MODELLING ATTRITION IN THE EUROPEAN COMMUNITY HOUSEHOLD PANEL: THE EFFECTIVENESS OF WEIGHTING

Leen Vandecasteele

Catholic University Leuven
Department of Sociology
E. Van Evenstraat 2B
3000 Leuven
Tel. 0032 16 32 31 76
Leen.Vandecasteele@soc.kuleuven.ac.be

Annelies Debels

Catholic University Leuven
Department of Sociology
E. Van Evenstraat 2B
3000 Leuven
Tel. 0032 16 32 31 76
Annelies.debels@soc.kuleuven.ac.be

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ABSTRACT

The European Community Household Panel is a rich source of information about living standards and living circumstances in the European Union, but just like other panel studies, it suffers from substantial attrition among participants. This attrition can lead to biased results if it does not happen at random. Weighting can overcome these problems, on condition that data are missing at random within the categories of the variables used for weighting. This paper tries to assess the effectiveness of weighting in the ECHP, by testing the effect of poverty on dropout propensity, under control of the variables used for weighting. The analyses are conducted with data of the first seven waves for eleven countries in the ECHP.

After describing initial nonresponse, different patterns of participation and indvidual versus household nonresponse; we focus on the effect of poverty on attrition. Therefore, the effect of poverty on dropout is investigated by means of a logistic regression model as well as a time-discrete logistic hazard model. In line with previous research, we find poor people dropping out significantly more than nonpoor people in the northern countries, while this effect is reversed (though not always significant) in the southern countries and in Ireland. Next, this paper tests whether dropout is random within the categories of the variables used in the ECHP-weighting procedure. This is accomplished by examining if the effect of poverty on dropout continues to exist under the control of relevant weighting covariates, using both ordinary logistic regressions and discrete-time logistic hazard models. The effect of poverty on dropout disappears in some countries, but remains highly significant in others. Hence we conclude that the correction for non-random attrition, obtained by weighting, tends to work out differently between countries.

KEY WORDS

Attrition / dropout / poverty / weighting / ECHP

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1. Introduction

The unique design of panel studies offers a wide and appealing range of opportunities to social scientists. In particular, panel data allow researchers to analyse change on the micro-level, to investigate dynamic behaviour and transitions over time, and to estimate the effect of events over the life course. However, panel studies also tend to have some drawbacks, which can lead to bias in the results if neglected. The main problem in this respect is the attrition or dropout of observation units throughout the subsequent waves of a panel study. The consequences of this attrition are twofold (Engel & Reinecke, 1996; Rose, 2000). First, it can strongly decrease the sample size, thereby diminishing the efficiency of the estimates. Second, it can lead to biased estimates whenever cases are not dropping out randomly from the original sample.

This paper examines the extent of the problem of non-random attrition in the European Community Household Panel (ECHP). Although the ECHP offers a wide range of variables relating to many different topics, we focus on one variable, namely income poverty. This variable has proved to be a key variable throughout multiple empirical researches conducted on the basis of the ECHP and similar datasets. Therefore, it is imperative to investigate whether the attrition patterns of poor people differ systematically from those of the non-poor.

In addition, this paper tests to what extent problems of non-random attrition with respect to poverty can be solved by using the weights provided in the ECHP User Database as a correction mechanism. The ECHP provides longitudinal as well as cross-sectional weights. These weights attempt to correct not only for unequal selection probabilities, but also for differing dropout probabilities. It is argued that weighting will only be effective with respect to the problem of non-random dropout when the data are missing at random within the categories of the variables used for weighting. Applied to our variable of interest, this means that the effect of income poverty on dropout

probability should be cancelled when controlling for the variables that are used for creating longitudinal weights in the ECHP. Conversely, if this effect continues to exist, longitudinal weighting is not a satisfactory solution to the problem of non-random dropout and these weights should not solely be relied on.

The paper is structured as follows. The first section surveys the results of previous research concerning non-random dropout in socio-economic panel studies. Next, the methodological rationale behind this paper is documented in a discussion of different dropout mechanisms. The following section deals with design details of the ECHP, in particular its construction of weights, and with the definition and operationalization of the main concepts in this study. The final section breaks up in a descriptive and an inferential part. The former contains descriptive statistics with respect to different types of unit-nonresponse in the ECHP. In the latter the effect of poverty on dropout is modelled univariately as well as multivariately under the control of variables used in the ECHP weighting procedure.

2. Selective dropout in panel studies: previous findings

With a view to assessing the impact of panel dropout, previous research has revealed various predictors of panel nonresponse and panel dropout in socio-economic and/or household panels. In this section, we will focus on such research that was conducted on the European Community Household Panel (ECHP), as well as on its American equivalent, the Panel Study of Income Dynamics (PSID).

Researchers investigating the covariates of dropout patterns within the PSID generally find indications of selective attrition processes. In particular, attriters tend to be less educated, older and less frequently married than non-attriters (Fitzgerald, Gottschalk & Moffit, 1998; Lillard & Panis, 1998; Zabel, 1998). Furthermore, divorced and separated people display lower propensities to stay in the PSID (Fitzgerald, Gottschalk & Moffit, 1998; Zabel, 1998). Finally, families with fewer children and with lower household incomes, as well as people not owning a dwelling are more likely to attrite (Fitzgerald, Gottschalk & Moffit, 1998; Zabel, 1998).

