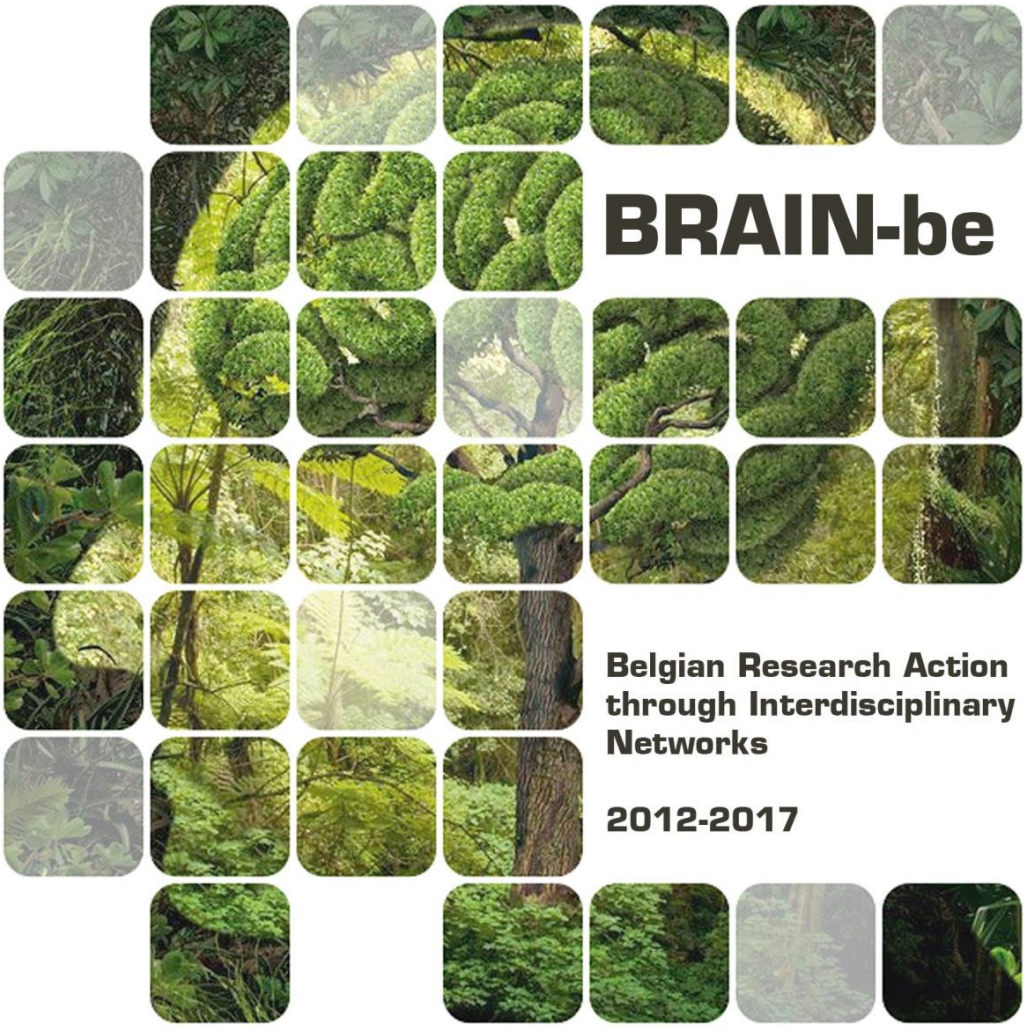


CIRCLE
Care and Income Redistributive Cycles in the Lives of Europeans

Gerlinde Verbist (Universiteit Antwerpen) – Tim Goedemé (Universiteit Antwerpen) - Ella-Marie Assal (Universiteit Antwerpen) - Johannes Derboven (Universiteit Antwerpen) - Giulia M. Dotti Sani (University of Milano) – Matteo Luppi (INAPP) – Sarah Marchal (Universiteit Antwerpen) – Sakura Panagamuwa (Universiteit Antwerpen) - Josefine Vanhille (Universiteit Antwerpen)

Axis 4: Federal public strategies

belspo .be

NETWORK PROJECT

CIRCLE
Care and Income Redistributive Cycles in the Lives of Europeans

Contract - BR/165/A4/CIRCLE_JPI MYBL

FINAL REPORT

PROMOTORS: Gerlinde VERBIST (Universiteit Antwerpen)
Tim GOEDEMÉ (Universiteit Antwerpen)

AUTHORS: Gerlinde VERBIST (Universiteit Antwerpen)
Tim GOEDEMÉ (Universiteit Antwerpen)
Ella-Marie ASSAL (Universiteit Antwerpen)
Johannes DERBOVEN (Universiteit Antwerpen)
Giulia M. DOTTI SANI (University of Milano, Italy)
Matteo LUPPI (INAPP, Italy)
Sarah MARCHAL (Universiteit Antwerpen)
Sakura PANAGAMUWA (Universiteit Antwerpen)
Josefine VANHILLE (Universiteit Antwerpen)

Published in 2022 by the Belgian Science Policy Office
WTCIII
Simon Bolivarlaan 30 Boulevard Simon Bolivar
B-1000 Brussels
Belgium
Tel: +32 (0)2 238 34 11 - Fax: +32 (0)2 230 59 12
http://www.belspo.be
http://www.belspo.be/brain-be

Contact person: Aziz NAJI
Tel: +32 (0)2 238 36 46

Gerlinde Verbist – Tim Goedemé - Ella-Marie Assal - Johannes Derboven - Giulia M. Dotti Sani– Matteo Luppi – Sarah Marchal – Sakura Panagamuwa - Josefine Vanhille. ***Care and Income Redistributive Cycles in the Lives of Europeans.*** Final Report. Brussels : Belgian Science Policy Office 2022 – 110p. (BRAIN-be - (Belgian Research Action through Interdisciplinary Networks))

TABLE OF CONTENTS

ABSTRACT

The CIRCLE project explores the effects of the ongoing economic and demographic changes on: 1) the intergenerational distribution of income and 2) the intra-household informal insurance of care and income risks in Europe. The project provides new cross-country empirical evidence on the impact of the interaction between economic and demographic changes and welfare systems on the distribution of resources, rights and responsibilities between generations. In many European countries welfare provisions addressed to older people are pay-as-you-go financed and fast population ageing boosts redistribution from the young to the old. However, compensatory mechanisms redistributing resources in the opposite direction, i.e. from the old to the young, are often implemented at intra-household level. The analysis takes under-researched redistributive flows into account and covers a variety of European welfare state models, giving a strong base for generalizing the results and deriving useful policy implications.

Objectives

The overarching aim of the CIRCLE project is to provide new cross-country empirical evidence of the impact of the interaction between economic and demographic changes and welfare systems on the distribution of resources, rights and responsibilities between generations. The project takes two major redistributive flows into account as it explores the effects of the ongoing economic and demographic changes on: 1) the intergenerational distribution of income and 2) the intra-household informal insurance of care and income risks in Europe. More specifically in this report we focus on the following objectives:

1) To contribute to the debate on the fairness of minimum income provisions from an intergenerational point of view, by comparing long-term trends in the level and adequacy of non-contributory minimum income provisions of persons at active age to those for persons above the legal retirement age;
2) To unravel the vertical and horizontal equity effects of the taxation of different pensions schemes in Europe;
3) To investigate intergenerational solidarity within multigenerational households, and assess how the formation of these households is related to poverty risks;
4) To understand to what extent career interruptions lead to adverse employment outcomes in later life, and the impact of institutional career break facilities on the accumulation of disadvantages and subsequent adverse late-life employment outcomes.

Conclusions

With respect to objective 1, the analysis indicates that relative generous trends in MIP for the working population (through changes in minimum wages and additional benefits) only rarely went hand in hand with more generous MIP for the non-working active age population. For the elderly a similar trend of lagging behind MIP for active age workers was observed, be it often less pronounced. As access to both contributory-based pension schemes and unemployment benefit schemes is being tightened, means-tested minimum income support will likely become even more relevant in the future. In this regard the general (and sometimes substantial) inadequacy of the last safety net should be cause for concern.

With respect to objective 2, the results indicate that in general the tax system functions as a social policy tool for pensioners. However, there is considerably heterogeneity across countries in terms of the degree of vertical equity, i.e. the changes in inequality and poverty for pensioners due to the tax system, and the degree of horizontal equity, i.e. the extent to which income from old age and from work are treated in a different way. Our results highlight that the position of pensioners in the income distribution is an important driver of the results regarding tax progressivity. In addition, while pension income is granted preferential treatment in nearly all countries, the existence of tax expenditures in other policy fields can (and do) impact the extent to which the principle of horizontal equity between pensioners and employees is maintained or violated.

With respect to objective 3 the results indicate that the formation of MG households operates mainly as solidarity from older to younger generations. Although not designed for this purpose, pensions thereby also serve as a function to alleviate child poverty in these countries where MG households are most prevalent. MG household formation is a short-term 'coping strategy', often directly related to inadequate social protection safety nets. Policy-makers should consider the short-term beneficiary impact of pensions on child poverty when implementing pension reform, and strengthen the social protection safety nets to alleviate child poverty.

With respect to objective 4 the analysis has revealed that short work interruptions do not have negative consequences on mothers' absolute or relative earned income in later life. Indeed, in all the countries considered it is longer work interruptions, that is of one year or more, or a failure to return to work completely that have the largest impact on mothers' long-term economic wellbeing. However, there are some important exceptions to this general rule: mothers in Sweden and Denmark, in fact, are largely unaffected by the length of work interruptions, both in absolute and in relative terms. These results support our hypothesis that the negative effect of work interruptions will be more modest in countries where the welfare state effectively decommodifies its citizens. Indeed, our results suggest that countries with mixed or low support – in terms of pension schemes or maternity leave − partially fail to limit mothers' long-term income penalties.

Keywords

Intergenerational redistribution, Intra-household insurance, Taxation, Welfare policies

1. INTRODUCTION

The traditional redistribution of resources from the young to the old operated by the welfare systems – mainly through the pay as you go financing of the main welfare provisions – is boosted by the fast population ageing. However, at intra-household level opposite mechanisms are in place through the shift of monetary and in-kind resources from the elderly to the youth – mainly through *inter-vivos* transfers and informal care provisions. The project CIRCLE takes both these redistributive flows into account as it explores the effects of the ongoing economic and demographic changes on: 1) the intergenerational distribution of income and 2) the intra-household informal insurance of care and income risks in Europe. The project provides new cross-country empirical evidence of the impact of the interaction between the economic and demographic changes and the welfare systems on the distribution of the resources, rights and responsibilities between generations. In many European countries welfare provisions addressed to older people are pay as you go financed and fast population ageing boosts redistribution from the young to the old. However, compensatory mechanisms redistributing resources in the opposite direction, i.e. from the old to the young, are often implemented at intra-household level. The analysis takes under-researched redistributive flows into account and covers a variety of European welfare state models, giving a strong base for generalizing the results and deriving useful policy implications.

The project has been executed by 3 academic partners from 3 different EU countries: Italy, Spain and Belgium. The coordinator is the Center for Research on Pensions and Welfare Policies (CeRP, Italy). Active within Collegio Carlo Alberto as research unit, CeRP is the first research centre in Italy (and one of the first in Europe) with a specific focus on welfare, pension economics and the economics of ageing. The two partner institutions are: Universidad de Alcalá - Department of Economics (UAH, Spain), a leading institution in national and European projects on Labour Economics and Welfare analysis; and the Centre for Social Policy (UA-CSB, Belgium), an interdisciplinary research Centre within the Faculty of Social Sciences of the University of Antwerp (UA) with long-time experience in both national and international research projects on social inequalities and wealth distribution. This report focuses on the BELSPO-funded contribution of the Universiteit Antwerpen.

2. STATE OF THE ART AND OBJECTIVES

The Great Recession threatened the financial sustainability of the public finances of many European countries and combined with the ongoing demographic changes poses their welfare state under stress, affecting deeply the intergenerational relationships. The overarching aim of this project is to provide new cross-country empirical evidence of the impact of the interaction between the economic and demographic changes and the welfare systems on the distribution of the resources, rights and responsibilities between generations.

The project has been structured in three different work packages. Work Package 1, *Intergenerational redistribution of resources,* evaluates the impact of different models of welfare state on the intergenerational relationships, focusing on the role of institutions aimed at providing resources to the elderly while the burden of their financing is mainly on the working age population.

Starting from Titmuss's (1955) articulation of social, fiscal, and occupational welfare, the work package focuses on the role of pensions and the tax system in shaping the gross and net income distribution adopting a cross-sectional perspective and providing new evidence on the relation between welfare provisions and elderly wellbeing. The social welfare perspective is exploited by the role of the minimum pension provisions on elderly wellbeing (Task 1.1; CIRCLE Working Papers 6 and 9). Fiscal and occupational welfare provisions are analysed by focusing on the redistributive effects of taxes on public and private pensions compared to taxes on earnings (Task 1.2; ; CIRCLE Working Paper 8) and the revenue and distributive consequences of pension tax expenditures that differentiate the system in place from a theoretical benchmark (Task 1.3; CIRCLE Working Papers 4 and 8).

Work-Package 2, *Intergenerational insurance of income and care risks*, investigates the implications of the demographic and economic changes on income distribution and informal caring provision at intra-household level in European countries in the last ten years. The Great Recession determined a sensible increase in the unemployment rates, especially among the young; a sharp reduction in the generosity of social assistance in favour of the low income and a reduction in the public provision of services. Work package 2 analyses the effect of this evidence on the patterns of income mobility by cohorts (Task 2.1; CIRCLE Working Papers 3 and 7), the trends in household living arrangements and the redistributive impact of the 'cross-generational transfers' (Task 2.2; CIRCLE Working Paper 5), the role of grandparents on labour market participation and fertility decisions of their daughters (Task 2.3; CIRCLE Working Paper 2), and the impact of career interruptions on labour market disadvantages (Task 2.4; CIRCLE Working Paper 1).

