Explaining the Long-Run Trend of Occupational Mobility

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April 30, 2020

Introduction

Over the past few decades the US labor market has experienced a noticeable decline in labor market fluidity. Workers are switching jobs less, new firms are being formed at lower rates, the rate of job hires and separations are falling and workers are moving across states at lower rates. Changes in occupational mobility however have been more puzzling.

After experiencing an unemployment spell workers are more likely to switch occupations, the rate has been increasing since the mid-1970s. However, when a worker switches jobs (with no unemployment spell in between) the probability that they will switch occupations had been rising from the mid-1970s to the mid-1990s, and falling since. The goal of this paper is to provide an explanation for the pattern of occupational switching.

Understanding the causes of occupational switching is important for many reasons. A large part of workers wages are due to their occupational specific skills. Kambourov and Manovskii (2009) find that 5 years of tenure in an occupation is associated with an 12-20 % increase in wages for example. In addition to wages a workers occupation is an important aspect of their identity and quality of life.

There are two main difficulties in developing a model to understand these changes, one conceptual the other methodological. Conceptually it's hard to understand why the switching behavior of the employed and unemployed should differ. For example if certification requirements have increased the cost of switching occupations then it would make sense to see both employed and unemployed switch less as the barriers to entry have increased thus increasing the returns to their occupational skills. Perhaps new technologies have made matching more efficient. As it becomes easier for workers to find jobs in occupations that are a good fit they have less incentive to leave. But this would also mean that upon losing their job they are more likely to return to their old occupation as they are more likely to be well matched in that occupation.

Methodologically any model that aims to explain the difference in behavior between employed and unemployed must capture many different aspects of the labor market. These include different occupations, both on and off the job search and the accumulation of occupational capital.

On the conceptual front this paper develops a model with an intuitive mechanism that generates a hump shaped pattern for employed workers and increasing occupational switching for unemployed workers. The model highlights how turbulence, skill loss during unemployment Ljungqvist and Sargent (1998), the distribution of skills across the labor force and firms optimal vacancy posting interact and impact occupational switching. As turbulence increases so does the number of unskilled unemployed workers, who are the most likely to switch occupations. As the skill distribution shifts toward lower skilled workers high productivity firms post less vacancies and low and mid level productivity firms post more vacancies. In a simulation of the model we show that this is able to generate a hump shape in the switching rates of employed workers while simultaneously having unemployed workers switch more.

The model I develop is an extended version of Lise and Robin (2017). I extend their model to include different occupations, on the job accumulation of occupational capital and depreciation of occupational capital while unemployed. The key feature of this model is that the surplus of a match is independent of the distribution of unemployed workers and other matches in the economy. This means that workers mobility choices are also independent of these distributions. I show that my model retains this feature which in turn makes it computationally tractable to solve. The benefits of this model are that it allows me to incorporate rich heterogeneity on both the firm (occupation and firm level productivity) and worker (occupational specific skill) side. In addition it allows me to model the search behavior of both the unemployed and employed within and across occupations.

Literature Review

My paper contributes to the literature that studies occupational mobility in labor search models, Kambourov & Manovskii (2008,2009) and Carrillo-Tudela & Visschers (2017). Like my paper these papers model ex-ante similar workers who work in different occupations and acquire occupational capital over time and choose to switch occupations. The main difference between my paper and these is that workers are able to search for jobs within and across occupations both while on the job and unemployed. This means that workers in my model don't have to make the choice to leave their current occupation before switching occupations, there is no option value associated with staying in your current occupation. This seems more reasonable as workers will only leave their current occupation if they receive a more lucrative offer. It also means that a worker is able to use his accumulated occupational capital to demand higher wages when switching occupations.

This literature has also ignored the difference between the switching patterns of the unemployed and employed. Kambourov & Manovskii (2008,2009) use the PSID survey to document the increase in occupation switching but combine both types of workers. Using the CPS survey, a monthly survey, Moscarini and Thomsson (2006) document an initial increase in occupational switching for employed workers then a gradual decrease. Similarly Xu(2018) documents the decline in occupational switching for employed workers since the 1990s. Fujita(2018) uses the CPS to document the increase in occupational switching of the unemployed since the mid-1970s. My paper complements these studies by focusing on the difference between the employed and unemployed over the entire time period considered by the literature.

Changes in occupational switching are closely linked to the literature studying the decline of labor market fluidity. This literature documents the decline in various measures of fluidity in the labor market. There has been little discussion on how occupational mobility fits into theses trends. On one hand this is understandable as earlier papers on occupational switching, Kambourov & Manovskii (2008,2009), showed increasing occupational mobility indicating a more fluid labor market. However the decline in occupational switching for employed workers seems to imply declining fluidity. Occupational mobility is clearly a solid indicator of fluidity, as workers progress in their careers they learn about which occupations suite them best and switch to ones that suit them best. However trying to infer whether fluidity has increased or decreased based on occupational mobility requires care. Simply focusing on either the employed or unemployed would lead one to very different conclusions about changing fluidity.

My paper is also linked to a literature that studies the effect of increased turbulence on the labor market. Ljungqvist and Sargent (1998) were the first to introduce the idea of turbulence in their study of differences in unemployment between the US and Europe. Kambourov & Manovskii (2008,2009) argued that the rise in occupational switching from the 1970s to the mid-1990s was evidence of increased turbulence. Likewise Fujita(2018) argued that the increase of occupational switching was indicative of increased turbulence. My paper is more closely relented to Fujita (2018) in that I only infer turbulence from the behavior of the unemployed. These papers have also used the increase in occupational mobility to justify an increase in turbulence. In this paper I present a mechanism through which an increase in turbulence will translate into different occupational switching behavior for unemployed and employed workers.

Empirical Evidence

This section presents empirical evidence of the difference in occupational mobility for unemployed and employed workers. All the evidence presented here is take form the CPS public micro use files. This dataset has the advantage of following workers for 4 months at a time and thus is able to measure occupational mobility at higher frequencies than annual datasets, such as the PSID. Kambourov & Manovskii (2013) contains a detailed discussion on the use of the CPS . Figure 1 is taken from Moscarini Thomsson (2007) and shows the hump shape in occupation mobility from the mid 1970s up to 2006. Figure 2, taken from Xu(2018), also shows occupational switching rates for employed workers. However it shows the decline has continued on up to the present day. Finally Figure 3, taken from Fujita(2018), shows the switching rates for unemployed workers. In addition to presenting the raw data these figures show the fit of a linear probability model estimated on the data, details of which can be found in Fujita(2018).

