ImPRovE
Poverty, Social Policy and Innovation

WORKING PAPERS

http://improve-research.eu

The interrelationships between the Europe 2020 social inclusion indicators

Sara Ayllón & András Gábos

Discussion Paper No. 15/01
January 2015

Poverty Reduction in Europe:
Social Policy and Innovation

FUNDED BY THE
7TH FRAMEWORK PROGRAMME OF THE EUROPEAN UNION

Acknowledgements

The research for this paper has benefited from financial support by the European Union's Seventh Framework Programme (FP7/2012-2016) under grant agreement n° 290613 (ImPRovE: Poverty Reduction in Europe: Social Policy and Innovation; http://improve-research.eu). The authors are solely responsible for any remaining shortcomings and errors.

January 2015

Bibliographic Information

Sara Ayllón and András Gábos (2015), The interrelationships between the Europe 2020 social inclusion indicators. ImPRovE Working Paper No. 15/01. Antwerp: Herman Deleeck Centre for Social Policy – University of Antwerp.

This paper can be downloaded from our website: http://improve-research.eu

Abstract

The aim of this paper is to dynamically analyse the three indicators of poverty and social exclusion covered by the EU2020 poverty target, while focusing on state dependence and feedback effects. We are interested in learning to what extent being at risk of poverty, severe material deprivation or low work intensity in one year is related to being in the same status one year later and if being in a given status predicts the occurrence of one of the others in subsequent periods. Our results indicate that the three social indicators of the EU2020 strategy are capturing different aspects of economic hardship in the majority of European countries analysed. We show that the three processes are affected by a considerable degree of genuine state dependence but weak evidence for one-year lagged feedback effects |with the exception of the Central-Eastern European countries where feedback loops between the three segments are found. Mostly, interrelationships occur via current effects, initial conditions and correlated unobserved heterogeneity. In terms of policy implications, our results suggest that the three phenomena should be handled by different interventions while expecting spill-over effects across time to be marginal.

Keywords: Europe 2020 indicators, poverty, material deprivation, low work intensity, state dependence, feedback effects, EU-SILC

JEL codes: I32, I31, J64

The interrelationships between the Europe 2020 social inclusion indicators

Sara Ayllón *
Department of Economics and EQUALITAS
Universitat de Girona

András Gábos †
TÁRKI Social Research Institute

Abstract

The aim of this paper is to analyse dynamically the three indicators of poverty and social exclusion covered by the EU2020 poverty target, while focusing on state dependence and feedback effects. We are interested in learning the extent to which the fact of being at risk of poverty, severe material deprivation or low work intensity in a given year is related to having the same status one year on, and whether being at risk in one domain in one year is a predictor of being at risk in one of the other domains in subsequent years. Our results indicate that the three social indicators of the EU2020 strategy capture different aspects of economic hardship in the majority of European countries analysed. We show that the three processes are affected by a considerable degree of genuine state dependence, but there is weak evidence for one-year lagged feedback effects — apart from in the Central-Eastern European countries, where feedback loops between the three segments are to be found. Mostly, interrelationships occur via current effects, initial conditions and correlated unobserved heterogeneity. In terms of policy implications, our results suggest that the three phenomena should be addressed by different interventions while it is expected that spill-over effects across time will be marginal.

JEL classification: I32, I31
Keywords: Europe 2020 indicators, poverty, material deprivation, low work intensity, state dependence, feedback effects, EU-SILC

*Corresponding author. Address: C/ Universitat de Girona, 10, 17071, Girona (Spain). Tel. (+34) 972 418779. E-mail: sara.ayllon@udg.edu

†Address: Budaorsi u. 45, P.O. 1518 Pf. 71, H-1112, Budapest (Hungary). Tel. (+36) 1 3097667. E-mail: gabos@tarki.hu

1 Introduction

In line with the EU2020 strategy for smart, sustainable and inclusive growth, the European Union has adopted a set of headline targets to reflect these three priorities (European Commission, 2010). Accordingly, aside from targets on employment, research and development, climate change and energy sustainability, and education, there is also one to measure progress in the fight against poverty and social exclusion. This target quantifies the related goal of the ten-year strategy, which aims to reduce by 20 million the number of European citizens living in poverty or social exclusion by the year 2020. Recently, the European Commission acknowledged that "the number of people at risk of poverty or social exclusion ... increased from 114 million in 2009 to 124 million in 2012" and so the EU "has thus drifted further away from its target" set in 2010 (European Commission, 2014: 14).

The measure covering the headline target in the fight against poverty and social exclusion is composed of three indicators. An individual is considered to be at risk of poverty or social exclusion if he or she is at risk of poverty, is severely materially deprived or lives in a household with very low work intensity.[1] While the overall EU target is based on the composite indicator, in setting their national targets, Member States were free to choose the most appropriate indicator (or any combination thereof).[2]

The use of social indicators to frame a Europe-wide monitoring system in the field of social inclusion is strongly linked to the start of the Lisbon era (Atkinson et al., 2002). The system of indicators adopted by the Laeken European Council in 2001 was further developed and extended during the 2000s within the framework of the Open Method of Coordination on Social Protection and Social Inclusion (European Commission, 2006; 2009; Marlier et al., 2007). The policy target in the Europe 2020 fight against poverty and social exclusion was based on individual measures that were either part of the Laeken set of indicators from the very beginning (like the at-risk-of-poverty rate) or have been developed in recent years on the basis of a single data source, the European Statistics on Income and Living Conditions (EU-SILC). See, for example, Guio (2009) for the material deprivation indicator; and Ward and Özdemir (2013) and Corluy and Vandenbroucke (2013) for the low work intensity indicator. Rather than being a tool designed to measure a clear European social policy programme, the composite indicator of multidimensional poverty was adopted as a result of a political decision that was motivated by the different views and interests of the Member States (Maître et al., 2013). Nor was the introduction of the composite indicator based on any previous theoretical work concerning the relationship between income poverty, material deprivation and low work intensity.

Once launched, the composite indicator became the subject of conceptual and methodological debate within the research community, which encouraged strong empirical work. Among others, recent work by Nolan and Whelan (2011a; 2011b), Copeland and Daly (2012), and Maître et al. (2013) discusses extensively the theoretical and policy implications of defining a single European-level target for combating poverty and social exclusion that is based on a multidimensional approach. The inclusion of non-monetary indicators is considered a step forward in monitoring the poverty target in an enlarged Europe (Nolan and Whelan, 2011b), even though the effectiveness of using a single measure of multidimensional poverty has come in for criticism (Ravallion, 2011). The choice of indicators

[1] For the detailed methodology of the composite and the three sub-indicators see `http://ec.europa.eu/social/BlobServlet?docId=10421&langId=en`

[2] `http://ec.europa.eu/europe2020/pdf/targets_en.pdf`

to complement income poverty and the way the composite indicator is defined have also been debated (Nolan and Whelan, 2011b).

Once the headline target was set, the European Commission started to monitor the Member States' advancement towards it by using a 'dashboard' approach (European Commission, 2013). Overall EU figures, country profiles and summary tables are used to report on the related social processes. All these analytical tools focus on outcomes and rely on the most recent cross-sectional data. However, from a policy point of view, it is also important to assess the dynamic interrelationship between poverty, severe material deprivation and low work intensity, based on longitudinal data. Policy interventions need to be based on a better understanding of the possible spill-over effects between the three phenomena over time.

Thus, the aim of this paper is to analyse dynamically the interrelationships between the three segments of poverty and social exclusion that are covered by the EU2020 poverty target. We are interested in learning the extent to which the fact of being at risk of poverty, severe material deprivation or low work intensity in a given year is related to having the same status one year on (state dependence), and whether being at risk in one domain in one year is a predictor of being at risk in one of the other domains in subsequent years (feedback effects). With this in mind, we build a first-order Markov chain trivariate probit model that controls for observed and unobserved characteristics and, at the same time, deals with the problem of initial conditions.

Overall, our results indicate that the three social indicators of the EU2020 poverty target are different and capture different aspects of economic hardship in the countries analysed. We have found that the three processes are affected by a considerable degree of genuine state dependence: being in a state *causally* increases the probability of being in the same state again in future (Jenkins, 2013). However, our results do not find evidence of one-year feedback loops between the three phenomena across Europe generally: only in the Central-Eastern European countries analysed do we consistently find feedback effects between the three segments. Poverty and material deprivation are much more affected by current effects, initial conditions and correlated unobserved heterogeneity, while the current status of low work intensity is the segment that clearly explains todays probability of living in income poverty. The relationship between material deprivation and low work intensity is even weaker than for the rest of the interrelationships analysed. In terms of policy design, our results suggest that each domain deserves its own policy intervention, and spill-over effects across time are likely to be marginal.

The remainder of the paper is organised as follows. Section 2 provides a literature review. The dataset and the problems encountered during preparation of the data are presented in Section 3. That is followed by a brief summary in Section 4 of descriptive statistics for the extent, dynamics and interrelationships between the three EU2020 indicators used in the fight against poverty and social exclusion. Section 5 presents the econometric strategy; Section 6 details the empirical results; and Section 7 provides a conclusion.

2 Literature review

The analysis and measurement of the dynamics of and the interrelationships between the EU2020 poverty and social exclusion indicators need to take account of two important elements. In the first place, one ought to consider that the three processes under study (poverty, material deprivation and low work intensity) may be affected by an important

degree of genuine state dependence. In the second place, all the possible feedback effects from one phenomenon to the other need to be accounted for. In what follows, we review the empirical literature that has already dealt with these issues.

2.1 State dependence

The literature has established the existence of a considerable amount of genuine state dependence in poverty: the fact of being below the poverty line in a given year increases the chances of being found in the same situation in the future (compared to someone not initially poor). Among other factors, the problem of demoralisation, loss of motivation, the stigma associated with receipt of social assistance and the depreciation of human capital — all associated with periods spent below the poverty line — help to explain future experience of economic deprivation (Biewen, 2009; Mullainathan and Shafir, 2013). See Cappellari and Jenkins (2004) for empirical evidence from the United Kingdom; Biewen (2009) from Germany; Devicienti and Poggi (2011) from Italy; Fusco and Islam (2012) from Luxembourg; and Ayllón (2013) from Spain.

