UNITED NATIONS UNIVERSITY
UNU-WIDER
World Institute for Development Economics Research

Working Paper No. 2010/72

Measuring the Effect of Spell Recurrence on Poverty Dynamics

José Maria Arranz,[1] and Olga Cantó[2]

June 2010

Abstract

The analysis of poverty dynamics yields important insights about the expected effectiveness of alternative social policies on poverty reduction. This paper analyses the effect of spell recurrence on poverty dynamics taking into account multiple poverty and non-poverty spells. Using longitudinal data for Spain we obtain that the poverty exit and re-entry rates vary not only with personal or household characteristics but also with spell accumulation and with the duration of past spells. Results indicate that the effect of duration dependence is significant and turns out to be different by spell order. Our findings support progress towards incorporating full individual poverty trajectories more explicitly in estimating the likelihood of future poverty.

Keywords: poverty dynamics, multiple spells, recurrence

JEL classification: C41, D31, I32

Copyright © UNU-WIDER 2010

[1] Universidad de Alcalá, E-mail: josem.arranz@uah.es; [2] Instituto de Estudios Fiscales and Universidade de Vigo, E-mail: ocanto@uvigo.es

This study has been prepared within the UNU-WIDER project on the Frontiers of Poverty Analysis, directed by Tony Shorrocks.

UNU-WIDER gratefully acknowledges the financial contributions to the research programme by the governments of Denmark (Royal Ministry of Foreign Affairs), Finland (Ministry for Foreign Affairs), Sweden (Swedish International Development Cooperation Agency—Sida) and the United Kingdom (Department for International Development—DFID).

ISSN 1798-7237 ISBN 978-92-9230-310-5

Acknowledgements

Authors are grateful for the financial support from the Instituto de Estudios Fiscales (IEF) in order to undertake this research project. Olga Cantó is also grateful for the finance from the Ministerio de Ciencia e Innovación (SEJ2007-67911-C03-01/ECON) and the Xunta de Galicia (PGIDIT05PXIC30001PN). Special thanks go also to Maite Blázquez for helpful discussions on the matter and to Francesco Devicienti for his interesting suggestions. Authors also wish to thank the comments received from participants in seminars that took place at the Universidad de Alicante (Spain) in May 2007, at the Universidade Técnica de Lisboa in October 2007 and at the Universidad de Alcalá (Spain) in November 2007. The paper was also presented at the ECINEQ Conference in Berlin in July 2007, at the VII Jornadas de Economía Laboral in Las Palmas de Gran Canaria in July 2007 and, most recently, at the Conference on Frontiers of Poverty Analysis in UNU-WIDER Helsinki in September 2008. The usual disclaimer applies.

The World Institute for Development Economics Research (WIDER) was established by the United Nations University (UNU) as its first research and training centre and started work in Helsinki, Finland in 1985. The Institute undertakes applied research and policy analysis on structural changes affecting the developing and transitional economies, provides a forum for the advocacy of policies leading to robust, equitable and environmentally sustainable growth, and promotes capacity strengthening and training in the field of economic and social policy making. Work is carried out by staff researchers and visiting scholars in Helsinki and through networks of collaborating scholars and institutions around the world.

www.wider.unu.edu *publications@wider.unu.edu*

UNU World Institute for Development Economics Research (UNU-WIDER)
Katajanokanlaituri 6 B, 00160 Helsinki, Finland

Typescript prepared by the Authors.

The views expressed in this publication are those of the author(s). Publication does not imply endorsement by the Institute or the United Nations University, nor by the programme/project sponsors, of any of the views expressed.

Introduction

The literature centred on the analysis of the lowest part of the income distribution has produced a large amount of work on the dynamics of poverty in recent years. A first interesting result of this research is the relevance of accounting for the time individuals spend below the poverty line in the measurement of poverty. The advantage of distinguishing the characteristics of individuals that suffer from *persistent* poverty in contrast with those that experience poverty for a relatively short time or *transitory poor*, is that different policies should be designed to combat each of these situations. Fighting against long-term or *persistent* poverty will imply designing educational and health policies for poor children and offering stable complementary monetary transfers for poor adults. In contrast, *transitory* poverty could benefit from short-term labour market policies promoting employment stability and some short-period money transfers working as income substitutes.

The literature on poverty dynamics has largely focussed on the analysis of spells and the estimation of entry and re-entry hazards after the seminal work of Bane and Ellwood (1986) followed more recently by Stevens (1999), Devicienti (2001) or Biewen (2006). These papers study the extent and composition of chronic poverty in a variety of countries using a hazard rate approach that accounts for multiple spells of poverty and incorporates spell duration, individual and household characteristics and unobserved heterogeneity. In general, all these papers assume that taking into account individual unobserved heterogeneity captures the correlation across individual poverty and non-poverty spells in the joint estimation of both hazards. This assumption imposes estimating a single exit and re-entry hazard rate independent of the number of poverty spells experienced by individuals along the observation period. However, one of the key findings of the OECD (2001) employment outlook is that: "…the typical year spent in poverty is lived by persons who experience multiple years of poverty and whose long-term incomes are below the poverty threshold on average, even though their yearly income may periodically exceed the poverty threshold" (Chapter 2, 1st page). Therefore, research on poverty dynamics should aim to characterise the complete low income pattern of individuals along time and thus consider possible differences in hazard rates as spells accumulate.

In this line of argument, we believe that it is important to investigate the relevance of poverty spell recurrence and, in particular, to measure to what extent the probability of leaving a poverty spell depends on having had a previous experience in poverty of a certain length. As

Gardiner and Hills (1999) point out, the income mobility process is not random and low-income escapers are more likely to drop back into the poorest than those who never suffered low-income.

Therefore, predicted exit and re-entry hazards should incorporate the information on both the duration and the accumulation of spells. This issue is virtually unexplored in the literature on the dynamics of poverty and social exclusion, even if this type of analysis has been commonly undertaken in a variety of other subjects. For example, demography researchers use these methods for the analysis of the life cycle fertility in order to know if the age of the marriage, the occurrence of births inside or outside the marriage, the age of first birth and the durations of previous birth intervals significantly affect the timing of subsequent births over the life cycle, see Heckman *et al.* (1985), Heckman and Walker (1990). In marketing, it is often used to analyse the purchase timing and brand switching decisions of households for a frequently purchased product in order to check if the price, feature advertisements, special displays and the household specific characteristics that affect the probability of buying products in the future - see Jain and Vilcassim (1991) and Vilcassim and Jain (1991). Furthermore, within the literature on labour economics an important number of papers are devoted to the analysis of recurrent unemployment and its effects on the individual's probability of leaving unemployment in a forthcoming spell. These models were introduced by Lancaster (1979, 1990) and are popular because they easily incorporate censored spells and variables that change over time while they also allow one to examine how the probability of leaving poverty changes with spell duration and when spells accumulate – see Heckman and Borjas (1980), Bonnal *et al.* (1997), Omori (1997), Roed *et al.* (1999) or Arranz and Muro (2004) for some examples of estimates of the individual probability of leaving unemployment conditional on the full individual unemployment history.

Our paper contributes to the literature on poverty dynamics by allowing that past poverty episodes affect future poverty. Therefore we provide empirical evidence on different poverty exit and re-entry hazards when spells accumulate, challenging previous studies based on poverty persistence that estimate one exit and one re-entry hazard rate independent of the number and duration of individual poverty experiences. For this purpose we estimate a mixed proportional hazard model with multiple states and multiple spells, in line with event history analysis. This approach allows us to incorporate the complete individual poverty history across time when estimating poverty exit and re-entry hazards.

Further, we provide a variety of results that make our conclusions robust to the key issue of including or excluding left-censored poverty spells in the sample of analysis. Most precisely, we estimate our model first on a sample that includes left-censored poverty spells where initial conditions are controlled for and then on a sample of spells of poverty that begin after the start of the observation period. Our empirical results show that past poverty (non-poverty) spells' duration is relevant in determining the current exit (re-entry) hazard in both of the samples used. Further, spell order matters and poverty exit and re-entry probabilities are different for the first spell in comparison those for to the second one.

The paper is organized as follows. Section 1 presents the advantages and disadvantages of the most relevant approaches to measuring transition probabilities. Section 2 presents the econometric model. In Section 3, we describe the longitudinal data set used, detailing the definition of the variables and undertaking a thorough descriptive analysis of the observed poverty and non-poverty spells. Section 4 discusses the main results of our estimations. Finally, the conclusions detail our main findings.

1. The different approaches to estimating the probability of leaving poverty

The analysis of the dynamics of poverty was initiated in the United States during the eighties, mainly as a result of the availability of a mature and reliable longitudinal data survey: the Panel Survey of Income Dynamics (PSID), ongoing since 1968. In the European context it is only at the beginning of the nineties that Duncan *et al.* (1993) try to compare, for the first time, the duration of poverty in a group of countries using a variety of data sources. Fortunately for the development of this literature, in 1994 the European Statistical Office (EUROSTAT) decided to obtain accurate and comparable longitudinal data information for most countries in the European Union initiating the European Community Household Panel Survey (ECHP) which, after some years, has become a basic tool for the analysis of social cohesion dynamics in the European Union. The exploitation of this dataset, together with some nationally based panels available for some particular countries, has allowed a large list of researchers to present plausible answers to important issues related to the duration and persistence of poverty in Europe.