Model

This section presents the model that will be used. It's structure is based on Lise and Robin (2017) which in turn is based on the models of Postel-Vinay and Robin (2002a,2002b). The key features of the model are multiple occupations with occupational human capital accumulation, the potential for skill loss while unemployed and search while both unemployed and on the job, both within workers current occupation and across.

Agents

The model consists of a unit mass of ex-ante identical workers and a unit mass of firms that are distributed evenly across M different occupations. As in Lise and Robin (2017) we assume firms are indexed by their technology y which is uniformly distributed on $[0, \frac{1}{M}]$ in each occupation. The reason for assuming this is to make job to job transitions within each occupation interesting. The search process of workers and firms is described below.

Occupations

While employed, workers accumulate occupation specific human capital through on the job learning, a workers occupational capital in an occupation is given by x_s whos values are assumed to lie on a finite grid $x_0 ... x_N$. When workers enter a new occupation they began with x_0 and each period they increase their occupational capital with probability ψ by one grid point. In addition to occupation specific capital each occupation has its own productivity term $z_{i,t}$ which follows a Markov process on the grid $z_{i,0} ... z_{i,N}$.We assume all occupations are the same ex-ante.

Stocks of workers

We index unemployed workers by their previous occupation and their level of occupational capital in that occupation. The total number of unemployed workers whos previous job was in occupation i and who had accumulated occupational capital x_s is $u_t(i, s)$.The total number of employed workers in occupation i with occupational capital x_s at firms with productivity level y is $e_t(i, s, y)$.

Timing

Time is discrete with each period being broken up into 4 sub periods. First each occupation draws a new level of productivity, then with fixed probability δ each match is hit with an exogenous separation shock, in addition all matches that are no longer mutually beneficial are also dissolved. After this each employed worker is hit with a shock that with probability ψ increases their occupational capital. The last shock to hit is the one to unemployed workers who with fixed probability γ lose all of their accumulated occupational capital. Finally workers search for new jobs and either accept or decline offers. It will be useful to define the stocks of unemployed and employed workers just after the productivity and separation shocks have hit as $u_{t+}(i, x_s)$ and $e_{t+}(i, x_s, y)$.

Matching technology

Workers and firms are matched according to a matching technology which takes as inputs workers effective search and the number of vacancies.The effective amount of search by workers in the economy is given by

$$L_t = \sum_{i=1}^{M}\sum_{s=0}^{S}\left[u_{t+}(i, x_s) + f\int e_{t+}(i, x_s, y)dy\right]$$

where f is the relative search effort of employed workers.

Denote the total number of vacancies in the economy at time t as

$$V_t = \sum_{i=1}^{M}\int v_t(i, y)dy$$

Where $v_t(i, y)$ is the number of vacancies posted by a firm with productivity y in occupation i.The function $M_t = M(L_t, V_t)$ maps the total number of vacancies and search effort to the total number of meetings. The probability a unemployed worker contacts a vacancy is defined as $\lambda_t = \frac{M_t}{L_t}$ and $f\,\lambda_t$ for an employed worker.

Value function of the unemployed

We assume each worker receives an unemployment benefit of b. If the worker has skill ($s \neq 0$) the worker becomes unskilled next period with fixed exogenous probability γ in which case their skill level drops to $s = 0$. When the worker accepts a job offer the value he receives is denoted as $W_{0,t+1}(x_s, y)$. We assume that the worker has no bargaining power so that the value offered by the firm is equal to the workers outside option. We can write the value function of the unemployed as

$$\begin{aligned} B_t(x_s) = b(x_s) + \frac{1}{1+r}E_t\Big[\gamma\left[(1-\lambda_{t+1})B_{t+1}x_0 + \lambda_{t+1}\sum_{j=1}^{M}\int_{y\in j} W_{0,t+1}(x_0, y, z_j)\frac{v_{j,t+1}(y)}{V_{t+1}}dy\right] \\ + (1-\gamma)\big[(1-\lambda_{t+1})B_{t+1}(x_s) + \lambda_{t+1}\sum_{j=1}^{M}\int W_{0,t+1}(x_s)\frac{v_{j,t+1}(y)}{V_{t+1}}dy\big]\Big] \end{aligned}$$

It is interpreted as follows. In the current period the worker receives unemployment benefits b. In the next period the worker receives an employment opportunity with probability λ_{t+1}, which has value $W_{0,t+1}(x_s, y)$. The worker will also become unskilled next period with probability γ in which case their occupational capital is set to x_0. Using the fact that the firm has all the bargaining power,so that $W_{0,t+1}(x_s, y) = B_{t+1}(x_s)$, we can simplify the value function as

$$B_{t+1}(x_s) = b(x_s) + \frac{1}{1+r}E_t\Big[\gamma\, B_{t+1}(x_0) + (1-\gamma)B_{t+1}(x_s)\Big]$$

An important feature here is that the flow benefit is a function of the workers accumulated occupational capital, this is important as it makes higher skilled workers more picky when it comes to switching occupations. We can further simplify the value of unemployment as

$$B_{t+1}(x_s) = b(x_s) + \frac{1}{1+r} E_t \left[B_{t+1}(x_s) \right]$$

Value of a match

Before describing the value of the match it will be useful to introduce some condensed notation. The value of a match depends on three components, firm productivity, workers occupational specific capital and the occupation specific productivity. I represent the state variables of a match as $c_t = (x_s, y, z)$. It is also necessary to represent the state of a potential match with a poaching firm which I will denote as, $c' = (x', y', z')$. Where if the new match is in the same occupation then $x' = x_s$ and $z' = z_{t,i}$ otherwise $x' = x_0$ and $z' = z_{t,j}$.

