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Measuring the effect of spell recurrence on poverty dynamics—evidence from Spain

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Abstract Accounting for the time individuals spend below the poverty line is an important dimension in order to design social policies to fight against poverty. The literature is currently aiming to construct a consistent aggregate measure of poverty over time that takes into account individual income lifetime profiles. It is however, far from clear which aspects of the specific patterns of poverty spells should be included. Using longitudinal data for Spain, this paper shows that the effect of spell recurrence on poverty dynamics is relevant. Poverty exit and re-entry rates vary not only with personal or household characteristics but also with spell accumulation and the duration of current and past spells. In general, our main findings support that an aggregate intertemporal poverty index should incorporate full individual poverty lifetime trajectories accounting for both poverty and non-poverty spell durations.

Keywords Poverty dynamics · Multiple spells · Recurrence

JEL Classification C41 · D31 · I32

1 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

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individuals spend below the poverty line in the measurement of poverty in order to design social policies to fight against *persistent*and/or *transitory* poverty.

Researchers have used different methods to capture poverty dynamics. In fact, the first approaches to considering the time dimension in poverty measurement such as Bane and Ellwood [4] were centred in analyzing poverty transitions and the duration of poverty spells (throughout this paper, we will consider a poverty spell as the set of consecutive periods during which income falls below the poverty line). All these contributions put forward the importance of flows into and out of poverty and the significant heterogeneity in the poverty dynamics pattern of different populations. More recently, there is an increasing research interest in constructing a consistent aggregate measure of intertemporal poverty taking into account individual income profiles along time. However, there are various challenges in developing an indicator with an axiomatic characterization that adequately incorporates a complete temporal perspective. In particular, those related to the specific pattern of poverty spells in time, i.e. their distribution over time, are not straightforward.

The proposals in the literature aiming to construct a desirable indicator can be classified into two main approaches, the *components approach* and the *spells approach*—see Gradín et al. [15]. As these authors expose "…the first of these approaches contributes to underline the relevance of permanent income in poverty analysis and is strongly related to the possibility of compensating low and high income periods". In contrast, the spells approach can incorporate duration as a poverty dimension while considering incidence in the aggregate poverty indicator. Recent contributions to the literature within the spells approach have proposed aggregate intertemporal poverty measures that allow for considering poverty intensity and how poverty spells are distributed over the lifetime. As Bossert et al. [8] underline, the concatenation of poverty periods may aggravate poverty and as Hoy et al. [22] discuss, lifetime poverty is influenced by the distribution of spells in time (see their contributions in this special issue). The relevance of taking into account the spell distribution over time in the measurement of dynamics was underlined by one of the key findings of the OECD [28] employment outlook. In their words: "…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). Similarly, Gardiner and Hills [14] pointed out that the income mobility process is not random and that low-income escapers are more likely to become poor again than those who were never poor.

Clearly, predicted exit and re-entry hazards should incorporate the information on both the duration and the accumulation of spells. Surprisingly, recurrence is virtually unexplored in the empirical 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, in demography for the timing of subsequent births over the life cycle, see Heckman et al. [21], Heckman and Walker [20], or in marketing to measure the probability of buying products in the future, see Jain and Vilcassim [24] and Vilcassim and Jain [36], or in the analysis of recurrent unemployment in labour economics, see Heckman and Borjas [18], Bonnal et al. [7], Omori [30], Roed et al. [32] or Arranz and Muro [3]. Considering the effect of recurrence on the probability of leaving or entering poverty is at the core of our approach.

Our paper contributes to the literature on poverty dynamics showing the empirical relevance of considering the distribution of individual spells over time in the

measurement of poverty dynamics. Poverty exit and re-entry rates vary not only with personal or household characteristics but also with spell accumulation and the duration of current and past spells. In fact, we advocate that individual past poverty experiences interrupted by non-poverty periods can also be relevant in determining future poverty transitions.

