Pitfalls in modelling labour market flows: A reappraisal

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Abstract

We discuss the relevance of the internationally-adopted methodology used to compare labour market flexibility based on a two-state labour market representation which neglects inactivity. We highlight the strengths and weaknesses of such an approach and compare the results with transition rates derived by using a three-state labour market representation for the UK, Italy and Spain. These countries represent the Anglo-Saxon and the continental Europe labour market frameworks. The implied transition rates are much higher even in continental Europe when inactivity is explicitly considered, thus suggesting that the conclusions derived using an incomplete representation of the labour market are flawed.

Keywords: Labour market flows, Transition probability matrices, Unemployment
JEL classification codes: J60, J62, C14, C15

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1 Introduction

The flow approach to labour market modelling has gained the attention it merits since the seminal studies -among others- by Blanchard and Diamond (1992); Davis *et al.* (2006); Shimer (2012).

These approaches have emphasized the role of labour market flows in affecting labour market stocks and particularly unemployment. Also, cyclical fluctuations have been analysed focusing on unemployment inflows and outflows over the business cycle.

These studies renew the stream of research pioneered by Marston *et al.* (1976); Clark *et al.* (1979) in which unemployment duration and unemployment differentials by gender and race were extensively estimated. Following this line of investigation, labour market flows have been used in different countries to analyse unemployment dynamics and the contribution of individual, sectorial and regional characteristics to the determinants of such flows.

In particular, Elsby *et al.* (2013) adopt the methodology suggested by Shimer (2012) to estimate transition rates between labour market states in the UK and in other OECD countries to ascertain the contribution of unemployment inflows and outflows to unemployment variation. This study confirms previous observations that European labour markets are typically inflexible compared to the US, showing much lower rates of reallocation of labour (Blanchard and Wolfers, 2000; Blanchard and Portugal, 2001).

However, these studies are based on a common wisdom that the European labour markets are inflexible and affected by sclerosis that does not enable unemployment to adjust quickly to aggregate demand or supply shocks. Indeed, even continental labour markets are more flexible than expected as documented by Burda and Wyplosz (1994) and Baussola and Mussida (2014).

In addition, the availability of recent data from the Eurostat (2015) show that labour market flows in Europe are relevant and that the level of mobility even in continental Europe is not negligible. This fact is significant as the stylized facts suggested by Elsby *et al.* (2013) are based on estimates of transition rates derived from aggregate unemployment stock data, thus not directly derived from labour force surveys that may include information of changes in individual occupational status and therefore on labour market flows.

Thus their evidence is based on crucial assumptions that enable them to provide estimates of transition rates that in our opinion are misleading, as they typically underestimate the true pattern of workers' flows.

Another relevant issue deals with the representation of the labour market, i.e., the inclusion of inactivity as a labour market state. Flows involving inactivity are significant and crucially affect inflows and outflows rate from and to unemployment. However, Elsby *et al.* (2013) adopted a two-state representation, thus considering only unemployment and employment for their calculation of the equilibrium (steady-state) unemployment rate and the implied hazard rates. For these reasons we think that the conclusion suggesting that flow hazard rates in continental Europe are on average less than half of those prevailing in Anglo-Saxon countries, thereby reinforcing the idea that European labour markets are sclerotic, is at best misleading as it is based on calculations derived from methodological hypothesis not representing real labour market conditions in Europe.

The aim of the paper is, therefore, twofold. On the one hand, we aim at stressing the relevance of the flow approach to labour market modelling and, on the other hand, we aim to highlight the main methodological hypothesis on which the analysis of workers' flows is based, to emphasize both advantages and disadvantages of such methodologies.

Section 2 describes the data and summarizes the methodology proposed by Elsby *et al.* (2013) and in Section 3 we underline strength and weakness of such an approach. We apply this methodology to new data available for the Italian and other European labour markets and discuss the implication, in particular concerning the exclusion of the non-labour force condition. Section 4 presents the implied inflows and outflows rates also comparing such evidence with standard Markovian transition rates. We draw conclusions and suggestions for future research in Section 5.

2 Using labour markets stocks to derive transition rates

2.1 Data

The empirical investigation presented in this study uses data from two sources. First, the annual stock from the OECD and, second, quarterly flows from Eurostat.

