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ABSTRACT

Labour Market Flows: Accounting for the Public Sector*

For the period between 2003 and 2018, we document a number of facts about worker gross flows in France, the United Kingdom, Spain and the United States, focussing on the role of the public sector. Using the French, Spanish and UK *Labour Force Survey* and the US *Current Population Survey* data, we examine the size and cyclicality of the flows and transition probabilities between private and public employment, unemployment and inactivity. We examine the stocks and flows by gender, age and education. We decompose contributions of private and public job-finding and job-separation rates to fluctuations in the unemployment rate. Public- sector employment contributes 20 percent to fluctuations in the unemployment rate in the UK, 15 percent in France and 10 percent in Spain and the US. Private-sector workers would forgo 0.5 to 2.9 percent of their wage to have the same job security as public-sector workers.

JEL Classification: E24, E32, J21, J45, J60

Keywords: worker gross flows, job-finding rate, job-separation rate, public sector, public-sector employment

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1 Introduction

In most European economies, around 20 percent of all workers are employed by the government. Government hire workers to produce goods and services. However, governments face different constraints than private-sector firms and are not driven by profit maximization. Hence, government employment and wage policies are driven by other objectives including: attaining budgetary targets (Poterba and Rueben, 1998; Gyourko and Tracy, 1989); implementing macroeconomic stabilization policy (Keynes, 1936; Holm-Hadulla *et al.*, 2010; Lamo *et al.*, 2013); redistributing resources (Alesina *et al.*, 2000; Alesina *et al.*, 1999; Wilson, 1982); or satisfying interest groups for electoral gains (Borjas, 1984; Matschke, 2003; Gelb *et al.*, 2000). As a consequence, public-sector labour markets might behave differently from their private-sector counterparts.

The objective of this paper is to establish a number of key facts about the French, Spanish, UK and US labour market flows, focussing on the role played by the public sector. We do so by examining data from the French, Spanish and UK *Labour Force Surveys* and the US *Current Population Survey* (CPS) over the past 15 years. We chose these four countries because they are large countries with sizable public sectors, and have been recently facing pressure to reform their public sectors. Furthermore, because they have different labour market institutions, public-sector hiring procedures and wage policies and various weights on different industries, facts that are found to be common across the four countries should be seen as intrinsic characteristics of the public sector. While we do not attempt to explain these facts, we believe that they are an important first step to foster theoretical research on the topic. They can help economists understand the characteristics of the public sector and its policies, as well as provide a guideline of the empirical features that models with a public sector should reproduce and help in the calibration or identification of key parameters. We show that public-sector labour markets do indeed behave differently than the private sector. The size of transition rates into and out of public-sector employment are different and its cyclical pattern as well. Furthermore, the government hires mostly women, college graduates and older workers, which creates asymmetric exposures to public-sector policies for different workers.

In the last decade in European countries, public-sector employment was a key policy variable. Following budgetary constraints, many countries imposed measures such as hiring freezes layoffs of public-sector workers, as well as wage cuts or freezes that affected the retention of these workers (Glasser and Watt, 2010). Given the policy role that public-sector employment played during the last decade, a new wave of research constructs search

and matching models of unemployment to study the labour market effects of public-sector employment and wages. Examples include Hörner *et al.* (2007), Quadrini and Trigari (2007), Afonso and Gomes (2014), Gomes (2015a, 2017), Michaillat (2014), Burdett (2012), Bradley *et al.* (2018), Albrecht *et al.* (2018), Bermperoglou *et al.* (2017) and Boeing-Reicher and Caponi (2017). Lying at the heart of these state-of-the-art models are the worker gross flows between private- and public-sector employment and non-employment.

However, the extensive literature that estimates and analyses worker gross flows has systematic ignored the role of the public sector. This literature has focused mainly on disentangling the relative importance of job-finding and job-separation rates in driving the unemployment rate. The most cited papers on the topic – Blanchard and Diamond (1990), Shimer (2012), Elsby *et al.* (2009) and Fujita and Ramey (2009) – study the US labour market, proposing different decompositions or examining the role of the time-aggregation bias. Also for the US, Borowczyk-Martins and Lalé (2019) distinguish between full-time and part-time employment, while Elsby *et al.* (2015) study the role of the participation margin. Smith (2011) proposes an out-of-steady-state decomposition and analyses the UK labour market. Gomes (2012) further analyses the UK labour market along other dimensions, such as education or labour force attachment, while Fujita (2010) concentrates on on-the-job search and job-to-job transition and Carrillo-Tudela *et al.* (2016) on the extent of worker reallocation across occupations and industries and their cyclicality. In two comparisons of the UK and the US, Razzu and Singleton (2016) study the fluctuations of unemployment among men and women, while Gomes (2015b) examines the role of conditional transition probabilities and how they depend on the frequency of the surveys. Other papers focussing on the UK include Elsby *et al.* (2011) and Elsby and Smith (2010).

Several studies examine other European labour markets. Petrongolo and Pissarides (2008) compare the relative importance of job-finding and job-separation rates across France, the United Kingdom, Spain and the United States. Silva and Vázquez-Grenno (2013) focus on the role of flows in and out of permanent and temporary employment in Spain. Baussola and Mussida (2014) study Italian gross flows, concentrating on unemployment gender gaps. Charlot *et al.* (2018) split between employment in abstract, routine and manual occupations in France and the US. Other works examining the French labour market include Hairault *et al.* (2012) and Fontaine (2016). Hertweck and Sigrist (2015) study the German labour market and Daouli *et al.* (2012) the Greek labour market during the crisis. Despite looking at worker flows from different angles, all the papers in this exhaustive list have ignored the duality between the private and the public sectors.

In Section 3, we provide evidence on the size and cyclicality of the flows between pub-

lic and private employment, unemployment and inactivity. France and the UK have larger public sectors than either Spain or the US. Over the last business cycle, public-sector employment was pro-cyclical in France, countercyclical in the US, and acyclical in Spain and the UK.

In Section 4, we quantify how government hiring and separations have contributed to unemployment fluctuations. We show that ignoring these flows in unemployment decompositions can potentially bias the relative importance of job-finding and job-separation rates, although in our sample, this bias turned out to be small. We find a relative split of 80-20 percent of the contribution of private- and public-sector employment to fluctuations in the unemployment rate in UK, 85-15 in France and of 90-10 percent in Spain and the US. We performed a counterfactual analysis and show that since 2008, if governments had kept the same hirings and separations from the previous years, unemployment rate would have been lower, by up to 1 percentage point, in the France and the UK, but it would have been higher in the US and Spain. In our view, this finding reflects the different macroeconomic policies conducted by governments in response to the Great Recession, with a larger focus on austerity policies by some European countries.

We document that jobs are safer in the public sector – aggregate job-separation rates are lower. In Section 5, we further investigate this result by using a multinomial logit model to estimate the differences in transition rates from employment to unemployment and inactivity from the two sectors, conditional on observable characteristics. The argument that public-sector jobs are safer is often used in policy discussions surrounding public-sector pay. However, while there are several papers estimating the wage differentials across sectors, there are no estimates of the value of the job-security.[1] We use a simple back-of-the-envelope calculation to find the percentage of their wage that private-sector workers would be willing to forgo to have the same job-separation probability as in the public sector. In our preferred scenario, risk-neutral workers would pay 0.5 to 1.6 percent of their wage for the same job security, which can be seen as a lower bound for the insurance value of public-sector employment. Risk-averse workers without any savings mechanism would pay 1.0 to 2.9 percent of their wage, which can be seen as an upper bound. The value of job safety in the public sector is equivalent to between 0.4 to 0.7 percent of total government spending in France and between 0.2 to 0.4 percent in the UK, Spain and the US.

[1]Using micro level data, several papers find that, on average, the public sector pays higher wages than the private sector. Examples include: Katz and Krueger (1991) for the United States; Postel-Vinay and Turon (2007) or Disney and Gosling (1998) for the United Kingdom; and Christofides and Michael (2013), Castro, Salto, and Steiner (2013) and Giordano et al. (2011) for several European countries.

2 Preliminary concepts

2.1 Labour market dynamics

In order to analyse labour market dynamics, we use some fundamental equations that describe the evolution of the stock of the employed in the private and public sectors (P and G) and the stock of the unemployed U. The pool of the inactive is denoted by I. Adding the four pools gives us the working-age population W, while the sum of employment and unemployment corresponds to the labour force L. The unemployment rate is defined as $u = \frac{U}{L}$ and the participation rate as $p = \frac{L}{W}$.

Changes in private and public employment evolve according to the following equations:

$$\Delta P_{t+1} = \lambda_t^{GP} G_t + \lambda_t^{UP} U_t + \lambda_t^{IP} I_t - (\lambda_t^{PG} + \lambda_t^{PU} + \lambda_t^{PI}) P_t, \tag{1}$$

$$\Delta G_{t+1} = \lambda_t^{PG} P_t + \lambda_t^{UG} U_t + \lambda_t^{IG} I_t - (\lambda_t^{GP} + \lambda_t^{GU} + \lambda_t^{GI}) G_t, \tag{2}$$

where λ^{ij} is the transition probability between the pools indicated by the superscript. Similarly, for unemployment and inactivity:

$$\Delta U_{t+1} = \lambda_t^{PU} P_t + \lambda_t^{GU} G_t + \lambda_t^{IU} I_t - (\lambda_t^{UP} + \lambda_t^{UG} + \lambda_t^{UI}) U_t, \tag{3}$$

$$\Delta I_{t+1} = \lambda_t^{PI} P_t + \lambda_t^{GI} G_t + \lambda_t^{UI} U_t - (\lambda_t^{IP} + \lambda_t^{IG} + \lambda_t^{IU}) I_t. \tag{4}$$

The transition rate multiplied by the stock is equivalent to the total number of transitions. For each stock, the terms with a positive sign reflect the inflows from the three remaining pools, while the term with a negative sign corresponds to the outflows.

2.2 Data

The information about jobs sectors (public/private), individuals' position in the labor market, worker flows and associated transition rates are extracted from each country's representative labour market survey, from which official statistics are drawn: the French *Labour Force Survey* (FLFS), the UK *Labour Force Survey* (UKLFS), Spanish *Labour Force Survey* (SLFS) and the US *Current Population Survey* (CPS).

Since a redesign in 2003, the FLFS is conducted quarterly. The sample of the survey is a rotating panel composed of six waves. In each quarter, one sixth of the sample is renewed: the "oldest" wave leaves the sample, whereas a new wave enters. The survey provides a set of information about individuals' characteristics, such as their education, their labour market

status (constructed according to the definitions of the International Labour Organization) and their economic activity. The longitudinal structure of the FLFS allows us to match observations belonging to two consecutive surveys. We compute individuals' transitions and aggregate them to calculate the gross worker flows and transition rates in each quarter. Due to the structure of the database, at best, five sixths of the sample can be matched between two consecutive surveys. Panel attrition and non-response that reduce the size of the longitudinal sample, as well as sample fluctuations, may affect the estimation of labor market states (and so worker flows). In order to solve these statistical problems, Shimer (2012) and Silva and Vázquez-Grenno (2013) drop missing observations and reweight measured transitions by the missing-at-random method. We proceed differently: each longitudinal sample is reweighted by a method similar to the one proposed by Lundstrom and Sarndal (1999). The purpose is to equalize, according to some leading variables (labour market states in the first quarter; age pyramid by gender; household type; and education level), the structure of the longitudinal sample with the known population structure in period t. See Fontaine (2016) for details.[2]

The UKLFS is a quarterly survey of households living at private addresses in the United Kingdom. The panel samples around 60,000 households for five successive quarters. The sample is split into five waves. Every quarter, one wave of approximately 12,000 households leaves the survey and a new wave enters. See Gomes (2012) for more details on the survey. Although the quarterly survey effectively starts in 1993, our baseline sample is restricted to the period between 2003:1 and 2018:4 to allow for a more straightforward comparison with the French survey.[3] The Office for National Statistics already provides the census population longitudinal weights, which we use to construct the flows series.

Like its French counterpart, the SLFS is a quarterly representative survey in which the sample is divided into six waves. The SLFS samples about 65,000 households, which is equivalent to around 180,000 individuals. See Silva and Vázquez-Grenno (2013) for more details on the survey. Although the quarterly survey starts in 1999, for the main results we restrict our sample to the period between 2005:1 and 2018:4. The reason is that, before 2005, the Spanish Statistical Office implemented a significant methodological change regarding both the questionnaire and the data collection. As a consequence, it is not possible to link the time series of labour market transitions with the two different methodologies. As no longitudinal weights are provided, we follow the same procedure as the French survey to

[2]As Lundstrom and Sarndal (1999) demonstrate, this procedure can reduce sample fluctuations and the non-response bias and has been adopted by the French National Institute of Statistics and Economic Studies to correct non-response bias and sample fluctuations in the FLFS.

[3]Furthermore, the current ONS files exclude the April-Sept dataset for 2001 and the Autumn-Winter for 1996. The full sample is available in the dataset that accompanies the paper.

recalculate them.

For comparison with the rest of the literature, we provide evidence for the US, based on the CPS. The CPS surveys households for four consecutive months, omits them for eight months and then interviews them again for another four months. See Shimer (2012) for a description of the survey. In contrast to the European surveys, the CPS allows the researcher to compute the transition probabilities in the labour market at a monthly frequency. We extend the Shimer (2012) code, publicly available on his webpage. To avoid the breaks in the survey that are recurrent until 1995, we start our sample in 1996, but for comparison with the European countries, we report the results for the 2003-2018 period in the main text.

2.3 Definition of public jobs

In our view, the defining characteristic of the public-sector is that its goods or services are not sold, but are provided directly to the population. It uses the power of taxation to finance the production of public goods, rival or non-rival, and governmental services. There are two main government decisions that affect its employment level. First, governments decide the scope of the public sector – which goods and services they want to provide. Second, they decide whether to supply them directly by hiring workers – in-house production – or by outsourcing it to private sector firms. These decisions are usually the outcome of a political process and vary drastically across countries. As a consequence, the extent of the operation of the public sector in different industries varies. It is important to bear in mind that, in this paper, we do not focus on particular industries, i.e. public adminstration, but the entire sphere of public-sector employment, even if it involves different weights on particular industries. Given this conceptual view, we exclude from our definition of public-sector employment, public enterprises, or state-owned enterprises, that provide various private goods and services for sale and usually operate on a commercial basis.

The distinction between public- and private-sector jobs is based on a self-reported variable, which is in accordance with how official statistics are drawn. During the survey, the interviewer asks the individual to classify his employer. In the UK, we include the following categories in our definition of public-sector employment : i) Central Government, Civil Service; ii) Local government or council (incl. police, fire services and local authority controlled schools or colleges); iii) University or other grant-funded educational establishment; iv) Health authority or NHS trust; and v) Armed forces. We exclude from our definition every private organization, as well as: i) Public company; ii) Nationalised industry or state corporation; iii) Charity, voluntary organisation or trust; and iv) other organisation. A sim-

ilar definition is used for France.[4] For Spain, the survey asks directly whether respondents work for the public or the private sector. For the United States, the definition of public sector is working for the government (federal, state or local government).[5]

The shortcoming of a such declarative variable is that it could be subject to misclassification of the sector of work. Misreporting of the sector is not a serious problem in computing the overall stock of public and private sector employment, but it might overstate the transitions from public to private sector (and vice versa). Given that, for the unemployment decomposition in Section 4, we compute a time-aggregation bias correction; the overstating of flows between the two sectors can introduce noise or bias in all transition rates. A similar problem exists for the flows in between unemployment and inactivity and was addressed by Elsby *et al.* (2015). To solve this problem, we check whether the transitions between the sectors are spurious by controlling for the tenure of jobs. We validate a direct transition between the two sectors only when the respondent states that he has been working for the same employer for less than three months. Bradley *et al.* (2018) use a similar method. For the United States we use a different approach similar to Elsby *et al.* (2015). We calculate the three-period transitions and calculate and remove the fraction of moves between one sector and the other that revert to the initial sector on the following month (remove the P-G-P from P-G flows, and the G-P-G out of the G-P flows).

The percentage of flows between public and private sector that are consider spurious varies across countries. In the US, France, the UK and Spain, 17, 32, 55 and 87 percent of the flows, respectively are spurious. Although the number for the Spain looks high, one should put it in perspective. The error is relatively large, partly because the number of transitions is very small. If we measure them relative to total employment, this high number in Spain could be explained if 0.6 percent of the employees make a mistake in reporting their sector. Still, one should be cautious about the quality of the Spanish data.

[4]We include: i) État; ii) Collectivités territoriales; iii) Hôpitaux publics; and iv) Sécurité sociale. We exclude: i) Particulier; ii) Entreprise publique; and iii) Entreprise privée.

[5]Defining the sphere of the public sector is hard and we opted for a conservative definition. Both the UK and the US surveys distinguish the "not-for-profit" private employment. This employment, which is non-negligible – 6 percent in the US and 4 percent in the UK – is attached to the private sector despite having different features. Publicly owned firm that represent 5.7, 2.6 and 0.9 percent of employment in the France, UK and Spain is also attached to the private sector.

3 Worker gross flows

3.1 Average gross flows

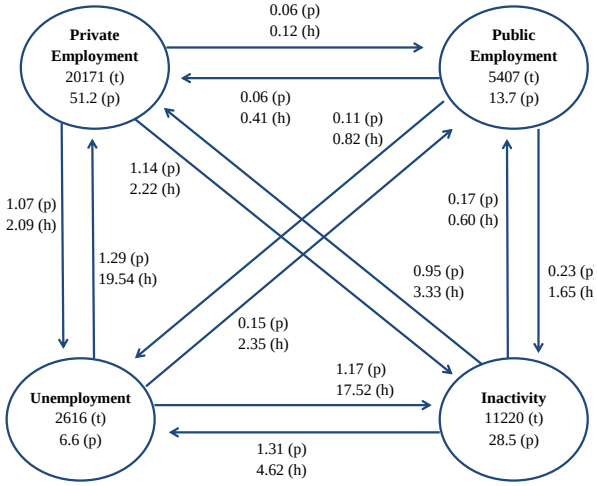
Figure 1 summarizes the average quarterly (monthly) worker flows over the 2003-2018 period for the three European countries (United States). It reports the stocks of workers in thousands (t) and as a percentage of the working-age population (p), as well as the number of people that change status every quarter (month) as a percentage of the working-age population (p) and as a transition probability or hazard rate (h). We restrict our analysis to the working-age population (16 to 64 years old). The public sector employs 17.0 percent of the working-age population in the UK, 13.7 percent in France, 12.0 percent in the US and 7.8 percent in Spain. It represents 23, 21, 16 and 16 percent of total employment, respectively.

