

# Are income poverty and perceptions of financial difficulties dynamically interrelated? \*

SARA AYLLÓN

Department of Economics  
Universitat de Girona and EQUALITAS, Spain

ALESSIO FUSCO

CEPS/INSTEAD, Luxembourg

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## Abstract

The economic well-being of an individual can be measured in several ways. The standard income poverty approach aims at determining *objectively* whether individuals' income fall short from a pre-defined income poverty line. Alternatively, one may rely on *subjective* information about perceived financial difficulties to assess individuals' economic welfare. Income poverty and perceived financial difficulties are therefore complementary concepts highlighting different dimensions of disadvantage. These two concepts are also likely to be dynamically interrelated. For example, current perceptions may be affected by the lasting effects of previous income poverty. Conversely, past perceived financial difficulties may affect an individual income-generating ability and current poverty status. Empirical knowledge about the extent to which these concepts are dynamically interrelated is limited. By estimating dynamic (probit and ordered) bivariate models controlling for state dependence, unobserved heterogeneity and initial conditions to Luxembourg survey data, we precisely aim at filling this gap. Our main result highlights the existence of a feedback effect from past perceived financial difficulties on income poverty suggesting

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that subjective perceptions can have objective effects on individuals' behavior and outcomes. In addition, a feedback effect from past income poverty on current perceived financial difficulties was also found when perceived financial difficulties was modelled as an ordinal variable, but not when it was modelled as a binary variable.

***Keywords:*** feedback effects, state dependence, income poverty, perceived financial difficulties

***JEL classification:*** D31, D60, I32

# 1 Introduction

The economic well-being of an individual can be measured in several ways. The conventional income poverty approach aims at determining *objectively* whether individuals' income fall short from a pre-defined income poverty line. Concern about this approach is sometimes expressed for practical reasons, such as measurement error in income (e.g. Nicoletti et al., 2011) or difficulties in identifying relevant poverty lines or equivalence scales (e.g. Ravallion, 1996). In addition, objective approaches may miss part of the problem. For example, Bourguignon (2006) highlights the following paradox in developed countries: while the presence of an efficient redistribution system contributed to the reduction of (absolute) poverty, a 'feeling' of poverty is still often reported in some population subgroups such as beneficiaries of minimum income guarantee programs. Receiving social assistance may even amplify this feeling in the case individuals feel stigmatized. Henceforth, the concept of poverty or welfare cannot be reduced to the single criterion of low income. One of the relevant alternatives consists in relying on *subjective* information about the experienced level of financial difficulties to assess individuals' welfare (Deaton, 2010).

Therefore, income poverty and perceptions of financial difficulties are different concepts aiming at highlighting different aspects of disadvantage. Despite being distinct, these two concepts are also likely interrelated. First, it may seem natural that the current objective situation unveiled by the income poverty approach directly influences individuals' perceptions on their financial difficulties. In addition, the interrelation between both concepts may happen through feedback effects (Biewen, 2009). For example, current perceptions of financial difficulties may be affected by the lasting effects of the previous poverty status. In turn, individuals' past perceptions of financial difficulties may affect their income-generating abilities which might then impact on their current poverty status. The channels explaining the latter relationship include loss of motivation, stigma or negative effect of financial difficulties on psychological well-being (Taylor et al., 2011) or on cognitive abilities affecting the decision making process (Bertrand et al., 2004, Duflo, 2006, Mani et al., 2013, Carvalho et al., 2014). Identification of such feedback effect is crucial for our understanding of the various dimensions of poverty. Our empirical knowledge about the extent to which these two concepts are dynamically interrelated is however limited. One of the aims of the paper is precisely to analyse this question and requires the joint modelling of the two outcomes. While the literature analysing the dynamics of both concepts separately is abundant (e.g. Pudney, 2008, Jenkins, 2011, Kaya, 2013), to our knowledge there are no econometric attempts to characterize the joint dynamics of objective and subjective financial difficulties.

Another behavioral effect needs to be taken into account when analysing the dynamics of these phenomena: the issue of state dependence. State dependence refers to the question as to whether a concept is autoregressive, that is, in our case, the extent to which being poor in a given moment increases *by itself* the probability

of being poor in the future (Heckman, 2001, Skrondal and Rabe-Hesketh, 2013).<sup>1</sup> As well established in the literature, both income poverty (see among others Cappellari and Jenkins, 2004, Jenkins, 2013) and perceived financial difficulties (e.g. Pudney, 2008) are affected by a considerable degree of state dependence. Regarding income poverty, this empirical regularity can be explained by the fact that experiencing poverty may modify an individual preferences or ability that will increase his risk of being income poor in the future compared to an identical individual that did not experience poverty in the first place. In the case of subjective variables, in addition to the same genuine effect from the past on the present, state dependence can also be related to the idea of inertia of perceptions, that is the time necessary for perceptions to adjust to change in circumstances (see Bottan and Perez Truglia, 2011, Wunder, 2012).<sup>2</sup> Henceforth, modelling state dependence is crucial to avoid the potential bias that estimating static models would yield and to obtain unbiased estimates of the feedback effects.

