Nowcasting the Income Distribution in Europe

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Nowcasting the Income Distribution in Europe[1]

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Abstract

The at-risk-of-poverty rate is one of the three indicators used for monitoring progress towards the Europe 2020 poverty and social exclusion reduction target. Timeliness of this indicator is critical for monitoring the effectiveness of policies. However, due in part to the complicated nature of the European Union Statistics on Income and Living Conditions (EU-SILC), estimates of the number of people at risk of poverty are published with a 2 to 3 year delay. This paper presents a method of estimating ('nowcasting') the current distribution of household income, including the at-risk-of-poverty rate, using a tax-benefit microsimulation model (EUROMOD) based on the EU-SILC, combined with up-to-date macro-level statistics. The method is applied to 13 EU Member States experiencing differing economic conditions over the period in question, including those which have been affected comparatively little by the crisis as well as those which have suffered a major reduction in economic activity and employment.

JEL Classification: C81, H55, I3

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1. Introduction

Time matters. Especially when it comes to the evaluation of the socio-economic situation of the EU population and the design of effective tax and benefit policies, obtaining timely information on household incomes becomes a key priority issue. The recent crisis has further increased the importance of having timely and reliable data in order for policy makers to be able to assess the impact of the economic downturn on poverty and income distribution (Atkinson, 2013; Stiglitz, 2012). In March 2010, the alleviation of income poverty officially became part of the EU's long-term strategy, by constituting one of the three components of the Europe 2020 targets for poverty and social exclusion, with the other two being reduction in material deprivation and low work intensity.

Since 2010 the European Union Statistics on Income and Living Conditions (EU-SILC) are being used for monitoring the progress of Member States towards the Europe 2020 targets. However, due to the complexity of income micro-data collection and processing, relevant income data only become available after a considerable delay. For instance, micro-data from EU-SILC 2015, reporting incomes earned in 2014, will be released in March 2017 and Eurostat normally publishes indicators using these data about six months earlier.

The aim of this paper is to nowcast changes in the distribution of income over a period for which EU-SILC data are not yet available and assess the implications of these changes for the number of people at risk of poverty. The term 'nowcasting' refers to estimation of current indicators using data on the past income distribution and various other sources of information, including the latest available macroeconomic statistics. This research extends and updates previous work on nowcasting indicators of poverty risk (Navicke et al., 2013) by refining the methodological approach, updating the underlying micro- and macro- data, extending the timing of projections up to 2013, performing the analysis for more EU countries and enriching the estimated poverty indicators to include both non-anchored and anchored at-risk-of-poverty (AROP) rates.

The paper makes use of EUROMOD, the microsimulation model that is based on EU-SILC micro-data and which estimates in a comparable manner the effects of taxes and benefits on the income distribution in each of the EU Member States. Standard EUROMOD elements (i.e. updating market incomes and simulating policy changes) are enhanced with additional adjustments to the input data needed to capture changes in the employment characteristics of the population over time.

The nowcasting method is applied to EU-SILC 2010 data (2009 incomes) and AROP rates are estimated for 2009-2013. The performance of the method is assessed by comparing the predictions with actual EU-SILC indicators where the latter are available. The thirteen EU countries that are included in the analysis are Germany, Estonia, Greece, Spain, France, Italy, Latvia, Lithuania, Austria, Poland, Portugal, Romania and Finland. The methodology used ensures the comparability of results both through time and across countries.

The most important results can be summarised as follows. Both mean and median incomes in 2013 are estimated to be significantly different from their 2011 levels in all countries studied, with the exception of France. The country where the AROP rate is predicted to rise the most in 2011-2013 is Greece, by almost two percentage points. The AROP rate is also predicted to rise in Romania, Latvia and Estonia, but at a slower pace. In other countries the changes in the total AROP rates are either non-significant or negative. Looking at poverty rates by age group, with the exception of the three Baltic countries and Romania, the elderly seem to have improved their relative position in terms of income. The use of the alternative indicator of poverty risk based on the fixed poverty threshold results in a prediction of higher total AROP rates for the four Southern European countries, Estonia, France, Lithuania and Austria.

The structure of the paper is the following: Section 2 offers a brief review of the literature. In Section 3 the methodology for nowcasting poverty risk is explained. Section 4 presents and discusses the predictions of the key indicators of poverty risk. Section 5 reflects on the main limitations of this approach. Finally, Section 6 concludes by summarising the most important findings and policy implications of this research.

2. Literature review

The lack of timely information on household incomes or, as it is the case in some countries, the complete lack of information needed to compute poverty estimates, has led to the development of a number of methodological approaches attempting to overcome this obstacle.

One line of research has explored alternative indicators that could be used as proxies for the traditional poverty risk indicators. Examples of such proxies include indicators of financial distress, households' self-assessment of their financial situation, administrative information on social benefit receipt and use of social services. A comprehensive review of these indicators can be found in Minty & Maquet-Engsted (2013). The main criticism that these indices have received is related to their subjectivity and inability to provide information on the distributional impact of policy changes. Vulnerability measures have also served as predictors of future poverty rates (Chaudhuri, 2003). While these measures have been proved to be relatively good predictors of overall poverty rates, they do not perform well at a more disaggregated level (Bérgolo et al., 2012).

A second line of research has focused on the development of econometric modelling methods. Macro-level data such as unemployment levels, aggregate social benefit receipt/expenditure, historical trends of poverty and GDP are some of the most commonly used explanatory variables in these poverty-predicting models. Some recent applications of this method in the U.S. include Isaacs & Healy (2012) and Monea & Sawhill (2009). As changes in tax-benefit policies are commonly disregarded, econometric methods may give satisfactory results in contexts where welfare policies have a limited impact on poverty. Another drawback of these models is that they are not able to capture the distinct effects of changes in income and household circumstances at different points in the income distribution.

Microsimulation has also been used for assessing the distributional impact of current tax-benefit policies as well as future policy reforms. Using microsimulation techniques based on representative individual level data enables changes in the distribution of market income to be distinguished and the effects of the tax-benefit system to be identified taking into account the complex ways in which these factors interact with each other (Peichl, 2008; Immervoll et al., 2006).

Linking micro-level analysis to economy-wide changes has opened up new horizons for microsimulation research. The World Bank has been pioneering in the development of this modelling strategy that focuses on the combined impact of policies and macroeconomic shocks on poverty and income distribution. Elaborate simulation methodologies and techniques have been developed and used in several applications, with a special emphasis on developing countries. For a thorough review see Bourguignon et al. (2008) and Essama-Nssah (2005). In these studies the construction of the necessary macro-level data is usually based on Computable General Equilibrium (CGE) models. These data are then fed into a microsimulation model.

In the context of the current crisis in Europe, mircosimulation has been increasingly used as a tool for establishing the ex-ante distributional impact of policy reforms and broader economic developments. In the UK, a static microsimulation model augmented with forecasts of key economic and demographic characteristics was used to forecast poverty among children and working-age adults (Brewer et al., 2011) and to establish the effects of the recession up to 2016 (Brewer et al., 2013). In Ireland (Keane et al., 2013), Italy (Brandolini et al., 2013) and Greece (Leventi & Matsaganis, 2013) microsimulation techniques combined with macro data have been used in order to investigate the poverty and distributional impact of the crisis. In a comparative setting, Ajwad (2013) used microsimulation to analyse the impact of improving employment and education conditions on poverty and social exclusion indicators in ten new EU member states. Narayan & Sánchez-Páramo (2012) have also enriched microsimulation modelling with macroeconomic projections in order to perform an ex-post analysis of the distributional impact of the economic crisis experienced in Bangladesh, Mexico, Philippines and Poland in 2008-2009.

This paper attempts to add to this growing literature by suggesting a methodology to nowcast poverty in European countries over a period for which EU-SILC data is not yet available.

3. Methodology

This section presents the method used for nowcasting AROP indicators in a selection of EU countries.[2] The main dimensions that are required in order to estimate AROP rates are median income and income of those at the lower end of the income distribution. The accuracy of predictions depends on the extent to which the simulated changes in the underlying income distribution manage to capture the most important macro-economic developments, country-specific policy changes and the ways in which these two factors interact with each other.

We use EU-SILC 2010 data (2009 incomes) for predicting AROP rates up to 2013. EUROMOD is used to simulate changes in the income distribution within the period of analysis.[3] The main advantage of using EUROMOD is its capacity to estimate, in a comparable way, the effects of changes in taxes and benefits on income distribution for each of the 27 Member States. It is, however, a static tax-benefit microsimulation tool. Standard practice in such models is to assume that labour market and demographic characteristics of the population remain unchanged. This is a plausible assumption for short term analysis in a stable macro-economic climate, but may bias the results in a period of rapid demographic or economic change. While major demographic shifts are less of a concern within a four-year time frame than over a longer period, changes in the labour market were particularly important within the period under consideration. We thus adjust the input data to account for changes in the labour market.

Labour market changes are accounted for by explicitly simulating the transitions between labour market states (Figari et al., 2011; Fernandez Salgado et al., 2014; Avram et al., 2011). Observations are selected based on their conditional probabilities of being employed rather than being unemployed or inactive.[4] A logit model is used for estimating probabilities for working age (16-64) individuals in the EU-SILC based EUROMOD input data. We estimate the model separately for individuals with higher and lower levels of educational attainment to allow for structural differences in the labour market situation of the two groups. This

[2] The method used is similar to the one reported in Navicke et al. (2013). For more detailed discussion see this paper.

