The interrelationships between the Europe 2020 social inclusion indicators

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Discussion Paper No. 15/01
January 2015
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
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Abstract

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**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

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Abstract

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∗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). 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 constructing 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.

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1 Introduction

In line with the EU2020 strategy for a smart, sustainable and inclusive growth, the European Union adopted a set of headline targets, reflecting these three priorities (European Commission, 2010). Accordingly, besides targets on employment, research and development, climate change and energy sustainability, and education, one on the fight against poverty and social exclusion was included among the measures. This target quantifies the related goal of the ten-year strategy that aims to reduce the number of European citizens living in poverty or social exclusion by 20 million by 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 of the fight against poverty and social exclusion headline target 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, severely materially deprived or living in a household with very low work intensity. While the overall EU target is based on the composite indicator, Member States were free to choose the most appropriate indicator or any of their combinations in setting the national targets.

The use of social indicators in framing 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 2000’s within the frame of the Open Method of Coordination on Social Protection and Social Inclusion (European Commission, 2006, 2009; Marlier et al., 2007). The Europe 2020 fight against poverty and social exclusion policy target 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 during 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 Vandenburgroucke (2013) for the low work intensity indicator. The adoption of the composite indicator of multidimensional poverty was rather the outcome of a political coordination motivated by the different views and interests of the Member States than a measurement tool representing clear European social policy programme (Maître et al., 2013). Neither was the introduction of the composite indicator based on a previous theoretical work about the relationship between income poverty, material deprivation and low work intensity.

Once launched, the composite indicator became the object of a conceptual and methodological debate within the research community, which further induced a strong empirical work. Among others, recent works by Nolan and Whelan (2011a, 2011b), Copeland and Daly (2012), and Maître et al. (2013) extensively discuss the theoretical and policy implications of defining a single target at the European level of the fight against poverty and social exclusion based on a multidimensional approach. The inclusion of non-monetary indicators is considered as 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 is a matter of criticism (Ravallion, 2011). The choice of

1For the detailed methodology of the composite and the three sub-indicators see http://ec.europa.eu/social/BlobServlet?docId=10421&langId=en
2http://ec.europa.eu/europe2020/pdf/targets_en.pdf
indicators complementing income poverty and the way the composite indicator is defined has also been debated (Nolan and Whelan, 2011b).

Once the headline target was set, the European Commission has 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 dynamically analyse the interrelationship between the three segments of poverty and social exclusion covered by the EU2020 poverty target. 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 (state dependence), as well as, in how being in one status may predict the occurrence of one of the others in subsequent time periods (feedback effects). With this objective 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 they are capturing 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 the future (Jenkins, 2013). However, our results do not confirm evidence for one-year feedback loops between the three phenomena across Europe. Only in the Central-Eastern European countries analyzed, we consistently find feedback effects between the three segments. Poverty and material deprivation are much more affected via current effects, initial conditions and correlated unobserved heterogeneity, while the current status of low work intensity is the one that clearly explains today’s probability of living in income poverty. The relationship between material deprivation and low work intensity was even weaker than for the rest of 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 expected to be marginal.

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

2 Literature review

The analysis and measurement of the dynamics and interrelationships between the EU2020 social inclusion indicators needs to take into account 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 both issues.

2.1 State dependence

Literature has established the existence of considerable amount of genuine state dependence in poverty: being below the poverty line in a given year increases the chances of being found again in the same situation in the future (compared to someone not initially poor). Among others, the problem of demoralization, loss of motivation, the stigma associated with social assistance receipt or the depreciation of human capital that are associated with periods below the poverty line help explaining future experiences in 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 or Ayllón (2013) from Spain.

Research on state dependence in material deprivation is more scarce although some recent works focus on the evolution in time of material deprivation (Guio et al., 2014). The indicator of persistent material deprivation (defined similarly to the persistent at-risk-of-poverty rate) is used for reporting purposes but no analytical work has been done yet in this field according to our knowledge. Also, the development of an intertemporal material deprivation indicator, which captures part of the issue, is more and more in 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, our cross-country comparative results would differ from that given by the yearly figures.

