EUROMOD WORKING PAPER SERIES

**EM13/14**

# Re-weighting EUROMOD for demographic change: An application on Slovenian and Lithuanian data

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June 2014

# Re-weighting EUROMOD for demographic change: An application on Slovenian and Lithuanian data[1]


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**Abstract**

This paper discusses an application of re-weighting to account for demographic change within a comparative micro-simulation setting. We use the Slovenian and Lithuanian components of the EUROMOD micro-simulation model with data referring to demographic characteristics of the population in 2010 to test the proposed procedures. The data are re-weighted to reflect demographic change up to 2012 and 2020 as indicated in the Eurostat Population Projections (Europop).



**JEL Classification:** C81 D31 I32

**Keywords:** microsimulation, re-weighting, demographic change, Slovenia, Lithuania



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[1] This paper uses EUROMOD version 6.20. The process of extending and updating EUROMOD is financially supported by the Directorate General for Employment, Social Affairs and Equal Opportunities of the European Commission [Progress grant no. VS/2011/0445]. We are grateful for access to microdata from the EU Statistics on Incomes and Living Conditions (EU-SILC) made available by Eurostat and the Lithuanian version of the EU-SILC (PGS) made available by the Lithuanian Department of Statistics. All results and their interpretation presented in this paper are the authors' responsibility.

## 1. Introduction

EUROMOD is the European Union tax-benefit microsimulation model. It simulates individual and household tax liabilities and benefit entitlements according to the policy rules in place in each member state (Sutherland and Figari 2013). One of the applications of EUROMOD is *ex-ante* analysis of the effects of actual, planned or hypothetical changes in tax-benefit policies on income distribution. However since EUROMOD is a static micro-simulation model the socio-demographic characteristics of the population (e.g. age, marital status, household composition, etc.) in the micro data used for simulations are assumed to be fixed. This is unlikely to pose a problem when simulating policy changes within a short-term time frame as major demographic or compositional shifts are unlikely. It may however bias estimations in the context of rapid migration or household (re-)formation, fertility "bubbles", or when the time lag of the analysis increases in relation to the input data reference year. The latter is the case e.g. if the model is to be used for analysing impact of current policies or policy reforms in e.g. 2013 on the longer-term social targets such as Europe 2020.

One way of accounting for demographic change in tax-benefit microsimulation modelling is re-weighting of the micro data. Re-weighting can be described as a calibration of the survey weights to match the micro-data with the external aggregates. The procedure changes only weights while all other variables remain unchanged. One of the first papers regarding calibration methods was published by Särndal and Deville in 1992. Since then, calibration has been used relatively often. Among several examples, Vanderhoeft (2001) described the calibration method in Belgium, while calibration method used in Australian Bureau of Statistics household surveys was described by Bell (2000). Creedy (2003) explored different procedures to calibrate weights for large cross-sectional surveys used for microsimulation modelling with an application on data for New Zealand; Cai at al. (2006) investigated the use of sample reweighting in a behavioural tax microsimulation model to examine the implications of population ageing for government taxes and expenditure in Australia. Within a static microsimulation framework re-weighting is used e.g. by Brewer at al. (2009) to assess prospects for child poverty in 2010 and 2020 in the UK under current government policies and by Lefebure et al. (2007) to project the effect of ageing on the inter- and intra-generational distribution in Belgium in 2021. Within the EUROMOD framework the performance of re-weighting was evaluated in a case study conducted using Finnish data by Immervoll et al. (2005) which compared results from a 1998 dataset with those derived from aged 1996 data. Drawing on previous research we explore procedures and potential sources of information for re-weighting micro data for demographic change in a comparative setting. Since EUROMOD is built as a cross-country micro-simulation tool with an advantage of comparability across the EU member states, we aim for procedures that can be applied in a comparative way across countries. This implies that while there may be highly relevant demographic projections and other sources of information available at the national level, we limit the external information used for re-weighting in this exercise to comparative sources across the EU. We use Slovenian and Lithuanian data referring to the demographic characteristics of the population in 2010 to test the proposed procedures. The data are re-weighted to reflect demographic change at two points in time: 2012 and 2020.

We limit our analysis to the effects of changes in the demographic structure, without adjusting other socio-economic characteristics in the data. Thus income is not updated beyond the latest time point available in EUROMOD version 6.20, i.e. 2012. The underlying labour market characteristics used for simulations correspond to the income reference year of the input data, i.e. 2009. This implies that the results on tax revenues and expenditures on benefits for both 2012 and 2020 are presented in 2012 income terms and assuming 2009 labour market conditions. While outside of the scope of this paper, labour market adjustments are being developed in EUROMOD for a number of countries (see Navicke et al. 2013) and could be combined with the demographic adjustments discussed here. Alternatively, socio-economic characteristics in the data could be adjusted within the re-weighting framework using additional information on future labour market, economic and other characteristics.

## 2. Input data and external information used for re-weighting

The EUROMOD input data in most cases are derived from the European Union Statistics on Income and Living Conditions (EU-SILC) data as released by Eurostat. The information on demographic characteristics in the EU-SILC data refers to the time of the interview, while information on both income and taxes refers to the previous calendar year for most countries, including Slovenia and Lithuania (Eurostat 2012). Thus in the 2010 EU-SILC data demographic characteristics refer to 2010, while income refer to 2009. When deriving EUROMOD data the information on demographic characteristics needed for EUROMOD simulations (e.g. age, marital status, household composition) is taken directly from the EU-SILC data and kept constant for subsequent policy years. Adjustments to original variables are kept to a minimum, except for some manipulations to align demographic, labour and socio-economic information with the income data reference period for reasons of internal consistency of the model. For example these include dropping from the input micro-data children born after the income data reference year. In the EU-SILC user database for 2010 used for constructing EUROMOD input datasets the age variable is top coded at 80.[2]

EUROMOD data based on the EU-SILC 2010 are used for the re-weighting exercise for Slovenia and Lithuania. The observation units are private households. In the table below the basic database characteristics are presented.

**Table 1** EUROMOD database description

| | ***Lithuania*** | ***Slovenia*** |
|---|---|---|
| *EUROMOD database* | LT_2010_a2 | SI_2010_a1 |
| *Based on* | UDB_v10-1 | UDB_v10-1 |
| *Year of collection* | 2010 | 2010 |
| *Period of collection* | May-June 2010 | 1st Feb – 14th Jun 2010 |
| *Income reference period* | 2009 | 2009 |
| *Sampling* | Stratified random sampling | Two stage random sampling |
| *Unit of assessment* | Household and individual | Household and individual |
| *Coverage* | Private households | Private households |
| *Sample size* | 5314 households | 9,364 households |
| | 13,235 individuals | 29,474 individuals |
| *Response rate* | *83.5%* | *77.62%* |

Source: EUROMOD Country Reports for Slovenia and Lithuania available at:
https://www.iser.essex.ac.uk/euromod/resources-for-euromod-users/country-reports

[2] More information about input dataset preparation can be found in EUROMOD Country Reports for Slovenia and Lithuania (available at: https://www.iser.essex.ac.uk/euromod/resources-for-euromod-users/country-reports)

An obvious source of demographic projections for the EU are Eurostat Population Projections (Europop) produced for the Member States of the EU and the European Free Trade Association (EFTA) countries based on common methodology. The latest Europop2010 contains statistical information on projected 1st January population at the national level from 2010 to 2060 by sex and 5-year age groups, by 5-year time interval. The methodology of the Eurostat population projections is based on the main assumption that socio-economic differences between Member States of the EU and countries of EFTA will fade out in the very long run. Values of major demographic indicators – total fertility rate, life expectancy and net migration – are thus set such to converge across countries. Specifically, fertility rates are assumed to converge to levels achieved by Member States that are considered to be 'forerunners' in the demographic transition. Life expectancy increases are assumed to be greater for countries at lower levels of life expectancy and smaller for those at higher levels, thus following convergent trajectories. In each Member State, immigration and emigration flows assumed are to converge, also taking into account the changes in the national age structures (Eurostat 2011).

Table 2 shows the actual values of the assumptions used for the Europop2010 projection for Slovenia and Lithuania. The initial fertility rates are very similar in the two countries and the assumed increase in this indicator is marginal for the period of 2010-2020. Life expectancy at birth is significantly higher in Slovenia compared to Lithuania in 2010. The gap is of about 8 years for males and 3.6 years for females. This means that assuming a convergence scenario the population in Lithuania, especially the male population, will age at a higher pace, gradually closing the gap. The two countries also have different starting points in terms of migration, with negative net migration in Lithuania and positive net migration in Slovenia. During the period of 2010-2020 these figures converge, but in both cases positive or negative net migration flows persist. All these assumptions anticipate a more rapid population decrease and ageing in Lithuania compared to Slovenia and a corresponding effect on the outcomes of the national tax/benefit systems.

**Table 2** Assumptions underlying Europop 2010 convergence scenario

| | | ***2010*** | ***2015*** | ***2020*** | ***2030*** | ***2040*** | ***2050*** | ***2060*** |
|---|---|---|---|---|---|---|---|---|
| ***Total fertility rate*** | Lithuania | 1.55 | 1.56 | 1.57 | 1.59 | 1.61 | 1.63 | 1.66 |
| | Slovenia | 1.54 | 1.55 | 1.56 | 1.58 | 1.60 | 1.63 | 1.65 |
| ***Life expectancy at birth: males*** | Lithuania | 67.7 | 69.2 | 70.7 | 73.5 | 76.1 | 78.5 | 80.7 |
| | Slovenia | 75.8 | 76.8 | 77.7 | 79.4 | 81.0 | 82.5 | 84.0 |
| ***Life expectancy at birth: females*** | Lithuania | 78.7 | 79.6 | 80.6 | 82.4 | 84.0 | 85.6 | 87.1 |
| | Slovenia | 82.3 | 83.0 | 83.7 | 85.1 | 86.4 | 87.6 | 88.8 |
| ***Net migration: total*** | Lithuania | -13,013 | -8,833 | -5,101 | -1,051 | 1,235 | 2,230 | 777 |
| | Slovenia | 10,952 | 8,739 | 6,316 | 5,654 | 5,570 | 5,018 | 3,817 |

Source: Eurostat [proj_10c2150a]

There are several advantages and limitations arising from using Europop projections for re-weighting data in a comparative micro-simulation setting. The main advantages of Europop are comparability, EU scope and regular updating as projections are carried out every second year. Secondly Europop projections are widely used for other socio-economic projections and forecasts, which could be utilized when adjusting other socio-economic characteristics of the population, accounting for the effect of the economic growth on income or for validation purposes. For example, Europop is the basis for the age-related expenditure projection for the

27 EU Member States, which also includes in a consistent way, labour force, labour productivity and GDP projections (European Commission 2011).