When a worker and firm do match they produce output with production function $p(x_s, y, z)$. This function is similar across all occupations. The value of a match is then given by

$$\begin{aligned} P_t(c) =& p(c) \\ &+ \frac{1}{1+r_t} \mathbb{E}_t[(1 - (1-\delta)\, \mathbb{1}\{\mathrm{P_{t+1}(c) \geq B_{t+1}(x_s)}\}) B_{t+1}(x_s) \\ &+ (1-\delta)\, \mathbb{1}\{\mathrm{P_{t+1}(c) \geq B_{t+1}(x_s)}\}((1 - s\, \lambda_{t+1}) P_{t+1}(c_{s+1}) \\ &+ [f\, \lambda_{t+1} \sum_{j=1}^{M} \int \max\{W_{t+1}(c', c), P_{t+1}(c_{s+1}, c')\} \frac{v_{j,t+1}(y')}{V_{t+1}} dy']]) \end{aligned}$$

To interpret this first note that the probability the match is not destroyed next period is $(1-\delta)\, \mathbb{1}\{\mathrm{P_{t+1}(c) \geq B_{t+1}(x_s)}\}$, the match is not hit by the exogenous separation shock and it remains mutually beneficial. If the match is destroyed the worker becomes unemployed and receives a value of $B_{t+1}(x_s)$. After the realization of the separation shock the workers skills are upgraded to x_{s+1} (if the match isn't destroyed). The worker then receives a job offer with probability $f\, \lambda_{t+1}$. When the worker receives a job offer his current firm and the new firm compete for the worker via Bertrand competition as in Lise and Robin (2017). This means the match will only continue if the surplus of this match is higher than the surplus of the new match, if it continues the value of the match is $P_{t+1}(x_{s+1}, y)$ if it doesn't the value of the match is zero.Therefore we can further simply the expression as

$$\begin{aligned} P_t(c) =& p(c) \\ &+ \frac{1}{1+r} \mathbb{E}_t[(1 - (1-\delta)\, \mathbb{1}\{\mathrm{P_{t+1}(c) \geq B_{t+1}(x_s)}\}) B_{t+1}(x_s) \\ &+ (1-\delta)\, \mathbb{1}\{\mathrm{P_{t+1}(c) \geq B_{t+1}(x_s)}\}\, P_{t+1}(c_{s+1})] \end{aligned}$$

As in Lise and Robin (2017) our model becomes tractable when working with the surplus function. The surplus function is defined as

$$
\begin{aligned}
S_t(c) = P_t(c) - B_t(x_s)& \\
&= p(c) - b \\
&+ \frac{1}{1+r}\,\mathbb{E}_t\Big[(1-(1-\delta)\,\mathbb{1}\{\mathrm{P_{t+1}(c) \geq B_{t+1}(x_s)}\})B_{t+1}(x_s) \\
&+ (1-\delta)\,\mathbb{1}\{\mathrm{P_{t+1}(c) \geq B_{t+1}(x_s)}\} \\
&[f\,\lambda_{t+1}\sum_{j=1}^{M}\int \max\{W_{t+1}(c',c), P_{t+1}(c,c')\}\frac{v_{j,t+1}(y')}{V_{t+1}}dy'] \\
&+ (1-f\,\lambda_{t+1})P_{t+1}(c_{s+1})\Big] \\
&- \frac{1}{1+r}\,\mathbb{E}_t[(1-\gamma)B_{t+1}(x_s) + \gamma\,B_{t+1}(x_0)]
\end{aligned}
$$

Which can be further simplified as

$$
\begin{aligned}
S_t(c) =& p(c) - b \\
&+ \frac{1}{1+r}\,\mathbb{E}_t\Big[(1-(1-\delta)\,\mathbb{1}\{\mathrm{P_{t+1}(c) \geq B_{t+1}(x_s)}\})B_{t+1}(x_s) \\
&+ (1-\delta)\,\mathbb{1}\{\mathrm{P_{t+1}(c_{t+1}) \geq B_{t+1}(x_s)}\}\,P_{t+1}(c) - (1-\gamma)B_{t+1}(x_s) \\
&- \gamma\,B_{t+1}(x_0)\Big]
\end{aligned}
$$

And once more as

$$
\begin{aligned}
S_t(c) =& p(c) - b \\
&+ \frac{1}{1+r}\,\mathbb{E}_t\Big[\,\gamma(B_{t+1}(x_s) - B_{t+1}(x_0))\Big] \\
&+ \frac{1}{1+r}\,\mathbb{E}_t\Big[(1-\delta)\,\mathbb{1}\{\mathrm{P_{t+1}(c_{t+1}) \geq B_{t+1}(x_s)}\}\,S_{t+1}(c_{s+1})\Big]
\end{aligned}
$$

Again it is important to note that in our model the value of being unemployed is the same across all workers, if this was not the case then the above would be the surplus of a match, however we can further simplify the surplus as

$$
\begin{aligned}
S_t(c) =& p(c) - b \\
&+ \frac{1}{1+r} \mathbb{E}_t \left[(1-\delta) \mathbb{1}\{\mathrm{P_{t+1}(c_{t+1}) \geq B_{t+1}(x_s)}\} S_{t+1}(c_{s+1}) \right]
\end{aligned}
$$

What is important to note about this function is that it is independent of the distribution of unemployed workers and worker-firm matches, it is block recursive. Solving for the surplus function requires solving for $S(x_N, y)$ and then preceding backwards for all other skill levels $(x_0, ..., x_{N-1})$.

Vacancy creation

As in Lise and Robin each firm faces a convex cost $c(v_t(y_j))$ of posting vacancies. The firm chooses the optimal number by setting the marginal cost of another vacancy equal to the expected value of a contact

$$
c'[v_t(y)] = q_t J_t(y)
$$

Where $q_t = \frac{M_t}{V_t}$ is the probability the firm matches with a worker and $J_t(y_j)$ is the expected value of a match to the firm.

The expected value of a contact is

$$
\begin{aligned}
J_t(y) = & \sum_{j=1}^{M} \sum_{s=0}^{S} \frac{u_t(j,s)}{L_t} \max\{S(c), 0\} \\
& + \sum_{j=1}^{M} \sum_{s=0}^{S} \int \frac{fe_t(j,s)}{L_t} \max\{S(c) - S(c'), 0\} dy'
\end{aligned}
$$

The firm will either contact an unemployed worker or an employed worker. If the worker is unemployed the firm will hire them only if the surplus if greater than zero. If the worker is employed the firm will hire the worker if the surplus created by the firm and worker is higher than the surplus of the workers current match.

