Markovian Transition of Social Welfare Clubs in the EU

Mamatzakis, E and Christodoulakis, G

University of Piraeus

18 October 2009

Markovian Transition of Social Welfare Clubs in the EU

October 2009

George A. Christodoulakis[1] and Emmanuel C. Mamatzakis[2]

Abstract

This paper focuses on the dynamics of welfare by studying the persistence and transition of poverty risk, social transfers, employment and unemployment in the four European Country Clubs as defined by Esping-Andersen, G. (1990) and Bertola et al. (2001). We model their evolution in a multistate Markov process for proportions of aggregate data and estimate the transition matrix by adopting a Bayesian approach under inequality constraints and Monte Carlo Integration. Our approach uncovers the entire empirical posterior distribution of persistence and transition probabilities, for which statistical inference is readily available. The results show high persistence in unemployment rate in the Anglo-Saxon social club, whilst regarding social expenditures the four identified social clubs converge to two, the Nordic with the Continental club and the Anglo-Saxon with the Southern club. The half life statistics show fast pace across all variables of interest.

Keywords: Social Clubs, Markov Chains, Monte Carlo Integration, Transition, Poverty, Social Transfers.

JEL Classification: O4, I3.

[1] Manchester Business School, University of Manchester, MBS Crawford House, Booth Street West, Manchester M15 6PB, UK, Tel: +44-161-3066402, george.christodoulakis@mbs.ac.uk

[2] Department of Economics, University of Piraeus, 80 M. Karaoli and Dimitriou street
Piraeus 185 34, Greece, Tel: +30-210-4142297, tzakis@unipi.gr.

1. INTRODUCTION

Over recent years the European Union (EU) shows strong economic dynamism as depicted by its inclusion among the world's most productive, competitive and innovative economies. Both the single market and the single currency, the euro, have assisted this dynamism and the creation of a more integrated economic area. Yet, if the economy of the EU is compared to the US economy a productivity gap emerges. Attempts to bridge this gap focus mainly on structural reforms. The Lisbon strategy, launched in March 2000, served this purpose, setting a ten-year time table to make the EU the world's '*most dynamic and competitive economy'*. Though it proved rather sluggish in the beginning this strategy seems recently to bear some fruits, in particular after its re-launch and refocus towards growth and jobs in 2006. The re-launch recognises that a necessary condition to successfully implementing structural reforms that would enhance economic efficiency and bridge the productivity gap is to raise social welfare and to create jobs, as both are among the basic prerequisites of building strong social consensus in favour of the reforms (European Commission, 2006b).

However, social welfare presents symptoms of chronic heterogeneity across EU Member-States, raising uncertainties over the final outcome of the Lisbon strategy. This heterogeneity of national social policies on employment and the income distribution has caused some heated discussions among policy makers and economists alike, leading some countries within the EU to call for protectionist measures, including barriers to cross-border trade, labour, and investment flows (European Commission, 2005a). This was the outcome of a growing scepticism in some countries in EU regarding the recipients of their social policies and their ability to safeguard relatively high and evenly shared living standards among their citizens (see European Commission, 2006b).

A possible solution, other than resorting to protectionism, would have been to achieve a common understanding, a coordination of national policies across EU that would attempt to bridge the differences in social welfare in EU. For this to happen though a necessary precondition is that a convergence in social welfare takes place across EU Member States. However, given the soft coordination of social policies in Europe convergence may prove a task of high order. In many aspects a common EU social welfare policy would have been a solution, yet this proposition at the present is quite unrealistic that resembles utopia, leaving harmonisation across EU various social welfares as the only realistic option (European Commission, 2006a).

This paper is the first attempt in the literature to investigate integration in social welfare in EU. Moreover, we follow a club analysis that fits the stylised heterogeneity within the EU in terms of social policies (see Bertola, 2006). To this end our analysis identifies if a process of integration between the various social welfare clubs exists. The notion of the formation of different social systems, mirroring at different social clubs, first appears in the Espring-Andersen (1990), followed by Bertola et al. (2001). Similarly, we identify four 'social welfare" clubs within the EU-15: the Nordic club, the Continental club, Anglo-Saxon club and last the Southern club.

Our methodology follows Quah (1993) and Mamatzakis and Fousekis (2007) who estimate transition probabilities matrices to describe the migration from a particular social club to any other. To this end, the presence of high transition probabilities would imply a process of integration in terms of social welfare across EU. In case that disaggregate data are available, robust estimation of these probabilities can be trivially performed by calculating the proportion of objects, which migrate from one social club to another. However, it is often the case that these individual transitions cannot be observed or simply are not available to the analyst or policy maker. For example, the variables such as the risk of poverty and social transfers both fall into this category, for which Eurostat provides aggregate data. Yet, a solution could be to model the evolution of poverty risk and social transfers with respect to broad European social clubs using Markov Chains for proportions of aggregate data. Estimation of the transition matrix can be easily performed vias least squares with equality constraints. However, this approach goes back to the work of Miller (1952), Lee et al (1970) and MacRae (1977), for which the least squares estimator of the transition probabilities under inequality constraints has unknown distribution, thus preventing statistical testing. In this paper we shall adopt a Bayesian approach as in Christodoulakis (2007), which utilises Monte Carlo Integration (MCI), proposed by Kloek and van Dijk (1978) and van Dijk and Kloek (1980). In this respect our approach uncovers the entire empirical posterior distribution of transition probabilities, for which statistical inference is readily available. Furthermore, the Bayesian MCI approach performs well in cases of very small samples as shown in Christodoulakis (2008).

The contribution of this paper is, thus, twofold. First, we study process of integration among identified social clubs, using the dynamics of poverty risk, social transfers, employment and unemployment rates through a Markov process and a largely unexplored EU data. Second, we employ a Bayesian estimation method for the transition matrix under inequality constraints within a Monte Carlo Integration, thus uncovering the entire empirical posterior distribution of transition probability matrices.

In what follows, section 2 presents the data and the institutional framework, while section 3 reports the methodological framework. Section 4 presents the empirical results, while section 5 concludes.

