EUROMOD

WORKING PAPER SERIES

EUROMOD Working Paper No. EM 11/13

Nowcasting Indicators of Poverty Risk in the European Union: A Microsimulation Approach

Jekaterina Navicke, Olga Rastrigina, Holly Sutherland

July 2013

Nowcasting Indicators of Poverty Risk in the European Union: A Microsimulation Approach[1]

Jekaterina Navicke[a]
Olga Rastrigina[a]
Holly Sutherland[a]

[a]ISER, University of Essex

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 to complicated nature of the European Union Statistics on Income and Living Conditions (EU-SILC) poverty risk estimates are published with a 2 to 3 year delay. This paper presents a method that can be used to estimate ("nowcast") the current at-risk-of-poverty rate for the European Union (EU) countries based on EU-SILC microdata from a previous period. The EU tax-benefit microsimulation model EUROMOD is used for this purpose in combination with up to date macro-level statistics. We validate the method by using EU-SILC data for 2007 incomes to estimate at-risk-of-poverty rates for 2008-2012, and where possible compare our predictions with actual EU-SILC and other external statistics. The method is tested on eight EU countries which are among those experiencing the most volatile economic conditions within the period: Estonia, Greece, Spain, Italy, Latvia, Lithuania, Portugal and Romania.

JEL Classification: C81 D31 I32

Keywords: microsimulation, poverty, Euromod, nowcast, income, European Union

Corresponding author:
Jekaterina Navicke,
E-mail: jnavicke@essex.ac.uk

[1] This work has been supported by the second Network for the analysis of EU-SILC (Net-SILC2), funded by Eurostat. We are grateful to Tony Atkinson, Silvia Avram, Andrea Brandolini, Francesco Figari, Tim Goedemé, Horacio Levy, Eric Marlier, Cathal O'Donoghue and Alari Paulus for very helpful comments, suggestions and/or practical assistance. We also acknowledge the contribution of all past and current members of the EUROMOD consortium. This paper uses EUROMOD F6.4. The process of extending and updating EUROMOD is financially supported by the Directorate General for Employment, Social Affairs and Inclusion of the European Commission [Progress grant no. VS/2011/0445]. For Estonia, Latvia, Lithuania, Portugal and Romania we make use of micro-data from the EU Statistics on Incomes and Living Conditions (EU-SILC) made available by Eurostat under contract EU-SILC/2011/55 and contract EU-SILC/2011/32; and for Greece, Spain and Italy we make use of the national EU-SILC data made available by respective national statistical offices. The usual disclaimers apply.

1. Introduction

The Europe 2020 target for poverty and social exclusion has three components (income poverty, material deprivation, and work intensity). It is important to be able to monitor progress towards meeting the target, not only because of the need to understand what extra effort is required between now and 2020 but also because measures of current poverty and income distribution are a fundamental component of any evaluation of the current social and economic situation of the EU population. However, the most recent estimates based on micro-data from EU-SILC are available with a considerable lag because of the time taken to collect, process and analyse the micro-data. For example in mid-September 2012 there were estimates available from the 2011 EU-SILC based on 2010 incomes for only 9 out of 27 Member States. For the remaining two thirds, there was still no EU-SILC based indicators for the current decade. Continuing in this way it will be 2023 before we know whether or not the Europe 2020 target has been reached. In the meantime it is necessary to wait three years in order to be able to assess the current state of play. In a wider context the availability of more timely poverty risk indicators could complement macro-economic short-term forecasts (of e.g. GDP growth, inflation, employment) and serve to promote the importance of distributional issues when assessing current economic and social developments.[2]

The focus of this paper is on nowcasting the income based component of the Europe 2020 target – the at-risk-of-poverty (AROP) indicator. The term 'nowcasting' refers to estimation of current indicators using data on the past income distribution combined with other information including the latest available macroeconomic statistics. AROP measures the share of population living in households with equivalized disposable income below 60% of the median. Movement in AROP indicators depend on many factors and interactions between them. The nature of the indicator requires a prediction of both income at the median and of the lower end of the distribution of income. Use of macro-level time series data for predictions is likely to result in biased estimates because it will not capture the differential effects of changes in income and household circumstances at different points in the distribution. Nowcasts based on micro-data will capture the variation in household circumstances but in order to take account of the interactions between household circumstances, changing policies and macro-economic situation, microsimulation models are the appropriate tools (Immervoll et al. 2006).

At the national level, microsimulation has been used for future scenario building, for example in the UK in order to predict child poverty in 2020 (Brewer et al. 2011), looking at the effects of the recession (Brewer et al. 2013), in Ireland to nowcast the policy effects of the crisis (Keane et al. 2013), in Bangladesh for the ex-ante analysis of the poverty and distributional impact of the global crisis (Habib et.al. 2010). The aim of this paper is to present and validate an application of the microsimulation method to estimate current AROP rates for the EU

[2] For the critique of the current measures of economic development and an argument of the importance of bringing distributional issues into policy debates see e.g. Atkinson (2013), Stiglitz (2012).

countries in a synchronized way. Implementation of such an exercise at the EU level using national models would be inhibited by the fact that suitable models do not exist (or are not generally accessible) in all countries. Even if they were available, considerable challenges would be associated with making the results comparable and with reconciling results using national data with those from the EU-SILC. We make 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 27 Member States[3]. In this paper we combine the standard EUROMOD elements (i.e. updating market incomes and simulating policy changes) with additional adjustments in the input data needed to capture changes in the employment characteristics of the population over time. The method and the data on which it relies are synchronised across countries in order to produce results that are comparable.

For validation purposes we apply the method to EU-SILC data on 2007 incomes and project AROP rates for 2008-2012 (i.e. aiming to reflect what EU-SILC 2009-2011 shows and EU-SILC 2012-13 will show).[4] We assess performance of the method by comparing our predictions with actual EU-SILC indicators where possible and other external statistics. We test the procedure on eight EU countries that are among those experiencing the most volatile economic conditions in the period of 2008 to 2012: Estonia, Greece, Spain, Italy, Latvia, Lithuania, Portugal and Romania. Having established a method the intention in the future is to apply it regularly to the most up-to-date EU-SILC micro-data that are available, for all EU27.

The structure of the paper is as follows: in the next section we explain the method proposed for nowcasting poverty risk using microsimulation and validate components of the method by comparing results against external sources of statistics as well as most recent EU-SILC based estimates. In the third section we discuss our predictions of the key indicators of poverty risk and compare them against actual EU-SILC estimates that are available for the period in question. Finally we conclude with an evaluation of the proposed method and highlight potential improvements to it.

2. The toolbox for nowcasting

This section presents the method proposed for nowcasting AROP indicators in the EU countries and validation of its components.[5] Two main dimensions are required in order to estimate current AROP: income at the median and income of those of the lower end of the income distribution. Importantly, predictions of the changes in income should capture the way in which macro-economic changes affect households at different points in the income distribution as well as on how country-specific policies mediate or mitigate the effects of the changes. With this in mind the proposed method combines the use of the EU wide microsimulation model EUROMOD with additional adjustments needed to capture the effects of the most important changes in the labour market characteristics over time.

---

[3] For to the current state of the art of EUROMOD development and its applications see Sutherland and Figari (2013).
[4] Note that EU-SILC data collected at time *t* (e.g. 2011) contains income information collected for time *t-1* (e.g. 2010).
[5] A detailed discussion of the method is available in Navicke et al. (2013).

EUROMOD is a static tax-benefit microsimulation model for the EU that estimates, in a comparable manner, the effects of taxes and benefits on income distribution, work incentives and public budgets for each of the 27 Member States and for the EU as a whole. EUROMOD operates on anonymized EU-SILC cross-sectional micro-data which is the main EU instrument for collecting comparable data on income, poverty, social exclusion and living conditions.