The annual stocks from the OECD are used to derive and estimate transition rates by following the same methodology proposed by Elsby et al. (2013). In this latter work, as explained in the Introduction, the estimates of transition rates are derived from aggregate employment and unemployment data since a two state labour market representation is adopted. By using the OECD stock data, we replicate the methodology by using updated data. The estimates will be compared with the results obtained by using directly flow data from the second source, i.e., Eurostat.

This latter publishes quarterly labour market flows, based on seasonally unadjusted data derived from the European Union Labour Force Surveys (EU-LFS). Quarterly flows are available from 2010q2 to 2015q4.[1]

Labour market flows show individual movements between employment, unemployment, and inactivity and allow for a more detailed analysis of changes occurring in the labour market, in that it is then possible to set up transition matrices showing labour mobility in different economies.

Data for the European Union (EU) presented in the current release cover 26 out of the 28 Member States. However, in this study, we focus on Italy, Spain and the UK as we aim at highlighting differences between the so-called continental and Anglo-Saxon labour market frameworks.

The former are typically supposed to represent a sticky labour market framework dominated by institutional settings that do not encourage labour market transitions; the latter, on the contrary, is viewed as an example of an institutional framework in which high labour flexibility guarantees higher employment growth rates and therefore quick unemployment adjustments.

We aim to challenge this view that is based on empirical evidence derived from data that are inconsistent with the real patterns of the labour markets.

[1]Data are available in Internet at http://ec.europa.eu.Eurostat/data/database.

2.2 Estimation with Stock Data

We first present and discuss the methodology adopted by Elsby *et al.* (2013). The estimation of rate of inflow into unemployment and outflow rate from unemployment, by assuming that all of the inflow into unemployment originates from employment (two-state labour market representation), for the t-th year under study (resp. s_t and f_t) is based on the following equation:

$$u_{t+1} = u_t + u_{t+1}^{<1} - F_t^{<1} \cdot u_t,$$

in which u_t is the stock (fraction of the labour force) of unemployed in the t-th month, $F_t^{<1}$ is the probability for an unemployed worker to find a job in the current month (*outflow monthly probability*) and $u_{t+1}^{<1}$ is the stock of *short-term* unemployment, that is the fraction of workers experiencing an unemployment spell shorter than one month.

From the previous equation we can estimate the outflow probability

$$F_t^{<1} = 1 - \frac{u_{t+1} - u_{t+1}^{<1}}{u_t},$$

and the corresponding hazard rate:

$$f_t^{<1} = -ln(1 - F_t^{<1}). \tag{1}$$

Analogously, when we consider short-term unemployment's spells shorter than d months, the associated hazard rates is

$$f_t^{<d} = -\frac{1}{d} ln(1 - F_t^{<d}) = -\frac{1}{d} ln\left(\frac{u_{t+d} - u_{t+d}^{<d}}{u_t}\right). \tag{2}$$

Having at disposal the observed $u_t^{<3}$, $u_t^{<6}$ and $u_t^{<12}$, in Elsby *et al.* (2013) the estimated $f_t^{<3}$, $f_t^{<6}$ and $f_t^{<12}$ are used to improve, when possible[2], the estimation of the global outflow rate f_t given by $f_t^{<1}$. It is worth noting that Eq. 2 is based on the assumption that f is constant for at least d months (authors of the aforementioned paper suppose that flow hazard rates f and s are constant within years).

In the OECD data-set, short-term statistics are annually gathered, then $u_{t+d}^{<d}$ is not available when $d = 1, 3, 6$ and t indicates the year under study. Then an approximation is made using the following formula:

$$f_t^{<d} = -\frac{1}{d} ln\left(\frac{u_t - u_t^{<d}}{u_{t-d}}\right).$$

A further approximation is required since unemployment stocks are available only for quarters. Let q_t^i be the unemployment rate for the i-th quarter in the t-th year. On one hand, with the aim of smoothing data, the annualized version of u_t, u_{t-3}, u_{t-6} and u_{t-12} is used according with the following formulas:

$$u_t = \frac{q_t^1 + q_t^2 + q_t^3 + q_t^4}{4},\ u_{t-3} = \frac{q_{t-1}^4 + q_t^1 + q_t^2 + q_t^3}{4},$$

