_l, z, z_l)$ is decreasing in p until it hits the boundary $U(z)$, implying that nominal wages are adjusting for workers receiving no surplus. To depict the role of renegotiation boundaries in wage contracting, Figure 2b plots the wage policy function for two types of workers: a worker employed at a firm receiving the full share of surplus and a worker at a firm receiving zero share of surplus. Figure 2b considers how the contracted wage varies with inflation. Figure 2b illustrates that, in the presence of deflation, a worker receiving the full value of match surplus rationally agrees to renegotiate her wage so that the job is not destroyed, with no change in the wage contract occurring with inflation until the zero surplus boundary is hit. It also illustrates that, in the presence of inflation, a worker receiving zero surplus is capable of forcing renegotiation, as she has a credible threat of severing the match by quitting into unemployment, with no change in the wage contract occurring with deflation until the full surplus boundary is hit. As will be discussed in the simulation exercise, these boundaries play an important role in generating a wage compression mechanism, with changes in the price index dampening inequality across workers.

3 Simulation

In order to illustrate the impact of an inflationary shock on wages and the underlying mechanisms, we perform a simulation exercise. First, we solve the model following the procedure described in section 7, setting parameters so that outcomes in steady-state roughly match long-run averages observed empirically in the US, abstracting away from aggregate shocks to productivity to focus on fluctuations in the price level, such that p is the only aggregate state variable. We assume $b(z) = z$ and a linear production technology $f(y, z) = yz$. We impose a distribution of vacancies across firm-types in our assumed y-grid. We consider $\{u_t, h_t(y)\}_{t=0}^{T}$ over a T large enough so that we have convergence towards their long-run values. Second, we simulate the employment and earnings histories for a large number of individuals, sampling from transition rates implied by objects from the model. Our implementation of the inflation shock is straightforward: the price-level is taken to be fixed, at a low level, up until the time of the shock (T_{shock}), upon which it jumps. Table 1 lists the values for each parameter used in this exercise.

Parameter	Description	Value
β	Discount rate	0.9644
δ	Exogenous separation rate	0.0297
ρ	Persistence in price level	0.999
s	Relative search efficiency	0.25
λ	Contact rate	0.244
$v(y)$	Vacancy distribution	(0.20,0.23,0.26,0.31)
y_{grid}	y-grid size	13
p_{grid}	p-grid size	20
T	Number of time periods (months)	480
T_{shock}	inflation shock time	432
N	Number of individuals	50,000

Table 1: Parameter Values

To illustrate, the main mechanisms of the model and their implications, we consider a large shock to the price level such that prices suddenly jump by 70 percent as of T_{shock}. As discussed previously, when search is passive, our model predicts that inflationary shocks will have no effect on the allocation of workers across firms and between unemployment and employment. However, as wage contracts may only be renegotiated by mutual agreement, they are rigid in presence of inflation for workers without an outside option, reducing earnings in real terms for most workers, as shown in Figure 3b. As many workers earn no share of surplus because they were hired out of unemployment, many workers possess a credible outside option forcing renegotiation. Workers on this boundary have wages that adjust immediately with the shock, resulting in the compression of the real wage distribution observed in Figure 3c. As displayed in Figure 3d, the compression of the wage distribution occurs as the wages of workers outside of this zero surplus boundary fall in real terms, moving closer to the real wages received by workers at the zero surplus boundary before the shock. Finally, Figure 3b and 3c illustrate that the dynamics of adjustment of the real wage distribution to its steady-state value display non-linearities in aggregate terms: the adjustment of moments of the wage distribution is very swift initially, but becomes more sluggish, such that the adjustment back to steady-state is drawn-out.

