RESEARCH PAPER

A Dynamic Analysis of Arrears and Income Poverty in Italy

Chiara Mussida[1] · Dario Sciulli[2]

Abstract

We explore the effects of income poverty on the probability of being in arrears in Italy. We account for endogeneity by using a bivariate discrete response model, which allows considering feedback effects from arrears to future poverty status and selection issues. We also offer an analysis by macro-region. We use longitudinal 2016–2019 EU-SILC data. Our results suggest that being in arrears is characterized by a significant trap effect, which, however, tends to decline over time. We also find the presence of feedback effects from arrears condition to future poverty status. Notably, current poverty status is negatively associated with current arrears status, but the correlation is positive in the medium term. This may suggest that income conditions need time to exert their effects on the probability of being in arrears. In the medium term, being in arrears increases the probability of being poor. We also note heterogeneity at the regional level.

✉ Dario Sciulli
dario.sciulli@unich.it

Chiara Mussida
chiara.mussida@unicatt.it

1 Department of Economic and Social Sciences, Università Cattolica del Sacro Cuore, Via Emilia Parmense 84, Piacenza 29122, Italy

2 Department of Economic Studies, University of Chieti-Pescara, Viale Pindaro 42, Pescara 65127, Italy

🖄 Springer

1 Introduction

The post-Great Recession period has been characterized by increasing attention to household over-indebtedness by public and private authorities, policymakers, and academics. This is not surprising considering its potential consequences at both the micro and macro level. On the one hand, over-indebtedness may affect the sustainability of household indebtedness and may determine undesirable social, health, and labor effects for households (e.g., Fitch et al. 2011; Angel and Heitzman 2015). On the other hand, household difficulties in meeting financial commitments may be transmitted to financial intermediaries and affect the stability of the financial system (e.g., D'Alessio and Iezzi 2013; Mian et al. 2017). In this context, the situation in Italy has become more critical over recent years, as the previously relatively low levels of household debt have begun to grow and the financial difficulties experienced by Italian households as a consequence of the Great Recession and the application of austerity measures have increased. Given these circumstances, it is of interest to investigate the Italian situation and uncover the potential determinants and consequences of household over-indebtedness. This paper contributes to this goal by providing a dynamic analysis of the phenomenon. In particular, we focus on the dynamics of being in arrears, one of the possible aspects of over-indebtedness,[1] and whether and how this is affected by income poverty.

The literature suggests that a poor income condition is a major predictor of over-indebtedness and being in arrears (Bridges and Disney 2004; Brown and Taylor 2008; Sierminska 2014). While this evidence may appear quite trivial, the identification of the related effect may be difficult because the relationship between these phenomena is likely to run in both directions (Kuypers and Verbist 2022). Being in arrears, or more generally over-indebtedness, may determine conditions such as poor health, higher perceived depression, and a higher risk of involvement in crime, which in turn are associated with poverty (Shen et al. 2014; D'Alessio and Iezzi 2016; Angel 2016; Blazquez and Budria 2018).

We contribute to the related literature in various ways. First, we model arrears in a dynamic setting, uncovering the presence or absence of state dependence in over-indebtedness and income poverty processes. This may help to characterize the transitory/permanent nature of the probability of being in arrears, which in turn is important to predict the duration and the severity of the phenomenon. Second, in studying the effect of income poverty on the probability of being in arrears, we account for possible endogeneity issues. To this aim, we adopt a bivariate discrete response model, which enables us to consider possible feedback effects from arrears to future poverty status as well as selection issues stemming from time-invariant unobserved factors jointly affecting both arrears and poverty processes. Finally, we also provide an analysis by macro-region to uncover the existence of territorial disparities in the investigated phenomena.

---

[1] Over-indebtedness is a complex phenomenon with no univocal definition. Recently, studies have moved toward the use of a common set of indicators that reflect (a) making high repayments relative to income, (b) making heavy use of credit, (c) being in arrears, (d) finding debt to be a burden (see D'Alessio and Iezzi 2016).

Our analysis is based on the Italian section of the European Union Statistics on Income and Living Conditions (EU-SILC) panel data. A main advantage of using this dataset is the possibility of modeling the analyzed process in a dynamic way. In addition, the richness of the information available allows controlling for a variety of factors affecting the probability of being in arrears and of experiencing poverty. A potential shortcoming, however, is represented by the impossibility of considering other facets of over-indebtedness. Thus, the empirical measure of the phenomenon that emerges from this study is not likely to overlap with that arising from analyses based on multi-faceted definitions of over-indebtedness. This may imply that the poverty-related effect would be different according to the definition adopted.

The empirical analysis is carried out following the Wooldridge (2005) approach, in order to deal with the initial conditions problem. More specifically, we adopt a bivariate dynamic probit model with endogenous initial conditions and correlated random effects. The model accounts for the possible endogeneity of poverty in the arrears equation, which is important to consistently estimate the magnitude of the relationship between the two phenomena. In addition, it may help mitigating the potential bias occurring because of the lack of information on other aspects of over-indebtedness.

Our results suggest that being in arrears is characterized by significant true state dependence, suggesting that being in arrears is characterized by a certain degree of persistence. The trap effect[2] tends to decline over time, however. We also find evidence of endogeneity issues in the relationship between being in arrears and poverty. This is due to the presence of unobserved factors that jointly affect the investigated processes and the presence of feedback effects from arrears condition to future poverty status. Once we account for endogeneity issues, we find that current poverty status is negatively associated—in a not statistically significant way—with current arrears status. In the medium term, however, the correlation is positive and statistically significant. This may suggest that income conditions need some time to exert their effects on the probability of being in arrears. In addition, unobserved factors favor the realization of both phenomena. Finally, we note that in the medium term, being in arrears increases the probability of experiencing poverty. In this context, we note some heterogeneity at the regional level. In particular, both state dependence in arrears status and the medium-term effect of poverty on the probability of being in arrears appear to be greater in the southern regions than in other Italian macro-regions.

