Flexible Jobs in Macroeconomic Stabilization*

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December 2, 2024

Abstract

In this paper, I argue that labor market flexibility, through flexible jobs, serves as an important policy tool for stabilizing the economy. Motivated by the empirical evidence, I build a tractable heterogeneous-agent version of the New Keynesian model in which regular and flexible jobs coexist. I then estimate the model using Bayesian techniques to match salient features of the European labor market and argue that the interaction between incomplete markets and the lower unemployment risk fluctuations associated with a labor market with flexible jobs generates a qualitatively important stabilization effect on the economy.

Keywords: flexible jobs, unemployment risk, business cycle, welfare analysis, macroeconomic stabilizers, temporary-contracts, Bayesian estimation
JEL Codes: E12, E24, E52, J41.

*Acknowledgments: For their suggestions and comments I would like thank to Burak Uras, Harry Huizinga, Florian Sniekers, Jeffrey Campbell, Basile Grassi, Ata Can Bertay, Hugo van Buggenum, Michal Kobielarz, Corina Boar, Javiera de la Quintana, Giulio Fella, Gadi Barlevy, Franck Portier, Has van Vlokhoven, Guzman Ourens, Vincent Sterk, Nathanael Vellekoop, Jierui Yang, Pedro Roje, Raul Santaeulalia-Llopis, Lex Meijdam, Bas Werker, Dajan Xhani and seminar participants at ERMAS 2023, Tilburg University. Results include my own calculations based on microdata made available by Statistics Netherlands. The views expressed here are solely those of the author and do not necessarily reflect the views of the Central Bank of Chile. Any remaining errors are my own.

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1 Introduction

Since the mid-1980s, most advanced labor markets have progressed in flexibilizing employment through flexible jobs, such as temporary positions. The natural question then is: What role do flexible jobs play in shaping economic outcomes? Research on this question has largely focused on the job destruction dynamics associated to flexible jobs. For example, in a recent survey, Boeri and Garibaldi (2024) show that the role of flexible jobs has been limited to topics such as job destruction, unemployment volatility, matching quality, search efforts, and wage dynamics. Not surprisingly, then, flexible jobs have rarely been regarded as having a major impact on macroeconomic outcomes. However, Figure 1 suggests the opposite for the Eurozone: flexible jobs appear to have a large impact on macroeconomic outcomes and thus on GDP volatility.

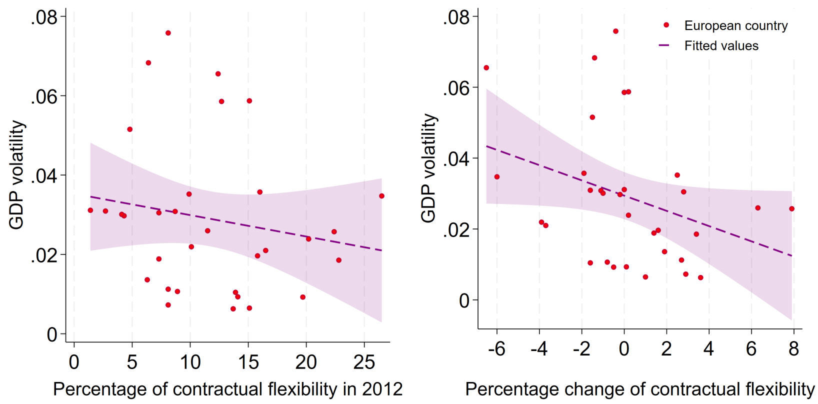
This paper proposes an alternative approach to understanding the role of flexible jobs in the economy, which is consistent with the evidence shown in Figure 1. I argue that the fundamental role of flexible jobs lies in maintaining a more stable unemployment risk throughout the business cycle. While in a perfect-insurance setting, which is the dominant framework for understanding the role of flexible jobs in the economy, the unemployment risk channel is irrelevant, in an imperfect-insurance setting, the unemployment risk channel plays a crucial role in shaping aggregate demand fluctuations. Therefore, the interaction between an imperfect-insurance setting and the lower unemployment risk fluctuations associated to a labor market with flexible jobs generates a qualitatively important stabilization effect on the economy.[1]

I am interested in understanding the role of flexible jobs in an imperfect-insurance setting. To do so, I start the analysis with an illustrative model that isolates the role of expectations in determining the equilibrium response to labor market transitions. In this illustrative model, with two periods, prudence and market incompleteness implies that consumption in the first period is determined by the household expectations associated with labor market transitions. I show that flexible jobs help stabilize aggregate demand by reducing unemployment risk, as long as these jobs more than compensate for any reduction in regular jobs, a relationship well supported in the data (Bertand et al., 2022; Cahuc et al., 2016).[2] If this is not the case, then flexible jobs simply replace good jobs

[1]This role is is powerful, automatic, and complementary to other discretionary tools designed to deal with the business cycle.Thus, the existence of flexible jobs expands the degree to which stabilization would be possible using discretionary tools alone, especially when monetary policy is constrained by the zero lower bound.

[2]In other words, when households anticipate a decrease in regular employment, but an increase in flexible jobs, their perceived unemployment risk falls. Consequently, households reduce precautionary

Figure 1: Cross-country relationship between contractual flexibility and GDP volatility.



Notes: This figure shows the relationship between contractual flexibility and GDP volatility for 32 European countries. I calculate the GDP volatility as the standard deviation of GDP growth over the years 2010-2019. The percentage change of contractual flexibility (2019 vs. 2012) corresponds to the measure of workers under a fixed-term contract. Data from Eurostat.

with bad ones, in terms of consumption, becoming detrimental to the economy. Thus, the illustrative model highlights a novel channel, that is, the unemployment risk channel, for understanding the role of flexible jobs in the economy, although it remains an open question whether this channel is qualitatively important in a richer model of the economy.

To quantify the role of flexible jobs in a richer model of the economy, I set up a tractable heterogeneous-agent version of the New Keynesian model with imperfect unemployment insurance and a labor market with a two-sector search model. In this model, regular and flexible jobs are substitutes, and the extent of this substitution is determined by the wage setting. Regular jobs have rigid wages, while flexible jobs do not. Since the share of flexible jobs is determined in equilibrium, I also assume that flexible jobs, compared to regular jobs, have a higher destruction rate, lower productivity, and lower vacancy-opening cost. In this setting, job prospects are uncertain, exposing households to time-varying idiosyncratic risk. Households cannot fully insure against this risk, so they have precautionary motives. Because precautionary savings motives are driven, in part, by the labor market transitions of workers into different types of jobs, flexible jobs play an important role in determining fluctuations in workers' unemployment risk and thus on aggregate demand fluctuations.

I estimate the model using Bayesian techniques and use Eurozone data from Area-Wide Model (AWM) database of the ECB, which provides quarterly data for the Eurozone.

savings, in the lower expectations of next-period unemployment, which limits the decline in aggregate demand today compared to a scenario without flexible jobs.

This dataset treats the Eurozone as a single economy, so the data can be interpreted as either the aggregate behavior of Eurozone as a whole or the behavior of a representative country in the region. This feature allows me to estimate the model in a broad and comprehensive manner without sacrificing its relevance to the Eurozone context.

I derive three main sets of results. First, I confirm that flexible jobs substitute regular jobs over the business cycle, and thus these jobs play an important role in reducing the unemployment risk fluctuations of workers. To understand the mechanism at play, consider a contractionary productivity shock. In this scenario, the real wage falls for both regular and flexible jobs, but the decline is steeper for flexible jobs. This leads to an increase in flexible job employment and a decrease in regular job employment. Compared to a model without flexible jobs, my model shows a smaller decrease in total employment because the fall in regular jobs is more than compensated by flexible jobs, resulting in a lower increase in unemployment risk for regular workers. This decrease in unemployment risk reduces the precautionary motive of regular workers, leading to a smaller decline in aggregate demand, and thus contributing to stabilize the economy after a contractionary shock. Two important insights help us better understand the role of flexible jobs. First, flexible jobs help to stabilize the economy, not through the consumption-saving decisions of flexible workers, but through the expectations of workers in regular jobs, the largest group of workers in the economy. Because of this, even when the share of flexible jobs may be low, flexible jobs can play a significant role in stabilizing the economy. Second, flexible jobs help reduce unemployment risk fluctuations, but their adjustment is hindered by labor market search frictions. As a result, flexible jobs' short-term contribution to reduce unemployment risk fluctuations is limited.

Second, comparing the model with a counterfactual economy without flexible jobs, I document a large drop in the volatility of output, employment, and inflation as a result of a larger share of flexible jobs in the economy. For example, an economy with a 30% share of flexible jobs exhibits an output volatility that is 10% lower than an economy without flexible jobs. In my analysis of employment volatility, I confirm that the decrease in total employment volatility and thus on output volatility is largely explained by the substitution between flexible and regular jobs. In my model, which is supported by Bayesian estimation, the fall in regular employment is more than compensated for the rise of flexible jobs, which explains the decrease in total employment volatility as the share of flexible jobs increases. Consequently, this creates lower unemployment risk fluctuations, helping to stabilize aggregate demand and output. I conducted several robustness checks and confirmed that the volatility-reducing role of flexible jobs remains consistent across different parametrizations of the model. Two important insights emerge from this analysis. First, when regular jobs are more rigid in terms of wage flexibility, and second, when monetary policy is loose, flexible jobs become even more relevant in helping the economy reduce fluctuations in aggregate demand.

Third, I find that the volatility gains of flexible jobs come at a cost to flexible workers in terms of excessive fluctuations in employment. Compared to my baseline specification of 12% flexible jobs, I estimate that employment volatility is approximately one-time greater for flexible workers compared to regular workers, which is largely consistent with microdata from the Dutch labor market. Because workers are risk-averse, they are affected by high employment volatility. Therefore, it may be the case that flexible jobs are welfare-decreasing, despite their overall volatility-decreasing benefits. To study this, I approximate the utility function up to a second order and focus on the unconditional welfare to rank the counterfactual simulations with different shares of flexible jobs. Although this welfare measure is not perfect, because it does not take into account labor market transitions, it is a first approximation to measure welfare in a setting with heterogeneous agents. I confirm that flexible jobs are welfare-reducing. In my baseline specification with 12% of flexible jobs, I estimate that the share of flexible jobs depresses welfare equivalents by an average of 4 percent of lifetime consumption.

Related Literature. My paper is related to several strands of research. The first is the literature that combines microeconomic evidence with macroeconomic models to study the macro implications of flexible jobs. In this respect, I am close to Dolado et al. (2002), Cahuc and Postel-Vinay (2002), Caggese and Cuñat (2008), and more recently to Dolado et al. (2021), Carreño and Uras (2024), and Cahuc et al. (2022). The results of this paper are distinct from previous models of labor market flexibility because I accommodate and focus on the combination of incomplete markets and nominal rigidities. In this setting, the novelty of my paper is to show that the evolution toward a more flexible labor market where regular and flexible jobs coexist changes both the labor market flows, as largely documented in the literature, and the unemployment risk fluctuation of workers. This important channel has not been studied before in the context of flexible jobs and imperfect unemployment insurance. This is the main contribution of my paper.

This paper is also related to the literature that studies the advantages of labor market flexibility (Caballero et al., 2004; Galí and Monacelli, 2016). In this context, Galí and Monacelli (2016) is a paper close to this paper. Galí and Monacelli (2016) study the gains from increased wage flexibility using a small open economy model with staggered price and wage setting. Galí and Monacelli (2016) conclude that wage flexibility may be welfare-reducing in an economy that is part of a currency union. Although our models are entirely different, I also show that having flexible jobs may be welfare-decreasing. Therefore, Galí and Monacelli (2016) and I share the view that “higher flexibility” in labor markets may not always be desirable.

My paper is also related to papers studying macroeconomic policies aimed at stabilizing the business cycle. For example, McKay and Reis (2016) study the role of fiscal stabilizers in the US business cycle and find that tax-and-transfer programs that affect inequality and precautionary savings have a significant effect on reducing aggregate volatility.[3] Contrary to McKay and Reis (2016), I partial out the interaction of fiscal transfers and precautionary savings to focus on the role of flexible jobs on precautionary savings. I show that flexible jobs act as an automatic stabilizer of the economy by reducing the precautionary saving motives of workers under regular contracts over the business cycle. This precautionary savings channel has also been studied in the context of unemployment insurance (UI). For example, Kekre (2021) study the effects of discretionary UI extensions on aggregate consumption and find that UI stimulates the consumption of unemployed workers, but also affects the consumption of employed workers via precautionary savings, in the same venue as flexible jobs change the precautionary motives of regular workers. My results suggest that flexible jobs, fiscal stabilizers, and unemployment insurance can complement each other as macroeconomic policies to reduce output volatility, primarily by influencing the level of precautionary savings.

Another strand of literature that my paper complements is the literature that uses incomplete-markets models with nominal rigidities to answer business-cycle questions (Challe, 2020; Challe and Ragot, 2016; McKay and Reis, 2016; Ravn and Sterk, 2017, 2021). Challe (2020) and Ravn and Sterk (2017) are all papers close to this paper. In particular, my model extends Challe (2020) model to a two-sector search model in which regular and flexible jobs coexist. Challe (2020) and Ravn and Sterk (2017) analyze the interaction of market incompleteness, precautionary savings motive, aggregate demand, and unemployment risk in an economy that prevents the emergence of a cross-sectional wealth distribution. Whereas Challe (2020) and Ravn and Sterk (2017) focus on optimal monetary policy and on accounting for key features of the Great Recession, I focus on the macroeconomic-stability implications of flexible jobs.

[3] McKay and Reis (2016) also argue that these results may be largely affected by the labor market dynamics.

2 Illustrative Model

In this section, I use an illustrative model that isolates the role of expectations in determining the equilibrium output response to labor market transitions. There are two periods, $t = 0, 1$. The population is populated by a measure one of households, a representative firm, and a government. The sequence of events within the two periods is the same. First, the representative firm randomly hires a fraction of households. Second, production takes place, and households make consumption-saving decisions.

Firm. A competitive firm produces a final good Y_t from labor N_t according to the production function $Y_t = N_t$. The representative firm offers two types of jobs, regular jobs, N_t^r, with a real salary of w_t^r, and flexible jobs, N_t^f, with a real salary of w_t^f. I assume that regular jobs are more productive than flexible jobs. The only cost of production is the real wage w_t paid to the workers. Therefore, the total production is given by $Y_t = N_t = \chi N_t^r + N_t^f$, where $\chi > 1$ is the productivity wedge between regular and flexible jobs. An exogenous rule, $s_t(\cdot)$, governs the share of flexible jobs within the representative firm, so that the firm hires just enough workers to meet aggregate demand while making zero profits.

