At the margin: By how much do social transfers reduce material deprivation in Europe ?

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Abstract([1])

Since the adoption of the Europe 2020 social inclusion target, the population at risk of poverty or social exclusion has not decreased sufficiently to meet the target in EU countries. It is therefore important to evaluate the role and effectiveness of the policies adopted to combat income poverty and social exclusion in Europe. This paper takes a regression-based approach to estimating the effects of transfers on material deprivation, using the 32 countries covered by the EU Statistics on Income and Living Conditions (EU-SILC) and the new indicator of material and social deprivation agreed at the EU level in 2017 (see Guio et al., 2017). It thereby complements established methods using income to evaluate policy impacts. The approach has broader applicability, suited to social indicators whose scaling has similar properties, such as housing deprivation indicators. This paper is the first to estimate and compare the average marginal effect (AME) of a small income transfer across the 32 EU-SILC countries. It finds that the impact of social transfers on material deprivation is higher at lower living standards, an effect that is present both within and across countries and underlines the importance of a progressive social transfer system. It further finds that households receiving non-pension transfers would experience, on average, the largest decrease in material deprivation. In many Eastern European countries, receivers of pension transfers would also see above population average reductions in material deprivation. A comparison of the Baltic States illustrates how factors other than the national social transfer system and living standards studied here play a role in explaining cross-national differences in AME. The paper further calculates the predicted effects of such increases in social transfers on the EU's official material deprivation rate and social spending levels. From an econometric point of view, this paper offers new methodological insights, by systematically comparing the performance of count data models (Poisson, negative binomial and zero-inflated negative binomial) and ordered regression models (ordered logit and generalized ordered logit) to predict the material deprivation distribution. It finds that ordered logit models systematically outperform the count models.

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1 Introduction

Since its adoption in 2010, the European Union (EU) has not made the expected progress towards achieving its social inclusion target of lifting at least 20 million people from poverty and social exclusion by 2020. It is therefore important to remain vigilant in assessing the role and effectiveness of the policies adopted to combat income poverty and social exclusion in Europe. Making methodological improvements is also necessary, especially in areas where the existing toolbox lacks tools to assess the effect of policies on a stated policy goal.

The Europe 2020 social inclusion target recognises the importance of three dimensions of poverty and social exclusion: financial poverty, severe material deprivation, and joblessness. The income poverty component of the target focuses on the population living in households with disposable income below 60% of the median national income([2]). Material deprivation encompasses the population who lack a certain number of desirable items because they do not have the financial resources to afford them([3]). The third component measures labour market attachment and focuses on the population living in households where working-age members do not work at all or very little.

The level and distribution of social transfers in each country are particularly influential factors in reducing income poverty and material deprivation. While long-established methodologies for evaluating the effect of social transfers on disposable income exist, this is not the case for material deprivation. Building on previous research, this paper offers new methodological insights by means of a thorough performance comparison of five non-linear regression estimators in 32 countries (Notten, 2015; Notten and Guio, 2016). It uses the 2015 cross-section of the EU Statistics on Income and Living Conditions (EU-SILC) and the EU's new indicator of material and social deprivation (see Guio et al., 2017). For predicting material deprivation levels before and after transfers, we show that ordered logit models systematically outperform count models.

The paper is the first to compare the average marginal effect (AME) of a small income transfer on material deprivation across the 32 EU-SILC countries. It shows that the impact of a universal 150 Euro (PPS([4])) social transfer on material deprivation is higher among persons having fewer resources, an effect that is present both within and across countries and underlines the importance of a progressive social transfer system. The analysis further suggests that households receiving non-pension transfers would experience, on average, the largest decrease in material deprivation. In many Eastern European countries, receivers of pension transfers would also see above population average reductions in material deprivation. Yet the paper shows that other factors, such as social

([2]) Household income is equivalised using the modified OECD adult equivalence scale and then distributed to each household member.

([3]) The severe material deprivation rate is the proportion of people living in households lacking at least four of the following nine household items: (capacity) to avoid arrears in rent, mortgage or utility bills (1), to keep their home adequately warm (2), to face unexpected expenses (3), to have a meal with meat, chicken, fish or vegetarian equivalent every second day (4), to have one week annual holiday away from home (5), to have access to a car for private use (6), as well as to have a washing machine (7), a TV set (8) and a telephone (9). This list of items was initially agreed at the EU level in 2009 (see Guio 2009). In March 2017, the European Commission and all EU countries decided to replace it with a list of items. The new list consists of the 13 items used in this paper.

([4]) Expressed in Purchasing Power Standards (PPS) and using Purchasing Power Parities updated from Eurobase February 2017.

spending on in-kind transfers and differences in the collection and preparation of survey data, also most likely explain cross-national differences in impacts. A universal 150 Euro (PPS) transfer would reduce the number of persons with five or more deprivations in the EU by 876 000, whereas a 1 500 Euro transfer would reduce that number by 8.6 million. The costs of such an expansion in social spending are modest when expressed as a share of average social spending in the EU, but they are considerable for EU-Member States with lower spending levels, and would be a large investment in terms of the EU's current budget.

Section 2 discusses important drivers of material deprivation, by using the capabilities approach as a conceptual framework. Section 3 describes the data, the methodology and includes the performance comparison of five regression estimators. Section 4 applies the methodology by analysing the predicted impact of a very modest universal transfer on material deprivation. Section 5 concludes.

2 Conceptual framework

The relationship between social transfers and material deprivation may appear straightforward at first glance. Material deprivation focuses on a person's ability to finance the doings and beings which are customary, or at least widely encouraged or approved, in the society (s)he lives in (Townsend, 1979; Sen, 1999). By providing social transfers, the state supplements the market income (net of taxes) of people, who thereby have more resources to finance the things they want to do and be (Barr, 2012; Sen, 1999). Social transfers can thereby reduce material deprivation for people who would otherwise not have enough financial resources to finance their doings and beings. For some people, social transfers have no effect on material deprivation because they have sufficient resources to meet these customary doings and beings without receiving transfers.

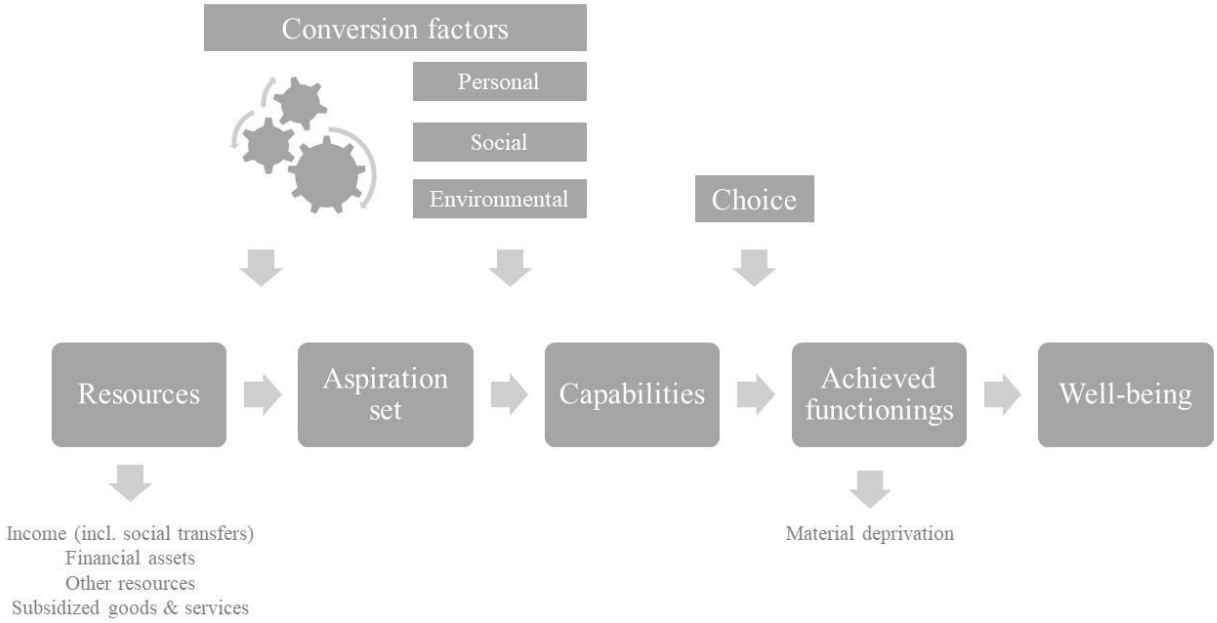
Measuring the effect of social transfers on material deprivation is, however, challenging, especially in a cross-national comparative context. Using Amartya Sen's capability approach as a conceptual framework, this section illustrates some of the complexities involved. The capabilities approach is particularly useful here because it accommodates complexity in explaining:

I. The relationship between a person's resources and well-being, and;

II. The within and between country variation in this relationship due to differences in a person's environment.

Where the capability framework lacks detail, other social science theories offer complementary and compatible insights on, for instance, the interaction between a person's choices and a country's social protection system (including social transfers), economy and society more broadly (Barr (2012) and Béland & Mahon (2016) review key theories in social policy).

Figure 1: Social transfers and material deprivation in light of the capabilities approach



NB: Created by authors
Source: Inspired by Sandars & Hart (2015), Svensson & Levine (2017) and Wells (not dated).

In the capability approach, well-being results from a person's capabilities.([5]) Capabilities are the opportunities or freedoms that a person has "to convert her available resources into aspirations and into valued doings and beings (functionings)" (Sandars & Hart, 2015, p. 8). As illustrated by Figure 1, a person's capabilities depend on her resources and many conversion factors that allow/constrain her to use her resources for doing the things she enjoys doing or being.

Resources can be financial (i.e. income, financial assets, access to credit) but they do not need to be (i.e. personal skills, durable possessions, social capital, access to public infrastructure). Yet, despite having access to a particular resource, a person may not be able to use it for a desired purpose because certain conversion factors are not in place. Such conversion factors can be personal, social or environmental. A person may have the resources to purchase a book or have access to a library, but cannot directly use a book to acquire knowledge if her literacy skills are insufficient (personal). Government support that requires clients to first liquidate (most of) their financial assets may worsen a family's capabilities to meet its basic needs now and in the foreseeable future (social). Working from home may not be feasible if key tasks require an internet connectivity that exceeds the capacity of telecommunication infrastructure in the community (social and environmental).

The intricate relationships between resources and conversion factors determine whether a person has the capability to use a resource for a purpose she desires. A person's capability set comprises all the doings and beings she could potentially pursue given her resources, her personal characteristics and her broader surroundings. Achieved functions are the actual realizations of a capability, involving both the individual's choice to pursue and the possibility of its accomplishment. Note that conversion factors also play a psychological role in the sense that they influence the formation of a person's aspirations (i.e. through norms, values, societal expectations and role models).

([5]) This paper only offers a cursory introduction to the capabilities approach; for more see, for instance, Sen 1999 and Sandars & Hart (2015).

When cast in terms of the capability approach, complexities in the relationship between social transfers (a resource) and material deprivation (an achieved functioning) become evident. By supplementing or fully replacing income obtained through market and other social relationships, state-provided social transfers are one of potentially many resources that recipients can use to accomplish their desired doings and beings. The concept of material deprivation focuses on the failure to achieve one or more specific doings and beings considered as basic or customary in a given society (Townsend, 1979). The typical operationalization of material deprivation further implies that a person is only considered deprived when she cannot achieve a particular doing or being because she does not have the financial resources (Guio et al 2017; Guio, 2009; Saunders & Wong, 2011). A person's characteristics (personal) and those of her environment (family, community, state, society) play a key role in her capabilities to transform the resources she commands (conversion factors) into achieved functionings such as avoiding material deprivation.

The relation between income (including social transfers) and material deprivation is central to our regression-based empirical strategy but, as this conceptual overview indicates, there are potentially many confounding factors. For a similar level of current income, people may reach a very different deprivation level. This may arise, first, because of their access to other resources as well as their individual conversion factors. The availability and quality of the data determines in large part for which factors we can (not) control, and the resulting omission of explanatory variables likely introduces bias. Second, measurement issues in the dependent and explanatory variables may further bias the regression coefficients.([6]) For material deprivation, these are issues such as adaptive preferences, shame to admit deprivation, variations in cultural perceptions of survey questions etc., which may also bias the income coefficient. For income, these are well known issues such as the in/exclusion of the imputed value of own consumption, imputed rent, difficulties of measuring self-employment income or capital income, etc.

([6]) As we use a non-linear regression model, bias in the other explanatory variables also affects the impact estimates (see Section 3).

3 Data and methodology

This study first tests five regression models to estimate the impact of income, of which social transfers are one source, on material deprivation in the 32 EU-SILC countries. Then it uses the preferred regression model to predict the effect of a small transfer on the average number of deprivations. A marginal impact analysis is less likely to violate the strong assumptions required for such an analysis. For instance, the analysis assumes that transfer recipients make the same choices (with respect to work, care, spending) with or without the treatment (social transfer), i.e. that the absence of social transfers does not lead to behavioural changes. This assumption may be plausible for small transfers (relative to a person's other resources) but increasingly difficult to defend as transfers become more substantive. The methodology further assumes that the transfer amount is the only aspect that affects a person's access to publicly provided resources. The reality is that countries' social protection systems are complex, comprising both cash and in-kind benefits, with some benefits acting as complements and others as substitutes. Thus, a change in a social transfer received from one cash transfer programme may trigger additional benefits (underestimating the effect of the treatment), while one received through another programme reduces benefits received from other programmes (overestimating the effect of the treatment).

This section describes the methodology by first discussing the dependent variable (the number of deprivations), the explanatory variable of interest (income), the other explanatory variables and other model specification choices. This part largely builds on findings from Notten (2015) and Notten & Guio, (2016). Then, we discuss the regression estimators newly tested in this paper and we compare their relative performance. Finally, we describe the methodology used for predicting the impact of social transfers, which differs from that in our earlier work.

3.1. Dependent variable – The number of deprivations

The dependent variable reflects the number of material and social deprivations suffered by each individual. This paper uses the EU's new deprivation scale, proposed by Guio et al (2017) and adopted by the EU in 2017. The 13-item scale includes both household-level items and items collected at the individual level for adults (aged more than 15). Whereas the EU's new deprivation indicator is a binary variable reflecting the percentage of people not able to afford five or more items, we use the entire deprivation scale as our dependent variable so as not to lose potentially valuable information.

At the household level, the items include the inability for the household to:

1. Face unexpected expenses;
2. Afford one week annual holiday away from home;

3. Avoid arrears;
4. Afford a meal with meat, fish or vegetarian equivalent every second day;
5. Afford to keep their home adequately warm;
6. Have access to a car for personal use;
7. Replace worn-out furniture.

At the individual level, the items include the inability for the person to:

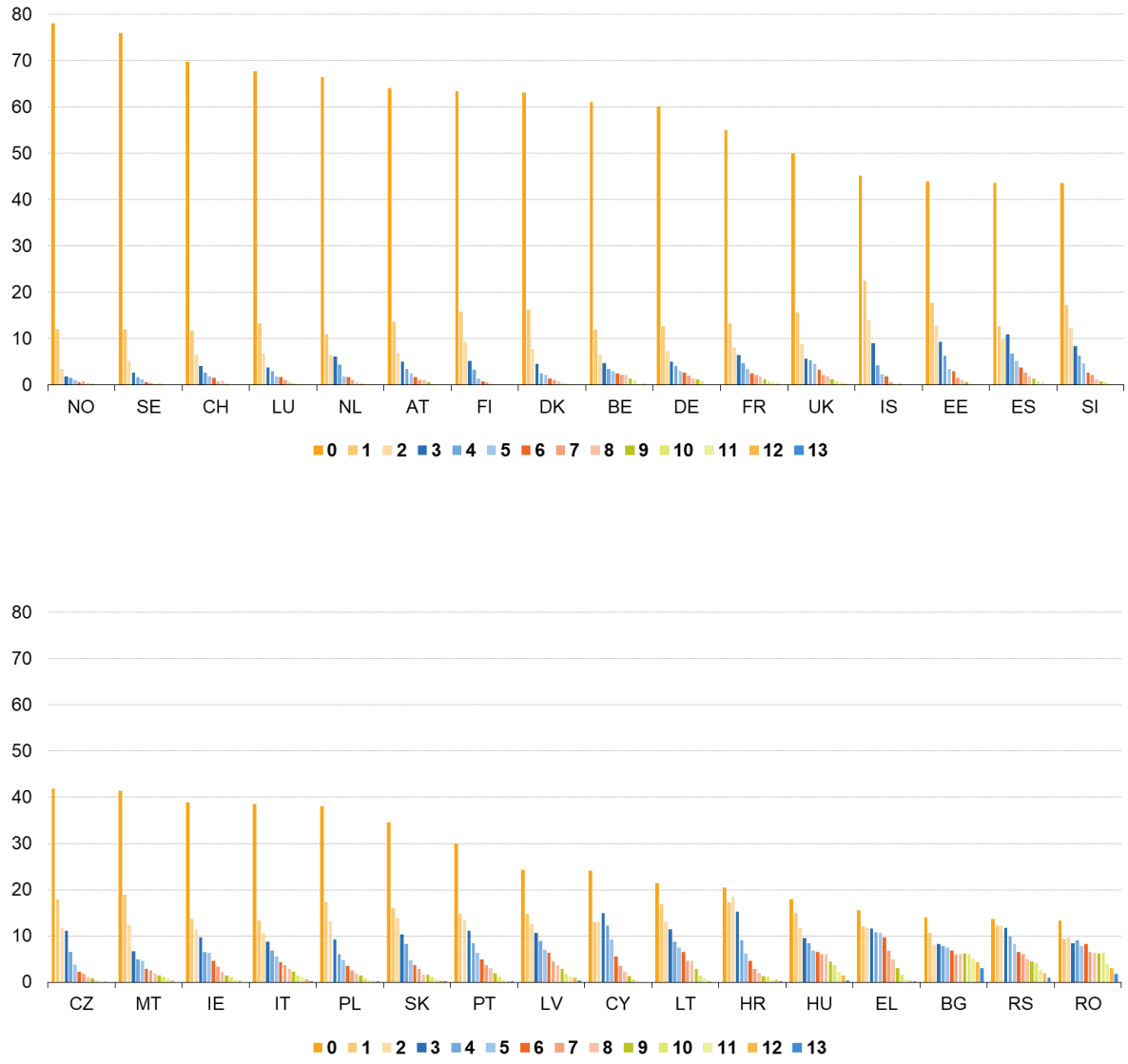
8. Replace worn-out clothes;
9. Have two pairs of properly fitting shoes;
10. Spend a small amount of pocket money each week;
11. Have regular leisure activities;
12. Get together with friends/family for a drink/meal once a month;
13. Have an internet connection.

Table A1 in the Annex lists the number of observations by country in the 2015 dataset and the percentage of individuals that remain at different stages of the analysis. The number of missing values for the material deprivation count is limited in most countries, except in Switzerland, Ireland and the United Kingdom (where it attains respectively 12%, 23% and 11%). These countries are included in the analysis for illustrative purposes, but we cannot exclude the possibility that the missing information is selective and that this has an effect on the sample representativeness. Table A2 shows the percentage of individuals that are deprived per item.

Figure 2 displays distribution of the number of deprivations for each country, ordered from a high to a low population share with zero deprivations to facilitate analysis of the variation of the distribution by average living standard. The percentage of individuals with zero deprivations is the largest group in each country. In most countries, the distribution decreases monotonically, but there are some exceptions (Cyprus (CY), Spain (ES), Croatia (HR) and Romania (RO)). As the average living standard decreases, the percentage of individuals with one or more deprivations increases.

Figure 2: Dependent variable – the number of item deprivations (0-13)

(percentage of individuals)



NB: Authors' estimations. Ranked according to highest percentage of zero deprivations.
Source: EU-SILC 2015 cross-sectional data, version September 2017

3.2. Variable of interest – Income

Social transfers are part of a household's income and thereby contribute to the level of financial resources that persons have to meet their social and material needs (Figure 1). We define the impact of social transfers on material deprivation as the difference between the predicted number of material deprivations estimated using income before the treatment (i.e. income before transfers) and that related to income after the treatment (current income).

We use the EU-SILC's total disposable household income variable (hy020), which we adjust for differences in family size using the modified OECD equivalence scale (hx050) and cross-national differences in purchasing power parities (PPP). Given the large differences in scale between this and the other explanatory variables, we further rescale income into thousands of Euros.([7])

In each country, a relatively small number of observations have a zero or negative value for current income (representing less than one percent of the sample in each country). For reasons discussed in more detail in Section 3.4, we replace the income value for these observations by one Euro before applying the above-described adjustments to income. In estimating the regression model, we further exclude these and all other observations in each country's first income percentile while including them in our impact predictions. Tables A3 in the Annex summarize the mean values for the disposable income definition.

In the EU-SILC, social transfers are broken down into various categories. Using this classification([8]), we define four mutually exclusive categories of transfer recipients, namely those:

- Not receiving any social transfer;
- Receiving only pension transfers (old-age and survivors' benefits);
- Receiving only non-pension transfers (unemployment benefits, sickness benefits, disability benefits, family/children related allowances, social exclusion not elsewhere classified and housing allowances);
- Receiving both pension and non-pension transfers.

Table A4 summarizes population shares for each transfer category.([9]) The share of the population that does not receive any social transfers is very small for Denmark (3 %) and Serbia (1 %) and highest for the Czech Republic and Poland (35 %). The share of the population that only receives non-pension transfers are often the largest in a country, with rates varying from 22% in Greece to 75% in Denmark. In Serbia, the share of the population receiving both pension and non-pension transfers is considerably higher than that in most other countries (41%). Table A6 summarizes the median transfer values for the three recipient categories. We prefer using median values because outliers have a substantive impact on the mean.([10]) Not surprisingly, median values of those receiving only pensions are considerably higher than those receiving only non-pension transfers. Cross-national differences in generosity are also evident. Note that for non-pension transfers we use the gross transfer values because the net transfer values are not available for every country (see Leventi, Papini and Sutherland, 2018). As these transfers are often taxed, using gross values leads to an overestimation of the effect of transfers.

Figure 3 visually displays the relation between the deprivation variable and current income for various countries, selected to illustrate the tendencies at different average levels of material well-being and ordered from low levels of deprivation to high (Austria, Czech Republic, Italy and Bulgaria).

Figure 3 illustrates the well-known stylized fact that there is a moderately negative correlation between

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([7]) An alternative approach (and one that we used in Notten, 2015 and Notten & Guio, 2016) would have been to take the logarithm. As the deprivation scale reflects an absolute level of well-being and one that covers only one part of the entire material well-being scale (including representative basic items but excluding luxury items), it is the relationship between material deprivation and the absolute level and change in Euro income that is of interest here. Additional tests estimating the impact, using income expressed in logarithms or PPS (not shown here), reveal that impact estimates differ at the lowest income percentiles, with the PPS definition estimating larger impacts on such households. Impacts are very similar for other incomes.