Empirical evidence is scarce as for state dependence in low work intensity 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 in a period (2006-2009) and low work intensity rate in a given year (2009), indicating that the larger the proportion of people living in households with low work intensity, the larger the proportion among these living 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) or Stewart (2007), among many others, have pointed to an important scarring effect in unemployment by which individual’s previous unemployment experiences have implications for future labour market possibilities. If this is the case across all European countries, we expect that households that suffer from low work intensity are 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 social inclusion indicators are affected by a non negligible amount of genuine state dependence.

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2.2 The feedback effects

2.2.1 Poverty and material deprivation

The dynamic interrelationship between poverty and material deprivation has been the object of study by several authors before. However, previous findings do not seem to have reached a strong consensus in favour or against a positive correlation between both phenomena over time. Indeed, part of the literature agrees on a relationship between poverty and material deprivation with different degrees of importance and dependence. Devicienti and Poggi (2011), for the Italian case, find that both phenomena reinforce each other. As an example, they estimate that the probability of being poor in a given year was 3% for someone that was neither poor nor materially deprived during the previous period. However, the probability of being poor at $t$ multiplied by more than five times (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. A recent work by Guio et al. (2014), based on the cross-country comparative analysis of EU-SILC data, suggests that the periods of time spent in poverty are positively associated with material deprivation rates. According to their analysis, the level of and the change in income are predictors of both entries and exits from material deprivation.

Other scholars examined the role of income in a wider sense, not only 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 a similar fashion, Figari (2012) examined the role of socio-economic determinants in explaining cross-country differences in multiple deprivation using data from the ECHP. His results show that changes in income and deprivation do not strictly coincide and that past income matters more than current income in determining the deprivation level. Also, the role of socio-economic determinants may largely vary across countries. Fusco (2012)’s findings on Luxembourg 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 cross-sectional poverty, although they highlighted that the two are far from overlapping 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 phenomenon (Nolan and Whelan 2011b: 191). Finally, Muffels and Fouarge (2004), while studying the role of welfare regimes at explaining deprivation, found that a past poverty experience had no significant effect on observed material deprivation.
2.2.2 Poverty and low work intensity in the household

Literature on the relationship between employment and poverty is vast. The attachment to the labour market of all household members is clearly one of the main protective factors against economic hardship. However, works that precisely account for the feedback effect from poverty to employment opportunities (and reversely) are not so many. Three exceptions are commented in what follows. 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 holding again a type of contract that is associated with economic hardship. Biewen (2009) establishes that past poverty experiences reduce the probability of employment by 9% among prime-age men in Germany. And, similarly, Ayllón (2015) finds that past poverty jeopardizes the probability of current employment (by between 4 and 7%) among young people in seven out of eight European countries analyzed.

2.2.3 Material deprivation and low work intensity in the household

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

In short, despite poverty, material deprivation and low work intensity have been the object of analysis by 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 the EU Member States. The EU-SILC contains detailed information on socio-economic and demographic characteristics of all households members and it is intended to be 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 the poverty target progress.

In most countries, the longitudinal component is derived from a rotating panel sample with four replications. This means that from one year to the next one, a rotational group (25% of the sample) is dropped and replaced by a new one. In our case, we have constructed a pooled data set 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 have built our panel by taking the information from the last file in which a given rotational group is in.
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 that are at least in 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 (AROP).** An individual is defined as poor if s/he 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 a different threshold is set in each country every year. Total household income is equivalised by using the modified OECD equivalent scale that gives a weight of 1 to the first adult, of 0.5 to the rest of adult members in the household and 0.3 to children under the age of 14. The equivalence scale has been built with the age of the 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.