The remainder of the paper proceeds as follows. Section 2 reviews the existing literature. Section 3 describes the data used and offers a descriptive analysis. The empirical model is described in Sect. 4. Section 5 discusses the main findings, and Sect. 6 offers some concluding remarks.

---

[2] The arrears/poverty trap refers to the self-reinforcing mechanism according to which once individuals are in arrears or in poverty, this tends to persist over time unless targeted measures are promoted. Such a mechanism may depend on individual observed (e.g. education, health, work status) and unobservable characteristics, as well as behaviors such as demoralization, loss of motivation, depreciation of human capital, and unfavorable attitudes.

2 Literature

Over-indebtedness is a multi-faceted phenomenon including social, economic, legal, and political aspects. Previous studies have proposed methodologies and indicators based on their specific goals, but a common definition is still lacking (see, for instance, Anderloni and Vandone 2008). Given the complexity of the phenomenon of over-indebtedness, it is also difficult to obtain exhaustive measures (Mutsonziwa and Fanta 2019). Studies of over-indebtedness have attempted to use a common set of indicators, with no universal agreement regarding which indicator best captures true over-indebtedness (Keese 2009). The most commonly used indicators broadly reflect four aspects of over-indebtedness: making high repayments relative to income, being in arrears, making heavy use of credit, and finding debt to be a burden (D'Alessio and Iezzi 2013). Moreover, the estimates of these indicators vary according to the survey used.

Although over-indebtedness is generally considered a phenomenon separate from other aspects of financial exclusion, there are cause–effect links between them. The relationship between the two conditions and social exclusion are complex. On the one hand, we have to consider the link between over-indebtedness—as a cause—and financial exclusion—as a consequence. In this respect, over-indebtedness can be a major factor in creating poverty, particularly among low-income, old-age households and single-parent households with young children (Betti et al. 2007). On the other hand, the relationship can be reversed: financially and socially excluded people can become the most exposed to the risk of over-indebtedness (Anderloni and Vandone 2008). High indebtedness also has a profound impact on social and psychological wellbeing (Fitch et al. 2011).

In the last two decades, interest in the issue of household over-indebtedness has grown rapidly in many European countries. Until relatively recently, excessive consumer debt was rare and largely a marginal problem in Europe. With the Great Recession and the subsequent changing economic situation, labor market dynamics, volatility, and competition in the financial sector exposed a growing number of people to the risk of over indebtedness. In the case of Italy, for many years household debt conditions did provide cause for concern. Nonetheless, the situation has become more critical over time as a consequence of the Great Recession and the application of austerity measures. Indeed, the relatively low levels of household indebtedness have begun to grow, and the financial difficulties experienced by Italian households have been increasing (D'Alessio and Iezzi 2016).

The evidence for Italy suggests that over-indebtedness, as measured by outstanding debts and/or arrears, is primarily experienced by poor households (Fondeville et al. 2010). This suggests a link between the phenomena of over-indebtedness and poverty. Interestingly, in recent decades the literature on poverty has mainly considered its dynamic character by investigating both the determinants of poverty and its persistence over time (Ayllón 2013). The studies investigating the dynamics of poverty in Italy include, for instance, Devicienti and Poggi (2011) and the more recent works by Fabrizi and Mussida (2020) and, for Europe, Mussida and Sciulli (2022). All the mentioned works found sizable state dependence for poverty, regardless of the period investigated. Devicienti and Poggi (2011) explored the 1994–2001 period,

while Fabrizi and Mussida focused on the 2013–2016 period. Mussida and Sciulli (2022), instead, explored both the pre-Great Recession period of 2005–2008 and the post-Great Recession period of 2015–2018, enlarging the investigation to Europe. Their results suggest a relevant degree of genuine state dependence, which in Europe increased slightly from the pre- to post-Great Recession period, on average. Notably, Italy was among the countries with a significant increase.

Given this context, it is of interest to investigate the Italian situation and uncover the potential determinants and consequences of household over-indebtedness. At the individual level, over-indebtedness is associated with an increased chance of emotional distress (Gathergood 2012; Hodson et al. 2014), the deterioration of well-being and/or mental health (Fitch et al. 2011), poor health (Shen et al. 2014; Cuesta 2015; Angel 2016), and higher perceived stress and depression (Sweet et al. 2013). Over-indebtedness is also associated with decreased self-esteem and degraded social relationships (Wang 2010). Other studies also report that over-indebtedness causes family breakdown, leading to higher divorce rates (see Bridges and Disney 2016). As mentioned above, the excessive accumulation of debt also causes the deterioration of household social and economic well-being, thus leading to poverty (Betti et al. 2007; D'Alessio and Iezzi 2013).

Although there exists an intuitive link between poverty and household (over-)indebtedness, there is a lack of research on this issue (Kuypers and Verbist 2022). On the one hand, official poverty indicators produced by EUROSTAT, the OECD, or national statistical offices, for instance, are expressed in terms of household disposable income and thus do not account for the fact that, in practice, debt repayments lower the actual "disposability" of income for many households (Kuypers and Marx 2019). On the other hand, studies on household debt often find that income is one of the strongest predictors of over-indebtedness, even after controlling for other factors (Bridges and Disney 2004; Kempson et al. 2004; Brown and Taylor 2008; Sierminska 2014). This clearly suggests a link with poverty, but often this link is not made explicitly. This may be partly due to the fact that the relationship is difficult to disentangle, as causality is likely to run in both directions. Indeed, as mentioned above, household debt can be both a cause and consequence of poverty. Inspired by the existing literature, we explore the dynamic relationship between household over-indebtedness, as measured by the presence of arrears, and household poverty in Italy, taking into account the clear reverse causality between the phenomena.

