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MIDDLE CLASS, GOVERNMENT EFFECTIVENESS AND POVERTY IN THE EU: A DYNAMIC MULTILEVEL ANALYSIS

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Using the 2008-2011 EU-Statistics on Income and Living Conditions data, we implement a dynamic three-level model to analyze poverty persistence in 26 EU countries. We isolate true state dependence phenomena by disentangling the effects of observed and unobserved heterogeneity at country level and employ cofactors not previously considered by the literature. Estimates show that unobserved heterogeneity across individuals remains large, even after explicitly controlling for the observable components of individual characteristics. The initial value of poverty has large effects on current poverty status but this effect is not uniform across countries. The risk of poverty is negatively related to the size of the *structural* middle class and to the level of *structural* social expenditure but it increases when *lagged* total public expenditure increases (with respect to the structural value). There is strong evidence of true state dependence.

JEL Codes: C23, C25, I30

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1. Introduction

The 2008 economic crisis and the protracted period of instability and stagnation that almost immediately followed the outbreak of the crisis came with an increase in poverty across the EU (Dueilla and Turrini, 2014; Stockhammer, 2015, Bosco, 2016a). In particular, in the member states most severely hit by the crisis, the prospects for the most vulnerable parts of the population became a serious source of concern. In the 2010, the EU member states endorsed a new EU strategy (called Europe 2020) designed to promote, among other objectives, "social inclusion in particular through the reduction of poverty" by aiming to lift at least 20 million people out of the risk of extreme poverty and social exclusion. Logically, the fulfillment of the above ambitious 20-million-people program requires a thoughtful analysis of how future income growth, educational levels, technical development and any other economic improvements as well as political accountability and institutional quality can generate social inclusion and poverty risk reduction or persistence. Yet,

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the causes behind the dynamic process that leads an individual to be poor are both *macro* and *micro* and the persistence of poverty may arise from individual heterogeneity as well as countries' economic and political factors. Hence, if individuals experience poverty in a specific time because of adverse idiosyncratic personal characteristics, they will be likely to experience poverty in other subsequent periods. This may happen notwithstanding the improvements in the country's general economic conditions from one period to the next. These adverse characteristics can be either observable or unobservable. Empirical literature has widely inquired the impact on poverty of individual observable characteristics (i.e. sex, level of education, household status, occupation status) and country-level (mainly) observable characteristics (i.e. per capita income, different qualitative and quantitative measures of the welfare state effort and country specific effects). We contribute to this literature by analyzing in a dynamic longitudinal multilevel framework the relationship between poverty dynamics and observable as well as unobservable country factors. We feel that a proper understanding of the above dynamic relationship can be a useful support to any anti-poverty program in the EU as elsewhere.

The specific aim of this paper is twofold. We want to estimate the probability of poverty persistence in the EU when observable and unobservable heterogeneity at the country level are correctly disentangled and the dynamic process that leads an individual to be poor has been defined in order to isolate true state dependence phenomena. Distinguishing between the two processes (true state persistence and heterogeneity) is crucial since the policy implications of the two are very different. If persistence of poverty is (at least partly) due to a true state dependence, then it makes sense to plan measures aiming *at pulling the individual out of poverty* at time t in order to reduce her chance of experiencing poverty at time $t+1$ and to implement measures that intervene on factors that generate the true state dependence in order to break the "vicious poverty circle". On the contrary, if the persistence of poverty is mainly due to unobserved heterogeneity, any short-term policy aimed to pull the individual out of poverty at time t would not be effective at time $t+1$. It is therefore crucial to disentangle the effects of country-level explanatory variables and to isolate state dependence. To this end, the paper implements a three level dynamic multilevel model. Building on the technique proposed by Wooldridge (2005)—that allows to consistently estimate a two level model with both lagged dependent and exogenous variables to distinguish between true state dependence and heterogeneity at the individual level—we propose a method that adds a further level of the analysis in order to investigate the impact of heterogeneity at country level on the individual risk of poverty. This three-level approach permits to disentangle the effects of country-level explanatory variables and to appreciate the effects of country dummies by specifying country membership as a random effect.

Framing the analysis in the above methodology, we contribute to the literature by expanding the set of hypotheses about the effects of observed heterogeneity and include for the first time the size of the middle class in each country as one of the fundamental drivers of individual poverty dynamics. We also control for the quality of public policy implementation measured by an appropriate internationally recognized index of government effectiveness. Yet, direct reference to the middle class represents the main new hypothesis of this paper and it is motivated by the observation that the size of the middle class is beheld to be instrumentally important to economic development. A large

stand of current literature views middle class as a factor that fosters entrepreneurship, shifts the composition of consumer demand and makes it possible to implement those political and institutional reforms conducive to growth and, ultimately, to poverty reduction. Consequently, middle-class is a key factor in the implementation of some (theoretically common) anti-poverty EU policy measures. After controlling for the dissimilarities among national welfare systems and the organization and operation of each public national administration as possible sources of cross-country heterogeneity, we specifically conduct a test of the role of the middle class size as a cofactor explaining cross-country differentiated levels of people exposition to the risk of poverty.

Hence, this paper proposes a dynamic three-level estimation strategy and expands the hypotheses about the countries' sources of observable heterogeneity by including, alongside welfare related factors (e.g. social expenditure), the size of the middle class and a measure of the quality of public policy. In doing so we intend to offer fresh empirical evidence on the determinants of poverty in the EU during a period characterized by a deep economic crisis. Results show that the new hypotheses are consistent with the data generation process. The coefficient on the lagged poverty is highly statistically significant and the initial value of poverty shows, with significant cross-country differences, that there is substantial correlation between the initial poverty condition and the unobserved heterogeneity. This will affect future realizations of poverty: individuals experiencing poverty at a certain point in time have a higher probability to experience poverty in the future than non-poor individuals do (i.e. there is evidence of true state dependence). Yet, structural high levels of both middle class and social expenditure reduce the above probability of experiencing future poverty, which is also reduced by positive deviations of lagged values of social expenditure from their structural mean values. On the contrary, "good" public policy reduces the risk of poverty only in a subgroup of countries or when the poverty line is held constant over the period covered by the analysis. Moreover, the estimate of the true state dependence under the hypothesis of a structurally *limited* middle class is much higher than the one observed assuming a structural *extended* middle class. Thus, estimates allow inferring that an extended middle class combined with high social expenditure and good public policy may help reducing the adverse future impact of experiencing poverty in a specific period. However, the effectiveness of similar measures implemented to contrast initial poverty (e.g. a one percent increase of social expenditure) can be hampered/amplified by unobserved country characteristics according to the initial state of poverty. Our estimates show how serious this problem can be.

The rest of the paper proceeds as follows. In Section 2, the literature on poverty dynamics is shortly reviewed. Section 3 contains our discussion of the hypotheses to test about the role of the middle class and the quality of institutions. In Section 4, we present the data set employed in the estimation strategy. Section 5 contains a presentation and a discussion of the estimation results and tests. Section 6 concludes.

2. Longitudinal Studies of Poverty

2.1. *Longitudinal Approach and Micro-Drivers of Poverty*

Longitudinal research on poverty has covered two main themes: the duration of poverty spells (and its persistence) and the determinants of poverty states

(individuals' attributes and life events—as well as macro factors—that affect individual poverty condition). Studies on poverty duration aim at understanding whether poverty is a transitory status which individuals are exposed to in some phases of their life (i.e. temporary poverty) or it is a condition lasting for longer periods (i.e. persistent poverty). Empirical studies have revealed high levels of mobility into and out of poverty. Pioneers in this kind of analysis were Bane and Ellwood (1986) and Stevens (1994). The former proposed the so-called individuals' spells approach aimed to study mobility into and out of poverty and to identify characteristics and trigger events of poverty exit and re-entry in US during the period 1970-1982. Stevens (1994) extended this approach by allowing for multiple or repeated spells and applies it to 1970-1987 US data. The analysis has, then, been extended to many other countries.[1] Most of the findings suggest that the majority of the experiences with poverty are short-lived, whereas a minority of the poor are below the threshold for long period. However, empirical evidence shows that the probability of exit from poverty depends on the state duration: the longer is the period spent in poverty, the lower is the probability that the transition out of poverty occurs. Most studies find that poverty duration dependence remains significant even when controlling for observed/unobserved heterogeneity. For example, Canto (1996) examines the duration dependence for poverty entries and exits in Spain using a nonparametric specification of the hazard rate. She controls for unobserved heterogeneity indirectly by testing the homogeneity of the hazard rate between groups that are likely to have different spell lengths. She finds significant duration dependence both for poverty reentries and exits. Cappellari and Jenkins (2004) using data from the BHPS for the 1990s conclude that there is substantial state dependence in poverty, separately from the persistence caused by heterogeneity. Biewen (2006) reports that even after controlling for observed and unobserved individual characteristics, there is negative state dependence in poverty exit and reentry behavior. Andriopoulou and Tsakloglou (2011) found that the probability of exiting poverty is inversely related to the duration of the poverty spell even after taking into account socio-economic characteristics, demographic events, and unobserved heterogeneity across individuals. Thus, poverty is simultaneously *fluid* and characterized by long-term traps (Oxley *et al.*, 2000; OECD, 2001).