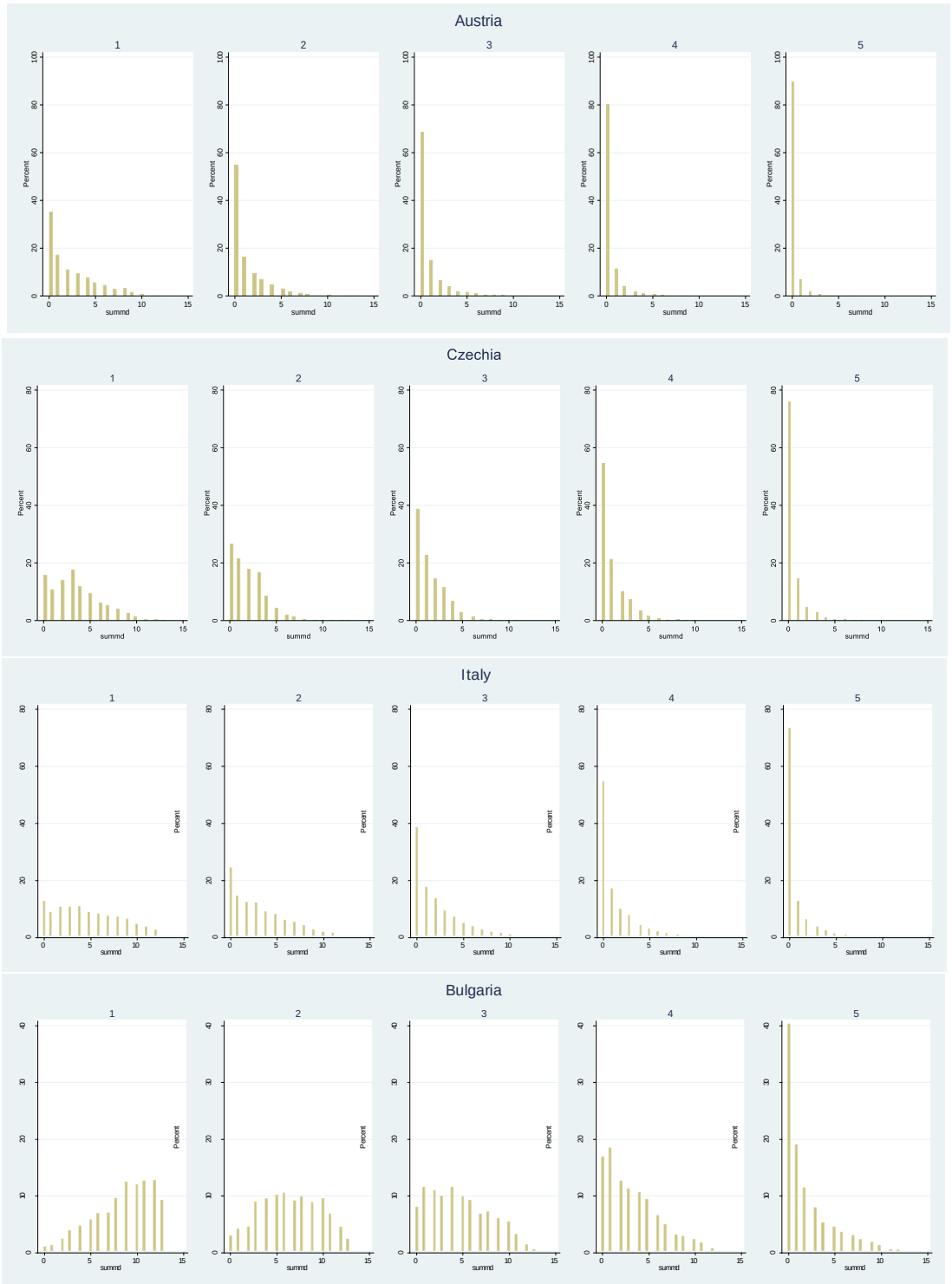
([8]) We thereby exclude the categories of "education-related allowances" and "other benefits not elsewhere classified".

([9]) Table A3 in the Annex also summarises the mean values of income before social transfers (using several definitions) and indicates the source variables in the EU-SILC data. Table A5 in the annex also summarizes the coverage rates for another typology, distinguishing between any transfer, non-pension transfers, pensions, social insurance transfers and household level transfers.

([10]) Mean values are available on request.

income and material deprivation (Fusco, Guio and Marlier, 2011; Whelan and Maître, 2006): persons with more income tend to have fewer deprivations, although this relation is far from perfect. The percentage of zero deprivations increases by income quintile. Yet even in rich countries, there are still some non-zero observations at higher income quintiles. Moreover, at the lower income quintiles the deprivation distribution is flatter, particularly for countries with higher average deprivation levels.

Figure 3: Deprivation distribution, by disposable income quintile, selected countries



NB: Authors' estimations. Ranked according to highest percentage of zero deprivations.

Source: EU-SILC 2015 cross-sectional data, version September 2017

3.3. Explanatory variables – Control variables

In addition to income, there are many other determinants of material deprivation.([11]) Following our conceptual framework in Section 2, we group these determinants as (non-income) resources and conversion factors. As some of this information is available only for adults or at the household level, we have to assume that persons living together in a household pool resources and take account of members' needs in employing them. Variables indicated in grey are either not available in the data (NA), of insufficient quality (IQ), or excluded for reasons such as multicollinearity, lack of explanatory power, parsimony and consistency in model specification across different estimators (EX).

Resources or lack thereof:

- Adjustments to disposable income:
  - Imputed rent (IQ)([12]);
  - Monetary value of home production of goods for own consumption (IQ)([13]);
- (In)adequacy of financial resources:
  - Dummies indicating whether housing costs are a financial burden (heavy and slight);
  - Dummies indicating whether debt payment is a financial burden (heavy and slight);
- Proxies for wealth:
  - Income from property and capital (IQ);
  - Housing tenure status (owner, paying mortgage, paying rent);
  - Taxes on wealth (IQ);
- Access to public goods and services, including in-kind transfers (NA)([14]);
- Availability and affordability of childcare / after school care (EX);
- Access to other resources such as social capital (NA);
- Interaction between income, other resources and/or conversion factors (i.e. proxies for wealth, burden of debt and housing costs, self-perceived health and limitation in activities) (EX).

Conversion factors

- Dummy for low self-perceived health of adult members and/or limitation in activities because of health problems of adult members;
- Dummy for chronic illness of adult members (EX);
- Dummy for a household with dependent children;
- The number of dependent children in the household;
- The number of adults in the household;
- Dummies for education level of member with highest education (primary, secondary, tertiary);
- Dummy for non-EU country of birth of adult members;
- Dummy for low work intensity household([15])

([11]) In selecting control variables, we rely in part on results from Notten & Guio (2016), where we investigated and tested the effects of a broader range of controls on four EU countries (Germany, Greece, Poland and the United Kingdom).
([12]) On the quality of imputed rent variable and its impact on the income distribution, see Törmalehto and Sauli (2017).
([13]) For a study on the quality of self-consumption income in EU-SILC, see Comic (2018).
([14]) On the distributional impact of public services on income, see Aaberge, Langørgen and Lindgren (2017).
([15]) The household work intensity is the ratio of the total number of months that all working-age (18-59) household members have worked, to the total number of months the same household members could have worked in theory.

- Dummies for self-reported economic status of adult members (unemployment and retired);
- Dummies for region (db040), where available.

Tables A7 and A8 in the Annexes summarise the average value/incidence of the variables by country, also indicating the labels of the source variables in the EU-SILC User Database.

Despite using the best data available for cross-national comparisons in Europe, the above listing indicates remaining data challenges for the EU-SILC. Of particular concern is the absence of information on a person's access to non-income resources. All other things being equal, a person with access to alternative resources is likely to have a lower deprivation level than a person with the same income with meagre access to alternative resources. There is thus unobserved heterogeneity between observations from the same country, the effects of which biases the income and other regression parameters to an unknown extent. Moreover, systematic differences in the composition of resources between countries (i.e. the prevalence of home production for own consumption, the relative importance of in-kind versus cash public transfers) also biases the cross-national comparison of impact estimates of social transfers to an unknown extent. For country-specific research, alternative national level microdata may offer a partial remedy to this missing data problem. For our research, however, this option is not available.

3.4. Regression estimators and model specification

This section reviews various families of regression estimators, identifies several promising models within each family, discusses other model specification issues, and compares how well each estimator fits the data, resulting in the choice of the preferred regression approach for this research (an ordered regression model).

The theory underlying the measurement of Europe's material deprivation indicator offers some guidance as to which regression estimators may be appropriate to estimate the relation between material deprivation and income. According to Guio, Gordon, Marlier (2012), material deprivation reflects an individual trait that researchers cannot directly observe, but that they measure indirectly by collecting information about a person's capacity to afford (a limited set of) consumer durables and social activities. Material deprivation is thus a latent variable and, together, the deprivation items form the scale on which this concept is measured. Using the material deprivation scale, one should be able to distinguish between non-deprived and deprived persons (discrimination). Moreover, for deprived persons, the scale makes it possible to distinguish between various degrees of deprivation (severity). The scale reflects the number of items that a person cannot afford, taking on integer values between zero and thirteen. As Figure 2 shows, the variable has a non-symmetric distribution, with the highest density at zero and densities for subsequent values gradually tapering off.

Given such properties, suitable regression models treat the dependent variable as either a count or an ordered variable (Long & Freese, 2014). In a count regression, the underlying model assumes that a one-unit change in deprivation level reflects the same substantive change at every possible level. Thus, an improvement from five to four deprivations should reflect, on average, the same substantive improvement as that from one to zero deprivation or from two to one deprivations. An ordered regression requires a weaker assumption, requiring only that lower values of the dependent variable reflect lower deprivation levels.

3.4.1 Count regression models

In count models, the dependent variable can only take on non-negative and integer values (Long and Freeze, 2014). Other distributional characteristics of the dependent variable subsequently determine which count model is most appropriate:

- Poisson model: This model assumes that the mean is equal to the variance. In practice, the Poisson rarely fits due to over-dispersion (Long and Freeze, 2014, p. 507).
- Negative binomial model: This model addresses over-dispersion by adding a parameter (α) that reflects unobserved heterogeneity among observations (Long and Freeze, 2014, p. 507). Notten (2015) and Notten and Guio (2016) show that this model is more appropriate for European material deprivation data than the Poisson model.
- Two-step estimators: The number of zero values is often larger than expected by a Poisson or negative binominal distribution as these models assume that only one process generates the data. If this is not true, then it is possible to have more zeros than expected by the Poisson/negative binomial models. Two-step estimators allow, instead, for the presence of two data-generating processes. We investigated two different two-step count estimators:
  - Hurdle model: Hurdle models assume that all zeros are "structural". "The idea underlying the hurdle formulation is that a binomial probability model governs the binary outcome whether a count variate has a zero or a positive realization [i.e. a transition stage]. If the realization is positive the "hurdle" is crossed, and the conditional distribution of the positives is governed by a truncated-at-zero count data model [i.e. events stage]" (Mullahy, 1986, p. 345). A hurdle model first estimates a binary model to predict the zeros, and then it estimates a count model to predict positive values.
  - Zero-inflated model: Unlike hurdle models, zero-inflated models assume that zero values can have two different origins: "structural" and "sampling". As with hurdle models, the first step of a zero-inflated model involves estimating a binary model, followed by estimating a count model (typically a Poisson or a negative binominal model).

We assess that the assumption underlying zero-inflated models better captures the nature of our data than hurdle models.([16]) ([17]) By design, the material deprivation variable only measures the lower part of the material well-being distribution (i.e. it does not measure a person's financial capacity to purchase high-end sports cars or a second house). A person who has enough financial resources to afford the 13 customary items has a value of zero deprivations, irrespective of whether that person has just enough or ample resources. Thus, the variation in resources within this group of observed zeroes is likely larger than that observed for another deprivation value. Moreover, this within-group variation tends to increase as the average living standard of a country rises because that usually also means a rise in the population share of the zero value group (as illustrated in Figure 2).([18])

From the above argument, we deduce that the zeros probably consist of two separate groups (see also Long and Freeze, 2014, p. 394). One group has so many resources that their chances of material deprivation are indistinguishable from zero (the structural zeros). The other group is currently able to get by but may be one or two adverse events removed from experiencing deprivation (the sampling zeros). A hurdle model assumes that the latter group does not exist. The characteristics of these sampling zeros should thus be included when estimating the second step (the count model).

This paper therefore tests the empirical performance of three count models, namely the Poisson model, the negative binomial model and the zero inflated negative binomial model.

([16]) For a visual example of the difference between Poisson, zero-inflated and hurdle distributed count values, see Figure 1 in Hu et al. (2011).

([17]) Although Beduk (2018) also recognized the importance of treating people suffering from no deprivation separately, he opted for a hurdle model, which does not, in our view, take account of the heterogeneity of "zeros".

([18]) In Notten and Guio (2016) we explored, using a negative binomial regression model, the opportunities for separating these two populations through the inclusion of a dummy variable identifying people with very high income levels. The results suggested that for people with very high incomes, income was considerably less important as a determinant for the observed level of material deprivation in the countries studied (Germany, Greece, Poland and the United Kingdom).

3.4.2 Ordered regression models

Ordered models are less restrictive than count models because they treat the different deprivation values as ranked categories instead of equidistance categories. Given its construction methodology, there is a priori no reason to expect that the substantive distance between deprivation categories is constant over the entire deprivation distribution. Previous research showed that there is an order of deprivation (Guio and Pomati, 2017). Usually, people lacking only one item suffer from one of the least severe problems (lack of holidays, furniture or incapacity to face unexpected expenses). Those lacking more items combine less severe and more severe items. As the severity differs between items (see Guio, Gordon, Najera and Pomati, 2017), we may expect that the steps of the deprivation scale are not equidistant either.

This paper therefore also tests two ordered regression models:

- Ordered logistic model (O): An ordered model absorbs level variation between deprivation values in different constants (also called thresholds as they represent level differences between consecutive values of the latent variable). This model assumes that the coefficients of the explanatory variables have the same value across deprivation levels (parallel slope assumption).
- Generalized ordered logit model (G): This model additionally allows the coefficient of one or more explanatory variables to differ between deprivation levels. This could be relevant, as a given change in income (or another explanatory variable) may not have the same effect at different deprivation levels.

3.4.3 Other modelling and estimation aspects

We specify and estimate a separate regression model for each country. This is because the EU-SILC countries are very heterogeneous in terms of living standards, economy, labour market, welfare state, demography and culture. It is therefore reasonable to expect variation in parameter values between countries (in terms of magnitude but possibly also the significance and sign of some control variables). We therefore think that the impact of social transfers should be assessed at the country level.

The model specification includes the variables discussed in Sections 3.1 to 3.3. This specification captures the within-country variation of each variable in most countries. However, in some counties we use a more parsimonious specification by dropping variables and/or re-categorizing variable values with low variation (thus creating a model nested in the default model specification). To illustrate, take for instance the variable housing tenure status, which can take three values: owner, paying mortgage, and paying rent. In most countries, the population share of each of these three categories is sufficiently large to merit distinguishing between three categories. However, in some countries the population share of a category is so small that a re-categorization into two categories is more appropriate. In Lithuania (LT) for instance, few people live in rented accommodation, and among those who rent, very few have zero deprivations. For Lithuania, we therefore put renters into the same category as owners paying a mortgage (see Table A6). A model that includes irrelevant variables is less efficient.

Moreover, because of the added complexity in the regression models' structure, it is often more challenging to estimate the zero-inflated and the generalized ordered regression models. This is because these models involve estimations of more parameters and thereby place additional requirements on the variance of the data. For instance, the first step of the zero-inflated model involves estimating a binary model, comparing observations with zero deprivations to observations reporting positive deprivations. If, for one group, the distribution of an explanatory variable is very much skewed towards one value (i.e. very few zero deprivation observations live in rented housing), the estimator can sometimes not reach a solution (i.e. it does not converge). The underlying reason for this is that the model is misspecified (i.e. a dummy for rented housing cannot explain the observed variation for this subsample). We find that it is particularly the incidence of low cell frequencies for values accruing to observations with zero deprivation that give rise to this problem. Because the low cell frequency problem does not arise in the majority of countries, and when it occurs, it does not occur for the same variable values, we tackle this problem by using a more parsimonious model specification.([19]) This strategy resolves estimator convergence problems for most but

([19]) We identified likely problem cells by reviewing cell frequencies for all regressors dividing the sample into zero and positive deprivation groups. If a cell held fewer than 100 observations for a particular variable value, either we dropped

not all countries.([20]) The merged cells in tables A5 and A6 show in which country and variable cases we followed this simplification strategy.

We estimate the zero-inflated negative binomial regression model using the same explanatory variables as in the logit model (first step) and the negative binomial model (second step). For the generalized ordered regression model, we first test the relevance of relaxing the parallel slope assumption for all explanatory variables.([21]) Subsequently, we estimate the recommended model, which typically includes parallel slopes for some variables and different slopes for other variables.

We further estimate each regression model excluding observations in the lowest income percentile (while including these when making predictions, thereby applying the estimated parameters to the entire sample).([22]) This relatively small group has extremely low incomes and there are several reasons why we are concerned that this group might result in a bias of the parameter estimates of the model. Some of the observations in this group report a negative income, which is technically possible, but raises the concern that this group largely relies on alternative resources (for which other variables only crudely control). In a similar vein, a small number of households report no income or a very low income. Again, it is likely that for this group the relationship between income and deprivation is largely dependent on non-income resources, or that such observations result from errors. This first income percentile group is also, however, likely to be highly heterogeneous, with some observations having very low levels of non-income resources and others with modest or even high levels of non-income resources. We want to include this group in our impact analyses as it also includes, in part, observations with high deprivation levels who are of key interest to this research. As discussed in Section 3.2, we replace negative and zero incomes by one Euro, which should moderate the influence of the (likely) overestimated impacts of transfers for the sub-group with high levels of alternative resources, and its influence on the averaged impacts of larger populations.([23]) This strategy cannot solve the accuracy problem for observations in the lowest income percentile, and it probably underestimates the impact on the low resources-high deprivation sub-group. However, it enables its inclusion while erring on the side of caution in terms of impact.

Finally, and only for the performance comparison in the next section, we reclassified all material deprivation values above nine into one group when estimating the two ordered regression models. This adjustment does not affect the performance results but greatly simplifies the programme, estimating five regression models and a series of post-estimation commands over 32 countries, thereby reducing the risk of analytical errors.([24])

3.4.4 Performance comparison

This section compares the performance of the five selected regression estimators. Interpreting the results of non-linear estimators is more challenging than for a linear estimator because the effect of the variable of interest additionally depends on the level of all variables in the model (Long and Freese, 2014, p. 7). We start with a series of post-estimation analyses to assess how each estimator performs. Systematically, we

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the variable from the model specification (binary variables) or we re-categorized the value with another value (variables holding at least three values). In the few cases where re-categorization was possible, either we merged the low frequency value with a value that, conceptually speaking, was closest (education dummies) or we merged the value with the next smallest value in that country (home ownership).

([20]) The zero-inflated model does not converge for six countries (Cyprus, Greece, Romania, Serb Republic, Sweden and the United Kingdom). The generalized ordered estimator does not converge in one country (Romania). Our tests indicate that these countries require further tailoring of the model specification and/or the specific optimization algorithm applied. Unlike the strategy followed here, the resulting model specifications are not nested. For instance, for Greece, Romania and Serbia, a logarithmic scale would, in addition, need to be applied to income.

([21]) We use the for Stata user-written ado file “gologit2”, specifying the option “autofit”.

([22]) The fourth column of Table A1 shows how many observations are included in the estimation of the model. The difference between the third and fourth column arises because of 1) missing values in the regressors and 2) the observations excluded from the first income percentile. The fifth column of Table A1 shows how many observations are included in the impact estimates.

([23]) A somewhat higher average marginal effect is expected for this group. A robustness check (available on request) shows that the average marginal effect of a small universal income transfer on the first income percentile is somewhat higher than the average marginal effect on the first income decile.

([24]) In some countries, there are no observations in the sample reporting the highest deprivation value(s). Without this adjustment we need to estimate Stata’s ologit” and “gologit2” syntax over four as opposed to one loop. Comparison of the ordered logit results with and without this adjustment suggests that this simplification does not influence the performance comparisons (results available on request).

exclude the lesser performing estimators while deepening our focus on those remaining. This section finds that the ordered regression model offers the best trade-off between flexibility and parsimony in the context of our research.

The first test is the likelihood ratio test of Alpha, which tests the key assumption underlying the Poisson model, namely that the mean is equal to the variance. The rejection of the null hypothesis means that a negative binomial regression model, which additionally includes a constant parameter called Alpha, better fits the data. We reject the null-hypothesis in all 32 countries.([25])

The second test involves a comparison of the Akaike (AIC) and Baysian (BIC) information criteria (Table 1), which produce lower values for estimators that better fit the data. Again, the results are highly consistent across the 32 countries and for both criteria.([26]) The AIC and BIC values decrease most moving from the Poisson model (P) to a negative binomial model (N), followed by increasingly smaller improvements moving from a negative binomial model to a zero-inflated regression model and the two ordered regression models. Ordered models (O and G) generally outperform the zero-inflated model (Z), with the generalized ordered regression model (G) having the lowest values. In four countries, the zero-inflated model outperforms the ordered model (Finland, Iceland, Luxembourg and Slovenia). In two countries, the zero-inflated model also outperforms the generalized ordered model (Switzerland and Luxembourg). Differences between the information values for the zero-inflated model and the ordered models are relatively small.

The third post-estimation analysis shows how well the three count models reproduce the observed material deprivation distribution, thereby offering a more fine-grained perspective than the information criteria.([27]) ([28]) Figure 4 compares, for a selection of countries, the deviation between the predicted and the observed count values (vertical axis) at different values of the count distribution (horizontal axis). Smaller deviations overall indicate a better fit of the model. If a deviation at a given count value is positive, the model under-predicts the number of observations relative to the number actually observed (and vice versa for negative values). The results are consistent across countries, with the zero-inflated model having, on average, the smallest deviations. The Poisson and negative binomial models have trouble reproducing the distribution at lower values (zero and one deprivation in particular). While the zero-inflated regression model fits the left tail much better in all countries, it nonetheless consistently underestimates population shares in the tails (especially the population with one deprivation) while overestimating those in the middle.([29])

The above analyses indicate that, relative to the other three models, the Poisson model and the negative binomial regression model consistently underperform. We therefore continue our analysis retaining the three best-fitting models. As a fourth step, we compare the (weighted) sample frequencies with the predicted probabilities of the deprivation distribution (Cameron and Trivedi, p. 528).([30]) At a population level, the predictions of the three models reproduce the observed distribution quite well, with the predicted population shares for the ordered models being visually indistinguishable from the observed population shares (Figure 5).([31]) Focusing instead on the percentage point deviation between the predicted and the observed population shares (Figure 6), the superior performance of ordered models becomes visible. Whereas deviations of one percentage point and higher are common for the zero-inflated model, those deviations are typically below 0.02 percentage points for most deprivation values in most countries. While not visible from the graphs, deviations for the generalized ordered model are, on average, somewhat

([25]) We do not report further details here, but can provide them on request.