Subjective variables are typically ordinal variables. An additional contribution of the paper is that we consider different modelling assumptions of the subjective variable to assess the robustness of the results. In particular, we compare the results obtained when dichotomizing the subjective variable with those obtained when making full use of the available information and using the ordinal variable. While Newman et al. (2008) apply this strategy to analyse the question of state dependence in financial well being, to our knowledge our paper is the first one doing so in the context of a dynamic bivariate model.<sup>3</sup>

The joint modelling approach also allows us to analyse the effect of some covariates on both concepts simultaneously. For example, the effect of having children on economic well-being has been well researched and may differ according to the dimension of well-being under scrutiny (see, e.g., Mussa, 2010). For example, on the basis of separated transitions models applied to the same Luxembourgish sample, Fusco and Islam (2012) find that an additional child aged between 12 and 17 years old increase the probability of entering income poverty while Fusco (2013) finds that it has no effect on the probability of entering perceived financial difficulties. With

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<sup>1</sup>State dependence and feedback effects refer in fact to two behavioral effects involving the impact of the past on the present. In the case of happiness, Bottan and Perez Truglia (2011) make the distinction between two channels of habituation: *general habituation* (or satisfaction treadmill) refers to genuine state dependence while *specific habituation* (or hedonic treadmill) refers to habituation to specific lagged effects of life events. For an analysis of the adaptation of happiness to poverty see Clark et al. (2013).

<sup>2</sup>Full inertia occurs if current perceptions do not adjust to changes in circumstances and are completely determined by past perceptions. If this is the case, perceptions might not be good indicators of current well-being. By contrast, full adjustment means that current perceptions are not affected by previous perceptions and changes in perceptions can be fully ascribed to changes in circumstances; perceptions can then be considered a good indicator of current well-being. The true situation usually lies in between these two extreme cases, and is ultimately an empirical question.

<sup>3</sup>Amuedo-Dorantes and Serrano-Padial (2010) use a multinomial regression to model labour flexibility jointly with a probit modelling of poverty. They however consider the same unobserved factor for each process.

the empirical strategy used in the current paper, we are able to analyse the impact of the presence of older children on income poverty and perceived financial difficulties simultaneously. Since the unobservable factors related to each process may be correlated, this strategy may yield different results compared to separated models.

Our empirical illustration is based on Luxembourg data. Following the development of the financial sector since the middle of the 1980s, Luxembourg became one of the richest countries in terms of GDP per capita (see e.g. Fusco et al., 2014). It may then appear surprising to devote efforts in studying financial difficulties in this country. However, it can also be argued that subjective approaches bring valuable information that can be relevant precisely in rich countries such as Luxembourg, given that they are likely to capture the feeling of social exclusion referred to by Bourguignon (2006). By estimating dynamic bivariate models controlling for state dependence, unobserved heterogeneity and initial conditions (e.g. Devicienti and Poggi, 2011), we aim at determining whether both concepts are characterized by dynamic cross-effects. Our main result highlights the existence of a feedback effect from past perceived financial difficulties on income poverty. In addition, a feedback effect from past income poverty on current perceived financial difficulties was also found when perceived financial difficulties was modelled as an ordinal variable, but not when it was modelled as a binary variable.

The paper is organized as follows. Section 2 presents the data used extracted from the Luxembourg Socio-Economic Panel “Liewen zu Lëtzebuerg” (PSELL3) for the years 2003 to 2011 as well as some descriptive statistics. The methodology applied is presented in Section 3 while section 4 contains the results. Finally, Section 5 concludes.

## 2 Data, definitions and descriptives

The Luxembourg Socio-Economic Panel “Liewen zu Lëtzebuerg” (PSELL3) is the Luxembourgish component of the European Union-Statistics on Income and Living Conditions (EU-SILC). This survey is running since 2003 and contains repeated annual information about residents’ incomes, living conditions and other personal and household characteristics. Since 2003, the same individuals are followed which makes it possible to track whether changes in (objective and subjective) economic well-being are associated with changes in household circumstances or labour market situations. In this paper, we use the nine waves of the PSELL3 data covering the years 2003 to 2011.

Perceived Financial Difficulties (PFD) is captured through the answers to the following question: “A household may have different sources of income and more than one household member may contribute to it. Thinking of your household’s total income, is your household able to make ends meet, namely, to pay for its usual necessary expenses?”. The possible answers were recoded in the following way: “0. Very easily; 1. Easily; 2. Fairly easily; 3. With some difficulty; 4. With

difficulty; 5. With great difficulty”.<sup>4</sup> We assume that each household has the same interpretation of each modality. We attributed this household level variable to each of the household members as is typically done in the income poverty literature and also by other authors (e.g. Taylor, 2011). Following the standard European Union practice, an individual is considered income poor if (s)he belongs to a household whose equivalent income is lower than 60% of the median equivalised income.

Our focus is on the adult population aged between 20 and 59 within the period covered by the data. Students, military and pensioners are excluded from the analysis because these population subgroups are very specific and concern about the reliability of their answers regarding their perceived financial difficulties is sometimes expressed. For example, elderly people are usually found to underestimate the financial difficulties they are confronted to and to consider their income as adequate, even when this income is in fact very low (e.g. Stoller and Stoller, 2003, Litwin and Sapir, 2009).

Table 1 shows the distribution of perceived financial inadequacy and the poverty rate for the studied sample and across the analysed period. In Luxembourg, a large proportion of individuals finds it ‘easy’ to make ends meet (on average 36%) or ‘fairly easy’ (31%).<sup>5</sup> Only about 10% of the studied sample answers that they can make ends meet ‘very easily’. Moreover, note that a sizeable group of nearly 8% of the individuals declares that to make ends meet is ‘difficult’ or ‘very difficult’ and about 15% say that it is ‘quite difficult’. From this point, we will consider that individuals are in financial difficulties if they answer ‘difficult’ or ‘very difficult’ to the aforementioned question. On average, 7.6% of the sample is found to be in financial difficulties, a percentage that evolves between 6% and 9% across the period. The last column shows the income poverty rate which was of 10.6% in 2003 and then evolved between 12% and 14% in the period 2004 to 2011.