Our methodology falls within the previously described spells approach to poverty dynamics and tries to disentangle the impact of three sources of poverty persistence: unobserved time-invariant characteristics, state dependence and spell recurrence. In particular, we estimate a mixed proportional hazard model with multiple states and multiple spells (in line with event history analysis) and 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. Our empirical results show that past poverty (non-poverty) spells' duration is relevant in determining the current exit (re-entry) hazard. Further, spell order matters and there are differences in poverty exit and re-entry probabilities between those individuals experiencing a first spell and those experiencing a second one. This underlines that policymakers should be particularly aware of the weight of recurrent transitory poverty in total poverty given that individuals who did not experience any previous poverty spell have significantly higher chances to leave poverty in comparison with those that already had a poverty spell. Note, however, that one must interpret our results cautiously given that we face a trade off in the generality of the treatment of unobserved heterogeneity and the number of equations currently included in the model. We assume that the effect of unobserved heterogeneity is constant over time for all individuals and exogenous to the process of a transition into or out of poverty. In general, we claim that more research is needed in the future in order to check if our results on left-censored spells and on the effect of lagged poverty duration on poverty transitions for Spain can be generalized to other countries.

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

2 The different approaches to estimating the probability of leaving poverty

The development of new statistical techniques in the estimation of transition probabilities, as Aassve et al. [1] note in their literature review, has produced a variety of ways to estimate transition risks in recent times.[1] Following the work of Lillard and Willis [27] 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 over

[1]See Cappellari and Jenkins [10] for an excellent review of the various approaches to measuring poverty outflow rates in the literature.

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 [33] and Devicienti [12] 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 [10] 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)[3] nor within the effectively observed at second interview (attrition problem). Similarly, recent proposals by Wooldridge [37] or Stewart [34] 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, and on an individual-specific effect and where initial conditions are endogenous.[4]

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 [13] underline, the magnitude of the duration dependence coefficient casts some doubts on the appropriateness of the first-order Markov assumption. 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 [26] and Allison [2], 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.[5]

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 [33] and then used by Devicienti [12], Hansen and Wahlberg [16] and Biewen [5]. 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, drop virtually,

[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 the individual's preferences or set of opportunities.

[3] Individuals observed at first interview in a survey on incomes have different probabilities to be counted within the poor depending on their demographic and socioeconomic characteristics. If this is not taken into account when measuring the probability of poverty persistence, results will be biased.

[4] An outstanding example of recent research linking current poverty and poverty state dependence, while controlling for serial correlation in the errors, is Bigsten and Shimeles [6] for Ethiopian data.

[5] A very relevant contribution to the easy estimation of hazard rates as an n-Markov chain by using a simple logit model was Jenkins [25].

the recurrence of poverty spells is assumed not to affect the estimated probability of transition. In this paper, 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 a longitudinal sample of Spanish individuals from 1994 to 2000.

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 includes information on individuals during eight consecutive years and was designed in order to obtain country-comparable statistics on many demographic and socioeconomic characteristics of the European population related to labour market issues, income, living standards, education, employment, 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 contemporaneous. As a result, the information on incomes for 1993 (declared in 1994) and on characteristics for 2001 is dropped, yielding 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.[6]

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.[7] As noted earlier, our sample is slightly reduced when we match demographic and socioeconomic characteristics with yearly income in time. Thus, it includes 19,129 individuals of which 15,096 (79%) are adults and 4,033 (21%) are children below 16 years of age (see Table 11 in the Appendix).[8]

For the purposes of our research, we use the standard European or EU definition of poverty, thus an individual is poor if total household income of the household she

[6]See Debels and Vandecasteele [11] for a discussion of the empirical relevance of ignoring this time lag in analysing poverty dynamics in the European Union.

[7]We eliminate between 1 and 2% of individuals due to the lack of complete interview—see Table 10 in the Appendix.

[8]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 is around 9–14% smaller than a non-contemporaneous sample, depending on the year—see Table 11 in the Appendix.

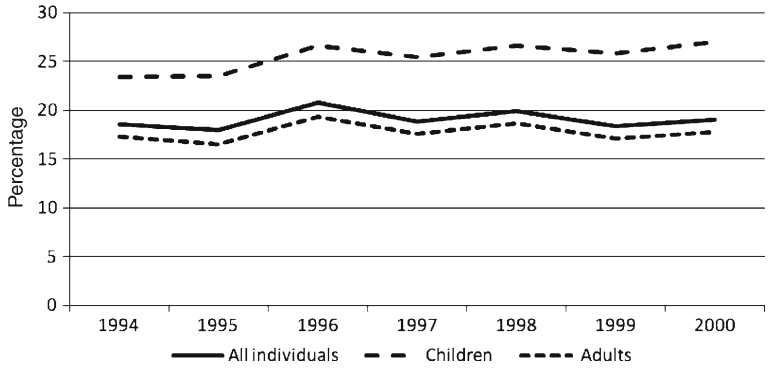

Fig. 1 Relative individual poverty incidence in Spain: headcount index (H). ECHP 1994–2001

lives in is less than 60% of the contemporary household median equivalent income.[9] The results on static poverty for this sample are reported in Fig. 1 and show that cross-sectional poverty rates in Spain were quite stable during the period under study.