Analyses of long-term poverty traps, aiming at establishing whether observed persistence is due to underlying differences in individual attributes or due to true casual effects of past on future poverty, are also performed using dynamic discrete choice models. These models permit, in facts, to solve the initial conditions problem and to account for observed and unobserved heterogeneity to distinguish true state dependence (that is, experiencing poverty in a specific period, in itself, increases the probability of undergoing poverty in subsequent periods) from spurious state dependence (Heckman, 1981; Wooldridge, 2005). Using this approach, Poggi (2007) studies social exclusion dynamics in Spain and finds that both individual heterogeneity and true state dependence are related to the probability of experiencing social exclusion. Focusing on youth poverty in Spain, Ayllón (2015)

[1]Among the others, see Ducan *et al.* (1993), Canto (1996), Jenkins (2000), Oxley *et al.* (2000), Jenkins and Rigg (2001), Devicienti (2002), Hansen and Wahlber (2004), Fouarge and Layte (2005), Biewen (2006), Valletta (2006), Aranz and canto (2012), Andriopoulou and Tsakloglou (2011) and Demir Seker and Dayioglu (2015).

also finds that there is a substantial proportion of true state dependence in the poverty status. Devicienti and Poggi (2011) who apply a bivariate probit technique to model the dynamics of social exclusion jointly with poverty in Italy, find evidence of true state dependence and cross effects. The present study can be included in the group of longitudinal studies of poverty using this approach (dynamic discrete choice models).

As it was stressed above, the analysis of poverty dynamics analyzes the main determinants of transitions in and out from poverty. Transitions between the two states could be linked to individuals' attributes or to specific individual events changing individuals' needs or resources. We can refer to these factors and events as micro-drivers of poverty. According to Bane and Ellwood (1986), the literature distinguishes between demographic and economic events. The former are mainly changes associated to family composition (e.g. births, deaths, marriage, divorce), the latter are factors related to changes in family income (e.g. changes of occupational statuses, increases or decreases of workloads or welfare benefits). Some authors suggest that poverty transitions are much more related to economic events than to demographic ones and a major role is played by circumstances on the labor market (e.g. Gottschalk, 1982; Polin and Raitano, 2012). Dynamic discrete choice models also investigates individual heterogeneity as determinant of poverty states. In particular, these models control for both observed (i.e. household size, age, gender, education, marital status, occupational status, area of residence) and unobserved individual characteristics (e.g. Poggi, 2007; Devicienti and Poggi, 2011; Ayllón, 2015). Empirical evidence shows that both unobserved and observed heterogeneity matter in determine poverty.

Finally, one can also use decomposition methods to inquire individual heterogeneity as driver of poverty. In facts, decomposition methods permit to evaluate the impact of socio-demographic and labour market country specific characteristics of poverty. For example, Dickens and Ellwood (2001) provide a strategy for decomposing the factors influencing poverty in Britain and the United States and find that demographic and wage change is a dominant force in both nations. Demir Seker and Dayioglu (2015) propose a decomposition method to examine the factors accounting for changes in absolute poverty rates over the two sub-periods. D'Ambrosio *et al.* (2011) introduce a decomposition procedure to determine the exact marginal impact of a set of explanatory variables (i.e. household size, age, gender, marital status and occupational status) on poverty using Belgium, France, Germany, Italy and Spain. Reference to individual level is therefore essential to enable us to simultaneously control for the effects of individual-level variables, contextual variables and cross-level influence on individual-level poverty. Yet, the risk in overemphasizing the individual level is to present the entire data generation process (poverty levels and dynamics) as the result of the individual characteristics of poor people and to predetermine an explanation of poverty as result of the behavior and attributes of the poor.[2] Partly in response to the necessity to prevent

[2]Brady *et al*. (2009) discuss this issue in depth with respect to American cultural climate, which, according to the authors, contains an enduring focus on individual characteristics within the social science of poverty. Using Iceland's (2003) classification of the different perspectives on the causes of poverty, and adopting the interpretation suggested by Callens and Croux (2009) one might even say that in the so-called individual perspective the poor themselves create their own poverty.

this danger, this paper will make an effort to contextualize stratification within the institutional framework and the socio-economic relations that generate poverty. The next section discusses how macro drivers can be included in the present analysis.

2.2. *Macro Drivers of Poverty*

Among the macro factors affecting poverty, the negative relationship between different qualitative and quantitative measures of *welfare state and income poverty* is a well-established result (e.g. Goodin *et al.*, 1999; Kenworthy, 1999; Layte *et al.*, 2001; Van den Bosch and Cantillon, 2006). The hypothesis that institutional quality may directly affect poverty stems from the idea that in parliamentary regimes, inequality generates political and electoral pressure for redistribution but poor institutional quality creates the conditions for rent seeking behaviors that reduce the effectiveness of redistribution policies (Ross, 2001).[3] On the one hand, inequality and absolute poverty make the median voter worse off relative to the national *well-being* average and provide the middle class electorate with incentives to support redistribution policy measures (e.g. taxation, expenditure and regulation). At the same time, however poor institutional, legal and political features of each country may contribute to poverty persistence and poverty differences across countries because they can impinge upon antipoverty measures (Bosco, 2016a, 2016b).

Many cross-sectional and longitudinal studies that use the individuals' spells approach offer empirical support confirming the existence of a negative relationship between welfare state and poverty. For example, Fouarge and Layte (2005) explore how different country welfare regimes (classified as corporatist, social democratic and liberal) impact on the distribution of poverty and its duration in Europe for the period 1994–1998. Dewilde (2008) evaluates to what extent between-country differences in the probability of being "multidimensional" poor can be explained by a range of "domain-specific" indicators of welfare regime arrangements (e.g. replacement rate in case of unemployment, social assistance benefits, labour market flexibility, and support for families). After controlling for the nesting of individuals within households and countries by using robust standard errors, she concludes that institutional arrangements do influence the risk of multidimensional poverty in the expected direction. Other authors have focused on the transfer system, since it is an important component of the welfare regime. They find a significant relationship between social policy generosity and poverty (e.g. Jenkins, 2000, Whelan *et al.*, 2008; Kenworthy *et al.*, 2011, Dueilla and Turrini, 2014). Since both welfare state generosity and the level of poverty are at least partly determined by the general level of economic welfare in a society, the impact of institutions is often estimated controlling for affluence, measured in terms of GDP per capita (Dewilde, 2008). Cross-sectional empirical evidence seems to indicate that the association between GDP and poverty is expected to be small (Whelan

[3]An extensive review is in Ross (2001, chapter 10), whereas Bénabou (1996) describes the linkage between poverty, inequality, growth and political conflict. References to institutional and political factors are made in the various essays included in Banerjee *et al.* (2006). Banerjee *et al.* (2006, 12) stresses that among the various alleged causes of poverty are overpopulation, corruption and ethnic conflicts; poorer countries are plagued by these problems, affecting poverty adversely.

and Maître, 2012) or inexistent (Kenworthy *et al.*, 2011). Yet, longitudinal evidence shows that economic growth seems to play an important role in determining poverty states (Demir Seker and Dayioglu, 2015; Bosco, 2016a).

Whereas research on the effects of welfare state measures on poverty abounds, longitudinal studies based on dynamic discrete choice models have only rarely analyzed the impact of the *institutional context* on poverty. Many dynamic discrete choice models (e.g. Devicienti and Poggi, 2011; Poggi, 2007) includes only sets of year and country dummies to capture respectively the macroeconomic environment and structural differences in local conditions (e.g. structural differences in welfare state). These models normally do not include specific country level variables in order to keep the specification as simple as possible. Among the exceptions, Poggi and Florio (2010) analyze the impact of country specific energy reforms on deprivation and find evidence that the national energy market structure is correlated with the probability of households experiencing deprivation. The result holds even after controlling for the nesting of households within countries by using robust standard errors.

Another potential driver for poverty reduction/persistence is the size of the middle class. Although the middle class might be considered as instrumentally important to economic development, so far the size of the middle class has not been included in longitudinal studies of poverty. A large middle class is supposed to foster entrepreneurship, shift the composition of consumer demand and make it possible to implement those political and institutional reforms conducive to growth.[4] Aristotle's *Politics* (350 BCE) gives a definition of middle class still useful to poverty analysis:[5]

Of oligarchies, one form is that in which the majority of the citizens *have some property, but not very much*; and this is the first form, which allows to any one who obtains the required amount *the right of sharing in the government*. …, [hence] it follows that the law must govern, and not individuals. …. In respect of property [middle class people] have *neither so much as to be able to live without attending to business, nor so little as to need state support*, they must admit the rule of law and not claim to rule themselves. But if the men of property in the state are fewer than in the former case, and own more property, there arises a second form of oligarchy. For the stronger they are, the more power they claim, and having this object in view, they themselves select those of the other classes who are to be admitted to the government; but, not being as yet strong enough to rule without the law, they make the law represent their wishes. When this power is intensified by *a further diminution of their numbers and increase of their property*, there arises a third and further stage of oligarchy, in which the governing class keep the offices in their own hands, and the law ordains that *the son shall succeed the father*. When, again, the rulers have great wealth and numerous friends, this sort of family despotism approaches a monarchy; individuals rule and not the law.

