By How Much Do Social Transfers Reduce Income Poverty and Material Deprivation in Europe? The Impact of Social Protection Transfers on the 2020 Social Inclusion Target

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Paper prepared for the 34th IARIW General Conference

Dresden, Germany, August 21-27, 2016

Session 3 (Plenary): Well-Being I

Time: Friday, August 26, 2016 [Morning]

The impact of social transfers on income poverty and material deprivation

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Draft 19 July 2016

Abstract:

This paper develops a simulation approach to study the effects of income transfers on material deprivation. The method is applied to pre-recession and post-austerity EU-SILC data for Germany, Greece, Poland and the United Kingdom. The results show that income transfers can not only reduce income poverty but they can also substantially reduce the extent and depth of material deprivation. Changes in social transfers have therefore a two-fold effect on the Europe 2020 poverty reduction target.

Keywords: economic well-being, poverty, social exclusion, income, material deprivation, social transfers, Europe 2020 strategy, simulation

JEL: D31, I32, I38

Acknowledgements: This project was undertaken under affiliation with the University of Ottawa as part of research project proposal 210/2014-EU-SILC. The responsibility for all conclusions drawn from the data lies entirely with the authors.We would like to thank John Hills, David Gordon, Tim Goedemé, Brian Nolan and Ainslie Cruickshank for their valuable feedback.

1. Introduction[1]

In 2010, European Union (EU) Heads of State and Government launched the Europe 2020 strategy and committed to lifting at least 20 million people out of poverty and social exclusion, i.e. from around 116.5 million (based on 2008 EU-SILC[2] figures) down to 96.5. The EU social inclusion target is based on a combination of three indicators: income poverty (also referred to as 'poverty risk' or 'relative poverty'), severe material deprivation and (quasi-)joblessness. According to the 2013 EU-SILC data (the most recent available data when drafting this paper), the number of people at risk of poverty or social exclusion is now 121.6 million people; this a jump of more than five million since the adoption of the EU target which mainly results from the great recession and subsequent austerity policies implemented by EU Member States.

One of the commonly agreed EU social indicators is the income poverty rate before social tranfers. When compared with the income poverty rate after social transfers (which is one of the components of the Europe 2020 target), this indicator allows assessment (crudely) of the impact of social transfers. This paper develops a similar approach by simulating the effects of social transfers on material deprivation, showing thereby the effects of social transfers that we miss by only considering their impact on income poverty. This is important because neglecting the impact of social transfers on material deprivation and focusing only on their impact on income poverty understates both their effectiveness (i.e. the impact of social transfers on expected outcomes such as reducing the number of targeted people in poverty and social exclusion) and their efficiency (i.e. the relative cost of this reduction). Furthermore, evidence shows that a family can be materially deprived even when their income is above the poverty threshold and vice versa (see among others Guio et al, 2012; Nolan & Whelan, 2010). Using both indicators allows to better take into account a larger diversity of situations of poverty and social exclusion, as recognised by the EU Social inclusion target. Using the 2008 and 2013 EU-SILC data, this paper focuses on four Member States (Germany (DE), Greece (EL), Poland (PL) and the United Kingdom (UK)), which have been chosen because they have different levels of living standards and redistributive capacity and beause the crisis affected their economies differently.

The simulation method used in this paper is still under development. In future work it will need to be refined and expanded to all 28 EU countries. However, the results presented already highlight the importance of assessing the impact of social transfers on material deprivation, and they show how this approach can usefully complement the current EU approach, which looks only at the impact of social transfers on income poverty.

[1] The methodology in this paper was pioneered in ImPRovE working paper 13/13 (Notten, 2013), Notten (2015) and further tested and refined here.

[2] Data from the 2008 wave of the EU Statistics on income and living conditions (EU-SILC) were the most recent data available. For more information on EU-SILC, see Eurostat web-site. See also Di Meglio et al. (2016).

The paper is organized as follows. Section two sets the scene; it briefly discusses the concepts of income poverty and material deprivation and provides a description of trends in economic growth, poverty and social protection expenditures in the four selected Member States between 2008 and 2013. The simulation methodology is presented in Section three and the results in Section four. The conclusion discusses the main findings.

2. Setting the scene

The concepts of income poverty and material deprivation

The EU indicator of income poverty (also called 'at-risk-of poverty' (AROP) rate) is defined as the percentage of the population living in a household whose equivalised income is below 60 per cent of the national median equivalised disposable income. The disposable income is the total income of a household, after tax and other deductions, that is available for spending or saving. All monetary income received from any source by each member of the household are added up; these include income from work, income from capital and social benefits, plus any other household income; taxes, social contributions and regular inter-household cash transfers that have been paid are deducted. In order to reflect differences in a household's size and composition, the disposable income is divided by the number of 'equivalent adults', using the modified OECD scale which gives a weight of 1.0 to the first adult; 0.5 to the second and each subsequent person aged 14 and over and 0.3 to each child aged under 14. The income reference period is the previous calendar year for all countries except the UK where the income reference period is the current year (UK). As mentioned above, another EU social indicator is the income poverty rate before social transfers, which is the share of people living in households whose equivalised disposable income before social transfers is below the at-risk-of-poverty threshold calculated after social transfers.

Since 2009, the EU portfolio of social indicators also includes a material deprivation measure, that complements the income poverty indicators (see Guio, 2009). The household deprivation information is collected at the household level and assigned to all household members (including children). This indicator considers nine deprivations: the houshold cannot (1) afford one week annual holiday away from home; (2) face unexpected expenses; (3) avoid arrears (mortgage or rent, utility bills or hire purchase instalments); (4) afford a meal with meat, chicken, fish or vegetarian equivalent every second day; (5) afford to keep their home adequately warm; (6) afford to have a car/van for private use (if wanted[3]); (7) afford to have a washing machine (if wanted); (8) afford to have telephone (if wanted); (9) afford to have a television (if wanted).

A person is deprived if his/her household lacks three or more items and *severely* deprived if his/her household lacks four or more items. The indicators of 'standard' and 'severe' material deprivation are currently being revised (see Guio et al. 2012). The policy importance of the

[3] 'If wanted' refers to the fact that it is not by choice that the household does not have the item but because it cannot afford it for financial reasons.

concept of ‘severe’ material deprivation has increased dramatically in 2010 as it is one of the three indicators the Europe 2020 social inclusion target is based on. Therefore, this paper also focuses on severe deprivation.

Material deprivation indicators have also gained importance outside Europe, for example in countries such as Australia, Canada and New Zealand (i.e. Saunders & Wong 2011, Notten 2015, Perry 2015). In the United States, research communities use similar though not identical ‘material hardship’ indicators (i.e. Cancian & Meyer, 2004; Wu & Eamon, 2010; Huston & Bentley, 2010).

Income and material deprivation are complementary because they reflect related but different concepts of material wellbeing and each has its own specific measurement challenges (see Battiston et al. 2013; Bossert & D’Ambrosio 2014; Cancian & Meyer 2004; Guio et al. 2012, Marlier et al. 2007, Nolan & Whelan 2010). Consequently, while income and material deprivation indicators often ‘agree’ about a person’s economic wellbeing they also regularly ‘disagree’. It is important to understand the reasons for this (Fusco et al. 2011). In Western Europe, for instance, the negative but relatively modest correlations between equivalised income and the number of deprivations range from -0.17 in Denmark to -0.36 in Belgium resulting in mixed status (deprived but not income poor or income poor but not deprived) of 12-20 percent of the population (Fusco et al, 2010, Tables 6.1 and A4). The results are similar when using somewhat different definitions (e.g. Cancian & Meyer, 2004; Nolan & Whelan, 2010).

Following Ringen (1988), material wellbeing can be conceptualized either in terms of consumption (direct concept) or resources (indirect concept). A direct concept should be operationalized using a direct indicator (i.e. material deprivation, expenditures) and an indirect concept with an indirect indicator (i.e. income, wealth). The empirically observed disagreement between income and material deprivation indicators is thus in part the result of this conceptual distinction. However, measurement imperfections, including errors, also play a role: An indirect indicator may not reflect a person’s potential living standard and a direct indicator may not reflect a person’s actual living standard.

Starting with income, there are several reasons for discrepancies between a household’s income and its potential living standard. Conceptually, the rationale for using income is that it is for most households the largest source for funding consumption. However, households can also fund their living standard by depleting assets or taking up loans (Brandolini et al, 2010). Income indicators are often not adjusted for receipt of in-kind transfers and payments of indirect taxes (Aaberge, Sutherland & Tsakloglou forthcoming; Garfinkel et al, 2006; Paulus, Sutherland, & Tsakloglou, 2010; Verbist et al, 2014). While commonly adjusted for differences in household size (see above), income indicators are usually not adapted for differences in needs such as chronic illness or disability of household members (Sen, 1999). An implicit assumption underlying a resource-based indicator is also that needed goods and services can be purchased in well-functioning markets (Bourguignon & Chakravarty, 2003). Furthermore, in some surveys, income from the

previous year is seen as the best proxy for the current income, even if this implies inconsistencies between income and the current household composition and activity status information. Finally, measurement errors due to intentional (informal earnings, tax evasion) or unintentional (memory failure) underreporting tend to underestimate actual income levels.

Rather than measuring resources, material deprivation indicators measure a household's actual living standard more directly by focusing on the affordability of items considered as essential to have a decent standard of living in the society where people live (Guio, 2009; Guio et al, 2012; Townsend, 1979). The items typically reflect common perceptions of what are social necessities. Material deprivation indicators thereby circumvent the challenges of accounting for alternative resources, needs and non-cash or durable consumption when constructing monetary indicators such as income or consumption. There are, however, various reasons for having discrepancies between a household's level of material deprivation and its actual living standard. Firstly, the selection of deprivation items assumes a common prioritization of needs in society. Differences in needs and priorities by minority groups may thus be overlooked or mistakenly interpreted as deprivation. Secondly, adverse circumstances may lower a person's aspirations to the degree that she responds by not having an item because she does not want it (Guio, 2009; Guio et al, 2012). Thirdly, feelings of shame may also result in underreporting of deprivation (Breunig & McKibbin, 2011). Finally, information of the quality of the different goods and their longevity (e.g. durables) is usually not taken into account.