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 some interesting statistics on poverty duration in various European countries. Results are in line with those obtained by Valletta [35], OECD [29] and, more recently, by Cantó et al. [9] and show that Spain registers a relatively low percentage of individuals that experience large poverty durations compared to other EU countries with similar levels of cross-sectional poverty. In contrast, Spain stands out as a country with a large percentage of individuals in short-term poverty: 44% of individuals are poor at least once in a 7-year period; among the Spanish short-term poor, there is a relevant group of individuals (13.4% of the sample) that experience poverty only 1 year during the period of observation. This percentage, together with that of Denmark, is the largest of all countries. However, if we divide the short-term poor in two groups, attending to the number of spells during the observation period, we can easily observe that an important part of short-term poverty in Spain is of a *recurrent* nature, given that more than 40% of individuals who are transitory poor, register two or more poverty spells.[10] This is the highest percentage of the six countries analysed.

In a preliminary descriptive analysis of the sample we use an unbalanced panel of individuals present in the survey in 1994.[11] 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. 2-year poverty persistence. For the entire period, these results show that there is substantial poverty persistence in Spain: 48.4% of individuals who

[9]The equivalence scale used is the modified OECD scale.

[10]A spell is defined as a continuous situation of poverty during one or various year periods as in Bane and Ellwood [4]. Results in OECD [28] and Cantó et al. [9] for Spain indicate that the high poverty recurrence obtained for this country is mainly driven by the recurrence observed for individuals living in a household whose head is between 18 and 65 years of age, i.e. working-age.

[11]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 of observation.

Table 1 Poverty dynamics in various EU countries

Country	Sample	Mean poverty headcount	One poverty experience, at most	Always poor	Poor at least once	Poor at least once	
						One poverty spell	Two or more poverty spells
Germany	9,830	10.7	11.8	1.9	28.0	73.2	26.8
Denmark	3,019	10.4	13.7	1.0	28.7	77.0	23.0
Spain	9,595	18.8	13.4	2.7	43.9	58.4	41.6
France	9,225	15.0	11.6	2.7	32.5	68.6	31.4
Portugal	9,305	20.5	11.6	5.6	44.0	68.5	31.5
United Kingdom	7,116	17.4	11.4	2.8	36.1	70.8	29.2

These results are obtained using the information on household income in the European Community Household Panel (ECHP) 1994–2000 for individuals in the panel all eight interviews (in Spain, for instance, these are 9,595 individuals out of the 13,251 effectively observed in 2000). Income is converted in equivalent income using a modified OECD equivalence scale and the income information is contemporary to household characteristics. The poverty line is fixed at a 60% median equivalent household income. Individuals are weighted by their household's population weight each particular year. Headcount poverty rates shown here are the mean of those obtained for the period 1994–2000 for each of the countries considered. All dynamic results use longitudinal weights in order to avoid attrition bias

were poor in 1994 continue to be in poverty in 1995. In subsequent waves, this conditional probability fluctuates only slightly, from 51.9% in 1997 to 59.8% 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.[12] 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.

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 observed in poverty at first interview (in 1994). This new subsample is an unbalanced panel of 3,398 observations.[13] 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

[12] Our results match those obtained for the period 1994–1996 by the OECD [28] 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%).

[13] In this sample we try to avoid a form of sample selection bias referred to by Stevens [33] and Iceland [23] when dropping left-censored spells. Ignoring the existence of left-censored spells is common practice in poverty dynamics analysis. However, Stevens [33] 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 result in higher transition probabilities than considering the entire population because those who begin a spell have already experienced at least one transition since the start observation window.

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

These results are obtained using the information on household equivalent income in the European Community Household Panel (ECHP) 1994–2000 using a modified OECD equivalence scale. All calculations of the headcount index consider individuals weighted by their population weight each particular year. The sample here is that of all individuals present in 1994 and in consecutive interviews in the ECHP panel until the survey ends or the individual leaves the survey (attrition). Note that $y_t = 1$ if the individual is poor at time t and 0 if the individual is non-poor, "*mis*" means that attrition occurred

exit rate (from 35.0 to 28.8%), 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.[14] Obviously, second, third or subsequent spells are never left-censored.