There are several limitations to using Europop. First as we use standard projections by 5-year intervals provided in the Eurostat online database, projected figures for each year are notreadily available. Therefore we use a linear trend between 2010-2015 Europop figures to derive 2012 figures. Alternatively projections by 1-year intervals could be requested from Eurostat and used directly. Secondly Europop projections are limited to the age-gender structure of the population, thus other important demographic characteristics, such as the composition of the households, are unknown. Given the lack of information on household composition certain assumptions need to be made, which will be discussed in detail in the following section.

Lastly, it should be noted that neither EU-SILC 2010 data nor Europop 2010 projections take into account the demographic changes that may have been recorded during the latest population and housing censuses carried out in 2011 across the EU. We do not correct for it in this exercise. However, in cases where the census uncovered important changes in the population structure, this would affect the results. This is true for Lithuania where the total population figure was lower by around 6% in 2010 according to the population census compared to EU-SILC 2010 estimates, with a decrease of around 8.5% in the prime age population aged 15-64 (including an 11 percent decrease in prime age female population) and an increase of around 4% increase in the population aged over 64.[3] While these changes would alter the population projections for Lithuania had they been taken into account, they are effectively not considered in Europop 2010 and in this paper. The Central Register of Population is used for calibration of the sex-age structure in the Slovenian EU-SILC 2010 (Inglic et al. 2011). Although the detailed population structure in EU-SILC 2010 differs slightly from the official statistical sources (and Europop 2010) due to calibration to other variables, the total population and structure of broader sex-age groups in the Slovenian EU-SILC 2010 match those from register data.

## 3. Methodology of the calibration process used for re-weighting

Each household in the EU-SILC micro data has a survey weight calculated by the statistical offices. The procedure of calculating cross-sectional weights in EU-SILC takes into account the probability of selection in the sample, adjustments made for non-response and calibration to external demographic and often income totals (Eurostat 2010). Thus the resulting cross-sectional weights in EU-SILC 2010 gross up to demographic (economic) aggregates that match actual aggregate variables in 2010.

In order for the procedure of re-weighting to produce the results in line with the original weights the non-response adjusted design weights should ideally be calibrated using the new totals matching those used by the statistical offices as closely as possible. This however is complicated in two ways. First the aggregates used for the calibration are not uniform across the EU countries and are documented with different amount of detail in the EU-SILC national quality reports.[4] For example in case of Slovenia, aggregates from administrative sources

[3] Own calculations according to population figures published by Statistics Lithuania and EU-SILC.
[4] National quality reports available on the Eurostat webpage: http://epp.eurostat.ec.europa.eu/portal/page/portal/income_social_inclusion_living_conditions/quality/national_quality_reports

used for calibration include: sex-age classes, family and children related allowances, employee cash or near cash income minus sickness benefits, pensions, unemployment benefits and education related allowances (Inglic et al. 2013). According to the Lithuanian EU-SILC quality report only demographic estimates are used for calibration of 2010 data to external sources: number of persons by different strata, by age group and by gender (Statistics Lithuania 2012). It is not clear from the documentation what age-sex classes or strata are used for calibration in each case. This makes it difficult or even impossible to find comparable external projections or forecasts matching calibration totals used in different countries. Secondly variables containing design and non-response adjusted design weights are not included into the UDB SILC datasets and thus cannot be used as initial weights in the re-weighting process.[5]

Given the limitation discussed above and since the original calibrated survey weights can contain a great deal of information about the original population, it makes sense to adjust control totals by changing the existing calibrated survey weights as little as possible. The distances of new weights to the original ones might be measured using different distance functions and are then minimised by a re-weighting algorithm (Creedy 2003, Immervoll et al. 2005). The command *'calibrate'* in STATA allows the use of seven different distance functions to calibrate weights to external totals and is used in this exercise.[6] There is no guarantee that a solution to the calibration equations exits; the calibration process might not converge or it can result in negative weights.

According to the EU-SILC guidelines on re-weighting (Eurostat 2010 p.32) a bounded linear method is recommended to use for calibration as it avoids negative weights, which are not acceptable from the practical point of view in the analysis of household surveys. We chose to run calibration using bounded linear and logistic distance functions as both can ensure that calibration weights are positive. The linear and logistic methods are the equivalent to Methods 1 and 2 of Deville and Särndal (1992). The bounded linear method is an iterative method that uses the linear method while also constraining the ratio of the exit weight to the entry weight to be between specified limits (Singh and Mohl, 1996). By using two methods the chances of at least one of them converging increases, we are also able to compare the results of using different calibration procedures in order to trace any unanticipated changes in the process of re-weighting.

Setting the upper and lower bounds for the exit rates within the bounded linear calibration method is arbitrary. It is however important as estimates can be sensitive to extreme weights. EU-SILC guidelines say that the bounds are to be determined by the "guess and check" method, starting with a small interval and enlarging it until the procedure converges (Eurostat 2010). The resulting weights are than trimmed to exclude extreme values.[7] Creedy (2003 p.13) proposes an opposite solution of initially selecting wide bounds well outside the range of ratios obtained using the other distance functions and gradually reducing those to the potentially restrictive values. The default value for the lower bound in Stata is 0.2 and the

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[5] According to the EU-SILC documentation (Eurostat 2010), design weights and design weights adjusted for non-response at the household level are recorded, correspondingly, in variables DB080 and DB080N (or in PB070 and PB070N when a sample of persons is used). Neither are included into the UDB SILC2010.

[6] Other commands with slightly different functionalities and distance functions available in Stata include 'reweight' and 'reweight2'. The latter uses analgorithm defined in Gomulka (1992) to minimize the difference in weights. Results using logistic and bounded linear distance functions in 'calibrate' and 'reweight' in our case produce same results.

[7] Weights are trimmed if the outcome weights normalised by their mean are less than a third or more than three times larger compared to initial normalised weights (see Eurostat 2010 p. 37).

upper bound is 5. The process of experimentation with bounds is troublesome when dealing with a number of countries. Arbitrary changes to the weighting function also produce different sets of weights and results. We thus opt for initially setting wide unrestrictive bounds for the bounded linear function just avoiding negative weights (lower bound at 0.01, upper at 10). We than compare those to the weights and estimates produced by an unrestricted logistic function, discuss the distribution of weights and possible implications of using non-restrictive bounds within the linear calibration procedure.

Although re-weighting enables data adjustments to projected population structures and the use of current databases for *ex-ante* analysis, we must not overlook possible problems. First, as Immervoll et al. (2005) say: "The minimum distance criterion ensures that weights are changed as little as possible in order to achieve a given set of control totals but it does not limit the alternation of weights in any absolute sense". Thus controlling for chosen dimensions can easily lead to distortions of other population totals. In addition, the distributional information contained in the data can be significantly changed. Thus it is important to carefully choose the dimensions to control for during the re-weighting. Secondly, the issue of comparability of external data to EU-SILC should be given careful consideration. As noted in the EU-SILC guidelines: "In the framework of calibration, it is critical that the external control variables are strictly comparable to the corresponding survey variables, the distribution of which is being adjusted" (Eurostat 2010 p. 33). Finally, consistency between household and individual estimates based on new weights should be preserved. This is especially important when the controls we use are at the individual level, while all weights should be re-calculated at the household level. Below we discuss the choice of the controls, ways of dealing with comparability of external controls to EU-SILC and issues of consistency of individual and household level estimates.

- *Consistency of individual and household level estimates*

One way of ensuring consistency between household and individual estimates is by making household and individual weights equal. This is indeed the case in the original EU-SILC data. In order to preserve this equity, a method of 'integrative calibration' is recommended by Eurostat when calibrating EU-SILC weights (Eurostat 2010): "The idea is to use both household and individual external information in a single-shot calibration at household level. The individual variables are aggregated at household level by calculating household totals such as the number of male/female in the household, the number of persons aged 16 and over, etc. The calibration is then carried out at the household level using household variables and the individual variables in their aggregated form". We thus carry out calibration at the household level, using integrative calibration in all cases when controls are at individual level.

- *Comparability of external controls with EU-SILC*

The issue of comparability of external controls to EU-SILC variables has at least two dimensions to it. On the one hand, the concept used for measurement may not be strictly comparable. This is especially true in the case of complex concepts, such as employment.[8]

[8] The issue of the comparability of employment concepts in LFS and EU-SILC is discussed in Navicke at al. (2013).

This should not be the case when considering simple concepts (such as age, gender) and is easy to correct for in case of the concepts that can be re-constructed from the data (e.g. household types).

On the other hand, estimates of the comparable dimensions in external and EU-SILC data may not align perfectly well. In practice this is probably true in most cases and attributable to a number of reasons, including survey errors, different frames used for constructing survey weights in the EU-SILC, etc. For example, while age-sex structure of the population in Europop should correspond well to the age-sex structure of the population captured in EU-SILC for the base year (i.e. 2010), we still observe discrepancies, which are relatively big in some age-sex groups. Discrepancies are larger for the smaller age-sex groups, but also in the old-age population. The latter is due to the fact that, unlike the Europop, EU-SILC only includes the non-institutional population. We thus have to aim for precision and at the same time deal with inconsistencies in the data. A compromise solution utilised in this exercise is to aim to replicate the relative change in the projected population structure compared to the base year, rather than the absolute population numbers. For example, the new number of females aged 15 to 19 years in 2020 is not supposed to match Europop 2010 projections for 2020 in absolute terms, but is derived by applying the relative change in the number of females in this age group from 2010 to 2020 as projected in Europop onto the EU-SILC 2010 numbers. A similar solution of using relative changes in the levels of projected totals compared to the base year rather than the absolute numbers can be used when controlling for other dimensions in EU-SILC 2010 if absolute consistency cannot be assumed.

- *Choosing controls for calibration*

As we aim to account for demographic change in 2012 and 2020 compared to 2010, selected control variables should cover demographic dimensions of the population that are likely to impact the results of the tax-benefit microsimulation. However the spread of weights is likely to increase with the number of controlling variables. A high number of controls may also result in the re-weighting procedure not converging at all.

Most authors use common target variables: sex-age structure, family composition, employment status, regions, etc. For instance, Immervoll et al (2005) chose to control for eight age groups by gender where age groups are aligned with eligibility conditions for social benefits (child benefits, study related benefits, early retirement and old age benefits), four different types of employment status (wage earner, unemployed, farmers and self-employed) and twelve regions. Five year age groups by gender, family types, the number of unemployed persons by age and gender and the number of income support recipients by type of benefit were used as controlling variables in a study which examined the implications for government taxes and expenditure of population ageing in Australia (Cai et al. 2006). Creedy (2003) also controlled for benefits (five types of benefits), besides family types and age-sex types. Brewer et al. (2009) took into account population size, number of households, household size, regions, age groups, number of employed, ethnicity, lone parent families, housing tenure and the number of lone parents employed.