[3] For further information on EUROMOD and its applications see Sutherland & Figari (2013).

[4] Unemployment and inactivity are not modelled separately. Transition into inactivity is defined implicitly through restricting eligibility for unemployment benefits.

approach is similar to that used in Habib et al. (2010) and Ferreira et al. (2004). The higher level of education is defined as completed upper secondary education or above (ISCED 1997 levels 3-5). Working-age individuals in receipt of disability or retirement pensions as well as those in education are excluded from the estimation unless they report working for a full year in the underlying data. Also excluded are mothers with children below 2 years of age. The specification of the logit model used and the estimated coefficients are reported in Appendix 1.

The weighted total number of observations that are selected to go through transitions based on their probabilities corresponds to the relative net change in employment levels by age group, gender and education (a total of 18 strata) as shown in the Labour Force Survey (LFS). Macro level LFS statistics are used as the most up-to-date source of information on employment which is synchronised across EU countries. We use annual LFS employment rates for 2010-2012 and an average of the last four available quarters (2012Q3-2013Q2) for 2013. It should be noted however, that labour market concepts do not align perfectly between EUROMOD and the LFS. In the LFS employment status is determined through an extensive set of questions on activity in the reference week.[5] However, EUROMOD relies on self-defined labour market status from the EU-SILC income reference period.[6] The analysis by Navicke et al. (2013) showed that despite inconsistencies in EU-SILC and LFS definitions of employment and the resulting differences in the levels of employment rates, the dynamics of employment are mostly consistent between the two surveys. Thus employment adjustments carried out in relative terms give satisfactory results. It should, however, be acknowledged that divergences between the two surveys may occur which can result in biased estimations.[7]

Selecting observations to move from employment or self-employment to unemployment and vice versa allows the detailed tax-benefit implications to be captured in EUROMOD. Changes from short-term to long-term unemployment are also essential to capture because of their implications for eligibility and receipt of unemployment benefits. The latter are modelled based on a similar selection procedure to that described above. We use LFS figures on long-term unemployment of 12 months or more as an external source of information.

Labour market characteristics and sources of income are adjusted for those observations that are subject to transitions. In particular, employment and self-employment income is set to zero for individuals moving out of employment; for individuals moving into employment, earnings are set equal to the mean among those already employed within the same stratum.

After modelling employment transitions, the next step for nowcasting poverty indicators with EUROMOD involves two tasks: updating non-simulated income beyond the income data reference period and simulating tax and benefit policies for each year from 2009 to 2013. Updating incomes is carried out in EUROMOD using factors based on available administrative or survey statistics. Specific updating factors are derived for each income source, reflecting the change in their average amount per recipient between the income data

[5] In the LFS employed persons are persons aged 15 and over (15-74 years in Estonia and Latvia) who performed work, even for just one hour per week, for pay, profit or family gain during the reference week or were not at work but had a job or business from which they were temporarily absent because of, for instance, illness, holidays, industrial dispute, and education or training (Eurostat, 2006).

[6] In EU-SILC a person is considered to be employed or self-employed in a given month if he or she worked (or was in paid apprenticeship or training) the majority of the weeks in that month. Information on every month is collected. If a person had a job, but was temporarily absent because of maternity leave, injury or temporary disability, slack work for technical or economic reasons, he or she is considered employed (Eurostat, 2010).

[7] Minor deviations occur due to differences in the EUROMOD and LFS structure of the working age population in the base year and changes in the demographic structure thereafter.

reference period and the target year. In order to nowcast non-simulated income sources in EUROMOD official forecasts are used to derive updating factors for the current year. In cases where such forecasts are not available, estimations are made using quarterly data or updating by alternative appropriate factors (e.g. CPI or the GDP deflator).

The evolution of employment income is of particular importance for capturing changes in household disposable income (and hence for correctly estimating median income and the resulting poverty line). It is often the main source of income for households, and it can be subject to large fluctuations, especially in times of rapid economic changes, such as the period of the recent economic crisis. In order to capture differential growth rates in employment income, updating factors are disaggregated by economic activity and/or by private and public sector in cases where such information is consistently available in national statistics and the SILC data. Average employment income is also affected by changes caused by the labour market adjustments described above.

After updating market income and other non-simulated income sources, EUROMOD simulates tax-benefit policies for each year from the income data year (2009) up to 2013. All simulations are carried out on the basis of the tax-benefit rules in place on the 30th June of the given policy year. The model uses market incomes, labour market status and other individual and household characteristics, and the tax and benefit rules in place in order to simulate cash benefits, social insurance contributions and personal direct taxes. The components of the tax–benefit system that cannot be simulated (for example, those depending on disability status) are taken directly from the EU-SILC data.[8] In these cases the recorded values are uprated as for other non-simulated income sources. Detailed information on the scope of simulations and updating factors is documented in EUROMOD Country Reports.[9]

The last methodological step involves an attempt to account for differences between EUROMOD and EU-SILC estimates. AROP indicators that are calculated using simulated incomes from EUROMOD may diverge from those calculated by Eurostat for the same income data reference year. The main reasons for this are related to precision of tax-benefit simulations when information in the SILC data is limited, issues of benefit non take-up and tax evasion, small differences in income concepts and definitions, as well as the possibility that some income components are under-recorded in the EU-SILC (Figari et al., 2012; Jara & Sutherland, 2013).

In order to account for these discrepancies, a calibration factor is calculated for each household which is equal to the absolute difference between the value of equivalised household disposable income in the 2010 EU-SILC (variable HX090) and the EUROMOD estimate for the same period and income concept. The same household specific factor is applied to all later policy years. This is based on the assumption that the discrepancy between EUROMOD and EU-SILC estimates remains stable over time. For that reason, it is to be expected that calibration will perform better if applied to countries or time periods with greater economic stability.

4. The nowcast

This section provides the main nowcast results. First, the simulated dynamics of equivalised household income at the median and AROP rates are presented and compared to the available

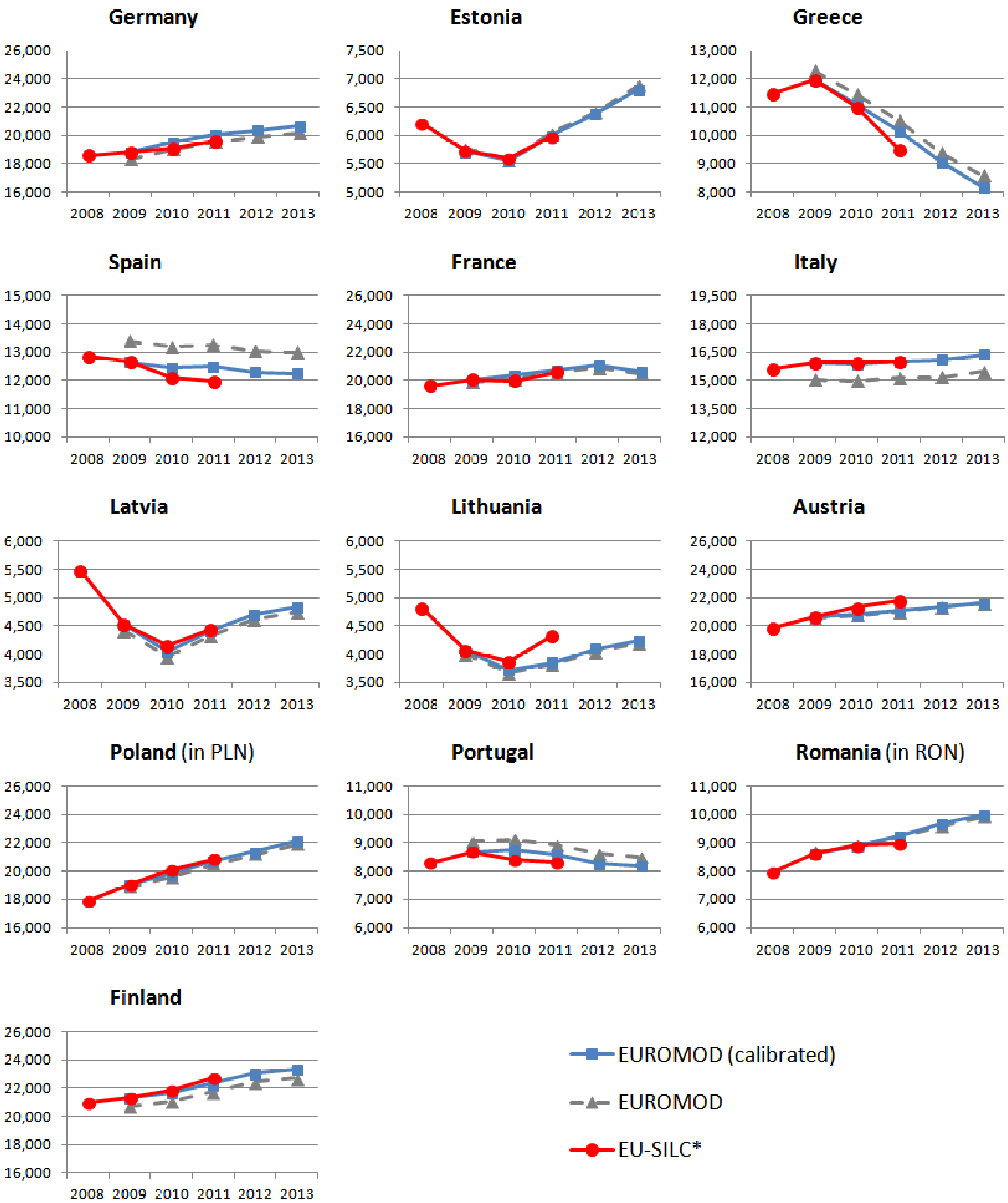
[8] In some cases, EU-SILC provides information on income components in a harmonised way (i.e. benefits are aggregated according to their function). In preparing the input database for EUROMOD the information on the individual benefit payments is recovered using imputation techniques.