Switching Cutoffs

To understand the causes of occupational switching it is helpful to derive the necessary condition for a worker to switch. To do this consider a worker in occupation i at firm y with occupational capital skill level x_s. The surplus of this match is given by $S(x_s, y, z_i)$. As discussed above the worker will only switch if the surplus from the poaching firm is higher than with the current firm, that is if

$$S(c') > S(c)$$

As the worker must start at the new occupation with the lowest level of human capital $x_{j,0}$ it must be the case that either the new firm is sufficiently more productive ($y' > y$) or that the new occupation is more productive than the workers current one ($z' > z$), or both. Note that workers will sometimes move to less productive occupations, if the poaching firm is much more productive, and less productive firms, if the poaching firm is in a much more productive occupation. We can define the set of firm level and occupational productivities for which a worker will switch occupations as

$$\mathcal{S} = \{(y', z')|S(c') > S(c)\}$$

Likewise for an unemployed worker we can define the set of firm and occupational productivities for which the worker will accept a job as

$$\mathcal{U} = \{(y', z')|S(c') > 0\}$$

Equilibrium

In terms of decisions the model is very simple. All decisions by the firm and worker are optimal, workers only accept a job if the match surplus is higher than the value of unemployment or the surplus from the workers current match. Firms searching for workers post the optimal number of vacancies.

Equilibrium: An equilibrium consists of a surplus functions,$S_t(x_s, y, z)$, a firm vacancy posting rule $v_t(y)$ and worker cutoff sets, $\mathcal{S}(y, x, z)$, $\mathcal{U}(y, x, z)$ such that

1. The surplus functions solve the bellman equations

$$\begin{aligned} S_t(c) =& p(c) - b \\ &+ \frac{1}{1+r} \mathbb{E}_t \left[(1-\delta) \mathbb{1}\{\mathrm{P_{t+1}(c_{t+1}) \geq B_{t+1}(x_s)}\} S_{t+1}(c_{s+1}) \right] \end{aligned}$$

   for all x_s

2. Firms vacancy posting is optimal.

$$c'[v_t(y)] = q_t J_t(y)$$

3. Unemployed workers job acceptance decisions are optimal

$$(y, z) \in \mathcal{U}(c) \iff S(c) > 0$$

4. Employed workers mobility decisions, within and across occupations, are optimal

$$(y', z') \in \mathcal{S}(c) \iff S(c') > S(c)$$

Labor Market Flows

When describing the evolution of the stock of workers we focus on the stocks after the exogenous separation shock has hit employed workers and the skill loss shock has hit unemployed workers. Therefore we only worry about the out flow of unemployed workers into new jobs.For unemployed workers of skill level s in occupation j the flows are described by

$$u_{j,t+1} = \sum_{j=0}^{M} \sum_{s=0}^{S} u_{j,t+}(s)(1 - \int \lambda \frac{v_t(j)}{V_t} \mathbb{1}\{S(c) > 0\} dy)$$

The change in unemployed workers is simply the outflow to jobs.To describe the flows on the employed we focus on pairs of skill s and firm productivity y

$$\begin{aligned} e_{t+1,j}(s, y) = e_{t,j}(s, y)[1 - \sum_{j=1}^{M} \sum_{s=1}^{S} \int \lambda_{t+1} f \frac{v_{j,t+1}(y')}{V_{t+1}} \mathbb{1}\{S(c') > S(c)\} dy'] \\ + \sum_{j=1}^{M} \sum_{s=0}^{S} \int e_{t,j}(s, y) f \lambda_{t+1} \frac{v_{t+1}(y)}{V_{t+1}} \mathbb{1}\{S(c) > S(c')\} dy' \\ + \sum_{j=1}^{M} \sum_{s=0}^{S} u_{j,t+} \lambda_{t+1} \frac{v_{t+1}(y)}{V_{t+1}} \mathbb{1}\{S(c) > 0\} \end{aligned}$$

The first term describes the workers who leave this job,either switching occupations or moving to more productive firms within their current occupation. The second term is the inflow of workers from other jobs and the third term is the inflow of workers from unemployment.

Occupation switching rates

Here we describe the rate of workers who have switched occupations. The amount of employed workers who have switched occupation in occupation j with skill level s at firms with productivity level y is

$$ES^j_{t+1}(x_s, y) = e^j_{t+}(x_s, y)[\sum_{i \neq j}^{M} \int f \, \lambda_{t+1} \, \frac{v_{i,t+1}(y')}{V_{t+1}} \mathbb{1}\{S_{t+1}(c') > S_{t+1}(c)\} dy']$$

This is just the amount of workers who have received an offer from a firm in another occupation which the match surplus is higher. Then the total amount of employed workers who have switched occupations is.

$$ES = \sum_{j=1}^{M} \sum_{s=0}^{S} \int ES^j_{t+1}(x_s, y) dy$$

The rate of occupational switching among the employed is then given by the above divided by the total amount of employed workers who have switched jobs.

The total amount of unemployed workers in occupation j with skill level s who have switched occupation is given by

$$US^j_{t+1}(x_s) = u^j_{t+}(x_s) \sum_{i \neq j} \int s \, \lambda_{t+1} \, \frac{v_{i,t+1}(y)}{V_{t+1}} \mathbb{1}\{S(c) > 0\} dy$$

Unemployed workers switch occupations only if they contact a firm that is able to offer them a higher value than unemployment. The total number of unemployed workers who then switch occupations is

$$US_{t+1} = \sum_{j=1}^{M} \sum_{s=0}^{S} \int US^j_{t+1}(x_s) dy$$

The rate of occupational switching among the unemployed is then given by the above divided by the total number of unemployed workers who have returned to employment.

Simulation

In this section we simulate the model to shed light on its mechanisms. Our goal is only to illustrate how the model is able to generate the observed patterns of occupational switching. A more serious calibration will be needed to see how well the model performs quantitatively.

Functional forms and Parametrization

Our choice of functional forms are fairly standard and are taken from Lise and Robin (2017). We assume the matching function is cobb-douglas.

$$M_t = M(L_t, V_t) = min\{\alpha L_t^{\omega} V_t^{1-\omega}, L_t, V_t\}$$

The cost of posting v vacancies is

$$\frac{c_0 v_t^{1-c_1}}{1-c_1}$$

.