[2] Authors clarify that $f_t^{<1}$, $f_t^{<3}$, $f_t^{<6}$ and $f_t^{<12}$ are all consistent estimates of the aggregate outflow rate f_t only if there is no duration dependence in the short-term outflow rates.

$$u_{t-6} = \frac{q^3_{t-1} + q^4_{t-1} + q^1_t + q^2_t}{4},\ u_{t-12} = \frac{q^1_{t-1} + q^2_{t-1} + q^3_{t-1} + q^4_{t-1}}{4}.$$

On the other hand u_{t-1} is not available and it has to be interpolated. In Elsby *et al.* (2013) (online appendix) the assumption is made that $ln(u_\tau)$ is linear with respect of τ at least for $\tau \in [t-3,t]$. Substituting data about u_{t-3} and u_t, we obtain that $ln(u_{t-1}) = \frac{2}{3}ln(u_t) + \frac{1}{3}ln(u_{t-3})$.

Having estimated f_t with $f_t^{<1}$ or with a (weighted) average of $f_t^{<1}$, $f_t^{<3}$, $f_t^{<6}$ and $f_t^{<12}$, the inflow rate s_t is obtained solving the following equation:

$$u_t = \lambda_t \cdot u^*_t + (1-\lambda_t)u_{t-12}, \tag{3}$$

where $u^*_t = \frac{s_t}{s_t+f_t}$ is the steady-state unemployment rate and $\lambda_t = 1 - e^{-12(s_t+f_t)}$ is the annual rate of convergence to steady state. Actual and estimated steady-state unemployment rates are presented in Tab. 1.

2.3 Estimation with Flow Data

As we have previously discussed, the methodology proposed by Elsby *et al.* (2013) enables one to derive transition rates in the absence of flow data. However, such a methodology implies significant drawbacks as it is based on strong economic assumptions. We thus present the estimates of transitions rates when flow data are available, and then compare these results with those derived by applying the methodology described in Section 2.2. When flow data are available, an alternative method for estimating f_t and s_t exists and is based on the observed number of transitions between employment and unemployment. Usually flow data contain information about inactive workers, which is an advantage in the estimation of f_t and s_t, as it will be clarified in the following. As in Baussola and Mussida (2014) we then consider three states E, U and I, and for every t the corresponding transition matrix

$$P_t = \begin{bmatrix} ee & eu & ei \\ ue & uu & ui \\ ie & iu & ii \end{bmatrix}.$$

Quarterly transition matrices are in this case extracted from the Eurostat data-set. Having no further information, we suppose that hazard rates f_t and s_t are constant within quarters. On such basis we can calculate the generator matrix Q_t such that $P_t = exp(Q_t)$, where $exp(\cdot)$ is in this case the *matrix exponential function*[3]. Q_t allows us to estimate the flow hazard rate with a continuity correction as in Shimer (2012): we suppose indeed that, within the t-th quarter, transitions are ruled by a continuous-time Markov chain with generator matrix Q_t, which has to satisfy $Q_{lj} > 0$ for every $l \neq j$ and $Q_{ll} = -\sum_{j \neq l} Q_{lj}$ (the subscript t is avoided for shortness). It is then known that

1. Q_{lj} represents the rate of transitions from l to j for every $l \neq j \in \{e,u,i\}$;

[3]Given a $k \times k$ matrix A, the exponential of A is defined by $exp(A) = \sum_{n=0}^{\infty} \frac{1}{n!} A^n$.

2. the *persistence time* in the l-th state is an exponentially distributed random variable with parameter $-Q_{ll}$.

In consequence of that, the hazard rate for the l-state corresponds to the same value $-Q_{ll}$ (Kiefer, 1988).
On such basis we can estimate the inflow and ouflow rates as follows:

- the outflow rate f_t corresponds to $-Q_{uu}$, the hazard rate related to the unemployment state;

- the inflow rate s_t corresponds to the hazard rate towards the unemployment state. In this case we suggest to introduce an alternative state S, which coincides with E if we decide to consider only employment/unemployment and with $E+I$ if we choose to include inactive workers. The inflow rate is then evaluated as $-Q_{ss}$.