([26]) The AIC criterion penalizes model complexity more heavily than the BIC criterion. Due to rounding, Table 1 does not show that the AIC values are consistently lower than the BIC values.

([27]) The syntax producing these graphs only works for count models. Results for all countries are available on request.

([28]) The chi-squared diagnostic test developed by Andrews (1988 a, b) offers a formal goodness-of-fit test that is less sensitive to estimation error than the Pearson chi-squared test (Cameron and Trivedi, 2010). Manjón and Martínéz (2014) developed the code “chi2gof” to implement this test in Stata. Unfortunately, this code only works for samples containing less than 10 000 observations, which is not the case with our large national survey samples. For a subset of countries, we ran this test on the three count models using households as the unit of analysis (thus selecting a representative household member instead of all individuals). The test results consistently suggest that the zero-inflated model offers a better but still insufficient fit (rejecting the null hypothesis that the tested model is appropriate). These results are available on request.

([29]) In most countries the density of the material deprivation distribution is very low in the right tail (Figure 2). We therefore focus the analysis on values zero to nine.

([30]) Results for all countries are available on request.

([31]) Despite their capacity to reproduce the observed distribution at a population level, at the level of individuals such errors of prediction can be quite substantial. This is the main reason why we prefer averaging predicted impacts of transfers at a population level as opposed to calculating the error of prediction at the individual level and subsequently averaging the error of predictions (see Section 3.5).

smaller than for the ordered model. Albeit much smaller in magnitude, a non-random pattern remains in the prediction errors, predicting too many middle values while predicting too few in the right tail.

Figures A1 and A2 in the appendix illustrate the cumulative effect of the prediction error in the right tails from the perspective of the EU's official material deprivation rate, which counts persons as deprived if they have five or more deprivations. Whereas the prediction based on the zero-inflated model regularly underestimates the observed material deprivation rate by more than one percentage point (with a few higher deprivation countries having deviations of around three percentage points), the underestimation of the ordered models nowhere exceeds 0.8 percentage points. Interestingly, for most countries, the deviations from the observed deprivation rate are smallest for the ordered model, suggesting that this model outperforms the generalized ordered model at higher deprivation levels.

We now review the regression results for the three estimators, focusing on whether the coefficients are statistically significantly different from zero and whether the sign of the coefficients aligns with the conceptual framework. With a non-linear estimator, the effect of a one-unit change of an explanatory variable not only depends on its coefficient but also on the level of all other explanatory variables (Long and Freese, 2014, p. 7). The effect of a change in a person's income on material deprivation thus not only depends on the income coefficient but also on that person's income level, the coefficients of the other variables, and the person's values for the other variables. Using a selection of countries, Table 1 summarizes the results for the ordered logit model (our preferred estimator, see argument in Section 3.4.3) and Tables A9 and A10 summarize the results for the zero-inflated and the generalized ordered models.([32])

The regression results are in line with the conceptual framework, while also reflecting cross-national differences in the relationship between income and material deprivation. The income coefficient is negative and statistically significant from zero in all countries, which is in line with the theoretical expectation that more income leads to lower deprivation. Similarly, the coefficients of variables associated with lower resources are positive and statistically significant in all countries (i.e. debt and housing costs being a financial burden or being a tenant). Variables related to barriers/conversion factors, such as low household work intensity, presence of unemployed members, low education level and health problems have the expected significant positive impact. For other variables, the signs of the coefficients differ between countries and/or are statistically significant from zero in some but not in other countries. In Austria, for instance, the insignificant coefficient for "owner paying mortgage" suggests that this group is not very different from "outright owners" (the reference group). In the Czech Republic and Italy, homeowners paying a mortgage are at significantly higher risk of deprivation than outright owners. In Bulgaria, ownership or tenancy is not at all associated with material deprivation. Such cross-national differences also occur for the demographic variables, and we interpret them as reflecting differences in the societal structures of these European countries.

The zero-inflated results (Table A9) further report a significant Alpha coefficient, which suggests that using the negative binomial model for the second step is more appropriate than a Poisson model. Table A9 further lists results from the first step of the zero-inflated model. As this model aims to identify the "structural zeroes", the signs of the coefficients are reversed, indicating that persons with higher income, higher other resources and fewer barriers are more likely to avoid material deprivation.

The ordered regression results (Table 2) further include thirteen cut-off points, which indicate the different thresholds of the latent variable (material deprivation) identifying the fourteen deprivation values observed in our data. Note that this model assumes that the latent variable is continuous, which is what the theoretical framework assumes.

([32]) Results for all countries are available on request. Unless mentioned otherwise, we estimate statistical significance using standard errors that control for clustering using the household identifier.

Table A10 lists the income coefficients and cut-off points for each comparison group in the generalized ordered regression.([33]) ([34]) ([35]) ([36]) We tested the validity of the parallel slope assumption. If rejected for a particular variable in a given county, the coefficient varies between deprivation levels; if not rejected, the coefficient is the same regardless of the deprivation level.([37]) There is no common cross-national pattern in the parallel slope test results. In Austria, the parallel slope assumption holds for all explanatory variables, implying that an ordered regression model suffices. In the Czech Republic the parallel slope assumption is violated for seven variables, in Italy for eleven variables (including income), and in Bulgaria for five variables. For income, the parallel slope assumption holds in 16 countries; it does not hold in the other 16 countries. Table A10 shows that Italy's income coefficient increases for higher deprivation comparison groups, a pattern that also occurs for the other 15 countries, suggesting that the relation between income and material deprivation is stronger at higher deprivation levels.

In conclusion, in reproducing the observed material deprivation distribution, our different tests unambiguously show that (generalised) ordered regression models perform better than count models. The generalized ordered logit model marginally outperforms the ordered logit model, but not in all countries and not for the highest deprivation levels. For the generalized ordered logit estimator to reach convergence in Romania, further tailoring of the model specification to the country context is required. Even though in many countries (but for differing variables) flexibility in the coefficients across levels of material deprivation would be desirable, there is a trade-off between the benefits of increased flexibility and the cost of increased complexity (see Williams (2016), whose article specifically focuses on this trade-off). In consideration of all of the above, we favour parsimony over further flexibility in the context of this 32-country comparison and use the ordered regression model for the remainder of this paper.([38]) ([39]) The next section shows that the calculated impacts of a small transfer on material deprivation are very similar for both ordered models.

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33 The regression output of this model is very long. The complete regression output for all countries is available on request.

34 As opposed to estimating one model, the generalized ordered regression estimates a sequence of models. Each model compares two populations, which together include the entire sample. The composition of the two reference groups shifts between levels of deprivation. The first model, for instance, compares all observations reporting zero deprivations to a group we call "reference group 1" in Table A10, which consists of all observations with one or more deprivations. The second model, however, compares all observations with zero or one deprivation to "reference group 2" (including all observations with two or more deprivations).

35 The author of Stata's gologit2 ado-syntax also authored a web page holding a series of troubleshooting instructions, many of which helped us implement this estimator (Williams, personal website, accessed 15 June 2018).

36 Our standard and up to date computer equipment only has sufficient working memory to perform the computations needed to test for all possible combinations of varying slopes if we specify the option "iter(20)" and work with a minimized sized country level dataset.

37 Nonetheless, the Wald test for the joint significance of the parallel slope assumptions in the final model rejects the null-hypothesis that the final model is appropriate in 11 countries (using a one percent significance threshold). Because it looks at all variables combined, this test is more stringent than the variable level parallel slope assumption test.

38 Empirically identifying the 'best' regression model in each of the 32 countries, using data collected by 32 national statistics office and harmonized ex post, is fraught with challenges. While there often exists a solution to each challenge, the collective outcome of solving them exponentially increases the chances of making analytical errors because the programmes and results for each of the tests become lengthier and more dispersed. The many footnotes in this paper merely represent the tip of the proverbial iceberg of these challenges. This issue is particularly salient when estimating the zero-inflated and generalized ordered regression models.

39 We believe there is scope for further research here. If the research context involves only one country, further tailoring of the model specification (i.e. inclusion / definition variables, possibly including interaction and cubic variables) and regression estimator (i.e. generalized ordered regression model) could yield substantive gains (as cross-national comparability of results is not an issue). In a cross-national comparative context, larger gains in fit are possible by reducing the number of comparison groups in the generalized ordered regression model (i.e. from 10 or even 12 groups to 3 or 4) while allowing for flexibility in the coefficients in cases where the parallel slope assumption does not hold. One of our explorations suggests that a generalized ordered model comparing fewer deprivation levels may offer a better compromise in terms of fit (regrouping deprivation values into zero, one, 2-5 and five or more deprivations, and results available on request).

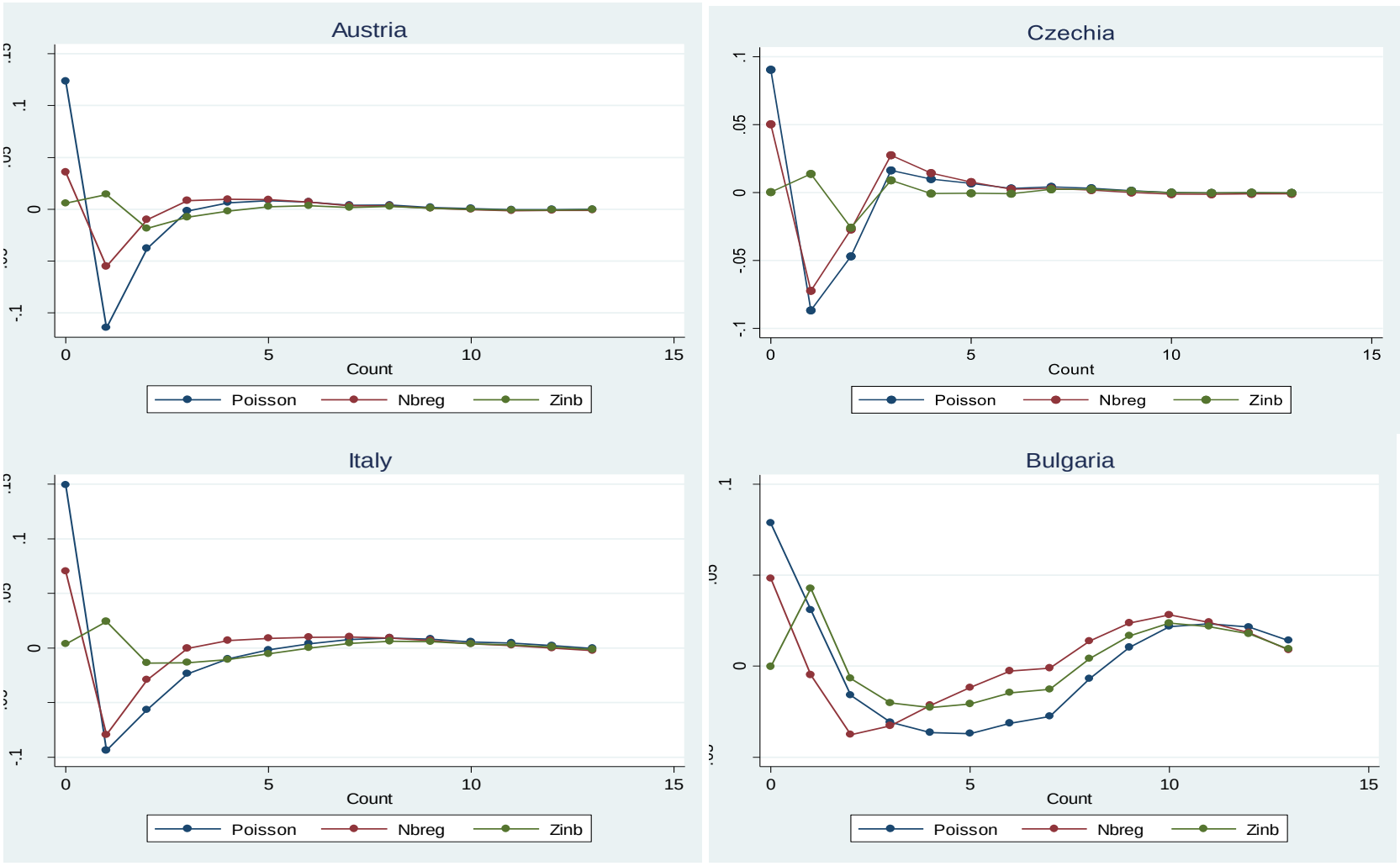
Table 1: Akaike and Baysian information criteria, by estimator
(in millions)

	AIC					BIC				
	P	N	Z	O	G	P	N	Z	O	G
Belgium	27.4	25.4	24.4	23.7	23.5	27.4	25.4	24.4	23.7	23.5
Bulgaria	37.3	35.2	34.6	29.9	29.7	37.3	35.2	34.6	29.9	29.7
Czechia	30.9	30.4	29.6	29.5	29.3	30.9	30.4	29.6	29.5	29.3
Denmark	12.4	11.7	11.5	11.3	11.3	12.4	11.7	11.5	11.3	11.3
Germany	201.1	185.9	177.4	174.4	173.0	201.1	185.9	177.4	174.4	173.0
Estonia	3.8	3.7	3.7	3.6	3.6	3.8	3.7	3.7	3.6	3.6
Ireland	12.0	11.5	11.0	10.8	10.7	12.0	11.5	11.0	10.8	10.7
Greece	41.3	41.3	N.C.	39.8	39.2	41.3	41.3	N.C.	39.8	39.2
Spain	144.4	140.0	133.8	132.6	131.0	144.4	140.0	133.8	132.6	131.0
France	176.8	163.0	156.9	153.8	152.0	176.8	163.0	156.9	153.8	152.0
Croatia	14.6	14.6	14.4	14.3	14.1	14.6	14.6	14.4	14.3	14.1
Italy	230.0	214.7	207.8	201.4	200.0	230.0	214.7	207.8	201.4	200.0
Cyprus	3.0	3.0	N.C.	2.9	2.9	3.0	3.0	N.C.	2.9	2.9
Latvia	7.5	7.3	7.2	6.9	6.9	7.5	7.3	7.2	6.9	6.9
Lithuania	11.4	11.2	11.0	10.8	10.7	11.4	11.2	11.0	10.8	10.7
Luxembourg	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0
Hungary	38.2	37.8	37.4	35.1	34.8	38.2	37.8	37.4	35.1	34.8
Malta	1.4	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.3
Netherlands	33.5	32.2	30.2	30.2	29.4	33.5	32.2	30.2	30.2	29.4
Austria	20.3	18.6	18.0	17.8	17.8	20.3	18.6	18.0	17.8	17.8
Poland	113.2	108.3	106.2	104.8	104.0	113.2	108.3	106.2	104.8	104.0
Portugal	37.9	37.1	36.2	35.7	35.3	37.9	37.1	36.2	35.7	35.3
Romania	100.1	95.5	N.C.	83.6	N.C.	100.1	95.5	N.C.	83.6	N.C.
Slovenia	6.0	5.9	5.7	5.7	5.7	6.0	5.9	5.7	5.7	5.7
Slovakia	18.6	18.1	17.6	17.4	17.2	18.6	18.1	17.6	17.4	17.2
Finland	10.3	10.1	9.7	9.7	9.5	10.3	10.1	9.7	9.7	9.5
Sweden	12.7	12.4	N.C.	11.9	11.7	12.7	12.4	N.C.	11.9	11.7
United Kingdom	154.9	149.1	N.C.	142.1	140.0	154.9	149.1	N.C.	142.1	140.0
Iceland	0.8	0.8	0.8	0.8	0.8	0.8	0.80	0.8	0.8	0.8
Norway	7.0	6.6	6.5	6.4	6.2	7.0	6.6	6.5	6.5	6.2
Switzerland	14.1	13.0	12.4	12.4	13.0	14.1	13.0	12.4	12.4	13.0
Serbia	31.4	30.7	N.C.	28.3	28.2	31.4	30.7	N.C.	28.3	28.2

NB: Authors' estimations, Estimated in Stata (command): P: Poisson (poisson), N: Negative binomial (nbreg), Z: Zero-inflated negative binomial (zinb), O: Ordered logit (ologit) and G: Generalized ordered logit (gologit2). AIC: Akaike information criterion (the lower the better); BIC: Bayesian Information criterion (the lower the better). N.C.: The estimator does not converge using the default model specification.

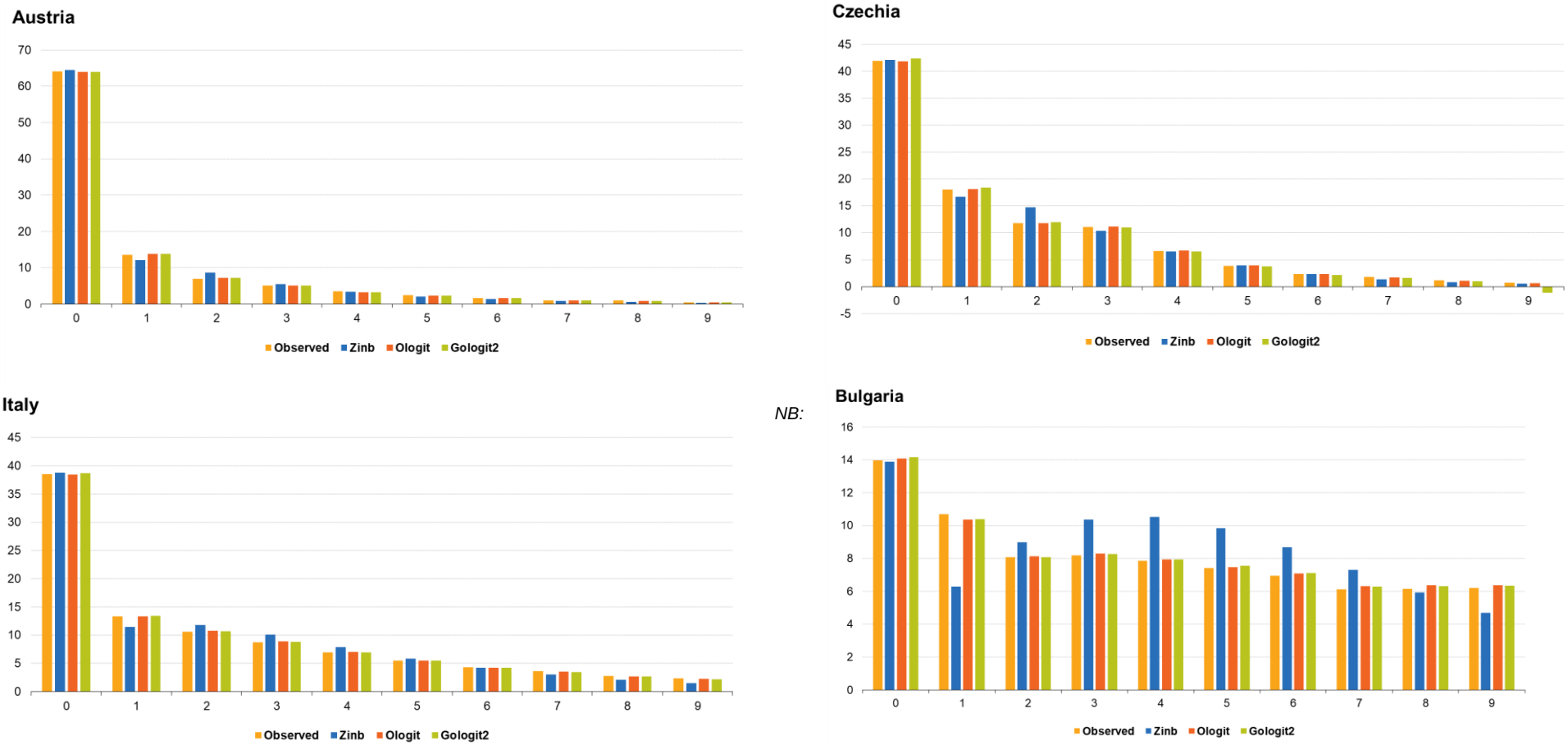
Source: EU-SILC 2015 cross-sectional data, version September 2017

Figure 4: Goodness-of-fit: Deviation of observed from predicted counts: Poisson, Negative Binomial (Nbreg), zero inflated negative binomial (Zinb), selected countries



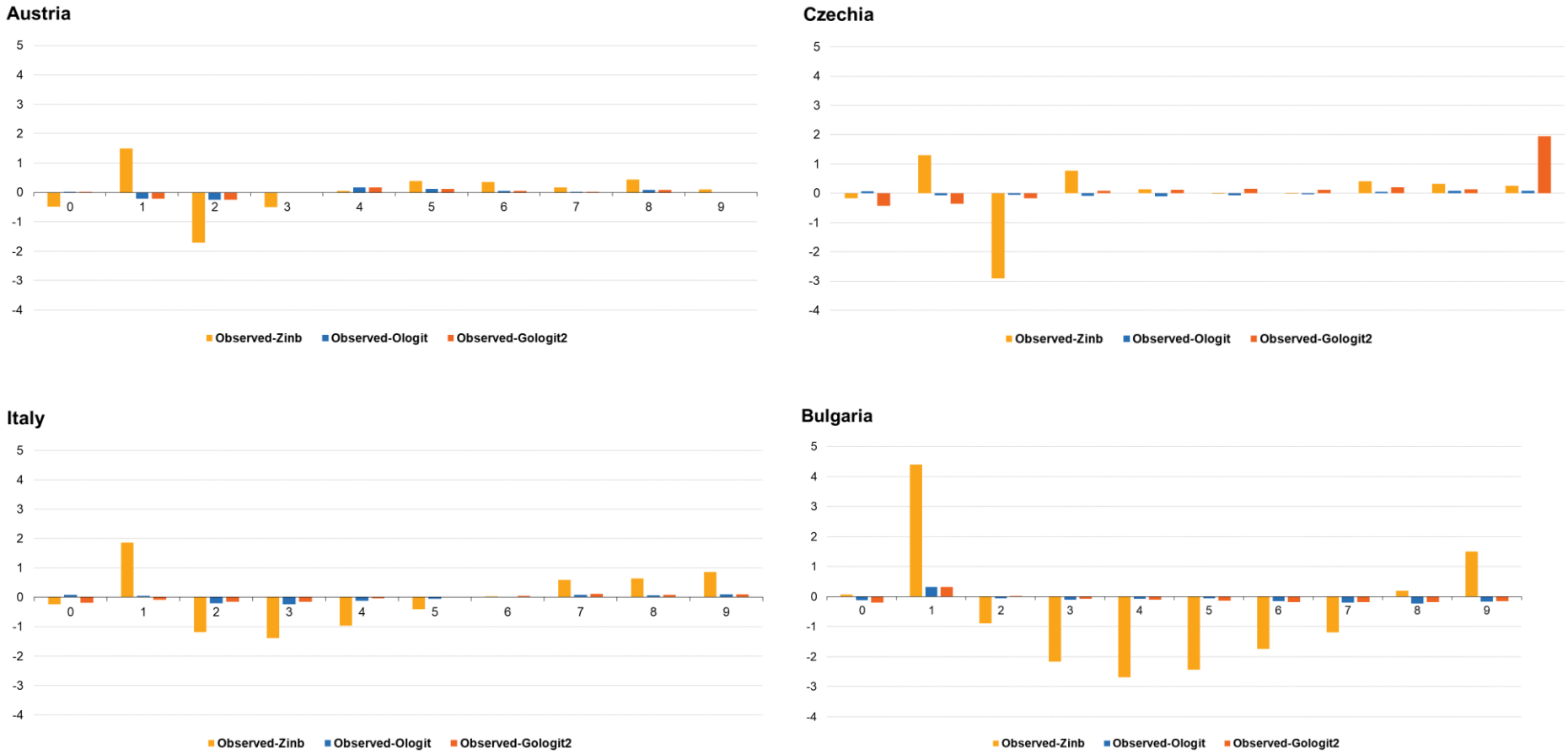
NB: Authors' calculations. Graphs produced in Stata (PRCOUNTS command developed by Long and Freeze, 2014). Comparisons count data models: Poisson, negative binominal (Nbreg) and zero-inflated negative binominal (Zinb). A value of 0.05 means that the model underpredicts the observed count rate by 5 percentage points.
Source: EU-SILC 2015 cross-sectional data, version September 2017