As it was mentioned above we opted to use Europop 2010 to derive control totals for 2012 and 2020. Despite Europop comparability across countries and other advantages, its projections are limited to population forecasts by sex and 5-year age groups. We therefore lack external information on other relevant demographic characteristics of the population, e.g.

household composition. We thus have to make assumptions on how other dimensions we want to control for are going to change. We chose the following control variables:

- age/ sex structure,
- household composition,
- employment and non-employment rates.

When controlling for *age-sex structure* we use Europop 2010 population projections by sex and 5-year age group: in total 17 sex/age groups ranging from below 5 to 80 and over years old. Due to the problem of comparability of the external totals and EU-SILC, relative changes in the levels of projected totals in each age-year group applied on the base year estimates are used rather than the absolute numbers. Ideally we would also like to keep accuracy around specific age groups (child definition for child benefits, eligibility for maternity/paternity benefits, pension age, etc.). While available Europop predictions do not allow for this level of precision, 5-year age groups by gender seem to be reasonably detailed.

We also considered the calibration to the projected number of pensioners, but this is highly correlated with the change in old-age population given that the vast majority of people over the pension age receive pensions. Another potential problem might be the very low absolute number of persons of pensionable age currently not receiving pensions in the data, since their weights could become highly inflated.

Secondly we need to control for the *household composition* in the population. Europop projections are limited to the age-gender structure, thus the future household composition of the population is unknown. Not controlling for the household structure may change it in unanticipated ways, and the results on income distribution, poverty and benefit receipts would be impossible to interpret. For example, weights for the households with many children could be inflated if fertility rates are set to rise, which would have spill over effects on expenditures on child benefits and social assistance, poverty rates among households with children and in the general population, etc. We thus need to control for the changes in the household composition of the population, making careful assumptions in order to be able to interpret the results.

An intuitive assumption for unknown processes, such as the future dynamics of the household composition of the population, is to keep characteristics unchanged over time. However the assumption that the household composition of population is fixed over time may not be plausible. As population ages, the increase in the number of elderly people and decrease in the number of children will most probably affect the average household size and composition. With no external information on the predicted changes in the household structure of the population, the only transparent assumption to make is of the constant share of individuals living in households with certain characteristics over time. For example, the share of single prime-age adults is assumed to remain unchanged when the total number of prime-age adults changes. We decided to control for the share of individuals living in household with and without children separately using the method of integrative calibration discussed above. It should be noted that there is a slight complication in defining children for purposes of our calibration. In most of the EU countries a standard threshold of being considered a dependent child and an age of emancipation is 18, however for purposes of defining eligibility for benefits/tax allowances a concept of a dependent child is often extended (e.g. up to 24 in Lithuania or 26 in Slovenia) given other conditions are met, such as being in full-time education. We are restricted in the selection of the age threshold for defining a dependent child by the 5-year structure of Europop projections we use. We thus opt for controlling for the shares of children and young adults of 20 years and younger in the households.

We thus first control for the share of children/young adults living in households with:

- 1 adult and 1-2 children/young adults,
- 1 adult and 3 or more children/young adults,
- 2 or more adults and 1-2 children/young adults,
- 2 or more adults and 3 or more children/young adults.

It is straightforward to calculate the proportion of each type of children/young adults living in a certain household type from the current population and then derive a new control total by applying this proportion on the new population as we know the forecasted number of children and young adults of 20 years and younger.

Secondly, we control for the share of adults living in households without children/ young adults (as defined above):

- share of single adults aged less than 65,
- share of single adults aged 65 or over,
- share of adults living in couples,
- share of adults living in households with more than two adults.

In this way we are able to control for the number of single households as their number is expected to grow among the older population due to population ageing (increased number of widowers), and also for adults living in couples and extended households. The share of single adults, aged 65 or more, is kept constant, but their number is expected to grow due to increase in this population group. Besides, single people are more vulnerable to poverty which justifies controlling for the population of such people.

Finally, we control for *employment and non-employment rates* in the population. In EUROMOD, for reasons of internal consistency, employment rates are commonly defined based on the number of months spent in work rather than using the economic status of the person (see Navicke et al. 2013). We followed this practice and kept employment and non-employment rates, split by gender and age groups (15-24, 25-49, 50-74) constant in all years. It should be kept in mind that effectively the total employment rate can change in the population due to compositional changes, while it is fixed within the age-sex classes.

## 4. Results

Table 3 shows the ratio between exit weights (weights calculated using reweighting procedure) and entry weights (original EU-SILC weights). As expected, the entry weights are more similar compared to the exit weights in year 2012 as the population structure is quite similar to that in 2010. The dispersion of the ratios increases for year 2020, but the lower and upper bounds are still reasonable. The bounds we used for the bounded linear distance function only affected the exit weights at the lower end in 2020 in both countries. The distribution of ratios is graphically presented in the appendix. As expected the exit rates are more dispersed in 2020 compared to 2012 and in Lithuania compared to Slovenia. The latter is expected because of the underlying assumptions of Europop 2010, which anticipate a more rapid decrease and ageing of the population in Lithuania compared to Slovenia (see Section 1).

**Table 3** Ratio between exit and entry weights, basic statistics

| | ***Slovenia*** | | | | ***Lithuania*** | | | |
|---|---|---|---|---|---|---|---|---|
| | 2012 | 2020 | 2012 | 2020 | 2012 | 2020 | 2012 | 2020 |
| | ***Logistic*** | | ***bounded linear*** | | ***logistic*** | | ***bounded linear*** | |
| **Mean** | 1.012 | 1.047 | 1.012 | 1.044 | 0.999 | 1.014 | 0.999 | 1.004 |
| **Std.Dev** | 0.089 | 0.404 | 0.088 | 0.374 | 0.106 | 0.454 | 0.103 | 0.388 |
| **Min** | 0.642 | 0.131 | 0.571 | 0.01 | 0.639 | 0.132 | 0.588 | 0.01 |
| **Max** | 2.626 | 6.526 | 2.567 | 5.919 | 1.78 | 5.546 | 1.584 | 2.9 |
| **Percentiles:** | | | | | | | | |
| 5th | 0.884 | 0.531 | 0.88 | 0.43 | 0.816 | 0.414 | 0.81 | 0.33 |
| 95th | 1.165 | 1.738 | 1.165 | 1.655 | 1.181 | 1.789 | 1.172 | 1.643 |

Source: Authors' calculations.

Comparing logistic and linear weights, it can be noted that both distance functions produce similar results. Nevertheless differences are observed at the lower and upper ends of the distribution of weights. Figure 1 shows how the ratios of exit to entry weights produced using bounded linear and logistic methods relate to each other. The 45° reference line shows how those ratios would align if both distance functions produced identical exit weights. We can see that in 2012, the actual distribution of weight ratios is very close to the reference line. At the lower end of the weights distribution, the bounded linear method produces a "tick" at the lowest possible value that the function is restricted to (in this case at 0.0)1. The logistic distance function is however less sensitive to producing high weights ratios, thus the scattered values lean upwards in relation to the reference line as the weights ratios increase. Given this pattern, the bounded linear regression is to be preferred for calibrating weights to account for demographical change; attention however should be given to setting the upper and the lower bound of this distance function.

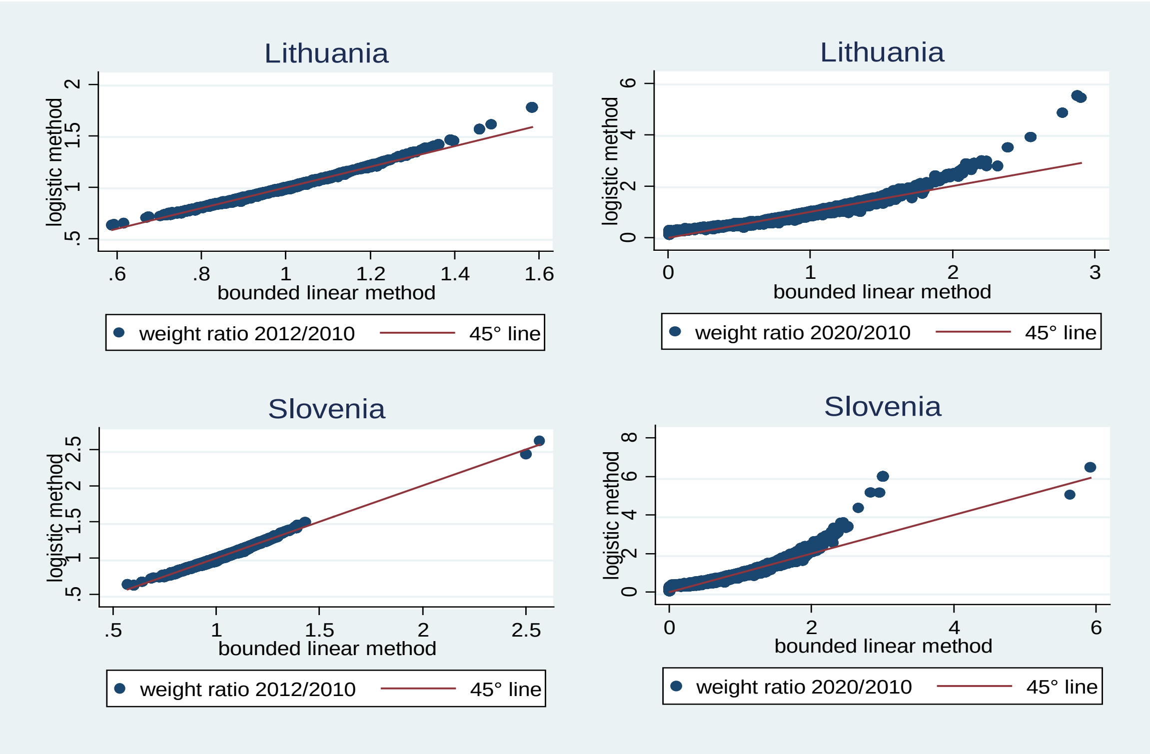

**Figure 1** Distribution of exit to entry weight ratios using bounded linear and logistic methods

Source: Authors' calculations.

Control totals for years 2012 and 2020 are presented in Table 8 (see Annexes). The number of children below 15 is predicted to increase in Slovenia by about 3% by 2012 and by about 13.4% in 2020 compared to 2010. In Lithuania the number of children remains relatively stable in 2010-2012 and only a slight increase of about 3.4% is observed between 2010 and 2020. In relative terms, however, the share of children below 15 in the total population is slightly increasing in both countries (to the extent of about 1.3 percentage points), consistent with the assumption of increasing fertility rates in Europop 2010 for both Slovenia and Lithuania. The prime age population (15-64) is stable up to 2010 in Slovenia, but is predicted to shrink by 2.2% in the period 2010-2020. On the other hand, the decrease of prime age population in Lithuania is noticeable, i.e. 1.4 % in the period 2010-2012 and 8.2% in 2010-2020. The absolute number of elderly (65 and over) is going to increase substantially by 2020 both in Slovenia (by around 24.7%) and Lithuania (by around 4.3%). The number of employed and unemployed persons in both Slovenia and Lithuania is set to decrease in younger (15-24) and prime (25-49) age groups, and increase in older age groups (50-74). However, this change is entirely driven by changes in population structure as we keep the employment and unemployment rates constant in all years. Similarly, as we keep the share of children per each household type constant, the absolute number of children by household types changes only due to the changes in the number of children.