According to this tradition, middle class size affects both the form of the state (not its efficiency) and wealth distribution. Following Aristotle's observation that the middle class benefits from democratic institutions, many economists maintain

[4]See Ravallion (2009) and the literature quoted in his paper.

[5]We thank an anonymous referee for urging us to discuss Aristotele's teaching on this topic.

that the middle class demands good government and helps sustain it by financing public goods through willing payment of taxes (Birdsall, 2010; Alesina *et al.*, 2012; Loayza *et al.*, 2012). Barro (1999) has shown that countries are more likely to be democratic the higher the share of income going to middle-class families. In particular, the middle class wants a government that maintains a level playing field in the economic arena, free of insider rents and privileges, capable of regulating effectively natural monopolies, and able to administer and enforce tax systems adequate to provide security, basic infrastructure, and other public and collective goods and services (Birdsall, 2010). A large middle class can also reduce the negative impact of credit market failures on development and then on poverty. Thus, to the middle class is generally attributed "not only a moderating role vis-à-vis political extremists, but also an interest in political democratization, in good and transparent governance, and respect of civil rights" (Birdsall, 2015, 225). As a result, poverty should ultimately decrease as middle class increases because not only more middle class implies higher growth but also because meeting the demands of the middle class—or, conversely, attending to their need for security – is crucial for the success of welfare policies. As for the relation between middle class and *individual* poverty, one should be aware that middle class—being a contextual factor—might not be the same for all types of people in a country. For example, while it may matter for the poverty outcomes of one particular group of people, it may not have the same influence upon the poverty experiences of other groups. This means that in a particular country, the size of the middle class may affect poverty at the individual level (by amplifying or reducing the expected trade, credit and employment *individual* opportunities provided by both market and state activities). Yet the experiences of an individual may be more or less variable than those of another individual. This kind of heterogeneity, both between individuals and between countries, provides another reason for framing the relationship between poverty and middle class into a three level modelling for it permits to control for between-context and between-individual heterogeneity even when a clear-cut relationship between the size of the middle class in a country and the extent of individual poverty in that country is not known.

In a study on poverty, the measurement of middle class however is a critical issue and, as we will see in detail in Section 4, this issue is not entirely settled. Therefore, any measure of middle class results in some way arbitrary and open to criticisms. In developed countries, economists normally define as middle class the individuals having an income within some interval that includes the median and it is often symmetric (e.g. between 75 and 150 percent of median income) around the median value. That interval obviously excludes the poverty line, which is generally set at 60 percent of the national median equivalized disposable income. As a result, the condition of being middle class is independent upon the income level defining poverty. Still, middle class living standards begin when poverty ends and therefore the view that the ratio between those who are poor and those who are middle class should be independent upon the value of the poverty line in use in each country is open to questionings. Changes in the size of middle class, therefore, could be related to changes in the headcount of the poor from one period to the next. To see this, define income distributions $F_{t+i}(y)$ over a range of poverty lines (where t is time and $i \in [0, T]$). Then, the adoption of Atkinsons' view (Atkinson, 1987) on

the measurement of poverty implies that when comparing $F_{t+i}(y)$ with $F_{t+i+1}(y)$, Atkinson's first-order stochastic dominance (FSD) conditions for a headcount poverty reduction (Atkinson, 1987, 751) requires $[F_{t+i+1}(y) - F_{t+i}(y)] \leqq 0$ with at least some y for which a strict inequality holds. If all individuals in the society have an increasing utility function defined over income – U(y) with U'(y) > 0 – it follows that, under the above FSD, $E_{Ft+i+1}U(y) \geq E_{Ft+i}U(y)$, where E is expected value (necessary condition for FSD). The average utility of a risk neutral society increases when $[F_{t+i+1}(y) - F_{t+i}(y)] \leqq 0$ holds and the headcount poverty ratio decreases because $\text{Min}(y)_{Ft+i+1} \leqq \text{Min}(y)_{Ft+I}$ (necessary condition for FSD). Still, a value judgment is difficult to formulate and the fact that from year t to year t+i a left tail reduction is observed (the headcount poverty ratio reduces and the middle class headcount increases) simply implies that the society is maximizing the expected value of utility from income. Ravallion (2009, 445) discusses, as a possible case, the shift from an initial cumulative distribution function (CDF) of income (call it A) to two possible final distributions, (call them B and C), both with the FSD property with respect to A. The change from A to B is constructed to illustrate the hypothesis that all incomes increase by a same proportion. The change from A to C to illustrate the hypothesis that gains are larger at lower poverty lines. Both satisfy FSD conditions with respect to A (a poverty reduction is shown by the left tail condition) but distribution C has a "larger middle income bulge" than B. This implies that the density is appreciably higher in a wide interval around the median and that distribution C has more people vulnerable to an aggregate economic contraction that B. Poverty reduction seems more exposed to reversibility in the case of distribution C and the gains attributable to an increase in the middle class are more transitory than permanent. Therefore when studying the impact of middle class expansion on poverty reduction the issue of the evolution of poverty over time is important. The transition from Ravallion's distribution A to distribution B or to distribution C may depend upon structural (as opposed to spurious) state dependence and this requires an analysis of the relevance of the state dependence on the probability to experience poverty, conditional upon the poverty status in the previous period. The contribution that the middle class can give to poverty reduction can be strong, stable (as held by the literature quoted at the beginning of this section) or reversible according to how middle class affects the dynamic of past poverty. If the estimates of the state dependence of poverty in countries characterized by large middle class is high, this implies that middle class can reduce the state dependence and have a significant impact on the dynamics of future poverty. We will follow this line of research in the rest of the paper and we will include the size of the middle class in the set of macro drivers. Our measurement of the middle class headcount is in Section 4.

3. Model and Methodology

Recent cross-sectional studies propose to use multilevel methods for assessing to what extent differences in the characteristics of individuals and country-specific factors can explain country differences with respect to individual outcomes. These methods are attractive because they offer a means of quantifying

the extent to which differences in outcomes reflect differences in the effects of country-specific features (e.g. socio-economic institutions), which are distinct from differences in outcomes associated with variations in the attributes of the individuals themselves (Bryan and Jenkins, 2015). Using this kind of models, Whelan and Maître (2012) find that the inclusion of country-level variables does not contribute much to the explanation of country differences in basic deprivation. On the contrary, Bárcena-Martín *et al.* (2014) emphasize the need to combine micro and macro levels and show that country-specific factors seem to be much more relevant than individual effects in explaining country differences in material deprivation. Whelan and Maître (2012) also find a significant statistical interaction between deprivation and country attributes. Building on the methodology first developed in Bosco and Poggi (2016), in the present paper we adapt the technique proposed by Wooldridge (2005) and propose the use of a dynamic three level discrete choice model to analyze poverty persistence. The original structure of the model consistently estimates a two level model with both lagged dependent and exogenous variables to distinguish between true state dependence and heterogeneity at individual level. We extend the model adding a further level of analysis in order to investigate the impact of heterogeneity at country level on the individual risk of poverty. The result is a three level model with random intercepts. Below there is a systematic illustration of our variant of the model. In this connection, our model is similar to the model of Bárcena-Martín *et al.* (2017) who follow an approach based on dynamic multilevel models to examine child poverty persistency in Europe and analyze whether and to what extent the previous status of children in poverty affects current child poverty, after controlling for individual heterogeneity and contextual factors.

3.1. *The Wooldridge's Model*

Balanced panel data can be thought of as clustered or two-level data with "occasions" at level 1 and units (e.g. individuals) at level 2. When units are clustered, multilevel models are the most appropriate approach since they permit to fully exploit the richness of hierarchical data structures (Goldstein, 1995; Hox, 1995; Snijders and Bosker, 1999; Skrondal and Rabe-Hesketh, 2004). Wooldridge (2005) presents a dynamic panel data model that can be seen as a two level model with random effects in the form of random intercepts. Below we present a model based on Wooldridge (2005). For individual i observed from time $t = 1$ to (in our case) t = 3, the conditional probability that an event (poverty of individual i at time t) occurs is

$$P(y_{it} = 1 | y_{it-1}, \ldots, y_{io}, z_i, c_i) = \emptyset(z_{it}\gamma + \rho y_{it-1} + c_i) \tag{1}$$

where $\emptyset$ is the logistic distribution function, the dependent variable y_{it} is the poverty state of individual i at time t, γ and ρ are the parameters to be estimated, z_i and z_{it} are, respectively, vectors of time-constant and time-varying explanatory variables, and c_i is the individual specific effect (modeled as random intercept). Quoting Wooldridge (2005, p. 41) himself, the assumptions implied by this equation are the following: "First, the dynamics are first order, once z_{it} and c_i are also conditioned