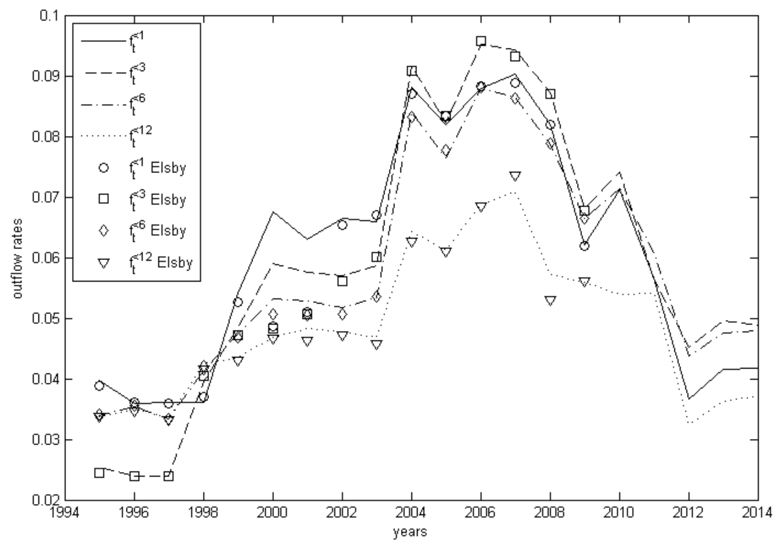
3 Strength and weakness of flow rates estimation with stock data

3.1 Strength: international comparisons when flow data are unavailable

In this section, we aim at pinpointing the advantage provided by using aggregate stock data to derive transition rates. This enables us to compare such an analysis with the corresponding disadvantages and then to derive conclusions and suggestions for future research. As a first step, we use OECD stock data as in Sect. 2.2 to estimate the Italian flow rates. Fig. 1 displays the comparison between the estimated values of $f_t^{<1}$, $f_t^{<3}$, $f_t^{<6}$ and $f_t^{<12}$ from Elsby *et al.* (2013) and the same values obtained using updated yearly OECD data from 1995 to 2014 (we cut away the earlier years because a break in the data is signaled in 1993 - 1994), calculated by using a two state labour market representation, i.e., employment and unemployment. The comparison helps us to check the correctness of our calculus.

Our results are coherent with the older ones, and we can see that all the estimated short-term outflow rates (and consequently the estimated f_t) show the same behaviour: an ascending trend until 2006-2007 followed by a decline which corresponds to the economic crisis.
We analyse the outflow and the inflow rates in two countries of Southern Europe, Italy and Spain, and in the UK. We select these countries which are also compared since they have different institutional frameworks, i.e., continental and Anglo-Saxon labour market frameworks, with different labour institutions and regulations. Italy and Spain have a typically southern European labour markets, composed of segments characterized by significantly varying levels of employment protection, and therefore different labour costs, while the United Kingdom has a typically Anglo-Saxon labour market characterized by less employment protection legislation Theodossiou and Zangelidis (2009). Despite these intrinsic differences, both labour markets have high labour mobility overall, but this mobility characterizes the labour market flows (here inflows and outflows) in each country in different ways. We aim at emphasizing how the average

Figure 1: Estimated short-term outflow rates $f_t^{<d}$, $d = 1, 3, 6, 12$ for Italy, 1995 - 2014.



Source: Authors' calculations on OECD data.