Work-Package 3, *Intergenerational conflicts*, investigates the perceptions and comprehension that individuals have of the aims of the main welfare provisions and of their implications in term of intergenerational relationships given the current demographic trends (CIRCLE Working Paper 10). Under the threat of the financial crises many European countries underwent through radical reforms of their welfare systems. These reforms have been undoubtedly successful in recovering the financial sustainability, but met the strong opposition of large groups of the population. Almost by definition reforms aiming at reducing the generosity of welfare provisions disrupt the plans for the future of many households and are resisted by the ones involved. However, the last reforms met the strong opposition also of groups of the population that actually were supposed to gain from them, that is the young. This work package aims at exploring the underlying reasons of this evidence and proposing strategies to help European countries avoiding intergenerational conflicts while facing challenging ageing process and weak public finance sustainability. A new survey has been run in Belgium, Italy and Spain allowing new empirical research to be conducted on the role of communication, economic and financial literacy, and comprehension of the overall design of the welfare systems, exploiting the cross country specificities.

This report focuses on the contribution of the Universiteit Antwerpen, which was funded by BELSPO; this relates mainly to parts of Work Packages 1 and 2. For Work Package 3, the UA-CSB contribution consisted of designing the questionnaire for the respondents in Belgium and supervising the field work; the empirical analysis of the collected data was executed by CeRP. We now consider the objectives of the different parts of the contribution of the Universiteit Antwerpen and funded by BELSPO (CIRCLE Working Papers 1, 5, 6 and 8). The study in CIRCLE Working Paper 1 was subcontracted to CeRP and performed by Giulia Dotti Sani and Matteo Luppi.

2.1 Intergenerational redistribution of resources through public transfers

Within Work Package 1, which investigates the intergenerational redistribution of resources in an international comparative setting, the focus has been on the role of minimum pensions on elderly well-being on the one hand, and on the interaction between the pension and the personal income tax system on the other.

2.1.1 Minimum income protection for the elderly and the non-elderly

Minimum income protection schemes are part of income support policies to prevent poverty in the old-age. They lie outside pure insurance mechanisms for the old-age and are generally financed through general taxation, being a clear example of an intergenerational redistributive policy. We aim at contributing to the debate on the fairness of minimum income provisions from an intergenerational point of view, by comparing long-term trends in the level and adequacy of non-contributory minimum income provisions of persons at active age to those for persons above the legal retirement age. Whereas previous studies have focused either on minimum income provisions for persons that have reached the legal retirement age (e.g. Goedemé, 2013; Goedemé and Marchal, 2016), or on persons at active age (e.g. Van Mechelen and Marchal, 2013; Marchal et al., 2016, Van Mechelen et al., 2011), we will compare the adequacy of minimum income provisions between both groups.

The adequacy (and trends in the adequacy) of minimum income protection for the elderly has been studied in a comparative way by Goedemé (2012); Goedemé (2013) and by Goedemé and Marchal (2016), observing substantial variation in design and adequacy of minimum income protection for the elderly, yet at the same time noticing relatively positive trends compared to average living standards in the EU15 countries throughout the 1990s and 2000s. The (in)adequacy of minimum income protection for the non-working of active age has been studied more extensively. Overall, it has been time and again demonstrated that minimum income protection generally does not suffice to protect non-working active age households against poverty: guaranteed net disposable incomes of hypothetical households are consistently found to be below the EU at-risk-of-poverty threshold (Van Mechelen and Marchal, 2013; Immervoll, 2012; Immervoll and Scarpetta, 2012; Nelson, 2013). Whereas benefit levels are usually increasing in real terms, most authors have noted general declines relative to living standards throughout the 1990s and 2000s, although individual country experiences differ (Nelson, 2013; Van Mechelen and Marchal, 2013). Various researchers have sought to explain trends in minimum income protection for those out of work. Pierson (1994) stated that minimum income benefits would be more immune to retrenchment, given their small budgetary impact. Nelson (2007b), in a comparison of the resilience of social insurance benefits and means-tested minimum benefits did not find evidence for this. He referred to the power resources theory in order to explain the higher resilience of social insurance benefits, as benefits that have larger and more powerful middle class coalitions benefiting from them, relative to minimum income benefits. Van Mechelen (2010) has highlighted the “less eligibility” principle in order to explain the hierarchy of social insurance benefits above minimum income benefits. Finally, Noël (2018) found a positive association between the overall generosity of the welfare state and minimum income protection adequacy, and a negative association with public debt.

Others have aimed to explain trends in minimum income benefits as such, independent of their relation to social insurance benefits. Van Mechelen and Marchal (2013), focusing on the variation

between countries, have highlighted the importance of indexation mechanisms. Most countries have indexation mechanisms that protect minimum income benefit levels against inflation. These countries usually perform better than countries without statutory indexation. Countries with more generous indexation practices, for instance in line with average wage, generally did better, at least in the years prior to the crisis. Still, indexation mechanisms do not suffice to keep benefits in line with living standards, for which additional increases are necessary. Other scholars have focused more on the general or most common trends over countries. Nelson (2013) has related trends in minimum income benefits to active labour market spending, and showed that active labour market spending has a negative effect on minimum income protection generosity. Van Vliet and Wang (2019) have found indications that globalization and trade openness may have a negative impact on minimum income protection adequacy, whereas Scruggs and Hayes (2017) showed that increasing inequality at the top has an eroding effect on minimum income protection policies.

Recently, Cantillon, Parolin and Collado (2018) have assessed minimum income protection for the non-working and the working of active age in combination. They took a functionalist approach to minimum income benefit generosity for both target groups. They argue that exogenous, structural forces substantially limit the degrees of freedom governments have with regard to safeguarding the adequacy of their minimum income protection for those of active age. The standstill at inadequate minimum income protection packages in a large number of countries is hence no coincidence, but stems from the increase in wage inequality, and the practical and fiscal problems in trying to maintain a decent social floor with adequate work incentives in a more unequal and diverse society. The standstill of low gross wages (in an era of globalization and wage pressure) coupled to a desire to maintain work incentives for those out-of-work leads to a trilemma for social policy makers: they can only increase social assistance benefits if they also increase the net incomes of working families in a context of stagnating gross wages. This greatly amplifies the budgetary implications of raising out-of-work benefits (see also Collado et al., 2019). However, they also highlight that countries are able to make different decisions regarding the adequacy of the social floor (i.e. that some countries are willing to face the bill). Also, countries where work incentives are high, will be less confronted with this trilemma than others.

Similar perspectives that compare the development of minimum income protection for different target groups in tandem are rare. Bahle, Hubl and Pfeifer (2011) have in their assessment of the state of the last safety net indeed described the minimum income protection provisions for various non-working target groups, including the disabled, those of active age and the elderly, as have Marx and Nelson (2013), but these studies generally did not explicitly compare and interpret differences in trends across target groups. Goedemé and Marchal (2016), while only looking at minimum income protection for the elderly, have hinted at the possibility of more generous trends in minimum income protection for the elderly vis-à-vis those of active age because of reasons of deservingness and the smaller concerns regarding financial incentives to work for this group. However, they did not include an assessment of the generosity of minimum wage workers, nor did they check this hypothesis.

The aim of the analysis within CIRCLE is twofold. First, we want to update and extend the literature on trends in minimum income protection with a detailed inventory of recent changes in minimum income protection for three different target groups, notably the elderly, the non-working at active age and the working at active age. We will focus in our discussion on individual country experiences, providing much needed background information for scholars of minimum income protection trends.

Second, we expressly want to compare trends for these three different target groups to one another, in order to explore the different reasoning and policy focuses that may apply to the different target groups. We do not endeavour to provide an all-encompassing theory of minimum income protection trends for different target groups. Rather, we argue that additional insight can be gotten from comparing trends in minimum income protection for different target groups, with a specific focus on individual country experiences. The analysis covers all EU countries, makes use of hypothetical household simulations and is based on the expert-sourced CSB Minimum Income Protection Indicator dataset.

2.1.2 The social inequality dimension of the tax treatment of pensions

Income in old age is determined not only by the pension system, but also by the tax system. Yet there is relatively little research that analyses how the interaction between both systems influences outcomes of poverty and inequality in old age. To guide our analysis, we assume that the type of welfare state influences both sides of the tax-benefit system, in distinct but related ways. In this sense, we follow the reasoning of Kammer et al. (2012, p. 458), who "claim that welfare state institutions even affect the redistributive capacity of individual welfare state instruments as well as the emergence of a complementary fiscal policy mix". In other words, even though the objectives of the tax system differ from those of the pension system, our analysis departs from the idea that the underlying principles of the welfare state type influence decisions regarding key elements of both systems. At the very least, this implies that we expect that the characteristics of the tax system do not counteract the effects of the pension system. Table 1 provides an overview of the connection between the key elements of the pension and taxation system. We now explain in more detail how these elements are connected.

In general, pension systems have two fundamental objectives (Zaidi, 2010). The first is to provide protection against poverty at old age. This can be linked to the solidarity principle, whereby the system aims to guarantee a minimum income to everyone. The second objective is to safeguard, to a certain extent, the living standard a person had during their working life. This can also be understood in terms of consumption smoothing over the lifetime, and is often indicated by replacement rates (income from pensions as a percentage of income from work). The underlying principle here is one of insurance.

Table 1: Key principles of pension and taxation systems

Welfare state principle	**Solidarity**	**Insurance**
Goal	Adequate living standards for everyone	Consumption smoothing
Result	Poverty alleviation	Reproducing living standards in old age
Corresponding principle in taxation	Vertical equity	Horizontal equity

The relative importance of each objective differs across countries. In part, it is related to the Beveridge/Bismarck dichotomy of social security systems and the typology of welfare states as

proposed by Esping-Andersen (1990) and amended by Ferrera (1996). Esping-Andersen's (1990) typology of welfare states distinguished three types: conservative, social-democratic and liberal, Ferrera (1996) added the fourth type of Southern or Mediterranean states. Historically, in Beveridgean countries, poverty prevention has been the main objective of the state. To achieve this, the state provides flat-rate, universal benefits (albeit possibly means-tested). In the case of pensions, the responsibility to maintain living standards obtained during working life is left with the individuals. The countries belonging to this group are the Netherlands, Ireland, the United Kingdom, Denmark, Finland and Sweden (Hinrichs & Lynch, 2010). The group of Beveridgean countries can be divided into two welfare state types: the social-democratic or Nordic countries (Denmark, Finland, Sweden) and the liberal countries (the United Kingdom and Ireland) (Fuest et al., 2010). In liberal type welfare states, social security is provided universally, but is means-tested while in Nordic countries it is universal and provides equal benefits to all.

In Bismarckian countries, on the other hand, the social security system is organized around the logic of social insurance (Fuest et al., 2010). This means that benefits are related to contributions made during working life. This implies that contribution-based pension policies, aimed at income maintenance, are at the centre of the pension system (Ebbinghaus, 2021; Hinrichs & Lynch, 2010). In this group, a distinction can be made between conservative and Southern welfare states. According to Fuest et al. (2010), the differences between conservative and southern countries are mainly found in the levels of social spending and of taxes and redistribution. Although there is discussion about their categorization, Central Eastern European (CEE) and Baltic countries are often categorized as being similar to continental and southern welfare states. In a way, they can be seen as relatively smaller (or not yet mature) social insurance states (Fuest et al., 2010).

Since their conception, both Beveridgean and Bismarckian countries have made changes to their pension systems, incorporating contribution-based and minimum protection elements, respectively (Hinrichs & Lynch, 2010). In addition, demographic ageing processes and fiscal budget constraints have led to pension reforms in many countries. More specifically, there has been a shift towards the privatisation and marketisation of pensions (Ebbinghaus, 2015). Due to these changes, pension systems have become more complex and now consist of multiple policies (OECD, 2019). Therefore, the Beveridge/Bismarck dichotomy alone is not sufficient to fully capture the diversity of pension systems. It can be coupled to the OECD (2019) taxonomy, which is a useful instrument to understand the architecture of pension systems. At the same time, we argue that even with increasingly complex pension systems, connections can be made between different types of pensions systems and the underlying principle of the welfare state type a country adheres to.

In the OECD (2019) taxonomy, pension policies are categorized into three tiers. The first tier is public and mandatory and consists of social protection policies, aimed at providing an adequate standard of living (i.e. preventing poverty). These could be basic pensions, targeted plans or minimum pensions. Their most important characteristic is that they are independent of past earnings, though they can be made dependent by including a residence criterium, or (current) income and/or assets being below a certain threshold or the number of years one contributed during their working life. The second tier comprises all mandatory, earnings-related programs. Within the public second tier pensions, three types of schemes exist. Firstly, in the schemes that follow defined benefit rules (DB), pensions depend on the number of years one contributed, (pensionable) earnings and accrual rates. Pay-as-you-go schemes follow these applied benefit rules. Secondly, in point schemes workers earn

pension points based on their earnings, which are converted into a pension income when the worker retires. A third category are defined contribution (DC) plans, whereby contributions flow into an account (either funded (FDC) or notional (NDC)). At the age of retirement, the accumulated contributions and investment returns are converted into a monthly pension. DC schemes can also be organised privately, either as part of the mandatory second tier or as the voluntary third tier. The third tier is made up by voluntary earnings-related provisions, which can be personal or provided by an employer.