Table 4 and Table 5 show how reweighting affects the household structure of the population. This is of interest as the future household structure is not known at the moment and all changes are driven by matching other individual and household level characteristics. The tables show the shares of wide-spread household types that are slightly different from the ones we controlled for. In this way we check how the dimensions that were not controlled for directly changed due to calibration.

**Table 4** Household types, share of households, Slovenia

| Household type | Original data 2012 | Logistic method 2012 | Logistic method 2020 | Bounded linear method 2012 | Bounded linear method 2020 |
|---|---|---|---|---|---|
| Single, aged less than 65 | 14.3 | 14.2 | 13.4 | 14.2 | 13.4 |
| Single, aged 65 or more | 12.7 | 13.0 | 15.0 | 13.0 | 15.0 |
| Couple, both aged less than 65 | 12.7 | 12.5 | 11.0 | 12.5 | 10.8 |
| Couple, at least one aged 65 or more | 12.0 | 12.0 | 13.1 | 12.1 | 13.4 |
| Single parent, one child | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |
| Single parent, two or more children | 0.8 | 0.8 | 0.9 | 0.8 | 0.9 |
| Two adults, one child | 7.5 | 7.4 | 6.6 | 7.4 | 6.6 |
| Two adults, two or more children | 12.5 | 12.7 | 13.9 | 12.7 | 13.9 |
| Number of households | 777,777 | 788,613 | 825,804 | 788,613 | 825,804 |
| Average household size | 2.57 | 2.56 | 2.52 | 2.56 | 2.52 |

Source: Authors' calculations.

**Table 5** Household types, share of households, Lithuania

| Household type | Original data | Logistic method | | Bounded linear method | |
|---|---|---|---|---|---|
| | 2012 | 2012 | 2020 | 2012 | 2020 |
| Single, aged less than 65 | 15.88 | 15.94 | 15.75 | 15.94 | 15.73 |
| Single, aged 65 or more | 15.73 | 15.91 | 17.04 | 15.90 | 17.02 |
| Couple, both aged less than 65 | 13.00 | 13.16 | 13.13 | 13.15 | 12.99 |
| Couple, at least one aged 65 or more | 9.49 | 9.43 | 9.44 | 9.43 | 9.56 |
| Single parent, one child | 3.01 | 2.98 | 2.89 | 2.98 | 2.93 |
| Single parent, two or more children | 1.08 | 1.03 | 1.00 | 1.03 | 0.98 |
| Two adults, one child | 9.75 | 10.02 | 10.10 | 10.04 | 10.31 |
| Two adults, two or more children | 10.09 | 9.4 | 8.82 | 9.4 | 8.89 |
| Number of households, thous. | 1,354.38 | 1,344.82 | 1,309.31 | 1,345.06 | 1,311.09 |
| Average household size | 2.44 | 2.43 | 2.41 | 2.43 | 2.41 |

Source: Authors' calculations.

The share of older single households (single persons aged 65 years or more) in Slovenia increases as expected: from 13% in 2012 to 15% in 2020, regardless the re-weighting method. Similarly, the share of elderly couples increases too in the analysed period, while the share of "younger" single households and the share of younger couples decrease. All changes are consistent with expected changes in the population structure. A similar situation is observed when applying re-weighting on the Lithuanian data. The share of elderly single households also goes up to about 17%, however the share of couples with at least one elderly person remains relatively stable. There is little change in the shares of other household types and only slight adjustments between the shares of different types of households with children in both cases. It can be noted that the share of two-adult households with two or more children goes down by a little more than 1 percentage point compared to 2010 in Lithuania. This is different from Slovenia, where the share of the latter households increases slightly accompanied by a decrease in couples with one child.

To sum up, controlling for the household types helps to insure that the changes in the household structure are consistent with the changes in the overall age structure of the population. However as keeping the shares of the household types to be constant seems unrealistic in the context of the predicted changing age-sex structure of the population, some flexibility needs to be allowed for. Integrative calibration used in this paper is one way of allowing for such flexibility. The interpretation of the outcomes, however, should be transparent to the adjustments in household structure introduced in the process of re-weighting.

Similarly Table 6 and Table 7 show how re-weighting impacts the educational structure of the population. We didn't control for changes in educational structure while re-weighting, thus changes are driven by changes in characteristics other than education.

**Table 6** Highest education achieved, share of population aged 15 years and more, Slovenia

| **Level of education** | **Original data** | **Logistic method** | | **Bounded linear method** | |
|---|---|---|---|---|---|
| | **2012** | **2012** | **2020** | **2012** | **2020** |
| Not completed primary education | 0.4 | 0.4 | 0.5 | 0.4 | 0.5 |
| Primary | 3.6 | 3.7 | 3.9 | 3.7 | 3.9 |
| Lower Secondary | 20.7 | 20.6 | 20.4 | 20.6 | 20.4 |
| Upper Secondary* | 56.9 | 56.8 | 56.0 | 56.8 | 56.1 |
| Tertiary | 18.3 | 18.5 | 19.2 | 18.5 | 19.1 |
| Number of persons aged 15 years and more | 1,693,252 | 1,704,420 | 1,737,928 | 1,704,420 | 1,737,928 |

Note: Post secondary level of education does not exist in Slovenia.

Source: Authors' calculations.

**Table 7** Highest education achieved, share of population aged 15 years and more, Lithuania

| **Level of education** | **Original data** | **Logistic method** | | **Bounded linear method** | |
|---|---|---|---|---|---|
| | **2012** | **2012** | **2020** | **2012** | **2020** |
| Not completed primary education | 1.83 | 1.91 | 2.13 | 1.91 | 2.10 |
| Primary | 8.84 | 8.80 | 8.94 | 8.80 | 8.95 |
| Lower Secondary | 16.23 | 16.07 | 15.70 | 16.07 | 15.77 |
| Upper Secondary | 29.65 | 29.48 | 28.57 | 29.47 | 28.47 |
| Post Secondary | 18.62 | 18.72 | 19.28 | 18.72 | 19.27 |
| Tertiary | 24.83 | 25.03 | 25.38 | 25.04 | 25.45 |
| Number of persons aged 15 years and more | 2,807,798 | 2,776,959 | 2,643,563 | 2,776,959 | 2,643,562 |

Source: Authors' calculations.

The share of population aged 15 years or more with the lowest levels of education (uncompleted primary or primary) increases slightly in the re-weighting process in both Slovenia and Lithuania, especially in the longer term (in 2020). The increase in the share of population with no or few years of schooling is a bit unexpected and is a by-product of re-weighting, as educational characteristics are not controlled for explicitly. A more substantial reason is an increase in the share of the elderly population in both countries – the population group where the prevalence of lower levels of education or no formal education are currently higher compared to the rest of the adult population for historic reasons. This however may not hold for the more recent and future generations of retirees who gained their education during the post war period in the former Soviet Union or former Yugoslavia. To avoid this, education variables could have been directly controlled for when re-weighting. Similar unanticipated changes may occur in the case of other characteristics not controlled for, therefore carefully choosing dimensions to be controlled for is important.

It should however be noted that the overall change in educational structure is quite minor in both Lithuania and Slovenia, even without explicitly controlling for this dimension in the reweighting. Changes are also more consistent for the higher levels of education. The share of population with lower and upper secondary education is set to decrease slightly, while the share of post-secondary and/or tertiary educated population increases in both countries. These changes are in line with the Europe 2020 social targets and strategy for a lower share of early school leavers and higher shares of people with completed tertiary or equivalent education.

Table 9 and Table 10 (see Annexes) show the number of recipients of different income types in both countries. As we keep the employment and non-employment rates constant within the chosen age-gender groups, the numbers of employed and not employed change solely due to the changed population structure. However, it is interesting, how re-weighting alters the number of recipients of the different types of market income, benefits and pensions.

Results of re-weighting for Slovenia show, that the number of employment income recipients remains relatively stable, while the number of self-employment income recipients increases in 2020. A higher increase is expected in the number of recipients of income from contractual work and from investments. On the other hand, the numbers with income from student work decreases, as expected due to the shrinking of the population in this age group. The changes in the number of income recipients are very similar regardless of whether bounded linear or logistic function is used in the re-weighting process. Similarly, an increase in the number of old-age and invalidity pensioners is expected due to population ageing. On the contrary, the group of survivors's pension recipients is expected to shrink slightly which is driven by the decreasing number of potential recipients (children up to age 18 or up to age 26 if enrolled into regular education, and widow/ers). The same trend can be observed with non-simulated benefits; the number of attendance supplement and disability supplement recipients is going to increase, as these benefits are more likely to be received by the elderly, while on the contrary, the number of scholarship and paternal payment recipients is going to decrease. The number of unemployment wage compensation recipients is increased less than the number of unemployed. Although we cannot control for the number of births (persons aged less than 1), the number of recipients of birth related benefits[9] in Slovenia is estimated to decrease in 2020, which is an expected trend. Even if the population of potential child benefit recipients is going to decrease slightly, the re-weighting process resulted in an increased number of (income-tested) child benefit recipients. The reason is the use of a limited number of targeted variables which results in changed size of population groups with different combinations of characteristics. Obviously, the weights of lower income families were increased when adjusting for future population changes. Fewer families will be eligible for the large family supplement, which is in line with the declining average household size in Slovenia.

In Lithuania, the number of those receiving employment and self-employment income changes consistently and in accordance to the change in the total number of the working age population. The drop by 2020 is about 6% for both sources of income. More difficult to interpret are the dynamics of smaller sources of income, such as private transfers, educational benefits or even survivor pensions. The decrease in the receipt of private transfers as reflected by both sets of weights is about 18%; the decrease in the number of recipients of educational benefits by 2020 is even higher - about 34%; the decrease in receipt of survivor pensions is about 25%. Another unanticipated change is a decrease of social assistance recipients by around 20%. As also noted by Immervoll et al. (2005) re-weighting can produce unexpected dynamics in the income sources not controlled for, especially in the minor categories. It is thus worth considering setting up additional controls by income source that are important for a specific analysis. This is less of a concern for major income sources, taxes and benefits. For example, the number of recipients of the old age pensions increased in Lithuania in absolute terms by about 2% in 2012 compared to 2010 and by around 9% by 2020. This however does not take the planned extension of the retirement age into account. Additional adjustments

[9] birth grant, paternal allowance, parental payment, parental allowance

would be needed to account for the planned increase in retirement age to 65 for both sexes by 2026 in Lithuania.