The main limitation of the standard version of EUROMOD in the context of this paper is that it does not capture changes in demographic or labour market characteristics. Borrowing from the methods used in dynamic microsimulation modelling (O'Donoghue 1999; Dekkers and Zaidi 2011) we implement adjustments to labour market status in order to account for major changes in employment levels. Rapid changes in the labour market were particularly important within the analyzed period of the global economic crisis and have important distributional effects (Jenkins et al. 2013). In contrast, changes in demographic structure are less critical to adjust for within a short-term time frame, as major demographic or compositional shifts are unlikely. Exceptions may apply in the case of rapid economic (return) migration during the recession or fertility "bubbles" at the height of the economic boom. Such changes are beyond the scope of the analysis in this paper.

The toolbox for nowcasting based on the EUROMOD microsimulation framework consists of the following components:

1. Standard EUROMOD simulations:
   a) Updating market and other non-simulated incomes;
   b) Simulating policy changes between the income data year to those prevailing currently;
2. Data adjustments to account for labour market change between the income data year and the most recently available information;
3. Calibration to account for differences between EUROMOD simulation and EU-SILC estimates.

Below we discuss the steps proposed for nowcasting poverty risk in a logical order of their implementation, i.e. first we adjust EUROMOD input data for changes in employment, second we run standard EUROMOD simulations on the adjusted data, and last we calibrate the results. We validate components of the method by comparing results against external sources of statistics as well as most recent EU-SILC based estimates.

2.1 Accounting for labour market change

There are two basic methods of adjusting micro-data for labour market change using information from external sources. The first, re-weighting, involves re-calculation of cross-sectional weights to incorporate changed numbers of employed, unemployed etc., while holding other dimensions constant or allowing them to shift given that additional external information on control totals is available. The method is sometimes known a "static ageing" (Immervoll et al. 2005). The second method introduces an element of dynamic change into the static microsimulation approach, by explicitly simulating the transitions between labour market states (Figari et al. 2011; Fernandez et al. 2013; Avram et al. 2011).

Re-weighting is relatively easy to implement but there are disadvantages. It may distort joint distributions of important variables, in particular alternative sources of income (Creedy 2003; Immervoll et al. 2006). Furthermore, in the context of rapidly changing labour market re-weighting would assign the characteristics of those unemployed (employed) in the baseline data to the “new” unemployed (employed), while they may in fact differ in important ways, such as duration of employment or unemployment and resulting eligibility for benefit receipt. Due to low unemployment rates during the economic boom and rapid increase during the crisis, re-weighting may also result in high weights being assigned to a few observations which can distort the results of simulations affecting dimensions not controlled for. For these reasons we opt for the explicit simulation of labour market transitions in this paper.

Explicitly selecting people to move from employment or self-employment to unemployment (and, where relevant, vice versa) allows the detailed tax-benefit implications to be captured in EUROMOD. The modelling of labour market transitions makes use of Labour Force Survey (LFS) data. There is a choice whether to use micro-data from the EU-LFS which allows for a wide choice of characteristics for estimating transitions and a multivariate approach (Fernandez et al. 2013; Avram et al. 2011), or to use the more limited LFS-based quarterly aggregate statistics that are made available with less time-lag (Figari et al. 2011). This presents a trade-off between the extent to which the nowcast is based on up-to-date information, and the level of detail accounted for.

In this paper we model explicit labour market transitions based on published LFS employment statistics split by three sets of characteristics: age group, gender and education level (a total of 18 strata). The net change in employment rates is modelled by randomly selecting observations to be moved out or into employment within each stratum, the probability of selection being equal to a relative change in employment rate within strata according to the LFS statistics during the period in question. Cross-sectional household weights are used for controlling modelled change in employment in the EUROMOD data so that it corresponds to that indicated by the LFS statistics. Similarly we model changes in the prevalence of long-term unemployment, which have important implications for eligibility and receipt of unemployment benefits. Lastly labour market characteristics and sources of income are adjusted for those observations that are subject to transition and household income is re-calculated using EUROMOD simulations (see Section 2.2).

It should be noted that since our employment adjustments are based on random assignment within each of the age-gender-education strata, different selections may result in different effects on household income and on the AROP indicators because of the characteristics that are relevant for the effect of employment transition on household income but not controlled for. In order to account for this additional source of variability and to derive more robust results we conduct 200 replications of random draws (for each year) and use the mean values of AROP estimates for nowcasting purposes.

Adjustments to account for changes in employment are modelled for the period of 2008-2012, with 2008-2011 numbers based on the annual LFS figures, and using an average of the last four available quarters (2011Q4-2012Q3) for 2012.

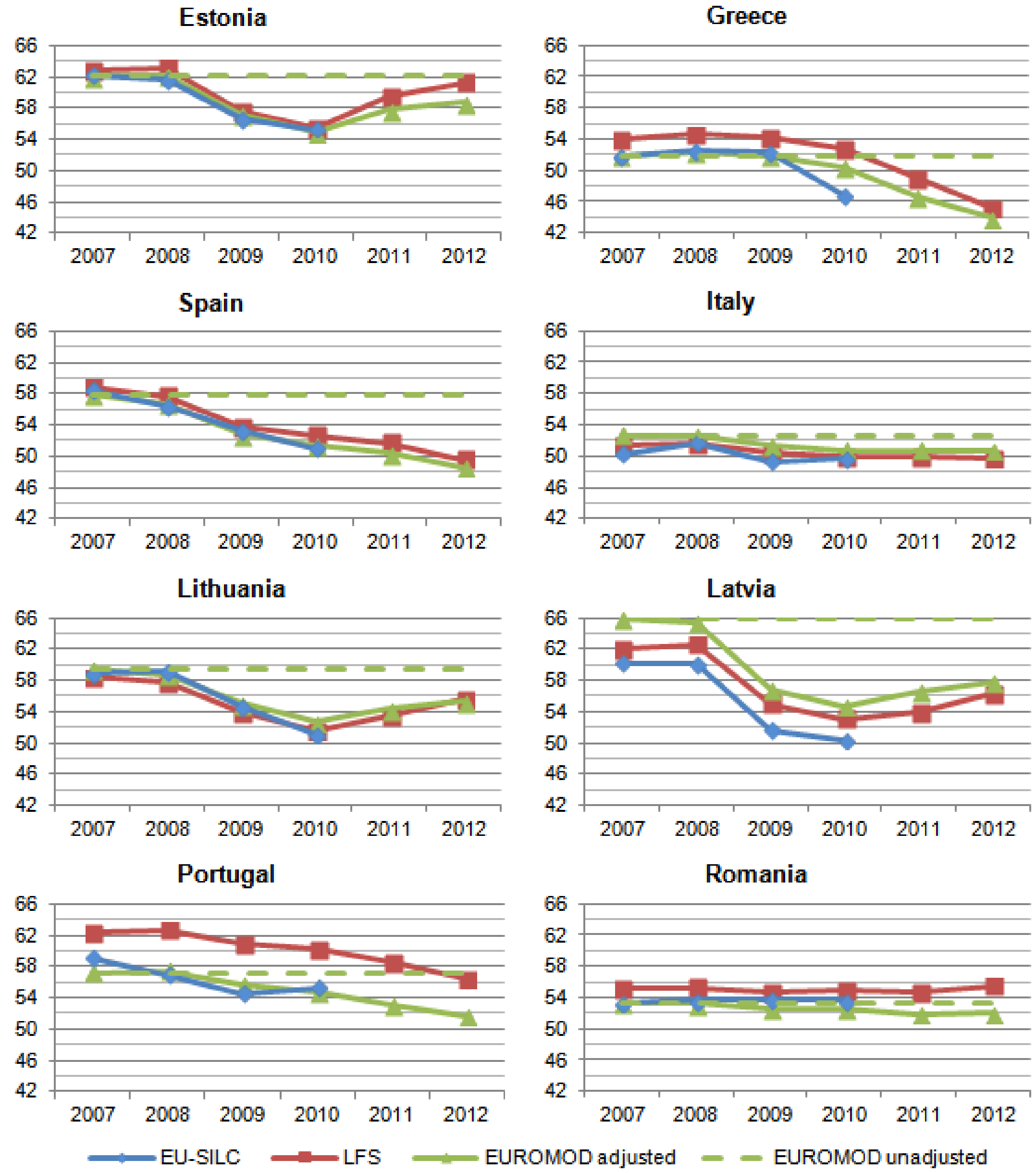
It should be noted that labour market concepts do not align perfectly between EUROMOD and LFS. While in LFS employment status is determined through an elaborate set of questions on activity in the reference week,[6] EUROMOD relies on (mostly) self-defined labour market status from the EU-SILC income reference period[7]. Moreover, for reasons of internal consistency EUROMOD adjusts labour market status to correspond with information on income sources. In order to align EUROMOD based estimates of employment indicators with those derived using LFS, the weighted average number of months in work per person per year in the EUROMOD and EU-SILC data is taken into consideration. An important issue to consider is whether EU-SILC employment estimates indeed follow those of the LFS, despite of the differences in the definitions, survey methodology and sampling frames. In order to validate our approach, we compare the dynamics of employment rates in the LFS, EUROMOD and available EU-SILC data for the period in question (see Figure 1).

