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Emilie Arnoult, Richard Duhautois

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Emilie Arnoult
Conservatoire des arts et métiers (CNAM)-Lirsa and CEET

Richard Duhautois
Conservatoire des arts et métiers (CNAM)-Lirsa and CEET

Abstract

The understanding of the spatial location of jobs and people has a long tradition in the economic literature because it can induce changes in the social and economic conditions between regions within countries. Most studies analyzing which comes first, jobs or people, focus on variations in jobs and people instead of worker and people flows. Generally, only stock measures are available so that they are used as proxy to estimate flows. In this paper, we aim to augment our knowledge of the spatial dynamics of jobs and population by distinguishing inflows and outflows. We mobilize several available data on residential mobility and labor movements between 2012 and 2013 in France. Our results show that population and job adjustments are not simultaneous, and a rise in job exits does not have an immediate impact on population exits.

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Contact: Emilie Arnoult - emilie.arnoult@lecnam.net, Richard Duhautois - richard.duhautois@lecnam.net.
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1. Introduction

The understanding of the spatial location of jobs and people has a long tradition in the economic literature because it can induce changes in the social and economic conditions between regions within countries. Part of the theoretical literature, based on the model developed by Carlino and Mills (1987), presumes that households are mobile in order to maximize their utility, and that firms seek dynamic local markets to reduce their costs. The relationships between households and firms location strategies are interconnected, but empirically there is no consensus if the population follows job or job follows people.

Boarnet (1994) proposes an extension of the model of Carlino and Mils by introducing spatial interaction variables: a local job market does not only depend on local employment and people, but also draws on neighboring areas. He found that the growth of employment and the growth of population in any one area was affected by neighboring areas Hoogstra et al. (2005) show that the results depend on the chosen specification. Especially, the urban scale has an impact on the results: people follow job on a fine-scale modelling, and on a larger one, jobs and people growth influence one another (Carruthers and Mulligan (2007); Henry et al. (2001)). The spatialized specification has also a huge influence. If the local growth of population/job of neighboring areas is not taken into account, the estimators are biased and inconsistent (see Gebremariam and al. (2008) and Krishnapillai and al. (2014)).

In this paper, we aim to augment our knowledge of the spatial dynamics of jobs and population. Most studies analyzing which comes first, jobs or people, focus on variations in jobs and people. Since flows data are not often available, stock measures are used as proxy to estimate flows. Actually, analyzing directly flows instead of stock variations allow estimating more precisely which comes first and in particular, show that dynamics of entry or dynamics of exit are not always similar. To our knowledge the traditional spatial model has not been applied to the entry and exit of people, rather than variations.

We can distinguish inflows and outflows by mobilizing several available data on residential mobility and labor movements between 2012 and 2013 in France. The data allow us to identify the individual characteristics of people and to focus on the working age population by supposing that they are the most affected by job location. This distinction offers significant results, and notably shows that population and job adjustments are not simultaneous, and a rise in job exits does not have an immediate impact on population exits.

2. Data and empirical strategy

2.1 Data description

We use data on individual residential mobility from the French 2013 Population Census. This gives us the place of residence of individuals on January 1st of 2013 and on January 1st of 2012. Since the objective of our paper is to study the geographical mobility of workers we focus on the residential mobility of the working-age population, i.e. employed or unemployed men and women aged from 15 to 64. We aggregate the individual data at the level of employment area (French *Zone d'Emploi*). We only study the 297 employment areas of mainland France. We calculate the number of people who entered (people inflows = $\mathrm{Pin}_{i,t}$) and who left (people outflows $\mathrm{Pout}_{i,t}$) each area between 2012 and 2013. In the database there are more than 8 million individuals, and among them 15.9% moved between 2012 and 2013: 5.9% within the same town, 4.9% between towns in the same employment area, and 5.1% between employment areas. We focus on the last category, representing 32% of those who were mobile, i.e. 415,958

individuals. The entry rates of population (the sum of entries in an area divided by the population area in 2012) vary between 1.13% and 5.24%, and the population exit rates (the sum of exits in an area divided by the population area in 2012) vary between 1.83% and 5.69%.

