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

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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 to complicated nature of the European Union Statistics on Income and Living Conditions (EU-SILC) poverty risk estimates are published with a 2–3 years 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. The method is validated by using EU-SILC data for 2007 incomes to estimate at-risk-of-poverty rates for 2008–2012 and to compare the 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.

**Keywords** Microsimulation · Poverty · EUROMOD · Nowcast · Income · European Union

## 1 Introduction

The Europe 2020 target for poverty and social exclusion has three components: income poverty, material deprivation and work intensity. It is important for policy makers and

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commentators 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 scientific or policy-driven 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 were still no EU-SILC based indicators for the current decade. Continuing in this way it will be 2023 before it is known 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.[1]

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 depends 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.

There are several methods that could be applied for predicting poverty risk indicators. Using macro-level time series data may give satisfactory results in contexts where a fixed poverty threshold is used and welfare policies are limited in their scope and generosity as in the US (see e.g. Isaacs and Healy 2012). In other contexts and when predicting relative poverty risk indicators, macro level estimations are likely to be biased as they will not capture the differential effects of changes in income and household circumstances at different points in the distribution. Using microsimulation techniques based on representative individual level data enables the interactions between household circumstances, changing policies and the macro-economic situation to be taken into account (Immervoll et al. 2006; Bourguignon et al. 2008). Combined macro–micro modeling is considered to be the appropriate approach for analysis focusing on the impacts of macroeconomic policies and shocks on poverty and income distribution (Bourguignon et al. 2008; Essama-Nssah 2005).

With an increasing demand for ex-ante evaluation of the distributional and poverty impacts of policy reforms and economic developments, a number of studies have moved beyond historical analysis towards forward-looking simulations. 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) and looking at the medium-term effects of the recession up to 2016 (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). However, there are few papers offering comparable estimates for several countries. One example is Ajwad

[1] 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).

(2013) who analyzes the impact of improving employment and education conditions on poverty and social exclusion indicators for ten new EU member states.

The aim of this paper is to present and validate an application of the microsimulation method to estimate current AROP rates in a comparable and consistent way across the EU. The contribution of this paper is to implement and test such an exercise for several countries using common data sources and assumptions in a synchronised way so that results may be compared across countries and through time.

This 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.[2] 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 method and the data on which it relies are synchronised across countries in order to produce results that are comparable.

Following a similar validation strategy as the World Bank (Habib et al. 2010; Ajwad 2013) the method is applied to EU-SILC data several years older than the most recent (2007 incomes) and AROP rates are estimated for 2008–2012 (i.e. aiming to reflect what EU-SILC 2009-2011 shows and what EU-SILC 2012–2013 will show).[3] The performance of the method is assessed by comparing the predictions with actual EU-SILC indicators where possible, as well as other external statistics. The procedure is tested on eight EU countries that are among those experiencing the most volatile economic conditions in the period 2008–2012: Estonia, Greece, Spain, Italy, Latvia, Lithuania, Portugal and Romania.

The structure of the paper is as follows: in the next section the method for nowcasting poverty risk using microsimulation is explained and components of the method are validated by comparing results against external sources of statistics as well as most recent EU-SILC based estimates. In the third section the predictions of the key indicators of poverty risk are discussed and compared with actual EU-SILC estimates that are available for the period in question. Finally, the proposed method is evaluated and potential improvements to it are highlighted.

## 2 Data and Methods

This section presents the method proposed for nowcasting AROP indicators in the EU countries and validation of its components.[4] 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 how country-specific policies mediate or mitigate the effects of the changes.

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

[3] Note that EU-SILC data collected at time $t$ (e.g. 2011) contains income information collected for time $t - 1$ (e.g. 2010).

[4] A detailed discussion of the method is available in Navicke et al. (2013).

