The conditional Ins and Outs of French Unemployment

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Abstract

In this paper, I investigate the relative contributions of the Ins and Outs of unemployment with empirical and theoretical points of view. A New-Keynesian DSGE model embedding search frictions on the labor market and an endogenous job separation margin is developed. The theoretical framework serves as a basis for the empirical model and allows counterfactual analyses. Then, starting from French data, I estimate a sign restriction VAR and I identify two shocks of quite different nature: a technology supply shock and a monetary demand shock. The empirical framework and the model predict an increase in unemployment during the impact period after the shocks. Nonetheless, the driving forces leading to unemployment changes exhibit two sources of discrepancy. Firstly, the data reveal that the contribution of transition rates in explaining unemployment differ across the two shocks. After a technology shock unemployment fluctuations are mainly explained by the job finding process, while the contributions of the two margins are more balanced for the monetary shock. Secondly, in the case of a technology shock, the theoretical framework is not able to reproduce the underlying mechanisms inducing unemployment. In the model, the contribution of the job separation margin is overestimated and amounts to 65%. In contrast, in the data the same contribution is sharply lower and accounts for 28% of unemployment changes.

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1 Introduction

The influence of worker flows and transition rates in explaining unemployment variations is actively debated. Initiated by Shimer (2012), unconditional decompositions of unemployment rate variance indicate that the job finding rate plays a prevailing role in shaping U.S. unemployment. Based on this evidence, Shimer goes farther and concludes that the job separation margin is acyclical and can be disregarded when one models the labor market (for example, in a matching framework). This view of the origin of unemployment variations challenges an older literature, represented by the pioneer contribution of Blanchard and Diamond (1990). According to them, an increase in unemployment takes place, in a first time with a wave of layoffs, and it remains persistent, in a second time, because the job finding probability declines. Also based on unconditional analyses, Hairault et al. (2015) provide evidences close to those of Shimer for the French economy over the 2004-2010 period.

Evidences provided by unconditional analyses may be inaccurate to characterize unemployment dynamics. Although this kind of exercise remains useful, the unconditional contributions of the Ins and Outs may emerge from different factors, indistinguishable only with worker flow data. Then, unconditional analyses are essentially descriptive measures of the contributions. They do not say how transition rates respond (and so unemployment) to business cycle shocks of different nature. It is possible that the underlying mechanisms leading to unemployment variations are different, depending on the source of the shock. Finally, this literature is mainly empirical and, to the best of my knowledge, no paper studies the theoretical contributions of transition rates in explaining cyclical changes in unemployment. This paper addresses these issues and studies the conditional contributions of transition rate in generating unemployment. Are the origins of unemployment in terms of transition rates the same across shocks of quite different nature? Is a theoretical model able to reproduce the underlying mechanisms inducing unemployment variations? To provide answers to these questions, two points of view are used jointly. The first one is based on a New-Keynesian DSGE model embedding search frictions on the labor market and an endogenous mechanism of job separation. The second one is empirical. Starting from French data, I estimate a structural vector autoregression (VAR, henceforth) in which two different structural shocks are identified: a technology supply shock and a monetary demand shock.

The model economy developed in this paper is largely based on the one proposed by Trigari (2009). However, I adapt her framework to the purpose of my paper. In particular, the model is calibrated to replicate the cyclical properties of the French economy[1]. Hence,

[1] It is noteworthy that the paper focuses exclusively on the French labor market. I believe that this specific labor market, with relatively small level of worker flows, high level of employment protection and generous unemployment insurance, can exhibit particular unemployment driving forces.

the parameters governing the endogenous separation are chosen to match with the empirical volatility of the French job separation rate. Furthermore, I add a technology shock to the model. The model is used for two purposes. Firstly, it allows me to have a solid theoretical foundation for the empirical part of the paper. Secondly, the series of transition rates (job finding rate and job separation rate) generated by the model are finely analyzed. Most prominently, from the benchmark calibration of the model, I analyze the dynamics of the Ins and Outs and their contributions in explaining theoretical unemployment changes.

The impact of structural shocks on unemployment rate is estimated with a VAR containing five important variables of the model: the labor productivity, the inflation rate, the interest rate and the two main transition rates. Along the lines of Uhlig (2005), I disentangle shocks of interest by means of sign restrictions directly imposed to the impulse response functions. This strategy is convenient when shocks of different nature - as it is the case in this paper - have to be identified. However, to be robust the identification of structural shocks needs solid theoretical justifications. Thus, in order to derive solid sign restrictions, I take into account the uncertainty about the parameters of the model by following a strategy similar to Peersman and Straub (2009), Pappa (2009) and Foroni et al. (2015). As a result, the technology shock is identified by imposing the labor productivity and the inflation rate to move in opposite direction. For the monetary demand shock, it is required that the co-movements between inflation and interest rate are negative. A powerful advantage of the sign restriction framework is that I remain agnostic about the response of labor market transition rates.

Empirically, after a positive technology shock, the labor market turnover (captured by the two transition rates) is reduced. Both transition rates decline after the shock. However, the fall in the job finding is stronger leading ultimately to an increase in unemployment during the impact period. In other words, my empirical evidence demonstrates that the co-movement between the labor productivity and the unemployment rate is positive for the French economy. As suggested by Balleer (2012), this empirical finding constitutes a "job finding puzzle" and it is close to the "hours puzzle" stressed by Gali (1999). For the negative monetary demand shock (an increase in the level of the interest rate), while the job separation rate significantly increases, the response of the job finding rate is negative. The combined effects lead to an unambiguous rise in unemployment. Both shocks are followed by an impact increase in unemployment. However, the shape of the responses looks different, the one for unemployment after a technology shock being u-shaped.

Then, from the impulse responses of the empirical and theoretical models, I investigate the relative contributions of the Ins and Outs of unemployment conditionally to both shocks. The results obtained from the data are as follows: after a technology shock, French unemployment is explained mainly by cyclical fluctuations of the job finding process. For the tightening in monetary policy, the influence of the two transition rates in shaping unemployment is balanced. The story told by the theoretical simulations is not necessarily in line with the empirical one, especially for the technology shock. Effectively, conditionally to a technology improvement the model predicts that 65% of unemployment variations are generated by the job separation rate. In the data only 28% of unemployment fluctuations are explained by this margin. On the overall, the exercises conducted in this paper highlight two important facts. On the one hand, the sources of unemployment differ depending on the origin of business cycle shocks. On the other hand, although the theoretical model predicts the good impact responses of unemployment, it does not identify the good unemployment driving forces. For the technology shock, it attributes a too little role to the job finding rate. This theoretical finding is contrary to the empirical exercise provided here but also to previous studies, as the one proposed by Hairault et al. (2015) for France or by Shimer (2012) for the U.S..

My work is related to several recent empirical works which examine the conditional dynamics of transition rates in shaping unemployment. However, it is the only one to propose a theoretical analysis of the contributions of the Ins and Outs. Canova et al. (2013) investigate the Ins and Outs of U.S. unemployment in regard to two technology shocks: a neutral one and an investment-specific one. They come to the conclusion that a neutral technology shock is contractionary and induces an increase in unemployment, due to a sharp rise in the job separation rate. On the contrary, the investment-specific technology shock is expansionary. It induces a fall in unemployment, mainly caused by a decline in the job separation rate. My empirical evidence for the French economy is opposite and the job finding margin appears to be more important than the job separation margin. Focusing on an aggregate shock, Fujita (2011) finds that the role of the job separation margin cannot be ignored, since it is quantitatively equally important than the job finding. Based on a framework close to Fujita (2011), Hairault and Zhutova (2014) pay attention to the French labor market. The result emerging from their conditional analysis is that the outflow process is dominant in generating French unemployment fluctuations. My empirical findings are in lines with theirs and confirm that the job finding is central for understanding French unemployment fluctuations, especially in the case of a technology shock.

The plan of the paper is as follows. Section 2 develops the model economy, its calibration and its business cycle properties. Section 3 discusses the data, the empirical framework and the identification scheme chosen to recover the structural shocks. In the next section, I present the impulse response functions and I study the contribution of transition rates to unemployment variations. Section 5 discusses the results. Finally, section 6 concludes.