Figure 1 shows that despite of the differences in the way employment rates are calculated in LFS and EU-SILC and the resulting discrepancies in the absolute levels of the indicator, the dynamics of the employment rate in both surveys follow similar trends. Exceptions are the 2010 year for Greece and the 2008-2009 years for Portugal. Differences in the base-line year estimates can be observed between the original EU-SILC and EUROMOD in Italy, Portugal and, considerably, in Latvia. These are due to imputations done when constructing the EUROMOD input dataset, mainly synchronization of information on income received and months spent in work. The graph also shows what the employment level would be in EUROMOD if no employment adjustments are implemented. Except of Romania, where changes in employment levels were small, unadjusted employment rates result in a substantially higher numbers of people receiving employment income, with consequential distributional implications. In this exercise the effect is especially strong for countries where employment levels drop most between 2007-2012 (e.g. Greece, Spain, Portugal) and where high fluctuations in employment levels are observed (e.g. Estonia, Lithuania, Latvia).

[6] In 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).

[7] 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).

Fig 1 Employment rates in the LFS, EU-SILC and in EUROMOD before and after labour market adjustments



Source: Own calculations based on EU-SILC micro-data (2007-2010 incomes) and EUROMOD simulations. LFS annual employment figures for 2007-2012 [lfsa_ergaed] published by Eurostat.

Importantly, despite of the limitations due to differences in employment concepts and aggregate statistics used the employment adjustments in all cases track the employment dynamics shown by LFS quite closely. Some minor deviations are due to several main factors. These include differences in the EUROMOD/LFS structure of the working age population in the base year and changes in the demographic structure thereafter. For countries with small populations (e.g. in Estonia, Lithuania) discrepancies may occur due to employment changes in small stratum that were ignored due to data reliability issues.

2.2 Updating incomes and simulating policies

The next step following adjustment of EUROMOD input data for changes in employment is updating non-simulated incomes and simulating tax-benefit policies from the income data year up to the year in question. This has been a standard practice since tax-benefit microsimulation first began in the 1980s.[8]

Uprating of non-simulated income beyond the income data reference period is carried out in EUROMOD using factors based on available administrative or survey statistics. Specific uprating factors are derived for each income source, reflecting the change in their average amount per recipient between the income data reference period and the target year. However, both administrative statistics and household surveys other than EU-SILC face similar timeliness issues, while average annual statistics for the current year naturally cannot become available before the end of that 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 appropriate default factors (e.g. CPI).

The evolution of employment income is of particular importance for capturing changes in household disposable income. It is often the main source of income for households, and it can exhibit large fluctuations, especially in times of rapid economic changes, such as the recent economic crisis. When employment income substantially decreases it also pushes down median household income and hence the poverty line. Poverty risk, being a relative indicator, may also show a large reduction. In EUROMOD predictions we capture changes in the distribution of employment income over time in two ways. First, as explained above, we uprate employment income using the best available information on the development of average gross wages and salaries over time in each country. In order to capture differential growth in employment income, uprating factors are disaggregated by economic sector where possible. Second, the average employment income in EUROMOD predictions is affected by adjustment of employment status described above to the extent that there are compositional effects.[9]

In order to validate the changes in employment income modelled in EUROMOD we compare evolution of average employment income in EUROMOD (incorporating employment adjustments) to what is observed in the EU-SILC. As an alternative and more up-to-date source of information for validation we use statistics on compensation per employee obtained from the annual macro-economic dataset of DG ECFIN (AMECO).[10] Compensation per employee in AMECO is defined according to the European System of national and regional accounts (ESA 95). Besides gross wages and salaries in cash it also includes fringe benefits and employer social insurance contributions. While it is a broader income concept than

[8] Among many examples, see Atkinson and Sutherland (1988)
[9] In scope of the exercise the employment and self-employment income for the newly unemployed was set to zero and for the newly employed was set to the mean of employment income among those employed within the same stratum.
[10] Available at: http://ec.europa.eu/economy_finance/db_indicators/ameco/

employment income in EU-SILC data[11], the changes in compensation per employee should generally resemble movements in gross cash employment income.[12] An obvious advantage of using AMECO dataset is that it is comparable across countries, readily available, and includes forecasts for the current year as well as for the year ahead.