There are numerous factors resulting from macro-economic and social change that might affect income distribution in a country. First of all, the level and distribution of market income (i.e. income from employment, self-employment, capital, etc.) change over time. For example, wage dynamics are different across sectors, occupations, firms, etc. Second, tax-benefit policies may be reformed and this will affect the disposable income of households. Third, individuals may change their status in the labour market moving between education, employment, unemployment and inactivity or retirement. Fourth, the demographic structure of the population changes due to natural population change (e.g. deaths and births) and migration. Last of all, household composition may change with respect to size, age, and gender which has implications for the equivalence scale as well as the distribution of income across households. Moreover, these factors interact with each other and can also lead to behavioural responses. For example, if the distribution of market income becomes more unequal or unemployment rises, the government may decide to make social assistance rules more (or less) generous. This in turn, can reduce (or improve) work incentives for some people and trigger transitions into (or out of) inactivity. Or inability to make ends meet may lead to formation of larger households in order to share resources, or to household splits due to the pressures resulting from poverty.

It is not possible to take into account all complexities, but it is feasible to focus on some of the factors that are likely to be more important in the short run. 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.

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) adjustments to labour market status are made to account for major changes in employment levels. Rapid changes in the labour market were particularly important within the 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 a recession or fertility "bubbles" at the height of an economic boom. Such changes are beyond the scope of the analysis in this paper.

Below the steps proposed for nowcasting poverty risk are described in the logical order of their implementation, starting with adjusting EUROMOD input data for changes in employment, followed by microsimulation of tax and benefit policies on updated EU-SILC data and finally, calibrating the results. The components of the method are validated by comparing results against external sources of statistics as well as the most recent EU-SILC based estimates.

## 2.1 Accounting for Labour Market Change

Labour market change is accounted for within the static microsimulation framework by explicitly simulating the transitions between labour market states (Figari et al. 2011; Fernandez et al. 2013; Avram et al. 2011). 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. The modelling of labour market transitions is informed by Labour Force Survey (LFS) data which are made available more quickly compared to the EU-SILC.

There is a choice between using micro-data from the 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 using the more limited LFS-based quarterly aggregate statistics that are made available with less time-lag (Figari et al. 2011). This choice involves a trade-off between the extent to which the nowcast is based on up-to-date information, and the level of detail accounted for. Here, the most recent aggregate LFS based statistics are used, split by three sets of characteristics: age group, gender and education level (a total of 18 strata). Changes in employment levels are thus modelled for the period of 2008–2012 based on 2008–2011 annual LFS figures, and an average of the last four available quarters (2011Q4-2012Q3) for 2012.

The net change in employment rates is modelled by randomly selecting observations to be moved out of or into employment within the 18 age-gender-education strata available in the LFS aggregate statistics. The probability of selection is equal to the relative change in employment rate within the strata according to the LFS statistics during the period in question. To account for an additional source of variability caused by random assignment within the stratum and to derive more robust results, 200 replications of random draws are carried out for each year and the mean values of AROP estimates are used for nowcasting purposes. While this method is computationally intensive, it has the advantage of not imposing the structural relationship and transitional probabilities estimated based on the data from the previous period. The latter is the case when econometric models of occupational choice are estimated for modelling labour market transitions (e.g. Habib at al. 2010; Ferreira et al. 2004).

Changes in the prevalence of long-term unemployment are important to capture because of implications for eligibility and receipt of unemployment benefits. These are modelled based on LFS statistics on long-term unemployment following a similar selection procedure as in case of modelling employment change. 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.

It should be noted that labour market concepts do not align perfectly between EUROMOD and the LFS. While in the LFS employment status is determined through an elaborate set of questions on activity in the reference week,[5] EUROMOD relies on self-defined labour market status from the EU-SILC income reference period.[6] Moreover, for

[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 1 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 illness, holidays, industrial dispute, and education or training (Eurostat 2006).

[6] In the 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).

reasons of internal consistency EUROMOD adjusts labour market status to correspond with information on income sources. 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 the approach, Fig. 1 compares the dynamics of employment rates in the LFS, EUROMOD and available EU-SILC data for the period in question.

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 year estimates can be observed between the original EU-SILC and EUROMOD in Italy, Portugal and, considerably, in Latvia. These are due to synchronization of information on income and employment in EUROMOD. The graph also shows what the employment level would be in EUROMOD if no employment adjustments are implemented. Except for Romania, where changes in employment levels are small, unadjusted employment rates result in a substantially higher numbers of people receiving employment income, with consequential distributional implications. The effect is especially strong for countries where employment levels drop most between 2007–2012 (e.g. Greece, Spain, Portugal) and where large fluctuations in employment levels are observed (e.g. Estonia, Lithuania, Latvia).