[9] See for details: https://www.iser.essex.ac.uk/euromod/resources-for-euromod-users/country-reports.

EU-SILC estimates (Figures 1 and 2). These are followed by a discussion of the nowcasted change in the mean, median and AROP rates split by age groups and sex (Table 2) for the period of 2011-2013 when the EU-SILC figures are not yet available. Lastly we discuss the predicted changes in poverty risk if it is measured using a poverty threshold anchored in 2009 and adjusted by the harmonized consumer price index (Figure 3). The latter reflects the evolution of income at the bottom of the distribution relative to change in prices rather than change in median income of the population. The EUROMOD-based estimates of mean equivalised household income by gender and age group are reported in Appendix 2.

Figure 1 shows the levels and dynamics of median equivalised disposable income shown in EU-SILC and simulated in EUROMOD with and without calibration. The assumption of the discrepancy being constant over time between the two sources of information results in a parallel movement of the calibrated and non-calibrated simulated median income across the whole period. This is also the case for mean equivalised disposable income reported in Appendix 2. Given that the shift is parallel and does not alter the direction and scale of the movement, we discuss the calibrated results.

Figure 1. Median equivalised disposable income: EUROMOD 2009-2013 and EU-SILC 2009-2011, EUR per year (unless otherwise specified)



Notes: EUROMOD based estimates are obtained with employment adjustments and with/without calibration as described in section 2. Note that the charts are drawn to different scales and the gridlines approximately correspond to 10% of the median in each country. For the cases of Poland and Romania, where the exchange rate is not fixed, income data are presented in national currency values. *EU-SILC (ilc_di03) numbers are lagged by one year to correspond to the income reference year.

Source: Eurostat (extracted on 19 Dec 2013) http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_di03&lang=en.

It should be noted that in some countries EU-SILC based statistics were recently revised following the updated information from the 2011 population censuses. A break in the series is reported by Eurostat for Latvia (in EU-SILC 2011). To our knowledge this is also the case for Lithuania, where the break occurred in the EU-SILC 2012 data (2011 incomes) with backward revisions to previously published statistics. In Spain following the census the estimates were revised from as early as SILC 2004, giving a better representation of the immigrant population in the country. A break is also reported in EU-SILC 2012 in Austria as administrative data were used by Statistics Austria for as many income sources as possible starting with that year. In the case of Latvia, Austria and Lithuania structural breaks in the EU-SILC data are not captured in the nowcasted results presented below, thus the estimates show the evolution of median income and poverty risk had the break not occurred, because EUROMOD input data are based on the EU-SILC before revisions. For Spain it was possible to update the input dataset incorporating the revised weights.

The simulated estimates of the median shown in Figure 1 for 2009-11 incomes align well with the actual EU-SILC values in most cases. An especially good fit is observed for Estonia, France, Italy, Latvia, Poland and Finland. For Germany and Portugal simulated growth in the median income is slightly over-estimated compared to EU-SILC in 2010 and 2011. The opposite is true for Austria where the simulated median seems to be under-estimated. This can probably be attributed to the break in the Austrian series for 2011 incomes. For Romania, estimates align well up to 2010 but start to diverge in 2011, when the rise in median income estimated by EUROMOD does not appear in EU-SILC.

More substantial discrepancies in the dynamics of simulated median income compared to what is shown by the EU-SILC are observed in the three remaining countries: Greece, Lithuania and Spain. For Greece and Lithuania the EUROMOD estimates follow the EU-SILC trend throughout the period in question. However, in 2011 EUROMOD does not capture the magnitude of the drop in the median (-13.4%) that is revealed in EU-SILC for the case of Greece, nor the steep rise in median income which is shown for the case of Lithuania. For Spain our results show somewhat different trends compared to the persistent drop in median income which is shown by the EU-SILC, and end up estimating substantially higher levels of median income in 2011.

A plausible explanation for the higher median that EUROMOD estimates for Greece is that the official figures used for updating employment and self-employment income in EUROMOD are not capturing important negative changes that occurred in the large informal sector of the economy or in areas of activity that are not covered by official collective bargaining agreements.

On the other hand, in case of Lithuania the rise in the median income between 2010 and 2011 is likely to be over-estimated in the EU-SILC. The increase in the median of 12.4% and in the mean of 13.8% reported in EU-SILC for Lithuania are the highest across the EU and exceed the growth reported in the other Baltic countries by more than 5 percentage points. The over-estimation in the EU-SILC may be due to the break in the series following the population census, survey sampling error or other survey methodological issues.

A comparison of the EUROMOD simulated values for Spain with the available EU-SILC micro data for the income reference periods of 2009 and 2010 showed a larger decrease in the number of recipients of employment income in Spain compared to the modelled change in employment based on the LFS statistics.

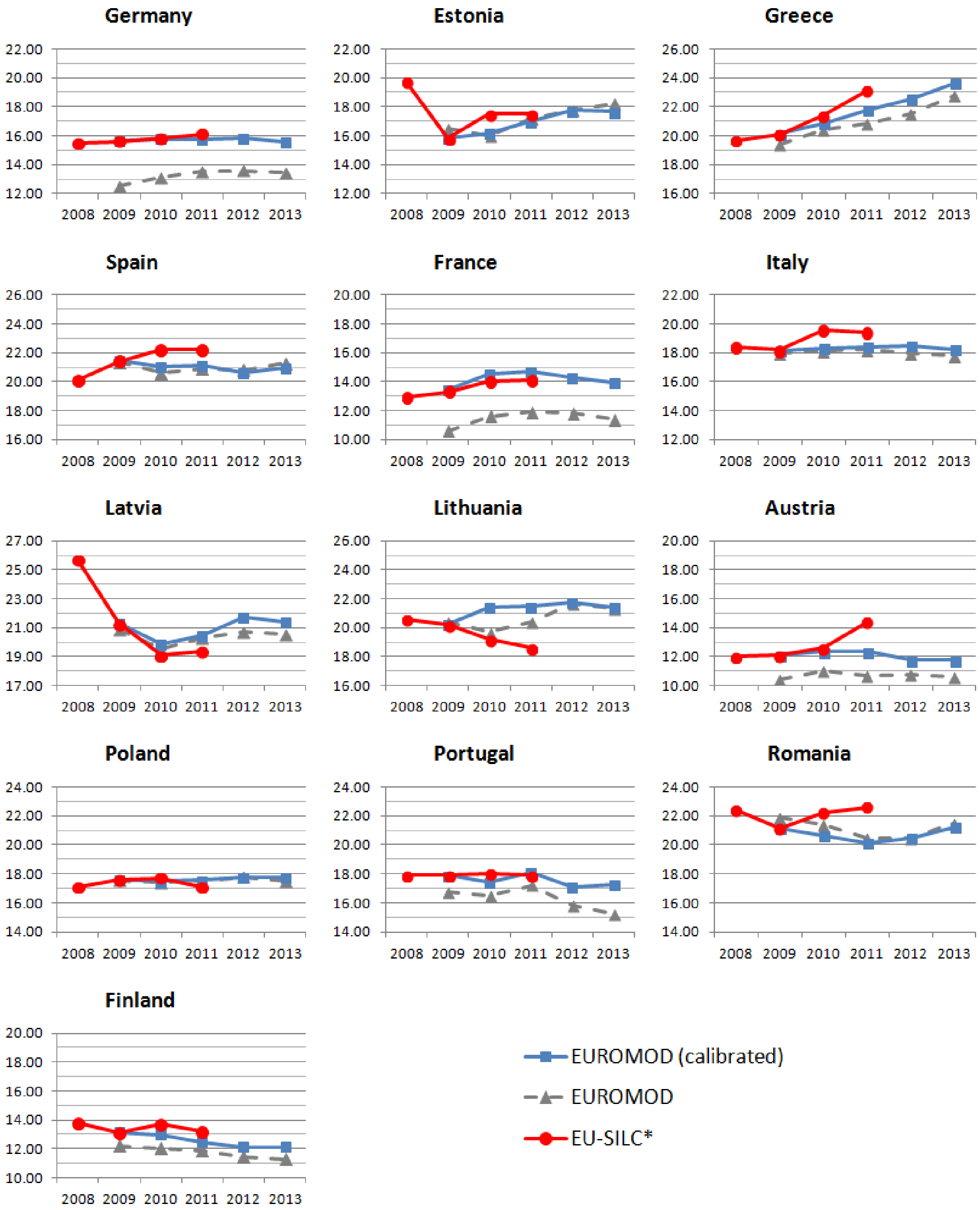
Figure 2 shows how the standard AROP indicator, estimated using a poverty threshold at 60% of the median equivalised disposable income, moves in the period up to 2011 according to EU-SILC and up to 2013 according to our simulations. Despite the close match in the simulated levels of the median income reported in Figure 1 for most countries, the simulated poverty risk rates appear to follow those from the EU-SILC with less precision. The dynamics of AROP are captured reasonably well by EURMOD in Germany, Greece, France, Latvia, Poland, Portugal and Finland. In other countries differences in the EU-SILC based and the simulated indicators are higher and it is only in Spain where the higher official levels of AROP may be explained by the over-simulation of the median in EUROMOD. In Austria, Latvia and Lithuania the discrepancies observed may in part be caused by the breaks in the EU-SILC series within the period that is analysed.