So far, we have discussed the main objectives of pension systems and linked them to pension system designs and different welfare state typologies. However, when it comes to the (financial) wellbeing of the elderly, one cannot stop at assessing gross pension levels. Another social policy tool has yet to be applied: taxation. Even though the objectives of taxes and benefits clearly differ, there is also common ground: "tax and benefit policies should be viewed as components of an overarching welfare strategy, …" (Feher & Jousten, 2018, p. 3). Theoretically, elements of the tax system can be linked to the different welfare principles (solidarity and insurance), as we show in Table 1. Taxes are levied by the government to acquire the funds to fulfil its tasks, thereby following the principles of horizontal and vertical equity (Elkins, 2006). Both principles should be respected, but governments may attach different relative importance to them (Feher & Jousten, 2018). Horizontal equity implies that people in similar positions face similar tax burdens, while vertical equity requires that the tax burden is distributed over the entire population according to ability to pay. While horizontal equity requires an agreement on which individuals are defined as "equals", vertical equity requires decisions with regards to the distributive effect of taxes, which is a matter of social taste and political debate (Musgrave, 1990). Typically, the literature on the taxation of pensions considers three stages at which pensions can be taxed (Cremer and Pestieau, 2016): namely the phase of pension contributions, capital income accruals and pension payments. The most common system taxes both public and private pensions and follows the so-called EET approach (Exempt contributions, Exempt capital income accruals and Taxed benefits). However, there are several exceptions across countries which configure as tax expenditures in particular when social insurance contributions for pension schemes are taxed (fully or partially) or pensions are not taxed (fully or partially, by means of extra allowances and credits).

In our study we focus on how the vertical and horizontal equity principles are put into practice, and how these principles align with the objectives of pension systems. In countries based on the solidarity principle, the state's main focus is providing an adequate income level to its citizens. In this case, we might expect the vertical equity objective to be relatively more important than the horizontal equity objective. At the very least, it would be natural to expect that the minimum income protection for elderly is adequate also after taxation or to expect that low-income pensioners are taxed less heavily (which may lead to changes in progressivity of taxes on pension income as compared to employment income). In addition, the notion of stronger shoulders carrying more of the burden that is inherent in vertical equity/progressive taxation, is compatible with the solidarity principle. In insurance-based countries, the horizontal equity concern might be relatively more important. If pension systems are seen as an instrument to maintain in old age living standards obtained during working life, then one might aim to treat employees and pensioners with similar incomes in an equal way in the tax system. Just as there are differences in the extent to which the insurance principle is present in the design of the pension system, the horizontal equity might be more important in countries with DC schemes than in countries with DB schemes.

As explained earlier, pension income can originate from different tiers, and each tier is linked to a different objective and hence probably also to a different tax treatment (as is the case in nearly every country in the EU-27 and the United Kingdom, see Barrios et al., 2020). Because of the objectives of the different tiers, the logic of the relative importance of horizontal and vertical equity would apply here as well. We would expect a relatively smaller tax burden on first tier pension policies, so as to make sure that the poverty-alleviating objective is not undone. Again, this would lead to (more) progressive taxes on retirement income as compared to employment income. Second and third tier benefits would be taxed similarly to incomes from work, since these benefits are concerned with reproducing income from work and can therefore be expected to be taxed according to the horizontal equity principles.

Although the main aim of the tax system is to generate revenue, governments also use the tax system to achieve social and economic goals in various policy fields (e.g. education, housing, pensions) through the use of tax expenditures, which may impact on the degree of both vertical and horizontal equity. Tax expenditures related to old-age or pension benefits generate differences in the taxation of (different sources of) pension income and employment income, by reducing the final tax liability for certain individuals or (categories of) households. They can take the form of tax credits, allowances, deductions, exemptions or preferential tax rates and are part of what is called the hidden welfare state, in the sense that they oftentimes fulfil a social goal but are not categorised as social expenditures. It is for this reason that Poterba (2011) advocates the abolishment of tax expenditures, believing they are untransparent, inefficient and unfair. In contrast, others argue that tax expenditures are in fact a more efficient policy tool, reducing fraud and issues of non-take up and stigma (Adema, 2001; Avram, 2018).

2.2 Intergenerational insurance of income and care risks

For the investigation of the intergenerational insurance of income and care risks**,** we focus here on two different analyses, notably patterns in household living arrangements with respect to cohorts cohabitation and the redistributive impact of the ’cross-generational transfers’, and the impact of career interruptions on labour market disadvantages. The analysis on patterns in household living arrangement brings in the key household dimension analysing how households can both protect themselves against adverse labour market outcomes and also influence these outcomes.

2.2.1 Intergenerational solidarity within multi-generation households

We focus on the tax-benefit instruments that although they are aimed at a specific generation (e.g. pensions or child benefits), they also benefit other individuals belonging to the same family as they configure as pure ’cross-generational transfers’. When three generations cohabit within the same household, pension benefits can reduce child poverty, and child benefits and working income can reduce elderly poverty. Such extended families are commonly observed in Southern and Eastern Europe. The prevalence of such families in some countries and their virtual absence in other countries is driven to a large extent by cultural factors. Nonetheless, the decision to form a multigenerational household or not, is likely to depend on need and financial circumstances as well.

Extended families, where three or more generations cohabit within the same household, are a relatively common household form in Southern Europe and, especially, Eastern Europe. There can

be different reasons or motivations behind the formation of such families, ranging from individual preferences to the external socio-economic or cultural context imposing this form of cohabitation. In previous work, researchers have generally focused on the impact of extended families on labour supply and time spent on informal and formal care (e.g. Bertrand, Mullainnathan and Miller, 2003). However, one important implication of the formation of extended families is often left out. Elderly typically bring pensions and other income into the household, which may be of substantial size. This is particularly relevant given that extended families especially form in poor countries where social protection from cash transfers is generally low, but pensions are relatively high. Moreover, extended families are especially common among poor families that cannot rely on market income alone. As such, financial distress or poverty risks can be a main driver behind the formation of extended families. In any case, they are a relevant aspect of cohabiting because they automatically change the income position of the household, and often substantially so.

Studies that look at the poverty alleviating effect of co-residing have so far ignored its impact on child poverty. Rendall and Speare (1993), for instance, examine the poverty alleviation effect of co-residing with a focus on elderly poverty (in the US in 1984). Diris et al. (2017) estimate the direct impact of social spending on child poverty. They thereby distinguish between spending on pensions and spending on all other cash transfers. The study uncovers an ambiguous role for increases in pension spending size: more pension spending worsens the relative income position of children and thereby increases child poverty, but also alleviates child poverty in MG households. The study of Diris et al. (2017) is performed at an aggregate level, i.e. it aims to explain the impact of aggregate pension spending on aggregate child poverty rates at the country level. The current study analyses the issue at the micro-level. We focus here on the complex relationship between child and elderly poverty and MG households. We look at two specific channels, notably the impact of the income that the elderly bring into the household and the impact of the presence of the elderly on the equivalence scale and the underlying resource-sharing assumption.

In distributive analyses, it is common to apply an equivalence scale on household income, thus deriving a needs-adjusted or equivalized income, used for the measurement of inequality and poverty. As each individual in the household is assigned the same equivalized income, this means that one assumes equal sharing of resources in the household (see Burton et al for a conceptual overview on this issue). If this assumption is violated, this approach can be highly problematic (Atkinson, 1975; Decancq et al., 2014). A number of studies have rejected this ‘classical’ model of resource-sharing, as different individuals have different levels of bargaining power in the family (see e.g. Thomas, 1990; Schultz, 1990; Fortin and Lacroix, 1997; Bennett, 2013). Typically, such analyses are exclusively focused on working age adults with or without children, but it is likely that differences in bargaining power also apply to extended families. Albertini and Kohli (2012) look at MG households in Southern-Europe and find a low prevalence of effective cash transfers. We emphasize, however, that direct cash transfers are not necessary for elderly income to benefit children in extended families. Elderly can improve the living conditions of children by contributing to the household budget, i.e. by (co-)financing goods and services that are to the benefit of all household members, or of children in particular. The number of studies that look at the impact of within-household resource-sharing on child poverty is very limited, and studies conducted on developed countries (see e.g. Cantillon and Nolan, 2001 on Ireland; Burton et al., 2007 on Canada) do not consider extended families. Research on South-Africa indicates that increased contribution

from pensions to the household budget has a positive impact not only on food, health care and clothes consumption shares of the children (Hamoudi and Thomas, 2005), but also on their cognitive and physical development (Duflo, 2000). It appears that these pensions shift bargaining power from the male household head to the grandparent (which is generally a grandmother), which might actually benefit children, even controlled for income changes. In other words, judging the effects of increased pension income on child well-being through income poverty alone might even understate the true benefits from a total child welfare perspective. In any case, the empirical evidence indicates that at least a significant share of the extra pension income brought into the household is used to the benefit of children.

In our study, we analyse intergenerational solidarity within multigenerational (MG) households, and assess how the formation of these households is related to poverty. MG households combine different income sources; typically child benefits and working income from the side of the child and its parents, and pension income from the side of the elderly. Previous research on extended families has generally focused on implications for labour supply and time spent on informal and formal care (e.g. Pezzin and Schone (1999); Bertrand, Mullainnathan and Miller (2003); Dimova and Wolff (2011)). However, the direct impact of the formation of MG families on financial means and poverty risks has been largely neglected.

2.2.2 Adverse employment outcomes for women of career interruptions

The availability of formal and informal care can have an important impact on the work-life balance and labour market participation, especially of women. However, also other policy measures may contribute to a better work-life balance, including parental leave schemes and opportunities for part-time work. Given current pressures to extend working lives, an important question is to what extent career interruptions lead to adverse employment outcomes in later life, and the impact of institutional career break facilities on the accumulation of disadvantages and subsequent adverse late-life employment outcomes.

This study addresses long-term absolute and relative income inequality among mothers aged 45 and above in ten European countries. Much previous research has focused on absolute differences in income and earnings between childless women and men, mothers and fathers (Sigle-Rushton and Waldfogel 2007), and between women and their partners (Dotti Sani 2015; Klesment and Van Bavel 2017; Stier and Mandel 2009). Beyond predictable variations tied to socio-economic background and type of occupation (England et al. 2016), empirical evidence on the topic is univocal: mothers have lower earnings than childless women and men. Multiple explanations of the so-called motherhood penalty have been suggested (Budig and England 2001): mothers are likely to have less remunerative albeit family-friendly jobs, or to work part-time; they may be less productive at work; they may miss important career opportunities or crucial training while on leave; they might suffer statistical discrimination; or they could be a self-selected group. In contrast, either because they increase their productivity in view of family enlargement or because of positive selection into fatherhood, fathers tend to earn more than childless men (Killewald 2013).

The combination of motherhood penalties and fatherhood premiums leads to the formation of a ‘family gap’ in income. This has immediate consequences in terms of relative power within the couple, and can have negative medium- and long-term consequences in the case of partnership

dissolution through death or divorce (Fasang et al. 2013; Peeters and De Tavernier 2015). Moreover, a key finding in previous literature is that women have lower pensions than men in many western countries (Folbre et al. 2007). This result is attributed to the very different lifecycles of women and men, with women being more responsible for unpaid domestic work and therefore less likely than men to be employed, to be employed full-time, or to earn a high income. Moreover, women who do work are much more exposed to job interruptions than men (Jefferson 2009). However, while much research has investigated the short- and medium-term consequences of job interruptions, less is known about the long-term consequences of interruptions due to childbearing and childrearing on elderly mothers' absolute and relative earned income. Indeed, previous research on gender differences in income in later life is mostly based on single-country studies (Baum 2002; Ejrnæs and Kunze 2013; Phipps et al. 2001). Cross-national studies investigating the long-lasting effects of childbirth and child-related work interruptions on women's earnings seldom focus on mothers in their later years (e.g. aged 60 and above), and international comparisons are mostly confined to a few countries (Fasang et al. 2013; Ginn 2003; Phipps et al. 2001; Sigle-Rushton and Waldfogel 2007).

Among the studies that have focused on the long-terms consequences of family events on women's income in a broader comparative perspective, Sigle-Rushton and Waldfogel (2007) use data from the Luxembourg Income Study to investigate the differences in long-term earnings between childless women, mothers and men in eight industrialized countries. Their results indicate that mothers have lower earnings than childless women and men, and the effects of childbearing and childrearing are not just immediate but also long-lasting. However, their analysis based on women and men up to the age of 45 does not shed light on income inequalities in later life. In a single-country study on Britain by Ginn (2003), General Household Survey data are used to study the private pension coverage of women with different marital and parenthood statuses in three stages of the life course. The analysis indicates that both in the midlife and younger groups mothers have lower chances of contributing to individual pension plans compared to childless women. Using data for the US from the National Longitudinal Survey of Young Women, Kahn et al. (2014) show that motherhood has negative consequences on women's labour force participation, occupational status and wages, but that the negative effects decrease with age. However, women older than fifty are excluded from the study, leaving unanswered questions about the very long-term consequences of motherhood on income. Similarly, Phipps et al. (2001) for Canada show that work interruptions negatively affect mothers' wages but the effects are larger for those who change job after the interruption. Again, however, the results are confined to women aged 54 or younger.

Previous studies have underlined the fundamental role of national institutional and cultural features in shaping women's labour market behaviour around childbirth. Family policies, such as the duration of maternity and parental leave and the relative level of remuneration, childcare availability, legislation regarding job protection and cultural norms regarding childrearing practices, all contribute to women's decisions regarding work interruptions.