Trends in income poverty, material deprivation economic growth and social protection expenditures

The 2008 economic and financial crisis and its aftermath had very different effects on poverty in EU Member States. The four countries we study in this paper were selected to illustrate that variation in experiences (summarized in Table 1). Between 2008 and 2013, income poverty increased in Greece, remained stable in Germany and Poland, and declined in the United Kingdom. During the same period, material deprivation increased in Greece, remained stable in Germany and decreased in Poland. Material deprivation also increased in the United Kingdom since 2009. However, the large increase in 2012 (2.7 percentage points to 7.8%) coincides with a switch to another survey instrument and could also reflect differences in data collection.

Table 1: Income poverty and material deprivation trends (2008-2013)

	At-risk-of-poverty rate	Severe material deprivation rate
Germany	Stable	Stable
Greece	Increase	Increase
Poland	Stable	Decrease
United Kingdom	Decrease	Increase

Note: Table A1 presents the time series data.
Source: Eurostat

The pattern of economic growth is a key factor explaining these trends. The United Kingdom and Greece in particular were hard hit by the recession. The UK's economy was in recession for two years (2008 and 2009) while Greece's economy shrank for six consecutive years (2008 to 2013). Severe austerity measures and reforms followed. In the UK, the recession reduced median income proportionally more than the lower incomes, shifting both the income poverty threshold and the income poverty rate downwards. At the same time the inability to afford four or more deprivation items increased somewhat till 2011. In Greece, lower incomes were harder hit by the recession and cutbacks resulting in increased income poverty and in a decline in the real standard of living (Matsaganis & Leventi, 2014). Poland's economic growth slightly slowed down but the economy did not enter a recession. Germany's economy shrank only in 2009 after which it rebounded strongly. In both countries the income poverty threshold rose gradually and at roughly the same pace in the middle and bottom of the income distribution. Yet, in Poland the real living standard of those with many deprivations also improved gradually while it did not in Germany.

Table 2: Trends in social protection expenditures (2008-2012, per inhabitant at constant prices)

	Social protection	Pensions & survivors	Work-age social insurance	Family, Housing & Social exclusion
Germany	Increase	Increase	Increase	Increase
Greece	Decrease	(Net) increase	Decrease	Decrease
Poland	Stable	(Net) increase	Stable	(Net) decrease
United Kingdom	Increase	Increase	Increase	Increase

Note: The data for Greece are provisional. Table A1 presents the complete time series data.
Source: Eurostat

Social protection expenditures are known to be an influential factor too. In a recession the expenditures accruing to working age individuals and their families work as automatic stabilizers (partially) compensating market income lost due to the contraction of the economy. The size of the effect on income poverty and material deprivation depends on the design of the country's social safety net. Changes in income poverty and material deprivation effects over time depend on if and how the safety net has been reformed as part of austerity measures. Table 2 provides some first clues by summarizing the social protection expenditure trends. Comparing 2008 and 2012, expenditures per capita (at constant prices) rose in all categories in Germany and the United Kingdom. In Greece, except for pension and survivor benefits all other categories saw a decline. Total expenditures in Poland remained stable though the role of pension and survivor benefits gained importance relative to social assistance benefits. The remainder of this paper quantifies the impact of these spending categories on income poverty and material deprivation.

3. Method

We use a static simulation technique to estimate the effect of social transfers on income poverty and we develop and test a similar method for material deprivation. We compare 2008 (our pre-crisis yardstick[4]) and 2013 EU-SILC data (the most recent available data at the time of writing).

At the EU level, the impact of social transfers on income poverty is assessed by comparing income poverty rates on the basis of the total household disposable income with and without social transfers (there are two indicators: one indicator counting pensions as 'original income' and one counting pensions as transfers); for both rates (before and after transfers), the threshold used is the post-transfer income poverty threshold (see above). This method overestimates the effects of transfers on income poverty. Firstly, because it assumes that the receipt of transfers does not change the behavior of persons and households. Particularly when transfers are large this assumption is likely to be violated. Secondly, because it fails to take into account that (not) receiving one transfer affects a person or household's eligibility for other transfers. Advanced micro-simulation models would lead to better estimates because they take tax-benefit rules and/or behavioural effects into account (Figari et al, 2015, Berg, 2005). Our focus here is on developing and testing a method that yields equivalent estimates of the effects of transfers on material deprivation. Incorporating it into more sophisticated simulation models is left for future research.

The post-transfer income indicator is the EU-SILC's total disposable household income variable (Di Meglio et al., 2016). We further use five pre-transfer income indicators. The first is total disposable household income before all social transfers. This variable is constructed by subtracting all social transfer amounts from a household's total disposable income (old-age and survivor pensions, social insurance, family, housing, social assistance and other benefits/allowances).[5] The second is total disposable household income before all social transfers except old age and survivor pensions. The other three pre-transfer income variables measure income before old-age and survivor pensions, income before gross social insurance benefits (unemployment, sickness, disability) and income before gross household transfers (family allowances, social assistance, housing allowances). All income variables are adjusted using the modified OECD equivalence scale (Table 3). All results are weighted using the EU-SILC's household cross-sectional weights (households) or individual cross-sectional weights (individuals).[6]

[4] This choice offers the best approximation as the effects of the crisis on economic growth started in 2008. The income reference period of EU-SILC 2008 is 2007 for Germany, Poland and Greece (2008 for the UK) and the deprivation reference period is either the present or the past 12 months.

[5] According to EU-SILC regulation, countries have to provide three net-of-taxes household income amounts: 1) the total disposable household income (including all social transfers); 2) the total household income excluding all social transfers except pensions (i.e. pensions are considered part of the original income); and 3) the total household income excluding all social transfers (i.e. pensions are included in social transfers). In practice, though, countries compute the 2) and 3) amounts in different ways. Some do compute net social transfers amounts whereas others simply deduct gross transfers from the total disposable income. In the latter case, the impact of social transfers on the reduction of income poverty is overestimated.

[6] For illustrative purposes Tables A2 and A3 also present standard errors. Standard errors are likely larger than we can currently estimate. Goedemé (2013) developed a method for adjusting this information but it has not yet been

The post-transfer material deprivation indicator is based on the number of deprivations a household cannot afford (see definition above). To simulate what the number of deprivations would be before transfers, we first estimate a multivariate regression model, for each country separately using the household as the unit of analysis. The dependent variable, the number of (post-transfer) deprivations, is regressed on disposable income (in natural logarithm) and various controls. We use the resulting income elasticity of material deprivation to predict a household's number of deprivations using pre-transfer and post-transfer income. The difference between these predictions reflects the change in the number of deprivations due to social transfers. We use the resulting pre-transfer deprivations count to calculate the EU's severe material deprivation rate before transfers. This method assumes that different sources of income contribute similarly to avoiding material deprivation.

Estimating the income elasticity is the crucial step in our simulation model and thus requires the selection of an appropriate multivariate estimator and model specification. Our preferred estimator is a maximum likelihood estimator based on a negative binomial regression model (Hilbe 2011) because the dependent variable reflects count data (the number of deprivations) for which the variance is larger than the mean (overdispersion). Different alternative estimators have been used to investigate the relation between income and material deprivation. Focusing on explaining cross-national differences in material deprivation, Nelson (2012) chooses a Probit model but discards a lot of information by creating a binomial dependent variable. Muffels & Fouarge (2004) use a Tobit regression model. However, Angrist and Pischke (2009) argue that a Tobit model is only needed when data are truly censored (p. 102). Relying on this argument, Figari (2012) uses a linear fixed effects model and longitudinal data to explain cross-national differences in material deprivation. However, a linear estimator relies on the assumption of a normal distribution while count data typically have a Poisson-like distribution. Our tests show that this also holds for our dependent variable.

updated to the 2013 wave. As recommended by Goedemé, we use the household ID variable (DB030) as a proxy for clustering.

Table 3 Summary Statistics

	Germany		Greece		Poland		United Kingdom	
	2008	2013	2008	2013	2008	2013	2008	2013
								Number of observations
- Individuals	28,785	26,633	16,748	17,909	4,1120	36,413	20,962	23,168
- Households	13,247	12,656	6,455	7,385	13,951	12,884	8,886	10,114
Equivalised income (nominal annual mean, in Euro)								
- Before all transfers	14,724	15,702	9,611	5,834	3,636	4,402	17,166	15,330
- Before old-age and survivor pensions	16,816	17,873	9,999	6,266	3,954	4,693	19,061	17,790
- Before transfers other than pensions	18,974	20,407	12,391	8,932	4,630	5,689	20,694	19,284
- Before social insurance benefits	20,107	21,789	12,554	9,091	4,752	5,802	22,129	21,101
- Before household social transfers	20,001	21,284	12,626	9,210	4,833	5,877	21,265	20,011
- Disposable	21,066	22,577	12,779	9,365	4,948	5,981	22,589	21,744
Distribution of the population by number of deprivations:								
- 0	57.3	60.1	40.2	28.2	27.2	30.2	64.2	49.4
- 1	16.9	16.8	23.1	19.0	18.6	19.7	13.1	19.0
- 2	12.8	11.5	15.1	15.7	21.8	24.5	11.4	14.2
- 3	7.5	6.2	10.6	17.0	14.6	13.6	6.8	9.1
- 4+	5.5	5.4	11.0	20.0	17.8	11.9	4.5	8.3
Correlation								
- Log disposable income & number of deprivations	-0.472	-0.506	-0.537	-0.545	-0.482	-0.509	-0.347	-0.432
Number of households excluded from analysis								
- Disposable income ≤ 0	66	20-49	20-49	54	20-49	<20	20-49	58

Notes: Discrepancies with the severe material deprivation rate of that reported by Eurostat are due to the exclusion of observations with negative disposable income. Income is expressed in Euro in the EU-SILC data and the exchange rate used is provided by the HX010 variable.
Source: Authors' computation, UDB August 2010 and March 2015.