In the Baltics the EU-SILC based AROP estimates show very different dynamics, despite the similar trends in the median income depicted in Figure 1. Interestingly, in EUROMOD the dynamics of the poverty risk indicators are similar across the three countries. The common simulated trend can be described as decreasing poverty levels for 2009 and 2010 as the medians fall, an increase in AROP in 2011 and 2012 as growth resumes, and levelling out in 2013.[10] This trend is most clear and consistently estimated in the EU-SILC and EUROMOD simulations for Latvia. While counter-intuitive, this is largely consistent with the broader economic and policy developments in the region. In 2009-2010 the fall in AROP was driven by decreasing relative poverty risk among pensioners, whose incomes were better protected, compared with high losses in income experienced by the working age population due to increased unemployment, decreased wages and other sources of original income and benefits. The magnitude of change was largest in Latvia, where the initial poverty risk level among the population aged 65 and over was 47.5% in 2008 and dropped to 8.9% in just 2 years. This was followed by re-adjustment in 2011-2012 as the economies in the Baltics started to recover, stabilising in 2013.

A word of caution should be added about the substantial discrepancy between EU-SILC and EUROMOD estimates for Lithuania. The EU-SILC based estimates show persistently decreasing AROP rates throughout the crisis and despite the rapidly growing median in 2011 recorded in the survey data. If correct, this would mean that within the period the relative position of the lower part of the income distribution improved considerably. In EUROMOD, however, we estimate an increase in the AROP rates since 2010. This is driven not only by the negative changes in the labour market, but also by the temporary cuts in social benefits, effective since 2010. The cuts affected those receiving unemployment, child and family benefits, whereas progressive cuts were also implemented in the case of public pensions. Social insurance pensions were restored to their pre-austerity levels in 2012, preventing a lag between growth in average pensions and original incomes. Thus, the simulated trend in the AROP rates in Lithuania is more in line with the economic and policy related changes in the country (had the break in the Lithuanian EU-SILC series not occurred). The example of Lithuania illustrates the general point that breaks in the SILC series due to changes in methods and assumptions can confuse assessments of the evolution of poverty risk over time, and simulations can provide valuable evidence on the effects of the main drivers of poverty risk without such breaks.

[10] In Lithuania this trend is more explicit in the non-calibrated EUROMOD series.

Figure 2. At risk of poverty rates (using 60% of median as the threshold): EUROMOD 2009-2013 and EU-SILC 2009-2011



Note: EUROMOD based estimates are obtained with employment adjustments and with/without calibration as described in section 2. * EU-SILC (ilc_li02) numbers are lagged by one year to correspond to the income reference year.

Source: Eurostat (extracted on 19 Dec 2013) http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_li02&lang=en.

In the South of Europe EU-SILC consistently picks up an increasing rate of poverty risk in 2009-2011. The exception is Portugal, where the EU-SILC numbers stay roughly constant throughout this period (at about 18%), with a similar trend simulated in EUROMOD. In Greece the EUROMOD estimates also follow a similar trend to the one depicted in EU-SILC. However, they do not capture the magnitude of the increase in AROP rates in 2010-2011 that is picked up by the latter. In Italy, Romania and Spain EUROMOD results do not reflect the rise in poverty which is depicted in EU-SILC for 2010 and end up estimating significantly lower AROP rates in 2011. In Romania, this discrepancy is mostly due to the falling poverty rates that are estimated for children and the working age population, despite all the simulated fiscal consolidation measures.[11] In Spain, the increase in poverty risk for the working-age population shown by the SILC is not captured. This is likely to be related to the inability to fully account for losses in employment income observed in SILC due to differences between the LFS and the EU-SILC composition of the employed.

The economic situation in Austria, Germany, Finland and France was much less volatile within the period compared to the other countries that are analysed. The use of monetary policy instruments in Poland (depreciation of the national currency in 2009) resulted in a slow-down in real economic growth in 2009, but allowed Poland to recover promptly in 2010 and 2011. The dynamics of the simulated results are consistent with the official AROP estimates in all five of the above-mentioned countries, except for the year 2011 in Austria when the break in the EU-SILC series occurred. In Finland we do not capture a slight increase in the recorded poverty risk level in 2010. This increase is most pronounced for males and for the working-age population but is below 1 percentage point. In France the simulated growth in AROP rates is slightly higher in 2010-2011 compared to the official figures. This is mostly due to the decrease in poverty levels among the elderly recorded in EU-SILC (by around 1 percentage point). Since there were no structural policy changes during that time, this decrease is most probably related to changes in the composition of the elderly population that are not captured by the simulations. In other age groups, i.e. children and working-age adults, the simulated increases in poverty risk levels align well with the EU-SILC estimates. In Germany and Poland the simulated and the EU-SILC poverty risk estimates are well aligned and stable in 2009-2011, and are also stable for the later years.

Table 1 shows the nowcasted changes in equivalised income and poverty rates for the period when the official EU-SILC estimates are not yet available (i.e. 2011-2013 income corresponding to EU-SILC 2012-2014). It also reports initial levels as in EU-SILC 2012 (2011 income). The reason for focusing on changes in indicators rather than their absolute values is mainly due to sampling and other errors that may lead to wide confidence intervals around point estimates of the AROP indicators in EU-SILC (see Goedemé, 2010; Goedemé, 2013).[12] However, the nowcasts of direction and scale of change are likely to be more reliable than the point estimates for each particular year. Using one dataset for microsimulation across all years, which is the case for the simulations in this paper, involves a reduction in the standard errors due to covariance in the data (Goedemé et al., 2013). Changes in the value of indicators between 2011 and 2013 that are statistically significant, taking into account the covariance in the data, are marked in Table 1.

[11] For a review of the simulated fiscal consolidation measures see Avram et al. (2012)

[12] EU-SILC Quality reports available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/income_social_inclusion_living_conditions/quality.

Table 1. Eurostat levels and nowcast change in median income, mean income and AROP rates, 2011-2013

	Level and % change		Poverty rates (60% of median) and change in p.p.					
	Mean	Median	All	Male	Female	Children (<18)	Adults (18-64)	Elderly (65+)
Germany								
Eurostat level 2011	*22,022*	*19,595*	*16.1*	*14.9*	*17.2*	*15.2*	*16.6*	*15.0*
Calibrated change 2011-2013	3.0%***	3.0%***	-0.22*	-0.44**	0.00	0.39†	-0.39**	-0.15*
Estonia								
Eurostat level 2011	*7,119*	*5,987*	*17.5*	*16.8*	*18.1*	*17.0*	*17.7*	*17.2*
Calibrated change 2011-2013	13.0%***	13.5%***	0.69†	-0.29	1.53***	0.56	-0.68†	6.11***
Greece								
Eurostat level 2011	*10,676*	*9,513*	*23.1*	*22.5*	*23.6*	*26.9*	*23.8*	*17.2*
Calibrated change 2011-2013	-18.9%***	-19.7%***	1.84**	2.15**	1.53*	2.58*	3.03***	-2.91**
Spain								
Eurostat level 2011	*13,885*	*11,970*	*22.2*	*22.2*	*22.1*	*29.9*	*21.9*	*14.8*
Calibrated change 2011-2013	-2.1%***	-2.0%***	-0.19	0.09	-0.48†	0.26	0.48†	-3.39***
France								
Eurostat level 2011	*24,499*	*20,603*	*14.1*	*13.6*	*14.6*	*19.0*	*13.7*	*9.4*
Calibrated change 2011-2013	-1.8%***	-0.3%	-0.80***	-0.74**	-0.86***	-0.76†	-0.48†	-2.07***
Italy								
Eurostat level 2011	*18,204*	*16,029*	*19.4*	*18.1*	*20.7*	*26.0*	*18.6*	*16.3*
Calibrated change 2011-2013	2.0%***	2.3%***	-0.16	-0.06	-0.25†	-0.11	0.02	-0.74***
Latvia								
Eurostat level 2011	*5,456*	*4,436*	*19.4*	*19.5*	*19.4*	*24.7*	*19.4*	*14.0*
Calibrated change 2011-2013	10.5%***	9.9%***	0.93**	0.09	1.65***	0.44	-0.20	5.90***
Lithuania								
Eurostat level 2011	*5,124*	*4,337*	*18.6*	*18.1*	*19.0*	*20.8*	*17.9*	*18.7*
Calibrated change 2011-2013	9.4%***	9.9%***	-0.04	-0.43	0.30	0.53	-0.75	2.23***
Austria								
Eurostat level 2011	*24,423*	*21,807*	*14.4*	*13.5*	*15.3*	*17.5*	*13.3*	*15.1*
Calibrated change 2011-2013	3.2%***	2.5%***	-0.57**	-0.44†	-0.70*	-0.35	-0.36	-1.61***
Poland	(in PLN)							
Eurostat level 2011	*24,320*	*20,850*	*17.1*	*17.1*	*17.1*	*21.5*	*16.5*	*14.0*
Calibrated change 2011-2013	6.7%***	7.0%***	0.22	0.32*	0.12	0.64**	0.36*	-1.07***
Portugal								
Eurostat level 2011	*10,251*	*8,323*	*17.9*	*17.5*	*18.2*	*21.7*	*16.9*	*17.4*
Calibrated change 2011-2013	-5.6%***	-4.7%***	-0.82*	-0.77†	-0.87*	-0.45	-0.58	-2.07***
Romania	(in RON)							
Eurostat level 2011	*10,233*	*8,970*	*22.6*	*21.9*	*23.2*	*34.6*	*21.0*	*15.4*
Calibrated change 2011-2013	8.3%***	8.1%***	1.12***	0.94***	1.29***	1.05*	0.96***	1.94***
Finland								
Eurostat level 2011	*25,148*	*22,699*	*13.2*	*12.9*	*13.6*	*11.1*	*12.4*	*18.4*
Calibrated change 2011-2013	4.0%***	4.6%***	-0.31*	-0.25	-0.36*	-0.15	-0.04	-1.50***