3 Data and Descriptive Analysis

We explore data from the longitudinal sample of the European Union Statistics on Income and Living Conditions (EU-SILC) survey for the 2016–2019 period. The survey is conducted in most countries across the European Union by the relevant national institutes of statistics, using harmonized definitions and survey methodologies. The topics covered by the survey encompass living conditions, income, social exclusion, housing, work, demography, and education. We select data for Italy, and our unit of analysis is the household.

We focus on the dynamics of being in arrears and whether and how this is affected by income-poverty condition. We estimate a dynamic bivariate probit model that accounts for genuine state dependence, endogenous initial conditions, correlated random effects, and possible feedback effects from past poverty to the condition of being in arrears. Table 1 reports summary statistics for the variables used in the econometric analysis.

The dependent variables used in our investigation are being in arrears and being at risk of poverty (0, 1). Being in arrears is defined according to the presence of arrears in at least one out of three items, defined at the household level: arrears on mortgage or rental payments (variable HS011 in the EU-SILC code), arrears on utility bills

Table 1 Descriptive Statistics

Variables	Mean	Std. Dev.
Arrears	0.053	0.225
Poor	0.171	0.377
Household head aged 16–24	0.012	0.109
Household head aged 25–34	0.087	0.281
Household head aged 35–44	0.187	0.39
Household head aged 45–54	0.256	0.436
Household head aged 55–64	0.192	0.394
Household head aged over 64	0.267	0.442
Household head female	0.345	0.475
Household head low educated	0.415	0.493
Household head middle educated	0.416	0.493
Household head highly educated	0.169	0.374
Household head married	0.612	0.487
Number of children aged 0–3	0.065	0.265
Number of children aged 4–15	0.371	0.709
Number of members with disabilities	0.095	0.328
Homeowner	0.747	0.435
Number of members employed with permanent contracts	0.704	0.774
Number of members employed with temporary contracts	0.149	0.406
Number of members self-employed	0.207	0.483
Number of members not employed	0.831	0.975
Number of pensioners	0.216	0.411
Year 2016	0.162	0.368
Year 2017	0.289	0.453
Year 2018	0.289	0.453
Year 2019	0.260	0.439
North-West	0.255	0.436
South	0.188	0.391
Islands	0.076	0.266
North-East	0.225	0.418
Centre	0.256	0.436
Observations	76,463	

Note: In our model, we include the interactions between region and time dummies

Source: Authors' elaborations on EU-SILC data

Table 2a The relationship between poverty and arrears

	Not in arrears	In arrears
Not poor	96.26	3.74
Poor	87.00	13.00

Source: Authors' elaborations on EU-SILC data

Table 2b Current arrears status and the dynamics of poverty

Source: Authors' elaborations on EU-SILC data

	Time t	
Time t-1	Not poor	Poor
Not poor	0.028	0.089
Poor	0.077	0.122

(HS021), and arrears on hire-purchase instalments or other loan payments (HS031).[3] At risk of poverty is defined as the fraction of people living in a household with an equivalized income below the threshold of 60% of the national household median. Equivalized household income is defined as the total disposable household income (after taxes and social transfers) divided by an equivalized household size calculated according to the modified OECD scale.[4] From Table 1, we note that 5.3% of the individuals in our sample are in arrears, while those at risk of poverty represent 17.1%.

We now briefly outline the covariates included in our specification. We control for household characteristics, including characteristics of the head of household[5] such as age (divided into age ranges from 16 years to over 64 years), gender, education, marital status (civil union), and home ownership. We also consider the number of children (considering the age ranges of 0–3 and 4–15), the number of disabled people, and the presence of employees, fixed-term employees, self-employed persons, non-employed persons, and pensioners (aged 65 and over) in the household. Finally, to control for time-varying local economic conditions, we include the interactions between the (macro-)region and time dummies. As we use panel data, we also include yearly dummy variables.

A preliminary descriptive analysis is provided in Tables 2a and 2b. Table 2a reports the relationship between poverty and being in arrears at time t. The results show that poverty is positively associated with the risk of being in arrears, considering that 13% of poor individuals are in arrears, while the frequency lowers to 3.74% among non-poor individuals.

Table 2b introduces the relationship between the dynamics of poverty and being in arrears. Each cell illustrates the observed frequency of being in arrears conditional on the transition between poverty statuses over time. Being in arrears is crucially dependent on the time spent in poverty. The observed incidence of being currently in arrears is 2.8% for individuals who were not in poverty both in the previous and the

---

[3] EU-SILC data do not allow us to obtain exhaustive over-indebtedness indicators, due to missing information on some aspects of this phenomenon. Despite this, the dataset does allow us to analyze some aspects of over-indebtedness (e.g., arrears) and, especially, to study the dynamics of factors that may contribute to the surge and persistence of over-indebtedness and financial difficulties.

[4] This is a standard equivalence scale to calculate the number of "equivalent adults" in a household. The scale assigns a weight of 1.0 to the first adult, 0.5 to the second and each subsequent person aged 14 and over, and 0.3 to each child under 14.

[5] The head of household is defined as the highest income earner.

current period, while it increases up to 12.2% for individuals who were in poverty in both periods. Poverty also determines a lag effect. Being in arrears is observed for 7.7% of sampled individuals who were poor in the previous period and not in the current one. In other words, exiting an arrears status once poverty has been experienced may require some time. Finally, 8.9% of sampled individuals who were not poor in the previous period but are currently poor are currently in arrears.