Figure 5: Goodness-of-fit: Observed versus predicted distribution by estimator, selected countries



NB: Authors' calculations. Comparison observed distribution (observed) with predicted distribution for various estimators: zero-inflated negative binomial (zinb), ordered logistic (ologit), and generalized ordered logistic (gologit2). Prediction based on sample used to estimate the model. Distribution displayed up to 9 deprivations and numbers rounded to nearest integer.
Source: EU-SILC 2015 cross-sectional data, version September 2017

Figure 6: Goodness-of-fit: Percentage point deviation between observed and predicted distribution by estimator, selected countries



NB: Authors' calculations. Percentage point deviation between observed and predicted distribution for various estimators: zero-inflated negative binomial (zinb), ordered logistic (ologit), and generalized ordered logistic (gologit2). Prediction based on sample used to estimate the model. Distribution displayed up to 9 deprivations and numbers rounded to a single digit. A positive value indicates underprediction.
Source: EU-SILC 2015 cross-sectional data, version September 2017

Table 2: Results OLOGIT (preferred model), selected countries

	Austria	Czechia	Italy	Bulgaria
Variable of interest:				
Income (in 1 000s Euro PPS)	-0.067***	-0.186***	-0.069***	-0.190***
Thresholds:				
Cut1	0.671**	-0.563*	0.334	-1.973***
Cut2	1.693***	0.539*	1.199***	-0.994***
Cut3	2.401***	1.341***	1.895***	-0.431
Cut4	3.066***	2.309***	2.512***	0.062
Cut5	3.660***	3.145***	3.058***	0.493
Cut6	4.255***	3.869***	3.560***	0.886**
Cut7	4.846***	4.504***	4.029***	1.260***
Cut8	5.373***	5.213***	4.521***	1.610***
Cut9	6.158***	5.933***	5.026***	1.995***
Cut10	6.925***	6.759***	5.632***	2.440***
Cut11	8.272***	7.640***	6.209***	2.969***
Cut12	9.097***	8.363***	7.085***	3.630***
Cut13	9.851***	9.563***	8.657***	4.609***
Other explanatory variables:				
Health problem	0.580***	0.454***	0.443***	0.311***
Debt is a heavy burden			0.764***	
Debt is a slight burden	0.649***	0.670***	0.012	0.011
Housing costs are a heavy burden	2.372***	2.533***	1.505***	
Housing costs are a slight burden	0.701***	0.983***	0.003	1.481***
Outright owner	Reference	Reference	Reference	Reference
Owner paying mortgage	0.21	0.419***	0.324***	
Tenant	0.797***	0.759***	0.778***	0.1
≥ 1 adult has other country of birth	0.267*	0.275	0.576***	X
Household with dependent children	-0.189	-0.243*	-0.187*	-0.490***
Number of adults in household	-0.123*	0.04	0.034	-0.049
Number of children in household	0.05	0.053	0.004	0.308***
Post-secondary/tertiary	Reference	Reference	Reference	Reference
Upper secondary	0.268**	0.633***	0.455***	0.908***
Lower secondary or below	0.839***		1.055***	
Low work intensity household	0.529***	0.905***	0.417***	X
≥ 1 adult is unemployed	0.795***	0.802***	0.707***	X
≥ 1 adult is retired	-0.142	0.116	-0.247***	-0.185*
Region 1	Reference	Reference	Reference	Reference
Region 2	0.083	-0.132	0.737***	0.108
Region 3	-0.081	-0.313*	0.443***	
Region 4		0.077	-0.101	
Region 5		-0.440***	0.095	

Region 6		-0.162		
Region 7		-0.216		
Region 8		-0.106		
Observations	13 067	17 589	42 623	11 803
MacFadden's R2	0.1806	0.1714	0.1525	0.0900

NB: Authors' estimations, using Stata (ologit). Ordered logit (OLOGIT, p-values: p<0.10 *, p<0.05, ** p<0.01, ***, standard errors estimated using survey design variables following Goedemé (2013)). Countries ranked according to highest percentage of zero deprivations. Cells marked with X indicate that variable is omitted due to low variation in variable (i.e. cell size below 100 within either the sub-population with zero deprivations or the sub-population with one or more deprivations). For the same reason we have merged categories of variables for certain countries (identifiable by merged cells in above table). Interpretation income coefficient: A one-unit increase in income (1 000 Euro PPS) reduces an Austrian's ordered log-odds of having a higher level of material deprivation by 0.067 while the other variables in the model are held constant. In addition to sample restrictions mentioned earlier, this estimation further excludes a small number of observations for which the ordered logit model is completely determined. Following Stata's automatically generated error message and the diagnostic steps suggested on Stata's user forum (accessed 15 January 2019), we find that in all countries these are observations whose predicted probability of zero deprivations is either one or very close to one. Following this finding, we apply the recommended solution of dropping these observations from the model's estimation (while including them using the model for predictions). For this reason, there is a very small discrepancy between the number of observations reported in this table and those reported in tables A9 and A10. These regression results are obtained without top-coding the dependent variable above nine deprivations whereas, for ease of programming, all other results in this section are obtained using the top-coded variable.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

3.5. Method of impact calculation

We estimate the impact of social transfers on the level of material deprivation in each of the 32 EU-SILC countries using the coefficients from the ordered regression model. Our method of impact estimation involves a comparison of the *predicted* material deprivation distribution using income before the transfer with that of the *predicted* distribution using income after the transfer.([40]) The difference between both distributions reflects the estimated impact.

For the reasons discussed in Sections 3.2 and 3.4, we replace reported incomes of zero and below by one Euro and we estimate the coefficients excluding the first income percentile in each country. The impact calculations include these observations by applying the coefficients obtained from the estimation sample.

We illustrate this method by estimating the effect of a very small universal transfer of 150 Euro (in purchasing power).([41]) This amount represents about one percent of the equivalised median annual income (in purchasing power) in the EU-SILC data. Because the material deprivation scale is the same across countries, we use the same (absolute) amount for the marginal effect analysis.([42])

Here we analyse the marginal effect of this transfer on the material deprivation distribution in four selected countries, leaving a deeper analysis of impacts for the results in Section 4. Figure 7 shows that in Austria, for example, the universal transfer would increase the population share of Austrians with zero deprivations by about 0.15 percentage points, whereas the population shares at higher deprivation levels would decrease. This 'leftward' shift of population densities from higher to lower deprivation levels is also present in the other countries. For countries with a higher average deprivation level, such as Bulgaria, the population shares of lower deprivation levels rise while those of higher deprivation levels decline. The universal transfer leads to a (predicted) decrease in material deprivation. These results once again illustrate that the methodology set out in this paper yields predictions that are plausible in light of our understanding of the relationship between income and material deprivation (as set out in Section 2).

The marginal effects are the largest in the Czech Republic. The Czech Republic's comparatively large value for the income coefficient is most likely a main driver behind this finding (Tables 2, A9 and A10). While the income coefficient is only one of a range of factors driving the impact estimates (see Section 3.4 for a discussion of the non-linearity of count and regression models and its resulting effect on predictions), the distributional shifts in the Czech Republic even outstrip those for Bulgaria (the country with the lowest average living standard in the EU-SILC). We further analyse this in Section 4.

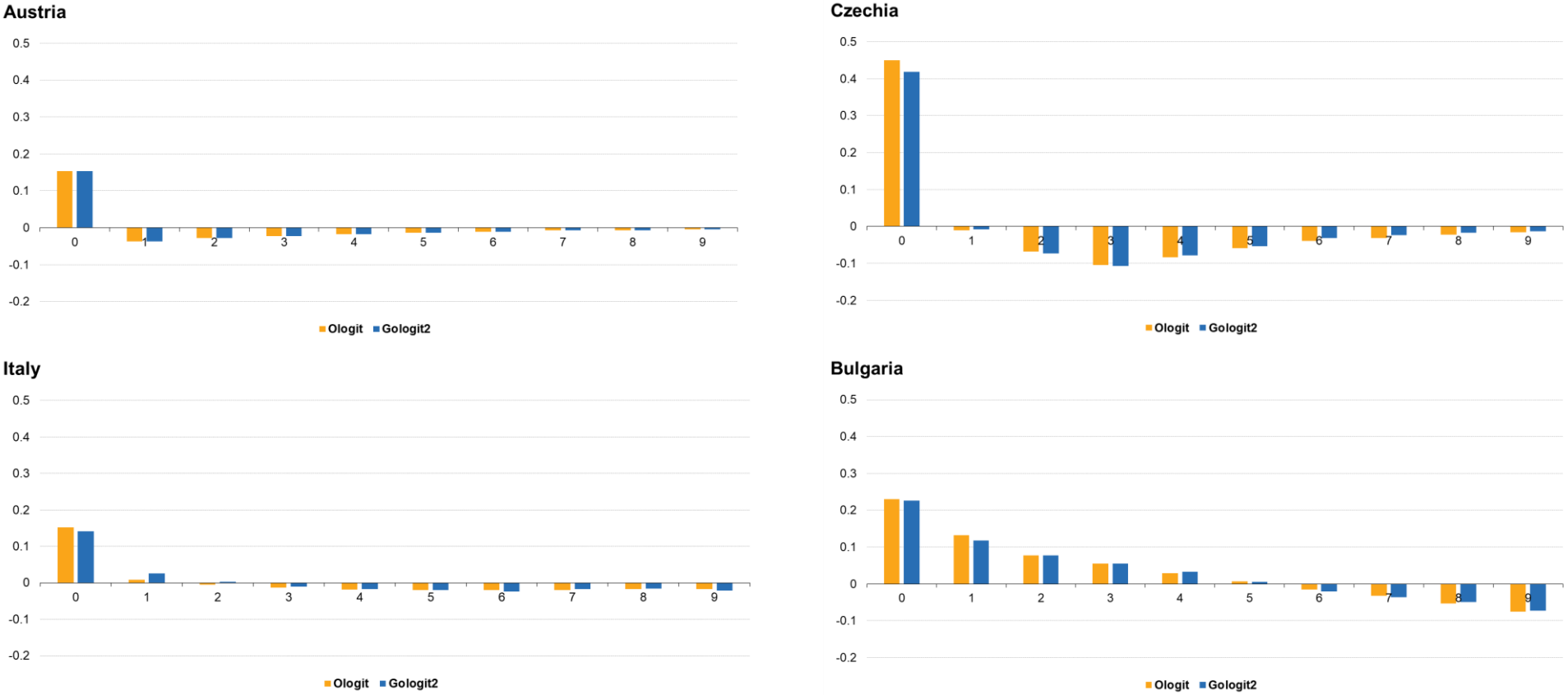
Figure 7 finally illustrates that using a generalized ordered regression model instead of an ordered regression model has a relatively small effect on the (averaged) impact estimates: the ordered logit slightly underestimates (overestimates) the effect of income transfers on material deprivation at lower (higher) income levels.

([40]) Using Stata's default post-estimation syntax "predict". This syntax predicts, for each person, the probabilities of being observed in each of the deprivation values (the probability of deprivation values 0 to 13, with these probabilities summing up to one at the individual level). Following Cameron and Trivedi (2010, p. 528), the predicted deprivation distribution is the mean probability of each deprivation value in the weighted sample.

([41]) In our data, individuals are the unit of analysis (row) and household income is in adult equivalent amounts using the modified OECD-equivalence scales (1 for the first adult, 0.5 per adult thereafter, and 0.3 per child). By adding an amount of 150 to each row, the amount of transfer a household would receive in reality would vary with the household composition: a family consisting of two adults and two children would receive 315 Euro (150*2.1) while a single adult person would receive 150 Euro (150*1).

([42]) One could finance such a transfer, for instance, through a tax paid by wealthy European residents whose probability of material deprivation is zero. In this exercise, however, we do not take account of the tax collection side meaning that also for the wealthy we add 150 Euro (PPS) to their disposable income. As this tax would fall on residents having a close to zero probability of deprivation, this simplification is unlikely to affect the impact estimates.

Figure 7: Marginal effect of a universal 150 Euro (PPS) income transfer on deprivation count distribution, by estimator and for selected countries
(percentage point change in population share)



NB: Authors' calculations. Average marginal effect on count distribution (percentage point change in population share), for various estimators: ordered logistic (ologit) and generalized ordered logistic (gologit2 using autofit). Numbers rounded to three digits. For Austria, all parallel slope assumptions are valid, implying that the generalized ordered logit model is the same as the ordered logit model.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

4 Results

This section illustrates the methodology developed in this paper by analysing the impact of a small expansion of countries' current social transfer spending through various lenses, by using the scenario of a universal transfer of 150 Euro (PPS). This paper is the first to offer population level impact estimates of social transfers on material deprivation for 32 European countries using the 2015 wave of the EU-SILC data. The impacts presented have been obtained through country-level ordered logit regressions, predicting the probabilities of deprivation before and after the transfer (Section 3). We express the average marginal effect (AME) as the decrease in the average predicted number of item deprivations.([43]) By comparing the AMEs of different populations, within and between countries, we analyse the distributional impacts over the entire deprivation distribution and its association with selected characteristics of countries' social transfer systems. We also calculate the impact in terms of the EU's official material deprivation rate and explore the costs associated with various transfer scheme designs. The analysis focuses on the impacts of small income changes, since the data do not allow us to identify a strong control group while maintaining a cross-national comparative perspective.

4.1 Distributional impacts of a universal 150 Euro (PPS) transfer

Studying the distributional impacts of an (imaginary) small universal transfer on material deprivation offers interesting policy insights, especially in a comparative context involving countries with considerable differences in living standards, societal structures and social protection systems.

One could think of such a transfer as a modest step towards enhanced solidarity within the European Union while simultaneously softening (some of) the effects of rising inequalities (driven by global market forces) on European residents with low levels of financial resources. The required financing for such a transfer could for instance come from a very small EU tax on large international financial transactions.([44]) If designed well, such a tax could (largely) avoid burdening European residents having a positive probability of material deprivation, with the incidence of the tax falling instead on wealthy European residents (whose probability of material deprivation is effectively zero), wealthy non-European residents and businesses.

([43]) One can express the AME in several ways by focusing on different moments or segments of the material deprivation distribution. For instance, another policy relevant expression of the AME would be to calculate the impact of a transfer in terms of the EU's official material deprivation indicator (thereby focusing on the percentage point change in the population experiencing five or more deprivations). Here we prefer a measure that also acknowledges the benefits of a transfer to a population experiencing fewer than five deprivations.

([44]) The design of this tax follows the spirit of Piketty's global wealth tax (2014).

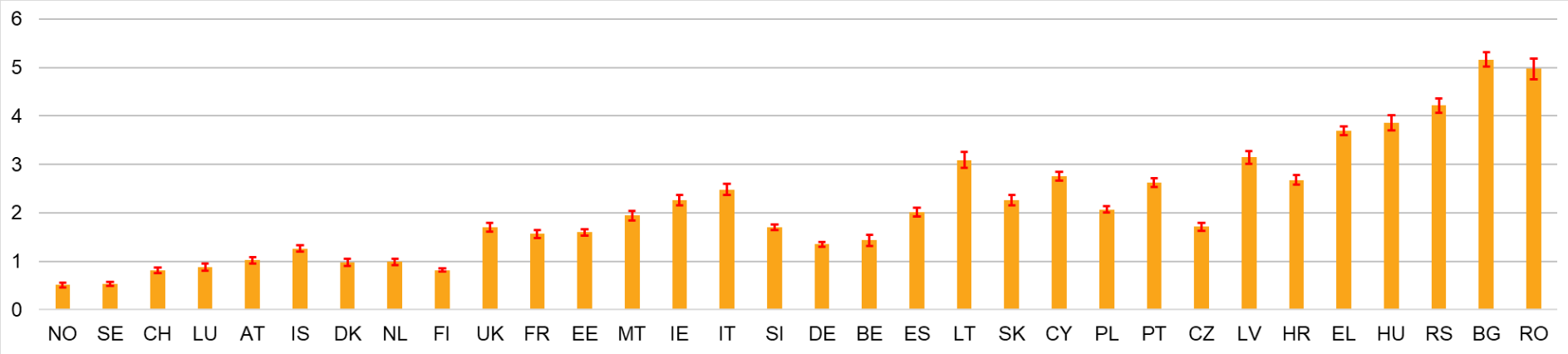
Our estimates show that a universal 150 Euro (PPS) transfer would reduce the average number of deprivations in every European country (Figure 8A). The impact varies from a reduction of 0.003 deprivations in Norway to 0.09 in Bulgaria, with AMEs rising as the standard of living declines. Figure 8B, which uses the average number of deprivations as a proxy for a country's standard of living, shows that there is a negative correlation between AME and a country's prosperity level. In the most deprived country (Bulgaria), in which the population suffers on average from 5.2 deprivations, the 0.09 decline is the largest. Figure 9 shows that this intuitive finding also applies to individuals within countries, with the AME increasing by (observed) deprivation level and decreasing by (observed) income quintile. Given that we use the same scale to measure deprivation, a universal transfer (in purchasing power) ought to have a larger impact on an individual / country with fewer resources (as illustrated by the conceptual framework in Figure 1).

Yet the correlation between AMEs (Figure 8A) and average living standards (8B) is far from perfect, which suggests that other societal forces play a role as well. Italy's AME, for instance, is considerably smaller than the Czech Republic's, even though its living standard is lower. In fact, Italy's AME is smaller at every deprivation level and income quintile (the lines Figures 9A and 9B do not intersect). Public policy and social policy are some of the societal factors that could explain cross-national differences in AMEs. Another important and potentially interrelated explanatory factor is the nature of the domestic economy and its interactions with other economies. Finally, cross-national differences in the EU-SILC data collection and data preparation could also play a role. In this paper, one can think of the national level coefficients of the ordered logit regression model as 'summarizing' the collective effect of societal forces on material deprivation (as outlined by our conceptual framework in Section 2). Figure 10 shows there is a strong positive correlation between a country's income coefficient and its AME, despite the fact that the marginal effect in a non-linear regression model not only depends on a person's income level but also on her other characteristics (and thus on all regression coefficients).([45]) In the remainder of this paper we further explore what role social policy (could) play(s) in influencing material deprivation.

[45] In a linear model, the predicted effect is the coefficient of the treatment variable – hence a constant.

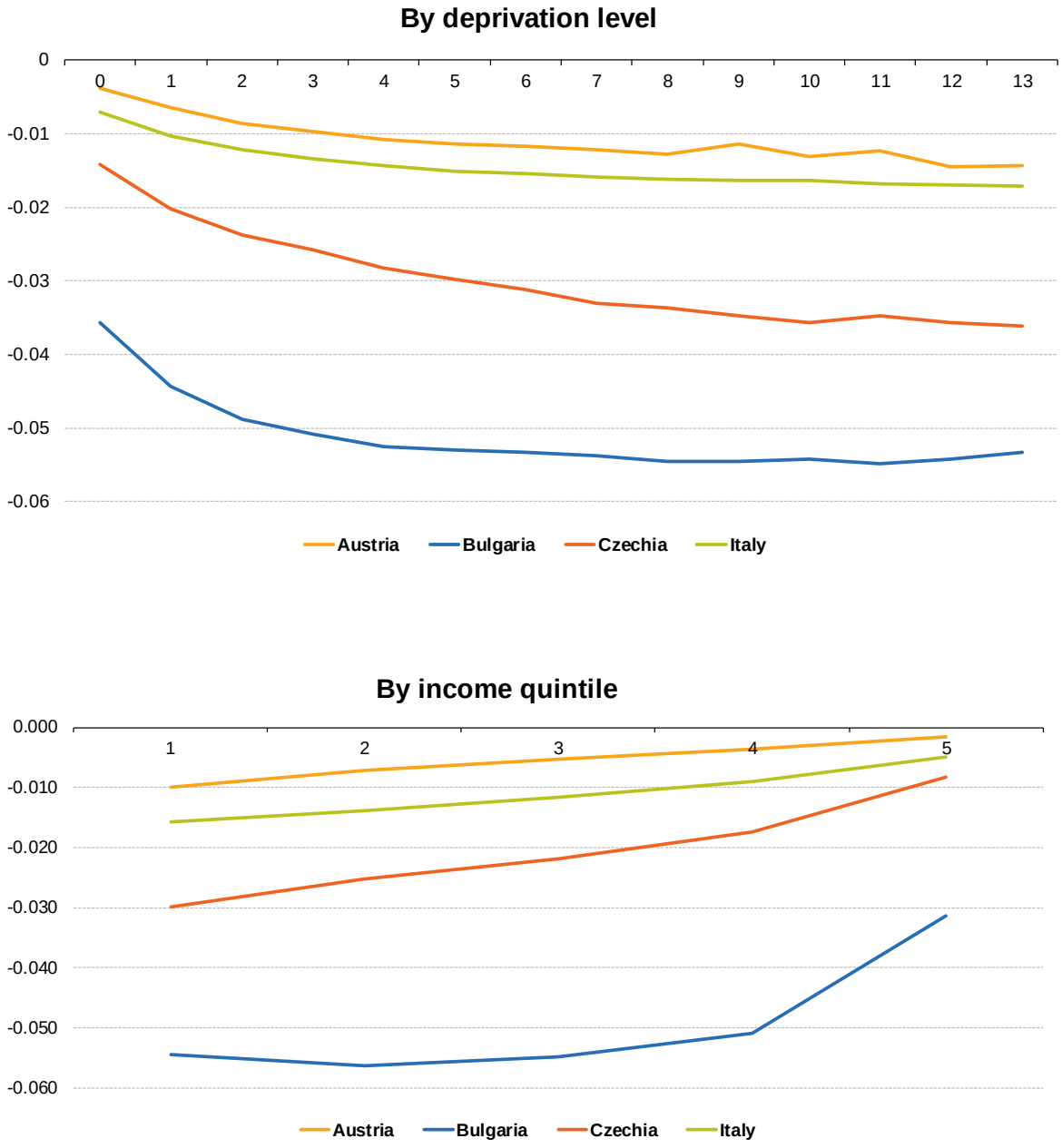
Figure 8A: Impact (AME) of a universal 150 Euro PPS social transfer on the number of deprivations, ranked from lowest to highest

Figure 8B: The average number of deprivations, ranked from lowest to highest AME



NB: Authors' estimations, using Stata command ologit. The average marginal effect (AME) measures the change in the average number of item deprivations, averaged over the national population. The average number of deprivations is based on the predicted probability distribution. The confidence intervals take survey design into account (Goedemé, 2013). See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

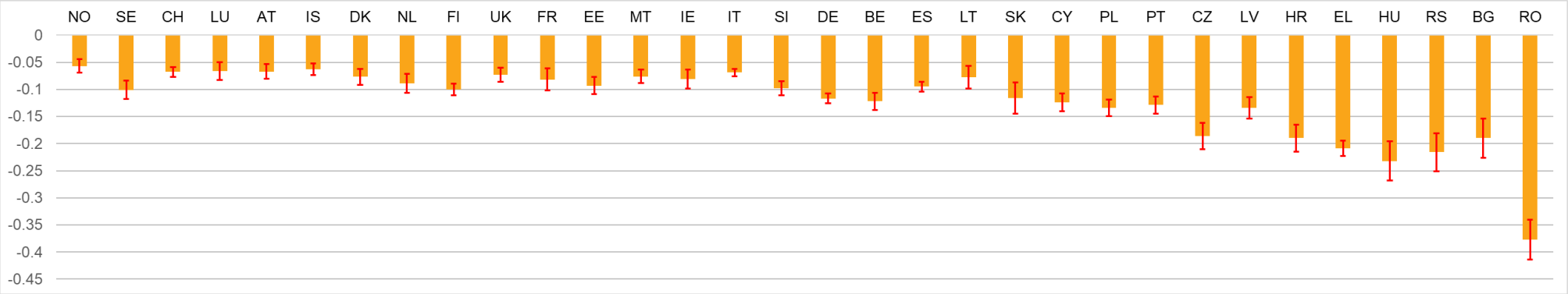
Figure 9: Impact (AME) of a universal 150 Euro PPS social transfer on the number of deprivations, by (observed) deprivation level and (observed) income quintile, selected countries



NB: Authors' estimations, using Stata command ologit. The average marginal effect (AME) measures the change in the average number of item deprivations, averaged over deprivation values (displayed up to 9 deprivations) or income quintiles.