Research on state dependence in material deprivation is scarcer, although some recent works focus on the evolution in time of material deprivation (Guio et al., 2014). The indicator of persistent material deprivation (defined in a similar way to the persistent at-risk-of-poverty rate) is used for reporting purposes, but to the best of our knowledge, no analytical work has yet been done in this field.[3] Also, the development of an intertemporal material deprivation indicator, which captures part of the issue, has more and more been at the focus of recent initiatives. For example, D'Ambrosio (2013) claims that if the path of material deprivation experienced by individuals over time was followed, cross-country comparative results would differ from those given by the yearly figures.

Empirical evidence is also scarce for state dependence in low work intensity, as measured by the labour market attachment of all household members. Using EU-SILC longitudinal data for cross-EU comparative analysis, Ward and Özdemir (2013) find that there is a positive correlation between persistent low work intensity observed over a period (2006 - 2009) and the low work intensity rate in a given year (2009), indicating that the greater the proportion of people living in households with low work intensity, the greater the proportion of them live in households with *persistently* low work intensity. We know more about individual-level processes. Arulampalam et al. (2000; 2001), Biewen and Steffes (2010), Knights et al. (2002) and Stewart (2007) are among the many authors to have pointed to an important scarring effect in unemployment, by which an individual's previous unemployment experiences have implications for future labour market possibilities. If this is the case across all European countries, we would expect households that suffer from low work intensity to be likely to be found in the same situation in the future.

Thus, from the aforementioned literature, it seems likely that we are going to find that the three poverty and social exclusion indicators are affected by a non-negligible amount of genuine state dependence.

[3]See a brief discussion of the persistent material deprivation indicator from the 'Social Situation Monitor' at `http://ec.europa.eu/social/main.jsp?catId=1050&intPageId=1997&langId=en`

2.2 The feedback effects

2.2.1 Poverty and material deprivation

The dynamic interrelationship between poverty and material deprivation has already been a subject for study by several authors. However, previous findings do not seem to have reached a strong consensus either for or against a positive correlation between the two phenomena over time. Part of the literature agrees on a relationship between poverty and material deprivation, but with different degrees of importance and dependence. Devicienti and Poggi (2011), for the Italian case, find that the two phenomena reinforce one another. As an example, they estimated that the probability of being poor in a given year was 3% for someone who was neither poor nor materially deprived during the previous period. However, the probability of being poor at time t was more than five times greater (up to 17%) if the person had not been poor, but was materially deprived at $t-1$. The feedback from poverty to material deprivation was also found to be strong, positive and statistically significant. Recent work by Guio et al. (2014), based on the cross-country comparative analysis of EU-SILC data, suggests that periods of time spent in poverty are positively associated with material deprivation rates. According to their analysis, the level of and change in income are predictors of both entries to and exits from material deprivation.

Other scholars have examined the role of income in a wider sense, not simply restricting it to poverty. Using data from the British Household Panel Survey, Berthoud and Bryan (2011) found that there is a close underlying link between households' income and material deprivation over time: people with long-term low income are likely to report long-term deprivation. However, they also found a weak dynamic link between the two: an increase in income is less associated with a fall in deprivation. In similar fashion, Figari (2012) examined the role of socio-economic determinants in explaining cross-country differences in multiple deprivation, using data from the European Community Household Panel. His results show that changes in income and deprivation do not coincide strictly, and that past income matters more than current income in determining the deprivation level. Also, the role of socio-economic determinants may vary greatly across countries. Fusco (2012)'s findings, based on Luxembourg's panel data, suggest that housing deprivation is less affected by short variations in income than by measures of permanent income, and that unobserved characteristics of households (such as their wealth or assets) may affect the relationship between long-term income and long-term deprivation.

Whelan et al. (2003) analysed the value-added of using persistent poverty measures, compared to cross-sectional ones, in explaining present levels of deprivation in a cross-country comparative framework. Their starting point was the observation that the link between current levels of income poverty and life-style deprivation is weak. The research was based on the assumption that persistent poverty is instead a better predictor of deprivation, due to its ability to better capture permanent income and command of resources. Their results confirmed that persistent poverty is better correlated with material deprivation than is cross-sectional poverty, although they highlighted the fact that the two do not by any means overlap perfectly. In a later work, Noland and Whelan (2011b) concluded that even when longitudinal measures are used and measurement errors are corrected for, income poverty and material deprivation measure relatively distinct phenomena. Finally, Muffels and Fouarge (2004) found, while studying the role of welfare regimes in explaining deprivation, that a past poverty experience had no significant effect on observed material deprivation.

2.2.2 Poverty and low work intensity in the household

The literature on the relationship between employment and poverty is vast. Attachment to the labour market on the part of all household members is clearly one of the main factors protecting against economic hardship. However, there are not so many works that account precisely for the feedback effect from poverty to employment opportunities (and vice versa). Three exceptions might be mentioned. Amuedo-Dorantes and Serrano-Padial (2010) study the poverty implications of flexible work arrangements in Spain. They find that a temporary contract increases the probability of current poverty and also of future poverty, because this kind of contract increases the probability of again having a type of contract that is associated with economic hardship. Biewen (2009) establishes the fact that past experience of poverty reduces the probability of employment by 9% among prime-age men in Germany. And similarly, Ayllón (2015) finds that past poverty damages the probability of current employment (by 4 - 7%) among young people in seven out of eight European countries analysed.

2.2.3 Material deprivation and low work intensity in the household

As far as we are aware, the direct feedback effects between material deprivation and the attachment of household members to the labour market have not been studied in the literature. However, there is evidence of material deprivation having indirect effects on other outcomes (for example, health status), which can be directly linked to low performance in the labour market. For example, Navarro et al. (2010) find that housing deprivation has a negative effect on individuals' health, which in turn is related to poorer outcomes in the labour market. Similarly, health economists have long agreed on the relationship between, for example, a poor diet and worse economic status (Smith, 1999).

In short, although poverty, material deprivation and low work intensity have been the subject of analysis in previous literature, to the best of our knowledge this is the first paper that jointly analyses the three phenomena, while accounting for state dependence and feedback effects.

3 Data and definitions

The dataset used is the European Union – Survey on Income and Living Conditions (EU-SILC), which collects comparable cross-sectional and longitudinal data across all EU Member States. The EU-SILC contains detailed information on the socio-economic and demographic characteristics of all households members and is intended as the reference data source for the analysis of poverty and social exclusion across the European Union. It is also the data source used by the European Commission for the analysis of progress towards the poverty target.

In most countries, the longitudinal component is derived from a rotating panel sample with four replications. This means that each year, one rotational group (25% of the sample) is dropped and replaced by a new group. In our case, we constructed a pooled dataset that contains all the countries, waves and rotational groups available in the panel from 2004 to 2010. In order to guarantee that the same methodology is applied longitudinally to each rotational group, we built our panel by taking the information from the last file in which a given rotational group figures.

As explained in the introduction, the EU2020 target for the fight against poverty and social exclusion defines people at risk of poverty or social exclusion (AROPE) as a percentage of the total population of individuals who find themselves in at least one of the following three conditions: (i) at risk of poverty; (ii) in severe material deprivation; (iii) in a household with low work intensity.

At-risk-of-poverty rate (AROP). An individual is defined as poor if he or she lives in a household with an equivalised disposable income (after social transfers) below the poverty threshold, which is set at 60% of the national median equivalised disposable income. That is, poverty is defined in relative terms, and every year a different threshold is set in each country. Total household income is equivalised by using the modified OECD equivalent scale, which assigns a weight of 1 to the first adult, 0.5 to any other adult members in the household, and 0.3 to children under the age of 14. The equivalence scale uses the age of household members at the end of the income reference period. Moreover, and in order to make results comparable across time, household disposable income includes the sum of pensions received from individual private pension plans in all waves.[4]

Severe material deprivation rate (SMD). This is defined as the inability to afford at least four of the following items:[5]

1. to avoid arrears in rent, mortgage or utility bills;
2. to keep the home adequately heated;
3. to face unexpected expenses;
4. to eat meat or proteins regularly;
5. to go on holiday;
6. to have a television set;
7. to have a washing machine;
8. to have a car;
9. to have a telephone.

The indicator distinguishes between individuals who cannot afford a certain good or service (enforced lack), and those who do not have it for another reason (for example, because they do not want or need it). Severe material deprivation was not part of the Open Method of Coordination on Social Protection and Social Inclusion, but was introduced as part of the EU2020 target by raising the original threshold from at least three items to at least four. Both the material deprivation and the severe material deprivation indicators are now under revision (Guio et al., 2012; Guio and Marlier, 2013); the eventual decision may further affect the headline indicator itself.

Low work intensity rate (LWI). Individuals are defined as living in households with very low work intensity if they are aged 0–59 and the working-age members of the household worked for less than 20% of their potential during the previous year (see Eurostat, 2012 and Ward and Özdemir, 2013, for a critical review of the methodology).

[4]Eurostat has only recently decided to include private pension plans as part of household income.

[5]Using the same approach as other authors, missing values in the different deprivation items or activities are treated as no deprivation (see D'Ambrosio, 2013).

More precisely, the indicator is computed as the ratio of the total number of months that all working-age household members have worked during the income reference period to the total number of months that the same individuals could theoretically have worked (i.e. those of working age, 18–59 years old, with the exclusion of students in the age group 18–24). In addition, households composed only of students aged below 25 and of people aged 60 or over are excluded from the indicator calculation.