The development of new statistical techniques in the estimation of transition probabilities, as Aassve *et al.* (2005) note in their literature review, has produced a variety of

ways of estimating transition risks in recent times.[1] Following the work of Lillard and Willis (1978) some papers have used *components of variance* models to capture the dynamics of income using a complex error structure in order to predict the fraction of the population likely to be in poverty for different lengths of time. This methodology has the advantage of including all individual income information in time while avoiding the ex-ante definition of poverty using a binary indicator. Its main disadvantage, however, is that one must assume that the dynamics of the income process are identical for all individuals in the sample, whatever their income level. Clearly, this does not seem to match reality and, in fact, Stevens (1999) and Devicienti (2001) conclude that, in comparison with duration models, components of variance models perform worse in fitting observed patterns of poverty in the US and the UK respectively.

Cappellari and Jenkins (2004) propose the estimation of a first-order *markovian transition model* in order to disentangle the two processes that can generate persistence: unobserved heterogeneity and *true state dependence*[2], while taking simultaneously into account that individuals are neither randomly distributed either within the poor at first interview (initial conditions problem) nor within the effectively observed at second interview (attrition problem). These authors follow Blumen *et al*. (1955) who argued that the reason why empirical transition matrices underestimate the main diagonal is sample heterogeneity and avoid assigning any relevance to spell duration in the determination of the outflow rate. In this same line, recent proposals by Wooldridge (2005) or Stewart (2007) suggest summarizing the effect of *true state dependence* in a coefficient estimated for one-period lagged poverty in their binary dependent dynamic random effects model where the current poverty situation also depends on a list of covariates, on an individual-specific effect and where initial conditions are endogenous.

In general, most empirical results using these proposals find large negative duration dependence in poverty exit, even after controlling for unobserved heterogeneity. As Devicienti and Gualtieri (2007) underline, the magnitude of the duration dependence coefficient casts some doubts on the appropriateness of the first-order Markov assumption. In fact, Shorrocks (1976), in contrast with Blumen *et al*. (1955), suggested that the lack of consideration of higher order dynamics in the determination of the transition rates was the best argument to

[1] See Cappellari and Jenkins (2008) for an excellent review and classification of the various approaches to measuring poverty outflow rates in the literature.

[2] In the first process, individuals could be heterogeneous with respect to the unobserved characteristics that change their probability of leaving poverty. In the second process, experiencing poverty during a specific time period increases the probability of undergoing poverty in subsequent periods given that past poverty experiences may alter the individual's chances of experiencing poverty again through changes in individual's preferences or set of opportunities.

explain the underestimation of the main diagonal in empirical transition matrices. Attributing this bias to a violation of the first-order Markov assumption clearly implies that the extension of the Markov process, in as much as the longitudinal information allows us to, is the way to proceed in the accurate estimation of the hazard rate. In this line of argument, a long-standing approach to model poverty transitions has been the use of *duration models*. Since the main methodological contributions to this literature due to Kalbfleisch and Prentice (1980) and Allison (1982), a large list of papers have developed single-spell duration models that allow for the estimation of the transition probability taking into account all the relevant longitudinal information offered by panel datasets. A very relevant contribution to the easy estimation of hazard rates as an n-Markov chain by using a simple logit model was Jenkins (1995).

More recently, a list of papers have highlighted the limitations of the use of single-spell approaches in fitting the observed pattern of poverty persistence and have proposed a new methodology that allows for the consideration of multiple poverty and non-poverty spells simultaneously. These methods were first suggested by Stevens (1999) and then used by Devicienti (2001), Hansen and Wahlberg (2004) and Biewen (2006). These papers not only consider the estimation of the probability of leaving a poverty spell but are able to estimate the hazard rate for multiple spells while controlling for unobserved heterogeneity, an important source of bias for the estimated coefficients for duration. However, this approach has an important disadvantage in order to study poverty spell recurrence given that it only allows for the estimation of a single exit and re-entry hazard rate, independent of the number of poverty experiences that the individual may have accumulated in time. This means that, virtually, the recurrence of poverty spells is assumed not to affect the estimated probability of transition.

The analysis presented here tries to improve our knowledge about the extent up to which the accumulation of poverty spells in the individual's poverty history (lagged poverty and non-poverty durations) has a relevant role in determining future poverty risks. Therefore, we aim to relax the assumption on the independence of the recurrent poverty and non-poverty experiences while controlling for initial conditions, unobserved heterogeneity and allowing for the inclusion of time-varying covariates. For this purpose, we estimate different hazard exit and re-entry rates jointly by spell order while including lagged spell durations as explanatory variables for Spanish longitudinal data from 1994 to 2000.

2. Econometric approach: a multi-state multi-spell hazard model

Our econometric strategy consists in estimating up to four hazard rates simultaneously, mirroring the individuals' complete poverty history. The exit rates from poverty into non-poverty (and vice versa) are analysed using discrete hazard model techniques.[3] In general, the hazard rate of exits from poverty into non-poverty may be defined as:

$$h_{pi}(t) = h_p(t, X_{pi}(t)) \equiv \Pr(T_{pi} = t / T_{pi} \geq t, X_{pi}(t)) \qquad (1)$$

In this equation, subscript *i* indicates the individual and *p* the period in poverty. The term T_{pi} is the latent current duration of individual *i´*s *p*'th poverty spell and X_{pi} is a vector of time-invariant and time-varying covariates for individual *i* during the poverty period.

The likelihood contribution of individuals who exit from poverty into non-poverty in the s^{th} interval may be written as:

$$\Pr\left[\mathrm{T_{pi}} = \mathrm{t}\right] = \mathrm{h_p}(T_{pi}, X_{pi}(T_{pi}))\prod_{\mathrm{s=1}}^{\mathrm{T_{pi}}-1}\left[1-\mathrm{h_p}(\mathrm{s},\mathrm{X_{pi}}(s))\right] \qquad (2)$$

However, given that there are some poverty spells that continue to proceed after the sample period finishes, right censored spells also contribute to the likelihood. Their contribution can be expressed as:[4]

$$\Pr\left[\mathrm{T_{pi}} > \mathrm{t}\right] = \prod_{\mathrm{s=1}}^{\mathrm{T_{pi}}}\left[1-\mathrm{h_p}(\mathrm{s},\mathrm{X_{pi}}(s))\right] \qquad (3)$$

Given that we are interested in incorporating multiple spells of both poverty and non-poverty to our analysis, our likelihood function contains several components that are able to capture the multiple individual exits from poverty to non-poverty and vice versa. In particular the likelihood for any observed individual *i* can be expressed as[5]:

---

[3] See Allison (1982) and Jenkins (1995) for a survey.

[4] Similarly to the poverty exit rate, the hazard rate for re-entry is given by an analogous expression where "p" changes to "r". Thus the probability of ending a spell of non-poverty in the r^h interval is given by: $\Pr\left[\mathrm{T_{ri}} = \mathrm{t}\right] = \mathrm{h_r}(T_{ri}, X_{ri}(T_{ri}))\prod_{\mathrm{s=1}}^{\mathrm{T_{ri}}-1}\left[1-\mathrm{h}(\mathrm{s},\mathrm{X_{ri}}(s))\right]$ and the contribution to the likelihood of non-poverty spells that continue to proceed at the end of the sample is $\Pr\left[\mathrm{T_{ri}} > \mathrm{t}\right] = \prod_{\mathrm{s=1}}^{\mathrm{T_{ri}}}\left[1-\mathrm{h}(\mathrm{s},\mathrm{X_{ri}}(s))\right]$

[5] We omit $\mathrm{X_{ip}}(\mathrm{T_{ip}})$ and $\mathrm{X_{ip}}(\mathrm{s})$ and $\mathrm{X_{ir}}(\mathrm{T_{ir}})$ and $\mathrm{X_{ir}}(\mathrm{s})$ to simplify notation.

$$L_i=\left\{\prod_{s=1}^{T_{p1}}(1-h_{p1}(s))\right\}^{(1-d_{1i})}\times$$

$$\left\{\left[h_{p1}(T_{p1})\prod_{s=1}^{T_{p1}-1}(1-h_{p1}(s))\right]\left[\prod_{s=1}^{T_{r1}}(1-h_{r1}(s))\right]\right\}^{d_{1i}(1-d_{2i})}\times$$

$$\left\{\left[h_{p1}(T_{p1})\prod_{s=1}^{T_{p1}-1}(1-h_{p1}(s))\right]\left[h_{r1}(T_{r1})\prod_{s=1}^{T_{r1}-1}(1-h_{r1}(s))\right]\right\}^{d_{1i}d_{2i}}\times$$

$$\left\{\left[h_{r1}(T_{r1})\prod_{s=1}^{T_{r1}-1}(1-h_{r1}(s))\right]\left[\prod_{s=1}^{T_{p2}}(1-h_{p2}(s))\right]\right\}^{d_{2i}(1-d_{3i})}\times$$

$$\left\{\left[h_{r1}(T_{r1})\prod_{s=1}^{T_{r1}-1}(1-h_{r1}(s))\right]\left[h_{p2}(T_{p2})\prod_{s=1}^{T_{p2}-1}(1-h_{p2}(s))\right]\right\}^{d_{2i}d_{3i}}\times$$

$$\left\{\left[h_{p2}(T_{p2})\prod_{s=1}^{T_{p2}-1}(1-h_{p2}(s))\right]\left[\prod_{s=1}^{T_{r2}}(1-h_{r2}(s))\right]\right\}^{(1-d_{4i})d_{3i}}\times$$

$$\left\{\left[h_{p2}(T_{p2})\prod_{s=1}^{T_{p2}-1}(1-h_{p2}(s))\right]\left[h_{r2}(T_{r2})\prod_{s=1}^{T_{r2}-1}(1-h_{r2}(s))\right]\right\}^{d_{4i}d_{3i}}\times \qquad (4)$$

where T_{p1} and T_{p2} are first and second poverty spell durations respectively; and T_{r1} and T_{r2} are first and second non-poverty spell durations respectively. T_{r1} takes place between T_{p1} and just before $T_{p2,}$ and T_{r2} takes place after T_{p2}. Finally, d_{1i}, d_{2i}, d_{3i}, d_{4i} are dummy variables that allow us to distinguish between censored and completed poverty and non-poverty spells.