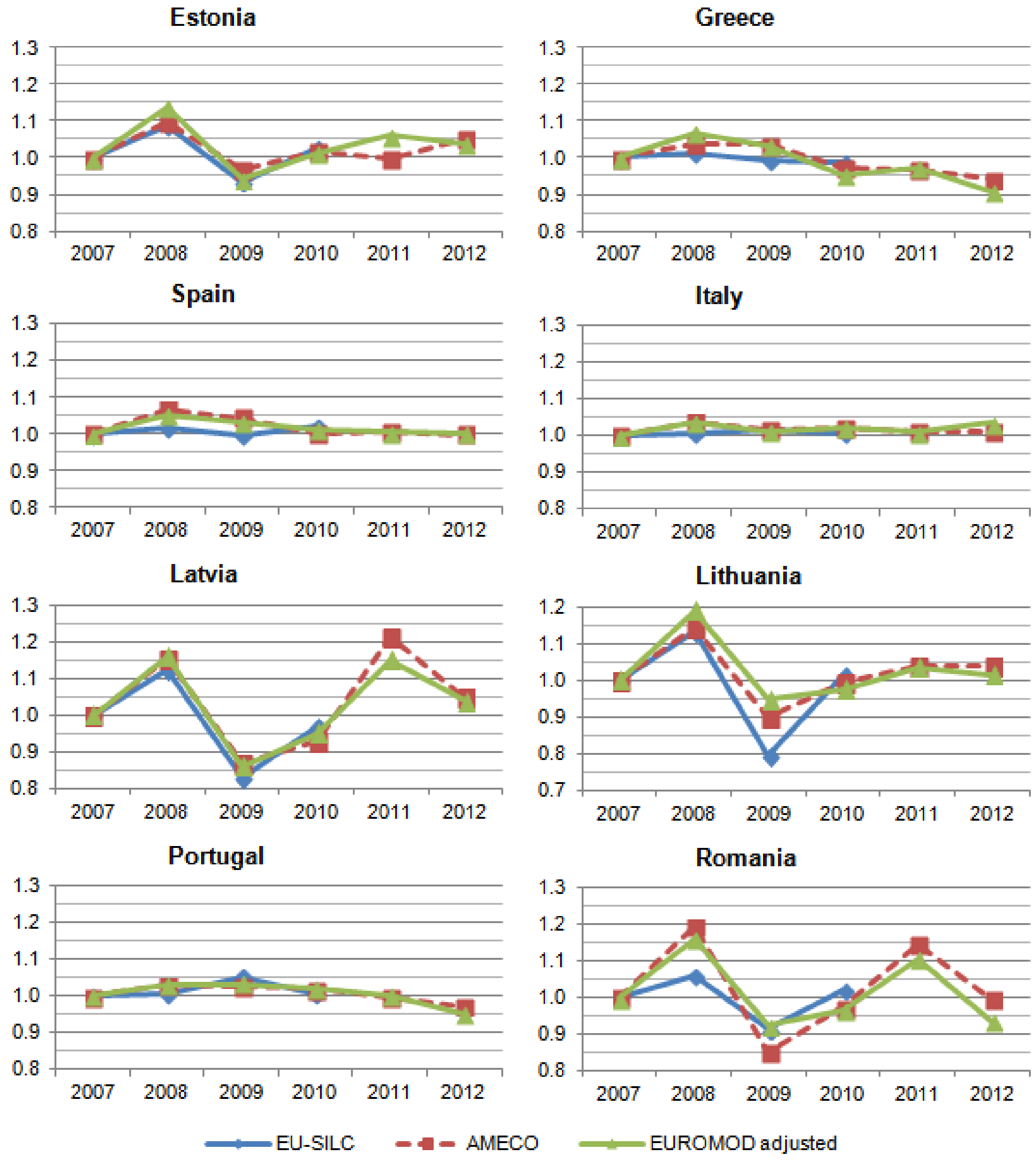
Figure 2 shows that despite differences in income definitions changes in average employment income in EUROMOD follow quite closely changes in compensation per employee in AMECO in 2007-2010. The match is somewhat worse in Romania where employment income shows quite large fluctuations over the period. In 2010-2012 there is some divergence between the evolution of income in the two data sources in Estonia, Latvia and Romania. However, the divergence seems to be smaller if cumulative change over the two years is considered. Average employment income in EU-SILC shows a pattern of changes similar to EUROMOD in 2007-2010. Only in two cases average income in EU-SILC seems to be substantially lower than according to other data sources: in Lithuania in 2009 and in Romania in 2008. This is likely to be related to peculiarities of the survey in these particular years. Despite some divergences in the dynamics of the average employment income in particular years, overall EUROMOD performs quite well and the nowcasted changes in employment income for the period of 2011-2012 are well in line with the changes in compensation per employee captured in AMECO.

After updating market income and other non-simulated income sources, we use EUROMOD for simulating tax-benefit policies from the income data year up to the current state of affairs. EUROMOD simulates tax liabilities and benefit entitlements based on their rules each year and information on characteristics of households and market incomes updated as described above. Income elements simulated by EUROMOD include cash social insurance, universal and assistance benefits, social insurance contributions and personal direct taxes. Exceptions are those benefits and taxes that cannot be simulated due to the lack of necessary information in the underlying data. This mostly concerns benefits for which entitlement is based on previous contribution history (e.g. pensions) or unobserved characteristics (e.g. disability benefits). In these cases the recorded values are uprated as explained above. All simulations are carried out on the basis of the tax-benefit rules in place on the 30th of June of the given policy year. This approach makes it possible to simulate current-year policies, but also means that simulations do not 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 of June. It may thus result in discrepancies compared with the forthcoming annual administrative statistics or survey data.

[11] Employment income in EU-SILC/ EUROMOD is defined as gross employee cash or near cash income. It refers to the monetary component of the compensation of employees in cash payable by an employer to an employee. It includes the value of any social contributions and income taxes payable by an employee or by the employer on behalf of the employee to social insurance schemes or tax authorities (EUROSTAT, 2010).

[12] This holds under the assumption that compensation in kind remains proportional to compensation in cash and no major reforms in employer social insurance contributions take place.

Fig 2 Nominal proportional year-on-year changes in average gross employment income (EUROMOD and EU-SILC) and compensation per employee (AMECO), EUR



Source: Own calculations based on EU-SILC micro-data (2007-2010 incomes) and EUROMOD simulations. Annual macroeconomic dataset of the DG ECFIN (AMECO): http://ec.europa.eu/economy_finance/db_indicators/ameco/

It should be noted that we simulate tax liabilities and benefit entitlements based on the data already adjusted for changes in labour market characteristics (described in Section 2.1). We also make necessary adjustments in market income or other non-simulated income sources for those observations that are subject to labour market transitions. In particular, we set to zero employment and self-employment income (including non-cash employment income) for those individuals who move from employment into unemployment. For individuals who move from unemployment into employment we set employment income to the mean among those already employed within the same stratum. Finally tax liabilities or benefit entitlements are simulated using EUROMOD based on the adjusted labour market characteristics and non-simulated incomes. It is especially important to correctly define eligibility for unemployment and social assistance benefits for those newly unemployed as these are likely to affect disposable income at the lower part of the income distribution. Country specific rules were taken into account, e.g. eligibility for unemployment benefits of long-term unemployed.

Detailed information on the scope of simulations and updating factors is documented in EUROMOD Country Reports.[13] For further information on EUROMOD see Lelkes and Sutherland (2009), Lietz and Mantovani (2007), Sutherland and Figari (2013).

2.3 Calibration to account for differences between EUROMOD and EU-SILC estimates

In the context of this paper the purpose of nowcasting is to predict the level of AROP that the EU-SILC will show once it is available. However, AROP indicators that are calculated using simulated incomes from EUROMOD may diverge from those calculated by Eurostat for the same data year. The main reasons for this are related to small differences in income concepts and definitions, precision of tax-benefit simulations given the limited information in the SILC data, issues of benefit non take-up and tax evasion, as well as the possibility that some income components are under-recorded in the EU-SILC (Figari et al. 2012; Avram and Sutherland 2012).

In order to account for the discrepancies a calibration factor is calculated which brings the EUROMOD estimate of 2007 equivalized household disposable income for each household in line with the value of the corresponding EU-SILC variable (HX090) for that household in the 2008 EU-SILC. The same household specific factor is applied to later policy years. This is based on the assumption that EUROMOD deviates from the EU-SILC in the same way across the years. While this assumption may hold for some countries, we acknowledge that this is unlikely for the countries where macroeconomic conditions, poverty and income inequality indicators exhibited high volatility over 2007-2012.

We assess performance of EUROMOD based AROP predictions with and without calibration against the actual EU-SILC data in order to decide which of the two performs better. The assessment is carried out first for the main Europe 2020 AROP indicator, the total risk of poverty rate calculated for the poverty threshold at 60% of the median, considering both levels of estimates and their annual changes.

Table 1 shows absolute deviations of EUROMOD predictions from the EU-SILC for the main AROP indicator. We assess AROP predictions for 3 years (2008, 2009, and 2010)[14] and for annual changes between 2007-2010. Euromod predictions with calibration perform considerably better than without calibration for Estonia and Latvia (in all years), and for Greece and Portugal (in all but one year). For Italy, Lithuania and Romania the results are mixed. Only for Spain we can conclude that the simulation without calibration works better

[13] See for details: https://www.iser.essex.ac.uk/euromod/resources-for-euromod-users/country-reports.
[14] We do not report here the comparison for the base year 2007 because it coincides with the SILC by construction.

than with calibration. However, if we look at the predictions of AROP changes in 2007-2010, the differences between the two scenarios are quite minor.

Based on the results for eight countries shown in Table 1, we can conclude that in more than half of cases nowcasts with calibration perform better than without calibration. Moreover, it seems that the gains in precision for the countries that perform better are likely to outweigh the losses for countries that perform less well. Only on four occasions calibration alters the direction of predicted change in risk of poverty (two times in Portugal, and two times in Romania). However, in three cases out of four this brings predicted changes in poverty risk in line with those observed in the SILC.