There are several caveats that need to be borne in mind in any analysis that uses data from the EU-SILC. First, it is important to acknowledge that the data are not based on a standardised questionnaire, but instead use a common framework with a set of target variables and rules. Indeed, each country decides on the data-collection method. Secondly, the target population consists of all private households throughout the national territory in every country, and hence indigent individuals are left out of the analysis. And, finally, it is important to note that there is a difference in the reference period for the three sub-indicators of the composite AROPE. While data to compute the at-risk-of-poverty rate and the low work intensity rate are collected for the preceding calendar year (rather than the survey year), the severe deprivation indicator refers to the year of the survey. In analytical terms, this would imply that we should 'lag' the severe material deprivation rate, so as to have the same reference period for all three sub-indicators. There are two arguments for why we did not follow this procedure here. First, some of the individual items of the material deprivation indicator also refer (or could be understood to refer) to the preceding year: for example, the reference period for being in arrears is the previous year. Although the concept of the questions regarding ability to pay for an annual holiday, for adequate heating or for a proper diet would make reference to the actual financial situation of the household, it is uncertain how respondents perceive these questions in the interview situation — to what extent their response is driven by their past experiences or by their actual situation. Secondly, as we have explained, the survey design of the EU-SILC means that, in the vast majority of countries, individuals are followed for up to four years. Thus, we can observe at most three status transitions. If we correct for the (possible) time bias, we would be left with three observations for each individual and with the modelling of two transitions, which would (possibly) jeopardise our econometric strategy (see below).

Covariates of the model were selected by examining the related literature (Nolan and Watson, 1999; Nolan and Whelan, 2011b; Chzhen, 2014). At the individual level, we included gender, age, age squared, suffering poor health, marital status (being married, single, divorced or widowed) and educational attainment (low, mid or high education). At the household level, variables refer to the number of children in the household (of age 0–5, 6–12 and 13–17), household size and tenure status (ownership, rent or free). In addition, we included city size (densely, intermediate or thinly populated area) and year and regional dummies (at NUTS level 1 or 2, depending on the information available in each country).[6]

Our results refer to individuals aged 16–59. The lower bound was set at 16 because individual information is only collected on those over 15. We also excluded individuals aged 60 or over because, by definition, the low work intensity indicator does not cover them.

Finally, our findings are based on a manageable selection of eight countries: Ireland,

[6]Note the impossibility of adding controls relative to the labour market attachment of household members, as the low work intensity indicator (its initial condition and lagged value) captures part of this information.

the United Kingdom, Italy, Spain, Austria, Belgium, Hungary and Poland. That way, we have a selection of English-speaking, Mediterranean, Continental European and Central-Eastern European countries. We would have liked to include the Nordic countries, but the low work intensity indicator cannot be computed for them.[7] Moreover, we selected those countries that had a similar panel structure starting in 2004 or 2005 (in the case of Hungary, Poland and the United Kingdom) with the same number of rotational groups, thus making our results more comparable.[8] [9] Total sample size for each country is detailed at the bottom of Table 1.

4 The extent, persistence and interrelationships of the indicators: a description

Before presenting our econometric strategy and the estimated effects we are interested in, we provide a short description of the extent of poverty, deprivation and low work intensity, as well as the persistence of each phenomenon and the interrelationships between the three processes.[10]

4.1 Extent

The extent of poverty, severe material deprivation and low work intensity differ to a large extent across the Member States. Figure 1 shows the average rates for each phenomenon over the period under analysis. As can be seen, while countries fit in a relatively tight range when we consider at-risk-of-poverty and low work intensity rates, much larger differences can be observed when we look at severe material deprivation. This large variation is caused by the huge disparities between the old and the new Member States. See, for example, the differences between Spain (where less than 4% of adults are affected by severe material deprivation) and Poland (where practically one adult in five suffers from it). Moreover, the ranking of countries in each graph varies greatly: there are some countries with relatively low poverty and deprivation rates but high rates of low work intensity (for example, Belgium) and others with relatively low rates of low work intensity and deprivation, but high rates of poverty risk (for example, Spain). For this reason, in each graph, there are no clusters to be observed.

4.2 Persistence

The persistence of EU2020 poverty and social exclusion indicators in each country is detailed in Figure 2, which presents average percentages of individuals at risk against

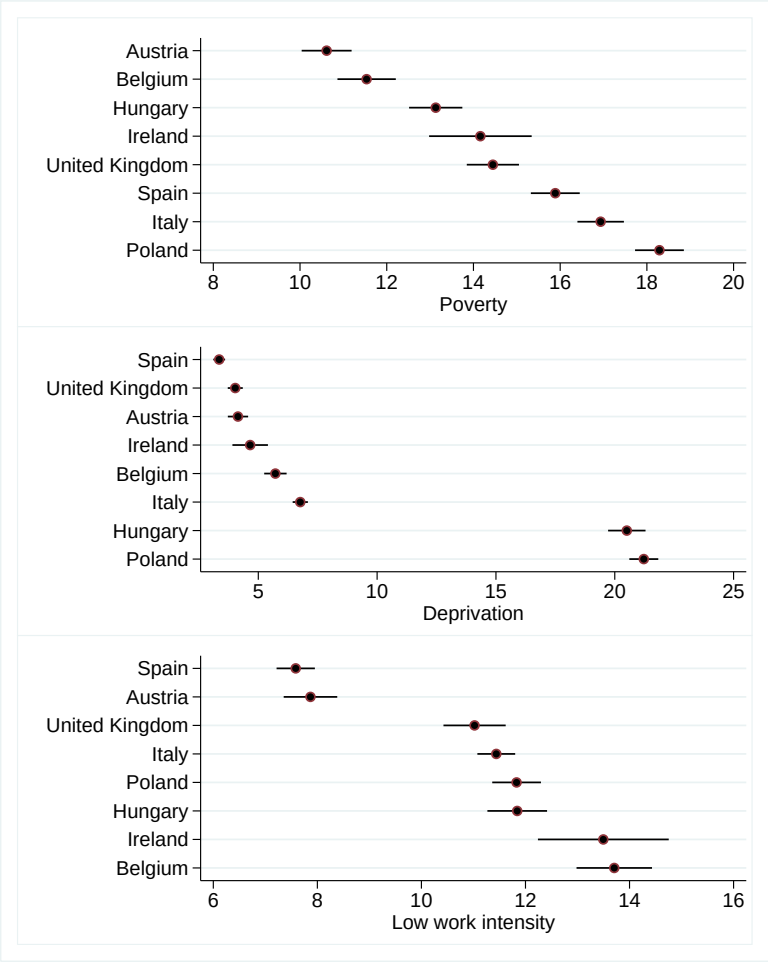
[7] The Nordic countries and the Netherlands have a sub-sampling procedure according to which they collect the variables of main activity status throughout the preceding year only for selected respondents aged 16+ in the sampled households, so the household work intensity variable cannot be calculated, as we do not have the information on other adults in those sampled households.

[8] The only exception is the United Kingdom, which starts the panel with one rotational group less than the other countries.

[9] The number of waves would have been too small for countries such as Bulgaria, Malta or Romania. Other countries were not considered because of their relatively small sample sizes: Estonia, Lithuania and Latvia. Finally, France and Luxembourg were also disregarded, as the French sample is built from nine rotational groups, and the component from Luxembourg constitutes a full panel.

[10] Each point on the graphs presented in this section shows the average across years (and not the average of annual rates).

Figure 1: Average rates of poverty, deprivation and low work intensity, by country, for individuals aged 16–59, 2004–2010



Source: Own calculations based on the EU-SILC, 2005-2010. .
Note: Confidence intervals throughout the paper have been computed by bootstrapping with 1,000 replications and clustering within households. See Goedemé (2013).

persistence rates for each phenomenon.[11] As Figure 2a shows, the average risk of persistent poverty across the countries analysed varies between 45% and 70%, being lowest in Austria and highest in Italy. The persistence rate is also particularly high in Poland. Moreover, a positive relationship between the average poverty rate and persistence can be observed from the graph.[12]

Severe material deprivation persistence rates are lower than those observed for monetary poverty and are in the range 35% and 65%, as shown in Figure 2b. In this case, the Central-Eastern European countries, namely Hungary and Poland, clearly stand out as a cluster, with the highest average deprivation and persistence rates. Spain is the country with the lowest persistence rate.

A completely different picture emerges when we plot average low work intensity rates and persistence in the phenomenon. First, low work intensity persistence rates are in general considerably higher than the persistence rates for the other two phenomena. Secondly, at country level, Belgium (where relatively low average levels of poverty and severe material deprivation are characteristic) is the country with the highest rate of low work intensity persistence (see Figure 2c). Again, Spain stands out as the country with the lowest persistence rate, while the United Kingdom and Austria show persistence rates that are somewhat below what would be expected, according to their average levels of low work intensity.

Overall, if we understand persistence in any of the phenomena analysed as a *proxy* for state dependence, we should expect state dependence to be stronger in the case of low work intensity (with persistence rates of between 70% and 85%), followed by poverty (with rates of between 45% and 70%), and finally severe material deprivation (given that, for the majority of countries, persistence is below 60%).