Table 2 displays the joint distribution of both concepts across time. Between 3% and 5% of the individuals in the sample are both income poor and in perceived financial difficulties. The percentage is very similar for those individuals reporting being in financial difficulties but at the same time are not income poor (on average 3.8%). Instead, 9.5% of individuals do not state to be in financial difficulties but are considered income poor. In total, an average of 17.1% of the sample is affected by either one or both phenomena. Moreover, Table 3 indicates that 28.4% of the income poor perceive themselves in financial difficulties, while only 4.4% of the non income poor are in such a situation.<sup>6</sup> These pooled results indicate that the overlap between the two measures is not perfect which suggests that the two definitions of

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<sup>4</sup>Note also that Taylor (2011) or Taylor et al. (2011) use it as a dimension of financial capability. The concept of financial capability is studied in-depth in a special issue of the *Journal of Economic Psychology* (see Hoelzl and Kapteyn, 2011).

<sup>5</sup>Figures on the overall population are similar and can be found in STATEC (2013).

<sup>6</sup>Conversely, close to 50% of the individuals in perceived financial difficulties are income poor, while only 10% of individuals having difficulties to make ends meet are found in poverty (not shown for brevity).

**Table 1:** Distribution of perceived financial difficulties and poverty rate, per year

Wave	Perceived financial difficulties						Poor
	very easily	easily	fairly easily	quite difficult	difficult	very difficult	
1	11.2	37.2	30.5	13.9	5.3	1.9	10.6
2	13.9	36.0	29.4	14.1	4.8	1.9	13.0
3	12.3	38.6	28.6	14.1	4.6	1.7	12.7
4	10.7	37.5	32.3	13.8	4.3	1.5	13.1
5	9.8	38.7	30.5	14.2	5.0	1.9	12.9
6	9.1	37.7	30.1	15.5	5.7	2.0	13.4
7	8.8	33.7	31.9	17.6	5.9	2.1	14.4
8	7.9	34.7	32.7	15.8	6.6	2.3	14.5
9	9.2	32.0	32.3	17.1	6.6	2.8	13.3
<b>Total</b>	<b>10.1</b>	<b>35.9</b>	<b>31.1</b>	<b>15.3</b>	<b>5.5</b>	<b>2.1</b>	<b>13.2</b>

Source: PSELL3/EU-SILC, 2003-2011, authors computation. Weighted results.

financial difficulties, subjective or objective, are complementary. Sample size is also shown in the last column.

Previous results were based on cross-sectional data. We now turn to the longitudinal dimension. In terms of transitions, first panel of Table 4 shows the probability of reporting being in financial difficulties, conditional on the previous year's perception. Note that 45.9% of the individuals initially in perceived financial difficulties remain in the same situation, compared to 4.3% of the initially non in perceived financial difficulty. The corresponding percentages in the case of income poverty are respectively 68.4% and 4.5% (see lower panel of the table). This suggests a sizeable scarring effect (state dependence) for both concepts, especially strong in the case of income poverty (Fusco and Islam (2012) and Fusco (2013) find similar results).

Looking at the relation between the two concepts in consecutive years, in Table 5, we can see that lagged income poverty and current perceived financial difficulties are linked: the conditional probability of being currently in perceived financial difficulty is 26.2% for the initially poor, while it is only 4.4% for the initially non poor. The relative risk is of 5.96. The relative risk of being income poor depending on the previous perceived financial difficulties status is of 5.4 (the probability of being currently income poor for the initially in perceived financial difficulty is 52.5%; for the initially non poor it is of 9.7%).

These descriptive statistics suggest that both concepts display state dependence and are related dynamically. Whether these descriptives are the results of individual heterogeneity or of causal mechanisms is an empirical question we try to disentangle in the rest of the paper.

**Table 2:** Joint distribution of financial difficulties and income poverty

Wave	Not poor, nor in FD	Income poor only	In FD only	Both	N
1	85.3	7.5	4.0	3.1	4951
2	83.6	9.7	3.4	3.3	5055
3	83.6	10.1	3.8	2.6	5089
4	84.1	10.2	2.7	3.0	5455
5	84.3	8.9	2.8	4.1	5582
6	82.9	9.4	3.7	3.9	5412
7	81.6	10.4	4.0	4.0	5891
8	81.4	9.7	4.1	4.8	6684
9	81.4	9.2	5.3	4.2	7522
<b>Total</b>	<b>83.0</b>	<b>9.5</b>	<b>3.8</b>	<b>3.8</b>	<b>51641</b>

Source: PSELL3/EU-SILC, 2003-2011, authors computation. Weighted results.

**Table 3:** Probability of being in financial difficulties given poverty status at the same year

		Perceived financial difficulties at $t$		
		Not in FD	In FD	Total
Poverty at $t$	Not poor	95.6	4.4	100.0
	Poor	71.6	28.4	100.0
	<b>Total</b>	<b>92.4</b>	<b>7.6</b>	<b>100.0</b>

Source: PSELL3/EU-SILC, 2003-2011, authors computation. Weighted results. Pooled observations across the period.



**Table 4:** Probability of being in financial difficulties at  $t$  given status at  $t - 1$  and probability of being poor at  $t$  given status at  $t - 1$

		Perceived FD at $t$		
		Not in FD	In FD	Total
Perceived FD at $t - 1$	Not in FD	95.8	4.3	100.0
	In FD	54.1	45.9	100.0
	<b>Total</b>	<b>92.8</b>	<b>7.2</b>	<b>100.0</b>
		Poverty at $t$		
		Not poor	Poor	Total
Poverty at $t - 1$	Not poor	95.5	4.5	100.0
	Poor	31.6	68.4	100.0
	<b>Total</b>	<b>87.2</b>	<b>12.8</b>	<b>100.0</b>

Source: PSELL3/EU-SILC, 2003-2011, authors computation. Weighted results. Pooled observations across the period.