**Severe material deprivation (SMD).** It is defined as the inability to pay for at least four of the below mentioned items:

1. their rent, mortgage or utility bills;
2. keeping their home adequately warm;
3. facing unexpected expenses;
4. eating meat or proteins regularly;
5. going on holiday;
6. having a television set;
7. having a washing machine;
8. having a car;
9. having 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 do not need it. As the indicator selection is concerned, severe material deprivation was not part of the Social Open Method of Coordination on Social Protection and Social Inclusion, but was introduced as part of the EU 2020 target by lifting the original threshold from at least three items to at least four. Both the material deprivation and severe material deprivation indicators are now under revision (Guio et al., 2012; Guio and Marlier, 2013), which decision may further affect the headline indicator itself.

**Low work intensity (LWI).** Individuals are defined as living in households with very low work intensity if they are aged 0-59 and the working-age members in the household worked less than 20% of their potential during the past year (see Eurostat, 2012 and Ward 2018).
and Özdemir, 2013, for a critical review of the methodology). 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 and the total number of months that the same individuals could have theoretically worked—being a working-age member a person aged 18-59 years, with the exclusion of students in the age group between 18 and 24 years. In addition, households composed only of students aged less than 25 and/or people aged 60 or more are excluded from the indicator calculation.

There are several caveats that one needs to bear in mind in analysis that use data from the EU-SILC. First, it is important to acknowledge that the data is not based on a standardised questionnaire, but rather uses a common framework with a set of target variables and rules. Indeed, each country decides on the data collection method. Second, the target population consists of all private households throughout the national territory in every country and hence, indigenous households 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 and the low work intensity rates are collected for the preceding calendar year as compared to the survey year, the severe deprivation indicator refers to the year of the survey. In analytical terms, this would imply for us to have to lag the severe material deprivation rate as to have the same reference period for all the three sub-indicators. There are two arguments why we did not follow this procedure in this paper. First, some of the individual items of the material deprivation indicator also refer or may be suspect of referring to the preceding year. For example, the reference period of arrears is the previous year in an explicit way. Although the concept of the questions regarding the ability to pay for annual holiday, for adequate heating or a proper diet would make reference to the actual financial situation of the household, it is still an open question how respondents conceive these questions in the interview situation, to what extent their response is driven by their past experiences or by their actual situation. Secondly, and as we explained, the survey design of the EU-SILC means that in the great majority of countries, household are followed up to four years. Thus, we can observe at maximum three status transitions. If we would correct for the (possible) time bias, we would be left with three observations for each household and with the modelling of two transitions which would (possibly) jeopardize 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) and by the set of variables available on the EU-SILC dataset. At the individual level, we included gender, age, age squared, suffering a bad health condition, 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 (between the ages of 0 to 5, 6 to 12 and 13 to 17), household size and tenure status (ownership, rent or free). Additionally, 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).[

Our results refer to individuals between the ages of 16 and 59. The lower bound was considered because individual information is only collected for those above the age of 15. We also excluded individuals 60 or more because the low work intensity indicator does
not cover them by definition.

Finally, our findings are based on a manageable selection of eight countries: Ireland, United Kingdom, Italy, Spain, Austria, Belgium, Hungary and Poland. That way, we have a representation of English-speaking countries, Mediterranean, Continental Europe and Central-Eastern Europe. We would have liked to introduce the Nordic countries but the low work intensity indicator cannot be computed for them. Moreover, we selected the countries that had a similar panel structure starting in 2004 or 2005 (in the cases of Hungary, Poland and United Kingdom) with the same number of rotational groups thus making our results more comparable. Total sample size for each country is detailed at the bottom of Table 1.

4 The extent, persistence and interrelationships between the Europe 2020 social inclusion indicators: a brief description

Before presenting our econometric strategy and the estimated effects we are interested in, we provide in what follows a short description for the extent of poverty, deprivation and low work intensity, as well as the persistence involved in each phenomena and the interrelationships between the three processes.