Households. In period t, $N_t \in [0, 1]$ of households are employed in regular or flexible jobs. The remaining $U_t = 1 - N_t$ households are unemployed. Employed workers earn a real wage w_t^r in a regular job or w_t^f in a flexible job. Unemployed workers receive real benefits $\delta_t \in (0, 1)$, financed by a lump-sum tax τ_t levied on all households. Once their employment status for the current period, e_t, is determined, and their type of job, q_t, households choose consumption c_t an savings a_t in a non-contingent bond with real return r to maximize their anticipated life-time utility

$$\ln(c_0) + \beta \ln(c_1),$$

subject to the period budget constraints

$$c_t + a_t = (1 + r)a_{t-1} + e_t(q_t w_t^r + (1 - q_t)w_t^f) + (1 - e_t)\delta_t - \tau_t$$

and borrowing constraints $a_t \geq 0$ for $t = 0, 1$. Consumption can take three states: consumption when employed in a regular job, $c_t^{e,r}$, consumption when employed in a flexible job, $c_t^{e,f}$, and consumption when unemployed, c_t^u. At time 0, households do not have perfect foresight about their transitions in the labor market, unemployment benefits, and taxes, and hence of their own consumption. Let $\mathbb{E}[p(s_t)_1^r]$, $\mathbb{E}[p(s_t)_1^f]$, $\mathbb{E}[\delta_1]$, and $\mathbb{E}[\tau_1]$, denote their expectation for finding a regular job, finding a flexible job, government benefits, and taxes in period $t = 1$. I assume that all households have the same beliefs and do not consider uncertainty.

Equilibrium: I assume that the government runs a balanced budget $\tau_t = U_t \delta_t$ and prices are fully rigid, $P_t \equiv 1$. Given initial assets a_{t-1}, exogenous variables $\{s_t(\cdot), \delta_t, r\}$, and beliefs $\{p(s_t)_1^{E,r}, p(s_t)_1^{E,f}, \delta_1^E, \tau_1^E\}$, an equilibrium is a collection of prices $\{w_t^r, w_t^f\}$ and allocation $\{c_t^{e,r}, c_t^{e,f}, c_t^u, N_t^r, N_t^f, \tau_t\}$ such that the representative firms optimize, households optimize, the government budget is balanced, the borrowing constraint is satisfied, the good market clears $y_t = c_t = N_t^r c_t^{e,r} + N_t^f c_t^{e,f} + U_t \delta_t$, and the assets markets clears $0 = a_t = N_t^r a_t^{e,r} + N_t^f a_t^{e,f} + U_t a_t^u$ at zero liquid limit.

I make two further simplifying assumptions. First, I assume that in period 0, the competitive firm offers only regular jobs. This allows me to study how the availability of flexible jobs in period 1 affects equilibrium consumption in period 0 through a simple expression. Second, I assume that at the end of period 0, all workers lose their regular jobs. This allows me to simplify the set of alternatives for workers.

Role of Labor Market Expectations. In this illustrative model, prudence and market incompleteness implies that consumption in period 0 is determined by the household expectations of landing in a regular job, $\mathbb{E}[p(s_t)_1^r]$, flexible job, $\mathbb{E}[p(s_t)_1^f]$, or falling into unemployment, $\mathbb{E}[U_1]$. I can show this from the employed workers' Euler equation

$$\frac{1}{c_0^{e,r}} = \beta(1+r)\left[\mathbb{E}[p(s_t)_1^r]\left(\frac{1}{c_1^{e,r}}\right) + \mathbb{E}[p(s_t)_1^f]\left(\frac{1}{c_1^{e,f}}\right) + \mathbb{E}[U_1]\left(\frac{1}{c_1^u}\right)\right]. \tag{1}$$

Equation 1 states that, for example, if a regular worker expects a higher unemployment risk tomorrow, they will reduce consumption today to smooth consumption. Because I am interested in determining the equilibrium output response to an arbitrary change in the availability of flexible jobs, in Proposition 1, I characterize how such a change, expressed by the change in the expectations of finding a flexible job, $\mathbb{E}[p(s_t)_1^f]$, affects the equilibrium output. For understanding Proposition 1, it is important to note that, as is standard in models at the zero liquid limit (Werning, 2015), i.e., $a_t = 0$, the model is purely-forward-looking. Household expectations are relevant for equilibrium in period 0, but the equilibrium at time 1 is independent of the conditions at time 0, including the expectations that the household holds in period 0.

Proposition 1: *The equilibrium output response in period $t = 0$ to an arbitrary change* *to the expectations of finding a flexible job in period $t = 1$ is given by:*

$$\frac{\partial y_0}{\partial\, \mathbb{E}[p(s_t)_1^f]} = \Psi \left[\frac{\partial\, \mathbb{E}[p(s_t)_1^r]}{\partial\, \mathbb{E}[p(s_t)_1^f]} \left(\frac{1}{c_1^u} + \frac{1}{c_1^{e,r}} \right) + \left(\frac{1}{c_1^u} - \frac{1}{c_1^{e,f}} \right) \right]$$

where $\Psi = N_0^r(\beta(1+r))^{-1}\Big[\mathbb{E}[p(s_t)_1^r]/c_1^{e,r} + \mathbb{E}[p(s_t)_1^f]/c_1^{e,f} + \mathbb{E}[U_1]/c_1^u\Big]^{-2} > 0.$

Proposition 1 shows how an arbitrary change in the expectations of finding a flexible job affects the equilibrium output, and how this effect is determined by the relationship between regular and flexible jobs, expressed by $\partial\, \mathbb{E}[p(s_t)_1^r]/\partial\, \mathbb{E}[p(s_t)_1^f]$. It is important to note at this point that workers' expectations are aligned with how the labor market functions, particularly regarding labor market flows and the relationship between regular and flexible jobs. The following proposition simplifies the interpretation of the results.

Proposition 2: *There exist a minimum threshold for* $\frac{\partial\, \mathbb{E}[p(s_t)_1^r]}{\partial\, \mathbb{E}[p(s_t)_1^f]}$ *such that* $\frac{\partial y_0}{\partial\, \mathbb{E}[p(s_t)_1^f]} > 0$ *for any parameter configuration. This threshold is given by:*

$$0 > \frac{\partial\, \mathbb{E}[p(s_t)_1^r]}{\partial\, \mathbb{E}[p(s_t)_1^f]} > -\left[\frac{c_1^{e,r}}{c_1^{e,f}} \frac{(c_1^{e,f} - c_1^u)}{(c_1^{e,r} + c_1^u)} \right] > -1.$$

Armed with Propositions 1 and 2, I can interpret the main results of this illustrative model. I start with the extremes to gain intuition. If an increase in flexible jobs also increases regular jobs, thereby reducing the unemployment risk in the model, equilibrium output increases, as households need to save less for precautionary reasons. On the contrary, if an increase in flexible jobs is offset by a decrease in the number of regular jobs, thereby keeping the unemployment risk constant, equilibrium output decreases, as households are just reallocated into worse jobs, in terms of consumption, when compared to a scenario without flexible jobs. Interestingly, there is a plausible case, as I will argue later, where an increase in flexible jobs is not fully offset by a lower number of regular jobs, resulting in an increase in equilibrium output. In other words, if flexible jobs more than compensate for a potential fall in regular jobs, such as during an economic contraction, these jobs play a significant role in stimulating aggregate demand through stabilization of unemployment risk.

What is the relationship between regular and flexible jobs? Although this question has been poorly studied in the empirical literature, there is consensus on two facts. First, flexible jobs act as a substitute for regular jobs (Bertrand et al., 2021; Cahuc et al., 2016). For example, Cahuc et al. (2016) show that the stringency of legal constraints on the termination of regular jobs induces a large-scale substitution of temporary jobs for regular jobs, which leads to lower aggregate production. Second, flexible jobs are more volatile than regular jobs. Cahuc et al. (2016) also show that, in France, changes in total employment inflow are mainly driven by flexible jobs. As argued by Josten and Vlasbom (2018), in the case of the Netherlands, firms use flexible jobs to deal with the business cycle, which explains the large volatility of these jobs. Therefore, these two facts support the substitute relationship between flexible and regular jobs and thus the role of flexible jobs in stimulating aggregate demand through the stabilization of unemployment risk.

Additional insights. Three additional insights in the results help explain the relevance of flexible jobs in the economy. First, flexible jobs stimulate aggregate demand, not through the consumption-saving decisions of flexible workers, who are usually hand-to-mouth agents, but through the expectations of workers in regular jobs. Because of this, even when the share of flexible jobs may be low, flexible workers can play a significant role in stimulating aggregate demand. Second, the above results assume that the monetary authority maintains a constant real interest rate. However, it may be the case that the initial stimulus to aggregate demand, motivated by an increase in the expectation of finding a job, could be undone by a subsequent increase in the real interest rate. In the quantitative model studied later in this paper, I will show that, for any parametrization of the monetary policy rule, flexible jobs play an important role in determining fluctuations in workers' unemployment risk and thus, on aggregate demand fluctuations. Third, the role of flexible jobs is particularly important in a setting with low unemployment insurance. In Proposition 1, the derivative $\frac{\partial y_0}{\partial \mathbb{E}[p(s_t)_1^f]}$ grows larger as c_1^u decreases. In other words, when finding a flexible job is much better than falling into unemployment, in terms of consumption, flexible jobs have a much larger effect on output. Thus, they can act as a complement to the unemployment insurance, which is a discretionary, sometimes controversial, macroeconomic tool to deal with business cycle.

Summing up. The key takeaway is that the rise of flexible jobs may play an important role in stimulating aggregate demand through worker expectations. With this mechanism in mind, the rest of the paper quantifies the effect of flexible jobs in a richer model of the economy.

3 Model

The economy consists of households that consume, save, and work. The production structure has three layers. Intermediate goods firms produce using workers' labor (with no capital involved). Then these goods are sold to wholesale firms, each of which transforms intermediate goods into differentiated goods. Wholesale firms are monopolistically competitive and face nominal rigidities a la Calvo. Wholesale goods are purchased and reassembled by final goods firms. The labor market is characterized by search and matching frictions, where intermediate goods firms decide whether to open regular vacancies or flexible vacancies. This is a two-sector search model as in Acemoglu (2001). In this setting, flexible jobs are substitutes for regular jobs. Workers cannot self-select into these types of job as the worker assignment is exogenous. Due to search and matching frictions, job prospects are uncertain, which expose households to idiosyncratic risk. Households cannot fully insure against this income risk (i.e., financial markets are incomplete), so they have precautionary motives to save when employed and to borrow when unemployed.

3.1 Households

Households are of two types: there is a unit measure of workers, who can be employed or unemployed, and a measure $\Lambda > 0$ of capitalists who manage the firms and collect dividends. As in Challe (2020) and Ravn and Sterk (2021), I use capitalists to absorb fiscal transfers (including firm rents) that may affect the cyclicality of income risk and thus the implied savings response of workers to unemployment risk (see, for example, Acharya and Dogra, 2020).

Households. A worker $i \in [0, 1]$ may be employed ($em_{i,t} = 1$) or unemployed ($em_{i,t} = 0$). When employed, a worker can have a regular job ($q_{i,t} = 1$) or a flexible job ($q_{i,t} = 0$). A worker chooses the consumption sequence $\{c_{i,t+k}\}_{k=0}^{\infty}$ that maximizes $V_t^i = \mathbb{E}_t \sum_{k=0}^{\infty} \beta^k u(c_{i,t+k})$, where $c_{i,t} \geq 0$ is consumption.[4] Employed workers in a regular (flexible) job earn the real wage w_t^r (w_t^f), while unemployed workers earn the exogenous home production income δ_t. Workers transit randomly between labor market statuses, and the associated income risk is uninsured. The budget of worker i at date t is given by, respectively,

$$a_{i,t} + c_{i,t} = em_{i,t}(q_{i,t} w_t^r + (1 - q_{i,t}) w_t^f) + (1 - em_{i,t})\delta_t + R_t a_{i,t-1} \tag{2}$$

where $a_{i,t}$ is the real value of worker's bond wealth at the end of date t and R_t is the gross real return on assets. Workers hold no wealth at $t = 0$. The optimal consumption-saving choices of workers must satisfy the Euler condition $\mathbb{E}_t[MRIS_{i,t+1} R_{t+1}] \leq 1$, where $MRIS_{i,t+1} = \beta u'(c_{i,t+1})/u'(c_{i,t})$ denotes the common marginal rate of intertemporal substitutions.

Capitalists. Capitalists have the period utility function $\tilde{u}(c)$. Capitalists do not face any

[4] $\mathbb{E}_t$ is the rational-expectations operator and $u()$ is a period utility function such that $u' > 0$ and $u'' < 0$ for all $c \geq 0$.

idiosyncratic income risk and initially do not hold wealth. Because of these assumptions, capitalists always stay symmetric, so I drop the i subscript. I denote their common individual consumption and end-of-period asset wealth by c_t^C and a_t^C, respectively. Since the final goods sector is perfectly competitive, in every period capitalists get an equal share of the aggregate profits that results from profits of wholesale firms (Π_t^W) and profits from intermediate good firms (Π_t^I) as well as a home production income of amount Ω_t, in the aggregate, and a lump sum fiscal transfer of amount τ_t in the aggregate. A capitalist thus maximizes $V_t^C = \mathbb{E}_t \sum_{k=0}^{\infty} \beta^k \tilde{u}(c_{t+k}^C)$, subject to

$$a_t^C + c_t^C = \frac{\Pi_t^W + \Pi_t^I + \Omega_t + \tau_t}{\Lambda} + R_t a_{t-1}^C. \tag{3}$$

Given their preferences and constraints, the optimal consumption plan of a capitalist must satisfy $\mathbb{E}_t[MRIS_{t+1}^C R_{t+1}] \leq 1$, where $MRIS_{t+1}^C = \beta \tilde{u}'(c_{i,t+1}^C)/\tilde{u}'(c_{i,t}^C)$.

3.2 Firms

The production structure has three layers as in the New Keynesian tradition: final goods firms, wholesale firms, and intermediate goods firms.

Final Goods Sector. There is a representative and competitive firm that produces the final good by combining wholesale inputs according to the function

$$y_t = \left(\int_0^1 y_{h,t}^{\frac{\iota-1}{\iota}} \right)^{\frac{\iota}{\iota-1}}, \tag{4}$$

where $y_{h,t}$ is the quantity of wholesale good h used in production and $\iota > 1$ is the cross-partial elasticity of substitutions between wholesale inputs. The demand for inputs is given by $y_{h,t} = y_t p_{h,t}^{-\iota}$, where $p_{h,t}$ is the price of wholesale good $h \in [0,1]$ in terms of the final good. I assume that this sector is perfectly competitive.