Table 1 Absolute deviation of EUROMOD predictions from the EU-SILC for the main AROP indicator, with and without calibration (in percentage points)

	AROP (levels)			AROP (changes)		
	2008	**2009**	**2010**	**2007-2008**	**2008-2009**	**2009-2010**
Estonia						
EUROMOD	0.909	1.292	0.121	1.014	2.201	1.412
EUROMOD with calibration	0.827	1.155	0.033	0.755	1.983	1.189
Greece						
EUROMOD	0.873	1.408	0.529	0.053	0.025	0.045
EUROMOD with calibration	0.953	1.245	0.379	0.045	0.013	0.044
Spain						
EUROMOD	0.343	0.258	1.987	0.032	0.031	0.084
EUROMOD with calibration	0.657	0.350	2.053	0.033	0.052	0.083
Italy						
EUROMOD	0.444	0.159	1.465	0.021	0.016	0.072
EUROMOD with calibration	0.335	0.746	0.584	0.019	0.022	0.073
Latvia						
EUROMOD	1.744	1.223	0.087	0.058	0.009	0.059
EUROMOD with calibration	0.836	0.590	0.047	0.032	0.004	0.028
Lithuania						
EUROMOD	1.159	2.113	1.464	0.041	0.050	0.035
EUROMOD with calibration	1.339	2.039	1.043	0.069	0.038	0.054
Portugal						
EUROMOD	1.674	1.322	1.187	0.025	0.018	0.007
EUROMOD with calibration	0.518	0.708	0.712	0.027	0.010	0.000
Romania						
EUROMOD	1.095	2.481	0.497	0.038	0.062	0.090
EUROMOD with calibration	1.376	2.091	0.640	0.051	0.033	0.067

Notes: EUROMOD based estimates are obtained with employment adjustments as described in Section 2.1. The lower absolute deviation from the EU-SILC is highlighted in green.

Similar assessment was performed for AROP estimates using alternative poverty lines (40%, 50%, 70% of the median), AROP by gender and by age and for estimates of median equivalized disposable income which provides a measure of how well the poverty line is predicted.[15] The conclusions remain largely the same. However, it should be noted that calibration performs better for poverty thresholds at 60-70% of the median than for 40-50% of the median. Calibration is especially effective correcting AROP indicators for children, youth and elderly, and less so for the prime-age population. There is no particular difference in how calibration works for AROP indicators by gender. Based on results for multiple AROP indicators together, we can say that the calibration seems to improve predictions for Estonia, Greece, Italy and Latvia, but makes results worse for Spain. For Lithuania, Portugal and Romania the evidence is mixed.

For estimates of median equivalized disposable income (and therefore, the poverty line), we find mixed results for most of the countries. Calibration is likely to bring predicted median closer to the true median in Spain and Portugal. In Latvia and Lithuania calibration results in overestimation of the median in 2008-2010.[16] Nevertheless, annual movements in the median seem to be predicted better with calibration.

In this section we assessed how calibration performs if we predict AROP indicators for the recent past, i.e. for the years when SILC is available. The results show that the precision of EUROMOD-based AROP estimates improves on average with calibration. Based on this we expect that calibration will also improve on average the precision of nowcasts. However, if one looks at the results for a particular country, it may happen that the nowcasts without calibration are more accurate. Nevertheless, we retain calibration as a part of the nowcasting toolbox for all countries as our aim is to develop a common methodology for the EU 27. We also expect that calibration will perform better if applied to countries or time periods with more stable economic development.

3. The nowcast

This section provides the main nowcast results. First, we present the EUROMOD based estimates of median equivalised household income and AROP rates for the total population, validating the results against the published EU-SILC estimates that are available (2007 to 2010 incomes). Second, we present the nowcast of AROP indicators focussing on the scale and direction of movement up to 2012 relative to the latest available EU-SILC estimates (2010 incomes).

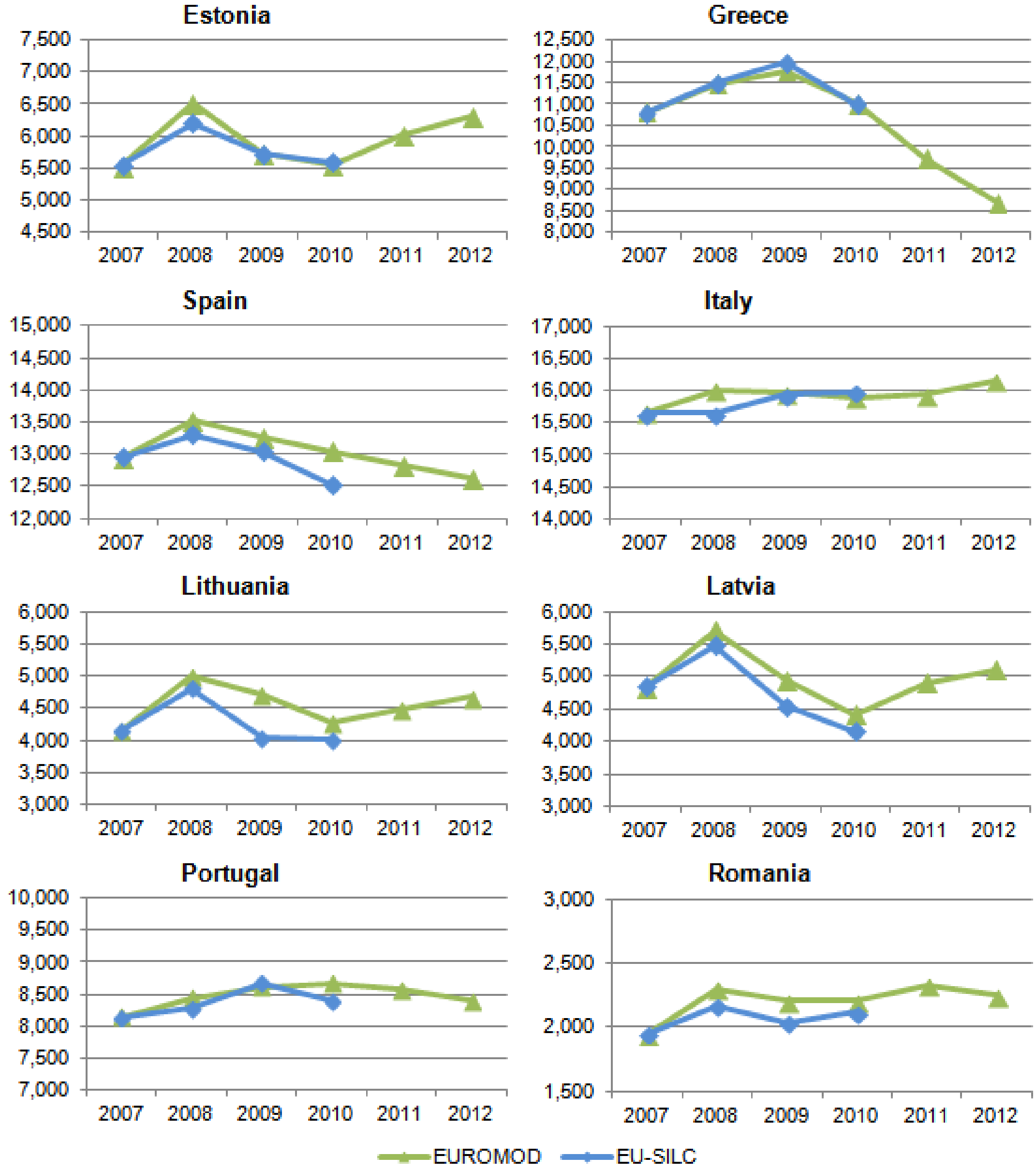
The EUROMOD estimates of the median in Figure 3 track the EU-SILC values up to 2010 quite successfully in Estonia, Greece and Portugal. In Lithuania and Latvia the simulated value does not fully reflect the EU-SILC drop in the median partly because the calibration to 2007 EU-SILC involves an increase in income that was not sustained into the downturn. In Spain, calibration has little effect but still the labour market adjustment does not fully capture the reduction in the median as revealed by the EU-SILC. In Romania, where the changes are small EUROMOD performs reasonably well. The Italian results for median income show

[15] The results of the comparison are not reported in the paper but are available upon request.