4.1 Extent

The extent of poverty, severe material deprivation and low work intensity differ at a large extent across Member States. Figure 1 shows the average rates for each phenomena across the period under analysis. As can be seen, while countries fit in a relatively tight range when considering at-risk-of-poverty and low work intensity rates, much larger differences can be observed when looking at severe material deprivation. This large variation is determined by the huge disparities between old and new Member States. See, for example, the differences between Spain where less than 4% of the adults is affected by severe material deprivation, and Poland, where practically 1 out of 5 adults suffer it. Moreover, the ranking of countries in each graph varies greatly with cases with relatively low poverty and deprivation rates and high low work intensity rates (for example, Belgium) or countries with relatively low work intensity and deprivation rates but high poverty risk (for example, Spain). For this reason, in each graph, we do not observe clusters of countries.

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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 of other adults in those sampled households.

8 The only exception being the United Kingdom that starts the panel with one rotational group less than the rest of countries.

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

10 Each point in the graphs presented in this section are the average across years (and not the average of annual rates).
Figure 1: Average rates for poverty, deprivation and low work intensity by country for individuals between 16-59, 2004-2010

Source: Own calculations on the EU-SILC, 2005-2010.
Note: Confidence intervals throughout the whole paper have been computed by bootstrapping with 1000 replications and clustering within households. See Goedemé (2013).
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 persistence rates in each phenomena. As shown in Figure 2a, the average risk of persistent poverty across the analysed countries varies between 45% and 70%, being the lowest in Austria and the 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 in the graph.

Severe material deprivation persistence rates are lower than those observed for monetary poverty and move in the range between 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 phenomena. First, low work intensity persistence rates are in general considerably higher compared to the two other phenomena. Secondly, at country level, Belgium, which characterises by relatively low average levels of poverty and severe material deprivation, is the country with the highest low work intensity persistence rate—see Figure 2c. Again, Spain stands out as the country with the lowest persistence rate while United Kingdom and Austria show persistence rates that are somehow below what would be expected according to their average levels of low work intensity.

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

4.3 Interrelationships

As discussed earlier, beyond the analysis of state dependence, we are interested in feedback effects between the EU2020 indicators. That is, to what extent 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 be. Figure 3 provides a first insight in 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 in material deprivation according to past poverty status is shown in Figures 3a and 3b, respectively. In all countries, the likelihood of being deprived is increased if the individual was previously poor (compared to someone not

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11 Persistence in our case 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 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](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 current poverty rate and 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 between 16-59, 2004-2010

Source: Own calculations on the EU-SILC, 2005-2010.
Figure 3: Risk of deprivation and low work intensity at $t$ according to poverty status at $t-1$ by country for individuals between 16-59, 2003-2010

Source: Own calculations on the EU-SILC, 2005-2010.
Note: Countries have been ranked according to the distance that there is between the two dots. All the X axis use the same rang to ease comparison.
poor) but this is so especially in the case of Poland and Hungary that show the largest
distance between the two points. Instead, it is in Spain where we could expect to find
the weakest effect of past poverty on material deprivation. The differences between the
probability of being poor according to previous deprivation are larger than the other way
round—which could indicate a stronger feedback from deprivation on poverty than the
opposite. However, across countries such differences are not very large.

Figures 3c and 3d show the interrelationship between poverty and low work intensity.
It is easily observed that it is in Spain and Poland where past low work intensity statuses
seem 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 where we should observe the
weakest feedback effects between the two phenomena. Instead, it is in Ireland and Belgium
where the difference between the probability of experiencing one phenomena is mostly
influenced by previous experiences of the other one. Again, no cluster of countries are
clearly observed.

Deprivation status at $t$ also differentiates between observed probabilities of low work
intensity at $t - 1$—being the distance especially large in Hungary and Poland while
rather small in Italy and Spain—as can be observed from Figure 3e. There is not much
differences across countries in the probability of being in low work intensity for those not
in deprivation during the previous year, but large disparities are observed for those in
depression (Figure 3f). Close to 60% of those in severe material deprivation in the past
are observed in low work intensity status in the future in Ireland, Belgium, the United
Kingdom, while 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 im-
portance 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 having an effect on future low work intensity.