The main difference between the two sectors is their turnover. Labour turnover, between employment and non-employment, is lower in the public sector. In each quarter in the UK and France, flows in and out of private-sector employment represent around eight percent of its stock, while for the public sector, they are around 4.5 percent of its stock. In the United States, monthly turnover represents seven percent in the private sector and 4.6 percent in the public. In Spain, the turnover is larger, with 15.4 percent in the private sector and 9.3 percent in the public sector.

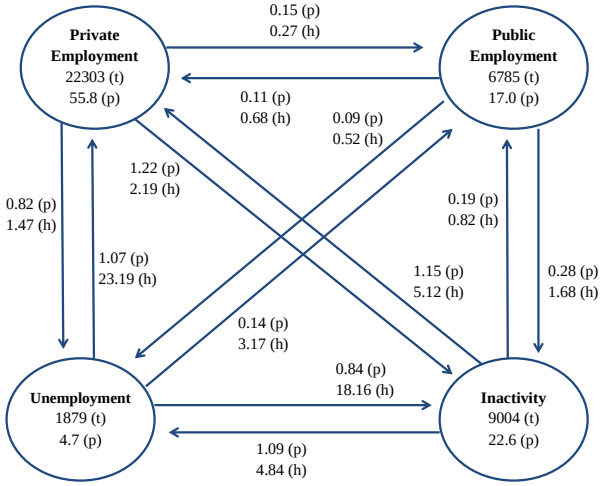
Fewer people separate from the public sector. The probability of moving from employment to unemployment is more than two times higher if working in the private sector in the four countries. It is almost three times in the UK, where the probability is 1.47 percent in the private sector and only 0.52 in the public sector. In all countries, the probability of moving from employment to inactivity is around 30 percent higher in the private relative to the public sector. Fewer separations imply that there are fewer hires. In the three European countries, while roughly 20 percent of the unemployed find a job in the private sector each quarter, only two to three percent find one in the public sector. In the United States, each month, 20.73 percent of the unemployed find a job in the private sector, while only 1.88 percent find a public-sector job.

When leaving public-sector jobs to non-employment, workers are more likely to withdraw from the labor force. In France, 67 percent of outflows from the public sector (to non-employment) are directed to non-participation. The corresponding statistic for the private sector amounts to 51 percent. The finding is stronger in the UK and the US, where more than 72 percent of public-sector separations are to inactivity, but weaker in Spain, at 52 percent. Likewise, returns to public jobs from non-participation are also more frequent.

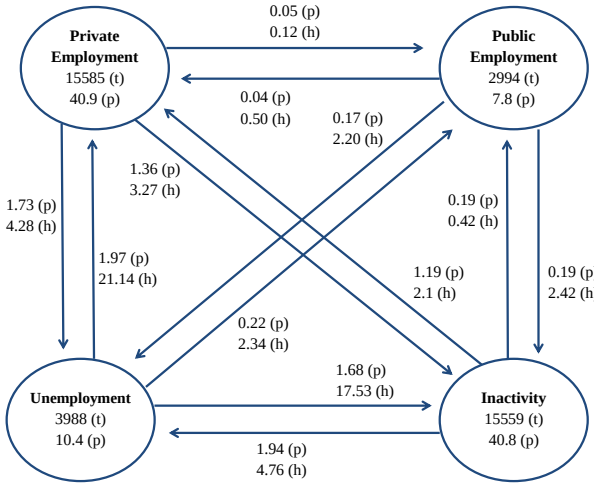
Figure 1: Average worker flows, 2003-2018



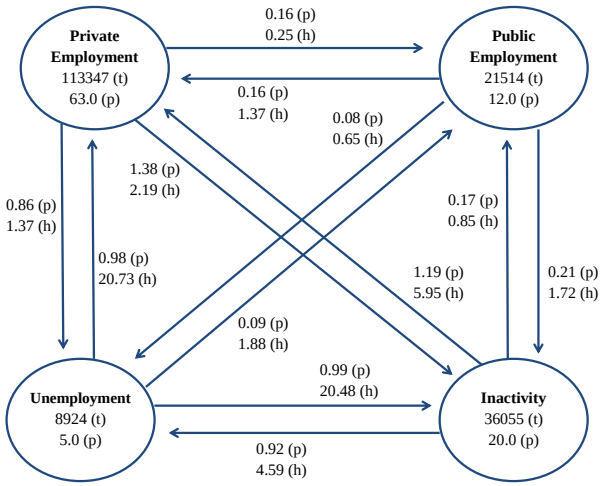
(a) France, quarterly flows



(b) UK, quarterly flows



(c) Spain, quarterly flows



(d) US, monthly flows

Note: the worker stocks and flows are expressed as total number of people in thousands (t), as a percentage of the working-age population (p) or as a hazard rate (h). Data extracted from the French, UK and Spanish Labour Force Survey, and the CPS. ∗ For the US, flows between private and public employment were adjusted with a different methodology.

In France and the UK, more than 50 percent of new hires in the public sector come from inactivity, whereas in the private sector, that number is less than 50 percent. In Section 5, we use a multinomial logit model to reevaluate these differences in separation probabilities between sectors, controlling for observable characteristics.

There are few direct transitions between employment in the two sectors. Each quarter in the France and Spain, only 0.12 percent of private-sector workers switch sector without a measured spell of unemployment. This represents less than 15 percent of all inflows into the public sector. In the UK and US these flows seem more important. In each quarter, 31 and 38 percent of the new hires in the public sector come directly from private employment.[6] Understanding the importance of the direct transitions across the two sectors has implications for the theoretical literature on the effects of public-sector employment. While Bradley *et al.* (2018) model the direct transitions across the two sectors, most of the literature – including Gomes (2018) or Albrecht *et al.* (2018) – ignores these. We find that, although transitions between the two sectors are not negligible, most of the inflow into public-sector employment comes from non-employment. These results are also consistent with the view, described in Chassamboulli and Gomes (2018), that Spain and French public sectors are more segmented, requiring competitive entry exams, which is not the case for the majority of public-sector jobs in the UK and US.

The industries having the highest share of public-sector employment vary by country. In France and the UK (see table in Appendix I) public-sector employment represents 85-90 percent of total employment in "Public administration and defence." With around 75-80 percent of public-sector employment, "Education" is the sector with the second-highest fraction of public-sector employment. "Health and social work" has also a very high number of public-sector workers, but they represent only 55 percent of the total workers in the industry in the UK and 36 percent in France. Other industries where the public sector is relevant include "Water supply, sewerage, waste", "Arts, entertainment and recreation" and "Extraterritorial organizations". In the SLFS, the industries "Public Administration, education and health activities" are not disaggregated, but within this group, 73 percent

[6]For the US, we have calculated the job-finding rate to public and private sector conditional on previous status. These rates, shown in Appendix V, support the conclusion that the choice of sector is persistent, even after an unemployment spell. The unconditional job-finding rate in the public sector is only 1.8 percent, but conditional of being in the public sector in the month preceding unemployment it is close to 30 percent. Curiously, the job-finding rate conditional on being previously employed in the private is 1.4 percent, roughly equal to the rates conditional of previously being unemployed or inactive. For the private sector, again we see the attachment of workers with a conditional job-finding rate of more than 40 percent. Being previously employed in the public sector does not raise the job-finding rate in the private sector relative to the ones that were unemployed or inactive (with job-finding rates of around 16 percent).

of employment is in the public sector. In the US, the public sector accounts for all of the employment in the industries of "Public administration" and "Armed forces" but only 35 percent of employment in "Educational and health services".

3.2 Disaggregated worker flows

The tables in Appendix III show the average stock and flows of different subgroups of workers, disaggregated by gender, education and age. Public-sector employment is particularly relevant for women. On average, 16.5 and 22.2 percent of all women are working in the public sector in France and in the UK, respectively. However, given than women's labour market participation is lower than men's, public-sector employment corresponds to 27 and 33 percent of total employment for women in the two countries, roughly double than for men. For Spain and the US, the gender differences are smaller. The Spanish and US public sectors hire 19 percent of all working women, and only 12 percent of all working men. In the four countries, the probability of a woman finding a job in the public sector is twice as high as for men.

The public sector hires predominantly workers with tertiary education. The French public sectors employs 23 percent of the population with tertiary education, 13 percent of people with secondary education and only ten percent of people with only primary education. In the UK, these numbers are 30, 15 and seven percent. In Spain, these are 19.1, 5.1 and 0.9 percent, similar to the 18.7, eight and 2.2 percent in the US. Public-sector employment of college graduates represents more than a fifth of their employment in France, Spain and the US and an extraordinary 36 percent in the UK.

Job-finding rates are increasing and job-separation rates are decreasing in education in both sectors. In France, the fraction of the job-finding rate accounted for by the public sector increases from ten percent for primary-educated workers to 13 percent for college graduates. In the other countries, the differences are larger. This fraction increases from seven to 22 percent in the UK, from eight to 17 percent in Spain and from two to 16 percent in the US. In the US, the public sector does not play any role in the labour market for primary-educated workers, but it accounts for one fifth of all new hires of college graduates.

The public sector hires few young workers. Out of all employed workers aged 16 to 29, the public sector accounts for only 16 percent in France and the UK, about eight percent in Spain and 10 percent the US. In France and the UK, most public-sector employment is concentrated on prime-age workers. The French and UK's public sectors employ 17.6

and 20.9 percent, respectively, of all workers aged 39-49. However, as a fraction of total employment, the public sector is more significant for older workers (age 50-64), accounting for 24 and 27 percent of their employment. This means that, in the private sector, older workers leave the labour force at a faster pace. This age profile is even stronger in Spain and the US, where the public sector employs around 15 percent of prime-age employed workers and 22 percent of older employed workers.

3.3 Evolution of labour market stocks and flows

Figure 2 displays the evolution of the public and private employment rates and the unemployment rate, while Figure 3 shows the transition probabilities between unemployment and employment in both sectors. All the gross worker series were previously seasonally adjusted. The graphs with the remaining transition probabilities are shown in Appendix I.

Our sample covers the period of the Great Recession. In France, from 2003 until 2008, the unemployment rate fell to seven percent. After that, it increased regularly until it peaked at the end of 2015. In the UK, prior to the Great Recession, the unemployment rate was stable at five percent. In 2008, it increased sharply, hit its peak in 2012 at 8.5 percent and has fallen since. In Spain, the unemployment rate increased from less than ten percent before 2008 to 25 percent in 2013. In the US, the unemployment rate increased sharply between 2008 and 2010, but then began to decline, reaching pre-crisis levels by the end of the sample.

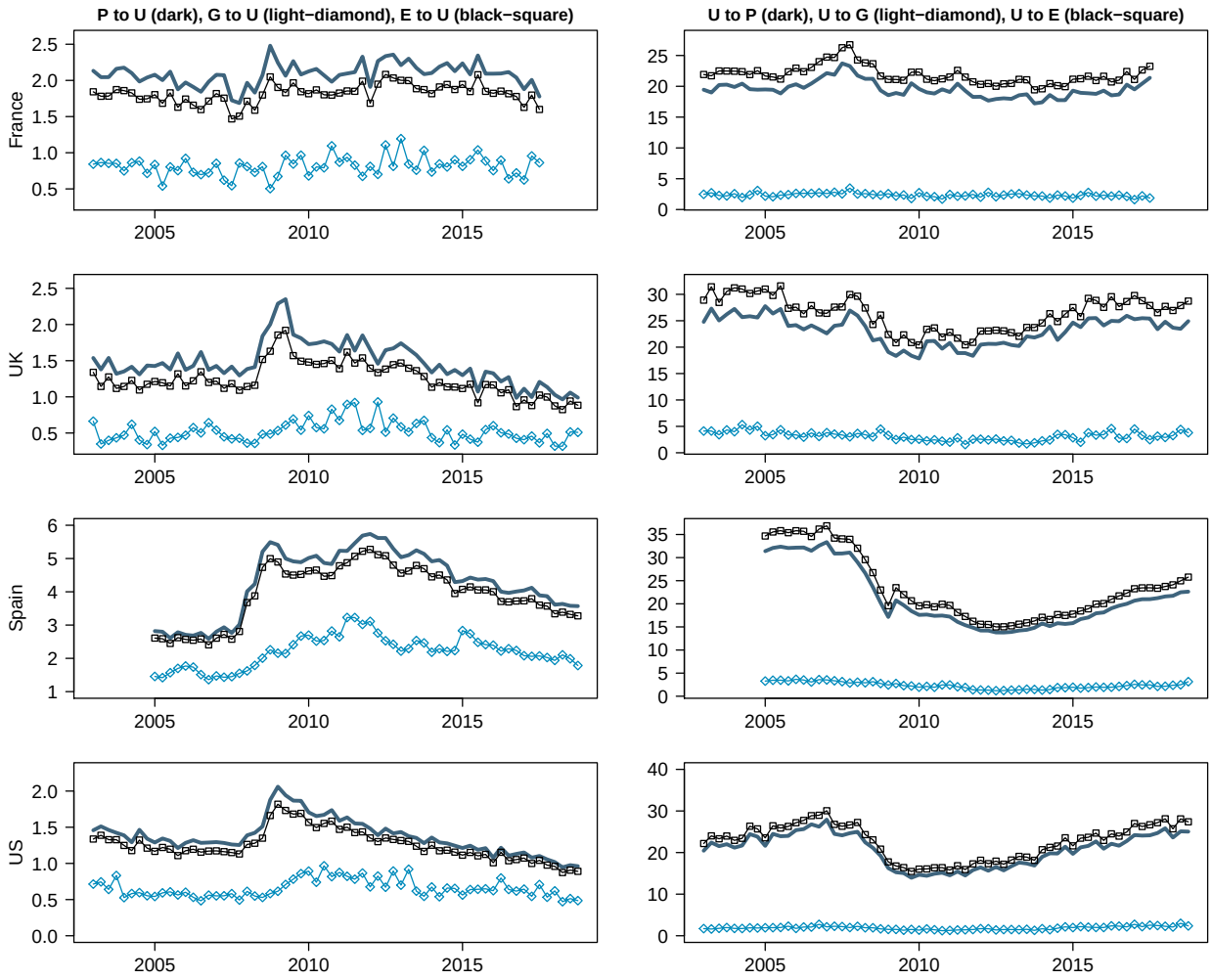
One can observe that the size of the public sector diminished in all countries in the last years of the sample, apart from Spain. In France, starting in 2008, it decreased by 300,000 workers - 1 percentage point of the working-age population. This means that the government did not carry a countercyclical policy. On the contrary, in the UK, the government initially increased the number of public-sector workers between 2008 and 2010, by 1 percentage point of the working-age population. The fact that there was no increase in job-finding rate nor a visible decrease in job-separation rate is because the change was in large the consequence of a sharp fall in the direct flows to private employment. The reduction of public-sector employment started only after 2010, with a decline equivalent to two percentage points of the working-age population - equivalent to half a million workers. This sharp reduction in public-sector employment since 2010 was achieved mainly with increases in outflows. Compared to the first half of the sample, there were five thousand more workers that moved to unemployment and 7.5 thousand more that move to inactivity from public employment in each quarter.

Figure 2: Labor market stock

Note: private- and public-sector employment are expressed in percentage of the working-age population. The unemployment rate is in percentage of the labour force.

In Spain, from its peak in 2011, public employment fell by 400,000 workers in less than three years (1 percent of the working-age population), recovering almost entirely by the end of the sample period. The job-separation rate to unemployment increased from 1.5 percent in the beginning of the sample and reached 3.5 percent in 2011. Also, the job-finding rate in the public sector fell from 3.5 percent at the beginning of the sample to 1.5 percent at the end. In the US, public-sector employment declined as a fraction of the working-age population between 2008 and 2018

Figure 3: Transition rates between employment and unemployment.



3.4 Cyclicality of worker flows

To have a more precise measure of the cyclicality of the hazard rate, we run an ordinary least squares regression of the log of each transition rate on a linear trend and the unemployment rate. This follows Baker (1992), who undertakes a similar procedure to analyse the cyclical movements of unemployment duration. The results are shown in Table 1.[7] The table also shows the cyclicality of several measures of the public-sector employment stock. We consider the largest sample available for the four countries.

The regression of different measures of stocks of public-sector employment confirms the differences in cyclicality across the four countries, over the last recession. When we measure public-sector employment in levels (logs) or as a fraction of the working-age population,

[7]Appendix I contains similar table with the results with the gross flows as a fraction of the working-age population.