Wholesale Sector. Wholesale firms transform intermediate goods into specialized goods that are supplied to the final goods sector. The profit of the wholesale firm h is $\Pi_{h,t}^W = y_{h,t}[p_{h,t} - \varphi_t(1-\tau^W)]$, where φ_t is the price of intermediate goods in terms of the final good and τ^W a production subsidy to the wholesale sector, financed through a lump sum tax on capitalists. Wholesale firms face nominal pricing friction a la Calvo. In every period, a fraction $(1-\omega) \in [0,1]$ of the firms are able to reset their price optimally, while the other firms keep prices unchanged. The time-varying distribution of wholesale prices can be summarized by the optimal reset price $\tilde{p}_t$, the final good inflation π_t, and the price dispersion index Δ_t. The total profits of wholesale firms are given by

$$\Pi_t^W = y_t[1 - \varphi_t(1-\tau^W)\Delta_t]. \tag{5}$$

Intermediate Goods Firms. A continuum of firms, indexed by j, produce differentiated goods using labor,

$$y_{j,t} = z_t \chi^s n_{j,t}^s, \tag{6}$$

where $s \in \{regular, flexible\}$, $y_{j,t}$ is firm j's output, χ^s is a productivity wedge between regular and flexible workers (i.e., $\chi^r > 1$, $\chi^f \equiv 1$), and $n_{j,t}^s$ its employment relationship which may be a regular or a flexible. z_t is an aggregate productivity shock, $z_t = \mu_z z_{t-1} + \epsilon_{z,t}$, where $\mu_z \in (0,1)$ and $\epsilon_{z,t}$ is a white noise process with mean zero. In this setting, one firm is one job.[5]

In a regular employment relationship, the real wage is sticky at the steady-state real wage. In contrast, in a flexible employment relationship, the real wage responds rapidly to economic conditions (the wage setting is discussed in Section 3.4). I also assume that regular employment relationships (compared to flexible jobs) are (i) more productive (Addessi, 2014; Caggese and Cuñat, 2008); (ii) have a lower separation rate (Cahuc and Postel-Vinay, 2002; Centeno and Novo, 2012; Serrano, 1998); (iii) and have a higher vacancy-opening cost (Abowd and Kramarz, 2003; Kramarz and Michaud, 2010). In this setting, firms post vacancies, $v_{j,t}^s$, at a cost η^s per unit. Each vacancy is filled with probability λ_t^s and firms are assumed to be sufficiently large that λ_t^s is also the fraction of vacancies that are filled.[6] The job separation rate is ρ^s and thus the law of motion of employment for firm j with a type of worker i is given by

$$n_{j,t}^s = (1-\rho^s) n_{j,t-1}^s + v_{j,t}^s \lambda_t^s. \tag{7}$$

Capitalists decide to open a regular or flexible vacancy based on the value of each type of job, J_t^s, which is a function of job-characteristics and economic conditions. In particular, J_t^s is the sum of a flow payoff - the after-tax rent generated by the match - and a continuation value that depends on the survival rate of the match $(1-\rho^s)$ and capitalists' MRIS. J_t^s is given by

$$J_t^s = (1-\tau^{I,s})(z_t \chi^s \varphi_t - w_t^s + T + \zeta_t) + (1-\rho^s) E_t[MRIS_{t+1}^C J_{t+1}^s], \tag{8}$$

[5]This assumption allows me to partial out the implications of a multi-worker firm setting, namely, an endogenous dispersion in the distribution of firm sizes, an endogenous dispersion in the optimal share of flexible jobs, and wage dispersion within and between firms and types of jobs (see, for example, Acemoglu and Hawkins, 2014), so I can focus on the trade-off between regular and flexible jobs in the simplest and most transparent way.

[6]The underlying assumption here is that the search is undirected and thus both types of vacancies have the same probability of meeting workers.

where T is a wage subsidy and $\tau^{I,s} \in [0,1]$ is the corporate tax. The corporate tax may be different for each type of job.[7] The variable ζ_t is a random wage tax evolving as $\zeta_t = \mu_\zeta \zeta_{t-1} + \epsilon_{\zeta,t}$ where $\mu_\zeta \in (0,1)$ and $\epsilon_{\zeta,t}$ is white noise process with mean zero. I use the wage tax for presenting the pure dynamics of cost-push shocks. [8] I assume a free entry condition, so the cost of a vacant job (η^s) must be equal to the expected payoff ($\lambda_t^s J_t^s$), since vacancies can be filled immediately.

Unemployed workers search for jobs and are matched with a firm with probability f_t^s. The job-finding and the vacancy-filling rates are taken as given by the agents, but are determined in equilibrium by a matching function that relates the measure of new matches (M_t^s) to the measures of vacancies (v_t^s) and job searchers (e_t). I assume a Cobb-Douglas matching function: $M^{s,t} = m^s (v_t^s)^{1-\gamma}(e_t)^\gamma$, where $m^s > 0$ and $\gamma \in (0,1)$. It follows that the job-finding and vacancy-filling rates are

$$f_t^s = m^s(\theta^s)^{1-\gamma}, \tag{9}$$

$$\lambda_t^s = m^s(\theta^s)^{-\gamma}, \tag{10}$$

where $\theta_t^s = v_t^s / e_t$ is the labor market tightness. Combining equations (8), the free entry condition, and equations (9) and (10), I get the forward recursion for the job-finding rate:

$$(f_t^s)^{\frac{\gamma}{1-\gamma}} = (1-\tau^{I,s})\frac{(m^s)^{\frac{1}{1-\gamma}}}{\eta^s}(z_t \chi^s \varphi_t - w_t^s + T - \zeta_t) + (1-\rho^s)\,\mathbb{E}_t\left[MRIS_{t+1}^C (f_{t+1}^s)^{\frac{\gamma}{1-\gamma}}\right]. \tag{11}$$

Equation (11) governs the job-creation part of this model, and will be different for each type of job.

3.3 Worker's Consumption Decisions and Unemployment Risk

Now I focus on workers' consumption decisions. Agents receive information about aggregate productivity shocks at the beginning of each period. Employed workers are separated from their firms with probability ρ^s at the end of the last period but can find a job with probability f_t^s at the beginning of the period (after the realization of shocks). Households take their consumption decision after the new matches are formed. Therefore, the unemployment risk for a regular worker, i.e., the probability of losing a job at the end of the

[7]This assumption is motivated by the evidence that show that firms pay different taxes for different jobs, usually associated to social security.

[8]The productivity and cost-push shocks are symmetric only in the case of flexible prices, as in that case, $\varphi_t = 1$. However, this symmetry is broken under sticky prices, which is the case of my model.

period and not finding a new one at the start of the period, is

$$U_t^r = \rho^r(1 - f_t^r - f_t^f). \tag{12}$$

Equation (12) states that the unemployment risk is the joint probability of exogenous separation and the failure to find any type of job on the labor market after the exogenous separation. Since the unemployment risk is a function of the job-finding rates of both regular and flexible jobs, the model will produce a time-varying precautionary motive. In order to study job-to-job transitions later in the paper, I define the probability of losing a regular job as $\sigma_t^r = \rho^r(1 - f_t^r)$. In an equivalent way, I define the unemployment risk for a flexible worker and the probability of losing a flexible job. Finally, the aggregate rent generated by intermediate goods firms is

$$\Pi_t^I = n_t^r(1-\tau^{I,r})(z_t\chi^r\varphi_t+T-\zeta_t-w_t^r)+n_t^f(1-\tau^{I,f})(z_t\varphi_t+T-\zeta_t-w_t^f)-(\eta^r v_t^r+\eta^f v_t^f). \tag{13}$$

Therefore, the aggregate profits to capitalists are $\Pi_t^W + \Pi_t^I$. In Appendix C, I present the expressions for the evolution of regular employment (n_t^r), flexible employment (n_t^f), and the number of job searches (e_t).

3.4 Wage Setting for Regular and Flexible Jobs

A salient feature of flexible jobs, compared to regular jobs, is that they allow firms to gain control over their labor costs (see, for example, Gu et al., 2018). A simple way of introducing this feature to my model, is by assuming that the real wage of flexible jobs is Nash Bargained (responding strongly to economic conditions) while the real wage of regular jobs is also Nash Bargained but *rigid* around the long-run real wage (that is, a slow adjustment to the economic conditions).[9] Under this wage-setting mechanism, the Nash wage is given by

$$(w_t^s)^N = argmax(S_t^s)^{1-\alpha}(J_t^s)^\alpha,$$

where $\alpha \in (0,1)$. S_t^s and J_t^s are the values of the match to the worker and the capitalists. The value of J_t^s is given by (8) (firms are assumed to be symmetric), while the worker's match surplus (S_t^s) is determined as the difference between the value of being employed in a job s ($V_t^{s,e}$) and the value of being unemployed (V_t^u) as $S_t^s = V_t^{s,e} - V_t^u$. In the Appendix C, I show that S_t^r and S_t^f can be written as

$$S_t^r = u(w_t^r) - u(\delta_t) + \beta\,\mathbb{E}[(1 - \sigma_{t+1}^r - f_{t+1}^r)S_{t+1}^r - f_{t+1}^f(1-\rho^r)S_{t+1}^f], \tag{14}$$

[9] As argued by Shimer (2005), a typical feature of calibrated search and matching models with Nash bargaining is to generate a too strong response of the real wage, and thus a too small a response of unemployment (as firms can reduce their labor costs through wage reductions).

$$S_t^f = u(w_t^f) - u(\delta_t) + \beta\, \mathbb{E}[(1 - \sigma_{t+1}^f - f_{t+1}^f)S_{t+1}^f - f_{t+1}^r(1-\rho^f)S_{t+1}^r]. \tag{15}$$

Equation 14 makes clear that the worker's match surplus of a regular job depends negatively on the worker's match surplus of a flexible job. As a job becomes more valuable, the value of the alternative jobs needs to decrease to maintain the equilibrium in the labor market (otherwise the worker's match surplus will explode).[10] In other words, the model generates flexible jobs as substitutes for regular jobs, which is consistent with the empirical literature (as discussed at the end of Section 2). Finally, since workers and firms are risk neutral and have the same discount rate, Nash bargaining implies that $(w_t^s)^N$ will be chosen so that

$$(1-\alpha)J_t^s = \frac{\alpha S_t^s}{u'((w_t^s)^N)}. \tag{16}$$

Therefore, the real wages are

$$w_t^r \equiv ((w_t^r)^N)^{1-\phi}(w^*)^{\phi}, \tag{17}$$

$$w_t^f \equiv (w_t^f)^N, \tag{18}$$

where w^* is the long-run wage and $\phi \in [0,1]$ is the degree of wage inertia. Equation (17) makes the real wage of regular workers less responsive to economic conditions (Shimer, 2005). In contrast, equation (18) states that the worker's pay of flexible workers is the Nash-bargained salary.

To clarify the relationship between employment and wage setting, in Proposition 3, I log-linearize the job-finding rate, which governs the job creation dynamics of the model, for both regular and flexible jobs under two simplifying assumptions. First, I assume that regular and flexible jobs are identical except for wage setting, as explained above. Therefore, I focus on the wage-setting differences between these job types. Second, I assume that $\rho^r = \rho^f = 1$, which means that all workers are reallocated either to other jobs or to unemployment in every period. This assumption eliminates the intertemporal dimension of hiring decisions.

Proposition 3: *Suppose that regular and flexible jobs are identical except for wage setting and $\rho^r = \rho^f = 1$, meaning that all workers are reallocated either to other jobs or to unemployment in every period. Then, the availability of flexible employment compared to regular employment can be approximated by*

[10] It is also important to note that as the number of flexible jobs goes to 0, $f_{t+1}^f \to 0$, equation (14) converges to the expression $\lim_{f_{t+1}^f \to 0} S_t^r = u(w_t^r) - u(\delta_t) + \beta\, \mathbb{E}[(1 - \sigma_{t+1}^r - f_{t+1}^r)S_{t+1}^r]$, which is equivalent to the expression derived by Challe (2020).

$$\hat{f}_t^f - \hat{f}_t^r \simeq \Upsilon[\hat{w}_t^r - \hat{w}_t^f],$$

with $\Upsilon = (w^*)\Big(\frac{\gamma}{1-\gamma}(1-w^*)\Big)^{-1} > 0$. *The variables* $\hat{f}_t^f$ *and* $\hat{f}_t^r$ *represent the level deviation of the job-finding rate of flexible and regular jobs from the steady-state, respectively. Similarly,* $\hat{w}_t^r$ *and* $\hat{w}_t^f$ *denote the level deviation of the wage rate for regular and flexible jobs from the steady-state.*

Proposition 3 makes clear that the availability of flexible jobs compared to regular jobs (i.e., the share of flexible jobs) is associated to firm's labor cost, which in this case is summarized by the real wage gap between the two job types. Since the real wage of flexible workers is highly sensitive to economic conditions, the employment of flexible workers also reacts rapidly to economic conditions.

3.5 Monetary Policy Rule

The central bank controls the nominal interest rate on bonds i_t and follows this monetary policy rule

$$1 + i_t = R^{(1-\mu_\pi)}(1 + i_{t-1})^{\mu_\pi}(1 + \pi_t)^{\phi_\pi(1-\mu_\pi)}\xi_t \tag{19}$$

where R is the steady state interest rate, μ_i is the degree of interest rate inertia, ϕ_π is the elasticity of the policy rate to inflation, and ξ_t is an IID monetary policy shock. Note that this monetary policy rule is general in terms of robustness checks tests (see, for example, Table A1). For example, when $\mu_\pi = 0$, I arrive at the same monetary policy rule used by Acharya and Dogra (2020) or Ravn and Sterk (2017) to study tractable HANK models: $1 + i_t = R(1 + \pi_t)^{\phi_\pi}\xi_t$. Finally, the gross real ex-post return that results from the policy rate and the dynamics of inflation is $R_t = (1 + i_{t-1})/(1 + \pi_t)$, with $R = (1 + i)$ in steady state.

3.6 Government and the Constrained-Efficient Steady State

The government sets the taxes and subsidies τ^W, $\tau^{I,r}$, $\tau^{I,f}$ and T and rebates the net revenue to capitalists in a lump sum manner. The net transfer to capitalists is

$$\begin{aligned}\tau_t = \tau^{I,r}[n_t^r(z_t\chi^r\varphi_t - w_t^r)] + \tau^{I,f}[n_t^f(z_t\varphi_t - w_t^f)] - \tau^W\varphi_t\Delta_t y_t \\ - (n_t^r(1-\tau^{I,r}) + n_t^f(1-\tau^{I,f}))(T - \zeta_t).\end{aligned} \tag{20}$$

Equations (5), (13), and (20) allow me to calculate the consumption of capitalists as $C_t^F = (\Pi_t^W + \Pi_t^I + \tau_t)/\Lambda$. In Appendix D, I decentralize the efficient allocation in the absence of aggregate shocks in steady state by conveniently setting taxes and transfers.

3.7 Solution of the Model

Given the measures of workers and capitalists (1 and Λ) and the market and home production of final goods, the market-clearing conditions for bonds and final goods are given by $\int_0^1 a_{i,t}di + va_t^C = 0$ and $\int_0^1 c_{i,t}di + \Lambda c_t^C + \eta^r v_t^r + \eta^f v_t^f = y_t + (1-n_t)\delta_t + \Omega$, respectively. The supply of intermediate goods is $z_t\chi^r n_t^r + z_t n_t^f$, while the demand for intermediate goods is $\int_0^1 y_{h,t}dh = \Delta_t y_t$. Hence, clearing the market for intermediate goods requires $\Delta_t y_t = z_t\chi^r n_t^r + z_t n_t^f$.

I define equilibrium as a set of sequences of optimal household decisions $\{c_t^C, a_t^C, c_t, a_t,\}_{t=0}^{\infty}$ with $i \in [0,1]$, firms' decision $\{y_t, y_{h,t}, \tilde{p}_t\}_{t=0}^{\infty}$ with $h \in [0,1]$, central banks' decision ($\{i_t\}_{t=0}^{\infty}$) given prices; and aggregate variables $\{v_t^r, v_t^f, J_t^r, J_t^f, \lambda_t^r, \lambda_t^f, f_t^r, f_t^f, U_t^r, U_t^f, \sigma_t^r, \sigma_t^f, \theta_t^r, \theta_t^f, n_t^r, n_t^f, e_t, \Delta_t, \varphi_t, \pi_t, \Pi_t^W, \Pi_t^I, R_t\}_{t=0}^{\infty}$, that solve the optimal reset price, the final good inflation, the price dispersion index, and equations (5) to (20), together with the free entry conditions $\eta^s = \lambda_t^s J_t^s$.