2. DEVELOPMENTS IN THE SOCIAL WELFARE OF EU

The notion of forming different social welfare systems first appears in the Espring-Andersen (1990), followed by Bertola et al. (2001) that identify four different social welfare clubs within the EU-15: the first club includes the Nordic countries, namely Denmark, Finland and Sweden, together with Netherlands that traditionally endorses a generous welfare system accompanied by strong active labour market policies and high unemployment insurance benefits, aiming at full employment. The second club includes Continental counties, which are Austria, Belgium, France and Germany, and it has lower, than the first club, public social expenditures as pensions, health services and unemployment benefits are primarily financed by contributions, while it counts on a centralised wage negotiation system with rigid employment protection legislation to achieve full employment. The third club is based on the Anglo-Saxon model of the UK and Ireland, where public social expenditures and unemployment insurance benefits are low, labour markets are not regulated and there exist little employment protection. Lastly, the club of Southern countries, including Greece, Italy, Portugal and Spain, has the lowest level of public social expenditures as the government is not the main contributor in the social welfare, where family still plays the dominant role.

Given the soft coordination in social welfare policies in Europe, see Bertola (2007), one need to assess whether process of integration in the national policies takes place. In turn, national governments address the problems associated with income inequality and poverty through measures of poverty risk, unemployment and social transfers. Thus, we opt for those social expenditure transfers to investigate for integration in social welfare in EU. In addition, we employ similar analysis for the employment and unemployment rates. Labour market dynamics are of particular importance for combating poverty and social exclusion. This has been widely recognised in EU by the recent launch of Social Policy Agenda for Europe, (see European Commission, 2005b). The Social Agenda for Europe prioritises the improvement of quality and productivity at work, the strengthening of social cohesion that would attract and retain unemployed in employment, thus raising labour supply. It also seeks the modernisation of social protection systems.

Given the plurality of social welfare systems in EU, prior to the empirical analysis we need to be able to facilitate cross-country comparisons of social expenditure. Thus, the first step is to adopt a formal definition of the variables of our interest for testing the integration process of social welfare in EU. Based on the definition of OECD social expenditure includes the benefits, which includes also financial contributions, to households and individuals so as to assist their welfare in case of adverse events. This definition is adopted by the Eurostat (see Eurostat, 2006), our source of data, in the the European System of integrated Social Protection Statistics (ESSPROS) as redefined in 1996.[3]

Moreover, public social expenditure includes cash benefits such as pensions, maternity payments, and social assistance. In fact, about half of the public social expenditure refers to pension expenditures. Of course there exist other social transfers in terms of social services like, childcare, care for the elderly and disabled, while tax exemptions also serve as social transfers as they could treat favourably families with children, expenditures to private health plans.[4]

In this study due to data availability issues we include the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and UK. This group of countries would be referred as EU-15. Then, four social clubs are defined so as to provide an analysis of the underlying distribution dynamics, referring to an evolving cross-sectional distribution over time and its persistence and transition characteristics between these clubs.

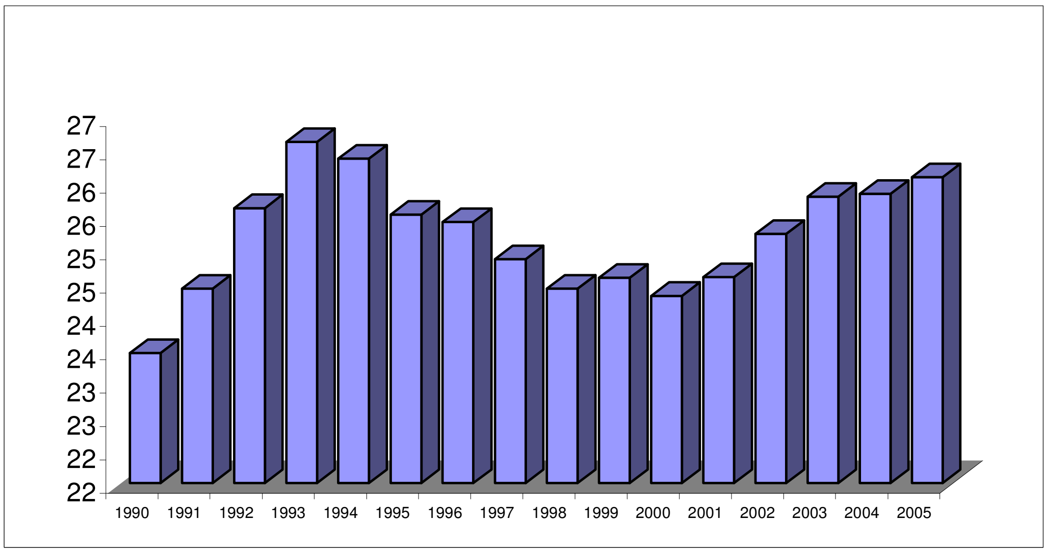
Diagram 1 shows the cross-sectional average of the social protection benefits transfers as percent of GDP other than in kind for each year of the sample. Average social benefits increased rapidly from 1990 to 1994 but followed a downward trend for a prolonged period of time, from 1993 to 2000. Since 2000 this trend appears to be

[3] At the outset, it is worth noting that there exists no universally accepted definition of the scope of social protection.

4 Social spending is an aggregate of all (or a group of) social benefits. It does not include contributions and other payments by households that finance social programmes. Such payments are considered to be 'social contributions' although they are an expenditure item from the perspective of the contributor. Social expenditure or social spending also does not include wages and salaries.

reversed, but stabilizing at lower level than the one of 1993. Given that it is well evident that income inequality has been increasing over the period considered in this study (see Bertola 2006 and 2007), the depicted decline of social protection benefits have an impact on income inequality and poverty. It is also worth noting that the period of declining social protection benefits coexisted with the period of the required nominal economic convergence prior to the adoption of the single currency, the euro. It is, therefore, of interest to examine whether there has been also a convergence in terms of social protection benefits in Europe over this period.

Diagram 1: Social Protection Benefits (as percent of GDP).