The differences in maternity and parental leave regulations characterizing the countries selected for analysis in the years under study are pivotal for our study. In most of the countries, maternity leave was provided for as early as the 1960s, and since then the amount of time off work around childbirth and maternity pay have increased considerably in all countries (Gauthier 2011). However, some countries offered more generous packages from the beginning. The literature on the effects of work interruptions for childbearing and childrearing generally finds that mothers are more likely to return

to work when the leave is short and well-remunerated, whereas a long unpaid leave reduces mothers' chances of returning to the workforce (Lalive and Zweimüller 2009; Uunk et al. 2005). Therefore, we would expect the long-term negative effects of work interruptions to be more modest in countries where maternity pay is high and for a relatively short period of time.

A second factor to consider regards the characteristics of the pension system. Different models of pension system have been identified in the literature on the basis of the institutional features taken into consideration (Bonoli 2003; Esping-Andersen 1999; Hinrichs 2000). Beyond the particularities of different pension regimes, transversal features of national systems can mediate the long-term effects of work interruptions for childbearing and childrearing. One of these is the number of working years required for pension entitlement. If fairly low numbers of insured years are required to access fully covered pensions, the long-lasting effects of work interruptions might be mitigated. Similarly, an availability and generosity of minimum pensions represents a form of income support for women with fragmented working careers, while a substantial level of ordinary pensions can improve economic conditions in later life. Thus, a high retirement age for women with fragmented working careers could affect their pension income in countries with scant minimum income schemes, as could high thresholds of insured years being required for fully covered pensions.

Differences in pension arrangements in the countries analysed are crucial for understanding the long-term effects of job interruptions. In the last three decades, half of the countries analysed have witnessed a slight increase in women's age at retirement, with a reduction of national differences (Scruggs et al. 2014). However, when focusing on the long-term effects of maternity leave, the evolution of the national pension systems analysed suggests that women's access to pensions varies in the countries considered. Sweden, Denmark and the Netherlands combine a redistribution of public resources that ensure fair economic support even from minimum pensions with mechanisms that foster the permanence of women in the labour market, thus guaranteeing an entitlement to full pension coverage even with a relatively short working career. The female retirement age has been stable at 65 in Sweden and the Netherlands, while Denmark joined these countries in 2004 introducing a reduction of two years. The Dutch pension system does not require a threshold of contribution-years for entitlement to full pension coverage, while in the two Nordic countries this requirement has gradually increased from a very generous threshold of 15 years in Denmark and 20 years in Sweden in 1980 to 30 and 40 years respectively in 2011. The key feature in these countries is a relatively high level of economic support provided by minimum income pensions compared to the regular one. Indeed, despite a reduction in the Swedish case, the minimum income pension guarantees between 40% and 50% of previous pay, while regular pensions, on average, provide around 50% and 65%.

Italy, Germany and Spain are characterized by relatively low redistribution toward minimum income schemes with a long earnings history needed to reach the contribution years criterion. Women are entitled to retire after the age of 60 in Italy and 65 in Germany and Spain, with, respectively, 40, 45 and 35 years of work. Additionally, these countries show the largest differential between retirement and minimum pensions in terms of replacement rates. If regular pensions ensure almost the entire fictive reference salary (see note 4), minimum income pensions represent a limited source of economic support for women, with a replacement rate around 18% in Germany and 27% in Italy and Spain. Greece can be included in this group, with the only exception being that women with fragmented working histories are supported with a more generous minimum income pension, with

an average replacement rate in the period considered of 45%. The three remaining countries, France, Belgium and Austria, are characterized by important entry barriers in terms of retirement age and years of contributions, but provide substantial income support in the form of both minimum and retirement pensions. In France and Austria, women are entitled to pension benefits after the age of 60, with 45 and around 40 years of contributions respectively. In this regard, Belgium slightly differs, in that 35 years of working are sufficient to claim retirement pensions. Income support provided by minimum pensions has gradually increased in all three countries, ensuring replacement rates in 2010 of 45% in France and 50% in Belgium, which are just 10-15 percentage points lower than what is ensured by regular pensions. In Austria, instead, retirement pensions ensure around 80% of the reference salary.

As Jefferson (2009) highlights, gender gaps in coverage and contributions often lead to gaps in pension entitlements or benefits, which can be partially compensated by the generosity of non-contributory schemes. Thus, we would expect long-term negative effects of work interruptions to be greater in countries that have stringent age and years of contribution requirements and do not provide generous non-contributory pensions schemes.

In a nutshell, the literature has repeatedly outlined that men out-earn their wives and partners and has revealed the existence of a family gap in earnings, especially in the presence of children, but the extent to which motherhood penalties and fatherhood premiums engender long-term differences in earned income has not been fully investigated.

Following Peeters and De Tavernier (2015: 1172), we argue that to understand “why the financial situation of many elderly women remains so precarious, it is essential to investigate how family histories, career histories and social policy interact.” Therefore, this article goes beyond previous research by taking a comparative approach to studying income inequalities among mothers in later life (average age 65). Specifically, considering that work interruptions for childbearing and childrearing are known to have negative consequences on women’s labour force participation and therefore on their earnings, savings and pensions, we test the extent to which absence from work due to childbearing and childrearing impacts mothers’ absolute and relative earned income at an older age. Moreover, we test whether family policies and pension systems (Esping-Andersen 1990; Korpi et al. 2013) mitigate the relationship between work interruptions and income. The analysis is based on data from the Survey of Health, Ageing and Retirement in Europe (SHARE), rounds two (2006-7), four (2011-12) and five (2013), combined with the retrospective wave of the survey (round three, 2008-2009), and concerns ten European countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain and Sweden.

3. METHODOLOGY

Different methodologies and data have been used to study the various research questions. We discuss here the data used for the different empirical analyses, as well as the models and the indicators that present the results. For the first two topics, we make use of the multi-country European wide tax-benefit microsimulation model (see e.g. Sutherland and Figari (2013); for further information on EUROMOD).

3.1 Hypothetical household simulations in EUROMOD to assess minimum income protection measures

We use hypothetical household simulations in order to comparatively assess the generosity of minimum income protection. Hypothetical household simulations are calculations of the legally guaranteed income of a hypothetical household in line with the applicable tax benefit rules. As the rules for combining means-tested minimum income support with other benefits, such as child benefits and housing allowances, may differ between countries, hypothetical household simulations are elementary in order to compare like with like, and to assess the generosity of minimum income protection *packages:* hypothetical household simulations allow to assess the generosity of actual policy rules in combination in a comparable fashion over time and across countries, without confusing policies with the underlying demography or economy. In addition, they provide us with headline indicators of the generosity of social policy, taking account of the interaction between different policy rules. Finally, they allow to assess policies for specific groups – such as lone parents or minimum income beneficiaries – that may be theoretically interesting, but who may be underrepresented in surveys. Clearly, these indicators also have limits: they refer to the situation of very specific households, that may be more or less representative for individual country experiences. Seemingly small parameters of the household may have a large effect on overall assessments of generosity (see Van Mechelen et al., 2011). Still, they are a commonly accepted way to assess and compare the generosity of benefit systems (see e.g. Immervoll, 2012; Bahle, Hubl and Pfeifer, 2011; Bradshaw and Finch, 2002; Gough et al., 1996).

One of the first to adopt this approach in the comparative study of minimum income protection was the seminal study by Eardley et al. (1996). They described in detail the institutional design of out-of-work minimum income protection in the OECD countries. Their efforts were followed by the OECD Benefits and Wages model, that allows to assess the financial incentives when moving from out-of-work benefits to in-work income, by calculating the net disposable incomes for hypothetical households in different income and benefit situations in the OECD countries from 2001 onwards. At the University of Antwerp, Cantillon et al. (2004) and Van Mechelen et al. (2011) established the CSB MIPI dataset, that collected hypothetical household calculations made by national experts, and that allowed to assess the generosity of minimum income protection for the working, the non-working and the elderly at specific moments in time. This dataset focused on the minimally guaranteed income by functionally equivalent minimum income schemes selected through a risk-type approach. Specific risks were defined (such as being unemployed and uninsured but able to work), and indicators on the generosity of the applicable schemes in the different countries were gathered. Finally, Kenneth Nelson (2007a) established the SaMIP dataset that contains annual hypothetical household disposable incomes to monitor the generosity of minimum income protection for the non-working of active age. Previous research looking at the generosity of minimum income protection has in general benefited from these three important data sources especially with regard to minimum income protection for working and non-working active age households (see e.g. Van Vliet and Wang, 2019; Cantillon, Parolin and Collado, 2018). In Table 2, we summarize the information contained in these different datasets.

Table 2. Available datasets on minimum income protection for the working, non-working able-bodied of active age and the elderly

Dataset	Minima	Coverage
CSB MIPI	Income guarantee elderly	1992(EU15)/2001(EU27)/2009
	Minimum income active age	/2012
	Minimum wage	Five model families
→ MIPI-HHoT	Income guarantee elderly	EU28
	Minimum income active age	four model families
	Minimum wage	2009-2018
OECD	Minimum income active age	2001-2019 (OECD/EU)
	Wage incomes (full range of incomes and work hours)	Flexible model families
SaMIP/SPIN	Minimum income active age	1992-2015 (OECD)
		Three model families

We use here the newly developed MIPI-HHoT database (https://zenodo.org/record/2533898), which is a continuation and improvement upon the CSB MIPI data. MIPI-HHoT is developed specifically to track trends in the generosity of the minimum guaranteed net incomes for different target groups, more specifically the working, the non-working of active age and the elderly. In the selection of applicable schemes, we again follow a risk-type approach, by first establishing the specific risk situation, and then assessing which schemes would be applicable in each country. Whereas each of the datasets mentioned here have their specific merits and advantages in terms of focus and time span, we use the MIPI-HHoT indicators for a number of reasons: first of all, we developed this dataset in order to reflect *minimal* situations, adopting carefully balanced and empirically grounded country-specific and general assumptions that allow to gauge a minimal situation while simultaneously including the full scope of rights-based benefits in a country (see Marchal, Siöland and Goedemé, 2018: for a full discussion). Second, this dataset is the only one that allows to look at three target groups to which minimum income protection may apply simultaneously.

The MIPI-HHoT indicators are developed using the hypothetical household function HHoT (Hypothetical Household Tool) of the EUROMOD microsimulation model (Hufkens et al., 2016). They reflect the minimally guaranteed incomes through the working of the tax benefit system of a family in three income situations: (i) with one-earner full-time working at the minimum wage, (ii) as an uninsured active age family with no income from work nor other income, solely relying on benefits guaranteed through the tax benefit system, most commonly social assistance, and (iii) as an uninsured (i.e. not insured in the social insurance scheme) elderly family with no income from work nor other income, solely relying on benefits guaranteed through the tax benefit system, most commonly a minimum income guarantee for elderly. Indicators are developed for these three income situations for four different family types: a single, a couple, a couple with two children and a lone parent with two children (for the latter two households, the elderly income situation is not calculated). Adults are 35 years old, children are aged 14 and 7. The families are assumed to be tenants, and rent their accommodation at the median rent. **Error! Reference source not found.** gives the key characteristics of these model households, which are further discussed in Marchal, Siöland and Goedemé (2019: 8-11).

For these 10 hypothetical households (4 working active age, 4 non-working active age, and 2 elderly, see Table 3) we record the households' net disposable incomes and its specific income components

segmented into eight categories: wage income (or, for old-age households, minimum income guarantees for the elderly), social assistance, heating benefits, housing allowances, child benefits, income taxes and tax credits, social insurance contributions and 'other' income, incorporating income programmes which do not fit neatly into one of the other categories. The precise income categories are listed in Table 4.

Table 3. Characteristics of the hypothetical households considered

Household type	**Children**	**Housing costs**	**Income situation specific assumptions**			**General assumption**
			Minimum wage case	***Social assistance case***	***MIG elderly case***	
single	none	median market rent for 1 person household [a]	age 35 works full-time at minimum wage	adults are aged 35, looking for work	minimum pensionable age, inactive	full take-up of non-discretionary and non-contributory benefits no access to social insurance
single	two, aged 7 and 14, regularly attending school	median market rent for 3 person households [a]			n.a.	
married couple	none	median market rent for 2 person households [a]	adults aged 35 one adult works full-time at minimum wage, spouse is inactive		minimum pensionable age, inactive	
married couple	two, aged 7 and 14, regularly attending school	median market rent for 4 person households [a]			n.a.	

[a] Based on 2015 EU SILC rents, up- or downrated to years of interest, see Marchal et al. (2019).

In order to track trends in the adequacy of minimum income protections, we compare the net disposable incomes obtained through the hypothetical household method to the EU at risk of poverty threshold. This is set at 60% of the national median equivalent household income (Eurostat, 2019; Atkinson et al., 2002). We use this measure as it is widely accepted as a poverty measure in both policy and academic circles, and is available for all EU Member States throughout the period 2009-2018. An obvious drawback is its arbitrary nature, both in the choice of the equivalence scales (modified OECD scale) as in the 60% cut-off rate. The modified OECD equivalence scale attributes a weight of 1 to the first adult in the household, a weight of 0.5 to other individuals aged 14 or more and a weight of 0.3 to children under 14. While the 60% cut-off rate is part of the official EU statistical apparatus, other international organisations, e.g. the OECD use 50% of the median income. Also the equivalence scales differ. A study by Goedemé et al. (2019) compared the 60% at-risk-of-poverty thresholds to reference budgets for selected EU Member States. Reference budgets are based on an expert- and focus group- based list of prized goods and services, that are deemed to be necessary in order to participate with dignity in a society. According to this study, the 60% poverty line is in line with the minimally needed budget in the Western EU Member States. For the Eastern EU Member States, the 60% poverty line may be too low in order to protect against poverty. This means that we

may overestimate the adequacy of the Eastern European Member States to some extent in this paper.