My model generates a non-degenerate cross-sectional distribution of income, consumption, and wealth, as well as individual mobility across the distributions. This is because households in my economy are subject to uninsurable idiosyncratic labor income risk (e.g., unemployment spells), which translates into a different "history of shocks" they face in their life. I refer to this model as a Heterogeneous Agent New Keynesian (HANK) model (Kaplan et al., 2018). Although HANK models are important for understanding the transmission of monetary policy (Auclert, 2019; Kaplan et al., 2018), HANK models are difficult to solve (Debortoli and Galí, 2017; Ragot, 2018). However, recent literature has shown that models with reduced heterogeneity (henceforth RHANK) can very well reproduce, both from a qualitative and a quantitative viewpoint, the aggregate output dynamics of a canonical HANK model in response to aggregate shocks, monetary and non-monetary shocks (Bilbiie, 2020; Debortoli and Galí, 2017; Kaplan and Violante, 2018; Ragot, 2018). I take advantage of these results and use a RHANK model to quantify the role of flexible jobs in the economy.[11]

3.8 From HANK to RHANK

To use a RHANK model with two types of job (henceforth, RHANK-2J), I assume that in addition to the assumptions made so far, agents cannot borrow (Bilbiie, 2020; Challe, 2020; Ravn and Sterk, 2017). So, no one is providing the asset that precautionary savers

[11] While this simplification reduces the complexity of the model without sacrificing the aggregate output dynamics, it does not take into account the redistributive effects of monetary policy on household's heterogeneity, which may be important from a policy point of view.

(i.e., employed workers) would be willing to buy for self-insurance. I also assume perfect insurance within types (but limited across types): employed-regular, employed-flexible, and unemployed. So, all agents within types have the same income and consumption.

Proposition 4: *The equilibrium of the RHANK-2J model is characterized by the following three equations*

$$a_{i,t} = 0 \quad \forall_i, \tag{i}$$

$$c_t = \begin{cases} w_t^r, & \textit{if employed in a regular job} \\ w_t^f, & \textit{if employed in a flexible job} \\ \delta_t, & \textit{unemployed} \end{cases} \tag{ii}$$

$$\mathbb{E}_t\left[\left((MRIS_t^{regular,e})^{\vartheta_t^r}(MRIS_t^{flex,e})^{(1-\vartheta_t^r)}\right)R_{t+1}\right] = 1, \tag{iii}$$

where ϑ_t^r is the share of regular jobs.

Point (i) states that because no one is issuing the assets that the employed workers would be willing to buy for self-insurance, all individual households hold zero bonds in equilibrium (the no-trade equilibrium of Krusell et al. (2011)). Point (ii) makes clear that all households consume their current income. This generates a degenerate wealth distribution. Point (iii) is the weighed Euler equation of the two employed workers (similar to the Euler equation of the analytical-HANK model of Bilbiie (2020), where unconstrained agents can become constrained agents). Importantly, this weighted Euler equation prices the bonds even though they are not traded. Since the weighted Euler equation takes into account the MRIS of each type of employed worker, I can pin down the equilibrium real interest rate as a function of aggregate variables. To see this, consider the employed worker's MRISs, which are given by

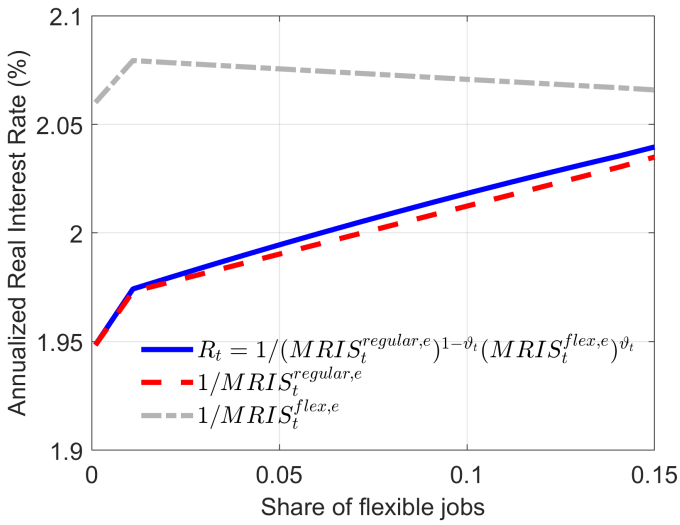
$$MRIS_t^{regular,e} \equiv \beta\frac{1}{u'(c_t^r)}\Big[\underbrace{\overbrace{(1-\sigma_{t+1}^r)u'(c_{t+1}^r)}^{\text{Keeping the job}} + \overbrace{\rho^r f_{t+1}^f u'(c_{t+1}^f)}^{\text{Job-to-Job transition}} + \overbrace{c_{t+1}^u u'(\delta_{t+1})}^{\text{Losing the job}}}_{\text{Labor market transitions next period}}\Big], \tag{21}$$

$$MRIS_t^{flex,e} \equiv \beta\frac{1}{u'(c_t^f)}\Big[\overbrace{(1-\sigma_{t+1}^f)u'(c_{t+1}^f)}^{\text{Keeping the job}} + \overbrace{\rho^f f_{t+1}^r u'(c_{t+1}^r)}^{\text{Job-to-Job transition}} + \overbrace{c_{t+1}^u u'(\delta_{t+1})}^{\text{Losing the job}}\Big]. \tag{22}$$

Equations (21) and (22) show that equilibrium real interest rate is partially determined by the labor market transitions of workers.[12] Thus, any change in unemployment risk fluctu-

[12]Note that $1 - U_{t+1}^r = (1-\sigma_{t+1}^r) + \rho^r f_{t+1}^f$. Since $\delta_t < w_t^r, w_t^f$, hence $u'(\delta_{t+1}) > u'(w_{t+1}^r), u'(w_{t+1}^f)$. It is important to note that the Euler equation and consequently the MRIS equation, are expressed as one-period deviations (today vs. tomorrow). This may wrongly suggest that employed workers do not

Figure 2: Real interest rate as function of the share of flexible jobs.



Notes: The figure shows the annualized real interest rate as function of the share of flexible jobs. The calibration uses the parametrization described in the next section. $MRIS_t^{regular,e}$ and $MRIS_t^{flex,e}$ are defined in Equations (21) and (22), respectively. ϑ_t corresponds to the share of flexible jobs.

ations, generated by a change in the number of flexible jobs, will affect the consumption decisions of both employed workers and, consequently, the entire economy through the equilibrium real interest rate.

To gain intuition about the model's dynamics, in Figure 2, I plot the annualized real interest rate as a function of the share of flexible jobs. In this example, I use different values for the job-finding rate of both job types to find different shares of flexible jobs. I highlight three results. First, R_t is very close to $1/MRIS_t^{regular,e}$. Because the share of flexible jobs is small, $(1-\vartheta_t^r)$, as discussed in the next section, the consumption decisions of the workers in regular jobs play a decisive role in explaining the dynamics of the model. For this reason, when explaining the results in the following sections, I focus on employed workers in regular jobs. Second, $MRIS_t^{regular,e}$ is larger than $MRIS_t^{flex,e}$, so $1/MRIS_t^{regular,e}$ is smaller than $1/MRIS_t^{flex,e}$ for any share of flexible jobs. Because the fall of consumption, in case of unemployment, is larger for regular workers than flexible workers, so employed workers in regular jobs want to precautionary-save more. Finally, the real interest rate increases with the share of flexible jobs. As the share of flexible jobs increases, the unemployment risk decreases, which reduces the precautionary motives of the employed workers in regular jobs, thus reducing $MRIS_t^{regular,e}$ and increasing the real interest rate. In the case of workers in flexible jobs, the increase in the share of flexible

consider the entire sequence of unemployment risks when making decisions about today's consumption. Since optimizing agents equalize the present-value marginal flow benefit from consume across periods (e.g., $u'(c_t) = \beta^k R_{t+k}^k u'(c_{t+k})$), they only need to care about tomorrow's outcomes, as the Euler equation characterizes the evolution of consumption along any optimal path.

jobs makes them more exposed to unemployment, and thus their $MRIS_t^{flex,e}$ increases, as they want to precautionary-save more. Therefore, $1/MRIS_t^{flex,e}$ decreases as the share of flexible jobs increases.[13]

Finally, unemployed workers and capitalists are borrowed-constrained, so for both type of agents, Euler holds with strict inequality. Because unemployed workers have the possibility of finding a job, they want to borrow today to smooth consumption. However, it is not possible to borrow in this economy, so the Euler holds with strict inequality $\mathbb{E}_t[MRIS_t^u R_{t+1}] < 1$. Capitalists are also borrowing-constrained. Because employed workers desire to precautionary-save to bring down the interest rate, capitalists want to borrow to take advantage of a lower interest rate (lower than $1/\beta$).[14] However, capitalists cannot borrow to the prevailing interest rate, so the Euler equation also holds with strict inequality $\mathbb{E}_t[MRIS_t^C R_{t+1}] < 1$.

Summing up. My heterogenous-agent version of the New Keynesian model can account for the interdependence between regular and flexible jobs, through job-to-job transitions, while having an operational precautionary saving motive.[15]

4 Bayesian Estimation of the Model

I estimate the model using Bayesian techniques, as in Smets and Wouters (2003), and benchmark the model calibration with Eurozone data, paying special attention to the Netherlands, a country with a large flexible labor sector, and data that allow me to calibrate microparameters, such as the destruction rate of flexible jobs. This approach enables me to utilize previous information from an extensive literature on macro-models

[13]To explain the role of the precautionary savings motive, I consider the case of higher unemployment risk next period. Higher unemployment risk next period contracts today's demand because it implies more need for self-insurance. Households internalize this by demanding more savings (or less consumption). But savings needs to be zero in equilibrium, so households consume less today and income adjust accordingly to deliver this allocation (starting a negative feedback loop).

[14]As it is well known in the literature, market incompleteness contributes to a smaller steady-state interest rate compared to the complete market case (see, for example, Aiyagari, 1994).

[15]Additionally, my model distinguishes between two types of households at each point in time, which are labeled as "unconstrained" or "constrained", depending on whether their consumption satisfies or not a consumption Euler equation. Compared to the RHANK model developed by Debortoli and Galí (2017), the number of constrained/unconstrained households changes over time in my model. However, in my model, unconstrained households do not have access to financial markets, as is the case of Debortoli and Galí (2017), where unconstrained households can save while constrained households do not have access to financial markets. This assumption allows Debortoli and Galí (2017) to make the distinction between "normal" households that save and consume and hand-to-mouth households that always consume their current income. Although this is an important distinction for understanding the consumption dynamics of both households, in my model, I focus on the behavior of one group of workers: the workers in regular employment.

Table 1: Priors and estimation results.

	Description	Prior Mean (1)	Prior Std. (2)	Prior Distr. (3)	Posterior Mean (4)	Posterior HDP interval (5)
Parameters						
ρ^r	Job-destruction rate regular workers	0.25	0.01	Beta	0.15	0.14/0.16
ρ^f	Job-destruction rate flexible workers	0.35	0.01	Beta	0.34	0.32/0.35
δ/w	Constant loss upon unemployment	0.9	0.001	Beta	0.90	0.89/0.90
ι	Elasticity of substitution	6.0	0.01	Normal	5.99	5.98/6.02
ω	Share of constant prices	0.75	0.01	Beta	0.54	0.52/0.55
Ω	Capitalists' home production	0.50	0.01	Beta	0.49	0.48/0.51
$\tilde{\sigma}$	Firm owners'risk aversion	0.283	0.01	Beta	0.287	0.272/0.304
ϕ	Wage inertia (regular firms)	0.95	0.001	Beta	0.95	0.94/0.96
η^r/w^r	Vacancy cost regular jobs (percent of wage)	0.045	0.005	Beta	0.045	0.037/0.054
η^f/w^f	Vacancy cost flexible jobs (percent of wage)	0.015	0.005	Beta	0.015	0.007/0.0221
γ	Elasticity of matching function	0.67	0.005	Beta	0.73	0.72/0.74
χ^r	Productivity regular workers	1.03	0.01	Normal	1.03	1.01/1.04
π_ϕ	Reaction to inflation	1.2	0.01	Normal	1.24	1.22/1.25
μ_π	Interest rule inertia	0.77	0.01	Beta	0.76	0.74/0.78
μ_{pol}	Persistence monetary policy shock	0.95	0.01	Beta	0.98	0.97/0.98
μ_z	Persistence productivity shock	0.95	0.01	Beta	0.96	0.94/0.97
μ_ζ	Persistence cost-push shock	0.95	0.01	Beta	0.91	0.88/0.93
Standard deviation of shocks						
μ_{pol}	Monetary policy shock	0.01	0.0005	InvGamma	0.0102	0.0094/0.0110
μ_z	Productivity shock	0.01	0.0005	InvGamma	0.0111	0.0101/0.0122
μ_ζ	Cost-push shock	0.01	0.0005	InvGamma	0.087	0.0081/0.0093
Key moments of the simulated data		**Value**				**Value**
$Cov(n_t^f, n_t^r)$		-0.0933		$Cov(w_t^f, w_t^r)$		0.0023
$Var(n_t^f)$		0.5111		$Var(w_t^f)$		0.0197
$Var(n_t^r)$		0.0361		$Var(w_t^f)$		0.0004
$Cov(n_t^f, unemployment_t)$		-0.4178				
$Cov(n_t^f, y_t)$		-0.0234				
$Cov(y_t, unemployment_t)$		-0.0070				

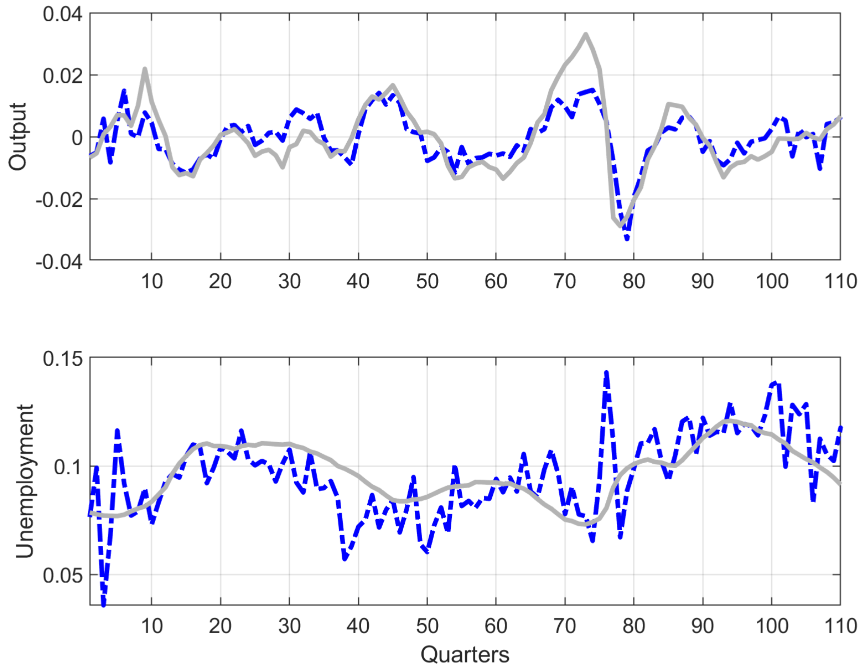
Notes: The Table reports the priors of the model, the estimation results, and some key moments of the simulated data. Column (1) reports the mean prior, Column (2) reports the standard deviation prior, Column (3) reports the type of the prior distribution, Column (4) reports the mean of the posterior and Column (5) reports the 90% Highest Density Region (HDR) interval, which is also known as credible interval. The priors and the initial parametrization of the model are explained in Appendix B.

of the Eurozone (Christoffel et al., 2008) and to compare different model specifications and assess their relative performance based on the data (Canova and Sala, 2009).