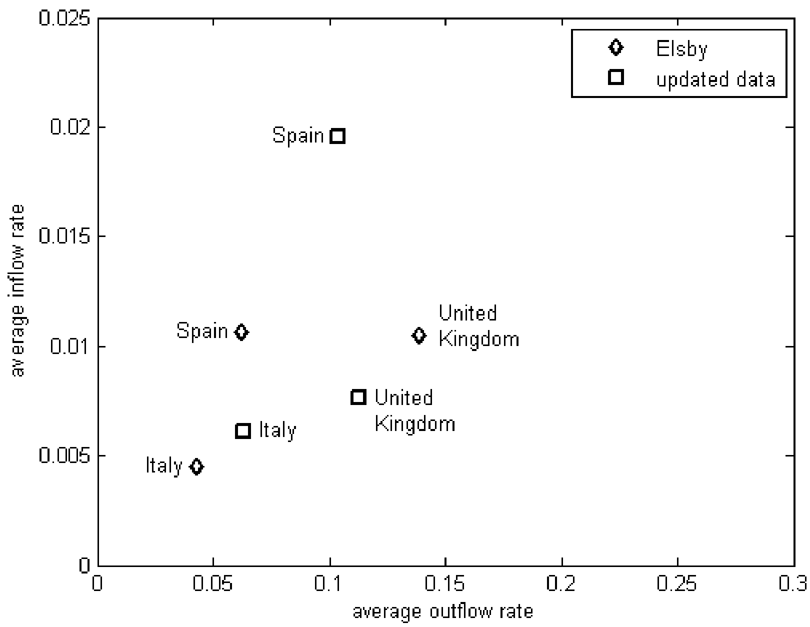
inflow and outflow rates react in these countries to the use of Elsby's technique, i.e. if it captures the differences in the labour markets of these countries.

We use OECD data for the period from 2006 to 2014, since UK data have a break in 2005. Our aim is to analyze the relationship between the average outflow and inflow rates. Then we estimate f_t using the value $f_t^{<1}$ as explained in Sect. 2.2, and consequently we calculate s_t as in Eq. 3. Possible improvements of the estimation through $f_t^{<d}$, $d > 1$, will be subject of future research.
Fig. 2 contains the average values, in comparison with results from Fig. 1 in Elsby *et al.* (2013)

In detail, in Fig. 2 we use updated OECD data from 2006 to 2014, while Elsby used data up to 2009. We, therefore, have the opportunity to update Elsby's analysis and to show if there are any impacts of the economic recession on the estimated (average) outflow and inflow. Fig. 2 shows differences between the updated series and those used by Elsby in all the countries analysed, i.e., Italy, Spain and UK. These changes might partly be due to the crisis which affected all the economies. In detail, the highest impact is found in Spain, where both the average inflow and especially the average outflow increase from the older to the latest series. The same impact, a positive change (increase) in both inflow and outflow is found in Italy to a lower extent. Finally, in the UK we find the opposite effect on both the flows. There is indeed a reduction of around the same amount of inflow and outflow.

To sum up, the extension of the Elsby's technique to the most recent years is very interesting at least twofold. First, there is an impact of the crisis on all the indicators in all countries. Second, there are differences among countries both in the relevance and in the sign of those impacts. While in Southern Europe there is an increase in the movements between the two labour market states of employment and unemployment (due partly to the crisis) and especially in Spain, in the UK the opposite is true, i.e., a reduction of the inflows and outflows. The Elsby's technique, therefore, captures the differences in the labour countries among countries.

Figure 2: Average outflow and inflow rates obtained with 2006 - 2014 OECD updated data.



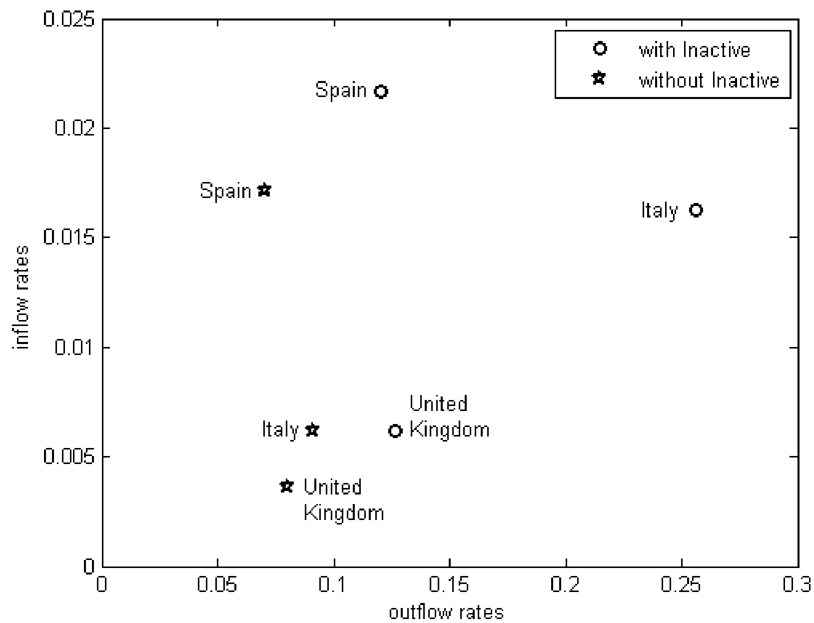
Source: Authors' calculations on OECD data.