on; second, the unobserved effect is additive inside the distribution function, Ø; third, z_{it} satisfies a strict exogeneity assumption." Wooldridge (2005) suggested that the parameters in equation (1) can be consistently estimated by assuming a density for the individual specific effect given the poverty initial condition, y_{i0}, and the time-constant explanatory variables, z_i. Thus, Wooldridge offers a solution to the initial condition problem. The latter may arises when the start of the observation period does not coincide with the start of the stochastic process generating individual poverty experiences (i.e. Heckman, 1981; Arulampalam et al, 2000). In other words, individuals could experience poverty before the period under study and, therefore, individuals excluded at the start of the observation period may be there because of an earlier history of poverty or because of some characteristics affecting their poverty propensity. But, "finding the individual specific effect distribution conditional on the initial value (and the observed history of strictly exogenous explanatory variables)" permits to account for the correlation between the individual specific effects (that are all unobserved individual determinants of poverty and are time-invariant) and the levels of poverty experienced by the individuals in the initial period (Wooldridge, 2005). Moreover, it is also possible to allow for the correlation between unobserved and observed individual characteristics. For example, if ability is an unobserved factor, lack of ability may be the cause of the current level of poverty, but it may also be correlated with the level of poverty experienced by the individual at the initial period and the level of education achieved by the same individual. Therefore, we assume that

$$c_i|y_{i0},z_i \sim Normal(\alpha_0+\alpha_1 y_{i0}+z_i\alpha_2,\sigma_a^2) \tag{2}$$

where α_0, α_1 and α_2 are parameters to be estimated and σ_a^2 is the conditional standard deviation of the individual specific effect, c_i. Note that the vector z_i appears in (2), and not on the right hand side of (1), because otherwise we could not identify the coefficients for the time constant covariates. Given (1) and (2), we can write the conditional density for the conditional distribution and maximize the density obtained integrating the above equation with respect to the normal distribution in equation (2) in order to estimate the parameters γ, ρ, α_0, α_1, α_2, σ_a^2. The estimation is consistent only under the hypothesis that the model is correctly specified.

The latent variable version of the model described in (1) and (2) is the following

$$y_{it}^* = z_{it}\gamma+\rho y_{it-1}+\alpha_0+\alpha_1 y_{i0}+z_i\alpha_2+a_i+u_{it} \tag{3}$$

where u_{it} is a zero mean and constant variance error term. In the model, the value of ρ determines whether the poverty sequence $\{y_{it}\}$ features true state dependence. In other words, it determines whether experiencing poverty in a specific year, in itself, increases the probability of undergoing poverty in subsequent years. In particular, if $\rho > 0$, then experiencing poverty at time $t-1$, ($y_{it-1} = 1$), increases the chance to experience poverty at time t ($y_{it} = 1$). Moreover, information about the direction of the relationship between unobserved individual characteristics and the level of poverty at the initial period is given by the estimate of α_1. The estimate

of σ_a^2 indicates the size of the dispersion that is attributable to the unobserved heterogeneity. Finally, note that Wooldridge's method has some advantages in facing selection and attrition problems (e.g. problems that may arise using unbalanced data). In particular, as explained in Wooldridge (2005, 44), it allows the selection and attrition to depend on the initial conditions and, therefore, it allows attrition to differ across initial levels of poverty. In particular, individuals with different initial statuses are allowed to have different missing data probabilities. Thus, we consider selection and attrition without the need to explicitly model these phenomena as a function of the initial individual conditions. As a result, the analysis is less complicated and it compensates for the potential loss of information from using a balanced panel.

3.2. *The Proposed Variant of the Model*

When individuals belong to different country, the two level model is not appropriate. An individual living in a certain country tends to be more similar to the other individuals of that country than to some other individual living in a different country. As a result, standard errors may follow a country dependency path. Ignoring this problem, i.e. pulling the data together, would produce downward biased estimated standard errors. Hence, significance test about the effects of country/covariates are not reliable and may produce spurious "significant" results (Hox, 1995) and, consequently, a correct understanding of the macro drivers of poverty might be difficult. A simple solution could be that of using robust methods to estimate standard errors but multilevel models are more appropriate since they permit to fully exploit the hierarchical structure of the data.

We extend Eq. 3 to allow a three-level dynamic logit model where the first level is time (t = year), the second is the individual (i) living in a country, and the third is the country (k). The equation of interest is

$$y^*_{ikt} = z_{ikt}\gamma + \rho y_{ikt-1} + \alpha_0 + \alpha_1 y_{ik0} + z_{ik}\alpha_2 + a_{ik} + v_k + u_{ikt} \tag{4}$$

where the dependent variable y_{ikt} is the poverty state of individual i in country k at time t; α_0, α_1, α_2, γ and ρ are the parameters to be estimated. As above, z_{ik} and z_{ikt} are, respectively, vectors of time-constant and time-varying explanatory variables. a_{ik} is the random intercept for individual i and v_k is the random intercept for country k. The random intercepts are assumed to be independently normally distributed. Then the multilevel longitudinal model of equation (4) accounts for both the possible dependence existing among observations recorded in different years for each individual and the possible dependence existing in each year across different units of the same country.

Before concluding this part, a word of caution is in order. Multilevel modelling and estimation of country effect might not provide robust conclusions about "country effects" when the number of countries is limited. Bryan and Jenkins (2015) show that with large sample sizes of individuals within each country but only a small number of countries, analysts can reliably estimate individual-level effects but estimates of parameters summarizing country effects could be unreliable (e.g. country random variances could be biased downwards and have confidence

intervals that are too narrow). They suggest using at least 30 countries for logit model to safely estimate country-level parameters (i.e. to achieve a bias close to zero). However, the critical number of countries depends on a researcher's definition of acceptable accuracy and upon the model to be estimated. In a binary logit model with random intercepts, the biases of the country-level covariate parameters and the country level random intercept variance become very small if the number of countries is at least 25: biases reduce to less than 5 per cent (Bryan and Jenkins, 2015). In our case, we will employ a multilevel logit model with random intercepts in which the number of countries is 26. Moreover, our country covariates are time variant and we use three time waves.

4. Data and Indicators

In the present study, we use both macro and micro data. The latter come from the 2011 EU Statistics on Income and Living Conditions (EU-SILC) longitudinal files. These files refer to data covering the four survey years 2008-2011. Because the reference period for EU-SILC income data is the calendar year preceding the year of data collection, the income years covered are 2007–2010. Countries included in the analysis are Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Greece, Spain, Finland France, Hungary, Italy, Lithuania, Luxemburg, Latvia, Malta, Nederland, Norway, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia and the United Kingdom.[6] Table S1b in the Appendix reports summary statistics. The period of analysis is 2008–2010 and we use the 2007 income data to derive initial conditions about individual poverty. The EU-SILC is a cross-sectional and longitudinal sample survey, coordinated by Eurostat, based on data from the EU member states. EU-SILC provides data on income, poverty, social exclusion and living conditions in the European Union. The advantage of the EU-SILC is that it permits us to analyze economic and social individual conditions from a dynamic point of view. To minimize sample selection and attrition problems our analysis uses the longitudinal weights available in the EU-SILC, as appropriate. However, Jenkins and Van Kerm (2017) provide evidence that application of longitudinal weights available in the EU-SILC does not fully account for the effects of attrition and that different assumptions about the poverty status of attritors lead to wide bounds for estimates of persistent poverty rates for most Member States. As discussed in the previous section, our econometric strategy permits to partially overcome this problem considering sample selection and attrition without explicitly modelling them as a function of the initial conditions.

Using the EU-SILC, we define an individual as income poor if his/her household equivalent income is less than a chosen poverty line. The latter is defined as 60 percent of contemporaneous median income. While we believe that either consumption or income is a useful aggregate money metric of welfare, we acknowledge that both measures fail to incorporate some important aspects of individual welfare, such as consumption of commodities supplied or subsidized by the public

[6]Data for the United Kingdom deviate from this rule: the income reference period refers to the period around the date of the interviews.

sector (e.g. schools, health services, public sewage facilities) and several dimensions of the quality of life (e.g. consumption of leisure and the ability to lead a long and healthy life). A significant disadvantage of our income measure, however, is the omission of homeless populations that would be expected to be poor.

Note that, even if this may be seen as arbitrary, its use has become common practice in Europe and, therefore, it allows comparisons with other studies on poverty dynamics. Robustness analysis is performed holding the poverty line anchored in 2007 (see Section 5.6 for a discussion). The income variable considered is "equivalent household income," obtained after adding up income from all sources from any household member, and then dividing the result by the number of equivalent adults (using the OCED-modified equivalence scale). EU-SIlC also provides detailed data on individual and household characteristics. As indicators of micro determinants of poverty, we use information about gender, age, education (highest ISCD level attained), consensual union, proportion of active members in the households, number of children aged under 14 in the household and existence of individuals with chronical diseases in the household. Descriptive statistics are in Table S1a in the online Appendix.

Our macro (country specific) covariates are obtained by different sources. Using the EU-SILC, we measure the size of the middle class.[7] As discussed in Section 3, there is no universally accepted definition of middle class. We use a popular and frequently used notion (see Pressman, 2007; Grabka and Frick, 2008), where middle-class households are defined as those households whose adjusted household disposable income falls between 75 and 150 percent of median income. Then, we compute the size of the middle class in each country at a particular point in time. Thus, somebody who is middle class in a country might not be deemed middle class by the standards of some other country having a higher median.[8] See Table S1b for average national values over the period 2008-2010. The Scandinavian nations of Denmark and Norway have the largest middle class (respectively, 72 percent and 75 percent) while Latvia, Spain, Bulgaria and Romania have the smallest middle class (about 50 percent or below).