Notes: Calibrated change. Estimated changes between 2011-2013 are statistically significant at the: † 90% level, * 95% level, ** 99% level, *** 99.9% level. Information on the sample design of EU-SILC 2010 used for calculations was derived following Goedemé (2010) and using do files Svyset EU-SILC 2010 provided at: http://www.ua.ac.be/main.aspx?c=tim.goedeme&n=95420. Standard errors around AROP indicators are based on the Taylor linearization using the DASP module for Stata. Household incomes are equivalised using the modified OECD scale. The changes shown are percentage changes in the median and the mean and percentage point changes in AROP indicators. The nowcast change is the difference in the EUROMOD estimates for 2013 compared with that for 2011, the income year corresponding to the latest available Eurostat SILC estimate. Mean and median equivalised household income in EUR per year, unless otherwise specified.

Table 1 suggests that both mean and median incomes in 2013 are significantly different from their levels in 2011 in all the countries, except for the median in France. The highest increases in the mean and median income are predicted for the three Baltic States. An increase around 10% in Latvia and Lithuania is largely consistent with the expected wage and GDP growth over the period. A 13% increase in Estonia is beyond the expected GDP growth, but it is largely consistent with accelerated nominal wage growth driven by rising vacancies and skill mismatches, recent minimum wage increases, and pay agreements for health workers and teachers.[13] A more modest increase in the median is projected for Germany, Italy, Austria, Poland, Romania and Finland. Among these countries the growth in the median is estimated to exceed inflation only in Poland and Romania, while in the other four countries the median is shrinking in real terms. In Finland, despite a slowdown of the economy observed in 2012 and the beginning of 2013, wages are still increasing due to collective wage agreements.[14] A fall in the median equivalised disposable income is predicted for most South European countries: Spain, Portugal and especially Greece (-19.7%).

In spite of the large reduction in the poverty threshold in Greece the headline poverty rate is still increasing (by around 2 percentage points). Greece and Romania are the only two countries among those analysed where a substantial increase (above 1 percentage points) in the AROP indicator is predicted between 2011 and 2013. In Estonia and Latvia the predicted increase is somewhat smaller.[15] In other countries the changes in the total AROP rates are either non-significant or negative.

In Spain and Portugal, where median incomes are falling, poverty rates are decreasing as well. However, the reduction is less than 1 percentage point and in the case of Spain it is also statistically insignificant. In both countries the elderly at the bottom of the income distribution seem to have suffered relatively smaller income losses compared to the rest of the population, due to cuts in the pensions being mainly targeted on those with higher entitlements.

In Lithuania, unlike Latvia and Estonia, the increase in the median income does not lead to a significant rise in the AROP indicator. While the changes in poverty risk among children and the prime-age population are similar in all three countries, poverty risk for the elderly is predicted to rise less in Lithuania compared to the estimated increase of around 6 percentage points in the other Baltic countries. As mentioned above, pensions in Lithuania were progressively cut in 2010 and mostly restored in 2012, while in Latvia pensions remained frozen until September 2013, and in Estonia growth in pensions lags behind growth in market incomes as the indexation is based on indicators from the previous period.

In all countries, except the three Baltic States and Romania, the AROP rate among the elderly is expected to drop. In Greece, Spain, France, and Portugal reductions in the AROP rate among the elderly are nowcasted to be about 2-3 percentage points. Hence, in all these countries the elderly are improving their relative position with respect to the rest of the population during the period in question. In Greece this is despite the additional taxation of pension benefits in 2011-12 and the further pension cuts that were introduced in 2013. Poverty rates among the elderly in Poland are also in decline within the period due to

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[13] According to 2013 Autumn economic forecasts at: http://ec.europa.eu/economy_finance/eu/forecasts/2013_autumn_forecast_en.htm.

[14] Same as above.

[15] In Latvia an increase in poverty risk in 2012 (by 1.4 percentage points) is offset by a small drop in 2013. The latter is likely to be related to a considerable increase in the amount of childcare benefit paid to non-employed parents of small children.

favourable indexation and a one-off increase in pensions by a fixed amount in 2012, which increased the smallest public old-age pension by almost 10% in a single year.

In most countries the changes in the AROP rates among children are consistent with those predicted for the working age adult population. This is not the case for Germany, where the AROP rate for the prime age population is estimated to decrease by about half of a percentage point while the poverty risk among children is estimated to increase to the same extent. One possible explanation might be the fact that in Germany there is no systematic statutory indexation of tax and non-pension benefit levels for inflation and most of the non-contributory, means-tested benefits targeted at families with children remained constant since 2010, causing the value of these benefits to erode in real terms.

By construction, the standard poverty line rises as median income improves, and falls as median income falls. This is quite consistent with the concept of relative poverty, and may not have much effect when income change is slow either way. However, at times of rapid changes in living standards, individuals may compare their situation not only with that of 'the median person' in the society in which they live, but also with their own in a previous period. To approximate for this perspective, our second indicator fixes the poverty line at 60% of the 2009 median and adjusts it for inflation in later years. This is done using the harmonized index of consumer prices which is presented in Appendix 3.

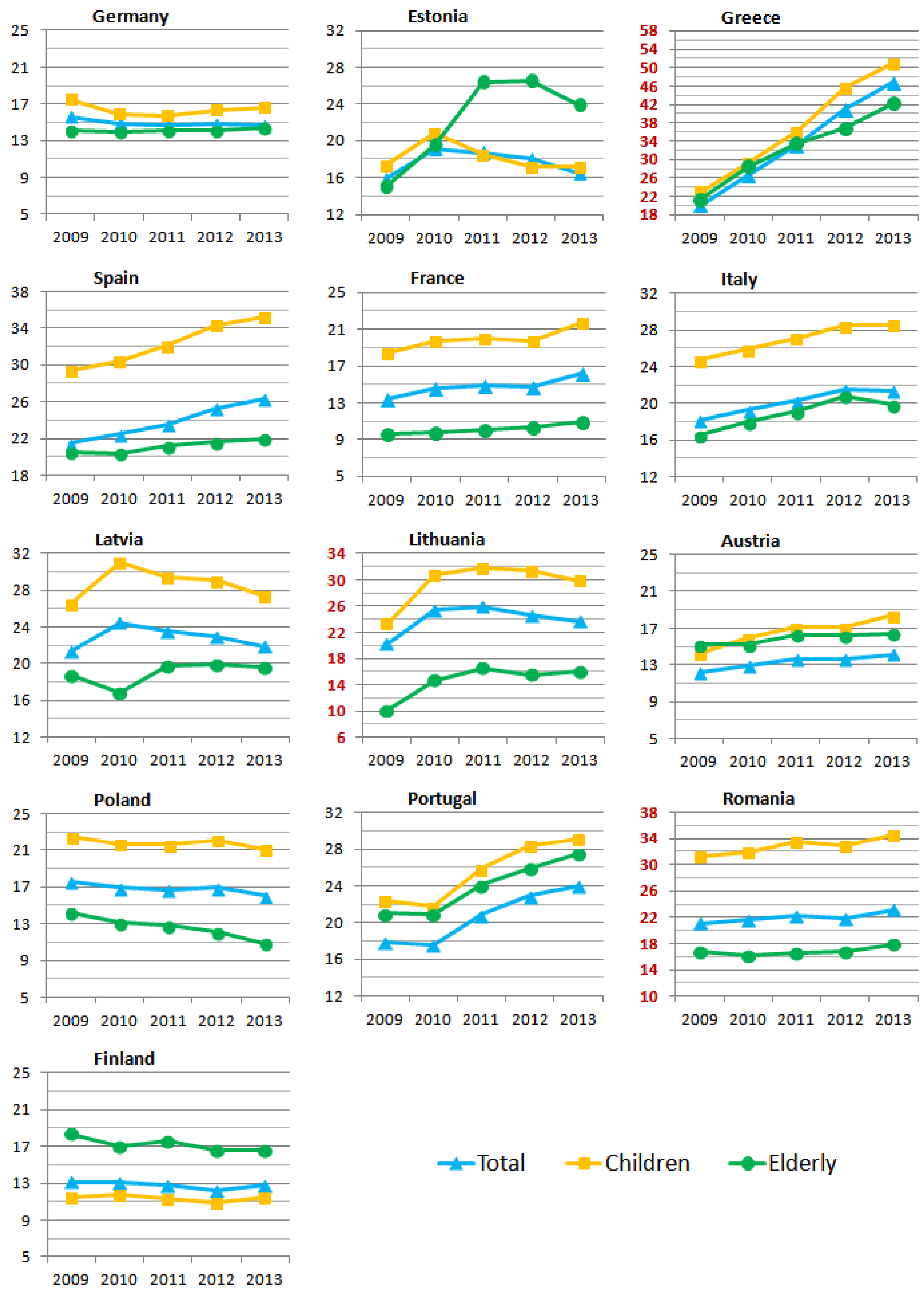
Figure 3 shows the development of risk of poverty using thresholds anchored in 2009. In all countries, except for Estonia, Greece, Spain, Latvia and Austria, the dynamics of fixed poverty levels develop similarly across groups. In Estonia the elderly are much more likely to fall below the fixed poverty threshold from 2011 onwards compared to the rest of the population. This coincides with resumed economic growth, while pensions grew at a lower pace due to Estonian indexation of pensions being based on changes from a lagged time period. Compared to the other Baltic countries inflation was higher in Estonia after it joined the euro zone on 1st January 2011. With rising prices and low growth in pensions, elderly people in Estonia became worse off both in relative and in absolute terms.