Table 11 and Table 12 (see Annexes) refer to the aggregate amounts of benefits and market income in Slovenia and Lithuania. As the monetary amounts were not updated, the results are consistent with the changes in the number of income type / benefit recipients. It should also be noted that estimates produced using new weights based either on the logistic or the bounded linear method are very similar, especially concerning major sources of income.

Finally, Table 13 and Table 14 (see Annexes) show how the re-weighting procedure affects inequality and relative poverty risk measures. The difference between using the re-weighted or EU-SILC 2010 data with original weights is insignificant for 2012 in both countries. Thus the demographic change within a short term period has a minor impact on inequality and poverty estimates. The impact is more profound in a longer term period, i.e. 2020.

Our estimates show that the total poverty risk rate at 60% of median household disposable income in Slovenia is estimated to go up in 2020 due to the modelled demographic change and regardless of the re-weighting method used. If we look into poverty rates by age, we find that the change in poverty risk is not uniform across age groups. Children (0-17 years) and older age groups (50 years and more) experience slightly lower poverty rates in 2020, while an increase in poverty rates is predicted for other groups. Inequality in Slovenia is predicted to increase as the share of the elderly population goes up.

In Lithuania, the poverty risk rates for the total population are relatively stable. The changes are more significant when poverty rates by age groups are taken into account. In Lithuania, poverty rates are predicted to decrease slightly for the younger generation (up to 24 years) and increase for the population aged 25 and more due to demographic change. The elderly (65 years and more) face higher poverty rates, which is in contrast with the improving position of the elderly in Slovenia. Also unlike Slovenia, in Lithuania the changes in the demographic structure seem to decrease inequality. This may however be due to the peculiarity of the socio-economic situation in 2010 with unprecedented levels of unemployment caused by the economic crisis in Lithuania, which made pensioners relatively better off compared to those depending on sources of market income. Assuming the labour market situation normalises by 2020, the higher share of the elderly population is likely to result in increasing inequality, similar to changes predicted for Slovenia. Thus adjusting for labour market changes as well as for the demographic situation is crucial for analysis, especially if we start with non typical data years corresponding to periods of economic crisis or rapid growth. It should also be noted that as we do not control for income sources the interpretation of the dynamics of poverty and inequality is not straightforward and should be carried out with care.

## 5. Conclusions

In this paper, we presented an application of re-weighting to account for demographic change within a comparative micro-simulation setting. We aimed for procedures that can be applied in a comparative way across countries, limiting the external information used for re-weighting in this exercise to comparative sources across the EU. As an external source of information for re-weighting, we used Eurostat Population Projections (Europop) produced for the EU and EFTA countries based on a common methodology. Our approach has the main advantages of comparability, EU scope, regular updating and availability of other projections based on Europop. A disadvantage is that Europop projections are limited to the age-gender structure of the population, while other important demographic characteristics, such as the household composition of the population, are unknown. We could thus directly control only for age/sex structure based on the Europop projections. Assumptions had to be made for other controls. These included employment and non-employment rates (assumed to be constant within sex-age groups) and shares of individuals living in widely spread household types (assumed constant). The problem of consistency of individual and household level estimates was solved by using integrative calibration. We used relative changes applied to the population totals rather than absolute numbers to avoid the problem of comparability of external controls with the EU-SILC.

As the analysis was limited to the effects of changes in the demographic structure, the final estimates on receipt and amounts of market income, taxes and benefits should be interpreted with care. Since no adjustments were made for updating income beyond 2012 or for the change in socio-economic characteristics of the population, figures for both 2012 and 2020 are presented in 2012 income terms and assuming 2009 labour market conditions. Further adjustments of the population characteristics and income uprating would require additional external data, which potentially could be taken from other Europop based projections such as age-related expenditure projection for the 27 EU Member States (European Commission 2011). Major policy reforms, such as increase in retirement age, would require additional data adjustments that may go beyond re-weighting.

Our exercise shows that the application of the proposed procedure picks up the effects of the change in the age-sex structure of the population consistently with respect to the main sources of income and major population groups. Using distance functions based either on the logistic or the bounded linear methods produces very similar results for the major groups/income sources. The logistic distance function is however less sensitive to producing high exit-entry weights ratios. Therefore in a more detailed analysis, using a bounded linear regression with carefully chosen upper and lower limits is the preferable approach for calibrating weights to account for demographic change.

The exercise has also shown that it is important to choose the characteristics to control for during re-weighting carefully, as otherwise unanticipated dynamics in characteristics and income sources not controlled for may occur. Extensions to the proposed list of calibration totals could include such characteristics as educational level and receipt of major income sources, but also region, ethnicity, level of urbanization, etc. Adjusting for labour market changes as well as for the demographic situation is crucial for analysis, especially if the original data refer to a non typical year of economic recession or rapid growth. The spread of weights is, however, likely to increase with a higher number of controlling variables. A high number of controls may also result in the re-weighting procedure not converging at all.

Finally, it has been demonstrated that t demographic change within a short term period of around 2-3 years has a minor impact on inequality and poverty estimates. The impact is more profound in a longer term period, i.e. comparing 2012 and 2020 estimates. It should be noted that the interpretation of the dynamics in poverty and inequality, as well as other estimates, should be carried out with care. The assumptions underlying the re-weighting procedure should always be made transparent in the analysis.

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**Table 8: Control totals from EUROMOD dataset and from EUROPOP projections for years 2012 and 2020**

| | Number of individuals | | | | | |
|---|---|---|---|---|---|---|
| | Slovenia | | | Lithuania | | |
| | **2010** | **2012** | **2020** | **2010** | **2012** | **2020** |
| ***Males*** | | | | | | |
| up to 4 years | 55,956 | 57,573 | 57,034 | 95,729 | 99,931 | 102,416 |
| from 5 to 9 years | 51,173 | 54,089 | 62,436 | 104,214 | 106,761 | 123,388 |
| from 10 to 14 years | 49,554 | 49,146 | 55,255 | 87,196 | 80,938 | 76,310 |
| from 15 to 19 years | 57,464 | 55,214 | 50,609 | 84,895 | 76,334 | 52,272 |
| from 20 to 24 years | 73,513 | 68,548 | 54,663 | 133,895 | 127,312 | 88,212 |
| from 25 to 29 years | 69,421 | 67,718 | 54,005 | 122,253 | 125,357 | 115,046 |
| from 30 to 34 years | 76,424 | 76,187 | 70,611 | 107,729 | 111,152 | 125,620 |
| from 35 to 39 years | 80,032 | 83,338 | 86,983 | 113,867 | 109,039 | 111,875 |
| from 40 to 44 years | 79,439 | 79,368 | 86,818 | 116,580 | 112,978 | 97,205 |
| from 45 to 49 years | 77,719 | 77,747 | 77,410 | 123,598 | 118,213 | 102,616 |
| from 50 to 54 years | 77,090 | 76,816 | 76,421 | 107,166 | 110,452 | 103,795 |
| from 55 to 59 years | 75,839 | 76,232 | 76,290 | 84,512 | 89,790 | 106,540 |
| from 60 to 64 years | 47,636 | 53,871 | 64,299 | 70,056 | 73,110 | 91,541 |
| from 65 to 69 years | 43,752 | 45,437 | 63,957 | 56,986 | 55,563 | 60,536 |
| from 70 to 74 years | 32,006 | 32,989 | 38,292 | 52,551 | 51,359 | 47,686 |
| from 75 to 79 years | 25,272 | 26,437 | 30,848 | 39,744 | 39,907 | 38,965 |
| from 80+ | 18,966 | 21,704 | 31,747 | 26,020 | 27,948 | 34,274 |
| ***Females*** | | | | | | |
| up to 4 years | 50,063 | 51,898 | 51,667 | 66,876 | 69,361 | 70,466 |
| from 5 to 9 years | 50,833 | 54,427 | 64,414 | 49,674 | 51,019 | 58,346 |
| from 10 to 14 years | 46,494 | 46,504 | 54,142 | 90,557 | 84,107 | 79,945 |
| from 15 to 19 years | 51,327 | 49,504 | 46,503 | 153,527 | 137,704 | 93,989 |
| from 20 to 24 years | 63,892 | 60,832 | 50,610 | 131,802 | 124,726 | 84,913 |
| from 25 to 29 years | 69,232 | 67,823 | 57,346 | 118,139 | 121,032 | 109,850 |
| from 30 to 34 years | 69,457 | 69,197 | 64,816 | 107,514 | 109,463 | 121,496 |
| from 35 to 39 years | 73,159 | 75,626 | 78,135 | 118,355 | 112,509 | 109,976 |
| from 40 to 44 years | 72,445 | 71,186 | 74,720 | 124,352 | 120,640 | 101,476 |
| from 45 to 49 years | 79,161 | 79,036 | 75,281 | 136,072 | 130,224 | 112,891 |
| from 50 to 54 years | 70,363 | 70,584 | 70,558 | 126,535 | 129,124 | 119,129 |
| from 55 to 59 years | 74,526 | 75,137 | 76,669 | 106,609 | 112,853 | 128,987 |
| from 60 to 64 years | 51,047 | 56,456 | 65,988 | 97,534 | 100,455 | 120,907 |
| from 65 to 69 years | 53,104 | 53,879 | 69,766 | 96,467 | 94,351 | 98,647 |
| from 70 to 74 years | 46,017 | 46,462 | 49,185 | 92,418 | 90,526 | 83,723 |
| from 75 to 79 years | 46,571 | 45,915 | 46,497 | 72,558 | 73,182 | 71,302 |
| from 80+ | 38,376 | 41,175 | 48,899 | 86,066 | 91,656 | 110,096 |
| ***Employed males*** | | | | | | |
| from 15 to 24 years | 28,756 | 27,172 | 23,115 | 53,650 | 49,698 | 34,249 |