[7]The boundaries of the middle class are computed using the EU-SILC longitudinal files. Yet, the boundaries of the middle class could be also computed using the EU-SILC cross section files, as it was suggested by a referee. Since differences in the measurement of the median income are observed between cross sectional and longitudinal files (Krell *et al*., 2017), our decision to measure middle class using the EU-SILC longitudinal files could in principle have an impact on our results. The main advantage of our choice is that it permits to include in our analysis 26 countries. On the contrary, due to data availability the alternative option reduces the sample set to 20 countries. Nonetheless, we estimated our model adopting both approaches (i.e. using middle class data extracted from cross sectional and longitudinal files). Estimates of the effects of the middle class proved to be robust to the above option and they are available upon request.

[8]In a study on poverty in developing countries, alternative approaches to measure middle class have been used. Ravallion (2009), Bhalla (2007) and Milanovic and Yithzaki (2002) set the bounds in a way that they have the same real value in different countries. Ravallion (2012) defines the overall lower bound as the median value of the poverty lines in developing countries (70 in his study) and the upper bound as the US-2005 poverty line. The alternative, more restricted, interval had 9$ PPP2005 lower cut-off level. As a result, the first interval defines a headcount of $F_t(13) - F_t(2)$ and the second an headcount of $F_t(13) - F_t(9)$ where $F_t(.)$ is the cumulative distribution function of personal income. The idea behind this approach is that an individual in the developing word is middle class if she/he is not poor in *any* developing country (first interval) or is not poor by Western (specifically, by US) standards. However, in our view, this approach is more appropriate in developing countries than in developed ones.

TABLE 1
THE NULL MODEL. DEPENDENT VARIABLE: POVERTY AT TIME t

	2-levels model		3-levels model	
	Coefficient	SE	Coefficient	SE
Static model				
Constant	-4.930**	0.067	-2.411**	0.251
var(individual)	11.455**	0.305	11.529**	1.382
var(country)			0.470**	0.117
ICC_{id}	77.69%		75.41%	
$ICC_{country}$			3.07%	
Log likelihood ratio test (2-level model vs 3-level model)			Prob > chi2 =	0.000
Dynamic model				
poverty_t-1	1.005**	0.089	0.977**	0.093
poverty(2008)	4.232**	0.153	4.241**	0.553
Constant	-4.792**	0.082	-3.014**	0.286
var(individual)	4.233**	0.290	4.271**	0.689
var(country)			0.228**	0.064
icc_{id}	56.27%		54.83%	
$icc_{country}$			2.93%	
Log likelihood ratio test (2-level model vs 3-level model)			Prob > chi^2 =	0.000

Note: Level 1 variance = 3.2899.
*Statistically significant, at 5% level.
**Statistically significant, at 1% level.

As for the quality of public policy, we use the data on Government Effectiveness[9] released by the Word Bank. This variable reflects the perceptions of the quality of policy formulation and implementation and the credibility of the government's commitment to such policies. The units in which this explicatory variable is measured follow a normal distribution with a mean of zero and a standard deviation of one in each period; this implies that the scores range between approximately –2.5 (weak) and 2.5 (strong) government performance. Since we are interested in the "threshold" effect of Government Effectiveness, we transformed the original continuous variable into an ordinal dummy. In this way, we can treat Government Effectiveness as a country fixed shift observable component. The dummy take value 1 when the country has a recorded value of Government Effectiveness belonging to the top quartile of the distribution and zero otherwise (see Table S1b).

We also use Eurostat data on Total Public Expenditure (as a percentage of GDP) and Social Expenditure (as a percentage of total expenditure). The former partially represents the "weight" of the public sector in each economy. Social Expenditure as a share of Total Expenditure is a rough indicator of the extent of the government political orientation towards the welfare state in each country. Finally, we use the PPP Converted GDP Per Capita (Laspeyres) at 2005 constant price as provided in the Penn Tables (https://pwt.sas.upenn.edu/php_site/pwt71/pwt71_retrieve.php) to test whether the state of the economy, approximated by per-capita income, impacts on the exposition to the risk of poverty (Table 1).

[9]World Bank, *Worldwide Governance Indicators* (WGI) https://info.worldbank.org/governance/wgi/index.asp.

5. Results

To ease the interpretation of the empirical results we discuss them adopting a "cascade" presentation approach. Since the aim of the paper is to estimate the combined effects on poverty of micro and macro cofactors, we first discuss the results of "only micro" determinants (Table 2: column Model 1) . Then the model is extended to encompass both "micro" and "macro" cofactors (Table 2: columns Model 2 and Model 3). Comments will focus on comparative results. Notice that in order to avoid violation of the orthogonality conditions we have included in any specification of the model a vector with the longitudinal averages of explanatory variables for each individual (Mundlak, 1978). Moreover, we have also controlled for the effect of some base-year time constant individual variables (such as sex, age, age squared and level of education, high or medium). Period variables have also been included to capture the presence of a possible time trend.

The interpretation of the dynamic implications of the estimates is based on results reported in Table 3 where state dependence coefficients are illustrated. The next sections and Tables present the results of robustness analysis.

5.1. *The Micro Level Determinants of Poverty*

Estimates of the evolution of poverty over time are reported in Table 2. Columns 1 and 2 report the parameter estimates and the standard errors of the three level dynamic logit random intercepts model that includes micro covariates only (Model 1) or both micro and macro (Models 2 and 3). After controlling for the unobserved effects, the coefficient on the lagged poverty is highly statistically significant in any estimated model. The initial value of poverty is also very important, and it implies that there is substantial correlation between the initial condition and the unobserved heterogeneity, once again for any specification of the model. In fact, the coefficient on initial poverty (average value is 3.5 across the three specifications) is much larger than the coefficient on the lag (average value is 0.9 across the three specifications). Moreover, the estimate of the variance of the random intercept for individuals (σ_a^2) is positive and statistically significant. This means that there is large unobserved heterogeneity across individuals, even after explicitly controlling for the heterogeneity that we can observe by using socio-demographic characteristics. The latter are the time-varying individual variables corresponding in Table 2 (all Models) to *a*) the proportion of active household members; *b*) the presence of individuals with chronical diseases (that lead to strong limitations in daily activities) in the household; and *c*) the presence of children aged under 14 in the household.

Results show that the level of education (high and medium) and a high proportion of household active members significantly reduce the probability of experiencing poverty. Note that we include for each time-varying individual variable, the corresponding time-invariant individual dummies in order to allow for a correlation between the individual specific effects and the time-varying variables. We find that the probability of experiencing poverty increases in households with chronical diseases. On the contrary, the estimated coefficients of the gender variable are not statistically significant. The coefficients of age and its square indicate that an increase in the individual's age increases the probability of experiencing

TABLE 2
ESTIMATES OF THE POVERTY DYNAMICS: THREE-LEVEL RANDOM INTERCEPT LOGIT MODEL

Dependent Variable: Poverty at time t	Model 1		Model 2		Model 3	
	Coef.	SE	Coef.	SE	Coef.	SE
Poverty t-1	0.907**	0.101	0.912**	0.102	0.916**	0.101
Poverty (t_0=2007)	3.475**	0.401	3.479**	0.394	3.458**	0.394
Micro determinants						
Sex	0.008	0.030	0.025	0.034	0.018	0.034
Age	0.029*	0.013	0.029*	0.014	0.029*	0.014
Age Squared	-0.001**	0.000	-0.001**	0.000	-0.001**	0.000
Medium education	-0.719**	0.049	-0.676**	0.053	-0.691**	0.052
High education	-1.817**	0.172	-1.789**	0.185	-1.803**	0.185
Living in consensual union	-0.092**	0.016	-0.082**	0.015	-0.086**	0.016
% active members	-0.864**	0.106	-0.871**	0.108	-0.875**	0.112
No. children under14	0.184	0.141	0.184	0.142	0.183	0.143
Chronical diseases in the household	0.322**	0.075	0.323**	0.074	0.323**	0.075
Longitudinal average variables (micro)	-1.592**	0.376	-1.573**	0.432	-1.632**	0.436
% active members						
Number of children under14	-0.080	0.175	-0.078	0.188	-0.087	0.188
Chronical Diseases	0.171	0.225	0.174	0.218	0.164	0.220
Macro determinants						
Longitudinal average variables (macro)					-0.076	0.048
High Government Effectiveness (t-1)						
% middle class (t-1)					-4.407**	0.341
Total Public Expenditure (t-1)			0.066**	0.011	0.074**	0.014
Social Expenditure (t-1)			-0.056**	0.010	-0.016**	0.005
GDP (t-1)			-0.909**	0.099	-0.033	0.055

Table 2 (*Continued*)

Dependent Variable: Poverty at time t	Model 1		Model 2		Model 3	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Variables at Mean Values						
High Government Effectiveness (t-1)-mean					0.243	0.133
% middle class (t-1)-mean					0.603	2.864
Total Public Expenditure (t-1)-mean			-0.010	0.028	0.002	0.034
Social Expenditure (t-1)-mean			-0.068**	0.018	-0.070**	0.018
GDP(t-1)-mean			-1.269	1.258	-1.471	1.244
Time Control						
year dummies	yes	yes	yes	yes	yes	Yes
Constant	-2.054**	0.162	6.289**	0.763	-3.315**	0.964
var(id)	3.675**	0.636	3.665**	0.634	3.649**	0.627
var(country)	0.096**	0.028	0.152**	0.034	0.101**	0.016
ICCid (%)	52.05		51.58		51.83	
ICCcountry (%)	2.36		2.13		1.44	
Pseudo-R^2 (%)		20.61		20.65		20.71

Note: No. Obs: 210243; No. Individuals: 70152; No. Countries: 26.
*Statistically significant, at 5% level.
**Statistically significant, at 1% level.