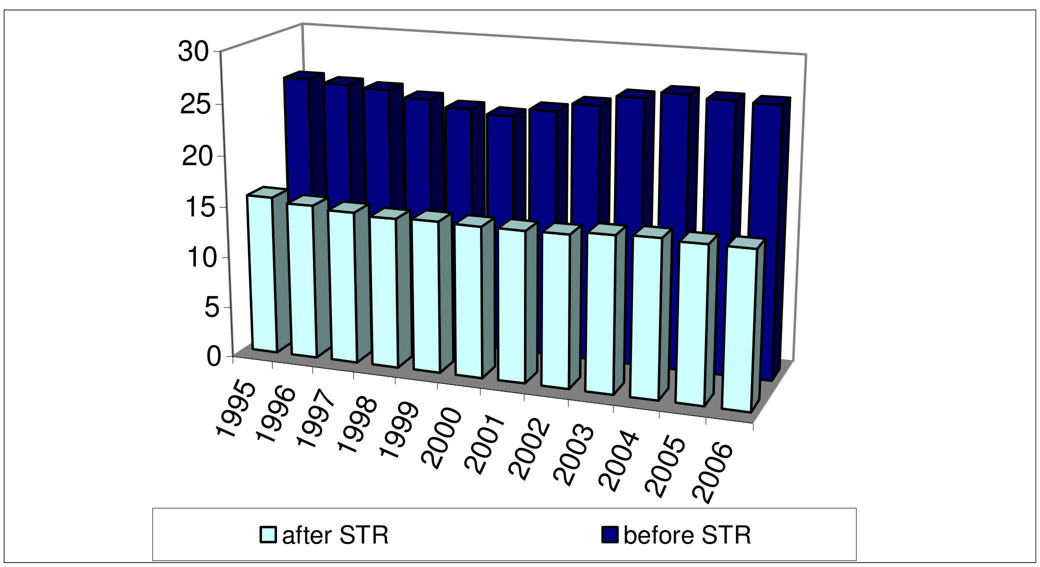


Source: Eurostat.

The main objective of the social benefits is to reduce the risk of poverty. According to the Eurostat classification, the risk of poverty rate is calculated on the basis of the household income received by all household members. Based on this definition the risk of poverty rate refers to the individuals that line in households where equivalised income is bellow the threshold of 60% of the national equivalised median income before and after social transfers. Of course having an income below this 60% threshold is neither a necessary nor a sufficient condition of classifying an individual as being poor, given that is difficult to account all instances that some basic needs in an individual's everyday life are scarce or limited due to income constraints, like access to health, education services. As a result, the Eurostat indicator is referred to as a measure of poverty risk

Diagram 2 bellow shows the risk of poverty rate before and after social transfers over the sample period. There exist an apparent strong resilience in both risks of poverty, though without social transfers such as unemployment pay, public assistance, housing allowance or children's allowance, the risk of poverty in the EU-15 would have been 10% higher. Nevertheless, the risk of poverty remains quite substantial after the transfers, above 15 percent of the EU-15 population in 2006, around 44 million people.

Diagram 2: Risks of poverty after and before social transfers.

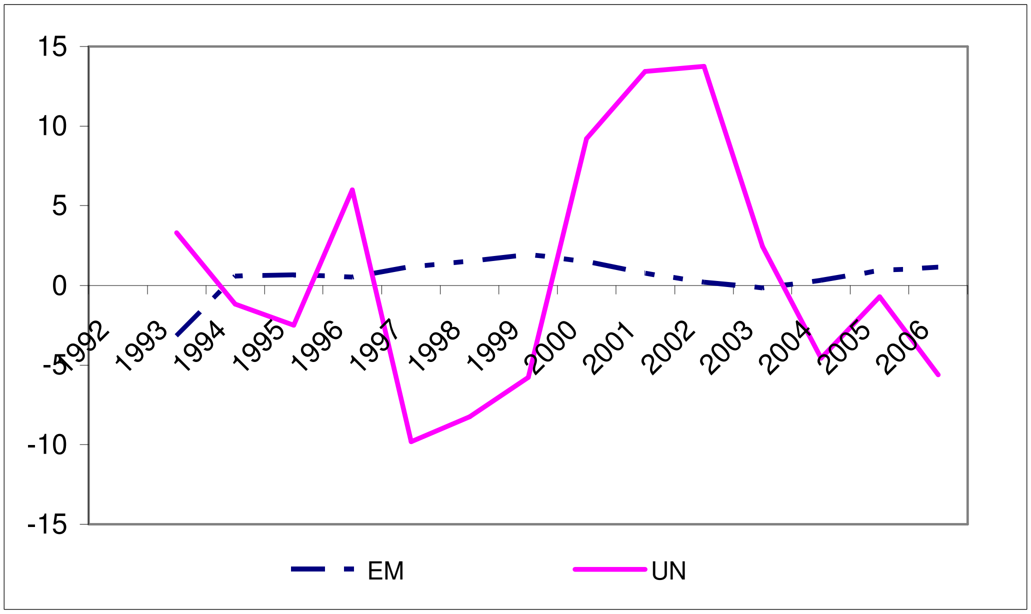


Source: Eurostat.

An analysis of social expenditure and poverty risks should be complemented by the dynamics of labour market. The re-launch of the Lisbon strategy acknowledges the interaction between poverty and employment, aiming at boosting jobs. This perception is also shared by the by many EU citizens. A recent Eurobarometer (2007) survey reports results that show a wide spread opinion among EU citizens that poverty is a widespread problem that affects the majority of people to some extent, whilst citizens believe that in the area where they live one person in ten lives in situations of extreme poverty. It is also of interest to note that, based on the Eurobarometer (2007), long-term unemployment is the most frequently quoted cause of poverty (35%), followed by current work not paying enough (34%) and social benefits or pensions not being high enough (33%).

Thus, we extend our analysis so as to access whether employment and unemployment rates show some similar dynamics with those of social expenditures and poverty risks. A first glance at the employment and unemployment dynamics shows that there exists large variation in the rate of change in unemployment (see Diagram 3), and not that high in the rate of change in employment, underlying the uncertainties and risks attached to labour market developments. Note, for example the pick in the unemployment rate in 2002, the year of the introduction of the euro.

Diagram 3: Rate of change in employment and unemployment.



Source: Eurostat.

In the present analysis the variables of our interest are taken as proportions in terms of the four identified social clubs following Espring-Andersen (1990) and Bertola et al. (2001). These proportions are then represented in changes so as to be able to estimate the underlying distribution dynamics from one social club to another social club, referring to an evolving cross-sectional distribution over time and its persistence and transition characteristics.