2 Theoretical framework

The benchmark model used in this paper is largely based on the one proposed in Trigari (2009). I simplify her model in several aspects and adapt it to my own purpose. In particular, a technology shock is added, forward looking retailers are not taken into account and the model is calibrated to replicate the cyclical properties of the French economy. Thus, the contribution of the paper does not rely on the technical development of the model. Instead, the model serves for the identification of structural shocks and for counterfactual analyses.

2.1 Model

The economy is New-Keynesian in the extent to which prices are sticky and do not adjust instantaneously. As commonly done in this literature, prices adjustment are modeled as suggested by Calvo (1983). The production process is split in two sectors. First, the wholesale firms produce intermediate goods by using labor as sole input. To begin production they must be matched with an unique worker recruited in a frictional labor market. Here, the standard framework of Mortensen and Pissarides (1994) is developed. Second, retailers purchase intermediate goods, transform them in retail goods directly sold to the households on a monopolistic competitive market.

2.1.1 The representative household

The representative household is composed of a continuum of members indexed by i on the unit interval. The members of the household could be either in employment, either in unemployment. In order to avoid fluctuations in consumption due to its position on the labor market, it is assumed, as in Merz (1995) and Andolfatto (1996), that each member pools their income and insures each other. The representative utility function is as follows:

$$E_t \sum_{t=0}^{\infty} \beta^t \left(\ln(c_t - ec_{t-1}) - \kappa_h \frac{h_t^{1+\phi}}{1+\phi} - \chi_t a_t \right) \tag{1}$$

where the parameter e captures habit persistence in consumption c_t. If it is equal to 0, there is no habit persistence. The parameter β is the subjective discount factor. The disutility of supplying hours is represented by the two last members of (1), where κ_h is a scalar parameter, h_t the number of hours worked, ϕ the inverse of the Frisch elasticity and χ_t a binary indicating if the members is employed or unemployed. Finally, a_t is the idiosyncratic i.i.d preference shock used to model the endogenous separation. It is assumed that it follows a log-normal distribution with cumulative distribution function $F(a_t)$. The household maximizes its consumption level c_t and its holding of bonds B_t under the following budget constraint:

$$c_t + \frac{B_t}{p_t r_t^n} = d_t + \frac{B_{t-1}}{p_t} \tag{2}$$

with, d_t a compact term representing all household revenues (wages, unemployment benefits, profits from firm minus government lump-sum tax used to finance unemployment benefit), r_t^n the nominal interest rate and p_t the level of prices. The derivation of the Euler equation is standard.

2.1.2 The labor market

The labor market is frictional, intermediate firms and workers can not match instantaneously. Before production begins, both engage in a costly search process. The number of new job matches during period t is given by the following Cobb-Douglas matching technology:

$$m_t = \varrho u_t^{\alpha} v_t^{1-\alpha}, \text{ with } 0 < \alpha < 1 \tag{3}$$

Here, v_t is the number of job vacancies posted by intermediate firms, u_t is the number of searching workers and α the elasticity of the matching function relative to searchers. The scalar parameter ϱ reflects the efficiency of the matching technology. It is convenient to derive some useful and classical aggregate variables related to the matching framework. Thus, $s_t = \frac{m_t}{u_t}$ is the job finding rate of workers, $q_t = \frac{m_t}{v_t}$ the job filling rate of vacancies and $\theta_t = \frac{v_t}{u_t} = \frac{s_t}{q_t}$ the labor market tightness. If θ_t is above (below) 1, then the labor market is tighten from the firms (workers) side.

There are two sources of job separation in the model. At the beginning of each period, a fraction ψ^x of existing matches is broken for some exogenous reasons. The second source of separation is due to the idiosyncratic shock of disutility a_t. If the realization of the shock is greater than a threshold $\underline{a}_t$, the employment relationship becomes unprofitable for the firm/worker pair and the match is severed. The endogenous job separation probability is $\psi_t^n = Pr(a_t > \underline{a}_t) = 1 - F(a_t)$, implying an overall job separation rate equal to $\psi_t = \psi^x + (1 - \psi^x)\psi_t^n$. Whenever a job separation takes place, there is no production. Given this framework, employment evolves as $n_t = (1 - \psi_t)n_{t-1} + m_{t-1}$, with n_t the level of employment in period t on the labor market. The participation decision is not taken into account and the labor force is normalized to one.

2.1.3 Wage setting and intermediate firms

Let $J_t(a_t)$, V_t, $W_t(a_t)$ and U_t be the present-discounted value of expected income from a filled job, a vacancy, employment and unemployment, respectively. The Bellman equation for a filled job can be written as:

$$J_t(a_t) = x_t f(h_t) - w_t(a_t)h_t + E_t\beta_{t,t+1}(1-\psi_{t+1})\int_0^{a_{t+1}} J_{t+1}(a_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})} \tag{4}$$

where x_t is the relative price of the intermediate good which is equivalent to the real marginal cost, $f(h_t)$ the production function and $w_t(a_t)h_t$ the wage rate. This equation states that for a filled job a firm receives a net return $x_t f(h_t) - w_t(a_t)$ plus the continuation value. In the following period, the match is not discontinued with a probability $1-\psi_{t+1}$ and the firm enjoys the expected value of a job. It is important to note that, with probability ψ_{t+1}, the match is severed and the firm is left with nothing. Analogously, the asset value of a vacancy is:

$$V_t = -\frac{\kappa}{\lambda_t} + E_t\beta_{t,t+1}\left[q_t(1-\psi_{t+1})\int_0^{a_{t+1}} J_{t+1}(a_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})} + (1-q_t)V_{t+1}\right] \tag{5}$$

with κ the vacancy posting cost and λ_t the marginal utility of consumption. Hence, an open vacancy yields a current negative return equal to the utility cost. In the future period, a vacancy is filled (and not destroyed in the same time) with probability $q_t(1-\psi_{t+1})$ and the firm obtains the future value of a job. In contrast, with probability $(1-q_t)$ the vacancy remains unfilled and the firm obtain the future value V_{t+1}.

From the worker side, the logic is similar. The present-discounted value of an employed worker is:

$$W_t(a_t) = w_t(a_t)h_t - \frac{\kappa_h h_t^{1+\phi}}{(1+\phi)\lambda_t} - \frac{a_t}{\lambda_t} + E_t\beta_{t,t+1}\left[(1-\psi_{t+1})\int_0^{a_{t+1}}(W_{t+1}(a_{t+1}) - U_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})} + U_{t+1}\right] \tag{6}$$

This equation indicates that the value of a match yields, for an employed worker, a current net return equal to the wage minus the disutility of supplying work, plus the continuation value due to a possible change in its labor market position. Finally, the present-discounted value of unemployment is:

$$U_t = b + E_t\beta_{t,t+1}\left[s_t(1-\psi_{t+1})\int_0^{a_{t+1}}(W_{t+1}(a_{t+1}) - U_{t+1})\frac{dF(a_{t+1})}{F(\underline{a}_{t+1})} + U_{t+1}\right] \tag{7}$$

The unemployed worker enjoys the net return b from non-labor market activities (unemployment benefit, home production etc.) and expects to find and keep a job with probability $s_t(1-\psi_{t+1})$. In the opposite case, the worker receives the future value of unemployment.

As usual in the matching literature, vacancy posting is governed by the free entry condition. As long as the value of a vacancy is positive, firms open new vacancies. In equilibrium $V_t = 0$ and the vacancy posting condition can be written as:

$$\frac{\kappa}{\lambda_t q_t} = E_t \beta_{t,t+1}(1-\psi_{t+1})\left(x_{t+1} f(h_{t+1}) - w_{t+1} h_{t+1} + \frac{\kappa}{\lambda_{t+1} q_{t+1}}\right) \tag{8}$$

The free entry condition is key and exhibits how a decrease in the expected value of a job may impact the labor market. Note that, in the last equation w_{t+1} is the aggregate wage which can be written as: $w_{t+1} = \int_0^{\underline{a}_{t+1}} w_{t+1}(a_{t+1}) \frac{dF(a_{t+1})}{F(\underline{a}_{t+1})}$.