We determine the preferred model specification with the principal aim to obtain an income elasticity of material deprivation that is representative for the population of interest, namely households receiving transfers who are at considerable risk of material deprivation. The choice of control variables has further been driven by the theoretical and empirical evidence regarding the nature of the relationship between income and material deprivation. As discussed in Section two, for similar income levels, material deprivation may differ, depending on the debt/wealth level, specific needs and costs (housing, childcare, health) or other measurement issues (diversity

of preferences, difficulties to measure incomes, such as self-employment or capital incomes). Other considerations involve the cross-national comparability of control variables: to enhance comparability we use the same model specification for each country. Our preferred model specification includes variables controlling for:

- survey year (a dummy for the 2013 wave);
- high income household (a dummy indicating whether the household's income is ranked in the top deciles of the income distribution)[7];
- very low income household (a dummy indicating whether the household's income is below that of the first percentile of the income distribution);
- high transfer household (a dummy indicating whether the household's non-pension transfer income is above 25 percent of disposable income);
- debt burden (two dummies indicating whether debt repayment is a heavy/modest burden for the household);
- housing costs (two dummies indicating whether housing costs are a heavy/modest burden for the household);
- home ownership (a dummy indicating whether the household's residence is rented);
- proxy health costs (one dummy indicating whether at least one adult member has a chronic illness, derived from PH020);
- household demographics (six household type dummies derived from HX060 and three variables indicating the number of children, adults and elderly);
- education level (four dummies constructed from PE040 indicating the highest level of education attained for the adult household member with the highest education)
- self-defined economic status (eight dummies constructed from PL030 indicating whether at least one adult member is in full time employment, part time employment, self-employed, unemployed, retired, inactive due to disability, fulfilling domestic work, or otherwise inactive);
- citizenship (two dummies indicating that at least one adult member has EU/non-EU citizenship).

[7] The exact cut-off is country specific and is set at the first decile for which the proportion of individuals with at least one deprivation is less than its share in the overall population: the top 30 percent for Germany and Greece, the top 20 percent (2008) and 30 percent (2013) for Poland and the top 40 percent for the United Kingdom.

Table 4 Income elasticity of material deprivation: Comparison Ordinary Least Squares (OLS) and Negative Binomial (NB) estimators

Dependent variable: number of deprivations								
	Germany		Greece		Poland		United Kingdom	
Independent variables:	OLS	NB	OLS	NB	OLS	NB	OLS	NB
Log income	-0.569***	-0.505***	-0.868***	-0.434***	-0.739***	-0.404***	-0.165***	-0.331***
Household:								
- Observed in wave 2013	0.042**	0.029	0.037	0.060***	-0.283***	-0.143***	0.254***	0.271***
- High income	-0.073**	-0.668***	-0.310***	-0.461***	-0.178***	-0.275***	-0.152***	-0.221***
- Lowest income percentile	1.025***	1.023***	0.861***	0.714***	0.592***	0.487***	0.425**	0.588***
- High non-pension transfer income	0.448***	0.307***	0.234***	0.079***	0.308***	0.106***	0.532***	0.343***
Number of observations	25903	25903	13840	13840	26835	26835	19000	19000
(Pseudo) R-squared	0.4822	0.2122	0.4855	0.1806	0.4411	0.1651	0.5141	0.2258
P-value (P-test of Alpha)		0		0		1		0

P-value: 10% (*), 5% (**) and 1% (***). Estimated in STATA using a negative binomial regression model (nber) and controlling for survey design (svy). For OLS we report R-squared and for NB pseudo R-squared.
Source: Authors' computation, UDB August 2010 and March 2015.

Table 4 summarizes the key results estimated using a negative binomial (NB) regression, our preferred estimator, and those using Ordinary Least Squares (OLS). The income elasticity of material deprivation ranges from -0.33 for the United Kingdom to -0.51 in Germany indicating that a 1 percent increase in household income reduces the household's number of deprivations by 0.33 to 0.51 percent.

Using an OLS estimator, the estimated income elasticity is close to the NB elasticity for Germany (-0.57) and higher for Greece (-0.88) and Poland (-0.74) but lower for the United Kingdom (-0.17). The high percentage of zero deprivations (Table 3) shows that the values violate the normal distribution assumption required for a linear estimator. The zero p-values of the likelihood-ratio test of Alpha (Table 4) further show that the variance is larger than the mean for most countries confirming that a negative binomial regression model is a better fit than a Poisson model. For Poland a model without an alpha (Poisson) would be somewhat more efficient. Table A3 in the appendix summarizes the coefficients and standard errors for all variables. Table A4 summarizes the coefficients of the income elasticity of material deprivation for alternative model specifications.

With the exception of Germany, the 2013 dummy is significant indicating that material deprivation levels differ across survey waves, being positive in 2013 in Greece and the UK and negative in Poland. The inclusion of the wave dummy takes into account the temporal evolution of the intercept between 2008 and 2013. This implies that only the change in the average deprivation level is captured, but not the possible evolution of the relation between income / controls and deprivation, which are estimated using the pooled sample regrouping both the 2008 and 2013 samples. This is a strong assumption, which allows us to disentangle the evolution of simulated effects due to the change in the level / distribution of social transfers from possible changes in the income elasticity. The 2013 dummy helps control for the UK's break in the data but, the impact of the break in data collection may be more complex, warranting extra caution when interpreting the results for the UK.

The high income dummy is significant and negative in all countries indicating that such households have a lower risk of deprivation. Without the inclusion of this variable, the income elasticity would be higher in all four countries, considerably so in Germany (Table A4, model 2) resulting in a too large simulated effect of transfers on material deprivation for lower income households, who are at higher risk of material deprivation. The very low income dummy is significant and positive in all countries indicating that such households have a higher risk of deprivation. This relatively small number of observations has a disposable income well below the country's relative poverty line and, if excluded, exerts a downward influence on the income elasticity: without the inclusion of this variable, the income elasticity would be considerably lower (Table A4, model 3). The high transfer income dummy is significant and postive in all countries indicating that such households have a higher risk of deprivation. Without its inclusion

the income elasticity would only be somewhat larger in some countries (Table A4: model 7).[8] We prefer to include this variable because the non-behavioural change assumption in a static simulation is more likely to be violated when the size of transfers increases.

The coefficients of the other control variables have the expected signs and tend to vary in significance and magnitude across countries. In addition to the usual control variables (demographics, citizenship, economic status) the discussion in Section two suggests the inclusion of controls regarding non-income financial resources, in-kind transfers, costs of living and special needs. Due to data limitations, our preferred model specification may not sufficiently control for differences in wealth (such as assets, savings and borrowing) and in-kind transfers (such as access to subsidized goods and services). Differences in wealth and in-kind transfers can explain why people with the same income experience different levels of material deprivation. While our model likely captures some of these effects through the debt burden (access to borrowing), home ownership and other controls associated with higher wealth (high disposable income, education), the lack of better proxies may affect the estimated income elasticity to an unknown degree.

The robustness checks in Table A4 further illustrate the effect of the inclusion or exclusion of controls on the income elasticity. Excluding controls regarding the costs of debt and health does not make a big difference (Table A4: models 9 and 12). Excluding controls regarding the costs of housing, home ownership and education has a modest effect on the income elasticity (Table A4: models 10, 11 and 13). The inclusion of a proxy for child care costs does not make a difference (Table A4: model 8). The inclusion of a proxy for emergency savings had a large downward effect on the income elasticity (model 14). However, the proxy is based on the deprivation item that indicates whether the household is capable to face unexpected financial expenses (HS060). Including this proxy as a control, however, implies that the item cannot be used to construct the dependent variable.

Further tests of the sensitivity of the income elasticity to the exclusion or inclusion of specific population groups show that the exclusion of households with (only) adults above the age of 65 has a large downward effect (models 15, 16) suggesting that the relationship between income and material deprivation differs between pensioner and non-pensioner households. Including an additonal control regarding the importance of pension income does not solve this issue (model 6). A potential solution would be to estimate the model separately for both groups or to allow for interaction effects in the model. We leave this as an issue for further research. The exclusion of households with self-employed adults has a very small effect (model 17). The inclusion of the relatively few households with a negative disposable income has a very large downward effect, which justifies their exclusion from the sample (model 18).

[8] The results are not very different when a dummy indicating whether the household's non-pension transfer income is above 10 or 50 percent of disposable income is used (instead of 25%).

At this point it is useful to summarize the assumptions behind the model and discuss their potential implications for the estimations. A first set of assumptions is made in both the pre-tranfers income poverty and the deprivation approaches:

- These approaches do not correct for the tax-transfer rules: they should deduct in theory nettransfer amounts from disposable income, but in pratice gross amounts of each specific tranfers are not available, leading us to ignore possible taxes paid on benefits. Furhermore, they assume that the loss of a transfer would not be (entirely or partially) compensated by other transfers or tax reductions (social assistance may partially compensate for loss of unemployment benefits etc.). Both aspects imply that this paper overestimates the effect of transfers on material deprivation. Future research could verify the size of this effect by applying the estimation method to Euromod data.
- These approaches also assume that transfers do not affect the behaviour of households in terms of labour supply, family formation etc. In other words, it implies the assumption that households with low pre-transfer income (and thus higher disposable income) behave the same as households with low disposable income. Especially when transfers are large this assumption is likely to be violated. This implies that this paper overestimates the effect of transfers on material deprivation, particularly for households receiving relatively large amounts of transfers. The size of this effect could be verified by applying the estimation method in the context of a dynamic simulation model. Moreover, in the absence of such models, restricting estimates to the effects of relatively small / marginal transfers would be preferable.