[16] For Latvia and Lithuania 2007 was an exceptional year of high economic growth. But the following years brought severe economic decline. Therefore, calibration of income based on 2007 baseline results moves the median income too high up in 2008-2010.

different trends compared to EU-SILC statistics in 2008-2009, and stabilize in 2010.

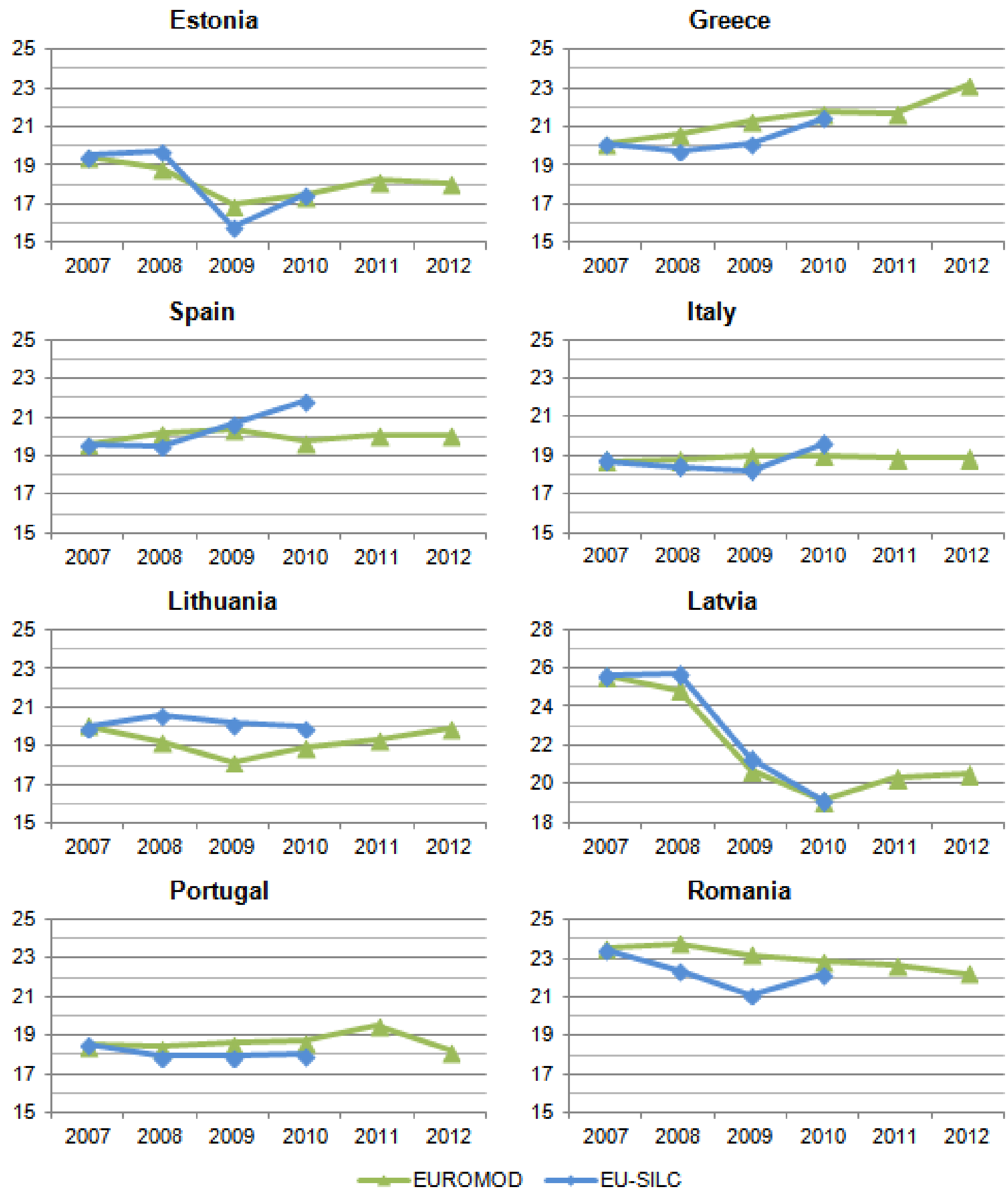
Fig 3 EUROMOD 2007-2012 and EU-SILC 2007-2010: Median equivalized disposable income, EUR



Notes: EUROMOD based estimates are obtained with employment adjustments and calibration as described in section 2. Note that the charts are drawn to different scales and the gridline interval is always €500. EU-SILC (ilc_di03) numbers are lagged by one year to correspond to the income reference year.

Figure 4 shows that the EUROMOD estimates up to 2010 capture the dramatic reduction in risk of poverty shown in the EU-SILC for Latvia rather well. It also tracks quite closely the evolution of AROP over the period in Estonia (where it fell and then rose again) and in Portugal. On the other hand in Lithuania where the EU-SILC indicator stays roughly constant, the EUROMOD estimate shows a decline in 2009 and then a slight recovery; in Spain, Romania and Italy the EUROMOD estimate does not capture the large increase in risk of poverty rates in 2009-2010 picked up by the EU-SILC.

Fig 4 EUROMOD 2007-2012 and EU-SILC 2007-2010: At risk of poverty rates (using 60% of median as the threshold)



Note: EUROMOD based estimates are obtained with employment adjustments and calibration as described in section 2. EU-SILC (ilc_di03) numbers are lagged by one year to correspond to the income reference year.

For the two most recent years, when the EUROMOD estimates are the only information currently available, we estimate an increase in the median equivalized disposable income in 2011-2012 in Estonia, Latvia and less strongly in Lithuania and Italy (Figure 3). In Portugal the median only starts falling in 2011 (the 2010 reduction revealed by the EU-SILC not being captured by the simulation). In Greece it falls steeply, continuing the trend since 2009. In

Spain the median falls in both 2011 and 2012. Figure 4 shows that in the period 2010-2012 EUROMOD predicts little change in AROP rates in most of the countries. Exceptions are a continuing rise in Greece and Lithuania, a reverse of direction from falling to rising in Latvia and a reduction (2011-12) in Portugal.