[14]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.

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

See notes Table 2

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% have two occurrences along the complete time of observation and 6.0% have three or more occurrences. This implies that 36.8% of the individuals in the sample re-enter poverty during the 7-year period and, out of these, 20% actually re-enter twice or three times.

Indeed, Table 5 shows that 47.7% of first poverty spells have an elapsed duration of 1 year and this percentage increases up to 54% if we are in a second occurrence

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

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	
	Freq	%	Freq	%	Freq	%
1	1,620	47.68	1,020	45.68	676	54.08
2	596	17.54	453	20.29	281	22.48
3	380	11.18	239	10.70	157	12.56
4	204	6.00	169	7.57	100	8.00
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
Mean (Std. dev.)	2.50 (1.96)		2.36 (1.67)		1.83 (1.10)	

Elapsed duration	Second non-poverty spell		Third poverty spell		Third non-poverty spell	
	Freq	%	Freq	%	Freq	%
1	394	53.24	163	76.89	45	77.59
2	168	22.70	40	18.87	13	22.41
3	122	16.49	9	4.25	–	–
4	56	7.57	–	–	–	–
5	–	–	–	–	–	–
6	–	–	–	–	–	–
7	–	–	–	–	–	–
Total individuals	740	100	212	100	58	100
Mean (Std. dev.)	1.78 (0.89)		1.27 (0.53)		1.22 (0.42)	

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	4,869	1,753	715	61.14	38.86	0.73	48.23	1.12
2	3	2,401	636	281	43.94	56.06	0.78	32.74	1.28
3	4	1,484	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	3,031	935	524	66.23	33.77	0.9	40.63	1.3
2	3	1,572	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	–	–

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	–	–

See note in Table 6

and to 76.9% 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 both to exit and to re-enter poverty shortly after, thus experiencing 1- or 2-year spells all 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).[15]

[15]Note, however that this last result is affected by the 7-year interview limit imposed by the structure of the dataset.

3.3 Life-table estimates of transition rates

Tables 6 and 7 and Figs. 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 Fig. 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 3 years of spell evolution while the exit hazard rate experiences a rapid decline during the first 3 years even if it is fairly constant from then onwards.

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 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.

In fact, for first poverty spells we can see that hazard rates decline rapidly during the first 2 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% of individuals remain poor only during 1 year, 45.7% 2 years, 35.8% at least 3 years and just about 20% 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