4.3 Interrelationships

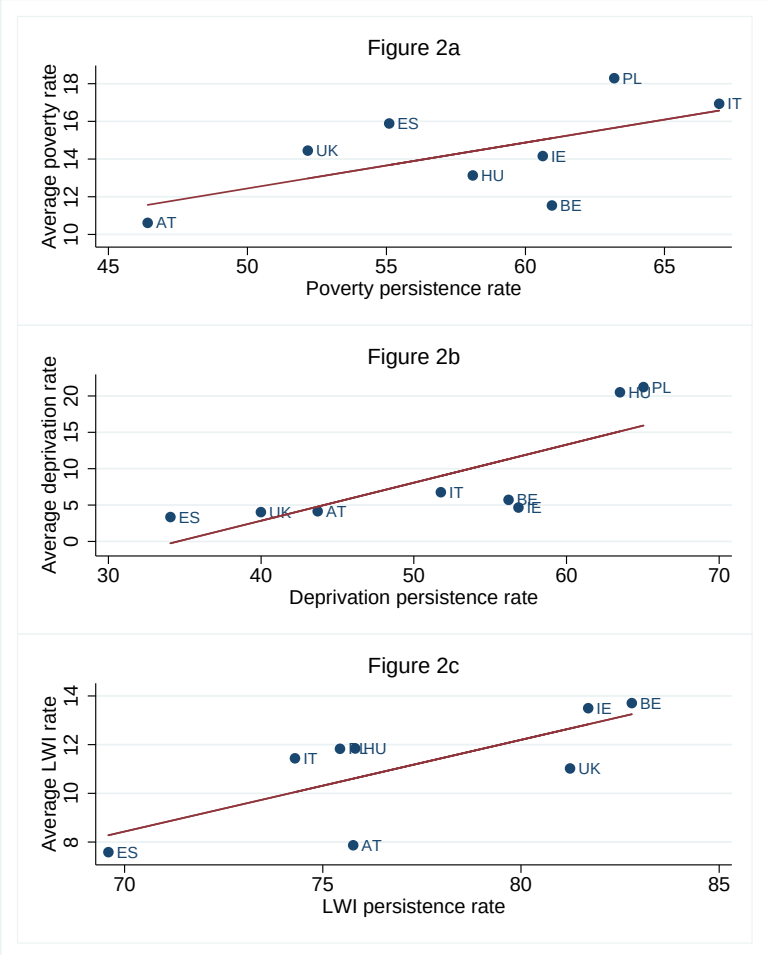
As was discussed earlier, beyond analysing state dependence, we are interested in feedback effects between the EU2020 indicators. That is, the extent to which a given problem influences the future probability of another one. A priori, given the lack of consensus in previous literature or missing research in the field, it is difficult to foresee how the interrelationships should appear. Figure 3 provides a first insight into these relationships, by focusing on one-year lagged effects between statuses in poverty, severe material deprivation and low work intensity. In each figure, the countries have been ranked according to the distance between the two points.

The difference in the probability of being poor depending on past material deprivation status and the probability of being materially deprived according to past poverty status is shown in Figures 3a and 3b, respectively. In all countries, the likelihood of being deprived increases if the individual was previously poor (compared to someone not poor), but this is especially the case in Poland and Hungary, which show the largest distance between the two points. It is in Spain that we find the weakest effect of past poverty on material deprivation. The differences between the probability of being poor if previously

[11] Persistence here is defined as being at risk in period $t-1$ and also at t. Instead, Eurostat defines persistent poverty as the share of persons with an equivalised disposable income below the at-risk-of-poverty threshold in the current year and in at least two of the preceding three years. See `http://epp.eurostat.ec.europa.eu/portal/page/portal/structural_indicators/documents/sc031_-_At_persistant_risk_of_poverty.pdf`

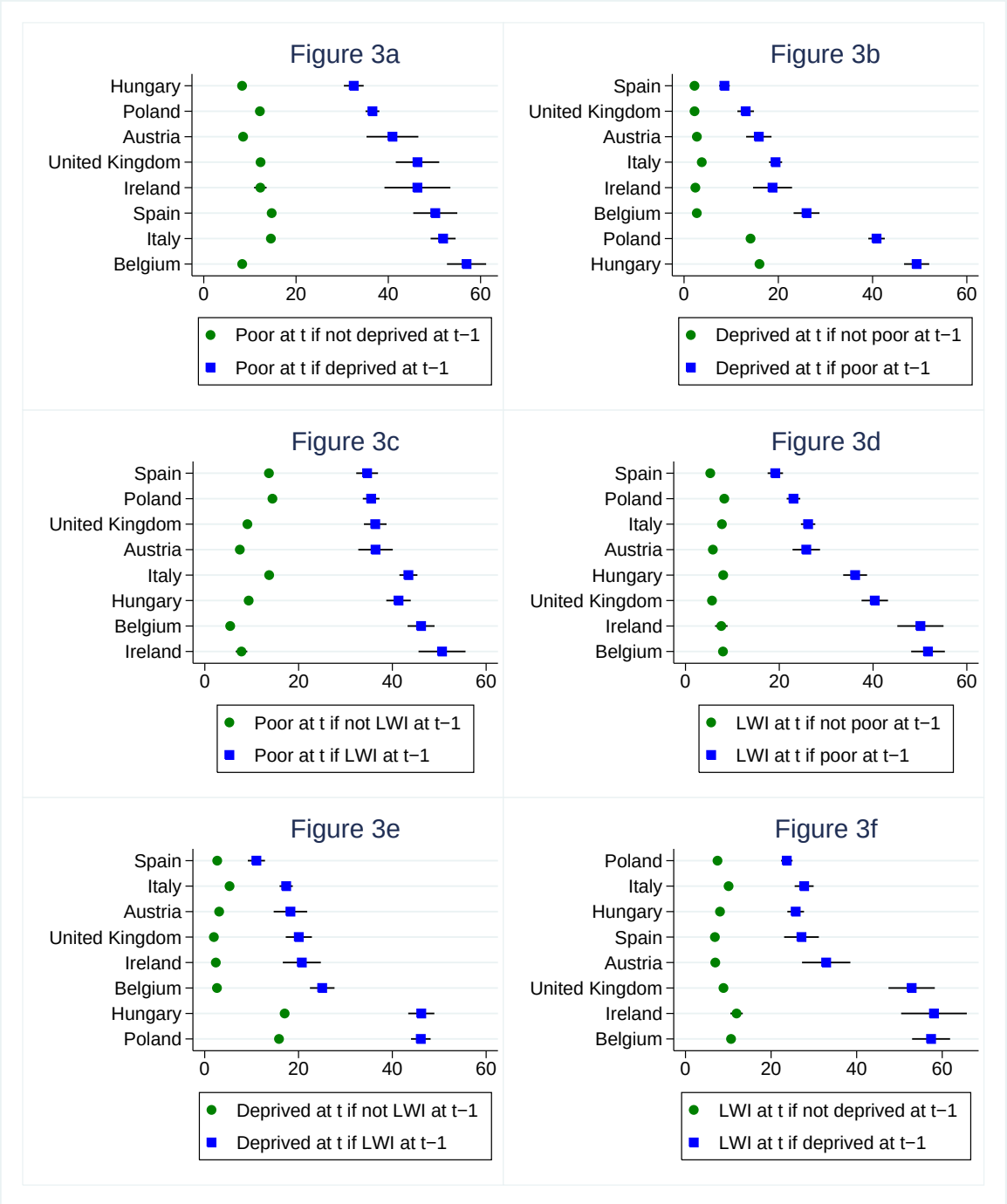
[12] See Jenkins and Van Kerm (2014) for an in-depth analysis of the near-linear relationship between the current poverty rate and the persistent poverty rate, using data from the EU-SILC.

Figure 2: Poverty, material deprivation and low work intensity persistence rates, by country, in relation to cross-sectional rates for individuals aged 16–59, 2004–2010



Source: Own calculations based on the EU-SILC, 2005–2010.

Figure 3: Probability of being at risk of poverty, in severe material deprivation or in low work intensity at t, according to another status at $t-1$, by country, for individuals aged 16–59, 2004–2010



Source: Own calculations based on the EU-SILC, 2005–2010.
Note: Countries have been ranked according to the distance between the two dots. All the x-axes use the same range in order to facilitate comparison. .

deprived are larger than the other way round: this could indicate a stronger feedback from deprivation to poverty than vice versa. However, across the countries these differences are not very large.

Figures 3c and 3d show the interrelationship between poverty and low work intensity. Clearly it is in Spain and Poland that past low work intensity status seems to have the smallest influence on the probability of poverty at the current level. This is true also for the influence of past poverty on the likelihood of low work intensity. If such results are confirmed, it is in these two countries that we should observe the weakest feedback effects between the two phenomena. Conversely, it is in Ireland and Belgium that the difference between the probability of experiencing one phenomenon is mostly influenced by previous experience of the other. Again, no cluster of countries can be clearly observed.

Deprivation status at t also shows differences between observed probabilities of low work intensity at $t-1$ — the distance is especially large in Hungary and Poland, and rather small in Italy and Spain (see Figure 3e). There is not much difference across countries in the probability of current low work intensity for those not deprived during the previous year, but large disparities are observed for those who were deprived (Figure 3f). Close to 60% of those who were severely materially deprived in the past are observed to have low work intensity status subsequently in Ireland, Belgium and the United Kingdom, while the figure is below 30% in Poland, Italy, Hungary and Spain.

These descriptive statistics suggest that the three segments of the EU2020 poverty target display persistence and are dynamically interrelated, with different degrees of importance in different countries. Whether these associations are the result of individual and household heterogeneity or of causal mechanisms is an empirical question that we try to address in the remainder of this paper.

5 The econometric strategy

Our results are the outcome of a first-order Markov chain random-effects trivariate probit model for monetary poverty, material deprivation and low work intensity in each country. This econometric strategy accounts for state dependence, and also for the possibility that each process may have an influence on future values of the other outcomes — e.g. past poverty could have an effect on future low work intensity.