Table 2 Nowcast estimates for median income and AROP rates, 2010-2012

		Poverty rates (60% of median) in p.p.					
	Median	**All**	**Males**	**Females**	**Children (<18)**	**Prime-age**	**Elderly (65+)**
Estonia							
Nowcast change	13.3%***	0.62	-0.77	1.80***	-1.77*	-1.57**	9.79***
Nowcast level 2012	6,340	18.1	16.8	19.2	17.7	14.3	22.9
Greece							
Nowcast change	-21.0%***	1.38**	1.85**	0.91^	3.94***	4.08***	-8.95***
Nowcast level 2012	8,683	22.8	22.8	22.8	27.6	22.7	14.7
Spain							
Nowcast change	-3.2%***	0.32	0.65*	0.00	1.89***	1.47***	-4.54***
Nowcast level 2012	12,111	22.1	21.8	22.4	29.1	21.9	16.3
Italy							
Nowcast change	1.6%***	-0.19	-0.22	-0.16	-0.10	-0.05	-0.15
Nowcast level 2012	16,225	19.4	18.1	20.6	26.2	19.1	16.9
Latvia							
Nowcast change	15.6%***	1.38**	0.23	2.35***	-0.28	-0.78	9.20***
Nowcast level 2012	4,796	20.5	20.2	20.8	24.7	18.5	18.1
Lithuania							
Nowcast change	9.2%***	0.98	0.81	1.13*	2.82^	0.00	1.81***
Nowcast level 2012	4,373	21.0	20.6	21.2	27.1	19.8	13.9
Portugal							
Nowcast change	-3.0%	-0.52	-0.49	-0.55	-0.02	-0.29	-2.25***
Nowcast level 2012	8,155	17.5	17.1	17.8	22.4	14.7	17.7
Romania							
Nowcast change	1.8%^	-0.63*	-0.71*	-0.55*	-0.80	-0.84^	-0.40
Nowcast level 2012	2,155	21.6	21.2	21.9	32.1	21.0	13.7

Notes: Change in 2010-2012 statistically significant at: ^ 90% level, * 95% level, ** 99% level, *** 99.9% level. Information on the sample design of EU-SILC 2008 used for calculations was derived following Goedemé (2010) and using do files Svyset EU-SILC 2008 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 equivalized using the modified OECD scale. The changes shown are percentage changes in the median and percentage point changes in other indicators. The nowcast change is the difference in the EUROMOD estimates for 2012 compared with that for 2010, the income year corresponding to the latest available Eurostat SILC estimate. The nowcast estimate of the level of the indicator is calculated by applying the change to the latest Eurostat estimate based on 2010 incomes.

Table 2 summarises the results of the nowcasts for the median equivalised disposable income and AROP indicators in total population and split by groups. We predict what EU-SILC 2013 (2012 income) will show by applying the nowcasted change in indicators (as shown in Figures 3 and 4) to the latest EU-SILC estimates. We do so in order to eliminate the discrepancies between the EUROMOD and EU-SILC estimates that still remained after adjusting for changes in the labour market characteristics and calibration. While we do report point estimates of our nowcasts for 2012, we argue for focusing on the relative changes in indicators rather than their absolute values. This is primarily due to survey-based estimates being subject to sampling and other errors that may lead to wide confidence intervals around point estimates of the AROP indicators[17]. The information on standard errors for AROP indicators provided in the EU-SILC quality reports shows that those may vary significantly between the countries in question: from around 0.4 percentage points for Italy and Spain and up to around 0.9 percentage points for Lithuania[18]. The resulting width of the confidence intervals around the point estimates indicate that most of the discrepancies between our and EU-SILC poverty risk indicators shown in Figure 4 are in fact within the 95% confidence intervals. However, the nowcasts of direction and scale of change are likely to be more reliable compared to the point estimates for each particular year. This results from a reduction in the standard errors due to covariance in the data as the same dataset based on the EU-SILC 2008 is used for simulations across all the analysed years. Changes in indicators between 2010-2012 that are statistically significant taking into account the covariance in the data are marked in Table 2. Unmarked changes are not statistically different from zero at 90% significance level.

The aim of this paper is not to interpret or explain the nowcasted trends, as a much more detailed analysis would be necessary to decompose the predicted changes in indicators and attribute them to policy changes or other factors. However, below we provide some tentative analysis of the results to demonstrate the potential of such exercises as demonstrated in this paper.

Table 2 suggests that median incomes in 2012 are significantly higher than in 2010 in the three Baltic States and Italy. The increase in the median in Romania is less significant. We also predict a significant decrease in the median equivalized disposable income in Spain and especially Greece. In spite of the large reduction in the poverty threshold in Greece the headline poverty rate does not fall. However, the nowcasts for population sub-groups reveal that poverty risk is estimated to have risen significantly for children and working age adults (by about 4 percentage points) and to have fallen dramatically for elderly people (by nearly 9 percentage points). This is at least partly caused by a freeze in pension benefits while other incomes have been falling in nominal terms.

In contrast, in Latvia as median income rises, the headline risk of poverty indicator also increases somewhat. In both Latvia and Estonia the rise in AROP indicator is particularly large for elderly people due to a combination of pension growth lagging behind that of other incomes and a concentration of elderly people with incomes around the poverty threshold. In

[17] While EU-SILC employs complex sample design in most countries, relevant variables are missing from the EU-SILC user databases due to data confidentiality issues (Goedemé 2013b). The lack of this information complicates estimation of the accurate standard errors and confidence intervals of EU-SILC based AROP indicators for the users (Goedemé 2010, 2013).

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

all three Baltic countries there is a significant increase in AROP for women, which is not the case for men. This partly reflects the gender composition of the older population and also a return to the pre-crisis trend of the male population being less exposed to poverty in the Baltic countries – a direction of change that is not unexpected given the resumed growth in original income.[19] In Lithuania we predict an increase in poverty for children, where the AROP rate is estimated to have risen by almost three percentage points. This may be explained by a combination of several factors, including policy measures such as tightening of eligibility conditions and reducing the levels of contributory and non-contributory family benefits, and the social assistance benefit for large families. On the other hand restoration of contributory pensions to their pre-crisis levels in Lithuania in 2012 makes the difference to poverty levels among the elderly, in particular if compared to Latvia where pensions continue to be frozen.

In Portugal and Spain, significant reductions in AROP are nowcasted among the elderly (by about 2 and 4.5 percentage points respectively) while the change in the headline indicator is insignificant in both countries. However while in Portugal AROP rates remain relatively stable for other age groups, increase in AROP rates among children and the working age population is expected in Spain. In both cases earnings fell relative to pensions in this period. Changes in AROP indicators are insignificant for Italy and are small for Romania.

Finally it should be noted that all estimates provided in this section should be interpreted with care as for testing purposes the nowcasting methodology was applied for a period of 5 years. Applying the methodology on the latest available EU-SILC data with a resulting time gap reduced to 3 years would potentially provide more accurate results, especially taking into account the highly volatile period of economic crisis used for the analysis.

4. Discussion

The aim of the work reported here has been to present and validate a method for nowcasting the current values of the AROP indicators for EU countries. In order to take account of the interactions between household circumstances, changing policies and macro-economic situation the proposed methodology uses the EUROMOD tax-benefit microsimulation model, which is unique in its potential to provide comparable microsimulation results for each of the 27 Member States. The proposed nowcasting toolbox consists of both standard EUROMOD simulations and additional adjustments in order to capture changes in the labour market characteristics of the population, as well as to calibrate results towards those of EU-SILC. Importantly, we argue for focusing on the scale and direction of movement in the nowcasted median income and AROP indicators relative to the latest available EU-SILC estimates, rather than their exact point estimates.

In scope of the nowcasting exercise we rely on external sources of information both for updating non-simulated income sources in EUROMOD as well as for modeling labour market adjustments. When choosing the source of external statistics we usually face dilemma of using country-specific information or synchronized information, more detailed and more

[19] Gender differences in income poverty in the pre-crisis period and after are discusses in e.g. in Bettio et al. (2013).

precise information or more timely and easier available information. We try to take these decisions so as to ensure that our results are comparable, precise and available in a timely manner. For example, when we model labour market adjustments we opt for using published aggregate LFS statistics instead of LFS micro-data which provides more detailed information but is available with delay. On the opposite, when choosing updating factors for non-simulated incomes we opt for country-specific indexes as they are usually more precise and more timely available. However, in some cases the latter may result in a somewhat lower degree of comparability. The validation shows that by employing this strategy EUROMOD performs well in tracking the dynamics of both employment rates and income levels shown by external sources such as aggregate LFS figures and AMECO.