4 Econometric Approach

This section describes a bivariate discrete response model for panel data to investigate whether and how poverty condition affects the probability of being in arrears. We provide a dynamic approach to the study of the arrears process to uncover the presence of state dependence and account for the possible endogeneity of poverty status in the arrears equation. Such endogeneity may result from two issues. The first is the presence of feedback effects from being in arrears to future poverty status, meaning the future risk of poverty might be correlated with recent arrears condition. For instance, being in arrears or, more generally, over-indebtedness may lead to conditions such as lower well-being, poor health, higher perceived depression, and a higher risk of involvement in crime (e.g., d'Alessio and Iezzi 2013; Shen et al. 2014; Angel 2016; Blazquez and Budria 2018; EU 2013), which in turn are associated with poverty. Second, the presence of time-invariant unobserved factors jointly affecting the probability of being in arrears and poverty may determine a self-selection problem, leading to biased parameter estimates if these are not controlled for.

Let us define a_{it} as the arrears status of individual $i=1\dots n$ at time $t=1\dots T$. We assume that being in arrears is described by the following benchmark model:

$$a_{it} = 1\left\{\gamma a_{it-1} + \beta p_{it} + \delta p_{it-1} + \omega x_{it} + \lambda year_t + \kappa region_{it} + \zeta\left(year_t \times region_{it}\right) + g_i + u_{it} > 0\right\}, \quad (1)$$

where 1 is an indicator function, a_{it-1} is the lagged arrears status, p_{it} is a dummy variable indicating whether an individual is poor in the current year or not, p_{it-1} is the lagged poverty status variable, and x_{it} is a vector of strictly exogenous individual and household characteristics. γ is the state dependence parameter, and β is the parameter of interest describing the impact of being poor on arrears status, while δ and ω are sets of parameters to be estimated. λ, κ, and ζ are also sets of parameters to be estimated, referring to year dummy, regional dummy, and interacted year-region dummy variables. Finally, g_i and u_{it} represent the unobserved time-invariant individual effect and the idiosyncratic error term; we assume that these are both normally distributed and that u_{it} is not serially correlated. The poverty equation reads as:

$$p_{it} = 1\left\{\alpha p_{it-1} + \kappa a_{it-1} + \tau x_{it} + \psi year_t + \varphi region_{it} + \sigma\left(year_t \times region_{it}\right) + h_i + \varepsilon_{it} > 0\right\}, \quad (2)$$

where h_i is the random effects term, and ε_{it} is an idiosyncratic error we assume to be normally distributed. α, κ, and τ, are parameters to be estimated. Ψ, φ, and σ, are also sets of parameters to be estimated, referring to year dummy, regional dummy, and interacted year-region dummy variables.

The specified model has a recursive structure. This assumption may be justified both at the economic and methodological level. With regard to the economic level, income conditions may directly and immediately affect being in arrears, which requires more time to determine the effects on poverty status. As for the methodological level, when considering qualitative outcomes simultaneous systems are non-logically consistent. Finally, the recursive structure of the model allows for its identification without imposing exclusion restrictions (Biewen 2009).

The presence of unobserved heterogeneity in the model requires the treatment of two related issues. First, the initial values of the outcomes are potentially correlated with the unobserved factors, generating the so-called initial conditions problem. Second, because of the incidental parameters problem (Heckman 1981), the time-invariant unobserved individual effects cannot be estimated as standard parameters. The former is approached by adopting the strategy of Wooldridge (2005), who proposed the use of an alternative conditional maximum likelihood (CML) estimator that considers the distribution conditional on the value in the initial period. The latter is addressed by relaxing the hypothesis that individual-specific random effects are independent of other covariates (Mundlak 1978).[6]

The conditional densities of the unobserved effects are specified via the following auxiliary models:

$$g_i = \theta_0 + \theta_1 a_{i1} + \theta_2 p_{i1} + \theta_3 \bar{x}_i + \mu_i, \tag{3}$$

$$h_i = \pi_0 + \pi_1 a_{i1} + \pi_2 p_{i1} + \pi_3 \bar{x}_i + \varepsilon_i, \tag{4}$$

where a_{i1} is the status of the initial arrears, p_{i1} is the initial poverty status, and $\bar{x}_i$ is a set of time-averaged time-variant control variables calculated from periods 2 to T. Finally, θ_k and π_k, with $k=0, 1, 2, 3$, are parameters to be estimated.

Considering that unobservable factors that determine the poverty status condition also increase the probability of being in arrears, we model the correlation between unobserved heterogeneity terms to reduce the risk of biased estimates of the poverty effect on arrears. We assume that arrears and poverty equations are linked via random effects and that they are drawn from a bivariate normal distribution with zero mean and variance σ^2. Their association is captured by the correlation term $\rho = \text{corr}(\mu_i, \epsilon_i)$. The significance of the correlation term is suggestive of the importance of using a joint estimation approach to avoid inconsistent estimates (e.g., Ayllón 2015). Finally, because the estimated coefficients describe the sign of the relationship but are inappropriate for determining the magnitude of the impact between outcome and explanatory variables, we compute and report average marginal effects (AMEs).

---

[6] We assume correlated random effects by decomposing the unobserved heterogeneity term into two parts, one correlated and one uncorrelated with time-variant covariates.

5 Results

This section focuses on the results obtained from the bivariate dynamic probit model described in Sect. 4. Section 5.1 illustrates the main findings, while Sect. 5.2 describes additional results. Section 5.3 presents a regional analysis.

5.1 Main Findings

The main estimates are displayed in Table 3, which reports the AMEs of explanatory variables of both equations. The first panel of estimates highlights the role of state dependence in arrears and poverty processes and the relationship between both outcomes. The second panel, instead, illustrates the role of control variables. Finally, at the bottom, we report the estimated correlation term.