**Table 5:** Probability of being in financial difficulties at  $t$  given poverty status at  $t - 1$  and probability of being poor given status in perceived financial difficulties at  $t - 1$

		Perceived FD at $t$		
		Not in FD	In FD	Total
Poverty at $t - 1$	Not poor	95.6	4.4	100.0
	Poor	73.8	26.2	100.0
	<b>Total</b>	<b>92.8</b>	<b>7.2</b>	<b>100.0</b>
		Poverty at $t$		
		Not poor	Poor	Total
Perceived FD at $t - 1$	Not in FD	90.3	9.7	100.0
	In FD	47.6	52.5	100.0
	<b>Total</b>	<b>87.2</b>	<b>12.8</b>	<b>100.0</b>

Source: PSELL3/EU-SILC, 2003-2011, authors computation. Weighted results. Pooled observations across the period.

### 3 Methodology

Our econometric strategy consists in estimating jointly the two processes of income poverty ( $P_{it}$ ) and perceived financial difficulties ( $S_{it}$ ) while controlling for unobserved heterogeneity, initial conditions, state dependence and feedback effects. We estimate two different models. In Model 1, we estimate jointly a dynamic random effects probit for  $S_{it}$  and  $P_{it}$ . In Model 2, we make use of all the information available in the data set and estimate jointly a dynamic random effect probit for  $P_{it}$  and a dynamic random-effects ordered probit for  $S_{it}$ . Formally, both simultaneous equations can be written as follows:

$$S_{it}^* = \alpha S_{it-1} + \theta P_{it} + \beta P_{it-1} + \gamma' X_{it} + u_i + \epsilon_{it} \quad (1)$$

$$P_{it}^* = \chi P_{it-1} + \delta S_{it-1} + \eta' Z_{it} + v_i + \mu_{it} \quad (2)$$

where  $i = 1, 2, \dots, N$  are individuals and  $t = 2, \dots, T$  are the number of periods under study.

We assume that in period  $t$ , individuals can be characterised by a latent propensity for perceived financial difficulties,  $S_{it}^*$ , that takes the form:

$$S_{it} = I(S_{it}^* > 0) \quad (3)$$

where, in Model 1,  $I(S_{it}^* > 0)$  is an indicator function taking the value of 1 if  $S_{it}^*$  is positive and 0 otherwise.

In the case of the ordered variable (Model 2), the latent outcome  $S_{it}^*$  is not observed but we do have an indicator of the category in which the latent category falls,  $S_{it}$ . Thus,

$$S_{it} = j \quad \text{if} \quad \mu_j < S_{it}^* \leq \mu_{j+1}, \quad j = 1, \dots, m \quad (4)$$

where  $\mu_0 = -\infty, \mu_j \leq \mu_{j+1}, \mu_m = +\infty$ . As explained above,  $S_{it}$  is a variable with six categories ( $j$ ).

The same assumptions are done in the case of income poverty with

$$P_{it} = I(P_{it}^* > 0) \quad (5)$$

and  $I(P_{it}^* > 0)$  is an indicator function taking the value of 1 if  $P_{it}^*$  is positive and 0 otherwise.

As already mentioned, both poverty and perceived financial difficulties are affected by a considerable degree of state dependence. Thus, the one year lag of each variable assures the control over state dependence and we expect  $\alpha$  and  $\chi$  to be positive and statistically significant. In order to take into account the possible interrelationship between poverty and perceived financial difficulties, we introduce a feedback effect in each equation that will assess the degree of dependence between both phenomena. That is,  $\beta$  will control for the influence of past poverty on current perceived financial difficulties. We expect  $\beta$  to be positive and statistically

significant showing that past poverty harms the current subjective perception of own financial situation. In a similar fashion,  $\delta$  that captures the influence of past financial difficulties on current poverty status is likely to be positive and precisely estimated indicating that households that perceived in the past that they had difficulties to make ends meet are more likely to be found in poverty in the present period.<sup>7</sup>

Furthermore, we consider the possibility that current poverty status  $P_{it}$  enters as an explanatory variable in the perceived financial difficulties equation to assess the importance of the relationship between both phenomena at the current period. Note that we do not consider that perceived financial difficulties influence current poverty as we believe that the objective situation is prior to the subjective evaluation so that simultaneous effects are ruled out. In our dynamic framework, the objective situation can only be influenced by feedback effects from past perceptions and not by current effects. The effect of income poverty on perceived financial difficulties is immediate while the effect of perceived financial difficulties on income poverty is delayed.

