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Abstract

This paper aims to show how the newly developed Hypothetical Household Tool of the EUROMOD microsimulation model can be used to generate institutional minimum income protection indicators. It does so by updating the CSB's Minimum Income Protection Indicators (CSB-MIPI) dataset using EUROMOD and HHoT. We discuss the necessary assumptions for this exercise, and describe, present and validate the obtained indicators. In doing so, we provide and discuss both an updated minimum income protection indicator dataset, and give guidance to researchers who want to use the flexibility of HHoT to calculate purpose designed minimum income protection indicators.

JEL: C81, H55, I31, I38

Keywords: HHoT, hypothetical household simulations, minimum incomes, minimum wage, minimum income guarantees for elderly, social pension, social assistance, social protection indicators

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1. Introduction

Researchers have put great effort into developing quantitative indicators that capture welfare state institutions and social policies. In this paper we focus on institutional indicators that show the functioning of welfare states, irrespective of the population to which policies are applied. This type of institutional data is extremely valuable as it allows for a timely, objective and accurate assessment of policy *intent* over time and between nations: they explicitly represent the levers that policy makers can directly impact on. Well-known examples are indices that represent levels of employment protection legislation or benefit conditionality (Hasselpflug, 2005, Venn, 2009, 2012), social insurance replacement rates (Scruggs, 2013, Swedish Institute for Social Research, 2016), and hypothetical household simulations (Gough et al., 1996, Bradshaw and Finch, 2002, Nelson, 2007, OECD, 2011, Van Mechelen et al., 2011). In this paper we focus on the challenge of creating comparable indicators of the generosity of minimum income protection using hypothetical household simulations. More specifically, we explore how the new Hypothetical Household Tool (HHoT), which is now part of the European microsimulation model EUROMOD, can be used to develop indicators for all EU Member States on the generosity of minimum income policies in Europe while ensuring the substantive comparability of indicators across countries. We focus on minimum income provisions for the working active-age population, the non-working active age population, and the elderly.

In the next section, we elaborate on the type of comparability we aim to ensure in our indicators of minimum income protection. We focus on how hypothetical household calculations are used to obtain such comparability. Afterwards, we discuss in depth how we constructed the indicators presented in this paper using the Hypothetical Household Tool of the EUROMOD software, and the EUROMOD software itself. We pay particular attention to the assumptions we make in order to come to comparable indicators of the generosity of minimum income provisions for different target groups. Afterwards, we provide a validation of these indicators. Finally, we discuss the benefits and limitations of this approach, and conclude.

2. Comparability

Following Goedemé et al. (2015: 7), we make a distinction between substantive comparability and procedural comparability. Procedural comparability simply means that the same procedures are followed for measuring a phenomenon or characteristic in different social contexts, countries or time periods. A more demanding form of comparability is substantive comparability. This requires that the same phenomenon is captured similarly in different social contexts, countries or time periods. Substantive comparability is what researchers typically aim for. However, it should be clear that whether or not an indicator is comparable in a substantive (and not just in a procedural) sense depends on the research question at hand. For instance, if one would be interested in assessing the generosity of the typical social assistance scheme in each country, a different indicator is required as compared to assessing how much

people receive if they have no income from work or social security. In the first case one might limit oneself to looking at what social assistance schemes offer. The second case concerns the policy package and the question is which parts of the social protection system contribute to ensuring a minimum income, and how much they do so.

In this paper, we are interested in finding out what the minimum guaranteed incomes are for people in specific situations in the EU Member States. Hence, we are interested in substantively comparable indicators of minimum income protection which include all relevant income sources that come into play for guaranteeing a minimum income. In particular, we are interested in the guaranteed minimum incomes for three different target groups: (i) one-earner families with one minimum wage-earner participating full-time on the labour market, (ii) unemployed families that are able-bodied and willing to work, but who lack sufficient contributions to the social security system to receive contributory benefits, and (iii) elderly persons that did not contribute sufficiently to the public pension system to receive a regular (minimum) pension. We specify the details of these target groups below.

In line with our aim to construct substantively comparable indicators of generosity, we follow a 'risk-type' approach: we start from a particular case, and subsequently ask the question which social protection schemes kick in and how much protection they offer. More specifically, we make use of hypothetical household simulations that calculate the net disposable income of a hypothetical family in line with the applicable tax-benefit legislation. In contrast to a more straightforward comparison of the benefit levels supplied by different schemes, this method allows for the assessment of the combined impact of tax and benefit rules (and their interactions) relevant for vulnerable families in a uniform way across countries. Hence, it is a generally accepted way to assess benefit generosity (Behrendt, 2002, Bahle, Hubl and Pfeifer, 2011, Immervoll, 2012, Nelson, 2013, Marchal and Van Mechelen, 2017). As the net disposable income is calculated for the same hypothetical household according to the applicable policy rules, differences between countries and over time can only be attributed to policy differences. Whereas this approach has clear advantages that explain its popularity within comparative research, hypothetical household simulations are also subject to important limitations. Their heavy reliance on assumptions means that results are not representative for the population as a whole (Van Mechelen et al., 2011, Goedemé, 2012), nor do they give information on the share of the population that benefits from the included income support measures. Results risk being heavily driven by the researchers' assumptions regarding the income situation and individual and family characteristics.

In order to achieve substantive comparability, it is essential that the assumptions regarding the characteristics of the (hypothetical) households under study are formulated in the same way across countries. As we will show below this may appear easier than it is, as for some countries very specific characteristics are relevant in assessing the eligibility to or level of some benefits, while these same characteristics may be completely irrelevant in other countries. In other words, some generic specifications may comply with the requirements of 'procedural comparability', but to achieve substantive

comparability, it is essential to elaborately test and check whether the characteristics of the hypothetical households are specified in such a way that they really do generate comparable results. This approach also implies that even though we are interested in the 'safety net of last resort' (typically social assistance schemes), we take other parts of the social protection system into account, and sometimes some social assistance schemes are left out when they are not relevant for the case under study. By first defining the characteristics of the household at risk, and only then assessing which policy instruments become relevant, this technique is able to ensure the comparison of functionally equivalent provisions between countries, taking account of the different national policy contexts.

3. Building on prior experience

Hypothetical household simulations are often produced ad hoc to illustrate the impact of specific policy changes. However, for some specific income situations, including child benefits and minimum income protection, great effort has gone into developing and maintaining comprehensive datasets. In the field of minimum income protection, Nelson (2007) has developed the SaMIP (Social assistance and minimum income protection) database which tracks trends and variation in social assistance for the target group of able-bodied beneficiaries in over 30 countries, based on three model families (Nelson, 2007, Swedish Institute for Social Research, 2016). The OECD publishes the Benefits and Wages data, showing the evolution of net disposable incomes of typical families when moving out of social assistance dependency and into work (OECD, 2014). This allows for comparison of their guaranteed net disposable incomes at different percentages of the average wage in the OECD countries for the period 2001-2015. The underlying expert-sourced model is also available for use, allowing researchers to change the characteristics of the underlying model families.

Our own research centre has developed the CSB's Minimum Income Protection Indicators (CSB-MIPI) database, that monitors trends and variation in minimum income protection for three target groups: those in work, those who are able-bodied but out of work, and the elderly (Cantillon et al., 2004, Van Mechelen et al., 2011). Hypothetical household simulations are calculated for five typical families: a single person household, a couple with and without children, and two lone parent households. While the primary focus is on income levels, CSB-MIPI also contains information on conditionality requirements in social assistance, associated rights and in-kind benefits. The data have been gathered for four different moments in time (1992, 2001, 2009 and 2012), spanning two decades. These characteristics ensured that the dataset has been used to cover research questions regarding the nature of activation (Marchal and Van Mechelen, 2017), the adequacy of minimum income protection for workers, the social assistance population and the elderly (Marx and Nelson, 2013, Goedemé and Marchal, 2016), the policy shifts and trade-offs regarding minimum income protection (Marchal and Marx, 2018, Cantillon, Goedemé and Hills, 2019), and the effectiveness of different forms of minimum income protection (Vandenbroucke et al., 2013, Bradshaw

and Chzhen, 2015). CSB-MIPI derives from data collection through a network of national experts, expanding on earlier data collection efforts by Jonathan Bradshaw of the University of York (Eardley et al., 1996, Bradshaw and Finch, 2002). The experts were asked to calculate the net disposable income (and its income components) for hypothetical households defined by the Centre for Social Policy. The experts judged which schemes were most relevant for the defined hypothetical household type. Where additional assumptions, beyond those provided by the central team, were necessary, experts were asked to make a 'minimal' assumption, i.e. best depicting a minimum income situation. Only rights-based benefits were included. In addition, the country experts filled out questionnaires with background information on the selected schemes and their conditionality.

An important drawback of this approach was that CSB-MIPI only contained the results of the calculations, and comprised only limited information of the underlying policy systems. In this paper we show whether and how we can use the newly developed HHoT add-on[1] to the EUROMOD software to generate hypothetical household simulations with the same advantages of substantive comparability but more regularly and transparently, and with the added flexibility of access to the underlying policy model.

EUROMOD is a microsimulation model that comprises tax-benefit policies applicable in the different EU Member States (Sutherland and Figari, 2013). It is explicitly designed to calculate the effects of national policy changes on survey data (usually the European Union's Survey on Income and Living Conditions but other datasets are also possible, see e.g. the work of Kuypers, Figari and Verbist, 2016). The HHoT add-on generates data files for hypothetical families that can be run by EUROMOD instead of the more commonly used microdata files (EUROMOD, 2017). To define the household type, researchers insert the desired characteristics of their model families in the EUROMOD add-on. These are then translated by HHoT to the actual variables needed by EUROMOD to simulate specific tax-benefit systems. In other words, HHoT effectively makes an input data file of hypothetical households, than can be read by EUROMOD as the model would read survey data. This means that in contrast to the hypothetical household databases mentioned above, HHoT is very flexible: it allows the user to specify all relevant characteristics of the hypothetical household situations. Also, given its integration into EUROMOD, users can simulate the effects of policy reforms on hypothetical household and integrate these with the results of microsimulations that build on representative survey data (see also Gasior and Recchia, 2018). The added flexibility, and the regular updating, gives EUROMOD-HHoT some clear advantages relative to the static, expert-sourced data sets or hypothetical household models such as CSB-MIPI and SaMIP. HHoT is developed to run on EUROMOD policy years from 2009 onwards.

To make the add-on user friendly, HHoT does not require researchers to define each variable necessary to run the model, instead using a number of base variables that have to be defined by the user in combination

[1] The Hypothetical Household Tool (HHoT) has been jointly developed by the University of Essex and the University of Antwerp as an add-on of the EUROMOD software (Hufkens et al., 2019).

with default settings for other variables and derived variables whose value is linked to the settings the researcher chose for the base variables. Other user resources are a technical manual (EUROMOD, 2017) and the HHoT hypothetical household files used by Gasior and Recchia (2018) to generate baseline indicators,[2] which assess the generosity and the interaction of tax-benefit policies. In addition, Gasior and Recchia (2018) provide an overview of specific actions required to achieve meaningful baseline indicators.

This is not to say that developing substantively comparable hypothetical household-based minimum income protection indicators in HHoT for the purpose of comparative and cross-temporal institutional research is self-evident. First of all, since EUROMOD is primarily designed to run on microdata, some choices have been made in the programming of policies that reflect the availability of microdata, rather than the full legislative framework that defines eligibility or benefit levels (see e.g. Gasior and Recchia (2018: 10) on the simplified asset test in Cyprus). Second, and related, using a model developed for actual microdata on hypothetical families brings to the fore that national legislation is often too specific for a single, generally defined hypothetical household to assess the generosity of functionally equivalent minimum income schemes. National legislation may for instance specify job search criteria for unemployment benefits or quality criteria for housing allowances. To the extent that these are included in the policy programming, in order to calculate country-specific national net disposable minimum incomes, specific hypothetical household characteristics need to be defined. In expert-sourced hypothetical household calculations or models, the national experts – often implicitly – carry out these refinements, taking account of the purpose of the dataset and the eligibility thresholds included in national legislation in order to make sure that functionally equivalent benefits are selected. Using a more flexible model means that these assumptions must be explicitly identified and included in the hypothetical household definition. Not doing so will lead to less comparable institutional indicators.

4. Using HHoT to generate minimum income protection indicators

In this paper, we benefit from our past experience of constructing the expert-sourced CSB-MIPI data set to analyse how we should use EUROMOD-HHoT for the calculation of comparable and meaningful hypothetical household simulations of functionally equivalent minimum income provisions. A thorough comparison of MIPI with EUROMOD-HHoT estimates for the overlapping years 2009 and 2012 taught us which country-specific assumptions are relevant and where model choices must be adjusted to better reflect the purpose of rights-based hypothetical household simulations. We build on this information to construct updated institutional minimum income protection indicators for three different target groups (the working, the non-working able-bodied of active age, and the elderly). A consequence of this approach is that this paper only discusses and presents indicators for countries and income situations for which this

[2] The HHoT hypothetical household files can be retrieved at https://www.euromod.ac.uk/using-euromod/user-resources/hhot-manual-households.

comparison was possible. In particular, EU Member States that were not included in CSB-MIPI are not covered (Croatia, Cyprus and Malta), nor are the income situations included for countries that in 2012 did not have minimum income provisions for specific target groups (i.e. the working case in Germany, and the non-working case in Italy and Greece). Sweden, Finland, Denmark and Italy still do not legally guarantee a minimum wage in order to ensure a minimum income from work.

In the next section, we discuss how we used EUROMOD and HHoT to generate substantively comparable minimum income protection indicators for three different target groups. We provide a detailed overview of (i) the assumed characteristics of the hypothetical households, and (ii) the issues one needs to take account of when using EUROMOD to calculate hypothetical household indicators. Whereas we build on our prior experience with CSB-MIPI, we benefit from this revision to reconsider and streamline some assumptions for the indicators presented in this paper.

4.1. Assumed characteristics

4.1.1. General assumptions

We aim to calculate series of minimum income protection levels for four hypothetical family types, in three different income situations: a working, active-age breadwinner household; an active age and able-bodied household, but without income or social insurance entitlements; and a household of pensionable age, but without income or social insurance entitlements.

The active age family types (in-work, and out-of-work) are:

- A single man, not-divorced, aged 35;
- A married heterosexual couple, both partners aged 35;
- A married heterosexual couple, both partners aged 35, with 2 children: a 14-year-old son, and a 7-year-old daughter (attending lower secondary and primary school, respectively);
- A divorced mother, who does not receive alimony, aged 35, with 2 children: a 14-year-old son, and a 7-year-old daughter (attending lower secondary and primary school, respectively).

In the in-work case, the breadwinner is full-time employed at the minimum protection offered in each country (i.e. the minimum wage). The breadwinner is a white-collar worker, working in the Sales and Services sector. He or she does not have prior work experience. The partner is inactive (i.e. being part of a breadwinner family is a conscious choice, and thus the partner is not looking for work). In the non-working case, all adults are looking for work (i.e. they are unemployed rather than inactive, even though they are not entitled to unemployment insurance). We assume that no formal child care is required for either working or non-working active-age households with children.

Two family types relate to people in old-age:

- A single man, not-divorced or widowed, of *pensionable age*;
- A heterosexual couple, both partners of *pensionable age.*

Quite unrealistically, we assume they have no prior work history, since we are interested in the absolute minimum guaranteed to elderly persons.

None of the adults are attending education. Their highest educational level attained is upper secondary.

All families are tenants on the private market. Rents are set at the national median rent for each family type, calculated on the EU SILC 2015 and up- and down-rated in line with Eurostat's Harmonized Consumer Price Indices for housing costs (see Table A1 in Appendix for housing costs). We assume the single and couple households live in a one-bedroom apartment and the families with children in a three-bedroom apartment. The families have no other income except for incomes derived from the tax-benefit scheme, and, in the case of the working family, income from full-time employment. The families do not hold assets, do not have social insurance entitlements (i.e. they do not have prior work history) and do not receive alimony.

We are interested in full-year incomes, i.e. we assume that families have the same position throughout the year. This means that they are eligible for holiday allowances and other annual bonuses, if statutorily guaranteed.

4.1.2. Country-specific assumptions

These general assumptions often require additional clarifications in each country. This is especially the case for the definition of pensionable age, working time, the housing situation and locality, and behaviour. In line with our aim to capture the different minimum income provisions in substantively comparable indicators, we adhere here as much as possible to two guidelines. First, we aim to make assumptions in line with eligibility requirements, ensuring that – within the framework of the main assumptions outlined above – minimum requirements for receipt are fulfilled. This is to ensure that we fully capture the levels of available minimum income provisions. Second, where such an eligibility rule was less evident or not reconcilable with our general assumptions, we use country-specific assumptions in line with the national social context. We illustrate the implication of these rules of thumb below.

Age

We included an elderly case as we are interested in the minimum income protection for the elderly. The concept of 'old age' is however in full flux in some European countries. In order to account for the national social context, the assumed age is the pensionable age. Since pensionable age may differ in some countries depending on sector or benefit scheme, we use the minimum pensionable age to be eligible for the minimum income guarantee for elderly (often, but not always, equivalent to the general pensionable age). Table A2 in Appendix provides a complete overview.

Working hours

Working hours are relevant not only regarding the guaranteed take-home pay, but potentially also for the calculation of certain in-work benefits. In this paper, we were interested in understanding the situation of full-time workers. Yet the number of hours required to be considered a full-time worker differs between countries. Where possible, we followed the legal requirements. Yet a legal definition of what constitutes full-time work is lacking in most countries, since working time is often negotiated between the social partners in national, sectoral or individual agreements. For the data presented in this paper, we used the working hours mentioned in the EUROMOD country reports (see Table A3 in Appendix). These were broadly in line with indications of full-time work found in other studies (e.g. De Spiegelaere and Piasna, 2017).

Housing

In order to calculate the housing benefits relevant for tenants on the private market,[3] additional assumptions are needed in some countries. In particular, housing benefit calculation rules generally take account of the actual rents paid. In addition, they depend on the number of rooms relative to the number of persons in the household in Estonia and the UK and the size of the dwelling in square metres in Estonia, Hungary, Poland and Slovenia. Eligibility thresholds relating to the number of rooms in Estonia and the United Kingdom fall well within our (minimal) general assumption of one bedroom for the single and the couple household, and three bedrooms for the families with children – one bedroom per person or married couple. We assumed country-specific values on housing surfaces in order to ensure that the hypothetical households were eligible in each country (see Table A4 in Appendix).

This approach is less self-evident in the case of rent levels. Whereas there may be rent levels that will disqualify you for housing allowances in some countries these are often discretionarily assessed, or depend

[3] Please note that also tenure status and private vs. social rented may be relevant eligibility conditions for housing benefit schemes in some countries.

on the share of housing costs relative to the household's income. In addition, the level of housing allowances very much depends on rent levels, yet the actual relation between the two may run in different directions in different countries. We therefore opt to assess the overall generosity of minimum income protection including housing allowances based on empirically grounded and comparable rents for each country, by calculating the national median rent based on the EU SILC 2015 (see Table A1 in Appendix for an overview).[4] Heating allowances, that are included in EUROMOD for Bulgaria, Denmark, Finland, Germany, Greece, Luxembourg and the United Kingdom, are usually lump-sums, meaning that no additional assumptions regarding heating expenses are necessary.[5]

Locality

The locality of the hypothetical households within a country can have a substantial impact on the guaranteed minimum income. Important income components may differ between regions or even municipalities within the same country. As a general rule, we assume the family's locality to be the second largest city, other than the capital. In countries such as France and Latvia, where not all policies are simulated in EUROMOD, the largest non-capital category was used. The reason is that the capital is often a more expensive city, and that benefits aimed to compensate for this elevated cost of living will make the country seem more generous.[6] Of course it is not always straightforward to determine which the second largest city is, and this may vary by what is taken as the precise standard, or whether or not the broader agglomeration is included. We provide a full table of the selected localities for the data presented in Table A6 in Appendix.[7] If more general descriptions are required, we assume the family to live in a densely

[4] Self-evidently, other choices can be made. The OECD approach (also adopted in the baseline scenarios of Gasior and Recchia, 2018) assumes that each family type has the same housing costs set at 20% of the gross average wage. This approach has transparency as an obvious advantage, yet it may lead to unrealistically high rent levels for small families. In the SaMIP data, housing costs are based on national experts' judgement. With our EU SILC based estimates, we aim to find a middle ground between these two approaches. An alternative approach is suggested in Van den Bosch et al. (2016), who link a normative approach with empirical data. In their paper, they estimated the costs of an adequate dwelling at the 30th percentile, where an adequate dwelling was defined based on a normative assessment. The construction of a similar model for all the EU Member States falls outside the scope of this paper.