3. BAYESIAN ESTIMATION OF FIRST ORDER MARKOV TRANSITION PROBABILITIES

Given the paucity of disaggregate data, we shall assume that the analyst observes only the sample aggregate proportions of objects in each country club for every time period *t*. The probability of the joint event that an object z_t falls in two different states, s_i and s_j, in two sequential periods as in Christodoulakis (2007), and it is written as

$$\Pr\left(z_t = s_j, z_{t-1} = s_i\right) = \Pr\left(z_{t-1} = s_i\right)\Pr\left(z_t = s_j \mid z_{t-1} = s_i\right) \tag{1}$$

which recursively yields

$$\Pr\left(z_t = s_j\right) = \sum_i \Pr\left(z_{t-1} = s_i\right)\Pr\left(z_t = s_j \mid z_{t-1} = s_i\right) \tag{2}$$

The state, s_i takes the form of four mutually exclusive country clubs, which are the Nordic (C1), the Continental (C2), the Anglo-Saxon (C3) and the Southern (C3). We are interested in estimating the conditional transition probabilities between social clubs, forming the time homogeneous transition probability matrix *P*.

$$P = \begin{bmatrix} p_{C1,C1} & p_{C1,C2} & p_{C1,C3} & p_{C1,C4} \\ p_{C2,C1} & p_{C2,C2} & p_{C2,C3} & p_{C2,C4} \\ p_{C3,C1} & p_{C3,C2} & p_{C3,C3} & p_{C3,C4} \\ p_{C4,C1} & p_{C4,C2} & p_{C4,C3} & p_{C4,C4} \end{bmatrix}$$

The conditional transition probabilities in equation (2) represent the entries of a row in matrix *P*. The stochastic matrix *P* will be representative of a stochastic process only if it is associated to a converging generator matrix *G*, which is ensured if and only if *P* is diagonal dominant. Therefore, the empirical implementation of the transition probability matrix *P* is subject to constraints, so its entries should be non-negative, each row sums to unit and every diagonal element exceeds 0.5.

It is now possible to transform the recursive relation (2) into an empirical model by replacing the unconditional probabilities with observed aggregate proportions q_j and adding a random error term u_j. Then, the conditional transition probabilities can be treated as unknown parameters β_{ij} and equation (2) can be written as:

$$q_{j,t} = \sum_i q_{i,t-1}\beta_{ij} + u_{j,t} \tag{3}$$

where $q_{j,t}$ is the proportion of value or objects in the class j at time t over total value or objects. When a finite time series sample of T observations is available and conditional transition probabilities are properly constrained, equation (3) can be written as:

$$\begin{aligned} &\boldsymbol{q}_j = X_j\boldsymbol{\beta}_j + \boldsymbol{u}_j \\ &\text{s.t.} \\ &\mathbf{1'}\boldsymbol{\beta}_j = 1, \quad \boldsymbol{\beta}_j \geq 0, \quad \beta_{ji} > 0.5 \text{ for } j = i \end{aligned} \tag{4}$$

where $\boldsymbol{q}$ is a vector of T observations of portfolio returns, X a matrix of T observations for K credit quality classes, β a vector of K conditional transition probabilities, $\mathbf{1}$ is a vector of units and $\boldsymbol{u} \sim N(0,\sigma^2 I)$.

By restating model (4) in deviation form from the k-th country club proportion, we effectively impose the equality constraint, so that

$$\begin{aligned} &\boldsymbol{q}_j^* = X_j^*\boldsymbol{\beta}_j^* + \boldsymbol{u}_j \\ &\text{s.t.} \\ &\boldsymbol{\beta}_j^* \geq 0, \quad \beta_{ji}^* > 0.5 \text{ for } j = i \end{aligned} \tag{5}$$

where the new variables are now expressed in deviation form and the t-th elements are given by $q_t^* = q_t - x_{k,t}$ and $x_{i,t}^* = x_{i,t-1} - x_{k,t-1}$, where $i = 1,\ldots,K\text{-}1$ is the i-th column of X. The vector β^* has K-1 elements whilst the K-th beta can now be obtained from the constraint $1-\mathbf{1'}\beta^*$. All elements of X^* are assumed to be independent of each other and of u, β^* and σ^2. Then Bayes law states that the posterior density of β^* and σ^2 is:

$$\text{Posterior}\left(\boldsymbol{\beta}^*, \sigma^2 \middle| \boldsymbol{q}^*, X^*\right) = \text{Likelihood}\left(\boldsymbol{\beta}^*, \sigma^2 \middle| \boldsymbol{q}^*, X^*\right) \times \text{Prior}\left(\boldsymbol{\beta}^*, \sigma^2\right) \quad (6)$$

where we have dropped the country club subscript *j*. We follow van Dijk and Kloek (1980) and use a prior that is composed of an uninformative component for σ^2 and an informative one for β^* which captures our existing knowledge for the parameter inequality restrictions. By independence:

$$\text{Prior}\left(\boldsymbol{\beta}^*, \sigma^2\right) = \sigma^{-1}\ \mathrm{T}\left(\boldsymbol{\beta}^*\right) \quad (7)$$

where

$$\mathrm{T}\left(\boldsymbol{\beta}^*\right) = \begin{cases} 1 & \text{if } \mathbf{1'}\boldsymbol{\beta}^* \leq 1 \text{ and } \boldsymbol{\beta}^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Assuming multivariate normality for *u* and integrating out *σ*, Christodoulakis (2007) follows standard analysis to show that the marginal posterior probability density function of vector $\boldsymbol{\beta}^*$ is a multivariate t with mean zero, variance $\frac{\lambda}{(\lambda-2)\hat{\sigma}^2} X'^* X^*$ and $\lambda = v$ degrees of freedom.