In a passive search environment, as discussed previously, the three direct mechanisms underlying the adjustment of the real wage distribution to its steady-state are those of (1) job-to-job transitions (2) renegotiation after arrival of job offer from another firm, and (3) renegotiation using the value of unemployment as an outside option. As shown in Figure 4a, a permanent positive shock to the price level has the effect of inducing the immediate renegotiation of wages for workers who, absent such a negotiation, would find it more profitable to quit into unemployment. However, this only occurs upon impact of the shock. As discussed previously, for workers above the zero surplus boundary after the shock, the adjustment of wage contracts occurs either through job to job transitions or through renegotiation based on outside job offers. As shown in Figure 4b, the job-to-job transition rate is not responsive to shocks to the price level, but the renegotiation rate responds substantially to shocks to the price level before settling down to its steady-state level. This occurs as workers receiving $w(y, y_l, p, p_l)$ obtain a smaller share of surplus, expanding the scope of *types* of job offers that may result in renegotiation. Over time, as a greater share of workers are receiving wages negotiated at the current price level, the renegotiation rate diminishes towards its value before the shock.

As a consequence of the mechanisms of wage adjustment, real wage growth of job switchers responds quite strongly in the period after the shock, as all job switchers negotiate contracts based on the current price level, but the vast majority will have been paid based on contracts denominated at the previous price level. In contrast, real wage growth of workers remaining at the same firm only responds through the channel of renegotiation and, as shown in Figure 4b, the renegotiation rate, while responsive to the shock, only benefits a small fraction of workers in each month. As the search intensity of employed workers is constant, the renegotiation rate does not increase because the arrival rate of offers increases, but, rather, due to the fact that a wider set of outside offers may trigger renegotiation. This limits the pace of wage adjustment after the shock and helps to explain why the wage growth of job switchers responds much more strongly after the shock than for job stayers. This forms a motivation for considering a model that moves beyond the passive search environment: if inflationary shocks raise the rewards of searching for other employment opportunities, we would expect workers to intensify their search activity in response to inflation.

4 Endogenous Search

[In Progress]

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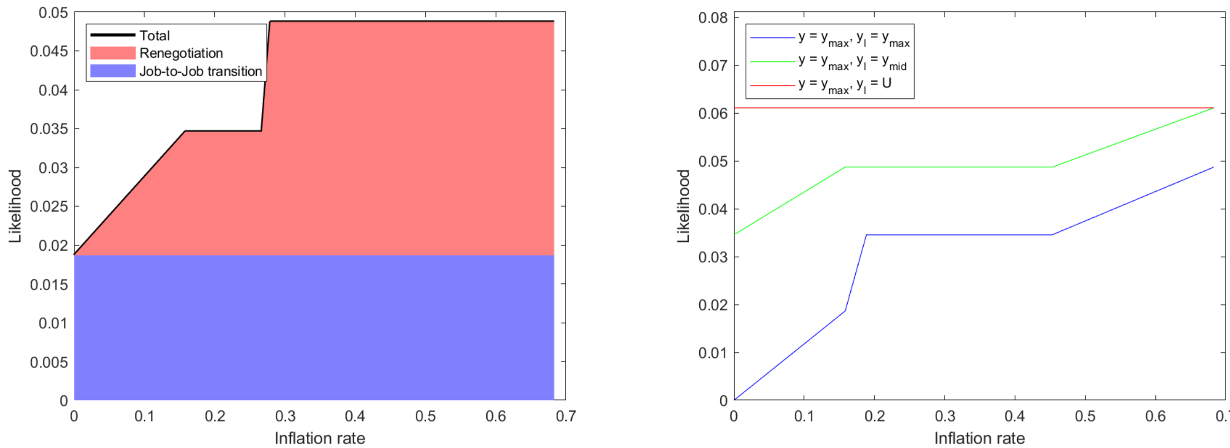
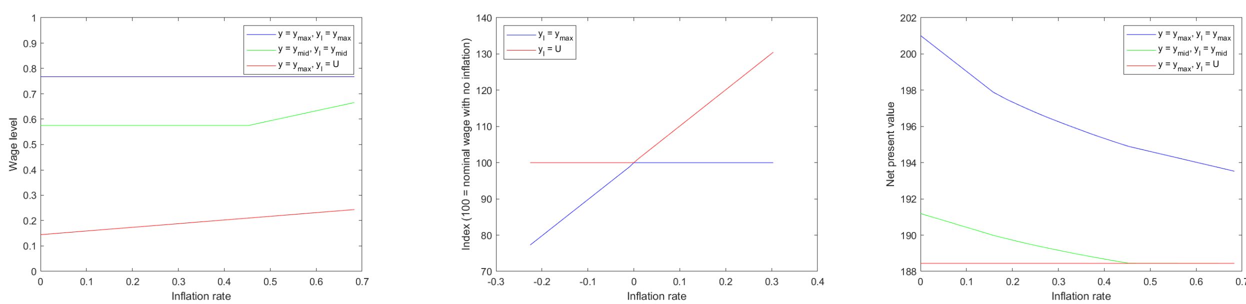