In Lithuania and Latvia anchored poverty rates increased during the economic crisis and levelled off once the economy started to recover again. The exception to this common trend is a surprising drop in the anchored poverty risk for the elderly observed in Latvia in 2010. This was driven by the decrease in the anchored poverty line (due to price deflation) with pensioners' incomes remaining relatively stable. In 2011 an increase in the anchored poverty line reversed the trend.

Looking at the Southern European countries, anchored poverty rates increased dramatically within the period, especially in the case of Greece where they more than doubled. Elderly households seem to be a bit less likely to fall below the fixed poverty threshold compared to the rest of the population. This is because older persons on low incomes, though not fully protected, suffered relatively lower income losses (e.g. cuts in pensions) than most other social groups.[16]

[16] Note, however, that funding cuts and other changes in health care (not taken into account here) raised the costs of services and others barriers to access for those depending on them, among which the elderly feature prominently.

Figure 3. At risk of poverty rates 2009-2013 anchored in 2009 (using 60% of 2009 median adjusted for inflation as the threshold)



Note: EUROMOD based estimates are obtained with employment adjustments and calibration as described in section 2. The vertical scale corresponds to 20% change in all countries, except EL, LT and RO. Minor gridlines are of 2 percentage points in each graph.

The situation of children seems to be worrying in Spain and Italy, where the gap between the anchored poverty rates for children and the rest of population is high and exceeds 6 percentage points throughout the years considered. In Spain poverty risk for children increased faster than for the total population in 2011 and 2012. This is likely to be related to cuts in child-related benefits (e.g. elimination of the universal birth grant, and a reduction in child benefit for children aged 0 to 2). The support for children in Italy is channelled through the tax system, as non-refundable tax concessions, for parents who are in work or receiving replacement income. Thus the effect of increasing unemployment between 2009 and 2013 was exacerbated by the loss of this support for families with children. In Portugal the gap between poverty risk among children and the rest of population is also on the rise, reaching 5.2 percentage points in 2013 (from 4.5 percentage points in 2009). This is mostly due to the rising unemployment rates that affect households with children and to the consolidation policies that were implemented during the same period (including a less favourable equivalence scale for the social insertion income and a child benefit reduction).

In France the anchored poverty rate increased by almost 3 percentage points in 2009-2013. Children are much more likely to fall below the fixed poverty threshold compared with the rest of the population. In Germany, Austria, Poland, Romania and Finland the anchored poverty rates remain relatively stable within the period that is analysed. In Germany and Austria the anchored poverty risk among children is estimated to increase during the most recent years – in both countries family/child benefit amounts have been kept nominally constant over the period and were thus subject to fiscal drag. There were also reductions to child supplements and special payments of the family benefits in Austria. In Poland the elderly are better off due to favourable indexation of pensions and a one-off fixed amount increase in 2012. In Romania the overall anchored poverty rates do not change considerably despite the fact that prices have risen more than any other country under consideration. The gap in the anchored poverty rates between children and the rest of population is high and remains close to 10 percentage points throughout this period.

This discussion illustrates how the nowcast of the main income-related poverty indicators has a potential to facilitate monitoring of the effects of the most recent changes in tax-benefit policies and macro-economic conditions on poverty risk. It should be noted that all estimates presented here should be interpreted with care. The main reasons for caution are discussed in the following section.

5. Reasons for caution

A certain amount of caution is called for when interpreting the results reported above. The main issues, either to do with the methods or with the assumptions used, are briefly discussed below.

There are numerous factors resulting from macro-economic and social change that might affect a country's income distribution. During periods of crisis the level and distribution of market income may exhibit large variations and wage dynamics might follow different paths across sectors, occupations, firms, etc. In order to capture these differences, the factors that were used for updating market incomes from 2009 up to 2013 were disaggregated into as many levels as possible using the information available at the time of writing. However, the existence of cases (countries) where such detailed information is not available or is based on administrative statistics that face similar timeliness issues to EU-SILC leaves no other option but to assume that everyone's income from a given source changes by the same rate over the relevant period. This puts considerable limits on the potential to model changes in the distribution of market income and consequently the distribution of equivalised disposable income. There is a strong case for improving the timeliness of macro-level statistics on the evolution of average market income and particularly earnings, and for investing in the harmonisation of such statistics at EU level.

Using a tax-benefit microsimulation model allows us to simulate the distributional effects of tax-benefit policy changes with a high degree of accuracy. And yet, for all the effort put into capturing as much detail as possible, simulations remain a simplification of the complexity of real life. In order to enhance the credibility of estimates, an effort has been made to address issues such as tax evasion (e.g. in Greece and Spain) and benefit non take-up (e.g. in Estonia, France and Romania). For more information on how this is done see Jara and Sutherland (2013). However, such adjustments are necessarily approximate and are not possible to implement in all countries where tax evasion and benefit non-take-up are relevant issues, due to data limitations (e.g. in Latvia).

Another limitation is that simulations are carried out on the basis of the tax-benefit rules in place on the 30th June of a given policy year. This allows policy rules for a given year to be incorporated in EUROMOD by the end of that year. However, this also means that simulations will not be able to reflect any reforms made after this reference date or those rules that were effective in the first half of the year, but changed before the 30th June. This may lead to discrepancies between EUROMOD results and patterns observed in the EU-SILC (as the latter usually captures income for the whole calendar year).

Moreover, changes in the tax-benefit system can also lead to behavioural responses. For example, making social assistance rules more (or less) generous might reduce (or improve) work incentives for some people and perhaps push them into (or out of) inactivity. On a different note, the introduction of additional taxes might also lead to changes in the existing tax evasion patterns. Or reforms to benefits might alter take-up propensities. Such second-order behavioural responses are not captured by EUROMOD in this analysis.

Although significant progress has been made towards modelling changes in labour market characteristics, accounting for all the complex transitions between education, different intensities of employment, unemployment, inactivity and retirement is beyond the scope of this analysis. The method that we have adopted attempts to account for the transitions that are likely to explain a major part of changes in the income distribution over the period 2009-2013: from employment to unemployment (and vice versa) and from short-term to long-term unemployment. Transitions to and from inactivity are modelled implicitly through restricting eligibility for unemployment benefits, according to the prevailing rules. Focusing on net changes in employment rates allows EUROMOD to capture the net employment dynamics shown by LFS. However it does not fully capture all transitions in the labour market and the extent of compositional changes in the population of employed and unemployed that might have taken place within the period of analysis.

Whereas changes in the labour market are carefully taken into account, no similar adjustments are made to account for demographic changes or changes in the composition of households. To some extent, changes in demographic structure and in household composition are less critical to adjust for within a short-term time frame, as major shifts are unlikely to happen. However, in countries where the recent financial crisis has led to large migration flows or to significant changes in the composition of households (such as the formation of larger households in order to share resources) the nowcast estimates have to be interpreted with caution.

An attempt to reduce differences between EUROMOD and EU-SILC poverty estimates has been made with the use of household-specific calibration factors.[17] These factors are

[17] For an analytical description of the underlying causes of these discrepancies see Jara and Sutherland (2013).

calculated for 2009 and are then applied to all later years based on the assumption that EUROMOD estimates for disposable income deviate from the equivalent EU-SILC estimates in a fixed way across time. While this assumption may hold for some households, it must be acknowledged that it is less likely in to hold in countries where economic conditions were highly volatile over the period 2009-2013.

Last of all, changes in the EU-SILC methodology over time inhibit the potential for EUROMOD to predict what the EU-SILC will show once it becomes available. In attempts to improve the quality of the EU-SILC data the National Statistical Offices introduce changes in the way the data are collected, imputed, weighted or converted from net to gross. Such changes usually result in jumps in estimates of median incomes and the AROP indicators that are difficult (if not impossible) to predict using previous EU-SILC waves. The existence of quality reports and transparent documentation on these important changes would contribute to a better understanding of the discrepancies observed between the nowcasted and EU-SILC results and would enhance the trustworthiness of the EU-SILC estimates.

6. Conclusion

The aim of this paper has been to nowcast changes in the distribution of income over a period for which EU-SILC data are not yet available. The microsimulation model EUROMOD was used to simulate country-specific policy reforms. Building on Navicke et al. (2013), changes in the labour market were taken into account by simulating transitions between labour market states. A logit model was used for estimating probabilities for working age individuals in the EU-SILC based EUROMOD input data. The total number of individuals that were selected to go through transitions corresponds to the relative net change in employment levels by age group, gender and education as shown in the EU-LFS statistics. Poverty rates were estimated for 2009-2013 for a total of 13 EU countries. The performance of the method was assessed by comparing the predictions with actual EU-SILC indicators for the years where the latter are available.