Importantly, despite of the limitations due to differences in employment concepts and aggregate statistics used, the employment adjustments in all cases track closely the employment dynamics shown by LFS. Some minor deviations are due to several factors. These include differences in the EUROMOD and LFS structure of the working age population in the base year and changes in the demographic structure thereafter.

## 2.2 Updating Incomes and Simulating Policies

The main advantage of tax-benefit microsimulation models like EUROMOD is to be able to calculate the effects on income of policy changes. It has been a standard practice since such models first started to be used in the 1980s to simulate the effects of current policies on market income updated from the micro-data income year to the policy year in question.[7] The way in which this updating is done is of particular importance in times of economic change and in the context of nowcasting.

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 updating 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

[7] Among many examples, see Atkinson and Sutherland (1988).

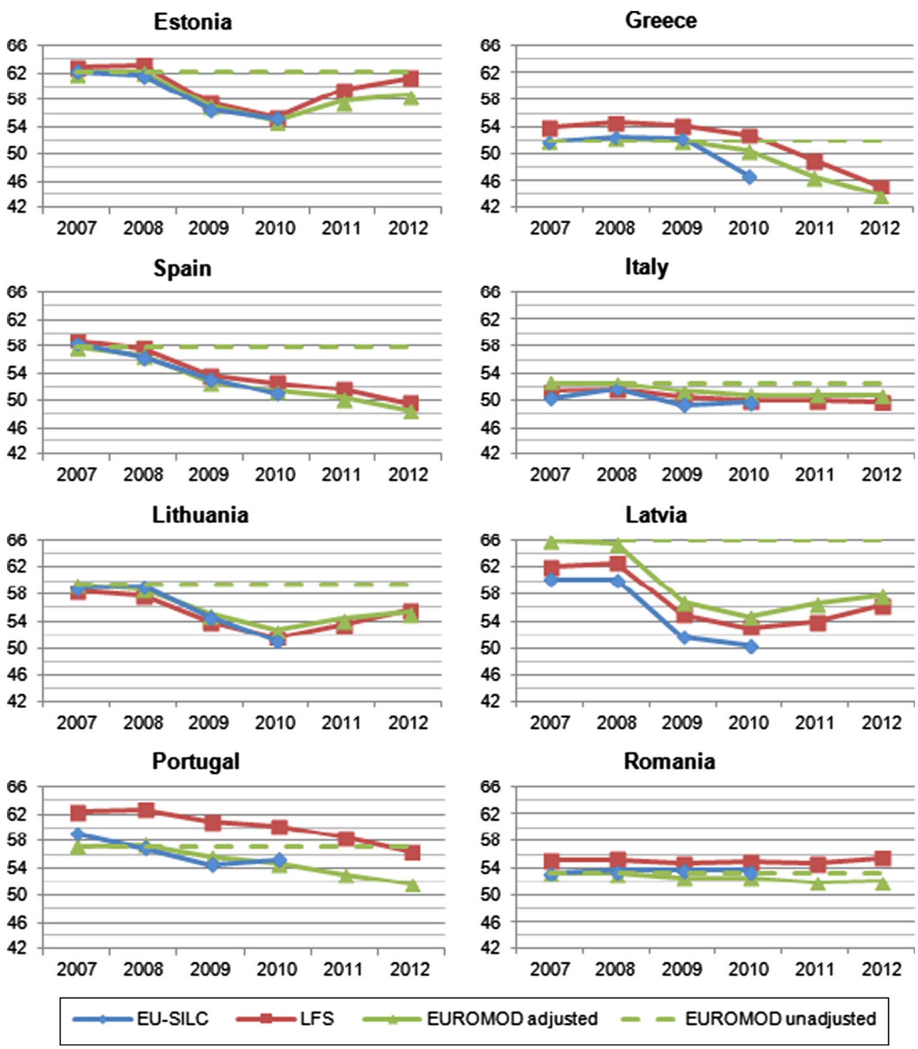


**Fig. 1** Employment rates in the LFS, EU-SILC and in EUROMOD before and after labour market adjustments. *Source* Own calculations based on EU-SILC micro-data (2007–2010 incomes) and EUROMOD simulations. LFS annual employment figures for 2007–2012 [lfsa_ergaed] published by Eurostat

period of 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.