Following Kloek and van Dijk (1978), for any function $R(\,.\,)$, the point estimator of $R(\boldsymbol{\beta}^*)$ is given by:

$$E\left(R\left(\boldsymbol{\beta}^*\right) \middle| \boldsymbol{y}^* X^*\right) = \frac{\int R\left(\boldsymbol{\beta}^*\right) \text{Posterior}\left(\boldsymbol{\beta}^* \middle| \boldsymbol{q}^* X^*\right) d\boldsymbol{\beta}^*}{\int \text{Posterior}\left(\boldsymbol{\beta}^* \middle| \boldsymbol{q}^* X^*\right) d\boldsymbol{\beta}^*} \quad (10)$$

Estimator (10) can be implemented numerically by using an approximation for the posterior distribution, an importance function $\operatorname{Im} p\left(\boldsymbol{\beta}^*\right)$, from which random draws of $\boldsymbol{\beta}^*$ will be drawn. It can be shown that for $\boldsymbol{\beta}_1^*, \boldsymbol{\beta}_2^*, ..., \boldsymbol{\beta}_N^*$ being a set of N random draws from $\operatorname{Im} p\left(\boldsymbol{\beta}^*\right)$, then:

$$\lim_{N\to\infty} \frac{1}{N} \sum_{i=1}^{N} \frac{R\left(\boldsymbol{\beta}_i^*\right) \text{Posterior}\left(\boldsymbol{\beta}_i^* \middle| \boldsymbol{q}^* X^*\right)}{\operatorname{Im} p\left(\boldsymbol{\beta}_i^*\right)} = E\left(R\left(\boldsymbol{\beta}^*\right) \middle| \boldsymbol{q}^* X^*\right) \tag{12}$$

apart from a normalizing constant which can be calculated separately. In this case our estimator is reduced to $\frac{1}{N} \sum_{i=1}^{N} R\left(\boldsymbol{\beta}_i^*\right) \mathrm{T}\left(\boldsymbol{\beta}_i^*\right)$. Thus, our simulation procedure generates $\boldsymbol{\beta}_i^* = \boldsymbol{b} + A\, \boldsymbol{z}_i \left(\frac{\lambda}{w_i{}' w_i}\right)^{\frac{1}{2}}$, where $\boldsymbol{b}$ is the least squares estimate, A comes from the Cholesky decomposition of the least-squares covariance matrix, z is a K-1 vector of standard normal variables and w is a λ vector of standard normal variables Thus our parameter estimates can now be obtained using (12) and $R\left(\boldsymbol{\beta}_i^*\right) = \boldsymbol{\beta}_i^*$.

4. THE DISTRIBUTION DYNAMICS

In this section we estimate the transition probability matrices with four states, corresponding to the EU social clubs as described in Bertola (2006). Our estimation procedure follows the Bayesian approach under inequality contraints, using Monte Carlo Integration (MCI). In this respect we produce the entire empirical posterior distribution for every transition probability within the transition matrix. In Tables 1 to 4 we present the transition matrixes for all data sets as formed by the posterior means, whilst in Tables A1 to A6 in the Appendix we report the full set of statistics for each estimated distribution. Note that the probabilities on the main diagonals show the likelihood of the proportion of the variable under investigation remaining in the same club next period. Now, the upper off-diagonal probabilities show the likelihood of transition to less generous social security systems that could be seen, if the aim is to raise social welfare and thus social expenditure, as a downgrade. Similarly, the lower off-diagonal probabilities show the likelihood of transition to more generous social security systems, an upgrade in this paper.

In detail, Table 1 shows the transition probability matrix for total public social expenditure and social protection benefits as percent of GDP. The elements in the main diagonal are estimates of non-transition probabilities, that is the likelihood of staying in the same club next period. According to the results for total public social expenditure as % of GDP, there is 66 percent probability that the proportional expenditure of club 1 remains the same next year, thus showing persistence that is similar to the one of club 2. For clubs 3 and 4 the relevant non transition probability is lower, 57.6 percent and 57.9 percent respectively, which implies that the proportional public social expenditure carries lower persistence for the less generous social security systems, i.e. the Southern club and the Anglo-Saxon. The off diagonal matrix elements in Table1 are quite substantial in magnitude in the case of transition from club 1 to 2 and 4 (P_{12} = 13.6 percent and P_{14} = 14.3 percent), from club 2 to 1 (P_{21} =16.4 percent), from club 3 to 2 and 4 (P_{32} =12.8 percent and P_{34}= 19.8 percent), and finally from club 4 to 3 (P_{43} = 24.3 percent). Note the pattern in off diagonal elements that emerges as the clubs of the Southern and the Anglo-Saxon appear to exhibit high transition probabilities between them, whilst similar high transition probabilities are observed between the Nordic and Continental clubs. This pattern could be interpreted as essentially a convergence of the four clubs into two that is Nordic with Continental the one club and the Aglo-Saxon with the Southern the other club. Next, if one takes a sub-category of public social expenditure that is social protection benefits as percent of GDP, non transition and transition probabilities draw a similar picture for the convergence into two wider clubs.[5]

Table 1. The One-Step Transition Probability Matrix for Social Expenditure (% of GDP).

	Total Expenditure (% of GDP).			
	C_1	C_2	C_3	C_4
C_1	0.662	0.136	0.059	0.143
C_2	0.164	0.653	0.087	0.096
C_3	0.098	0.128	0.576	0.198
C_4	0.086	0.092	0.243	0.579
	Social Protection Benefits (% of GDP).			
	C_1	C_2	C_3	C_4
C_1	0.697	0.138	0.057	0.107
C_2	0.147	0.634	0.118	0.101
C_3	0.097	0.121	0.575	0.206
C_4	0.092	0.149	0.170	0.589

Source: Authors' Estimations.

To enrich our analysis we produce transition probability matrixes for the above variables measured as proportions of million euros and of per capita (see Table 2). A strong pattern that concerns the diagonal elements, i.e. the non-transition probabilities, appears on per capita variables, in which the highest value is observed for club 3, whereas all the remaining clubs have similar in magnitude persistence. The picture for the variables in millions is similar to some extent as the non-transition probabilities have little difference between each other, though club 3 remains slightly

[5] Note that our approach uncovers the entire empirical posterior distribution of transition probabilities, for which statistical inference is reported in the Appendix for all variables.

more persistent than the rest. As far as the off diagonal elements is concerned, in contrast with the variables as percent of GDP, we observe high transition probabilities from clubs with generous social systems (club 1, 2) to less generous ones, whilst the reverse is observed for the least generous clubs (club 4, 3) that tend to improve. In particular, club 1 transits more to club 2, whereas club 2 transits more to club 4.

Table 2. The One-Step Transition Probability Matrix for Social Expenditure (mil. Euros and per capita).