Table 1: Cyclical variation of public-sector employment stock and hazard rates

	France		**UK**		**Spain**		**US**	
Stock of public-sector employment								
$\log G$	-0.015**	(-4.22)	-0.005	(−1.27)	0.000	(0.00)	0.008**	(7.17)
$\frac{G}{W}$	-0.195**	(-4.86)	-0.006	(-1.30)	-0.007	(−1.19)	0.021*	(2.26)
$\frac{G}{P+G}$	-0.115*	(-2.02)	0.167*	(2.13)	0.148**	(12.72)	0.238**	(20.42)
$\frac{G}{P}$	-0.185*	(-2.03)	0.287*	(2.15)	0.210**	(12.62)	0.338**	(20.41)
Hazard rates								
$P \to U$	0.046**	(2.99)	0.077**	(10.09)	0.038**	(10.33)	0.072**	(23.65)
$G \to U$	0.082*	(2.30)	0.120**	(8.82)	0.033**	(10.02)	0.066**	(9.88)
$P \to I$	0.016	(1.46)	-0.020**	(-4.32)	-0.016*	(−12.72)	-0.026**	(−12.06)
$G \to I$	0.032	(1.45)	0.004	(0.54)	-0.003	(1.12)	-0.018**	(−4.57)
$U \to P$	-0.067**	(-6.21)	-0.072**	(-17.14)	-0.045**	(−31.03)	-0.108**	(−48.07)
$U \to G$	-0.041	(-1.44)	-0.142**	(-11.02)	-0.049**	(−15.87)	-0.109**	(−16.14)
$I \to P$	-0.036**	(-3.11)	-0.043**	(-6.48)	-0.036**	(−20.82)	-0.051**	(−23.94)
$I \to G$	-0.056*	(-2.16)	-0.056**	(-5.76)	-0.010**	(−2.45)	-0.030**	(−6.51)
$U \to I$	0.011	(0.58)	-0.063*	(-15.99)	-0.035**	(−22.53)	-0.044**	(21.50)
$I \to U$	0.115**	(6.34)	0.080**	(22.22)	0.029**	(16.93)	0.096**	(47.41)
$P \to G$	-0.150**	(-3.05)	-0.109**	(-9.76)	-0.064**	(−8.40)	-0.007	(−1.34)
$G \to P$	-0.171**	(-2.88)	-0.052**	(-3.37)	-0.040**	(−7.06)	0.010	(−1.64)

*Note: the cyclicality of the hazard rates is the coefficient on unemployment rate in a regression of the series in logs on a time trend and the unemployment rate. The cyclicality of the stock is the coefficient on unemployment rate in a regression of the indicated measure on a time trend and the unemployment rate. T-statistics are in brackets.** denotes significant at 1% and * significant at 5%. The sample is: France (between 2003:1 and 2017:4, 59 observations), UK (between 1994:4 and 2018:4, 97 observations), Spain (between 2005:1 and 2018:4, 56 observations), US (between 1996:1 and 2018:12, 276 observations).*

it is procyclical in France, countercyclical in the US and acyclical in Spain and the UK. Naturally, when we measure it as a fraction of total employment or private employment, as the denominator is very procylical, it makes the ratio more countercyclical.

The hazard rates into and out of public-sector employment are very cyclical, with signs similar to those of its private sector counterparts. The separation rates from employment in both the public and private sectors to unemployment are strongly countercyclical, while the job-finding rates are strongly procyclical. There is, however, a substantial asymmetry between the coefficients. For example, the separation rate to unemployment from the public sector is more cyclical than from the private sector in France and UK, but not in Spain or the US. The hazard rates between the two sectors are also strongly procyclical, except in the US. In expansions, there are more direct transitions between the two sectors. These might justify some of the asymmetry between the cyclicality of public-sector employment across countries. The other explanation might be the cyclicality of flows between employment and inactivity. In the US, the hazard rate goes down in recessions, but not in France. In the UK and Spain the procyclicality of separation rate to inactivity is only present in the

private sector. In all countries, inflows into employment from inactivity (public or private) are moderately procyclical. We now analyse in more detail the importance of inflows and outflows into public-sector employment for unemployment fluctuations.

4 The role of the public sector in driving unemployment

4.1 Why does the public sector matter?

To understand the effects of ignoring the public sector when decomposing unemployment fluctuations, consider the following example of an economy with a public sector that has extremely low turnover. By this, we mean a separation rate λ^{GU} very close to zero, as well as the hiring rate λ^{UG}. There are also no movements between public and private sector. This scenario translates into a public sector with fixed size $\bar{G}$, unresponsive to the economic cycle. If one were to do a standard two-state decomposition, between total employment (E) and (U), the measured job-finding and job-separation rates would be:

$$\lambda^{UE} = \lambda^{UP},$$

$$\lambda^{EU} = \frac{N^{PU}}{P + \bar{G}} = \frac{\lambda^{PU}}{1 + \frac{\bar{G}}{P}},$$

where N^{PU} is the total number private sector workers that lost their jobs. We get the second equality by dividing both the numerator and denominator by P. Notice that the presence of the public sector would not affect the job-finding rate, but it would reduce the job-separation rate by a factor of $(1 + \frac{\bar{G}}{P})$. This can be seen clearly in Figure 3 - the overall job-finding rate is the sum of the job-finding rates in the two sectors, but the job-separation rate is a weighted average of the sectoral job-separation rates. The main problem for the unemployment decomposition is that, in a scenario with fixed public-sector employment, the ratio $\frac{\bar{G}}{P}$ will have a cyclical pattern. Consider a recession driven simultaneously by a decrease in job-finding and an increase in job-separation from the private sector. As $\frac{\bar{G}}{P}$ goes up, λ^{PU} would go up by less than the separation rate in the private sector, so one would underestimate the true contribution of separations.

The role of the public sector is more complex than this example shows because, in reality, its employment has a cyclical pattern. As we have seen, it can be procyclical as in France, countercyclical as in the US, or acyclical, as in Spain and the UK. Furthermore, whether this cyclicality happens because the government increases or decreases hirings in recessions,

or because there are fewer or more separations, could either reinforce or mitigate this bias in the unemployment decomposition.

4.2 Unemployment decompositions

The starting point for all unemployment decompositions is the equation of the steady-state unemployment u_t^{ss}. With four states, the equilibrium unemployment is a function of all 12 transition probabilities. See Appendix II for the exact formula and the comparison between equilibrium and actual unemployment in the four countries. We perform two decomposition methods, one based on Shimer (2012) and the other on Fujita and Ramey (2009). In this section, all the transition probabilities were previously corrected for time-aggregation bias using the methodology applied by Shimer (2012). Other exercises, such as alternative variables, no detrending, 3-states decomposition, and a non-steady-state decomposition, are shown in Appendix II.

Table 2 displays the importance of each transition probability for the four countries and the two methodologies. The bottom part of the table provides the relative split of the contribution of different rates to fluctuations in the unemployment rate. Out of the total contribution of flows in and out of employment, 20 percent are attributed to the public sector in the UK, 15 percent in France, while only ten percent in Spain and the US. Out of these, the inflows to public employment are more important than the outflows, with a relative split of around 70-30.

Consistent with the literature, private sector job-finding rate is more important than its job-separation rate, with a rough 60-40 split. In Appendix II, we show the usual three-state decomposition. Given the cyclicality of the stocks and transition probabilities in this sample, accounting for the public sector barely changes the relative importance of job-finding and job-separation rates in France, but it matters marginally for the UK, Spain and the US, where the ratio of public to private employment is more strongly countercyclical.

As in Elsby *et al.* (2011) or Hertweck and Sigrist (2015), we perform the unemployment decomposition for different sub-groups of the population, based on gender, age and education. We show the complete tables in Appendix III. In general, the contribution of the public sector to fluctuations in unemployment is proportional to its size. In France and the UK, the transition rate in and out of public-sector employment contributes to around 25 percent of women's unemployment, compared to less than ten percent of the male unemployment rate. In the European countries, the public sector accounts for a larger fraction of fluctuations in the unemployment rate of prime-age workers, with 29, 20 and 11 percent for France, UK and

Table 2: 4-states unemployment decompositions

	Shimer decomposition				Fujita & Ramey decomposition			
	France	**UK**	**Spain**	**US**	**France**	**UK**	**Spain**	**US**
$P \to U$	0.24	0.24	0.23	0.22	0.25	0.22	0.21	0.22
$G \to U$	0.03	0.04	0.03	0.02	0.04	0.04	0.02	0.02
$P \to I$	-0.02	-0.02	-0.04	-0.03	-0.02	-0.02	-0.04	-0.02
$G \to I$	0.00	0.01	-0.00	-0.00	0.00	0.01	0.00	-0.00
$U \to P$	0.39	0.32	0.47	0.38	0.40	0.30	0.47	0.39
$U \to G$	0.06	0.09	0.08	0.03	0.06	0.08	0.08	0.04
$I \to P$	0.08	0.10	0.08	0.07	0.08	0.10	0.08	0.06
$I \to G$	0.02	0.03	-0.00	0.01	0.02	0.03	-0.00	0.02
$I \to U$	0.14	0.08	0.05	0.13	0.14	0.07	0.04	0.12
$U \to I$	0.06	0.10	0.11	0.13	0.06	0.10	0.10	0.13
$P \to G$	0.02	0.02	0.00	-0.00	0.02	0.01	0.00	-0.00
$G \to P$	-0.01	-0.01	-0.00	0.00	-0.01	-0.01	-0.00	0.00
Relative contributions (sum to 100)								
Private employment vs. Public employment								
	86-14	79-21	88-12	91-9	85-15	80-20	88-12	90-10
Public job-finding rate vs. Public job-separation rate								
	63-37	67-33	75-25	64-36	60-40	67-33	76-24	69-31
Private job-finding rate vs. Private job-separation rate								
	62-38	57-43	67-33	63-37	62-38	58-42	69-31	64-36
Job-finding rate vs. Job-separation rate [3-states]								
	62-38	61-39	67-33	66-34	61-39	62-38	70-30	66-34

Note: the gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time-aggregation bias using the methodology applied by Shimer (2012). The series are then detrended with an HP filter with smoothing parameter of 100000. Number in the top half panel of the table reports the variance contributions of transition rates to changes in steady-state unemployment. For instance, the first number of column 2 reads as follows: private job separation rate accounts for 24% of the variations in French steady-state unemployment.

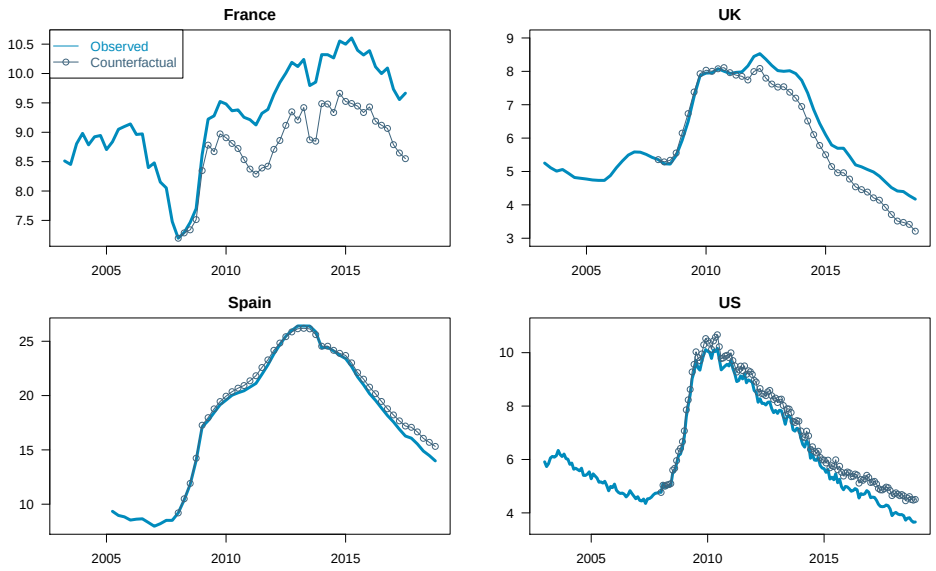
Spain. Finally, the public sector accounts for more than 20 to 30 percent of the fluctuation in the unemployment rate of college graduates in the three European countries.

4.3 Unemployment during the Great Recession: a counterfactual

While the previous sub-section is based on an analysis of the transition rates, we now perform an alternative analysis based on the level of worker gross flows. From the first quarter of 2008, we calculate what the unemployment rate would have been if the number of people hired and separated from the public sector had been equal to the average of the sample until 2007. We assume that the number of people that transited between the other three states (private-sector employment, unemployment and inactivity) are equal to the actual ones.

Figure 4 shows the actual and counterfactual unemployment rates. In France, from

Figure 4: Counterfactual unemployment rate



2010 onwards, the unemployment rate would have 1.1 percentage points lower if the hirings and separations in the public sector had been kept constant. In the UK, since 2012, the unemployment rate would have fallen faster if the government had not reduced public-sector employment. The difference is 0.9 percentage points. Spain and the US have the opposite pattern. By the end of the sample, the unemployment rate would have been higher without a change in policy, by 1.3 percentage points in Spain and 0.8 in the US. While the government employment component of American Recovery and Reinvestment Act of 2009 contributed to reduce unemployment, the government employment component of the austerity policies followed by France and UK generated higher unemployment.

5 How safe are public-sector jobs?

The argument that public-sector jobs are safer is often used in policy discussions over public-sector wages. According to Gomes (2015a), the optimal design of the public-sector wage schedule should take job security into account. Safer jobs raise a job's expected duration of a job and reduce the expected time spent in unemployment. Thus, the government should offer lower wages in order to keep the value of a public-sector job in line with that of the private-sector job. Hence, the estimation of the differences in job-loss probabilities between the two sectors is extremely relevant from a policy perspective, but to the best of our knowledge, there are no available estimates of value of the job safety that government provides.

5.1 Conditional job-separation rates

The evidence on the average gross flows provided in Section 3 suggests that jobs in the public sector are indeed safer than those in the private sector.[8] However, we also documented a significant amount of heterogeneity along gender, education and age, so the lower aggregate job-separation rates might be due, in part, to composition effects. In this section, using a multinomial logit model, we estimate the probabilities of transiting out of employment conditional on observable characteristics. Conditional on being employed, a worker can keep his job, become unemployed or become inactive. We consider, staying employed as the base outcome and compute the probabilities of becoming unemployed or inactive as:

$$\lambda_i^U = \frac{\exp(x_i\beta_U)}{1 + \exp(x_i\beta_U) + \exp(x_i\beta_I)}, \tag{5}$$

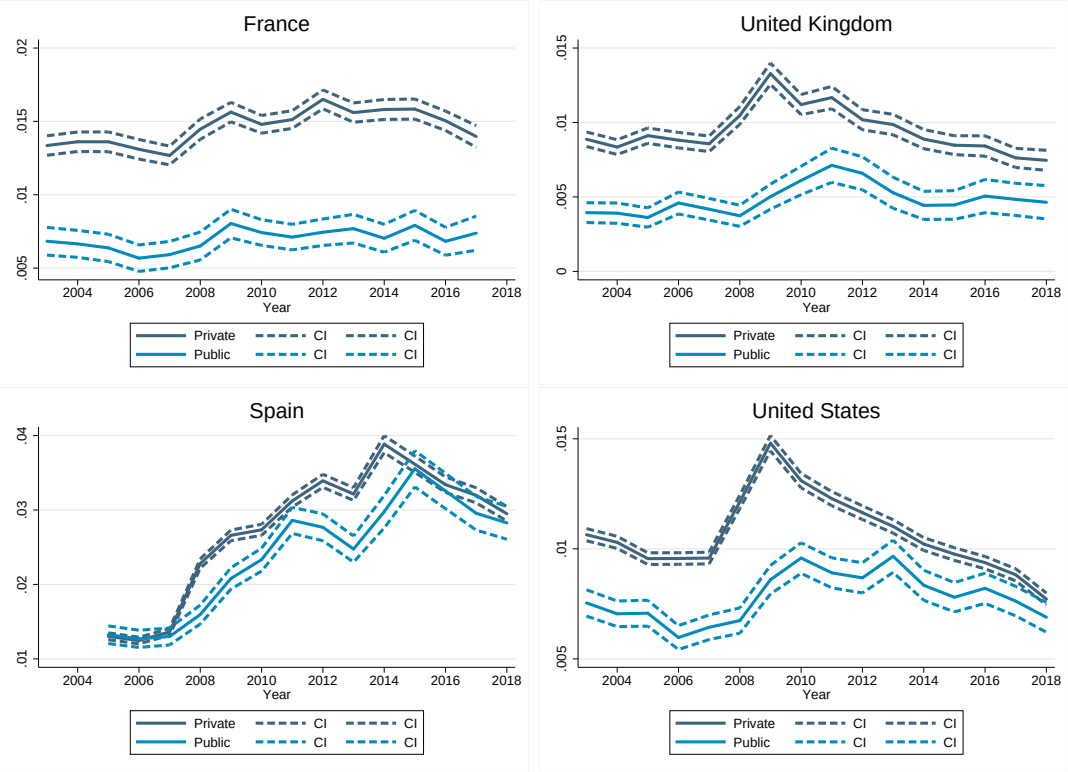
$$\lambda_i^I = \frac{\exp(x_i\beta_I)}{1 + \exp(x_i\beta_U) + \exp(x_i\beta_I)}, \tag{6}$$

where x_i includes, as control variables, dummies for education, region, gender, occupation and age. It also includes year dummies and year dummies interacted with being previously employed in the public sector. Using the estimates, we are able to compute the evolution of the predicted transition probabilities in both sectors over time, for an employee with the average characteristics in the economy. Figure 5 shows the predicted probability of moving to unemployment.

There are still large differences in the probability of moving to unemployment in the two sectors, even controlling for observable characteristics. However, they are smaller than the difference in unconditional separation rates, suggesting that a significant part is due to composition effects. These differences are particularly large in France and the UK, where the job-separation rates are twice as high in the private sector. The differences are smaller in the United States, where the probability of moving to unemployment is 36 percent higher in the private sector, and even smaller in Spain, where it is only 15 percent higher. In all countries, job-separation rates in the private sector increased in the first years of the crisis. However, they also increased in the public sector, but in later years, thus reducing the gap

[8] We associate the lower job-separation rate to safer jobs. The difference between the job-separation rates in the two sectors might not only reflect on differences in job-riskiness, but could also encompass differences in quit rates. For instance, if public-sector wages are higher relative to the private sector, quit rates might be lower. The UK Labour Force has a question differentiating between involuntary separations, quits and other voluntary separations. We have computed the shares of job-separation flows into these groups for private and public employment. The fraction of involuntary job-separations out of the total is similar across public and private sector, around the 50 percent found in Gomes (2012), meaning that both involuntary and voluntary separations are lower in the public sector by the same proportion.

Figure 5: Transition probability from employment to unemployment, by sector



Note: Based on estimation of equations 5 and 6 using a multinomial logit. For France, there were 1,884,703 observations and a pseudo R-squared of 0.090. For the UK, there were 1,678,331 observations and a pseudo R-squared of 0.130. For Spain, there were 2,522,803 observations and a pseudo R-squared of 0.094. For the US, there were 7,571,635 observations and a pseudo R-squared of 0.070. For France, the UK and Spain, the transition rate was quarterly, while in the US, it was monthly. We used as controls regional, gender, age, education and occupation dummy variables. The predicted probability is calculated based on an individual with the average characteristics of the employed population. The sample covers 2003-2018 for UK and US, 2005-2018 for Spain and 2003-2017 for France. The dashes lines report the 95 percent confidence interval on the prediction.

with the private sector by the end of the sample. In Appendix IV, we show the predicted probabilities of moving to inactivity, but for the transition to inactivity difference between the two sectors is small in all countries – between 10 to 16 percent higher – and, in general, the confidence intervals overlap.