The first component in equation (4) captures the likelihood that the individual during her first poverty period remains in poverty all the period under study. The second and third component account for the likelihood of individuals who exit during their first poverty period to their first non poverty period, remaining in this state the rest of years (first component) or re-enter poverty again registering a second poverty experience (second component). Within the latter group some will remain in their second poverty experience the rest of years (fourth component) or they will exit to their second non-poverty experience (fifth component). Finally, the last two components capture the likelihood that the individuals who enter a second non-poverty period either remain in this state the rest of the years or exit to a new poverty experience.

In our estimations we use a quadratic form for the baseline hazard rate as in Biewen (2006) given that our results from life-tables confirm the adequateness of this particular form

of duration dependence. In order to take unobserved heterogeneity into account, a finite-mixture unobserved heterogeneity distribution with unknown support points is also considered.[6] Therefore, the likelihood function for individual *i* is obtained by integrating the following conditional likelihood distribution:

$$L_i(\beta,\theta,\gamma,\pi) = \prod_{s=1}^{S} L(\beta,\gamma \mid \theta = s)\pi(s) \qquad (5)$$

where θ are the location points, π the probability associated to them, and *s* the number of support points.

Our main interest in the regressions is to isolate the effect of true state dependence and of previous poverty and non poverty spells on the hazard rates while controlling for other relevant covariates. These covariates will try to capture differences in household structure, education, labour market activity and employment.[7] Further we will control for initial conditions at first interview in all left-censored poverty spells using variables related to the household members' health, the labour potential of female members and head's experiences in unemployment in the last five years.

3. The ECHP data set

3.1 A short description of the ECHP data set

The dataset we use is constructed using the information for Spain from the ECHP for the period 1994-2001. The survey is annually based and has a longitudinal structure that allows following individuals during eight years and was designed in order to obtain country-comparable statistics on many demographic and socio-economic aspects of the European population related to labour market issues, income, living standards, education, employment and not employment-related satisfaction, health and migration, among others. The information on annual individual income refers to that obtained during the previous year while demographic and socioeconomic covariates refer to the current year. Thus, in the construction of the relevant income variable we make household demographic and income information

[6] Heckman and Singer (1984) show that standard parametric form assumptions for unobserved heterogeneity might be biased when the chosen distribution for the unobservable term is incorrect. They solve the problem by assuming that unobserved heterogeneity is discretely distributed with unknown support points.

[7] We will mostly use as covariates a group of variables that resume the household situation. This strategy is largely adequate in the context of EU countries where, as reported by the European Foundation for the Improvement of Living Conditions (see Peña-Casas and Latta, 2004), in recent years the labour market situation of other household members different from the head, such as the spouse or other adults, has become a key issue in order to determine the household's poverty risk.

contemporaneous. This imposes dropping information on incomes for 1993 (declared in 1994) and on characteristics for 2001 and using seven complete waves instead of eight. The advantage of this procedure is that the definition of poor is based on contemporaneous information on incomes and needs which becomes crucial when we aim to correctly measure the effect of time-varying covariates on the individual's probability of experiencing a transition.[8]

3.2 Sample selection and descriptive analysis of duration

Our sample includes individuals with a complete interview in the survey and whose household reports previous year income information.[9] As noted earlier, our sample reduces slightly when we match demographic and socioeconomic characteristics with yearly income in time. Thus, our sample includes 19,129 individuals of which 15,096 (79 percent) are adults and 4,033 (21 percent) are children below 16 years of age (see Table A2 in the Appendix).[10]

[place Figure 1 around here]

For the purposes of our research, we use the standard definition of poverty, thus an individual is poor if total household income of the household she lives in is less than 60 per cent of the contemporary household median equivalent income.[11] The results on static poverty for this sample are reported in Figure 1 and show that individual adult poverty rates in Spain were quite stable during the period under study.

[place Table 1 around here]

Regarding the particular characteristics of poverty dynamics in Spain, and limiting our sample to those individuals that are observed at all interviews, Table 1 provides a measure of chronic and transitory poverty in various European countries. Our results are in line with those

[8] See Debels and Vandecasteele (2008) for a discussion of the empirical relevance of ignoring this time lag in analysing poverty dynamics in the European Union.

[9] We eliminate between a 1 and 2 percent of individuals due to the lack of complete interview – see Table A1 in the Appendix.

[10] It is important to note here that given that individuals change households by creating a new one between two consecutive interviews (emancipation, divorce or separation), we must undertake adjustments to household income so that individuals that change household effectively contribute to the income of the household where they were when household characteristics were observed. Clearly, when attrition occurs, this strategy implies that we lose information on some individuals and our sample reduces. Indeed, our final sample reduces between a 9 to 14 percent with respect to a non-contemporaneous sample depending on the year considered – see Table A2 in the Appendix.

[11] The equivalence scale used is the OECD modified that counts as 1 the first household member, as 0.5 all other adult members and as 0.3 all children under 14 years of age.

obtained by Valletta (2006), OECD (2008) and, more recently, by Cantó *et al.* (2010) and show that Spain registers a relatively low level of chronic poverty compared to other EU countries with similar levels of cross-sectional poverty. In contrast, Spain stands out as a country with a high percentage of transitory poverty: 44 per cent of individuals are poor at least once in a seven year period. Moreover, if we divide the transitory poor in two groups, attending to the number of spells during the observation period, we can easily observe that an important part of transitory poverty in Spain is of a *recurrent* nature, given that more than 40 per cent of individuals who are transitory poor register two or more poverty spells. [12] This is the highest percentage of the six countries analysed.

[place Table 2 around here]

In a preliminary descriptive analysis of the sample we use an unbalanced panel of individuals present in the survey in 1994.[13] Results on the conditional probability of transition are reported in Table 2. The first row of these conditional probabilities indicates the individual probability of remaining in poverty in two consecutive interviews i.e. two-year poverty persistence. For the entire period, these results show that there is substantial poverty persistence in Spain: 48.4 per cent of individuals who were poor in 1994 continue to be in poverty in 1995. In subsequent waves, this conditional probability fluctuates only slightly, from 51.9 per cent in 1997 to 59.8 per cent in 2000. As expected, transition probabilities from poor to non-poor are higher than from non-poor to poor but entry and exit from poverty do not seem to have a clear pattern along the period.[14] Interestingly, the probability of attrition does not appear to be determined by the individual poverty situation. Indeed, even if in 1995, 1997 and 2000 the probability of attrition was slightly higher for the group of the poor, results are precisely the reverse in the intermediate periods.

[place Table 3 around here]

From this first sample we select two subsamples in order to undertake our estimations. The first subsample includes all left-censored poverty spells and selects individuals who are

[12] A spell is defined as a continuous situation of poverty during one or various year periods as in Bane and Ellwood (1986). Results in OECD (2001) and Cantó *et al.* (2010) for Spain indicate that the particular characteristics of poverty recurrence in Spain are mainly driven by the situation of individuals living in working-age households.

[13] This first sample includes 19,129 individuals (a total of 101,539 person-year observations) and, as it would be expected due to attrition, the sample size falls along the period.

[14] Our results match those obtained for the period 1994-1996 by the OECD (2001) report where the headcount index is 19.2, the entry rate is 8.3 and the exit rate is 39.7 (note, however, that our mean exit rate is slightly lower, 35 per cent).

observed in poverty at first interview (in 1994). This new subsample is an unbalanced panel of 3,398 observations.[15] The second subsample drops all left-censored spells by selecting a sample of new-entrants to poverty at second interview (in 1995). This second subsample will only be used to check the robustness of our main results to sample choice.

Our first sample selection has two main effects on transitions (see Table 3): first, it increases the mean poverty entry rate (from 8.5 to 27.5) given that we are including a group of poor individuals that may have been for some time in poverty already and thus are more likely to fall back in it. Second, it slightly decreases the mean poverty exit rate (from 35.0 to 28.8 per cent) given that we are likely to include more individuals with a large experience in poverty and thus a lower exit hazard. Given that poverty incidence, short-term persistence and recurrence remain quite constant across the period we believe that this sample selection is particularly adequate in this context. In fact, it allows us to use the longest observation window possible and provides us with a stock of individuals in poverty whose first poverty spell is, by definition, in progress at the start of the sample period.[16] Obviously, second, third or subsequent spells are never left-censored.