$X_{it}$  and  $Z_{it}$  are the explanatory variables that are expected to affect both process. They reflect both demographic and working characteristics and refer to the individual (age, age squared, gender, citizenship, employment status, health status, marital status, education) and the household (household composition, the attachment to the labour market, tenure status). Gender and citizenship are treated as time-invariant variables. Regarding the latter, this choice was justified by the fact that the proportion of individual changing citizenship is extremely low in our estimation sample. In the case of perceived financial difficulties, we expect variables suggesting additional financial resources (e.g. an additional individual at work) to decrease the risk of being in perceived financial difficulties through a risk diversification effect, while variables reflecting additional expenditures (henceforth increasing the (perception of) resources needed), such as an additional child, are expected to increase the risk of being in perceived financial difficulties

In order to take into account unobserved heterogeneity, both equations follow Wooldridge (2005)'s approach in the treatment of initial conditions. The control over unobserved heterogeneity is important in our model to avoid overestimating state dependence (see, for example, Weber, 2002). Moreover, the inclusion of an individual specific effect results in an initial conditions problem: we cannot know whether the observed phenomena started even before each individual entered the survey. That is, we need to control that each initial condition is correlated with

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<sup>7</sup>Buddelmeyer and Cai (2009) use a similar strategy to study the interrelationship between health and poverty. In their case, they introduce the lagged value of poverty in a health equation while current health (not lagged) in the poverty equation. Their argument is that the effect of health on income is immediate while the effect of income on health is slow. Other applications of this methodology can be found in Alessie et al. (2004), Cai and Kalb (2006), Cai (2009), Haan and Myck (2009), Amuedo-Dorantes and Serrano-Padial (2010), Cai (2010), Devicienti et al. (2010), Devicienti and Poggi (2011), Michaud and Tatsiramos (2011), Ayllón (2014b).

the individual specific effect ( $u_i$  and  $v_i$ , respectively). Ignoring the initial conditions problem would result in inconsistent estimates.

Wooldridge (2005) proposes to find the density of the dependent variables from  $t = 1, \dots, T$  conditional on the initial conditions and the explanatory variables. That is, we specify the density of the unobserved specific effect conditional on the dependent variables at  $t = 0$ . Formally, we can write the specification as follows,

$$u_i = a_0 + a_1 P_{i0} + a_2 S_{i0} + a_3 \overline{X_i} + \kappa_i \quad (6)$$

$$v_i = b_0 + b_1 S_{i0} + b_2 P_{i0} + b_3 \overline{Z_i} + \nu_i \quad (7)$$

Following Stewart (2007), the mean of each time-varying explanatory variable is added in order to allow for a certain degree of correlation between the independent variables and the individual specific effect (see also Mundlak, 1978, Alessie et al., 2004).  $\kappa_i$  and  $\nu_i$  are integrated out using Gauss-Hermite quadrature with 12 points in order to get consistent estimates. Moreover, a bivariate normal distribution with zero mean and  $\sigma_{\kappa_i, \nu_i}^2$  variance is assumed for both individual-specific effects which are allowed to be freely correlated:  $\rho_{\kappa_i, \nu_i}$ . If  $\rho$  is positive, it means that unobservables that make individuals more likely to be poor also make them more likely to perceive that they have great financial difficulties to make ends meet.<sup>8</sup> Estimates of the model parameters are obtained by Conditional Maximum Likelihood (CML).<sup>9</sup>

Finally, the idiosyncratic error terms include each a white noise error that changes over time ( $\epsilon_{it}$  and  $\mu_{it}$  for each equation, respectively) assumed to follow a normal distribution with zero mean and unit variance and are serially independent.

## 4 Empirical results

Table 6 shows the results of Models 1 and 2. Recall that, in the first case, we run a joint bivariate random effects (RE) probit with simple feedback effects for perceived financial difficulties and poverty. In the second case, ‘perceived financial difficulties’ ( $S_{it}$ ) is modelled by means of an ordered RE probit. In both cases, current poverty status ( $P_{it}$ ) is included in the perceptions equation following the idea that current financial difficulties are likely to be affected not only by past poverty experiences but also by the current economic situation of the family.

In Model 1, the positive and highly significant coefficients for  $S_{it-1}$  on  $S_{it}$  (0.44\*\*\*) and  $P_{it-1}$  on  $P_{it}$  (0.75\*\*\*) indicate that both phenomena are affected by a considerable degree of genuine state dependence as commonly found in the literature. That is, experiencing one of the outcomes in the past increases *by itself* the probability of experiencing the same outcome in the present, even when the two processes are modelled jointly. Noticeably, the coefficient for the initial conditions in both equations is greater than the lagged which indicates a considerable correlation between

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<sup>8</sup>The models are estimated using the software aML (see e.g. Ayllón, 2014a).

<sup>9</sup>Consistent results were obtained when running the models with 6 and 24 quadrature points.

the unobserved heterogeneity effect and the initial conditions. These results are confirmed by Model 2, that is when perceived financial difficulties are modelled using an ordered RE probit.

Turning to the feedback effects, results suggest that past perceived financial difficulties have a positive influence on current poverty while past poverty has no effect on the current feeling of financial difficulties. As a matter of fact, both phenomena would seem to be strongly related mainly through the initial conditions. However, results from the RE ordered probit that is, when we make use of all the information available in the data set, show the existence of a interrelationship between both phenomena. Past poverty increases the probability of current perceived financial difficulties (0.08\*\*\*). And, at the same time, past perceived financial difficulties increase the probability of being currently income poor for those that were finding it ‘somewhat difficult’, ‘difficult’ and ‘very difficult’ to make ends meet.<sup>10</sup> The feedback effect from perceived financial difficulties on income poverty constitute our main result since it provide evidence for the fact that subjective perceptions can have objective effects on individuals’ outcomes (see e.g. Neve et al., 2013). This result is in line with the recent literature suggesting that financial stress can have an effect on individuals’ behaviour so that psychological mechanisms should not be overlooked when it comes to design anti-poverty policies.

Last rows in the Table 6 show the standard deviation of the individual-specific effects for each equation which are highly significant pointing to the importance of taking into account unobserved heterogeneity in this context. Moreover,  $\rho$  that informs of the correlations between both effects, indicates that unobservables that make an individual more prone to be poor also make him/her more likely to perceive that he/she has difficulties to make ends meet.