5.2 The value of safety in the public sector: a back-of-the-envelope calculation

What do these differences represent? We use a metric to perform a back-of-the-envelope calculation, based on the Bellman equation of employment and unemployment, stipulated

by search models in continuous time:

$$rV^e = \frac{w^{1-\sigma}}{1-\sigma} - \delta(V^e - V^u), \tag{7}$$

$$rV^u = \frac{(z \times w)^{1-\sigma}}{1-\sigma} + f(V^e - V^u), \tag{8}$$

where the V^e and V^u are the value of employment or unemployment, w the wage rate, z the flow value of unemployment expressed as a replacement rate of the wage, f the job-finding rate, δ the job separation rate, σ the degree of risk aversion and r the discount rate. Using these two equations, we can calculate the value of a lower job-separation rate. The exercise is to calculate what fraction of their wage private-sector workers would be willing to give up to have the same job-separation rate as public-sector workers.

We consider two cases. In the first case, workers are risk-neutral ($\sigma = 0$), meaning that the value from job security comes only from spending a smaller fraction of time unemployed. This provides a lower bound on the value of job security. In the second case, we consider risk-averse workers ($\sigma = 2$) with no method of savings, which we interpret as an upper bound.

Using the two equations, we calculate $V^e - V^u$ and substitute back in equation 7 in order to get the value of employment as a function of wage, separation rate, job-finding rate, unemployment replacement rate, risk aversion and interest rate. For two different separation rates, δ^1 and δ^2, the ratio of wages that equate the value of employment is given by:

$$\frac{w^2}{w^1} = \left[\frac{(r + \delta^2 + f)}{(r + \delta^1 + f)} \frac{(r + \delta^1 \times z^{1-\sigma} + f)}{(r + \delta^2 \times z^{1-\sigma} + f)}\right]^{\frac{1}{1-\sigma}}, \tag{9}$$

which, under risk neutrality, collapses to:

$$\frac{w^2}{w^1} = \frac{(r + \delta^2 + f)}{(r + \delta^1 + f)} \frac{(r + \delta^1 \times z + f)}{(r + \delta^2 \times z + f)}. \tag{10}$$

The ratio of the two wages depends on the value of unemployment – in particular, how bad it is relative to employment replacement rate) and how persistent it is (job-finding rate). Notice that when the replacement rate is 1, the four terms cancel out, meaning that workers would not be willing to sacrifice any wage for a lower job-separation rate. Naturally, if the flow value on unemployment is exactly the same as the value of working, differences in job-separation rates do not matter.

For the back-of-the-envelope calculation, we have five scenarios for the value of unem-

Table 3: Back-of-the-envelope calculation on public-sector job-security premium

	Scenario for value of unemployment					Government budget (medium scenario)		
	Very low	Low	Medium	High	Very high			
	$z = 0.3$	$z = 0.3$	$z = 0.5$	$z = 0.7$	$z = 0.7$	Millions	% of GDP	% of Gov
	$f = min$	$f = mean$	$f = mean$	$f = mean$	$f = max$			Spending
Lower bound: risk neutrality ($\sigma = 0$)								
France	2.5%	2.2%	1.6%	0.9%	0.8%	4422 (€)	0.20	0.39
UK	1.5%	1.2%	0.8%	0.5%	0.4%	1430 (£)	0.08	0.19
Spain	1.3%	0.9%	0.6%	0.4%	0.2%	716 (€)	0.07	0.16
US	1.4%	0.8%	0.5%	0.2%	0.1%	9963 ($)	0.05	0.16
Upper bound: risk aversion ($\sigma = 2$) and no insurance								
France	6.9%	6.3%	2.9%	1.3%	1.1%	8241 (€)	0.38	0.72
UK	4.5%	3.5%	1.6%	0.7%	0.6%	2741 (£)	0.15	0.37
Spain	2.8%	2.1%	1.0%	0.5%	0.3%	1241 (€)	0.11	0.28
US	3.7%	2.2%	1.0%	0.3%	0.2%	18854 ($)	0.10	0.30

Note: The first five columns of table report the fraction of the wage that a private-sector worker is willing to forgo to have the same conditional job-separation rate as a public-sector worker in each country, depending on the replacement rate and job-finding rate. The discount rate r is set to 0.005 for France, the UK and Spain and to 0.0017 for the US. We calculate the budgetary value of job-security based on 2015 data on wage compensation of government workers, GDP and total government spending provided by AMECO and FRED datasets.

ployment, created with different values for the replacement rate ($z = 0.3$, $z = 0.5$ and $z = 0.7$) and for the job-finding rate (the mean, minimum and maximum of the sample for each country). The results are in the Table 3, using the average conditional rates in Figure 5.

The lower bound of the value of job security varies between 0.1 and 2.5 percent of the wage for this range of realistic scenarios across the four countries, and the upper bound varies between 0.2 and 6.9 percent of the wage. For the medium scenario for the value of unemployment, workers would value this job security between 1.6 and 2.9 percent for France, 0.8 to 1.6 percent for the UK and 0.5 to 1.0 percent for Spain and the US. We redo the exercise using the unconditional job-separation rates in Figure 1, as well for the different education levels, and show them in Appendix IV.[9]

To have an alternative metric, we get national accounts data from AMECO and FRED datasets on "Compensation of employees: general government" for 2015. The compensation to government employees represents, respectively, 12.8, 9.1, 11,1 and 10.3 percent of GDP

[9]Using the unconditional rates, the job-security premium is roughly double from the baseline numbers. In France, the UK and the US, workers with less education are willing to pay more for the job safety of the public sector. On the other hand, the Spanish public sector has a lower separation rate for only college graduates.

in France, the UK, Spain and the US. The numbers from national accounts will bias the size of the public-sector wage bill downward, because they only account for a subset of the total number of public-sector workers. Using the medium value of unemployment scenario and risk neutrality, the value of a lower job-separation rate is equivalent to between 0.05 to 0.2 percent of GDP, or, alternatively, 0.16 to 0.4 percent of total government spending. The upper bound is roughly double: between 0.10 to 0.37 percent of GDP or 0.3 to 0.72 percent of total government spending.

This exercise provides only an interval for the value of job-security in the public sector, as we are considering two extreme scenarios. In the lower bound, with risk-neutral workers, the value arises from differences in expected duration of the match. In the upper bound, we do not allow any self-insurance mechanism. A more precise answer would require considering several insurances mechanisms, but that would require a more complicated framework. We leave such calculations for future work.

6 Conclusion

The objective of this paper was to establish a number of key facts about public- and private-sector labour market flows. It provides a picture of a wide range of information about worker gross flows from different angles, improving our understanding of the workings of these two labour markets. The main findings of this paper can be summarised as follows:

- In France and the UK, the public sector represents 21 and 23 percent of total employment, respectively. Spain and the US have smaller public sectors, representing 16 percent of total employment.
- There is 30 to 50 percent less turnover in the public sector relative to the private sector.
- In each quarter (month in the US), the probability of a worker losing his job is 2-3 times higher in the private sector. Part of the difference is due to composition effects.
- In each quarter (month in the US), an unemployed worker has a 20 percent probability of finding a job in the private sector and only a two to three percent chance of finding a public-sector job.
- There are few direct transitions between the public and private sectors: 60 to 85 percent of the new hires in the public sector come from non-employment.

- The French and UK public sectors accounts for around 30 percent of total employment of women. The Spanish and US public sectors account for 20 percent. In all countries, the probability of women finding a job in the public sector is twice as high as for men.
- Public sectors hire predominantly college graduates, accounting for between 20 and 40 percent of their employment. The public sector is not relevant for workers with only a primary education.
- The public sector represents a larger fraction of employment of older workers, accounting for 25 percent of their employment in France and the UK and 22 in Spain and the US. The public sector hires few young workers.
- Public-sector employment has been countercyclical in the US, procyclical in France and acyclical in Spain and the UK.
- Public-sector employment explains 20 percent of the fluctuations in the unemployment rate in the UK, 15 percent in France and ten percent in Spain and the US.
- Public-sector employment explains a larger fraction of the fluctuations in unemployment rate of women, college graduates and older workers.
- Public-sector employment policies contributed to higher unemployment rate in France and UK between 2010 and 2015, by 1.1 and 0.9 respectively. On the other hand, they contributed to lower unemployment rate in Spain and US by 1.3 and 0.8 percentage points.
- Private-sector workers would be willing to forgo 0.5 to 2.9 percent of their wage to have the same job security as in the public sector.

This paper is starting point of a larger research agenda to study the effects of public-sector employment using structural models, focussing on the heterogeneity across education (Chassamboulli and Gomes, 2018), gender (Gomes and Kuehn, 2018) and age (Gomes and Wellschmied, 2018).

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COMPANION APPENDIX

Labour market flows: Accounting for the public sector

Idriss Fontaine, Ismael Galvez-Iniesta, Pedro Gomes and Diego Vila-Martin

I - Extra material: Section 3

II - Extra material: Section 4

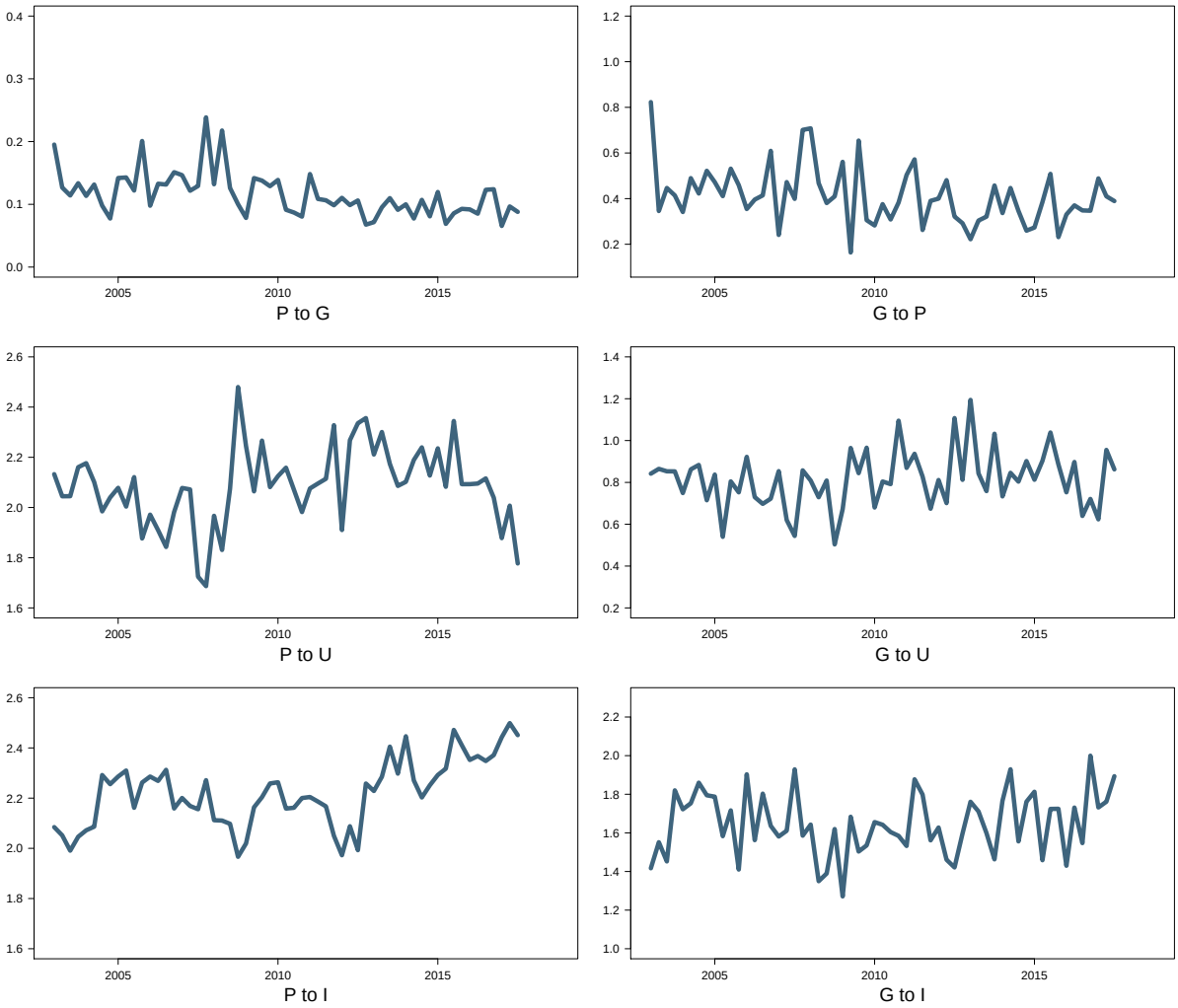
III - Extra material: Different subgroups

IV - Extra material: Section 5

IV - Extra material: Conditional transition rates

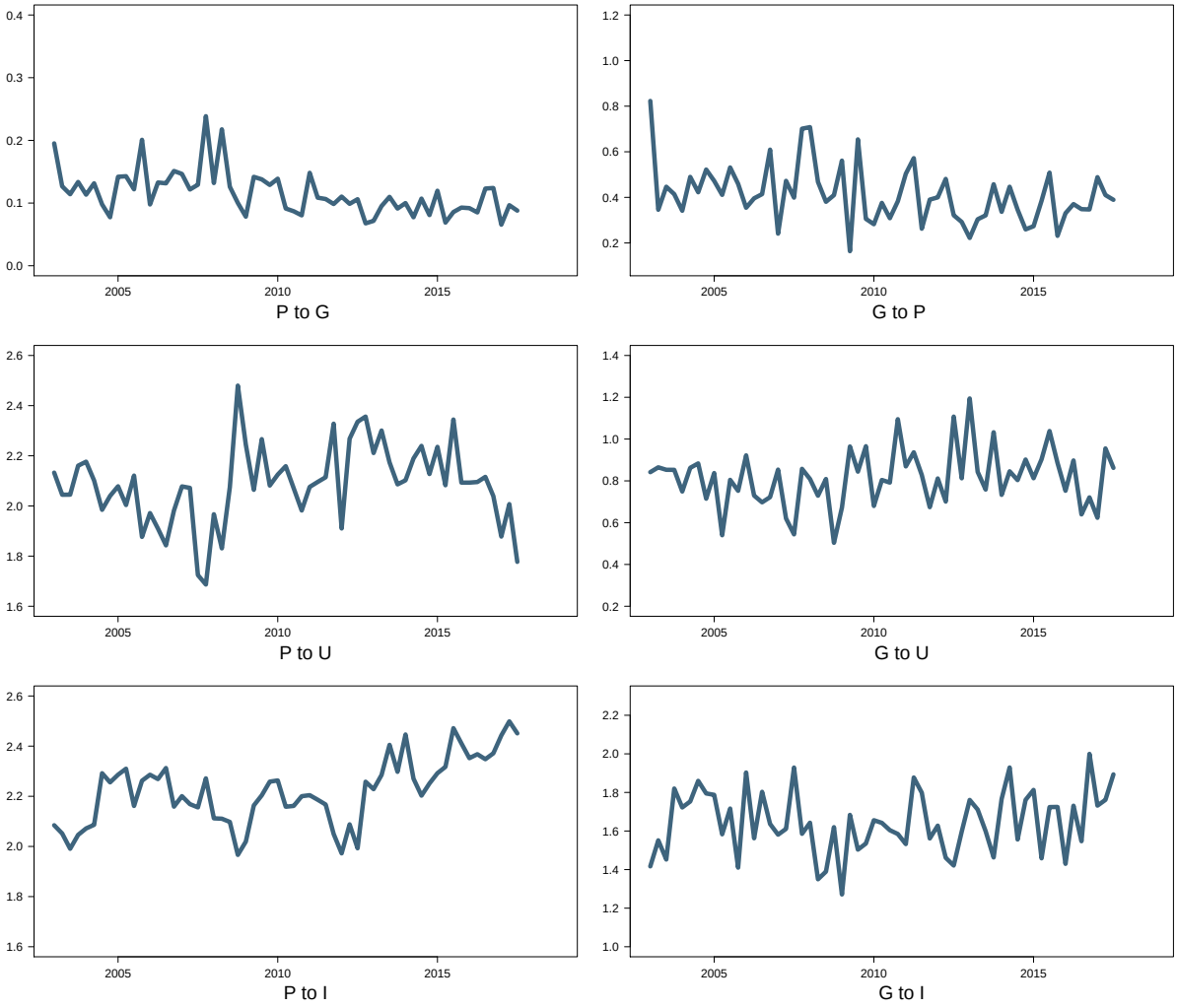
I - Extra material: Section 3

Figure A1: Individual transition rates, France



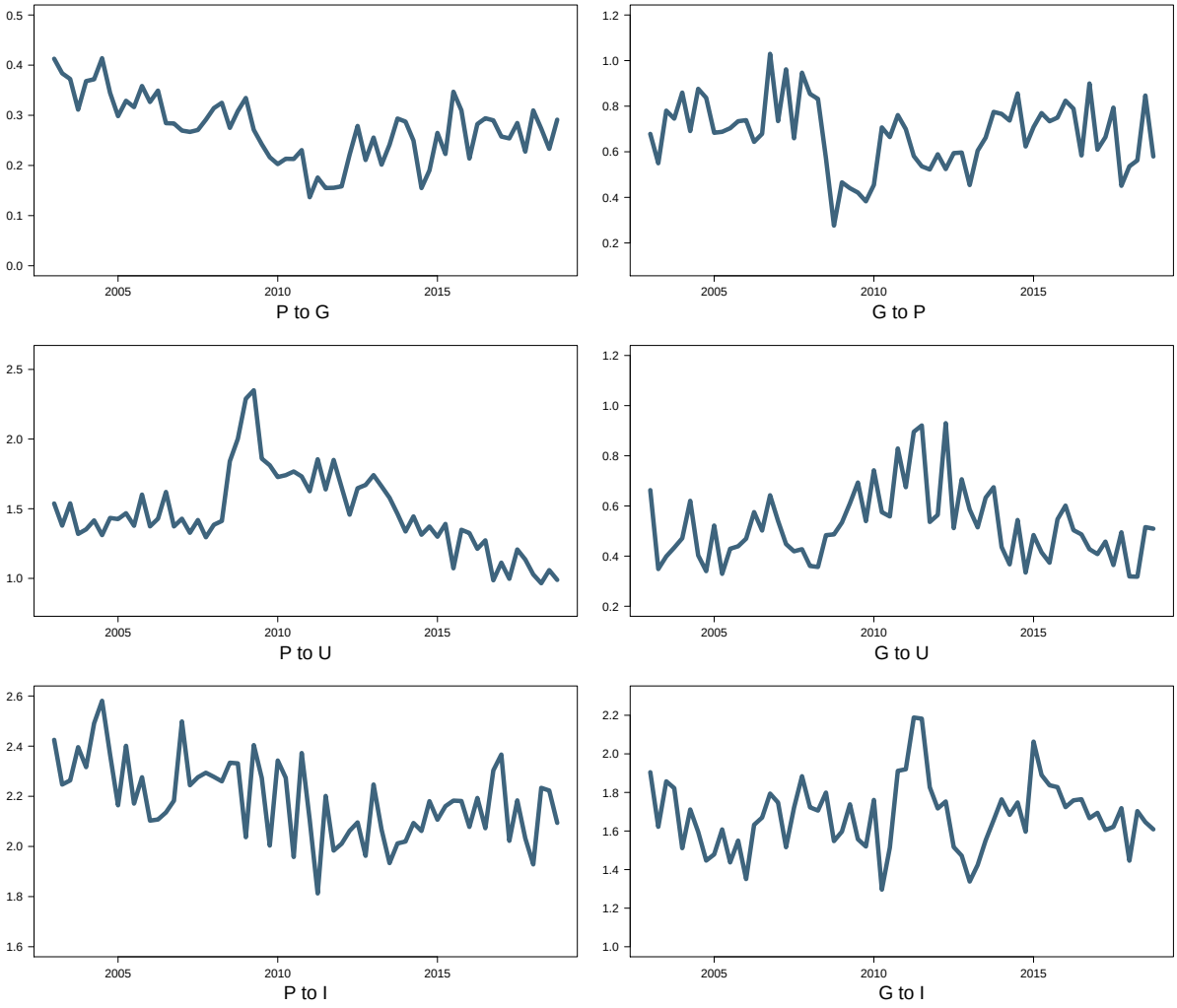
Source: French Labour Force Survey.