(a) Prob. worker receives Δw (b) Likelihood of renegotiation

Figure 1: Wage adjustment mechanisms

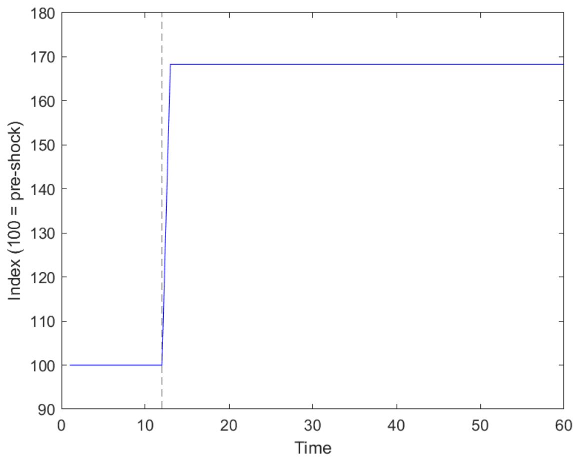
Notes: Figure 1a considers the probability of a wage change occurring for an employed worker, decomposing this probability into its two components: EE transition probability and renegotiation probability. This is done for a worker employed at a firm with a y-type one below the maximum. Figure 1b plots the renegotiation rate for a worker of the same y-type (top of job ladder) but with different negotiation benchmarks denoted by y_l. Finally, in both figures, p_l is set to the minimum of the price grid and p is varied, producing an inflation rate.



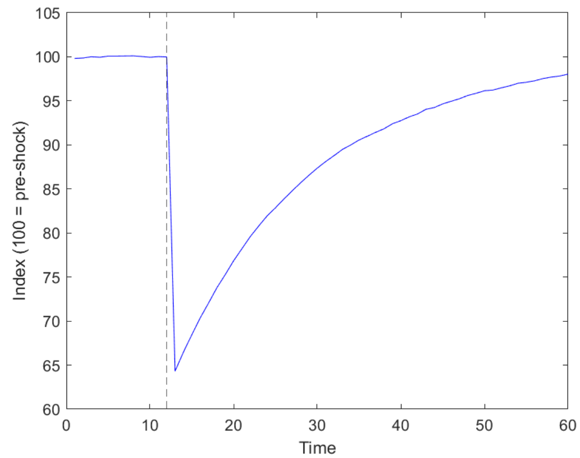
(a) Wage policy function (b) Boundaries of wage function (c) Value of employment