	Total Social Expenditure (mil. euros)			
	C_1	C_2	C_3	C_4
C_1	0.565	0.256	0.055	0.124
C_2	0.079	0.569	0.074	0.278
C_3	0.093	0.159	0.593	0.155
C_4	0.102	0.144	0.167	0.587
	Total Social Expenditure (per capita)			
	C_1	C_2	C_3	C_4
C_1	0.587	0.280	0.068	0.066
C_2	0.126	0.607	0.081	0.186
C_3	0.178	0.071	0.645	0.105
C_4	0.098	0.127	0.185	0.590
	Social Protection Benefits (mil. euros)			
	C_1	C_2	C_3	C_4
C_1	0.565	0.261	0.057	0.117
C_2	0.078	0.566	0.076	0.280
C_3	0.092	0.161	0.593	0.154
C_4	0.092	0.149	0.170	0.589
	Social Protection Benefits (per capita)			
	C_1	C_2	C_3	C_4
C_1	0.587	0.287	0.070	0.056
C_2	0.129	0.603	0.083	0.185
C_3	0.176	0.070	0.650	0.104
C_4	0.094	0.127	0.200	0.580

Source: Authors' Estimations.

Table 3 reports the transition probability matrix for a key variable in the core of evaluating social policy in EU that is the risk of poverty rate before and after social transfers. The main diagonal shows the probability that the proportion of population remaining within the same risk of poverty rate club. We observe that the persistence of the risk of poverty rate reduces after social transfers only for the generous social systems, in particular for club 1 and less so for club 2. For club 3 and 4, at best the probability of risk of poverty rate remains the same after social transfers. This result verifies the general belief that traditionally socially minded countries are more effective in delivering results in terms of lowering poverty. On the other side, the estimated transition probabilities reveal some interesting dynamics. In particular, after social transfers people in clubs that are more generous have to fear of facing a higher transition probability of getting club 3 and 4 type of poverty. As it turns out, if you are within club 3 (club 4) you face a transition probability after social transfers that improves your odds of facing a risk of poverty of type club 2 (club 3).

Table 3. The One-Step Transition Probability Matrix for Risk of Poverty.

	Risk of poverty rate before social transfers			
	C_1	C_2	C_3	C_4
C_1	0.663	0.117	0.134	0.086
C_2	0.074	0.607	0.155	0.165
C_3	0.100	0.155	0.591	0.155
C_4	0.130	0.190	0.095	0.585
	Risk of poverty rate after social transfers			
	C_1	C_2	C_3	C_4
C_1	0.593	0.089	0.124	0.195
C_2	0.098	0.584	0.124	0.194
C_3	0.097	0.187	0.600	0.116
C_4	0.106	0.092	0.209	0.594

Source: Authors' Estimations.

Table 4 reports the transition probability matrix for the employment and the unemployment rate. It is striking that the persistence in unemployment is higher, 69.3 percent, for club 4 that is the Anglo-Saxon club, characterized by a highly unregulated labor market, in comparison to the persistence for club 1, which includes the Nordic countries with highly regulated labor markets. These dynamics shed light on the importance to convergence in terms of social cohesion policy within EU if poverty traps were to be avoided. The off diagonal elements show that there are exist high transition probabilities from club 3 and club 4 to club 2, whereas club 1 and 2 transit to club 3. For the employment, persistence appears to form two major groups of clubs that is 3, 4, and 1, 2. Transition probabilities show that club 1 goes to club 2 with a 27.1 percent probability, whilst the remaining clubs tend to reach 1 with high transition probabilities.

Table 4. The One-Step Transition Probability Matrix for Labour.

		Employment		
	C_1	C_2	C_3	C_4
C_1	0.610	0.271	0.072	0.047
C_2	0.145	0.599	0.129	0.126
C_3	0.169	0.086	0.657	0.088
C_4	0.142	0.076	0.117	0.665
		Unemployment		
	C_1	C_2	C_3	C_4
C_1	0.609	0.089	0.210	0.091
C_2	0.108	0.660	0.147	0.085
C_3	0.081	0.179	0.599	0.141
C_4	0.048	0.133	0.126	0.693

Source: Authors' Estimations.

A relevant question is how fast the actual distribution approaches the steady state one. This can be assessed from the system's '*half life'* obtained as:

$$hl = -\frac{\ln 2}{\ln|\lambda_2|} \qquad (8)$$

where λ_2 is the second eigenvalue of the one-step probability matrix.

Our results are presented in Table 5. The results show a rather fast pace as half life ranging from 0.93 years in the case of total social expenditure in million euros to 1.37 years in the case of social protection benefits as percent of GDP. It is of interest to note that the half life falls if one uses million of euros rather than percent of GDP, insinuating that the pace of which the actual distribution approaches the steady state is lower if one takes into account also the evolution of GDP, and thus measures the dynamics of expenditures in relative terms rather than in absolute terms. Also, note that the pace of adjustment is higher for poverty risk after social transfers compared to before social transfers, whereas for the labor market the pace for employment is close to the one for unemployment.

Table 5. Half Life to Steady-State Distributions.

	λ_2	Half Life
Social Expenditure (% GDP)	0.5922	1.3230
Social Expenditure (mil. euro)	0.4765	0.9351
Social Protection Benefits (% GDP)	0.6047	1.3780
Social Protection Benefits (mil. EUR)	0.4588	0.8896
Risk of Poverty after social transfers	0.4948	0.9851
Risk of Poverty before social transfers	0.5624	1.2043
Employment	0.5556	1.1794
Unemployment	0.5772	1.2613

Source: Authors' Estimations.

5. CONCLUSIONS

This paper focuses on the process of integration some key variables of national social welfare policy in EU-15 by estimating the underlying persistence and transition probabilities within four social clubs as defined in Espring-Andersen (1990) and Bertola et al. (2001). We model the dynamics as a transition probability matrix using Markov chains and a Bayesian approach under inequality constraints with Monte Carlo Integration (MCI) for proportions of the aggregate data. In this respect our approach uncovers the entire empirical posterior distribution of transition probabilities.