A second set of assumptions ia linked to the methodology proposed here:

- The income variable is expressed in logarithms which means that its estimated parameter can be interpreted as an elasticity. This implies that at lower income levels a smaller absolute change in income is needed to obtain a given percentage change in the number of material deprivations (in comparison to higher incomes). In other words, a 1 Euro increase in transfers for a low income household will have a larger effect on the material deprivation count than a 1 Euro increase for a high(er) income family (all else equal).
- The number of pre-transfer deprivations is an estimate that is obtained by adding the difference in predicted deprivations (for disposable and pre-transfer income) to the observed number of deprivations. It is the number of deprivations a household would be expected to have if their disposable income would have the value of their pre-transfer income. It thus assumes that all other factors remain equal which is unlikely to be the case, especially when tranfers are relatively large.
- The model's dependent variable is a count variable. Given the large differences in prevalence and severity of deprivation items, the income elasticity might also differ

between deprivation items (see Guio and Pomati 2016). We plan to investigate this issue in follow up research.

- The model does not make any distinction between various sources of income. The income elasticity may differ for different sources of income (i.e. regular wage earnings versus social transfers, bonus payments, income from capital). We plan to investigate this issue in follow up research.
- The relationship between income and material deprivation might have a contemporary and a longitudinal component. A longitudinal component may exist because of data collection: for most countries (except the UK) income data refer to the past year while deprivation data refer to the implied present. A contemporaneous relationship would thus have to be measured by matching a household's deprivation level from the previous survey round to the income level available in the current survey round. Moreover, longitudinal research suggests that current deprivation may be related to past changes of income (Berthoud and Bryan, 2011). We plan to investigate this issue in follow up research.

4. Results

The EU's statistical office, Eurostat, routinely produces two indicators that measure the effect of social transfers on the at-risk-of-poverty rate. One indicator measures the effect of all transfers on the income poverty rate and the other measures the effect of all non-pension transfers. The indicators are obtained through the static simulation technique described in Section three. It assumes that a 1 Euro transfer to a poor individual reduces the total income poverty gap by 1 Euro. This paper develops and tests a similar technique to estimate the effect of transfers on the EU's severe material deprivation rate. The income elasticity of material deprivation, estimated through multivariate regression, suggests that, depending on the Member State, a 1 percent increase in (transfer) income reduces the number of material deprivations of a household by an order of 0.33 to 0.51 percent.

This Section presents the effects of social transfers on the number of deprivations and on the EU's severe material deprivation rate (SMD), and compares them to the income poverty reduction effects obtained using the EU's at-risk-of-poverty rate (AROP). Both indicators have significant political importance as they are used to monitor progress on the EU's social inclusion target, which is to be met by 2020. The great recession in 2008/9 and following austerity measures, however, made meeting this target even more challenging. The comparison of income poverty reduction effects between 2008 and 2013 sheds light on the degree to which the role of social transfers has changed therein.

Table 5 summarizes the average reduction in the number of material deprivations for the sample as a whole and several sub-populations. In this simulation exercise, the well-being levels of those not receiving transfers remain unchanged and, the estimated effect on transfer recipients increases as the amount of transfers received increases. Both patterns are observed for all

countries over both years. Take for instance Germany in 2008 where transfers reduce the average number of deprivations by 1.8 for the population as a whole and by 2.2 for those individuals living in households receiving transfers. Pensions (old age and survivor) have the largest effect, reducing deprivations among transfer recipients by 4.4. Social insurance transfers (unemployment, sickness and disability) and household transfers (family, housing and social assistance) reduce deprivations by 1.1 and 0.3 in the group of (all) transfer recipients.

The disaggregation of effects by post-transfer deprivation levels is interesting because it informs us about the likelihood that transfers will reduce the severe material deprivation rate. Because the severe deprivation threshold is set at four deprivations, it is particularly individuals reporting one, two or three deprivations (after transfers) that are more likely to have been lifted out of severe material deprivation due to a transfer. For individuals reporting four or more post transfers deprivations, the transfers they receive (if any) are clearly insufficient to avoid severe deprivation but they nontheless reduce the number of deprivations suffered substantively. Table 5 shows that, on average, transfers have larger effects on individuals with lower levels of material well-being.[9] Taking again Germany in 2008, transfers reduce on average the number of deprivations by 3.1 among recipients reporting four or more post transfers deprivations, 2.3 among recipients reporting 1 to 3 deprivations, and 2.0 among recpients reporting no deprivation. This pattern is observed for all countries when focusing on the combined effect of all transfers and all non-pension transfers. It suggests that transfers are progressively distributed over the material deprivation distribution.[10] Looking at the effects further disagregated by type of transfer, we see that pensions have a higher impact than non-pensions transfers (such as household transfers and social insurance) in most countries and for all deprivation levels, except in the UK for the severely deprived where non-pension transfers have the largest impact. Social insurance and household transfers have a very weak impact for people with zero (post transfers) deprivation. Among those suffering from intermediate level deprivation (1-3 deprivations), the impact of these social insurance and household transfers is larger in Germany (1.5 in 2013) and the UK (1.2 in 2013) but remains limited in Poland and Greece (0.5 or 0.4), raising the question of the importance of social protection and minimum income for non elderly people in these countries. For those suffering from severe post transfers deprivations, the impact of non-pension transfers is lower in Poland and Greece than in the UK and Germany. In the UK household tranfers have a larger impact than social insurance while in Germany social insurance has a larger impact.

[9] For reasons explained in footnote 6 we do not report confidence intervals for these estimates. Differences between groups should thus be interpreted with caution because they may not be statistically significant.
[10] It is not a perfect indicator though as we disaggregate by the number of deprivations after transfers rather than before transfers.

Table 5: Average effect of transfers on the number of deprivations

	2008					2013				
	All transfers	Pensions	All non-pension transfers	Social insurance	Household transfers	All transfers	Pensions	All non-pension transfers	Social insurance	Household transfers
Total population										
Germany	1.8	1.3	0.5	0.2	0.1	1.9	1.4	0.4	0.2	0.1
Greece	1.2	1.0	0.1	0.1	0.0	2.1	1.6	0.3	0.2	0.1
Poland	1.4	0.9	0.3	0.2	0.1	1.3	1.0	0.2	0.1	0.1
United Kingdom	1.4	0.7	0.5	0.1	0.3	1.6	0.8	0.6	0.1	0.4
Receivers of transfers										
Germany	2.2	4.4	0.8	1.1	0.3	2.3	4.8	0.8	0.9	0.3
Greece	2.2	2.6	0.4	0.5	0.2	3.3	3.8	0.9	1.3	0.5
Poland	1.9	2.3	0.7	0.8	0.4	1.9	2.3	0.6	0.6	0.4
United Kingdom	1.8	2.4	0.8	0.4	0.5	2.1	2.6	1.2	0.7	0.7
Receivers of transfers, 0 material deprivations (after transfers)										
Germany	2.0	4.5	0.1	0.3	0.0	2.2	4.9	0.2	0.4	0.1
Greece	2.0	2.5	0.1	0.2	0.0	3.5	4.1	0.2	0.4	0.1
Poland	1.5	2.0	0.2	0.3	0.1	1.8	2.3	0.1	0.2	0.1
United Kingdom	1.4	2.5	0.2	0.2	0.1	1.8	2.7	0.2	0.3	0.1
Receivers of transfers, 1 to 3 material deprivations (after transfers)										
Germany	2.3	4.5	1.2	1.3	0.3	2.4	4.7	1.5	0.9	0.4
Greece	2.3	2.5	0.3	0.5	0.0	3.2	3.7	0.5	0.9	0.2
Poland	1.8	2.4	0.4	0.6	0.2	1.8	2.3	0.4	0.5	0.2
United Kingdom	2.3	2.1	1.3	0.4	0.8	2.1	2.3	1.2	0.5	0.7
Receivers of transfers, 4 or more material deprivations (after transfers)										
Germany	3.1	3.2	2.8	2.3	1.3	3.5	3.3	3.1	1.9	1.5
Greece	2.8	3.0	1.1	1.0	0.9	3.4	3.8	2.1	2.5	1.6
Poland	2.4	2.7	1.5	1.5	1.1	2.4	2.5	1.5	1.4	1.2
United Kingdom	3.0	1.4	2.7	1.0	1.9	3.4	1.8	3.2	1.4	2.2

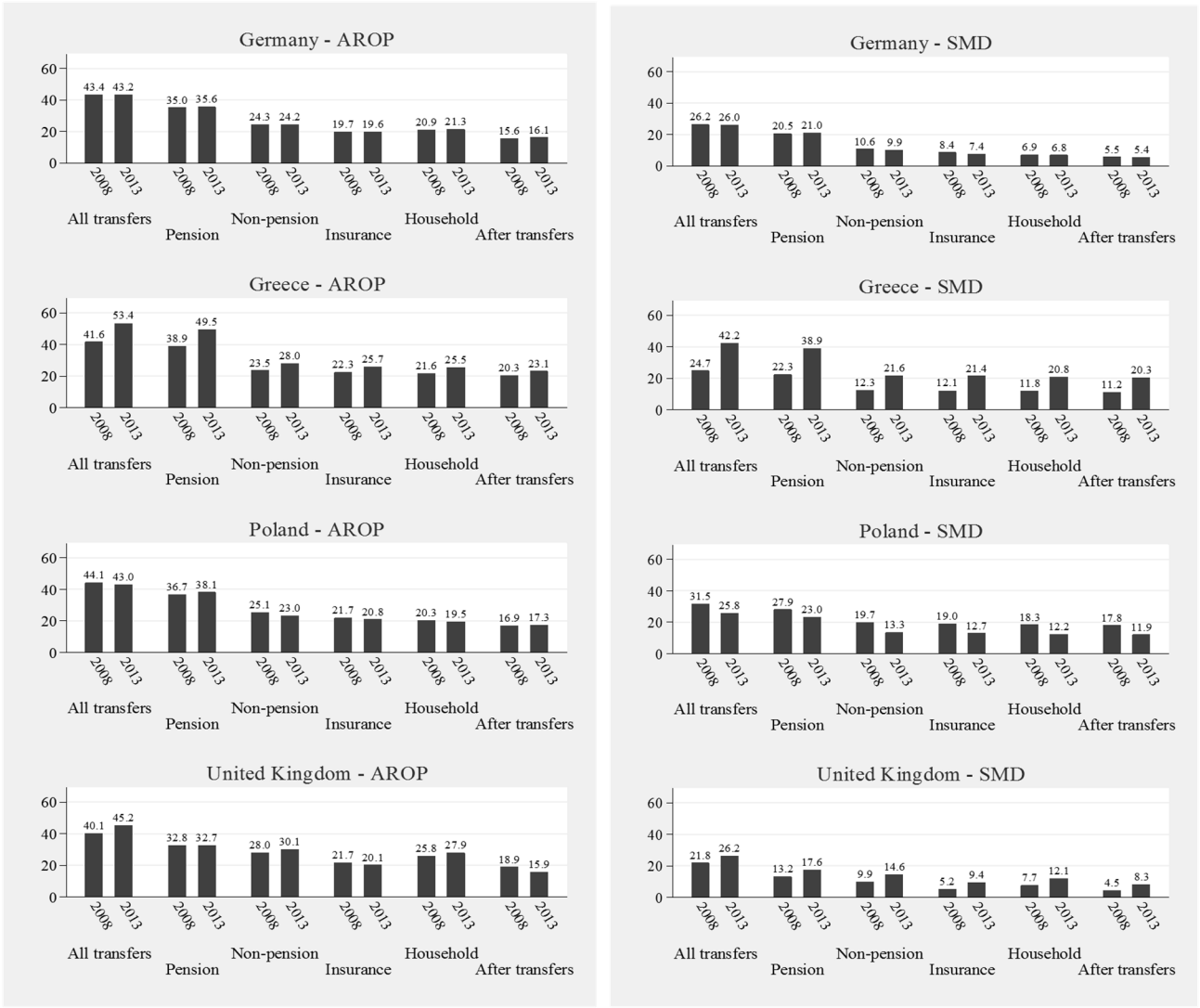
Note: Numbers are rounded to one decimal point.
Source: Authors' computation, UDB August 2010 and March 2015.