Table 4. Income components included in the hypothetical household calculation of net disposable income (if applicable according to national tax benefit legislation) in the three different income situations under study

Income components	Description	Minimum wage case	Social assistance case	Minimum income guarantee elderly case
Minimum wage	Statutory minimum wage [a], full-time employment	x		
Social assistance	Means-tested minimum income-protection, available to general population (some countries have categorical schemes for the active age population)	as a top-up	x	as a top-up, or if no MIG elderly exists
Minimum income guarantee elderly	Non-contributory benefit available to elderly[b] This category also includes smaller, income top-ups which are specific to the old-age population.			x
Income taxes		x	x	x
Social insurance contributions	Employee-specific social insurance contributions.	x	x	x
Housing allowance	Benefits compensating for housing costs	x	x	x
Heating allowance	Benefits relating to energy costs and/or the heating of residences.	x	x	x
Child benefits	Benefits relating to compensating the cost of having children. The category combines universal and means-tested measures, and specific top-ups relating to e.g. lone parent households.	households with children only		
Other income	Non-contributory and non-discretionary benefits for which the model family is eligible, but that do not fit into other categories, mostly in the form of tax credits for families or working households. [c] Also includes benefit for payment of health insurance in the Netherlands, and in some countries larger income replacements for lone-parent households (e.g. in Ireland and Malta).	x	x	x

[a] In some cases – as in Belgium, Austria and Greece before 2012 – quasi-statutory minimum wages are also considered. Countries without statutory or quasi-statutory minimum wages are not included in the minimum wage-earning case, with the exception of Austria. [b] For a more extensive discussion on the differences between social pension, guarantee pension and social assistance, cf. Goedemé (2013). [c] These are summarised in Marchal, Siöland and Goedemé (2019, Table A11).

3.2. Measuring the tax burden on pensions using EUROMOD and EU-SILC

In order to measure the tax burden on pension incomes and how it impacts on inequality and poverty for the EU-27 countries and the United Kingdom, we use the European tax-benefit model EUROMOD model. The data used to calculate benefits, taxes and contributions is nationally representative and is based on the EU-SILC data of 2017. The simulations are performed using tax-benefit policies in place in (the middle of) 2019. To adjust the data to reflect the situation in 2019, uprating indices have been applied to adjust monetary amount to the policy year. In addition, we express all monetary values in PPPs to ensure cross-country comparability.

Pensioners in this analysis are defined as individuals of 65 years old and over and having received a pension every month during the entire reference period of twelve months. Similarly, workers are defined as individuals between the ages of 18 and 60 that have received income from work during the entire reference period.

We use several income concepts in this analysis. The first is pre-tax income, which captures income from all sources (for example, (self-)employment income, benefits, capital or property income) before the deduction of personal income taxes (PIT) and social insurance contributions (SIC). Similarly, pre-tax pension or employment income captures income from pensions (for the group of old-age individuals) and employment (for employees) before personal income taxes and contributions. Disposable income equals pre-tax income minus personal income taxes and contributions. Taxable income is the income concept on which the tax rate is applied, i.e. after deduction of tax-exempt income components, allowances and deductions. We look at the impact of the total of personal income taxes and social insurance contributions, as well as of each of these components separately.

We distinguish three income components: income from work (or employment income), income from old age or pensions, and income from other sources. First, income from work is defined as gross employee cash or near cash income. Second, income from pensions include both public and private pensions. Lastly, we consider income from all other sources; for pensioners and workers, this component captures all remaining income, for example self-employment, property or investment income. For individuals who are not part of either subgroup, this component can capture income from many different sources. Since we will only consider income from work for the earlier defined group of workers and income from pensions for the earlier defined group of pensioners, income from other sources also includes income from these components (work or pensions) received by individuals that did not work or receive a pension during the entire reference period of twelve months. Consequently, income from other sources is used in our analysis as a residual.

For pensioners, retirement income can come from each of the different tiers identified in the literature review. We have split up total pension income into three tiers and one “other” category. The first source is first tier retirement income (in countries where it is provided). The second source contains earnings-related pension income. Note that in some cases this might not be entirely accurate, as we include in this variable all pension income that is not specifically identified as a non-contributory benefit or a disability, widow(er)’s pension, early retirement benefit etc. The third source contains private pension income. Finally, a remaining variable (‘Other pensions’) contains disability pensions, survivors’ pensions, early retirement benefits etc., which do not fit into the logic of the pension tiers. We show the average contribution of each pension tier to total pre-tax pensions in Table 5. In most countries, second tier pensions are the most important source of pension income, with shares of

often more than 90%. The only countries where this is not the case are Denmark (6.2%) and the Netherlands (35.7%). Smaller shares are reported for Cyprus (74.5%) and the United Kingdom (68.5%). In Denmark, the Netherlands, Ireland and Cyprus, first tier pensions make up a large part of total pension income; they are even the largest source of pension income in Denmark and the Netherlands. The United Kingdom and Denmark are the only two countries where third tier benefits are quite important. In most other countries, the third tier is either non-existent (especially in most of the Baltic and CEE countries) or only very small. Note that Table 5 only shows average contributions to total pension incomes. Consequently, it is unclear whether the low average contribution of first and third tier benefit are because of low amounts for the entire old age population or high amounts for only a very small part of the old age population. Finally, in most countries, the category "other pensions" is quite small. Luxembourg and Italy are the only countries where these other pensions make up more than 10% of total pre-tax pension income (14 and 11.6%, respectively).

Table 5: Composition of pre-tax pensions of old-age individuals (as % of pre-tax pensions), 28 European countries, 2019

Group	**Country**	**Tier 1**	**Tier 2**	**Tier 3**	**Other pensions**
Nordic	Denmark	69.7	6.2	23.3	0.8
	Finland	0.2	91.9	1.4	6.5
	Sweden	0	96.2	3.6	0.2
	Netherlands	64	35.7	0	0.3
Anglo-Saxon	Ireland	12.5	85.7	1.8	0.1
	UK	2.8	68.5	28.4	0.2
Contin.	Austria	0	90.5	0.9	8.6
	Belgium	0	99.4	0.1	0.5
	France	1.5	98.1	0	0.4
	Germany	0.9	89.6	1	8.5
	Luxembourg	0	85.9	0.1	14
Baltic	Estonia	0.8	99	0.2	0
	Latvia	0.1	99.8	0	0.1
	Lithuania	0	96.7	0	3.3
CEE	Bulgaria	0.2	97.3	0	2.4
	Czech Rep.	0	93.4	0.1	6.5
	Hungary	1.4	98.5	0	0.1
	Poland	0	99.3	0	0.7
	Romania	1.4	98.4	0	0.2
	Slovakia	0	93	0	7
	Slovenia	0.5	99.1	0.3	0.1
	Croatia	0	100	0	0
South.	Cyprus	17.7	74.5	1.2	6.7
	Greece	0	98.2	0	1.8
	Italy	0.6	87.8	0	11.6
	Portugal	1.4	92.3	0.3	6
	Spain	2.6	90	1.7	5.8
	Malta	4.6	94.6	0.8	0

Source: EUROMOD, own calculations

As income from retirement and employment can be combined by an individual or a tax unit, it is not always straightforward to allocate taxes to a specific income source. We have opted for the following strategy to allocate personal income taxes and social contributions to (1) pensions; (2) income from work; (3) other income sources. First, SIC are allocated to the income component on which they are levied, e.g. employee social insurance contributions are entirely allocated to income from work. Second, for PIT we take a proportional approach, i.e. we allocate taxes to an income component according to the share of this income component in taxable income. This means that when income from work makes up 70% of total taxable income, 70% of this tax paid is allocated to this income component. This approach ensures that tax exempt income components, which are part of pre-tax income but not of taxable income, are allocated a tax amount of zero. In Greece, Italy, Lithuania, Netherlands, Romania, Sweden, Slovenia, Slovakia, UK, we use the same method to allocate social insurance contributions to employment and/or retirement income.

A further complication arises when personal income taxation is not levied on an individual basis. In those countries where joint taxation is applied, we have made some assumptions to divide income over individuals in a joint tax unit. In France, Germany, Poland, Portugal, Luxembourg there is income splitting, meaning that incomes are first summed within the tax unit and then divided by a certain number (in most cases, divided by 2, in France divided by an equivalence scale based on family composition). Taxes are then calculated based on this divided income and multiplied again to obtain total taxes within the tax unit. In this case, we apportion PIT according to the share of the income component in the divided income and allocate taxes to each individual according to the share of their individual income component in the total tax unit income component. In Spain, Ireland and Malta taxes are calculated using pooled tax unit income. Here, we use the share of each income component in pooled household income to calculate taxes paid on the respective income components, and again allocate these taxes to each individual according to the share of their individual income in the total income component of the tax unit. In Belgium, finally, the method to calculate is again slightly different because of the marital quotient. Under certain conditions, the partner with highest income can allocate a part of their income to their partner. As a result, the transferred income is taxed at a lower rate. In the cases where this happens, we calculate how much of the taxes paid by the partner with lowest income can be attributed to the transferred income, by using a proportional approach. We then transfer this amount of taxes back to the individual with highest income, who earned this component. We calculate proportional taxes on employment and retirement income using this adjusted amount of PIT.

To measure to what extent the tax treatment of old age pensions (and their components) is in line with the underlying principles, we use the following indicators. First, we operationalise horizontal equity by comparing the tax burden on old age pensions with that on income from work. Tax expenditures may be one reason why income from work and old age pensions have a different tax burden. But aside from the tax expenditures, differences in the average tax burden between employees and pensioners also depend on the size of the respective income components. Because old age income is generally smaller than employment income, the tax burden for pensioners will generally be lower than the tax burden of the working-age population in countries with progressive taxation. In addition, in many countries pensioners pay less social insurance contributions than the working-age population (or none at all), due to the fact that they have less risks to be insured against (Verbist, 2007). For this reason, we also look at the difference in tax burden between workers and pensioners across income quintiles. Quintiles are constructed on the basis of pre-tax equivalised

household income. Incomes (and income components) are equivalised by dividing them by the modified OECD equivalence scale.

Next, we use two indicators for vertical equity. On the one hand, we focus on the bottom of the income distribution and calculate to that extent pensioners are taxed into poverty. This is the share of old-age individuals that are considered non-poor based on pre-tax income, but that become poor after the deduction of PIT and SIC on component income. On the other hand, we show to what extent taxes on old age income contribute to overall progressivity. A common way to measure the progressivity of taxes is the Kakwani index (Kakwani, 1977; 1984). The index is a measure of how much the tax system deviates from proportionality. A positive Kakwani indicates that the tax is progressive, I.e. pro-poor, while a negative Kakwani points to a regressive tax. A Kakwani that is (close to) zero means that the tax is proportional. The Kakwani can be decomposed, such that it shows the contribution of each tax component to overall progressivity, using the following equation:

$$\prod_T = \sum_i^n \frac{t_i}{t} \prod_{T_i} ,$$

where $\prod_T$ is the Kakwani index for total taxes, *t* is the average tax rate of total taxes, t_i is the average tax rate of the specific tax component and $\prod_{T_i}$ is the Kakwani index of each specific tax component (Kakwani, 1977; Verbist & Figari, 2014). Both for poverty and progressivity indicators, equivalised incomes are used (equivalised with the modified OECD scale).

3.3 Measuring the extent of financial solidarity within multi-generational households

The aim is to investigate the redistributive effects of such cross-generational transfers in multigenerational households, disentangling the effects of their design from the impact of the different living arrangements. Moreover, multi-generational households also provide economies of scale as more people live together. This affects the equivalence scale compared to a situation of separate households. First, the analysis explores the interactions of the 'cross-generational transfers' with the tax-benefit system in order to derive the net effects on disposable incomes. Second, the analysis explores to what extent sharing assumptions differ across household types and how this may affect the equivalence scale traditionally used in empirical analysis. Standard practice in distribution analysis is to assume that resources are fully shared within the household. The literature, however, is becoming increasingly critical of this assumption; such criticism may hold *a fortiori* for extended families. Hence, we will then test several scenarios under different sharing assumptions and their impact on distributional outcomes.

The empirical analysis on the financial solidarity within multi-generational households (MGHs) is performed on the data of EU Statistics on Income and Living Conditions (EU-SILC) 2013. The 2013 database contains representative samples of private households of 32 countries (the EU member states at the time, plus Croatia, Iceland, Norway, Serb Republic and Switzerland). An MGH is defined here as a household with at least one child, one elderly individual and one of working age. A child is defined as any person in the survey younger than 18, an elderly individual as any person older than 64 and a working-age individual as any person aged between 18 and 64.

The SILC data reveal several specific characteristics of MGHs (these variables are also used in the logistic regression as controls, see infra). First of all, elderly individuals in MGHs are much more

likely to be grandmothers than grandfathers, especially in those countries where MGHs are more prevalent. In the Northern countries, grandfathers are more frequent in MGHs. The large majority of elderly individuals in MGHs do not report to suffer from poor health. This suggests that the need to care for a grandparent with health concerns is not a major factor behind MGH formation. Another key characteristic is the higher likelihood of having only one working-age adult in MGHs. As such, the grandparent can be seen as a substitute for a second parent figure in many MGHs. MGHs are also more likely to have a non-EU migrant background in Nordic, Continental, Anglo-Saxon and Eastern European countries, but not in Southern Europe. MGHs also have lower levels of human capital and a lower household work intensity. Remarkably, the difference in work intensity is absent in Eastern European countries, where MGHs are most present. This might reflect that the impact of the MGH formation on the propensity to work can operate in opposite directions. The elderly could require more care and take time away from labour market activity, but they can also serve as facilitators to labour market participation by acting as caregivers to the grandchild. These SILC-based observations largely confirm observations by Glaser et al (2018): 'grandparent households' are associated with socio-economic disadvantage (whether measured by marital status, work status or education level) in all the countries they study; grandmothers are more present than grandfathers; and they are more often formed in migrant households.