[5] There are only two exceptions: Finland and Germany. Yet for both countries the EUROMOD programming does not require explicit assumptions on heating costs: within the coding of the policy heating costs are either imputed based on the region in which the household resides (Finland), or are programmed to be the national average for each household size (Germany).

[6] We benefited from this update to more carefully consider the assumptions regarding locality. In the original CSB-MIPI dataset, for historical reasons, for some countries the capital was included, while not for others. Also, for a number of countries, CSB-MIPI included assumptions regarding locality that are no longer useful for EUROMOD. That is because these assumptions were needed to simulate local taxes (not included in EUROMOD, or if included, generally a national or regional average) or to provide background information on the behavioural conditionality of the social assistance benefit, which is often defined at the local level (see e.g. Saraceno, 2002, Sabatinelli, 2010).

[7] Of course, it is a distinctive advantage of MIPI-HHoT that it is possible for a substantial number of countries to generate estimates for other regions in the country without much additional effort. Depending on the precise research questions, researchers may want to focus on a different region than the one we selected here, as they may favour other characteristics also for the other assumptions. Researchers interested in regional variation may for instance be inclined to define all assumptions, including the housing cost assumption, more in line with the situation in a specific region. Table A6 in Appendix shows to what extent regional variation is included in EUROMOD for each country.

populated area. In line with our rule of thumb, when prior residence requirements apply, we consider these to be fulfilled.

Behaviour

As per our general assumptions, in the in-work case, the breadwinner is assumed to be full-time employed at the minimum guaranteed in each country (see above). The partner is inactive (i.e. being a breadwinner family is assumed to be a conscious choice). In the non-working case, all adults are assumed to be looking for work (i.e. unemployed rather than inactive), but not entitled to contributory social insurance benefits.[8]

In some countries, looking for work is defined in more detail (see also Marchal and Van Mechelen, 2017). Some countries require compliance with an individual activation contract or regular meetings with a social worker. In 2009, Lithuania even required registration with the public employment service during the six months prior to the claim. Participating in workfare measures, or benefit increases for participation in active labour market programmes (as in Slovakia and the Czech Republic) are also common conditions. For other benefits, behavioural conditions are less common, although they exist. For the child-related supplement to social assistance in Slovakia it is necessary that the children regularly attend school. In Portugal, a supplement to the child benefit exists depends on "doing well in school". In line with the guideline mentioned above, we assume these behavioural conditions to be fulfilled.

However, as a general rule, the more conditional benefits are, the less relevant they are from an adequacy perspective. In a later stage, we may therefore want to add a more minimal case, where we exclude benefits that require more effort, such as the aforementioned Portuguese child benefit, or the participation-conditional top-ups to social assistance. This is an important issue that researchers should consider when developing policy indicators based on HHoT, as well as when using the indicators presented in this paper.

4.2. Benefit selection

As explained above, we follow a 'risk-type approach': we specify the characteristics of households, and subsequently evaluate what the entitlements of these households are, given their characteristics. When working with EUROMOD-HHoT this is not sufficient to generate comparable indicators: users should also always check whether all relevant benefits are included in the model and what the default settings are. In the previous section, we defined the hypothetical households for which to compare the guaranteed

[8] These assumptions, in our view necessary to achieve a meaningful understanding of minimum income protection for the non-working of active age, in the sense that looking for work is an important eligibility condition (see Marchal and Van Mechelen, 2018), are not always straighforward to define in the HHoT add-on. In all countries, the 'unemployed' characteristic by default leads to a derived variable initiated by the add-on that indicates unemployment insurance receipt. In order to implement our assumptions of both 'looking for work' (i.e. being unemployed) and 'no unemployment insurance receipt' simultaneously, the calculation of this derived variable must be disabled. This is further detailed in Table A7 in Appendix.

minima. We already highlighted that in some countries assumptions were chosen specifically to make sure they will trigger the calculation of functionally equivalent minimum income provisions. Here we ask whether additional changes to the underlying simulation model are necessary in order to make sure all legally guaranteed benefits and income components applicable to the hypothetical household are included.

From the previous CSB-MIPI round we know which benefits those are in each country, at least for 2009 and 2012. Non-contributory legally guaranteed minimum income provisions consist of minimum wages, applicable taxes and social insurance contributions, housing and heating allowances, minimum income protection benefits for the able-bodied of active age and the elderly, child benefits and other benefits. In principle EUROMOD includes these legally guaranteed benefits. There are however some exceptions. These are generally related to the prime purpose of EUROMOD as a micro-simulation model, designed to run on survey data. First, sometimes policies are coded in such a way that prohibits the benefit to be awarded to the hypothetical household, for instance when specific policies have to be turned on manually by researchers, explicitly mandating the model to include those[9] (see Gasior and Recchia, 2018 for an overview of countries where such an action is needed to trigger the unemployment insurance benefit). Second, eligibility is sometimes taken from the data, i.e. the benefit is only calculated for households that were identified as beneficiaries in the underlying microdata. Third, the policy may not be included in EUROMOD, for instance because the parameters necessary to calculate the policy may not be available in the original microdata.

In this section we discuss the benefits included in EUROMOD, and whether some additional changes or specifications in the model itself were necessary in order to get substantively comparable indicators of minimum income protection generosity.

Minimum wages

The EUROMOD software simulates the annualized minimum wage applicable to the breadwinners in our hypothetical households, based on their age, experience, sector and working hours. These are all characteristics that we defined for the hypothetical households (see section 4.1). The only additional requirement is to make sure that the corresponding policy programming in the model is activated (see Table A5 in Appendix for more details).

[9] In future updates of the EUROMOD software, this issue will be addressed.

Minimum income protection for the non-working of active age who are willing to work

When the looking-for-work condition is coded in HHoT in the appropriate way (cf. footnote 8), the EUROMOD software will in principle select the relevant minimum income scheme for able-bodied people of working age who are willing to work. Specific additional changes required to simulate the minimum income protection for active age are summarised in Table A7 in Appendix. These pertain to either making sure the policy is switched on, or that corrections for non-take-up are disabled. These are included in EUROMOD to make sure that microdata calculations of policy effects take account of the high non-take-up present in minimum income schemes. As such a correction is superfluous when calculating the *entitlements* of hypothetical households, the EUROMOD software will usually turn off take-up corrections for input data made by HHoT. Still, for some countries additional checks are necessary for individual policies where non-take up calculations may be in effect.

Minimum income protection for the elderly

In Europe, several types of social protection schemes fulfil the function of a 'safety net of last resort' apart from the general social assistance scheme: minimum pensions, basic pensions, conditional basic pensions and means-tested minimum incomes (see Goedemé, 2013b). We would like to compare the generosity of the non-contributory minimum provisions for the elderly. These policies were often switched off in the EUROMOD 'policy spine'[10], or eligibility was taken from the data, for one of two reasons. First, for most of these minima for elderly, a residence condition applies that cannot be simulated using the usually used microdata. For hypothetical household simulations, which explicitly assume that typical persons comply with residence requirements, this is less of a problem. Second, it is difficult to disentangle the simulated non-contributory minima from the non-simulated contributory pensions using the microdata. In order to prevent double-counting of pension income, the minima for elderly are often switched off.

Table A8 in Appendix shows for which countries we had to, as a consequence, take action to turn on the policies in the policy spine. Also, when eligibility was taken from the data, it was necessary to assume benefit receipt for our model families to ensure the correct amounts were in fact calculated. Because of the comparison with the 2009 and 2012 CSB-MIPI data, where a country expert determined eligibility, we felt quite confident to do so – but of course, the more time passes since such a validation, the larger the margin of error of forcing benefit calculation in such a way.

[10] In EUROMOD, the policy spine is the part of the code that determines which policies are simulated and in which order they are simulated.

Housing and heating allowances

The combination of the different housing- and locality-related assumptions (see Section 4.1.1) usually triggered the correct housing and heating benefits. Housing costs can be too low or too high to actually entitle families to a housing allowance, but with our assumption of empirically estimated median rents this was nowhere the case. Table A9 lists the countries for which additional action was required. It usually refers to the explicit switching on of the housing allowance policy or corrections programmed in the policy spine to counteract the unreliability of the housing costs available in the usually used microdata. This latter consideration is again less relevant when assumed housing costs are used for model families.

Child benefits

The characteristics we defined for the hypothetical children usually suffice to ensure the calculation of the needed benefits. Our comparison with the child benefits included by the national CSB-MIPI experts only showed a few differences. In some cases, particularly with regard to lone-parent benefits, the assumptions used by the national CSB-MIPI experts to include these child benefit were too strict to be useful in an international comparison. For instance, in Estonia a lone-parent child benefit was included that was only awarded if the name of the father was not mentioned on the birth certificate. For the present comparison we only assume that the lone-parent households dot not have a partner and do not receive any alimony, and that the more stringent requirements of the absent parent are not fulfilled by default, meaning that the lone-parent child benefit in Estonia is not included. In other cases, the benefit is awarded purely on the basis of the lone parent not having a spouse present, and/or their income status Where this is the case, the benefits have been included. Table A10 in Appendix shows the actions needed to trigger the calculation of these benefits, where necessary.

Taxes and social insurance contributions

Taxes and social insurance contributions were broadly in line with the CSB-MIPI calculations. Differences generally pertained to a difference in accounting for mandatory private social insurance contributions, but we found no reason to prefer the original MIPI treatment relative to the programming in EUROMOD. A consistent difference regarding taxes was the inclusion of municipal taxes in CSB-MIPI, whereas these are generally not included in EUROMOD or, if included, are set at the regional or national average rather than at that of the assumed locality. This is the main reason (together with the opportunity taken for streamlining the assumptions, as discussed above) why we have to accept a break in series with the original CSB-MIPI estimates. Yet as was clear from earlier hypothetical household simulations, the impact of local

taxes for the minimum income cases we are interested in, is generally small enough not to distort cross-national and cross-temporal comparisons of minimum income adequacy.

Missing income components

Finally, from the comparison with CSB-MIPI for 2009 and 2012, we found some income components to be missing from the EUROMOD model. Whereas there are good reasons for this (e.g. it may be impossible to calculate the benefits with the available microdata, or benefits may be minor benefits with very few recipients), this does in some countries call into question the validity of the calculated net disposable incomes as indicators of the adequacy of the social floor for different target groups. Here we give an overview of the benefits that are not included in our minimum income protection indicators when we use EUROMOD-HHoT, and give an indication of the likely impact. For some of these benefits, most importantly some of the missing housing allowances, we plan to add these policies to future updates of the data. Table 1 summarises the missing income components and their impact on our indicators of income adequacy.

Notably, the general housing allowance scheme is not simulated for Austria, and in Finland prior to 2015. In both countries this is to some extent mitigated in the comparison of net disposable income due to the structure of the social assistance benefit, which covers those housing costs that are not covered by the general housing allowance. Yet researchers should be aware that EUROMOD-HHoT-based generosity indicators may underestimate the legally guaranteed minimum protection to some extent. For this reason, we do not include HHoT-based minimum income protection indicators for specific countries.

Elsewhere, the exclusion of housing benefits poses less of a problem. In Ireland, EUROMOD does not include a housing allowance that was included in the CSB-MIPI calculations. However, whereas the Irish housing allowance represents a sizeable amount for some family types, conditions for receipt are relatively strict. Most importantly, one has to show that at the start of the lease, the family was able to afford the dwelling. Such a condition of changed circumstances runs counter to our general assumption of assessing a minimal income situation. Whereas there are regional housing allowance funds in Italy, eligibility is not legally guaranteed as rankings of needy claimants and budgetary concerns are highly important in determining who gets a benefit. The exclusion of these benefits from EUROMOD will therefore not impact on the validity of our minimum income protection indicators. Even more strict is the non-simulated housing allowance in Bulgaria, which is only accessible for lone parents and pensioners living in municipal housing. Given the additional assumptions that need to be made, its exclusion will in this case not impact on the validity of the indicators of minimum income protection adequacy. The relatively low Hungarian gas consumption allowance, which was abolished in 2011, is also not included. Also in Denmark, Ireland, Italy and Lithuania, the exclusion of heating allowances may lead to slight underestimations of minimum income protection adequacy for certain target groups.

Further, the non-contributory minimum income guarantee for the elderly is not programmed for each country. In Estonia, the social pension policy is not simulated in EUROMOD as it cannot be distinguished from other pensions in the micro-data. Based on the validation against 2009/2012 CSB-MIPI values, the value of subsistence benefit together with its housing component likely exceeds the social pension rate for the cases presented in this paper.[11] The Estonian old-age case is therefore essentially accounted for. However, the longer the period between our last country-specific information and the present simulation, the less sure we can be that the general social assistance level will indeed be a good indicator of the minimally available protection to Estonian elderly. Also in Lithuania the social pension is lacking from the simulations. In Sweden, EUROMOD does not include the simulation of the conditional basic pension due to the unavailability of the residence history, which is an important eligibility condition in the usually used microdata. Prior to 2012, the elderly in Slovenia were eligible to a non-contributory state social pension, which is not simulated in EUROMOD. In 2012, this scheme got abolished and was replaced by permanent income support, which is included in EUROMOD policies, meaning that for the Slovenian old-age household, we can assess guaranteed minima from 2012 onwards.

[11] Note however, that housing cost taken into consideration for the calculation of Estonian subsistence benefit in EUROMOD are capped at average housing costs in order to avoid overestimation of granted benefit levels (cf. Tables A13-A15 in Appendix for further discussion). Such calibration was not done in EUROMOD-HHoT, leading to the simulated CSB-MIPI and MIPI-HHoT benefit levels diverging more than otherwise would have been the case. Differences between the two data sets are similar for old-age and active-age cases.

Table 1. Income components not included in EUROMOD programming.

Country	Missing income component	Impact on indicator of adequacy
AT	Housing allowance	Underestimation, not included in indicators.
BE	Housing allowance	Very small target group – only those on social housing waiting list for specific duration – no impact.
BG	Housing allowance	Very small target group – only specific categories living in municipal housing – no impact.
CZ	Job-seeking aspect of social assistance	EUROMOD does not currently withdraw social assistance from those who are unemployed and not searching for jobs, leading to an overestimation for unemployed spouses in the minimum wage-earning case. These two households are therefore excluded from the indicators.
DK	Means-tested heating subsidy for pensioners	Slight underestimation.
	Alimony benefit	Underestimation, not included in indicators.
EE	National pension	Topped-up to levels similar to or above minimum income for validated period, presumably no major impact on indicators of adequacy.
EL	Housing benefits from OEK social insurance	Very small target group – no impact.
ES	Regional housing benefits	Very small target group – no impact.
FI	Housing allowance prior to 2015	Underestimation for both, not included in indicators.
	Maintenance support for lone parents not receiving alimony	
HU	Gas consumption allowance (abolished in 2011)	Slight underestimation pre-2011.
IE	Housing allowance	Housing allowance is highly conditional and has a discretionary element – rightfully excluded – no impact.
	Heating allowance	Heating allowance exclusion leads to slight underestimation.
IT	Housing allowance	Housing allowance not legally guaranteed – rightfully excluded – no impact.
	Social card	Exclusion of heating allowances will lead to small underestimation for eligible categories.
	Gas consumption allowance	
LT	Social pension	Underestimation for elderly, not included in indicators.
	Housing cost (heating) allowance	Housing cost allowance exclusion leads to slight underestimation for eligible groups.
RO	Heating allowance	(Near) in-kind benefit – no impact.
SE	Conditional basic pension	Underestimation of minimum for elderly, not included in indicators.
	Guaranteed alimony	Guaranteed alimony included in means-test for social assistance, presumably no impact.
SI	State social pension (before 2012)	Underestimation pre-2012, not included in indicators.
	Means-tested child benefit increase for lone parents (after 2012)	Slight underestimation of adequacy indicator for lone parents.
SK	Guaranteed alimony	Requires court decision on whether or not the partner has paid alimony – no impact.

As mentioned above, in some countries, the legally guaranteed alimony is not included, usually due to lacking information on parents outside of the household. This is the case for Finland, Sweden, Denmark and Slovenia. In Finland this leads to a small underestimation of the generosity of the legally guaranteed minima for the lone parent families. A similar situation applies in Denmark, where child support varies based on the absent parent's income. This information is not available in the microdata and so is not programmed in EUROMOD, and we make no assumptions regarding the absent parent's income. As a result, the Danish lone-parent household is not included in this comparison. In Sweden, this benefit is included in the means-test for social assistance, meaning that the estimates of the guaranteed minimum for the non-working case is fully in line with what this family will actually be entitled to, even though the actual composition will be slightly different. Finally, in Slovenia the means-tested child benefit for single parents is not included after 2012, when the benefit was reformed to cover a narrower range of families where either (i) the absent parent is deceased and the child does not receive support from their estate, (ii) if the other parent is unknown, or (iii) if the child does not receive income support from the other parent. While the third situation would apply to our model household where no alimony receipt is assumed, these conditions cannot be simulated in microdata and thus the benefit is not programmed in EUROMOD from 2012 onwards. This leads to a small underestimation for the Slovenian lone-parent household, which therefore is presented separately in Appendix.

5. Results

5.1. The MIPI-HHoT indicators

In Table 2 we present the minimum income protection indicators we constructed using HHoT-EUROMOD for 2017, based on the general principles and specific assumptions and modifications outlined above in order to ensure substantively comparable indicators[12]. The corresponding indicators for the entire period 2009 – 2017 are published with open access and can be retrieved online (Marchal, Siöland and Goedemé, 2018).[13] We plan to further update this dataset regularly, and to extend it with information for the countries that are currently missing, due to the impossibility to validate against the CSB MIPI indicators or due to benefits that will be added in the (near) future.

In the remainder of this section, we first compare the MIPI-HHoT indicators relative to a "basic" EUROMOD-HHoT run, address the comparability of these indicators to the former CSB MIPI dataset, and assess the validity of these indicators to track trends in minimum income protection over time.

[12] The data are based on all the assumptions and small changes to EUROMOD discussed in Section 4, a full summary of which can be found in Table A12 in Appendix. In addition, during our validation, we noted small ambiguities in some EUROMOD policies which will be addressed in the next release. In the data shown in this paper, we have already incorporated these changes.

[13] If using data, please cite as Marchal, S., L. Siöland and T. Goedemé (2018). *MIPI-HHoT*, Version 1.0.0. Zenodo. DOI: 10.5281/zenodo.2366232.