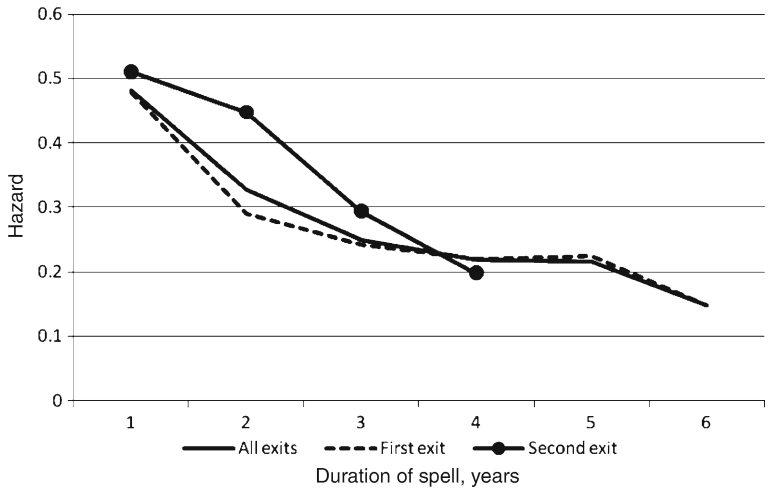

Fig. 2 Life-table hazard rates as duration evolves. ECHP 1994–2001

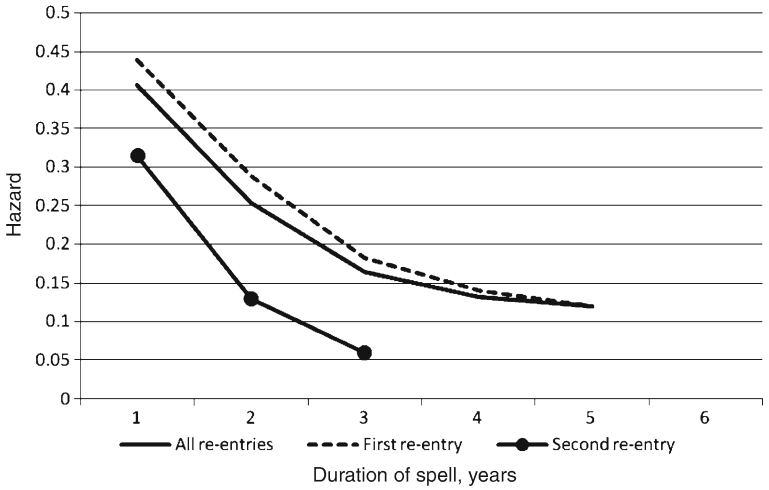

Fig. 3 Life-table hazard rates as duration evolves, by spell order. ECHP 1994–2001

than in the first one. Interestingly this difference increases up to a 15% during the second year of poverty spell duration. Therefore, we find evidence that individuals remain a relatively shorter time in poverty if they have managed to leave deprivation for some time 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 favour of reducing the probability of coming back to poverty.

4 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.[16] In general, the hazard rate of exits from poverty into non-poverty may be defined as:

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

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.

[16] See Allison [2] and Jenkins [25] for a survey.

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

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

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:[17]

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

Given that we are interested in incorporating multiple spells of both poverty and non-poverty in 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:[18]

$$\begin{aligned}
\mathrm{L_i} = & \left\{ \prod_{\mathrm{s}=1}^{\mathrm{T_{p1}}} \left(1 - \mathrm{h_{p1}}\left(s\right)\right) \right\}^{(1-\mathrm{d_{1i}})} \\
& \times \left\{ \left[\mathrm{h_{p1}}\left(T_{p1}\right) \prod_{\mathrm{s}=1}^{\mathrm{T_{p1}}-1} \left(1 - \mathrm{h_{p1}}\left(s\right)\right) \right] \left[\prod_{s=1}^{T_{r1}} \left(1 - h_{r1}\left(s\right)\right) \right] \right\}^{\mathrm{d_{1i}}(1-\mathrm{d_{2i}})} \\
& \times \left\{ \left[\mathrm{h_{p1}}\left(T_{p1}\right) \prod_{\mathrm{s}=1}^{\mathrm{T_{p1}}-1} \left(1 - \mathrm{h_{p1}}\left(s\right)\right) \right] \left[h_{r1}\left(T_{r1}\right) \prod_{s=1}^{T_{r1}-1} \left(1 - h_{r1}\left(s\right)\right) \right] \right\}^{\mathrm{d_{1i}d_{2i}}} \\
& \times \left\{ \left[\mathrm{h_{r1}}\left(T_{r1}\right) \prod_{\mathrm{s}=1}^{\mathrm{T_{r1}}-1} \left(1 - \mathrm{h_{r1}}\left(s\right)\right) \right] \left[\prod_{s=1}^{T_{p2}} \left(1 - h_{p2}\left(s\right)\right) \right] \right\}^{\mathrm{d_{2i}}(1-\mathrm{d_{3i}})} \\
& \times \left\{ \left[\mathrm{h_{r1}}\left(T_{r1}\right) \prod_{\mathrm{s}=1}^{\mathrm{T_{r1}}-1} \left(1 - \mathrm{h_{r1}}\left(s\right)\right) \right] \left[h_{p2}\left(T_{p2}\right) \prod_{s=1}^{T_{p2}-1} \left(1 - h_{p2}\left(s\right)\right) \right] \right\}^{\mathrm{d_{2i}d_{3i}}}
\end{aligned}$$

[17] 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: $\Pr\left[\mathrm{T_{ri}} = \mathrm{t}\right] = \mathrm{h_r}\left(T_{ri}, X_{ri}\left(T_{ri}\right)\right) \prod_{\mathrm{s}=1}^{\mathrm{T_{ri}}-1} \left[1 - \mathrm{h}\left(\mathrm{s}, \mathrm{X_{ri}}\left(s\right)\right)\right]$ and the contribution to the likelihood of non-poverty spells that continue to proceed at the end of the sample is $\Pr\left[\mathrm{T_{ri}} > \mathrm{t}\right] = \prod_{\mathrm{s}=1}^{\mathrm{T_{ri}}} \left[1 - \mathrm{h}\left(\mathrm{s}, \mathrm{X_{ri}}\left(s\right)\right)\right]$

[18] 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.