The solution to the firms vacancy posting problem is then

$$v_t(y) = \Big[\frac{\alpha}{\theta_t^w}\frac{J_t(y)}{c_0}\Big]^{\frac{1}{c_1}}$$

This also allows us to solve for market tightness

$$\theta_t = \Big[\frac{1}{L_t}\int (\frac{\alpha J_t(y)}{c_0})^{\frac{1}{c_1}} dy\Big]^{\frac{c_1}{c_1+\omega}}$$

We model worker value added as

$$p(x_i, y_j, z_o) = z_o(y_j x_s - \rho y_j^2)$$

Just to recap, z_0 is the occupation specific productivity y_j is the firm specific productivity and x_s is the workers occupational capital. The important feature of worker value added is that a worker must hold sufficient occupational capital before being able to contribute positive value added. A y type firm will only receive positive value added from a worker who holds at least ρy units of occupational human capital. Thus ρ determines the degree of complementarity between firm productivity and occupational capital.This feature will play a key role in explaining occupational switching patterns which we discuss below. Finally we assume the workers unemployment benefit is given by $b(x_s) = \kappa p(x_s, y_j^*, \bar{z})$ where $y^* = \underset{y}{arg\,max}\; p(x_s, y_j, \bar{z})$.

Table one presents the chosen values for our simulation. In addition to these values we need to specify grids for occupational capital, x, firm productivity, y and occupational productivity, z. For firm and occupational productivity we choose an even grid of 50 points on the unit interval and for occupational capital we choose an even grid of 27 points on the interval $(0.2, 1)$, we set the lower bound of occupational capital above the lower bound of firm productivity so that there will be firms for whom unskilled workers add value to.

Table 1: Parametrization

Parameter	Value
β	0.95
δ	0.05
ψ	0.7
κ	0.2
ρ	0.7
α	0.05
ω	0.7
c_0	0.05
c_1	0.2
f	0.02

Switching Behavior

In order to understand how how turbulence affects the pattern of occupational switching it is useful to first look at how it affects the switching sets of employed and unemployed workers within and across occupations.

Figure 6 plots the surplus values of an unemployed worker with skill level x at firms with different combinations of y and z in a *different occupation*. The value plotted is $max\{P(x_1, y, z) - B(x_i), 0\}$. Firms with low productivity are unable to compensate the worker enough to convince them to switch and firms with sufficiently high productivity don't find it worthwhile to hire the worker as they are inexperienced in the occupation.

As expected when turbulence, γ, increases both P and B fall. The effect on the surplus function will depend on the workers occupational capital, for workers with low occupational capital B can only fall a little and so the total surplus generated by a match will fall. Workers with high levels of occupational capital have B fall much more than P and thus the surplus of a match increases.

These results also carry over to employed workers. Figure 7 plots the difference between surplus values for a worker employed in one occupation and the surplus that would be created if the worker were to switch occupations. The value plotted is $maxS(x_1, y, z) - S(x_i, y, z), 0$. The intuition is the same now however note drastic reduction in firm types that a worker would be able to switch too.

Finally Figure 8 plots $max\{S(x_i, y', z') - S(x_i, y, z), 0\}$. This figure shows us which firms a employed worker would be willing to move to in his current occupation. In this case the surplus doesn't change much as the worker doesn't have to start at the bottom of the skill ladder when he switches jobs.

Vacancy Posting

As the value of a potential contact for a firm depends on the surplus generated by the firm and worker as well as the distribution of workers the effect on vacancy posting may be different for different firms. The increase in turbulence effects both the skills of unemployed and employed workers in steady state. As unemployed workers are more likely to lose their skill the proportion of unskilled unemployed increases. This now means that fewer skilled workers are hired. Thus the total number of skilled workers across all occupations also decreases.

As figure 5 shows the increase in turbulence effects different firms differently. With more unskilled workers among the unemployed and employed less productive firms are more likely to meet a worker who they will be willing to employ and thus they post more vacancies. On the other hand high productivity firms are less likely to meet a high skilled worker, again among both the unemployed and employed and thus they post less vacancies.

Occupational Switching

Figures 4 plots the change in occupational switching for unemployed workers and employed workers. While the proportions of workers switching is far too high we are able to capture the general pattern of occupational switching.

Understanding the increase in switching amongst the unemployed is straightforward, with higher turbulence more unemployed and employed workers are low skilled. With more low skilled workers among the unemployed and employed lower productivity firms post more vacancies and therefore the chances of an unemployed worker meeting a firm in another occupation that he would be willing to switch to is higher.

The hump shaped pattern of switching for the employed can be explained as follows. As turbulence increases and more unemployed workers switch occupations there are more low skilled employed workers. This again leads to low productivity firms posting more vacancies and high productivity firms posting fewer. For small increases in turbulence this may lead to more employed workers switching. However as turbulence increases the more productive firms that would be able to poach workers with accumulated occupational capital in one occupation post fewer and fewer vacancies and the rate of switching among the employed falls.

These results highlight that it is absolutely key to have some complementarity between workers occupational capital and firms productivity. If the value added from each worker was simply increasing in firm productivity then as turbulence increased and the number of low skilled workers increased, high productivity firms would find it more profitable to post vacancies as they would expect to have to compensate new hires less when splitting the surplus. Thus both unemployed and employed workers would switch occupations more.

Conclusions

This paper has pointed out a puzzling feature of occupational switching over the past few decades in the US labor market. Workers who have experienced a unemployment spell have become more likely to switch while workers who are switching on the job have become less likely in recent years, although their switching rates had been initially increasing.

Extending the model of Lise and Robin (2017) easily allows for the inclusion of different occupations, occupational human capital and search on and off the job, as well as within and across occupations. The model highlights a simple connection between turbulence and occupational switching of employed and unemployed workers. As turbulence increases more unemployed and employed workers are low skilled and therefore low productivity firms post more vacancies and high productivity firms post less. Unskilled unemployed workers are willing to take jobs at low productivity firms and thus switch occupations more. While employed workers may initially switch more as turbulence increases there are less and less available high productivity firms posting vacancies and therefore employed workers choose to stay in their current occupation.