Similar determinants of attrition have been detected with respect to the ECHP. Watson (2003) and Nicoletti & Peracchi (2002) show that attrition rates are higher for young adults and older people. Similarly, Behr, Bellgardt & Rendtel (2002) find that young people are less likely to respond. Renting a dwelling as well as moving have a negative impact on response probabilities (Watson, 2003; Peracchi & Nicoletti, 2002), but the latter effect is not consistent between different countries (Behr, Bellgardt & Rendtel, 2002). Generally, the response rate of married people is higher than that of other marital statusgroups (Watson, 2003; Behr, Bellgardt & Rendtel, 2002). Furthermore, households with children are less likely to drop out (Watson, 2003). According to Nicoletti & Peracchi (2002) this effect is mainly explained by the larger probability of contact success for this group.

In addition, several studies have demonstrated that the higher educated tend to have higher participation rates (De Keulenaer, 2003; Behr, Bellgardt & Rendtel, 2002; Nicoletti & Peracchi, 2002). Watson (2003) has further investigated the effect of edcucation and has found that it works out differently between countries. In Northern European countries, higher educated people are indeed less likely to be lost, but the effect is reversed in Southern European countries, where higher educated people are more likely to drop out. A similar interaction effect has been established with respect to income and country. In Southern European countries and Ireland, there is a higher attrition ratio for high incomes, whereas in Northern European countries, individuals on the bottom of the income distribution are more likely to drop out (Watson, 2003; Behr, Bellgardt & Rendtel, 2002; Behr, Bellgardt & Rendtel, 2003a). Consequently, the poverty line is underestimated in Southern European countries and Ireland, while it is overestimated in the Northern European countries (Rendtel, Behr & Sisto, 2003).

Finally, research has also identified the importance of panel design and previous panel experiences in explaining dropout. In particular, response probabilities decrease when the interviewer is not the same across the waves (Nicoletti & Peracchi, 2002; Behr, Bellgardt & Rendtel, 2002). Moreover, individuals not completing their interview in the first wave are more prone to attrite, and so are persons with missing values on crucial variables (e.g. income, tenure status…) in previous waves (Watson, 2003).

Although evidence abounds that panel attrition is selective along important social characteristics, most studies conclude that this is not necessarily problematic for a correct estimation of statistics. For the PSID, Lillard & Panis (1998) have demonstrated that outcomes from analyses with household income, adult mortality, marriage formation and marriage dissolution do not change substantively if attrition is ignored. Concerning the ECHP, Watson (2003) as well as Behr, Rendtgardt & Rendtel (2003b) investigate the consequences of selective attrition for the estimation of income, poverty and inequality indicators by comparing wave one estimates for the complete sample with those for the people that never drop out. Since these estimates only differ slightly, they conclude that poverty and inequality indicators are not seriously biased by selective attrition in the ECHP.

This paper will treat the problem of selective attrition from a different angle, namely by making use of the possibilities offered by the ECHP-UDB to correct for non-random dropout by weighting the sample. In particular, it is possible that any effect of poverty on dropout ceases to exist within the categories of the weighting variables used in the ECHP weighting procedure. For example, Femke de Keulenaer (2003) has shown that for the Belgian data (PSBH), the effect of poverty on attrition probabilities disappears when controlling for socio-economic and socio-demographic covariates. This paper will test to what extent weighting in the ECHP can correct for selective attrition with respect to the poverty variable.

3. Missing values in panel analysis

In the missing-data literature different types of dropout mechanisms have been distinguished, each involving different consequences for analysis. This section discusses these mechanisms, using the terminology originally chosen by Rubin (1976) and Rubin and Little (1987).

Missing values can be the result of both item- and unit-nonresponse. Item-nonresponse occurs when values on a limited number of variables are missing for a particular observation unit. Alternatively, unit-nonresponse occurs when no values on variables were registered for an observation unit, for instance when this unit did not

participate in the survey. In longitudinal panel datasets unit-nonresponse is called dropout or attrition whenever a unit that once participated disappears from the panel for at least one wave of the panel study.

In order to determine the dropout mechanism at work, one has to examine whether one outcome variable Y has an influence on the response probability R. We also consider a set of variables X_i (e.g. age, sex, nationality…) that are not subject to nonresponse. If R is independent of Y and X_i, the missing data on the Y-variable are said to be missing-completely-at-random (MCAR). In this case, the units with missing values on Y form a random subsample of the complete sample (Little & Rubin, 1986). When the MCAR-assumption holds, we can simply pursue the analyses with the subsample of non-attriters. When missingness depends only on observed variables X_i' and not on Y (Little, 1995), the missing data on the Y-variable are called missing-at-random (MAR). In this case, R depends on X_i, and under the control of X_i there is no effect of Y on R. Hence, the subsample of units with missing values is not random with respect to Y, but within the subclasses of X_i it is. In this instance, weighting procedures and imputation techniques can be used to correct for possible bias in Y. The worst scenario occurs when the response probability R is related not only to the observed variables X_i, but also to the unobserved variable of interest Y. This missing value-mechanism is considered problematic and non-ignorable, and as correction for it is very difficult, analyses with these data tend to be biased.