We discuss the results regarding the covariates on the basis of Model 2 (see Table 7). We focus first on the results for demographic characteristics. Recall that for time-varying variables, the individual time averaged value of each covariate is included in the model (see Equations 6 and 7). The coefficients of these time-averaged variables (marked by a() in the Table) can be interpreted as long-term effects from the covariate on the outcome, while the coefficient of the covariate can be interpreted as the current effect. Having this in mind, it turns out that age is not related to monetary poverty but it is to having financial difficulties. The probability of having problems to make ends meet is negatively associated with age but the likelihood slightly increases at older ages — as indicated by the coefficient of age squared in the first equation.<sup>11</sup> The migrant population in Luxembourg is quite

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<sup>10</sup>Separate regressions would have indicated a stronger feedback from lagged perceived financial difficulties to poverty and also from past monetary poverty to current subjective economic hardship. That is, if we were to ignore the cross-effects between both phenomena that take place through unobservables, we would be overestimating the feedbacks between both processes. (Results are available from the authors upon request.)

<sup>11</sup>Note that the coefficient for average age and its square also indicates that being in an older cohort is positively associated with financial difficulties.

**Table 6:** Main results for the bivariate RE probits for  $S_t$  and  $P_t$  (Model 1) and the ordered RE probit model for  $S_t$  and bivariate RE probit for  $P_t$  (Model 2) including current poverty status

	Model 1		Model 2	
	$S_t$	$P_t$	$S_t$	$P_t$
$S_{t-1}$	0,44***	0,14***		
$S_{t-1}[0]$			-0,47***	0,13
$S_{t-1}[2]$			0,25***	0,04
$S_{t-1}[3]$			0,59***	0,17***
$S_{t-1}[4]$			0,76***	0,21***
$S_{t-1}[5]$			0,81***	0,40***
$S_0$	0,76***	0,38***		
$S_0[0]$			-0,68***	-0,22***
$S_0[2]$			0,61***	0,18***
$S_0[3]$			1,13***	0,43***
$S_0[4]$			1,31***	0,56***
$S_0[5]$			1,66***	0,69***
$P_t$	0,23***		0,20***	
$P_{t-1}$	0,01	0,75***	0,08***	0,73***
$P_0$	0,24***	0,93***	0,15***	0,85***
$\sigma_{\kappa_i}$	0,74***		0,69***	
$\sigma_{\nu_i}$	0,77***		0,76***	
$\rho_{\kappa_i, \nu_i}$	0,32***		0,26***	

Source: PSELL3/EU-SILC, 2003-2011, authors computation.

large and heterogeneous. The first waves of migration came to work in the steel industry and were characterised by low skills, while recent waves are composed of young, high skilled and mainly European migrants attracted by the financial sector and European institutions. This heterogeneity is reflected in our results which are in line with the previous literature (see e.g. Fusco and Islam, 2012): being portuguese or from a non EU15 country is positively related with declaring great financial difficulties and at the same time to be found in monetary poverty. By contrast, in the case of individuals from another EU15 country, we find that they are more likely to be below the poverty line but their nationality is not associated with having difficulties to make ends meet.

As for marital status, being divorced and especially being a widow is positively related with having difficulties to make ends meet compared to married individuals. A lower diversification of risk in terms of the number of persons in the household increase the risk of perception in financial difficulties, even when controlling for the objective situation. Moreover, single and divorced are amongst those with a higher probability of monetary poverty. Note that despite that the coefficient for single individuals is negative, the effect for the average number of years as a single person is positive and more precisely estimated. This suggests that the long term effect of being single on poverty is positive (compared to being married) but that when we control for this long term effect, the fact of being currently single slightly reduces the chances of being poor.

Lone parenthood is related both to financial difficulties and monetary poverty and it is a short-term effect as the coefficient for average years in lone parenthood is not statistically significant. As for the number of children in the household, results between the long-term effect and the current effect are conflicting in the case of perceived financial difficulties. While an additional child less than 6 (between 6 and 11 or between 12 and 17) increases (does not impact on) the risk of perceived financial difficulties, the average number over time of younger (older) children does not impact on (increases) the risk of perceptions of financial difficulties. Regarding income poverty, an additional child from any age category increases the risk of income poverty while only the time average variable of the older children' variable impacts on poverty. The result on younger children probably captures the immediate effect of a birth on the perception of individuals — which also results in a higher risk of income poverty — that disappears over time together with the risk of poverty. Older children have both a direct effect and a long-term effect on income poverty while only a long-term effect is denoted for perceived financial difficulties.

In terms of education, as expected, those in low education and holding a secondary degree are much more likely to display financial inadequacy and suffer economic hardship than individuals with a University degree. Interestingly, note that the effect is picked up by the mean of the variable indicating that the level of education acquired throughout the period is more important than a possible change in a given year (which is rather unlikely given the age of the sample used).

On the results relative to the labour market, noticeably, being in a part time job is only related to being found in monetary poverty but not with having finan-

cial inadequacy. This is partly explained by the fact that for an important number of individuals working in a part time job is a desired choice (73% in 2006 of those working in a part-time job according to (Blond-Hanten et al., 2008)). Instead, being unemployed is positively related with both phenomena. As a matter of fact, unemployment is probably the most important explanatory variable in both equations according for the size of the coefficient. Moreover, average years in self-employment is positive and highly significant for monetary poverty (but not for financial inadequacy). Self-employment in Luxembourg has been found to be related with poverty by STATEC (2010). ‘Other’ that contains inactive individuals in the labour market such as disabled or housewives is positively related with both subjective and objective measures of economic hardship. Interestingly, note that the mean of the variable is negative and precisely estimated possibly pointing to the fact that once an individual spends many years not receiving income from the labour market, accepts his/her situation and adapts to his/her own financial resources. Finally, the number of working adults in the household is clearly negatively related both to financial inadequacy and monetary poverty, being the effect reinforced by the average number of working adults throughout the period.