Table 2. Minimally guaranteed net disposable income for different hypothetical households, as defined in section 4, in EUR, 2017.[14]

	Working case				Non-working case				Old-age case	
	Single	**Couple**	**C2C**	**LP2C**	**Single**	**Couple**	**C2C**	**LP2C**	**Single**	**Couple**
AT	*1009*	*1267*	*2143*	*1826*	*949*	*1267*	*2143*	*1826*	*1187*	*1679*
BE	1454	1681	2110	2031	883	1175	1680	1682	1050	1399
BG	183	183	239	239	40	59	120	109	75	135
CZ	471			769	316	467	634	560	298	443
DE					819	1281	1975	1710	819	1281
DK					1222	2375	3292	*2022*	*1756*	*2573*
EE	398	398	734	645	249	353	703	614	259	353
EL	574	632	712	654					360	720
ES	764	764	813	913	424	479	709	736	582	1034
FI					999	1507	2393	*1903*	1139	1873
FR	1308	1627	2134	1968	760	1032	1505	1335	1075	1576
HU	270	270	444	470	74	140	242	199	88	147
IE	1380	1380	2413	1982	*838*	*1394*	*1932*	*1376*	1024	1970
IT									*499*	*1044*
LT	335	301	376	376	*102*	*184*	*332*	*260*		
LU	1837	2746	3776	3081	1529	2256	3226	2696	1578	2256
LV	288	288	374	374	99	164	295	282	99	164
NL	1737	1827	2218	2617	1201	1668	2059	1924	1388	1865
PL	351	419	716	788	113	172	554	533	142	241
PT	578	578	742	735	184	313	612	524	424	741
RO	233	237	313	322	31	56	151	143	114	228
SE					918	1319	2078	1756		
SI	684	757	1214	*1017*	386	593	1050	*853*	570	877
SK	356	411	582	476	180	322	457	351	180	322
UK	1154	1507	2385	2291	830	1164	1901	1726	1276	1819

Note: C2C: couple with two children. LP2C: lone parent with two children. Only countries for which 2009/2012 validation with MIPI was possible have been included. Non-minimum wage countries in 2009/2012 excluded for the working case (DE, DK, FI, IT, SE) as well as non-minimum income guarantee for those of active age in 2009/2012 (Italy and Greece). CY, MT and HR were not included in CSB-MIPI. Figures in italics indicate cases where a small under-estimation of NDI occurs due to the absence in programming of benefits which we otherwise would expect the households to receive. Finally, for some countries values are missing due to missing income components with a substantial impact. For a full overview, see Table 1.

Source: Calculated with EUROMOD-HHoT.

[14] See Marchal, S., L. Siöland and T. Goedemé (2018). *MIPI-HHoT*, Version 1.0.0. Zenodo. DOI: 10.5281/zenodo.2366232 for incomes spanning 2009 – 2017.

5.2. Comparing MIPI-HHoT indicators with the EUROMOD default

In order to show how important it is to carefully check the settings and defaults in EUROMOD when producing minimum income policy indicators, we ran a simulation using the unchanged EUROMOD program and only generally defined hypothetical households in the HHoT input data set (cf. section 4.1.1). In this simulation we omitted any triggers, policy changes or coding changes discussed in section 4.2 of this paper, as well as the country-specific assumptions and changes to HHoT that were selected only to ensure eligibility of certain benefits.

Table 3. Net disposable incomes for unchanged, default EUROMOD run as % of minimum income adequacy indicators as defined in Section 4, 2017.

	Working case				Non-working case				Old-age case	
	Single	**Couple**	**C2C**	**LP2C**	**Single**	**Couple**	**C2C**	**LP2C**	**Single**	**Couple**
AT	100	100	100	100	100	100	100	100	100	100
BE	100	100	101	101	100	101	96	101	0	0
BG	100	100	100	100	104	113	101	100	53	44
CZ	81			87	77	80	85	82	76	79
DE					100	100	100	100	100	100
DK					100	100	100	101	100	100
EE	100	100	100	100	95	100	100	100	95	100
EL	100	100	100	100					56	42
ES	100	100	100	100	0	0	7	7	0	0
FI					100	100	100	100	88	80
FR	103	115	120	113	103	102	102	102	73	67
HU	100	100	100	100	70	74	88	81	100	100
IE	100	100	100	100	22	27	41	43	0	0
IT									100	100
LT	100	100	100	100	100	100	100	100		
LU	100	100	100	100	100	100	100	100	100	100
LV	100	100	100	100	107	109	114	113	107	109
NL	100	100	100	100	100	100	100	100	100	100
PL	98	86	93	85	77	101	85	72	0	100
PT	100	100	100	100	100	100	100	100	43	42
RO	100	100	100	100	100	100	100	100	27	25
SE					100	100	100	100		
SI	100	100	100	100	100	100	100	100	68	79
SK	100	100	100	100	100	100	100	100	100	100
UK	63	70	76	79	100	100	100	100	100	100

Note: C2C: couple with two children. LP2C: lone parent with two children. Only countries included for which 2009/2012 validation with MIPI was possible. Non-minimum wage countries in 2009/2012 excluded for the working case (DE, DK, FI, IT, SE) as well as non-minimum income guarantee for those of active age in 2009/2012 (Italy and Greece). CY, MT and HR were not included in CSB-MIPI. Some countries values are missing due to missing income components with a substantial impact. For a full overview, see Table 1.

Table 3 shows the differences in outcomes of our adjusted minimum income protection adequacy indicators shown in Table 2 compared with the outcome of a default EUROMOD run on more general hypothetical households (i.e. without changes to trigger certain reactions from the model). Simulations for Austria, Italy, Lithuania, Luxembourg, the Netherlands, Slovakia and Sweden produce identical simulations, while those in Estonia and Denmark differ only marginally. Elsewhere, larger differences are found, which either illustrate the impact of our choices that aim to reflect as well as possible the adequacy of minimum income provisions for hypothetical households or the need for more fine-tuned hypothetical households in order to trigger all relevant benefits.

In the minimum wage case, due to the interaction of the hypothetical household with non-take-up corrections in the EUROMOD model (Poland and France), the non-activation of the minimum wage policy due to slightly different variables needed to detail the work situation of the earner in each household (in the UK), or the correction for potentially overestimated housing costs in the Czech Republic in the unadjusted run. In Belgium, differences are down to small variations in region-specific polices. Please note that in order to come to a meaningful comparison, we compared here with a run that was not completely unadjusted: calculation of the minimum wage was switched on to ensure a like-for-like comparison in the minimum wage-earning case.

For the non-working case at working age, some of the factors at play in the minimum wage case reoccur. The housing cost assumption programmed in the Czech housing allowance scheme remains relevant. For Latvia and France, we also see the impact of the locality assumption: the default HHoT assumption of the capital leads to higher social assistance rates than we obtain for our hypothetical households, all assumed to live in the second-largest city. In Estonia, Hungary and Ireland the differences are due to the assumption on unemployment benefit receipt: in the unadjusted HHoT version, the assumption of being unemployed (and hence to be looking for work, in contrast to the alternative labour market status inactive), triggers an assumption that the hypothetical household also receives unemployment insurance. Since we are interested in the non-contributory minimum income protection for persons looking for work, we disabled this practice in the adjusted version. This only has an effect in the abovementioned countries. The effect on disposable income is small in Estonia where social assistance leads to similar levels, while Hungary and Ireland see larger differences. Further, the need to manually trigger certain benefits in Poland and in Spain affects levels.

Finally, for the elderly case, differences for Belgium and Spain are due to changes required in EUROMOD's policy spine to switch on the pension benefits we are looking for, while Bulgaria, Finland, France, Romania and Slovenia require the benefit to be triggered in the construction of the households in HHoT by manually indicating receipt of the minimum income benefit for the elderly. Even though it is not apparent from Table 3, this is also the case for Latvia, where the unadjusted EUROMOD run leads to the simulation of the social assistance benefit rather than the non-contributory minimum income guarantee for the elderly. Country-specific age requirements are relevant for Greece, Portugal, Ireland and Poland (at least for a

single person household) where the minimum income has a higher age of eligibility than the age threshold of 65 years that we used for the unadjusted run.[15] Finally, the differences for the Czech Republic and some of the variation for Latvia is again due to the abovementioned reasons of geography and housing cost assumptions.

Importantly, EUROMOD proposes a number of baseline households. These do not specifically serve to assess the adequacy of the minimum income provisions for all three target groups discussed here. Rather, Gasior and Recchia (2018) use these baseline households in order to display the HHoT functionalities and produce estimations of the income profiles of households at various stages of the income distribution. Adjustments made in their simulation included switching on unemployment benefits in Belgium, Cyprus, Ireland, Italy, Sweden and Slovenia, while also turning on regional benefits in Spain.[16] Yet the aims of the net disposable incomes for their inactive case and our non-working case are sufficiently close to warrant a comparison, and in the process highlight the significant effects that seemingly small assumptions may have on final household incomes. In Table 4, we therefore compare the minimum income adequacy indicators presented in Table 2 to the net disposable income in 2017 of the three family types in Gasior and Recchia's (GR) simulation. We should note here that we make no further assumptions to either data, which already leads to some ex-ante differences, most importantly due to the different ages of the children, the inactive vs. the unemployed status, and the housing costs that are in the baseline households used by GR set at 20% of the EU-SILC average wage.

The reasons for the differences found between our and GR's simulations vary in their origin. A few countries produce identical simulations, such as Bulgaria, Estonia, Hungary and Romania. Marginal differences relating to different assumptions on housing prices and resulting higher housing benefits are seen in Denmark, Finland, Sweden and the UK, and Latvia, where differences are further enhanced due to the different assumptions regarding locality. Housing benefit is meanwhile not received at all in the Netherlands due to a much higher rent leaving the households ineligible. Geographical assumptions also apply in Belgium and in Spain where, although GR turn on regional benefits in their simulation, the standard EUROMOD assumption of Madrid is used rather than the more generous Catalunya which are used for the data shown in Table 2. The treatment of housing costs in the Czech Republic is also different, as stated above. The lower levels in Germany and Portugal is due to differences in children's ages between our and GR's simulations. In addition, housing benefit and lone-parent benefit is not turned on in the unadjusted policy spine for Poland and are not further mentioned in the GR baseline indicators, leading to drastically lower disposable incomes. The Lithuanian social assistance benefits are not available to inactive households, resulting in the very low levels found above for the inactive GR hypothetical households. A few different factors contribute to differences in France, including different housing allowance rates due

[15] The lower eligibility age for women in Poland does render the couple household eligible. For the Netherlands, the increasing pension age is not yet included in EUROMOD, hence the elderly households are also awarded the basic pension under the general 65 years assumption.

[16] For a technical summary of their changes to the EUROMOD spine, see Gasior and Recchia (2018: 26).

to differences in locality and a take-up correction of social assistance Christmas bonus. This leads to higher income for singles, while the increase for households with children is negated by lower children's education allowances due to different assumptions of age.

Table 4. Inactive household NDI using changes in Gasior & Recchia (2018), expressed as % of minimum income adequacy indicators as defined in Section 4.

Country	Single	C2C	LP2C
AT	100	99	98
BE	100	98	97
BG	100	100	100
CZ	71	76	74
DE	100	94	93
DK	100	102	103
EE	95	100	100
ES	89	82	79
FI	100	99	98
FR	103	99	100
HU	100	100	100
IE	100	100	100
LT	-34	-1	12
LU	100	98	97
LV	107	114	113
NL	100	98	98
PL	63	91	83
PT	100	94	90
RO	100	100	100
SE	100	89	88
SI	100	100	100
SK	100	96	95
UK	100	100	100

Note: C2C: couple with two children. LP2C: lone parent with two children. Only countries included for the non-working case in MIPI-HHoT were included for comparison.

5.3. Comparing CSB-MIPI and MIPI-HHoT

Before turning to the trends in household income displayed in the 2009-2017 MIPI-HHoT time series, the question whether CSB-MIPI and the new MIPI-HHoT dataset are comparable should be addressed. The 2009 and 2012 CSB-MIPI series were used to validate the EUROMOD output for this new series, ensuring that the analysis produced individual income components and net household incomes at the expected

levels. Where this was not the case, it was investigated whether there were benefits missing in the output which required manual triggers, whether levels of granted benefits were different from those that would be expected from CSB-MIPI, or whether there were income components included in CSB-MIPI which were missing altogether in the EUROMOD programming. The comparison of the two data sets found them to be largely comparable, albeit not entirely without differences. Figure 1 and Table 5 – and, more extensively, Tables A13-A15 in Appendix – show the comparison, with 2012 MIPI-HHoT net disposable incomes presented as percentages of the 2012 CSB-MIPI net disposable income for the same household.[17]

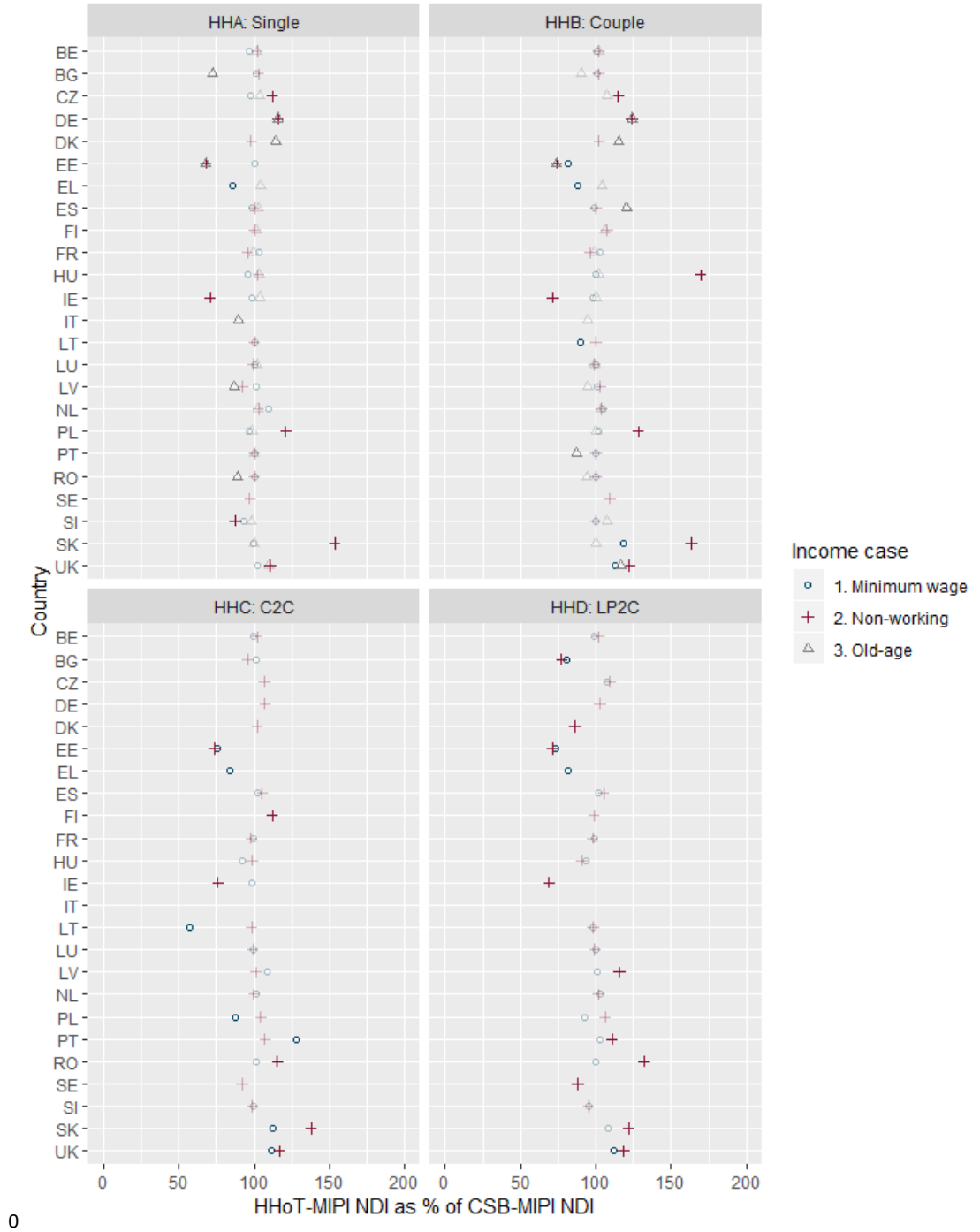
The most general cause of differences between CSB-MIPI and the new MIPI-HHoT indicators is found in the different housing costs being used: while both series use median rents derived from EU-SILC, CSB-MIPI is calculated based on the SILC 2009 wave while the MIPI-HHoT rents are based on the SILC 2015 wave.[18] Depending on country, these differences can lead to significantly higher housing-related benefits or social assistance, while in other countries the differences are minor – for Belgium, the Czech Republic, France, Hungary, Slovenia, Sweden and the UK this is the case for one or more households (elaborated fully in Tables A13-A15 in Appendix). Broadly, differences can be sorted into four categories, for instances where (i) streamlined assumptions and focus led to inclusion of additional benefits; (ii) benefits are no longer present in the updated MIPI-HHoT indicators thanks to the streamlined assumptions and focus; (iii) where benefits which ideally should be present are missing from simulation; and (iv) where benefit level or eligibility calculations have changed due to revised assumptions.

While the aim has been to keep selected benefits common between the two data series, some adjustments have been made to keep assumptions consistent. For some countries this led to benefits being added. In the old-age cases for Denmark and the UK, and both cases where Germany is included, this has led to the inclusion of heating benefits not previously counted. In Portugal a performance-based education allowance is included for children, and in Slovakia an assumption is made that non-working, adult household members are eligible for activation allowance. The total, resulting differences are generally small, except for in Slovakia where the activation allowance receipt (conditional on behaviour) leads to notably higher household incomes.

[17] Comparison is here displayed only for 2012 as the 2009 CSB-MIPI series has some differences in assumption compared to MIPI-HHoT, e.g. in that heating allowances were not investigated. Also note that CSB-MIPI included estimation of local taxes, which cannot be accurately simulated in EUROMOD. They have therefore been excluded from the comparison.

[18] Where there were too few observations for a credible estimate, median housing costs were calculated either for the whole population (Bulgaria, Lithuania and Romania) or with median calculated for households with 1-2 or 3-4 people, rather than for each household size (Estonia and Hungary). The rent estimates were up- and downrated in line with HICP for housing costs in order to reflect rents for each year.

Figure 1. Net disposable incomes of minimum wage-earning, non-working and old-age households in MIPI-HHoT as percentages of net disposable incomes in CSB-MIPI, EU-SILC median rents, 2012.



Note: Highlighted entries indicate >= 10% difference. Housing costs are SILC median rents of different waves, up/down-rated from SILC 2015 for MIPI-HHoT, and uprated from SILC 2009 for CSB-MIPI, as this was the latest available round at the time of the dataset's assembly.

Source: EUROMOD, Van Mechelen et al. (2011).

Table 5. Net disposable incomes of minimum wage-earning, non-working and old-age households in MIPI-HHoT as percentages of net disposable incomes in CSB-MIPI, EU-SILC median rents, 2012.