The most important nowcasted results can be summarised as follows. Both mean and median incomes in 2013 are significantly different from their 2011 levels in all countries, except for the median in France. The highest increases in mean and median incomes are predicted for the three Baltic States. Rather than explicit policy changes, this development is mostly connected to the return of the region to the path of economic growth. Real median equivalised disposable income is also estimated to grow in Poland and Romania. For Germany, Austria, Finland and Italy the predicted growth in the median between 2011 and 2013 is below inflation. A fall in the median equivalised disposable income in both nominal and real terms is predicted for Spain and Portugal; a dramatic decrease in the median is predicted for Greece.

While in most cases the growth in the median disposable income estimated with EUROMOD aligns well with the EU-SILC data, the nowcasted changes in the AROP rates are more accurately captured in the case of countries with more stable economic environments. The country where the AROP rate is predicted to rise the most in 2011-2013 is Greece. Worryingly enough, it seems that the rise in unemployment is directly translated into increased poverty due to the inability of the welfare state to compensate (even partially) for people's income losses and act as a safety net of last resort. In Romania, Estonia and Latvia the predicted increase in the AROP rate is somewhat smaller. Small poverty reductions are predicted for France, Portugal, Austria, Finland and Germany. In all other countries the changes in the total AROP rates are not statistically significant.

Changes in age-specific relative poverty rates show interesting patterns. With the exception of the three Baltic countries and Romania poverty risk for the elderly is predicted to fall. In the case of Greece, Spain, France, and Portugal reductions in the AROP rate among the elderly are nowcasted to be quite significant (about 2-3 percentage points). In Greece this is despite the additional taxes and pensions cuts introduced in 2011-2013. In most countries the changes in the AROP rate among children are similar to those predicted for the working age adult population. An exception is Germany, where the rate of poverty risk among children is estimated to increase while the AROP for the working-age population is nowcasted to move in the opposite direction.

Finally, the use of the alternative poverty indicator based on the fixed poverty threshold (anchored in 2009 and indexed by prices) results in a prediction of higher poverty risk for the four Southern European countries, Estonia, France, Lithuania and Austria. In all other countries the overall anchored poverty rates remain relatively stable in 2009-2013. From this perspective, the situation of children seems to be particularly worrying in Romania, Spain and Italy, where the gap between the anchored poverty rates for children and the rest of population exceeds 6 percentage points throughout the period in question.

A certain amount of caution is needed when interpreting the above results. The most important caveats are connected to the way the simulations and the labour market adjustments are performed, the information they are based on, and the reliability of the EU-SILC based estimates across years. In the case of countries where breaks in the EU-SILC data have occurred, it can be argued that the simulated results reflect the developments in the income and AROP indicators, had the break in series not taken place.

Despite these limitations, nowcasting the main income related poverty indicators has the potential to facilitate monitoring of the effects of the most recent changes in tax-benefit policies and macro-economic conditions on poverty risk. Given the relevance of these issues to evidence-based policy making, this research constitutes a sound alternative to waiting until official statistics are made available and can provide valuable ex-ante information on potential distributional effects of contemporary economic developments.

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Appendix 1. Specification of the logit model for predicting employment transitions

Table 1a. Age group between 15 and 64 years old, lower level of education (lower secondary or below: ISCED 1997 levels 0-2)

	lowDE	lowEE	lowEL	lowES	lowFR	lowIT	lowLV	lowLT	lowPT	lowPL	lowRO	lowFI
dgn	3.041**	4.102	2.603*	-1.016*	2.125***	-0.881	0.43	0.54	1.761	4.585***	-3.377*	2.239**
dey	0.184***	0.395	0.008	0.079***	0.044	0.13***	0.229	0.049	0.128**	-0.238***	0.06	..
dey_m	-0.139*	-0.481	0.134*	0.034	-0.022	-0.011	-0.066	-0.065	-0.043	0.094***	0.154*	..
dag	0.327***	0.208***	0.258***	0.205***	0.436***	0.357***	0.16***	0.182**	0.184***	0.113***	0.13**	0.33***
dag2	-0.004***	-0.002***	-0.003***	-0.003***	-0.006***	-0.004***	-0.002***	-0.002**	-0.002***	-0.001***	-0.002**	-0.003***
dag_m	-0.003	-0.003	-0.061***	0.026***	-0.033***	-0.003	-0.025*	0.026	-0.035***	-0.059***	-0.007	-0.039**
loc	-0.287***	-0.302***	-0.329***	-0.195***	-0.142***	-0.482***	-0.186***	-0.316***	-0.456***	-0.708***	-1***	-0.145***
loc_m	-0.172**	-0.091	0.003	-0.007	-0.053	0.231***	0.159*	-0.031	-0.037	-0.287***	0.394**	-0.047
hh_head	-0.295	0.271	0.249	0.195*	-0.005	0.627***	0.31	0.445	-0.104	-0.518***	-0.312	0.347*
hh_head_m	-0.641	0.07	0.696	-0.17	0.081	-0.069	-0.016	-0.814	0.637*	1.131***	0.444	-0.437
depend	-1.072**	0.089	0.285	-0.662**	-1.611***	-1.127***	0.155	0.562	-0.395	0.571*	0.000	-0.947*
depend_m	1.033	-1.502	-1.593*	0.081	0.961	0.718	-0.9	-0.029	0.309	-0.165	-0.816	0.696
in_educ	0.437	-3.072***	-1.052	-2.104***	-1.547***	-1.665***	-2.327***	-2.894***	-1.348***	-1.463***	-3.378***	-0.52
on_pension	-1.461***	-2.482***	-5.319***	-3.351***	..	-1.824***	-1.751***	-1.34***	-4.438***	-1.795***	-4.136***	-1.724***
in_educ_m	0.456	1.254	-2.932*	-0.129	-0.496	-0.724	-0.889	-0.481	-0.423	-0.913**	-3.912**	-0.668
partner	-0.118	-0.315	0.078	-0.756***	-0.105	-0.269	-0.148	0.734	-0.798***	-0.738***	-0.853*	-0.026
partner_m	1.184**	0.448	0.557	1.135***	0.195	0.886***	0.518	-0.445	1.167***	0.529**	1.044*	0.742*
les_partner	0.598**	0.831***	0.323	0.187*	0.598***	-0.081	0.416*	0.334	0.478***	1.11***	0.611**	0.719***
small_child	-0.602	-2.792***	-1.018*	-0.131	-0.87***	-0.1	-0.751*	0.43	-0.024	-0.306	-1.044**	-1.486***
small_child_m	0.289	3.26***	0.794	0.076	0.925*	0.017	0.963*	0.65	-0.063	1.2***	0.443	1.431*
2.drgn1			0.403**	0.127	-0.315*	0.113				-0.449***	0.243	
3.drgn1			-0.348	0.225	-0.991***	-0.322**				0.123	0.35	
4.drgn1			0.135	-0.196	-0.309	-1.026***				-0.391**	-0.302	
5.drgn1				-0.125	-0.249	-1.12***				-0.426**		
6.drgn1				-0.424***	-0.335					-0.706***		

	lowDE	lowEE	lowEL	lowES	lowFR	lowIT	lowLV	lowLT	lowPT	lowPL	lowRO	lowFI
7.drgn1				-0.529**	-0.194							
8.drgn1					-0.637***							
_cons	-5.176***	-3.975	-2.838	-1.868***	-6.231***	-2.996***	-3.706**	-1.93	0.74	5.584***	6.893***	-6.26***
N	2845	2213	4202	11755	4875	10460	2423	1788	5760	13510	3748	4113
r2_p	0.264	0.445	0.396	0.267	0.327	0.487	0.322	0.388	0.314	0.524	0.603	0.359
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Variable definitions:

dgn	Gender (= 1 if male)
dey	Years in education
dag & dag2	Age and age squared
loc	Occupational scale as measured by ISCO
hh_head	= 1 if a household head
drgn1	Regions
partner	= 1 if has a partner
on_pensions	= 1 if receives disability or old-age pension
dependent	dependency ratio (proportion of household members under 15 or above 64 years old)
in_educ	= 1 if is in education
les_partner	= 1 if the partner is in work (employer, employed, self-employed or farmer)
small_child	= 1 if there are children under 3 in the household
***_m**	Interaction terms with male