Our empirical analysis also uses the *Enquêtes sur les Mouvements de Main-d'Oeuvre* (EMMO) and the *Déclaration Mensuelle de Mouvements de Main-d'Oeuvre* (DMMO) from 2012. The EMMO is a survey that records movements of workers (entry and exit) at establishments with under fifty employees, and the DMMO is an administrative record of all movements of employees at all establishments with at least fifty employees. These two sources collect similar information about employee entry and exit. The data is quarterly, but we aggregate all movements for the year 2012 for all 297 employment areas. Thus we have the sum of employee entries ($\mathrm{Ein}_{i,t}$) and the sum of employee exits ($\mathrm{Eout}_{i,t}$). The entry rates of employment (the sum of entries in an area divided by the employment area in 2012) vary between 14 % and 217 %, and the exit rates from employment (the sum of exits in an area divided by the employment area in 2012) vary between 16 % and 216 %. The high values for employment in comparison to those of population are because workers can sign several short-term contracts.

We also mobilize several databases to control for the socioeconomic composition of areas, the housing market, the median revenue and the sectoral composition of employment, the local taxes and a land use register. These data are only available in 2012 and 2013 that's why we use a one-year interval dataset.

2.2 Empirical strategy

Most studies analyzing which comes first, jobs or people, focus on jobs variation (ΔE_t) and people variation (ΔP_t).

$$\begin{cases} \Delta P_t = P_t - P_{t-1} \\ \Delta E_t = E_t - E_{t-1} \end{cases}$$

Where E_t is the level of jobs at date t and E_{t-1} is the level of jobs at date t-1. P_t and P_{t-1} are the number of people at the same dates.

Usually, employing some hypotheses, the estimated spatial model is as follows (Boarnet, 1994):

$$\begin{cases} \Delta P_{i,t} = \alpha_0 + \alpha_1 \Delta \mathrm{E}_{i,t} + \alpha_2 W \Delta E_{i,t} + \alpha_3 W \Delta P_{i,t} + \alpha_4 P_{i,t-1} + \alpha_5 E_{i,t-1} + \alpha_k \sum_{k_1=1}^{K_1} X_{it-1}^{k_1} + \mu_{it1} \\ \Delta E_{i,t} = \beta_0 + \beta_1 \Delta \mathrm{P}_{i,t} + \beta_2 W \Delta P_{i,t} + \beta_3 W \Delta E_{i,t} + \beta_4 E_{i,t-1} + \beta_5 P_{i,t-1} + \alpha_k \sum_{k_2=1}^{K_2} X_{it-1}^{k_2} + \mu_{it2} \end{cases} \quad (1)$$

Where subscript *i* represents the employment area, W is the spatial weights matrix which describes the relation between each area and its neighbors, K_1 and K_2 represent the number of local characteristics introduced to describe the local job markets and living places. Thus, $X_{it-1}^{k_1}$ and $X_{it-1}^{k_2}$ represent the variables which influence the variation of people and jobs respectively. The error terms for r=1,2 can be decomposed into

$$\mu_{itr} = \rho_r \, W.\mu_{it} + \upsilon_{itr}$$

where ρ_r is the measure of spatial autocorrelation.

The equations for model (1) are estimated simultaneously. Interpretation of α_1 and β_1 enables us to tell if jobs follow people or people follow jobs. If $\beta_1 = 0$ and $\alpha_1 > 0$, people follow jobs. On the other hand, if $\beta_1 > 0$ and $\alpha_1 = 0$ jobs follow people. In the case where $\alpha_1 > 0$ and $\beta_1 > 0$, we consider that people and jobs influence each other.