We measure child and elderly poverty with a headcount rate, which takes the share of individuals within the relevant age group with an equivalised household income below the poverty line. Following common practice in the European Union, the poverty line is set at 60 percent of median equivalised household income; incomes are equivalised with the modified OECD scale to take household composition into account.

3.3.1 Measuring the direction of financial solidarity

From a financial perspective, the formation of an MGH can be beneficial for the children involved, for the elderly involved, or for both children and the elderly (throughout this paper, we use 'beneficial' to mean 'financially beneficial'). We use 'pro-child' and 'pro-elderly', respectively, to describe MGHs whose formation is solely beneficial for the children or for the elderly, and 'mutual' to mean MGHs whose formation is beneficial for both the children and the elderly. We present a simple, formal framework that allows us to classify MGHs into these three distinct categories.

From the perspective of the children, the formation of the MGH is beneficial if their equivalised household income in the MGH is higher than their equivalised income in a counterfactual household without the elderly, or, formally, if

$$\frac{P+NP}{ESMG} > \frac{NP}{ESCF_C} \qquad (1)$$

with:

P = sum of non-equivalised incomes of household member(s) older than 64 (mostly pension incomes, hence '*P*', but note that *P* includes all incomes of elderly household members)
NP = sum of non-equivalised incomes of household members younger than 65;
ESMG = parameter applied to equivalise income of MGH (i.e. the equivalence scale)
$ESCF_C$= parameter applied to equivalise income of counterfactual household, from which we exclude the elderly (persons 65+);

Expression (1) can also be written as:

$$\frac{P+NP}{NP} > \frac{ESMG}{ESCF_C} \quad (2)$$

or:

$$\frac{P}{NP} > \frac{ESMG-ESCF_C}{ESCF_C} \quad (3)$$

These expressions formalise a simple insight: the formation of the MGH is beneficial for the children if the ratio of the incomes of the elderly divided by the incomes of the non-elderly is *larger* than the relative increase in the equivalence scale generated by MGH formation (i.e. larger than the difference between the equivalence scale of the MGH and the equivalence scale of the counterfactual household without the elderly, divided by the latter counterfactual equivalence scale). In other words, if the elderly add more income than spending needs, the children gain.

We can apply a similar reasoning from the perspective of the elderly: the formation of the MGH is financially beneficial for the elderly involved, if:

$$\frac{NP}{P} > \frac{ESMG-ESCF_E}{ESCF_E} \quad (4)$$

with

$ESCF_E$= parameter applied to equivalise income of counterfactual household, from which we exclude the non-elderly.

Equation (4) tells us that the formation of the MGH is beneficial for the elderly if the ratio of the incomes of the non-elderly divided by the incomes of the elderly is *larger* than the relative increase in the equivalence scale generated by MGH formation. If the income share of the non-elderly is larger than their share in the equivalence scale of the MGH, the elderly will benefit.

The formation of the MGH will benefit both the children and the elderly, if both equations (3) and (4) hold. Equations (3) and (4) can only hold simultaneously if the following condition is satisfied:

$$\frac{ESMG-ESCF_C}{ESCF_C} < \frac{ESCF_E}{ESMG-ESCF_E} \quad (5)$$

In short, we label MGHs ‘pro-child’ if equation (3) holds but equation (4) does not hold; MGHs as ‘pro-elderly’ if equation (3) does not hold but equation (4) holds; and MGHs as ‘mutual’ if both equations (3) and (4) hold. It is not possible that MGHs are neither ‘pro-child’ nor ‘pro-elderly’, as this would require that $ESMG \geq ESCF_C + ESCF_E$, which is in contradiction with the economies of scale incorporated in standard equivalence scales.

If the formation of an MGH is beneficial for the children, equivalised household income (in the MGH) improves relative to the poverty threshold (compared with the counterfactual, whereby the elderly would be excluded from the household). Hence, if their counterfactual income is below the poverty threshold, the formation of the MGH makes it possible to surpass the threshold, but it need not do so. If a large share of children lives in MGHs that are either ‘mutual’ or ‘pro-child’, we can therefore presume a beneficial impact of MGH formation on child poverty, but the importance of that impact is an empirical question.

3.3.2 Multivariate analysis

The results from the analysis on the direction of financial solidarity (cf. infra), show that MGHs are predominantly 'pro-child'. Hence, the poverty-alleviating effect of co-residing is potentially largest with respect to child poverty. Therefore, the subsequent empirical poverty analysis focuses on child poverty and its specific relation to elderly income in MGHs. As indicated in the previous section, we look at the contribution of *total* income of the elderly. Pensions, nevertheless, make up the large majority of elderly incomes, so these are the main drivers of the results.

In order to identify how being part of an MGH affects child poverty, we present a set of logistic regressions. The dependent variable ($Poor_i$) is whether a child is poor (1) or not (0). Our independent variables of interest are whether the child lives in an MGH (MGH_i; yes/no) and whether income from an old-aged person is present (yes/no). For the latter, we make a distinction between only income from an old-aged man (YOAM), only income from an old-aged woman (YOAF) and income from both an old-aged man and an old-aged woman (YOAFM)[1]. We thus estimate the following two logistic regressions for each country:

Model 1: $$Poor_i = \alpha + \beta\, MGH_i + \gamma X_i + \epsilon_i$$

Model 2: $$Poor_i = \alpha + \beta_1 YOAF_i + \beta_2 YOAM_i + \beta_3 YOAFM_i + \gamma X_i + \epsilon_i$$

We include the following control variables (X): (1) whether there is only one working-age adult in the household (yes) or more; (2) whether the old-aged person suffers from bad health (yes if PH010 is 4 [bad] or 5 [very bad]), with a separate variable for man and woman; (3) whether the head of the household has a migrant background (yes if non-EU born); (4) whether the head of the household has attained a higher education degree; (5) age of the head of the household and (6) work intensity of the household. These models allow us to estimate the effect on child poverty of being in an MGH, compared to being in a two-generation household that has similar (observable) circumstances. Hence, we correct for the fact that MGHs tend to form in adverse socio-economic circumstances. Note that these models at the same time also control for any behavioural changes that MGH formation causes that operate through these control variables. For example, if MGH formation allows working-age adults to increase work intensity because grandparents act as caregivers to their children, this beneficial effect will not be picked up by the analysis.

3.3.3 Simulation analysis of resource-sharing assumption

In addition, we perform a simulation analysis, i.e. we assess what child poverty would be if there were no income from the elderly in the household. A standard means of investigating how different income components help to reduce poverty is a pre-post analysis: what would poverty be before and after inclusion of the component in household income (see e.g. Levy et al., 2007; Salanauskaite and Verbist, 2013)? This static analysis does not take into account possible behavioural reactions. This limitation of the method is well-known (Bergh, 2005; Jesuit and Mahler, 2010, Marx et al., 2016). Nevertheless, a pre-post analysis is relevant for our research question as it provides an indication of how important the pension income is in lifting the household above the poverty line.

[1] Given that in the large majority of MGHs the old-age person(s) has/have income, the reference category is children living in two-generation households.

We expand upon this standard pre-post analysis by also investigating the role of the equal-sharing assumption of household income that is standardly used in distributive analyses. The standard full-sharing assumption is probably especially unrealistic for MGHs. We therefore perform a selection of simulations to test the sensitivity of our outcomes to changes in the resource-sharing assumption. Two extreme assumptions would be: full-sharing on one hand and no sharing on the other. Neither is very realistic, but such simulation exercises present upper and lower bounds and hence provide a valuable indication of the importance of income sharing within the household (Burton et al., 2007). Simulation studies of this kind are rare (examples are Jenkins, 1991; Sutherland, 1997; Phipps and Burton, 1995). A few studies have investigated sharing within households using survey questions that explicitly ask about the degree of income-sharing (e.g. Woolley and Marshall, 1994). Using self-reported data from the ad hoc module of EU-SILC 2010 on the degree of sharing in households we can approximate the true degree of sharing in MGHs and construct a more plausible additional scenario. To the best of our knowledge, no previous study has analysed sharing in MGHs using direct survey data.

We find indeed that full sharing of incomes occurs less in three-generation than in two-generation households. In those countries where full sharing is relatively limited, there is still substantial partial sharing of resources. Additionally, the data show that old-aged members of an MGH share a substantial part of their income in the common household budget. In the countries with at least a moderate share of MGHs, the degree of sharing in MGHs centres around 70%. We present a scenario in which part of elderly income is shared within the household budget. This part is determined for each country by the weighted average of the reported degree of sharing.

Our simulations test the impact of the two factors that are relevant for child poverty in MGHs: (1) income from the elderly increases the income that can be shared in the household; and (2) living costs increase due to the additional household members, but less than proportional because of economies of scale. We calculate several pre-post scenarios, in which we change either the income shared by the elderly or the equivalence scale. As alternatives to our baseline scenario, which is the current situation with the full sharing assumption and unchanged equivalence scale, we present the following four scenarios:

1) *'No sharing, equivalence scale unchanged': elderly incomes removed from household income; household composition not changed; equivalence scale not changed*. This scenario corresponds to the situation where the old-aged person in the household would not share its income with the other persons in the household. The cost of living of the old-aged person is still taken into account as the equivalence scale is not altered. While this is not a realistic scenario, it indicates what child poverty would be in the absence of the elderly income in the household.
2) *'No sharing, no elderly in equivalence scale': elderly incomes not included in household income; elderly excluded from household; equivalence scale changed correspondingly*. This scenario corresponds to the situation where there would be no MGH; i.e. the elderly effectively form(s) a separate household. Hence, neither elderly incomes nor living costs are shared.
3) *'No sharing, split equivalence scale':* multigenerational households are divided into two sub-households under same roof, notably one consisting of the old-aged person(s) and one consisting of the children and working-age individuals, but the equivalence scale is adapted so that the first adult in both households gets a value 0.75 (rather than 1). This corresponds to the situation where the different generations live under the same roof and thus benefit from

economies of scale. We therefore divide the economies of scale over both households, but resources are not shared.

4) *'Part of elderly income shared, equivalence scale unchanged': incomes from elderly partially removed from household income; household composition not changed; equivalence scale not changed*. This scenario corresponds to the situation where the old-aged person in the household shares only part (based on the SILC-reported sharing degrees) of his/her income in the household; the cost of the old-aged person is taken into account as the equivalence scale is not altered. It provides an indication of what child poverty would be when only part of the income is shared in the household.

For scenarios 1) and 4), child poverty rates will increase by construction, compared to the baseline of full sharing. This increase will be especially strong in scenario (1). In the case of scenarios 2) and 3), child poverty can move either way (as compared to the baseline) depending on whether the effect of changing incomes or the effect of changing equivalence scales dominates.

3.4 Reconstructing employment and childbearing histories of mothers in SHARE

In particular, this study assesses whether the availability of institutional arrangements facilitating a better work-life balance for men and women in early- and mid-life employment has a positive effect on labour force participation after age 50. The analysis covers the EU countries based on SHARELIFE data, collected in 2008-2009 and applies longitudinal micro-econometric techniques, including survival analysis.

The analysis is based on four waves of data from the Survey on Health, Ageing and Retirement in Europe (SHARE), a unique cross-national longitudinal dataset that contains a wealth of information about the present and past lives of adults aged 50 and above in 27 European countries plus Israel. In SHARE, individuals and households were surveyed biannually from 2004-2005 (wave 1) to 2014-2015 (wave 6). Wave 3 is especially important for the scope of this article as it is retrospective and so allows reconstruction of the employment and childbearing histories of the mothers in our sample. Therefore, we select mothers who participated in waves 2, 4 or 5 and for whom there is also retrospective information in wave 3. This rather restrictive selection criterion significantly reduces the size of the sample for each country, and after list-wise deletion of missing cases we were forced to drop from our study many of the initially available countries. Thus, we are left with a total of 7,746, mothers − among which 5,855 are in a partnership − residing in ten countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain and Sweden.

We are interested in detecting individual economic consequences of job interruptions for childbearing and childrearing. To this end, we focus on mothers' *absolute earned income* in later life as our first dependent variable. Absolute earned income is a broad measure that includes three main sources of income: income from employment (both as an employee and self-employed); income from pensions (public and private); and income from a lump sum payment. We compute this variable using the imputed net annual incomes provided by the imputation models that each round of SHARE used. We pool together the average values of the multiple imputations of the different income sources, and correct for purchasing power parity.

The second dependent variable, instead, captures a different aspect of income inequality as it focuses on income differences between women and their partners. The variable − built using the previous income components − represents the mother's share of earned income relative to the sum of her and her partner's earned income. This approach allows for a more inclusive analysis of women's long-term penalties, highlighting the role of family and pension policies in diminishing between-gender income inequalities in later life.

The main independent variable is derived from the retrospective wave of the survey and taps the length of time that mothers interrupted their careers after the birth of their first child. Specifically, we use a categorical variable that has five response categories regarding whether and for how long the mother stopped working at the time of the birth of the child: no interruption (reference category); less than a year; over a year but she eventually went back to work; she never returned to work; she was not employed at the time of the birth.

The multivariate regression models control for a set of potentially confounding variables. These are the mothers' age, level of education (low as reference, medium and high), employment status (not employed as reference versus employed), the number of children she ever had and the year of birth of the first child. We also include a categorical variable indicating the employment status of the partner (no partner as reference versus retired, employed, other not employed). Finally, we include a variable measuring the mother's pay at the birth of the child. We compute this variable in different stages. We use the first net pay received from work prior to the birth of the first child. The pay is converted into dollars (Officer 2017), adjusted for inflation to 1999 values (calculation based on the Consumer Price Index), and then converted into euros. When focusing on mothers' relative incomes, we also control for the partner's level of education (low as reference, medium and high). Summary statistics for all the variables included in the models are presented in Table 6.