If we want to examine to what extent the dropout-mechanism is influencing the data in the ECHP, we need to test which of these three assumptions holds. The variable of interest (Y) in this paper is poverty. Since we want to test whether weighting in the ECHP is appropriate, let X_i be the variables used to construct the ECHP-UDB-weights (e.g. age, sex, …[1]). Finally, R represents the probability to drop out.

Instead of using Y_t (poverty measured in wave of dropout), we will use poverty measured before the dropout of the individual (Y_{t-c}) as a predictor of the dropout probability R_t in wave t. The same applies for the set of weighting variables $X_{i(t-c)}$. There are two reasons for using lagged variables testing the above assumptions. First, it is not

[1] For more detailed coverage, see section on ECHP weights

possible to test whether poverty in the year of dropout (Y_t) influences the dropout probability, because this variable is by definition unobserved for all the units dropping out. Besides that, previous research has shown that there are reasons to believe that the dropout probability will be influenced by poverty experienced in previous waves and by the concomitant experience of having to answer income questions under these conditions (Watson, 2003; Behr, Bellgardt & Rendtel, 2002; Behr, Bellgardt & Rendtel, 2003a).

Concluding, we will first examine whether our variable of interest (poverty) is related to attrition. In a second stage, we will investigate whether the effect of poverty on dropout remains under control of the variables used in the ECHP-weighting procedure. If the effect of poverty disappears under control of the other covariates, we can conclude that the dropout-mechanism is missing at random (MAR), and weighting or imputation of the data is appropriate.

4. Data and operationalization

4.1. Dataset: European Community Household Panel

The European Community Household Panel is a standardized survey that has been submitted annually to a panel of individuals and households in different European Union member states (Eurostat, 2003a). For most countries[2], it covers the period from 1994 to 2001. Austria joined from 1995 and Finland from 1996 onwards.

In Belgium and the Netherlands, since the outset of the study the ECHP-data are derived from existing national panels, which only needed slight adaptation to fit the ECHP-format (namely the Panel Study of Belgian Households-PSBH and the Dutch Socio-Economic Panel-SEP) (Peracchi, 2000). In contrast, in Germany, Luxembourg and the United Kingdom, the ECHP has been coexisting during three years with very similar existing national panels: the German Social Economic Panel–GSOEP, Luxembourg's Social Economic Panel–PSELL and the British Household Panel Survey-BHPS. Only

[2] Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, United Kingdom

from 1997 onwards, data for these countries are derived from the national panels. However, the information in the earlier waves of the GSOEP, the PSELL and the BHPS has been harmonized to enable comparison across waves.

In the first wave (1994), a sample of approximately 60.500 households and 130.000 individuals aged 16 and over was interviewed, with the aim to represent all the individuals living in private households within the European Union of that time. The questionnaire covers a wide range of topics, including income, poverty, health, education, housing, demography, employment, etc.

Not all persons that have been interviewed are sample persons. Only the persons that are drawn from the target population in the first wave and the children born out of sample women after the first wave are considered to be sample persons. Non-sample persons are individuals that were not initially in the sample, but started living together in the same household with a sample person. Sample persons are eligible for the personal interview when they have reached the age of 16 and live in a private household in the EU. Non-sample persons living in a household with at least one sample person are eligible under the same conditions.

At the moment of this study, seven waves of the ECHP were available, from 1994 to 2000. Only countries with complete coverage of these seven waves were included in this paper: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain and the United Kingdom.

4.2. Weighting in the ECHP

In the ECHP two types of weights can be distinguished, namely base weights (for individuals) and cross-sectional weights (for individuals and households) (Eurostat, 2003b). The base weights are only available for sample persons. Non-sample persons receive a zero base weight, but a nonzero cross-sectional weight.

The base weights are constructed as follows. Every sample person receives a starting weight. This is the design weight[3] in the first wave, or the final base weight from the previous wave in every subsequent wave. This starting weight is multiplied by a factor taking into account response probabilities, calculated on the basis of a logistic regression. These weights are calibrated in order to reflect the distribution of the population. This operation results in the base weights, suitable for longitudinal analyses, which are typically confined to persons interviewed in all waves or persons living in an interviewed household in all waves.

The cross-sectional weight is computed as the average of the base weights of all the persons in a household and is assigned to all the residents in the household. It is appropriate for cross-sectional analyses.

The variables used to adjust for response probabilities are the following: age, sex, household size, number of economically active persons in the household, region, arrivals to or departures from the household, type of household, tenure status, main source of income, whether split-off household and equivalised income. Generally, researchers assume that dropout will be random after using weighting variables in their analyses.

The aim of this paper is to test this assumption, using poverty as an explanatory variable. However, we will exclude equivalised income from the weighting variables, because it is a perfect predictor of poverty.