Formally, we define P_{it} as the individual poverty status, D_{it} as the material deprivation status and W_{it} as the low work intensity status.[13] We assume that in period t individuals can be characterised by the latent propensities p^*_{it}, d^*_{it} and w^*_{it} that take the form:

$$p^*_{it} = \alpha_0 D_{it} + \alpha_1 W_{it} + \alpha_2 P_{it-1} + \alpha_3 D_{it-1} + \alpha_4 W_{it-1} + \phi_1^{'} Z_{it} + c_i + u_{it} \quad (1)$$

$$d^*_{it} = \beta_0 W_{it} + \beta_1 P_{it-1} + \beta_2 D_{it-1} + \beta_3 W_{it-1} + \phi_2^{'} S_{it} + h_i + \epsilon_{it} \quad (2)$$

$$w^*_{it} = \gamma_0 P_{it-1} + \gamma_1 D_{it-1} + \gamma_2 W_{it-1} + \phi_3^{'} V_{it} + g_i + \lambda_{it} \quad (3)$$

$$P_{it} = I(p^*_{it} > 0) \quad (4)$$

$$D_{it} = I(d^*_{it} > 0) \quad (5)$$

$$W_{it} = I(w^*_{it} > 0) \quad (6)$$

where $i = 1, 2, ..., N$ refers to individuals, and $t = 1, ..., T$ is the number of periods under study (maximum of three, given that individuals participate in the panel at most for

[13] The notation draws heavily on Ayllón (2015). See the same reference for a review of the previous literature that has used a similar model.

four waves, as previously explained).[14] $I(p_{it}^* > 0)$, $I(d_{it}^* > 0)$ and $I(w_{it}^* > 0)$ are binary indicator functions equal to 1 if the latent propensity in each case is positive, and equal to 0 otherwise. Furthermore, Z_{it}, S_{it}, V_{it} are the independent variable vectors, which are assumed to be exogenous. The parameters represented by alphas, betas and gammas are the coefficients of interest. For example, α_2 captures the degree of state dependence in the poverty status and α_3 the feedback from severe material deprivation status to poverty. ϕ_1, ϕ_2, ϕ_3 are the rest of the parameters to be estimated. c_i, h_i and g_i refer to the individual-specific effects. Moreover, the idiosyncratic error terms in each process (u_{it}, ϵ_{it} and λ_{it}) are assumed to follow a standard normal distribution with zero mean and unit variance, and to be serially independent.

In the modelling, it is important to take account of the well-known problem of *initial conditions*. That is, the fact that the beginning of the observation period may not be the same as the beginning of the outcome experience (see Skrondal and Rabe-Hesketh, 2014). The initial response (at $t = 0$) is affected by the random intercept and the responses that would have taken place before the survey. Ignoring this endogeneity would lead not only to inconsistent estimators, but also to overestimation of the state dependence effect. As in Biewen (2004; 2009) and Devicienti and Poggi (2011), we have chosen to follow Wooldridge (2005) regarding the treatment of initial conditions. He proposes finding the density of the dependent variables from $t = 1, ..., T$ conditional on the initial period and the explanatory variables — instead of finding the density for the whole period $t = 0, 1, ..., T$. This implies a need to specify the density of the unobserved specific effects conditional on the dependent variables at $t = 0$.

Following Stewart (2007), we add the time-average of all time-varying observed variables (except for feedback effects and year dummies), in order to allow for a certain correlation between the individual specific effects and the time-varying variables (see also Chamberlain, 1984 and Alessie et al., 2004). Time-averaged explanatory variables are called $\overline{Z_i}$, $\overline{S_i}$ and $\overline{V_i}$.[15]

Formally, we can write the specification as follows:

$$c_i = r_0 + r_1 P_{i0} + r_2 D_{i0} + r_3 W_{i0} + r_4^{'} \overline{Z_i} + \kappa_{1i} \tag{7}$$

$$h_i = s_0 + s_1 P_{i0} + s_2 D_{i0} + s_3 W_{i0} + s_4^{'} \overline{S_i} + \kappa_{2i} \tag{8}$$

$$g_i = t_0 + t_1 P_{i0} + t_2 D_{i0} + t_3 W_{i0} + t_4^{'} \overline{V_i} + \kappa_{3i} \tag{9}$$

As explained by Wooldridge (2000; 2005) and in order to get consistent estimates, the residuals κ_{1i}, κ_{2i}, κ_{3i} are integrated out using a numerical integration algorithm based on Gauss-Hermite quadrature with 12 points. A trivariate normal distribution with zero mean and $\sigma_{k_{ji}}^2$ variance is assumed for κ_{1i}, κ_{2i}, κ_{3i} which are allowed to be freely correlated:

$$\rho_{12} = corr(\kappa_{1i}, \kappa_{2i}) \tag{10}$$

$$\rho_{13} = corr(\kappa_{1i}, \kappa_{3i}) \tag{11}$$

$$\rho_{23} = corr(\kappa_{2i}, \kappa_{3i}) \tag{12}$$

where ρ_{12} summarises the association between unobservable individual factors determining poverty status and material deprivation. ρ_{13} accounts for unobserved heterogeneity between poverty and low work intensity, and ρ_{23} between material deprivation and low

[14] Note that such a panel structure makes it nearly impossible to include higher-order dynamics.

[15] See Hsiao (1986), Chay and Hyslop (2001), Wooldridge (2005) and Skrondal and Rabe-Hesketh (2014) for reviews of the different strategies that have dealt with the initial conditions problem.

work intensity.[16] We expect all the correlations to be positive across countries. For example, $\rho_{12} > 0$ would indicate that unobservables that make some individual more likely to be poor also make him more likely to be materially deprived, and, $\rho_{23} > 0$ would indicate that unobserved factors that explain why an individual lives in a household with low work intensity are positively related to factors that make him more likely to be materially deprived.

It is important to take into account the fact that if all the parameters for the feedback effects were equal to 0, the recursive structure of the proposed model would not be necessary, and we could consistently estimate each outcome separately. If the feedback-effects coefficients were different from 0 but all the correlations were 0, again we could estimate each equation separately by assuming that the lagged values of each outcome that are used as explanatory variables are *weakly exogenous*. If not, joint estimation is necessary in order to obtain consistent estimates. Moreover, note that the recursive structure of the model assures identification by providing a multiplicity of exclusion restrictions (see Mroz and Savage, 2006).[17] The models have been estimated using the software package aML (*applied Maximum-Likelihood*) (see Lillard and Panis, 2003 and Ayllón, 2014).

6 Empirical results

The main results are shown in Table 1, which includes the estimates for state dependence, cross-current and feedback effects, unobserved heterogeneity, and random-effects correlations.[18] We focus first on the results relative to genuine state dependence, as measured by the coefficient of the lagged value of each dependent variable in each equation.

As is shown, state dependence is proved for all three segments of poverty and social exclusion, and for all countries. This means that being affected by a given problem in the past increases *by itself* the probability of experiencing the same outcome again in the future. A comparison of the coefficients and confidence intervals of each parameter confirms that low work intensity is more affected by state dependence than is monetary poverty, while being below the poverty line is more affected by state dependence than is material deprivation. Indeed, this is a phenomenon that was observed in Section 4 from the descriptive statistics of persistence rates. The existence of strong genuine state dependence is reinforced and strengthened by the estimated results for the initial condition of a given status. These are also positive for all three segments of poverty and social exclusion. Moreover, note that the standard deviation of the individual-specific random effects of each equation (σ_{κ_1}, σ_{κ_2}, σ_{κ_3}) is highly significant, pointing to the importance of considering unobserved heterogeneity in each phenomenon.

If we look at the countries, the coefficients indicate that poverty is most affected by state dependence in Poland, while this scarring effect is weakest in Spain. For deprivation, state dependence is highest in Hungary and Poland, while for low work intensity it is particularly high in Austria. Note that these results do not correspond perfectly to the rankings of persistence rates given in Figure 2. This is readily explained by the fact that genuine state dependence in each phenomenon captures only part of the persistence, while

[16] Correlations relate unobservables such as ability, intelligence, personality traits, ambition, family background and so on.

[17] In other words, and as explained in Wilde (2000), by the condition of logical consistency, the existence of one varying exogenous regressor is sufficient to avoid identification problems in multiple equation models for binary outcomes with endogenous regressors.

[18] The full models with all the coefficients are available from the authors upon request.

the rest needs to be attributed to observed and unobserved heterogeneity with different degrees of importance in each country.

Poverty and severe material deprivation. Evidence of feedback effects between poverty and severe material deprivation is not to be found in all the samples analysed. Only in the Central-Eastern European countries of Hungary and Poland do we find evidence of a feedback loop between the two phenomena, by which past poverty experiences increase the probability of material deprivation, and in turn material deprivation increases the likelihood of future poverty. This is partly in line with what we observed in Section 4, where we found that past poverty status makes a much greater difference to deprivation outcomes in the new Member States than in the old ones. However, the feedback from past deprivation experiences to poverty was less obvious from simple descriptive tabulations in both countries (see Figure 3a).

Estimated effects are not significant at the 95% confidence level neither in the English-speaking, the Mediterranean or Continental Europe Member States — with the exception of positive feedback from poverty on material deprivation in Austria and negative feedback between the two segments in Italy; and positive feedback in the opposite direction (from material deprivation on poverty) in Spain. Thus, in the majority of countries, one-year lags do not affect present outcomes in any substantial way. Feedback loops that reinforce both phenomena are not found. Rather, poverty and severe material deprivation are related via initial conditions, current effects and unobserved factors. A positive effect on poverty resulting from current severe material deprivation is observed in Spain, as well as in the Central-Eastern European countries. However, of the English-speaking and Continental European countries, a significant effect is found only in Belgium. Interestingly, ρ_{12}, which relates unobservables that affect poverty and material deprivation simultaneously, is positive and statistically significant at least at the 95% confidence level in all countries (except Ireland). That is, the relationship between both phenomena goes beyond the observed characteristics included in the model or the survey — for example, family background, personality or ability.

Poverty and low work intensity. A positive feedback effect from low work intensity to poverty is not present in the countries analysed, with the sole exception of Italy. Instead, we find a negative feedback in Spain and Poland, and an effect that does not statistically differ from 0 for the rest of the countries.[19] Indeed, in all countries the link between the two segments is provided by current effects: the estimated coefficients of low work intensity in the poverty equation are very strong positive in all countries. This just reflects the obvious fact that earnings from the labour market are key to prevent poverty in any country and that changes in earnings exert an immediate effect on the risk of poverty.