The importance of transfers as an instrument reducing income poverty and/or material deprivation seems to have increased since 2008. With the exception of Poland the reductions in the number of material deprivations seems to have become larger for most countries. In Greece, where material deprivation rates have seen the strongest increase since 2008, it is particularly pensions that had a stronger impact on material deprivation (from 2.6 in 2008 to 3.8 in 2013). However, those benefitting from pensions in 2013 are less likely to be part of the most deprived. In 2013 pensions decreased the number of deprivations among non-deprived by 4.1 but only by 3.7 and 3.8 for those with respectively one to three or four and more deprivations. Also in the UK, where severe material deprivation increased only modestly (at least until 2011), transfers have gained importance since 2008. Well known as a welfare state in which targeted transfers are relatively important, it is particularly the household level transfers that have the largest reduction effects among the more deprived people in the UK. Particularly among those with four or more deprivations, the effects of these transfers has increased (from 1.9 to 2.2). In Poland, where severe material deprivation steadily declined, the overall reduction effect of transfers remained constant (2.4).

The increased importance of transfers is likely due to the reduced overall earnings of households in recession hit countries which, in a model that uses the logarithm of income as an explanatory variable, implies that a 1 Euro transfer for a low income household has a larger effect on deprivation than a 1 Euro transfer to a high(er) income household. Another potential factor could be that the volume of transfers has increased. Table 2 suggests that this factor might play a role in the UK and Germany but less so in Greece.

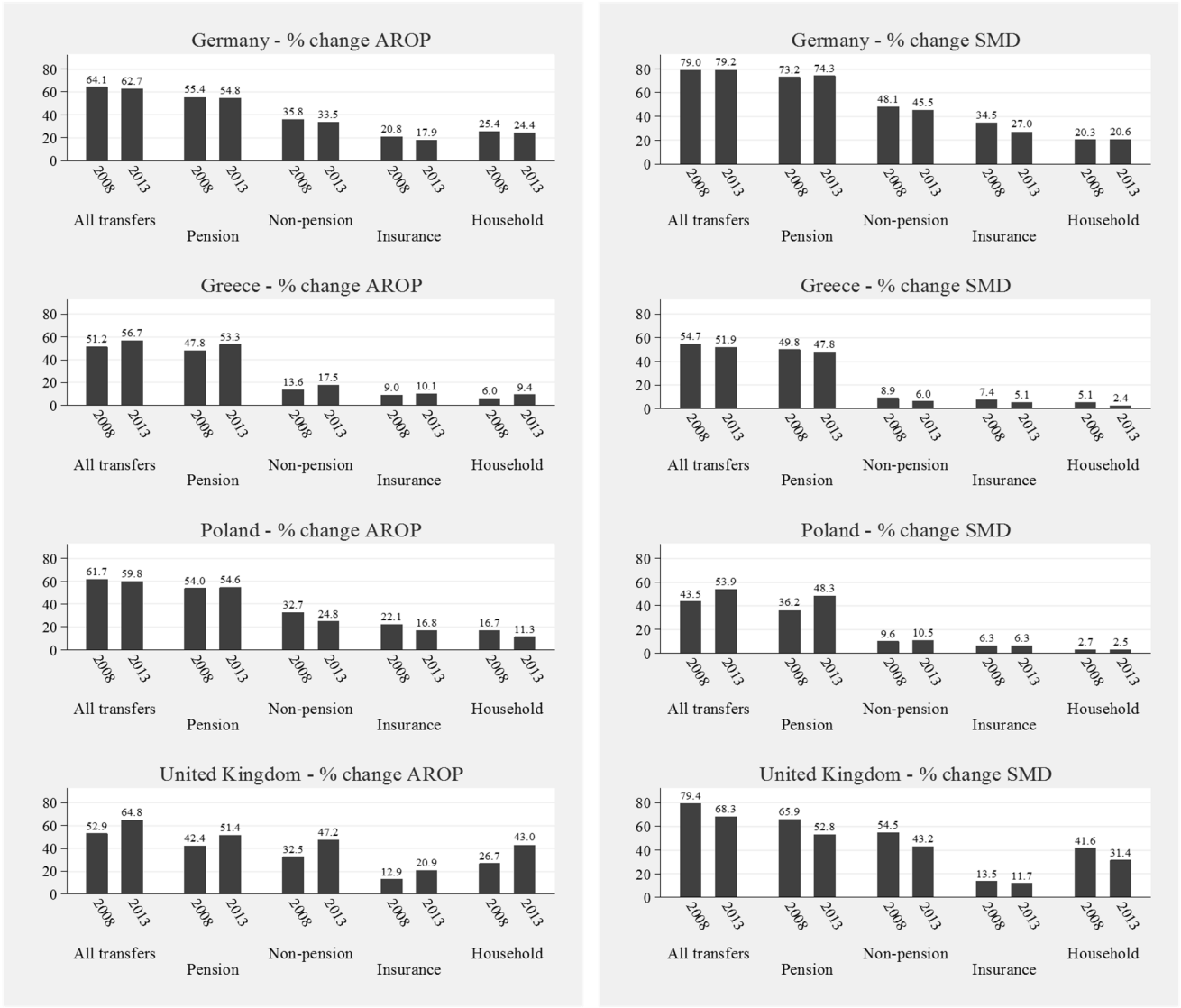
The Figures below present the impact of social transfers on the severe deprivation rate (SMD) and compare it with the EU's at-risk-of-poverty rate (AROP). The rates before transfers are much higher than those after transfers for both indicators (Figure 1). The rates before all transfers range from 40 to 53 percent for AROP and 22 to 42 percent for SMD. The rates after transfers range from 16 to 23 percent for AROP and 5 to 20 percent for SMD. The percentage point reduction in AROP rate, however, is consistently higher than that of the SMD rate. Thus, in an absolute sense, transfers seem to reduce AROP rates more than SMD rates, as income as only has an indirect effect on material deprivation (other resources and living arrangements matter to explain material deprivation, see discussion above). In Germany for instance, total transfers reduce income poverty by 27 (2013) and 28 (2008) percentage points but they reduce the SMD rate by 21 percentage points (both years).

Figure 1: At-risk-of-poverty rate (AROP) and severe material deprivation rate (SMD) before tranfers and after transfers, %



Source: Authors' computation, UDB August 2010 and March 2015.

Figure 2: Percentage reduction in at-risk-of-poverty rate (AROP) and severe material deprivation rate (SMD)



Source: Authors' computation, UDB August 2010 and March 2015.

This is due to the fact that the income elasticity is smaller than one; only half to a third of a one percent increase in income is translated into a percentage decrease in the number deprivations. However, the AROP rates are also consistently higher than the SMD rates for these four countries, implying that it also important to compare the impact in relative terms by calculating the percentage reduction in income poverty and material deprivation rates (Figure 2). In this relative sense, the impact of transfers is not always higher for AROP than for SMD. For example, in Germany, the percentage decline in the SMD rates is higher than for the AROP rates for most transfer categories. Household level transfers are the exception, with a higher relative reduction in the AROP rate. In Greece, the relative reduction is higher for AROP rates of social insurance and household transfers in both years. For pensions, the relative reduction is also higher for the AROP rate in 2013 but in 2008 it was similar to that of SMD rate. In Poland, the relative reductions of transfers on the AROP rate are consistently higher than those on SMD. In the UK the relative reduction of pensions on SMD rates is higher than that on AROP in both years while the relative reductions of social insurance and household transfers where higher for SMD rates in 2008 but lower in 2013. The charts confirm once again that in Greece and Poland the impact of transfers other than pensions is weak, either on the income poverty rate, or on the severe material deprivation rate.

While Table 5 suggests that reduction effect of transfers on the *average* number of deprivations may have become larger since the Great Recession, Figure 2 suggests that percentage reductions in AROP and SMD rates do not differ much between 2008 and 2013. One interpretation could be that while transfers improve material wellbeing for a broad population, their impact is insufficient to lift a smaller, and more vulnerable, group above the deprivation threshold. However, the role of transfers could have changed even if there is no statistically significant change. This is because changes in the the design and generosity of transfers may be obscured by simultaenous changes in the demography and economy.