The matching framework ensures that a job generates some economic surplus. The instrument used to split the surplus is the wage. The last one is derived following the standard Nash bargaining solution which maximizes the weighted product of the workers and firms net value [2]:

$$w_t = \text{argmax}(W_t(a_t) - U_t)^{\eta}(J_t(a_t) - V_t)^{1-\eta} \tag{9}$$

with $0 < \eta < 1$ the relative bargaining power of the worker. It should be noted that U_t and V_t correspond to the labor market outside options of the worker and the firm, respectively. Furthermore, in equilibrium free entry must hold and the value of an open vacancy for the firm is zero. Thus, the individual wage satisfies the following optimality condition:

$$\eta J_t(a_t) = (1-\eta)(W_t(a_t) - U_t) \tag{10}$$

Therefore, using (4)-(7) and the free entry condition we obtain the wage $w_t(a_t)h_t$:

$$w_t(a_t)h_t = \eta\left(x_t z_t h_t + \frac{\kappa}{\lambda_t}\theta_t\right) + (1-\eta)\left(\frac{\kappa_h h_t^{1+\phi}}{(1+\phi)\lambda_t} + \frac{a_t}{\lambda_t} + b\right) \tag{11}$$

The negotiation is not just on wages but also on hours worked. The hours worked chosen by a pair satisfies:

$$x_t z_t = \frac{\kappa_h h_t^{\phi}}{\lambda_t} \tag{12}$$

In the event that a firm and a worker succeed in forming a matched pair and that the job is not separated, production begins and its output is given by the following production function: $f(h_t) = y_t = z_t h_t$. The productivity disturbance z_t follows the autoregressive

[2]With Nash bargaining solution, it is implicitly assumed that wages are renegotiated at each period. Furthermore, a consequence of the Nash bargaining scheme is that wages are closely related to the level of aggregate productivity.

process $\ln(z_t) = \rho_z \ln(z_{t-1}) + \varepsilon_t^z$. Note that, this technology shock does not appear in Trigari (2009).

2.1.4 Retailers and prices adjustment

There is a continuum of retailers indexed by j operating on a monopolistic competitive market. Retailer j produces $y_t(j)$ units of final goods by disaggregating intermediate goods according to the following CES technology:

$$y_t = \left(\int_0^1 y_t(j)^{\frac{\epsilon-1}{\epsilon}} dj \right)^{\frac{\epsilon}{\epsilon-1}} \tag{13}$$

where ϵ is the elasticity of demand for each intermediate good. Retailers sell their final goods directly to the household at the nominal prices $P_t(j)$. They are confronted to the following demand function:

$$y_t(j) = \left(\frac{p_t(j)}{p_t} \right)^{-\epsilon} y_t \tag{14}$$

with $p_t = \left(\int_0^1 p_t(j)^{1-\epsilon} dj \right)^{\frac{1}{1-\epsilon}}$ the aggregate price level. Prices stickiness occurs at this level. In particular, retail firms are not free to adjust their own prices but reset their prices following the scheme proposed by Calvo (1983). Each period only a proportion $1 - \xi$ of retail firms is able to reset the prices. The other proportion ξ is stuck and charges the price prevailing in the previous period. Therefore, retailers choose their prices in order to maximize their expected profit by integrating that they may be stuck with a price during s periods

$$\max E_t \sum_{s=0}^{\infty} \xi^s \beta^s \frac{\lambda_{t+s}}{\lambda_t} \left(\frac{p_t(j)}{p_{t+s}} - x_{t+s} \right) \left(\frac{p_t(j)}{p_{t+s}} \right)^{-\epsilon} y_{t+s} \tag{15}$$

Finally, the evolution of the aggregate price is given by:

$$p_t = \left[(1 - \xi)(p_t^o)^{1-\epsilon} + \xi p_{t-1}^{1-\epsilon} \right]^{\frac{1}{1-\epsilon}} \tag{16}$$

where p_t^o is the optimal price charged by retail firms which can reset the price.

2.1.5 Monetary authority and market clearing

As standard in this literature a Taylor rule formulation is used by the central bank to control the monetary policy. Consecutive to some deviations of output and inflation from their steady state level, the nominal interest rate is adjusted as follows:

$$\frac{r_t^n}{(r^n)^*} = \left(\frac{r_{t-1}^n}{(r^n)^*}\right)^{\rho_m} \left(\frac{\pi_t}{\pi^*}\right)^{\gamma_\pi(1-\rho_m)} \left(\frac{y_t}{y^*}\right)^{\gamma_y(1-\rho_m)} \nu_t \tag{17}$$

where π_t is the inflation rate, ρ_m the degree of interest rate smoothing, γ_y the reaction coefficient to output deviations and γ_π the one for inflation deviations[3]. In (17) ν_t corresponds to the i.i.d monetary shock, it follows an autoregressive process $\ln(\nu_t) = \rho_m \ln(\nu_{t-1}) + \varepsilon_t^m$..

The market clearing is achieved by imposing that all output is consumed and therefore $y_t = c_t$. Finally, output in the retail sector is given by: $y_t = n_t(1 - \psi_t)h_t$. The dynamics of the model is then approximated by log-linearizing the equilibrium conditions around the deterministic steady state with no inflation.

2.2 A French calibration

The model economy is calibrated in order to replicate the structural features of the French economy. Time length is quarterly. As commonly done in the DSGE literature, the quarterly discount factor rate β is set to 0,99. I follow Le Barbanchon et al. (2011) by assuming that the parameter governing the degree of habit persistence e is equal to 0,7. For the probability that firms cannot reset their prices, I select the value of 0,9. This value is slightly higher than the one proposed in Christoffel et al. (2009) or Trigari (2009) but it is in line with Le Barbanchon et al. (2011). Microeconomics and macroeconomics estimates do not converge and there is a debate on how to calibrate the inverse of the intertemporal elasticity of substitution of leisure. Consistently with Trigari (2009), I set ϕ equal to 10 which implies a low elasticity of intertemporal substitution. I choose the conventional value of 10% for the price markup implying an elasticity of demand $\epsilon = 11$.

Let me now turn to the calibration of labor market parameters and steady states. The steady state values of worker transition rates are based on the average empirical estimates of Hairault et al. (2015). Therefore, the quarterly job finding rate s^* is set to 0,226 and the quarterly job separation ψ^* rate to 0,036. These two values imply a steady state unemployment rate of 0,136. It is difficult to have solid empirical evidences about the proportion of endogenous separations. Following den Haan et al. (2000) and Zanetti (2011), I assume that one third of separations is endogenous. The mean of the log-normal distribution of the idiosyncratic shock is normalized to 0. It is not possible to find an empirical counterpart for the calibration of the standard deviation of the log-normal distribution of $\underline{a}_t$. To do so, this standard deviation is chosen such that the theoretical volatility of the overall job sepa-

[3] The superscript * denotes steady state value.

	Variable	Data	Benchmark model
	Standard Deviations		
y_t	Real GDP	0,0096	0,0071
z_t	Productivity	0,0066	0,0078
u_t	Unemployment	0,0560	0,0464
s_t	JFR	0,0391	0,0430
ψ_t	JSR	0,0563	0,0669
v_t	Vacancies	0,0558	0,0786
	Autocorrelations		
y_t	Real GDP	0,887	0,895
z_t	Productivity	0,827	0,843
u_t	Unemployment	0,915	0,902
ψ_t	JFR	0,533	0,553
s_t	JSR	0,574	0,471
v_t	Vacancies	0,803	0,418
	Cross Correlations		
ρ_{y_t,z_t}	Real GDP, Productivity	0,775	0,606
ρ_{y_t,u_t}	Real GDP, Unemployment	-0,847	-0,402
ρ_{y_t,s_t}	Real GDP, JFR	0,661	0,472
ρ_{y_t,ψ_t}	Real GDP, JSR	-0,381	-0,292
ρ_{y_t,v_t}	Real GDP, Vacancies	0,8055	0,336
ρ_{u_t,v_t}	Unemployment, Vacancies	-0,603	-0,11

Table 1: Second moment properties

Sources: For transition rates and unemployment Hairault et al. (2015), for Real GDP and Vacancies French National Institute of Statistic and Economic Studies. Both simulated and observed time series are logged and HP filtered with a smoothing parameter equal to 1600. Simulated figures are computed from a sample of 200 observations.