Source: EU-SILC 2015 cross-sectional data, version September 2017

Figure 10: The income coefficient of the ordered logit model, ranked from lowest to highest AME



NB: Authors' estimations, using Stata command ologit. The sample used to estimate the coefficients excluded observations in the lowest income percentile. The confidence intervals take survey design into account (Goedemé, 2013). See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

4.2 Distributional impacts given countries' current social transfer systems

This section explores where a modest increase in transfer spending in a country's existing transfer system would have the largest impact. It analyses the relation between the AME of the universal 150 Euro (PPS) transfer and two aspects of a country's current social transfer system, namely its coverage and its generosity.([46])

We categorize receipt of transfers into four mutually exclusive groups of individuals: those (living in households) not receiving any income transfers; those receiving only pension transfers; those receiving only non-pension transfers; and those receiving both pension and non-pension transfers.([47]) Our analysis thus recognizes that, irrespective of specific programme eligibility criteria, the transfer is a resource that may (and often does) contribute to the wellbeing of any member in the household.

There are some commonalities among the otherwise considerable cross-national differences in the population shares of the transfer receipt categories (Figure 11A). In most countries, the share of the population living in households receiving non-pension transfers is the highest and is often well above 30 percent of the population. Typically, the second and third largest groups are those receiving only pension transfers and those not receiving any transfers. Those receiving both pension and non-pension transfers are usually the smallest group. Some notable exceptions to this pattern are Denmark and Serbia (having very small shares of non-transfer recipients and of those receiving only pension transfers), Malta (having a very small share receiving only pension transfers), and Greece and Poland. Because of lower precision, we do not analyse or report any results of population groups that comprise less than ten percent of the national population.([48])

Generosity, as measured by the level of transfer, is another important feature of transfer systems. Using median annual transfer levels, Figure 11B summarizes the typical generosity of transfers per transfer groups (see Section 3.2 for which transfers are included). Not surprisingly, transfer levels are higher in countries with lower AMEs. This reflects the fact that countries with a higher average living standard tend to have more generous transfer systems (OECD, not dated). Furthermore, in countries with a higher living standard, differences between pension and non-pension transfers tend to be larger. Nonetheless, even in Eastern European countries, the median level of pensions received is typically higher than that of non-pension transfers.

There are clear distributional differences in the effects of a modest increase in social spending on material deprivation, measured here as the AMEs of the mutually exclusive transfer receipt groups in each country (Figures 11C, 11D and Figure A4). First, between-group differences in AMEs are often statistically significant, even though the size of the effects is very small and the magnitude of variation between countries is considerably larger (Figure A4 illustrates this for selected countries).

Second, in all countries where this population share exceeds 10 percent, the AMEs are smallest for

([46]) The universal 150 Euro (PPS) transfer reflects a relatively large increase of transfers in countries with relatively low social spending, while the added spending is relatively small in countries with high levels of social spending (see Figure 13 in Section 4.4).

([47]) We include this group to cover possible situations where a country's social transfer system does not give any transfers to a population group that is (on average) at disproportionate risk of material deprivation. In all countries where this group is larger than 10% of the population, the AME of this group falls below that of the national AME, suggesting that, on average, those not receiving transfers are better off than those who do (results available on request).

([48]) This occurs in 12 groups (out of a total of 96). In four of these groups the population share is below 5 %; four groups are in the "only pension transfers" group and eight are in the "receiving both types of transfers" group.

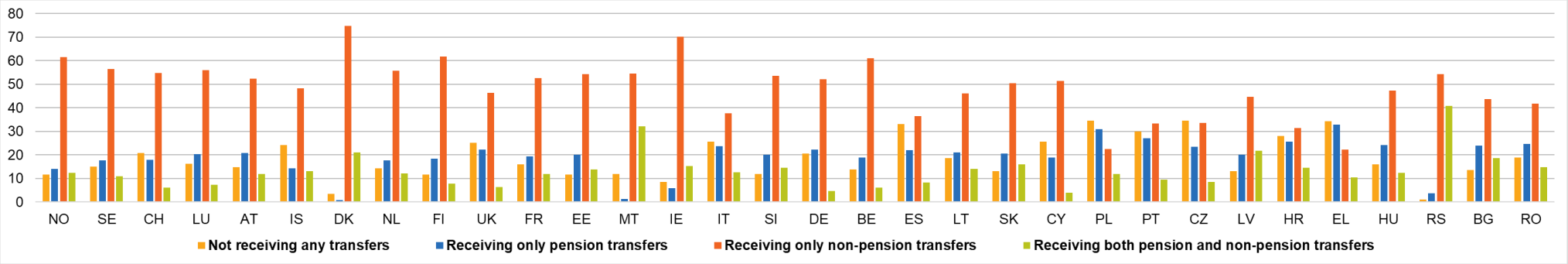
individuals living in households that do not receive transfers.([49]) This finding suggests that Europe's national social transfer systems are, on average, progressive in coverage in the sense that they disproportionately reach individuals with fewer resources and/or higher needs.

Third, in most countries, the AMEs of those receiving only non-pension transfers are larger than the national AME, while the AMEs of those receiving only pensions are lower than the national AME (Figures 11C and 11D). In fewer cases, the same holds for the AMEs of those receiving both types of transfer. In such countries, increasing social spending on non-pension transfers will achieve, on average, the largest reductions in material deprivation.

Fourth, in some eastern European countries, the AMEs of those receiving pension transfers are above the national AME (Estonia, Lithuania, Slovakia, Czech Republic, Latvia, Bulgaria and Romania). In these countries, one would expect the largest reductions in material deprivation to be achieved by increasing social spending on pensions (in the Czech Republic the AMEs of both types of transfers are above the national AME, with the AME of non-pension transfers being higher than that of pension transfers).

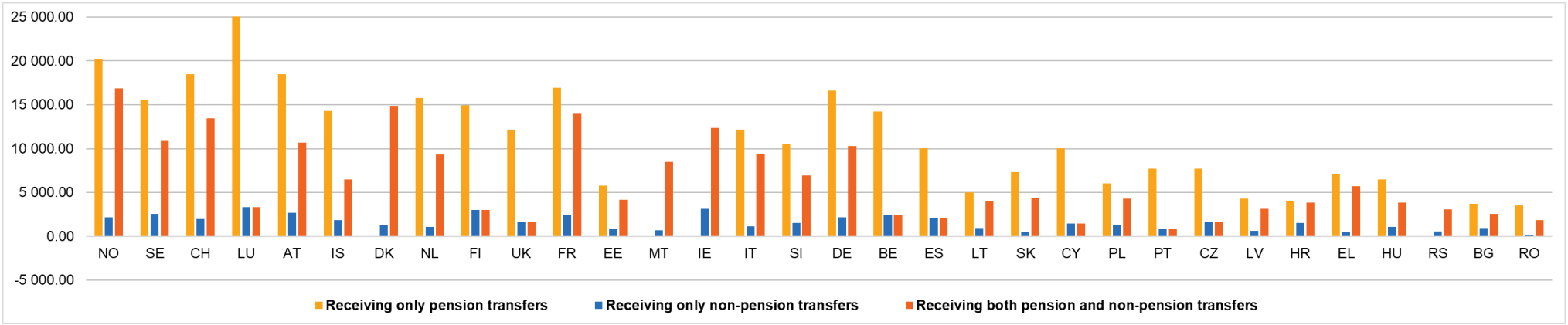
([49]) Results not displayed in graphs and available on request.

Figure 11A: Population shares by transfer groups (receiving: pensions only, non-pension transfers only, both
(%)



NB: Authors' estimations. Ranked from lowest to highest national AME. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Figure 11B: Median transfer amounts by transfer groups (receiving: pensions only, non-pension transfers only, both)
(Purchasing Power Standards (PPS))



NB: Authors' estimations. Ranked from lowest to highest national AME. Unit of analysis: individuals. In adult equivalent amounts (modified OECD scale (hx050)) and expressed in Purchasing Power Standards (PPS) (using Purchasing Power Parities updated from Eurobase February 2017). No bars displayed when population share of a transfer group is below 10% of national population. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Figure 11C: AME, national average and by transfer groups (receiving: pensions only (PO), non-pension transfers only (NPO), both (B))

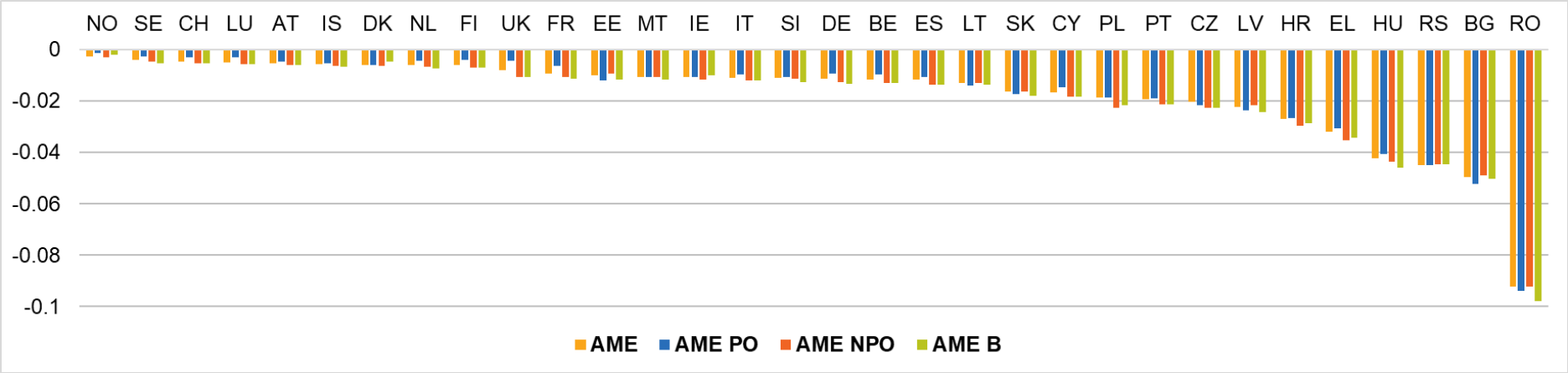
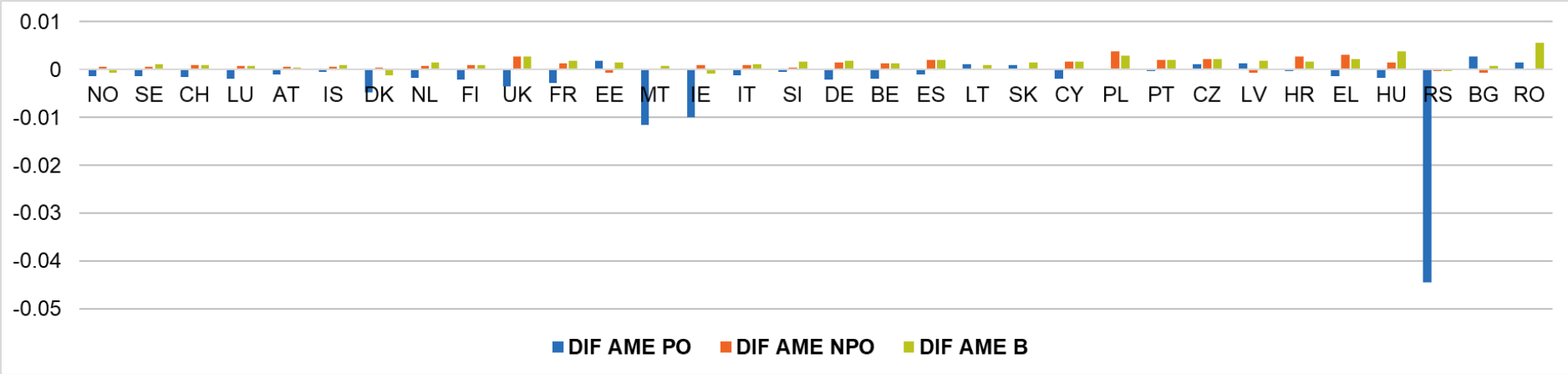


Figure 11D: Difference between the national average AME and the AMEs of each transfer group "(receiving: pensions only (PO), non-pension transfers only (NPO), both (B))"



NB: Authors' estimations, using Stata command ologit. Ranked from lowest to highest national AME. A positive value in Figure 11C means that the AME of the transfer group is larger than the national AME. No bars displayed when population share of a (transfer) group is below 10% of the national population. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

4.3 Exploring differences in distributional impacts – The Baltics

With the aim to better understand which factors drive cross-national differences in impact, this section takes a closer look at the Baltic States. Relative to other European countries, the Baltic States have a lot in common because of their regional proximity and their shared history throughout the early development of their welfare states, only gaining national autonomy since independence in the early 1990s. Furthermore, by focusing on a few countries, it is easier to cross-validate and supplement our findings with evidence from other studies. For convenience, Table 3 summarizes all results for the Baltics.

Of the Baltics, Latvia has the largest AME (-0.022, rank 26/32), followed by Lithuania (-0.013, rank 20/32) and Estonia (-0.010, rank 12/32).([50]) Our analysis below suggests that Estonia's relatively low AME is largely driven by its higher living standards and its more generous social transfer system. Differences between Latvia's and Lithuania's AME, on the other hand, cannot be explained by their very similar living standards but rather seem related to differences in their social protection system.

Estonia's living standard is higher than that of Lithuania and Latvia. The average number of deprivations (1.6) in Estonia is half that in the other two Baltic States. The share of the population of Estonia with zero deprivations is twice as large (44%), and the share of persons with five or more deprivations is about two-thirds smaller (10%) than in the two other countries. The higher living standard of Estonia thus seems a key factor explaining its lower AME, especially considering that this research uses the same deprivation scale across countries, and controls (to some degree) for cross-national differences in purchasing power.

Lithuania and Latvia, on the other hand, have very similar living standards but very different AMEs. Latvia's higher AME is likely related to its larger income coefficient: Latvia's income coefficient is the largest (-0.134), followed by that of Estonia (-0.093) and then Lithuania (-0.078). As shown earlier, there is a strong correlation between the income coefficients of the ordered logit regression and the AMEs. One potential explanation could be that Lithuania's social transfer system is more progressive than Latvia's. Indeed, persons living in a household that is more at risk of deprivation are more likely to be receiving (more generous) social transfers in Lithuania than in Latvia. By supporting those most vulnerable and/or by providing more generous support, social transfers contribute relatively more to the observed deprivation levels in Lithuania (this is true for people suffering from two deprivations or more, see Figure A3) and, consequently, the income coefficient is smaller in magnitude. The two measures for the coverage and generosity of social transfers confirm these differences in the social transfer systems of these countries. Lithuania's transfer system excludes a larger share of the population (19% versus 13%), and it has a considerably smaller share of the population receiving both pension and non-pension transfers (14% versus 22%). Lithuania's median transfers are also consistently higher than Latvia's for both types of transfer. Such numbers are consistent with the findings of Figure A3 that Lithuania's transfer system is more progressive than Latvia's.([51]).

Other characteristics of the social protection system (in-kind transfers, legal / contractual protections) are also likely to affect the relative importance of income for material deprivation. Generally speaking, a social protection system that 'de-commodifies' to a greater extent weakens the link between income and material deprivation (Esping-Andersen 1990). Indeed, public services in kind

([50]) We do not test for the statistical significance of the differences in Table 3. Given that these are either national level estimates, or sub-group estimates comprising at least 10 percent of the national sample, we expect that large differences (such as that between the AME of Latvia and the AMEs of Lithuania and Estonia) are statistically significant.

([51]) A more progressive transfer system may have a higher share of the population not receiving any transfers, as long as those not receiving transfers are those at low risk of deprivation, and if those at high risk of deprivation (also) receive more generous transfers. Finally, a progressive transfer system compresses resource distribution and thereby reduces inequalities in living standards.

bring down material deprivation, by reducing personal and household costs of services (Aaberge, Langørgen and Lindgren, 2017). Thus, an alternative hypothesis to explain the difference in AME would be that the other, non-cash, dimensions of Lithuania's social protection system are more inclusive. European social spending statistics([52]) suggest that differences in in-kind social spending may indeed play a role, with Lithuania's social spending on in-kind goods and services being much higher than in Latvia: Lithuania and Estonia spend respectively 1 116 and 1 069 (in purchasing power standard per head) on in-kind social benefits, while Latvia spends only 792.([53])

A similar argument holds for the pro-poorness of any government interventions which can impact on costs or income, including economic policy. In countries that systematically assess policies on their inclusiveness, particularly with respect to their more vulnerable groups, one would expect to find a weaker relationship between income and material deprivation. Cross-national differences in the collection and preparation of the EU-SILC data, however, as opposed to 'real' factors, may also play a role.

([52]) See Eurostat table spr_exp_ppsh
([53]) Available in Eurostat's social spending database at https://ec.europa.eu/eurostat/web/social-protection/data/database.

Table 3: Comparison results for the Baltic States, impacts and determining factors

	Estonia	Lithuania	Latvia
AME, average national reduction in deprivation count	-0.010	-0.013	-0.022
Deprivation distribution			
-Average number of deprivations	1.6	3.1	3.2
-Percentage of zero deprivations	43.9	21.5	24.3
-Percentage of five or more deprivations	9.9	28.5	28.7
Income coefficient	-0.093	-0.078	-0.134
Population share of transfer recipients			
-Not receiving any transfers	11.7	18.7	13.2
-Receiving only pension transfers	20.1	21.1	20.1
-Receiving only non-pension transfers	54.4	46.2	44.8
-Receiving both pension and non-pension transfers	13.8	14.0	21.9
Median transfer received			
-Receiving only pension transfers	5 764	5 027	4.29
-Receiving only non-pension transfers	829	924	620
-Receiving both pension and non-pension transfers	4 142	4.04	3 134
AME, by transfer recipients			
-Not receiving any transfers	-0.008	-0.011	-0.020
-Receiving only pension transfers	-0.012	-0.014	-0.024
-Receiving only non-pension transfers	-0.010	-0.013	-0.022
- Receiving both pension and non-pension transfers	-0.012	-0.014	-0.024
Difference with national AME, by transfer recipients			
-Not receiving any transfers	0.0023	-0.0020	-0.0027
-Receiving only pension transfers	-0.0018	0.0012	0.0014
-Receiving only non-pension transfers	0.0006	0.0000	0.0007
-Receiving both pension and non-pension transfers	-0.0016	0.0009	0.0018

NB: Authors' estimations. Unit of analysis: individuals. In adult equivalent amounts (modified OECD scale (hx050)) and expressed in PPS values (using PPP updated from Eurobase February 2017). AMEs of those not receiving any transfers and those receiving transfers are statistically significant in all Baltic States; AMEs of pension and non-pension recipients are smaller but still statistically significant, whereas differences between the two groups receiving pensions are not statistically significant.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

4.4 Effects on the EU material deprivation rate and social spending

Earlier analyses in this paper already showed that a universal transfer had the largest impact on those experiencing the highest number of deprivations. Here we show what this implies for the EU's official material deprivation rate, which counts persons as deprived if they have five or more deprivations. We also expand the idea of a relatively small transfer into various policy options, with varying transfer amounts (150 and 1500 Euro) and various designs in terms of coverage.

A 150 Euro universal transfer would have virtually no effect on the material deprivation rates in Europe's richest countries, but in other countries, rates could decrease from 0.08 percentage points in the United Kingdom to 1.04 percentage points in Romania (Figure 12A). The transfer would reduce the number of materially deprived Europeans (EU only) by about 876 000 persons (Table A11).

A scaled up universal transfer of 1 500 Euro would lead to close to proportionate decreases in the EU's official material deprivation rate, with reductions from close to one percentage point in the United Kingdom (figure 12B), up to five percentage points in Greece, Hungary and Bulgaria, and over 10 percentage points in Romania. In absolute numbers, the transfer would reduce the number of materially deprived persons (EU only) by about 8.6 million (Table A11).

In the scenario previously described, namely that of a small universal EU-wide transfer funded by a very small EU-wide tax on large(r) international capital transactions, the costs of such a scheme would amount to about one percent of average social spending in the EU zone (Figure 13), or close to 30 percent of the EU's 2015 budget. Expressed as a percentage of national social spending, the costs of such a transfer would be considerably larger for about half of those countries, reaching up to 3-3.5% for Latvia, Bulgaria and Romania.

Instead of a universal transfer, the costs of targeted transfer schemes designed to reach those with at least either one or five deprivations would be lower (Figure 13). At the EU level, the costs of a scheme targeted at persons with at least one deprivation amounts to about 0.57 percent of current social spending. The costs of a scheme targeted at those experiencing five or more deprivations would be 0.18 percent. In terms of the EU's 2015-budget, the costs of the targeted schemes would be respectively 16.4 and 5 percent (relative to 30 percent for the universal scheme).