Focusing on the arrears equation, we stress the presence of (genuine) state dependence in the dynamic process. Being in arrears in the previous period increases per se (by 5.9 p.p.) the probability of being currently in arrears, suggesting that the phenomenon is characterized by a certain degree of persistence. There are several mechanisms at work in determining this condition, such as demoralization, loss of motivation, unfavorable attitude, or even negative behaviors in payment issues. The statistical significance of the AME associated with the initial arrear status is indicative that initial conditions and confounding factors are correlated. This confirms the importance of dealing with the initial condition problems to obtain robust estimates of state dependence. In addition, some studies (e.g., Ayllón 2015) jointly interpret the estimates of lagged and initial values of the response variable to learn about the evolution of the related trapping effect. Following this approach, we can conclude that while the arrears trap is at work (AME 5.9 p.p., as mentioned above), its intensity tends to decline over time (the AME for initial value is equal to 2.8 p.p.).

Now we turn to the way poverty affects the probability of being in arrears. We find that being currently poor does not have a clear impact on the risk of being in arrears, as the AME is -3.4 p.p. with a p-value close to being significant, while AMEs associated with past poverty values both display positive and significant signs ($+3$ p.p. and $+1$ p.p., respectively). This suggests that poverty needs time to exert its detrimental effects on arrears status, while in the short run, some forces work in the opposite direction. We note that this finding is somehow connected to the endogenous treatment of poverty status in the arrears equation. On the one hand, the statistical significance of the AME of the past arrears variable in the poverty equation ($+1.7$ p.p.) validates the existence of feedback effects from arrears to future poverty. On the other hand, we note that random effect terms are correlated ($\rho = 0.33$, significant at the 5% level), suggesting that unobserved factors affect both processes in the same way. Finally, we note that once potential endogeneity is ignored, the probabilities of being in arrears and in poverty are positively associated (these results are available upon request). In other words, the expected positive relationship appears to be guided by factors that are usually not controlled for, rather than a genuine direct effect of poverty on arrears status in the short term. In the medium-term, instead, the expected positive correlation between the two phenomena emerges more clearly.

Table 3 Bivariate dynamic probit model AMEs by equation

	Arrears equation			Poverty equation		
	AME	s.e.		AME	s.e.	
Arrears time t–1	0.059	0.004	***	0.017	0.005	***
Arrears time 1	0.028	0.003	***	0.004	0.004	
Poor time t	-0.034	0.024				
Poor time t–1	0.030	0.013	**	0.194	0.003	***
Poor time 1	0.010	0.005	*	0.080	0.003	***
Covariates						
Household head aged 16–24	base-category					
Household head aged 25–34	-0.025	0.011	**	0.039	0.016	**
Household head aged 35–44	-0.039	0.011	***	0.045	0.016	***
Household head aged 45–54	-0.033	0.011	***	0.029	0.016	*
Household head aged 55–64	-0.026	0.012	**	0.020	0.016	
Household head aged over 64	-0.002	0.015		0.099	0.018	***
Household head female	0.003	0.002		0.018	0.002	***
Household head low educated	base-category					
Household head middle educated	-0.014	0.002	***	-0.019	0.003	***
Household head highly educated	-0.028	0.004	***	-0.046	0.004	***
Household head married	-0.021	0.008	***	-0.052	0.010	***
Number of children aged 0–3	-0.008	0.008		-0.003	0.011	
Number of children aged 4–15	-0.017	0.005	***	0.015	0.008	*
Number of members with disabilities	0.028	0.004	***	-0.006	0.005	
Homeowner	-0.013	0.011		0.046	0.014	***
Number of members employed with permanent contracts	-0.009	0.005	*	-0.071	0.006	***
Number of members employed with temporary contracts	0.004	0.005		-0.048	0.006	***
Number of members self-employed	0.001	0.006		-0.045	0.007	***
Number of members not employed	0.012	0.003	***	0.002	0.005	
Number of pensioners	-0.002	0.017		-0.044	0.018	**
Year 2018	0.006	0.005		-0.014	0.006	**
Year 2019	0.005	0.005		-0.006	0.006	
North-West	base-category					
South	0.022	0.005	***	0.018	0.007	***
Islands	0.019	0.007	***	0.034	0.009	***
North-East	-0.014	0.006	**	-0.013	0.007	*
Centre	0.009	0.005	*	0.000	0.006	
South x Year 2018	-0.002	0.006		0.028	0.008	***
South x Year 2019	0.008	0.006		0.007	0.008	
Islands x Year 2018	0.012	0.008		-0.005	0.011	
Islands x Year 2019	-0.013	0.009		-0.019	0.011	*
North-East x Year 2018	0.016	0.007	**	0.007	0.009	
North-East x Year 2019	0.015	0.008	*	0.001	0.009	
Centre x Year 2018	-0.007	0.006		0.011	0.008	
Centre x Year 2019	-0.003	0.007		0.014	0.008	*
$\rho\mu\varepsilon$	0.333	0.157	**			
Log-likelihood	-20,273.373					
Observations	54,269					

Source: Authors elaborations on EU-SILC data

Looking at the poverty equation, apart from the feedback effect at work mentioned above, we uncover the existence of a sizeable state dependence. Being poor in the past increases the probability of being currently poor by 19.4 p.p., according to our estimates. The statistical significance of initial poverty status confirms the presence of endogenous initial conditions also in the poverty process and points to the persistent nature of such a phenomenon, even though the trapping effect appears to decline over time (+8 p.p.).

Comparing the AMEs of covariates in both equations allows us to highlight important differences in the two processes. Arrears and poverty evolve quite differently along the age distribution. While we note a positive association between age of the head of household and arrears, there is a negative relationship between age and the at-risk-of-poverty. Although the gender of the head of household does not exert a role on the risk of being in arrears, households headed by females face an increased risk of income poverty, by 1.8 p.p. The presence of children aged 4–15 is detrimental to income poverty (+1.5 p.p.), while the opposite is true for arrears (–1.7 p.p.). The opposite is seen when considering the number of members with disabilities in the household (the AME for the arrears equation is +2.8 p.p.). We also stress that employment conditions are a guiding factor for poverty but not for arrears. The number of employees, and especially those with permanent contracts, quite strongly reduces the risk of poverty (–7.1 p.p.), while the effect is relatively small for the probability of being in arrears (–0.9 p.p.). For the latter, instead, the number of not employed individuals appears to be the most important predictor among those related to the labor market. Notably, the only individual characteristic that exerts a similar effect on both phenomena is being highly educated, as it reduces the risk of being in arrears by 2.8 p.p. and the probability of being poor by 4.6 p.p.