Notes: JFR corresponds to Job Finding Rate, JSR corresponds to Job Separation Rate.

ration match, as close as possible, the empirical volatility of the job separation rate. As a consequence, in the benchmark it is set to 0,45. This set of value implies a threshold $\underline{a}$ of 2,76. There is little evidence about the quarterly job filling rate on the French labor market. Here, I follow Christoffel et al. (2009) who calibrate this steady state to the Euro area by fixing q^* to 0,7. Burda and Wyplosz (1994) find that the elasticity of the matching function with respect to unemployment is equal to 0,7 in France. In their survey, Petrongolo and Pissarides (2001) conclude that a plausible value for this elasticity is between 0,5 and 0,7. I target α to 0,55 which is close to the lower bound suggested by the latter interval. Finally, the bargaining power is set to 0,5, a standard value in this literature.

Concerning the Taylor rule parameters, ρ_m the degree of interest rate smoothing is fixed at 0,85, γ_π the interest rate response to inflation is set to 1,5 while γ_y the interest rate response to output is set to 0,5.

Finally, I calibrate the two stochastic shocks of the model. The standard deviation of the productivity disturbance is set in order to reproduce the empirical volatility of French real GDP. After taking log and HP filtered the observed time series of output for the French economy, I fix σ_t^z the standard deviations of the productivity shocks to 0,00964. The serial correlation of the productivity shock is also based on this approximation and it is set to 0,9. Concerning the monetary shock, the evidences are less clear. For this reason, I follow a standard practice of the New-Keynesian literature by fixing the standard deviation of monetary shock to 0,001 and its first order autocorrelation to 0,85.

2.3 Business cycle properties

This subsection discusses the ability of the model to match French data characteristics. The table 1 compares the standard deviations, the autocorrelations, and some cross correlations of main labor market variables and output simulated by the model to those obtained from the data. Both observed and simulated time series are logged and HP filtered with a standard smoothing parameter equal to 1600 before computations. On the overall, the artificial time series mimic the behavior of empirical data fairly well. The theoretical volatility of unemployment, job finding rate, job separation rate, vacancies, output and labor productivity are very close to their empirical counterparts. In a seminal contribution, Shimer (2005) shows that a RBC setup embedding a frictional labor market is unable to replicate empirical moments. In particular, he highlights that artificial labor market data are 10 less volatile than in the data. Furthermore, he points out that the model does not exhibit internal propagation mechanism mainly because labor market outcomes, especially real wages, are too related with labor productivity. In the context of the model used in this paper and calibrated on French data, the so-called "Shimer puzzle" does not apply. As argued by Fujita and Ramey (2012) the introduction of a non-constant job separation margin in the matching framework may improve the ability of the model to reproduce labor market behavior.

As regard to the persistence generated by the model, the serial correlations are very close to their empirical counterparts except for vacancies. Finally, with respect to comovements generated between labor market aggregates and output, the model has some good properties, even though the degree of correlations appears to be lower. As expected, the unemployment rate and the job separation rate are counter-cyclical while the job finding rate is pro-cyclical. The cross correlation between unemployment and vacancies is negative suggesting that the model features a negative Beveridge curve. On the overall, the model appears to be a good benchmark for studying French labor market dynamics over the business cycles.

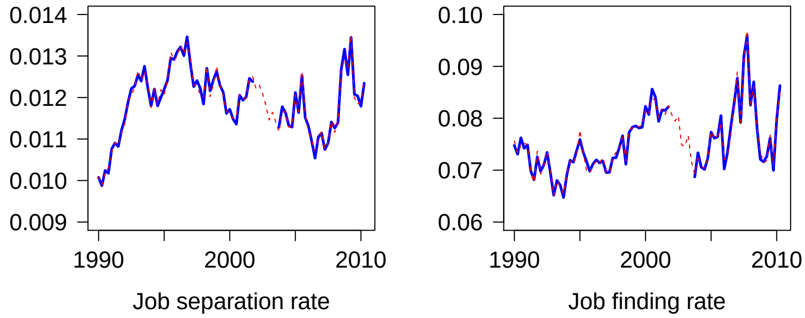

Figure 1: Comparison between the initial series of transition rates (solid blue lines) with the series obtained by TRAMO (dashed red lines).
Sources: Hairault et al. (2015), author's calculations.

3 Empirical methology

This section presents the empirical framework used in this paper. The data is first discussed and then the VAR econometric strategy. In particular, I identify structural economic shocks by means of sign restrictions as suggested by Uhlig (2005). Since this framework needs solid theoretical foundations, the model developed in the previous section will be useful for the identification.

3.1 Data

My benchmark specification contains five endogenous variables included in the vector $X_t = (\Delta z_t, \Delta\pi_t, r_t^n, \psi_t, s_t)'$, where Δ is the difference operator. All these variables are in logarithm. The labor productivity z_t is defined as output per employee[4]. The inflation rate $\Delta\pi_t$ is calculated from the Consumer Price Index (CPI) provided by the Federal Reserve Bank of St. Louis. The interest rate is based on a 3-month interbank interest rate also available on the FRED database[5]. The labor productivity and the interest rate are used to recover the two structural economic shocks that I aim to recover. I introduce the inflation rate in order to have a solid identification of the monetary shock because the interaction between them are well known in the literature.

The job separation rate ψ_t and the job finding rate s_t are taken from Hairault et al.

[4]In the literature, labor productivity is defined as output per hour. However, I do not have series of hours at quarterly frequencies. Eurostat provides an index of labor productivity based on quarterly output per hours. To check the robustness of my results (not shown in the paper), I re-estimate the VAR model with this data. The results are nearly the same.

[5]Both the index of CPI and the interest rate are freely available on the website of the Federal Reserve Bank of St. Louis.

	Variable	Range
e	Degree of habit persistence	[0,1 ; 0,9]
ϕ	Inverse of Frisch elasticity	[1 ; 10]
γ_π	Reaction of interest rate to inflation	[1,1 ; 2,5]
γ_π	Reaction of interest rate to output	[0 ; 1]
ξ	Probability of price stickiness	[0,6 ; 0,95]
α	Elasticity of matching function	[0,5 ; 0,7]
κ_h	Scalar of disutility	[0,1 ; 0,95]
η	Bargaining power of firms	[0,2 ; 0,9]
ρ_m	Persistence of monetary shock	[0,65 ; 0,9]
ρ_z	Persistence of technology shock	[0,6 ; 0,95]

Table 2: Ranges of varying parameters

(2015)[6]. These transition rates are calculated from the retrospective calendar of the French Labour Force Survey (FLFS). In this calendar, each individual interviewed for the first time recall his/her labor market status during the last twelve months. This measure of French labor market flows provides relatively long series since the retrospective calendar is available since 1990. However, due to the redesign of the FLFS in 2003 and to misclassification errors [7], the worker flows for the years 2003 and 2004 could not be calculated. For my purpose, this lack of observation is problematic because the VAR cannot be estimated with this kind of blank. To address this issue I fill the gap by estimating automatically via the TRAMO procedure the ARIMA model relied on each time series[8]. Then, the missing value are imputed using the estimations. Figure 1 compares the initial data and the series estimated by the TRAMO process. The estimated series track very well the initial data and discrepancies between them are negligible. Thus, I consider that data obtained for the years 2003 and 2004 with the estimated model are also close to the unknown initial data. The transition rates used in this analysis are corrected for temporal aggregation bias and for recall errors[9]. Notice that the transition rates are simply quarterly averages of monthly data.

Finally, the VAR is estimated with quarterly series over the period 1990:I-2010:III avoiding the problem of the zero lower bound of interest rate[10].