Instead of using directly the level of people and jobs at each date, we express variations as entry minus exit (with the notation described above): $\Delta P_t = \mathrm{Pin_t} - \mathrm{Pout_t}$ and $\Delta E_t = \mathrm{Ein_t} - \mathrm{Eout_t}$. Then we rewrite the model with the traditional hypothesis distinguishing between entry (model 2) and exit (model 3):

$$\begin{cases} \mathrm{Pin}_{i,t} = \alpha_0' + \alpha_1'\mathrm{Ein}_{i,t} + \alpha_2' W\mathrm{Ein}_{i,t} + \alpha_3' W\mathrm{Pin}_{i,t} + \alpha_4'\mathrm{Pout}_{i,t} + \alpha_5' W\mathrm{Pout}_{i,t} + \alpha_6'\mathrm{Eout}_{i,t} \\ \qquad +\alpha_7' W\mathrm{Eout}_{i,t} + \alpha_8' P_{i,t-1} + \alpha_9' E_{i,t-1} + \alpha_k \sum_{k_1=1}^{K_1} X_{i,t-1}^{k_1} + \mu_{it1} \\ \mathrm{Ein}_{i,t} = \beta_0' + \beta_1'\mathrm{Pin}_{i,t} + \beta_2' W\mathrm{Pin}_{i,t} + \beta_3' W\mathrm{Ein}_{i,t} + \beta_4'\mathrm{Eout}_{i,t} + \beta_5' W\mathrm{Eout}_{i,t} + \beta_6'\mathrm{Pout}_{i,t} \\ \qquad +\beta_7' W\mathrm{Pout}_{i,t} + \beta_8' E_{i,t-1} + \beta_9' P_{i,t-1} + \alpha_k \sum_{k_2=1}^{K_2} X_{i,t-1}^{k_2} + \mu_{it2} \end{cases} \quad (2)$$

$$\begin{cases} \mathrm{Pout}_{i,t} = \alpha_0' + \alpha_1'\mathrm{Eout}_{i,t} + \alpha_2' W\mathrm{Eout}_{i,t} + \alpha_3' W\mathrm{Pout}_{i,t} + \alpha_4'\mathrm{Pin}_{i,t} + \alpha_5' W\mathrm{Pin}_{i,t} + \alpha_6'\mathrm{Ein}_{i,t} \\ \qquad +\alpha_7' W\mathrm{Ein}_{i,t} + \alpha_8' P_{i,t-1} + \alpha_9' E_{i,t-1} + \alpha_k \sum_{k_1=1}^{K_1} X_{i,t-1}^{k_1} + \nu_{it1} \\ \mathrm{Eout}_{i,t} = \beta_0' + \beta_1'\mathrm{Pout}_{i,t} + \beta_2' W\mathrm{Pout}_{i,t} + \beta_3' W\mathrm{Eout}_{i,t} + \beta_4'\mathrm{Ein}_{i,t} + \beta_5' W\mathrm{Ein}_{i,t} + \beta_6'\mathrm{Pin}_{i,t} \\ \qquad +\beta_7' W\mathrm{Pin}_{i,t} + \beta_8' E_{i,t-1} + \beta_9' P_{i,t-1} + \alpha_k \sum_{k_2=1}^{K_2} X_{i,t-1}^{k_2} + \nu_{it1} \end{cases} \quad (3)$$

For both systems of equations (2) and (3), the interpretation of α_1' and β_1', as in equation (1), enables to tell if jobs entry/exit follows people entry/exit, or people entry/exit follows jobs entry/exit. The estimated parameters of equations (2) and (3) are different from equation (1) because of the weight matrix and the rewriting of the model. In particular, α_4' and β_4' are supposed to be equal to one.

We estimate the models with the generalized spatial three-stage least squares method (Kelejian and Prucha, 2001). This makes it possible to simultaneously estimate the two equations, taking into account the forms of spatial dependence, on the endogenous variables and on the error terms. First, equations are estimated by two-stage least squares. This first step corrects for the endogeneity between employment growth and population growth, using instrumental variables in each equation. In the second step, the estimated residuals are used to estimate the autoregressive parameter ρ in each equation using the generalized method of moments. In a third step, the system of simultaneous equations is finally re-estimated taking into account the calculated autoregressive parameter and the possible correlation between the error terms of the two equations.