Figure A1 (cont): Individual transition rates, France



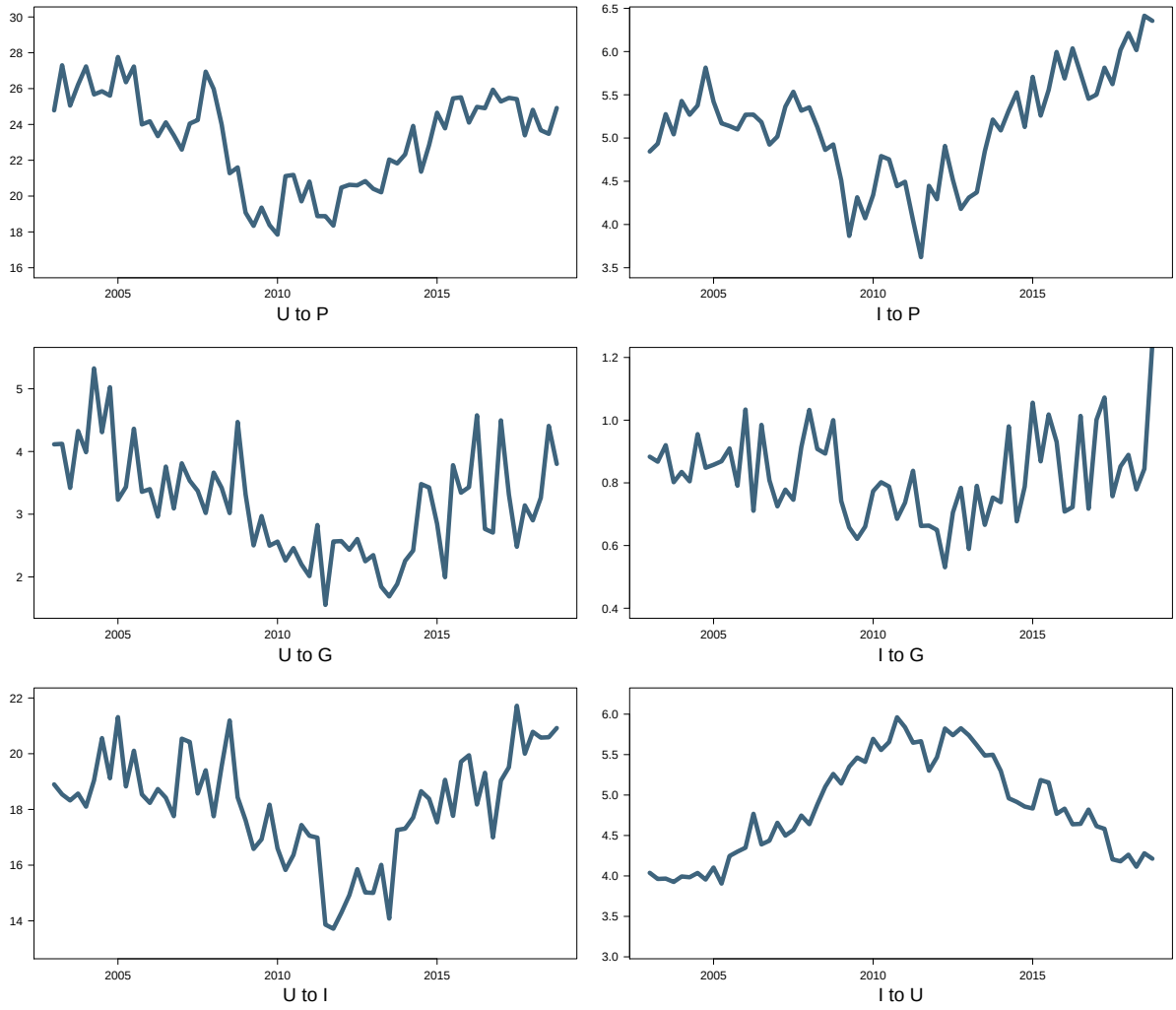
Source: French Labour Force Survey.

Figure A2: Individual transition rates, UK



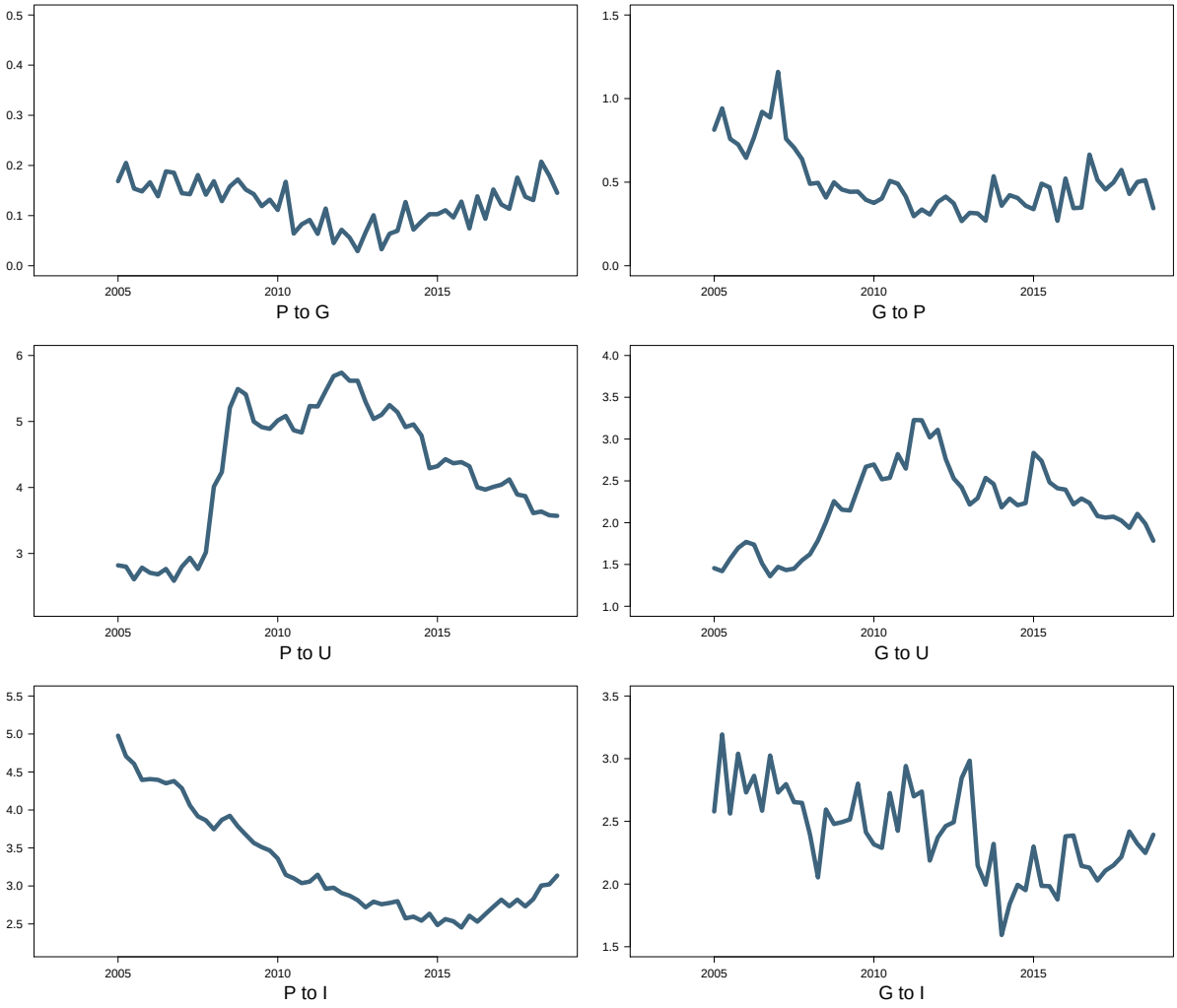
Source: UK Labour Force Survey.

Figure A2 (cont): Individual transition rates, UK



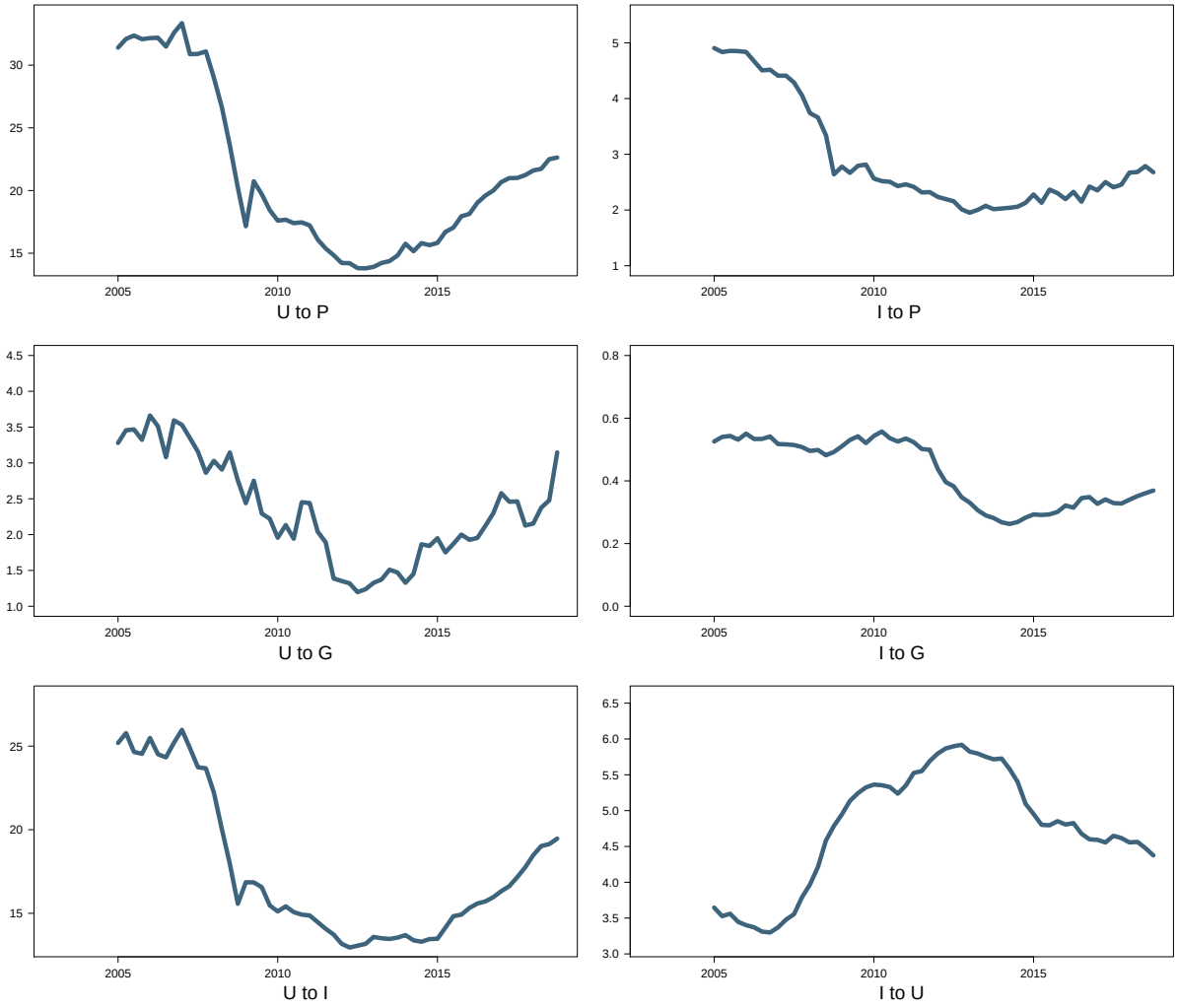
Source: UK Labour Force Survey.

Figure A3: Individual transition rates, Spain



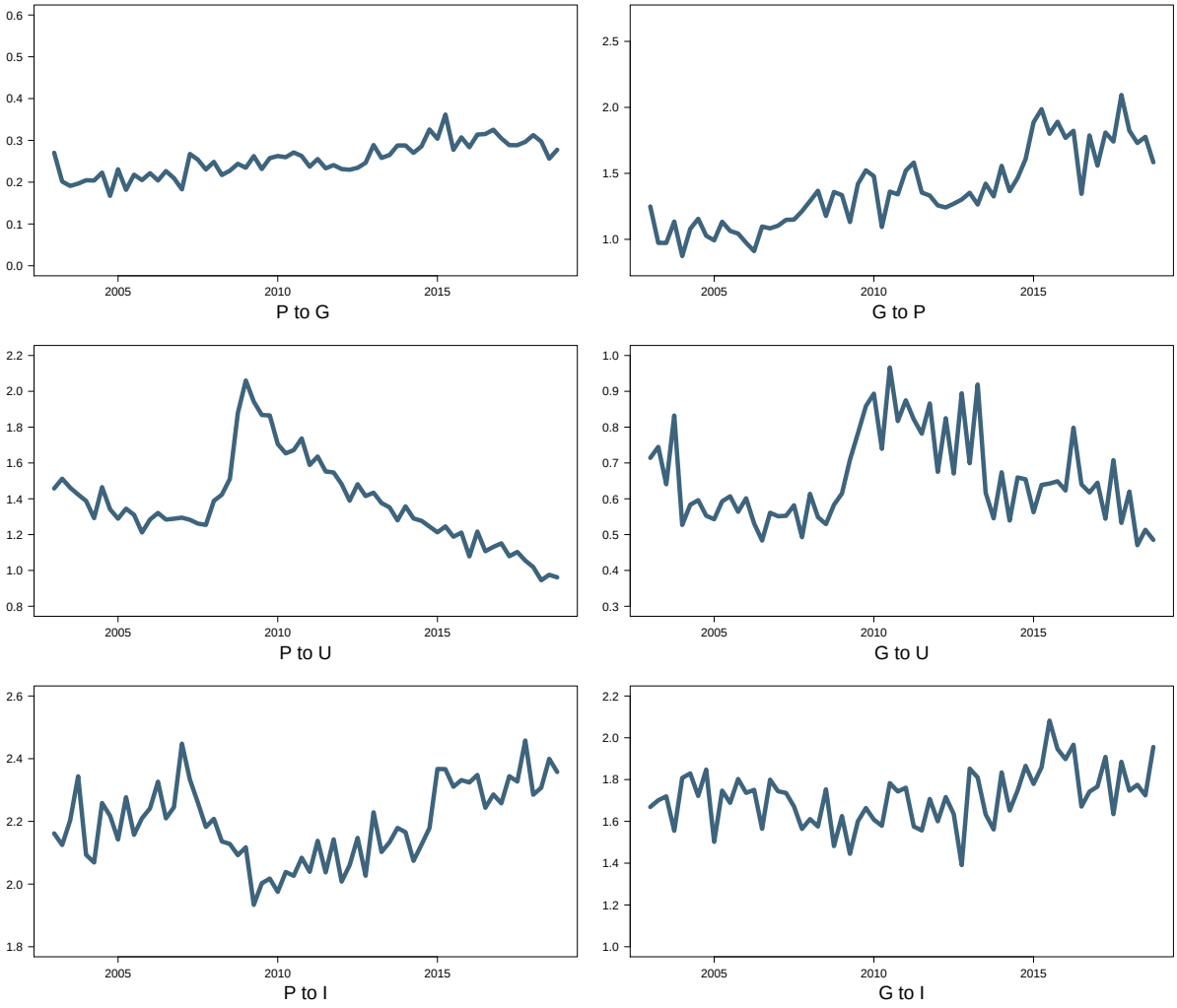
Source: Spanish Labour Force Survey.