To estimate the model, I use data from Area-Wide Model (AWM) database of the ECB (Fagan et al., 2005), which provides quarterly data for the Eurozone covering the period between 1990:Q1 to 2017:Q4. This dataset treats the Eurozone as a single economy, so the data can be interpreted as the aggregate behavior of the Eurozone as a whole or as the behavior of a representative country in the region. This feature allows me to estimate the model in a broad and comprehensive manner without sacrificing its relevance to the context of the Eurozone. I complement this database with data on the share of flexible jobs, from Eurostata, covering the period between 1998:Q1 to 2017:Q4.

I consider four observables in the estimation: output, unemployment, price inflation,

Figure 3: Simulated and actual time series.



Notes: The figure compares simulated data with actual (smoothed) data for two observables of the model: output and the unemployment rate. Data from Area-Wide Model (AWM) database of the ECB which provides quarterly data for the Eurozone covering the period between 1990:Q1 to 2017:Q4.

and the share of flexible jobs. The fact that the model contains three structural shocks (demand shocks, productivity shocks, and monetary policy shocks) and there are four observable variables raises issues with the estimation (i.e., stochastic singularity). To avoid this problem, I extend the model to consider a measurement error for each of the observed variables. I discuss the choice of the prior distribution in the Appendix B. In general, I set the mean values to correspond to those in other studies in the literature and set the standard deviations such that the domain covers a reasonable range of values. I report the priors in Table 1. Specifically, the first two columns of Table 1 present the properties for the prior distribution of the model parameters. I assume that the parameters follow either a Normal distribution or a Beta distribution (the latter for the parameters that are restricted to take values in the range 0-1). As is standard in the literature, the standard error associated with structural shocks follows an inverted gamma distribution.

Table 1 reports the estimated posterior distributions of the model parameters along with their corresponding 10th and 90th percentiles (HDP interval) obtained through the Metropolis-Hasting sampling algorithm using 20,000 draws. These posterior distributions, shown in column 2, indicate that most parameters are significantly different from zero and are in line with the prior estimates, as reported in column 1. In the bottom of the Table, I report key moments of the simulated data. As expected, I show that regular and flexible jobs covariate negatively, and the volatility of flexible employment is larger than the volatility of regular jobs. I also show that larger flexible employment is associated with larger output and lower unemployment. The worker's salary covariates in the same direction for both types of job, although the worker's pay is much volatile for flexible jobs to accommodate shocks. All these results are consistent with microdata from Europe on flexible job (see, for example, Cahuc et al., 2016). Finally, to show the relevance of the model, in Figure 3, I compare the simulated data with actual (smoothed) data for two important variables of the model: the output and the unemployment rate. The model gives a good account of the quarter-to-quarter variation in the time series. The model captures all major recession and expansion episodes in terms of output, although it is less volatile than the real data. The model also captures the movements in the unemployment rate. Overall, the results demonstrate that the model provides reasonable and significant parameter estimates and is relevant for studying the implications of flexible jobs in the economy.

5 Results

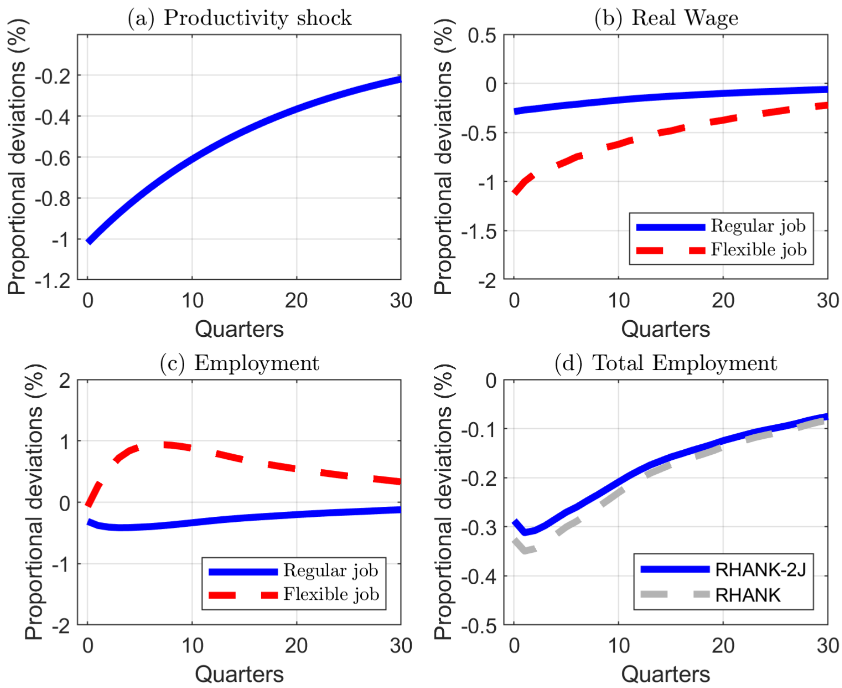
In this section, I start by explaining the mechanism through which flexible jobs operate in the economy. I then focus on the volatility gains of flexible jobs and their consequences for flexible workers.

5.1 Understanding the Role of Flexible Jobs in the Economy

To understand the implications of flexible jobs in an economy like the one described in Section 3, I study the economy's response to a contractionary shock for illustrative purposes in Figures 4 and 5. My baseline specification is the model with imperfect-insurance and 12% of flexible jobs in steady-state (RHANK-2J). For comparison, I also examine three alternative models: (1) the model with perfect-insurance but without flexible jobs (RANK); (2) the model with both perfect-insurance and 12% of flexible jobs (RANK-2J); (3) the model with imperfect-insurance but without flexible jobs (RHANK), as in Challe (2020).

Figure 4 shows the impulse responses to a productivity shock in the baseline model. Under a contractionary productivity shock, the real wage falls for both jobs. However, the drop is steeper for flexible jobs. This leads to an increase in flexible job employment and a decrease in regular job employment. In total, the employment decreases to accommodate the shock, although less than in a scenario without flexible jobs. Because the employment

Figure 4: Impulse responses to a productivity shock in the baseline model.



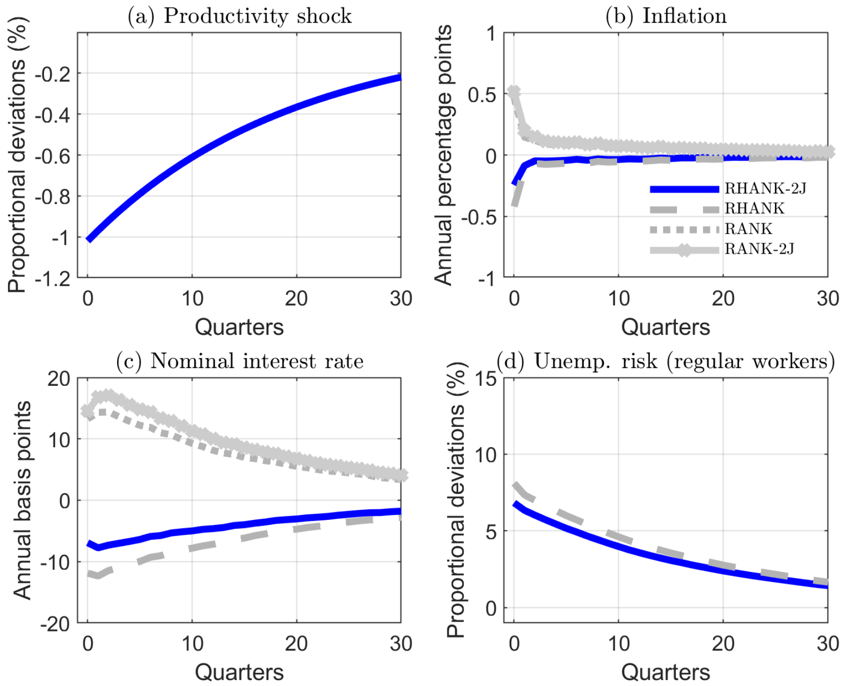
Notes: The figure shows the impulse response to a productivity shock under a monetary policy rule for the real wage and employment under a model with imperfect-insurance and 12% of flexible jobs in steady state (RHANK-2J). The model with imperfect-insurance but without flexible jobs is called (RHANK). Proportional deviations stand for the percentage deviations of the unemployment risk from the steady state value.

falls less, the unemployment risk also increases less, resulting in a lower fall in aggregate demand. This can have large consequences in terms of macroeconomic volatility.

To illustrate this, in Figure 5, I show the reaction of nominal interest rate, inflation, and unemployment risk (for regular workers) to the same contractionary productivity shock. In the RANK model, I show the standard response of inflation and the nominal interest rate to a contractionary productivity shock (Galí, 2015). A contractionary productivity shock results in an increase in inflation because there is the same aggregate demand for goods but a lower aggregate supply of goods. As a result, the central bank raises the interest rate to balance the goods market. When I incorporate flexible jobs into the RANK model, forming the RANK-2J model, the economy's response remains qualitatively similar to that of the RANK model. In other words, flexible jobs are largely irrelevant in a perfect-insurance setting (see, for example, Cahuc and Postel-Vinay, 2002).

In contrast, the inflation and the nominal interest rate exhibit different responses in a RHANK model, as documented in the HANK literature (Bilbiie, 2018; Challe and Ragot, 2016). The contractionary productivity shock decreases not only the aggregate supply of

Figure 5: Impulse responses to a productivity shock.



Notes: The figure shows the impulse response to a productivity shock under a monetary policy rule for the inflation, nominal interest rate, and the unemployment risk of regular workers. My baseline specification is the model with imperfect-insurance and 12% of flexible jobs (RHANK-2J). I compared it to three alternative models: (1) the model with perfect-insurance but without flexible jobs (RANK); (2) the model with both perfect-insurance and 12% of flexible jobs (RANK-2J); (3) the model with imperfect-insurance but without flexible jobs (RHANK). Proportional deviations stand for the percentage deviations of the unemployment risk from the steady state value. Please refer to the estimation section for more details about the steady state values.

goods (as in the RANK case), but also the aggregate demand of goods. This is because workers who expect to lose their job with greater probability tend to consume less in the present, leading to a decrease in aggregate demand. Under my parametrization, aggregate demand falls significantly more than the aggregate supply of goods, leading to a lower inflation rate. As a result, the central bank responds by decreasing the interest rate to stimulate the aggregate demand and equilibrate the goods market.

In the RHANK-2J model, I find similar dynamics to the RHANK model. However, a comparison of the unemployment risk of regular workers between the RHANK model and the RHANK-2J model reveals an interesting result: the unemployment risk of regular workers decreases from 9% in the RHANK model to 6% in the RHANK-2J model (when compared to the same steady-state value). This fall in unemployment risk reduces the precautionary motive of regular households, leading to a *lower* decrease in aggregate demand and inflation. As a result, the central bank decreases the interest rate to stimulate aggregate demand, but to a lesser extent than in the RHANK model.[16]

[16]In general, the response of the nominal interest rate will always fall between the responses of the

Robustness Checks. I perform several robustness checks and confirm the role of flexible jobs in reducing the unemployment risk fluctuations of regular workers. Specifically, I confirm that the unemployment risk for regular workers exhibits a smaller increase during a contractionary shock (as shown in Figure 5) and a smaller decrease in an expansionary productivity shocks. I also document that the results shown in Figures 4 and 5 are robust to different parametrization of the wage rigidity parameter (Figure A1), the monetary policy rule (Table A1), or shock characteristics, such as size, direction, and type (Figures A2 and A3). Another important insight is that flexible jobs play a more significant role in reducing the unemployment risk fluctuations of regular workers during long-lived shocks. Figure A4 shows the nominal interest rate response for two different values of the productivity-shock persistence. When shocks are long-lived (more than 10 quarters), as in my baseline specification, the contribution of flexible jobs is substantial in reducing the unemployment risk fluctuations, as shown in Figure 5. However, when the persistence of productivity-shocks is shorter than 10 quarters, the contribution of flexible jobs is marginal. Because of search frictions in the labor market, flexible employment cannot adjust rapidly enough during economic contractions to compensate for the decline in regular employment.

5.2 Volatility Gains in an Economy with Flexible Jobs

I have shown in the previous section how flexible jobs change the dynamics of the economy, in particular through lower unemployment risk fluctuations. In this section, I focus on the consequences of having more flexible jobs in the economy.

To understand the consequences of having a labor market with flexible jobs, I study the volatility gains associated to flexible jobs.[17] The top panel of Figure 6 shows the standard deviation of output, employment, and inflation based on the RHANK-2J model for observed levels of contractual flexibility in Europe.[18] To compare the different counterfactual simulations, the standard deviation is expressed as a ratio relative to that of the RHANK model (i.e., the RHANK-2J without flexible jobs), at which level the standard deviation is equal to 1. In order to compare different economies with different shares of flexible jobs, I assume a constant real interest rate throughout all simulations.[19]

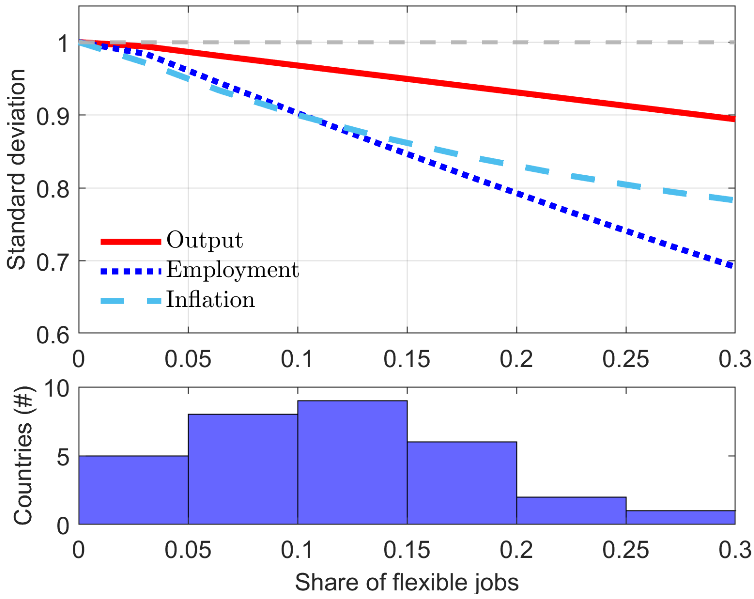
nominal interest rate in both the RANK and the RHANK models for any parameterization of the model.