[place Tables 4 and 5 around here]

Regarding the frequency distribution of poverty and non-poverty spells by order of occurrence in Table 4, we must highlight the importance of considering multiple spells in the analysis of poverty dynamics in Spain: out of the 3,398 individuals who are in poverty since 1994, 30.5 per cent have two occurrences along the complete time of observation and 6.0 per cent have three or more occurrences. This implies that a 36.8 per cent of the individuals in the sample re-enter poverty during the seven year period and, out of these, a 20 per cent actually re-enter twice or three times.

Indeed, Table 5 shows that 47.7 per cent of first poverty spells have an elapsed duration of one year and this percentage increases up to 54 per cent if we are in a second occurrence

[15] In this sample we try to avoid a form of sample selection bias referred to by Stevens (1999) and Iceland (1997) when dropping left-censored spells. Ignoring the existence of left-censored spells is common practice in poverty dynamics analysis. However, Stevens (1999) indicates that erasing spells in progress at the start of the sample provokes a form of sample selection bias. Thus, she asserts that considering individuals who begin a new spell after the start window period is likely to have higher transition probabilities than the entire population because they would have experienced at least one transition since the start window period.

[16] Note here that we cannot distinguish if the spell began precisely in 1994 or was in progress before the start of the sampling period. Further, our methodology provides results that control for left-censoring by estimating a separate baseline hazard for left-truncated spells (first spells). In any case, this sample does not include individuals who started the ECHP and may temporarily exit the ECHP presenting missing values across several years (because we do not know their status of poverty and non-poverty). There are 385 individuals of this type.

and to 76.9 per cent in a third one, meaning that if one has a second or third poverty spell, these spells are likely to be particularly short. A similar result is obtained for non-poverty spells. In sum, there seem to be individuals that are particularly prone to exit and re-enter poverty experiencing one or two year spells in a row. In terms of duration, first-spells have a mean duration of two and a half years while the duration of second and third poverty spells is slightly shorter (1.8 and 1.3 years respectively).[17]

4. Results

In a first approach to measuring the relevance of spell duration on the probability of leaving poverty we report life-table estimates of the probability of leaving and re-entering poverty. These results assume that the population is homogeneous in characteristics. We begin by analysing the whole sample of spells irrespective of their order and follow by distinguishing the order of each spell occurrence. In a second step we report results on estimated transition rates using our multivariate hazard regression model.

4.1 Life-table estimates of transition rates

Tables 6 and 7 and Figures 2 and 3 display the life-table estimates of hazard rates, survival probability and cumulative failure for all poverty exits and re-entries. Table 6 and Figure 2 illustrate that both types of spells show a decline of the transition hazard as duration evolves, thus supporting the idea of *negative duration dependence* for both situations. However, some differences are already observable between the exit and re-entry hazards. First, the probability of returning to poverty is significantly lower than the probability of exiting from poverty. Thus, non-poverty spells, in general are of a longer duration than poverty spells. Secondly, the re-entry hazard continues to decline after three years of spell evolution while the exit hazard rate experiences a rapid decline during the first three years even if it is fairly constant from then onwards.

[place Table 6 around here]

Distinguishing the order of spells and thus analysing the effects of spell accumulation is our main objective. Therefore, in Table 7 we include results on transition rates for each spell type by their order of occurrence. We can see that the results previously obtained turn out to be similar to those obtained for the first spell of poverty or non-poverty now, but are clearly

[17] Note, however that this last result is affected by the seven year interview limit imposed by the structure of the dataset.

different from those obtained for the second poverty or non-poverty spell. This underlines the importance of taking multiple spells into account and of considering the differential hazard rate due to the accumulation of multiple experiences in and out of poverty.

[place Tables 7 and Figures 2 and 3 around here]

In fact, for first poverty spells we can see that hazard rates decline rapidly during the first two years of observed poverty spell duration, thus supporting *negative duration dependence*. Also, a large number of individuals in our sample experience relatively short poverty spells while a minority (a fifth of the sample) experience relatively long spells: 61.3 per cent of individuals remain poor only during one year, 45.7 per cent two years, 35.8 per cent at least 3 years and just about 20 per cent seven or more years. In contrast, we observe that the probability that an individual leaves poverty when experiencing a second occurrence is significantly higher than it was during her first poverty spell. Indeed, during the first year the hazard rate in the second poverty period is 3.2 percentage points higher than in the first one. Interestingly this difference increases up to a 15 per cent more during the following year. Therefore, we find evidence that individuals remain a relatively shorter time in poverty if they have managed to leave deprivation for some time most recently.

Turning to results on non-poverty spells, we observe that the shape of the first re-entry hazard is also consistent with *negative duration dependence*. Interestingly we find that, in contrast with the impact of spell order in poverty experiences, re-entry hazard rates in the second non-poverty spell are lower than in the first one. Therefore, if one manages to step out of poverty, the accumulation of non-poverty periods plays in your favour by reducing the probability of coming back to poverty.

4.2 Estimation results on poverty exits and re-entries

In this sub-section, we estimate a hazard model of the determinants of leaving or re-entering poverty allowing for multiple exit and multiple re-entry hazards and thus taking into account the individual's complete poverty history. We are most interested in isolating the effect of duration dependence and lagged poverty spells on the current probability of transition, while controlling for demographic and socio-economic.

[place Table 8 around here]

Results in Table 8 confirm that lagged poverty and non-poverty durations have a strong effect on the probability of leaving poverty or re-entering it, which underlines the importance of accounting for the complete individual poverty experience. [18] In fact, the effects of lagged durations have the expected sign: lagged poverty duration reduces the poverty exit hazard and lagged non-poverty duration reduces the re-entry hazard. The longer the time spent below the poverty line in previous spells the lower the probability of leaving poverty in a second period. Alternatively, the time spent out of poverty plays the opposite role: the longer the time the individual is out of poverty, the lower the probability of poverty recall.

[place Figure 4 around here]

Figure 4 plots the shape of the hazard rate for different spell durations at the mean of all other covariates.[19] For individuals in their first observed poverty spell we find positive duration dependence until the third year and negative duration dependence thereafter. This implies that during a short time at the beginning, spell duration is not reducing the individual's chances to leave poverty whereas, once this period is over, spell duration, in itself, is an always growing disadvantage in order to manage stepping out of poverty. In contrast, for those experiencing a second spell, the effect of duration is somewhat different: the probability of leaving a second poverty spell is significantly higher than that of the first spell at the beginning. Further, we observe that, for the case of poverty recall the hazard shifts down importantly when spells accumulate. Thus, the probability of re-entering poverty in a second period is largely below that of the first period.

Further, we may interpret some of the coefficients of other covariates which, in general, suggest that the sign of the effect of a covariate on poverty exit and re-entry is the opposite. Thus, characteristics that help in leaving poverty also help in avoiding recurrence. For instance, household composition covariates have a significant and opposite effect on the individual's exit and re-entry hazard whatever the spell order. In any case, there are some differences in the magnitude of their impact: it is larger on re-entries than on exits and this difference becomes somewhat larger as the number of experienced poverty spells increases. Consequently household composition seems to play more relevant role in protecting the vulnerable than in promoting the poor. Those households in worst position are couples with

[18] We fitted a variety of other alternative specifications. For example, we considered including unemployment rates and GDP growth rate but they were not statistically significant and the distribution of the estimated parameters was very imprecise. Therefore, these covariates we not kept in the specifications reported here.

[19] We have also plotted the baseline hazard for the reference household by duration and results do not differ.

three or more children who have a lower probability of stepping out of poverty and a higher probability of re-entering it after exit. Consequently, they are more likely to suffer long-term poverty. In contrast, individuals in one person households, single parents and couples with no children or one child have a significantly lower probability of re-entering poverty once they managed to step out of it.

The age of the household head turns out to have a significantly different effect on poverty exits by spell order. Indeed, the distinction of first and second poverty spells shows that the advantageous position of young households in leaving a first poverty spell disappears if individuals are fluctuating often between poverty and non-poverty. Indeed, only in first poverty spells individuals below 30 years of age show a higher probability of leaving poverty in comparison with those in their thirties or forties. In contrast, for those in their second poverty spell, head of household's age does not have any effect on the exit hazard rate.

Finally, the increase in the number of individuals with a permanent contract in the household is particularly effective in order to avoid poverty recurrence whereas an increase in the number of fixed-term contracts, instead, is effective in helping households make a first step in order to leave a poverty situation.

4.3 Results when dropping left-censored spells

In our previous econometric estimation we have used a sample that includes left-censored spells in order to avoid a form of sample selection bias. However, we believe that giving some sound intuition on the expected differences in results when analysing exit hazard rates for a sample of new entrants to poverty is of interest in this context, particularly due to the relatively short observation window the ECHP allows us to consider (seven years of the individual's life). Thus, we select a sample with a common date of entry into poverty in order to reduce the effect of the initial conditions - see Heckman (1981). [20]

[place Table 9 around here]

Results in Table 9 indicate that the effects of lagged durations still hold. As a consequence, leaving a second poverty spell for new entrants is also less likely the longer the previous poverty spell. This confirms, for this sample, the previous result on the existence of

[20] Unluckily it is not possible for us to explicitly model the hazard rate of an individual's first entry into poverty (initial conditions) because we do not have information on the pre-1994 income histories of those who were already poor before 1994.

some state dependence effect in individuals' poverty histories. Regarding the effect of covariates, results are fairly similar, even if, in general, coefficients are less statistically significant, probably due to the reduction of the sample.