A striking finding that emerges from the transition probability matrix for social expenditure as percent of GDP is the convergence of the four social clubs into two that is between the Nordic and the Continental club and between the Anglo-Saxon and the Southern club. The analysis of non transition and transition probabilities for a sub-category of the social expenditure, which is the social protection benefits as percent of GDP, draw a similar picture, finding some evidence of integration dynamics into two wider clubs. For the risk of poverty we observe that the persistence reduces after social transfers only for the generous social systems, in particular for club 1, which includes Nordic countries, and less so for club 2, which includes Continental countries. This result verifies the general belief that traditionally socially minded countries are more effective in delivering results in terms of lowering poverty. High persistence is also observed regarding unemployment in club 4, the Anglo-Saxon club, characterized by a highly unregulated labor market. Lastly, the half life statistics show fast pace across all variables of our interest.

References

Bertola, G. 2007. Welfare Policy Integration Inconsistencies. in Helge Berger and Thomas Moutos, eds., Designing the New European Union, Amsterdam: Elsevier, pp.91-120.

European Commission. 2006. Implementing the Renewed Lisbon Strategy for Growth and Jobs: a year of delivery. Communication to the Spring European Council, Brussels.

Eurostat. 2006. Population and Social Conditions: Social Protection Expenditures.". Various Issues.

Esping-Andersen, G. 1990. The Three Worlds of Welfare Capitalism, Polity Press, Cambridge UK.

Kloek, T. and H. K. van Dijk. 1978. Bayesian Estimates of Equation System Parameters: an Application of Integration by Monte Carlo. Econometrica, 46 (1), 1-19.

van Dijk, H. K. and T. Kloek. 1980. Further Experience in Bayesian Analysis Using Monte Carlo Integration. Journal of Econometrics, 14, 307-328.

Mamatzakis, E. C. and P. Fousekis, (2007), "Toward a Common EU Policy on Income Distribution: the Case of Social Benefits Expenditures." Economics Bulletin, Vol. 9, No. 11, pp. 1-5, July.

Miller, G. A. (1952), Finite Markov Processes in Psychology, *Psychometrica*, Vol. 17, pp. 149-167.

van Dijk, H. K. and T. Kloek (1980), Further Experience in Bayesian Analysis Using Monte Carlo Integration, *Journal of Econometrics*, 14, 307-328.

APPENDIX

Table A1: Total Social Expenditure.

(% of GDP)	mean	median	Std.	Skew.	Kurt.
P11	0.662	0.658	0.089	0.287	-0.500
P12	0.136	0.127	0.086	0.542	-0.238
P13	0.059	0.046	0.051	1.603	3.692
P14	0.143	0.143	0.072	0.310	0.018
P21	0.164	0.163	0.079	0.178	-0.251
P22	0.653	0.650	0.084	0.299	-0.401
P23	0.087	0.076	0.061	0.993	1.141
P24	0.096	0.093	0.050	0.749	1.396
P31	0.098	0.081	0.078	1.079	0.954
P32	0.128	0.116	0.086	0.666	-0.023
P33	0.576	0.556	0.068	1.357	1.874
P34	0.198	0.205	0.090	-0.105	-0.544
P41	0.086	0.066	0.075	1.366	1.656
P42	0.092	0.060	0.090	1.163	0.707
P43	0.243	0.249	0.119	-0.222	-0.826
P44	0.579	0.560	0.069	1.149	0.987
(mil. Euro)	**mean**	**median**	**Std.**	**Skew.**	**Kurt.**
P11	0.565	0.548	0.060	1.732	3.673
P12	0.256	0.270	0.087	-0.676	0.207
P13	0.055	0.039	0.053	1.893	5.384
P14	0.124	0.118	0.074	0.575	0.281
P21	0.079	0.070	0.061	1.302	2.675
P22	0.569	0.555	0.058	1.601	3.929
P23	0.074	0.055	0.066	1.441	2.424
P24	0.278	0.293	0.082	-0.987	0.997
P31	0.093	0.078	0.073	1.087	1.043
P32	0.159	0.157	0.086	0.283	-0.374
P33	0.593	0.576	0.075	1.186	1.457
P34	0.155	0.148	0.093	0.413	-0.472
P41	0.102	0.082	0.084	1.058	0.569
P42	0.144	0.129	0.096	0.531	-0.462
P43	0.167	0.161	0.099	0.305	-0.827
P44	0.587	0.562	0.080	1.357	1.547
(per capita)	**mean**	**median**	**Std.**	**Skew.**	**Kurt.**
P11	0.587	0.566	0.075	1.369	1.887
P12	0.280	0.301	0.103	-0.705	-0.203
P13	0.068	0.052	0.060	1.601	3.144
P14	0.066	0.055	0.051	1.561	3.665
P21	0.126	0.113	0.087	0.642	-0.187
P22	0.607	0.591	0.081	0.886	0.335
P23	0.081	0.061	0.072	1.391	1.929
P24	0.186	0.192	0.089	-0.023	-0.537
P31	0.178	0.163	0.113	0.348	-0.848
P32	0.071	0.052	0.068	1.665	3.336
P33	0.645	0.624	0.103	0.605	-0.530
P34	0.105	0.087	0.082	1.075	0.872
P41	0.098	0.089	0.074	0.777	-0.183
P42	0.127	0.109	0.087	0.892	0.470
P43	0.185	0.191	0.111	0.367	-0.437
P44	0.590	0.567	0.077	1.688	3.429

Table A2: Social Protection Benefit.