TABLE 3
STATE DEPENDENCE OF POVERTY AT T (PROBABILITIES COMPUTED USING EQ. 7)

Three level random intercept logit model (Model 3)	Poverty (t-1) = 1	Poverty (t-1) = 0	State dependence
Probability (controlling for micro determinants only)	0.241	0.180	0.060
Probability (controlling for micro and macro determinants)	0.228	0.170	0.058
Probability controlling for micro and macro determinants…			
Assuming structural middle class = 0.40	0.289	0.220	0.069
Assuming structural middle class = 0.75	0.180	0.131	0.048

poverty (estimated coefficient is 0.03 on average for the three specifications). This phenomenon mildly attenuates (coefficients are negative, significant but close to zero in the three specifications) with age (around 30 years when some job opportunities might show up even for the less qualified and educated individuals).

To conclude the discussion of the (micro) results it is worth stressing that the estimated variance of the random intercept for countries (σ_v^2) is positive and statistically significant. In particular, after computing the interclass correlation between both individual variance (*ICC_id*) and country variance (*ICC_cc*),[10]

$$ICC\_id = \sigma_a^2/(\sigma_v^2 + \sigma_a^2 + \sigma_u^2) \tag{5}$$

$$ICC\_cc = \sigma_v^2/(\sigma_v^2 + \sigma_a^2 + \sigma_u^2) \tag{6}$$

where σ_u^2 is the first level variances,[11] we find that the individual and the country levels explain about the 52 percent and 2 percent of the total variability, respectively. This implies that the estimated proportion of total variability explained by the country level is not very large. To further investigate this issue, we computed the likelihood ratio test comparing the log likelihoods of the two-level and three level models. Results show that the difference is statistically significant (Prob > chi2 =.000). Therefore, we can maintain that the three level model fits the data significantly better than the two level model. We can also conclude that unobserved heterogeneity across countries is small, but it remains across countries: some individuals are more inclined to escape poverty than other individuals do simply due to the countries where they live. This prompted for the adoption of the more

[10]The intra-class correlation coefficients give the correlation between units belonging to the same level cluster and reflects therefore the "closeness" of latent responses in the same cluster relative to the "closeness" of latent responses in different clusters (Arpino and Aassve, 2007).

[11]Independence between random effects belonging to different levels is assumed.

encompassing micro-macro formulation of the model. Results are commented upon in the next section.

5.2. *The Macro Level Determinants of Poverty*

In this subsection, we focus on country heterogeneity disentangling the role of observed and unobserved heterogeneity *at the country level*. In particular, we comment on the estimated impact of the following possible macro determinants of poverty persistence: the quality of public policy (the regressor is the Index of Government Effectiveness) and the size of the middle class (longitudinal data, see fn. 14). We also control for a) the relevance of social policy in the ranking of policy priorities of governments (the regressor is the share of social expenditure over total public expenditure); b) the weight of the public sector in the economy (the regressor is total public expenditure as a percentage of GDP); and c) the value of real per-capita GDP (as a proxy for differences in average availability of resources for the entire society in each country).

Columns 3 (Model 2) and 4 (Model 3) of Table 2 present the conditional maximum likelihood estimates and the asymptotic standard errors obtained using the three level model that includes lagged macro level controls for total public expenditure, total public expenditure and GDP. Model 3 is a three level model that includes lagged variables of interests (lagged quality of institutions and the lagged size of the middle class) as well as lagged macro level controls.

Clearly, macro variables are considered constant for individuals within a given country-year, and are non-constant across both countries and the country-years nested within a given country. Following Fairbrother (2014), we can identify separate longitudinal and cross-sectional associations between macro variables and the probability of experiencing poverty as follows. We first calculate the mean of the macro variables across all relevant years for each country and then incorporate these longitudinal average variables into the model. The corresponding coefficients capture the effect on individual poverty of enduring cross-national differences (structural factors). Then, to capture the effect on individual poverty in each country of the time variation of the above macro variables, we subtract the mean from each realization of the time-varying variable. The resulting longitudinal component (a country-year level variable) is group-mean centered, and is orthogonal to the mean, such that the two coefficients can be estimated separately.[12]

Focusing on the structural macro controls, we find the following evidence. Firstly, we find a negative correlation between lagged social expenditure (mean) as a share of total public expenditure and poverty. This result is in line with previous findings that use other indicators of the amount of public resources dedicated to social targets (Jenkins, 2000, Dewilde, 2008, Whelan *et al.*, 2008, Kenworthy *et al.*, 2011 and Bárcena-Martín *et al*. 2014). Social expenditure used in the paper is of general — as opposite to selective — kind and the result should be interpreted in conjunction with that concerning middle class. Universal welfare state creates a structural coalition of interests between the least well-off and the politically more

[12]According to Mundlak (1978), the inclusion of the group mean in a model is sufficient to allow for a correlation between the specific effects and the time-varying variables even without centering (as we did for the time-varying individual variables), but in the case of macro variables centering yields more directly interpretable results (see Bell and Kelvyn, 2015).

powerful middle classes which, using a statement of Korpi and Palme (1998, 661), are included in the welfare state in a way that protects their accustomed living standard. Although data limitations do not allow conducting a proper test of the effects of general vs. targeted social expenditure, we interpret the (mean) estimates as an indication that general welfare expenditure does not create the paradoxical result that the more we increase general welfare program the less likely we are to reduce poverty.

Secondly, we find an unexpected *positive* correlation between poverty and lagged *total* expenditure (mean). Coefficients are approximately 0.7 in both Model 2 and Model 3. The opposite result emerges with respect to *social* expenditure. These findings may indicate that the poor mainly capture the effects of welfare expenditures but are at best unaffected by the general public expenditure. This can be due to the difficulties of general total public expenditure (comprehensive, for instance, of financial and military components) to strengthen human capabilities and alleviate social distress. Moreover, a too large public sector may take resources away from alternative possible pro poor uses and so a large public sector may increase rather than reduce the risk of poverty. Thirdly, we observe a negative, but not always significant, relationship between poverty and the mean component of longitudinal lagged per-capita GDP that disappears when the mean longitudinal lagged percentage of middle class is included (Model 3). The GDP result is in line with some previous studies. For example, employing a deprivation index for developed countries, Boarini and Mira d'Ercole (2006) and Kenworthy (2001) find no association between per capita GDP and material deprivation. On the contrary, in a model in which basic deprivation is regressed against both household income and per capita gross national disposable income (in deviation from the mean), Whelan and Maître (2012) find a negative significant relation between deprivation and per capita disposable income but the estimated coefficient sharply decreases when micro variables are included as regressors. Bárcena-Martín *et al.* (2014) obtain similar results in a multi-level model of frequency-based weighted material deprivation using GDP as a macro covariate.

The original specific factors included in the present multi-level study are the enduring cross-national differences in the quality of institutions (low/high perception of the effectiveness of the government) and in the size of countries' middle class. Estimates indicates that the regressor capturing the (mean and lagged) perception of quality of public policy does not play a statistically significant role, while the mean component of the lagged size of the middle class does. Of course, quoting Banerjee and Duflo (2008, 3), there is nothing new about a faith in the middle class. What is new is that robust estimations of this (expected) effect is obtained by controlling for cross-country compositional differences in relation to the dynamics of poverty, and so it accounts for a certain proportion of the between country heterogeneity. Although it is always difficult to avoid the risk of deducing an inappropriate inference about individuals from macro-country variables, yet estimates obtained after controlling for between country heterogeneity signal that on average the size of the middle class in each country affects individual poverty dynamics and state dependence in ways that are at least country specific. Even if the above inference cannot be treated as a predictor of the realization of future poverty for *any* individual in each country, estimates show that on average individuals in each

country have a state dependence probability of falling into poverty (or maintaining their poverty condition) higher when they live in countries with a reduced middle class. This result was never shown before. Estimates show that the larger the size of the middle class (mean) the higher the reduction of poverty. This can be interpreted as a sign of the fact that, in Europe, a larger middle class promotes a pro anti-poverty environment by increasing country standards (i.e. law, justice, association and cooperation, entrepreneurship, etc.) and by easing the assimilation of UE policies into domestic legislation and praxis. A large middle class can also reduce the negative impact of credit market failures on human capital accumulation and then on poverty. This implies that a large structural middle class may reinforce the impact of social expenditure and per-capita GDP on poverty reduction.

Finally, we focus on the longitudinal components of our macro variables. We find that the only longitudinal component that affects poverty in a statistically significant way is the longitudinal component of lagged social expenditure. An increase in lagged social expenditure (with respect to the structural value) decreases the individual risk of poverty. It is generally recognized that the risk of experiencing poverty can be *ceteris paribus* the result of different institutional types of welfare states for institutional differences (selectivity vs. universality) may lead to unexpected outcomes. In some cases, selectivity is successful but in some other cases it may generate the so called paradox of redistribution: the more we target benefits at the poor and the more concerned we are with creating equality via equal public transfers to all, the less likely we are to reduce poverty and inequality. Results discussed in this subsection show that the paradox could be a misplaced concern. Both the increasing of social expenditure (frequently the result of selective measures) and a more extended structural middle class reduce the probability of experiencing poverty.