[17]I focus on volatility gains because welfare losses are usually associated with deviations from the constrained-efficient steady state (as this model), which is usually approximated, when possible, through the standard deviations of variables such as output, employment, and inflation (Bilbiie, 2008; Carreño and Uras, 2024; Galí, 2015; Galí and Monacelli, 2016).

[18]See for example, Figure 1 (a) for Eurozone data about contractual flexibility.

[19]To achieve this, I set the discount factor β such that the annualized real interest rate is 2%.

Figure 6: Implied volatility of the model as a function of the share of flexible jobs.

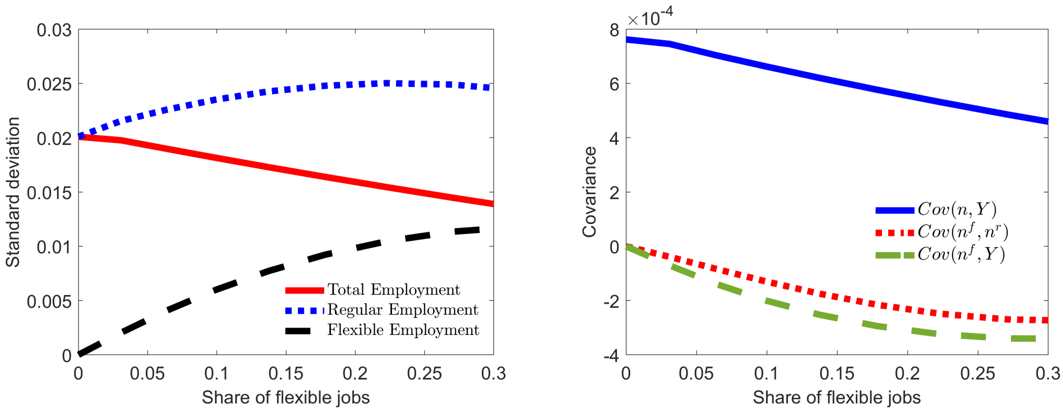


Notes: In to top panel, the figure shows the standard deviation of output, employment, and inflation as a function of the share of flexible jobs. The RHANK model is the baseline model, so I divide the standard deviation of the variables under a RHANK-2J with different shares of flexible jobs by the standard deviation of these variables in the RHANK model. I express the standard deviation as a ratio to those under a RHANK model without flexible jobs, at that level the standard deviation is equal to 1. All simulations have the same real interest rate to be comparable with each other. In the bottom panel, the figure shows the distribution of the share of flexible jobs in 2019 for European countries (see Figure 1).

The top panel of Figure 6 shows a large drop in the volatility of output, employment, and inflation as a result of a larger share of flexible jobs. Based on the simulations in the top panel, a country with 30% flexible jobs has an output volatility that is 10% lower than a comparable country without flexible jobs.[20] These are large volatility gains and represent real differences when taking into account the heterogeneity observed in the share of flexible jobs across developed countries. For example, in the bottom panel of Figure 6, I plot the distribution of the share of flexible jobs across European countries in 2019. European countries have a share of flexible jobs ranging between 5% and 20% and thus a 15% difference in the share of flexible jobs. This 15% difference in the share of flexible jobs is associated with a 5% reduction in output volatility. Moreover, the share of flexible jobs has been increasing over time, which implies that the role of flexible jobs in reducing volatility will become even more significant.

[20] To gain an idea of how sizable is the role of flexible jobs, I compare to Acemoglu et al. (2012). By using back-of-the-envelope calculations, Acemoglu et al. (2012) show that types of interconnections implied by the U.S. input-structure may generate aggregate fluctuations of approximately 2% standard deviation of the U.S. GDP. My findings suggest that a 10% change in the level of contractual flexibility over one year may generate aggregate fluctuations of approximately 2% standard deviation of GDP.

Figure 7: Employment volatility as a function of the share of flexible jobs.



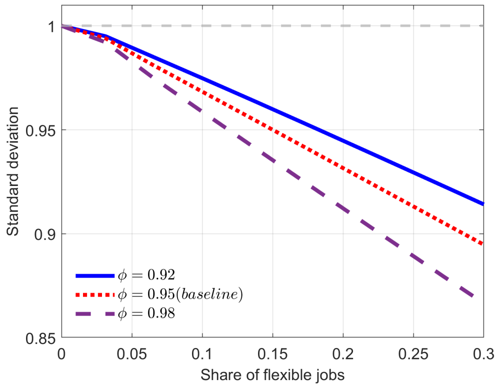
(a) Volatility (b) Covariance

Notes: Figure (a) shows the relationship between the volatility of total, regular, and flexible employment as a function of the share of flexible jobs. Figure (b) shows the covariance between total employment and output, $Cov(n, Y)$, between flexible employment and regular employment, $Cov(n^f, n^r)$, and between flexible employment and output, $Cov(n^f, Y)$ as a function of the share of flexible jobs. The RHANK model is the baseline model and the RHANK-2J is the model for the rest of the simulations. All simulations have the same real interest rate to be comparable with each other.

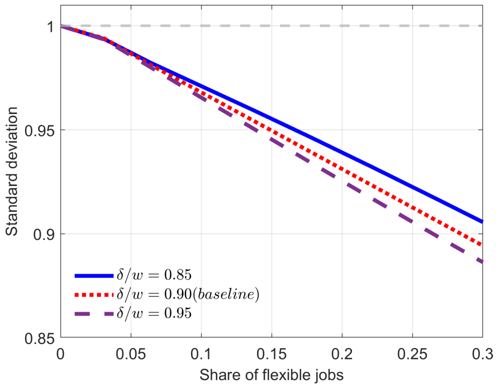
To further understand the role of flexible jobs in reducing output volatility through lower employment volatility, in Figure 7 (a), I plot the volatility of total employment, regular employment, and flexible employment as a function of the share of flexible jobs. When the share of flexible jobs is close to zero, the total employment volatility is equivalent to regular employment volatility as there are no flexible jobs in the economy. As the share of flexible jobs increases, the volatility of both regular and flexible employment increases, although faster for flexible employment. However, as flexible and regular employment covariate negatively (as shown in Figure 7 (b)), the total employment volatility decreases as the share of flexible jobs increases. In other words, for every regular worker who loses his job, there is more than one worker who gets a flexible job. As a result, the overall unemployment risk decreases, and thus the aggregate demand fluctuations decrease, which explains the results in Figure 6. To further explore these results, in Figure 7 (b), I plot the covariance between total employment and output, $Cov(n, Y)$, between flexible employment and regular employment, $Cov(n^f, n^r)$, and between flexible employment and output, $Cov(n^f, Y)$, as a function of the share of flexible jobs. The graph shows that the covariance between flexible employment and regular employment is negative, as expected, as is the covariance between flexible employment and output. Importantly, I find that the covariance between total employment and output is positive, though it decreases as the share of flexible jobs increases. This may be because the marginal contribution of flexible workers decreases as its numbers increase.

Robustness check: The volatility gains depend on several key parameters of the model.

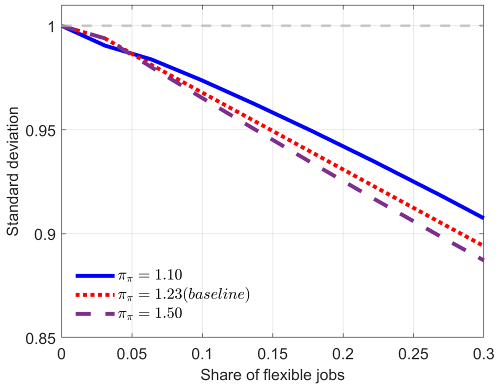
Figure 8: Volatility gains on output for different parametrization of the model.



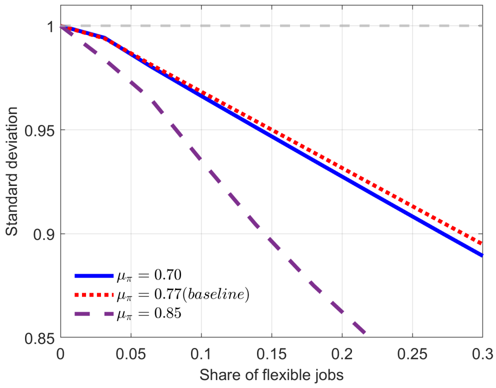
(a) Wage rigidity



(b) Constant loss upon unemployment



(c) Reaction to inflation



(d) Interest-rate inertia

Notes: The figure shows the standard deviation of output for different parametrizations of the model. The RHANK model is the baseline model, so I divide the standard deviation of the variables under a RHANK-2J with different shares of flexible jobs by the standard deviation of these variables in the RHANK model. I express the standard deviation as a ratio to those under a RHANK model without flexible jobs, at that level the standard deviation is equal to 1. All simulations have the same real interest rate to be comparable with each other.

Although the model parameters are estimated, I conduct several robustness exercises, as shown in Figure 8, and confirm the role of flexible jobs in reducing output volatility. In Panel (a), I show the relationship between output volatility and the share of flexible jobs as a function of the wage rigidity parameter. When the wage rigidity parameter is high, regular workers' pay is more rigid, making firms less flexible in adjusting marginal costs to absorb shocks. In this scenario, the contribution of flexible jobs becomes even more significant in reducing output volatility as shown by the purple dashed line. In Panel (b), I consider the constant loss upon unemployment, which measures the extent of the loss workers face when they become unemployed. As the constant loss upon unemployment increases, the loss from unemployment decreases. In fact, if the constant loss upon unemployment approaches one, the model converges to a RHANK model, where unemployment risk plays no role. Counterintuitively, I find that flexible jobs become even more important in reducing output volatility when overall unemployment risk is lower. However, this is mostly because a model with low unemployment risk is also a model with much lower volatility, independent of the role of flexible jobs. Importantly, the role of flexible jobs in reducing output volatility remains consistent between different parametrizations. As shown in Figure 5, the monetary policy rule also plays an important role on the macroeconomic effects of flexible jobs. In Panels (c) and (d), I consider different parameterizations of the central bank's reaction to inflation and the interest-rate inertia. In general, I observe that the volatility-reducing role of flexible jobs remains consistent, though it becomes even more pronounced when the central bank reacts more slowly to shocks that deviate inflation from its trend. In such cases, as expected, flexible jobs play an even more important role in restoring equilibrium and reducing output volatility.

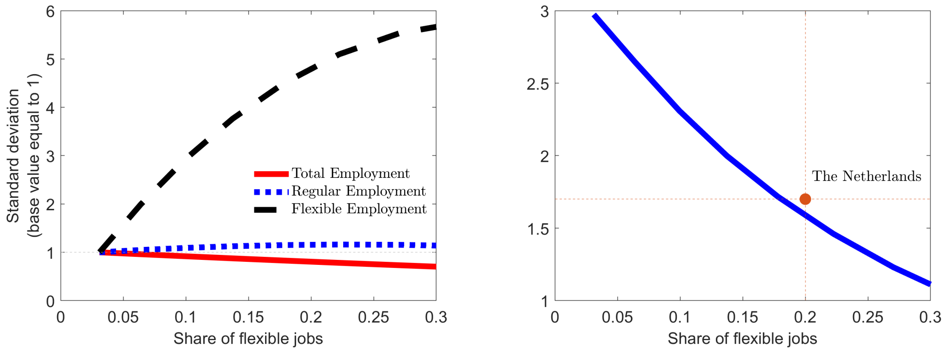
5.3 Volatility Gains Come at a Cost to Flexible Workers

I have shown that flexible jobs contribute to stabilizing aggregate demand through lower variation of total employment, resulting in less pronounced fluctuations in inflation and, consequently, output. However, my findings in Figure 7 show that the volatility of employment increases rapidly as the share of flexible jobs increases, reaching levels that suggest a high degree of volatility, especially considering the relatively low number of flexible jobs in these simulations.

To confirm this, in Figure 9 (a), I replot Figure 7 (a), but with a base level equal to 1 for the three employment volatility series. Since volatility is 0 for flexible employment when the share of flexible jobs is 0, I define the base level equal to one when the share of flexible jobs is 2%. This allows me to compare the growth rate of the three volatility series. Figure 9 (a) shows a substantial growth in employment volatility associated with flexible employment. Specifically, the volatility of flexible employment is about 5 times higher when the share of flexible jobs is around 30%, while the volatility of regular employment is only 13% higher.

These results in Figure 9 (a) suggest that flexible workers suffer an extreme level of employment volatility. To better understand these results, in Figure 9 (b), I plot the per-worker employment volatility for a flexible worker compared to a regular worker. This allows me to compare the employment volatility, at worker level, that implies a flexible job compared to a regular job. Figure 9 (b) gives two important insights. First, I find that the per-worker employment volatility is greater than one, indicating that flexible workers experience higher employment volatility compared to regular workers. Remarkably, my model reproduces a volatility pattern that aligns closely with microdata from The Nether-

Figure 9: Employment volatility growth and per-worker employment volatility.



(a) Employment volatility growth (b) Per-worker volatility ratio

Notes: Figure (a) shows the employment volatility (standard deviation) for total employment, regular employment and flexible employment. I define a common base level equal to 1 for all three employment volatility series. Since volatility is 0 for flexible employment when the share of flexible jobs is 0, I define the base level at around a 2% share of flexible jobs. Figure (b) shows the per-worker employment volatility for a flexible worker compared to a regular worker (ratio). In orange, the data point corresponding to The Netherlands as estimated in Table A3. For both figures, the RHANK model is the baseline model and the RHANK-2J is the model for the rest of the simulations. All simulations have the same real interest rate to be comparable with each other.

lands. In the Appendix, Table A3, by using microdata from The Netherlands, I show that the volatility of worked hours, a raw measure of employment volatility, is 78% higher for flexible workers compared to regular workers. Given that the share of flexible jobs was around 20% in 2019 in the Netherlands, my simulations produce similar volatility levels, closely matching the data (as shown by Figure 9 (b)) . Second, I show that per-worker employment volatility is decreasing in the share of flexible jobs. As flexible workers serve to absorb economic shocks, they need to over-compensate in terms of employment fluctuations. Therefore, a higher number of flexible workers reduces the volatility-per-worker ratio.

In summary, flexible workers suffer a high employment volatility, consistent with their volatility-reducing role. Because workers are risk-averse, they are affected by high employment volatility. Therefore, it may be the case that flexible jobs are welfare-decreasing, despite their overall volatility reducing effects. To study this, I measure how welfare changes when I consider a steady state with a different share of flexible jobs (Kim and Kim, 2003; Schmitt-Grohé and Uribe, 2007). Because it is not possible to arrive at an analytical approximation of the welfare function that allows me to decompose welfare effects, my welfare measure is given by the discounted lifetime utility of an average household (i.e., unconditional welfare).[21] While this welfare measure is not perfect, because it does not take into account labor market transitions, it is a first approximation to measure

[21] In the context of macro models with household heterogeneity, there have been some advances in welfare decomposition (see, for example, Bhandari et al., 2023). However, this is still ongoing research.

welfare in a heterogeneous agent setting.