4.3. Main concepts

Dropout or attrition has been defined as a particular type of unit-nonresponse, namely the nonresponse of complete units having participated at least once in the study, but not continuing participation until the end of the panel study. Dropout can take place both at the individual and the household level. In this paper the focus is on individual dropout, in order to be able to take into account the differences in participation within households.

[3] The design weight depends on the sample selection probability of the person or the household

Attrition occurs for different reasons. First, it is possible that a person is no longer eligible for the personal interview. This happens when the person dies or when (s)he moves out of scope of the survey, for example in the case of institutionalization, migration to a foreign country outside of the European Union, or movement of a nonsample person to a household without sample persons. Alternatively, dropout can be due to eligible persons no longer participating in the panel. In this respect, Lepkowski & Couper (2002) have developed a model of panel nonresponse, in which three causes for dropout are distinguished. First, in a panel study, problems can arise with the *location* of the respondent, especially when the respondent has moved since the last wave. When the respondent has been located, the interviewer can experience difficulties in *contacting* the person. Successful contact will strongly depend on the at-home patterns of the individuals. Finally, after locating and contacting the respondent, *cooperation* is required to complete the interview. However, individuals or households can refuse further cooperation for various reasons. Unsuccessful location, contact or cooperation are the main causes of dropout of eligible persons. Whenever these are more likely to occur to certain subgroups of the population, a problem of non-random dropout emerges.

Poverty is operationalized as a dummy variable indicating an income above or under 60% of the median income poverty line in a particular country. This poverty measure is widely used in current research with the ECHP. The income measure is defined as the total yearly net disposable household income, divided by the OECD equivalence scale in order to adjust for household size and composition. This equivalised income is then attributed to each member of the household, thus creating an individual income measure.

5. Findings

5.1. Descriptive statistics on unit-nonresponse in the ECHP

In this section a descriptive overview is provided of the most important characteristics and patterns of unit-nonresponse in the eleven countries of the ECHP dealt with in this study.

In a panel dataset, unit-nonresponse can take two forms. When it occurs in the first wave and hence relates to the initial sample, it is called initial nonresponse. Alternatively, when it refers to units not continuing participation in later waves, it is labelled dropout.

Table 1 presents initial response rates for the panels used in this study. Since the panels of Belgium, the Netherlands, Germany and the United Kingdom had already started before the onset of the ECHP in 1994, national information sources have been consulted for these countries. For the Netherlands, no precise information was available, but the initial response rate was estimated to be around 50 percent (ECHP Working Group, 1997). Together with Belgium and Ireland this is a fairly low initial response rate. However, the variance between countries appears to be rather large. The high response rates for Greece (90.1%) and Italy (90.7%) might be due to the fact that survey participation in these countries is obligatory (Peracchi, 2000).

Table 1. Initial response rate in the first wave, by country

	Initial response rate	Year	*Source*
Belgium	44,2	1992	*PSBH*
Denmark	62,4	1994	*ECHP*
France	79,5	1994	*ECHP*
Germany (West)	62,2	1983	*GSOEP*
Greece	90,1	1994	*ECHP*
Ireland	55,8	1994	*ECHP*
Italy	90,7	1994	*ECHP*
Netherlands	n.a.		
Portugal	88,9	1994	*ECHP*
Spain	67	1994	*ECHP*
United Kingdom	74	1991	*BHPS*

Sources: BHPS : Buck (2003), ECHP : Eurostat (1997),
GSOEP : Peracchi (2000), PSBH : Jacobs & Marynissen (1993)

A low initial response rate may indicate problems with the representativeness of the initial sample. However, since no information is provided in the ECHP on the units originally sampled but never participating, it is not possible to examine the biasedness of the starting samples with respect to poverty[4].

In this paper, further attention will be devoted to the other type of unit-nonresponse, namely dropout. Table 2 summarizes the occurrence of different participation patterns in each country under study for respondents participating for at least one year in the panel survey. A general distinction is made between *wave one-persons*, i.e. sample persons who actually participated in wave one, and *new entry-persons*, i.e. sample or non-sample persons who joined the panel after the first wave. Within each of these two broad categories, three types of participation patterns are distinguished: 1.) always participating, i.e. staying in the panel until the end of the observation period, 2.) monotone attrition, i.e. dropping out of the panel, but not returning to it, and 3.) variable participation, i.e. dropping out and returning to the panel at least once. For each country in table 2, the first row represents the percentage of all individuals (both wave one- and new entry-persons) displaying each pattern, whereas the second row relates to the wave one-persons only.

Considering all the individuals participating at least once, it appears from table 2 that the always-participating pattern is most frequent in every country, except in Ireland. In the latter, monotone attrition is more important, whereas this pattern occupies a second place for all other countries. The group of new entry-persons is less important, but not negligible, especially not in the Netherlands.