Being in arrears and in poverty has also evolved differently in the analyzed period. The time dummy variables reveal that the risk of being poor was reduced slightly in 2018, while the risk of being in arrears remained unchanged in the time period explored. We also note the existence of a certain degree of heterogeneity at the regional level. In this context, arrears and poverty processes are consistent, as living in southern regions (South and Islands) increases the risk of experiencing both phenomena. Finally, as for time-varying local economic conditions, i.e., interactions between (macro-)region and year, we note a risk of being in arrears in the North-East of Italy that worsens over time. In order to uncover potential differences in the analyzed processes, both in terms of dynamic aspects and the effect of poverty conditions on the risk of being in arrears, we provide a specific regional analysis in Sect. 5.3.

5.2 Additional Evidence

Our benchmark analysis highlights the dynamic relationship between the analyzed outcomes and offers consistent estimates of the effect of poverty on arrears by accounting for two possible sources of endogeneity, namely feedback effects and selection due to common unobservable factors. Despite this, our main results cannot be interpreted in a causal way, and the lack of a proper income shock (e.g. natural disaster or other exogenous event) prevents us from providing a causal assessment.

This section offers an additional analysis based on specific sub-samples of individuals who experienced breaks in their poverty patterns. In particular, we focus on individuals who were never poor in the past and are currently experiencing poverty. While this pattern does not identify a proper income shock, it may represent an approximation of the effects of income changes on the probability of being in arrears. Quite obviously, these additional results cannot be strictly compared with the benchmark analysis but offer evidence in the spirit of our research question.

This analysis is carried out by adopting two distinct approaches. The first consists of a single-equation dynamic probit model that accounts for unobserved heterogeneity, arrears state dependence, and endogenous initial conditions (Wooldridge 2005). The second approach consists of using an endogenous treatment model estimator, which estimates the average treatment effect (ATE) and average treatment on the treated (ATT) from observational data when treatment assignment (i.e., poverty status) is endogenous because of correlation with the potential outcomes. This procedure controls for the endogeneity of treatment assignment by including residuals from the treatment model (auxiliary equation) in the model of the potential outcomes (the so-called control function approach). For identification purposes, we include the relative change in the local unemployment rate in the auxiliary equation. The strength of this choice is based on the hypothesis that a change in the local unemployment rate does not affect the probability of being in arrears in the short term. For more technical details regarding this method, see Wooldridge (2010).

Results are displayed in the Appendix (Table A1). The analysis based on the dynamic probit model reveals that, conditional on being never poor in the past, currently being poor increases the probability of being in arrears by 1.2 p.p. (the coefficient corresponds to 0.262). According to the endogenous treatment model, conditional on not being poor in the past, the ATE of being poor in the current period on the risk of being in arrears is equal to 0.838. Instead, the ATT is 0.083. These results do not perfectly match those that emerged from the benchmark analysis due to methodological differences in the approaches adopted and the different samples analyzed. In addition, neither model accounts for the dynamic relationship between arrears and poverty. However, the results add insight into the poverty–arrears relationship, supporting the view that the insurgence of poverty increases the risk of being in arrears, thus highlighting the link between the two phenomena.

5.3 Regional Analysis

In this section, we comment on the analysis by macro-region to explore the existence of geographical disparities in the investigated phenomena, i.e., being in arrears and income poverty. The results are reported in Table 4. We control for the same covariates used in the model for the whole of Italy. For the sake of brevity, we only comment on the relationships of interest. Full estimates are available upon request.

From the top panel of Table 4, we note the presence of state dependence in arrears in all macro-regions, but at different magnitudes. The increase in the current probability of being in arrears due to being in arrears in the previous period ranges from 2.9 p.p. in the Centre to 10.6 p.p. in the South of Italy. Interestingly, if we jointly consider the AMEs of the lagged and initial values of arrears, we see important simi-

Table 4 Bivariate dynamic probit model AMEs by equation and macro-region

		North-West			North-East			Centre			South		
		AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.	
Arrears equation													
	Arrears time t–1	0.034	0.005	***	0.029	0.007	***	0.057	0.005	***	0.106	0.008	***
	Arrears time 1	0.026	0.005	***	0.033	0.006	***	0.025	0.005	***	0.043	0.007	***
	Poor time t	0.003	0.023		-0.063	0.015	***	0.048	0.018	***	-0.126	0.027	***
	Poor time t–1	0.006	0.014		0.054	0.010	***	-0.021	0.009	**	0.091	0.016	***
	Poor time 1	-0.002	0.006		0.021	0.007	***	0.009	0.006		0.021	0.009	**
Poverty equation		AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.	
	Arrears time t–1	0.027	0.010	***	0.019	0.010	**	0.012	0.010		0.016	0.011	
	Arrears time 1	0.003	0.009		0.004	0.008		0.007	0.009		0.002	0.009	
	Poor time t												
	Poor time t–1	0.199	0.006	***	0.140	0.006	***	0.176	0.006	***	0.249	0.007	***
	Poor time 1	0.047	0.007	***	0.065	0.006	***	0.082	0.007	***	0.120	0.008	***
	$\rho_{\mu\varepsilon}$	0.193	0.183		0.707	0.076	***	-0.339	0.117	***	0.625	0.079	***
	Log-likelihood	-4378.2			-3168.0			-4907.2			-7400.4		
	Observations	13,848			12,225			13,921			14,275		

Source: Authors' elaborations on EU-SILC data

larities and differences across macro-regions. While the arrears-trap effect is at work in all regions, the sign of the intensity over time differs across macro-regions: the intensity tends to increase over time in the North-East, while it reduces over time in the North-West, Centre, and South. Bringing in the evidence for all of Italy (Table 3 and Sect. 5.1), we can say that all macro-regions other than the North-West parallel the average decreasing intensity over time found for Italy as a whole.