| | Number of individuals | | | | | |
|---|---|---|---|---|---|---|
| | Slovenia | | | Lithuania | | |
| | **2010** | **2012** | **2020** | **2010** | **2012** | **2020** |
| from 25 to 49 years | 339,809 | 340,645 | 331,295 | 431,848 | 426,491 | 408,548 |
| from 50 to 74 years | 116,305 | 120,335 | 135,090 | 179,261 | 183,549 | 197,820 |
| ***Employed females*** | | | | | | |
| from 15 to 24 years | 13,839 | 13,253 | 11,671 | 54,682 | 50,469 | 34,400 |
| from 25 to 49 years | 302,994 | 302,364 | 291,705 | 498,018 | 489,319 | 457,908 |
| from 50 to 74 years | 79,316 | 81,405 | 89,356 | 199,160 | 202,150 | 211,277 |
| ***Unemployed males*** | | | | | | |
| from 15 to 24 years | 4,528 | 4,279 | 3,640 | 37,144 | 34,408 | 23,712 |
| from 25 to 49 years | 23,463 | 23,520 | 22,875 | 107,687 | 106,351 | 101,877 |
| from 50 to 74 years | 16,709 | 17,288 | 19,408 | 26,454 | 27,087 | 29,193 |
| ***Unemployed females*** | | | | | | |
| from 15 to 24 years | 3,851 | 3,688 | 3,248 | 15,988 | 14,756 | 10,058 |
| from 25 to 49 years | 31,869 | 31,802 | 30,681 | 50,056 | 49,181 | 46,024 |
| from 50 to 74 years | 14,258 | 14,633 | 16,062 | 27,425 | 27,837 | 29,094 |
| ***Children living in households with:*** | | | | | | |
| 1-2 children, 1 adult | 27,892 | 28,232 | 29,769 | 72,613 | 69,959 | 64,991 |
| 1-2 children, 2 or more adults | 299,774 | 303,429 | 319,949 | 529,631 | 510,273 | 474,040 |
| 3 or more children, 1 adult | 6,360 | 6,438 | 6,788 | 5,871 | 5,656 | 5,254 |
| 3 or more children, 2 or more adults | 78,539 | 79,496 | 83,825 | 122,276 | 117,806 | 109,441 |
| ***Single persons*** | | | | | | |
| up to 64 years | 110,686 | 111,246 | 109,279 | 212,790 | 211,919 | 202,775 |
| 65 years or more | 99,143 | 102,730 | 124,206 | 212,993 | 213,917 | 223,095 |
| ***Persons without children living in households:*** | | | | | | |
| couples, no children | 381,108 | 385,460 | 396,959 | 602,744 | 601,326 | 586,133 |
| more than 2 adults, no children | 431,743 | 436,674 | 449,700 | 491,665 | 490,508 | 478,115 |

Source: Authors' calculations.

**Table 9: Recipients of different income types, number of persons, Slovenia**

| | **Euromod data (I)** | ***Bounded linear function weights (II)*** | | ***Ratio in % (II/I)*** | | **Logistic function weights (III)** | | ***Ratio in % (III/I)*** | |
|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2012 | 2020 | *2012* | *2020* | 2012 | 2020 | *2012* | *2020* |
| Employed persons | 883 | 887 | 884 | *100.5* | *100.2* | 887 | 884 | *100.5* | *100.2* |
| Unemployed persons | 95 | 95 | 96 | *100.6* | *101.3* | 95 | 96 | *100.6* | *101.3* |
| **ORIGINAL INCOME** | | | | | | | | | |
| Original income | 1,324,358 | 1,331,930 | 1,348,152 | *100.6* | *101.8* | 1,331,893 | 1,347,083 | *100.6* | *101.7* |
| Employment | 822,940 | 825,802 | 818,801 | *100.3* | *99.5* | 825,761 | 817,797 | *100.3* | *99.4* |
| Self-employment | 232,130 | 234,152 | 239,350 | *100.9* | *103.1* | 234,210 | 240,599 | *100.9* | *103.6* |
| Investment income | 399,695 | 408,526 | 438,590 | *102.2* | *109.7* | 408,539 | 438,795 | *102.2* | *109.8* |
| Income from contractual work | 150,643 | 153,170 | 161,194 | *101.7* | *107.0* | 153,180 | 161,624 | *101.7* | *107.3* |
| Income from student work | 149,956 | 143,667 | 124,272 | *95.8* | *82.9* | 143,659 | 123,851 | *95.8* | *82.6* |
| **PENSIONS** | | | | | | | | | |
| Old-age pension | 336,398 | 349,971 | 403,502 | *104.0* | *119.9* | 349,910 | 402,152 | *104.0* | *119.5* |
| Disability pension | 82,369 | 84,104 | 90,636 | *102.1* | *110.0* | 84,137 | 91,372 | *102.1* | *110.9* |
| Survivor's pension | 70,530 | 70,246 | 69,744 | *99.6* | *98.9* | 70,293 | 70,673 | *99.7* | *100.2* |
| **NOT SIMULATED BENEFITS** | | | | | | | | | |
| Attendance supplement | 15,648 | 16,254 | 18,099 | *103.9* | *115.7* | 16,263 | 18,330 | *103.9* | *117.1* |
| Disability supplement | 50,814 | 52,062 | 57,011 | *102.5* | *112.2* | 52,074 | 57,262 | *102.5* | *112.7* |
| Scholarship | 81,469 | 77,278 | 66,105 | *94.9* | *81.1* | 77,306 | 66,375 | *94.9* | *81.5* |
| Parental payment | 36,250 | 37,062 | 35,180 | *102.2* | *97.0* | 37,055 | 35,062 | *102.2* | *96.7* |
| Unemployment wage compensation | 63,741 | 64,034 | 63,933 | *100.5* | *100.3* | 64,021 | 63,614 | *100.4* | *99.8* |
| Wage compensation for disabled workers | 51,141 | 51,915 | 54,007 | *101.5* | *105.6* | 51,914 | 53,920 | *101.5* | *105.4* |
| Paternal payment | 19,051 | 19,359 | 17,993 | *101.6* | *94.4* | 19,351 | 17,914 | *101.6* | *94.0* |
| **SIMULATED BENEFITS** | | | | | | | | | |
| Birth grant | 15,800 | 16,166 | 15,691 | *102.3* | *99.3* | 16,160 | 15,563 | *102.3* | *98.5* |

| | Euromod data (I) | *Bounded linear function weights (II)* | | *Ratio in % (II/I)* | | Logistic function weights (III) | | *Ratio in % (III/I)* | |
|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2012 | 2020 | *2012* | *2020* | 2012 | 2020 | *2012* | *2020* |
| Large family supplement | 29,551 | 29,315 | 29,255 | *99.2* | *99.0* | 29,324 | 29,207 | *99.2* | *98.8* |
| Child benefit (means tested) | 176,627 | 178,252 | 183,463 | *100.9* | *103.9* | 178,231 | 182,881 | *100.9* | *103.5* |
| Parental allowance | 758.82 | 766 | 700 | *100.9* | *92.2* | 765 | 688 | *100.8* | *90.7* |
| Housing benefit | 35,526 | 35,655 | 36,337 | *100.4* | *102.3* | 35,650 | 36,275 | *100.3* | *102.1* |
| Social assistance | 67,911 | 68,681 | 71,319 | *101.1* | *105.0* | 68,690 | 71,546 | *101.1* | *105.4* |
| Income support | 32,775 | 33,713 | 39,032 | *102.9* | *119.1* | 33,712 | 38,974 | - | - |
| Social contributions up to full working time for parents (part-time work) | 14,230 | 14,817 | 15,606 | *104.1* | *109.7* | 14,816 | 15,564 | *104.1* | *109.4* |
| Social contributions up to full working time for parents (not working) | 729.5 | 762 | 864 | *104.5* | *118.4* | 761 | 856 | *104.3* | *117.3* |
| **TAXES AND CONTRIBUTIONS** | | | | | | | | | |
| Personal income tax | 765,828 | 772,355 | 780,346 | *100.9* | *101.9* | 772,330 | 780,060 | *100.8* | *101.9* |
| Tax on investment income | 399,695 | 408,526 | 438,590 | *102.2* | *109.7* | 408,539 | 438,795 | *102.2* | *109.8* |
| Employer contributions | 880,582 | 884,958 | 883,682 | *100.5* | *100.4* | 884,912 | 882,700 | *100.5* | *100.2* |
| Employee contributions | 863,715 | 867,225 | 860,780 | *100.4* | *99.7* | 867,185 | 859,894 | *100.4* | *99.6* |
| Self-employed contributions | 74,375 | 75,141 | 75,855 | *101.0* | *102.0* | 75,173 | 76,491 | *101.1* | *102.8* |

Source: Authors' calculations.

**Table 10: Recipients of different income types, number of persons, Lithuania**

| | Euromod data (I) | Bounded linear function weights (II) | | Ratio (II/I) | | Logistic function weights (III) | | Ratio (III/I) | |
|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2012 | 2020 | *2012* | *2020* | 2012 | 2020 | *2012* | *2020* |
| Employed persons | 1,419 | 1,390 | 1,346 | *0.98* | *0.95* | 1,390 | 1,346 | *0.98* | *0.95* |
| Unemployed persons | 265 | 255 | 240 | *0.96* | *0.91* | 255 | 240 | *0.96* | *0.91* |
| **ORIGINAL INCOME** | | | | | | | | | |
| Original income | 1,723 | 1,688 | 1,628 | *0.98* | *0.94* | 1,687 | 1,628 | *0.98* | *0.94* |
| Employment | 1,521 | 1,487 | 1,428 | *0.98* | *0.94* | 1,487 | 1,429 | *0.98* | *0.94* |
| Self-employment | 239 | 231 | 226 | *0.96* | *0.94* | 231 | 225 | *0.96* | *0.94* |
| Investment income | 115 | 112 | 107 | *0.97* | *0.93* | 111 | 107 | *0.97* | *0.93* |
| Property | 64 | 64 | 64 | *0.99* | *1.00* | 64 | 64 | *0.99* | *0.99* |
| Private pension | 9 | 10 | 10 | *1.02* | *1.07* | 10 | 10 | *1.02* | *1.06* |
| Private transfers | 50 | 47 | 40 | *0.95* | *0.81* | 47 | 41 | *0.95* | *0.83* |
| **PENSIONS** | | | | | | | | | |
| Old-age pension | 661 | 677 | 720 | *1.02* | *1.09* | 677 | 721 | *1.02* | *1.09* |
| Disability pension | 170 | 175 | 169 | *1.03* | *0.99* | 175 | 169 | *1.03* | *0.99* |
| Survivor's pension | 53 | 49 | 39 | *0.93* | *0.73* | 49 | 40 | *0.93* | *0.75* |
| **NOT SIMULATED BENEFITS** | | | | | | | | | |
| Orphans' pension | 6 | 7 | 6 | *1.11* | *0.97* | 7 | 6 | *1.12* | *0.95* |
| Education benefits | 40 | 36 | 27 | *0.89* | *0.66* | 36 | 27 | *0.89* | *0.66* |
| Housing Benefit | 93 | 90 | 87 | *0.96* | *0.93* | 90 | 87 | *0.97* | *0.94* |
| Sickness benefit | 387 | 378 | 367 | *0.98* | *0.95* | 378 | 367 | *0.98* | *0.95* |
| **SIMULATED BENEFITS** | | | | | | | | | |
| Child allowance | 102 | 98 | 96 | *0.95* | *0.94* | 98 | 95 | *0.95* | *0.93* |
| Birth allowance | 31 | 34 | 32 | *1.09* | *1.04* | 34 | 32 | *1.09* | *1.04* |
| Maternity (paternity) | 75 | 77 | 74 | *1.03* | *0.99* | 77 | 74 | *1.03* | *1.00* |
| Maternity | 26 | 29 | 28 | *1.09* | *1.05* | 28 | 28 | *1.09* | *1.05* |
| Maternity (non-contr) | 5 | 5 | 5 | *1.08* | *0.98* | 5 | 5 | *1.08* | *0.98* |

| | Euromod data (I) | Bounded linear function weights (II) | | *Ratio (II/I)* | | Logistic function weights (III) | | *Ratio (III/I)* | |
|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2012 | 2020 | *2012* | *2020* | 2012 | 2020 | *2012* | *2020* |
| Paternity benefit | 24 | 26 | 25 | *1.08* | *1.02* | 26 | 24 | *1.08* | *1.02* |
| Social assistance | 133 | 115 | 106 | *0.87* | *0.80* | 115 | 107 | *0.87* | *0.81* |
| Unemployment benefit | 59 | 57 | 55 | *0.97* | *0.94* | 57 | 55 | *0.97* | *0.94* |
| **TAXES AND CONTRIBUTIONS** | | | | | | | | | |
| Income tax | 1,420 | 1,417 | 1,376 | *1.00* | *0.97* | 1,417 | 1,375 | *1.00* | *0.97* |
| Employee contribution | 1,521 | 1,487 | 1,428 | *0.98* | *0.94* | 1,487 | 1,429 | *0.98* | *0.94* |
| Self-employed contr | 332 | 325 | 315 | *0.98* | *0.95* | 325 | 313 | *0.98* | *0.94* |
| Employer contributions | 1,521 | 1,487 | 1,428 | *0.98* | *0.94* | 1,487 | 1,429 | *0.98* | *0.94* |
| Property tax | 257 | 257 | 253 | *1.00* | *0.98* | 257 | 253 | *1.00* | *0.98* |

Source: Authors' calculations.