Figure A3 (cont): Individual transition rates, Spain



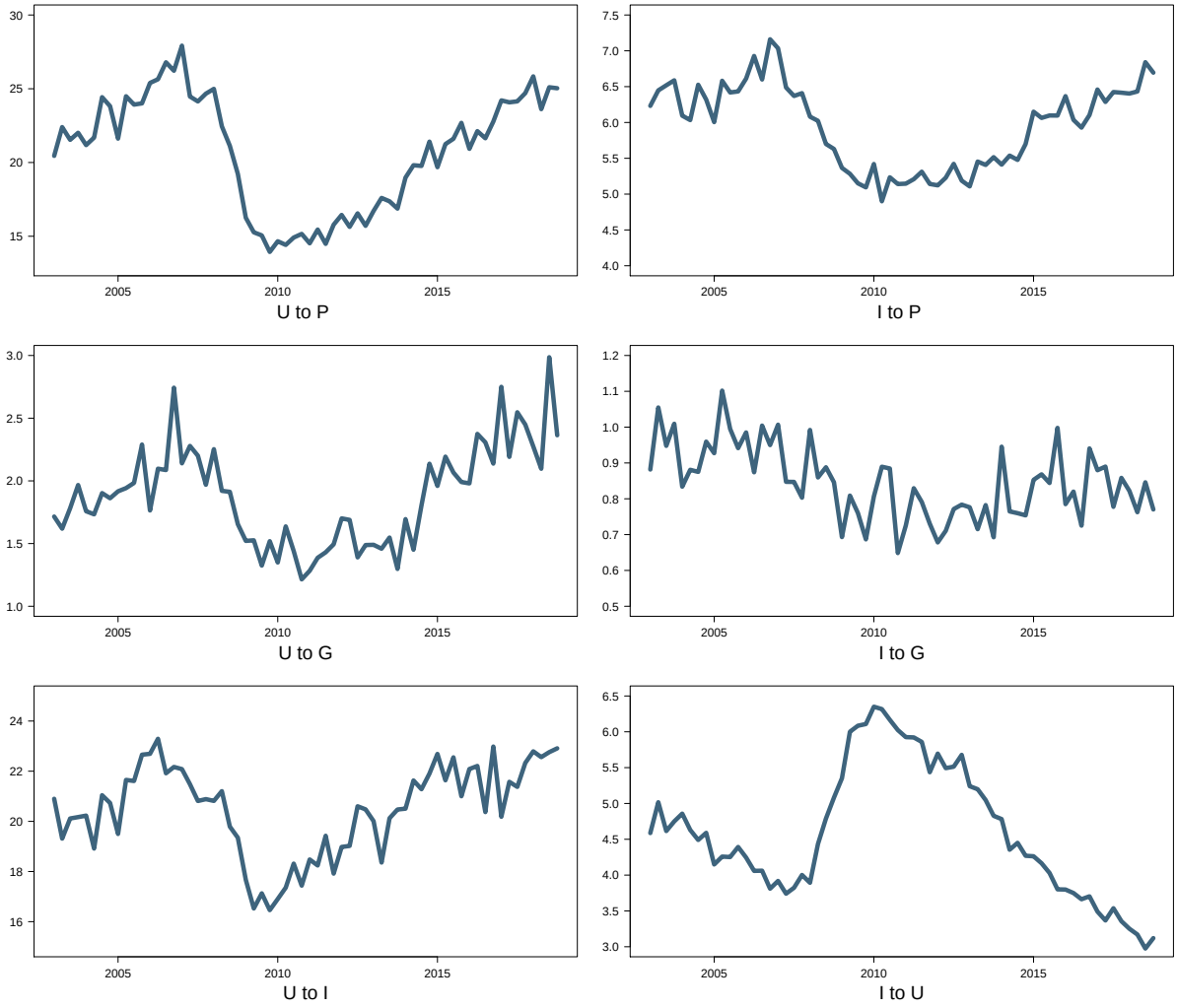
Source: Spanish Labour Force Survey.

Figure A4: Individual transition rates, US



Source: Current Population Survey.

Figure A4 (cont): Individual transition rates, US



Source: Current Population Survey.

Table A1: Most representative public sector industries, thousands

	France		**UK**	
Industry	Private sector	Public sector	Private sector	Public sector
E Water supply, sewerage, waste	155	34 (18%)	166	42 (20%)
O Public administration and defence	275	2220 (89%)	282	1585 (85%)
P Education	423	1471 (78%)	739	2363 (76%)
Q Health and social work	2291	1299 (36%)	1691	2035 (55%)
R Arts, entertainment and recreation	308	74 (19%)	571	142 (20%)
U Extraterritorial organisations	12	8 (67%)	20	23 (52%)

Note: For the UK, it is the average number of workers between 2009 and 2016. For France, it is the average number of workers between 2008 and 2015. The fraction of public-sector employment is in brackets. For both the UK and France, all the remaining industries have less than 10 percent of public-sector employment industries (A Agriculture, forestry and fishing; B Mining and quarrying; C Manufacturing; D Electricity, gas, air cond supply; F Construction, G Wholesale, retail, repair of vehicle; H Transport and storage; I Accommodation and food services; J Information and communication; K Financial and insurance activities; L Real estate activities; M Prof, scientific, technical activ.; N Admin and support services; S Other service activities; T Households as employers).

Table A2: Cyclical variation of labour market flows gross rates

	France		**UK**		**Spain**		**US**	
Rates								
$P \to U$	0.039*	(2.53)	0.063**	(9.06)	0.026**	(6.60)	0.057*	(18.50)
$G \to U$	0.068	(1.92)	0.120**	(8.58)	0.032**	(8.02)	0.068**	(10.19)
$P \to I$	0.009	(0.82)	-0.034**	(-7.65)	-0.028**	(−23.94)	-0.041**	(−19.56)
$G \to I$	0.018	(0.80)	0.004	(0.45)	-0.004	(−1.32)	-0.016**	(−3.99)
$U \to P$	0.050**	(4.65)	0.081**	(16.71)	0.018**	(14.09)	0.045**	(19.43)
$U \to G$	0.076**	(2.70)	0.011	(0.90)	0.013**	(3.41)	0.044**	(6.76)
$I \to P$	-0.042**	(-3.60)	-0.042**	(-7.84)	-0.039**	(−18.94)	-0.043**	(−20.97)
$I \to G$	-0.062*	(-2.38)	-0.056**	(-5.75)	-0.012**	(−3.24)	-0.022**	(−4.70)
$U \to I$	0.128**	(7.12)	0.091**	(20.65)	0.028**	(24.14)	0.109**	(44.26)
$I \to U$	0.109**	(5.90)	0.080**	(19.74)	0.026**	(17.55)	0.104**	(46.25)
$P \to G$	-0.157**	(-3.20)	-0.123**	(-10.77)	-0.076**	(−9.96)	-0.023**	(−4.20)
$G \to P$	-0.185**	(-3.12)	-0.052**	(-3.54)	-0.041**	(−7.46)	-0.009	(−1.29)

*Note: the cyclicality of the series is the coefficient on unemployment rate in a regression of the flows as percentage of the working-age population in logs on a time trend and the unemployment rate. T-statistics are in brackets.** denotes significant at 1% and * significant at 5%. The sample is between 2003:1 and 2018:4.*

II - Extra material: Section 4

Equilibrium unemployment with four-states transitions

In steady-state, there are no changes in the stocks so we set equations (1)-(4) to zero. Normalizing the working-age population to 1, we can substitute $I^{ss} = 1 - P^{ss} - G^{ss} - U^{ss}$, and write a system of the remaining states in matrix form

$$A \times \begin{pmatrix} P^{ss} \\ G^{ss} \\ U^{ss} \end{pmatrix} = B$$

where

$$A = \begin{pmatrix} (\lambda^{PG} + \lambda^{PU} + \lambda^{PI} + \lambda^{IP}) & (\lambda^{IP} - \lambda^{GP}) & (\lambda^{IP} - \lambda^{UP}) \\ (\lambda^{IG} - \lambda^{PG}) & (\lambda^{GP} + \lambda^{GU} + \lambda^{GI} + \lambda^{IG}) & (\lambda^{IG} - \lambda^{UG}) \\ (\lambda^{IU} - \lambda^{PU}) & (\lambda^{IU} - \lambda^{GU}) & (\lambda^{UP} + \lambda^{UG} + \lambda^{UI} + \lambda^{IU}) \end{pmatrix}$$

and

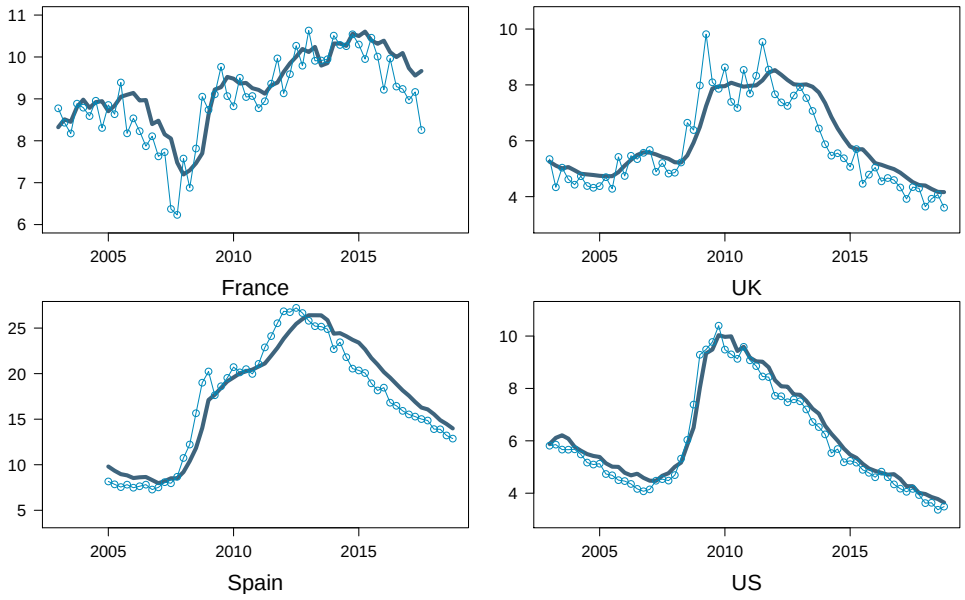
$$B = \begin{pmatrix} \lambda^{IP} \\ \lambda^{IG} \\ \lambda^{IU} \end{pmatrix}$$

The solution of this system is then given by:

$$\begin{pmatrix} P^{ss} \\ G^{ss} \\ U^{ss} \end{pmatrix} = A^{-1} \times B$$

To calculate the unemployment rate we need to compute $\frac{U^{ss}}{P^{ss}+G^{ss}+U^{ss}}$.

Figure A5: Unemployment rate (blue lines) and its steady state counterpart (dotted lines)



Continuous time-aggregation bias correction

We can record the transitions rates λ^{ij} in a 4×4 discrete time Markov transition matrix with columns summing to 1. Let μ denote a diagonal matrix of eigenvalues and p the matrix with corresponding eigenvectors of the discrete transition matrix. Suppose now that the transitions occur in a continuous time environment. Let $\tilde{\lambda}$ be the 4×4 continuous time Markov transition matrix that records in the off-diagonal the Poisson continuous arrival rate, $\tilde{\lambda}^{ij}$ from state $i \in \{P, G, U, I\}$ to state $j \neq i$. We can retrieve the continuous time transition matrix from the limit of the discrete transition matrix:

$$\tilde{\lambda}_m = \lim_{\Delta \to 0} \frac{p\mu^{\Delta}p^{-1} - I}{\Delta} \tag{A1}$$

Table A3: Three-states unemployment decompositions

	Shimer				Fujita & Ramey			
	France	**UK**	**Spain**	**US**	**France**	**UK**	**Spain**	**US**
$E \to U$	0.28	0.28	0.26	0.23	0.30	0.26	0.24	0.22
$E \to I$	-0.03	-0.04	-0.04	-0.02	-0.03	-0.03	-0.04	-0.02
$U \to E$	0.46	0.44	0.54	0.43	0.48	0.42	0.55	0.43
$I \to E$	0.10	0.12	0.08	0.07	0.10	0.11	0.08	0.07
$I \to U$	0.13	0.09	0.05	0.13	0.14	0.08	0.04	0.12
$U \to I$	0.06	0.10	0.11	0.15	0.06	0.09	0.10	0.15
Relative contribution								
Job-finding vs Job separation	62-38	61-39	67-33	66-34	61-39	62-38	70-30	6634

Note: the gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time aggregation bias using the methodology applied by Shimer (2012). The series are then detrended with an HP filter with smoothing parameter of 100000.

Table A4: Shimer's 4-states unemployment decompositions, no detrending

	France	**UK**	**Spain**	**US**
$P \to U$	0.21	0.23	0.19	0.17
$G \to U$	0.04	0.04	0.02	0.02
$P \to I$	0.03	-0.02	-0.07	-0.04
$G \to I$	0.01	0.01	-0.01	-0.01
$U \to P$	0.34	0.30	0.50	0.35
$U \to G$	0.07	0.08	0.09	0.03
$I \to P$	0.04	0.10	0.10	0.07
$I \to G$	0.03	0.02	0.01	0.01
$I \to U$	0.30	0.08	0.04	0.14
$U \to I$	-0.04	0.09	0.12	0.09
$P \to G$	0.02	0.02	0.00	-0.00
$G \to P$	-0.01	-0.01	-0.00	0.00
Relative contributions (sum to 100)				
Private employment vs. Public employment				
	81-19	80-20	86-14	91-9
Public job-finding rate vs. Public job-separation rate				
	64-36	67-33	78-22	68-32
Private job-finding rate vs. Private job-separation rate				
	63-37	57-43	73-37	68-32

Note: the gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time aggregation bias using the methodology applied by Shimer (2012).

Table A5: 4-states unemployment decompositions, no adjustment by tenure for job-to-job transitions

	France	**UK**	**Spain**	**US**
$P \to U$	0.24	0.23	0.24	0.22
$G \to U$	0.03	0.05	0.02	0.02
$P \to I$	-0.02	-0.02	-0.04	-0.03
$G \to I$	0.00	0.01	0.00	0.00
$U \to P$	0.39	0.32	0.49	0.38
$U \to G$	0.06	0.08	0.07	0.03
$I \to P$	0.08	0.11	0.08	0.07
$I \to G$	0.02	0.02	0.00	0.01
$I \to U$	0.14	0.08	0.05	0.13
$U \to I$	0.06	0.10	0.11	0.13
$P \to G$	0.02	0.02	0.00	0.00
$G \to P$	-0.01	-0.01	-0.01	0.00
Relative contributions (sum to 100)				
Private employment vs. Public employment				
	86-14	80-20	90-10	91-9
Public job-finding rate vs. Public job-separation rate				
	63-37	63-37	77-23	63-33
Private job-finding rate vs. Private job-separation rate				
	62-38	57-43	67-33	63-37

Note: The gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time aggregation bias using the methodology applied by Shimer (2012). The series are then detrended with an HP filter with smoothing parameter of 100000.

Table A6: Elsby et al. (2015) non-steady state decomposition, 4-states

	Elsby et al. (2015) non-steady state decomposition			
	France	**UK**	**Spain**	**US**
$P \to U$	0.19	0.10	0.19	0.16
$G \to U$	0.03	0.06	0.02	0.01
$P \to I$	-0.02	-0.01	-0.01	-0.03
$G \to I$	0.01	0.02	0.01	-0.00
$U \to P$	0.36	0.32	0.51	0.45
$U \to G$	0.07	0.09	0.06	0.03
$I \to P$	0.02	0.05	0.04	0.05
$I \to G$	0.00	0.01	-0.01	0.00
$I \to U$	0.23	0.10	0.08	0.14
$U \to I$	0.13	0.23	0.18	0.16
$P \to G$	0.00	0.00	0.00	0.00
$G \to P$	0.00	0.01	0.00	-0.00
Relative contributions (sum to 100)				
Private employment vs. Public employment				
	83-17	73-27	90-10	93-7
Public job-finding rate vs. Public job-separation rate				
	67-33	61-39	76-24	70-30
Private job-finding rate vs. Private job-separation rate				
	65-25	76-24	73-27	74-26

Note: the gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time-aggregation bias using the methodology applied by Shimer (2012). Series are "smoothed" with a 3-order moving average for France, UK and Spain, and a 9-order moving average for the US.