As for poverty, we see that the effect of current poverty on being in arrears differs across macro-regions, being not significant in the North-West, negative in the North-East and South, and positive in the South. If we also consider the effect of past poverty, we again find that this does not exert a role in the North-West of Italy, but for the other regions we see significant AMEs, with inverted signs. First, the significance of the sign is informative regarding the existence of feedback effects in all Italian macro-regions other than the North-West (and especially in the South, with +9.1 p.p.). As for the sign, for the North-East and South we confirm the evidence for Italy as a whole. For the Centre, we see a short-run/almost immediate detrimental effect of poverty on arrears status (+4.8 p.p.) that disappears over time (–2.1 p.p.).

Moving to the bottom panel, i.e., the poverty equation, we note the existence of sizeable state dependence, which ranges from 14 p.p. in the North-East of Italy to 24.9 p.p. in the South. This is due to the structural geographical differences that characterize the Italian economy (Mussida and Sciulli 2021). If we jointly consider the AME for past poverty and those for initial poverty, we find the presence of endogenous initial conditions in poverty status, suggesting the persistent nature of the phenomenon. Notably, in this case, the trapping effects decline over time in all macro-regions (the AME for initial poverty is lower than those for past poverty in all regions; see Table 4).

Finally, we see that random effects are correlated in all macro-regions other than the North-West, but the sign of the association changes. We find a positive correlation both in the North-East and in the South ($\rho = 0.71$ and $\rho = 0.63$, respectively, both significant at the 1% level), suggesting that unobserved factors affect both phenomena in the same direction. The opposite is true for the Centre, where the correlation is significantly negative ($\rho = -0.34$, significant at the 1% level). The analysis by macro-region therefore reveal some important geographical heterogeneity in the relationship between the phenomena under investigation.

6 Conclusions

This paper offers a study of the relationship between over-indebtedness and income poverty in Italy using the longitudinal version of the EU-SILC data. Over-indebtedness is defined according to the presence of arrears in at least one out of three items defined at the household level. We estimate a bivariate discrete response model, which allows considering possible feedback effects from arrears to future poverty status and selection issues stemming from time-invariant unobserved factors jointly affecting both arrears and poverty processes. We also provide an analysis by macro-region to uncover the existence of geographical disparities in the investigated phenomena.

We find the presence of genuine state dependence for being in arrears, but the intensity of this trap decreases over time. As for the effects of poverty on over-indebtedness, we see that being currently poor slightly reduces the risk of being in arrears, while past poverty is positively associated with being in arrears. This suggests that poverty takes time to exert a negative effect on over-indebtedness. Interestingly, our results suggest the existence of feedback effects from arrears to future poverty. We find an important state dependence and a poverty trap that declines across time.

From our geographical analysis, we see important heterogeneity across macro-regions. First, we note that state dependence in both phenomena, i.e., being in arrears and income poverty, is higher in the South of Italy with respect to other regions. Second, the intensity of the trap effects associated with both phenomena changes. As for being in arrears, the intensity tends to increase over time in the North-East, while it reduces over time in the North-West, Centre, and South. For poverty, the trapping effects decline over time in all macro-regions, as was found for Italy as a whole. Third, we see some differences in the possible feedback effects from past poverty to current arrears status. We find the existence of feedback effects in all Italian macro-regions other than the North-West. As for the sign, for the North-East and South we confirm the evidence for Italy as a whole. For the Centre, we see a short-run/almost immediate detrimental effect of poverty on arrears status (+4.8 p.p.), which disappears over time (–2.1 p.p.).

Thus, our analysis reveals that accounting for feedback effects is crucial to avoid a misleading picture of the effect of poverty on over-indebtedness. The relationships we found highlight the relevance of measures aimed at lifting individuals (and their households) out of poverty in the short term, as in the medium term poverty is found to positively affect over-indebtedness. There is also a need for measures that take into account the important geographical disparities we found, with the South showing relatively high state dependence in both phenomena and all macro-regions other than the North-West showing evidence of feedback effects from past poverty to current arrears status. An additional analysis based on a sub-sample of individuals who experienced a break in their income pattern suggests that the insurgence of poverty is associated with an increase in the risk of being in arrears.

A drawback of the analysis is represented by a lack of information that would allow us to characterize over-indebtedness as a multi-faceted phenomenon. Focusing only on being in arrears may underestimate the event and may affect the identification of the link between poverty and over-indebtedness. In particular, not accounting for other aspects of over-indebtedness may underestimate the magnitude of the poverty effect on the outcome. In this sense, our estimates may be interpreted as conservative.

Appendix

Table A1 Being in arrears and experiencing a break in poverty pattern

		Estimate	s.e.	
Wooldridge model	AME	0.012	0.003	***
Endogenous Treatment model	ATE	0.838	0.284	***
	ATT	0.083	0.008	***

Note. The analysis is based on the sub-sample of 43,353 individuals who was not experiencing poverty at both time t–1 and time 1

Source: Authors' elaborations on EU-SILC data

Data Availability Restrictions apply to the availability of the data used under license from EUROSTAT for this study. Data are available from the authors upon reasonable request and with permission of EUROSTAT only.

Declarations

Conflicts of Interest The authors declare that they have no conflicts of interest.

Research involving human participants and/or animals Not applicable.

Informed consent Not applicable.