Figure 2: Wage adjustment

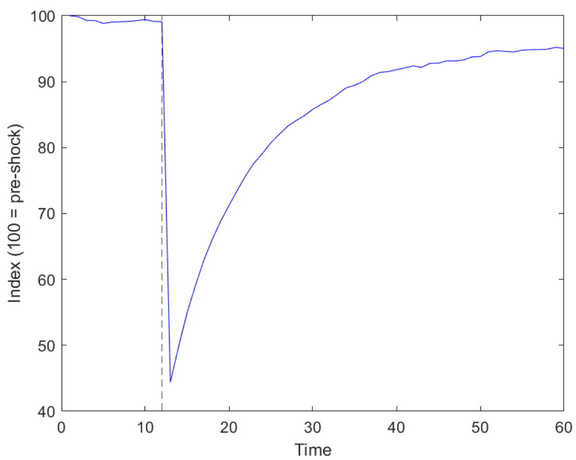
Notes: Figure 2a considers the wage policy function $w(y, y_l, p, p_l)$, for three values of (y, y_l) as described in the legend. Figure 2b plots $\frac{w(y,y_l,p,p_l)}{w(y,y_l,p,p)}$, transformed as an index. Figure 2c considers the value of employment $W(y, y_l, p, p_l)$ for three values of (y, y_l) as described in the legend. For 2a and 2c, p_l is set to the minimum of the price grid and p is varied, producing an inflation rate. For 2b, p_l is set to be the middle of the price grid and p is varied, producing an inflation rate.