The share of wave-one persons staying in the panel until the last wave varies from 34% in Ireland to 71 % in United Kingdom. The countries for which ECHP-data are part of a longer-term panel study, namely the United Kingdom, Germany, Belgium and the Netherlands, generally have moderate to high participation rates. The longer duration of

[4] One exception to this is the Finnish part of the ECHP. The sample of the first wave (1996) of these data was selected from the Finnish population register, which made it possible to collect register information also for those who refused to participate in the first wave of the Finnish ECHP. From such a comparison, Rendtel, Behr & Sisto (2003) found that the initial nonresponse had a substantive effect on the distribution of income in Finland. Surprisingly, this effect tended to diminish due to subsequent dropout from the panel.

the panel possibly entails a selection effect of the respondents, in the sense that respondents not attrited yet at the start of the ECHP are the ones willing to respond.

With respect to attrition, the main pattern is monotone attrition, whereas variable participation occurs in less than 10% of the cases, except for Denmark. So if attrition occurs, it mainly comes down to monotone attrition, and return to the panel is uncommon. Therefore, in the rest of this paper, we will not focus on a possible return into the panel, but limit ourselves to the first dropout of a respondent.

Table 2. Participation patterns in the ECHP

	Wave one-persons			New entry-persons				
	Always participating	**monotone attrition**	**variable participation**	**always participating**	**monotone attrition**	**variable participation**		**n**
Belgium	45,34	33,24	5,11	9,48	6,47	0,36	100%	8018
	54,17	39,72	6,11				100%	6710
Germany	53,49	21,72	4,17	14,52	5,83	0,27	100%	15411
	67,38	27,37	5,25				100%	12233
UK	52,21	18,00	3,53	14,98	11,07	0,22	100%	12244
	70,80	24,41	4,79				100%	9028
Denmark	37,34	35,19	9,47	8,99	8,25	0,75	100%	7198
	45,54	42,91	11,55				100%	5903
Italy	50,35	26,18	5,63	12,32	5,13	0,40	100%	21580
	61,28	31,86	6,85				100%	17729
Greece	45,06	31,54	5,65	11,23	6,30	0,22	100%	15188
	54,78	38,35	6,87				100%	12492
Spain	38,94	34,91	7,80	11,39	6,55	0,40	100%	21911
	47,69	42,75	9,56				100%	17893
France	52,21	37,27	6,02	11,85	6,93	0,21	100%	15008
	54,67	39,02	6,31				100%	14333
Ireland	28,67	52,61	2,46	8,02	8,04	0,19	100%	11826
	34,24	62,82	2,94				100%	9904
Netherlands	39,19	24,89	5,82	20,66	8,86	0,58	100%	13475
	56,06	35,61	8,32				100%	9407
Portugal	52,20	19,84	5,39	16,28	5,83	0,46	100%	15008
	67,41	25,63	6,96				100%	11621

Source: ECHP UDB-Version of June 2003.

In this paper, dropout for individuals is considered. Yet, individuals are always member of a household, and we might be interested how often individual nonresponse is part of a larger household dropout. Table 3 indicates how often individual nonresponse coincides with household nonresponse, by showing the percentage of wave-one persons

without a completed household interview in the wave of their first dropout. We find this percentage varying between 60% in United Kingdom and 91% in Denmark. This confirms that individual dropout does not always imply complete dropout of the household in the same wave. As a result, focusing on individual dropout holds an advantage over looking only at household dropout.

Table 3. Personal nonresponse versus household nonresponse: percentage of persons participating in the first wave but dropping out later in the panel, without a completed household interview in the wave of their first dropout

	Number of wave-one persons dropping out	% household interview not completed for individual attriters
Belgium	3075	83,58
Denmark	3215	90,48
France	6497	86,13
Germany	3990	81,8
Greece	5649	82,49
Ireland	6513	83
Italy	6864	88,32
Netherlands	4133	70,4
Portugal	3787	72,33
Spain	9360	78,6
United Kingdom	2636	60,24

Source: ECHP UDB-Version of June 2003.