	Working case				Non-working case				Old-age case	
	Single	**Couple**	**C2C**	**LP2C**	**Single**	**Couple**	**C2C**	**LP2C**	**Single**	**Couple**
AT	*94*	*86*	*89*	*88*	*93*	*96*	*89*	*91*	*99*	*99*
BE	97	100	99	99	102	102	102	102	102	102
BG	101	101	101	81	103	102	96	77	72	91
CZ	97			107	112	115	107	107	104	108
DE					116	124	107	103	116	124
DK					98	102	102	*86*	*114*	*115*
EE	100	82	75	73	68	74	74	71	68	74
EL	86	88	84	81					104	104
ES	99	99	102	102	100	100	105	105	103	121
FI					100	107	112	99	102	106
FR	103	103	99	99	95	96	98	98	100	99
HU	96	100	92	94	103	170	99	91	103	102
IE	98	98	98		71	71	76	69	104	100
IT									*89*	*95*
LT	100	89	57	98	100	100	98	98		
LU	100	100	100	100	99	99	99	99	102	99
LV	101	101	109	101	92	103	101	116	87	95
NL	109	105	101	103	103	104	100	102	103	103
PL	97	102	87	91	121	128	104	106	99	100
PT	100	100	128	128	100	100	107	111	100	88
RO	100	100	102	100	100	100	115	132	89	94
SE					97	109	92	88		
SI	93	100	99	*95*	88	100	99	*95*	98	107
SK	100	119	112	108	153	164	138	122	100	100
UK	102	113	112	112	111	122	117	118	110	117

Note: C2C: couple with two children. LP2C: lone parent with two children. Only countries included for which 2009/2012 validation with MIPI was possible. Non-minimum wage countries in 2009/2012 excluded for the working case (DE, DK, FI, IT, SE) as well as non-minimum income guarantee for those of active age in 2009/2012 (Italy and Greece). Entries in italics indicate where missing benefits are the main cause of difference between the two series. In the case of lone parents in minimum wage-earning households in Ireland, comparison is not possible due to lacking documentation on lone-parent benefits in CSB-MIPI, for which reason the entry is marked as missing. Housing costs are SILC median rents of different waves, down-rated from SILC 2015 for MIPI-HHoT, and uprated from SILC 2009 for CSB-MIPI, as this was the latest available round at the time of the dataset's assembly.

The second category concerns cases where benefits previously included are now excluded, either due to contribution requirements or discretionary elements. Greek minimum wage-earner families include family benefits in CSB-MIPI that are not simulated in EUROMOD, but that would be excluded in MIPI-HHoT regardless as they are conditional upon previous contributions. A heating allowance received by old-age households in Romania in CSB-MIPI is not included due to largely being in-kind. Discretionary housing benefits as previously received in Bulgaria, Ireland and Italy are also excluded. To this can also be added the third category where benefits are missing, as discussed above in Section 4.2 on missing income

components. This is notably the case for housing allowances in Austria and (pre-2015) in Finland, the heating allowance in Italy, and lone-parent benefits in Denmark, Ireland and Slovenia. These cases are included in italics in the tables but presented separately in Appendix.

For the final category, where country-specific assumptions differ between the two data series, we have sought to harmonize assumptions for cross-country comparability. This has led to adjustments to slightly lower minimum wages than in CSB-MIPI for Belgium and Greece where work experience was previously assumed to be 12+ months and 10+ years respectively, and in Slovenia and the UK where households were previously assumed to be social rather than private renters. For comparability, and as social housing is not available to all households, households are now assumed to be living in privately rented accommodation, with some consequences for the calculation of housing allowances. Also, for Romanian non-working households, 2012 differences are due to CSB-MIPI being estimated before a social assistance reform that year, and MIPI-HHoT being estimated after.

Finally, there are some cases where the calculation or eligibility for certain benefits and payments differ from CSB-MIPI in ways not necessarily related to different assumptions, but to the way in which calculations are made. In these cases we have consulted EUROMOD country teams and external literature to determine how the income components are to be interpreted and awarded. The MIPI-HHoT indicators represent our best understanding of each country's situation.

5.4. Trends

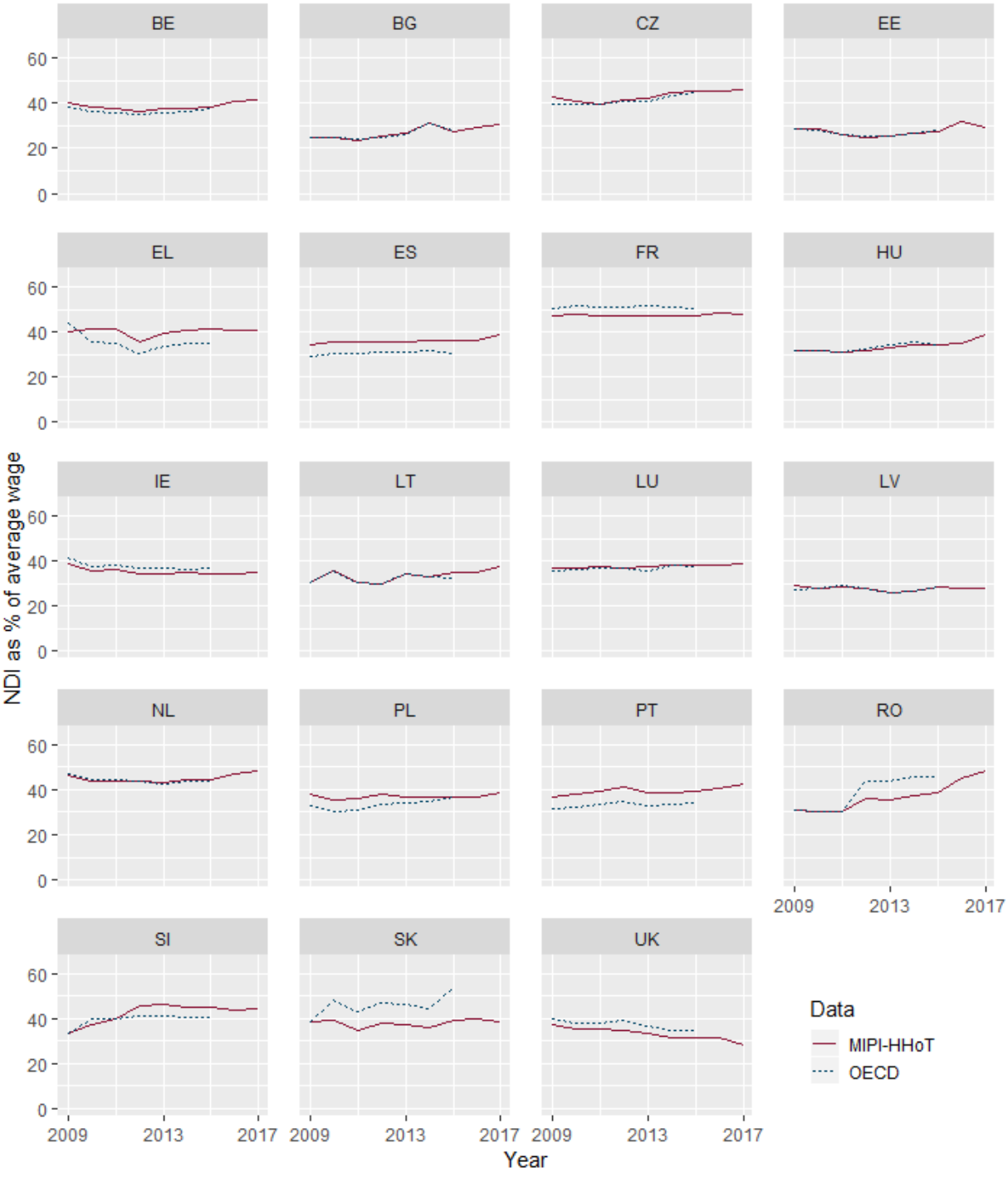
In order to verify the validity of our institutional minimum income protection adequacy indicators, we compare the trends shown by our indicators to those in other datasets which are commonly used in literature: the OECD Benefits and Wages output data (OECD B&W) and SaMIP. These datasets do not share all assumptions made in our MIPI-HHoT simulations, but both allow for a comparison with datasets that similarly investigate the income situation of minimum wage and social assistance households. The OECD B&W dataset includes a wider range of incomes, simulating the income situation for a number of households from a household employment income of 0 to 220% of the country's average wage, noting the tax and benefit implications for each percentage increase of incomes. In particular, OECD B&W allows for a comparison of disposable incomes before and after entering work. This means that some benefit eligibility assumptions differ, in that a minimum wage-earner in B&W is assumed to have just left unemployment and therefore may retain some social assistance while it is phased out, while no such assumption is made in our EUROMOD-HHoT-based estimates.[19] SaMIP considers social assistance cases only and holds data for singles, couples with two children, and lone parents with two children. Housing

[19] While in both the underlying models (EUROMOD and OECD B&W) assumptions can be changed, we use the OECD series here as a general comparison point, rather than as a model we are aiming to verify or validate. Hence we maintain the different assumptions regarding labour market entry and bear it in mind when comparing the series.

assumptions also differ between the data sets: OECD assumes a housing cost of 20% of average wages, while SaMIP utilizes rent levels from Eardley et al (1994: 114) uprated using ILO indices. The aim is not to validate the data in either OECD B&W or SaMIP, but to use both datasets as a reference point against which trends and possible divergences of our self-constructed indicators can be explained. Importantly, we did not find a full dataset on minimum income protection for the elderly. Hence, our validation for these series is limited to 2009 and 2012, the years for which CSB-MIPI is available. Large changes in more recent years are checked against descriptions of policy changes, to see whether there is an actual basis for these trends.

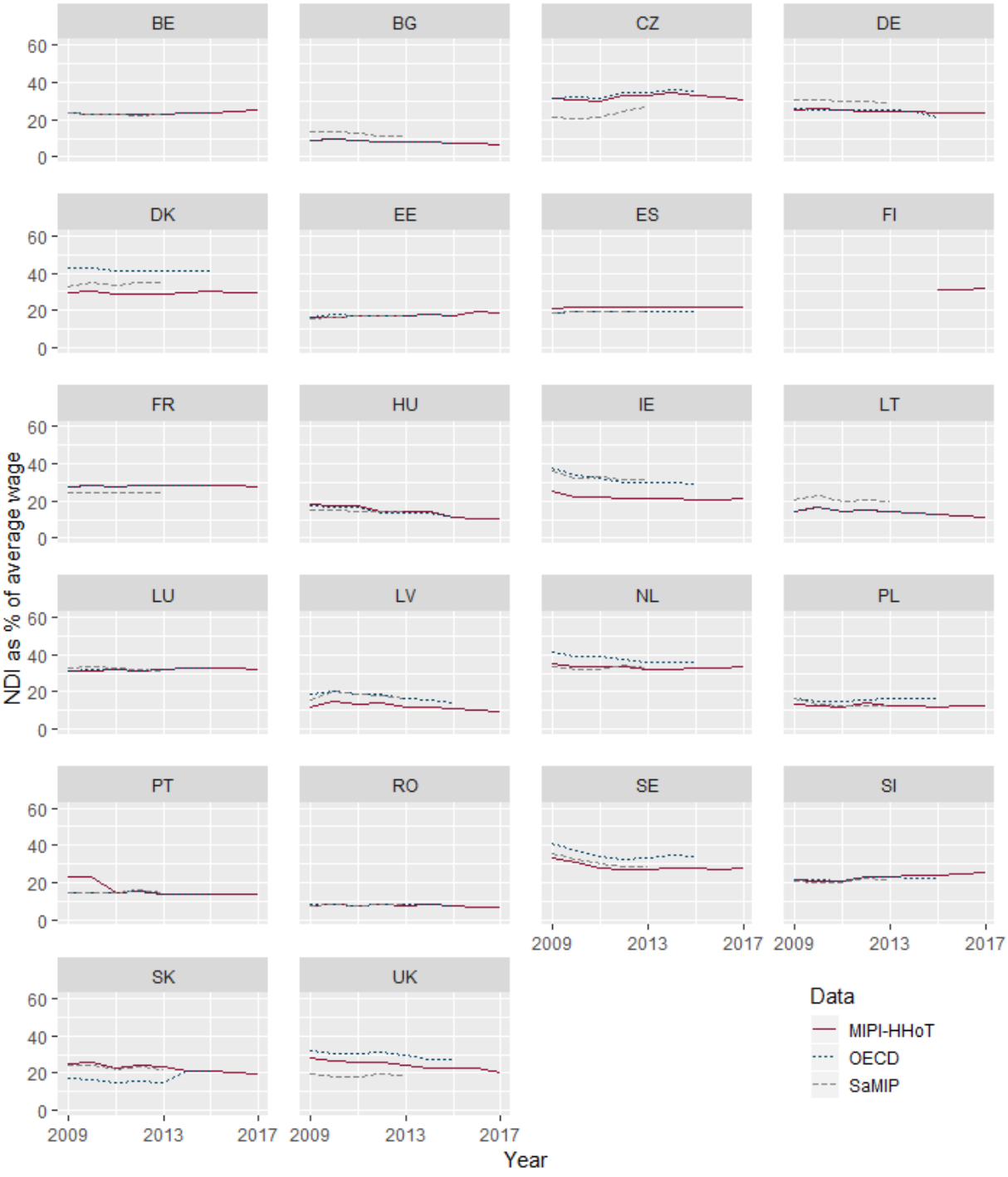
Below in Figures 2 to 4 we show the net disposable incomes for single person households in the three minimum income situations (working and non-working active age, and elderly) as per the assumptions discussed in this paper, and compare them to trends in the above mentioned datasets. An overview of the validation for the other family types for which a validation was possible is provided in Appendix with Figures A1-A7. Also note that Austria, Finland and the Danish and Slovenian lone-parent case are presented separately in Appendix in Figures A8-A11 as Austria lacks simulation of housing benefits for the whole time series, Slovenia lacks simulation of lone-parent benefit after 2012, Finland lacks simulation of alimony benefit for lone parents as well as housing benefit before 2015 and Denmark lacks simulation of lone-parent benefits for the full series. Additionally, the discussion above regarding missing income components and possible resulting underestimation applies for Ireland, Italy and Lithuania.

Figure 2. Trends of minimum guaranteed net disposable income for a working single, 2009 – 2017, MIPI-HHoT vs. OECD output data, net disposable income as % of EU-SILC average wages.



Source: EUROMOD, OECD (2018) 'Benefits, Taxes & Wages', *Social Protection and Well-being* database.

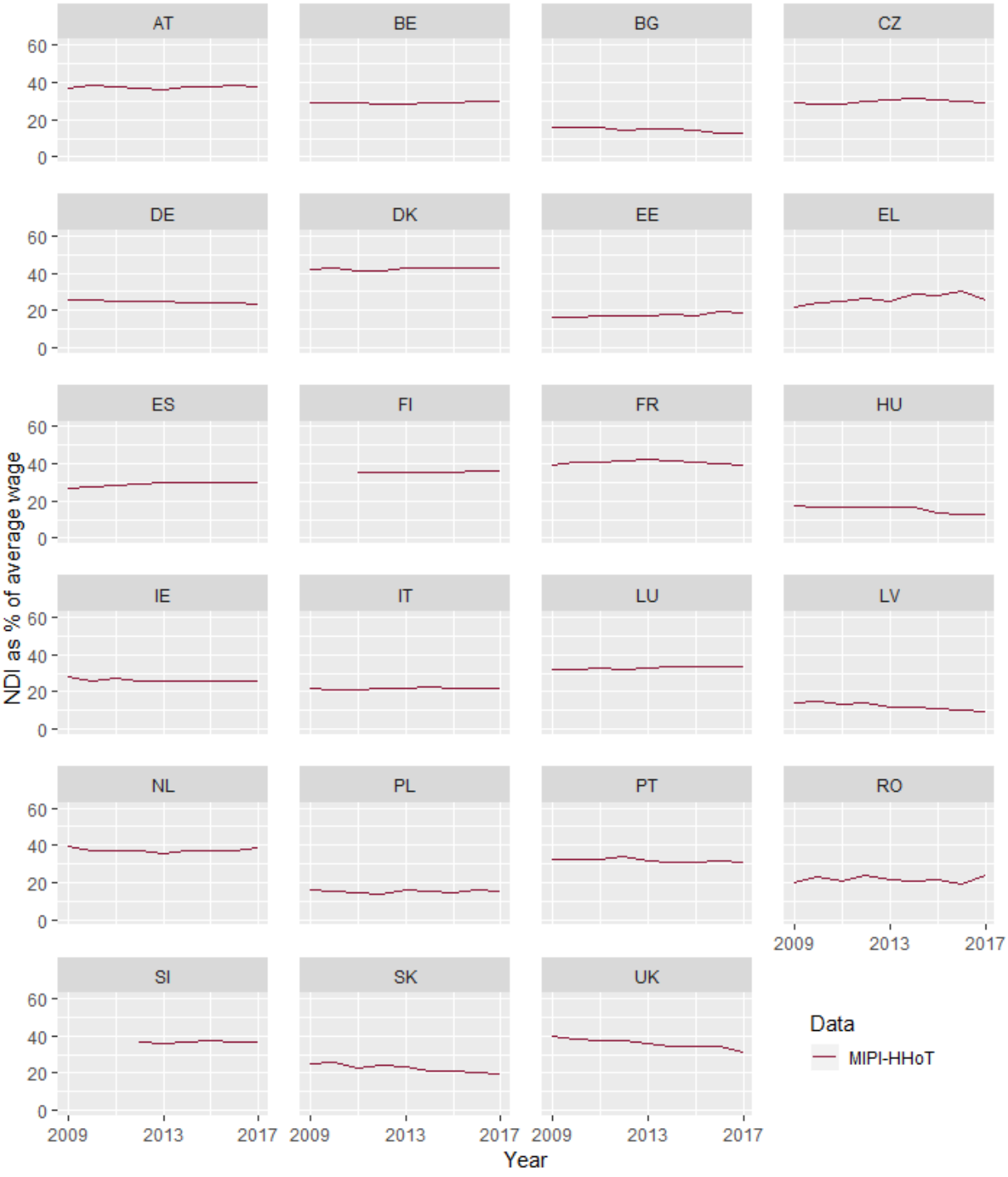
Figure 3. Trends of minimum guaranteed net disposable income for a non- working single, 2009 – 2017, MIPI-HHoT vs. OECD output data and SAMIP data, net disposable income as % of EU-SILC average wages.



Note: Austria and Finland pre-2015 are not included due to housing allowance not simulated, or not simulated for the full period in EUROMOD.

Source: EUROMOD, OECD (2018) 'Benefits, Taxes & Wages', *Social Protection and Well-being* database.

Figure 4. Trends of minimum guaranteed net disposable income for single old-age household, HHoT 2009 – 2017, MIPI-HHoT, net disposable income as % of EU-SILC average wages.



Note. The Finnish guaranteed pension was only implemented in 2011. The previous conditional basic pension is not included in EUROMOD, due to its residence requirements.

Source: EUROMOD.

Figure 2 shows the net disposable incomes for a single person household earning a minimum wage, with the net disposable incomes calculated according to the approach outlined in this paper based on EUROMOD-HHoT, respectively taken from the OECD Benefits and Wages output data.[20] For the single person households shown in Figure 2, we find that the trends for all countries bar the Czech Republic, France, the early part of the Greek time series, Poland, Romania, Slovenia and Slovakia match closely, or even exactly. Where differences occur these can be found in benefits associated with former benefit recipients returning to work – as is the case in Slovakia, France and Romania – or in variations regarding the housing assumption and resulting benefits, as is the case in Greece in 2009, Poland and the Czech Republic. In Slovenia, differences early in the series are due to slightly different income tax assumptions, after which differences are also due to housing assumptions. The same conclusions mostly hold for the couple households, although we here also see some differences early on in the series for Portugal, where the OECD household qualifies for social assistance due to recently taking up employment, and in Bulgaria due to the heating allowance that is not present in the OECD series. Larger variation occurs for the two cases where the households have children (see Figures A2 and A3 in Appendix). The discrepancies due to back-to-work allowances or housing benefits identified above generally still hold and contribute to the difference.

Additionally, different family assumptions made in OECD B&W contribute: children are assumed to be 6 and 4 rather than 14 and 7 years of age, as they are in MIPI-HHoT. Differences in Lithuania, Luxembourg, Latvia, and Portugal can all be explained wholly or in part by different age assumptions leading to different rates of child benefit or social assistance. Further, discrepancies in Bulgaria and Slovakia are rooted in the presence of alimony benefits or other lone-parent benefits which are not simulated in EUROMOD due to a lack of data.[21] Some differences in assumptions on social assistance scaling and eligibility lead to a divergence early on in the Hungarian case of a couple with children as well. Finally, for the Austrian households and the Slovenian lone-parent household (presented separately in Figures A8-A9 in Appendix) we observe generally close trends despite the missing benefits.