Feedback effects from poverty to low work intensity are positive at the 95% confidence level only in the United Kingdom, Italy and Hungary, and are not statistically meaningful in the rest of the countries. So we do not find general evidence of past poverty experiences jeopardising individuals' chances in the labour market by country cluster. Nor do our results correspond with the relationships and rankings observed at a descriptive level. Again, part of the link between poverty and low work intensity occurs via initial conditions and correlated unobserved heterogeneity. That is, unobserved characteristics that increase the probability of being poor also increase the probability of living in a household with low work intensity — this being true for six of the eight countries analysed.

[19]Recall that Spain and Poland were the countries where the difference between the probability of being poor according to past low work intensity status was the smallest in Figure 3c.

Severe material deprivation and low work intensity. Positive feedback effects from past low work intensity status to material deprivation are only precisely estimated in Poland and Hungary, where we also found feedback from past material deprivation to the likelihood of living in a household with low work intensity. Again, the results provide evidence of a feedback loop between the two phenomena in these Central-Eastern European countries. The same evidence is not found in the rest of the countries. Actually, we only observe positive feedback from past deprivation status to low work intensity in the United Kingdom, Belgium and Spain. There is negative feedback from past low work intensity to deprivation in the United Kingdom, and again negative feedback in Italy, but this time from deprivation to low work intensity. The rest of the possible feedback effects in the samples studied are not statistically significant. So, with the exception of the Central-Eastern European countries, we cannot find evidence of an interrelationship between material deprivation and low work intensity that would reinforce both phenomena. Nor are the two segments closely related via initial conditions everywhere, and so again it is the current low work intensity status that mainly has an influence on material deprivation — being the coefficient statistically significant in five of the eight countries studied. The results on correlations indicate that generally speaking unobservables do not play a very important role in this case either, since they are significant only in Austria, Spain and Italy.

Table 1: Coefficients for the trivariate probit model on poverty, severe material deprivation and low work intensity with feedback effects (standard errors in parenthesis)

	Ireland	**UK**	**Belgium**	**Austria**	**Spain**	**Italy**	**Hungary**	**Poland**
Poverty equation								
D_{it}	0.1453	-0.0438	0.2875 **	0.1779 *	0.3532 ***	0.0139	0.2193 ***	0.2183 ***
	(0.1575)	*(0.1157)*	*(0.1157)*	*(0.1048)*	*(0.0617)*	*(0.0473)*	*(0.0564)*	*(0.0372)*
W_{it}	1.1379 ***	0.5564 ***	0.8474 ***	0.9856 ***	0.7015 ***	0.8079 ***	0.8862 ***	0.8474 ***
	(0.1442)	*(0.0912)*	*(0.1095)*	*(0.1074)*	*(0.0516)*	*(0.0468)*	*(0.0706)*	*(0.0487)*
P_{it-1}	0.6893 ***	0.6837 ***	0.5548 ***	0.7654 ***	0.4276 ***	0.6400 ***	0.5735 ***	1.0835 ***
	(0.0868)	*(0.0517)*	*(0.0668)*	*(0.0561)*	*(0.0294)*	*(0.0282)*	*(0.0429)*	*(0.0245)*
D_{it-1}	0.1596	-0.0910	0.1535 *	0.0817	0.1924 ***	-0.0568	0.2238 ***	0.1393 ***
	(0.1532)	*(0.0894)*	*(0.0830)*	*(0.0968)*	*(0.0556)*	*(0.0378)*	*(0.0438)*	*(0.0288)*
W_{it-1}	0.0091	-0.0933	0.1320	-0.0105	-0.0971 **	0.0961 **	-0.0280	-0.1051 ***
	(0.1185)	*(0.0663)*	*(0.0869)*	*(0.0865)*	*(0.0443)*	*(0.0386)*	*(0.0570)*	*(0.0375)*
P_{i0}	1.1090 ***	0.7181 ***	1.0838 ***	0.7198 ***	1.1557 ***	1.4369 ***	1.0031 ***	0.7288 ***
	(0.1243)	*(0.0662)*	*(0.0921)*	*(0.0759)*	*(0.0416)*	*(0.0451)*	*(0.0612)*	*(0.0351)*
D_{i0}	-0.2783	0.3982 ***	0.3401 ***	0.5177 ***	0.2247 ***	0.3929 ***	0.2052 ***	0.1789 ***
	(0.1752)	*(0.1001)*	*(0.0989)*	*(0.1102)*	*(0.0658)*	*(0.0464)*	*(0.0554)*	*(0.0364)*
W_{i0}	-0.1382	0.2833 ***	0.2404 **	0.0530	0.2286 ***	0.0441	0.0980	-0.0359
	(0.1652)	*(0.0800)*	*(0.1131)*	*(0.1108)*	*(0.0542)*	*(0.0533)*	*(0.0709)*	*(0.0450)*
Severe material deprivation equation								
W_{it}	0.5065 **	0.3763 **	0.3970 **	0.1812	0.1273 *	0.4306 ***	0.1176 *	0.2521 ***
	(0.2524)	*(0.1536)*	*(0.1549)*	*(0.1477)*	*(0.0728)*	*(0.0609)*	*(0.0648)*	*(0.0503)*
P_{it-1}	0.1920	0.2062 *	0.1272	0.2330 ***	0.0127	-0.1177 ***	0.1199 **	0.0728 **
	(0.1603)	*(0.1064)*	*(0.1021)*	*(0.0851)*	*(0.0532)*	*(0.0413)*	*(0.0486)*	*(0.0343)*
D_{it-1}	0.3864 **	0.3852 ***	0.3393 ***	0.4584 ***	0.4135 ***	0.5054 ***	0.7498 ***	1.0068 ***
	(0.1507)	*(0.1093)*	*(0.0963)*	*(0.1045)*	*(0.0635)*	*(0.0409)*	*(0.0347)*	*(0.0268)*
W_{it-1}	0.1573	-0.2515 **	0.1753	0.1837	0.0567	-0.0217	0.1703 ***	0.0780 **
	(0.1806)	*(0.1258)*	*(0.1236)*	*(0.1193)*	*(0.0681)*	*(0.0501)*	*(0.0542)*	*(0.0387)*
P_{i0}	0.3438 **	0.1640	0.5424 ***	0.3506 ***	0.3253 ***	0.5874 ***	0.3573 ***	0.3365 ***

Continued on next page...

Table 1 – continued from previous page

	Ireland	**UK**	**Belgium**	**Austria**	**Spain**	**Italy**	**Hungary**	**Poland**
	(0.1619)	*(0.1084)*	*(0.1173)*	*(0.0899)*	*(0.0532)*	*(0.0429)*	*(0.0479)*	*(0.0338)*
D_{i0}	1.5916 ***	1.0905 ***	1.6698 ***	1.3235 ***	1.0278 ***	1.5029 ***	1.0791 ***	1.1109 ***
	(0.2447)	*(0.1472)*	*(0.1642)*	*(0.1451)*	*(0.0866)*	*(0.0652)*	*(0.0531)*	*(0.0444)*
W_{i0}	-0.1851	0.2948 *	0.2317	0.1252	0.1658 **	0.0077	-0.0243	0.0973 **
	(0.2947)	*(0.1517)*	*(0.1527)*	*(0.1460)*	*(0.0817)*	*(0.0706)*	*(0.0651)*	*(0.0486)*
Low work intensity equation								
P_{it-1}	0.2020 *	0.4198 ***	0.1448	0.1313 *	0.0605	0.1145 ***	0.1356 **	-0.0116
	(0.1214)	*(0.0738)*	*(0.0904)*	*(0.0791)*	*(0.0434)*	*(0.0411)*	*(0.0558)*	*(0.0414)*
D_{it-1}	-0.0527	0.2735 **	0.3319 ***	0.1339	0.1695 **	-0.1025 **	0.2369 ***	0.1787 ***
	(0.1837)	*(0.1345)*	*(0.1258)*	*(0.1095)*	*(0.0742)*	*(0.0483)*	*(0.0551)*	*(0.0420)*
W_{it-1}	1.5421 ***	1.0028 ***	1.3969 ***	1.7334 ***	1.0609 ***	1.2509 ***	1.4445 ***	1.5719 ***
	(0.1185)	*(0.0709)*	*(0.0809)*	*(0.0786)*	*(0.0472)*	*(0.0399)*	*(0.0487)*	*(0.0346)*
P_{i0}	0.3293 ***	0.2158 ***	0.3219 ***	0.1222	0.2586 ***	0.2902 ***	0.1985 ***	0.0638
	(0.1169)	*(0.0737)*	*(0.0930)*	*(0.0769)*	*(0.0457)*	*(0.0404)*	*(0.0541)*	*(0.0395)*
D_{i0}	0.3377 *	0.1181	0.3697 ***	0.3060 ***	0.3400 ***	0.2112 ***	0.0929 *	0.0963 **
	(0.1827)	*(0.1283)*	*(0.1202)*	*(0.1077)*	*(0.0790)*	*(0.0476)*	*(0.0530)*	*(0.0401)*
W_{i0}	1.4348 ***	1.2469 ***	1.6366 ***	1.0256 ***	1.4858 ***	1.6603 ***	0.8981 ***	0.9964 ***
	(0.2392)	*(0.1210)*	*(0.1689)*	*(0.1366)*	*(0.0813)*	*(0.0778)*	*(0.0789)*	*(0.0609)*
Unobserved heterogeneity								
σ_{κ_1}	0.6177 ***	0.6062 ***	0.7712 ***	0.6985 ***	0.8576 ***	0.8533 ***	0.7460 ***	0.5525 ***
	(0.0811)	*(0.0531)*	*(0.0603)*	*(0.0539)*	*(0.0271)*	*(0.0260)*	*(0.0412)*	*(0.0271)*
σ_{κ_2}	0.9603 ***	0.7917 ***	1.1724 ***	0.8233 ***	0.8324 ***	1.0178 ***	0.7142 ***	0.7201 ***
	(0.1413)	*(0.1003)*	*(0.1005)*	*(0.0928)*	*(0.0565)*	*(0.0379)*	*(0.0356)*	*(0.0281)*
σ_{κ_3}	0.7815 ***	0.8157 ***	0.9461 ***	0.6134 ***	0.9614 ***	0.8709 ***	0.5656 ***	0.6370 ***
	(0.1151)	*(0.0714)*	*(0.0845)*	*(0.0788)*	*(0.0426)*	*(0.0372)*	*(0.0523)*	*(0.0364)*
Correlations								
ρ_{κ_1,κ_2}	0.0463	0.3856 **	0.2439 **	0.5494 ***	0.2400 ***	0.4117 ***	0.2094 ***	0.2778 ***
	(0.1877)	*(0.1599)*	*(0.1016)*	*(0.1138)*	*(0.0546)*	*(0.0399)*	*(0.0694)*	*(0.0615)*
ρ_{κ_1,κ_3}	0.4865 ***	0.3259 ***	0.4120 ***	0.2115	0.3853 ***	0.2854 ***	0.2697 ***	0.0737

Continued on next page...