References

Anderloni L, Vandone D (2008) Households over-indebtedness in the economic literature. Departmental Working Papers 2008-46, Department of Economics, Management and Quantitative Methods at Università degli Studi di Milano

Angel S (2016) The effect of over-indebtedness on health: comparative analyses for Europe. Kyklos 69(2):208–227

Angel S, Heitzmann K (2015) Over-indebtedness in Europe: the relevance of country-level variables for the over-indebtedness of private households. J Eur Social Policy 25(3):331–351

Ayllón S (2013) Understanding poverty persistence in Spain SERIEs. – J Span Economic Association 42(2):201–233

Ayllón (2015) Youth poverty, Employment, and leaving the parental home in Europe. Rev. Income Wealth 61(4):651–676.

Betti G, Dourmashkin N, Rossi M, Ping Yin Y (2007) Consumer over-indebtedness in the EU: measurement and characteristics. J Economic Stud 34(2):136–156

Biewen M (2009) Measuring State Dependence in Individual Poverty histories when there is feedback to Employment Status and Household Composition. J Appl Econom 24:1095–1116

Blazquez M, Budria S (2018) The effects of over-indebtedness on Individual Health. Hacienda Pública / Review of Public Economics 227(4):103–131

Bridges S, Disney R (2004) Use of credit and arrears on debt among low-income families in the United Kingdom. Fisc Stud 25(1):1–25

Bridges S, Disney R (2016) Household finances, Income shocks, And family separation in Britain. Econ Inq 54(1):698–718.

Brown S, Taylor K (2008) Household debt and financial assets: evidence from Germany, Great Britain and the USA. J Royal Stat Society: Ser (Statistics Society) 171(3):615–643

Cuesta MB (2015) The effects of over-indebtedness on individual health, Discussion Paper No. 8912, Institute for the Study of Labor, Bonn

D'Alessio G, Iezzi S (2016) Over-indebtedness in Italy: how widespread and persistent is it? Bank of Italy, Occasional Paper No. 319, Bank of Italy, Rome

D'Alessio G, Iezzi S (2013) Household over-indebtedness: definition and measurement with Italian data. Bank of Italy Occasional Paper No. 149, Bank of Italy, Rome

Devicienti F, Poggi A (2011) Poverty and social exclusion: two sides of the same coin or dynamically inter-related processes? Appl Econ 43(25):3549–3571

EU (2013) The over-indebtedness of European households: updated mapping of the situation, nature and causes, effects and initiatives for alleviating its impact – part 1, Synthesis of findings. Available at https://ec.europa.eu/info/sites/info/files/final-report-on-over-indebtedness-of-european-households-synthesis-of-findings_december2013_en.pdf

Fabrizi E, Mussida C (2020) Assessing poverty persistence in households with children. J Economic Inequal 18(4):551–569

Fitch C, Hamilton S, Bassett P et al (2011) The relationship between personal debt and mental health: a systematic review. Mental Health Review Journal 16(4):153–166

Fondeville N, Ozdemir E, Ward T (2010) Over-indebtedness: new evidence from the EU-SILC special module. European Commission. DG Employment, Social Affairs and Equal Opportunities, Social Situation Observatory

Gatherhood J (2012) Debt and depression: causal links and social norm effects. Econ J 122(563):1094–1114

Heckman JJ (1981) The incidental parameters Problem and the Problem of initial conditions in estimating a Discrete Time- Discrete Data Stochastic process. In: Manski C, McFadden D (eds) Structural Analysis of Discrete Data with Econometric Applications. MIT Press, Cambridge

Hodson R, Dwyer RE, Neilson LA (2014) Credit card blues: the middle class and the hidden costs of easy credit. Sociol Q 55(2):315–340

Keese M (2009) Triggers and determinants of severe household indebtedness in Germany, SOEP Papers No. 239, DIW Berlin. The German Socio-Economic Panel (SOEP), Berlin

Kempson E, McKay S, Willitts M (2004) Characteristics of families in debt and the nature of indebtedness. Department for Work and Pensions, London. (Research Report No 211)

Kuypers S, Marx I (2019) The truly vulnerable: integrating wealth into the measurement of poverty and social policy effectiveness. Soc Indic Res 142(1):131–147

Kuypers S, Verbist G (2022) Over-indebtedness and poverty: Patterns across household types and policy effects. National Bank of Belgium Working Paper No. 420

Mian A, Sufi A, Verner E (2017) Household debt and business cycles worldwide. Quart J Econ 132(4):1755–1817

Mundlak Y (1978) On the pooling of Time- Series and Cross- Section Data. Econometrica 49:69–85

Mussida C, Sciulli D (2021) Poverty dynamics in Italy: an analysis of territorial disparities. Economia Italiana 3:17–54

Mussida C, Sciulli D (2022) The dynamics of poverty in Europe: what has changed after the great recession? J Economic Inequal 20(4):915–937

Mutsonziwa K, Fanta A (2019) Over-indebtedness and its welfare effect on households: evidence from the southern African countries. Afr J Economic Manage Stud 10(2):185–197

Shen S, Sam AG, Jones E (2014) Credit card indebtedness and psychological well-being over time: empirical evidence from a household survey. J Consum Aff 48(3):431–456

Sierminska E (2014) Indebtedness of households and the cost of debt by household type and income group. Research note 10/2014. European Commission, DG Employment, Social Affairs and Inclusion

Sweet E, Nandi A, Adam EK, McDade TW (2013) The high price of debt: household financial debt and its impact on mental and physical health. Soc Sci Med 91:94–100

Wang JJ (2010) Credit counselling to help debtors regain footing. J Consum Aff 44(1):44–69

Wooldridge JM (2005) Simple solutions to the initial conditions Problem in Dynamic, Non-linear Panel Data Models with Unobserved Heterogeneity. J Appl Econom 20:39–54

Wooldridge JM (2010) Econometric Analysis of Cross Section and Panel Data, second edition, Cambridge, Massachusetts: MIT Press