3.2 Bayesian VAR framework: implementing sign restriction

The analysis of this paper is based on a structural VAR identified with sign restrictions along the lines of Uhlig (2005). Let $A(L)X_t = \nu_t$ be the VAR representation of the process[11]. Under the stability assumption, the Wold theorem implies that the VAR can be expressed as an infinite Vector Moving Average $VMA(\infty)$: $X_t = A(L)^{-1}\nu_t = C(L)\nu_t$, with $C(L)$ a matrix of polynomials in the lag operator L. In the literature, there is a consensus about the estimation of a VAR and Ordinary Least Squares are largely used. However, disagreements appear when structural shocks have to be recovered. Indeed, the residual terms ν_t of the reduced form has no reason to be uncorrelated implying that its variance-covariance matrix Σ has also no reason to be diagonal. This is problematic, since one is generally interested in the interpretation of the responses of a set of variables to one shock affecting the system independently of its interactions with other disturbances. The purpose is to find a mapping that allows to retrieve meaningful structural (economic) shocks from the reduced form shocks. The reduced form disturbance ν_t and the structural disturbances ϑ_t are related by $\nu_t = D\vartheta_t$. Where the latter are mutually independent with a variance normalized to 1 and so $E(\vartheta_t\vartheta_t^{'}) = I$. In general, to achieve the identification of structural disturbances, the matrix D is computed, such that: $\Sigma = E(\nu_t\nu_t^{'}) = DE(\vartheta_t\vartheta_t^{'})D^{'} = DD^{'}$, where D is the Cholesky factor of Σ. Here, to find the matrix D, I follow Uhlig (2005) by noting that a candidate for the decomposition of Σ can also be $\Sigma = \tilde{D}\tilde{D}^{'}$, where $\tilde{D} = DQ^{'}$ and Q denotes some orthogonal matrix. Both D and $\tilde{D}$ provide a candidate for the decomposition of Σ $\left(\Sigma = \tilde{D}\tilde{D}^{'} = (DQ^{'})(QD^{'}) = DID^{'} = DD'\right)$. The matrix Q is also called a rotation matrix because it allows to rotate the initial Cholesky decomposition while maintaining the desired property of non-correlated shocks. Thus, I have to choose Q to retrieve the five meaningful shocks that I aim to estimate. Nonetheless, the matrix Q which allows to fully characterize the model is not unique and it is necessary to examine a large number of candidates.

In order to take into account the uncertainty about the multiplicity of Q and the uncertainty about the VAR parameters, I proceed in a Bayesian framework. The general procedure is as follows:

1. I perform a Bayesian estimation of $A(L)$ and Σ by imposing a prior and a posterior to belong to the Normal-Wishart family

[6]I thank Hairault et al. (2015) for making the data available.

[7]Before 2003, the survey was annual. Since 2003, the survey is quarterly.

[8]The method used is based on the TRAMO (Time series Regression with ARIMA noise, Missing values, and Outliers).

[9]Hairault et al. (2015) use an original framework for the correction of recall errors.

[10]The choice of the period is restricted by the availability of transition rate series

[11]With L the lag operator, A the coefficient matrix and ν_t the $(n, 1)$ matrix of residuals.

2. From the posterior distribution, I take n number of draws of $A(\hat{L})$ and $\hat{\Sigma}$. For each of these draws I evaluate m rotation matrix Q
3. For each joint draw I construct the impulse responses functions and I check if the sign restrictions are satisfied. If all the imposed conditions are met I save the draw. However, if one or more of the sign restrictions are not satisfied I discard the pair and it receives zero prior weight.

The inference is based on the median response together with the 16th and 84th percentile confidence intervals. In the baseline model, I fix n and m to 5 000 and 25 millions of candidates are examined.

3.3 Identification justification

To recover the shocks of interest, I impose sign restrictions directly on the impulse response functions. Comparatively to the traditional identification schemes which employ short-run or long-run neutrality restrictions, the sign restriction approach offers a more flexible framework. For instance, when shocks of different nature have to be identified, it is not easy to justify them jointly with the traditional approach. Nonetheless, the sign restriction approach needs solid theoretical support.

For the purpose of this paper, I base the isolation of structural shocks on the theoretical model developed in the previous section. More specifically, to derive robust sign restrictions, I depart from my benchmark calibration and I assume that some key parameters of the model are uniformly and independently distributed over a selected range. Table 2 gives the range chosen for varying parameters[12]. I then randomly draw 1000 sets of parameters. For each of them I run the model and I compute the impact responses of the theoretical variables. The entire distributions of the impact responses of key variables are displayed. Their shapes serve as a guide for the identification[13]. This strategy has been already used by Peersman and Straub (2009), Pappa (2009) and Foroni et al. (2015) (among other).

3.3.1 Technology shock

Since Gali (1999), the identification of a technology shock in an empirical VAR and its implications on the labor market outcomes are actively debated. By means of traditional long-run restrictions *à la* Blanchard and Quah (1989), he finds that a positive technology

[12] The admissible range of each parameter is based on a survey of the theoretical and empirical literature.

[13] It should be noted that in this subsection I focus on the two shocks of interest. In appendix A, I present the so-called "multiple shock" problem of the sign restriction framework and the identification of the other shocks of the VAR.

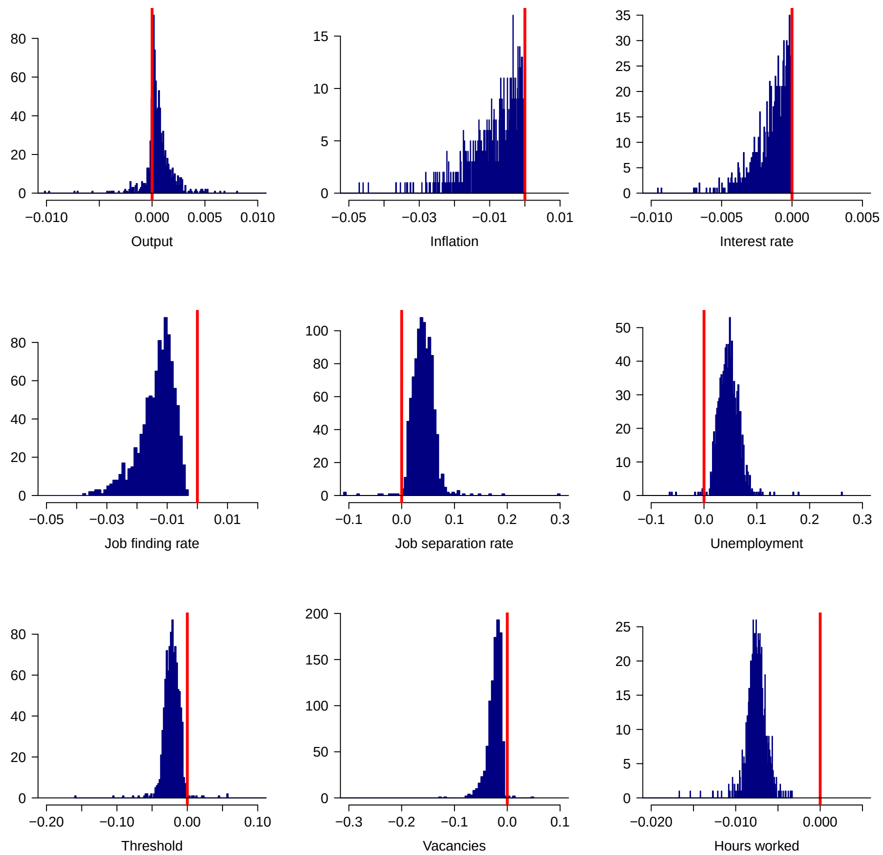

Figure 2: Distribution of theoretical impulse response to a technology shock.
Sources: Author's calculations.

improvement induces a fall in hours worked. Canova et al. (2013) and Balleer (2012)[14] adopt the same identification scheme within a Bayesian framework. In particular, they assess the impact of technology shocks on the U.S. labor market flows. The conclusions of these two works reiterate the Gali's puzzle and empirically show that (neutral) technological innovations are contractionnary for the labor market and increase unemployment. Dedola and Neri (2007) test the sensitivity of these conclusions and estimate structural VAR with sign restrictions. In such framework, they find that hours worked increase after a technology shock.

Figure 2 displays the distributions of the impact responses obtained from 1000 simulations of the model of the previous section. In a New-Keynesian economy, firms are not able to set their own prices at each period. They will take advantage of the technology improvement

[14]These two works identify two technology shocks: a neutral one and an investment-specific one. The neutral technology shock corresponds to a perturbation that impact the level of productivity, whereas, the investment-specific technology shock refers to a perturbation which affects the relative price of investment goods. Due to data limitations, I abstract from the possibility of investment specific technology to focus on the shock which changes the level of productivity, i.e. the neutral technology shocks. I use the generic term "technology shock" to refer to neutral technology shock.