(% GDP)	mean	median	Std.	Skew.	Kurt.
P11	0.697	0.701	0.094	-0.022	-0.647
P12	0.138	0.129	0.086	0.565	-0.155
P13	0.057	0.044	0.051	1.646	3.813
P14	0.107	0.101	0.064	0.751	0.785
P21	0.147	0.145	0.077	0.334	-0.164
P22	0.634	0.625	0.083	0.536	-0.190
P23	0.118	0.114	0.068	0.559	0.272
P24	0.101	0.097	0.054	0.691	1.119
P31	0.097	0.076	0.080	1.154	1.084
P32	0.121	0.106	0.088	0.838	0.360
P33	0.575	0.555	0.066	1.531	2.900
P34	0.206	0.212	0.099	-0.102	-0.694
P41	0.092	0.073	0.080	1.285	1.836
P42	0.149	0.147	0.090	0.459	-0.247
P43	0.170	0.167	0.101	0.275	-0.690
P44	0.589	0.564	0.078	1.277	1.439
(mil. Euro)	**mean**	**median**	**Std.**	**Skew.**	**Kurt.**
P11	0.565	0.548	0.060	1.725	3.811
P12	0.261	0.276	0.084	-0.786	0.507
P13	0.057	0.043	0.052	1.829	4.846
P14	0.117	0.112	0.070	0.702	0.706
P21	0.078	0.069	0.057	0.966	1.030
P22	0.566	0.554	0.053	1.325	2.457
P23	0.076	0.055	0.069	1.514	2.729
P24	0.280	0.295	0.081	-1.063	1.186
P31	0.092	0.074	0.073	1.137	1.244
P32	0.161	0.160	0.085	0.247	-0.347
P33	0.593	0.576	0.073	1.142	1.311
P34	0.154	0.147	0.093	0.405	-0.426
P41	0.092	0.073	0.080	1.285	1.836
P42	0.149	0.147	0.090	0.459	-0.247
P43	0.170	0.167	0.101	0.275	-0.690
P44	0.589	0.564	0.078	1.277	1.439
(per capita)	**mean**	**median**	**Std.**	**Skew.**	**Kurt.**
P11	0.587	0.566	0.075	1.392	2.027
P12	0.287	0.308	0.102	-0.782	-0.027
P13	0.070	0.055	0.060	1.499	2.786
P14	0.056	0.045	0.048	1.842	5.304
P21	0.129	0.116	0.087	0.644	-0.161
P22	0.603	0.588	0.077	0.986	0.816
P23	0.083	0.062	0.073	1.452	2.357
P24	0.185	0.189	0.091	-0.005	-0.621
P31	0.176	0.167	0.109	0.291	-0.828
P32	0.070	0.049	0.066	1.572	2.749
P33	0.650	0.637	0.102	0.549	-0.493
P34	0.104	0.088	0.077	1.020	0.908
P41	0.094	0.087	0.080	1.022	0.402
P42	0.127	0.099	0.097	0.931	0.076
P43	0.200	0.192	0.121	0.227	-1.095
P44	0.580	0.559	0.073	1.914	4.269

Table A3: Poverty before social transfers.

	mean	median	Std.	Skew.	Kurt.
P11	0.593	0.571	0.080	1.171	1.149
P12	0.089	0.069	0.076	1.313	1.807
P13	0.124	0.103	0.092	0.919	0.317
P14	0.195	0.195	0.108	0.085	-0.858
P21	0.098	0.079	0.080	1.196	1.423
P22	0.584	0.563	0.067	0.954	0.280
P23	0.124	0.096	0.097	0.864	-0.114
P24	0.194	0.188	0.112	0.234	-0.744
P31	0.097	0.075	0.081	1.030	0.393
P32	0.187	0.173	0.112	0.351	-0.709
P33	0.600	0.578	0.081	1.248	1.418
P34	0.116	0.099	0.085	0.821	0.167
P41	0.106	0.078	0.087	1.109	0.946
P42	0.092	0.075	0.077	0.980	0.201
P43	0.209	0.220	0.124	0.032	-1.136
P44	0.594	0.572	0.082	1.105	0.682

Table A4: Poverty after social transfers

	mean	median	Std.	Skew.	Kurt.
P11	0.663	0.660	0.089	0.161	-0.741
P12	0.117	0.127	0.074	0.486	-0.011
P13	0.134	0.120	0.106	0.853	-0.312
P14	0.086	0.063	0.080	1.550	1.591
P21	0.074	0.055	0.067	1.241	1.324
P22	0.607	0.583	0.090	1.262	1.306
P23	0.155	0.132	0.109	0.600	-0.513
P24	0.165	0.158	0.104	0.367	-0.672
P31	0.100	0.087	0.077	0.957	0.574
P32	0.155	0.145	0.105	0.617	-0.153
P33	0.591	0.569	0.080	1.399	2.229
P34	0.155	0.148	0.098	0.447	-0.389
P41	0.130	0.126	0.072	0.498	0.171
P42	0.190	0.192	0.101	0.049	-0.808
P43	0.095	0.079	0.074	1.082	1.096
P44	0.585	0.568	0.067	1.174	1.326

Table A5: Employment.

	mean	median	Std.	Skew.	Kurt.
P11	0.610	0.590	0.086	1.005	0.567
P12	0.271	0.289	0.115	-0.435	-0.707
P13	0.072	0.053	0.064	1.550	2.782
P14	0.047	0.034	0.045	1.860	5.038
P21	0.145	0.140	0.084	0.415	-0.267
P22	0.599	0.582	0.076	1.007	0.727
P23	0.129	0.126	0.069	0.453	0.172
P24	0.126	0.124	0.070	0.450	0.087
P31	0.169	0.169	0.087	0.142	-0.543
P32	0.086	0.069	0.072	1.228	1.506
P33	0.657	0.652	0.087	0.366	-0.378
P34	0.088	0.083	0.052	0.886	1.675
P41	0.142	0.133	0.086	0.551	-0.113
P42	0.076	0.059	0.065	1.380	2.138
P43	0.117	0.118	0.053	0.301	0.671
P44	0.665	0.669	0.078	-0.013	-0.486

Table A6: Unemployment.

	mean	median	Std.	Skew.	Kurt.
P11	0.609	0.591	0.082	0.927	0.409
P12	0.089	0.068	0.078	1.258	1.406
P13	0.210	0.210	0.116	0.043	-0.933
P14	0.091	0.079	0.067	1.078	1.323
P21	0.108	0.107	0.053	0.543	1.167
P22	0.660	0.659	0.082	0.229	-0.369
P23	0.147	0.144	0.077	0.310	-0.242
P24	0.085	0.074	0.061	1.124	1.631
P31	0.081	0.070	0.059	1.204	1.923
P32	0.179	0.182	0.092	0.050	-0.659
P33	0.599	0.583	0.075	1.001	0.764
P34	0.141	0.139	0.072	0.345	0.000
P41	0.048	0.034	0.046	1.882	5.036
P42	0.133	0.118	0.092	0.709	-0.073
P43	0.126	0.124	0.067	0.475	0.387
P44	0.693	0.698	0.093	-0.054	-0.662