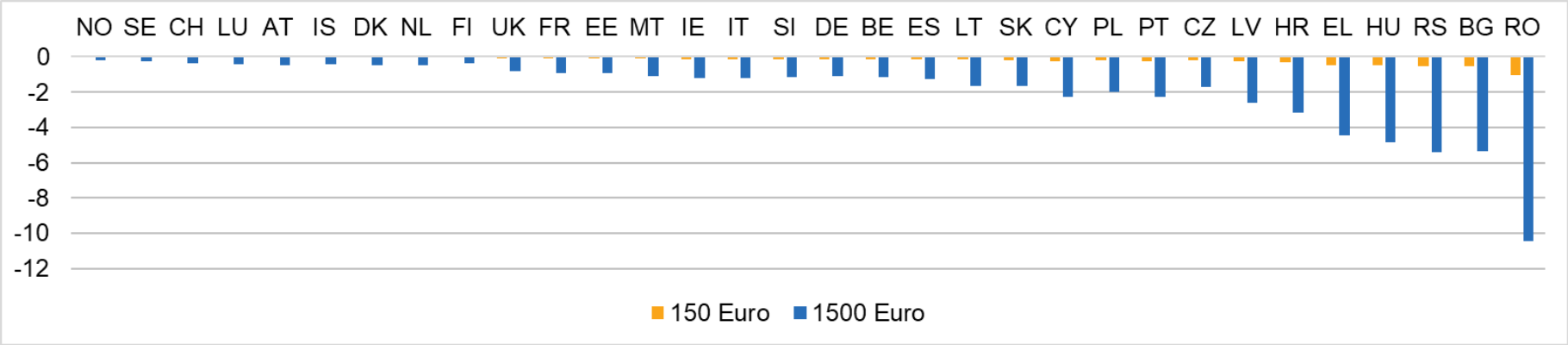
Cost differences between universal and targeted schemes depend on the average living standard of the country. In countries with higher living standards and thus fewer people experiencing high deprivation, the cost differences between the universal and targeted schemes are much larger than for countries with lower living standards.

The calculations in this section are only rudimentary, and serve to illustrate what types of analyses become feasible with the methodology developed in this paper. We assumed, for instance, that the programme delivery costs of a universal scheme would be 5 percent of total programme expenditure, whereas they would be 15 percent for both targeted schemes, as a targeted programme is more costly administratively. The administrative capacity and thus costs would most likely vary by country (Notten & Gassmann, 2008). We further made the rather implausible assumption that countries' administrations would accurately identify their residents' deprivation status. A failure of the assumption has implications for both the estimated programme costs and effects on material deprivation (Notten & Gassmann, 2008).

It is also important to keep in mind that the analysis makes the assumption that there are no behavioural changes, i.e. transfer recipients make the same choices (with respect to work, care, spending) with or without social transfers.

Figure 12A: Reduction in material deprivation rate after 150 Euro (PPS) transfer
(percentage points)

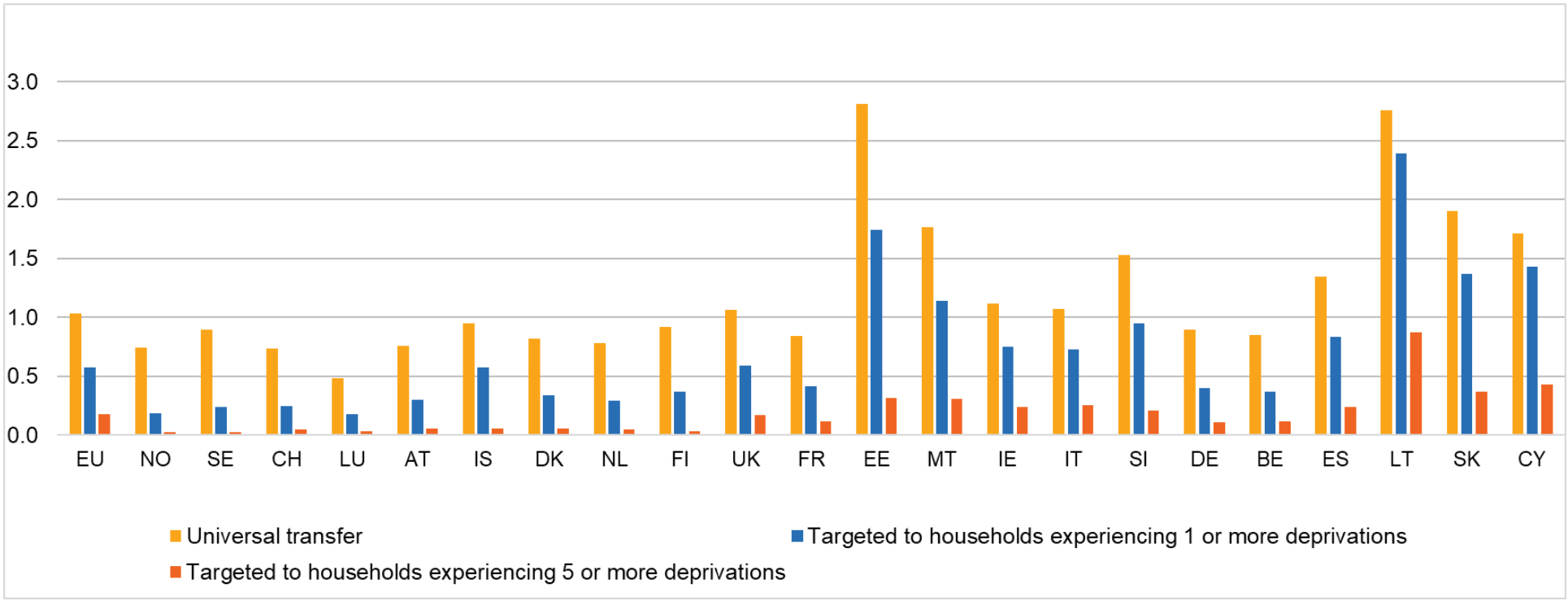
Figure 12B: Reduction in material deprivation rate after 150 and 1 500 Euro (PPS) transfer
(percentage points)



NB: Authors' estimations. Ranked from lowest to highest national AME (expressed in average number of deprivations). Unit of analysis: individuals. Counting persons as materially deprived when they have five or more deprivations. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Figure 13: Transfer spending as a percentage of total social spending

(%)



NB: Authors' estimations. Ranked from lowest to highest national AME. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017; Population (2015) and social spending statistics (2014) available on the Eurostat website.

5 Conclusion

The population at risk of poverty or social exclusion has not decreased sufficiently to meet the 2020 target in EU countries. It is therefore important to evaluate the role and effectiveness of the policies adopted to combat income poverty and social exclusion in Europe. This paper developed an approach to estimate the effects of transfers on material deprivation, using the 32 countries present in the EU-SILC and the new indicator of material and social deprivation agreed at the EU level in 2017 (see Guio et al., 2017). It thereby developed an addition to established methods, using income to evaluate the impact of social transfers on income poverty. The approach has broader applicability, suiting social indicators whose scaling has similar properties, such as housing deprivation indicators.

Building on previous research, this paper offers significant new methodological insights, by carrying out a systematic performance comparison of three count data models and two ordered regression models to predict the material deprivation distribution (Notten, 2015; Notten and Guio, 2016). First, the more complex zero-inflated negative binomial model consistently outperforms other count data models. With its ability to distinguish between two sub-populations, one comprising persons with a positive deprivation risk and another with a (by approximation) zero deprivation risk, the model is better able to reproduce the observed deprivation distribution. Second, ordered logit models systematically outperform the zero-inflated negative binomial model. The generalized ordered logit model, with variable slopes varying by deprivation level when needed, performs, on average, somewhat better than the ordered logit model, but its estimation posed various computational and analytical challenges in this cross-national comparative research. The paper also reveals promising avenues for further research. It suggests that (generalized) ordered regression models could perform better when grouping together individuals with similar, although not identical, levels of deprivation, i.e. using a simplified deprivation scale (from 14 values to a smaller number). It also suggests there is scope for improving the model specification, particularly at the country level, or performing a smaller cross-national comparison of more similar countries.

Subsequently, we used the ordered regression model to calculate the impact of a small income transfer (150 Euro PPS) across all 32 EU-SILC countries. We find that the impact of social transfers on material deprivation is higher at lower levels of income, an effect that can be observed both within and across countries; this underlines the importance of a progressive social transfer system, and progressive policies more generally. However, comparing countries with a similar deprivation distribution, we regularly find substantive cross-national differences in average impact. To investigate the role of national social transfer systems, we subsequently analysed where a modest increase in social transfers would have the largest effect on reducing material deprivation. Our findings suggest that households receiving non-pension transfers would benefit from, on average, the largest decrease in material deprivation in the population. In many Eastern European countries, receivers of pension transfers would also experience above population average reductions in material deprivation. An analysis of the Baltic States suggests that the progressive nature of the national social transfer system must play a role as well. The universal 150 Euro (PPS) transfer would reduce the number of persons with five or more deprivations in the EU by 876 000, whereas a 1 500 Euro transfer would reduce that number by 8.6 million. The costs of such an expansion in social spending are modest when expressed as a share of average social spending in the EU, but they are

considerable for EU Member States with lower spending levels and would represent a large investment in terms of the EU's current budget.

Concluding, this paper is the first to offer population-level impact estimates of social transfers on material deprivation for 32 European countries, using reasonably comparable data (the best available) and using a reasonably comparable estimation methodology.([54]) It represents significant methodological progress in developing and testing available tools to measure the impacts of a very influential policy instrument in Europe's societies on a social and politically valued aspect of people's well-being. Further research can expand on this new knowledge by testing the tools in settings expected to yield more accurate impact estimates (i.e. as part of microsimulation models such as Euromod) and/or in settings where there is scope for establishing a better counterfactual using advanced regression-based analyses of treatment effects, such as the difference in difference and regression discontinuity models. Our research also highlights the importance of continuous efforts to improve the EU-SILC data to capture differences in national contexts, while also making progress on cross-national comparability. Without such improvements, we cannot expect to make progress in our understanding of the role of a country's policies on the well-being of its residents.

[54] The numerous technical footnotes in the methodology section illustrate clearly the data, measurement and methodological challenges routinely faced by analysts carrying out cross-national comparative research.

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Annexes

Table A1: Number (and %) of observations used in analysis

	in database	in material deprivation	in regression	in prediction	in prediction and receiving transfers (%):				
	(number)	count (%)	(%)	(%)	Total transfers	Non-pension transfers	Pensions	Social insurance	Household transfers
Belgium	14 209.0	99.2	97.8	99.0	86.4	67.6	25.0	30.3	54.8
Bulgaria	12 031.0	99.3	98.1	99.1	87.7	58.6	51.5	43.9	32.6
Czechia	17 714.0	100.0	99.3	100.0	68.1	38.2	39.5	24.8	17.8
Denmark	13 969.0	99.5	98.5	99.0	96.2	95.5	24.6	90.6	53.1
Germany	26 290.0	96.0	94.7	95.8	78.0	50.9	32.7	17.7	43.6
Estonia	14 558.0	99.0	98.1	98.9	91.0	70.8	37.9	48.2	51.4
Ireland	13 793.0	77.4	75.5	76.2	70.1	64.6	20.1	30.2	57.6
Greece	34 465.0	99.3	98.1	99.1	65.4	28.9	45.5	8.7	22.9
Spain	32 380.0	99.0	98.3	99.0	68.6	44.8	33.5	38.5	8.3
France	26 645.0	96.6	94.5	95.5	81.5	61.4	31.5	22.8	53.1
Croatia	17 177.0	98.3	97.2	98.3	72.8	43.9	43.7	25.2	24.9
Italy	42 987.0	100.0	99.1	100.0	74.7	48.4	38.9	27.7	32.5
Cyprus	11 966.0	100.0	98.9	100.0	77.4	52.6	30.9	26.2	36.5
Latvia	13 923.0	97.9	96.5	97.5	86.5	63.5	46.7	38.0	49.0
Lithuania	11 015.0	98.7	97.8	98.5	81.9	53.9	46.5	43.8	20.3
Luxembourg	8 767.0	99.8	98.3	99.6	83.7	64.4	28.7	16.7	54.1
Hungary	18 682.0	97.7	95.1	95.8	84.5	59.5	39.2	25.5	49.9
Malta	11 252.0	99.2	98.2	99.2	88.1	86.7	37.6	26.7	75.9
Netherlands	23 338.0	99.1	98.2	98.9	84.6	68.3	29.2	20.3	54.2
Austria	13 213.0	99.8	98.9	99.8	84.6	61.4	32.9	26.8	51.4
Poland	33 652.0	92.0	88.8	89.8	61.0	31.3	40.7	15.4	20.3

NB: Authors' estimations. Unit of analysis: individuals. Analysis excludes observations with missing values for regression variables and individuals living in households classified as "Other (these household are excluded from Laeken indicators calculation)" in variable "Household Type" (hx060).
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A1 (continued): Number (and %) of observations used in analysis

	in database	in material deprivation	in regression	in prediction	in prediction and receiving transfers (%):				
	(number)	count (%)	(%)	(%)	Total transfers	Non-pension transfers	Pensions	Social insurance	Household transfers
Portugal	21 965.0	99.8	98.6	99.8	72.0	42.6	40.1	19.5	30.3
Romania	17 468.0	99.8	98.4	99.4	77.4	42.5	49.3	7.5	37.7
Slovenia	26 150.0	100.0	99.3	100.0	90.6	72.5	41.9	50.2	45.3
Slovakia	16 181.0	100.0	99.3	100.0	89.5	67.7	41.7	22.9	58.2
Finland	26 433.0	98.4	97.0	98.1	87.8	72.2	23.6	40.9	54.7
Sweden	14 250.0	95.8	94.6	95.1	84.4	75.1	28.3	42.6	47.9
United Kingdom	21 231.0	89.2	87.1	87.9	69.8	48.4	27.4	10.9	44.7
Iceland	8 608.0	94.9	93.9	94.7	70.9	58.3	26.9	20.4	50.4
Norway	15 700.0	97.0	95.7	96.4	87.7	75.4	25.5	50.8	52.7
Switzerland	17 164.0	87.8	85.2	86.2	70.5	53.3	22.4	9.7	49.3
Serbia	1 827.0	98.1	97.0	98.1	96.8	93.4	49.6	17.9	92.5

NB: Authors' estimations. Unit of analysis: individuals. Analysis excludes observations with missing values for regression variables and individuals living in households classified as "Other (these household are excluded from Laeken indicators calculation)" in variable "Household Type" (hx060).
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A2: Deprivation items, incidence, by country

(%)

	Holidays	Furniture	Arrears	Meat	Unexpected expenses	Getting around	Clothes	Friends	Leisure	Pocket money	Warm	Shoes	Internet
Belgium	26.4	16.0	6.9	5.1	25.7	6.6	8.5	11.4	13.9	12.2	5.2	2.3	3.0
Bulgaria	60.4	67.7	33.6	36.8	53.5	24.1	40.8	26.0	31.1	37.2	39.2	49.7	16.5
Czechia	32.4	45.2	4.5	11.4	36.0	8.6	6.7	2.3	6.6	8.4	5.0	1.3	3.2
Denmark	15.8	10.9	6.3	1.6	25.8	9.3	5.2	2.9	5.5	5.9	3.2	1.7	1.0
Germany	19.2	15.2	5.2	6.8	29.9	7.0	5.5	13.2	12.0	12.2	4.0	1.7	3.3
Estonia	32.0	32.1	9.3	5.0	36.8	12.0	7.3	5.1	6.0	8.0	2.0	1.4	2.8
Ireland	42.1	24.8	15.9	2.8	50.4	7.4	10.8	17.6	19.7	15.2	9.1	5.4	4.8
Greece	53.7	50.0	49.3	12.8	53.4	10.3	2.1	20.0	29.7	47.5	29.1	1.5	10.1
Spain	41.4	38.7	11.7	2.6	39.7	5.8	6.0	7.7	16.2	14.1	10.5	1.4	5.8
France	23.7	23.4	9.0	7.1	32.5	2.4	9.2	5.4	14.1	16.4	5.5	5.7	1.9
Croatia	65.5	25.1	29.7	14.4	59.7	8.6	13.0	7.6	5.6	21.2	9.8	4.0	3.8
Italy	47.3	36.8	14.9	11.8	39.9	2.2	15.9	12.0	20.2	17.4	17.0	5.2	7.5
Cyprus	53.5	49.7	31.6	3.9	60.5	2.2	14.3	2.1	16.9	6.4	28.3	0.9	5.2
Latvia	41.0	50.1	18.1	16.0	60.5	21.7	26.5	8.2	17.3	14.5	14.6	19.2	7.3
Lithuania	44.3	48.7	9.7	14.3	53.4	13.0	22.3	17.1	28.5	19.6	30.8	0.6	7.0
Luxembourg	13.1	18.9	5.1	2.2	22.9	2.0	5.1	5.3	4.2	6.1	0.9	0.8	1.2
Hungary	56.5	47.8	22.0	24.2	72.5	20.3	28.2	35.8	32.1	25.4	9.7	3.7	9.4
Malta	44.0	21.7	10.7	12.9	20.9	3.0	6.3	10.3	17.0	21.8	13.8	9.3	2.6
Netherlands	16.5	21.6	5.8	2.1	22.7	7.2	3.6	2.6	6.8	4.8	2.8	1.2	0.8
Austria	17.4	10.4	6.4	6.8	22.6	5.8	4.4	5.3	11.4	6.8	2.6	0.6	1.5
Poland	43.5	27.4	10.8	8.0	41.9	9.0	10.4	10.5	19.2	13.2	7.5	1.5	3.9
Portugal	51.3	53.0	10.1	3.6	40.7	8.3	16.4	11.7	17.5	15.9	23.8	2.5	7.6
Romania	67.5	62.8	19.6	19.8	51.4	35.5	31.5	33.1	52.7	52.2	13.1	31.5	26.5
Slovenia	28.2	24.3	19.2	6.4	42.9	3.6	4.8	6.4	19.4	5.8	5.6	0.8	2.4

NB: Authors' estimations.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A2 (continued): Deprivation items, incidence, by country
(%)

	Holidays	Furniture	Arrears	Meat	Unexpected expenses	Getting around	Clothes	Friends	Leisure	Pocket money	Warm	Shoes	Internet
Slovakia	46.6	39.2	7.7	20.1	36.7	13.0	11.7	8.8	11.4	16.6	5.8	2.7	5.7
Finland	13.0	9.8	10.3	2.8	28.0	8.4	2.5	1.1	1.8	1.1	1.6	0.2	0.7
Sweden	8.4	4.2	5.6	1.6	18.3	2.7	1.3	1.0	3.6	4.3	1.0	0.6	0.7
United Kingdom	26.3	21.1	9.9	6.4	37.5	8.3	9.0	9.4	10.1	18.3	6.9	3.6	3.9
Iceland	4.4	14.9	15.4	4.5	36.4	3.1	4.6	10.6	16.0	11.1	1.5	0.7	2.4
Norway	5.2	6.2	5.7	2.2	16.6	4.1	2.5	2.1	2.6	2.8	0.5	0.6	0.4
Switzerland	8.4	10.5	8.4	1.4	20.7	5.5	4.2	3.6	9.3	7.0	0.6	0.6	1.4
Serbia	68.7	65.1	37.6	24.6	47.4	24.6	27.1	23.5	29.4	19.9	15.3	23.7	15.0

NB: Authors' estimations.
Source: EU-SILC 2015 cross-sectional data, version September 2017

Table A3: Income and social transfer definitions (source variables), mean annual
(Euros-PPS)

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU
Income definitions																
Total disposable income (hy020)	21 576	8 327	12 162	22 877	23 164	12 552	20 203	9 844	1 637	2 324	8 863	17 319	18 231	9 957	10 331	3 302
Total disposable income before social transfers (hy023)	15 304	6 283	9 157	16 794	16 468	9 979	1 936	6 336	11 693	15 927	6 292	11 945	13 507	7 670	7 935	23 345
Total disposable income before non-pension transfers (hy022)	1 887	7 623	11 296	19 925	20 923	11 553	16 576	9 456	14 851	21 081	7 928	1 625	16 458	9 226	942	29 654
Transfer definitions																
Total net transfers (hy020 - hy023)	7 279	2 368	4 594	6 295	8 436	2 914	6 848	5 342	699	8 707	3 577	723	6 353	2 635	2 945	11 554
Total net non-pension transfers (hy020-hy022)	4 029	1 128	2 057	3 081	3 926	1 462	4 236	1 184	3 369	3 328	2 015	2 113	3 175	1 086	1 506	5 227
Net pension & survivor transfers (hy022-hy023)	1 437	3 167	6 804	15 446	18 123	4 665	12 401	7 641	10 501	16 879	4 113	1 848	14 557	3 735	431	23 668
Gross social insurance transfers (py090g + py120g + py130g)	5 741	830	1 794	3 073	4 715	1 231	4 307	2 229	3 566	3 675	2 544	3 185	3 826	921	1 135	9 303
Gross household level transfers (hy050g + hy060g + hy070g)	2 062	885	1 859	1 258	2 503	934	2 326	699	1 733	2 258	1 024	630	1 538	700	1 309	3 752

NB: Authors' estimations. Unit of analysis: individuals. In adult equivalent amounts (modified OECD scale (hx050)) and expressed in PPS values (using PPP updated from Eurobase February 2017). The social insurance variables are first summed to the household level. Included in average income amounts are 1) observations with positive post-transfer income and 2) observations with negative or zero post-transfer income, included with an imputed income value of 1 Euro. Included in average transfer amounts are only observations with positive post-transfer income and whose transfer income is positive. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A3 (continued): Income and social transfer definitions (source variables), mean annual

(Euros-PPS)

	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	IS	NO	CH	RS
Income definitions																
Total disposable income (hy020)	8 559	18 638	21 842	24 461	11 412	12 191	4 989	15 774	10 578	21 461	21 021	21 308	23 261	28 609	30 887	5 684
Total disposable income before social transfers (hy023)	5 603	14 811	16 431	16 893	8 316	8 247	3 306	11 139	7 743	1 511	14 749	15 536	18 238	20 565	24 108	3 485
Total disposable income before non-pension transfers (hy022)	7 671	17 454	1 999	21 918	10 843	11 363	475	14 151	9 821	18 682	18 072	19 128	21 034	24 642	28 529	807
Transfer definitions																
Total net transfers (hy020 - hy023)	3 524	4 351	6 314	8 898	4 729	5 643	2 071	5 261	3 266	7 203	7 378	7 716	662	9 125	8 571	2 225
Total net non-pension transfers (hy020-hy022)	1 479	1 366	2 705	3 956	1 633	1 926	423	2 362	1 142	3 975	3 906	4 129	3 606	535	3 851	922
Net pension & survivor transfers (hy022-hy023)	5 837	7 966	12 278	15 488	5 933	9 527	3 676	8 797	573	13 693	14 071	13 621	11 812	158	2 244	3 108
Gross social insurance transfers (py090g + py120g + py130g)	1 109	1 402	6 559	3 952	2 185	3 322	1 417	2 238	158	449	2 835	4 211	5 754	6 021	7 739	2 163
Gross household level transfers (hy050g + hy060g + hy070g)	1 225	887	1 955	2 483	1 049	548	265	1 749	741	2 258	2 283	3 269	1 883	2 203	2 347	557