The welfare measure is calculated with a second-order approximation of the value function and evaluated at the model's steady state (Kim et al., 2008; Kim and Kim, 2003).[22] To derive an alternative interpretation of welfare improvements, in Figure 10, I express the gains and losses of the agents in terms of consumption equivalent (CE) variation, that is, the maximum fraction of consumption ξ that the agents would be willing to forgo (in perpetuity) in an economy with $A\%$ share of flexible jobs to join an economy with $B\%$ share of flexible jobs. Formally, ξ must satisfy

$$\mathbb{E}\left[\sum_{k=0}^{\infty}\beta^k \ln(c_{t+k}^A(1+\xi))\right] \equiv \mathbb{E}[W_t^A(\xi)] = \mathbb{E}[W_t^B] \equiv \left[\sum_{k=0}^{\infty}\beta^k \ln(c_{t+k}^B)\right], \tag{23}$$

where c_t^A and c_t^B stand for aggregated consumption (from the central planner's point of view). Solving equation (23) for ξ, I find

$$\xi = exp((1-\beta)\,\mathbb{E}[W_t^B] - \mathbb{E}[W_t^A])) - 1. \tag{24}$$

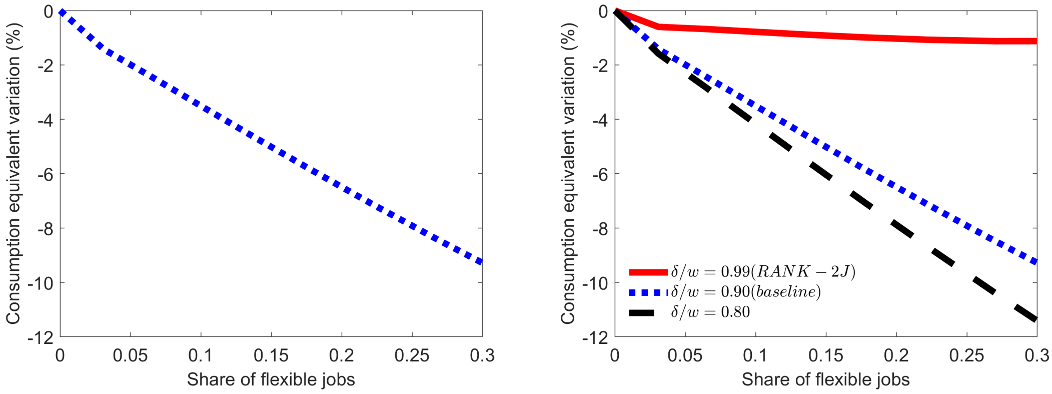
Therefore, the CE variation is positive when the economy with $B\%$ share of flexible jobs is the one with the highest welfare. This implies that the agents would require $\xi \times 100$ percent of consumption (extra) each period to be willing to remain in an economy with $A\%$ share of flexible jobs. The units are in consumption perpetuities. Figure 10 (a) shows the relationship between CE variation and the share of flexible jobs. As Figure 10 (a) shows, the relationship between the welfare measure and the share of flexible jobs is negative. The costs of a higher share of flexible jobs are large for a 12% share of flexible jobs: 4 percent of lifetime consumption.[23]

These results are consistent with those of Carreño and Uras (2024). Carreño and Uras (2024) develop a small open economy DSGE model to examine the macro-welfare effects of flexible-hour contracts, concluding that excessive contractual flexibility may reduce welfare, as large fluctuations in working hours, wages, and employment are costly for flexible workers. In other words, to achieve lower output volatility, flexible employment must overadjust to reduce total employment volatility. In the same vein, although in a different setting, I show that flexible jobs are welfare-reducing, largely due to the explosive

[22]Regarding the welfare function, I simulate the economy over 200,000 times to calculate welfare, and these simulations incorporate all potential trajectories of workers.

[23]To put these numbers in perspective, I use the results of Bayer et al. (2019). In a DSGE model with precautionary savings and two assets to smooth consumption, Bayer et al. (2019) estimate that one standard deviation increase in household income risk (i.e., an increase in the variance of income shocks of 54%) depresses welfare equivalents to 0.27 percent of lifetime consumption on average.

Figure 10: Welfare as function of the share of flexible jobs.



(a) Welfare (b) Robustness Check

Notes: Figure (a) shows the relationship between welfare and the share of flexible jobs. Figure (b) shows the relationship between welfare and the share of flexible jobs for different values od the constant loss upon unemployment. I approximate the utility function up to a second order to calculate welfare, and I focus on the unconditional welfare to rank the counterfactual simulations with different share of flexible jobs. Both figures plot the consumption equivalent (CE) variation, that is, the maximum fraction of consumption ξ that the agents would be willing to forgo in an economy with $A\%$ share of flexible jobs to join an economy with $B\%$ share of flexible jobs. The units are in consumption perpetuities. All simulations have the same real interest rate to be comparable with each other.

increase in employment volatility, as illustrated in Figure 9. I also compare my results with Cahuc and Postel-Vinay (2002). Cahuc and Postel-Vinay (2002) study the desirability of temporary jobs, which are a form of flexible jobs, from a welfare point of view and calculate welfare as a function of the number of short-term contracts authorized by the government and the fixed cost of terminating any contract. My results contrast with those of Cahuc and Postel-Vinay (2002), who find that temporary jobs are always welfare-increasing. While my model assumes an imperfect-insurance setting, Cahuc and Postel-Vinay (2002) assume a perfect-insurance setting. To explore the impact of this assumption on the relationship between flexible jobs and welfare, I also estimate my model under a perfect-insurance setting in Figure 10 (b), that is, RANK-2J. Figure 10 (b) shows that flexible jobs are always welfare-decreasing, although to a lesser extent. This is because, in a perfect-insurance setting, workers are fully protected against any risks associated with flexible jobs, such as the risk of job loss. Therefore, the potential costs of contractual flexibility, such as reduced job security, are not important in a perfect-insurance setting, and the benefits of flexible jobs, such as greater wage flexibility, are fully realized. However, in my setting, flexible jobs are also less productive, which is a feature not considered in Cahuc and Postel-Vinay (2002). This factor has a more dominant impact on welfare than the benefits of, for example, wage flexibility.

6 Concluding Remarks

This paper argues that labor market flexibility, through flexible jobs, serves as an important policy tool for stabilizing the economy. To quantify the role of flexible job in stabilizing the economy, I use a tractable heterogeneous-agent version of the New Keynesian model with imperfect unemployment insurance and a labor market with a two-sector search model, where regular and flexible jobs coexist. I estimate the model using Bayesian techniques and Eurozone data from the Area-Wide Mode database of the ECB. I show that the interaction between incomplete markets and the lower unemployment risk fluctuations associated with a labor market with flexible jobs generates a qualitatively important macroeconomic-stabilization effect on the economy. However, this volatility-reducing role of flexible jobs comes at a cost to flexible workers, resulting in substantial employment volatility for this group.

My results have important policy implications for a range of developed countries with large and growing flexible job sectors. Specifically, these results highlight the importance of flexible jobs in stabilizing the business cycle. However, policymakers must ensure that all workers benefit from these contracts. In addition, my results suggest that labor market flexibility, through flexible jobs, is complementary to other discretionary tools designed to deal with the business cycle.

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APPENDIX

A Tables and Figures

Table A1: Difference in the nominal interest rate reaction for a model with and without flexible jobs under different parametrizations of the monetary policy rule.

Monetary policy rule: $i_t - i = \mu_\pi(i_{t-1} - i) + (1 - \mu_\pi)\phi_\pi \pi_t + \xi_t$

Panel A: Productivity shock	Interest-rule inertia: μ_π					
	$\mu_\pi = 0$	$\mu_\pi = 0.25$	$\mu_\pi = 0.55$	$\mu_\pi = 0.75$	$\mu_\pi = 0.85$	$\mu_\pi = 0.95$
Reaction to inflation: ϕ_π						
	Annual basis points:					
$\phi_\pi = 1.5$	12.45	11.68	10.91	9.41	7.80	4.81
$\phi_\pi = 2.5$	6.84	6.76	6.57	6.26	5.77	4.27
$\phi_\pi = 3.5$	5.70	5.73	5.60	5.47	5.20	4.19
$\phi_\pi = 4.5$	5.21	5.28	5.16	5.11	4.93	4.15
Panel B: Cost-push shock						
$\phi_\pi = 1.5$	12.27	11.59	10.83	9.35	7.73	4.29
$\phi_\pi = 2.5$	6.69	6.62	6.51	6.20	5.71	4.18
$\phi_\pi = 3.5$	5.56	5.60	5.53	5.42	5.15	4.15
$\phi_\pi = 4.5$	5.07	5.15	5.09	5.06	4.88	4.13

Notes: This table shows the difference in the nominal interest rate reaction for a model with and without flexible jobs under different parametrizations of the monetary policy rule. I compare two models with imperfect-insurance, one without flexible jobs (RHANK) and the other one with flexible jobs (RHANK-2J). The difference is calculated as the maximum difference over a 30 quarters-period of the interest-rate reaction for a productivity shock (panel A) and cost-push shock (panel B).

Table A2: Labor flows and the type of contract.

Panel A: Job-to-Job		Share of...					
	N	the total.		starting contracts.		ending contracts.	
	(1)	(2)		(3)		(4)	
(a): Regular to Flex	297,408	22%	=(a)/(e)	29%	=(a)/(a+b)	55%	=(a)/(a+d)
(b): Regular to Regular	735,206	53%	=(b)/(e)	71%	=(b)/(a+b)	89%	=(b)/(b+c)
(c): Flex to Regular	94,266	7%	=(c)/(e)	28%	=(c)/(c+d)	11%	=(c)/(b+c)
(d): Flex to Flex	248,275	18%	=(d)/(e)	72%	=(d)/(c+d)	45%	=(d)/(a+d)
		100%					
(e): Total	1,375,155						
Panel B: Job-Unemployment-Job							
(a): regular to Flex	49,087	22%	=(a)/(e)	34%	=(a)/(a+b)	47%	=(a)/(a+d)
(b): Regular to Regular	96,381	44%	=(b)/(e)	66%	=(b)/(a+b)	84%	=(b)/(b+c)
(c): Flex to Regular	19,001	9%	=(c)/(e)	25%	=(c)/(c+d)	16%	=(c)/(b+c)
(d): Flex to Flex	56,324	26%	=(d)/(e)	75%	=(d)/(c+d)	53%	=(d)/(a+d)
		100%					
(e): Total	220,793						

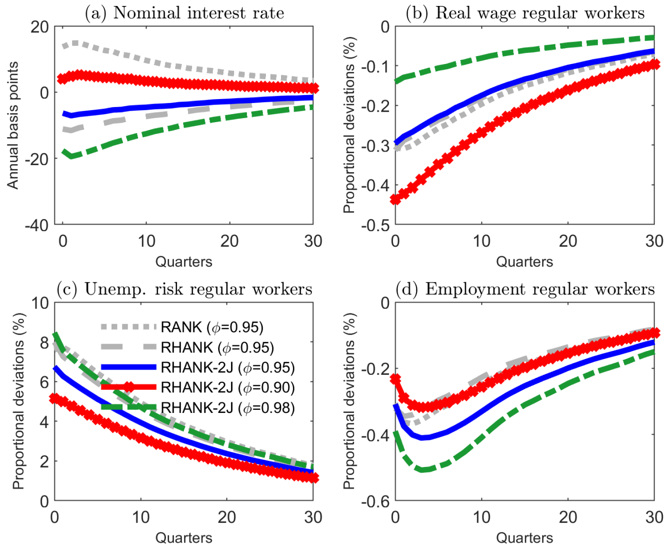
Notes: This table characterizes labor flows in the Netherlands by examining the types of contracts before and after workers change jobs. I analyze both job-to-job movements (Panel A) and job-unemployment-job movements (Panel B) among workers aged 25 to 55 during the period 2008-2016. I consider only the first job change for all workers in the sample, excluding any subsequent job movements. The total number of movements considered in this analysis (1,595,948) represents 40% of the total movements in the sample, each corresponding to a single worker changing jobs for the first time during the sample period.

Table A3: Characterization of flexible jobs in the Netherlands.

	Volatility worked hours (1)	Volatility gross wage (2)	Unemp. (next year) (3)
Flexible Jobs	0.155***	0.0133***	0.0165***
	(0.000279)	(0.000191)	(0.000311)
Mean (dependent variable)	0.198	0.436	0.049
Controls:			
Worker FE	Yes	Yes	Yes
Industry × year FE	Yes	Yes	Yes
Polynomial term age	Yes	Yes	Yes
Months flexible job	Yes	Yes	Yes
Observations	41,059,546	41,059,546	34,772,891
R2	0.611	0.717	0.327

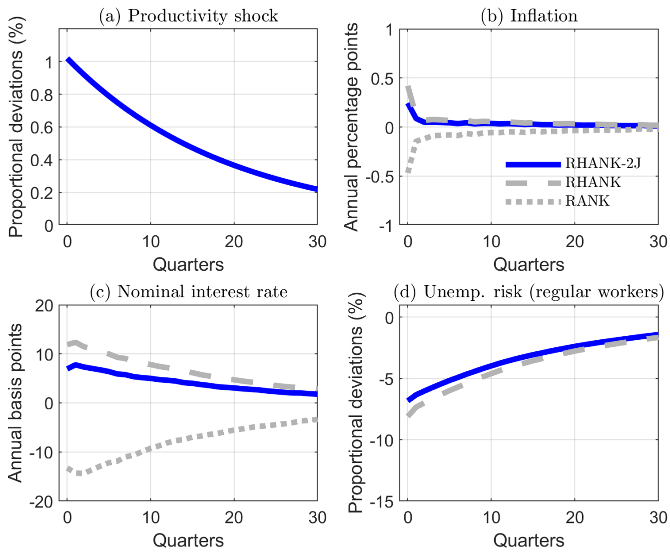
Notes: This table characterizes flexible jobs. I run the following the regression $Q_{i,t} = \phi \mathbf{1}_{it}^{Flex} + \boldsymbol{X\beta} + \alpha_i + \epsilon_{i,t}$, where $Q_{i,t}$ may be any of the following variables: the volatility of worked hours within a year, the volatility of the gross wage within a year, and a dummy variable for being unemployed next year; $\mathbf{1}_{it}^{Flex}$ is a dummy for employment in a flexible at the end of year; $\boldsymbol{X}$ includes a polynomial term on age (normalized to 40 years old), number of months under a flexible job within a year, and industry-year fixed effects; α_i are worker fixed effects; Finally, $\epsilon_{i,t}$ is the error term. I consider workers from 25 to 55 years old. I drop extreme values. Robust standard errors at the worker level. t-statistics in parentheses.

Figure A1: Impulse response to a productivity shock for different degrees of wage rigidity (ϕ).