Finally, access to property is only related to having difficulties to make ends meet and not to monetary poverty which is understandable given that access to property necessarily implies the payment of a mortgage. But, at the same time, one is only granted a mortgage when proving that a certain level of financial resources is achieved. On the opposite, being a tenant is both related to monetary poverty and to financial inadequacy — though the latter is only precisely estimated when considering the average of the variable.



**Table 7:** Coefficients for the RE ordered probit model for perceived financial difficulties jointly estimated with the RE probit model for poverty

	Perceived financial difficulties equation			Poverty equation		
	Coefficient	p-value	std. error	Coefficient	p-value	std. error
$S_{t-1}[0]$	-0.469	***	(0.028)	0.135		(0.090)
$S_{t-1}[2]$	0.247	***	(0.020)	0.040		(0.047)
$S_{t-1}[3]$	0.595	***	(0.028)	0.167	***	(0.055)
$S_{t-1}[4]$	0.764	***	(0.037)	0.207	***	(0.070)
$S_{t-1}[5]$	0.809	***	(0.048)	0.402	***	(0.090)
$S_0[0]$	-0.682	***	(0.038)	-0.223	***	(0.098)
$S_0[2]$	0.607	***	(0.029)	0.183	***	(0.056)
$S_0[3]$	1.136	***	(0.038)	0.428	***	(0.066)
$S_0[4]$	1.313	***	(0.050)	0.559	***	(0.080)
$S_0[5]$	1.659	***	(0.067)	0.686	***	(0.106)
$P_{t-1}$	0.083	***	(0.027)	0.735	***	(0.038)
$P_0$	0.149	***	(0.035)	0.852	***	(0.055)
$P_t$	0.200	***	(0.029)			
Female	0.028		(0.022)	-0.032		(0.039)
Portuguese	0.293	***	(0.034)	0.561	***	(0.055)
EU-15	0.017		(0.026)	0.207	***	(0.050)
Not EU-15	0.201	***	(0.045)	0.851	***	(0.069)
Age	-0.058	***	(0.019)	-0.042		(0.042)
a(age)	0.070	***	(0.021)	0.053		(0.046)
Age <sup>2</sup>	0.000	**	(0.000)	0.000		(0.000)
a(age <sup>2</sup> )	-0.001	***	(0.000)	-0.000		(0.000)
Bad health	0.192	***	(0.038)	-0.005		(0.068)
a(bad health)	0.531	***	(0.066)	0.165		(0.104)
Single	-0.017		(0.058)	-0.247	*	(0.137)
a(single)	0.067		(0.066)	0.327	**	(0.148)
Divorced	0.294	***	(0.057)	0.256	**	(0.110)
a(divorced)	-0.076		(0.069)	-0.159		(0.128)
Widowed	0.373	***	(0.135)	-0.107		(0.385)
a(widowed)	-0.274	*	(0.157)	-0.456		(0.425)
Lone-parent	0.285	***	(0.057)	0.677	***	(0.110)
a(lone-parent)	-0.114		(0.083)	-0.274	*	(0.152)
Children(1-6)	0.047	**	(0.023)	0.227	***	(0.042)
a(children,1-6)	0.044		(0.031)	-0.049		(0.055)
Children(6-11)	-0.040		(0.026)	0.140	***	(0.046)
a(children,6-11)	0.079	**	(0.034)	0.010		(0.060)
Children(12-17)	-0.004		(0.025)	0.158	***	(0.046)
a(children,12-17)	0.071	**	(0.033)	0.231	***	(0.058)
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Table 7 – continued from previous page

	Perceived financial difficulties equation			Poverty equation		
	Coefficient	p-value	std. error	Coefficient	p-value	std. error
Low education	0.068		(0.088)	0.083		(0.214)
a(low edu)	0.481	***	(0.093)	0.729	***	(0.220)
Mid education	0.019		(0.074)	0.080		(0.195)
a(mid edu)	0.372	***	(0.079)	0.376	*	(0.201)
Part-time	0.068		(0.085)	0.570	***	(0.154)
a(part-time)	-0.212		(0.147)	0.489	*	(0.252)
Unempl.	0.361	***	(0.039)	0.205	***	(0.067)
a(unempl.)	0.399	***	(0.079)	1.079	***	(0.120)
Self-emp.	-0.013		(0.070)	0.213		(0.137)
a(self-emp.)	0.096		(0.083)	0.986	***	(0.156)
Other	0.209	***	(0.040)	0.449	***	(0.074)
a(other)	-0.160	***	(0.052)	0.353	***	(0.093)
Adults	0.096	***	(0.020)	0.148	***	(0.038)
a(adults)	0.027		(0.026)	0.025		(0.049)
Adults work	-0.180	***	(0.021)	-0.506	***	(0.042)
a(adults work)	0.028		(0.030)	-0.188	***	(0.055)
Access housing	0.194	***	(0.039)	-0.056		(0.092)
a(access)	0.079		(0.052)	-0.031		(0.112)
Tenant	0.045		(0.051)	0.383	***	(0.117)
a(tenant)	0.373	***	(0.063)	0.064		(0.131)
Wave 3	0.097	***	(0.026)	0.123	*	(0.063)
Wave 4	0.153	***	(0.028)	0.244	***	(0.062)
Wave 5	0.167	***	(0.030)	0.230	***	(0.063)
Wave 6	0.293	***	(0.031)	0.198	***	(0.066)
Wave 7	0.230	***	(0.035)	-0.007		(0.070)
Wave 8	0.165	***	(0.036)	-0.070		(0.071)
Wave 9	0.216	***	(0.038)	-0.013		(0.075)
Constant				-3.821	***	(0.335)
Cut[1]	-0.308		(0.192)			
Cut[2]	1.715	***	(0.192)			
Cut[3]	3.286	***	(0.192)			
Cut[4]	4.534	***	(0.193)			
Cut[5]	5.572	***	(0.194)			
$\sigma_{\kappa_i}$			0.691 ***	(0.012)		
$\sigma_{\nu_i}$			0.758 ***	(0.034)		
$\rho_{\kappa_i, \nu_i}$			0.265 ***	(0.039)		
$\ln - L$			-46617.74			