5. Conclusion

Social transfers are a very influential policy instrument in the fight against poverty and social exclusion. This paper set out to fill in a gap in the analysis of poverty and social policy, namely the degree to which social transfers reduce material deprivation. This gap also has obvious political salience as the severe material deprivation rate is one of three indicators by which the EU monitors progress towards the Europe 2020 social inclusion goal. In the spirit of the commonly agreed EU indicator measuring the impact of social transfers on income poverty, we developed and tested a similar static simulation technique to estimate the effect of social transfers on the EU material deprivation indicator. Subsequently we analyzed the impact of transfers on the average number of deprivations in the population and on the EU severe material deprivation rate, also comparing absolute and relative changes in deprivation with those achieved in terms of the EU income poverty rate.

We estimated the income elasticity of material deprivation through multivariate regression. We found that a 1 percent income transfer reduces the number of material deprivations by an order of 0.51 percent in Germany, 0.43 percent in Greece, 0.40 percent in Poland and 0.33 percent in the United Kingdom. Thus, in contrast to the effect on income poverty, where a 1 Euro transfer to the income poor increases their aggregated income by 1 Euro, the effect on material deprivation is by definition indirect. Whereas cash transfers and income are both measured in monetary terms, material deprivation is not solely the result of a lack of financial resources, of which income is merely one. Indeed, material deprivation is also influenced by accumulated debt/wealth, access to non-financial resources such as in-kind transfers and specific needs of the household (child care, health, housing).

The impact of (total) social transfers is substantial, reducing the average number of material deprivations among recipients by 2.2 in Germany and Greece and by 1.9 and 1.8 in Poland and the United Kingdom. The impact is larger for recipients that are less well off. The impact of social transfers on severe material deprivation is also large, ranging from 13 to 22 percentage point reductions. In comparison, the reductions in at-risk-of-poverty rates are larger, ranging from 26 to 30 percentage points. In percentage terms however, the reduction in rates is not necessarily larger for the income poverty indicator than for the material deprivation indicator, this depends on the country and the type of transfers. This is not surprising. Firstly, income poor and materially deprived populations only partially overlap. The income poverty indicator misses out some of the well-being effects of transfers that reach materially deprived though not income poor households. Secondly, differences in the design of transfers (i.e. the level of targeting, targeting method, flat rate benefit) imply that some groups are more likely to receive (more generous) transfers than others. Thus, a specific transfer may have a comparative advantage in reducing material deprivation relative to income poverty (and the other way around). It is less clear whether the Great Recession and austerity have changed the role of transfers: transfers result in larger reductions in the *average* number of deprivations among transfer recipients in 2013 but the percentage reductions in severe material deprivation and at-risk-of poverty rates remain relatively constant.

In sum, the simulations in this paper show that social transfers reduce not only monetary poverty but also (subtantially) the extent and depth of material deprivation. Changes in social transfers therefore have a twofold effect on the Europe 2020 social inclusion target.

The simulation method presented in this paper is still under development. It will need to be refined and expanded to all 28 EU countries. However, the results presented here already highlight the importance of measuring the impact of social transfers on material deprivation, and show how this approach usefully complements the current EU approach consisting of looking only at income poverty before and after transfers. In particular, the method relies on the robustness of the estimation of the income elasticity of material deprivation. Through sensitivity analysis, we illustrated how the choice of the regression techniques and the selection of control

variables/subpopulations of interest influence the estimation of income elasticity. Further research is needed to assess if the uncertainty around the income elasticity of material deprivation can be further reduced. Just like the wage elasticity of labour supply is different for persons with different income, gender and family situation, our checks suggest that the income elasiticty of material deprivation may be different for specific population groups such as pensioners. Moreover, while there are theoretical and empirical grounds to prefer a negative binomial regression to an OLS estimator, there are alternative maximum likelihood based estimators such as ordered logit models and zero-inflated regression models that merit further analysis and testing. A dynamic specification based on individual changes in income and material deprivation (i.e. using panel data) would provide a relevant benchmark for comparison as well. Moreover, the issue of how to account for the evolution of the income elasticity over time also merits attention. Finally, testing the method on data that have better information on specific needs, financial resources and access to in-kind transfers would allow testing for the magnitude of the omitted variable bias of the specification used here.

Another challenge, which we could not tackle here, is to test the methodology in the context of a dynamic simulation model and/or a simulation model that would take account of the interrelationships between the different transfers in a complex tax-transfer system. The behavioural assumptions underlying a static simulation model result in inflated effects of transfers on poverty and material deprivation. Not taking into account that the interactions within a tax-transfer system can lead to both under- and overestimation of the effects of transfers on poverty.

6. List of references

Aaberge, R., Langørgen, A. & Lindgren, P. (forthcoming). The distributional impact of public services in European countries. In A.B. Atkinson, A.-C. Guio & E. Marlier (Eds.), Monitoring Social Europe, Luxembourg: Eurostat.

Angrist, J.D. & Pischke, J.-S. (2009). Mostly harmless econometrics. An Empiricist's Companion. Princeton. University Press, Princeton.

Battiston, D., Cruces, G., Lopez-Calva, L. F., Lugo, M. A., & Santos, M. E. (2013). Income and beyond: multidimensional poverty in six latin American countries. Social indicators research, 112(2), 291-314.

Bergh, A. (2005). On the Counterfactual Problem of Welfare State Research: How Can We Measure Redistribution?. European Sociological Review, 21(4), 345-357.

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

Bossert, W. & D'Ambrosio, C. (2014), Proximity-sensitive individual deprivation measures, Economics Letters, Elsevier, vol. 122(2), pages 125-128. Bourguignon, F., & Chakravarty, S. R. (2003). The measurement of multidimensional poverty. Journal of Economic Inequality, 1, 25-49.

Brandolini, A., Magri, S., & Smeeding, T. M. (2010). Asset-based measurement of poverty. Journal of Policy Analysis and Management, 29(2), 267-284.

Breunig, R., & McKibbin, R. (2011). The effect of survey design on household reporting of financial difficulty. Journal of the Royal Statistical Society: Series A (Statistics in Society), 174(4), 991-1005.

Cancian, M., & Meyer, D. R. (2004). Alternative measures of economic success among TANF participants: Avoiding poverty, hardship, and dependence on public assistance. Journal of Policy Analysis and Management, 23(3), 531-548.

Di Meglio, E., Dupré, D., Montaigne, F. & Pascal Wolff (2016). Investing in European social statistics: EU-SILC. In A.B. Atkinson, A.-C. Guio & E. Marlier (Eds.), Monitoring Social Europe, Luxembourg: Eurostat.

Figari, F., Paulus, A., & Sutherland, H. (2015). Microsimulation and Policy Analysis. In B. A. Anthony & B. François (Eds.), Handbook of Income Distribution, Vol. Volume 2, 2141-2221. Oxford: Elsevier.

Figari, F. (2012), Cross-national differences in determinants of multiple deprivation in Europe. Journal of Economic Inequality, 10 (3).

Fusco, A., Guio, A., & Marlier, E. (January 2011). Income poverty and material deprivation in European countries (Working Paper No. No 2011-04). Luxembourg: CEPS/INSTEAD.

Fusco, A., Guio, A., & Marlier, E. (2010). Characterizing the income poor and materially deprived. In A. Atkinson & E. Marlier (Eds.), Income and living conditions in Europe, 133-153, Luxembourg: Eurostat.

Garfinkel, I., Rainwater, L., & Smeeding, T. M. (2006). A re-examination of welfare states and inequality in rich nations: How in-kind transfers and indirect taxes change the story. Journal of Policy Analysis and Management, 25(4), 897-919.

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

Guio, A. (2009). What can be learned from deprivation indicators in Europe (Methodologies and working papers. Luxembourg: European Commission. Retrieved from

http://epp.eurostat.ec.europa.eu.proxy.bib.uottawa.ca/cache/ITY_OFFPUB/KS-RA-09-007/EN/KS-RA-09-007-EN.PDF

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

Guio, A.-C. and Pomati, M. (2016). How do European citizens cope with economic shocks? The longitudinal order of deprivation. In A.B. Atkinson, A.-C. Guio & E. Marlier (Eds.), Monitoring Social Europe, Luxembourg: Eurostat.

Hilbe, J. (2011). Negative Binomial Regression, 2nd ed., New York: Cambridge University Press.

Huston, A. C., & Bentley, A. C. (2010). Human development in societal context. Annual Review of Psychology, 61, 411-437.

Marlier E., Atkinson, A.B.,Cantillon B. & Nolan B. (2007), The EU and Social Inclusion: Facing the Challenges. Bristol: Policy Press.

Matsaganis M. and C. Leventi (2014). The Distributional Impact of Austerity and the Recession in Southern Europe, South European Society and Politics, 19:3, 393-412.

Muffels, R., & Fouarge D. (2004). The role of European welfare states in explaining resources deprivation. Social Indicators Research 68(3), 299-330.

Nelson, K. (2012). Counteracting material deprivation: The role of social assistance in europe. Journal of European Social Policy, 22(2), 148-163.

Nolan, B., & Whelan, C. T. (2010). Using non-monetary deprivation indicators to analyse poverty and social exclusion in rich countries: Lessons from europe? Journal of Policy Analysis and Management, 29(2), 305-325.

Notten, G. (2013). Measuring performance: Does the assessment depend on the poverty proxy?, ImPRovE Working Paper 13/13, Antwerp, BE, 1-46.

Notten, G. (2015). How poverty indicators confound poverty reduction evaluations: The targeting performance of income transfers in Europe, Social Indicators Research, 1-37.

Paulus, A., Sutherland, H., & Tsakloglou, P. (2010). The distributional impact of in-kind public benefits in european countries. Journal of Policy Analysis and Management, 29(2), 243-266.

Perry, B. (2015). The material wellbeing of New Zealand households: Trends and relativities using non-income measures, with international comparisons, Ministry of Social Development, Wellington.

Ringen, S. (1988). Direct and indirect measures of poverty. Journal of social policy, 17(03), 351-365.

Saunders, P., & Wong, M. (2011). Using deprivation to assess the adequacy of australian social security payments. Journal of Poverty and Social Justice, 19(2), 91-101.

Sen, A. K. (1999). Development as freedom Oxford University Press.

Townsend, P. (1979). Poverty in the united kingdom: A survey of household resources and standards of living. Harmondsworth: Penguin.