The brief analysis of the changes in AROP indicators and their drivers presented in the paper demonstrates the potential of AROP nowcast to facilitate monitoring of the effects of the most recent changes in tax-benefit policies and macro-economic conditions on poverty risk. Availability of more timely poverty risk indicators could complement macro-economic short-term forecasts (of e.g. GDP growth, inflation, employment) and, importantly, help to bring distributional issues into the centre of the policy debate. Our illustrative nowcast estimates indicate that within the first two years after Europe 2020 targets were set, the progress towards the AROP reduction target was limited and sometimes adverse in the eight analysed countries. This is due both to the difficult macro-economic conditions and changes in tax-benefits systems fuelled by austerity. As to the scale of predicted changes, within the period of 2010-2012 a significant increase in AROP of about 1.4 percentage points is predicted for Latvia and Greece. Changes in AROP for other countries, both positive and negative, lay within a range of 1 percentage point and are insignificant. We have also shown how children face an increasing poverty risk in countries as diverse in other ways as Lithuania and Greece, as well as in Spain. Results demonstrate how limiting the growth of pensions results in risk of poverty rising among older people in countries with rising median incomes (Estonia, Latvia) but still allows it to fall in countries with falling incomes generally (Greece, Spain). Additional insights may be obtained by more detailed decomposition of changes in the nowcasted AROP figures.

Finally, there are several ways in which our calculations can be made more precise and timely. First, we could make use of more recent EU-SILC data in EUROMOD. Once the method is established and tested, it should be possible to be using EU-SILC income data from *t-3* as the basis for a nowcast in year *t* (equivalent to using the 2010 SILC in 2012). Secondly, the updating of market incomes in EUROMOD could be further improved by increasing the degree of disaggregation (e.g. by updating earnings by sector, region, personal characteristics etc.). The main challenge in the latter case is in identifying sources of synchronized and very up-to-date macro-level information in the dimensions of importance, which also needs to be defined in a way that is consistent with information in the EU-SILC data. Adding further dimensions into the procedure of employment adjustments should also be beneficial subject to availability of more detailed synchronized information on a regular and timely basis.

References

Atkinson, A. B. (2013). Ensuring social inclusion in changing labour and capital markets. Economic Papers 481. DG ECFIN: Brussels.

Atkinson, A. B., Sutherland, H. (eds.) (1988). Tax Benefit Models. STICERD Occasional Paper 10, LSE.

Avram, S., Sutherland, H. (2012). "Baseline results from EUROMOD: 2006-2009 policies" EUROMOD Working Paper EM1/12 Colchester: ISER, University of Essex.

Avram, S., Sutherland, H., Tasseva, I., Tumino, A. (2011). "Income protection and poverty risk for the unemployed in Europe" Research Note 1/2011 of the European Observatory on the Social Situation and Demography, European Commission. http://www.socialsituation.eu/WebApp/ResearchNotes.aspx

Bettio, F., Corsi, M., D'Ippoliti C., Lyberaki, A., Lodovici, S. M., Verashchagina A. (2013)."The impact of the economic crisis on the situation of women and men and on gender equality policies", European Commission, Luxembourg.

Brewer et al. (2013). "The Short- and Medium-Term Impacts of the Recession on the UK Income Distribution", FISCAL STUDIES, vol. 34, no. 2, pp. 179–201. http://www.ifs.org.uk/docs/FSBrewerEtAl.pdf

Brewer, M., Browne, J., Joyce, R. (2011). Child and working-age poverty from 2010 to 2020, IFS Commentary C121. London: The Institute for Fiscal Studies. http://www.ifs.org.uk/publications/5711

Creedy, J., 2003. Survey Reweighting for Tax Microsimulation Modelling, Treasury Working Paper Series 03/17, New Zealand Treasury.

Dekkers, G., Zaidi, A. (2011). "The European Network for Dynamic Microsimulation (EURODYM) – A vision and the state of affairs", *International Journal of Microsimulation* 4(1) 100-105

Eurostat (2006). Basic concepts and definitions: The European Union labour force survey. http://circa.europa.eu/irc/dsis/employment/info/data/eu_lfs/lfs_main/lfs/lfs_concepts_and_definitions.htm

Eurostat (2010). *EU-SILC 065* (2008 operation). Description of Target Variables. Version January 2010. Luxembourg: Eurostat.

Eurostat (2011). *2008* comparative EU final quality report. Version 3—July 2011. Luxembourg: Eurostat.

Fernandez Salgado M., Figari, F., Sutherland, H., Tumino, A. (2013). Welfare compensation for unemployment in the Great Recession. *Review of Income and Wealth*. DOI: 10.1111/roiw.12035

Figari, F., Iacovou, M., Skew, A., Sutherland, H. (2012). Approximations to the truth: comparing survey and microsimulation approaches to measuring income for social indicators, *Social Indicators Research* 105, doi: 10.1007/s11205-010-9775-4

Figari, F., Salvatori, A., Sutherland, H. (2011). "Economic downturn and stress testing European welfare systems". *Research in Labor Economics* 32, pp.257-286.

Goedemé, T. (2010). The standard error of estimates based on EU-SILC. An exploration through the Europe 2020 poverty indicators. Working Paper No. 10 / 09. Antwerp: Herman Deleeck Centre for Social Policy, University of Antwerp, 36 p.

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' in *Social Indicators Research*, 110(1): 89-110. doi: 10.1007/s11205-011-9918-2.

Goedemé, T. (2013b). The EU-SILC sample design variables: critical review and recommendations. Working Paper No. 13 / 02. Antwerp: Herman Deleeck Centre for Social Policy, University of Antwerp, 36 p.

Habib, A., Narayan, A., Olivieri, S., Sanchez-Paramo, C. (2010). Assessing Ex Ante the Poverty and Distributional Impact of the Global Crisis in a Developing Country // A micro-simulation Approach with Application to Bangladesh. Policy Research Working Paper 5238. The World Bank, Washington DC. DOI: 10.1596/1813-9450-5238

Immervoll, H., Levy, H., Lietz, C., Mantovani, D., Sutherland, H. (2006). The sensitivity of poverty rates in the European Union to macro-level changes. *Cambridge Journal of Economics*, 30, 181-199.

Immervoll, H., Lindstrom, K., Mustonen, E., Riihela, M., Viitamäki, H. (2005). Static Data 'Ageing' Techniques. Accounting for Population Changes in Tax-Benefit Microsimulation Models. Euromod Working Paper EM5/05 Colchester: ISER, University of Essex.

Jenkins, S.P., Brandolini, A., Micklewright, J., Nolan, B. (2013). *The Great Recession and the Distribution of Household Income*, Oxford University Press, Oxford.

Keane C., Callan, T., Savage, M., Walsh, J.R., Timoney, K. (2013). Identifying Policy Impacts in the Crisis: Microsimulation Evidence on Tax and Welfare. *Journal of the Statistical and Social Inquiry Society of Ireland* (forthcoming).

Lelkes, O., Sutherland, H. (2009). Tax and Benefit Policies in the Enlarged Europe. Assessing the Impact with Microsimulation Models. Aldershot: Ashgate.

Lietz, C., Mantovani, D. (2007). A short introduction to EUROMOD: an integrated European tax-benefit model in Microsimulation in action: policy analysis in Europe using EUROMOD. Bargain, O (eds.). *Research in Labor Economics* 25. Amsterdam: Elsevier, 1-26.

Navicke J., Rastrigina, O., Sutherland, H. (2013). Using EUROMOD to "nowcast" poverty risk in the European Union, Eurostat Methodologies and Working papers series. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-13-010/EN/KS-RA-13-010-EN.PDF

O'Donoghue, C. (1999). Dynamic microsimulation: A methodological survey, *Brazilian Electronic Economic Journal* 4 (2).

Stiglitz, J.E. (2012). *The price of inequality: how today's devided society endangers our future*. – 1st ed. New York: W. W. Norton & Co.

Sutherland, H., Figari, F. (2013). EUROMOD: the European Union tax-benefit microsimulation model, *International Journal of Microsimulation* (2013) 6(1) 4-26.