Changes over time in the distribution of employment income are captured in two ways. First, as explained above, employment income is updated 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, an effect on the average employment income may come through compositional changes caused by labour market adjustments described above.

In order to validate the modelled changes in employment income, its evolution is compared with what is observed in the EU-SILC. An alternative and more up-to-date source of information for validation statistics on compensation per employee is obtained from the annual macro-economic dataset published by DG ECFIN (AMECO).[8] 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 employment income in EU-SILC data,[9] the changes in compensation per employee should generally resemble movements in gross cash employment income.[10] 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 modelled in EUROMOD closely follow the changes in compensation per employee as measured by AMECO for the period 2007–2010. The match is less good in Romania where employment income shows 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 is smaller if cumulative change over the 2 years is considered. Average employment income in EU-SILC shows a pattern of changes similar to that shown by EUROMOD for the period 2007–2010. Only in two cases does average income in EU-SILC seem to be substantially lower compared to external 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 average employment income, EUROMOD performs well overall and the nowcasted changes in employment income for the period of 2011–2012 are in line with the changes in compensation per employee captured in AMECO.

After updating market income and other non-simulated income sources, EUROMOD is used 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 updated market incomes. 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 for other non-simulated income sources. All simulations are carried out on the basis of the tax-benefit rules in place on the 30th 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 June. It may thus result in discrepancies compared with the forthcoming annual administrative statistics or survey data.

[8] Available at: http://ec.europa.eu/economy_finance/db_indicators/ameco/.

[9] 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).

[10] 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.