Verbist, G., & M. Matsaganis (2014). The redistributive capacity of services in the EU. In B. Cantillon & F. Vandenbroucke (Eds.), Reconciling work and poverty reduction in Europe: how successful are European welfare states? 185-211. Oxford: Oxford University Press.

Wu, C., & Eamon, M. K. (2010). Does receipt of public benefits reduce material hardship in low-income families with children? Children and Youth Services Review, 32(10), 1262-1270.

Appendix

Table A1: Trends in GDP growth, poverty, material deprivation and social protection expenditures, 2008-2013

	2008	2009	2010	2011	2012	2013
Real GDP growth rate – volume, Percentage change on previous year						
Germany	1.1	-5.6	4.1	3.7	0.4	0.3
Greece	-0.4	-4.4	-5.4	-8.9	-6.6	-3.9
Poland	3.9	2.6	3.7	4.8	1.8	1.7
United Kingdom	-0.3	-4.3	1.9	1.6	0.7	1.7
Severe material deprivation rate, Percentage of total population						
Germany	5.5	5.4	4.5	5.3	4.9	5.4
Greece	11.2	11.0	11.6	15.2	19.5	20.3
Poland	17.7	15.0	14.2	13.0	13.5	11.9
United Kingdom	4.5	3.3	4.8	5.1	7.8[1]	8.3[1]
At-risk-of-poverty rate, Percentage of total population						
Germany	15.2	15.5	15.6	15.8	16.1	16.1
Greece	20.1	19.7	20.1	21.4	23.1	23.1
Poland	16.9	17.1	17.6	17.7	17.1	17.3
United Kingdom	18.7	17.3	17.1	16.2	16.0[1]	15.9[1]
At-risk-of-poverty threshold, In Euro at 60% of median equivalised income						
Germany	10,986	11,151	11,278	11,426	11,757	11,749
Greece	6,480	6,897	7,178	6,591	5,708	5,023
Poland	2,493	3,058	2,643	3,015	3,036	3,098
United Kingdom	11,354	9,757	10,263	10,281	11,500	11,217
Social protection benefits, In Euro per inhabitant (at constant 2005 prices)						
Germany	7,779	8,402	8,448	8,316	8,514	
Greece	4,764	5,057	4,818	4,496	4,303	
Poland	1,451	1,591	1,583	1,537	1,467	
United Kingdom	7,829	8,256	8,158	8,196	8,349	
Old-age and survivor pensions, In Euro per inhabitant (at constant 2005 prices)						
Germany	3,308	3,401	3,402	3,352	3,418	
Greece	2,418	2,507	2,413	2,344	2,553	
Poland	843	944	922	901	881	
United Kingdom	3,517	3,691	3,669	3,643	3,762	
Sickness, disability, unemployment transfers, In Euro per inhabitant (at constant 2005 prices)						
Germany	3,433	3,885	3,884	3,810	3,912	
Greece	1,847	2,011	1,926	1,716	1,388	
Poland	494	525	528	510	499	
United Kingdom	3,308	3,497	3,381	3,481	3,519	
Housing, family/child, social exclusion transfers, In Euro per inhabitant (at constant 2005 prices)						
Germany	1,038	1,116	1,161	1,154	1,183	

Greece	498	539	479	437	363	
Poland	114	121	132	127	86	
United Kingdom	1,004	1,068	1,107	1,072	1,068	

Notes: In 2012 the UK's EU-SILC data source switched from General Lifestyle Survey to the Family Resources Survey. Our checks suggest that the latent concept of deprivation differs significantly between these sources.
Source: Eurostat, downloaded from website on 25 June 2015.

Table A2 Summary Statistics (standards errors in brackets), 2008 and 2013

	Germany		Greece		Poland		United Kingdom	
	2008	2013	2008	2013	2008	2013	2008	2013
Number of observations								
- Individuals	28,785	26,633	16,748	17,909	4,1120	36,413	20,962	23,168
- Households	13,247	12,656	6,455	7,385	13,951	12,884	8,886	10,114
Equivalised income (nominal annual mean, in Euro)								
- Before all transfers	14,724 (167)	15,702 (209)	9,611 (156)	5,834 (140)	3,636 (44)	4,402 (47)	17,166 (301)	15,330 (203)
- Before old-age and survivor pensions	16,816 (164)	17,873 (208)	9,999 (154)	6,266 (139)	3,954 (43)	4,693 (46)	19,061 (288)	17,790 (187)
- Before transfers other than pensions	18,974 (161)	20,407 (199)	12,391 (152)	8,932 (134)	4,630 (43)	5,689 (46)	20,694 (298)	19,284 (196)
- Before social insurance benefits	20,107 (156)	21,789 (194)	12,554 (152)	9,091 (133)	4,752 (42)	5,802 (45)	22,129 (286)	21,101 (178)
- Before household social transfers	20,001 (157)	21,284 (198)	12,626 (150)	9,210 (133)	4,833 (42)	5,877 (45)	21,265 (294)	20,011 (191)
- Disposable	21,066 (154)	22,577 (194)	12,779 (150)	9,365 (132)	4,948 (42)	5,981 (44)	22,589 (283)	21,744 (175)
Distribution of the population by number of deprivations:								
- 0	57.3 (0.5)	60.1 (0.5)	40.2 (0.8)	28.2 (0.8)	27.2 (0.5)	30.2 (0.6)	64.2 (0.7)	49.4 (0.7)
- 1	16.9 (0.4)	16.8 (0.4)	23.1 (0.7)	19.0 (0.6)	18.6 (0.5)	19.7 (0.5)	13.1 (0.5)	19.0 (0.5)
- 2	12.8 (0.3)	11.5 (0.4)	15.1 (0.6)	15.7 (0.6)	21.8 (0.5)	24.5 (0.5)	11.4 (0.5)	14.2 (0.5)
- 3	7.5 (0.3)	6.2 (0.3)	10.6 (0.5)	17.0 (0.6)	14.6 (0.4)	13.6 (0.4)	6.8 (0.4)	9.1 (0.4)
- 4+	5.5 (0.2)	5.4 (0.2)	11.0 (0.5)	20.0 (0.7)	17.8 (0.4)	11.9 (0.4)	4.5 (0.4)	8.3 (0.4)
Correlation								
- Log disposable income & number of deprivations	-0.472	-0.506	-0.537	-0.545	-0.482	-0.509	-0.347	-0.432

Number of households excluded from analysis								
- Disposable income ≤ 0	66	20-49	20-49	54	20-49	Below 20	20-49	58
Notes: Discrepancies with the severe material deprivation rate to that reported by Eurostat are due to the exclusion of observations with negative disposable income. Income is expressed in Euro in the EU-SILC data and the exchange rate used is provided by the HX010 variable. Source: Authors' computation, UDB August 2010 and March 2015.								

Table A3: Income elasticity of material deprivation: Comparison Ordinary Least Squares (OLS) and Negative Binomial (NB) Regression (standard errors in brackets)

Dependent variable: number of deprivations								
	Germany		Greece		Poland		United Kingdom	
Independent variables:	OLS	NB	OLS	NB	OLS	NB	OLS	NB
Log income	-0.569*** (0.031)	-0.505*** (0.044)	-0.868*** (0.036)	-0.434*** (0.019)	-0.739*** (0.032)	-0.404*** (0.016)	-0.165*** (0.025)	-0.331*** (0.033)
Household:								
- Observed in wave 2013	0.042** (0.014)	0.029 (0.016)	0.037 (0.027)	0.060*** (0.016)	-0.283*** (0.019)	-0.143*** (0.011)	0.254*** (0.016)	0.271*** (0.019)
- High income	-0.073** (0.024)	-0.668*** (0.043)	-0.310*** (0.037)	-0.461*** (0.028)	-0.178*** (0.030)	-0.275*** (0.021)	-0.152*** (0.026)	-0.221*** (0.036)
- Lowest income percentile	1.025*** (0.118)	1.023*** (0.099)	0.861*** (0.171)	0.714*** (0.070)	0.592*** (0.164)	0.487*** (0.055)	0.425** (0.144)	0.588*** (0.120)
- High non-pension transfer income	0.448*** (0.028)	0.307*** (0.025)	0.234*** (0.045)	0.079*** (0.021)	0.308*** (0.031)	0.106*** (0.014)	0.532*** (0.033)	0.343*** (0.027)
Debt burden (reference: debt is not a burden)								
- Debt heavy burden	0.865*** (0.038)	0.620*** (0.026)	0.543*** (0.041)	0.316*** (0.021)	0.728*** (0.034)	0.312*** (0.014)	0.620*** (0.041)	0.393*** (0.025)
- Debt somewhat burden	0.206*** (0.020)	0.320*** (0.023)	0.113*** (0.032)	0.085*** (0.022)	0.087*** (0.026)	0.073*** (0.017)	0.064** (0.023)	0.139*** (0.027)
Housing costs (reference: housing costs are not a burden)								
- Housing costs heavy burden	0.725*** (0.025)	0.759*** (0.027)	1.024*** (0.053)	0.886*** (0.064)	1.115*** (0.033)	0.948*** (0.041)	0.856*** (0.026)	1.211*** (0.039)
- Housing costs somewhat burden	0.157*** (0.015)	0.329*** (0.025)	0.160** (0.049)	0.415*** (0.064)	0.371*** (0.030)	0.532*** (0.041)	0.235*** (0.016)	0.737*** (0.038)
Home ownership (reference: owned home)								
- Rented home	0.334*** (0.014)	0.468*** (0.019)	0.372*** (0.036)	0.219*** (0.020)	0.242*** (0.047)	0.128*** (0.023)	0.666*** (0.024)	0.685*** (0.023)
Proxy health costs (reference: no chronic illness)								
- At least one adult member has chronic illness	0.127*** (0.015)	0.142*** (0.017)	0.225*** (0.030)	0.144*** (0.018)	0.157*** (0.021)	0.079*** (0.012)	0.060*** (0.017)	0.087*** (0.020)
Demographics:								