Conclusions

This paper has analysed the effect of spell recurrence on poverty dynamics taking into account multiple poverty and non-poverty spells (the complete poverty history) by spell order while controlling for initial conditions, household characteristics and individual unobserved heterogeneity. Using ECHP data we have estimated a mixed proportional hazard model with multiple states and multiple spells in order to provide empirical evidence on different poverty exit and re-entry hazards when spells accumulate, challenging previous studies based on poverty persistence that estimate one exit and one re-entry hazard rate independent of the number and duration of individual poverty experiences.

In general, our findings highlight the importance of considering spell order in the analysis of poverty dynamics given that lagged poverty and non-poverty durations have a significant effect on both exit and re-entry probabilities even when controlling for relevant covariates, initial conditions and unobserved heterogeneity. In particular, lagged poverty duration reduces the probability of leaving a poverty spell and lagged non-poverty duration decreases the probability of re-entering poverty in a second non-poverty spell. These results are robust to dropping left-censored poverty spells and estimating transition probabilities for a sample of entrants to poverty within the observation window, a key comparison in the analysis of transition rates at different poverty spell durations.

Also, the highest poverty exit rates are associated to individuals with shorter durations in poverty, who have a large number of earners in their household. Therefore, in a heterogeneous context controlling for relevant household characteristics and lagged poverty durations we only find some negative duration dependence after the poverty or non-poverty spell has evolved for two or three years. In the particular case of second poverty spells results show some strong positive duration dependence during the first two years of duration and becomes largely negative thereafter.

Interestingly our multivariate regressions suggest that the effect of a covariate on poverty exit and re-entry is often the opposite. Thus, characteristics that help individuals in leaving poverty also help them in avoiding recurrence. Additionally, the estimated coefficients

capturing the effect of covariates on exit and re-entry hazard rates change in magnitude and significance when we separate spells by their order. Household composition turns out to have a particularly strong effect on re-entries, especially in second non-poverty spells. Those households in worst position are couples with three or more children who have a lower probability of stepping out of poverty and a higher probability of re-entering it after exit. Consequently, they are more likely to suffer long-term poverty. In contrast, individuals in one person households, single parents and couples with no children or one child have a significantly lower probability of re-entering poverty once they managed to step out of it.

References

Aassve A, Burgess S, Propper, C, Dickson M (2005) Modelling Poverty by Not Modelling Poverty: A Simultaneous Hazard Approach to the UK. ISER Working paper 2005 – 26

Allison PD (1982) Discrete-time methods for the analysis of event histories. In: Leinhardt, S (ed) Sociological Methodology. Jossey-Bass Publishers, San Francisco: 61-97

Arranz, JM, Muro, J (2004) Recurrent Unemployment, Welfare Benefits and Heterogeneity, International Review of Applied Economics, 18 (4), 423-441.

Bane MJ, Ellwood DT (1986) Slipping Into and Out of Poverty: The Dynamics of Spells. Journal of Human Resources 21(1): 1-23

Biewen M (2006) Who are the Chronic Poor? An Econometric Analysis of Chronic Poverty in Germany, Research on Economic Inequality (13): 31-62

Blumen I, Kogan M, McCarthy PJ (1955) The Industrial Mobility of Labour as a Probability Process. Ithaca, N.Y.: Cornell University Press

Bonnal L, Fougere D, Serandon A (1997) Evaluating the Impact of French Employment Policies on Individual Labour Market Histories, Review of Economic Studies 64: 683-713

Cantó O, Gradín C and Del Río C (2010) La pobreza crónica, transitoria y recurrente en España, Documento de traballo, Departamento de Economía Aplicada, Universidade de Vigo, dt1003.

Cappellari L, Jenkins SP (2004) Modelling Low Income Transitions. Journal of Applied Econometrics 19(5): 593-610

Debels A, Vandecasteele L (2008) The Time Lag in Annual Household-based Income Measures: Assessing and Correcting the Bias, *Review of Income and Wealth*, series 54, number 1: 71-89

Devicienti F (2001) Poverty Persistence in Britain: a Multivariate Analysis using the BHPS, 1991–1997. Journal of Economics, Supplement 9: 1-34

Devicienti F and Gualtieri V (2007) The Dynamics and Persistence of Poverty: Evidence from Italy, LABORatorio R. Revelli, Working paper series, no. 62-2007, Torino

Duncan GJ, Gustafsson B, Hauser R, Schmauss G, Messinger H, Muffels R, Nolan B, Ray JC (1993) Poverty Dynamics in Eight Countries. Journal of Population Economics 6: 215-234

Gardiner K, Hills, J (1999) Policy Implications of New Data on Income Mobility. The Economic Journal, 109: F91-F111

Hansen J, Wahlberg R (2004) Poverty Persistence in Sweden, IZA Discussion Paper: 1209

Heckman J (1981) The Incidental Parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time-Discrete Data Stochastic Process. In: Manski C, Mc Fadden D (eds.) Structural Analysis of Discrete Data with Econometric Applications. The MIT Press Cambridge: 179-195

Heckman J, Borjas GI (1980) Does Unemployment cause Future Unemployment? Definitions, Questions and Answers for a Continuous Time model of Heterogeneity and State Dependence. Economica 47: 247-283

Heckman J, Singer B (1984) Econometric Duration Analysis. Journal of Econometrics 24: 63-132

Heckman J, Hotz V J, Walker J (1985) New Evidence on the Timing and Spacing of Births, American Economic Review 75: 179-184

Heckman J J, Walker J (1990) The Relationship Between Wages and Income and the Timing and Spacing of Births: Evidence From Swedish Longitudinal Data. Econometrica 58: 1411-1442

Iceland J (1997) The Dynamics of Poverty Spells and Issues of Left-censoring, PSC Report Series, University of Michigan: 97-378

Jain D, Vilcassim NJ (1991) Investigating Household Purchase Timing Decisions: A conditional Hazard Function Approach. Marketing Science 10: 1-23

Jenkins SP (1995) Easy Estimation Methods for Discrete-time Duration Models. Oxford Bulletin of Economics and Statistics 57: 129-37

Kalbfleisch JD, Prentice RL (1980) The Statistical Analysis of Failure Time Data. New York: John Wiley

Lancaster T (1979) Econometric Methods for the Duration of Unemployment, Econometrica 47: 939-956

Lancaster T (1990) The Econometric Analysis of Transition Data. Econometric Society Monographs, Cambridge University Press

Lillard LA, Willis RJ (1978) Dynamic aspects of Earnings Mobility. Econometrica (46): 985-1012

OECD (2001) Employment Outlook, June, Chapter 2: When Money is Tight: Poverty Dynamics in OECD countries, Paris

OECD (2008) Growing Unequal?, Chapter 6: 155-175, Paris

Omori Y (1997) Stigma effects of Non-employment. Economic Inquiry XXXV(April): 394-416

Peña-Casas R and Latta M (2004) Working poor in the European Union. European Fundation for the Improvement of Living and Working Conditions, European Union

Roed K, Oddbjorn R, Goldstein H (1999) Does Unemployment cause Unemployment? Micro-evidence from Norway. Applied Economics 31: 1207-1218

Shorrocks A (1976) Income Mobility and the Markov Assumption. The Economic Journal 86: 566-578

Stevens AH (1999) Climbing Out of Poverty, Falling Back In. (Measuring the Persistence of Poverty over multiple Spells). Journal of Human Resources 34: 557-588

Stewart MB (2007) The Interrelated Dynamics of Unemployment and Low-wage Employment. Journal of Applied Econometrics 22: 511-531

Valletta RG (2006) The Ins and Outs of Poverty in Advanced Economies: Government Policy and Poverty Dynamics in Canada, Germany, Great Britain and the United States. Review of Income and Wealth 52(2): 261-284

Vilcassim N J, Jain D (1991) Modelling Purchase Timing and Brand Switching Behavior Incorporating Explanatory Variables and Unobserved Heterogeneity. Journal of Marketing Research 28: 29-41

Wooldridge JM (2005) Simple Solutions to the Initial Conditions Problem for Dynamic, Nonlinear Panel Data Models with Unobserved Heterogeneity. Journal of Applied Econometrics 20: 39-54

APPENDIX

Table A1. Panel Data for Spain, ECHP (1994-2001).