In the non-working household case in Figure 3 we compare the EUROMOD-HHoT net disposable incomes to those from SaMIP households and to OECD households with no employment income. For the single

[20] The OECD output data do not explicitly identify specific income cases to be a minimum wage case. The minimum wage case was selected from the OECD data by selecting the income case with gross incomes closest to the gross minimum wages found by EUROMOD. An alternative approach in which the appropriate income was selecting based on OECD minimum wage series led to similar results.

[21] The Slovakian benefit requires a court decision to be granted in the event that an absent parent has not paid alimony in three months. It is therefore not technically considered a benefit in EUROMOD, and as there are circumstances where it might not be granted, we do not include it. The Bulgarian benefit also requires a court order, and so the same reasoning applies. In Slovenia the effect is relatively large: if included, it would have entailed an additional income of ca. 60 EUR monthly for the Slovenian lone parent households in 2017. As a result Slovenia is presented separately in Appendix along with other countries where there are missing variables.

households shown in Figure 3 most trends match closely or exactly with the compared series.[22] Trend discrepancies occur only in a few cases: differences in Portugal pre-2011 are due to a social assistance housing supplement which was not present in the OECD data set, and in Slovakia different assumptions regarding the activation allowance for the unemployed lead to different trend curves.

The same conclusions hold for the couple households in Figure A4 in Appendix: matching trends in most countries, and differences in Portugal and Slovakia for the same reasons as the single household. Just as in the minimum wage case, Hungary sees a trend discrepancy as the OECD assumptions do not scale up social assistance in households where more than one adult is present. For households with children differences in household income levels are generally due to different assumptions on children's ages. Couples with two children, displayed in Figure A5 in Appendix, see discrepancies in trends for broadly the same countries. Small trend differences in Sweden are due to the size of social assistance being in part determined by children's ages, which vary between the two data series. It is also worth mentioning that the notable 2016 increase in Poland, after the end of the OECD series, is due to the introduction of a new, universal child benefit that year. Finally, for a lone-parent household with two children (Figure A6 in Appendix), trend discrepancies in Lithuania and Portugal can both be explained by different assumptions on children's ages. In Bulgaria the difference in trends in 2014-2015 is due to the inclusion in OECD of a lone-parent benefit that is not included in MIPI-HHoT due to its rather discretionary nature.

Finally, for the excluded cases where significant benefits are missing in the EUROMOD programming for part or whole of the time series (Finland, Austria and the lone-parent household in Slovenia and Denmark, presented in Figures A10 and A11 in Appendix), trends are fairly similar. As in the minimum wage case, there are small discrepancies early in the series for Austrian single and couple households due to the interaction between social assistance and housing benefit, the latter of which is not simulated in EUROMOD. In Finland, levels differ due to different housing cost assumption but trends generally match. Where they do not, in the couple household, this is due to housing benefit only being simulated from 2015 onward in EUROMOD. Finally, for the Slovenian lone-parent case, differences in trends are again due to lone-parent benefits being excluded from social assistance means-testing.

Figure 4 shows the trends in net disposable income for an elderly single person household relative to average wages, based on the EUROMOD-HHoT simulations. As similar time series that can be used for validation are lacking, we complemented the CSB MIPI comparison (see section 5.3) with a comparison of minimum income protection trends reflected by the MIPI-HHoT data with information on known policy changes. From this we may note that some countries have implemented new social assistance measures to provide for the elderly population, which is for instance with the case of with the 2012 implementation of Slovenia's Income Support. Slovenia's introduction of the Income Support constituted an important step

[22] Note that in the case of Finland only one comparison point is available, in 2015. Finnish pre-2015 figures, without housing allowance programmed, are shown in Figures A10-A11 in Appendix – except for a lower level due to the missing income component, trends are matching.

in guaranteeing elderly residents a statutory income replacement, but the net effect is not investigated here as we do not consider the pre-2012 situation. Smaller increases are noted over the 2009-2015 period in Denmark, the Czech Republic and Greece, although it is worth noting that the Greek case sees its 2014-2015 increase due to one-off social dividends rather than permanent reform. Generally, the trends we observe are steady in relation to the respective countries' average wages, with stark changes in only a few countries.

6. Discussion and conclusion

In this paper, we (i) highlighted issues that arise when using EUROMOD-HHoT to construct hypothetical household simulation based institutional indicators of functionally equivalent minimum income provisions for working and non-working active-age persons and the elderly, (ii) presented and discussed the underlying assumptions of our updated data set, and (iii) offered a first validation of the obtained institutional minimum income protection indicators for these three different target groups.

We based ourselves on a comparison of the old CSB-MIPI data for 2009 and 2012 to assess whether we can produce similar indicators using the EUROMOD-HHoT program. We set out to use EUROMOD-HHoT to obtain a revamped dataset providing minimum income protection indicators based on the hypothetical household approach for the years 2009-2017. Building on this comparison, we were able to produce substantively comparable institutional indicators of minimum income protection for different target groups.

In producing these data, we remained close to the assumptions underlying the original CSB-MIPI data. We covered the same hypothetical households and situations: a single with and without children and a couple with and without children; who are either working full-time, non-working but looking for work; or have to rely on minimum income protection for the elderly. Due to a lack of cross-nationally comparable and recent child care costs, we so far did not include a fifth hypothetical household included in CSB-MIPI, that of a lone parent with a young child. At this stage, we only focused on countries that were included in CSB-MIPI, i.e. for which our approach of using a thorough 2009 – 2012 comparison in order to establish whether all correct benefits were selected and included in the MIPI-HHoT adjusted data was possible. This approach allowed us to make sure that all legally guaranteed benefits included in EUROMOD were actually triggered in the simulation. We did indeed find that, due to its origin as a microsimulation model, certain coding choices had to be overridden in order to obtain minimum income protection adequacy indicators that are as complete as possible. While for the majority of countries a default run of EUROMOD let to adequate results, we have illustrated in this paper that in a limited number of countries not adjusting EUROMOD-HHoT to our purposes would have a substantial impact on the levels of the minimum income packages that are identified by the model.

In addition, our comparison indicated that for some countries certain benefits are either (i) not included in EUROMOD, or (ii) only benefit levels are simulated, with actual eligibility taken from the data. As far as the first issue is concerned, in most countries, this refers to only quite minor benefits, presumably only leading to a (very) slight underestimation of the level of the minimum income package. In contrast, due to missing some benefits we excluded Austria for both the minimum wage and social assistance cases, Slovenia and Denmark for lone-parent households and Finland for the social assistance case pre-2015. Undoubtedly, it would be useful to extend the EUROMOD model with benefits that are relevant for studying minimum income protection, even though the policies would only be used for hypothetical household simulations and not microsimulations. This is for instance the case for minimum income policies targeted at persons in old-age that require data on the number of years persons have resided in the country and some housing and heating benefits.[23] The second issue is easily resolved by assuming in the underlying hypothetical households that they are eligible, so that the model will calculate the correct benefits. Based on the 2009/2012 comparison we felt quite confident in indicating this eligibility. Self-evidently, the more time passes between an external reference point, the less trust we can have in such a solution. Hence for further extensions of these data, we may want to consult with national experts regarding such specific eligibility questions. In other words, while EUROMOD-HHoT considerably simplifies the construction of a dataset with policy indicators for minimum income policies, regular consultation with national experts will remain a crucial element for ensuring high quality and valid outcomes.

In sum, we demonstrated that it is possible to use EUROMOD-HHoT to generate valid indicators of minimum income protection packages for hypothetical households, that compare favourably to other model family datasets, and this with relatively little effort and manipulations to the underlying model needed. Based on this approach, we succeeded in providing in this paper for a large number of countries readymade institutional indicators on minimum income protection levels for different target groups. For the reasons outlined above we were hesitant to diverge too far from our reference data – although we did benefit from the opportunity to streamline the assumptions of the hypothetical households - but in principle it is possible to use the enormous versatility that EUROMOD-HHoT offers to include a wide range of hypothetical households, in line with specific research interests. Researchers that contemplate such an extension may benefit from the tables we provided in Appendix that indicate where additional actions were required in order to make sure the model calculated all the benefits necessary to capture legally guaranteed minimum income packages. Some background knowledge is indeed necessary to make sure the correct benefits are triggered. The flexibility and user-friendliness of EUROMOD-HHoT makes it very tempting to quickly generate a large number of simulations and policy indicators. Nonetheless, researchers should be aware that in-depth policy knowledge and insight into the model and the underlying assumptions is essential to understanding the extent to which the indicators are valid and comparable.

[23] We are currently working on expanding EUROMOD with the most relevant housing and heating benefits in the context of the InGRID 2 project.

Therefore, we would like to remind the reader of some important limitations of our MIPI-HHoT minimum income indicators.

First, hypothetical household indicators largely depend on the underlying assumptions. For this reason, we devoted in this paper ample attention to the underlying assumptions, and described how we operationalized them in order to communicate them to the EUROMOD-HHoT software. We aimed for household characteristics that gave a full assessment of legally guaranteed provisions, which is why we assumed full compliance with behavioural conditions. It is however conceivable that researchers may be only interested in less conditional benefits, or that they would like to focus on the treatment of more specific hypothetical households. EUROMOD-HHoT does require some study on how to define the specific assumptions in line with the design and coding of the policy system, but it does allow to assess how changes to the underlying assumptions impact on the generosity of the minimum income protection packages. Hence researchers may be more interested in the generosity of minimum income protection vis-à-vis a one-earner couple with an unemployed rather than an inactive spouse, or may want to look more closely into the relation between housing costs and housing allowances. Rather than providing all conceivable indicators, we chose to present well-documented and relatively general indicators, coupled with a thorough description of how we constructed those, so that researchers may well change some of the underlying parameters they are interested in.

Second, and related to the previous issue, one should note that hypothetical households are not representative of the broader population. They cannot be used to make generalizations beyond the rather specific hypothetical households included. Rather they offer an illustration on how the tax-benefit scheme functions in specific situations. Even though this is very often revealing by showing how tax-benefit systems operate, the selected situations may be more relevant in some countries than in others. In an earlier study, we compared how common the assumed housing situation (tenancy vs. home-ownership) or family composition was in each country (see Van Mechelen et al., 2011; Goedemé, 2012). This analysis showed large variation between countries. The focus on these relatively generally formulated hypothetical households may therefore be more favourable for certain countries than for others.

These limitations should be kept in mind when using the MIPI-HHoT data for further research. Even though we are strongly convinced of the added value of having a standardised set of validated minimum income policy indicators such as those we have presented in this paper, the nice feature of EUROMOD-HHoT is that it allows researchers to simulate a much broader range of hypothetical households. This will show to what extent the observed trends are sensitive to the specific assumptions we made, and will help to further increase insight into the functioning of tax-benefit systems and the social rights they generate for those living on a low income. Also, increasing the number of hypothetical households and varying their associated assumptions will help to overcome the (valid) critique that the representativeness of specific hypothetical households varies across time and space. When fully exploiting EUROMOD-HHoT's capacity to generate a wider range of situations to address the issue of comparability, the next big question will be

how the outcomes of simulations across a broad range of hypothetical situations can be best aggregated into macro-level indicators of the generosity or adequacy of social protection systems. Even though efforts have been undertaken in the past with a different setup (see e.g. Nelson et al., 2016, OECD, 2017, Marchal and Van Lancker, 2018), we believe there is still substantial room for improvement in this area.

In the meantime, we believe that a well-considered use of the indicators provided here, in combination with alternative simulations taking account of the guidelines we provided in Appendix, will help in furthering the research into minimum income protection.

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Appendix

Table A1. Estimated median housing costs in EUR, EU-SILC 2015.

	1 person	LB	UB	2 persons	LB	UB	3 persons	LB	UB	4 persons	LB	UB
AT	391	376	407	500	475	525	540	513	567	580	527	633
BE	500	483	517	606	573	639	602	585	619	670	633	707
BG	**128**	**103**	**153**	*Same for all cases.*								
CZ	200	184	215	258	248	268	280	262	297	261	235	288
DE	324	319	329	430	420	440	479	455	503	500	469	531
DK	563	537	590	711	685	737	872	806	938	805	716	894
EE	**200**	**156**	**244**	*Same as in 1-person case.*			**240**	**181**	**299**	*Same as in 3-person case.*		
EL	250	240	260	300	290	310	300	290	310	280	265	295
ES	430	361	499	448	409	487	400	355	445	450	401	499
FI	490	477	503	650	621	679	711	657	765	900	820	980
FR	410	390	430	500	472	528	487	461	513	580	539	621
HU	**130**	**114**	**145**	*Same as in 1-person case.*			**97**	**73**	**121**	*Same as in 3-person case.*		
IE	450	377	523	700	602	798	700	631	769	600	468	732
IT	400	382	418	430	407	453	420	390	450	400	374	426
LT	**100**	**73**	**127**	*Same for all cases.*								
LU	725	659	791	1,000	927	1,073	995	897	1,093	1,100	1,002	1,198
LV	50	26	74	65	41	89	100	9	191	63	8	118
NL	470	458	482	550	537	563	590	558	622	585	540	630
PL	117	105	129	143	120	167	131	112	151	134	94	174
PT	206	180	232	250	226	274	250	227	273	275	251	299
RO	**68**	**34**	**101**	*Same for all cases.*								
SE	517	495	538	659	639	680	714	661	768	769	732	807
SI	140	116	164	190	168	212	250	213	287	250	211	289
SK	79	67	91	120	105	135	120	112	128	120	105	135
UK	550	526	574	700	676	724	850	777	923	850	752	948

Note: In Estonia and Hungary the individual categories had less than 50 observations per cell. Therefore combined categories of the median housing cost for 1- and 2-person households, and 3- and 4-person households, were used. For Bulgaria, Lithuania and Romania even fewer observations were available (with a sample size of below 50 for whole population in Lithuania). As a result, median housing costs for the whole population were used in these cases. LB = lower bound, UB = upper bound of 95% confidence interval. Confidence intervals take as much as possible account of the EU-SILC sample designs (cf. Goedemé, 2013a).[24]

Source: EU-SILC 2015 UDB, own calculations.

[24] Sample design variables and associated Stata do-files can be downloaded from https://timgoedeme.com/eu-silc-standard-errors/.

Table A2. Age required for entitlement to minimum income guarantee for elderly.

	2009	2010	2011	2012	2013	2014	2015	2016	2017
AT	65	65	65	65	65	65	65	65	65
BE	65	65	65	65	65	65	65	65	65
BG	70	70	70	70	70	70	70	70	70
CZ	62	62	62	62	62	62	63	63	63
DE	65	65	65	65	65	65	65	65	65
DK	65	65	65	65	65	65	65	65	65
EE	63	63	63	63	63	63	63	63	63
EL	65	65	65	65	67	67	67	67	67
ES	65	65	65	65	65	65	65	65	65
FI*			62	62	62	63	63	63	63
FR	65	65	65	65	65	65	65	65	65
HU	62	62	62	62	62	62	62	62	62
IE	66	66	66	66	66	66	66	66	66
IT	65	65	65	65	65	65	65	65	65
LT	62.5	62.5	62.5	62.66	62.83	63	63.16	63.33	63.5
LU	65	65	65	65	65	65	65	65	65
LV	62	62	62	62	62	62.25	62.5	62.75	63
NL	65	65	65	65	65	65	65	65	65
PL	65	65	65	65	65	65	65	66	66
PT	65	65	65	65	65	66	66	66	66
RO	64	64	64	64	65	65	65	65	65
SE	65	65	65	65	65	65	65	65	65
SI	66	66	66	66	66	66	66	66	66
SK	62	62	62	62	62	62	62	62	62
UK	65	65	65	65	65	65	65	65	65

Note: In order to ensure households qualified, the age used in the model families was *n*+1, where *n* is the age in the above table. The Finnish guaranteed pension was only implemented in 2011. One is eligible if one receives a pension and is at least 62/63 years old. The official retirement age is 65, which is also the eligibility age for immigrants claiming a guaranteed pension.

Source: EUROMOD and EUROMOD country reports.

Table A3. Standard full-time hours as defined in the EUROMOD policy spine

	2009	2010	2011	2012	2013	2014	2015	2016	2017
AT	40	40	40	40	40	40	40	40	40
BE	38	38	38	38	38	38	38	38	38
BG	40	40	40	40	40	40	40	40	40
CY	38	38	38	38	38	38	38	38	38
CZ	40	40	40	40	40	40	40	40	40
DE	37	37	37	37	37	37	37	37	37
DK	37	37	37	37	37	37	37	37	37
EE	40	40	40	40	40	40	40	40	40
EL	40	40	40	40	40	40	40	40	40
ES	40	40	40	40	40	40	40	40	40
FI	37	37	37	37	37	37	37	37	37
FR	35	35	35	35	35	35	35	35	35
HR	40	40	40	40	40	40	40	40	40
HU	40	40	40	40	40	40	40	40	40
IE	40	40	40	40	40	40	40	40	40
IT	38	38	38	38	38	38	38	38	38
LT	40	40	40	40	40	40	40	40	40
LU	40	40	40	40	40	40	40	40	40
LV	40	40	40	40	40	40	40	40	40
MT	40	40	40	40	40	40	40	40	40
NL	38	38	38	38	38	38	38	38	38
PL	40	40	40	40	40	40	40	40	40
PT	40	40	40	40	40	40	40	40	40
RO	40	40	40	40	40	40	40	40	40
SE	37	37	37	37	37	37	37	37	37
SI	40	40	40	40	40	40	40	40	40
SK	40	40	40	40	40	40	40	40	40
UK	35	35	35	35	35	35	35	35	35

Source: EUROMOD country reports, EUROMOD coding.

Table A4. Dwelling size limits for housing benefit eligibility or calculation, where relevant (m^2).

	Single (one person)	Couple (2 persons)	Lone parent with 2 children (3 persons)	Couple with 2 children (4 persons)
EE	33	51	69	87
HU	*35*	*45*	*55*	*65*
PL	35	40	45	55
SI	*30*	*45*	*55*	*65*

Note: HHoT default assumptions on flat size are 70.8 m² for Estonia and 65 m² for Poland (65 m2). While flat sizes affect housing benefits in Hungary and Slovenia, the policy spine assumes the family-size-dependent maximum size and as such no additional assumptions in HHoT are necessary. In Estonia the square meter "norm-space" of the dwelling is calculated as 15+(18*number of people in household), with square metres above the norm-space not taken into account in the calculation of the benefit. The size of dwellings in Poland can be up to 30% above the listed limits and still qualify for the benefit, although the level granted decreases proportionally – e.g. if an apartment is 30% above the limit, only 70% of the house area is taken into consideration when calculating the benefit entitlement.

Source: EUROMOD country reports.

Table A5. Activation of and changes to the minimum wage calculation in EUROMOD.

	Action required in EUROMOD policy spine	Action required for HHoT
SI	Turn on yem_s in policy spine.	In Derived Variables, indicate under yem00 assumption [yemtx > 0], and value [yemtx+yemtn].
UK	Turn on yem_s in policy spine.	Add > 0 in "main employment income" (yem). Enter working hours in "hours worked per week: main/basic" (lhw00).
All others		Add > 0 in "main employment income" (yem). Enter working hours in "hours worked per week", lhw.

Note: Austria, the Netherlands and Portugal include scaling of minimum wages to take into account holiday allowances. Scaling up to take into account payment of the 13th and 14th months' salary has been added for Belgium, Greece and Spain. These latter changes will be incorporated in future versions of EUROMOD.

Denmark, Finland, Italy and Sweden are excluded from the minimum wage household simulation as no statutory minimum wage exists. Germany is similarly excluded as a minimum wage only has been in place since 2015, and therefore no comparison was possible with 2009 and 2012 CSB-MIPI data.