Future work will include estimating the model to see how well it can account for the observed pattern. It will also be fruitful to explore the implications of the model on optimal labor market policies, such as unemployment benefits and certification regulation.

Figures

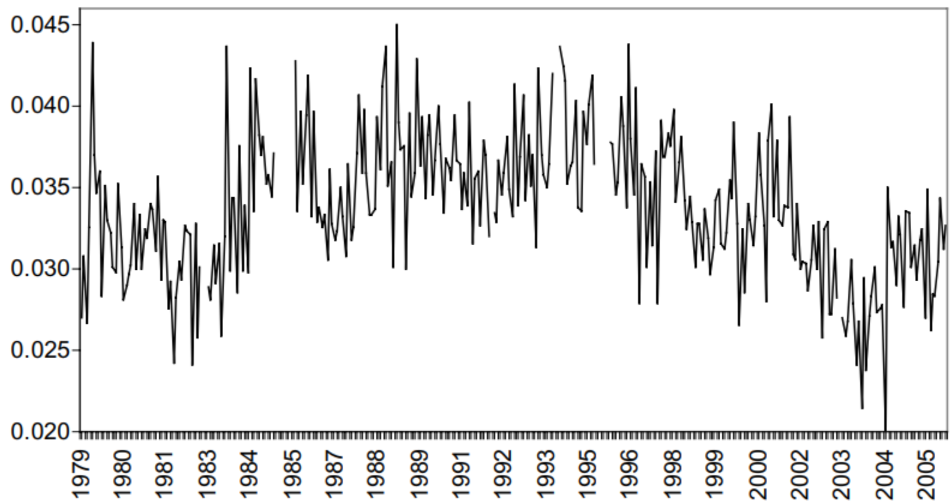


Figure 1: Occupational switching rates of the employed.
Source Moscarini & Thomsson (2006)

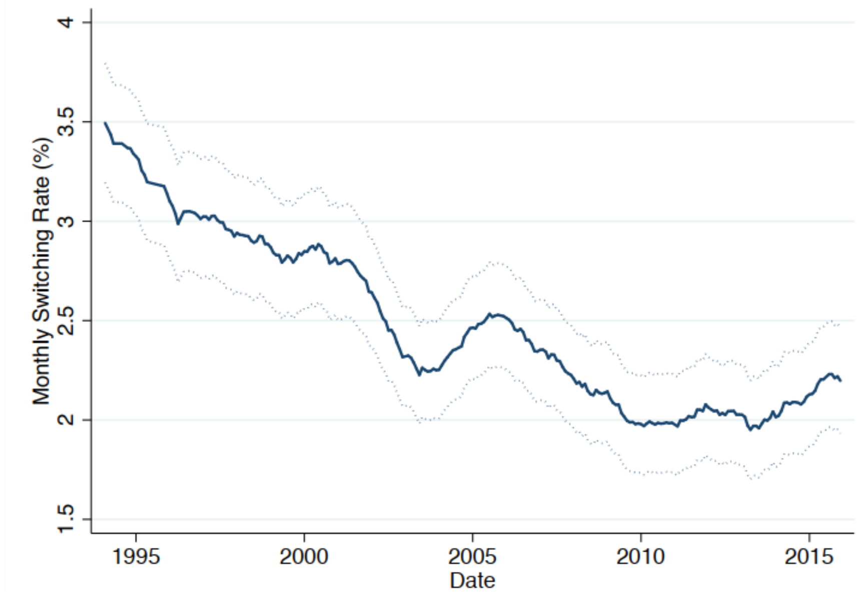


Figure 2: Occupational switching rates of the employed.
Source Xu(2018)

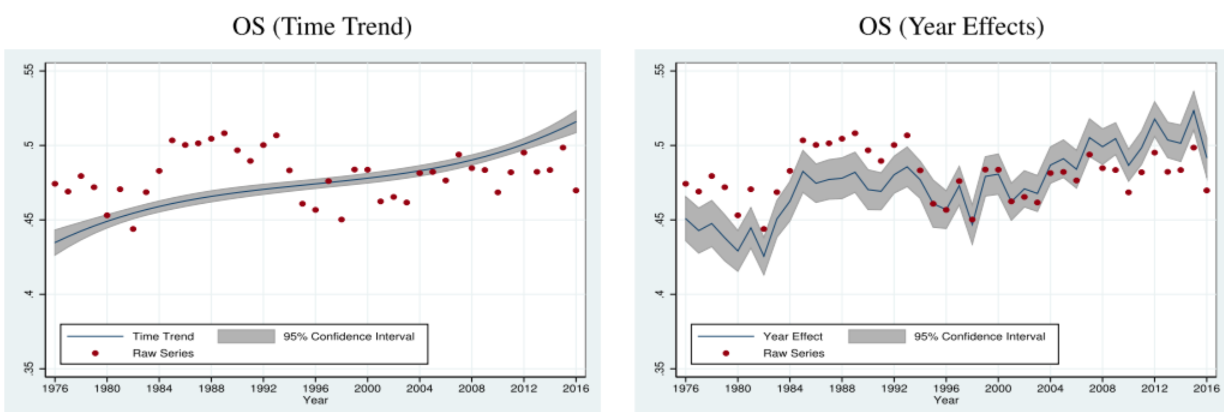
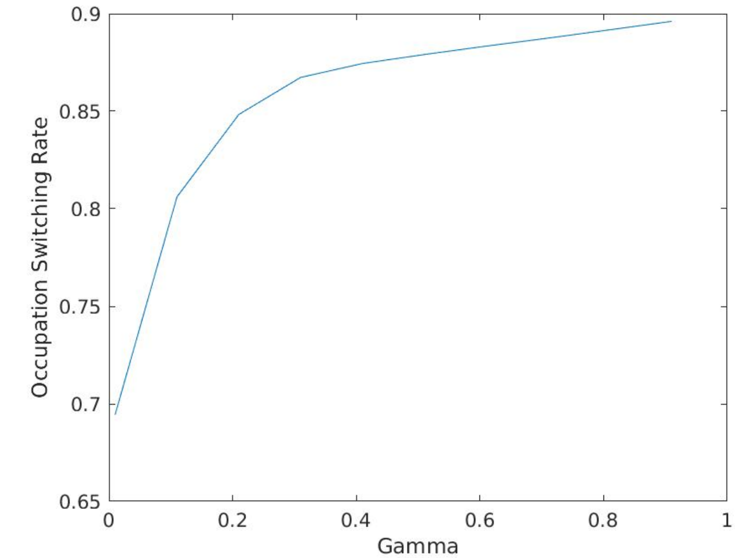
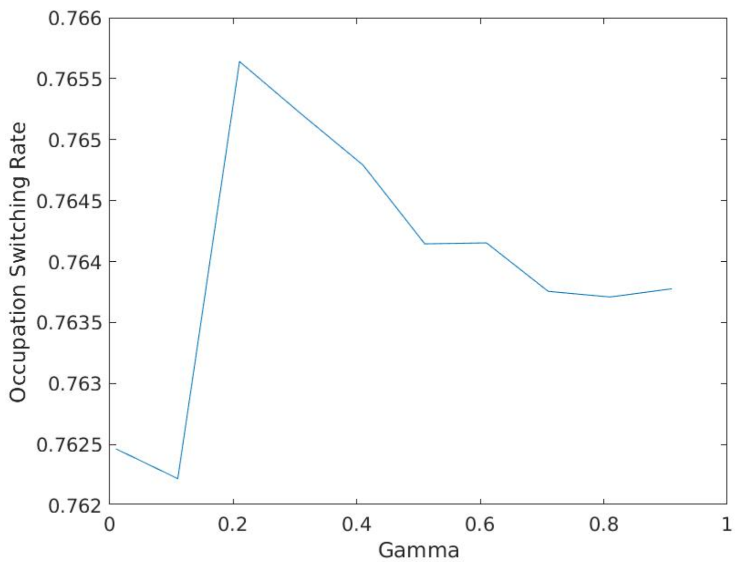