NB: Authors' estimations. Unit of analysis: individuals. In adult equivalent amounts (modified OECD scale (hx050)) and expressed in PPS values (using PPP updated from Eurobase February 2017). The social insurance variables are first summed to the household level. Included in average income amounts are 1) observations with positive post-transfer income and 2) observations with negative or zero post-transfer income, included with an imputed income value of 1 Euro. Included in average transfer amounts are only observations with positive post-transfer income and whose transfer income is positive. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

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TableA4: Social transfers, percentage of recipients
(%)

	Not receiving any transfers	Receiving:		
		Only pension transfers	Only non-pension transfers	Both pension and non-pension transfers
Belgium	14.0	19.0	61.0	6.0
Bulgaria	14.0	24.0	44.0	19.0
Czechia	35.0	23.0	34.0	9.0
Denmark	3.0	1.0	75.0	21.0
Germany	21.0	22.0	52.0	5.0
Estonia	12.0	20.0	54.0	14.0
Ireland	9.0	6.0	70.0	15.0
Greece	34.0	33.0	22.0	11.0
Spain	33.0	22.0	37.0	8.0
France	16.0	19.0	53.0	12.0
Croatia	28.0	26.0	32.0	15.0
Italy	26.0	24.0	38.0	13.0
Cyprus	26.0	19.0	52.0	4.0
Latvia	13.0	20.0	45.0	22.0
Lithuania	19.0	21.0	46.0	14.0
Luxembourg	16.0	20.0	56.0	7.0
Hungary	16.0	24.0	47.0	12.0
Malta	12.0	1.0	55.0	32.0
Netherlands	14.0	18.0	56.0	12.0
Austria	15.0	21.0	52.0	12.0
Poland	35.0	31.0	23.0	12.0
Portugal	30.0	27.0	33.0	10.0
Romania	19.0	25.0	42.0	15.0
Slovenia	12.0	20.0	54.0	15.0
Slovakia	13.0	21.0	50.0	16.0
Finland	12.0	19.0	62.0	8.0
Sweden	15.0	18.0	56.0	11.0
United Kingdom	25.2	22.2	46.3	6.3
Iceland	24.0	14.0	48.0	13.0
Norway	12.0	14.0	62.0	13.0
Switzerland	21.0	18.0	55.0	6.0
Serbia	1.0	4.0	54.0	41.0

NB: Authors' estimations. All numbers are rounded to the nearest integer.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A5: Social transfers (alternative typology), percentage of recipients
(%)

	Total transfers	Non-pension transfers	Pensions	Social insurance	Household level transfers
Belgium	86.0	67.0	25.0	30.0	53.0
Bulgaria	86.0	63.0	43.0	47.0	35.0
Czechia	65.0	42.0	32.0	26.0	21.0
Denmark	97.0	96.0	22.0	92.0	56.0
Germany	79.0	57.0	27.0	19.0	50.0
Estonia	88.0	68.0	34.0	45.0	49.0
Ireland	92.0	86.0	21.0	42.0	75.0
Greece	66.0	33.0	43.0	9.0	27.0
Spain	67.0	45.0	30.0	39.0	8.0
France	84.0	65.0	31.0	25.0	56.0
Croatia	72.0	46.0	40.0	25.0	29.0
Italy	74.0	51.0	37.0	29.0	34.0
Cyprus	74.0	56.0	23.0	27.0	40.0
Latvia	87.0	67.0	42.0	40.0	52.0
Lithuania	81.0	60.0	35.0	47.0	28.0
Luxembourg	84.0	64.0	28.0	17.0	54.0
Hungary	84.0	60.0	36.0	25.0	49.0
Malta	88.0	87.0	33.0	27.0	76.0
Netherlands	86.0	68.0	30.0	20.0	56.0
Austria	85.0	64.0	33.0	32.0	53.0
Poland	65.0	35.0	43.0	17.0	22.0
Portugal	70.0	43.0	37.0	19.0	30.0
Romania	81.0	56.0	40.0	7.0	53.0
Slovenia	88.0	69.0	35.0	48.0	43.0
Slovakia	87.0	66.0	36.0	21.0	58.0
Finland	88.0	70.0	26.0	40.0	54.0
Sweden	85.0	76.0	29.0	44.0	47.0
United Kingdom	75.0	53.0	29.0	12.0	48.0
Iceland	76.0	62.0	28.0	21.0	54.0
Norway	88.0	74.0	27.0	51.0	49.0
Switzerland	79.0	61.0	24.0	14.0	56.0
Serbia	99.0	95.0	45.0	16.0	95.0

NB: Authors' estimations. All numbers are rounded to the nearest integer.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A6: Social transfers, median annual
(Euros PPS)

	Receiving:		
	Only pension transfers	Only non-pension transfers	Both pension and non-pension transfers
Belgium	14 197.0	2 426.0	12 614.0
Bulgaria	3 705.0	920.0	2 556.0
Czechia	7 741.0	1 680.0	6 678.0
Denmark	23 142.0	1 233.0	14 855.0
Germany	16 587.0	2 176.0	10 320.0
Estonia	5 764.0	829.0	4 142.0
Ireland	12 933.0	3 111.0	12 368.0
Greece	7 116.0	517.0	5 729.0
Spain	10 000.0	2 122.0	9 142.0
France	16 926.0	2 454.0	13 951.0
Croatia	4 016.0	1 529.0	3 838.0
Italy	12 184.0	1 139.0	9 379.0
Cyprus	10 038.0	1 472.0	8 775.0
Latvia	4 290.0	620.0	3 134.0
Lithuania	5 027.0	924.0	4 040.0
Luxembourg	25 334.0	3 355.0	16 978.0
Hungary	6 497.0	1 086.0	3 871.0
Malta	8 518.0	659.0	8 479.0
Netherlands	15 796.0	1 086.0	9 311.0
Austria	18 489.0	2 703.0	10 709.0
Poland	6 046.0	1 357.0	4 277.0
Portugal	7 738.0	779.0	5 661.0
Romania	3 498.0	184.0	1 835.0
Slovenia	10 471.0	1 493.0	6 916.0
Slovakia	7 356.0	460.0	4 349.0
Finland	14 904.0	2 976.0	12 406.0
Sweden	15 579.0	2 522.0	10 851.0
United Kingdom	12 149.0	1 672.0	11 838.0
Iceland	14 265.0	1 815.0	6 483.0
Norway	20 153.0	2 135.0	16 882.0
Switzerland	18 490.0	1 948.0	13 431.0
Serbia	2 908.0	567.0	3 063.0

NB: Authors' estimations. Unit of analysis: individuals. In adult equivalent amounts (modified OECD scale (hx050)) and expressed in PPS values (using PPP updated from Eurobase, February 2017). Social insurance variables are first summed to the household level. Included are observations with positive post-transfer income and whose transfer income is positive.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A7: Control variables – dummies, percentage (source variables)

(%)

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU
Self-perceived health is bad or very bad and/or limitation in activities because of health problems (ph010 and ph030, at least one member aged 15+)	37.0	36.0	28.0	30.0	31.0	47.0	29.0	39.0	40.0	37.0	58.0	42.0	35.0	55.0	42.0	42.0	42.0
Debt payment is a heavy financial burden (hs150)	10.0				4.0		11.0	16.0	11.0	10.0	27.0	8.0	39.0			15.0	
Debt payment is a slight financial burden (hs150)	8.0	12.0	15.0	13.0	14.0	28.0	17.0	12.0	9.0	8.0	11.0	7.0	9.0	17.0	10.0	20.0	21.0
Housing costs are a heavy financial burden (hs140)	30.0		24.0	9.0	14.0	20.0	36.0	47.0	58.0	26.0	61.0	58.0	72.0	31.0	31.0	34.0	32.0
Housing costs are a slight burden (hs140)	32.0	95.0	67.0	30.0	59.0	58.0	53.0	49.0	39.0	23.0	34.0	41.0	21.0	50.0	56.0	44.0	58.0
At least one adult member has another country of birth (pb210, at least one member aged 17+)	13.0	X	2.0	7.0	15.0	21.0	7.0	9.0	11.0	11.0	17.0	10.0	16.0	22.0	9.0	16.0	X
Household with dependent children (hx060)	53.0	50.0	50.0	47.0	42.0	50.0	63.0	48.0	50.0	51.0	54.0	49.0	58.0	51.0	51.0	55.0	49.0
Low work intensity household (rx050)	13.0	X	6.0	9.0	8.0	6.0	17.0	16.0	15.0	7.0	14.0	11.0	11.0	X	X	6.0	X
Self-reported labour market status (pl031, at least one member aged 17+)																	
- At least one adult member is unemployed	12.0	X	12.0	7.0	7.0	10.0	15.0	32.0	32.0	13.0	35.0	19.0	29.0	15.0	15.0	9.0	X
- At least one adult member is retired	26.0	38.0	30.0	22.0	26.0	28.0	15.0	40.0	25.0	28.0	50.0	29.0	21.0	36.0	29.0	26.0	34.0

NB: Authors' estimations. Unit of analysis: individuals. All numbers are rounded to the nearest integer.Cells marked with X indicate that variable is omitted due to low variation in variable (i.e. cell size below 100 within either the sub-population with zero deprivations or the sub-population with one or more deprivations). For the same reason we have merged categories of financial burden of debt and housing costs for certain countries (identifiable by merged cells in above table). See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A7 (continued): Control variables – dummies (source variables)

(%)

	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	IS	NO	CH	RS
Self-perceived health is bad or very bad and/or limitation in activities because of health problems (ph010 and ph030, at least one member aged 15+)	15.0	29.0	50.0	44.0	56.0	42.0	30.0	52.0	29.0	13.0	35.0	18.0	16.0	44.0	44.0
Debt payment is a heavy financial burden (hs150)				8.0			13.0	10.0	5.0		8.0			6.0	23.0
Debt payment is a slight financial burden (hs150)	13.0	9.0	14.0	12.0	17.0	10.0	21.0	8.0	24.0	15.0	16.0	39.0	12.0	9.0	8.0
Housing costs are a heavy financial burden (hs140)	33.0	10.0	14.0	61.0	36.0		32.0	30.0	20.0	6.0	24.0	24.0	5.0	25.0	71.0
Housing costs are a slight financial burden (hs140)	55.0	34.0	56.0	35.0	51.0	96.0	56.0	59.0	55.0	27.0	42.0	52.0	34.0	58.0	27.0
At least one adult member has another country of birth (pb210, at least one member aged 17+)	11.0	15.0	17.0	1.0	10.0	X	16.0	X	4.0	16.0	14.0	7.0	6.0	17.0	11.0
Household with dependent children (hx060)	52.0	50.0	47.0	57.0	51.0	56.0	55.0	56.0	45.0	47.0	49.0	60.0	47.0	46.0	56.0
Low work intensity household (rx050)	8.0	8.0	7.0	7.0	11.0	X	8.0	X	8.0	6.0	10.0	X	6.0	5.0	20.0
Self-reported labour market status (pl031, at least one member aged 17+)															
- At least one adult member is unemployed	7.0	7.0	11.0	16.0	25.0	X	22.0	20.0	13.0	8.0	5.0	5.0	X	5.0	48.0
- At least one adult member is retired	25.0	17.0	34.0	35.0	34.0	40.0	37.0	33.0	24.0	23.0	23.0	12.0	18.0	21.0	51.0

NB: Authors' estimations. Unit of analysis: individuals. All numbers are rounded to the nearest integer. Cells marked with X indicate that the variable is omitted due to low variation in the variable (i.e. cell size below 100 within either the sub-population with zero deprivations or the sub-population with one or more deprivations). For the same reason we have merged categories of financial burden of debt and housing costs for certain countries (identifiable by merged cells in above table). See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A8: Control variables – categorical variables (source variables)

(%)

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU
Tenure status (hh021)																
Outright owner	29.0	82.0	60.0	14.0	26.0	62.0	35.0	61.0	47.0	33.0	85.0	56.0	53.0	70.0	81.0	30.0
Owner paying mortgage	43.0		18.0	49.0	27.0	20.0	35.0	14.0	31.0	32.0	5.0	17.0	20.0	10.0		43.0
Tenant	29.0	18.0	22.0	37.0	48.0	18.0	31.0	25.0	22.0	36.0	10.0	27.0	27.0	20.0	19.0	27.0
Number of adults (rx020)																
1	20.0	14.0	15.0	28.0	26.0	20.0	51.0	12.0	13.0	23.0	11.0	16.0	10.0	18.0	22.0	17.0
2	56.0	45.0	55.0	61.0	59.0	52.0	41.0	51.0	52.0	63.0	40.0	50.0	54.0	47.0	47.0	54.0
3+	23.0	41.0	31.0	11.0	15.0	27.0	7.0	37.0	35.0	15.0	50.0	34.0	36.0	35.0	31.0	29.0
Number of dependent children (rx020)																
0	54.0	56.0	57.0	56.0	64.0	55.0	42.0	58.0	56.0	53.0	54.0	59.0	51.0	55.0	56.0	53.0
1	17.0	23.0	19.0	16.0	15.0	21.0	18.0	17.0	21.0	17.0	19.0	20.0	21.0	23.0	21.0	19.0
2	19.0	17.0	19.0	20.0	16.0	18.0	24.0	18.0	19.0	21.0	18.0	17.0	20.0	16.0	18.0	22.0
3+	10.0	5.0	5.0	8.0	6.0	6.0	16.0	6.0	5.0	9.0	10.0	5.0	9.0	6.0	6.0	7.0
Highest level of education attained by member (age 15+) with highest education (pe040)																
Post-secondary/Tertiary	53.0	33.0	30.0	48.0	63.0	54.0	67.0	48.0	46.0	42.0	30.0	31.0	55.0	54.0	69.0	42.0
Upper secondary	32.0	67.0	70.0	41.0	33.0	37.0	18.0	31.0	23.0	45.0	60.0	41.0	32.0	46.0	31.0	37.0
Lower secondary or below	15.0			11.0	5.0	9.0	15.0	20.0	31.0	13.0	11.0	29.0	13.0			21.0
Region (db040)																
1	11.0	50.0	12.0	100.0	100.0	100.0	100.0	36.0	9.0	18.0	100.0	27.0	100.0	100.0	100.0	100.0
2	58.0	50.0	12.0					11.0	10.0	16.0		23.0				
3	32.0		12.0					29.0	14.0	8.0		11.0				
4			11.0					25.0	12.0	10.0		19.0				
5			14.0						29.0	16.0		20.0				
6			16.0						22.0	11.0						
7						12.0					4.0		11.0			
8						12.0							10.0			

NB: Authors' estimations. Unit of analysis: individuals. All numbers are rounded to the nearest integer. Cells marked with X indicate that the variable is omitted due to low variation in the variable (i.e. cell size below 100 within either the sub-population with zero deprivations or the sub-population with one or more deprivations). For the same reason we have merged categories of tenure status and education for certain countries (identifiable by merged cells in above table). See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A8 (continued): Control variables – categorical variables, percentage (source variables)

(%)

	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	IS	NO	CH	RS
Tenure status (hh021)																
Outright owner	68.0	60.0	8.0	30.0	72.0	38.0	X	65.0	78.0	30.0	68.0	27.0	14.0	21.0	44.0	80.0
Owner paying mortgage	19.0	21.0	61.0	26.0	11.0	37.0	X	11.0	11.0	43.0		37.0	64.0	62.0		
Tenant	14.0	19.0	32.0	44.0	17.0	25.0	X	24.0	11.0	27.0	32.0	37.0	22.0	17.0	56.0	20.0
Number of adults (rx020)																
1	17.0	12.0	20.0	20.0	16.0	12.0	12.0	14.0	10.0	23.0	25.0	20.0	18.0	28.0	36.0	10.0
2	48.0	47.0	63.0	53.0	45.0	52.0	42.0	50.0	41.0	65.0	63.0	66.0	57.0	60.0	51.0	36.0
3+	35.0	41.0	17.0	28.0	39.0	37.0	46.0	36.0	50.0	11.0	12.0	14.0	25.0	11.0	13.0	54.0
Number of dependent children (rx020)																
0	58.0	53.0	55.0	59.0	50.0	56.0	51.0	55.0	53.0	58.0	56.0	53.0	46.0	56.0	58.0	52.0
1	19.0	26.0	15.0	18.0	23.0	25.0	23.0	19.0	21.0	14.0	16.0	18.0	18.0	14.0	16.0	21.0
2	15.0	16.0	20.0	16.0	20.0	16.0	17.0	20.0	19.0	17.0	19.0	20.0	22.0	19.0	19.0	21.0
3+	8.0	5.0	11.0	8.0	8.0	4.0	9.0	6.0	7.0	11.0	9.0	9.0	15.0	10.0	8.0	6.0
Highest level of education attained by member (age 15+) with highest education (pe040)																
Post-secondary/Tertiary	41.0	41.0	50.0	46.0	43.0	29.0	28.0	45.0	40.0	51.0	52.0	49.0	56.0	50.0	49.0	37.0
Upper secondary	59.0	22.0	38.0	44.0	51.0	27.0	43.0	49.0	60.0	38.0	36.0	29.0	30.0	36.0	43.0	63.0
Lower secondary or below		37.0	13.0	10.0	6.0	45.0	29.0	6.0		11.0	13.0	22.0	15.0	14.0	7.0	
Region (db040)																
1	29.0	100.0	100.0	44.0	21.0	100.0	25.0	100.0	100.0	26.0	39.0	72.0	100.0	100.0	100.0	100.0
2	31.0			20.0	19.0		31.0			29.0	44.0	12.0				
3	40.0			37.0	18.0		27.0			21.0	18.0	5.0				
4					16.0		18.0			24.0		8.0				
5					10.0							3.0				
6					16.0											

NB: Authors' estimations. Unit of analysis: individuals. All numbers are rounded to the nearest integer. Cells marked with X indicate that the variable is omitted due to low variation in the variable (i.e. cell size below 100 within either the sub-population with zero deprivations or the sub-population with one or more deprivations). For the same reason categories of tenure status and education are merged for certain countries (identifiable by merged cells in above table). See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A9: Regression results of Zero-inflated negative binomial (ZINB), selected countries

	Austria	Czechia	Italy	Bulgaria
Count model (negative binomial):				
Income (in 1 000s Euro PPS)	-0.019*	-0.080***	-0.026***	-0.057***
Health problem	0.125*	0.183***	0.137***	0.098***
Debt is a heavy burden			0.186***	
Debt is f a slight burden	0.151*	0.148***	-0.111*	-0.007
Housing costs are a heavy burden	0.908***	0.734***	0.571***	
Housing costs are a slight burden	0.310**	0.264*		0.378***
Outright owner	Reference	Reference	Reference	Reference
Owner paying mortgage	-0.252*	0.151**	0.123***	
Tenant	0.147	0.208***	0.271***	0.027
≥ 1 adult has another country of birth	0.101	-0.067	0.202***	X
Household with dependent children	0.024	-0.057	-0.064*	-0.087*
Number of adults in household	-0.058	-0.002	0.003	-0.022
Number of children in household	-0.006	0.01	0.017	0.059***
Post-secondary/tertiary	Reference	Reference	Reference	Reference
Upper secondary	0.280***	0.177***	0.160***	0.363***
Lower secondary or below	0.407***		0.320***	
Low work intensity household	0.239**	0.185***	0.155***	X
≥ 1 adult is unemployed	0.241**	0.182***	0.215***	X
≥ 1 adult is retired	0.027	-0.014	-0.107***	-0.065**
Region 1	Reference	Reference	Reference	Reference
Region 2	0.008	-0.115	0.210***	0.024
Region 3	0.006	-0.191**	0.004	
Region 4		-0.062	-0.128***	
Region 5		-0.332***	-0.048	
Region 6		-0.222***		
Region 7		-0.184**		
Region 8		-0.142*		
Alpha (ln)	-1.338***	-3.498***	-1.836***	-1.940***
Inflation model (logit):				
Income (in 1 000s Euro PPS)	0.060***	0.114***	0.053***	0.094***
Health problem	-0.693***	-0.244	-0.408***	-0.441*
Debt is a heavy burden			-1.273***	
Debt is a slight burden	-0.860***	-0.979***	-0.328*	-0.234
Housing costs are a heavy burden	-2.373***	-2.771***	-1.291***	
Housing costs are a slight burden	-0.543***	-0.984***	0.221	-1.814***
Outright owner	Reference	Reference	Reference	Reference
Owner paying mortgage	-0.569**	-0.380*	-0.245*	
Tenant	-0.827***	-0.860***	-0.569***	-0.077
≥ 1 adult has another country of birth	-0.374	-0.966*	-0.479**	X
Household with dependent children	0.376	0.262	0.175	0.411
Number of adults in household	0.094	-0.12	-0.028	0.107
Number of children in household	-0.122	-0.005	0.11	-0.165

Upper secondary	Reference	Reference	Reference	Reference
Post-secondary/tertiary	0.033	-0.742***	-0.434***	-0.995***
Lower secondary or below	-0.745**		-1.125***	
Low work intensity household	-0.381	-0.449	-0.125	X
≥ 1 adult is unemployed	-0.999**	-1.122**	-0.669***	X
≥ 1 adult is retired	0.29	-0.424**	0.093	-0.390*
Region 1	Reference	Reference	Reference	Reference
Region 2	-0.104	-0.149	-0.766***	-0.116
Region 3	0.157	0.031	-1.131***	
Region 4		-0.185	-0.225*	
Region 5		-0.3	-0.395***	
Region 6		-0.475*		
Region 7		-0.253		
Region 8		-0.167		
Observations	13 079	17 604	42 634	11 816

NB: Authors' estimations, using Stata (zinb). Zero inflated negative binomial (ZINB, p-values: p<0.10 *, p<0.05, ** p<0.01, ***). Countries ranked according to highest percentage of zero deprivations. Cells marked with X indicate that variable is omitted due to low variation in variable (i.e. cell size below 100 within either the sub-population with zero deprivations or the sub-population with one or more deprivations). For the same reason we have merged categories of variables for certain countries (identifiable by merged cells in above table). Interpretation income coefficient: a one-unit increase in income (1 000 Euro) reduces an individual's deprivation count by 0.019 while the other variables in the model are held constant. Note that the results displayed here are estimated using a top-coded dependent variable (replacing values above 10 deprivations with a value of 10). This simplification greatly reduces the scope for human error while comparing the battery of (post)estimation results for 5 estimators across 32 countries discussed in Section 3.5. For the results of our preferred estimator (the ordered logit model), reported in Table 1 and Section 4, we use the entire range of deprivation values (0-13).
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A10: Selected results Generalized ordered logit, selected countries