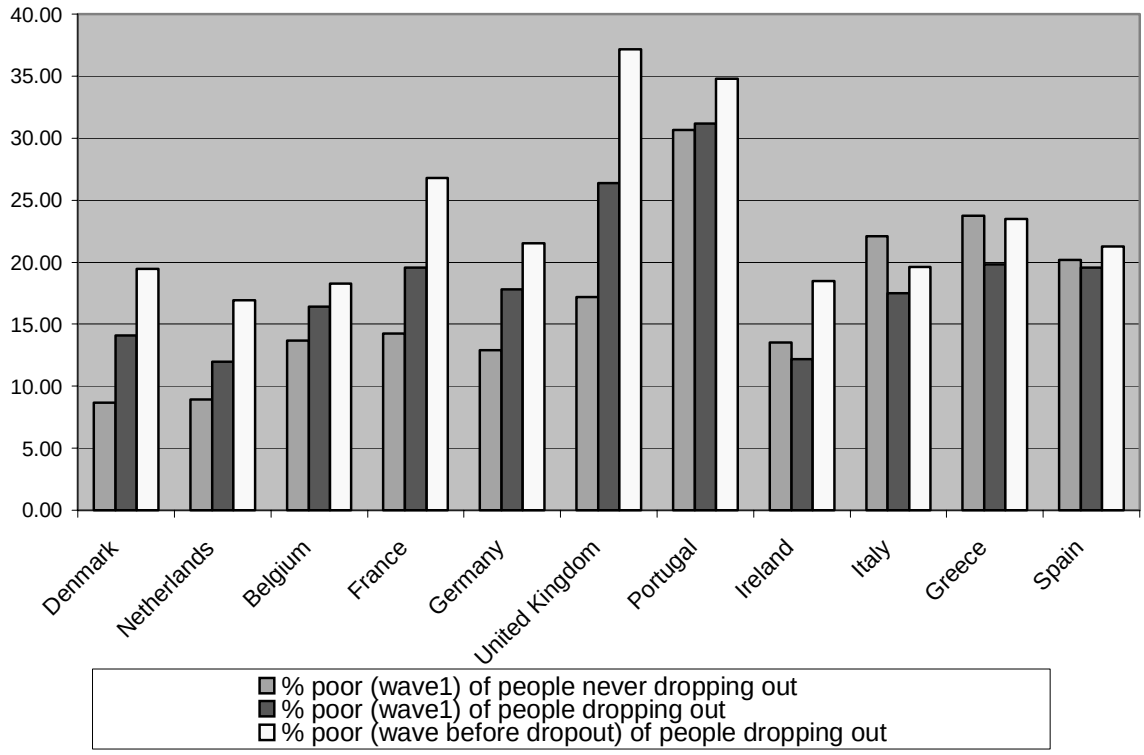
Finally, some preliminary descriptive statistics are provided with respect to the relationship between poverty and dropout in the different countries. This is illustrated in figure 1. The histogram only includes persons participating in the first wave, so people entering later in the panel are not included. For each country, three percentages are given. The first bar most to the left represents the percentage of poor people (poverty measured in the first wave) among those who stay in the panel till the end of the observation period. It can be compared with the second bar, representing the percentage of poor people (poverty measured in the first wave), among the ones dropping out later in the panel.

Two patterns can be discerned across the countries. On the one hand, in the southern European countries as well as in Ireland, there tends to be less poverty among the people dropping out than among people staying in the panel. Portugal is an exception, but there the difference between attriters and non-attriters is negligible. On the other

hand, all northern countries display the opposite pattern with higher poverty among people dropping out. Hence, our data tend to confirm previous findings in this area (Watson, 2003; Behr, Bellgardt & Rendtel, 2002; Behr, Bellgardt & Rendtel, 2003a). In the next section a logistic regression analysis will be conducted to see whether the effect of poverty on dropout is significant.

The third bar for each country in figure 1 again represents the percentage of poor people among the people dropping out. Unlike the second bar of each histogram however, poverty now is a time-dependent covariate, measured in the wave before the person drops out. The proportions of poor people among attriters tend to be higher when poverty is measured in this way. Therefore, this indicator of poverty can be assumed to be a better predictor of dropout. This explains why in the next section we also run dynamic logistic hazard models with poverty as a time-dependent predictor of dropout.

Figure 1. Histogram representing poverty percentages of different groups of first wave participants.



Source: ECHP UDB-Version of June 2003.

5.2. Regression analyses

In this section dropout is modelled as a function of poverty, both univariately and under control of the variables used for weighting in the ECHP. Four models are estimated, two of which employ static explanatory variables, referring to the first wave of the panel and two of which are dynamic hazard models, estimating the effect of poverty measured in the wave before dropout. In all four models, the dependent variable is a binary variable, indicating whether an individual does or does not drop out. Only individuals participating in the first wave are included, so new entry-persons are not taken into consideration in this section. Moreover, only the first attrition of each individual is modelled.

Table 4 shows the results of a logistic regression modelling the probability to drop out. Model 1 is a univariate model for each country, estimating the effect of poverty in the first wave on the probability to drop out. Poor people display a significantly higher chance to drop out in Belgium, Denmark, France, Germany, the Netherlands and the United Kingdom. This effect is reversed in Greece and Italy. In Ireland, Spain and Portugal no significant effect was encountered. This divide between Northern and Southern European countries supports findings of previous researchers (Watson, 2003; Behr, Bellgardt & Rendtel, 2002; Behr, Bellgardt & Rendtel, 2003a).

In model 2 the same effect is estimated under control of the variables used for weighting. These variables include age, sex, household size, number of economically active persons in the household, region, type of household, tenure status and main source of income, all measured in the first wave.[5] For countries with a significant effect of poverty on dropout, model 2 in table 4 shows whether this effect remains significant under control of the weighting variables. This appears to be the case only in four countries: Denmark, France, Germany and the Netherlands. In Belgium, Greece and Italy, the effect of poverty on dropout disappears under control of the weighting variables. For

[5] However, the variables 'arrivals to or departures from the household' and 'whether split-off household' are not included since they are not available in the first wave. 'Equivalised income' was dropped because it is a perfect predictor of poverty. In Denmark and the Netherlands, the effect of region is not estimated. In the Netherlands the variable 'region' is omitted because of confidentiality reasons, and in Denmark, only one region is distinguished.

the United Kingdom no second model is estimated, since in the BHPS other weighting variables are used.