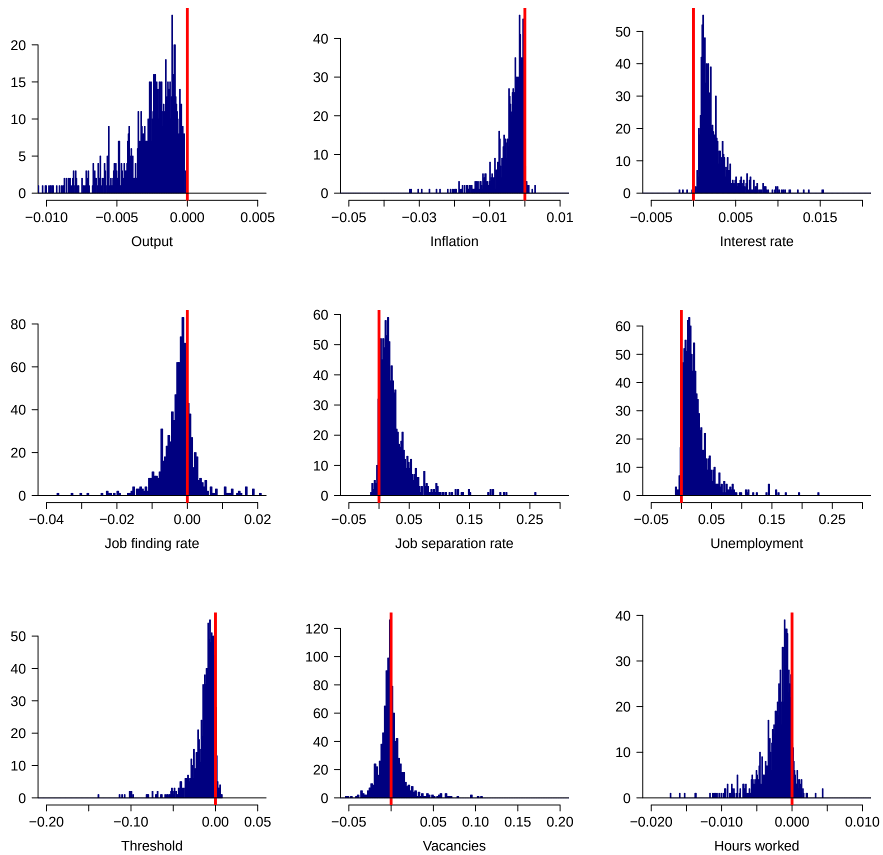

Figure 3: Distribution of theoretical impulse response to a monetary shock.
Sources: Author's calculations.

by reducing demand of labor. In the model, employment adjustment may occur at both margins. Thus, firms open fewer vacancies and the job finding rate decreases. Moreover, as hours, the real marginal cost and labor market tightness fall, the threshold at which a job match is severed diminishes. A direct consequence is the surge of the overall level of job separation. In the model unemployment unambiguously increases. Thomas (2011) shows that the incorporation of labor market frictions *à la* Mortensen and Pissarides (1994) in a New-Keynesian model is key to explain the sluggish response of inflation empirically observed. As shown in the figure, the responses of interest rate and inflation are negative whatever the specification of the parameters. Consequently, to isolate the technology improvement I choose a mix approach. I give up the long run sign restriction on the labor productivity for a shorter restriction. In particular, I restrict the response of labor productivity to be positive during 4 quarters. Otherwise, the responses of the inflation rate and interest rate are negatively restricted in the impact period. As mentioned previously, I remain agnostic about the response of unemployment. Specifically, I keep free the responses of transition

	Δy_t	$\Delta \pi_t$	r_t	λ_t^{EU}	λ_t^{UE}
Technology shock	+4	-1	-1	–	–
Monetary shock	–	-4	+1	–	–

Table 3: Sign restrictions imposed to the impulse responses

Notes: + for $\geq$ 0, - for $\leq$ 0, – for unrestricted, numbers next to the signs indicate the horizon of the restriction.

rates.

3.3.2 Monetary shock

In the New-Keynesian literature, the responses of the economy to a monetary shock are less controversial. Figure 3 presents the distributions of the impact responses in this case. As is standard, an increase in the interest rate acts as a negative demand shock. It decreases inflation and output. These results are insensitive to the parameter range. On the labor market, the distributions of the job finding rate and vacancies appear to be more sensitive to the set of parameters. However, as the threshold of endogenous separations is sharply negative, the response of unemployment is positive. The reader should note that in my favorite calibration (subsection 2.2) both the job finding rate and vacancy posting decrease. This indicates that the fall in profits induces firms to post fewer vacancies leading to higher unemployment. In this context, the fall in expected profit also decreases the threshold of endogenous separations.

To uniquely identify the negative monetary shock, I impose the interest rate to be positive one period after the shock and I force the response of inflation to be not positive during 4 quarters.

4 Results

In this section, I focus on the conditional Ins and Outs of French unemployment[15]. In a first time, I present the empirical responses of labor market variables to the two aggregate shocks. Then, in order to evaluate the relative contributions of transition rates to unemployment fluctuations, I adopt two illustrative methods. On the one hand, I analyze the path of impulse response functions of unemployment if one of the transition rates is maintained to

[15] Fujita (2011) and Hairault et al. (2015) study the relative contribution of transition rates conditionally to a generic aggregate shock identified by a SVAR with sign restrictions. Canova et al. (2013) also address this issue but focus on neutral and investment specific technology shocks. However, these papers focus on an empirical analysis of unemployment variations.

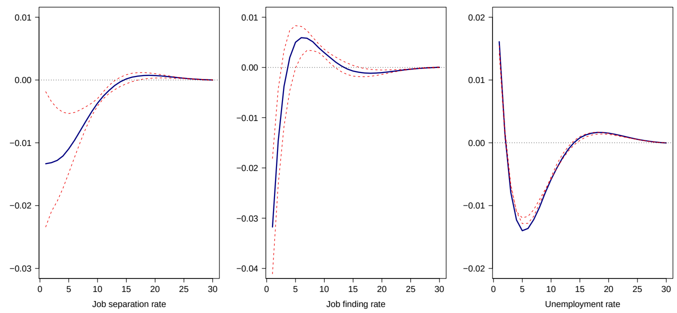

Figure 4: Impulse response functions to a one-standard deviation technology shock.
Sources: Author's calculation
Notes: Solid blue lines represent the median impulses responses. Dashed lines correspond to the 64% of the posterior distribution.

its steady state value. On the other hand, along the lines of Elsby et al. (2013), I compute "beta values" from the simulated series of transition rates.

4.1 Empirical impule responses

Figures 4 and 5, respectively display the impulse response functions conditional to technology and monetary shocks of the baseline structural VAR identified with the set of sign restrictions of table 3.

Following a technology shock (see figure 4), the labor market turnover, approximated by the sum of the two transition rates, is reduced. Indeed, on the French labor market, a positive technology shock implies an immediate fall in the job finding rate of about 3% relative to its steady-state equilibrium. This fall in the job finding takes between 4 or 5 quarters to regain its steady state level. As Balleer (2012) and Canova et al. (2013) among others, I find a negative co-movement between the job finding rate and the labor productivity. As argued by Balleer (2012), the path followed by the job finding rate after a technology improvement constitutes a "job finding puzzle" similar to the well-known "hours puzzle" of Gali (1999)[16]. However, the dynamics of the job separation rate is different from them, since its response is less strong and more persistent. The concomitant decrease in the job finding rate and the job separation rate leads to a positive rise in unemployment in the first period after the impact.

[16]In order to give a theoretical explanation to this phenomenon, she deviates from the New-Keynesian framework by arguing that the technology shock identified is positively biased towards new skilled. In a model with two types of workers, the skilled and the unskilled, a positive technology shock biased in favor of skilled increases their productivity. The job finding rate of the skilled workers will increase whereas the one of the unskilled is pushed down. If the latter effect is higher than the former, the overall job finding decreases, and therefore, the unemployment rises. For more details see Balleer and van Rens (2012).

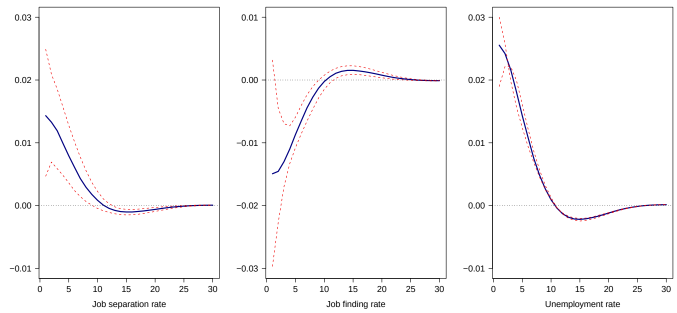

Figure 5: Impulse response functions to a one-standard deviation monetary shock.
Sources: Author's calculation
Notes: Solid blue lines represent the median impulses responses. Dashed lines correspond to the 64% of the posterior distribution.