3.2 Weakness: Does inactivity matter?

The estimation technique based on stock data represents an important tool to obtain flow rates when flow data are not available. Nevertheless, it has a weakness due to the strong assumption that inflow and outflow rates are constant within years. The method proposed in Sect. 2.3 is based on a similar assumption, but it regards shorter periods (quarters instead of years).

Estimation with flow data has another important feature: when data about inactive workers are available, the same method can be easily adapted to choose of estimating flow rates with or without the state *I*. Thank this feature, we are allowed to evaluate the impact of inactivity on the estimation of flow rates. We have at disposal quarterly Eurostat flow data, from 2010q2 to 2015q4, for Italy, Spain and the United Kingdom.

Figure 3: Outflow and Inflow rates estimated with and without Inactive workers, Eurostat quarterly data, 2010-2015.



Source: Authors' calculations on Eurostat data.

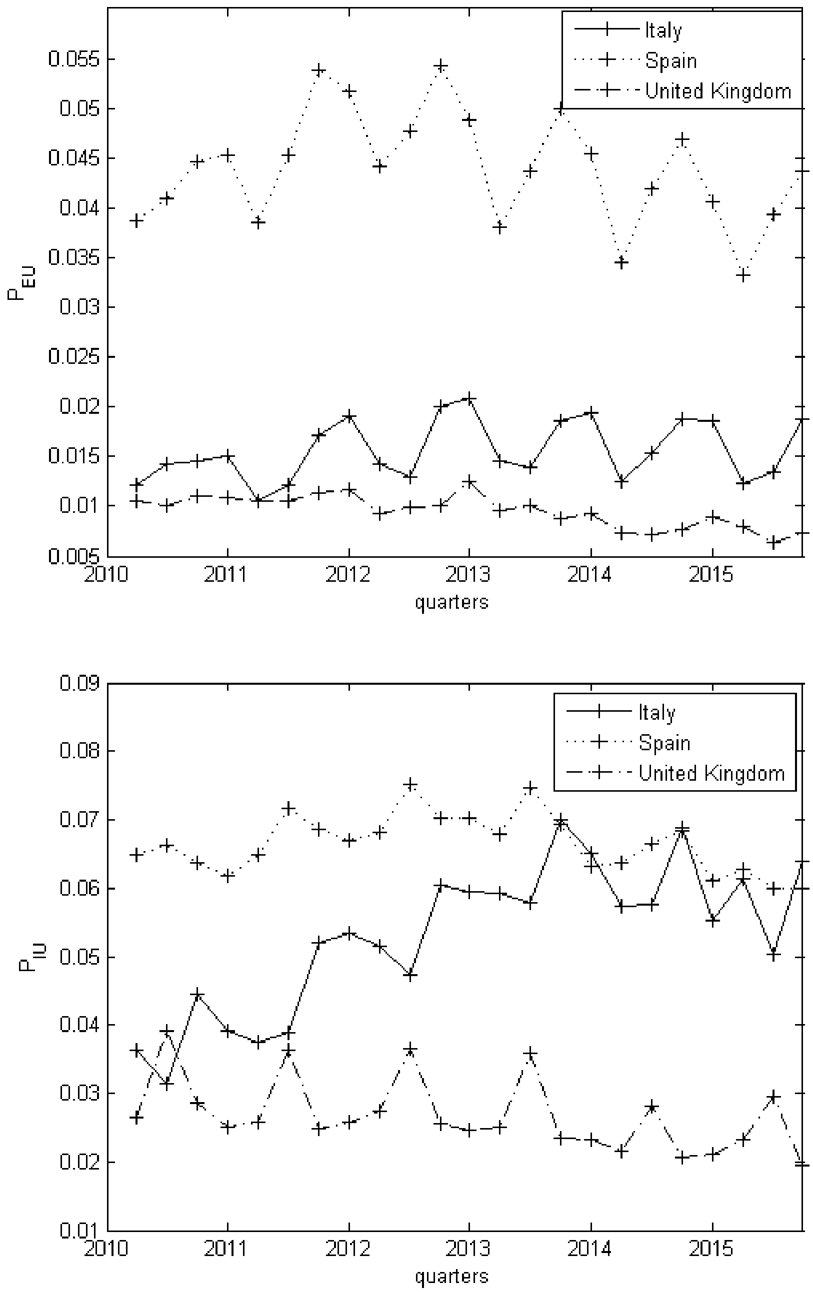
Fig. 3 shows the estimated average inflow and outflow rates obtained firstly excluding inactive workers from the sample under study and secondly re-including them (which means that inflows towards unemployment may happen both from employment and inactivity). Results based only on E - U states are similar to the values shown in Fig. 2, also if we note that Italy has a slightly higher outflow rate than the UK. In all countries considering inactivity is important, and there is an increase in both inflow and outflow rates (Fig. 2).