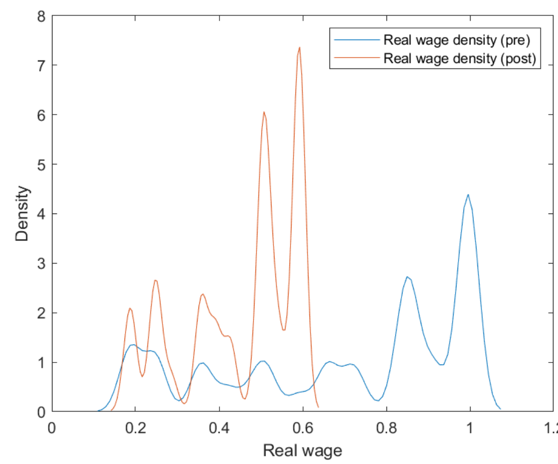
(a) Price index



(b) Average real wage index



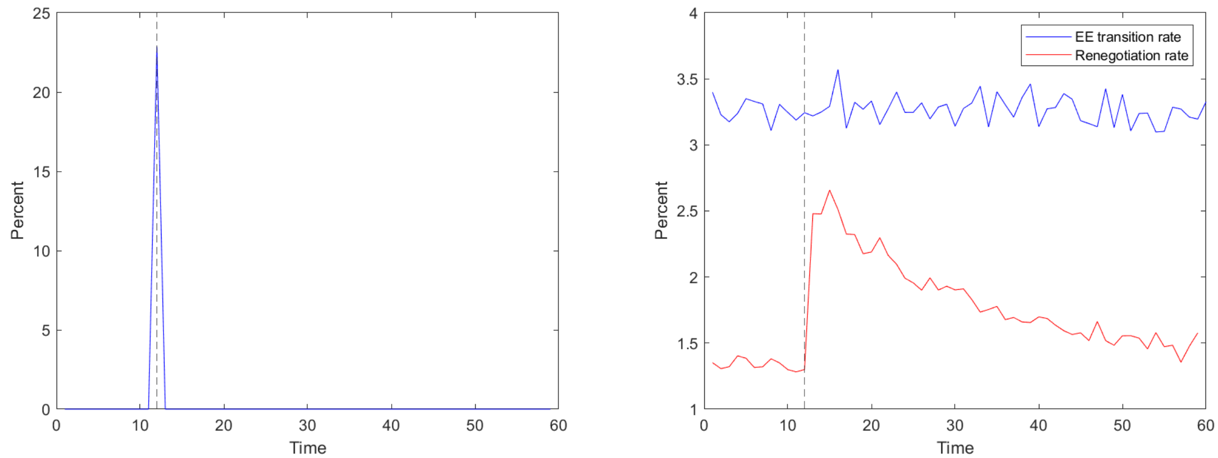
(c) Wage dispersion



(d) Real wage distribution

Figure 3: Labor Market Dynamics After Price Level Shock

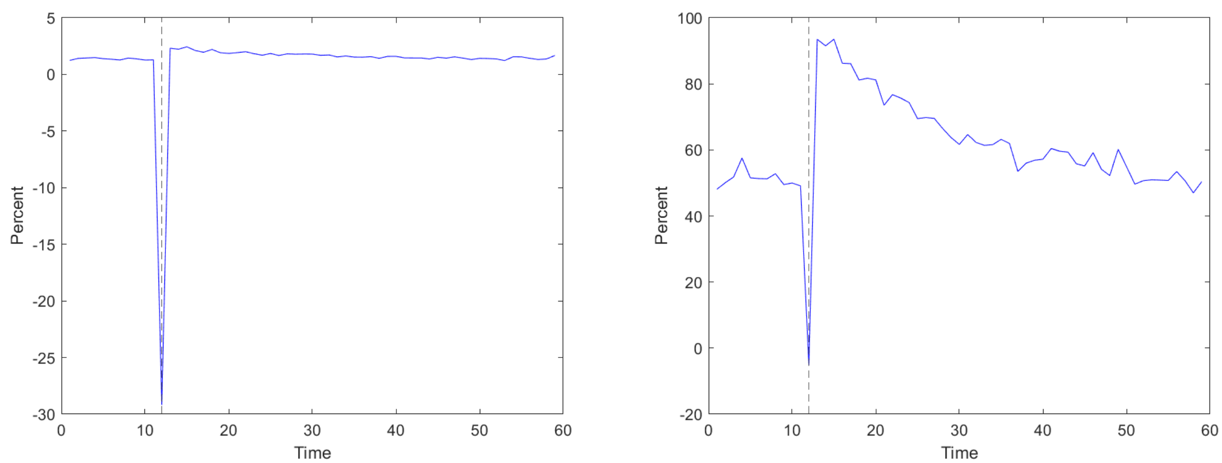
Notes: Figure 3a plots the price index at time t relative to the price index prior to the shock. Figure 3b plots the average observed wage, indexed relative to the average pre-shock wage. Figure 3c plots $Var(ln(wage_t))$, indexed relative to the variance of the pre-shock wage. In Figures 3 a-c, only 12 pre-shock months are shown, with the shock occurring at $t = 12$. In Figure 3d, nonparametric kernel density estimation is used to plot wage densities. The blue line depicts the distribution of real wages in the period *before* the shock and the orange line depicts the distribution of real wages in the period of the shock.



(a) Wage adjustment from zero surplus boundary (b) Wage adjustment from job offers

Figure 4: Mechanisms of Wage Adjustment

Notes: Figure 4a plots the share of employed workers receiving a nominal wage adjustment because they are on the zero surplus boundary such that $W(y, y_l, p, p_l) = U$. Figure 4b plots the job-to-job transition rate and the share of workers who receive an outside offer that triggers a renegotiation. In Figures 4 a-b, only 12 pre-shock months are shown, with the shock occurring at $t = 12$.



(a) Real wage growth (stayers) (b) Real wage growth (switchers)

Figure 5: Job Stayers and Job Movers

Notes: In the spirit of the Federal Reserve Bank of Atlanta's Wage Growth Tracker, we compute month-to-month wage growth in percentage terms experienced for each employed worker i. We partition the set of employed workers $\mathcal{I}$ into job stayers and job switchers. We compute the average wage growth over individuals in each group. We consider the average rather than the median, because, in our stylized setting, the median remains constant for stayers. We consider month-to-month wage growth because we are not constrained by the rotation structure of the CPS and wage adjustment mechanisms occur on a monthly basis by design in our model. Last, in Figures 5 a-b, only 12 pre-shock months are shown, with the shock occurring at $t = 12$.