For both dependent variables, we run models separately by country. Considering that the two outcomes differ in their distribution, we apply two different specifications. For absolute income, it is a common practice to use its natural logarithm rather than the raw version of the variable. However, this strategy has the drawback of eliminating subjects whose income is zero. Considering that we have a considerable number of mothers with zero income, we choose to use an alternative strategy and opt for a generalized linear model (GLM) with a log link (Model 1). This allows us to accommodate the skewed distribution of the variable without losing any observations. For mothers' relative income, since the variable is constrained between 0 and 1 we use a GLM with a logit link and the binomial family with robust standard errors (Model 2).

Table 6 Summary statistics (means and proportions) by country and overall

	Austria	Belgium	Denmark	France	Germany	Greece	Italy	The Netherlands	Spain	Sweden	Total
Absolute income	8573	10631	12941	12356	8282	5300	5235	10127	3906	11201	8362
Work-interruption											
No job interruption	.191	.325	.119	.359	.276	.0649	.176	.101	.0815	.0503	.175
<1 year	.202	.159	.429	.148	.203	.182	.172	.0819	.0908	.385	.192
>1 year	.294	.0665	.107	.102	.255	.0149	.0196	.272	.0244	.302	.119
Never returned	.14	.0829	.0688	.0546	.153	.0263	.0579	.215	.0314	.052	.0806
No job at the time	.173	.366	.277	.336	.114	.712	.575	.33	.772	.211	.433
Age	65.4	64.9	63.9	63.9	63.8	63.5	64.6	64.8	67.5	66.6	64.8
Level of education											
ISCED 0-1	.248	.24	.172	.402	.00531	.585	.589	.132	.698	.286	.371
ISCED 2-3	.569	.501	.437	.404	.731	.299	.348	.673	.246	.348	.437
ISCED 4/6	.183	.26	.391	.194	.264	.116	.0626	.196	.0559	.366	.191
Employment status											
Not employed	.876	.776	.599	.698	.707	.818	.854	.766	.868	.671	.772
Employed	.124	.224	.401	.302	.293	.182	.146	.234	.132	.329	.228
Partner employment status											
No partner	.534	.376	.361	.413	.329	.387	.306	.412	.333	.461	.378
Partner retired	.35	.379	.287	.365	.414	.342	.521	.387	.467	.343	.395
Partner employed	.102	.194	.306	.186	.196	.242	.141	.167	.137	.182	.188
Partner not employed	.0135	.0512	.0448	.0369	.061	.0289	.0317	.0336	.0629	.0139	.0395
N° children	2.35	2.42	2.34	2.41	2.19	2.1	2.33	2.5	2.69	2.26	2.35
Child year birth	1965	1965	1964	1965	1967	1963	1966	1965	1952	1958	1963
N	371	977	581	732	754	1140	1071	684	859	577	7746

4. SCIENTIFIC RESULTS AND RECOMMENDATIONS

4.1 Minimum income protection schemes in Europe: adequacy and trends

4.1.1 Adequacy of European minimum income provisions

Minimum-wage earning, active-age households

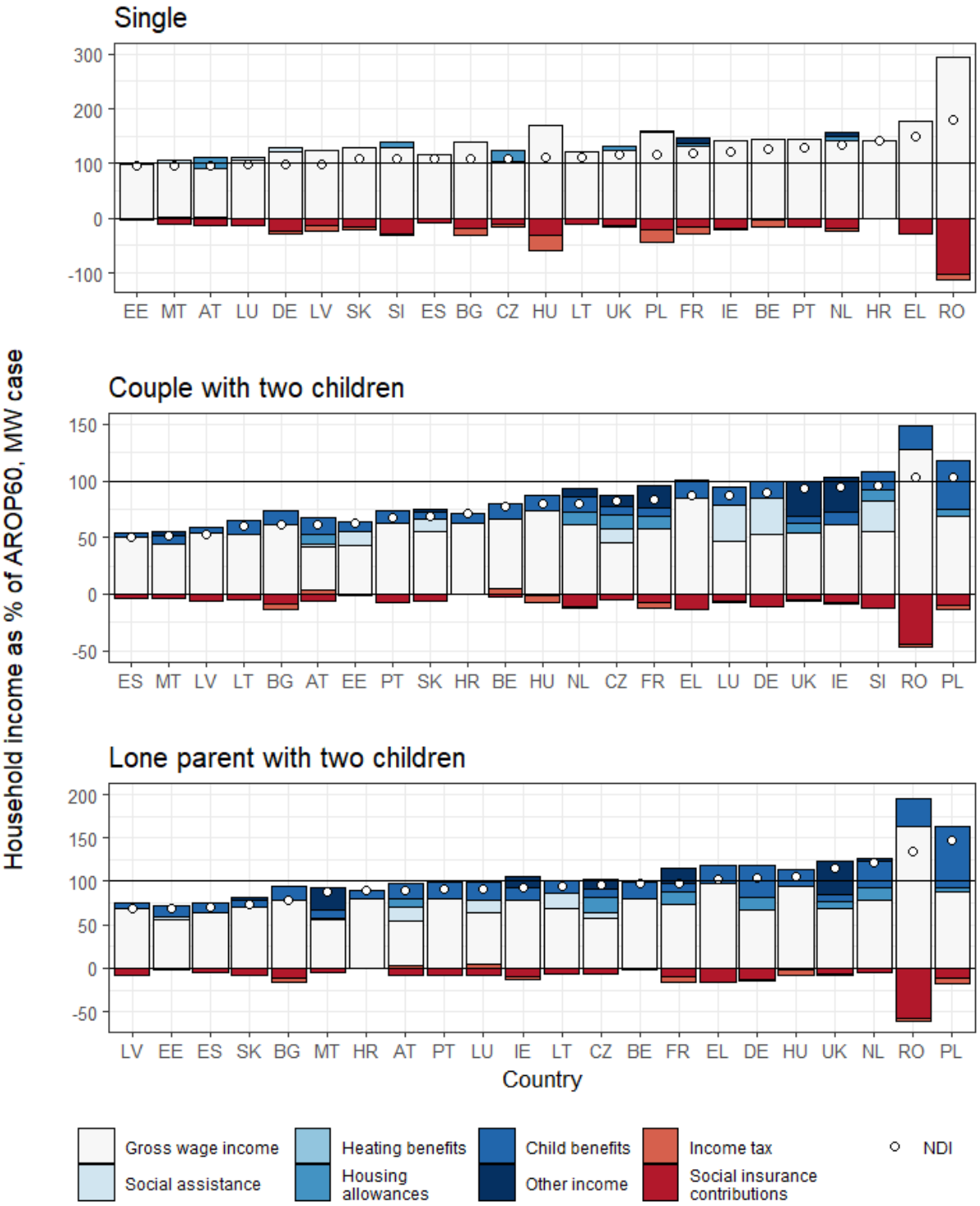
MIP provisions for the *working population* are usually upheld through a combination of a minimum wage and tax benefit policies. While most EU Member States have a statutory minimum wage on the national level, either set by government or expert committees or through agreement by social partners which is subsequently ratified and extended by legislation, a few retain sectoral agreements with diverging minimum rates depending on industry or firm. This is the case for Cyprus, Denmark, Finland, Italy and Sweden, although Cyprus has a separate, statutory minimum wage for a few sectors. In Figure 1, we show the adequacy of these MIP provisions for a single, a couple with 2 children and a lone parent with 2 children, all depending on one full-time minimum wage. We focus on countries with a national (quasi)statutory minimum wage and Austria. In Austria, the social partners agreed upon a national minimum wage for the first time in 2009. Whereas this agreement did not get the same status as a quasi-statutory minimum wage, it applies to nearly the entire work force (OECD, 2012), warranting its inclusion in Figure 1.

A first observation from this graph is that gross minimum wages largely differ between countries. Full-time minimum wages are surprisingly high in Romania, Greece and Croatia (Eurofound, 2018). At the other end of the spectrum, they are comparatively low in Austria, Estonia, Malta, Luxembourg, and the Czech Republic, where gross minimum wages do not (or only very nearly) suffice to keep a single minimum wage earner out of poverty. In the three latter countries, single minimum wage earners do receive a small additional (social assistance or housing) benefit, bringing their net disposable income at – or, in the case of the Czech Republic, above – the at-risk-of-poverty threshold, in spite of low minimum wages and (limited) social insurance contributions.

In spite of relatively low minimum wages in some countries, limited taxes do allow for single minimum wage earners to generally have a net disposable income at or above the 60% national at-risk-of-poverty threshold. Social insurance contributions, that are usually proportional rather than progressive (as is more likely in the case of taxes) do remain significant for minimum wage earners in most countries. In Luxembourg, Germany, Slovenia, the Czech Republic, France and the Netherlands, single minimum wage earners are eligible for (small) additional benefits. The households in Germany and Luxembourg receive social assistance top-ups due to their relatively low income, and in the Czech Republic and Slovenia housing allowance is granted due to high assumed housing costs (median rent, see Marchal et al., 2018) relative to the hypothetical household's income. In the Netherlands housing allowance and a benefit for the payment of compulsory health insurance are granted, whereas in France

single minimum wage earners are eligible for a housing allowance together as well as for the Prime d'Activité, an in-work benefit for low earners.

Figure 1. Income components of active age households with one minimum wage-earner, expressed as percentage of 60% of median income poverty threshold, 2018.



Note: Only countries with statutory minimum wages – and Austria – included. Slovenia is excluded from the lone-parent case due to missing lone parent benefits in EUROMOD.
Source: AROP60 thresholds retrieved from Eurostat.

For households with children, the situation is markedly bleaker. Net disposable incomes are clearly less sufficient, even with low levels of taxes in most countries and substantial additional benefits such as child benefits, housing allowances and even top-ups from the social assistance scheme. For breadwinner households with children, the poverty threshold is only exceeded or (almost) reached in the United Kingdom, Ireland, Slovenia, Romania and Poland. The available benefits clearly do not suffice. In some countries, means-tested social assistance may come into play when the hypothetical family's income is below the social assistance benefit (or slightly higher, as usually social assistance schemes apply limited disregards to earned incomes). However, as social assistance usually depends on a work willingness condition, it is not always clear whether such a top-up would be awarded to a breadwinner household, or whether a social worker would rule that the inactive spouse should start looking for work first. When only applying the income conditions, social assistance top-ups may be awarded in 2018 in Austria, Estonia, the Czech Republic, Germany, Luxembourg, Portugal, Slovakia and Slovenia.

Yet, the work willingness criterion meant that national experts deemed it unlikely that a breadwinner couple would receive a social assistance top-up in Portugal, and that they would receive a lower top-up due to the spouse's inactivity in Austria, the Czech Republic and Slovenia. These are all taken into consideration in Figure 1. For Slovakia, this correction was not possible (see Marchal et al., 2018). For Germany on the other hand, national experts did consider it likely that the social assistance top-up would be awarded, based on the clear effort of the working adult and the presence of children in the household. For Estonia and Luxembourg it is not clear which reasoning would dominate. For Estonia for instance it was noted that similar restrictions were likely to apply but with extensive variation between municipalities, which could not be predicted or readily assumed. Hence, for Estonia and Luxembourg, Figure 1 does include the social assistance top-up, possibly leading to an overestimation.

Incomes are slightly more sufficient to prevent against poverty in lone-parent households due to benefits that are often as high as for a couple with two children (and in some cases even higher, thanks to separate lone-parent benefits, and a social assistance top-up that does not depend on the work willingness of a spouse), whereas the equivalised poverty threshold is lower, due to only one adult being present.

In the countries that ensure net disposable incomes at or above the poverty threshold for families with children, child benefits play a particularly significant role in doing so in Poland and Romania for both households with children, and additionally in Belgium, Hungary, Luxembourg, the Netherlands, Slovenia, Greece and Germany for lone parents. In all these cases, the child benefits are equivalent to one fifth of the income required to pass the at-risk-of-poverty threshold. The Polish *Family 500+* childcare allowance is of particular note, providing a means-tested payment for the first child in a household and a universal, non-means tested payment for subsequent children. Since its implementation in 2016 it has contributed to a slight decrease in poverty, albeit also to a decrease in female labour force participation (Magda, Kiełczewska and Brandt, 2018). Romania combines universal and means-tested child benefits to raise the incomes of households with children, as do the Netherlands and Belgium

for lone-parent households. Luxembourg and Hungary see only – relatively generous – universal child benefits for lone parent families, while Greece has a means-tested benefit in place. Other relevant income components for working, low-income households with children are the aforementioned Prime d'Activité in France, the Working Tax Credit in the United Kingdom, and the Family Income Supplement in Ireland.