Table A6. Geographical assumptions specified for the hypothetical households (first column) and the default region in EUROMOD.

Country	MIPI-HHoT region	Default region in EUROMOD	Impact of choice on NDI	Full list of regions (drgn1 or drgn2, except LV where drgur00)
AT	Vienna	Vienna (only category)	No. No other alternatives available, so no variation.	N/A.
BE	Flanders	Brussels	Small differences in regional benefits and taxes.	Brussels, **Flanders**, Wallonia.
CZ	Stredni Cechy	Praha	Higher housing allowance in capital region Praha.	Praha, **Stredny Cechy**, Jihozapad, Severozapad, Severovychod, Jihovychod, Stredni Morava, Moravskoslezsko
ES	Catalunya	Madrid	Programmed framework of regional benefits with large variation across regions.	Galicia, Asturias, Cantabria, Pais Vasco, Navarra, La Rioja, Aragon, Madrid, Castilla y Leon, Castilla-La Mancha, Extremadura, **Catalunya**, Valencia, Ileas Balears, Andalucia, Murcia, Ceuta, Melilla, Canarias
FI	Helsinki-Uusimaa	Helsinki-Uusimaa	Higher imputed heating and water costs in northern regions.	**Helsinki-Uusimaa**, West Finland, South Finland, North and East Finland
FR	Corsica & Cities 100k>	Ile-de-France	Slightly higher benefit rates in capital region Ile-de-France.	Ile-de-France, **Corsica & Cities >100k**, Cities <100k.
IT	Lombardia	Lazio	Not at present. Location is used to define regional income tax, and the pensioner households analysed for Italy herein are below the earnings threshold to pay. Differences may however occur for working households.	Piemonte, Valle d'Aosta, **Lombardia**, Bolzano, Trento, Veneto, Friuli-Venezia-Giulia, Liguria, Emilia-Romagna, Toscana, Umbria, Marche, Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sardegna, Sicilia
LV	Other cities	Riga	Higher housing allowance available in capital city Riga.	Riga, **Other cities**, Thinly populated area
PL	Centralny	Centralny		**Centralny**, Południowy, Wschodni, Północno-Zachodni, Południowo-Zachodni, Północny
UK	North West	London	No. Location used to calculate uprating and take-up or to delimit council tax-benefit changes to only affect England. Neither of these affect current NDIs.	North East, **North West**, Yorks and the Humber, East Midlands, West Midlands, East of England, London, South East, South West, Scotland, Wales, Northern Ireland
EL, ES, LT, LV, RO	Densely populated area (variable drgur)		Generally higher benefit levels in densely populated than rural areas.	**Densely populated area**, intermediate area, thinly populated area

Note: Austria represents an exception to our general rule, since only the Viennese minimum income scheme is included in EUROMOD. Since the 2011 reform of the Bedarfsorientierte Mindestsicherung, regional variation has however declined. For Sweden, no assumptions were necessary. Even though municipalities can vary the minimum income protection level, EUROMOD is based on the national guidelines. Regional variation in the German housing allowance works through the price categories of maximum allowed rent levels, where EUROMOD assumes the median price category.

Table A7. Overview of variables covering minimum income protection for active age and actions required to trigger calculation in EUROMOD.

Country	Action required	Name of the benefit
AT		Social assistance Vienna (bsa_s).
BE		Income support (bsa_s).
BG		Guaranteed minimum income (bsa00_s).
CZ		Social assistance (bsa00_s).
DE		Unemployment benefits II and social benefits (bunnc_s).
DK		Social assistance benefit (bsa_s), benefit ceiling (bsard_s, from 2017).
EE		Subsistence benefit (bsa00_s).
ES	Turn ON bsarg_s (line 41).	Regional minimum income (bsarg_s).
FI	For labour market subsidy, add bunmtmy = 12 in advanced variables.	Local authority income support (bsa00_s), labour market subsidy (bunmt_s).
FR	Turn OFF random allocation of November and December bonuses for families (37.9). Keep take-up corrections on for bsa00_s (37.12) and bsawk_s (38.10) to ensure double take-up is prevented.	Means-tested guaranteed minimum income (bsa00_s).
HU		Stand-by allowance (bsa01_s), regular social benefit (bsa02_s).
IE		Jobseekers allowance (bunnc_s).
LT		Social benefit (bsa00_s).
LU		Social assistance (bsacm_s).
NL		Social assistance (bsa00_s).
PL	Turn on temporary SA (line 41.11), turn OFF calibration (41.12). Turn ON entitlement (line 41.13). Move income list up il_bsatm from 41.14 to 41.13.	Temporary social assistance (bsatm_s).
PT		Social insertion income (bsa00_s).
RO		Guaranteed minimum income (bsa_s).
SE		Social assistance (bsa_s).
SI		Social assistance (bsa_s).
SK		Means-tested social assistance (bsa00_s).
UK		Social assistance (bsa_s).

Note: Greece and Italy are not included in the social assistance case as they did not have legally guaranteed minimum income schemes for the non-working of active age in 2009 and 2012.

In addition to the above changes, Derived variables should be adjusted in HHoT to ensure that contributory unemployment benefits are not assumed to be granted to unemployed individuals. This is done by accessing the menu for Derived variables in the HHoT add-on [Advanced Options > Manage Settings > Manage Derived Variables]. For variables bun and bunct, change assumption from [les = 5 > bun/bunct =1] to [les = 5 > bun/bunct = 0]. For variable bunmt, change assumption to [les = 5 > bunmt = 1].

Table A8. Overview of variables covering minimum income protection for the elderly and actions required to trigger calculation in EUROMOD.

Country	Action required in policy spine	Action required in HHoT	Name of the benefit
AT			No contributory pension receipt. Instead social assistance (bsa_s).
BE	Turn ON bsaoa_s (line 30) and il_meansBsaOaY (line 6.12).		Income support for the elderly (bsaoa_s).
BG	Add poamt_s to ils_dispy and il_bsaY.		Social old-age penson (poamt_s).
CZ			No specific old-age scheme, instead social assistance (bsa_s).
DE			Social assistance for old-age (bsaoa_s).
DK			Basic old-age pension (poa00_s), old-age pension supplement (poa01_s), supplementary pension (poa02_s).
EE			Pensioner's living alone allowance (bsape_s, from 2017), subsistence benefit (bsa00_s, see Note below).
EL			Social pension (boanc_s).
ES	Turn poanc_s eligibility ON and eligibility from data OFF (lines 22.10-22.11). Turn ON regional component (line 22.7).		Non-contributory old-age pension (poanc_s).
FI		Add >0 in pmmtu receipt.	Guarantee pension (pmmtu_s, from 2011).
FR		Add >0 in bsaoa receipt.	Means-tested social assistance for the elderly (bsaoa_s).
HU			Old age allowance (poamt_s).
IE			State pension (poanc_s).
IT	Change poamt_s on line 7.7.15 from + to n/a.		Social pension (poamt_s), family allowance for couple and no child (bfacpxc_s).
LU			No data on statutory pension, so social assistance (bsacm_s).
LV		Add >0 in poass receipt.	Old-age state social security benefit (poass_s).
NL			State pension (poa00_s).
PL	Change line 41.8.7 to {i_bsapm_mx >= bsapmot} & {bsapmot>0}.		Permanent social assistance (bsapm_s).
PT	Turn OFF randomization between bsaoa_s beneficiaries (lines 25.11-25.14).		Solidarity supplement for older persons (bsaoa_s).
RO		Add >0 in bsaoa receipt.	Minimum social pension (bsaoa_s).
SI			Income support (bsapm_s, from '12).
SK			No specific non-contributory pension, instead social assistance (bsa00_s).
UK			Pension credit (boamt_s).

Note: Social pensions are not simulated in EUROMOD for Lithuania and Sweden, and Slovenia (before 2012) due to data limitations, for which reason these are not included in the present analysis. This is also the case for Estonia, but as social assistance here tops up incomes to the same level, Estonia is for the time being included herein (see also discussion on page 15-16).

Table A9. Overview of variables covering heating and housing allowances and actions required to trigger calculation in EUROMOD.

Country	Action required in the policy spine	Name of the benefit
AT		
BE		
BG		Heating benefit (bsaht_s).
CZ	Change imputed rent from +0.66 xhcrt and xhcot to +1.0 on lines 20.1.2-3 and 21.4.2-3.	Housing benefit (bho_s), supplement for housing (bsaho_s).
DE		Housing benefits (bho00_s).*
DK		Housing benefit (bho01_s), housing grant (bho02_s, old-age household), green check (bhtuc_s).
EE		
EL		Lump sum heating benefit (bhoxp_s, only 2009), rent allowance (bho_s, only 2015-2016).
ES		
FI	Turn ON in spine (line 30, from '15).	General housing allowance (bho00), pensioner housing allowance (bhope_s, only old-age household).
FR		Income-tested housing allowance for those renting (bhotn_s).
HU		Home maintenance (bsaho_s).
IE		
IT		
LT		
LU		Heating allowance (bsaht_s), social assistance rent component (bsaho_s).
LV		Housing benefit from municipality (bho_s).
NL		Housing benefit (bho_s).
PL	Add xhcrt to il_bhomx (row 40.9) if not present. Turn i_bho_rti to n/a and xhcrt to + to use own rents rather than imputed.	Housing benefit (bho_s).
PT		
RO		
SE		Housing allowance (bho_s), housing allowance for pensioners (bhope_s, only old-age household).
SI		Housing benefit (bho_s).
SK		
UK		Housing benefit (bho_s), winter fuel payment (boaht_s, only old-age household).

Note: Housing benefits are not simulated for Austria, Finland (before 2015), Ireland and Italy, and are therefore not included in the analysis. Various heating benefit schemes are also missing in Denmark (for pensioners), Hungary (from 2009-2011) and in Lithuania. Where eligibility is assumed and there may be a notable impact on income levels, as is the case for Austria and Finland, these figures have been presented separately in Appendix. Where impact is smaller or where the benefit has a discretionary element, e.g. in Ireland, these are presented with the other countries.

* = Housing benefit is technically included in Germany, but cannot be received simultaneously with social assistance. However, EUROMOD carries out a correction where households that are eligible for either are allocated the one which results in the highest household income.

Table A10. Overview of variables covering child benefits and actions required to trigger calculation in EUROMOD.

Country	Action required	Name of the benefit
AT		Main child benefit (bch00_s), family bonus Vienna (bfamt_s), child tax credit (tintcch_s), child care benefit (bcc00_s), simulated supplement for child care benefit (bcctu_s).
BE		Child benefits (bch_s), child tax credit (tintcch_s).
BG		Means-tested child benefit (bchmt00_s), child benefit for education (bchedyc_s).
CZ		Child allowance (bch00_s), social allowance (bchmt_s).
DE		Child benefits (bch00_s).
DK		Ordinary child benefit (bfach00_s), child family grant (bfachnm_s).
EE		Child allowance (bch00_s), childcare allowance (bcc00_s), means-tested family benefit (bsach_s, from 2013).
EL		Child benefit (bch_s, from 2013).
ES		Non-contributory child benefit (bch00_s), regional child benefit (bchrg_s).
FI		Child benefit (bch_s).
FR		Universal child benefit (bch00_s), means-tested benefit for young children (bhcyc_s), means-tested education allowance (bched_s).
HU		Family allowance (bchnm_s), regular child protection benefit (bchmt_s), child care allowance (bccnc_s).
IE		Child benefit (bch_s), one-parent family payment (bfalp_s).
LT		Child allowance (bch00_s).
LU		Child benefit (bfauc_s), new school year allowance (bched01_s), tax bonus for children (bch00_s, until 2016).
LV		State family benefit (bfana_s), child care benefit (bfacc_s).
NL		Child benefit (bfa_s), child allowance (bch_s).
PL	Turn bchlp00_s ON (line 34.6) and eligibility from data OFF (line 34.7).	Basic child benefit (bch00_s), supplement for lone parent (bchlp00_s), supplement for starting school year (bched_s), child care allowance (bchcc_s), from ’16).
PT	If excluding performance-based education supplement, turn OFF line 19.14 – otherwise leave on.	Family benefit (bch_s).
RO		Universal child benefit (bchnm_s), means-tested family benefits (bchmt_s).
SE		Child benefit (bch00_s).
SI		Child benefit (bchmt_s).
SK		Child benefit (bch_s).
UK		Universal child benefit (bch_s), parental allowance (bcc_s).

Note: Alimony replacement benefits are missing in the simulation due to non-inclusion in EUROMOD for Bulgaria, Denmark, Finland, Slovakia and Slovenia. These are also missing in Sweden, but are there wholly replaced by social assistance.

Table A11. Overview of remaining income and tax variables, and actions required to trigger their calculation in EUROMOD.

Country	Action required	Name of the benefit
FI		Tax: National income tax (tinna_s), from 2013 broadcasting tax (tinrd_s).
FR		Other: Refund tax credits (tinrf_s) until 2016, from 2016 bsawk_s.
IE		Other: Family income supplement (bwkmt_s), jobseekers allowance (bunnc_s).
LT		Tax: Personal income tax (tin_s), from 2010 compulsory health contributions (thl_s).
NL		Other: Care allowance (bhlmt_s).
PL		Tax: Income tax (tin_s), health insurance (thl_s).
SK		Tax: Negative income tax (tinrf_s).
UK		Other: Working Tax Credit (bwkmt_s), Child Tax Credit (bfamt_s).
BE, DE, HU, PT, SE		Tax: Income tax (tin_s)
All other countries	For other countries, no component is included as "Other" unless otherwise indicated above. For income tax, ils_taxsim unless otherwise indicated above. For social insurance contributions, ils_sicee for all.	

Table A12. Summary of HHoT and policy spine changes for all three income cases.

Country	Policy spine changes required	HHoT changes required.
All	For MW calculation, turn ON yem_s in policy spine.	For MW, add >0 in "employment income". Enter hours worked in "hours worked per week" (lhw).
AT		
BE	For MIGE, turn ON bsaoa_s (line 30) and il_meansBsaOaY (line 6.12).	Add >0 in pension (poamt) receipt.
BG	Add poamt_s to ils_dispy and il_bsaY.	
CZ	For housing benefit, change imputed rent from +0.66*xhcrt and xhcot to *1.0 (lines 20.1.2-20.1.3, 21.4-2-21.4.3).	
DE		
DK		
EE		
EL		
ES	Turn ON regional SA, bsarg_s (line 41). For MIGE, turn poanc_s eligibility ON and eligibility from data OFF (lines 22.10-22.11). Turn ON regional component (line 22.7).	
FI	Turn ON housing benefit from 2015 (line 30).	Add >0 in pension (pmmtu) receipt.
FR	Turn OFF random allocation of November and December bonuses for families (37.9).	
		Add >0 in pension (bsaoa_s) receipt.
HU		
IE		
IT	Change poamt_s on line 7.7.15 from + to n/a.	
LT		
LU		
LV		Add >0 in pension (poass) receipt.
NL		
PL	Turn on temporary SA (line 41.11), turn OFF calibration (41.12). Turn ON entitlement (line 41.13). Move income list up il_bsatm from 41.14 to 41.13. Turn ON bchlp00_s (line 34.6) and eligibility from data OFF (line 34.7). To use own rent, add xhcrt to il_bhomx (line 40.9) if not present. Turn i_bho_rti to n/a and xhcrt to +. Change line 41.8.7 to {i_bsapm_mx >= bsapmot} & {bsapmot > 0}.	For MW calculation, add >0 in "main employment income" (yempj).
PT	If excluding performance-based education supplement, turn OFF line 19.14.	
RO		Add >0 in pension (bsaoa) receipt.
SE		
SI		
SK		
UK		For MW, add hours in "hours worked per week: main/basic" (lhw00) rather than lhw.

Derived variables

In HHoT, access Derived variables [Advanced Options > Manage Settings > Manage Derived Variables.]
For bun and bunct, change assumption from [les = 5 > bun/bunct = 1], to [les = 5 > bun/bunct = 0]. For Slovenian minimum wage, indicate under yem00 assumption [yemtx > 0] and value [yemtx+yemtn].

Table A13. MIPI-HHoT NDI as percentage of net CSB-MIPI NDI, EU-SILC median rents (based on SILC 2009 for CSB-MIPI, and SILC 2015 for MIPI-HHoT*), minimum wage-earning case, 2012.

	A: Single	B: Couple	C: C2C	D: LP2C	Explanation for differences
BE	97	100	99	99	**All:** Differences due to housing costs.
BG	101	101	101	81	**D:** Highly conditional housing allowance included in CSB-MIPI not included in MIPI-HHoT.
CZ	97			107	**A, D:** Differences due to housing costs.
EE	100	82	75	73	**B, C, D:** Housing costs for subsistence allowance are capped at average housing costs in EUROMOD in an attempt to avoid over-estimation of benefits, as municipalities set their own rates. Such calibration was not done in CSB-MIPI.
EL	86	88	84	81	**All:** Main differences due to CSB-MIPI assuming 9+ years' work experience. In MIPI-HHoT, we assume no prior experience. **C, D:** CSB-MIPI further includes contributory family allowances which are excluded in MIPI-HHoT.
ES	99	99	102	102	
FR	103	103	99	99	
HU	96	100	92	94	**All:** Differences due to lower granted housing supplement in MIPI-HHoT. Lower housing supplements confirmed by EUROMOD.
IE	98	98	98	N/A	**D:** Not included due to lack of documentation on CSB-MIPI case, preventing full comparison.
LT	100	89	57	98	**B:** CSB-MIPI does not withdraw health tax from non-working spouse. **C:** In MIPI-HHoT, reforms mean that families with children are no longer eligible for all child benefits previously received. Confirmed by validation.
LU	100	100	100	100	
LV	101	101	109	101	
NL	109	105	101	103	**All:** Differences due to housing costs.
PL	97	102	87	93	**All:** The housing allowance is capped at 70% of standardized expenses. In CSB-MIPI this cap is taken into account at the end of the housing allowance calculation, whereas in the EUROMOD programming the housing allowance is calculated based on 70% of standardised expenses. The MIPI HHoT indicators follow the EUROMOD approach.
PT	100	100	128	128	**C, D:** A performance-based education supplement is included in MIPI-HHoT, but not in CSB-MIPI. **C:** MIPI-HHoT deducts SIC from SA means-test calculation, leading to a higher SA benefit.
RO	100	100	102	100	
SI	93	100	99	*85*	**A:** Differences due to housing costs. **D:** Difference due to missing lone-parent benefit in EM.
SK	100	119	112	108	**B, C:** MIPI-HHoT assumes activation allowance receipt for working spouse, CSB-MIPI does not. **C, D:** MIPI-HHoT includes refundable tax credits, which CSB-MIPI does not.
UK	102	113	112	112	**All:** Differences due to housing costs.

*** Note:** Housing costs referred to in Figure 1 and Table 5 of the main text, and Tables A13-A15 in this Appendix are SILC median rents of different waves, down-rated from SILC 2015 for MIPI-HHoT, and uprated from SILC 2009 for CSB-MIPI, as this was the latest available round at the time of the dataset's assembly.