5.3. *True State Dependence Dynamics*

We compute the magnitude of partial effects to analyze the relevance of state dependence on the probability to experience poverty, conditional on the poverty status in the previous period. For the three level dynamic logit version of the model with random intercepts, we use an adapted version of the consistent estimator proposed by Wooldridge (2005):

$$N^{-1}\sum_{i=1}^{N}\emptyset\left(z_{it}\gamma+\hat{\rho}_a y_{t-1}+\hat{a}_{0a}+\hat{a}_{1a}y_{i0}+z_i\hat{a}_{2a}\right) \tag{7}$$

where the parameters are the estimated ones and the a subscript indicates a multiplication by

$$(1+\hat{\sigma}_a^2+\hat{\sigma}_v^2)^{-1/2}.$$

Estimates of the probability of being poor in year t given that the individual is or is not poor in year t–1 are in Table 3. The difference is an estimate of the state dependence of being poor at time t. In the three level model including individual

covariates only, the probability to experience poverty given that the individual was poor at t–1 is 0.24, and it decreases to 0.18 if the individual was not poor at t–1. Thus, the estimate of the state dependence of poverty is about 0.06. The latter remain almost unchanged even if we control for country observed and *unobserved* characteristics although the probability to experience poverty conditional upon being poor during the previous year slightly reduces. This means that, ceteris paribus, individuals experiencing poverty in year t have a probability of being poor in year $t+1$ about 6% higher than those not experiencing poverty in year t. Thus, we can conclude that individuals living in a certain country and experiencing poverty in a certain period have, ceteris paribus, a higher probability to experience poverty in the future than non-poor individuals of that same country. Country factors reduce this probability for the impact on the dynamics of the past poverty depends on the macro and institutional context.

Table 3 also presents the estimation of true state dependence assuming limited middle class: 0.069. It decreases to 0.048 assuming extended middle class. Thus, a negative relationship between the extension of the middle-class and the persistence in poverty seems to emerge.

5.4. *Robustness Analysis I: A Different Country Data Set*

In order to test whether our results are robust to the choice of the countries included in the analysis, we perform some robustness analysis. First, we estimate our three level dynamic logit model excluding Romania and Bulgaria. These two countries can be seen as outliers driving the relation of poverty and some welfare characteristics (e.g. both countries are characterized by very low realizations of the government effectiveness regressor). Yet, estimated coefficients reported in Table 4 are very much similar to those of Table 2. The exclusion of these two potential outliers does not modify results in any significant way. Second, we exclude Italy and Spain. During the period of study, these countries exhibit a fast rise in unemployment rates as well as a sharply decline in GDP. Thus, one might consider them as other outliners. Table 4 shows that Table 2 findings are robust even to this test. Third, recall that Krell *et al*. (2017), analyzing the consistency of EU-SILC by comparing cross-sectional results about poverty rates with finding based on longitudinal samples, found that for some countries the results of that comparison differ widely. In particular, deviation in the poverty rates in Sweden and Norway range from 5 to 25 percent indicating an underrepresentation of poorer population subgroup in the balanced panel (see also Jenkins and van Kerm, 2017). Therefore, we re-estimated our three level dynamic logit model excluding these two countries. Once again, previous results proved robust. Forth, we also estimate our three level dynamic logit model excluding some continental countries (France and Belgium) and, once again, we confirm our full sample results. Finally, UK data differs from other countries data in the definition of the reference income period (see Section 4). Moreover, Krell *et al*. (2017) suggests that there could be problems with the weighting procedure in some countries including UK. Therefore, we decided to estimate our three level dynamic logit model excluding UK. Findings show that the original estimates are robust as shown in Table 4. Interestingly, the coefficient of the regressor incorporating the

TABLE 4

ESTIMATES OF THE POVERTY DYNAMICS (THREE-LEVEL RANDOM INTERCEPT MODEL): ROBUSTNESS ANALYSIS

Dependent Variable: Poverty at time t	without BU, RO		without IT,ES		without NO, SE		without FR, BE		without UK	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Poverty t-1	0.882**	0.092	0.910**	0.109	0.912**	0.102	1.087**	0.080	0.910**	0.103
Poverty (t_0=2007)	3.436**	0.419	3.577**	0.378	3.454**	0.404	2.828**	0.292	3.620**	0.335
Micro determinants										
Sex	0.026	0.036	0.012	0.036	0.013	0.034	0.054	0.039	-0.002	0.032
Age	0.029*	0.015	0.028	0.016	0.028	0.014	0.020	0.019	0.043**	0.005
Age Squared	-0.001**	0.000	-0.001**	0.000	-0.001**	0.000	0.000	0.000	-0.001**	0.000
Medium education	-0.659**	0.055	-0.701**	0.056	-0.694**	0.054	-0.651**	0.074	-0.733**	0.033
High education	-1.769**	0.197	-1.854**	0.184	-1.806**	0.190	-1.526**	0.117	-1.918**	0.145
Living in consensual union	-0.087**	0.017	-0.090**	0.018	-0.093**	0.016	-0.081**	0.030	-0.082**	0.017
% active members	-0.854**	0.111	-0.937**	0.122	-0.879**	0.116	-1.088**	0.339	-0.933**	0.132
No. children underl4	0.172	0.151	0.185	0.154	0.179	0.148	-0.055	0.120	0.252*	0.110
Chronical diseases in the household	0.338**	0.072	0.344**	0.072	0.316**	0.078	0.253**	0.079	0.328**	0.085
Longitudinal average variables (micro) % active members	-1.645**	0.447	-1.559**	0.494	-1.596**	0.451	-0.853*	0.426	-1.947**	0.257
No. children underl4	-0.085	0.195	-0.100	0.199	-0.091	0.192	0.255**	0.075	-0.150	0.179
Chronical Diseases	0.204	0.215	0.168	0.234	0.173	0.216	-0.196	0.156	0.153	0.272
Macro determinants										
Longitudinal. average variables (macro):										
High Government. Effectiveness. (t-1)	0.050	0.022	0.067	0.049	0.069	0.046	-0.255**	0.057	-0.342**	0.050
% middle class (t-1)	-3.985**	0.197	-3.993**	0.255	-4.952**	0.524	-3.355**	0.476	-3.129**	0.259
Total Public Expenditure. (t-1)	0.033**	0.007	0.031**	0.005	0.068**	0.017	0.076**	0.013	0.075**	0.006
Social Expenditure (t-1)	-0.039**	0.008	-0.043**	0.009	-0.014*	0.006	-0.014**	0.003	-0.015**	0.003
GDP (t-1)	-0.079*	0.032	-0.084	0.060	0.069	0.055	-0.117*	0.048	-0.016	0.040

Table 4 (*Continued*)

Dependent Variable: Poverty at time t	without BU, RO		without IT,ES		without NO, SE		without FR, BE		without UK	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Variables at Mean Values										
High Government Effectiveness (t-1)-mean	0.234	0.128	0.195	0.107	0.365	0.659	0.172	0.157	-0.023	0.337
% middle class (t-1)-mean	-0.942	3.113	-4.932	4.014	0.933	2.616	0.253	2.916	-1.448	3.098
Total public expenditure (t-1)-mean	0.006	0.036	-0.036	0.029	0.018	0.034	0.023	0.029	-0.018	0.041
Social expenditure (t-1)-mean	-0.096**	0.011	-0.122**	0.045	-0.070**	0.016	-0.054**	0.019	-0.035**	0.015
GDP(t-1)-mean	-1.763	1.720	-2.669**	0.991	-1.262	1.265	-0.647	1.057	-0.871	1.584
Time Control										
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	-3.377**	1.033	-3.368**	1.172	-3.155**	0.874	-3.224**	0.942	-5.005**	0.697
var(id)	3.604**	0.667	3.794**	0.643	3.621**	0.650	2.696**	0.409	3.954**	0.517
var(country)	0.145**	0.043	0.151**	0.056	0.101**	0.027	0.088**	0.022	0.124**	0.025
ICC_{id} (%)	51.20		52.44		51.64		44.38		53.67	
$ICCc_{ountry}$ (%)	2.06		2.09		1.44		1.45		1.68	
State dependence	0.040		0.041		0.052		0.072		0.047	
Pseudo R^2		20.4%		21.3%		20.6%		17.0%		22.0%
No. Obs		196528		194544		198455		185618		207760
No. Individuals		65892		65193		66525		62228		69570
No. Countries		24		24		24		24		25

Note: *Statistically significant, at 5% level.
**Statistically significant, at 1% level.

quality of public policy is statistically significant once we exclude France and Belgium (or UK) from the analysis. This finding shows that the quality of public policy could decrease the risk of poverty under some circumstances.