In equations (2) and (3), $X_{it-1}^{k_1}$ includes information on the resident population, the housing market, amenities and local taxation, and $X_{it-1}^{k_2}$ includes the characteristics of the labor force, the labor market and amenities. For the identification of the models, $X_{it-1}^{k_1}$ and $X_{it-1}^{k_2}$ are supposed not to be identical.

According to the literature, local taxes applicable to households can influence residential migration but have no impact on local employment growth (Carlino and Mills (1987), Henry et al. (2001)). In France, since council taxes are paid by all households and can influence the choice of residential location, we use this information as an exclusion variable in the first equation of models (2) and (3). We also suppose that the housing market only influences residential migration (Boarnet et al (2005), Henry et al., 2001) since mobile households pay attention to the type of housing available within areas. We introduce the total number of houses and the amount of new housing.

Only employment growth depends on the characteristics of the labor force and the labor market. Employment dynamics are related to the skill level of the workforce, which has little influence on choice of location. Thus we use as an exclusion variable in the second equation of the models the rate of managerial position (Henry et al., (2001)).

In addition to the exclusion variables we add the following variables in $X_{t-1}^{k_1}$ and $X_{t-1}^{k_2}$: the number of unemployed people, the median income, the population density, the green space area, a dummy variable for the proximity of another country, a dummy variable for the proximity of coasts, employment in manufacturing and employment in services industry.

2.3 The spatial weights matrix

The model of Boarnet (1994) seeks to test the presence of spatial autocorrelation. The values taken by a variable depend on the geographical distribution of the employment areas. The Moran index measures the global spatial autocorrelation and is calculated as the ratio of the covariance between neighboring observations and the total variance of the sample. The autocorrelation can be either positive or negative: if spatial autocorrelation is positive similar areas cluster, and if it is negative each area and its neighbor are different. The Moran index enables us to test the presence of autocorrelation and to choose the best spatial weights matrix.

We test two common spatial weights matrices. First, we assume that the residents of an area work either within the area or in employment areas that are directly adjacent to each other. In this case, for two adjacent areas i and j, $w_{i,j} = 1/nbEA$, where $nbEA$ is the number of adjacent areas; otherwise, $w_{i,j} = 0$. We suppose that this matrix is appropriate because the French National Institute of Statistics (INSEE) defines an employment area as a space in which the majority of individuals work and live. However, an individual's area of job search may be greater than the employment area, and business opportunities may exceed these limits. Second, we assume that the weights matrix is is $w_{i,j} = 1/d_{i,j}$ where $d_{i,j}$ is the Euclidean distance between the center of the areas i and j. In this specification the geographical dependence between two areas decreases with the distance that separates them.

Unsurprisingly, the Moran index test shows that there is spatial autocorrelation, and that the more appropriate spatial weights matrix is the first specification.

3. Estimation results

Before distinguishing between entries and exits we estimate model (1) to make sure that our data reproduces the traditional results. Table 1 only presents the estimated coefficients of jobs and people variation and associated spatial effects. The results are close to those found in previous studies oriented to employment area. People and jobs influence each other: a rise of 1 % in the variation of jobs involves a rise of 0.14 % in the variation of people, and when the variation of people increases by 1 %, the variation of jobs increases by 1.11%. As people and jobs variations influence each other, public policy can target households or companies to improve local dynamics.

Only two spatial effects are slightly significant: the variation of people in an area is positively correlated with the variation of people in an adjacent area. On the contrary, the variation of jobs in an area is negatively correlated with the variation of jobs in adjacent areas.

Table 1. Estimation results of equation (1)

	People variation	Jobs variation
Jobs variation	0,14*** (0,052)	
People variation		1,11*** (0,131)
W*(Jobs. variation)	-0,03 (0,047)	-0,20* (0,116)
W*(People. variation)	0,09** (0,039)	-0,05 (0,106)

Note: ***: p<0.01; **: p<0.05; *: p<0.1.