Figure 3: Occupational switching rates of the unemployed.
Source Fujita(2018)

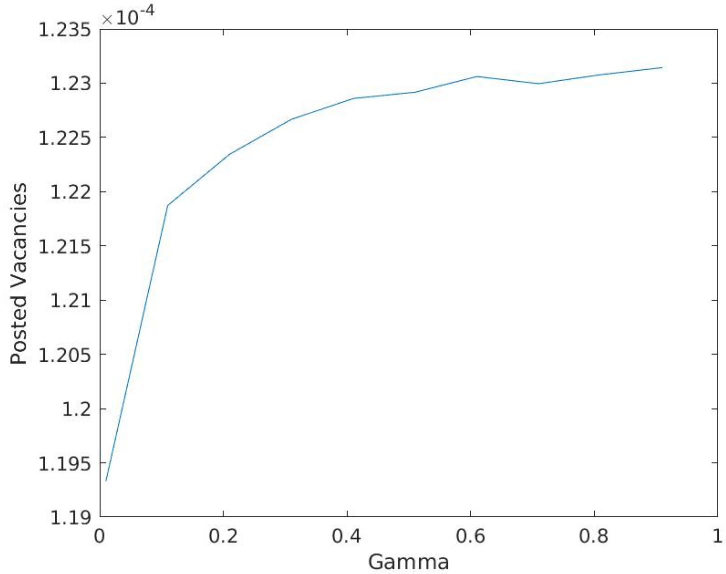


Unemployed

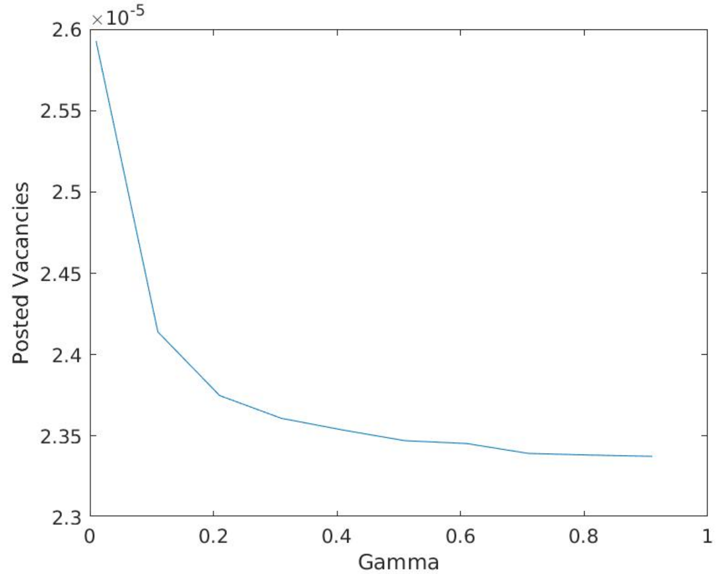


Employed

Figure 4: Occupation Switching Rates

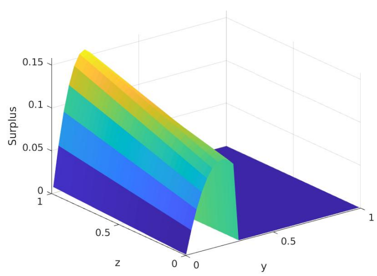


Low Productivity

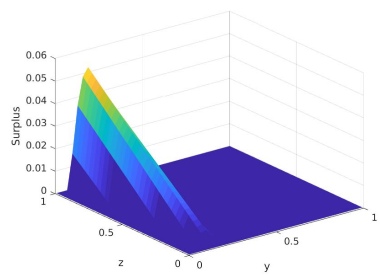


High Productivity Firm

Figure 5: Vacancy Posting and Turbulence



Low x_s Low γ



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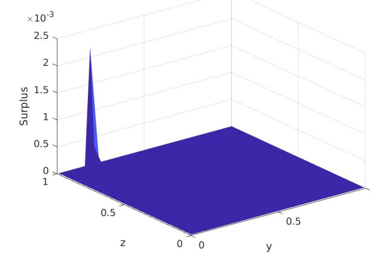
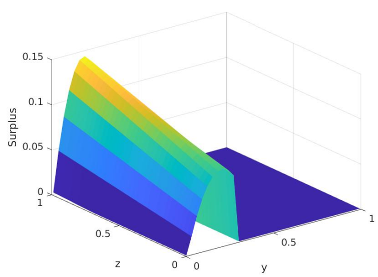
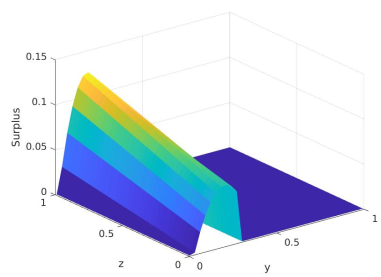