	1994	1995	1996	1997	1998	1999	2000	2001
Number of Households								
Households, initial sample	7,206	6,522	6,267	5,794	5,485	5,418	5,132	4,966
Households, all members complete interview	7,206	6,518	6,224	5,771	5,473	5,347	5,132	4,966
Households, all members complete interview and previous annual income information	7,142	6,448	6,125	5,709	5,430	5,289	5,040	4,941
Percentage of households eliminated	0.90	1.15	2.32	1.49	1.01	2.44	1.83	0.51
Number of Individuals								
All individuals, initial sample	23,025	20,708	19,712	18,167	16,728	16,222	15,048	14,320
Adults, initial sample	18,428	16,727	16,110	15,149	14,044	13,654	12,731	12,169
Children, initial sample	4,597	3,981	3,602	3,018	2,684	2,568	2,317	2,151
New born children in panel	--	142	142	151	133	153	156	127
Number of Individuals, complete								
All individuals, with complete interview	22,486	20,243	19,230	17,846	16,479	15,643	14,613	14,131
Adults, with complete interview	17,893	16,263	15,640	14,819	13,779	13,104	12,317	11,964
Children, in hh. all individuals complete interview (newborns included)	4,593	3,980	3,590	3,027	2,700	2,539	2,296	2,167
Percentage of individuals eliminated	2.34	2.25	2.45	1.77	1.49	3.57	2.89	1.32
Number of Individuals, complete + current household income (with complete interview + current household income information)								
All individuals	22,305	20,092	19,025	17,679	16,391	15,601	14,588	14,109
Adults	17,756	16,154	15,500	14,702	13,722	13,078	12,302	11,949
Children	4,549	3,937	3,525	2,977	2,669	2,523	2,286	2,160
Percentage of individuals eliminated	0.80	0.75	1.07	0.94	0.53	0.27	0.17	0.16
Percentage of adults eliminated	0.77	0.67	0.90	0.79	0.41	0.20	0.12	0.13
Percentage of children eliminated	0.96	1.08	1.81	1.65	1.15	0.63	0.44	0.32

Source: Own construction using ECHP (1994-2001).

Table A2. Final Sample for Spain, ECHP (1994-2001) using contemporaneous information on income and household characteristics.

	Different year of observation of household income & household characteristics							
	1993/1994	**1994/1995**	**1995/1996**	**1996/1997**	**1997/1998**	**1998/1999**	**1999/2000**	**2000/2001**
Number of Individuals, complete + household income (with complete interview + hh. income information)								
All individuals	22,305	20,092	19,025	17,679	16,391	15,601	14,588	14,109
Adults	17,756	16,154	15,500	14,702	13,722	13,078	12,302	11,949
Children	4,549	3,937	3,525	2,977	2,669	2,523	2,286	2,160

	Contemporary year of observation of household income & household characteristics						
	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
FINAL SAMPLE (using contemporaneous income)							
Number of Individuals, complete + annual household income (with complete interview + annual household income information)							
All individuals	19,129	17,676	16,532	15,434	14,486	13,621	13,181
Adults	15,096	14,159	13,379	12,809	12,056	11,395	11,090
Children	4,033	3,517	3,153	2,625	2,430	2,226	2,091
Percentage of individuals eliminated	14.24	12.02	13.10	12.70	11.62	12.69	9.64
Percentage of adults eliminated	14.98	12.35	13.68	12.88	12.14	12.87	9.85
Percentage of children eliminated	11.34	10.67	10.55	11.82	8.95	11.77	8.53

Source: Own construction using ECHP (1994-2001).

TABLES AND GRAPHS

Table 1. Poverty Dynamics in various EU countries.

					Poor at least once	
Country	**Sample**	**Mean Poverty Headcount**	**Always Poor**	**Poor at least once**	**One poverty spell**	**Two or more poverty spells**
Germany	9,830	10.7	1.9	28.0	73.2	26.8
Denmark	3,019	10.4	1.0	28.7	77.0	23.0
Spain	**9,595**	**18.8**	**2.7**	**43.9**	**58.4**	**41.6**
France	9,225	15.0	2.7	32.5	68.6	31.4
Portugal	9,305	20.5	5.6	44.0	68.5	31.5
United Kingdom	7,116	17.4	2.8	36.1	70.8	29.2

Notes:
(a)These results are obtained using the ECHP 1994-2000 contemporary income and characteristics information and using a modified OECD equivalence scale. The poverty line is 60% median adjusted household income (contemporaneous to characteristics).
(b) Calculations of headcound index are made for individuals weighted by their population weight each particular year. Results are for those individuals in the panel all eight interviews. These are in Spain 9,595 out of the 13,251 individuals observed in 2000 given that some individuals enter the panel after 1994 (27.6 per cent of the total simple in 2000). Headcount poverty rates are the mean for the 1994-2000 period for each country considered. All dynamic results use longitudinal weights to avoid attrition bias even if for static results we weight for population representativeness instead.

Table 2. Poverty Incidence and Short-term Persistence.

	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**Mean 1994-2000**
Poverty Incidence								
Headcount index (% poor over sample size no missing values)	18.5	18.0	20.8	18.9	19.9	18.4	19.1	**19.1**
Sample Size (weighted, no missing values)	*19,129*	*16,915*	*15,122*	*13,962*	*12,915*	*11,945*	*11,551*	
Headcount index (% poor over sample size, with missing values)	18.5	15.9	16.4	13.8	13.4	11.5	11.5	**14.4**
Sample Size (weighted)	*19,129*	*19,129*	*19,129*	*19,129*	*19,129*	*19,129*	*19,129*	
Conditional probabilities								
Poverty short-term persistence Prob (y_t=1/y_{t-1}=1)		48.4	55.7	51.9	57.3	52.5	59.8	**54.2**
Poverty entry occurs Prob (y_t=1/y_{t-1}=0)		8.1	9.7	7.7	9.0	7.5	8.8	**8.5**
Poverty exit occurs Prob (y_t=0/y_{t-1}=1)		39.0	32.6	34.7	34.3	37.1	32.3	**35.0**
Persistence out of poverty Prob (y_t=0/y_{t-1}=0)		80.6	78.1	82.1	80.6	81.4	84.0	**81.1**
Atrittion								
Prob (y_t=mis/y_{t-1}=0)		11.3	12.2	10.2	10.4	11.1	7.2	**10.4**
Prob (y_t=mis/y_{t-1}=1)		12.7	11.7	13.4	8.4	10.4	7.9	**10.7**

Notes:
(a) These results are obtained using the ECHP contemporary income and characteristics information and using a modified OECD equivalence scale.
(b) Calculations of headcound index are made for individuals weighted by their population weight each particular year.
(c) The sample here is that of all individuals present in 1994 and in consecutive interviews in the ECHP panel until the survey ends or they suffer from attrition. Note that y_t=1 if the individual is poor in time t and 0 if the individual is non-poor, "*mis"*means that attrition occurred.

Table 3. Poverty Incidence and Short-term Persistence: Maximum observation window.

	1994	1995	1996	1997	1998	1999	2000	Mean 1994-2000
Poverty Incidence								
Headcount index (% poor over sample size no missing values)	100	55.7	59.1	55.5	53.8	46.5	41.4	**58.8**
Sample Size (weighted, no missing values)	*3,398*	*3,042*	*2,745*	*2,473*	*2,318*	*2,098*	*1,945*	
Headcount index (% poor over sample size, with missing values)	49.8	47.7	40.4	36.7	28.7	23.7	49.8	**39.6**
Sample Size (weighted)	*3,398*	*3,398*	*3,398*	*3,398*	*3,398*	*3,398*	*3,398*	
Conditional probabilities								
Poverty short-term persistence Prob (y_t=1/y_{t-1}=1)		49.8	67.6	63.3	66.3	58.4	62.4	**61.3**
Poverty entry occurs Prob (y_t=1/y_{t-1}=0)		--	35.0	31.2	29.8	23.0	18.3	**27.5**
Poverty exit occurs Prob (y_t=0/y_{t-1}=1)		39.7	23.1	24.9	27.5	29.3	28.4	**28.8**
Persistence out of poverty Prob (y_t=0/y_{t-1}=0)		--	53.9	61.0	61.8	69.6	74.4	**64.1**
Atrittion								
Prob (y_t=mis/y_{t-1}=0)		--	11.1	7.8	8.3	7.4	7.3	**8.4**
Prob (y_t=mis/y_{t-1}=1)		10.5	9.4	11.7	6.2	12.2	9.2	**9.9**

Notes: See notes Table 2.

Table 4. Number of spells of poverty and non-poverty in total sample.

Number of occurrences	Poverty		Non-poverty	
	Freq.	%	Freq.	%
1	2,148	63.2	1,493	43.9
2	1,038	30.5	682	20.1
3	203	6.0	58	1.7
4	9	0.3	-	-
Total individuals	3,398	100	2,233	65.7

Note: Sample restricted to individuals who are poor in 1994 and consecutive observation in panel. ECHP 1994-2000.

Table 5. Frequency distributions of elapsed durations by order of occurrence.

Elapsed duration	First poverty spell		First non-poverty spell		Second poverty spell		Second non-poverty spell		Third poverty spell		Third non-poverty spell	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
1	1,620	47.68	1,020	45.68	676	54.08	394	53.24	163	76.89	45	77.59
2	596	17.54	453	20.29	281	22.48	168	22.70	40	18.87	13	22.41
3	380	11.18	239	10.70	157	12.56	122	16.49	9	4.25	-	-
4	204	6.00	169	7.57	100	8.00	56	7.57	-	-	-	-
5	190	5.59	152	6.81	36	2.88	-	-	-	-	-	-
6	88	2.59	200	8.96	-	-	-	-	-	-	-	-
7	320	9.42	-	-	-	-	-	-	-	-	-	-
Total individuals	3,398	100	2,233	100	1,250	100	740	100	212	100	58	100
Mean (Std. Dev.)	2.50 (1.96)		2.36 (1.67)		1.83 (1.10)		1.78 (0.89)		1.27 (0.53)		1.22 (0.42)	

Notes: See note in Table 4.