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

\begin{align}
    p^*_it &= \alpha_0 D_{it} + \alpha_1 W_{it} + \alpha_2 P_{i,t-1} + \alpha_3 D_{i,t-1} + \alpha_4 W_{i,t-1} + \phi_1' Z_{it} + c_i + u_{it} \\
    d^*_it &= \beta_0 W_{it} + \beta_1 P_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 W_{i,t-1} + \phi_2' S_{it} + h_i + \epsilon_{it} \\
    w^*_it &= \gamma_0 P_{i,t-1} + \gamma_1 D_{i,t-1} + \gamma_2 W_{i,t-1} + \phi_3' V_{it} + g_i + \lambda_{it}
\end{align}

\(^\text{13}\) The notation draws heavily on Ayllón (2015). See the same reference for a review of the previous
literature that has used a similar model.
\[ P_{it} = I(p_{it}^* > 0) \]  
\[ D_{it} = I(d_{it}^* > 0) \]  
\[ W_{it} = I(w_{it}^* > 0) \]

where \( i = 1, 2, ..., N \) refers to individuals and \( t = 1, ..., T \) are the number of transitions under study (at maximum three given that individuals participate in the panel at maximum for four waves, as previously explained). \( I(p_{it}^* > 0), I(d_{it}^* > 0) \) and \( I(w_{it}^* > 0) \) are binary indicator functions equal to one if the latent propensity in each case is positive and equal to zero otherwise. Furthermore, \( Z_{it}, S_{it}, V_{it} \) are the independent variables vectors assumed to be exogenous. The parameters represented by alphas, betas and gammas are the coefficients of interest. For example, \( \alpha_2 \) captures the degree of state dependence in the poverty status and \( \alpha_3 \) the feedback from severe material deprivation status on poverty. \( \phi_1, \phi_2, \phi_3 \) are the rest of parameters to be estimated. \( c_i, h_i, g_i \) refer to the individual-specific effects. Moreover, the idiosyncratic error terms in each process \( (u_{it}, \epsilon_{it} \text{ and } \lambda_{it}) \) 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 into account the well-known problem of initial conditions. That is, the fact that the beginning of the observation period may not be the same than 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 not only lead to inconsistent estimators but to the 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. The author proposes finding the density of the dependent variables from \( t = 1, ..., T \) conditional on the initial condition and the explanatory variables —instead of finding the density for the whole period \( t = 0, 1, ..., T \) given the explanatory variables. This implies the 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 \( \overline{V}_i \).

Formally, we can write the specification as follows,

\[ c_i = r_0 + r_1 P_{i0} + r_2 D_{i0} + r_3 W_{i0} + r_4 \overline{Z}_i + \kappa_{1i} \]  
\[ h_i = s_0 + s_1 P_{i0} + s_2 D_{i0} + s_3 W_{i0} + s_4 \overline{S}_i + \kappa_{2i} \]  
\[ g_i = t_0 + t_1 P_{i0} + t_2 D_{i0} + t_3 W_{i0} + t_4 \overline{V}_i + \kappa_{3i} \]

As explained by Wooldridge (2000, 2005) and in order to get consistent estimates, the residuals \( \kappa_{1i}, \kappa_{2i}, \kappa_{3i} \) are integrated out using a numerical integration algorithm based on Gauss-Hermite quadrature with 12 points. A trivariate normal distribution with zero