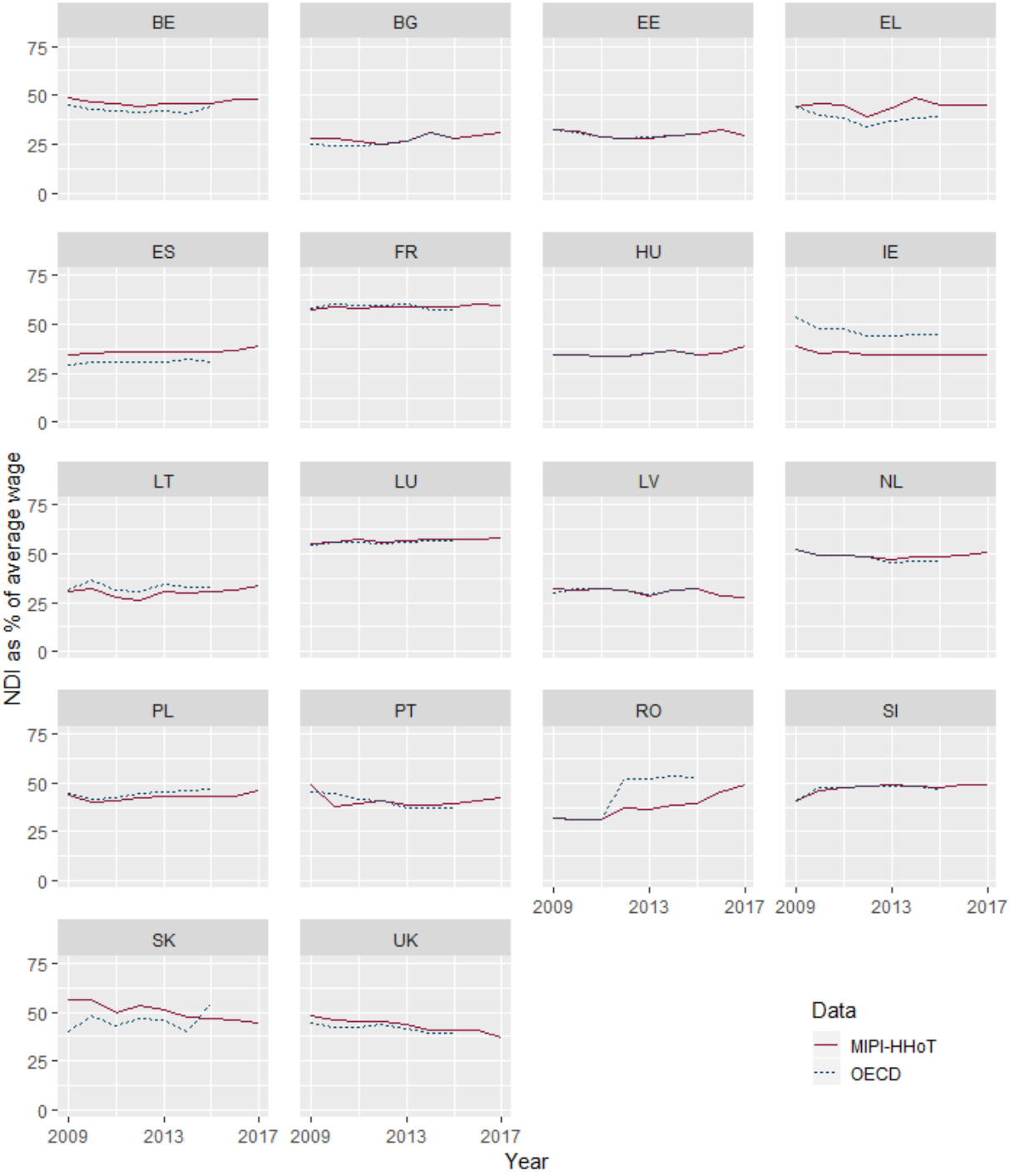
Table A14. MIPI-HHoT NDI as percentage of net CSB-MIPI NDI, EU-SILC median rents (based on SILC 2009 for CSB-MIPI, and SILC 2015 for MIPI-HHoT) non-working case, 2012.

	A: Single	B: Couple	C: C2C	D: LP2C	Explanation for differences
BE	102	102	102	102	
BG	103	102	96	77	**C,D:** In MIPI-HHoT child benefits are included in the social assistance means-test, which is not the case in CSB-MIPI. Confirmed by EUROMOD. For D, also excludes highly conditional housing allowance (cf. minimum wage case above).
CZ	112	115	107	107	**A:** Differences in housing allowance calculation. MIPI-HHoT follows EUROMOD programming.
DE	116	124	107	103	**All:** MIPI-HHoT includes in social assistance a lump-sum heating allowance based on average costs for the country.
DK	98	102	102	*86*	**D:** Alimony benefit not included in MIPI-HHoT due to missing data on contributions.
EE	68	74	74	71	**All:** Cf. discussion above for the minimum wage-earning case. EUROMOD limits social assistance levels based on average housing costs to account for municipal variation.
ES	100	100	105	105	**C, D:** CSB-MIPI only includes child benefit for one child. This should be granted *per child*, and is so in MIPI-HHoT.
FI	100	107	112	99	**All:** Housing benefits are not programmed for Finland in EUROMOD until 2015, with some knock-on effects for other benefits.
FR	95	96	98	98	**All:** Differences due to housing costs.
HU	103	170	99	91	**B:** CSB-MIPI assumes only one adult in household can receive SA. In EUROMOD, both adults can if they receive different parts of the SA. MIPI-HHoT follows EUROMOD programming. **D:** Lower social assistance in MIPI-HHoT.
IE	71	71	76	69	**All:** Housing allowance not simulated in MIPI-HHoT due to highly situational requirements.
LT	100	100	98	98	
LU	99	99	99	99	
LV	92	103	101	116	**All:** Data limitations mean that 2012 CSB-MIPI use average granted housing allowances. EUROMOD programming makes it possible to calculate the actual housing allowances.
NL	103	104	100	102	**All:** Main differences due to housing costs.
PL	121	128	104	106	**All:** Cf. Minimum wage case. Differences in order of housing allowance calculation.
PT	100	100	107	111	**C, D:** MIPI-HHoT includes a performance-based education supplement which is not in CSB-MIPI.
RO	100	100	115	132	**C, D:** Series simulated before (CSB-MIPI) and after (MIPI-HHoT) social assistance reforms, leading to difference.
SE	97	109	92	88	**All:** Differences due to housing costs.
SI	88	100	99	*95*	**All:** Differences in calculation of housing allowances and treatment of housing costs – MIPI-HHoT does not include assumptions for increases in allowed rent if renting privately, rather than non-profit.
SK	153	164	138	122	**All:** MIPI-HHoT assumes receipt of activation allowance for job-seeking individuals whereas CSB-MIPI does not given additional assumptions. See also note on conditionality in Section 4.1.2.
UK	111	122	117	118	**All:** Differences due to housing costs.

Table A15. MIPI-HHoT NDI as percentage of net CSB-MIPI NDI, EU-SILC median rents (based on SILC 2009 for CSB-MIPI, and SILC 2015 for MIPI-HHoT), old-age case, 2012.

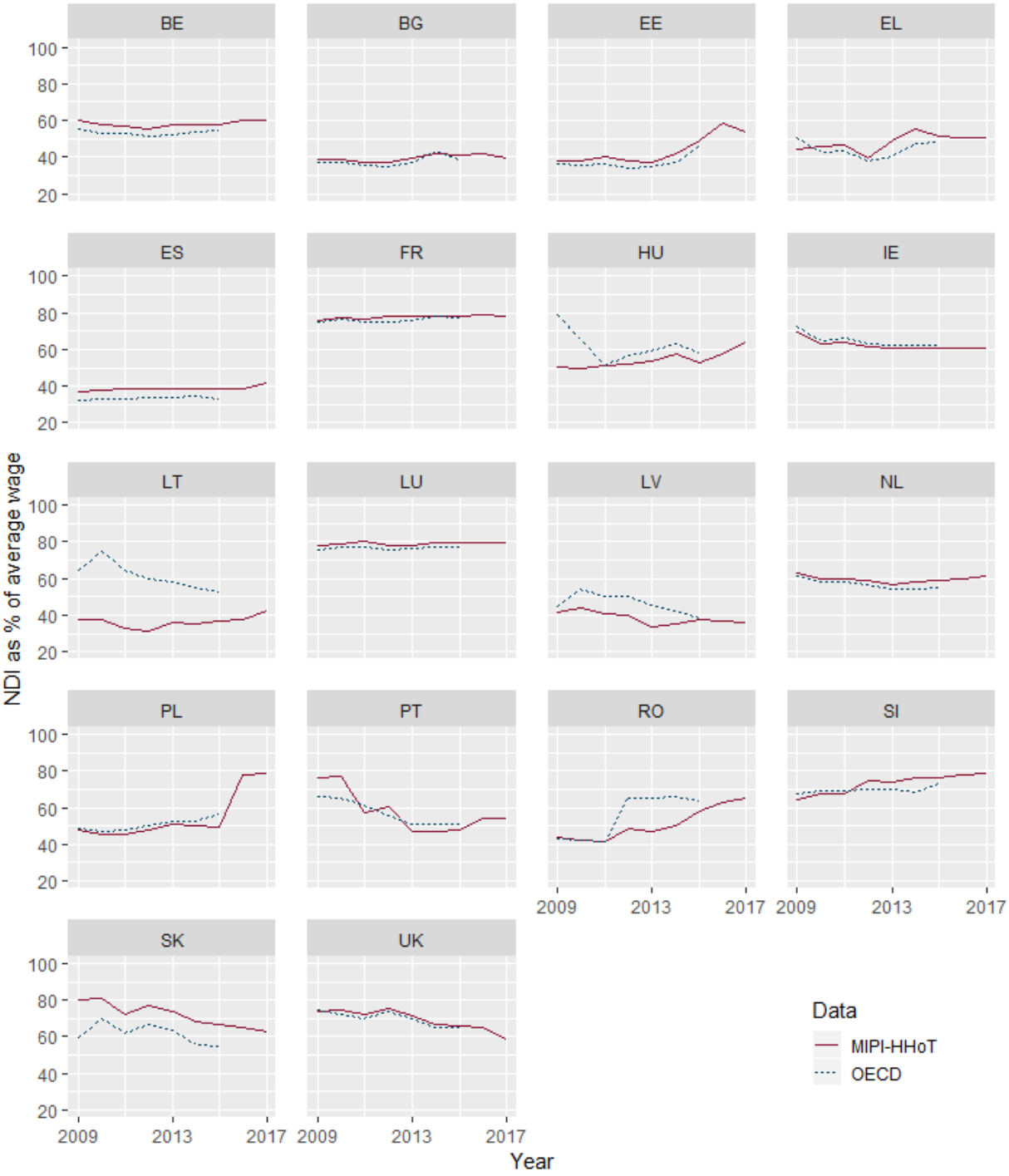
	A: Single	B: Couple	Explanation for differences
AT	*99*	*99*	
BE	102	102	
BG	72	91	**All:** CSB-MIPI includes a housing allowance which is highly situation-specific, and thus not included in MIPI-HHoT. Household B does not pass means-test for heating allowance in CSB-MIPI as a result, while they do in MIPI-HHoT.
CZ	104	108	**All:** Differences due to housing costs.
DE	116	124	**All:** MIPI-HHoT includes in social assistance a lump-sum heating allowance based on average costs for the country.
DK	*114*	*115*	**All:** MIPI-HHoT includes a Green check to compensate for energy costs, which is not included in CSB-MIPI. Further, differences in calculation of housing allowances lead to higher levels, and thus net incomes, in MIPI-HHoT.
EE	68	74	**All:** Differences due to housing costs and capping of allowed housing costs in EUROMOD (cf. discussion for minimum wage-earning and non-working cases above).
EL	104	104	**All:** Pensioners are not levied a 4% sickness social insurance contribution in MIPI-HHoT, while they are in CSB-MIPI. MIPI-HHoT follows EUROMOD programming.
ES	103	121	**B:** A pensioners' rent supplement used in CSB-MIPI is listed as household-based, whereas it is in fact individual and hence awarded to both household members in household B.
FI	102	106	
FR	100	99	
HU	103	102	**All:** Differences due to housing costs.
IE	104	100	
IT	*89*	*95*	**All:** CSB-MIPI includes housing benefit and heating subsidies which are discretionary and have low coverage due to sparse central government funding. As a result these are not included in MIPI-HHoT.
LU	102	99	
LV	87	95	**All:** Cf. IC4. Due to EU-SILC data limitations, the 2012 CSB-MIPI gives the average granted housing allowances rather than simulating independently.
NL	103	103	
PL	99	100	
PT	100	88	**B:** CSB-MIPI awards both household members the same income guarantee, whereas the second recipient should only receive 0.75 of the base rate. This is addressed in MIPI-HHoT.
RO	89	94	**All:** Differences as CSB-MIPI includes a (largely in-kind) heating benefit which EUROMOD does not.
SI	98	107	**All:** Differences due to housing costs.
SK	100	100	
UK	110	117	**All:** Differences due to housing costs and non-inclusion in CSB-MIPI of Fuel allowance for the elderly.

Figure A1. Trends of minimum guaranteed net disposable income for a couple with one minimum-wage earner, 2009 – 2017, MIPI-HHoT vs. OECD output data, net disposable income as % of EU-SILC average wages.



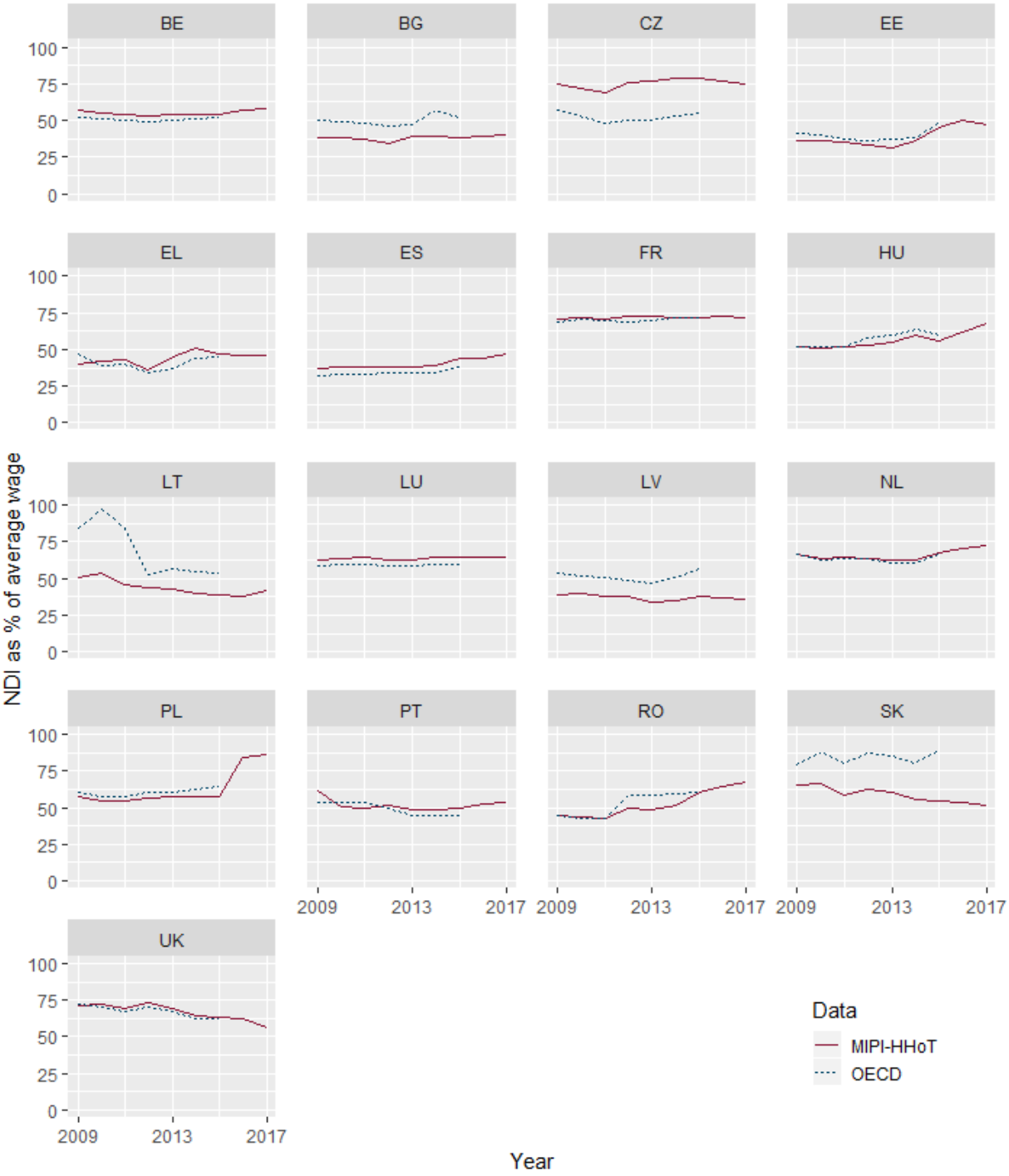
Note: Austria not included due to housing allowance not currently simulated in EUROMOD

Figure A2. Trends of minimum guaranteed net disposable income for a couple with one minimum-wage earner and two children aged 14 and 7, 2009 – 2017, MIPI-HHoT vs. OECD output data, net disposable income as % of EU-SILC average wages.



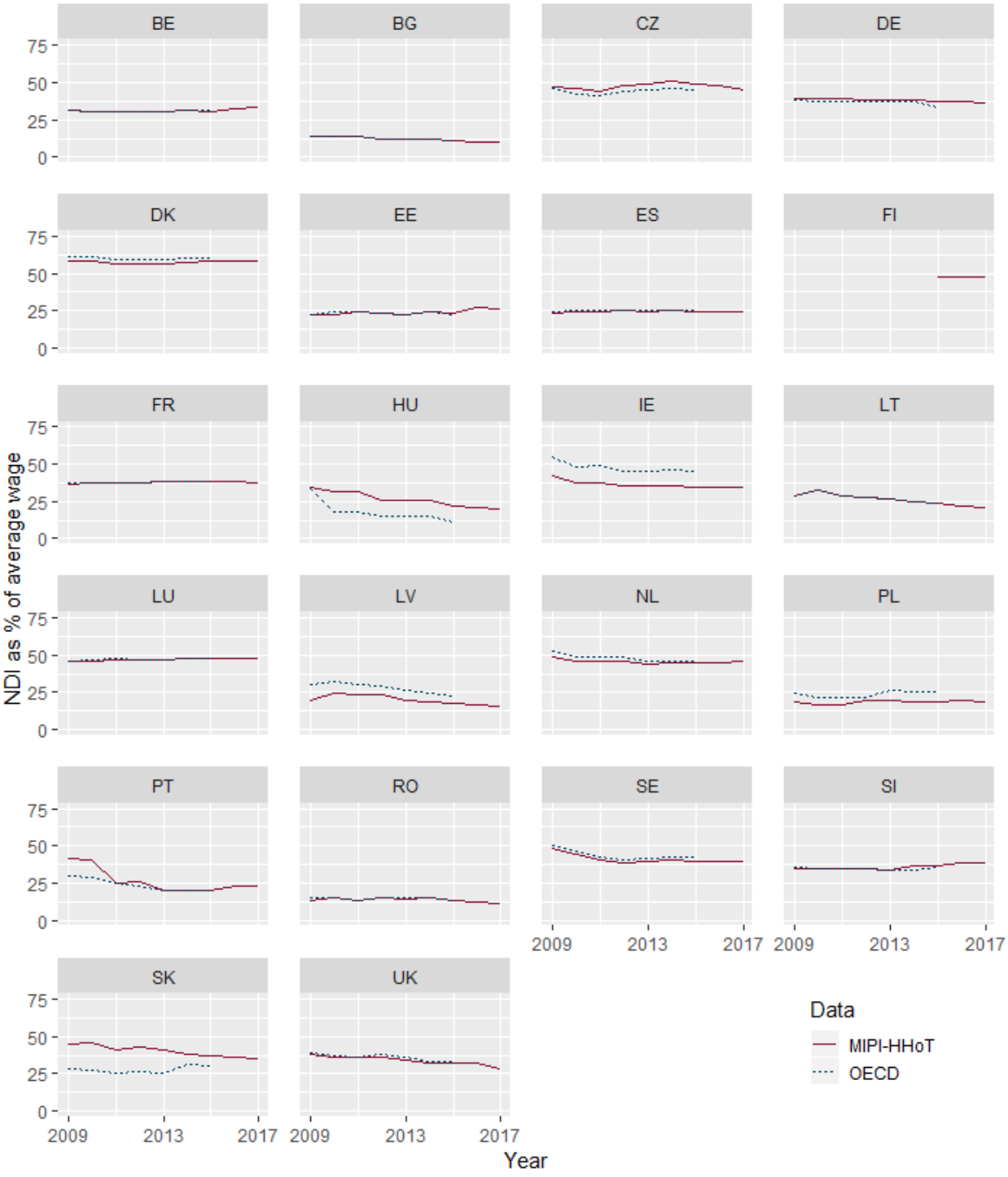
Note: Austria not included due to housing allowance not currently simulated in EUROMOD.