	Austria	Czechia	Italy	Bulgaria
Income coefficients (in 1 000s Euro PPS):				
Reference group 1	0.067	-0.0168***	-0.062***	-0.0178***
Reference group 2			-0.071***	
Reference group 3			-0.076***	
Reference group 4			-0.079***	
Reference group 5			-0.081***	
Reference group 6			-0.084***	
Reference group 7			-0.083***	
Reference group 8			-0.089***	
Reference group 9			-0.099***	
Reference group 10			-0.103***	
Threshold coefficients (constant):				
Reference group 1	-0.541*	0.491*	1.849***	2.511***
Reference group 2	-1.564***	-0.44	1.069***	1.809***
Reference group 3	-2.272***	-1.069***	-0.001	1.049***
Reference group 4	-2.937***	-1.864***	-0.597*	0.843***
Reference group 5	-3.531***	-2.483***	-1.577***	0.621*
Reference group 6	-4.126***	-2.967***	-2.598***	0.289
Reference group 7	-4.716***	-3.285***	-2.767***	0.006
Reference group 8	-5.243***	-4.057***	-3.145***	-0.082
Reference group 9	-6.027***	-4.708***	-3.203***	-0.393
Reference group 10	-6.791***	-6.453***	-3.854***	-0.893*
Observations	13 079	17 604	42 634	11 816

NB: Authors' estimations, using Stata (gologit2 using options autofit and iter(20)). Complete results available on request. Generalized ordered logit (GOLOGIT2, p-values: p<0.10 *, p<0.05, ** p<0.01, ***), relaxing the parallel slope assumption for all coefficients failing the parallel slop assumption at a five percent significance level. Countries ranked according to highest percentage of zero deprivations. Interpretation income coefficient: A one-unit increase in income (1 000 Euro) reduces an Austrian's ordered log-odds of having a higher level of material deprivation by 0.067 while the other variables in the model are held constant. Note that the results displayed here are estimated using a top-coded dependent variable (replacing values above 10 deprivations with a value of 10). This simplification greatly reduces the scope for human error while comparing the battery of (post)estimation results for five estimators across 32 countries.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Table A11: Reduction in the number of materially deprived persons (i.e. persons experiencing five or more deprivations), by universal transfers of 150 and 1 500 Euro PPS

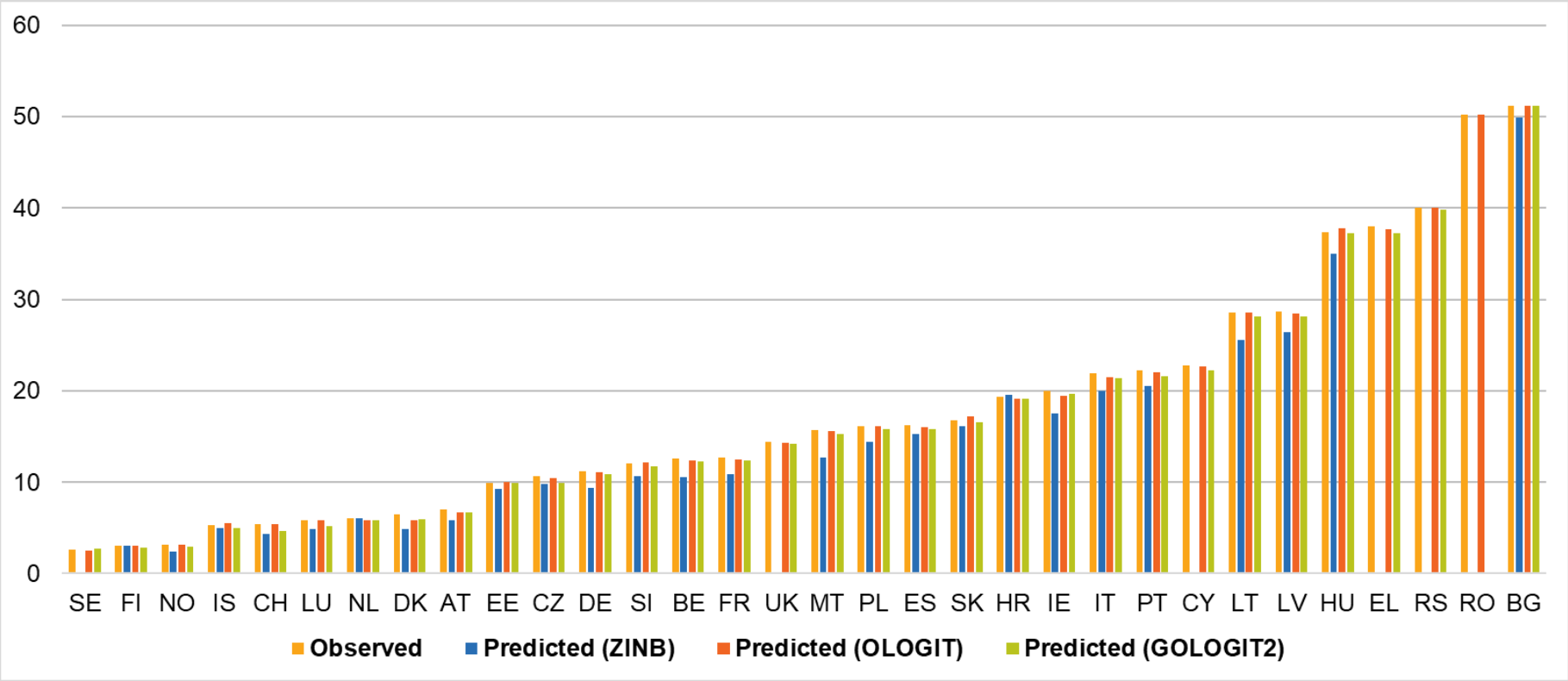
Transfer level	150 Euro	1 500 Euro
SE	-2 507	-24 162
LU	-245	-2 384
AT	-4 046	-39 465
IS	-139	-1 348
DK	-2 670	-25 934
NL	-8 050	-78 326
FI	-1 977	-18 909
UK	-54 362	-534 458
FR	-62 764	-612 978
EE	-1 245	-12 062
MT	-482	-4 711
IE	-5 679	-55 810
IT	-75 286	-742 295
SI	-2 399	-23 303
DE	-91 862	-888 550
BE	-13 464	-131 050
ES	-60 699	-593 436
LT	-4 890	-48 257
SK	-9 297	-90 205
CY	-2 005	-19 551
PL	-78 301	-752 587
PT	-24 190	-235 333
CZ	-19 392	-182 279
LV	-5 359	-52 572
EL	-49 454	-486 154
HU	-48 738	-477 280
BG	-38 491	-387 910
RO	-208 239	-2 084 306
EU total	-876 234	-8 605 615

NB: Authors' calculations. Ranked from lowest to highest national AME. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017. European population statistics retrieved from Eurostat website / Database under header Population and Social Conditions / Demography and Migration / Population Change in July 2019.

Table A12: Country acronyms

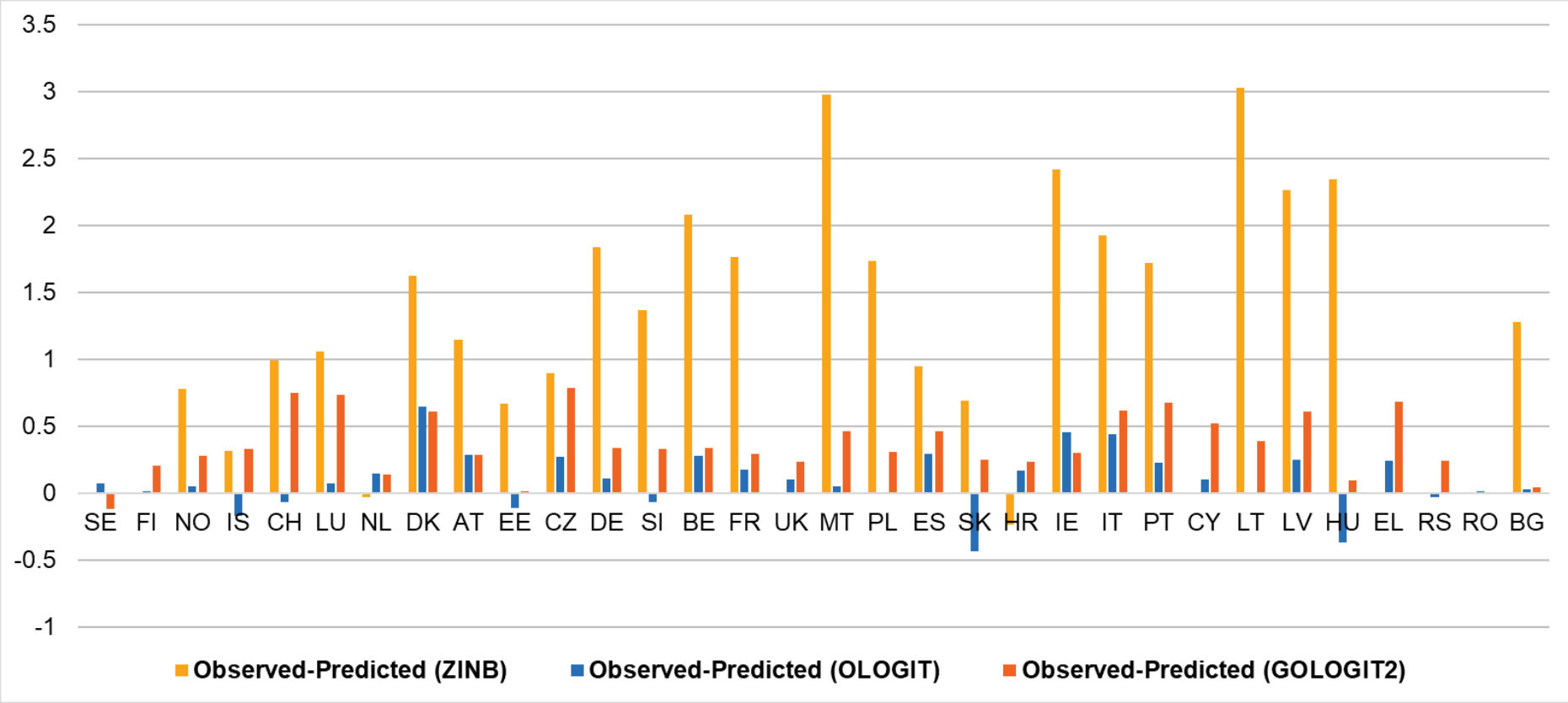
Name	Acronyms
Belgium	BE
Bulgaria	BG
Czechia	CZ
Denmark	DK
Germany	DE
Estonia	EE
Ireland	IE
Greece	EL
Spain	ES
France	FR
Croatia	HR
Italy	IT
Cyprus	CY
Latvia	LV
Lithuania	LT
Luxembourg	LU
Hungary	HU
Malta	MT
Netherlands	NL
Austria	AT
Poland	PL
Portugal	PT
Romania	RO
Slovenia	SI
Slovakia	SK
Finland	FI
Sweden	SE
United Kingdom	UK
Iceland	IS
Norway	NO
Switzerland	CH
Serbia	RS

Figure A1: Percentage of persons suffering from at least five deprivations, by estimator



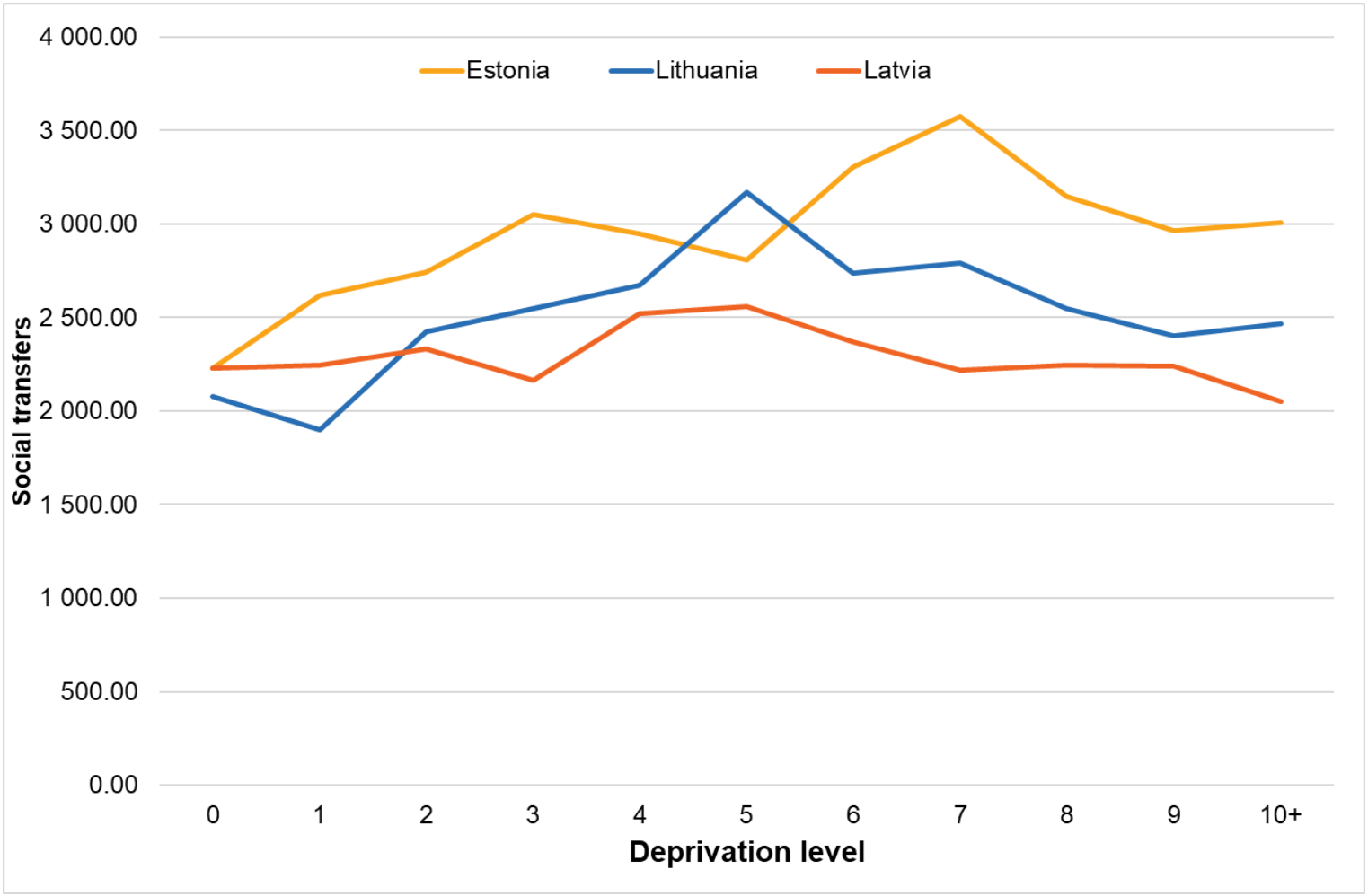
NB: Authors' calculations. Countries ranked according to the percentage of persons suffering from at least five deprivations (observed). Missing bars imply that the estimator does not converge. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Figure A2: Percentage point deviation from observed proportion of people suffering from at least five deprivations, by estimator



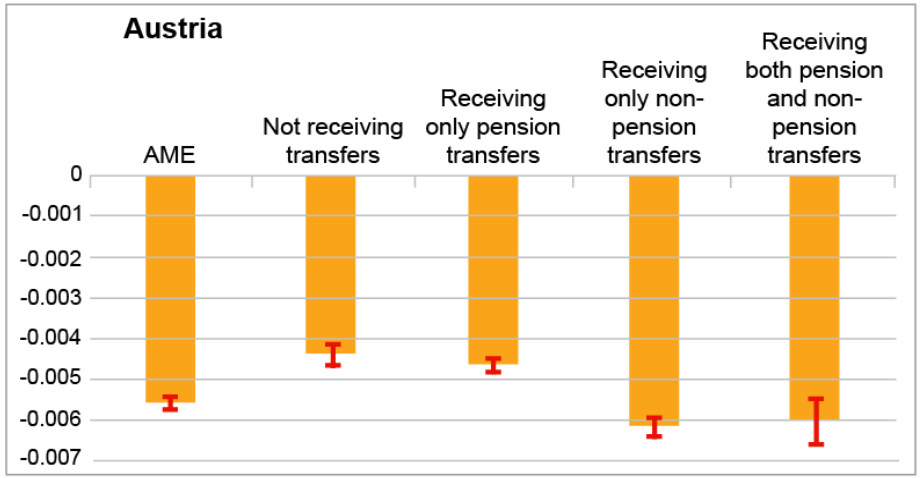
NB: Authors' calculations. Countries ranked according to the percentage of persons suffering from at least five deprivations (observed). Missing bars imply that the estimator does not converge. See Table A12 for country acronyms.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

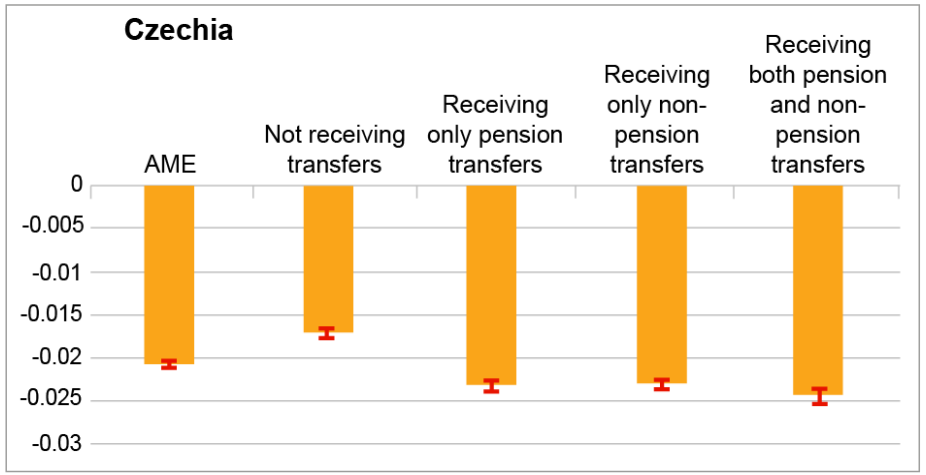
Figure A3: Average level of social transfers by level of deprivation, Estonia, Latvia, Lithuania
(Euros)

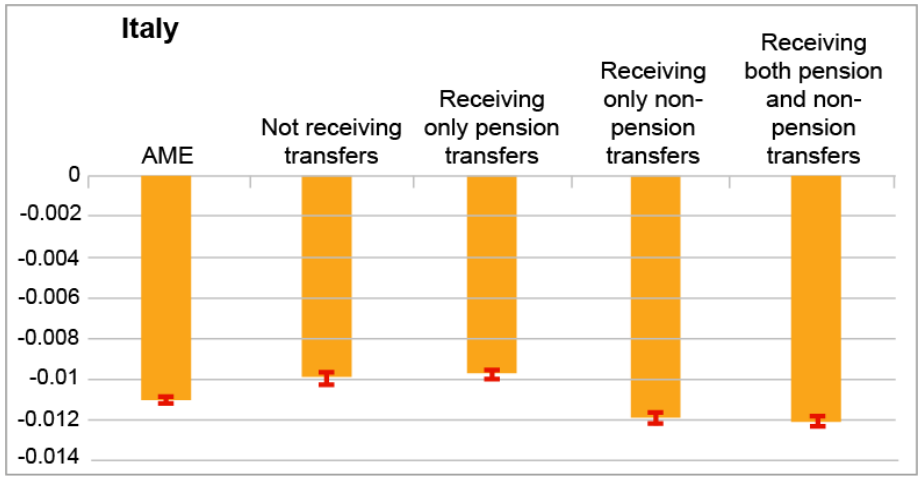


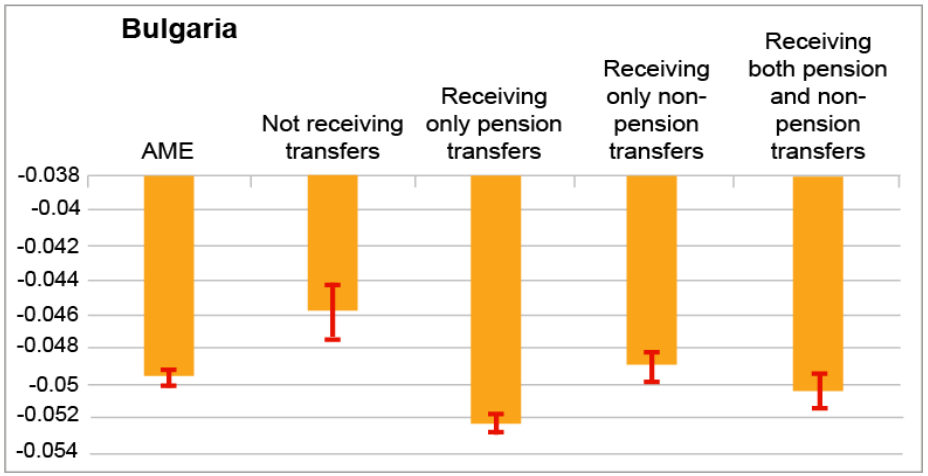
NB: Authors' calculations.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

Figure A4: AMEs by transfer receipt group, selected countries









NB: Authors' calculations. Selected countries.
Source: EU-SILC 2015 cross-sectional data, version September 2017.

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At the margin: By how much do social transfers reduce material deprivation in Europe ?

Since the adoption of the Europe 2020 social inclusion target, the population at risk of poverty or social exclusion has not decreased sufficiently to meet the target in EU countries. It is therefore important to evaluate the role and effectiveness of the policies adopted to combat income poverty and social exclusion in Europe. This paper takes a regression-based approach to estimating the effects of transfers on material deprivation, using the 32 countries covered by the EU Statistics on Income and Living Conditions (EU-SILC) and the new indicator of material and social deprivation agreed at EU level in 2017 (see Guio et al., 2017). It thereby complements established methods using income to evaluate policy impacts. The approach has broader applicability, suited to social indicators whose scaling has similar properties, such as housing deprivation indicators. This paper is the first to estimate and compare the average marginal effect (AME) of a small income transfer across the 32 EU-SILC countries. It finds that the impact of social transfers on material deprivation is higher at lower living standards, an effect that is present both within and across countries and underlines the importance of a progressive social transfer system. It further finds that households receiving non-pension transfers would experience, on average, the largest decrease in material deprivation. In many Eastern European countries, receivers of pension transfers would also see above population average reductions in material deprivation. A comparison of the Baltic States illustrates how factors other than the national social transfer system and living standards studied here play a role in explaining cross-national differences in AME. The paper further calculates the predicted effects of such increases in social transfers on the EU's official material deprivation rate and social spending levels. From an econometric point of view, this paper offers new methodological insights, by systematically comparing the performance of count data models (Poisson, negative binomial and zero-inflated negative binomial) and ordered regression models (ordered logit and generalized ordered logit) to predict the material deprivation distribution. It finds that ordered logit models systematically outperform the count models.

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