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\[^{14}\text{Note that such panel structure makes nearly impossible the inclusion of higher order dynamics.}\]

\[^{15}\text{See Hsiao (1986), Chay and Hyslop (2001), Wooldridge (2005) or Skrondal and Rabe-Hesketh (2014) for reviews of the different strategies that have dealt with the initial conditions problem.}\]
mean and $\sigma_{ki}^2$ variance is assumed for $\kappa_{1i}$, $\kappa_{2i}$, $\kappa_{3i}$ which are allowed to be freely correlated:

\[
\begin{align*}
\rho_{12} &= \text{corr}(\kappa_{1i}, \kappa_{2i}) \quad (10) \\
\rho_{13} &= \text{corr}(\kappa_{1i}, \kappa_{3i}) \quad (11) \\
\rho_{23} &= \text{corr}(\kappa_{2i}, \kappa_{3i}) \quad (12)
\end{align*}
\]

where $\rho_{12}$ summarises the association between unobservable individual factors determining poverty status and material deprivation. $\rho_{13}$ accounts for unobserved heterogeneity between poverty and low work intensity and $\rho_{23}$ between material deprivation and low work intensity.\(^{16}\) We expect all the correlations to be positive across countries. For example, $\rho_{12} > 0$ would be indicating 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 cohabits in a household with low work intensity are positively related to those that make him more likely to be materially deprived.

It is important to take into account that if all the parameters for the feedback effects were equal to zero, 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 zero but all the correlations were zero, again, we could estimate each equation separately by assuming that the lagged values of each outcome 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

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.\(^{18}\) Let’s 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 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 coefficients and confidence intervals of each parameter confirms that low work intensity is more affected by state dependence than monetary poverty and, in turn, being below the poverty line is more affected than material deprivation. Indeed, this is a phenomena that was already 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 same status initial conditions. These are also positive for all the three segments of poverty and social exclusion. Moreover, note

\(^{16}\)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.
that the standard deviation of the individual-specific random effects of each equation 
\((\sigma_{\kappa_1}, \sigma_{\kappa_2}, \sigma_{\kappa_3})\) are highly significant pointing to the importance of considering unobserved 
heterogeneity in each phenomena.

Across countries, coefficients indicate that it is in Poland where poverty is most af-
fected by state dependence and in Spain where this scarring effect is weakest. Deprivation 
state dependence is highest in Hungary and Poland while for low work intensity is partic-
ularly high in Austria. Note that these results do not perfectly correspond to the rankings 
of persistence rates in Figure 2. This is readily explained by the fact that genuine state de-
pendence in each phenomena captures only part of the persistence and 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 found in all the analysed samples. Only 
in the Central-Eastern European countries, Hungary and Poland, we find evidence of a 
feedback loop between both 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, that 
past poverty status makes a much stronger difference is deprivation outcomes in the new 
Member States compared to the old ones. However, the feedback from past deprivation 
experiences on poverty was less obvious from simple tabulations in both countries.

Estimated effects are not significant at 95% confidence level neither in the Anglo-
Saxon, the Mediterranean nor in the Continental Europe member states — with the ex-
ception of a positive feedback from poverty on material deprivation in Austria and a 
negative one in Italy and, a positive one from material deprivation on poverty in Spain. 
This means that one-year lags do not affect present outcomes in a substantial way in the 
majority of countries. Neither feedback loops that reinforce both phenomena are found. 
Rather, poverty and severe material deprivation are related via initial conditions, current 
effects and unobserved factors. A positive effect from current severe material depriva-
tion on poverty is observed. This is the case not only in the Central-Eastern European 
countries, but also in Spain. A significant effect is found only in Belgium out of the 
English-speaking and Continental Europe countries. Interestingly, notice that \(\rho_{12}\) which 
relates unobservables that affect simultaneously poverty and material deprivation is posi-
tive and statistically significant at least at 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 in-
tensity on poverty is not present in the analysed countries with the only exception of 
Italy. Instead, we find a negative feedback in the cases of Spain and Poland and an effect 
that is not statistically different from zero for the rest of the countries. 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.

Feedback effects from poverty to low work intensity are positive at 95% confidence 
level only in the United Kingdom, Italy and Hungary and not statistically meaningful in

\(^{17}\)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.
the rest of the countries. So, we do not find general evidence of past poverty experiences jeopardizing individuals’ chances in the labour market by country cluster. Neither, 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 out of the eight countries analysed.