Table 6. Life tables estimates of hazard rates, survival probability and cumulative failure for all poverty exits and re-entries.

Interval (years)		Total number of individuals at risk Total (individuals)	Deaths	Lost	Survival(%)	Cum. Failure (%)	Std. Error	Hazard (%)	Std. Error
All exits									
1	2	4869	1753	715	61.14	38.86	0.73	48.23	1.12
2	3	2401	636	281	43.94	56.06	0.78	32.74	1.28
3	4	1484	303	243	34.17	65.83	0.78	25.02	1.43
4	5	938	172	132	27.43	72.57	0.78	21.88	1.66
5	6	634	113	113	22.06	77.94	0.77	21.69	2.03
6	7	408	54	34	19.02	80.98	0.77	14.84	2.01
7	8	320	0	320	19.02	80.98	0.77	-	-
All re-entries									
1	2	3031	935	524	66.23	33.77	0.9	40.63	1.3
2	3	1572	318	316	51.34	48.66	1.01	25.34	1.41
3	4	938	124	237	43.57	56.43	1.07	16.37	1.47
4	5	577	61	164	38.2	61.8	1.14	13.13	1.68
5	6	352	33	119	33.89	66.11	1.23	11.96	2.08
6	7	200	0	200	33.89	66.11	1.23	-	-

Notes: Based on all poverty and non-poverty spells observed in ECHP 1994-2000 for individuals who are poor in 1994.

Table 7. Life tables estimates of hazard rates, survival probability and cumulative failure by order of occurrence.

Interval (years)		Total number of individuals at risk	Deaths	Lost	Survival (%)	Cum. Failure (%)	Std. Error	Hazard (%)	Std. Error
First poverty spell (1)									
1	2	3398	1241	379	61.32	38.68	0.86	47.95	1.32
2	3	1778	430	166	45.77	54.23	0.91	29.05	1.39
3	4	1182	240	140	35.89	64.11	0.91	24.19	1.55
4	5	802	155	49	28.73	71.27	0.89	22.14	1.77
5	6	598	113	77	22.93	77.07	0.86	22.47	2.1
6	7	408	54	34	19.76	80.24	0.84	14.84	2.01
7	8	320	0	320	19.76	80.24	0.84	-	-
First non-poverty spell (2)									
1	2	2233	755	265	64.06	35.94	1.05	43.82	1.56
2	3	1213	284	169	47.94	52.06	1.14	28.79	1.69
3	4	760	117	122	39.91	60.09	1.17	18.27	1.68
4	5	521	61	108	34.7	65.3	1.19	13.97	1.78
5	6	352	33	119	30.78	69.22	1.23	11.96	2.08
6	7	200	0	200	30.78	69.22	1.23	-	-
Second poverty spell (3)									
1	2	1250	466	210	59.3	40.7	1.45	51.10	2.29
2	3	574	194	87	37.62	62.38	1.54	44.75	3.13
3	4	293	63	94	27.98	72.02	1.55	29.37	3.66
4	5	136	17	83	22.95	77.05	1.69	19.77	4.77
5	6	36	0	36	22.95	77.05	1.69	-	-
Second non-poverty spell (4)									
1	2	740	171	223	72.79	27.21	1.78	31.49	2.38
2	3	346	34	134	63.92	36.08	2.11	12.98	2.22
3	4	178	7	115	60.21	39.79	2.41	5.98	2.26
4	5	56	0	56	60.21	39.79	2.41	-	-
Third poverty spell (5)									
1	2	212	46	117	70.03	29.97	3.7	35.25	5.12
2	3	49	12	28	46.02	53.98	6.12	41.38	11.69
3	4	9	0	9	46.02	53.98	6.12	-	-
Third non-poverty spell (6)									
1	2	58	9	36	77.5	22.5	6.6	25.35	8.38
2	3	13	0	13	77.5	22.5	6.6	-	-

Note: See note in Table 6.

Table 8. Discrete hazard models for all poverty exits and all poverty re-entries, by spell order controlling for unobserved heterogeneity.

	First poverty exit			First poverty re-entry (after first poverty exit)			Second poverty exit (after first poverty re-entry)			Second poverty re-entry (after second poverty exit)		
Variables	**Coef.**	**Std. Err.**	**P>z**	**Coef.**	**Std. Err.**	**P>z**	**Coef.**	**Std. Err.**	**P>z**	**Coef.**	**Std. Err.**	**P>z**
Intercept	-1.684	0.337	***	-0.223	0.411		-3.390	0.807	***	5.518	1.396	***
Spell characteristics:												
Duration	0.728	0.179	***	0.958	0.242	***	2.413	0.406	***	1.580	0.973	*
Duration square	-0.110	0.021	***	-0.169	0.035	***	-0.518	0.084	***	-0.509	0.256	**
Lagged poverty duration (years)							-0.720	0.111	***			
Lagged non poverty duration (years)										-1.531	0.246	***
Household education and labour market characteristics:												
Percentage adults with university education	0.341	0.309		-2.366	0.474	***	0.404	0.645		-1.223	1.017	
Percentage adults with secondary education	1.039	0.248	***	-1.427	0.377	***	-0.132	0.553		-1.215	0.856	
Number of active members in household	0.353	0.038	***	-0.169	0.061	***	0.147	0.066	**	-1.134	0.148	***
Percentage employed adults permanent contracts	-0.020	0.195		-1.140	0.209	***	0.500	0.264	*	-4.143	0.577	***
Percentage employed adults fixed-term contracts	0.532	0.128	***	-1.082	0.176	***	1.143	0.210	***	-1.574	0.392	***
Head of Household characteristics:												
Head of Household Age:												
Less than 30	ref			ref			ref			ref		
30-39	-0.447	0.140	***	0.288	0.241		0.205	0.275		-0.291	0.513	
40-49	-0.382	0.126	***	0.659	0.239	***	0.226	0.251		-0.313	0.467	
50-59	-0.306	0.140	**	0.981	0.253	***	0.140	0.269		-0.271	0.467	
60+	-0.266	0.163	*	0.705	0.273	***	0.162	0.322		-1.536	0.530	***
Household type*:*												
One person household	0.545	0.335	*	-2.135	0.420	***	0.470	0.800		-3.028	1.222	***
Lone parent with one or more children	0.461	0.249	*	-2.003	0.393	***	2.201	0.667	***	-4.050	1.167	***
Couple, no children	-0.360	0.293		-1.883	0.378	***	0.010	0.705		-3.360	1.162	***
Couple one or two children (child aged < 16)	0.798	0.217	***	-0.790	0.305	***	0.840	0.629		-3.602	1.083	***
Couple three or more(child aged < 16)	ref			ref			ref			ref		
Couple, one or more children (at least one child aged ≥16)	0.517	0.216	**	-1.177	0.310	***	1.834	0.619	***	-3.143	1.088	***
Other households	0.532	0.225	**	-1.616	0.324	***	1.380	0.632	**	-1.845	1.089	*
Initial conditions												
Percentage adults with very good health in the household	0.238	0.126	*									
Percentage of working-age females (>16, <65) in the household	-0.004	0.002	**									
Head had unemployment spell in last 5 years	-0.570	0.085	***									
Mass points and probability												
θ_1	2.592***											
θ_2	-1.199***											
$Pr(\theta_1)$	0.316											
$Pr(\theta_2)$	0.684											
Sample-individual observations)	8,486			5,279			2,289			1,320		
Log-likelihood	-8902.4443											

*** Indicates significance at 1 per cent; ** indicates significance at 5 per cent; * indicates significance at 10 per cent.

Note: The reference individual is a female living in a household whose head is less than 30 years of age, has less than secondary education and is employed. The household includes three or more children.

Table 9. Dropping left-censored spells: Discrete hazard models for all poverty exits and all poverty re-entries, by spell order controlling for unobserved heterogeneity.

	First poverty exit			First poverty re-entry (after first poverty exit)			Second poverty exit (after first poverty re-entry)			Second poverty re-entry (after second poverty exit)		
Variables	**Coef.**	**Std. Err.**	**P>z**	**Coef.**	**Std. Err.**	**P>z**	**Coef.**	**Std. Err.**	**P>z**	**Coef.**	**Std. Err.**	**P>z**
Intercept	-0.450	0.282		2.279	0.374	***	-1.710	0.711	**	2.176	0.949	**
Spell characteristics:												
Duration	0.013	0.176		-0.341	0.054	***	2.249	0.707	***	-0.952	0.443	**
Duration square	-0.080	0.034	**				-0.659	0.186	***			
Lagged poverty duration (years)							-0.875	0.188	***			
Lagged non poverty duration (years)										-0.974	0.416	**
Household education and labour market characteristics:												
Percentage adults with university education	0.262	0.347		-2.030	0.474	***	1.918	0.736	***	0.836	1.310	
Percentage adults with secondary education	1.562	0.328	***	-0.285	0.296		0.945	0.530	*	-0.080	1.078	
Number of active members in household	0.058	0.055		-0.250	0.066	***	0.051	0.112		-0.436	0.303	
Percentage employed adults permanent contracts	0.338	0.180	*	-1.137	0.218	***	0.589	0.324	*	-4.636	1.577	***
Percentage employed adults fixed-term contracts	0.061	0.164		-0.978	0.188	***	0.195	0.273		1.020	0.630	
Head of Household characteristics:												
Head of Household Age:												
Less than 40	ref			ref			ref			ref		
40-49	0.009	0.131		0.082	0.153		-0.949	0.239	***	2.383	0.671	***
50-59	0.051	0.154		-0.115	0.179		-1.188	0.298	***	0.669	0.695	
60+	0.131	0.165		-0.598	0.214	***	-1.381	0.357	***	1.787	0.899	**
Household type*:*												
One person household	0.462	0.346		-2.611	0.445	***	0.369	0.676		-3.714	1.527	**
Lone parent with one or more children	-0.029	0.251		-3.148	0.446	***	-0.258	0.517		-1.611	1.103	
Couple, no children	0.136	0.266		-2.062	0.392	***	0.745	0.502		-2.065	1.082	*
Couple one or two children (child aged < 16)	0.417	0.209	**	-1.627	0.355	***	0.237	0.358		-2.502	0.961	***
Couple three or more(child aged < 16)	ref			ref			ref			ref		
Couple, one or more children (at least one child aged ≥16)	0.311	0.211		-2.218	0.353	***	1.456	0.375	***	-1.507	0.829	*
Other households	0.294	0.214		-1.730	0.360	***	1.868	0.395	***	-4.729	1.153	***
Mass points and probability												
θ_1	-7.989											
θ_2	-0.012											
$Pr(\theta_1)$	0.01											
$Pr(\theta_2)$	0.99											
Sample-individual observations)	2075			2281			786			389		
Log-likelihood	-2835.1848											