**Table 11: Aggregate amounts of different income types, millions of Euros, Slovenia**

| | Original EUROMOD simulation (I) | EUROMOD Simulation based on bounded linear function weights (II) | | | | EUROMOD Simulation based on logistic function weights (III) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Million of Euros | | Ratio (II/I) | | Million of Euros | | Ratio (III/I) | |
| | 2012 | 2012 | 2020 | 2012 | 2020 | 2012 | 2020 | 2012 | 2020 |
| **ORIGINAL INCOME** | | | | | | | | | |
| Original income | 16,790.9 | 16,929.3 | 17,161.2 | 100.8 | 101.4 | 16,930.9 | 17,212.9 | 100.8 | 102.5 |
| Employment | 13,562.8 | 13,678.5 | 13,866.7 | 100.9 | 101.4 | 13,679.1 | 13,893.2 | 100.9 | 102.4 |
| Self-employment | 1,239.6 | 1,259.0 | 1,310.4 | 101.6 | 104.1 | 1,259.8 | 1,328.0 | 101.6 | 107.1 |
| Investment income | 130.9 | 135.8 | 156.3 | 103.8 | 115.1 | 135.8 | 157.6 | 103.8 | 120.4 |
| Income from contractual work | 317.9 | 326.4 | 359.9 | 102.7 | 110.3 | 326.6 | 366.4 | 102.7 | 115.3 |
| Income from student work | 353.6 | 338.7 | 288.1 | 95.8 | 85.1 | 338.7 | 287.6 | 95.8 | 81.3 |
| Employment (average) | 1,638.1 | 1,644.7 | 1,675.5 | 100.4 | 101.9 | 1,644.9 | 1,681.0 | 100.4 | 102.6 |
| **PENSIONS** | | | | | | | | | |
| Old-age pension | 2,997.6 | 3,124.1 | 3,640.5 | 104.2 | 116.5 | 3,123.5 | 3,625.6 | 104.2 | 120.9 |
| Disability pension | 552.5 | 567.0 | 624.9 | 102.6 | 110.2 | 567.2 | 628.1 | 102.7 | 113.7 |
| Survivor's pension | 371.5 | 372.0 | 375.9 | 100.1 | 101.0 | 372.2 | 380.3 | 100.2 | 102.4 |
| **NOT SIMULATED BENEFITS** | | | | | | | | | |
| Attendance supplement | 33.5 | 34.8 | 38.9 | 103.9 | 111.9 | 34.8 | 39.8 | 104.0 | 118.9 |
| Disability supplement | 30.1 | 30.8 | 33.7 | 102.4 | 109.4 | 30.8 | 33.9 | 102.4 | 112.6 |
| Wage compensation for disabled workers | 160.7 | 163.4 | 170.5 | 101.7 | 104.3 | 163.4 | 171.1 | 101.7 | 106.5 |
| Paternal payment | 13.7 | 14.0 | 13.2 | 102.1 | 94.8 | 14.0 | 13.2 | 102.1 | 96.8 |
| **SIMULATED BENEFITS** | | | | | | | | | |
| Birth grant | 4.5 | 4.6 | 4.4 | 102.2 | 97.8 | 4.6 | 4.4 | 102.3 | 98.5 |
| Large family supplement | 12.1 | 12.0 | 12.0 | 99.1 | 99.9 | 12.0 | 12.0 | 99.2 | 99.0 |
| Child benefit (means tested) | 274.6 | 278.0 | 294.1 | 101.2 | 105.8 | 277.9 | 293.4 | 101.2 | 106.8 |
| Parental allowance | 2.3 | 2.3 | 2.1 | 100.9 | 91.4 | 2.3 | 2.1 | 100.8 | 90.7 |

| | Original EUROMOD simulation (I) | EUROMOD Simulation based on bounded linear function weights (II) | | | | EUROMOD Simulation based on logistic function weights (III) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Million of Euros | | Ratio (II/I) | | Million of Euros | | Ratio (III/I) | |
| | **2012** | **2012** | **2020** | **2012** | **2020** | **2012** | **2020** | **2012** | **2020** |
| Housing benefit | 38.4 | 38.3 | 38.5 | 99.8 | 100.5 | 38.3 | 38.5 | 99.8 | 100.3 |
| Social assistance | 218.1 | 218.8 | 220.8 | 100.3 | 100.9 | 218.8 | 222.0 | 100.4 | 101.8 |
| Income support | 40.0 | 41.3 | 48.3 | 103.3 | 116.9 | 41.3 | 48.4 | 103.3 | 120.9 |
| Social contributions up to full working time for parents (part-time work) | 10.9 | 11.3 | 11.9 | 103.8 | 105.3 | 11.3 | 11.8 | 103.8 | 108.4 |
| Social contributions up to full working time for parents (not working) | 1.5 | 1.5 | 1.7 | 104.5 | 113.4 | 1.5 | 1.7 | 104.4 | 117.3 |
| **TAXES AND CONTRIBUTIONS** | | | | | | | | | |
| Personal income tax | 1,797.6 | 1,830.3 | 1,914.6 | 101.8 | 104.6 | 1,830.8 | 1,929.8 | 101.8 | 107.4 |
| Tax on investment income | 26.2 | 27.2 | 31.3 | 103.8 | 115.1 | 27.2 | 31.5 | 103.8 | 120.4 |
| Employer contributions | 2,265.3 | 2,285.1 | 2,318.3 | 100.9 | 101.5 | 2,285.2 | 2,323.3 | 100.9 | 102.6 |
| Employee contributions | 3,216.8 | 3,245.8 | 3,289.0 | 100.9 | 101.3 | 3,246.0 | 3,295.3 | 100.9 | 102.4 |
| Self-employed contributions | 345.3 | 350.2 | 359.4 | 101.4 | 102.6 | 350.4 | 363.5 | 101.5 | 105.3 |

Source: Authors' calculations.

**Table 12: Aggregate amounts of different income types, million of Litas, Lithuania**

| | Original EUROMOD simualtion (I) | EUROMOD Simulation based on bounded linear function weights (II) | | | | EUROMOD Simulation based on logistic function weights (III) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Euromod data (I) | Million of Litas | | Ratio (II/I) | | Million of Litas | | Ratio (III/I) | |
| | 2012 | 2012 | 2020 | 2012 | 2020 | 2012 | 2020 | 2012 | 2020 |
| **ORIGINAL INCOME** | | | | | | | | | |
| Original income | 34,877 | 34,208 | 33,359 | 0.98 | 0.96 | 34,197 | 33,249 | 0.98 | 0.95 |
| Employment | 30,547 | 29,956 | 29,147 | 0.98 | 0.95 | 29,949 | 29,094 | 0.98 | 0.95 |
| Self-employment | 3,479 | 3,404 | 3,431 | 0.98 | 0.99 | 3,402 | 3,402 | 0.98 | 0.98 |
| Investment income | 667 | 682 | 658 | 1.02 | 0.99 | 680 | 622 | 1.02 | 0.93 |
| Property | 163 | 156 | 155 | 0.96 | 0.95 | 156 | 152 | 0.96 | 0.93 |
| Private pension | 12 | 12 | 13 | 1.03 | 1.13 | 12 | 13 | 1.03 | 1.12 |
| Private transfers | 221 | 202 | 148 | 0.92 | 0.67 | 202 | 158 | 0.92 | 0.72 |
| **PENSIONS** | | | | | | | | | |
| Old-age pension | 7,040 | 7,201 | 7,641 | 1.02 | 1.09 | 7,202 | 7,652 | 1.02 | 1.09 |
| Disability pension | 1,130 | 1,167 | 1,125 | 1.03 | 1.00 | 1,170 | 1,126 | 1.04 | 1.00 |
| Survivor's pension | 135 | 125 | 98 | 0.93 | 0.72 | 126 | 100 | 0.93 | 0.74 |
| **NOT SIMULATED BENEFITS** | | | | | | | | | |
| Orphans' pension | 49 | 49 | 45 | 0.99 | 0.92 | 49 | 46 | 0.99 | 0.93 |
| Education benefits | 54 | 54 | 45 | 0.99 | 0.82 | 54 | 45 | 1.00 | 0.83 |
| Housing Benefit | 71 | 67 | 65 | 0.95 | 0.92 | 67 | 65 | 0.95 | 0.92 |
| Sickness benefit | 671 | 668 | 658 | 1.00 | 0.98 | 668 | 653 | 0.99 | 0.97 |
| **SIMULATED BENEFITS** | | | | | | | | | |
| Child allowance | 121 | 116 | 111 | 0.95 | 0.91 | 116 | 111 | 0.95 | 0.91 |

| | Original EUROMOD simualtion (I) | EUROMOD Simulation based on bounded linear function weights (II) | | | | EUROMOD Simulation based on logistic function weights (III) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Euromod data (I) | Million of Litas | | Ratio (II/I) | | Million of Litas | | Ratio (III/I) | |
| | 2012 | 2012 | 2020 | 2012 | 2020 | 2012 | 2020 | 2012 | 2020 |
| Birth allowance | 44 | 48 | 46 | 1.09 | 1.04 | 48 | 46 | 1.09 | 1.04 |
| Maternity (paternity) | 655 | 706 | 675 | 1.08 | 1.03 | 706 | 681 | 1.08 | 1.04 |
| Maternity | 172 | 189 | 184 | 1.10 | 1.07 | 189 | 186 | 1.10 | 1.08 |
| Maternity (non-contr) | 1 | 1 | 1 | 1.08 | 0.98 | 1 | 1 | 1.08 | 0.98 |
| Paternity benefit | 53 | 58 | 56 | 1.09 | 1.05 | 57 | 55 | 1.09 | 1.05 |
| Social assistance | 502 | 459 | 422 | 0.91 | 0.84 | 460 | 429 | 0.92 | 0.85 |
| Unemployment benefit | 134 | 129 | 125 | 0.97 | 0.93 | 129 | 125 | 0.97 | 0.93 |
| **TAXES AND CONTRIBUTIONS** | | | | | | | | | |
| Income tax | 4,485 | 4,427 | 4,339 | 0.99 | 0.97 | 4,425 | 4,319 | 0.99 | 0.96 |
| Employee contribution | 2,749 | 2,696 | 2,623 | 0.98 | 0.95 | 2,695 | 2,618 | 0.98 | 0.95 |
| Self-employed contr | 972 | 950 | 947 | 0.98 | 0.97 | 949 | 938 | 0.98 | 0.96 |
| Employer contributions | 9,531 | 9,346 | 9,094 | 0.98 | 0.95 | 9,344 | 9,077 | 0.98 | 0.95 |
| Property tax | 57 | 57 | 56 | 1.00 | 0.99 | 57 | 56 | 1.00 | 0.99 |

Source: Authors' calculations.