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

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

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

The first component in Eq. 4 captures the likelihood that the individual during her first poverty period remains in poverty throughout 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 for the remainder of the study (second component) or re-enter poverty again registering a second poverty experience (third 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 [5] given that our results from life-tables confirm the adequateness of this particular form of duration dependence. As usual, we consider unobserved heterogeneity (UH) in our empirical model because there may be unobserved individual characteristics that may affect the poverty and non-poverty hazards but are unobservable in the data, such as acquired skills, attitudes, motivation, inherent ability, and so on. We assume that the UH effect is constant over time, independent of the observed characteristics and not determined by the outcome of the poverty and non-poverty processes.[19]

Instead of assuming that unobserved heterogeneity is normally distributed,[20] we relax this assumption using a discrete distribution function with unknown finite support points (see Heckman and Singer [19], for details) with locations and probabilities. Therefore, the likelihood function for individual i is obtained by integrating the following conditional likelihood distribution:

$$L_i\left(\beta,\theta,\gamma,\pi\right) = \prod_{s=1}^{S} L\left(\beta,\gamma|\theta=s\right)\pi\left(s\right) \quad (5)$$

[19] In our estimation, however, the main limitation to control for UH in a more flexible way is the trade off we face in the generality of the treatment of unobserved heterogeneity and the number of equations currently included in the model.

[20] Another procedure would be to specify a parametric distribution for the unobserved heterogeneity such as a normal, gamma distribution, etc. This approach has been criticised by Heckman and Singer [19], because the unobserved heterogeneity distribution is unknown. They show that the estimated coefficients might be biased when the chosen distribution is incorrect, and try to avoid this problem by assuming that unobserved heterogeneity is discretely distributed with unknown support points.

where θ are the location points, π the probability associated to them, and s the number of support points.[21]

Our main interest in the regressions is to isolate the effect of true state dependence and the effect of having had 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.[22] 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 presence of working-age females and head's unemployment spells in the last 5 years. One may argue that these are not ideal instruments given that only one of these variables includes some pre-sample information. Unfortunately, the ECHP dataset does not provide us with any other better options.

5 Estimation results on poverty exits and re-entries

5.1 Estimation results on poverty exits and re-entries including left-censored spells

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.

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.[23] 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.

Unobserved heterogeneity is controlled for by the non-parametric procedure described in the previous section. We have checked that two support points are

[21]The maximum number of support points can be determined using an iterative approach. First, we fit the model with a given number of locations, s = 2 for instance. Keeping all the parameters equal to the resulting maximum likelihood estimates, we include another point with a small probability and evaluate the likelihood for a number of different locations for this point. If the likelihood increases for any of these locations, we have evidence that this point is required.

[22]We will mostly use as covariates a group of variables that capture the household situation. This strategy is adequate in the context of EU countries where, as reported by the European Foundation for the Improvement of Living Conditions (see [31]), 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.

[23]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 were not kept in the specifications reported here.

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.	Sign.	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.
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	***

Table 8 (continued)

Variables	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)		
	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.
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	−8,902.4443											

*** Indicates significance at 1%; ** indicates significance at 5%; * indicates significance at 10%

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

sufficient to approximate the unobserved heterogeneity term. This means that exit poverty and re-entry hazard rates are affected not only by the measured individual, household characteristics and previous poverty and non-poverty duration of individuals but also by their unmeasured characteristics.

In order to check if the number of mass points found is robust, we have used three alternative information criteria: Akaike information criterion (AIC), Hannan–Quinn information criterion (HIQ) and Schwarz information criterion (SIC). Table 12 in the Appendix reports the values of all these criteria. The preferred model is the one yielding the lowest IC value. All information criteria lead to the same conclusion: accounting for individual unobserved heterogeneity by distinguishing two mass points improves the fit of the model.[24] The inclusion of an additional support point results in two points being clustered and empirically indistinguishable, and therefore the likelihood function does not improve.

Figure 4 plots the shape of the hazard rate for different spell durations at the mean of all other covariates.[25] 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 a more relevant role in protecting the vulnerable than in promoting the poor. 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 just one child have a significantly lower probability of re-entering poverty once they managed to step out of it.