Let us turn to table 2. As in Table 1 the same control variables are not presented. The left part of the table presents the results for entry and the right part of the table presents the results for exit. Jobs and people entry in different employment areas influence each other: A rise of 1 % in jobs entry involves a rise of 0.23 % in people entry, and a rise of 1 % of people entry involves a rise of 0.96 % in jobs entry. Only people exit increases jobs exit: when people exit increases by 1 %, jobs exit increases by 0.61%. Our analysis shows that the spatial effects are mainly insignificant: only the rise in the number of people exiting adjacent employment areas involves a decrease in jobs exit.

If we distinguish between entry and exit of jobs and people, our results confirm that it takes longer for migration behavior to adapt to changes in employment than it does for changes in employment to alter patterns of migration. In particular, exit from jobs does not immediately affect residential mobility. This result may be partly related to the structure of our data and the one-year time window, but also be related to the fact that the jobs studied were in France. People who lose or leave their jobs might not move immediately, since their new job is in an area close to the old one. In France, job creation and job destruction follow a logic of agglomeration (mainly in the biggest cities) and residential migration is weakly correlated with the dynamics of the labor market. One reason is housing prices in and around big cities: Jobs are located in the city centre, and the nearer you are to the city centre, the higher is housing price.

Another possible reason is that workers wait for job stability before moving. In France, even if a majority of employees have an open-ended labor contract (*Contrat à durée indéterminée* (CDI)), the share of employees entering a firm with a fixed-term labor contract (*Contrat à durée déterminée* (CDD)) is about 85 %. Private sector employers have made greater use of fixed-term contracts since the 2008 financial crisis so that they can adapt to an economic environment that they consider increasingly uncertain. Moreover, in a context that is changing, fixed-term contracts also allow employers to select "good" employees and limit the costs associated with the breakdown of the employment relationship. When an employee has a fixed-term contract it is very difficult to gain access to housing.

The third reason for non-residential mobility is that people become attached to the region where they were born and grew up. Geographical mobility is not especially marked, even at the sub-national level. It can give rise to significant problems for employees, especially the unskilled, not only if it is forced upon them, but also if it is voluntary.

Table 2. Estimation results of equation (2) and (3)

	Population Entry	Job Entry		Population Exit	Job Exit
Job Entry	0,23*** (0,039)		Job Exit	0,05 (0,045)	
Population Entry		0,96*** (0,134)	Population Exit		0,61*** (0,220)
Population Exit	0,93*** (0,047)	-1,35*** (0,157)	Population Entry	0,69*** (0,037)	-0,30** (0,134)
Job Exit	-0,23*** (0,041)	1,03*** (0,010)	Job Entry	-0,05 (0,042)	0,93*** (0,009)
W*(Job entry)	n.s.	n.s.	W*(Job exit)	n.s.	n.s.
W*(Population entry)	n.s.	n.s.	W*(population exit)	n.s.	-0,47* (0,239)
W*(population exit)	n.s.	n.s.	W*(Population entry)	n.s.	n.s.
W*(Job exit)	n.s.	n.s.	W*(Job entry)	n.s.	n.s.

Note: ***: p<0.01; **: p<0.05; *: p<0.1

4. Conclusion

The contribution of our paper is to adapt a classical model of urban economics to study the entry and exit of the working-age population and workers in firms for France between 2012 and 2013. When decomposing variations between entry and exit, jobs follow people rather than people follow jobs. The main result is that jobs exit does not have an immediate effect on people exit. We can advance three reasons: first, people who lose or leave their jobs might not move immediately because their new job is in an area close to the old one; second, they can wait for job stability before moving; third, their attachment to the region can deter individuals from moving and their readiness to work in more distant geographical areas. In particular the attachment to the region is very important for blue unskilled workers that's why in future research it would be appreciable to decompose entry and exit by skill levels.

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