Figure A6: Counterfactual exercise, France

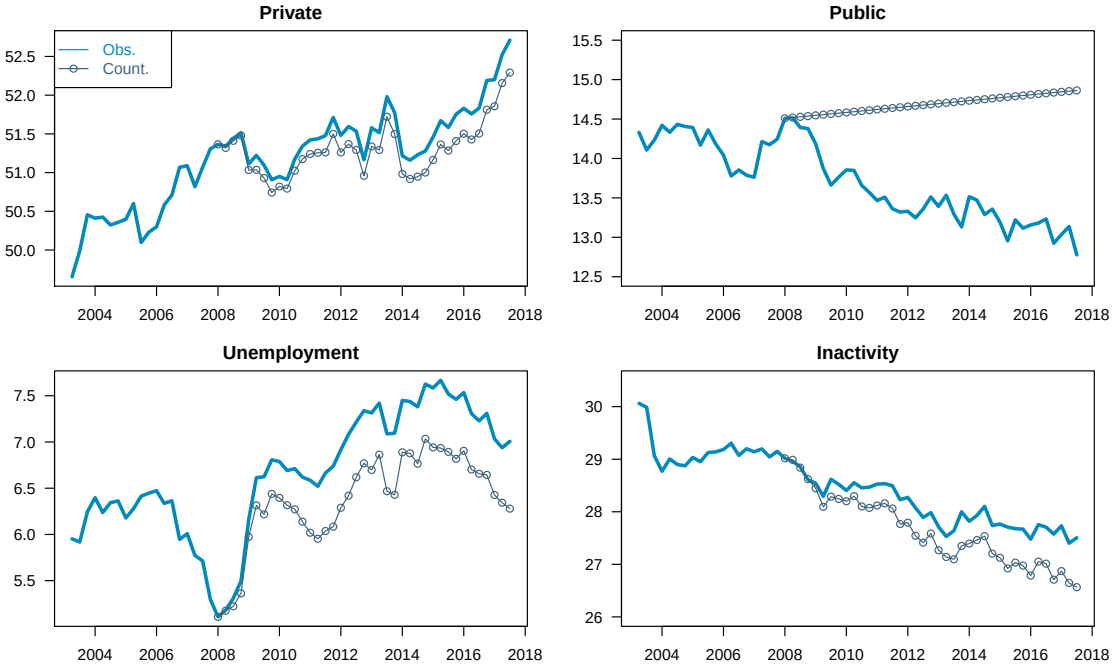


Figure A7: Counterfactual exercise, UK

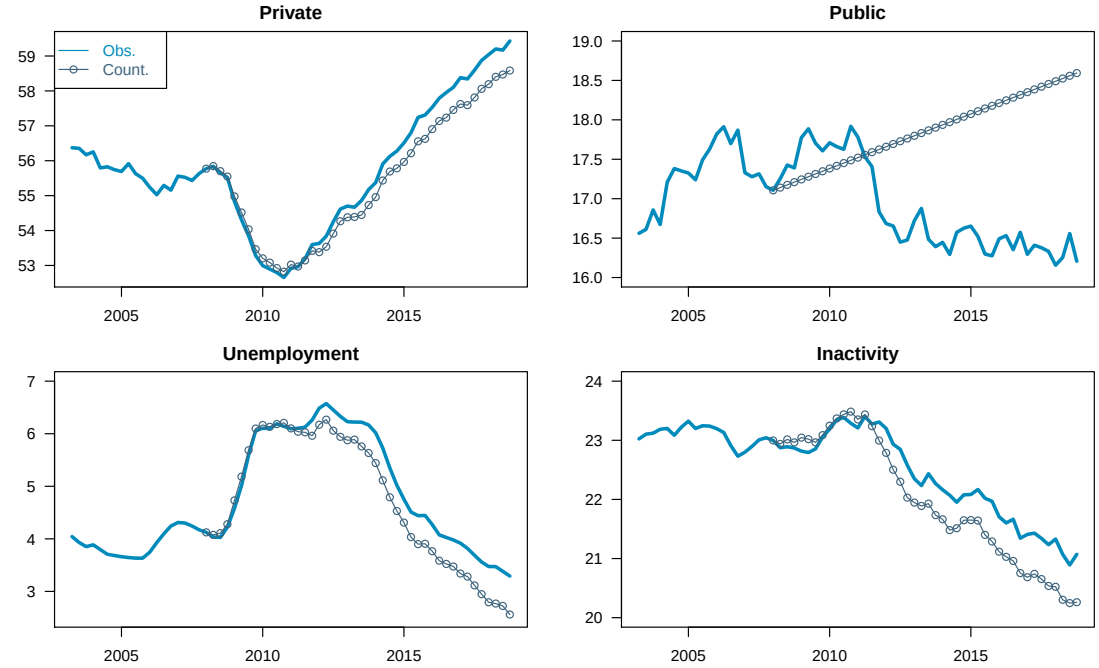


Figure A8: Counterfactual exercise, Spain

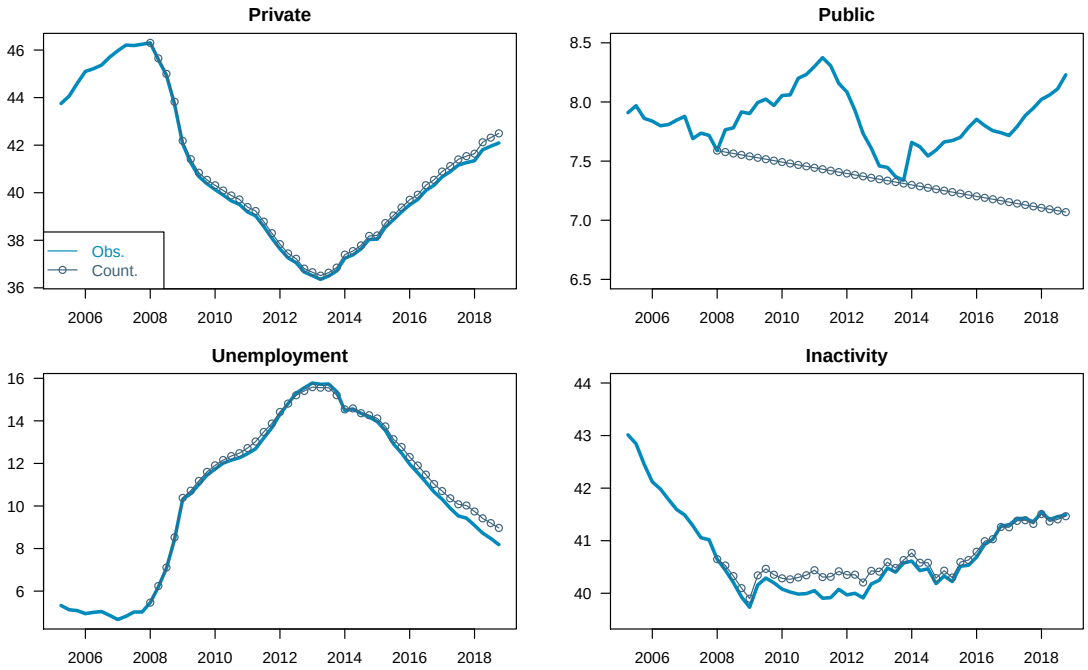
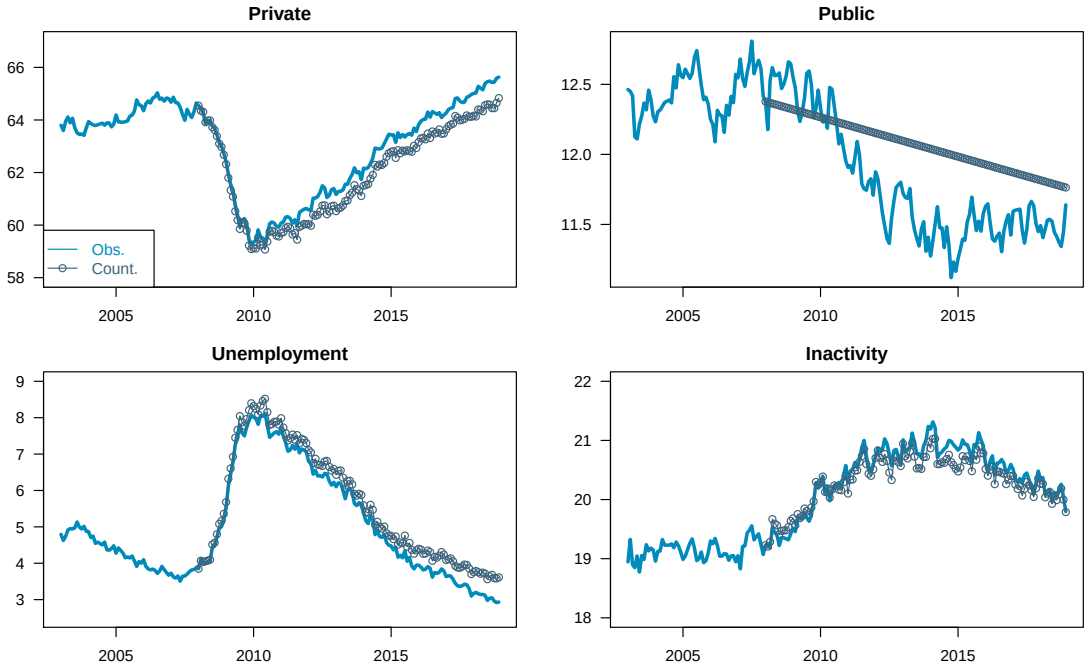


Figure A9: Counterfactual exercise, US



III - Extra material: Different subgroups

Table A7: Average quarterly worker flows. France 2003-2017

	Men			*Women*			*15-29*			*30-49*			*50-64*			*Primary*			*Secondary*			*Tertiary*		
	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)
Stocks																								
P	11340	58.54	–	8831	44.04	–	3995	37.73	–	10355	64.7	–	5822	45.32	–	10170	47.71	–	3837	50.29	–	6165	58.3	–
G	2100	10.85	–	3307	16.5	–	784	7.41	–	2819	17.61	–	1803	14.07	–	2051	9.6	–	987	13.05	–	2369	22.69	–
U	1328	6.84	–	1288	6.42	–	984	9.29	–	1107	6.91	–	526	4.08	–	1610	7.62	–	486	6.32	–	520	4.94	–
I	4602	23.76	–	6617	33.03	–	4828	45.58	–	1726	10.78	–	4660	36.53	–	7453	35.08	–	2306	30.33	–	1461	14.07	–
Flows																								
$P \to U$	230	1.19	2.03	191	0.95	2.17	182	1.72	4.55	176	1.1	1.7	63	0.49	1.07	234	1.1	2.31	90	1.17	2.33	97	0.92	1.57
$G \to U$	17	0.09	0.79	28	0.14	0.83	20	0.19	2.54	17	0.11	0.62	7	0.05	0.39	22	0.1	1.07	9	0.12	0.94	13	0.12	0.54
$P \to I$	211	1.09	1.86	237	1.18	2.69	178	1.68	4.46	126	0.79	1.22	144	1.12	2.49	237	1.12	2.34	111	1.45	2.89	101	0.95	1.63
$G \to I$	30	0.15	1.42	59	0.3	1.79	30	0.28	3.85	20	0.13	0.73	39	0.3	2.15	37	0.17	1.83	23	0.3	2.32	29	0.28	1.22
$U \to P$	267	1.37	20.24	242	1.21	18.86	227	2.14	23.22	215	1.34	19.48	67	0.52	12.63	272	1.28	16.99	110	1.43	22.76	126	1.2	24.43
$U \to G$	21	0.11	1.58	40	0.2	3.14	28	0.27	2.89	24	0.15	2.21	8	0.07	1.62	28	0.13	1.76	14	0.18	2.97	19	0.18	3.62
$I \to P$	170	0.88	3.7	203	1.01	3.07	226	2.13	4.68	95	0.6	5.54	52	0.41	1.12	173	0.81	2.32	114	1.5	4.94	87	0.83	5.92
$I \to G$	22	0.12	0.49	45	0.22	0.68	40	0.38	0.83	18	0.11	1.02	10	0.08	0.21	23	0.11	0.3	22	0.29	0.96	22	0.22	1.54
$U \to I$	207	1.06	15.41	254	1.27	19.67	179	1.69	18.13	173	1.08	15.56	109	0.84	20.57	292	1.39	18.06	93	1.2	18.93	76	0.72	14.59
$I \to U$	226	1.16	4.9	292	1.45	4.42	235	2.22	4.87	186	1.16	10.78	96	0.74	2.08	316	1.5	4.26	111	1.44	4.78	90	0.86	6.16
$P \to G$	8	0.04	0.07	15	0.07	0.17	12	0.11	0.3	9	0.06	0.09	2	0.02	0.04	9	0.04	0.08	7	0.09	0.17	8	0.08	0.13
$G \to P$	9	0.05	0.41	13	0.07	0.4	10	0.1	1.32	9	0.06	0.32	3	0.02	0.16	8	0.04	0.37	5	0.07	0.53	9	0.09	0.39

Note: France Labour Force Survey.

Table A8: Average quarterly worker flows. UK 2003-2018

	Men			*Women*			*15-29*			*30-49*			*50-64*			*Primary*			*Secondary*			*Tertiary*		
	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)
Stocks																								
P	13179	66.71	–	9122	45.38	–	6345	56.12	–	10576	60.96	–	5381	48.01	–	4085	48.79	–	13152	61.45	–	7243	55.21	–
G	2327	11.79	–	4458	22.19	–	1166	10.31	–	3635	20.95	–	1984	17.74	–	628	7.24	–	3498	15.43	–	3840	29.96	–
U	1058	5.35	–	799	3.97	–	957	8.43	–	609	3.5	–	291	2.6	–	546	6.53	–	930	4.45	–	359	2.73	–
I	3190	16.14	–	5713	28.47	–	2850	25.14	–	2531	14.58	–	3524	31.66	–	3111	37.44	–	3799	18.68	–	1598	12.1	–
Flows																								
$P \to U$	203	1.03	1.55	122	0.61	1.34	159	1.41	2.53	112	0.65	1.07	54	0.48	1.01	73	0.86	1.78	195	0.92	1.5	81	0.62	1.13
$G \to U$	15	0.08	0.65	20	0.1	0.45	12	0.11	1.05	14	0.08	0.38	9	0.08	0.47	4	0.05	0.7	20	0.09	0.57	17	0.13	0.44
$P \to I$	214	1.08	1.62	274	1.36	3.01	196	1.74	3.09	117	0.67	1.11	175	1.56	3.26	106	1.26	2.59	297	1.42	2.31	120	0.91	1.65
$G \to I$	34	0.17	1.45	80	0.4	1.8	25	0.22	2.15	28	0.16	0.77	61	0.55	3.07	14	0.16	2.24	60	0.27	1.74	58	0.45	1.51
$U \to P$	249	1.26	24.11	177	0.88	22.77	241	2.13	25.89	129	0.75	21.88	56	0.5	19.39	91	1.08	16.87	261	1.2	28.17	110	0.83	31.07
$U \to G$	21	0.1	2.05	36	0.18	4.76	25	0.22	2.77	22	0.13	3.9	9	0.08	3.22	7	0.08	1.21	31	0.14	3.26	28	0.22	8.41
$I \to P$	195	0.98	6.11	266	1.32	4.67	282	2.49	9.97	93	0.54	3.7	85	0.76	2.44	87	1.05	2.82	295	1.41	7.76	96	0.72	5.94
$I \to G$	23	0.11	0.71	51	0.26	0.9	35	0.31	1.25	21	0.12	0.81	18	0.16	0.5	7	0.09	0.23	41	0.19	1.06	33	0.25	2.12
$U \to I$	150	0.76	14.56	184	0.92	23.56	173	1.52	18.42	103	0.59	17.4	59	0.52	20.4	96	1.15	17.97	198	0.93	21.36	56	0.42	15.74
$I \to U$	196	0.99	6.14	240	1.2	4.21	267	2.35	9.33	117	0.68	4.64	53	0.47	1.51	121	1.45	3.88	266	1.24	6.91	72	0.55	4.54
$P \to G$	22	0.11	0.17	39	0.19	0.43	30	0.26	0.47	24	0.14	0.23	7	0.06	0.13	5	0.06	0.13	36	0.17	0.27	27	0.21	0.39
$G \to P$	18	0.09	0.77	28	0.14	0.63	18	0.16	1.54	20	0.11	0.55	8	0.07	0.41	4	0.05	0.69	25	0.11	0.76	23	0.18	0.6

Note: UK Labour Force Survey.

Table A9: Average quarterly worker flows. Spain 2005-2018

	Men			*Women*			*15-29*			*30-49*			*50-64*			*Primary*			*Secondary*			*Tertiary*		
	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)
Stocks																								
P	9151	49.21	–	6587	33.74	–	3009	40.31	–	9102	62.39	–	3502	41.96	–	1943	17.74	–	8579	48.34	–	5215	53.87	–
G	1280	6.88	–	1561	7.99	–	264	3.54	–	1581	10.84	–	974	11.58	–	99	0.89	–	897	5.06	–	1846	19.13	–
U	2059	11.01	–	1960	9.99	–	1264	17.6	–	1998	13.58	–	751	8.75	–	721	6.92	–	2449	13.59	–	849	8.59	–
I	6128	32.9	–	9417	48.28	–	2795	38.55	–	1921	13.19	–	3108	37.71	–	7844	74.45	–	5908	33.01	–	1792	18.41	–
Flows																								
$P \to U$	377	2.02	4.2	283	1.45	4.31	215	2.94	7.61	355	2.42	3.91	89	1.05	2.51	100	0.93	5.54	411	2.3	4.84	150	1.54	2.87
$G \to U$	29	0.15	2.25	37	0.19	2.39	18	0.25	7.38	36	0.24	2.26	12	0.14	1.18	7	0.07	8.72	32	0.18	3.53	27	0.28	1.47
$P \to I$	222	1.2	2.4	292	1.5	4.44	159	2.12	5.18	191	1.32	2.1	128	1.57	3.74	110	0.99	5.41	300	1.71	3.47	104	1.09	2.01
$G \to I$	27	0.15	2.12	45	0.23	2.9	16	0.21	6.04	26	0.18	1.65	24	0.28	2.45	10	0.09	10.43	31	0.17	3.43	32	0.33	1.73
$U \to P$	415	2.22	23.11	339	1.73	18.96	270	3.7	23.38	394	2.69	21.92	89	1.05	13.46	103	0.97	15.85	466	2.6	21.51	185	1.89	23.88
$U \to G$	35	0.19	1.91	49	0.25	2.73	24	0.33	2.06	44	0.3	2.54	15	0.17	2.17	9	0.08	1.3	39	0.22	1.8	36	0.37	4.78
$I \to P$	185	1	3.07	268	1.38	2.82	189	2.54	6.78	159	1.09	8.12	88	1.08	2.83	82	0.74	1.01	269	1.53	4.7	101	1.06	5.79
$I \to G$	22	0.12	0.37	44	0.23	0.46	23	0.31	0.84	25	0.17	1.31	15	0.18	0.48	9	0.08	0.11	27	0.15	0.48	30	0.31	1.7
$U \to I$	243	1.3	13.13	397	2.03	21.65	216	2.99	17.94	256	1.75	14.69	163	1.92	24.19	127	1.21	19	393	2.19	17.62	120	1.23	15.48
$I \to U$	280	1.5	4.56	460	2.35	4.9	293	4.05	10.51	286	1.95	15.45	158	1.87	5.14	136	1.29	1.73	453	2.53	7.72	152	1.56	8.47
$P \to G$	9	0.05	0.09	11	0.06	0.16	8	0.1	0.25	10	0.07	0.11	3	0.04	0.1	3	0.03	0.19	8	0.04	0.09	11	0.11	0.2
$G \to P$	7	0.04	0.56	8	0.04	0.51	6	0.09	2.43	7	0.05	0.45	3	0.04	0.35	3	0.03	4.23	7	0.04	0.77	7	0.07	0.36

Note: Spanish Labour Force Survey.