*** Indicates significance at 1 per cent; ** indicates significance at 5 per cent; * indicates significance at 10 per cent.
Note: The reference individual is a female living in a household whose head is less than 30 years of age, has less than secondary education and is employed. The household includes three or more children.

Figure 1. Relative individual poverty incidence in Spain: Headcount index.
ECHP 1994-2001.

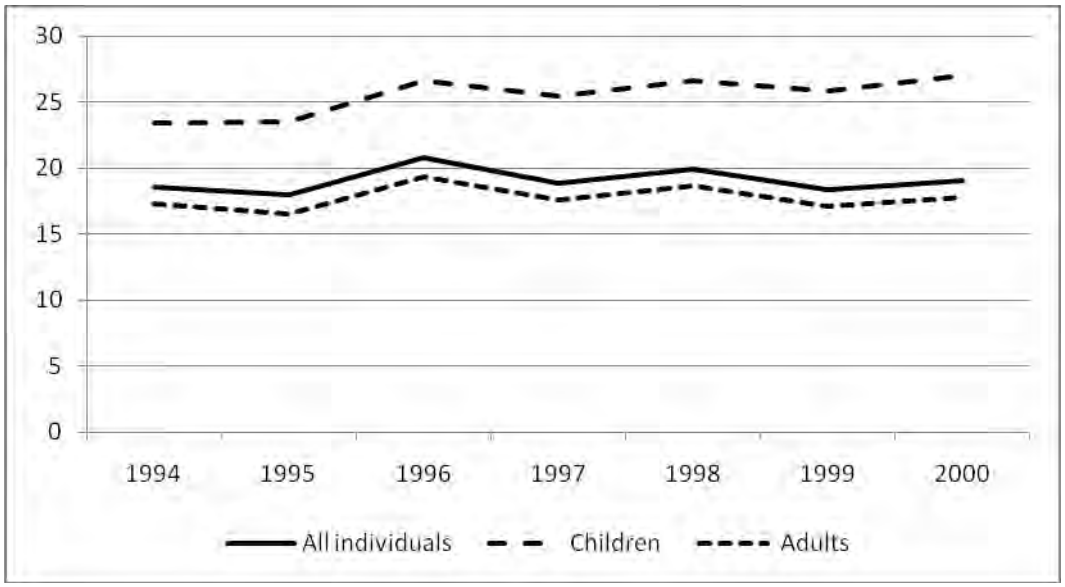

Figure 2. Life-Table Hazard rates as duration evolves.
ECHP 1994-2001.

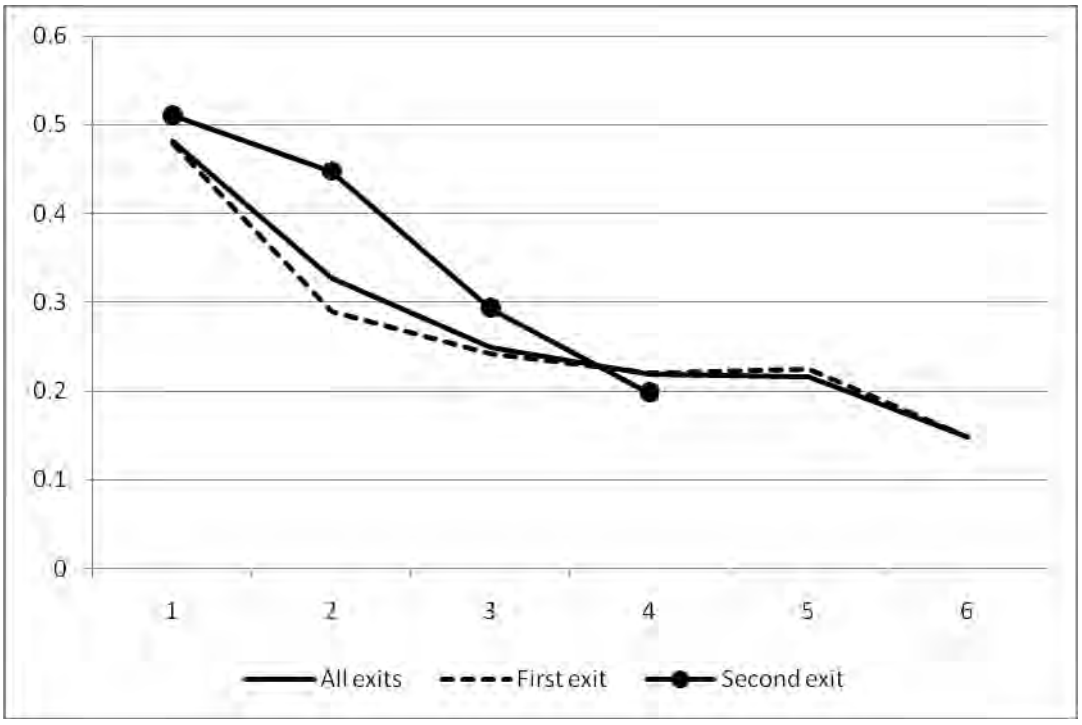

Figure 3. Life-Table Hazard rates as duration evolves, by spell order.
ECHP 1994-2001.

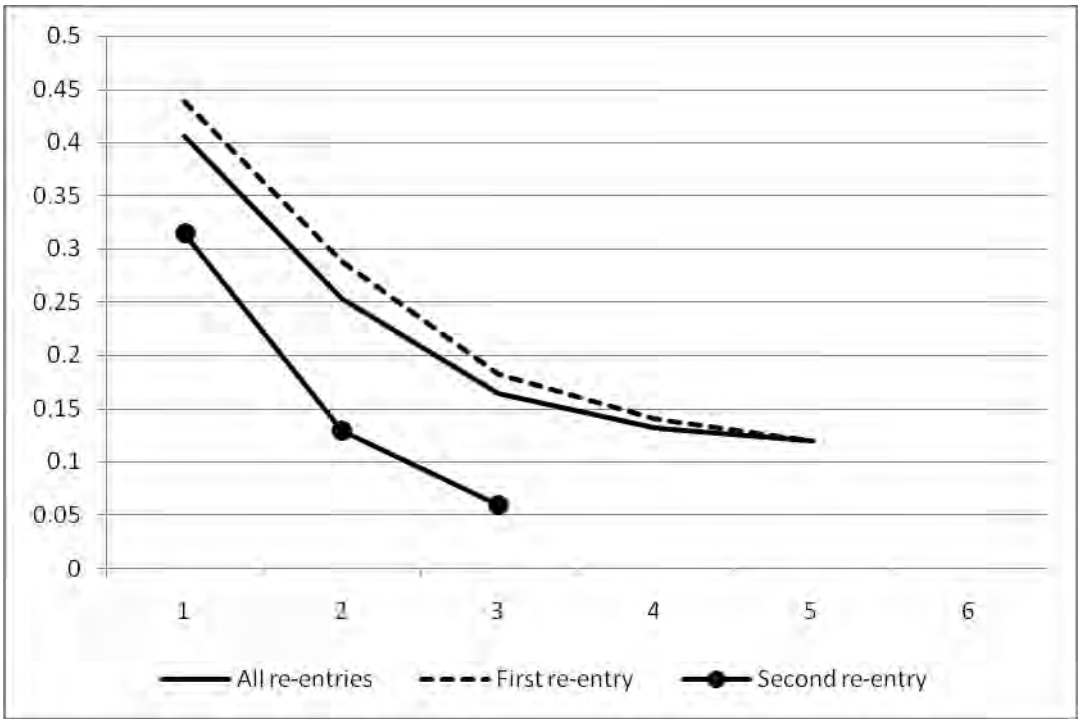

Figure 4. The shape of the predicted hazard rate for poverty and non poverty exits (after controlling for initial conditions, observed and unobserved heterogeneity) at the mean of covariates.
ECHP 1994-2001.