Table 4. Logistic regression modelling the effect of poverty in wave 1 on the dropout probability (Model 1), under control of ECHP weighting variables (Model 2)

		Model 1			Model 2		
	DF	Odds Ratio Estimate	Type III Analysis of Effects	p	Odds Ratio Estimate	Type III Analysis of Effects	p
Belgium	1	1,24	89,339	**	1,03	0,0923	ns
Denmark	1	1,73	37,331	***	1,28	64,784	*
France	1	1,47	629,522	***	1,21	125,276	***
Germany	1	1,46	464,818	***	1,38	270,993	***
Greece	1	0,79	24,526	***	0,97	0,2878	ns
Ireland	1	0,89	33,401	ns			
Italy	1	0,75	493,987	***	0,94	14,861	ns
Netherlands	1	1,39	206,987	***	1,33	132,364	***
Portugal	1	1,03	0,3209	ns			
Spain	1	0,96	0,823	ns			
United Kingdom	1	1,73	843,046	***			

*p<0.05, **p<0.01, ***p<0.001, ns = not significant
Source: ECHP UDB-Version of June 2003.

From this, it can be concluded that weighting is effective in Belgium, Greece and Italy, because the data are missing at random within the categories of the variables used for weighting. Moreover, in Ireland, Portugal and Spain, weighting in order to correct for non-random dropout of poor people is in fact not necessary, because the effect of poverty on dropout proves to be not significant. However, in Denmark, France, Germany and the Netherlands, weighting does not correct (sufficiently) for non-random dropout of poor people. In these countries, dropout is non-ignorable for researchers interested in poverty analyses.

Table 5. Discrete-time logistic hazard models, modelling the effect of poverty, measured in wave before dropout, on the dropout probability (Model 3), under control of ECHP weighting variables (Model 4)

		Model 3			Model 4		
	DF	Odds Ratio Estimate	Type III Analysis of Effects	p	Odds Ratio Estimate	Type III Analysis of Effects	p
Belgium	1	1,28	17,019	***	1,13	33,076	ns
Denmark	1	1,5	43,954	***	1,22	91,307	**
France	1	1,36	63,505	***	1,21	201,009	***
Germany	1	1,42	46,499	***	1,27	188,851	***
Greece	1	0,78	40,328	***	0,96	0,7344	ns
Ireland	1	0,83	16,547	***	0,83	131,709	***
Italy	1	0,74	66,124	***	0,93	3,143	ns
Netherlands	1	1,44	39,264	***	1,41	29,396	***
Portugal	1	1,02	0,3	ns			
Spain	1	0,93	4,907	ns			
United Kingdom	1	1,61	70,309	***			

*p<0.05, **p<0.01, ***p<0.001, ns = not significant
Source: ECHP UDB-Version of June 2003.

In table 5 the results of two discrete-time logistic hazard models are summarized. In these models, poverty is measured in the wave before dropout. However, the year in which poverty is measured does not correspond to the year in which the poverty is experienced, because in the ECHP-interview, the income is questioned for the year before. As a consequence, the poverty status experienced two years before the dropout is used in the hazard models. Model 3 displays the univariate regression outcome for the effect of poverty on the hazard of dropping out. In Belgium, Denmark, France, Germany, the Netherlands and the United Kingdom, the hazard of dropping out is significantly higher for poor people. For Greece, Ireland and Italy, the effect is reversed. For Portugal and Spain, no effect of poverty is found. So, for these two countries, dropout occurs completely at random (MCAR) with respect to the poverty variable. No weighting or imputation is necessary.[6]

[6] At least in order to correct for non-random dropout of poor people. Weighting is still necessary to correct for unequal sample probabilities.

Model 4 provides an estimate of the same effect under control of the covariates used for weighting: age, sex, region, main source of income, tenure status, household size, increase/decrease of household size since last wave, number of economically active persons in the household, type of household and whether split-off household.[7] Under model 4, we can examine if the effect of poverty on the dropout hazard remains significant after controlling for other variables. Again, the poverty estimate is measured in the wave before dropout, but actually refers to the poverty status two waves before dropout. Since we want to control for covariates measured at the same moment, we opted to use covariates measured two waves before dropout. For Belgium, Greece and Italy, the effect of poverty disappears under control of the covariates. The attrition pattern is at random (MAR), as within the categories of the variables used for weighting, dropout is found to be at random. As a consequence, weighting with the ECHP longitudinal weight is effective in these countries. In Denmark, France, Germany, Ireland and the Netherlands, the dropout pattern turns out to be non ignorable with respect to the variable of interest, poverty, even when correcting for the variables used for weighting. As a result, weighting with the ECHP-longitudinal weight is not a sufficient correction for the bias that occurs in the poverty estimates.

It can be interesting to know which variables used in the ECHP-weighting procedure have the strongest effect on the hazard of dropping out. Table 6 allows us to investigate these parameter estimates in further detail for each country. Overall, the R^2 of the different models is very low. Generally, the share of explained variance by the covariates used for weighting does not reach 1%. Tenure status is by far the most important predictor of dropout hazard. In all countries, people not owning a dwelling are more likely to drop out of the panel. Furthermore, females are less likely to drop out. Finally, in all countries except for Belgium and Germany, larger households tend to have lower dropout hazards.