[24] Alternatively, a simple likelihood ratio test confirms that unobserved heterogeneity is significant. The value of the likelihood ratio test statistic of a model with and without heterogeneity is 36.784. This value exceeds the critical chi-square value of 5.99 for 2 degrees of freedom at the significance level of 5% and, thus, the unobserved heterogeneity component should be included in the model specification.

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

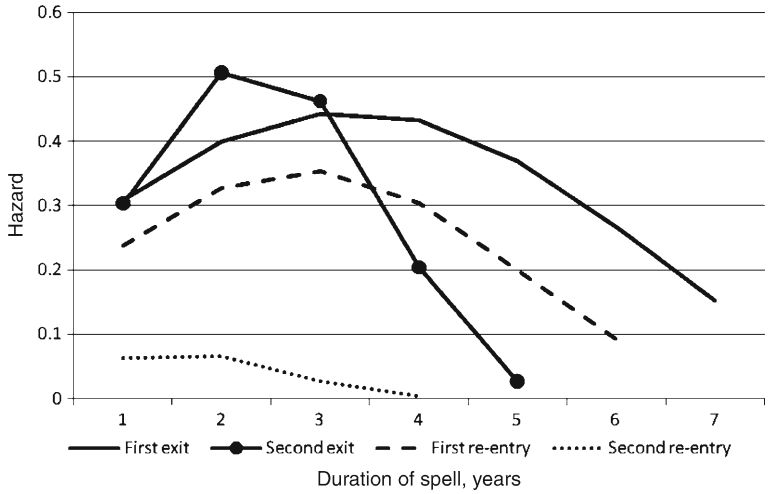

Fig. 4 The shape of the predicted hazard rate for poverty and non poverty exits (after controlling for initial conditions, observed and unobserved heterogeneity) at the mean of covariates. ECHP 1994–2001

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, individuals below 30 years of age show a higher probability of leaving poverty only in first poverty spells, compared with those in their thirties or forties. In contrast, for those in their second poverty spell, the age of the household head 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.

5.2 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 to 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 (7 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 [17].[26]

[26]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.

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.	Sign.	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.
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	**

Table 9 (continued)

Variables	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)		
	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.	Coef.	Std. err.	Sign.
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	2,075			2,281			786			389		
Log-likelihood	−2,835.1848											

*** Indicates significance at 1%; ** indicates significance at 5%; * indicates significance at 10%

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

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 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.

6 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 3 years. In the particular case of second poverty spells results show a strong positive duration dependence during the first 2 years of duration, which becomes largely negative thereafter. These results indicate that policymakers in Spain should be particularly aware of the large weight of recurrent transitory poverty in this country. Also, it is important to note the significantly higher chances to leave poverty of those individuals who did not experience any previous poverty spell in comparison with those that already had one. Short-term labour market policies promoting employment stability (as long as the wage level allows individuals to avoid poverty and that employment stability does not reduce the poverty exit rate by promoting *persistent* in-work poverty) together with short-period monetary transfers to avoid a first fall into poverty, appear to be particularly adequate interventions in Spain to reduce poverty incidence.

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. Households that are worst off, are couples with three or more children. They 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 just one child have a significantly lower probability of re-entering poverty once they have managed to step out of it.

In any case, we claim that more research is needed in order to check if our results on left-censored spells and on the effect of lagged poverty duration on poverty transitions for Spain can be generalized to other countries. Also, it would be interesting to know if they still hold in the case that individual unobserved heterogeneity is not assumed to be constant over time and exogenous to the process of a transition into or out of poverty. Indeed, some of our results may depend on our particular data given that Spain is a country with a relatively large percentage of short-term poor households in the population relative to European countries.

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Appendix

Table 10 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

Table 10 (continued)

	1994	1995	1996	1997	1998	1999	2000	2001
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 11 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)

Table 12 Specification tests for the number of mass points (unobserved heterogeneity)

	All
Information Criteria (IC)	
AIC	
No mass points	1.036
Two mass points	1.034
SIC	
No mass points	1.046
Two mass points	1.044
HIQ	
No mass points	1.033
Two mass points	1.030
Likelihood ratio (LR)	36.784

AIC is Akaike information criterion $= \frac{-2(l+2\cdot K)}{N}$; SIC is Schwarz information criterion $= \frac{-2(l+\cdot K\cdot \log(N))}{N}$; HIQ is Hannan–Quinn information criterion $= \frac{-2(l+2\cdot K\cdot \log(\log(N))}{N}$
l is the value of the log of the likelihood function with the K parameters estimated using N observations

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