Table 2a. Age group between 15 and 64 years old, higher level of education (upper secondary or above: ISCED 1997 levels 3-5)

	highDE	highEE	highEL	highES	highFR	highIT	highLV	highLT	highPT	lowPL	highRO	highFI
dgn	0.452	1.919**	1.961	1.062	-1.031	2.111**	0.82	0.971	0.952	4.585***	-0.279	-0.743
dey	0.055***	0.052*	0.115**	0.024	0.007	-0.011	0.083***	0.09**	0.13***	-0.238***	-0.158***	0.024
dey_m	-0.017	-0.032	-0.177**	-0.082**	0.073*	-0.155***	-0.016	-0.01	-0.078	0.094***	-0.068	0.067
dag	0.231***	0.17***	0.273***	0.311***	0.442***	0.378***	0.204***	0.254***	0.357***	0.113***	0.165***	0.343***
dag2	-0.003***	-0.002***	-0.003***	-0.004***	-0.006***	-0.004***	-0.002***	-0.003***	-0.004***	-0.001***	-0.002***	-0.004***
dag_m	-0.01	-0.045***	0.004	0.008	-0.02***	-0.016*	-0.02***	-0.012	-0.009	-0.059***	0.01	-0.021***
loc	-0.214***	-0.23***	-0.462***	-0.247***	-0.255***	-0.547***	-0.137***	-0.264***	-0.182	-0.708***	-0.652***	-0.22***
loc_m	0.017	-0.043	0.101*	0.044	0.09**	0.168***	0.005	0.007	0.041	-0.287***	0.221***	0.05
hh_head	0.021	0.405***	0.246	0.134	0.036	0.36**	0.06	0.156	-0.137	-0.518***	0.164	-0.1
hh_head_m	-0.07	-0.096	-0.14	-0.002	-0.104	0.176	-0.119	-0.189	0.048	1.131***	0.278	0.183
depend	-1.154***	-0.681*	-1.07**	-0.611**	-1.416***	-0.411	-0.293	0.159	-0.643	0.571*	-1.409***	-0.707**
depend_m	1.691***	0.486	0.213	0.513	1.642***	0.163	0.051	-1.67**	-0.776	-0.165	1.09	0.73*
in_educ	-1.593***	-0.9***	-1.509***	-0.256*	-2.004***	-2.274***	-0.31*	-0.338	-2.244***	-1.463***	-2.552***	-1.08***
on_pension	-2.756***	-2.074***	-5.657***	-4.696***	..	-2.609***	-1.488***	-1.197***	-5.542***	-1.795***	-6.19***	-1.557***
in_educ_m	-0.491**	-0.298	-0.494	-0.518**	-0.292	-0.315	-0.676**	-0.858*	-0.288	-0.913**	-0.951**	-0.149
partner	-0.363***	-0.076	-0.431	-0.206	-0.424***	-0.551***	-0.213*	0.153	-0.967*	-0.738***	-0.488	-0.081
partner_m	1.173***	0.969***	1.355***	0.735***	0.984***	1.02***	0.866***	0.174	1.514**	0.529**	0.619	0.536***
les_partner	0.508***	0.099	0.104	0.048	0.596***	0.264*	0.156	0.378**	0.629	1.11***	0.404*	0.478***
small_child_m	-1.75***	-1.679***	-0.284	-0.226	-0.477***	-0.567***	-0.688***	-0.549	1.014*	-0.306	-1.559***	-2.135***
small_child_m	1.64***	1.424***	0.166	0.215	0.4	0.326	0.462*	0.954*	-0.286	1.2***	0.958*	2.675***
2.drgn1			0.273	0.394***	0.104	0.112				-0.449***	-0.273*	
3.drgn1			-0.178	0.055	-0.211	-0.26*				0.123	-0.127	
4.drgn1			0.321	0.103	-0.083	-1.084***				-0.391**	-0.127	
5.drgn1				0.153	0.033	-1.076***				-0.426**		
6.drgn1				0.059	-0.011					-0.706***		
7.drgn1				0.158	-0.008							
8.drgn1					-0.208							

_cons	-2.068***	-1.711**	-2.574**	-3.88***	-4.467***	-1.758***	-3.363***	-3.662***	-4.708**	5.584***	6.067***	-4.177***
N	15143	6877	6925	12318	12128	15747	7254	7087	2512	13510	8169	13321
r2_p	0.277	0.263	0.416	0.238	0.331	0.515	0.147	0.247	0.457	0.524	0.614	0.251
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Variable definitions:

dgn	Gender (= 1 if male)
dey	Years in education
dag & dag2	Age and age squared
loc	Occupational scale as measured by ISCO
hh_head	= 1 if a household head
drgn1	Regions
partner	= 1 if has a partner
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in_educ	= 1 if is in education
les_partner	= 1 if the partner is in work (employer, employed, self-employed or farmer)
small_child	= 1 if there are children under 3 in the household
***_m**	Interaction terms with male

Appendix 2. Percentage change in mean equivalised disposable income in EU-SILC and EUROMOD

		All	Males	Females	Children (0-18)	Adults (18-64)	Elderly (65+)
Germany							
Change 2009-2011	Eurostat*	2.6	3.3	1.8	7.3	1.2	3.6
	Euromod	6.4	6.6	6.3	7.0	7.2	3.0
Change 2011-2013	Euromod	3.0	3.1	2.8	2.8	3.1	2.6
Estonia							
Change 2009-2011	Eurostat*	5.0	5.4	4.6	9.3	4.4	2.1
	Euromod	3.8	4.2	3.5	3.9	4.3	1.1
Change 2011-2013	Euromod	13.0	13.2	12.8	11.9	13.8	10.4
Greece							
Change 2009-2011	Eurostat*	-23.6	-23.3	-23.9	-21.7	-27.1	-11.2
	Euromod	-15.4	-16.0	-14.9	-14.6	-16.4	-12.3
Change 2011-2013	Euromod	-18.9	-19.4	-18.4	-19.8	-20.1	-13.1
Spain							
Change 2009-2011	Eurostat*	-3.4	-3.8	-2.9	-4.2	-4.4	2.5
	Euromod	-0.7	-1.0	-0.4	-1.1	-1.2	1.9
Change 2011-2013	Euromod	-2.1	-2.4	-1.9	-2.2	-2.8	0.8
France							
Change 2009-2011	Eurostat*	4.1	4.1	4.1	4.2	3.6	5.6
	Euromod	3.1	3.0	3.2	3.2	3.2	3.0
Change 2011-2013	Euromod	-1.8	-1.9	-1.7	-2.3	-2.5	1.3
Italy							
Change 2009-2011	Eurostat*	0.4	-0.2	1.0	-1.8	-0.1	3.3
	Euromod	0.8	0.7	0.9	1.0	0.9	0.6
Change 2011-2013	Euromod	2.0	1.9	2.1	2.1	2.0	2.0
Latvia							
Change 2009-2011	Eurostat*	-1.1	0.3	-2.3	1.1	-1.5	-0.7
	Euromod	-1.9	-2.0	-1.9	-3.4	-2.1	0.8
Change 2011-2013	Euromod	10.0	10.4	9.6	10.9	10.5	6.5
Lithuania							
Change 2009-2011	Eurostat*	2.1	2.6	1.7	0.6	5.2	-6.9
	Euromod	-3.7	-3.5	-3.9	-4.7	-3.0	-5.9
Change 2011-2013	Euromod	9.4	9.6	9.3	8.4	9.9	8.8
Austria							
Change 2009-2011	Eurostat*	5.5	6.5	4.4	..	..	..
	Euromod	2.1	2.1	2.1	1.9	2.0	2.6
Change 2011-2013	Euromod	3.2	3.1	3.2	2.9	3.1	3.6
Poland	(in PLN)						
Change 2009-2011	Eurostat*	9.9	10.1	9.6	11.0	9.3	11.3
	Euromod	8.4	8.3	8.5	8.0	8.2	10.0
Change 2011-2013	Euromod	6.7	6.6	6.8	6.3	6.5	8.4
Portugal							
Change 2009-2011	Eurostat*	-2.7	-2.6	-2.8	-5.2	-4.6	7.1
	Euromod	-2.3	-2.4	-2.2	-3.1	-2.4	-1.0
Change 2011-2013	Euromod	-5.6	-5.8	-5.3	-6.1	-5.8	-4.1
Romania	(in RON)						
Change 2009-2011	Eurostat*	1.7	2.9	0.5	-1.1	1.2	7.5
	Euromod	7.1	7.0	7.2	6.5	6.9	9.0
Change 2011-2013	Euromod	8.3	8.5	8.2	7.4	8.9	6.5
Finland							
Change 2009-2011	Eurostat*	6.9	6.3	7.5	6.9	6.9	8.5
	Euromod	5.3	5.4	5.3	5.2	5.3	5.7
Change 2011-2013	Euromod	4.0	3.8	4.1	3.6	3.9	4.6

Notes: EUROMOD based estimates are obtained with employment adjustments and calibration as described in section 2. * Eurostat EU-SILC (ilc_di03) numbers are lagged by one year to correspond to the income reference year. Change in the mean expressed in the national currency for non-Eurozone countries where the exchange rate is not fixed (Poland, Romania)

Appendix 3. Harmonised index of consumer prices, 2009-2013

	base change, 2009 = 100				
	2009	2010	2011	2012	2013
DE	100.0	101.1	103.6	105.9	107.8
EE	100.0	102.7	108.0	112.5	116.6
EL	100.0	104.7	108.0	109.1	108.2
ES	100.0	102.0	105.2	107.7	109.3
FR	100.0	101.7	104.1	106.4	108.1
IT	100.0	101.7	104.6	108.0	109.7
LV	100.0	98.8	102.9	105.3	106.8
LT	100.0	101.2	105.4	108.7	111.0
AT	100.0	101.7	105.3	108.0	110.4
PL	100.0	102.7	106.7	110.6	112.6
PT	100.0	101.4	105.0	107.9	108.7
RO	100.0	106.1	112.2	116.0	121.0
FI	100.0	101.7	105.1	108.4	111.1

Source: Eurostat (accessed on 19 Dec 2013). 2013 values as we use them are based on the EC Autumn 2013 forecast: http://ec.europa.eu/economy_finance/eu/forecasts/2013_autumn/statistical_en.pdf.