5.5. *Robustness Analysis II: An Alternative Measure of the Middle Class*

In this section, we describe the results of a robustness analysis of the effect of the size of the middle class. Rather than using in the multi-level model of Table 2 this regressor as a *continuous* variable, we followed a suggestion of a referee and transformed it into a dummy indicating whether a country belongs to the upper quartile of the distribution of the middle class size. In other words, we apply to middle class a transformation similar to that applied to the Index of the quality of public policy (Government Effectiveness). Obviously, the variables corresponding to the structural and longitudinal components are defined accordingly for regression purposes. The idea is to test the hypothesis that results about the middle class reported in Table 2 might be partially driven by a correspondence between the realization of the middle class observations (treated as a continuous variable) and the probability of being poor. A theoretical concern about this correspondence is not groundless since income distributions are usually highly skewed to the right and consequently most of the population fall into the lower part of the income distribution. This might lead to the above-mentioned possible correspondence: the greater extension of the middle-class, the smaller the extension of the lower class. Hence, we transformed the observations of the variable middle class into the above-described dummy and then rerun the model that now includes a variable incorporating a sort of threshold effect of the middle class. The threshold allows to investigate separately the behavior of countries above the threshold and countries below and to test for the effect of a "threshold" middle class without incurring into the potential danger of the above-mentioned relationship.

Results obtained using the transformed variable are shown in Table 5. These estimates mainly confirm our previous results. There is still strong evidence of unobserved heterogeneity (across both individuals and countries), of correlation between the initial condition and unobserved heterogeneity, and, above all, of true state persistence. The latter result confirms that individuals experiencing poverty at a certain point in time have a higher probability to experience poverty in the future than non-poor individuals do. The latter findings also confirm that the probability of experiencing poverty is negatively associated to the size of the structural middle class (estimated coefficient is even higher and more statistically significant than with the continuous variable) and to the longitudinal component of lagged social expenditure. We have also checked for correlation between this new dummy and the Government Effectiveness dummy.

5.6. *Robustness Analysis III: Using Anchored Poverty*

In this section, we perform a further robustness analysis considering the baseline poverty line constant over the period of study. In particular, we use the poverty line anchored in 2007 and adjusted for price inflation. In facts, several authors have suggested that, when measuring the evolution of poverty in periods

TABLE 5
THREE LEVEL RANDOM MODEL USING AN ALTERNATIVE VARIABLE FOR MIDDLE CLASS

	Model 4	
Dependent Variable: Poverty at time t	Coefficients	SE
Poverty t-1	0.916**	0.101
Poverty (t_0=2007)	3.458**	0.393
Micro determinants		
Sex	0.020	0.035
Age	0.029*	0.014
Age Squared	-0.001**	0.000
Medium education	-0.688**	0.053
High education	-1.806**	0.183
Living in consensual union	-0.084**	0.016
% active members	-0.871**	0.112
No. children under14	0.182	0.143
Chronical diseases in the household	0.323**	0.074
longitudinal average variables: % active members	-1.653**	0.432
longitudinal average variables: No. children under14	-0.091	0.187
longitudinal average variables: chronical diseases	0.157	0.225
Macro determinants		
Long average variable: high government effectiveness. (t-1)	-0.060	0.063
Long. average variables: middle class (dummy) (t-1)	-0.711**	0.062
Long. average variables total public expenditure (t-1)	-0.007	0.005
Long. average variables: social expenditure (t-1)	-0.007	0.005
Long. average variables: GDP (t-1)	0.058	0.085
High Government Effectiveness (t-1)-mean	0.239	0.130
% middle class (t-1)-mean	-0.137	0.094
Total public expenditure (t-1)-mean	0.002	0.034
Social expenditure (t-1)-mean	-0.069**	0.018
GDP(t-1)-mean	-1.452	1.256
year dummies	yes	yes
Constant	-2.014*	0.789
var(id - constant)	3.650**	0.628
var(country - constant)	0.091**	0.021
ICC_{id} (%)	51.91%	
$ICC_{country}$ (%)	1.30%	
Pseudo-R^2		20.48%
State Dependence		0.06
No. Obs		196528
No. Individuals		65892
No. Countries		24

Note: *Statistically significant, at 5% level.
**Statistically significant, at 1% level.

characterized by episodes of variability in the economic cycle (as in our period of study), it is worth using what is technically known as anchored poverty lines (Morelli *et al.*, 2014). The idea is simple: it entails fixing (or anchoring) a certain poverty threshold and studying the evolution of trends based on this new threshold, which is not affected by the fluctuations of the economic situation (Permanyer and Köksel, 2017). As results, during crises, the anchored poverty line results are more sensitive to the deteriorating economic status of the poor (Social Protection Committee, 2013) who can compare their income levels not only with that of the median person of their country, but also with their own income of a previous period (Matsaganis, 2013).

TABLE 6
ANCHORED POVERTY: THREE LEVEL LOGIT MODEL

	3-level model	
Anchored poverty	Coefficients	SE
Poverty t-1	0.865**	0.160
poverty(t_0 =2007)	3.321**	0.412
Micro determinants		
Sex	0.045	0.024
Age	0.029	0.017
Age Squared	-0.001*	0.000
Medium education	-0.645**	0.046
High education	-1.670**	0.074
Living in consensual union	-0.038	0.024
% active members	-1.099**	0.204
No. children under14	0.226	0.148
Chronical diseases in the household	0.365**	0.103
longitudinal average variables: % active members	-0.958*	0.443
longitudinal average variables: No. children under14	-0.050	0.215
longitudinal average variables: chronical diseases	0.094	0.143
Macro determinants		
Long. average variable High Government Effectiveness (t-1)	-0.518*	0.201
Long. average variable: % middle class (t-1)	-13.254**	1.457
Long. average variable total public expenditure (t-1)	0.043**	0.014
Long. average variable: social expenditure (t-1)	-0.014	0.017
Long. average variable: GDP (t-1)	-1.929**	1.315
High Government Effectiveness (t-1)-mean	0.498	0.404
% middle class (t-1)-mean	-0.785	3.459
Total public expenditure (t-1)-mean	0.027	0.051
Social expenditure (t-1)-mean	0.008	0.072
GDP(t-1)-mean	2.797	1.993
year dummies	yes	yes
Constant	-15.389**	2.686
var(id)	3.651**	0.718
var(country - constant)	0.223**	0.055
ICC_{id} (%)	50.96%	
$ICC_{Country}$ (%)	3.12%	
Pseudo R^2		19.8%
State dependence		0.06
No. Obs		196528
No. Individuals		65892
No. Countries		24

Note: *Statistically significant, at 5% level.
**Statistically significant, at 1% level.

Table 6 presents results of the estimations for the dynamic random intercept logit model of anchored poverty. These estimates mainly confirm our previous results and add some new insights. We confirm the importance of unobserved heterogeneity (across both individuals and countries) and we find evidence of true state persistence indicating that individuals experiencing poverty at a certain point in time have a higher probability to experience poverty in the future than non-poor individuals do.

The initial value of poverty is also very important indicating that there is substantial correlation between the initial condition and the unobserved heterogeneity.

We confirm that the probability of experiencing poverty is negatively correlated with the size of the structural middle class and structure social expenditure. Moreover, when the poverty line is held constant over the period of study the probability of experiencing poverty is also negatively related to the structural values of the quality of public policy (Government Effectiveness) and to the structural GDP level.

6. Conclusions and Policy Perspectives

In this paper we have implemented a dynamic three-level model to analyze poverty persistence in 26 EU countries. We disentangled the effects on poverty generation and persistence of observed and unobserved country heterogeneity by formulating and estimating a three level dynamic multilevel model. In order to test additional hypothesis about poverty determinants, we have enlarged the set of potential cofactors to capture observable sources of heterogeneity not previously analyzed in the literature. In particular, we analyzed for the first time whether and how the quality of public policy and the size of the middle class in each country affect an individual risk of poverty and its dynamics.

The multi-level analysis shows the following results. *First*, unobserved heterogeneity across individuals remains large, even after explicitly controlling for the part of individual heterogeneity that can be observed. *Second*, some individuals have higher probability to escape poverty than others *simply because of the country* where they live. *Third*, the initial value of poverty is also very important. We observe that in some countries the initial poverty status has large effects on current poverty status whereas for some other countries the effects is smaller. *Forth*, the risk of poverty is negatively related to the size of the *structural* middle class and to the level of *structural* social expenditure (relevance of the welfare state) and increases when the lagged total public expenditure increases (with respect to the structural value). On the other hand, high government effectiveness seems to reduce the risk of poverty only in a subgroup of countries or when the poverty line is anchored. *Fifth*, individuals experiencing poverty at a certain point in time have a higher probability to experience poverty in the future than non-poor individuals do (i.e. there is evidence of true state dependence). *Sixth*, the estimate of the true state dependence in countries characterized by limited middle class is much higher than the one observed in countries characterized by extended middle class. This means that an extended structured middle class may help reducing, ceteris paribus, the prolonged adverse impact of experiencing poverty in a specific period but also that given the structured level of the middle class an extended welfare state in each country contributes to poverty reduction.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix S1. Multicollinearity Analysis
Table A1. Collinearity diagnostic measures
Table A2. Correlations between pairs of estimated coefficients (see Table A1 for definitions)
Table 1a. Descriptive statistics: individual socio-demographic characteristics
Table 1b. Descriptive statistics: macro context (average values over the period)