However, the response of unemployment is u-shaped and takes between 3 or 4 quarters to become negative before it reaches definitively its steady state. On French data, the initial co-movement between the labor productivity and unemployment is positive and a rise in productivity pushes up the unemployment rate[17].

Figure 5 shows the impulse responses to a monetary policy shock. After the monetary policy contraction, the job separation rate significantly increases. This raise in the separation rate is relatively persistent since it takes approximately 8 quarters to go back to its steady state value. In contrast to the technology shock both margins do not react significantly. Thus, the response of the job finding rate is indistinguishable from 0 in the impact period. However after 2 or 3 quarters, it becomes significantly negative but its magnitude is slightly lower compared to what it is for the job separation rate. As a consequence of these cyclical behaviors of worker flows, the tightening in monetary policy causes a significant and relatively persistent raise in unemployment with a peak in the impact. The empirical path followed by unemployment after a tightening in monetary policy is very close to its theoretical counterpart (see also figure 6).

4.2 Hypothetical impulse responses

To shed light on the relative contributions of labor market flows in shaping unemployment I conduct the same exercise as in Fujita (2011). The starting point of the analysis is the impulse responses. More specifically, I fix one of the responses of transition rates to its steady state level, and I trace the hypothetical behavior of the steady state unemployment.

[17]The finding about the negative comovement between the labor productivity and the unemployment rate is a striking feature of French data. With a standard SVAR (including labor productivity and the two transition rates) identified with long run restrictions *à la* Blanchard and Quah (1989) I find the same relationship (not presented here).

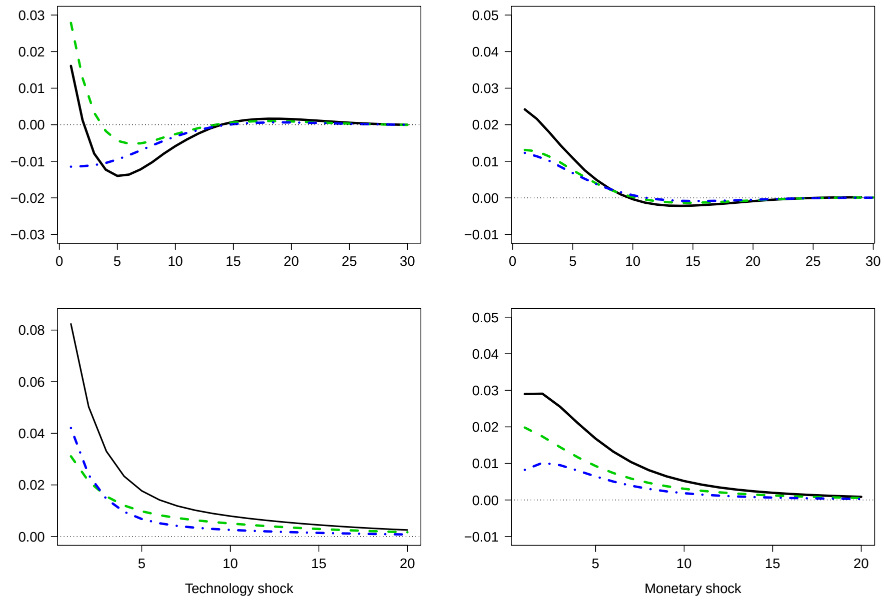

Figure 6: Contribution analysis from the impulse response functions.
Sources: Author's calculation
Notes: The first row corresponds to the impulse responses of the empirical model, the second row to impulse responses of the theoretical model. Black solid lines are the median impulse responses of steady state unemployment when both transition rates fluctuate. The blue "dot-dashed" lines refer to the median response of steady state unemployment when the job finding rate is set to its steady state value. The green dashed lines refer to the median response of steady state unemployment when the job separation rate is set to its steady state value.

The results are displayed in figure 6. The first row represents empirical paths whereas the second row reports theoretical paths. In each panel, the black solid line corresponds to the median response of steady state unemployment. The blue "dot-dashed" line refers to the path of unemployment if the job finding is voluntary fixed to its steady state value. This impulse response allows to shed light on how the job separation contributes to unemployment fluctuations. Finally, the green dashed line repeats the exercise by maintaining - this time - the job separation to its baseline steady state value. Therefore, the contribution of the job finding rate to unemployment fluctuations is evaluated.

The cyclical behavior of unemployment consecutive to a technology improvement is varying an depends on what transition rate is fixed. The dynamic response of unemployment is not retrieved when only the job separation fluctuates. However, when only the job finding rate varies the qualitative response of unemployment is entirely preserved. Note that the rise in unemployment is even greater than in the benchmark. This indicates that the job separation has a dampening role in the increase of unemployment. For a tightening in monetary policy, the message of the exercise looks different. The qualitative patterns of unemployment are the same in both cases and the two margins seem to contribute roughly equally to unemployment changes.

The theoretical analysis is not in line with the empirical one. Firstly, the responses of unemployment are more persistent in the model compared to those predicted by the data. Secondly, in the theoretical model the qualitative paths followed by unemployment are not sensitive to which transition rate is fixed. Concerning the contribution of transition rates in generating unemployment, the model does not reproduce well the underlying mechanisms leading to unemployment. For the monetary demand shock, the theoretical impulse responses suggest that the job finding has a slight dominant influence in explaining unemployment. However, the most important discrepancy between the model and the data concerns the contribution of the job finding rate in generating unemployment after a technology shock. Thus, the contributions of the two margins appear to be balanced in the model, while the empirical model suggests that the contribution of the job finding is largely prevailing. If the impact increase in unemployment following the two shocks is shared by the model and the empirical VAR, the underlying mechanism inducing unemployment fluctuations are not necessary in accordance, especially for the technology supply shock.

This illustrative approach gives some qualitative elements to shed light on the relative contribution of transition rates to unemployment variations. However, since the origin of unemployment varies across shocks, a more quantitative illustration of contributions may be more informative. In the next subsection, I quantify concretely the contributions of the job finding rate and the job separation rate to unemployment fluctuations.

4.3 Decomposing unemployment fluctuations

As in an unconditional analysis, it is conceivable to decompose unemployment fluctuations in contributions attributable to inflows and outflows. Again, the starting point of the exercise is the impulse response functions. For each shock, from the impulse responses I deduce two series of job separation rate and job finding rate. With these two hypothetical series in hand, I deduce the value of the steady state unemployment rate. Then, following Elsby et al. (2013), I decompose unemployment variations with a logarithm differentiation of u_t^*[18] :

$$\Delta \ln u_t^* \approx ((1 - u_t^*)(\Delta \ln(\psi_t) - \Delta \ln(s_t)) \tag{18}$$

[18]Hairault et al. (2015) argue that the steady state unemployment is a good approximation. In their application, the results are not affected by this assumption.

	Technology shock		Monetary shock	
	β^{EU}	β^{UE}	β^{EU}	β^{UE}
Empirical decomposition of $\ln u_t^*$	0,28	0,72	0,48	0,52
Theoretical decomposition of $\ln u_t^*$	0,65	0,35	0,43	0,57

Table 4: Unemployment decomposition conditionally to a technology and monetary shocks.
Sources: Author's calculation
Notes: "Betas" are defined as the contribution of changes in transition rates to the variance of steady state unemployment.

As emphasized by Fujita and Ramey (2009), equation (18) can lead to an exact decomposition of variance of $\ln u_t^*$, and so I compute "beta value" as:

$$\beta^k = \frac{cov(\Delta \ln u_t^*, k_t)}{var(\Delta \ln u_t^*)} \text{ with } k \in \{\psi, s\} \tag{19}$$

These "beta values" can be interpreted as the proportion of steady state unemployment u_t^* generated by the transition considered.