Source: PSELL3/EU-SILC, 2003-2011, authors computation. Significance: \*\*\* 99% confidence level, \*\* 95% and \* 90%.

## 5 Conclusions

The aim of this paper was to analyse whether income poverty and perceived financial difficulties are dynamically interrelated. We characterize this interrelationship by estimating dynamic (probit and ordered) bivariate models controlling for state dependence, unobserved heterogeneity and initial conditions to Luxembourg survey data. Our main result highlights the existence of a feedback effect from past perceived financial difficulties on income poverty. In addition, a feedback effect from past income poverty on current perceived financial difficulties was also found when perceived financial difficulties was modelled as an ordinal variable, but not when it was modelled as a binary variable.

The joint modelling of both concept also allowed us to find that individual-specific effects for each equation were highly significant pointing to the importance of taking into account unobserved heterogeneity in this context and that the positive correlation between unobservables suggest that unobservables that make an individual more prone to be poor also make him/her more likely to perceive that he/she has difficulties to make ends meet. In terms of covariates, it can be noted that employment (number of adult at works) and education protects from being income poor and from perceiving financial difficulties while being a lone parent or having young children increase the likelihood to be confronted to income poverty or perceived financial difficulties.

These results have important implications in terms of our understanding of the interrelationship between dimensions of poverty since they provide further evidence for the fact that subjective perceptions can have objective effects on individuals' behaviour and outcomes (see e.g. Neve et al., 2013). In fact, as mentioned by Mani et al. (2013) "being poor means coping not just with a shortfall of money, but also with a concurrent shortfall of cognitive resources. The poor, in this view, are less capable not because of inherent traits, but because the very context of poverty imposes load and impedes cognitive capacity. The findings, in other words, are not about poor people, but about any people who find themselves poor." These elements suggest that psychological mechanisms should not be overlooked when it comes to design anti-poverty policies. Indeed, as mentioned by Anand and Lea (2011), it is "increasingly recognised that poverty reduction policies which are informed by behavioral insights may, as a result, be more effective".

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## A Appendix



**Table A.1:** Variable labels and descriptives

Variables	Definition	Mean	Std. Dev.
subjo	ordinal Perceived Financial Difficulty (0. very easy; ...; 5. very difficult)	1.763	1.12
subjd	dichotomous Perceived Financial Difficulties 1 if difficulties, 0 otherwise	0.076	0.265
poor	1 if income poor (60% threshold), 0 otherwise	0.132	0.338
female	1 if female, 0 otherwise	0.499	0.500
Lux(ref)	1 if Luxembougish citizenship, 0 otherwise	0.522	0.499
Port	1 if Portuguese citizenship, 0 otherwise	0.182	0.38
EU15	1 if citizen of an EU15 country (except Lux and Port) 0 otherwise	0.224	0.417
NonEU15	1 if citizen of a non EU15 country, 0 otherwise	0.072	0.259
age	Age in years of the individual	40.248	10.06
agesq	Age <sup>2</sup>	1721.329	812.33
health	1 if (very) bad health, 0 otherwise	0.057	0.232
married (ref)	1 if married, 0 otherwise	0.624	0.483
single	1 if single, 0 otherwise	0.268	0.443
divor	1 if divorced or separated, 0 otherwise	0.092	0.289
widow	1 if widow, 0 otherwise	0.016	0.126
highedu (ref)	1 if higher education, 0 otherwise	0.258	0.437
lowedu	1 if low education, 0 otherwise	0.349	0.477
midedu	1 if middle education, 0 otherwise	0.393	0.488
ft(ref)	1 if work full time, 0 otherwise	0.723	0.447
pt	1 if work part-time, 0 otherwise	0.013	0.113
unemp	1 if unemployed, 0 otherwise	0.044	0.205
selfemp	1 if self employed, 0 otherwise	0.049	0.218
other	1 if other labour market status, 0 otherwise	0.169	0.375
nbl6	Number of children in household less than 6	0.294	0.602
nb611	Number of children in household aged 6-11	0.262	0.557
nb1217	Number of children in household aged 12-17	0.248	0.547
nbadult	Number of adults in the household	2.316	0.93
nbaoind	Number of adults at work	0.808	0.703
hhlone	1 if lone parent household, 0 otherwise	0.026	0.159
owner(ref)	1 if household own the accommodation, 0 otherwise	0.210	0.408
acced	1 if owner paying a mortgage, 0 otherwise	0.461	0.498
tenant	1 if tenant, 0 otherwise	0.329	0.469

Source: Own calculation on the PSELL3/EU-SILC, 2003-2011.