[7] Again, 'equivalised income' was dropped because it is a perfect predictor of poverty. In Denmark and the Netherlands, the effect of region is not estimated. For the United Kingdom, no second model is estimated.

Table 6. Parameter estimates for the hazard of dropout by country

		Main source of income in prior year							Number of economically active people			Household size									
	Poor	self-employment or farming	pensions	unemployment - redundancy benefit	other benefits or grants	private income	wages and salaries (ref)		0	1	more than 1 (ref)	2	3	4	>4	1 (ref)	no owner of dwelling	Female	household existed in last wave	Age	region	R^2
Belgium		++			+	++									++		++	- - -				0,004
Denmark	++	+++	+++									-					+++				/	0,009
France	+++	+			+++				+			-	- - -	- -			+++	-				0,005
Germany	+++								+++								+++	- -				0,006
Greece		- -				+						- - -	- - -	- - -	- - -		+++	- - -				0,024
Ireland	- - -		++			+				- - -				-			++	-		- - -		0,004
Italy			+++											-			+	-		+		0,011
Netherlands	+++	++	+++						-	- - -		- -		- - -			++	- - -	/	- - -	/	0,005
Portugal					-				+++			- - -	-				+++	- - -	- - -			0,013
Spain		- -	+++		++	++			- - -	- - -		- -	- -	- - -	-		+++	- - -				0,006

- negative effect with p<0.05, --negative effect with p<0.01, --- negative effect with p<0.001
+ positive effect with p<0.05, ++positive effect with p<0.01, +++positive effect with p<0.001
/: effect could not be estimated, empty: effect not significant
Source: ECHP UDB-Version of June 2003.

6. Conclusion

The aim of this paper was to study the relationship between poverty and dropout in eleven countries of the European Community Household Panel. Poverty was operationalized at household level as having an income below 60% of the median equivalised household income in a country, and was subsequently attributed to each individual within the household. In addition, dropout was defined as a specific type of unit-nonresponse, namely the nonresponse of observation units that have participated at least once in the study, but do not continue participation until the end of the panel study.

However, dropout is not the only important type of unit-nonresponse in the ECHP. This has appeared from the descriptive statistics in this paper. First, initial nonresponse was examined. This turned out to be rather high in Belgium, the Netherlands and Ireland, but quite low in Italy and Greece.

Subsequently, six different participation patterns were derived from the data: for wave-one participants as well as new entry-persons, there is the possibility to be always participating, monotone attriting or participating variably. In most countries, the group of always participating wave one-persons turned out to be the most important one, followed by the wave one-persons with monotone attrition. Ireland was an exception because monotone attrition appeared to be extremely high there among persons participating in the first wave. New entry-persons were omitted from all further analyses.

Since dropout can cause bias in research results whenever it is not random, this paper has examined to what extent and in which countries poverty and dropout are related in a problematic way. A preliminary exploration of the relationship between dropout and poverty confirmed findings from previous research: in northern countries poor people tend to drop out more often, while in the southern countries the reverse is true. The significance of this effect was subsequently tested in regression analyses.

In performing these regressions, advantage could be taken from the panel structure of the ECHP. In particular, the effect of poverty on dropout could be estimated because poverty measurements are available from previous waves for each attrited individual. Two models were estimated, a logistic regression model with a static poverty variable (poverty in the first wave of the panel) and a discrete-time logistic hazard model

with a dynamic poverty variable (poverty two waves before dropout from the panel). The results from both models were very similar. The effect of poverty on dropout turned out to be insignificant for Portugal and Spain. In northern countries (Belgium, Denmark, France, Germany, Netherlands and United Kingdom) poor people had a significantly higher chance of dropping out than non-poor people. This effect was reversed in Italy and Greece. Ireland was the only country with different results for the ordinary logistic and the discrete-time logistic hazard model. Whereas the effect of poverty appeared insignificant when modelling poverty in the first wave, it turned out to be highly significant when measuring poverty in the wave before dropout. In view of the extremely high attrition rates in Ireland, we assume this last model will be a better and safer approximation of reality.

In the second place, we have examined whether the effect of poverty on dropout remains under the control of the variables used in the ECHP-weighting procedure. If units drop out randomly within the categories of these variables, weighting can correct for non-random dropout of poor people. Again, this effect was estimated twice, once by using poverty in the first wave as an independent variable in an ordinary logistic regression and consequently by using poverty two waves before dropout as an independent variable in a discrete-time hazard model. Both models gave very similar results. In Belgium, Greece and Italy, there was no longer an effect of poverty on dropout when controlling for the variables used in the ECHP-weighting procedure. Hence, in these countries dropout is MAR, which implies that results will no longer be biased with respect to poverty when using weighting variables. In contrast, in Denmark, France, Germany and the Netherlands, poor people are still dropping out more frequently after controlling for the variables used for weighting in the ECHP. From the time-discrete logistic model it appeared that the reverse applies to Ireland, meaning that nonpoor people tend to drop out more than poor people. From these results, it can be concluded that in these five countries researchers will face non-ignorable dropout with respect to poverty, even after weighting with weights provided in the ECHP-UDB.

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