The table 4 reports the estimations for the relative contributions of the job separation and the job finding in generating conditional unemployment rate variance. Two sources of discrepancy stand out. The first one concerns the contribution of transition rates among shocks. The job finding is at the origin of 72% of cyclical changes in unemployment for the empirical technology shock against 52% for the empirical monetary shock. The second one corresponds to the divergent message delivered by the theoretical and the empirical models. Concerning the monetary demand shock, the contributions computed from the model are close to those computed from the data. Even if the contribution of the job finding is slightly higher, both transition rates generate an important share of unemployment fluctuations. As regard to the technology shock, the conditional Ins and Outs are not the same. Theoretically, the job separation rate accounts for 65% of unemployment rate variance. Empirically, its contribution is sharply lower since it amounts to 28%. In this case, the model is not able to reproduce the important role of the job finding.

5 Discussion

5.1 The empirical role of the job finding

The two exercises conducted in the last section are hypothetical scenarios. However, they illustrate important stylized facts on French unemployment dynamics. Firstly, the origin of unemployment is varying with the type of the economic shock. This plurality of mechanisms should be kept in mind to understand French unemployment fluctuations. In this respect, detecting the origin of economic fluctuations becomes an important issue, especially to reduce the raise in unemployment during periods of recession. Secondly, even if the two transition rates are important, it appears that the dominant role of the job finding in explaining unemployment is a striking feature of the French labor market. My finding reinforces the result provided by previous unconditional analyses. Hairault et al. (2015) demonstrate that - during the 2004-2010 period - the job finding rate explained 60% of unemployment changes. Furthermore, Hairault and Zhutova (2014) use conditional analysis and study the Ins and Outs of French unemployment for three shocks: an aggregate shock, a job-specific shock and a search job. The job-specific leads to unemployment variations which are due to a balanced contribution of the two margins. For the other two shocks, changes in unemployment are dictated mainly by changes in the job finding process. Both the unconditional analysis and the conditional analysis converge to the same result: none of the transition rates can be neglected, but the job finding remains, on the overall, more important.

5.2 Explaining the important theoretical role of the separation margin

In the case of a technology shock, the model attributes a larger role to the job separation margin. On the overall and as described in table 1, the model captures the cyclical properties of the data fairly well. It appears fundamental to describe which mechanism operates when a technology innovation hits the economy.

An unexpected raise in labor productivity in the presence of price stickiness induces firms to cut-off production. As they are not able to lower their prices, they will take advantage of the technology improvement by adjusting the employment level. To have more insight on which channel prevails, the following equation describes the loglinear version of the threshold:

$$\hat{\underline{a}}_t = \frac{\phi}{1+\phi}\frac{x^* h^* \lambda^*}{\underline{a}^*}\left(\hat{x}_t + \hat{h}_t\right) + \frac{\kappa(\alpha - \eta s^*)}{(1-\eta)\underline{a}^* q^*}\hat{\theta}_t + \left(1 - \frac{\kappa(1-\eta s^*)}{(1-\eta)\underline{a}^* q^*}\right)\hat{\lambda}_t \tag{20}$$

where, “hat” denotes a log deviation from steady state. The latter equation indicates that, for a constant marginal utility of consumption $\hat{\lambda}_t$, $\hat{\underline{a}}_t$ varies in the same direction of the marginal cost $\hat{x}_t$, the hours worked $\hat{h}_t$ and the labor market tightness $\hat{\theta}_t$. Consecutive to a technology shock, fewer inputs are used for production and hours worked decrease. As a consequence, the marginal cost of retailers also decreases[19]. Furthermore, firms have an

[19] The loglinear version of marginal cost equation being $\hat{x}_t = \phi \hat{h}_t - \hat{\lambda}_t$.

incentive to post fewer vacancies leading ultimately to a fall in the job finding rate and in labor market tightness. When this three channels are combined, the threshold value at which a job match is endogenously severed unambiguously decreases. All else being equal, more jobs are destroyed, the overall job separation is pushed up and the pool of searching workers increases. It should be noted that the increase in unemployment is due to higher separations and lower job finding probabilities[20]. The theoretical contributions calculated previously suggest that the former effect dominates over the latter.

6 Conclusion

In this paper, I have studied the responses of French labor market transition rates consecutive to two aggregate economic shocks. In particular, along the lines of Trigari (2009), I calibrate a New-Keynesian model incorporating labor market frictions and an endogenous job separation margin. The main interest of the model simulation is the identification of empirical structural shocks and the application of counterfactual analyses. I then estimate a VAR including the labor productivity, the inflation rate, the interest rate, the job separation rate and the job finding rate. To isolate structural meaningful economic shocks, I adopt the strategy of Uhlig (2005) by imposing sign restrictions directly on the impulse response functions.

The empirical technology shock induces a fall in both margins. The combined effects lead to a positive raise in unemployment in the short run. The aggregate monetary shock appears to be recessionary for the labor market by increasing unemployment. Then, I assess the conditional contributions of the Ins and Outs of unemployment. Two insights appear. Firstly, depending on the origins of the shock, the unemployment driving forces are not the same. Both transition rates contributed equally to unemployment variations after a monetary shock, while the job finding rate is largely dominant after a technology shock. Secondly, the model and the data do not reveal the same underlying mechanism leading to unemployment variations for a technology shock. The model tends to attribute an exaggerated importance to the job separation margin.

The empirical evidences emerging from this paper shed light on the plurality of mechanisms governing changes in the French unemployment rate. These patterns seem to be specific to the French economy, and are different to those highlighted with U.S. data. Furthermore, the theoretical application suggests that a simple benchmark is not sufficient to reproduce the underlying mechanism governing unemployment variations. This is especially

[20]The theoretical impulse responses indicate that the increase in the marginal utility of consumption λ induced by the technology shock does not alter the mechanism described above.

true when the economy is hit by a technology shock. This indicates that other features, e.g. the institutions of the labor market as firing cost or unemployment benefits, may be possible candidates in explaining the determinant role of the job finding. This further theoretical investigations are left for future research.

Appendices

A The other shocks of the VAR system

In his empirical framework, Uhlig (2005) imposes sign restrictions in order to isolate a unique monetary policy shock. However, the strategy consisting in the identification of a single shock in a sign restriction framework has been criticized in many works as in Fry and Pagan (2011). Consistently with the so-called multiple shock problem, I identify not only a single disturbance, but all disturbances of the system. More specifically, I identify the demand shock relative to the inflation rate and the two other shocks affecting transition rates.

The demand shock

In the NK literature, a demand shock is a perturbation on the utility of consumption and affects the household inter-temporal decisions. A positive demand shock induces an unexpected rise in consumption, which creates some positive pressure on inflation. This expansion of inflation coincides with an increase in output, and, contrary to the monetary shock, pushes up the interest rate. To recover a demand shock in my empirical model, I impose that the last one is required to increase the inflation rate for at least 4 quarters. Fujita (2011), Braun et al. (2007) and Peersman (2005) also use similar restrictions. Again, I do not restrict the responses of the job separation rate and the job finding rate and I let the data tell me how unemployment reacts consecutive to the shock.

Labor market shocks

In a NK economy characterized by nominal rigidities on prices, a shock on the job separation lowers the expected value of a job for firms, which react by opening fewer vacancies. This fall in the number of vacancies posted reduces the chances for a worker to find a job. Not surprisingly, these patterns of transition rates lead to higher unemployment. I translate these theoretical mechanisms by imposing the job separation to rise during 4 quarters and the job finding to decrease one quarter after the shock. Finally, I isolate a job search shock. A job search shock affects the efficiency of the matching process. It refers to all characteristics facilitating the meeting between firms and workers. Theoretically, this perturbation increases the probability for a worker to find a job and pushes up the job separation rate. The channel is as follows: a matching efficiency shock increases the job finding rate but also the value of unemployment spells. Since the value of unemployment for a worker increases it becomes more costly for the workers to supply labor. All else equal the threshold at which endogenous job separation takes place diminishes, and the overall job separation rate increases. These movements of transition rates reduce unemployment because the first effect dominates the second. Empirically, I impose that following the search shock, the job finding increases during four quarters. The response of the job separation is required to be positive during the impact period. The fact that the two transition rates move in the same direction is essential for the identification of the job search shock. Other evidences justifying why the job search shock leads to positive comovements between the job separation rate and the job finding rate can be found in Hairault and Zhutova (2014).

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