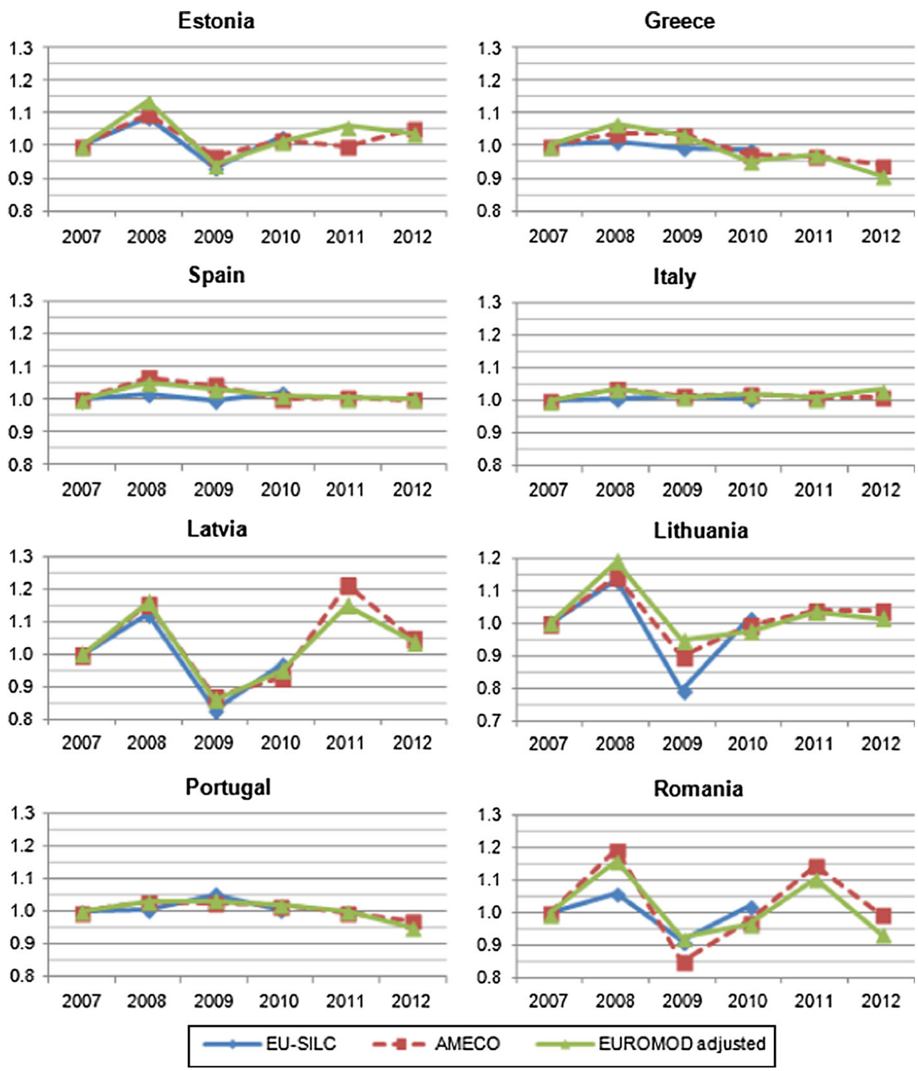


**Fig. 2** Nominal proportional year-on-year changes in average gross employment income (EUROMOD and EU-SILC) and compensation per employee (AMECO). *Source* Own calculations based on EU-SILC micro-data (2007–2010 incomes) and EUROMOD simulations. Annual macroeconomic dataset of the DG ECFIN (AMECO): http://ec.europa.eu/economy_finance/db_indicators/ameco/

It should be noted that tax liabilities and benefit entitlements are simulated using the data already adjusted for changes in labour market characteristics. Necessary adjustments are also made to market income or other non-simulated income sources for those observations that are subject to labour market transitions. In particular, employment and self-employment income (including non-cash employment income) is set to zero for those individuals who move from employment into unemployment. For individuals who move from unemployment into employment, earnings are set equal 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 incomes. It is especially important to define eligibility correctly for unemployment and social assistance benefits for those newly unemployed as these benefits are likely to affect disposable income in the lower part of the income distribution. Country specific rules, including for example any eligibility for unemployment benefits by the long-term unemployed, are taken into account.

Detailed information on the scope of simulations and updating factors is documented in EUROMOD Country Reports.[11] 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 what the AROP indicators in EU-SILC will show once the data on the current period become 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 for each household which is equal to the difference between the value of equivalized household disposable income in the 2008 EU-SILC (variable HX090) and the EUROMOD estimate for the same period and income concept. 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 households, it must be acknowledged that this is less likely in the countries where macroeconomic conditions, poverty and income inequality indicators exhibited high volatility over the period 2007–2012.

The performance of EUROMOD based AROP predictions with and without calibration is assessed against the actual EU-SILC data in order to decide which of the two performs better. Table 1 shows absolute deviations of EUROMOD predictions from the EU-SILC for the main 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. AROP predictions are assessed for 3 years (2008, 2009, and 2010) and for annual changes between 2007 and 2010.[12] 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 1 year. For Italy, Lithuania and Romania the results are mixed. Only in Spain is it clear that the simulation without calibration works better than with calibration. However, looking 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, it appears that in more than half the cases nowcasts with calibration perform better than without calibration. Moreover, it seems that the gains in precision for the countries that perform better outweigh the losses

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

[12] The comparison for the base year 2007 is not reported because it coincides with the SILC by construction.

for countries that perform less well. Calibration alters the direction of predicted change in risk of poverty at only four points among those shown (in Portugal and Romania). However, in three cases out of four it brings predicted changes in poverty risk in line with those observed in the SILC.

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.[13] The conclusions remain largely the same.

For estimates of median equivalized disposable income (and therefore, the poverty line), there are mixed results for most of the countries. Calibration is likely to bring the 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.[14] Nevertheless, annual movements in the median are predicted better with calibration.

Based on the evidence that the precision of EUROMOD-based AROP estimates improves on average with calibration, it is retained as a part of the nowcasting toolbox for all countries. It is also to be expected 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, the EUROMOD based estimates of median equivalised household income and AROP rates for the total population are presented, validating the results against the published EU-SILC estimates that are available (i.e. 2007–2010 incomes). This is followed by the nowcast of AROP indicators focussing on the scale and direction of movement up to 2012 relative to the latest available EU-SILC estimates (i.e. 2010 incomes).