The relevant result regards the estimated outflow and inflow rates when inactivity is considered. In this case, Italy has the highest outflow rate. At first sight it could appear as a positive result; however, it implies very high transitions from unemployment to inactivity thereby posing the issue related to the ability of the Italian economy to create an adequate number of jobs thus enabling employment to grow and unemployment to be reduced not just because of a discouragement effect (see Fig. 5).

A similar pattern is also observed in Spain, where the unemployment rate is however systematically higher. In this country, there is also an increase of the inflow and outflow rates when inactivity is not neglected. For the UK the impact on the outflows and inflows rates is milder in comparison with the two-state representation. This fact suggests that such a representation is more suitable for those institutional frameworks (e.g., Anglo-Saxon) in which the reciprocal flows from and to inactivity are less relevant.

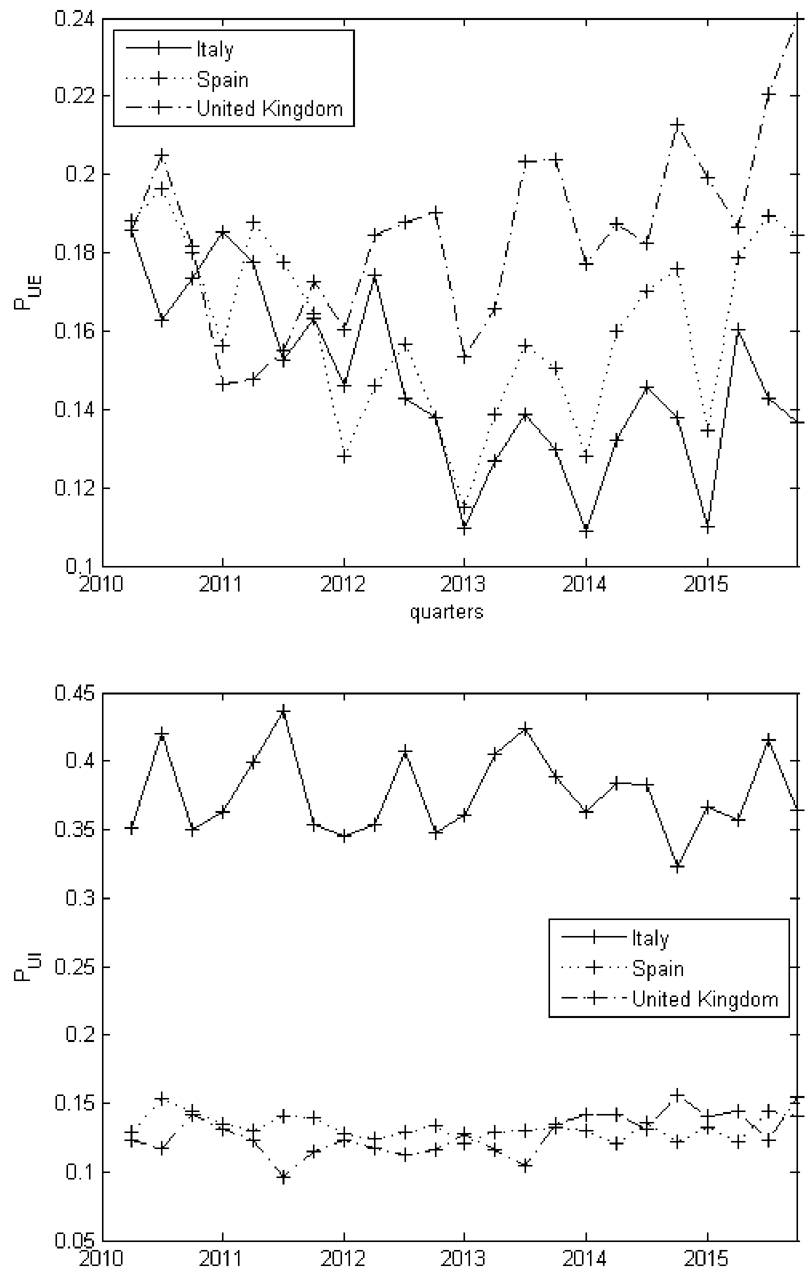
In any case, the proposed evidence suggests that inactivity is relevant and neglecting it leads to a significant and therefore not negligible underestimation of the overall/average inflows and outflows. In detail, this is especially the case of Southern European countries - particularly Italy - where the inclusion of inactivity leads to a significant increase in transition rates. Thus, policy suggestions based on a two-state representation are flawed, as they do not take into consideration the true representation - and therefore the true flexibility - of the labour market.(Fig. 5).