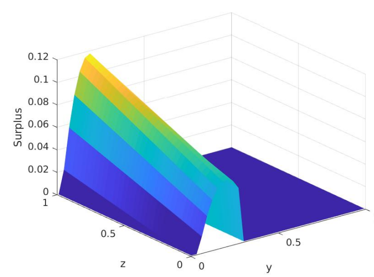
High x_s Low γ



Low x_s High γ



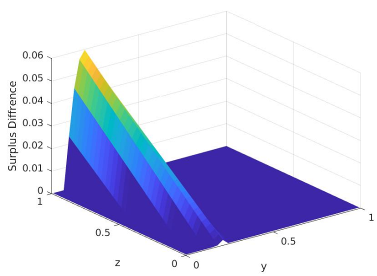
Medium x_s High γ



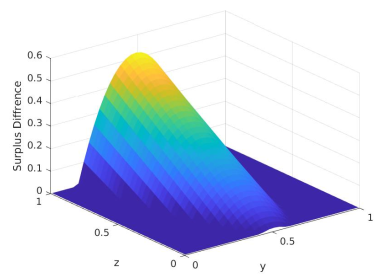
High x_s High γ

Figure 6: Switch Sets for unemployed workers

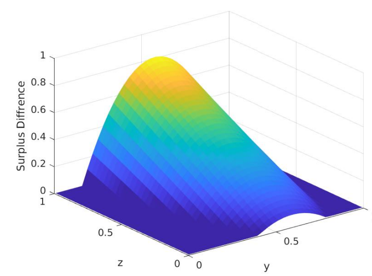
These graphs plot $P(x_1, y, z) - B(x_s)$ for different values of x_s and γ. Positive values indicate firms in a new occupation the worker would be willing to take a job at.



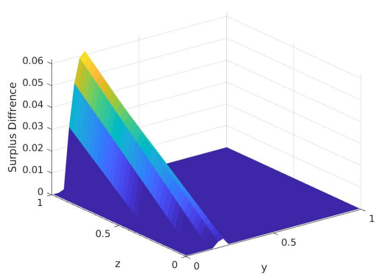
Low x_s Low γ



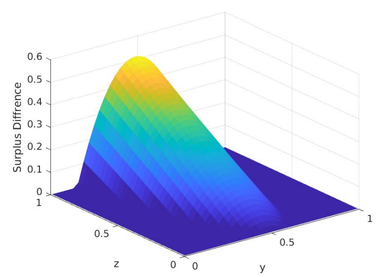
Medium x_s Low γ



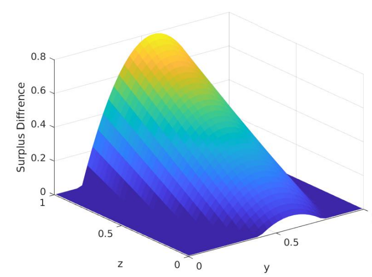
High x_s Low γ



Low x_s High γ



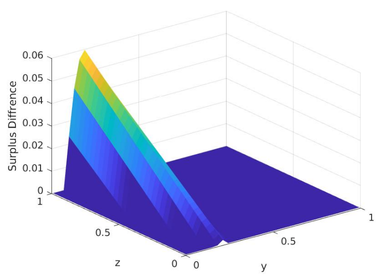
Medium x_s High γ



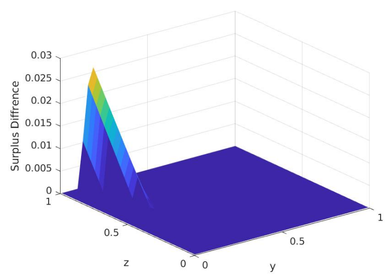
High x_s High γ

Figure 7: Within Occupation Job Switch Sets of the Employed

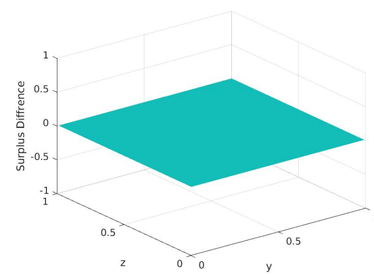
These graphs plot $S(x_s, y', z) - S(x_s, y, z)$ for different values of x_s and γ. Positive values indicate firms in the workers *current* occupation that they would be willing to take a job at.



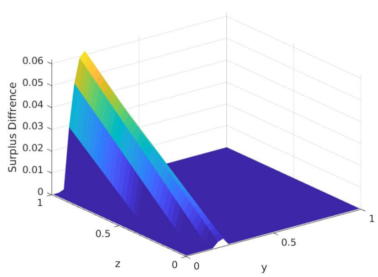
Low x_s Low γ



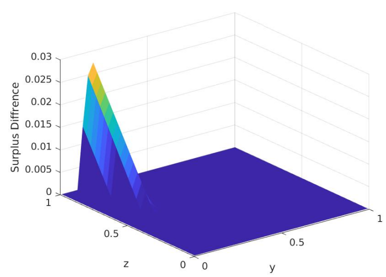
Medium x_s Low γ



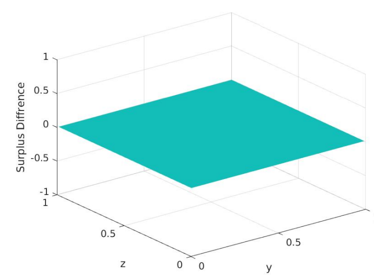
High x_s Low γ



L ow x_s High γ



Medium x_s High γ



High x_s High γ

Figure 8: Occupation Switching Sets for Employed Workers

These graphs plot $S(x_1, y', z') - S(x_{is}, y, z)$ for different values of x_s and γ. Positive values indicate firms in the workers *a new occupation* that they would be willing to take a job at.

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