Figure A3. Trends of minimum guaranteed net disposable income for a lone-parent minimum-wage earner with two children aged 14 and 7, 2009 – 2017, MIPI-HHoT vs. OECD output data, net disposable income as % of EU-SILC average wages.



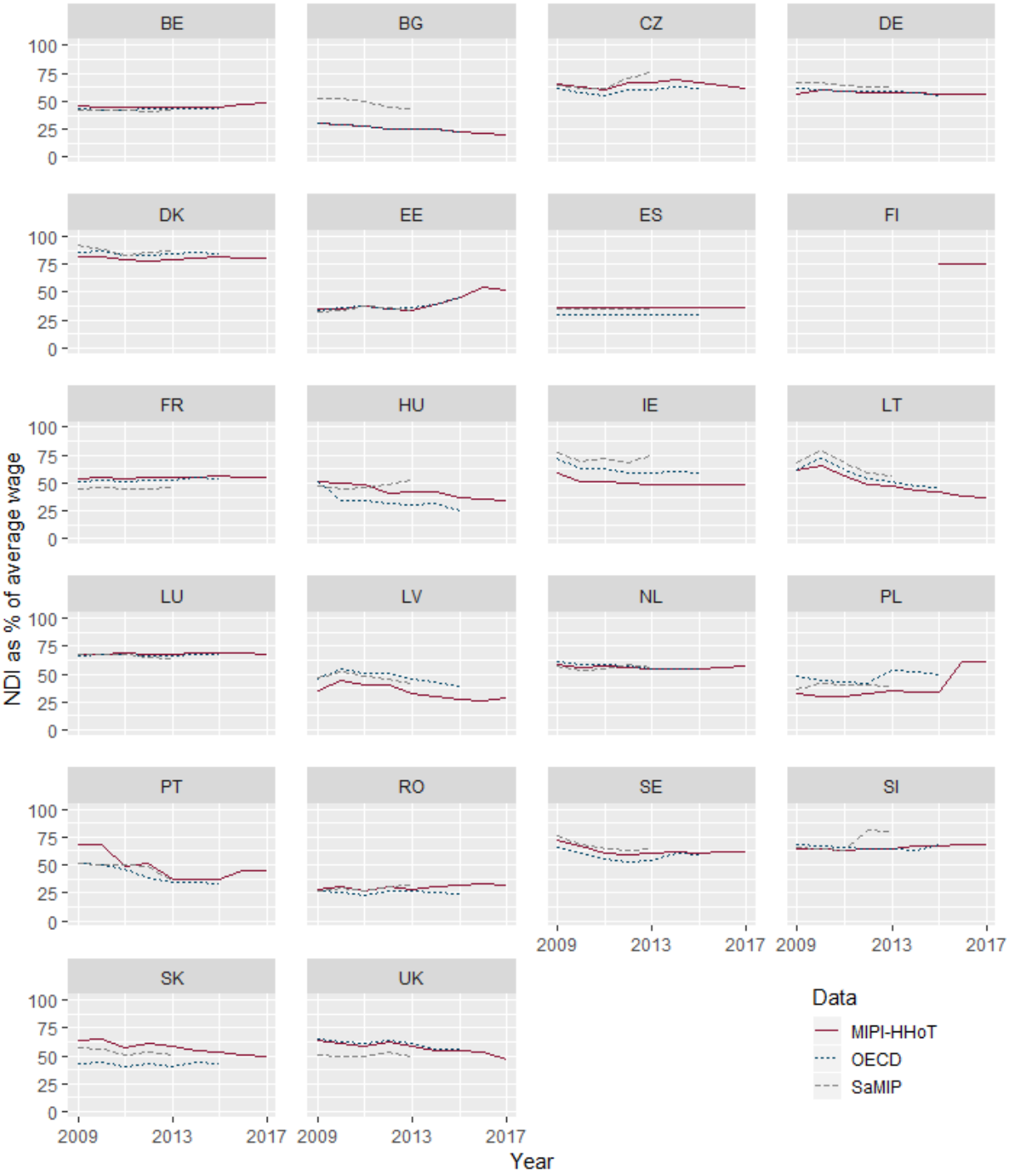
Note: Austria not included due to housing allowance not currently simulated in EUROMOD. Slovenia not included due to lone-parent benefit also not simulated in EUROMOD.

Figure A4. Trends of minimum guaranteed net disposable income for a non-working couple, 2009 – 2017, MIPI-HHoT vs. OECD output data, net disposable income as % of EU-SILC average wage.



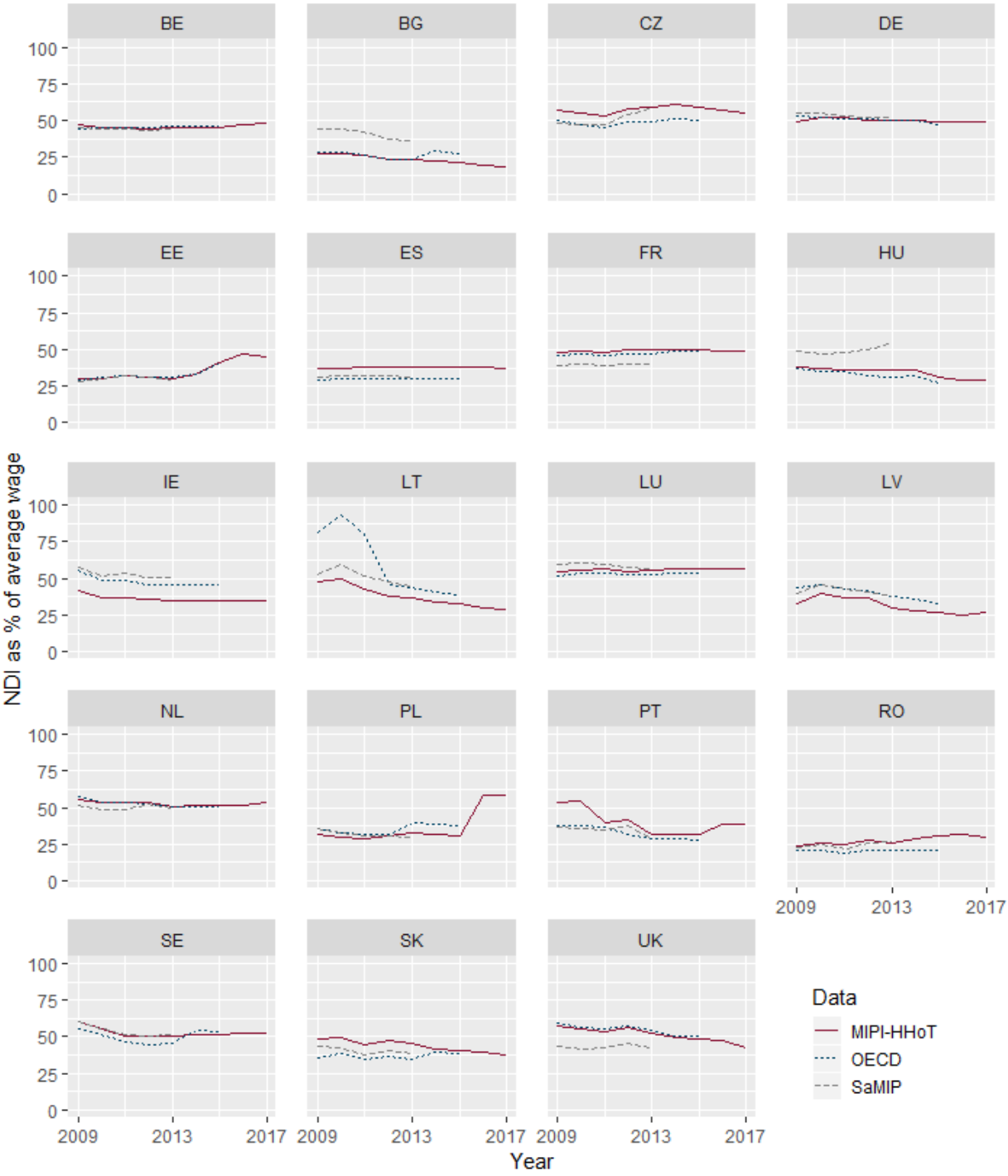
Note: Austria and Finland pre-2015 are not included due to housing allowance not simulated, or not simulated for the full period in EUROMOD.

Figure A5. Trends of minimum guaranteed net disposable income for a non-working couple with two children aged 14 and 7, 2009 – 2017, MIPI-HHoT vs. OECD output data and SAMIP data, net disposable income as % of EU-SILC average wage.



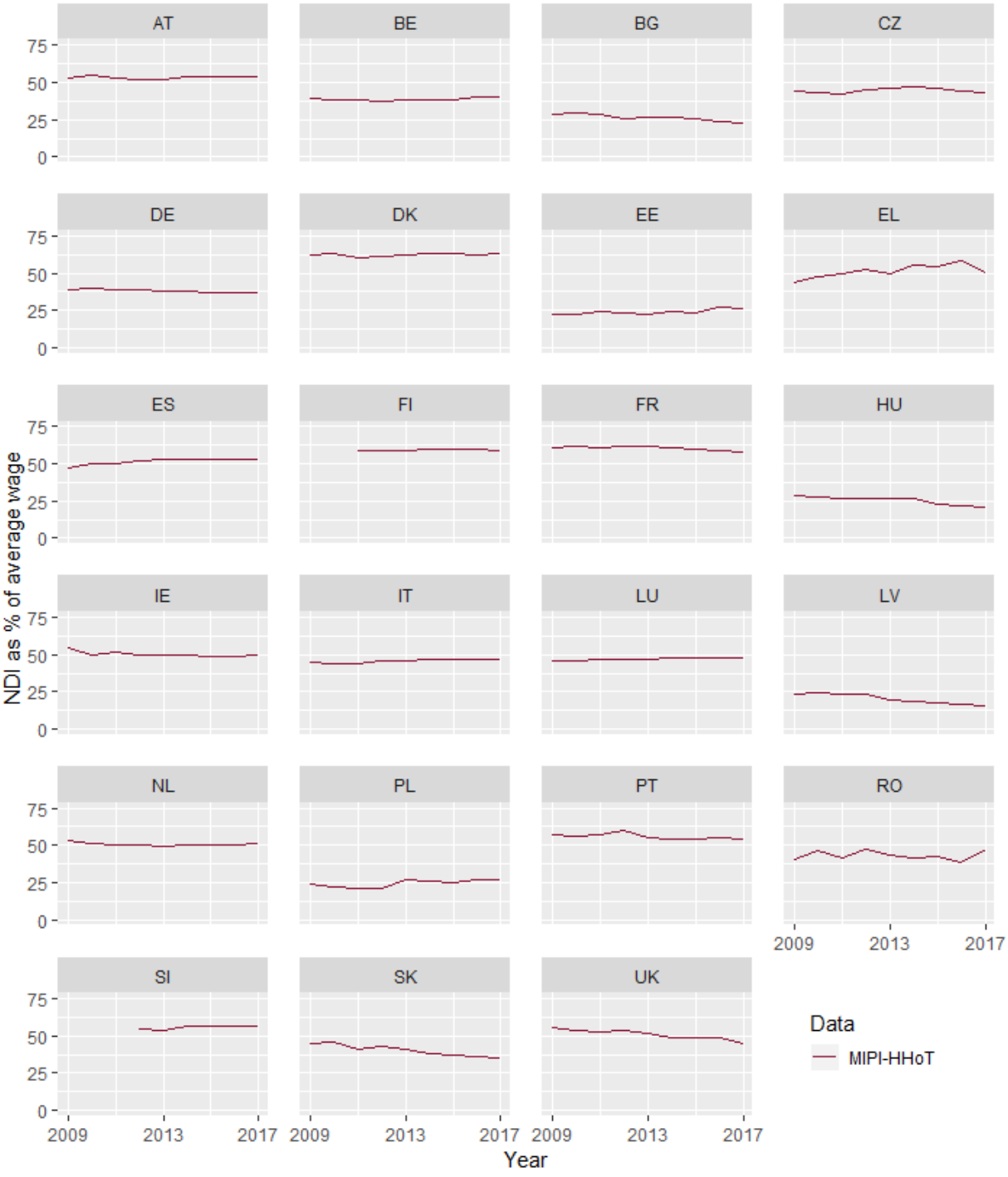
Note: Austria and Finland pre-2015 are not included due to housing allowance not simulated, or not simulated for the full period in EUROMOD.

Figure A6. Trends of minimum guaranteed net disposable income for a non-working lone parent with two children aged 14 and 7, 2009 – 2017, MIPI-HHoT vs. OECD output data and SAMIP data, net disposable income as % of EU-SILC average wage.



Note: Austria not included due to housing allowance not simulated. Slovenia and Denmark not included due to missing alimony benefits. Finland not included as missing both alimony benefit and housing benefit.

Figure A7. Trends of minimum guaranteed net disposable income for old-age couple household, 2009 – 2017, net disposable income as % of EU-SILC average wage.



Note: Slovenian simulations begin in 2012, as this was when the minimum income guarantee for the elderly was implemented. The Finnish guaranteed pension was only implemented in 2011. The previous conditional basic pension is not included in EUROMOD, due to its residence requirements.

Figure A8. Trends of minimum guaranteed net disposable income for households with one minimum wage-earner: single, couple and couples with two children aged 7 and 14, 2009 – 2017, MIPI-HHoT vs. OECD output data, net disposable income as % of EU-SILC average wage, Austria.

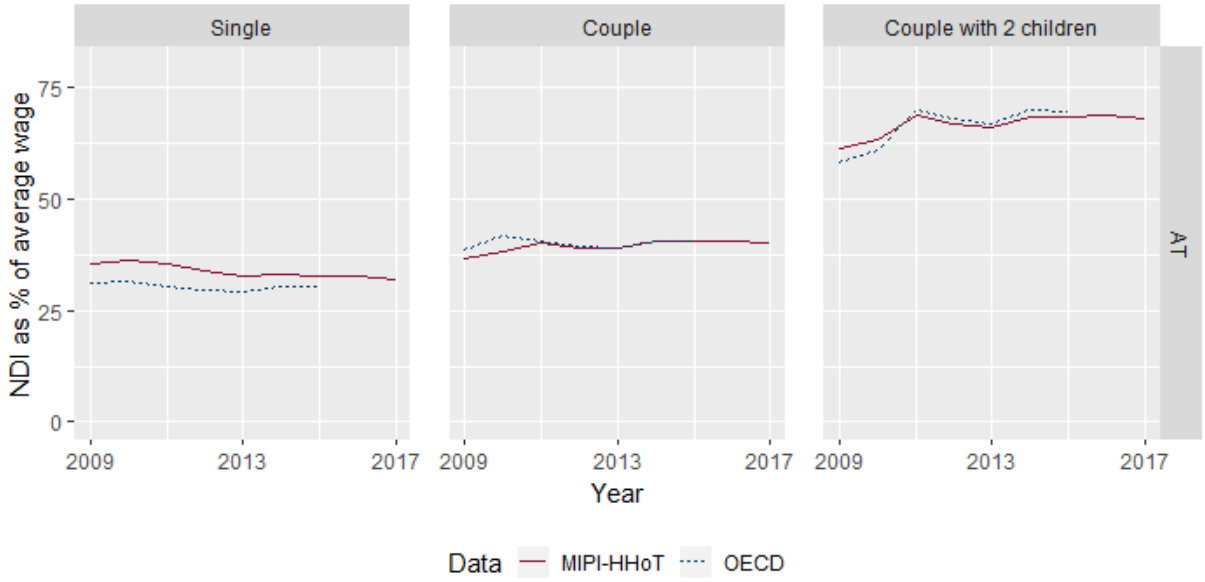


Figure A9. Trends of minimum guaranteed net disposable income for a lone parent minimum-wage earner and two children, 2009 – 2017, MIPI-HHoT vs. OECD output data, net disposable income as % of EU-SILC average wage, Austria and Slovenia.

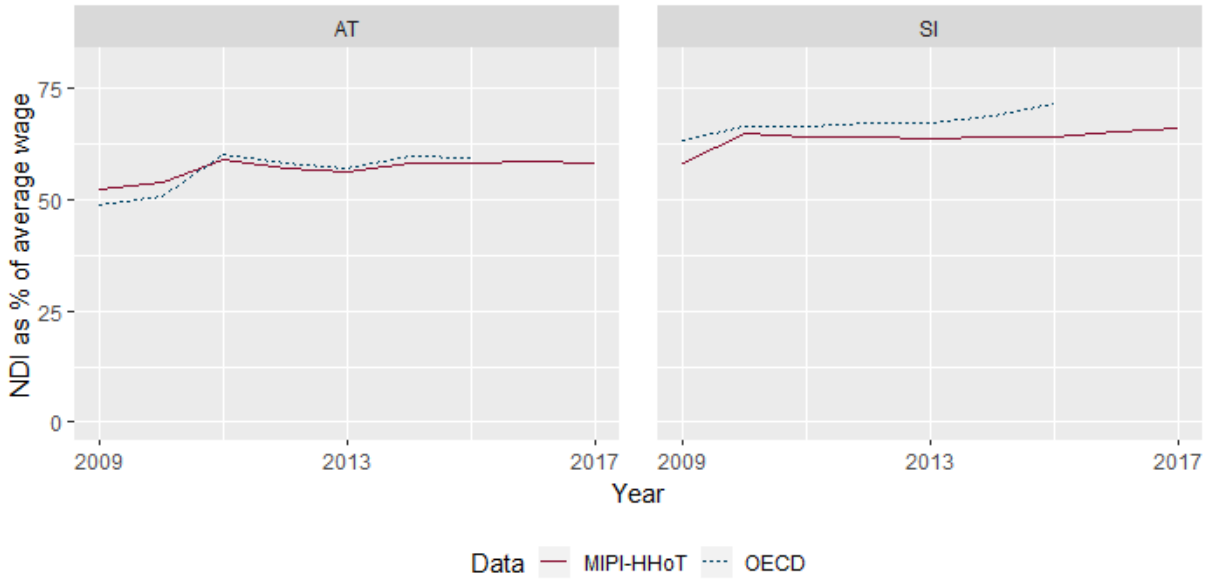


Figure A10. Trends of minimum guaranteed net disposable income for a non-working single, couple and couple with two children aged 7 and 14, 2009 – 2017, MIPI-HHoT vs. OECD output data and SaMIP data, net disposable income as % of EU-SILC average wage. Austria and pre-2015 Finland.

Figure A11. Trends of minimum guaranteed net disposable income for a non-working lone parent with two children aged 14 and 7, 2009 – 2017, MIPI-HHoT vs. OECD output data and SAMIP data, net disposable income as % of EU-SILC average wage. Austria, Denmark, pre-2015 Finland and Slovenia.[25]

[25] Trends match for all countries except for Slovenia, where in both the minimum wage-earning and non-working case the lack of programmed child benefits are the source of the discrepancy. This benefit was removed from the means-test of social assistance in 2014, leading to a higher household income in the OECD households for which the benefit is included in simulation.