Table 1 – continued from previous page

	Ireland	**UK**	**Belgium**	**Austria**	**Spain**	**Italy**	**Hungary**	**Poland**
	(0.1817)	*(0.1160)*	*(0.1043)*	*(0.1321)*	*(0.0436)*	*(0.0425)*	*(0.0948)*	*(0.0775)*
ρ_{κ_2,κ_3}	0.0561	0.2043	0.0947	0.3463 **	0.2490 ***	0.1726 ***	0.1228	0.0842
	(0.2103)	*(0.1577)*	*(0.1006)*	*(0.1600)*	*(0.0675)*	*(0.0476)*	*(0.0917)*	*(0.0656)*
ln-L	-8526.22	-13884.20	-12816.57	-12677.45	-47666.11	-68307.18	-30866.58	-62793.84
N	17031	26005	29359	29528	81937	123197	39428	77178

Source: Own calculations based on the EU-SILC, 2005–2010.
Note: Significance: *** 99% confidence level, ** 95% and * 90%. Covariates include gender, age, age squared, suffering poor health, marital status, educational attainment, number of children in the household (aged 0–5, 6–12 and 13–17), household size, tenure status, city size and year and regional dummies (except in Ireland) plus averages of all time-varying variables.

7 Conclusions

The aim of this paper has been to analyse dynamically the interrelationships between the three segments of poverty and social exclusion covered by the EU2020 poverty target: namely, the at-risk-of-poverty, the severe material deprivation and the low work intensity rates. We have paid special attention to measurement of the degree of state dependence in each phenomenon, as well as to the possible feedback effects between the three processes. Our results are the outcome of an econometric strategy that has controlled for observed and unobserved characteristics and the initial conditions problem, and are based on data from the EU-SILC for eight European Member States.

We have found that the three processes under study are affected by a considerable degree of genuine state dependence, according to which the past *in itself* influences the probability of someone experiencing the same problem again in the future. Once more, our results highlight the importance of accounting for past experiences when trying to understand the current processes of poverty, material deprivation and low work intensity. Of the three segments, material deprivation is the phenomenon least affected by *scarring*, and low work intensity is most affected. From a policy point of view, this means that interventions at a given point in time will have spill-over effects in the future; thus combating economic hardship *today* clearly reduces the problem *tomorrow*. Our results do not allow for identification of the mechanisms by which state dependence happens, but these are discussed in the literature (as was set out earlier in this paper). Of these, social benefit regimes may play a role, alongside other factors such as human capital depreciation, demoralisation, loss of motivation, or stigma.

In terms of feedback effects between poverty and material deprivation, we have found clear evidence of a feedback loop only in the Central-Eastern European countries, where both phenomena reinforce each other. In the remainder of the countries, there was no such evidence, which goes to highlight the fact that poverty and material deprivation are different in nature and may be identifying different individuals — while the former is relative and input based, the latter is objective and output based (Boarini and D'Ercole, 2006; Dewilde, 2004). Like Whelan and Maître (2007), we find that a weak association between poverty and material deprivation mainly characterises the more affluent Member States. Poverty and material deprivation are much more affected by current effects, initial conditions and correlated unobservables. The significance of the correlation for unobserved heterogeneity between the two phenomena in almost all countries indicates that the interrelationship is affected by other characteristics that either have not been taken into account or are not even contained in the dataset to hand.

Regarding the interrelationship between poverty and low work intensity, it is found that feedback effects are not important in explaining either phenomenon. Rather, it is the current status of low work intensity that clearly explains the probability today of living below the poverty line. Feedback effects from low work intensity to poverty were only found in three of the eight countries and did not allow the identification of a pattern by country cluster. Again, a positive and significant correlation between unobservables related to each phenomenon captures part of the link between the two segments.

The evidence of a relationship between material deprivation and low work intensity was even more mixed (in terms of signs and significance) than for the rest of the feedback effects analysed. Only in the Central-Eastern European countries was a feedback loop found between these two phenomena. Once more, it is current low work intensity status that mainly has an influence on material deprivation. Nor does the correlation between unobservable factors seem to play a significant role in the majority of countries.

Our econometric strategy has proved relevant for our analysis. The standard deviation of the individual-specific effects was significant at the 99% confidence level in the three equations for all the countries analysed. Failing to control for unobserved heterogeneity would have overestimated state dependence. Moreover, at least one correlation between unobservable factors

was significant, which points to the need for a joint model of the type presented in this paper. Furthermore, we have also learned that associations and country rankings according to simple descriptive statistics may differ quite substantially from the results of an econometric strategy that controls for observed and unobserved heterogeneity.

Overall, our results indicate and reinforce some of the existing findings of the literature that the three social indicators of the EU2020 strategy are (simply) different and capture different aspects of economic hardship in the majority of the countries analysed. However, we also found that the three segments are related via current effects in almost all the samples — in particular, low work intensity status is strongly linked with the risk both of income poverty and of severe material deprivation. In terms of policy, on the one hand, these results suggest that the three domains should be handled via different interventions, while spill-over effects across time are likely to be marginal, apart from in the Central-Eastern European countries. On the other hand, employment policies that reduce low work intensity clearly fight poverty in the first instance, but also severe material deprivation, via current effects.

Finally, we would like to stress that our results could be partly driven by data limitations and the fact that the EU-SILC collects data for at most four consecutive waves. As the literature shows, for example the correlation between income and material deprivation is stronger for individuals who have been confronted by monetary poverty for longer periods of time. The first-order dynamics introduced in our modelling strategy may fail to capture long-term erosion of resources (Dewilde, 2004). However, to take our knowledge on this topic any further, while considering a cross-EU comparative analysis, we would need the EU-SILC to start following the same individuals for more than the current four waves.

8 Acknowledgements

The research on which this paper is based is financially supported by the European Union's Seventh Framework Programme (FP7/2012-2016) under grant agreement n. 290613 (project title: ImPRovE). Sara Ayllón also acknowledges financial support from the Spanish projects ECO2010-21668-C03-02, ECO2013-46516-C4-1-R and 2014-SGR-1279. We would like to thank Tim Goedemé and Fabienne Montaigne for providing the do-file that helped us construct the low work intensity indicator. We are grateful to Karel Van den Bosch (Herman Deleeck Centre for Social Policy) and participants at the ImPRovE Meeting in Budapest (November 2014) for their useful comments. Any errors or misinterpretations are our own.

References

Alessie, R., S. Hochguertel, and A. Van Soest (2004): "Ownership of stocks and mutual funds: A panel data analysis," *The Review of Economics and Statistics*, 86(3), 783–796.

Amuedo-Dorantes, C., and R. Serrano-Padial (2010): "Labour market flexibility and poverty dynamics: Evidence from Spain," *Labour Economics*, 17(4), 632–642.

Arulampalam, W., A. Booth, and M. Taylor (2000): "Unemployment persistence," *Oxford Economic Papers*, 52(1), 24–50.

Arulampalam, W., P. Gregg, and M. Gregory (2001): "Unemployment Scarring," *Economic Journal*, 111(475), 577 – 584.

Atkinson, T., B. Cantillon, E. Marlier, and B. Nolan (2002): *Social Indicators: The EU and Social Exclusion*. Oxford University Press, Oxford.

Ayllón, S. (2013): "Understanding poverty persistence in Spain," *SERIES - Journal of the Spanish Economic Association*, 42(2), 201–233.

——— (2014): "From Stata to aML," *Stata Journal*, 14(2), 342–362.

——— (2015): "Youth poverty, employment and leaving the parental home in Europe," *Review of Income and Wealth, forthcoming*.

Berthoud, R., and M. Bryan (2011): "Income, Deprivation and Poverty: a Longitudinal Analysis," *Journal of Social Policy*, 40(1), 135–156.

Biewen, M. (2004): "Measuring state dependence in individual poverty status. Are there feedback effects to employment decisions and household composition?," IZA Discussion Papers 1138, Institute for the Study of Labor (IZA).

——— (2009): "Measuring state dependence in individual poverty histories when there is feedback to employment status and household composition," *Journal of Applied Econometrics*, 24(7), 1095–1116.

Biewen, M., and S. Steffes (2010): "Unemployment persistence: Is there evidence for stigma effects?," *Economics Letters*, 106(3), 188–190.

Boarini, R., and M. M. D'Ercole (2006): "Measures of material deprivation in OECD countries," Discussion paper, OECD Social, Employment and Migration Working Paper Series 37.

Cappellari, L., and S. P. Jenkins (2004): "Modelling low income transitions," *Journal of Applied Econometrics*, 19(5), 593–610.

Chamberlain, G. (1984): "Panel Data," in *Handbook of Econometrics*, ed. by Z. Griliches, and M. Intriligator, vol. 2, pp. 1247–1318. Amsterdam, North Holland.