- Number of children (aged less than 18 years)	-0.076*** (0.019)	-0.042* (0.021)	-0.038 (0.030)	-0.03 (0.017)	0.017 (0.016)	0.006 (0.008)	-0.064*** (0.018)	-0.056*** (0.013)
- Number of adults (aged between 18 years and 64 years)	-0.128*** (0.031)	-0.106** (0.040)	-0.011 (0.041)	-0.01 (0.025)	0.027 (0.019)	0.02 (0.010)	-0.067 (0.037)	-0.038 (0.033)
- Number of elderly (aged more than 64 years)	-0.152*** (0.038)	-0.123* (0.051)	-0.051 (0.049)	-0.013 (0.029)	-0.063* (0.028)	-0.012 (0.016)	-0.217*** (0.044)	-0.160*** (0.048)
Household type (reference: one person household)								
- 2 adults, no dependent child, both adults under 65 years	-0.107** (0.036)	-0.146** (0.044)	-0.232*** (0.060)	-0.191*** (0.037)	-0.328*** (0.039)	-0.197*** (0.022)	-0.104* (0.046)	-0.161*** (0.044)
- 2 adults, no dependent child, at least one adult aged more than 65 years	-0.138** (0.043)	-0.399*** (0.06)	-0.216*** (0.061)	-0.145*** (0.035)	-0.170*** (0.041)	-0.081*** (0.021)	0.031 (0.048)	-0.184** (0.059)
- Single parent household, one or more dependent child(ren)	0.160*** (0.048)	0.044 (0.038)	0.081 (0.108)	-0.022 (0.051)	0.071 (0.062)	-0.013 (0.029)	0.355*** (0.052)	0.114** (0.035)
- 2 adults, one or more dependent child(ren)	-0.061 (0.056)	-0.149* (0.067)	-0.307*** (0.079)	-0.250*** (0.048)	-0.516*** (0.048)	-0.300*** (0.028)	-0.03 (0.061)	-0.051 (0.054)
- Other households with dependent child(ren)	0.083 (0.094)	0.028 (0.116)	-0.205 (0.126)	-0.200** (0.076)	-0.446*** (0.070)	-0.245*** (0.038)	-0.007 (0.101)	-0.003 (0.096)
- Other households	0.068 (0.070)	0.017 (0.090)	-0.102 (0.102)	-0.117 (0.061)	-0.214*** (0.056)	-0.099** (0.031)	0.061 (0.092)	0.078 (0.081)
Education (reference: below secondary level)								
- Secondary	-0.436*** (0.038)	-0.205*** (0.024)	-0.214*** (0.036)	-0.120*** (0.019)	-0.492*** (0.033)	-0.156*** (0.013)	-0.085** (0.026)	-0.104*** (0.023)
- Post-secondary non-tertiary	-0.576*** (0.046)	-0.318*** (0.037)	-0.334*** (0.056)	-0.191*** (0.032)	-0.751*** (0.047)	-0.286*** (0.025)	0.086 (0.232)	0.163 (0.209)
- Tertiary	-0.649*** (0.038)	-0.518*** (0.028)	-0.481*** (0.040)	-0.404*** (0.027)	-0.893*** (0.038)	-0.533*** (0.022)	-0.237*** (0.027)	-0.346*** (0.030)
	-0.129	-0.076	0.332	0.176*	0.245	0.249	-0.06	-0.033

- Education information missing	(0.540)	(0.254)	(0.288)	(0.085)	(0.337)	(0.127)	(0.063)	(0.051)
At least one adult member is:								
- Working full-time	-0.236*** (0.028)	-0.046 (0.032)	-0.105* (0.045)	0.064* (0.027)	-0.124*** (0.031)	-0.01 (0.017)	-0.176*** (0.030)	0.006 (0.032)
- Working part-time	-0.029 (0.021)	0.007 (0.030)	0.158** (0.049)	0.165*** (0.028)	0.131*** (0.036)	0.101*** (0.019)	-0.050* (0.023)	-0.044 (0.030)
- Self-employed	0.052* (0.025)	-0.025 (0.038)	-0.112*** (0.031)	-0.110*** (0.023)	-0.316*** (0.024)	-0.228*** (0.017)	-0.111*** (0.024)	-0.183*** (0.038)
- Unemployed	0.634*** (0.041)	0.258*** (0.033)	0.329*** (0.045)	0.151*** (0.025)	0.374*** (0.033)	0.152*** (0.015)	0.443*** (0.058)	0.097** (0.036)
- Retired	-0.333*** (0.031)	-0.157*** (0.038)	-0.111** (0.040)	0 (0.025)	-0.138*** (0.027)	-0.029 (0.015)	-0.251*** (0.031)	-0.164*** (0.042)
- Not active due to disability	0.075 (0.057)	0.003 (0.042)	0.089 (0.106)	0.084 (0.048)	0.002 (0.037)	0.008 (0.017)	0.207*** (0.048)	0.044 (0.035)
- Otherwise not active	0.016 (0.034)	0.037 (0.037)	0.11 (0.057)	0.101** (0.031)	0.055 (0.028)	0.038** (0.015)	0.029 (0.053)	0.011 (0.042)
- Fulfilling domestic responsibilities	-0.074** (0.026)	-0.059 (0.037)	-0.116*** (0.031)	-0.027 (0.019)	0.018 (0.039)	0.03 (0.021)	0.133*** (0.038)	0.042 (0.032)
Citizenship (reference: citizen of the country)								
- EU citizenship	.	.	0.352** (0.111)	0.132* (0.058)	0.15 (0.270)	-0.085 (0.288)	-0.114* (0.048)	-0.069 (0.048)
- Non-EU citizenship	0.071 (0.040)	0.078* (0.039)	0.609*** (0.070)	0.204*** (0.029)	-0.126 (0.156)	-0.065 (0.117)	0.084 (0.058)	0.098* (0.046)
Number of observations	25903	25903	13840	13840	26835	26835	19000	19000
(Pseudo) R-squared	0.4822	0.2122	0.4855	0.1806	0.4411	0.1651	0.5141	0.2258
P-value (P-test of Alpha)		0		0		1		0
P-value: 10% (*), 5% (**) and 1% (***). Estimated in STATA using a negative binomial regression model (nber) and controlling for survey design (svy). For OLS we report R-squared and for NB pseudo R-squared. Source: Authors' computation, UDB August 2010 and March 2015.								

Table A4 Income elasticity of material deprivation: Sensitivity analysis

Dependent variable: number of deprivations		Germany	Greece	Poland	United Kindom
Model	Preferrred model	-0.505***	-0.434***	-0.404***	-0.331***
Alternative specification: inclusion/exclusion of controls regarding survey wave and extreme values in terms of income, material deprivation and transfers					
1*	- Excluding dummy wave	-0.500***	-0.452***	-0.440***	-0.308***
2*	- Excluding dummy high income household	-0.814***	-0.600***	-0.525***	-0.446***
3	- Excluding dummy lowest income percentile	-0.310***	-0.301***	-0.309***	-0.224***
4	- Including dummy lowest income vintile Replacing the dummy lowest income percentile.	-0.298***	-0.340***	-0.285***	-0.298***
5*	- Including dummy highest material deprivation percentile	-0.424***	-0.404***	-0.362***	-0.303***
6*	- Including dummy households receiving transfer high share of pension transfers	-0.505***	-0.435***	-0.405***	-0.330***
7*	- Excluding dummy households receiving transfer high share of non-pension transfers	-0.561***	-0.437***	-0.418***	-0.348***
Alternative specification: inclusion/exclusion of other controls					
8*	- Inclusion proxy child care costs At least one child in the household is receiving 8 or more hours child care by centre or professional (RL030, RL040, RL050)	-0.506***	-0.434***	-0.404***	-0.332***
9	- Excluding debt burden (two variables)	-0.491***	-0.427***	-0.401***	-0.327***
10	- Excluding proxy housing costs (two variables) Household indicates that the cost of housing is a heavy or modest financial burden (HS140)	-0.582***	-0.460***	-0.462***	-0.447***
11	- Excluding tenure status	-0.563***	-0.426***	-0.404***	-0.311***
12	- Exclusion proxy health costs At least one adult in the household suffers from any chronic illness or condition (PH020)	-0.506***	-0.430***	-0.403***	-0.329***
13	- Excluding education variables (seven variables)	-0.562***	-0.466***	-0.471***	-0.358***
14*	- Including proxy for emergency savings Houshold indicates that it is not capable to face unexpected financial expenses (HS060). As this variables is also a deprivation item, we excluded this item from the number of deprivations count.	-0.306***	-0.349***	-0.320***	-0.287***

Sub-populations: inclusion/exclusion of specific sub-population groups					
15*	- Excluding all households with at least one adult over age 64 The dummy indicating whether at least one adult in the household is self-employed (economic status) is dropped because of collinearity. Observations: DE: 15,923; EL: 7,343; PL: 15,874; UK: 12,904.	-0.310***	-0.337***	-0.343***	-0.345***
16*	- Excluding households with only adults over age 64 The dummy indicating whether at least one adult in the household is retired (economic status) is dropped because of collinearity. Observations: DE: 18,850; EL: 10,592; PL: 21,687; UK: 14,051.	-0.350***	-0.388***	-0.370***	-0.329***
17*	- Excluding households with at least one self-employed adult The dummy indicating whether at least one adult in the household is self-employed (economic status) is dropped because of collinearity. Observations: DE: 24002; EL: 10384; PL: 21,418; UK: 16,762.	-0.498***	-0.442***	-0.415***	-0.353***
18	- Include households with negative income Households are included by replacing the missing value for the logarithm of disposable income by zero. Observations: DE: 26,015; EL: 13,943; PL: 26,883; UK: 19,107.	-0.158***	-0.131***	-0.170***	-0.095***
Notes: Coefficients estimated using a negative binomial regression model. Unless mentioned otherwise above, the model includes the same variables and number of observations as in our preferred model specification. For models indicated with a star (*) convergence was not achieved after 20 iterations for one or more countries. Non-convergence is a signal that the model specification is not appropriate. Source: Authors' computation, UDB August 2010 and March 2015.					