The EUROMOD estimates of the median shown in Fig. 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 different trends compared to EU-SILC statistics in 2008–2009, and stabilize in 2010.

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. They also track the evolution of AROP over the period quite closely 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 that is picked up by the EU-SILC.

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

[14] For Latvia and Lithuania 2007 was an exceptional year of high economic growth. But the following years brought severe economic decline. It is plausible that dramatic changes in macroeconomic circumstances triggered behavioural responses which are not accounted for in the model (e.g. changes in tax evasion or benefit take-up behaviour).

**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* |

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

For the two most recent years, when the EUROMOD estimates are the only information currently available, an increase in the median equivalized disposable income is estimated in 2011–2012 in Estonia, Latvia and less strongly in Lithuania and Italy (Fig. 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 in Portugal in 2012.

Table 2 summarises the results of the nowcast change in median equivalised disposable income and AROP indicators for the total population and disaggregated into sub-groups. This predicts what EU-SILC 2013 (2012 income) will show by applying the nowcasted change in indicators as shown in Figs. 3 and 4 to the latest EU-SILC estimates. This is done in order to eliminate the discrepancies between the EUROMOD and EU-SILC estimates that still remain after adjusting for changes in the labour market characteristics

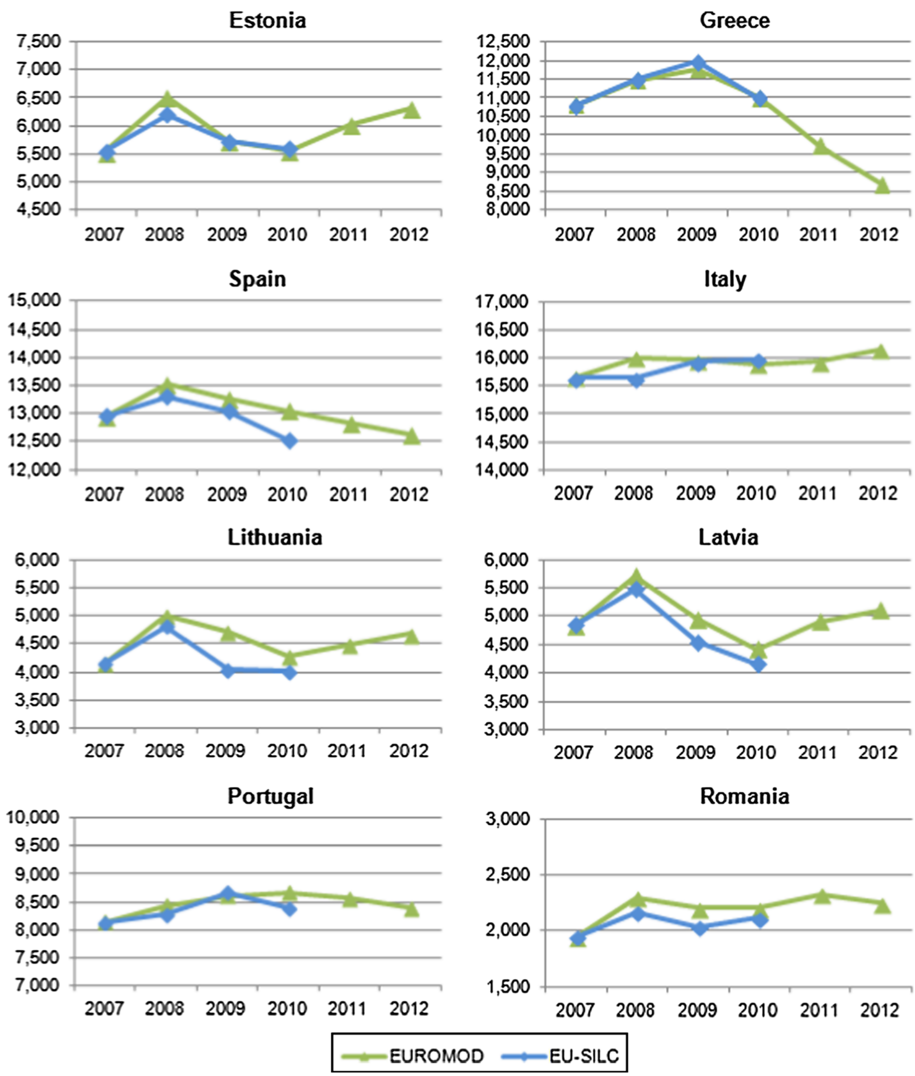


**Fig. 3** Median equivalized disposable income in EUROMOD and EU-SILC, EUR per year. *Notes* EUROMOD based estimates are obtained with employment adjustments and calibration as described in Sect. 2. Note that the charts are drawn to different scales and the gridline interval is always €500. EU-SILC (ilc_di03) numbers are lagged by 1 year to correspond to the income reference year

and calibration. While point estimates of the nowcasts for 2012 are reported, there is a strong case for focusing on the relative changes in indicators rather than their absolute values. This is primarily 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, 2013). 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

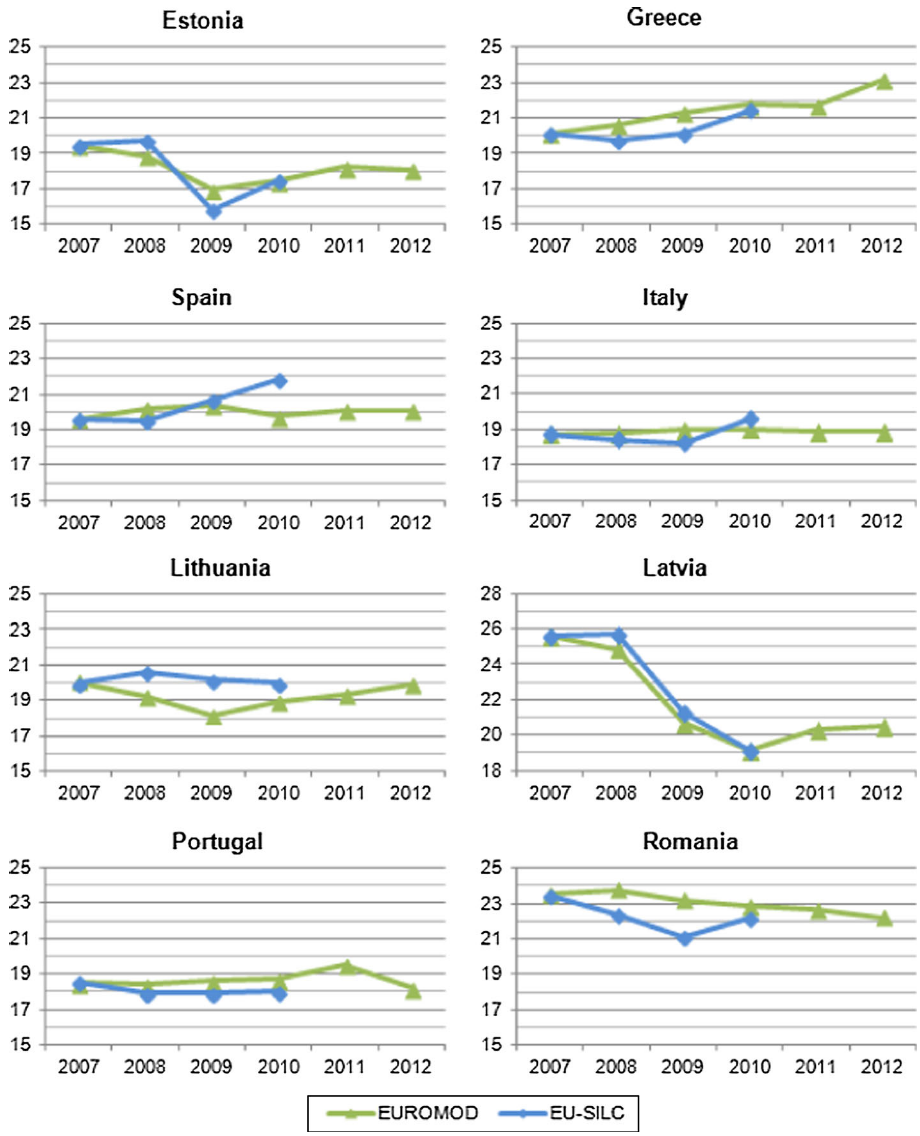


**Fig. 4** At risk of poverty rates in EUROMOD and EU-SILC (using 60 % of median as the threshold). *Note* EUROMOD based estimates are obtained with employment adjustments and calibration as described in Sect. 2. EU-SILC (ilc_di03) numbers are lagged by 1 year to correspond to the income reference year