Chay, K. Y., and D. Hyslop (2001): "Identification and estimation of dynamic binary response panel data models: Empirical evidence using alternative approaches," Discussion paper, available at SSRN: http://ssrn.com/abstract=1532468.

Chzhen, Y. (2014): "Child Poverty and Material Deprivation in the European Union during the Great Recession," Innocenti Working Paper 2014-06, UNICEF Office of Research, Florence.

Copeland, P., and M. Daly (2012): "Varieties of poverty reduction: Inserting the poverty and social exclusion target into Europe 2020," *Journal of European Social Policy*, 22(3), 273–287.

Corluy, V., and F. Vandenbroucke (2013): "Individual employment, household employment and the risk of poverty in the EU," Methodologies and Working Papers, Eurostat, Luxembourg.

D'Ambrosio, C. (2013): "The indicators of intertemporal material deprivation: a proposal and an application to EU countries," ImPRovE Discussion Paper No. 13/08, Herman Deleeck Centre for Social Policy, Antwerp. .

Devicienti, F., and A. Poggi (2011): "Poverty and social exclusion: two sides of the same coin or dynamically interrelated processes?," *Applied Economics*, 43(25), 3549–3571.

Dewilde, C. L. (2004): "The multidimensional measurement of poverty in Belgium and Britain: A categorical approach," *Social Indicators Research*, 68(3), 331–369.

European Commission (2006): "Portfolio of indicators for the monitoring of the European strategy for social protection and social inclusion," DG Employment and Social Affairs, Brussels.

——— (2009): "Portfolio of indicators for the monitoring of the European strategy for social protection and social inclusion - 2009 update," DG of Employment, Social Affairs and Equal Opportunities, Brussels.

——— (2010): "Europe 2020. A European strategy for smart, sustainable and inclusive growth," Communication from the Commission COM(2010)2020, Brussels.

——— (2013): "Social Europe. Current challenges and the way forward. Annual Report of the Social Protection Committee 2012," EU Commission Working Document, Publications Office of the European Union, Brussels.

——— (2014): "Taking stock of the Europe 2020 strategy for smart, sustainable and inclusive growth. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the COmmittee of the Regions," Communication from the Commission COM(2014) 130 final, European Commission, Brussels.

Eurostat (2012): "23% of EU citizens were at risk of poverty or social exclusion in 2010," Statistics in Focus 9/2012, European Statistical Office, Luxembourg.

Figari, F. (2012): "Cross-national differences in determinants of multiple deprivation in Europe," *Journal of Economic Inequality*, 10(3), 397–418.

Fusco, A. (2012): "The relationship between income and housing deprivation in Luxembourg: a longitudinal analysis," CEPS/INSTEAD Working Paper Series 2012-10, CEPS/INSTEAD.

Fusco, A., and N. Islam (2012): "Understanding the drivers of low income transitions in Luxembourg," *Research on Economic Inequality*, 20, 367–391.

Goedemé, T. (2013): "How much confidence can we have in EU-SILC? Complex sample designs and the standard error of the Europe 2020 poverty indicators," *Social Indicators Research*, 110(1), 89–110.

Guio, A.-C. (2009): "What can be learned from deprivation indicators in Europe?," Eurostat Methodologies and Working Papers, Eurostat, Luxembourg.

Guio, A.-C., D. Gordon, and E. Marlier (2012): "Measuring material deprivation in the EU. Indicators for the whole population and child-specific indicators," Eurostat Methodologies and Working Papers, Eurostat, Luxembourg: Office for Official Publications of the European Communities.

Guio, A.-C., and E. Marlier (2013): "Alternative vs. current indicators of material deprivation at EU level: What differences does it make?," ImPRovE Working Paper Series 13/07, Herman Deleeck Centre for Social Policy - University of Antwerp, Antwerp.

Guio, A.-C., E. Marlier, and M. Pomati (2014): "Evolution of material deprivation over time: The impact of the great recession in EU countries," Paper presented at the 2014 International Conference on Comparative Eu Statistics on Income and Living Conditions.

Hsiao, C. (1986): *Analysis of panel data*. Cambridge University Press, Cambridge.

Jenkins, S. P. (2013): "On State Dependence: a Case for Two-handed Economists," Discussion Paper 77, LASER, Labour and Socio-Economic Research Center.

Jenkins, S. P., and P. Van Kerm (2014): "The Relationship Between EU Indicators of Persistent and Current Poverty," *Social Indicators Research*, 116(2), 611–638.

Knights, S., M. N. Harris, and J. Loundes (2002): "Dynamic Relationships in the Australian Labour Market: Heterogeneity and State Dependence," *Economic Record*, 78(242), 284–98.

Lillard, L. A., and C. W. Panis (2003): *aML Multilevel Multiprocess Statistical Software, Version 2.0*. EconWare, Los Angeles, California.

Maître, B., B. Nolan, and C. T. Whelan (2013): "A critical evaluation of the EU2020 poverty and social exclusion target: An analysis of the EU-SILC 2009," GINI Discussion Paper 79, AIAS, Amsterdam.

Marlier, E., T. Atkinson, B. Cantillon, and B. Nolan (2007): *The EU and Social Inclusion: Facing the challenges*. Policy Press, Bristol.

Mroz, T. A., and T. H. Savage (2006): "The long-term effects of youth unemployment," *Journal of Human Resources*, XLI(2), 259–293.

Muffels, R., and D. Fouarge (2004): "The role of European welfare states in explaining resource deprivation," *Social Indicators Research*, 68(3), 299–330.

Mullainathan, S., and E. Shafir (2013): *Scarcity. Why having too little means so much*. Allen Lane, Penguin Books, London.

Navarro, C., L. Ayala, and J. M. Labeaga (2010): "Housing deprivation and health status: evidence from Spain," *Empirical Economics*, 38(3), 555–582.

Nolan, B., and D. Watson (1999): *Women and Poverty in Ireland*. Oak Tree Press, Dublin.

Nolan, B., and C. T. Whelan (2011a): "The EU 2020 Poverty Target," GINI Discussion Paper 19, AIAS, Amsterdam.

——— (2011b): *Poverty and deprivation in Europe*. Oxfor University Press, Oxford.

Ravallion, M. (2011): "On Multidimensional Indices of Poverty," Policy Research Working Paper 5580, World Bank Development Research Group, Washington DC.

Skrondal, A., and S. Rabe-Hesketh (2014): "Handling initial conditions and endogenous covariates in dynamic/transition models for binary data with unobserved heterogeneity," *Journal of the Royal Statistical Society: Series C (Applied Statistics)*, 63, 211–237.

Smith, J. P. (1999): "Healthy Bodies and Thick Wallets: The Dual Relation Between Health and Economic Status," *Journal of Economic Perspectives*, 13(2), 144–166.

Stewart, M. B. (2007): "The interrelated dynamics of unemployment and low-wage employment," *Journal of Applied Econometrics*, 22(3), 511–531.

Ward, T., and E. Özdemir (2013): "Measuring low work intensity an analysis of the indicator," ImPRove Discussion Paper no. 13/09, Herman Deleeck Centre for Social Policy, Antwerp.

Whelan, C. T., R. Layte, and B. Maître (2003): "Persistent income poverty and deprivation in the European Union: An analysis of the first three waves of the European Community Household Panel," *Journal of Social Policy*, 32(1), 1–18.

Whelan, C. T., and B. Maître (2007): "Income, deprivation and economic stress in the enlarged European Union," *Social Indicators Research*, 83(2), 309–329.

Wilde, J. (2000): "Identification of multiple equation probit models with endogenous dummy regressors," *Economics Letters*, 69(3), 309–312.

Wooldridge, J. M. (2000): "A framework for estimating dynamic, unobserved effects panel data models with possible feedback to future explanatory variables," *Economics Letters*, 68(3), 245–250.

——— (2005): "Simple solutions to the initial conditions problem in dynamic, non linear panel data models with unobserved heterogeneity," *Journal of Applied Econometrics*, 20(1), 39–54.

ImPRovE: Poverty Reduction in Europe. Social Policy and Innovation

Poverty Reduction in Europe: Social Policy and Innovation (ImPRovE) is an international research project that brings together ten outstanding research institutes and a broad network of researchers in a concerted effort to study poverty, social policy and social innovation in Europe. The ImPRovE project aims to improve the basis for evidence-based policy making in Europe, both in the short and in the long term. In the short term, this is done by carrying out research that is directly relevant for policymakers. At the same time however, ImPRovE invests in improving the long-term capacity for evidence-based policy making by upgrading the available research infrastructure, by combining both applied and fundamental research, and by optimising the information flow of research results to relevant policy makers and the civil society at large.

The two central questions driving the ImPRovE project are:

> How can social cohesion be achieved in Europe?
>
> How can social innovation complement, reinforce and modify macro-level policies and vice versa?

The project runs from March 2012 till February 2016 and receives EU research support to the amount of Euro 2.7 million under the 7th Framework Programme. The output of ImPRovE will include over 55 research papers, about 16 policy briefs and at least 3 scientific books. The ImPRovE Consortium will organise two international conferences (Spring 2014 and Winter 2015). In addition, ImPRovE will develop a new database of local projects of social innovation in Europe, cross-national comparable reference budgets for 6 countries (Belgium, Finland, Greece, Hungary, Italy and Spain) and will strongly expand the available policy scenarios in the European microsimulation model EUROMOD.

More detailed information is available on the website http://improve-research.eu.

Bea Cantillon (Coordinator)
E-mail: bea.cantillon@uantwerpen.be
Phone: +32 3 265 53 98
Address: University of Antwerp –Sint-Jacobstraat 2 (M.177) – 2000 Antwerp -Belgium

Tim Goedemé (Manager)
E-mail: tim.goedeme@uantwerpen.be
Phone: +32 3 265 55 55
Mobile: +32 494 82 36 27
Address: University of Antwerp – Sint-Jacobsstraat 2 (M. 185) – 2000 Antwerp - Belgium