**Table 13:** Poverty and inequality measures for years 2012 and 2020, Slovenia

| Household type | Original data | Logistic method | | Bounded linear method | |
|---|---|---|---|---|---|
| | 2012 | 2012 | 2020 | 2012 | 2020 |
| ***Poverty rates by sex, 60% median HDI*** | | | | | |
| Total | 12.86 | 12.96 | 13.14 | 12.96 | 13.13 |
| Males | 11.22 | 11.39 | 11.64 | 11.39 | 11.57 |
| Females | 14.48 | 14.51 | 14.64 | 14.51 | 14.67 |
| ***Poverty rates by age, 60% median HDI*** | | | | | |
| 0-17 years | 10.70 | 10.70 | 10.50 | 10.70 | 10.48 |
| 18-24 years | 10.81 | 11.02 | 11.67 | 11.01 | 11.49 |
| 25-49 years | 9.27 | 9.32 | 9.39 | 9.32 | 9.37 |
| 50-64 years | 14.76 | 14.69 | 14.38 | 14.68 | 14.25 |
| 65+ years | 23.04 | 23.12 | 22.30 | 23.12 | 22.47 |
| ***Gini Coefficient*** | 23.64 | 23.74 | 24.26 | 23.74 | 24.16 |
| ***Income quintile ratio (S80/S20)*** | 3.37 | 3.39 | 3.47 | 3.38 | 3.45 |

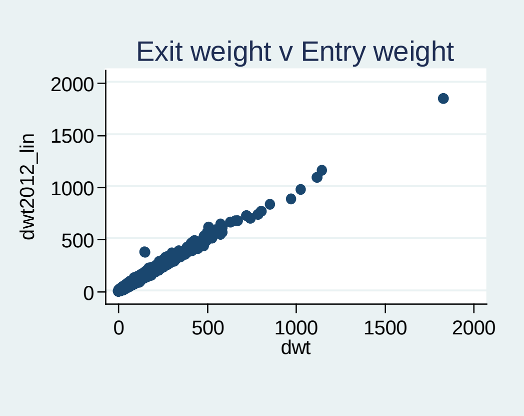
Source: Authors' calculations.

**Table 14**: Poverty and inequality measures for years 2012 and 2020, Lithuania

| Household type | Original data | Logistic method | | Bounded linear method | |
|---|---|---|---|---|---|
| | 2012 | 2012 | 2020 | 2012 | 2020 |
| ***Poverty rates by sex, 60% median HDI*** | | | | | |
| Total | 21.35 | 21.58 | 21.36 | 21.59 | 21.31 |
| Males | 21.87 | 22.08 | 22.02 | 22.09 | 21.99 |
| Females | 20.91 | 21.15 | 20.77 | 21.16 | 20.71 |
| ***Poverty rates by age, 60% median HDI*** | | | | | |
| 0-17 years | 28.16 | 27.94 | 27.69 | 27.98 | 27.82 |
| 18-24 years | 23.21 | 23.72 | 22.68 | 23.69 | 21.56 |
| 25-49 years | 21.98 | 21.98 | 22.06 | 21.99 | 22.01 |
| 50-64 years | 22.44 | 23.49 | 22.71 | 23.51 | 22.88 |
| 65+ years | 9.33 | 9.93 | 10.88 | 9.93 | 10.85 |
| ***Gini Coefficient*** | 36.64 | 36.42 | 36.26 | 36.43 | 36.32 |
| ***Income quintile ratio (S80/S20)*** | 6.66 | 6.60 | 6.54 | 6.60 | 6.57 |

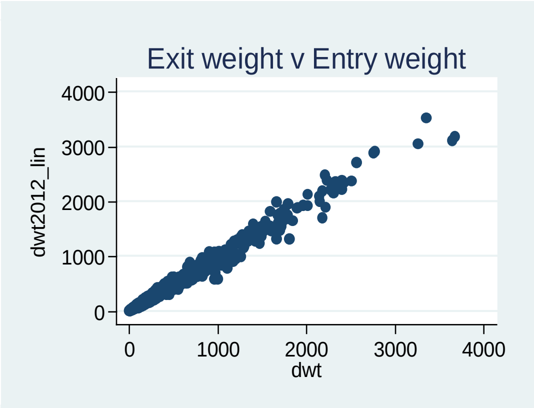
Source: Authors' calculations.

Figure 1: Exit weight versus entry weight, bounded linear method, 2012, Slovenia



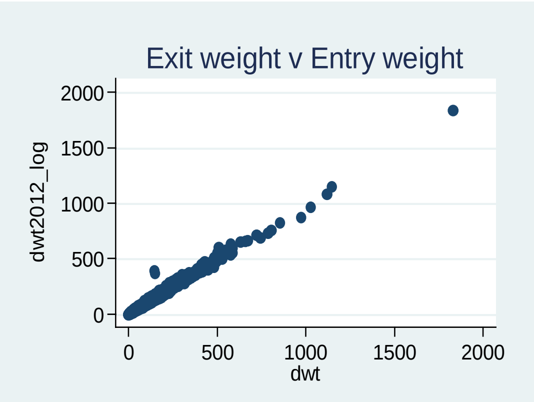

Source: Authors' calculations.

Figure 2: Exit weight versus entry weight, bounded linear method, 2012, Lithuania



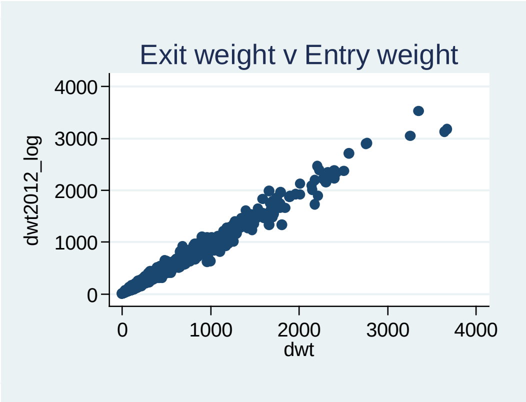

Source: Authors' calculations.

Figure 3: Exit weight versus entry weight, logistic method, 2012, Slovenia



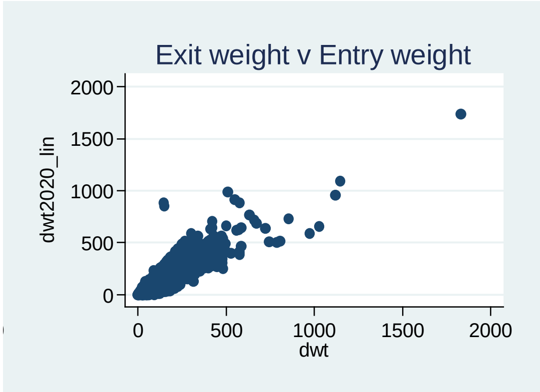

Source: Authors' calculations.

Figure 4: Exit weight versus entry weight, logistic method, 2012, Lithuania



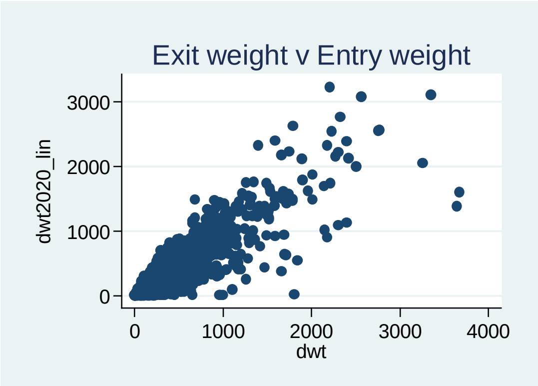

Source: Authors' calculations.

Figure 5: Exit weight versus entry weight, bounded linear method, 2020, Slovenia



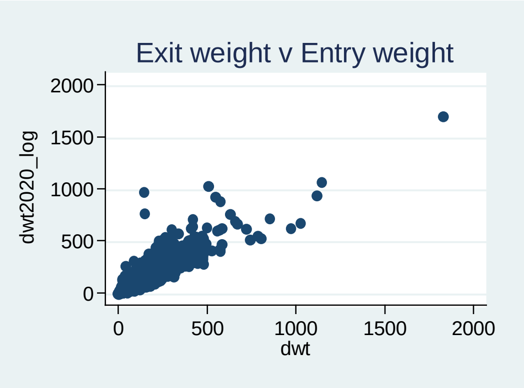

Source: Authors' calculations.

Figure 6: Exit weight versus entry weight, bounded linear method, 2020, Lithuania



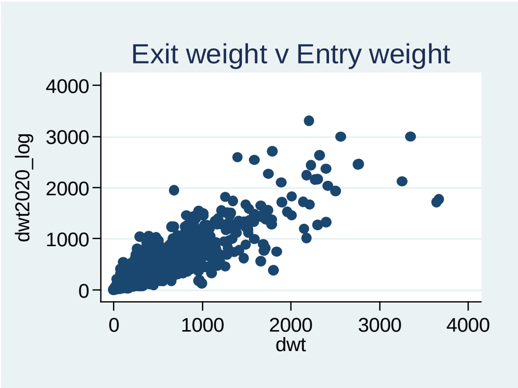

Source: Authors' calculations.

Figure 7: Exit weight versus entry weight, logistic method, 2020, Slovenia




Source: Authors' calculations.

Figure 8: Exit weight versus entry weight, logistic method, 2020, Lithuania




Source: Authors' calculations.