points for Lithuania.[15] The resulting width of the confidence intervals around the point estimates indicates that most of the discrepancies between the two sets of results (EUROMOD and EU-SILC) for poverty risk shown in Fig. 4 are in fact within the relevant

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

95 % confidence intervals. 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, causes a reduction in the standard errors due to covariance in the data (Goedeme et al. 2013). Changes in indicators between 2010 and 2012 that are statistically significant, taking into account the covariance in the data, are marked in Table 2.

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. A significant decrease in the median equivalized disposable income is also predicted 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 subgroups in Greece 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. 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 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.[16] In Lithuania an increase in poverty is predicted 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, increases in AROP rates among children and the working age population are predicted 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 is 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 this analysis.

[16] Gender differences in income poverty in the pre-crisis period and after are discussed in Bettio et al. (2013), among others.

**Table 2** Nowcast change and estimates for median income and AROP rates, 2010–2012

| | Median | Poverty rates (60 % of median) in p.p. | | | | | |
|---|---|---|---|---|---|---|---|
| | | All | Males | Females | Children (<18) | Prime-age (25–49) | 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 |

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

## 4 Discussion

The aim of this study is 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 the 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 EU Member States. It builds on traditional tax-benefit microsimulation techniques of policy simulations applied to updated market incomes with 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. Furthermore, a strong argument is made 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.

External sources of information are used both for updating non-simulated income sources in EUROMOD and for modeling labour market adjustments. When choosing the source of external statistics there are trade-offs between using country-specific information or cross-nationally synchronized information on the one hand, and more detailed and precise information or more timely and readily available information on the other. In this paper these decisions are taken so as to ensure that the results are comparable, precise and available in a timely manner. For example, when modelling labour market adjustments published aggregate LFS statistics are used instead of LFS micro-data which provide more detailed information but are available with greater delay. In contrast, when choosing updating factors for non-simulated incomes country-specific indexes are used as they are usually more precise and available more quickly. However, in some cases the latter may result in reduced cross-country comparability. Nevertheless, the validation exercise 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 nowcasting AROP 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 estimates could complement macro-economic short-term forecasts (of e.g. GDP growth, inflation, employment) and, importantly, help bring distributional issues into the centre of the policy debate. As in any other forecasting exercise, some failures in predicting AROP indicators are inevitable. However, the availability of such predictions may both stimulate and inform discussions on potential distributional effects of the most recent policy reforms and economic developments, as well as improving understanding of the underlying drivers of distributional change.

The illustrative nowcast estimates indicate that within the first 2 years after Europe 2020 targets were set, progress towards the AROP reduction target was limited and sometimes adverse in the eight countries that are analysed here. This is due both to the difficult macro-economic conditions and changes in tax-benefit 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 total AROP rates for other countries, both positive and negative, lie within a range of 1 percentage point and are insignificant. 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).

Finally, there are several ways in which the nowcast could be made more precise and timely. First, in an exercise not intended for validation of the method, use could be made of more recent EU-SILC data in EUROMOD. Having established and tested the method, 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. updating earnings by sector, region, personal characteristics etc.). The main challenge 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. Similarly, availability of official forecasts to derive updating factors for the current year, consistency of these forecasts across countries, and the degree of disaggregation play an important role in the precision and comparability of the results. Lastly, adding further dimensions to the procedure of employment adjustments could also be beneficial. Potentially useful additional dimensions include employment by sector and work intensity in households with and without children. However this would only be beneficial if there were on the one hand, timely and synchronized statistics available for these dimensions on a regular basis, and on the other hand if the EU-SILC collected information on the sector of previous employment for those who are currently not employed.

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