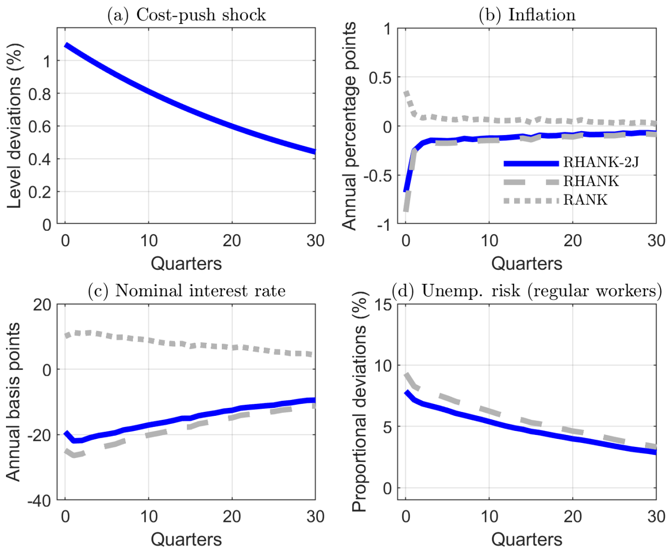
Notes: The figure shows the impulse responses to a productivity shock for the nominal interest rate, the real wage of regular workers, the unemployment risk of regular workers, and the employment for regular workers under a model with imperfect insurance and 12% of flexible jobs in steady state (RHANK-2J). Proportional deviations stand for the percentage deviations of the unemployment risk from the steady state value.

Figure A2: Impulse responses to an expansionary productivity shock.



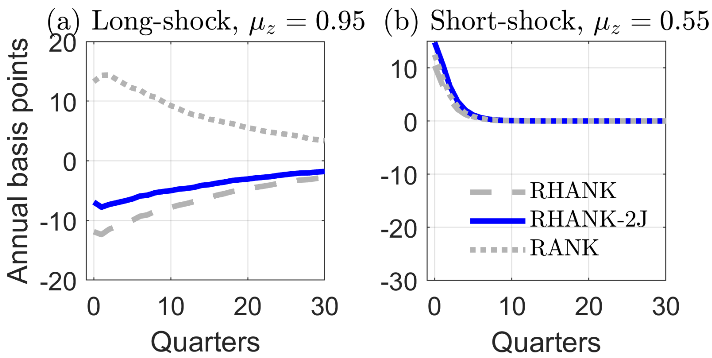
Notes: The figure shows the impulse response to a productivity shock under a monetary policy rule for the inflation, nominal interest rate, and the unemployment risk of regular workers. My baseline specification is the model with imperfect-insurance and 12% of flexible jobs (RHANK-2J). I compared it to two alternative models: (1) the model with perfect-insurance and without flexible jobs (RANK); and (2) the model with imperfect-insurance and without flexible jobs (RHANK). Proportional deviations stand for the percentage deviations of the unemployment risk from the steady state value (see estimation section for more details about the steady state values).

Figure A3: Impulse responses to a cost-push shock.



Notes: The figure shows the impulse response to a cost-push shock under a monetary policy rule for inflation, nominal interest rate, and the unemployment risk of regular workers. I consider three models: imperfect insurance with only regular jobs in steady state (RHANK); imperfect insurance with a 12% of flexible jobs in steady state (RHANK-2J); and perfect insurance limit with only regular jobs in steady state (RANK). Proportional deviations represent the percentage deviations of the unemployment risk from the steady-state value.

Figure A4: Monetary policy response and shock persistence.



Notes: The figure shows the impulse response to a productivity shock under a monetary policy rule for the nominal interest for two different values of the persistence of productivity shocks (μ_z): $\mu_z = 0.95$, which is the long-shock, and $\mu_z = 0.55$, which is the short-shock. My baseline specification is the model with imperfect-insurance and 12% of flexible jobs (RHANK-2J). I compared it to two alternative models: (1) the model with perfect-insurance and without flexible jobs (RANK); and (2) the model with imperfect-insurance and without flexible jobs (RHANK).

B Choosing the Priors for the Bayesian Estimation

I assume the following functional forms for preferences over consumption: $u(c) = \ln(c)$ for workers and $\tilde{u} = (c^{1-\tilde{\sigma}})/(1-\tilde{\sigma})$ for capitalists, where the inverse of the intertemporal elasticity of substitution is $\tilde{\sigma} > 0$. I target an economy with 15% flexible jobs, which is a conservative benchmark of the level of contractual flexibility for the euro area and the U.S.[24] Following the empirical analysis of Table A3, I also target an unemployment risk of 4.9% and 6.6% for regular and flexible workers. Consistent with Eurozone data over the years 2006-2018 from the De Nederlandsche Bank (DNB), I target an economy with an annual interest rate of 2% (Euribor - 12 months).[25]

Given these targets, I assign values for the parameters ρ^r, ρ^f, f^r, f^f, and β. I set the job-destruction rate for regular and flexible workers to $\rho^r = 0.25$ and $\rho^f = 0.35$. I also set the job-finding rate for regular and flexible workers at $f^r = 0.65$ and $f^f = 0.16$, respectively. As a result, the probability of losing a regular and flexible job is 8.8% and 29.4% in steady-state, which implies an expected duration of a flexible job of around one year. However, as defined by the targets, the unemployment risks are 4.9% and 6.6% for regular and flexible workers, respectively. The parameter β is set to match an annual interest rate of 2%. Because the implied interest rate is different between models with and without perfect unemployment insurance, I use two different β values to keep the interest rate constant between models.

An important parameter is the constant loss upon unemployment. Bertay et al. (11) estimate that Dutch households experience a labor income decrease of around 10% when they become unemployed. Therefore, I set the constant loss upon unemployment, common between workers, at a conservative value of 90%. This value is quite general; for example, in the U.S., Chodorow-Reich and Karabarbounis (28) estimate a consumption drop between 10% and 20% for households experiencing unemployment.

Without further guidance from Dutch data, I set the rest of the parameters based on

[24] For instance, Katz and Krueger (40) shows that the percentage of workers engaged in alternative work arrangements – defined as temporary help agency workers, on-call workers, contract workers, and independent contractors or freelancers – rose from 10.7 percent in February 2005 to possibly as high as 15.8 percent in late 2015. Although this definition does not include temporary workers and may include jobs that are not "insecure", I set a 15% of flexible jobs as a lower bound for the U.S. but also for Europe.

[25] This will allow me to compare different economies with different shares of flexible jobs as the interest rate would be equivalent among simulations.

Eurozone data. The elasticity of substitution, ι, is set to 6, resulting in a mean markup rate of 20% for wholesale firms. The Calvo price parameter, ω, is set to 0.75, which implies an average duration of individual prices of four quarters, a value well within the range used in Eurozone macro models (29; 35). I set the capitalist home production, Ω, to 0.5, the capitalists' risk aversion, $\tilde{\sigma}$, to 0.283, the wage inertia of regular jobs, ϕ, to 0.948. I set the vacancy cost to 4.5% of the wage of regular workers and 1.5% for flexible jobs (70% lower when compared to regular jobs) (1; 44). Since in the efficient steady state the real wage of regular and flexible workers should be the same, I use the productivity parameter of regular workers, χ^r to match the real wages. Thus, I set $\chi^r = 1.03$ (that is, regular workers are 3% more productive than flexible workers). As is commonly done, I set the elasticity of the matching function to 0.67. Concerning the monetary policy rule, I set the reaction to inflation, π_ϕ, to 1.2, and the interest rule inertia, μ_π to 0.85. Finally, I set the persistence of productivity shocks and cost-push shocks to 0.95.

C Completing the Derivation of the Model

Price setting in a Calvo setting. The expressions for $\tilde{p}_t$, π_t, and Δ_t (as derived by Challe (26)) are given by

$$\tilde{p}_t = \frac{\iota(1-\tau^W)\Xi_t}{(\iota-1)\Sigma_t}, \tag{A25}$$

$$\pi_t = [\omega^{-1} - (\omega^{-1}-1)(\tilde{p})^{1-\iota}]^{\frac{1}{\iota-1}} - 1, \tag{A26}$$

$$\Delta_t = (1-\omega)(\tilde{p})^{-\iota} + \omega(1+\pi_t)^{\iota}\Delta_{t-1}. \tag{A27}$$

with $\Xi_t = \varphi y_t + \omega(1+\pi_{t+1})^{\iota}\,\mathbb{E}_t[MRIS^C_{t+1}\Xi_{t+1}]$ and $\Sigma_t = y_t + \omega(1+\pi_{t+1})^{\iota-1}\,\mathbb{E}_t[MRIS^C_{t+1}\Sigma_{t+1}]$.

Number of Workers: Regular employment, flexible employment, and the number of job searchers evolve, respectively, as

$$n^r_t = \underbrace{f^r_t(1-n_{t-1})}_{\text{Unemployed finding a job}} + \underbrace{(1-\sigma^r_t)n^r_{t-1}}_{\text{regular keeping their job}} + \underbrace{f^r_t\rho^f n^f_{t-1}}_{\text{Flex finding a regular job}}, \tag{A28}$$

$$n^f_t = f^f_t(1-n_{t-1}) + (1-\sigma^f_t)n^f_{t-1} + f^f_t\rho^r n^r_{t-1}, \tag{A29}$$

$$e_t = 1 - (1-\rho^r)n^r_{t-1} - (1-\rho^f)n^f_{t-1}. \tag{A30}$$

Therefore, by combining equations (A28) and (A29), I get the law of motion for total employment

$$n_t = (f_t^r + f_t^f)(1 - n_{t-1}) + (1 - U_t^r)n_{t-1}^r + (1 - U_t^f)n_{t-1}^r. \tag{A31}$$

Wage Setting: The value functions of unemployed workers, regular workers, and flexible workers are

$$V_t^u = u(\delta_t) + \beta\,\mathbb{E}[f_{t+1}^f V_{t+1}^{p,e} + f_{t+1}^f V_{t+1}^{f,e} + (1 - f_{t+1}^r - f_{t+1}^f)V_{t+1}^u], \tag{A32}$$

$$V_t^{r,e} = u(w_t^r) + \beta\,\mathbb{E}[(1 - \sigma_{t+1}^r)V_{t+1}^{r,e} + \rho^r f_{t+1}^f V_{t+1}^{f,e} + U_{t+1}^r V_{t+1}^u], \tag{A33}$$

$$V_t^{f,e} = u(w_t^f) + \beta\,\mathbb{E}[(1 - \sigma_{t+1}^f)V_{t+1}^{f,e} + \rho^f f_{t+1}^r V_{t+1}^{p,e} + U_{t+1}^f V_{t+1}^u]. \tag{A34}$$

Using these expressions and rearranging terms, I have that S_t^r and S_t^f can be written as

$$S_t^r = u(w_t^r) - u(\delta_t) + \beta\,\mathbb{E}[(1 - \sigma_{t+1}^r - f_{t+1}^r)S_{t+1}^r - f_{t+1}^f(1 - \rho^r)S_{t+1}^f], \tag{A35}$$

$$S_t^f = u(w_t^f) - u(\delta_t) + \beta\,\mathbb{E}[(1 - \sigma_{t+1}^f - f_{t+1}^f)S_{t+1}^f - f_{t+1}^r(1 - \rho^f)S_{t+1}^r]. \tag{A36}$$

D Social Welfare Function

To decentralize the efficient allocation, I derive the constrained efficient steady state by maximizing the joint welfare of households and capitalists subject to the initial conditions, the law of motion for inflation and the price dispersion index, and the relationship between employment and vacancies. I write the social welfare function as

$$W_t = U_t + \beta\,\mathbb{E}_t[W_t], \tag{A37}$$

where $U_t = n_t^r u(w_t^r) + n_t^f u(w_t^f) + (1 - n_t)u(\delta_t) + \Lambda\Theta\tilde{u}(C_t^F)$ and Θ is the relative welfare weight of capitalists (26). The efficient allocation is then the solution to

$$W_t(n_{t-1}^r, n_{t-1}^f, \Delta_{t-1}; z_t) = \max_{\{\tilde{p}_t, w_t^r, w_t^f, n_t^r, n_t^f\}} \Big\{U_t + \beta\,\mathbb{E}_t[W_{t+1}(n_t^r, n_t^f, \Delta_t; z_{t+1})]\Big\},$$

subject to

$$\pi_t = [\omega^{-1} - (\omega^{-1} - 1)(\tilde{p})^{1-\iota}]^{\frac{1}{\iota-1}} - 1,$$

$$\Delta_t = (1-\omega)(\tilde{p})^{-\iota} + \omega(1+\pi_t)^{\iota}\Delta_{t-1},$$

$$v_t^r = \left[\frac{n_t^r - (1-\rho^r)n_{t-1}^r}{m^r e_t^\gamma}\right]^{\frac{1}{1-\gamma}},$$

$$v_t^f = \left[\frac{n_t^f - (1-\rho^f)n_{t-1}^f}{m^f e_t^\gamma}\right]^{\frac{1}{1-\gamma}}.$$

In the efficient allocation, the optimal resetting prices needs to be equal to one (no price distortions in steady state), so $\tilde{p}_t = 1$. The former result along with the initial conditions (no distortions) leads to an allocation with zero inflation and symmetric wholesale prices, $(\pi_t, \Delta_t) = (0, 1)$, for all t. Given this and the FOCs, the value of w_t^r and w_t^f satisfies:

$$\frac{u'(w_t^{r,*})}{\tilde{u}'\left(C_t^C\right)} = \frac{u'(w_t^{f,*})}{\tilde{u}'\left(C_t^C\right)}. \tag{A38}$$

Equation (A38) states that the efficient wage w_t^* is that which equates the marginal utilities of regular workers and flexible workers. From the FOCs with respect to n_t^r and n_t^f, I can get the forward recursion for the constrained-efficient job-finding-rate for regular and flexible workers

$$\begin{aligned}(f_t^{s,*})^{\frac{\gamma}{1-\gamma}} =& \left(\frac{(m^s)^{\frac{1}{1-\gamma}}}{\eta^s}\right)(1-\gamma)\left[z_t\chi^s - w_t^* + \frac{u(w_t^*) - u(\delta_t)}{u'(w_t^*)}\right] \\ &+ (1-\rho^s)\,\mathbb{E}_t\left[MRIS_{t+1}^{C,*}(f_{t+1}^{s,*})^{\frac{\gamma}{1-\gamma}}(1-\gamma)f_{t+1}^{s,*}\right].\end{aligned} \tag{A39}$$

I decentralize the efficient allocation in steady state now. First, the efficient allocation has $(\tilde{p}_t, \pi_t, \Delta_t) = (1, 0, 1)$, which eliminates the price dispersion in the wholesale prices. Second, I set $\tau^W = 1/\iota$ to get a $\varphi_t = 1$ and thus correct for monopolistic competition. Third, I set $(\tau^{I,r}, \tau^{I,f}, T)$ in such a way of making the job finding-rate (equation (11)) and the constrained-efficient job finding-rate (equation (A39)) equivalents in steady state. So, I get

$$T = \frac{u(w_t^*) - u(\delta_t)}{u'(w_t^*)}, \tag{A40}$$

$$\tau^{I,r} = 1 - \frac{(1-\gamma)[1-\beta(1-\rho^r)]}{1-\beta(1-\rho^r)(1-\gamma f^{r,*})}, \tag{A41}$$

$$\tau^{I,f} = 1 - \frac{(1-\gamma)[1-\beta(1-\rho^f)]}{1-\beta(1-\rho^f)(1-\gamma f^{f,*})}. \tag{A42}$$

Equation (A40) corrects for the lack of insurance and equations (A41) and (A42) correct for congestion externalities in the labor market.