**Severe material deprivation and low work intensity.** Positive feedback effects from past low work intensity status on material deprivation are only found in Poland and Hungary where we also find a feedback from past material deprivation on the likelihood of living in a household with low work intensity. Again, 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 a positive feedback from past deprivation statuses on low work intensity in the United Kingdom, Belgium and Spain. There is a negative feedback from past low work intensity on deprivation in the United Kingdom and another one of the same sign from deprivation on low work intensity in Italy. The rest of possible feedback effects in the studied samples are not statistically significant. So, with the exception of the Central-Eastern European countries, we cannot confirm evidence of an interrelationship between material deprivation and low work intensity that would reinforce both phenomena. The two segments are neither closely related via initial conditions everywhere so, again, it is the current low work intensity status that mainly has an influence on material deprivation —being the coefficient statistically significant at 95% in five of the eight countries studied. Results on correlations indicate that neither unobservables play a very important role in this case across all countries 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)

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Low work intensity equation

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Source: Significance: *** 99% confidence level, ** 95% and * 90%.
Note: Covariates include gender, age, age squared, suffering a bad health condition, marital status, educational attainment, number of children in the household (between the ages of 0 to 5, 6 to 12 and 13 to 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 the paper has been to dynamically analyse 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 the measurement of the degree of state dependence in each phenomenon, as well as the possible feedback effects between the three processes. Our results are the outcome of an econometric strategy that 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 by which, the past influences by itself the probability of 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. Out of the three segments, material deprivation was the phenomena that was the least affected by scarring and low work intensity the one that was most. From a political point of view, it means that social policy in a given point in time will have spill-over effects in the future thus fighting against economic hardship today, clearly reduces the problem tomorrow.

In terms of feedback effects between poverty and material deprivation, we have only found clear evidence of a feedback loop in the Central European countries where both phenomena reinforce each other. In the rest of countries, such findings were not confirmed which highlights 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). As in Whelan and Maitre (2007), we find that the weak association between poverty and material deprivation characterises mainly the more affluent Member States. Poverty and material deprivation are much more affected via current effects, initial conditions and unobservables. The significance of the correlation for unobserved heterogeneity between both 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 at hand.

Regarding the interrelationship between poverty and low work intensity, it is found that feedback effects are not important at explaining each phenomena. Rather, it is the current status of low work intensity that clearly explains today’s probability of living below the poverty line. Feedback effects from low work intensity on poverty were only found in three out 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 phenomena captures part of the link between both segments.

The evidence for a relationship between material deprivation and low work intensity was even more mixed (in terms of signs and significance) than for the rest of feedback effects analysed. Only in the Central European countries, a feedback loop between both phenomena was found. Once more, it is the current low work intensity status that mainly has an influence on material deprivation. Neither the correlation between unobservable factors seems to play a significant role in the majority of countries.

Our econometric strategy has proven to be relevant for our analysis. The standard deviation of the individual-specific effects was significant at 99% confidence level in the three equations of all the countries analysed. Failing to control over unobserved heterogeneity would have overestimated state dependence. Moreover, at least one correlation between unobservable factors was significant which points out the need for a joint model of the type presented in this paper. Additionally, we have also learnt that associations and country rankings from simple descriptive statistics may be fairly different from the results of an econometric strategy that controls over
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 they are capturing different aspects of economic hardship in the majority of countries analysed. However, we also found that the three segments are related via current effects in almost all the samples — especially, low work intensity status is linked strongly with both the risk of income poverty and of severe material deprivation.

In terms of policy, these results suggest, on the one hand, that the three domains should be handled via different interventions, while spill-over effects across time are expected to be marginal (except in the Central-Eastern European countries). On the other hand, employment policies that reduce low work intensity should clearly fight poverty and severe material deprivation via current effects.

Finally, we like to stress that our results could be partly driven by data limitations and the fact that the EU-SILC collects data at maximum for four consecutive waves. As literature has shown, for example, the correlation between income and material deprivation is stronger for individuals that have been confronted with 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 a larger number of waves than the current four.
References


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.


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.

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