Figure 4: Conditioned transition probabilities (hazard rates) towards Unemployment, from Employment (upper) and Inactivity (lower).



Source: Authors' calculations on Eurostat data.

Figure 5: Conditioned transition probabilities (hazard rates) from Unemployment to Employment (upper) and Inactivity (lower).



Source: Authors' calculations on Eurostat data.

4 Conclusions

Flexibility in the labour market is recognized as a requisite for enabling employment to grow steadily. In particular, it has been emphasized that higher unemployment inflows are also associated with corresponding higher unemployment outflows that bring about an increase in employment.

The Anglo-Saxon institutional framework is adopted as a benchmark for this representation, and aggregate data seem to be coherent with such a statement.

Also, international comparisons of aggregate inflow and outflow rates derived from aggregate unemployment stocks reinforce this wisdom.

We discuss this evidence by reproducing labour mobility in three different economies representing, on the on hand, the so-called southern European framework (e.g., Italy and Spain), and on the other hand, the Anglo- Saxon framework (UK).

We show that the two-labour-market-state representation (employment and unemployment) typically used for such international comparisons is flawed, as it systematically underestimates the inflow and outflows rates. Inactivity plays a crucial role and when included, provides a different picture of labour mobility, in that transition rates are much higher even in continental Europe.

Thus the steady growth of employment depends on more on structural characteristics of the economy (industry specializations, firm size, internationalization, relevance of multinational groups) rather than on labour flexibility per-se, which is -in any case- high even in continental Europe.

A Steady State and Observed Rate of Unemployment

Table 1: Yearly steady state for Italy, in comparison with the observed percentage of Unemployment.

Year	**Estimated f_t**	**Estimated s_t**	**Steady state $\frac{s_t}{s_t+f_t}$**	**Observed OECD u_t**
1995	0.0332	0.0046	0.1205	0.117
1996	0.0326	0.0041	0.1115	0.117
1997	0.0317	0.0041	0.1141	0.118
1998	0.0399	0.0052	0.1146	0.119
1999	0.0483	0.0057	0.1051	0.115
2000	0.0566	0.0058	0.0935	0.107
2001	0.0554	0.0049	0.0816	0.096
2002	0.0558	0.0049	0.0815	0.091
2003	0.0562	0.0051	0.0830	0.088
2004	0.0819	0.0069	0.0774	0.081
2005	0.0755	0.0061	0.0753	0.078
2006	0.0850	0.0058	0.0635	0.068
2007	0.0855	0.0052	0.0578	0.061
2008	0.0763	0.0058	0.0710	0.068
2009	0.0631	0.0059	0.0849	0.078
2010	0.0676	0.0065	0.0877	0.085
2011	0.0570	0.0052	0.0842	0.084
2012	0.0396	0.0063	0.1380	0.108
2013	0.0438	0.0070	0.1385	0.123
2014	0.0439	0.0067	0.1326	0.128

Source: Authors' calculations on OECD data.

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