Table A10: Average monthly worker flows. US 1996-2018

	Men			*Women*			*15-29*			*30-49*			*50-64*			*Primary*			*Secondary*			*Tertiary*		
	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)	(t)	(p)	(h)
Stocks																								
P	57996	67.25	–	54832	57.35	–	34272	60.35	–	47663	67.16	–	31004	57.1	–	7804	59.15	–	66952	61.78	–	40240	64.34	–
G	8806	10.22	–	12730	13.33	–	3617	6.37	–	9487	13.36	–	8283	15.4	–	294	2.22	–	8714	8.04	–	11634	18.74	–
U	4913	5.69	–	4201	4.39	–	3966	6.97	–	3230	4.56	–	1998	3.67	–	862	6.49	–	6659	6.12	–	2020	3.24	–
I	14565	16.84	–	23838	24.92	–	14973	26.3	–	10584	14.92	–	12915	23.82	–	4238	32.14	–	26114	24.06	–	8568	13.68	–
Flows																								
$P \to U$	896	1.04	1.56	640	0.67	1.17	704	1.24	2.07	555	0.78	1.17	300	0.55	0.98	193	1.45	2.47	1144	1.05	1.71	311	0.5	0.78
$G \to U$	50	0.06	0.57	92	0.1	0.72	47	0.08	1.32	53	0.08	0.56	42	0.08	0.5	4	0.03	1.55	77	0.07	0.88	58	0.09	0.5
$P \to I$	1053	1.22	1.81	1445	1.51	2.63	1362	2.4	3.97	661	0.93	1.39	507	0.93	1.63	254	1.93	3.25	1829	1.69	2.73	521	0.83	1.29
$G \to I$	126	0.15	1.43	246	0.26	1.93	134	0.24	3.72	110	0.16	1.16	131	0.24	1.58	13	0.1	4.51	202	0.19	2.32	158	0.25	1.36
$U \to P$	981	1.14	21.24	758	0.79	19.03	865	1.53	22.85	600	0.84	19.75	299	0.55	16.07	206	1.55	24.99	1288	1.19	20.58	360	0.58	18.85
$U \to G$	56	0.07	1.22	105	0.11	2.6	60	0.11	1.59	58	0.08	1.89	43	0.08	2.35	5	0.04	0.62	85	0.08	1.35	70	0.11	3.65
$I \to P$	898	1.04	6.21	1248	1.31	5.25	1231	2.17	8.28	557	0.79	5.27	385	0.71	2.98	243	1.84	5.73	1559	1.44	6	448	0.71	5.21
$I \to G$	104	0.12	0.72	203	0.21	0.85	124	0.22	0.83	96	0.13	0.9	90	0.17	0.7	12	0.09	0.29	169	0.16	0.65	128	0.21	1.51
$U \to I$	839	0.97	17.66	947	0.99	22.91	939	1.65	24.06	531	0.75	17.02	326	0.6	16.89	182	1.37	21.87	1358	1.25	20.95	310	0.49	15.65
$I \to U$	768	0.89	5.28	889	0.93	3.73	906	1.59	6.06	473	0.67	4.46	288	0.53	2.22	169	1.27	3.97	1246	1.15	4.77	302	0.48	3.53
$P \to G$	130	0.15	0.22	189	0.2	0.34	106	0.19	0.31	128	0.18	0.27	86	0.16	0.27	5	0.04	0.07	167	0.15	0.25	143	0.23	0.35
$G \to P$	108	0.13	1.23	157	0.16	1.24	84	0.15	2.32	105	0.15	1.11	78	0.14	0.94	5	0.03	1.55	136	0.12	1.57	123	0.19	1.05

Note: US Current Population Survey .

Table A11: Unemployment decompositions of subgroups (2003-2017). France

	Shimer								
	All	Men	Women	15-29	30-49	50-64	Primary.	Secondary	Tertiary
$P \to U$	0.24	0.39	0.11	0.28	0.24	0.26	0.32	0.20	0.26
$G \to U$	0.03	0.04	0.05	0.04	0.07	0.01	-0.02	0.05	0.05
$P \to I$	-0.02	-0.02	0.02	-0.02	0.04	0.05	-0.03	0.03	0.03
$G \to I$	0.00	0.01	0.01	0.02	0.06	0.01	0.02	0.01	0.01
$U \to P$	0.39	0.32	0.44	0.41	0.31	0.26	0.42	0.36	0.32
$U \to G$	0.06	0.02	0.12	0.03	0.06	0.02	0.04	0.11	0.06
$I \to P$	0.08	0.08	0.07	0.06	0.04	0.04	0.05	0.05	0.05
$I \to G$	0.02	0.01	0.06	0.02	0.08	0.03	0.02	0.02	0.06
$I \to U$	0.14	0.11	0.10	0.07	0.08	0.31	0.08	0.09	0.16
$U \to I$	0.06	0.03	0.05	0.07	0.01	0.00	0.08	0.07	0.03
$P \to G$	0.02	0.01	0.02	0.02	0.02	0.00	0.01	0.01	0.01
$G \to P$	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.02

Note: the gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time aggregation bias using the methodology applied by Shimer (2012). The series are then detrended with an HP filter with smoothing parameter of 100000.

Table A12: Unemployment decompositions of subgroups (2003-2018). UK

	Shimer								
	All	Men	Women	15-29	30-49	50-64	Primary.	Secondary.	Tertiary
$P \to U$	0.24	0.33	0.09	0.22	0.26	0.15	0.28	0.11	0.17
$G \to U$	0.05	0.02	0.05	0.05	0.07	0.03	-0.02	0.02	0.05
$P \to I$	-0.02	-0.01	-0.01	-0.03	-0.01	0.04	0.04	0.05	0.01
$G \to I$	0.00	0.01	0.00	0.00	-0.01	0.02	0.02	0.01	0.05
$U \to P$	0.32	0.34	0.33	0.40	0.34	0.31	0.51	0.53	0.34
$U \to G$	0.09	0.06	0.13	0.07	0.11	0.07	0.02	0.11	0.20
$I \to P$	0.10	0.10	0.10	0.09	0.06	0.10	0.09	0.07	0.04
$I \to G$	0.03	0.01	0.05	0.02	0.03	0.03	0.01	0.05	0.01
$I \to U$	0.07	0.04	0.07	0.06	0.03	0.08	-0.03	-0.10	0.04
$U \to I$	0.10	0.10	0.12	0.09	0.12	0.16	0.12	0.15	0.08
$P \to G$	0.02	0.00	0.03	0.01	0.01	0.00	0.01	0.01	0.01
$G \to P$	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.00	-0.01

Note: the gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time aggregation bias using the methodology applied by Shimer (2012). The series are then detrended with an HP filter with smoothing parameter of 100000.

Table A13: Unemployment decompositions of subgroups (2005-2018). Spain

	Shimer								
	All	Men	Women	15-29	30-49	50-64	Primary.	Secondary.	Tertiary
$P \to U$	0.23	0.29	0.17	0.22	0.30	0.21	0.25	0.26	0.18
$G \to U$	0.03	0.03	0.02	0.01	0.04	0.03	0.01	0.01	0.05
$P \to I$	-0.04	-0.01	-0.10	-0.05	-0.03	-0.03	0.01	-0.05	-0.03
$G \to I$	0.00	-0.01	0.01	-0.01	0.00	0.02	0.00	0.00	0.00
$U \to P$	0.47	0.46	0.50	0.54	0.41	0.36	0.45	0.50	0.43
$U \to G$	0.08	0.05	0.10	0.04	0.07	0.09	0.03	0.05	0.13
$I \to P$	0.08	0.06	0.11	0.11	0.04	0.07	0.04	0.08	0.05
$I \to G$	0.00	0.01	-0.02	0.01	0.00	-0.05	-0.01	0.00	0.02
$I \to U$	0.05	0.04	0.07	0.03	0.06	0.14	0.07	0.05	0.03
$U \to I$	0.11	0.09	0.13	0.09	0.10	0.16	0.12	0.12	0.11
$P \to G$	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
$G \to P$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: the gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time aggregation bias using the methodology applied by Shimer (2012). The series are then detrended with an HP filter with smoothing parameter of 100000.

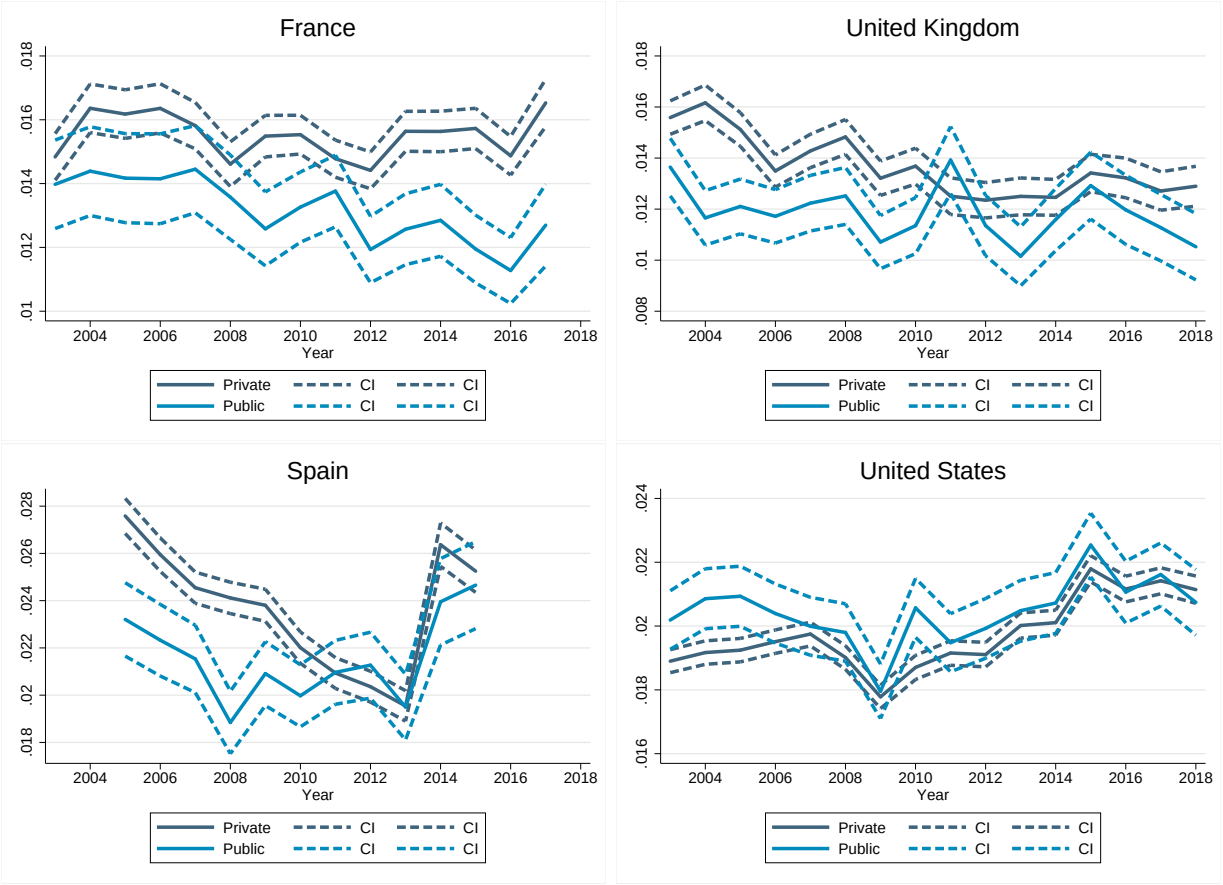
Table A14: Unemployment decompositions of subgroups (2003-2018). US

	Shimer								
	All	Men	Women	15-29	30-49	50-64	Primary.	Secondary.	Tertiary
$P \to U$	0.22	0.26	0.11	0.17	0.25	0.21	0.06	0.21	0.24
$g \to U$	0.02	0.02	0.03	0.01	0.03	0.04	0.01	0.01	0.02
$P \to I$	-0.03	0.00	-0.02	-0.01	-0.01	0.01	0.06	-0.02	0.00
$G \to I$	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
$U \to P$	0.38	0.40	0.38	0.46	0.38	0.31	0.56	0.42	0.33
$U \to G$	0.03	0.03	0.05	0.02	0.03	0.06	0.01	0.03	0.07
$I \to P$	0.07	0.05	0.06	0.08	0.03	0.03	0.03	0.07	0.03
$I \to G$	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.01	0.02
$I \to U$	0.13	0.09	0.13	0.09	0.11	0.12	0.03	0.10	0.12
$U \to I$	0.13	0.12	0.18	0.14	0.14	0.16	0.19	0.15	0.13
$P \to G$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$G \to P$	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00

Note: the gross flows series are previously seasonally adjusted using the X13 Census programme and the transition probabilities are corrected for time aggregation bias using the methodology applied by Shimer (2012). The series are then detrended with an HP filter with smoothing parameter of 100000.

IV - Extra material: Section 5

Figure A10: Transition probability from employment to inactivity, by sector



Note: Based on estimation of equations 5 and 6 using a multinomial logit. For France, there were 1,884,703 observations and a pseudo R-squared of 0.090. For the UK, there were 1,678,331 observations and a pseudo R-squared of 0.130. For Spain, there were 2,522,803 observations and a pseudo R-squared of 0.094. For the US, there were 7,571,635 observations and a pseudo R-squared of 0.070. For France, the UK and Spain, the transition rate was quarterly, while in the US, it was monthly. We used as controls regional, gender, age, education and occupation dummy variables. The predicted probability is calculated based on an individual with the average characteristics of the employed population. The sample covers 2003-2018 for the UK and US, 2005-2018 for Spain and 2003-2017 for France. The dashes lines report the 95 percent confidence interval on the prediction.

Table A15: Public-sector job-security premium, unconditional job-separation rates

	Scenario for value of unemployment					**Government budget** (medium scenario)		
	Very low	Low	Medium	High	Very high			
	$z = 0.3$	$z = 0.3$	$z = 0.5$	$z = 0.7$	$z = 0.7$	Millions	% of GDP	% of Gov
	$f = min$	$f = mean$	$f = mean$	$f = mean$	$f = max$			Spending
Lower bound: risk neutrality ($\sigma = 0$)								
France	4.0%	3.6%	2.5%	1.5%	1.3%	7161 (€)	0.33	0.63
UK	3.1%	2.4%	1.7%	1.0%	0.9%	2979 (£)	0.16	0.41
Spain	7.3%	5.1%	3.6%	2.1%	1.5%	4261 (€)	0.39	0.97
US	3.5%	1.9%	1.4%	0.5%	0.4%	25702 ($)	0.14	0.41
Upper bound: risk aversion ($\sigma = 2$) and no insurance								
France	10.5%	9.7%	4.6%	2.1%	1.8%	12963 (€)	0.59	1.13
UK	8.8%	7.1%	3.2%	1.4%	1.2%	5599 (£)	0.30	0.76
Spain	14.6%	11.8%	5.9%	2.8%	2.0%	7080 (€)	0.66	1.62
US	9.2%	5.7%	2.6%	0.7%	0.4%	48166 ($)	0.27	0.77

Note: The first five columns of table reports the fraction of the wage that a private sector worker is willing to forgo to have the same unconditional job-separation rate as a public sector worker in each country, depending on the replacement rate and job-finding rate. The discount rate r is set to 0.005 for France, UK and Spain and to 0.0017 in the US. We calculate the budgetary value of job-security based on 2015 data on wage compensation of government workers, GDP and total government spending provided by AMECO and FRED datasets.

Table A16: Public-sector job-security premium, different education groups

Country	**Scenario for value of unemployment**				
	Very low	Low	Medium	High	Very high
	$z = 0.3$	$z = 0.3$	$z = 0.5$	$z = 0.7$	$z = 0.7$
	$f = min$	$f = mean$	$f = mean$	$f = mean$	$f = max$
Primary educated workers					
France	2.9%-7.2%	2.6%-6.6%	1.8%-3.2%	1.1%-1.5%	1.0%-1.3%
UK	3.4%-9.1%	1.9%-5.5%	1.3%-2.5%	0.8%-1.1%	0.6%-0.8%
Spain	-	-	-	-	-
US	2.8%-5.8%	1.2%-3.3%	0.9%-1.6%	0.3%-0.4%	0.2%-0.3%
Secondary educated workers					
France	2.4%-7.0%	2.1%-6.0%	1.5%-2.8%	0.9%-1.2%	0.7%-1.0%
UK	1.7%-4.8%	1.1%-3.2%	0.8%-1.4%	0.5%-0.6%	0.4%-0.5%
Spain	-	-	-	-	-
US	2.2%-5.6%	1.3%-3.6%	0.9%-1.6%	0.4%-0.4%	0.2%-0.3%
Tertiary educated workers					
France	2.1%-6.2%	1.8%-5.2%	1.2%-2.4%	0.7%-1.0%	0.6%-0.9%
UK	1.0%-3.1%	0.7%-2.2%	0.5%-1.0%	0.3%-0.4%	0.2%-0.3%
Spain	2.1%-5.2%	1.2%-3.4%	0.8%-1.6%	0.5%-0.7%	0.3%-0.5%
US	0.7%-2.0%	0.4%-1.2%	0.3%-0.5%	0.1%-0.1%	0.1%-0.1%

Note: The table reports the lower and upper bound of fraction of the wage that a private sector worker is willing to forgo to have the same unconditional job-separation rate as a public sector worker in each country, depending on the replacement rate and job-finding rate The discount rate r is set to 0.005 for France, UK and Spain and to 0.0017 in the US.

V - Extra material: Conditional transition rates

Table A17: Conditional job-finding rates, US (Average 1996-2018)

	U-E rate		*I-E rate*	
	Public	Private	Public	Private
Unconditional	1.83	20.38	0.85	5.90
Conditional				
G	29.48	16.85	26.35	11.19
P	1.39	40.48	1.53	31.91
U	1.48	17.14	1.12	10.63
I	1.53	15.79	0.38	2.89

Note: The table reports the unconditional transition rates from unemployment (inactivity) to employment in a given sector, conditional on the state prior to unemployment (inactivity).