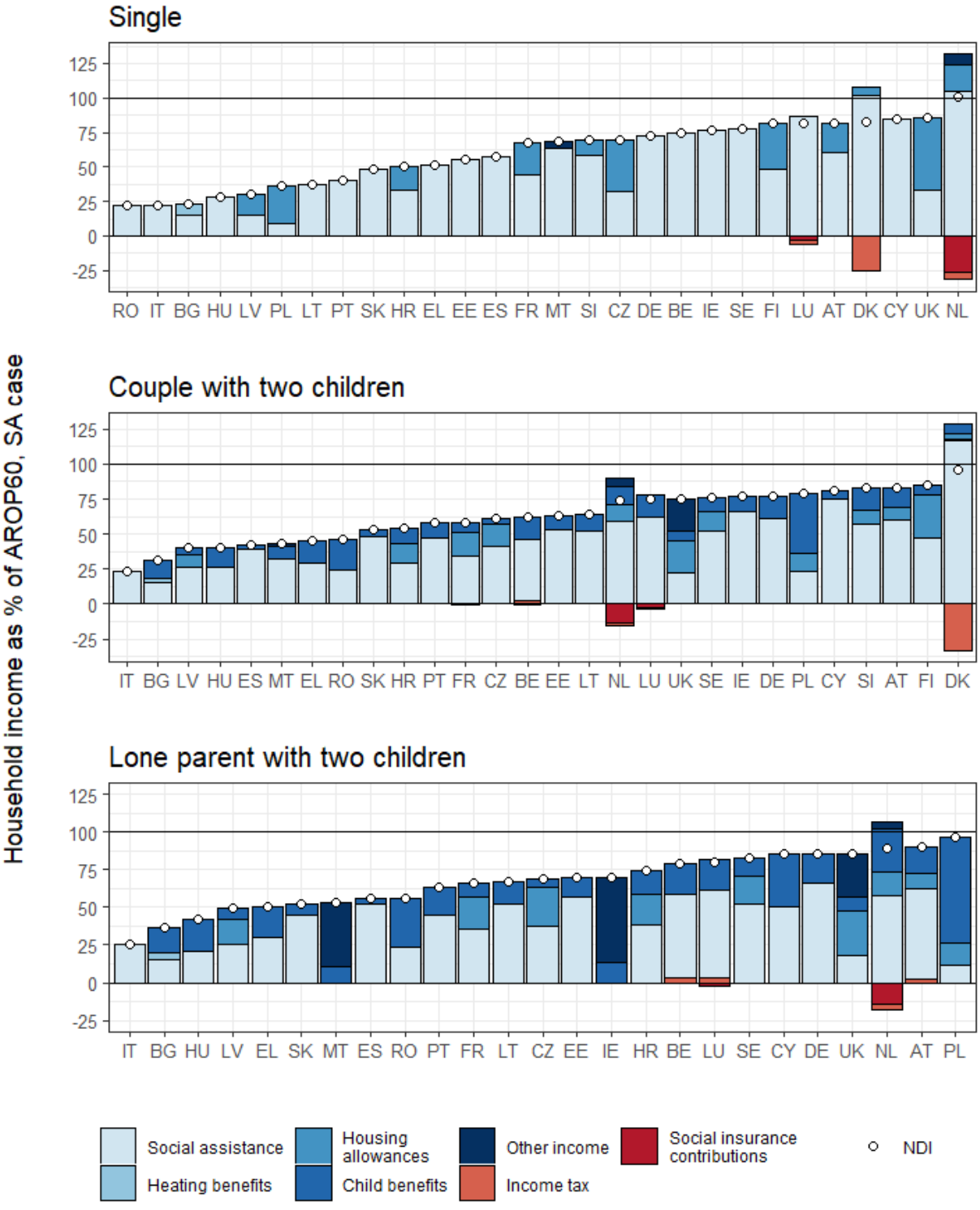
Please note that these estimates represent a 'best case' scenario, in which families are fully aware of all the benefits to which they are entitled, and take the necessary steps to apply for those. The graphs also show an annualized income, based on a full-year, full-time minimum wage, including holiday payment (if applicable) and assuming that all benefits are paid year-long. Given the often fluctuating incomes of low-wage earners, and the different application procedures for (means-tested) benefits, this is a rather strong assumption (Hills, 2014; Trlifajová and Hurrle, 2019).

Non-working active-age population

We now move on to the non-contributory minimum income protection packages available to *non-working households of active age*. As both Greece and Italy have recently introduced minimum income schemes, this target group can now rely on some form of means-tested assistance in each EU Member State. In most countries, this target group has access to a general social assistance scheme. In a limited number of countries however, non-working of active age may rely on a categorical scheme catering specifically to those who are able to work. This is the case in Finland, Germany, Hungary, Ireland and the United Kingdom. In addition, in some countries minimum income protection for the non-working of active age is not organised nationally, but arranged at the regional or local level. This is currently the case in Austria (even after a centralization haul in 2010, regional differences remain) and Spain. For countries where local differences in implementation and benefit levels may occur (which is for instance the case in Sweden and Poland), we focus on the nationally legislated base level.

Figure 2 shows the adequacy of the minimum income package for the non-working able-bodied of active age. The findings are in line with conclusions elsewhere: in most countries and situations, benefit levels for those of active age who are not in employment are not sufficient to protect against poverty (Van Mechelen and Marchal, 2013; Cantillon and Vandenbroucke, 2015). Of the three model households, only the single person household in the Netherlands achieves a net disposable income which surpasses the at-risk-of-poverty threshold (although couples with children in Denmark and lone parents in Poland are close). Between-country variation is high: for instance, the newly-introduced MIP levels in Italy reaches only between 22-25% of the AROP threshold. In general, guaranteed minimum incomes are higher for households with children, and lone parent-households see the smallest relative gap to the poverty threshold.

Figure 2. Income components of three non-working hypothetical households at active age, expressed as percentage of 60% of median income poverty threshold, 2018.



Note: Denmark, Finland and Slovenia excluded from lone parent case due to their lone-parent benefits not being simulated in EUROMOD.

Source: AROP60 thresholds retrieved from Eurostat.

What are the different income components that together make up the net disposable incomes of non-working active age households depending on social assistance? Single-person households usually solely rely on (general or categorical) social assistance, although in eleven countries housing allowances provide an important supplement to income. This is the case in Austria, the Czech Republic, Denmark, Finland, France, Croatia, Latvia, the Netherlands, Poland, Slovenia and the UK. Some of these countries reimburse all housing costs (that are here assumed to be the median rent for a single person in a country) below a certain ceiling, whereas others only reimburse a share of housing costs according to specific parameters (see Siöland, forthcoming; Marchal et al. 2018). Bulgaria also provides a contribution towards the costs of heating, and Danish households are eligible for a Green Cheque as compensation for costs associated with increases in energy taxes. In other categories, the Netherlands provides a top-up for the payment of mandatory health insurance, and in Malta a cash bonus is paid every half year to households in receipt of public benefits or pensions. Taxes and social insurance contributions are seldom relevant for social assistance beneficiaries. Child benefits on the other hand are of substantial importance for families with children. In around half of the EU MSs, child benefits are however included in the social assistance means-test, yet in those cases higher MIP base rates for families with children compensate for this.

For lone parent households, additional benefits are sometimes available: Cyprus, Hungary, Ireland, Malta, the Netherlands, Poland, Portugal and Romania all have separate child benefits to this effect. This is reflected in **Error! Reference source not found.**, where total child benefits make up a larger part of the total household income for lone parents than for couples. In two cases, lone parents benefit from categorical benefits specific to their situation which are of sufficient scale to be considered as separate income components rather than as part of the child benefit package: this is the case in Ireland with the One-Parent Family payment and in Malta with the Social Assistance for single parents, presented above in the category of ‘other’ income components. Small child-related refundable tax credits are relevant for social assistance beneficiaries with children in Belgium, Luxembourg and Austria.

Old-age, non-insured households

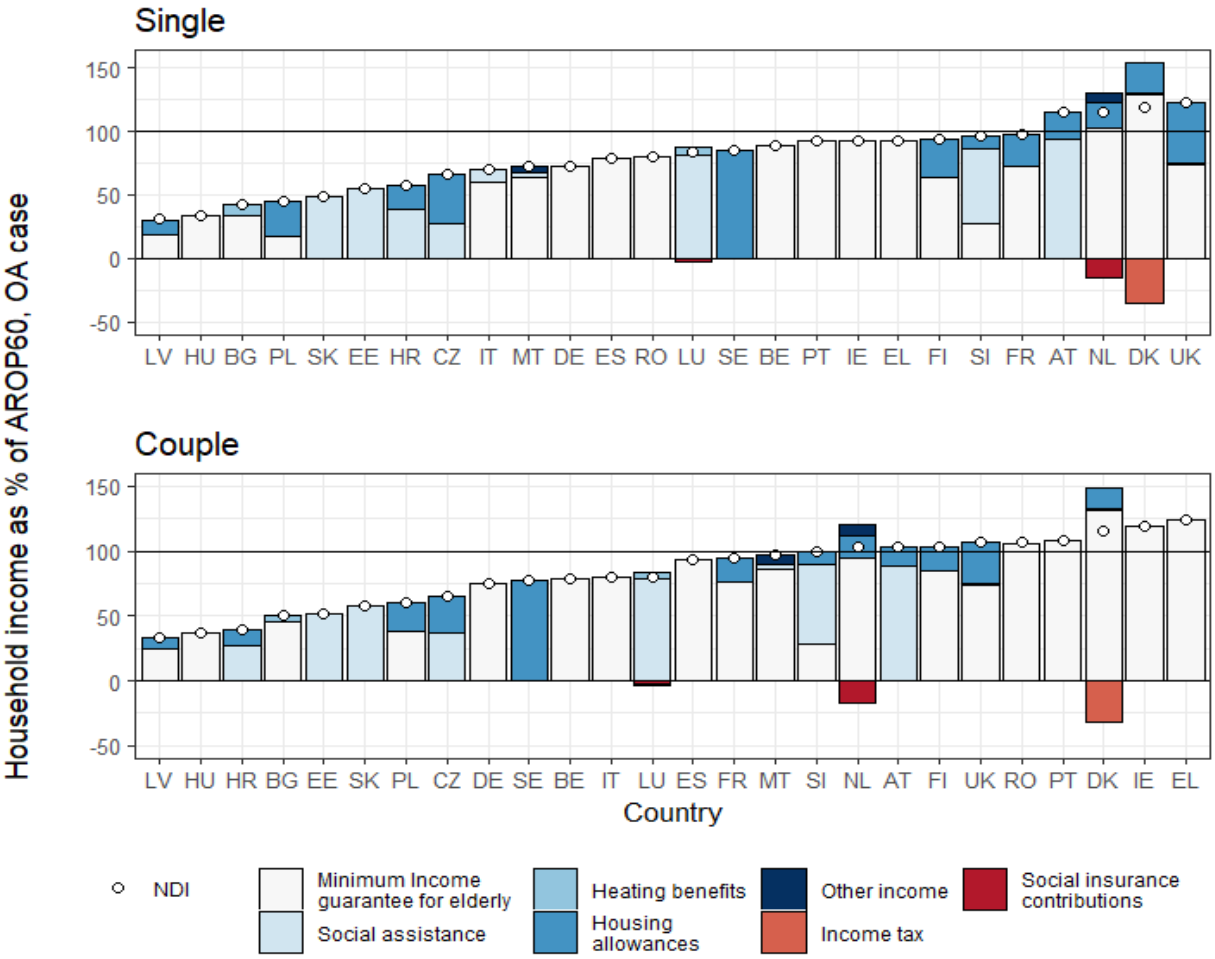
Finally, we consider the adequacy of *minimum income protection provisions for the elderly*. As for the other MIP provisions discussed, wide variation exists in both the design and coverage of MIP provisions for this target group. Two countries, Denmark and the Netherlands, have a basic pension as their main minimum income support scheme for the elderly. Such a provision is non-contributory, and also not means-tested. Its level solely depends on the number of years one has resided in the country (and is decreased per year lacking from the residence record). In Figure 3, where we show the adequacy of MIP provisions for the EU Member States, we show the basic pension for both countries, hence assuming that our typical families have full residence records. A different type of MIP provision for the elderly exists in Cyprus, Estonia, Finland and Sweden, where a conditional basic pension applies. This type of pension is pension-tested, but disregards other types of incomes or assets.

The most common form of minimum income protection for the elderly is however categorical means-tested support for the elderly, termed a “social pension” by Goedemé (2013). Usually, such a scheme also exists in the (conditional) basic pension countries, for residents who do

not have a sufficient residence record. Finally, for a few countries, elderly rely on the same social assistance programmes as the population at large. Still, often, even when elderly fall administratively under the social assistance scheme, additional top-ups or benefit rates may apply. In Austria and Croatia old-age households with low income receive social assistance, but with slightly different rates and allowances from the working-age population. Slovakia has separate, additional components available for old-age recipients. In Poland the benefit is part of the social assistance system, but the *permanent* social assistance (*Zasiłek stały*) is separate from the *temporary* received by those of working-age. This is similar to in Slovenia where the regular social assistance payment is combined with a top-up in the form of income support (*Varstveni dodatek*), which is made available for old-age households and others who are either incapable or permanently unemployable. Finally, in the Czech Republic and Luxembourg social assistance at substantively the same rate as for working-age households applies.

Figure 3 shows the adequacy of the minimum income guarantee for elderly without contribution records to the social insurance pension scheme for a single and a couple at pensionable age. This indicates a slightly more optimistic picture than for the non-working households at active age, with about a third of countries reaching or exceeding the poverty threshold. It is noteworthy that most countries only have one income component, being either the minimum income guarantee for elderly (MIGE) or social assistance. In Austria, Denmark, the United Kingdom, the Netherlands, Slovenia and Spain, housing and heating allowances contribute to a comparatively high income. However, the same benefits are received by households in the Czech Republic, Poland, Bulgaria, Croatia and Latvia, but here fail to prevent very low incomes. It is also worth noting that households in Italy and Malta combine MIGE and social assistance: the single Italian elderly household qualifies for the recently introduced ReI, the Maltese households benefit from the same bonus payments for recipients of public benefits as does the working-age non-employed household.

Figure 3. Income components of old-age households without access to contributory pensions or benefits, expressed as percentage of 60% of median income poverty threshold, 2018.



Note: Cyprus and Lithuania not included due to social pension not simulated in EUROMOD.
Source: AROP60 thresholds retrieved from Eurostat.

4.1.2 Trends

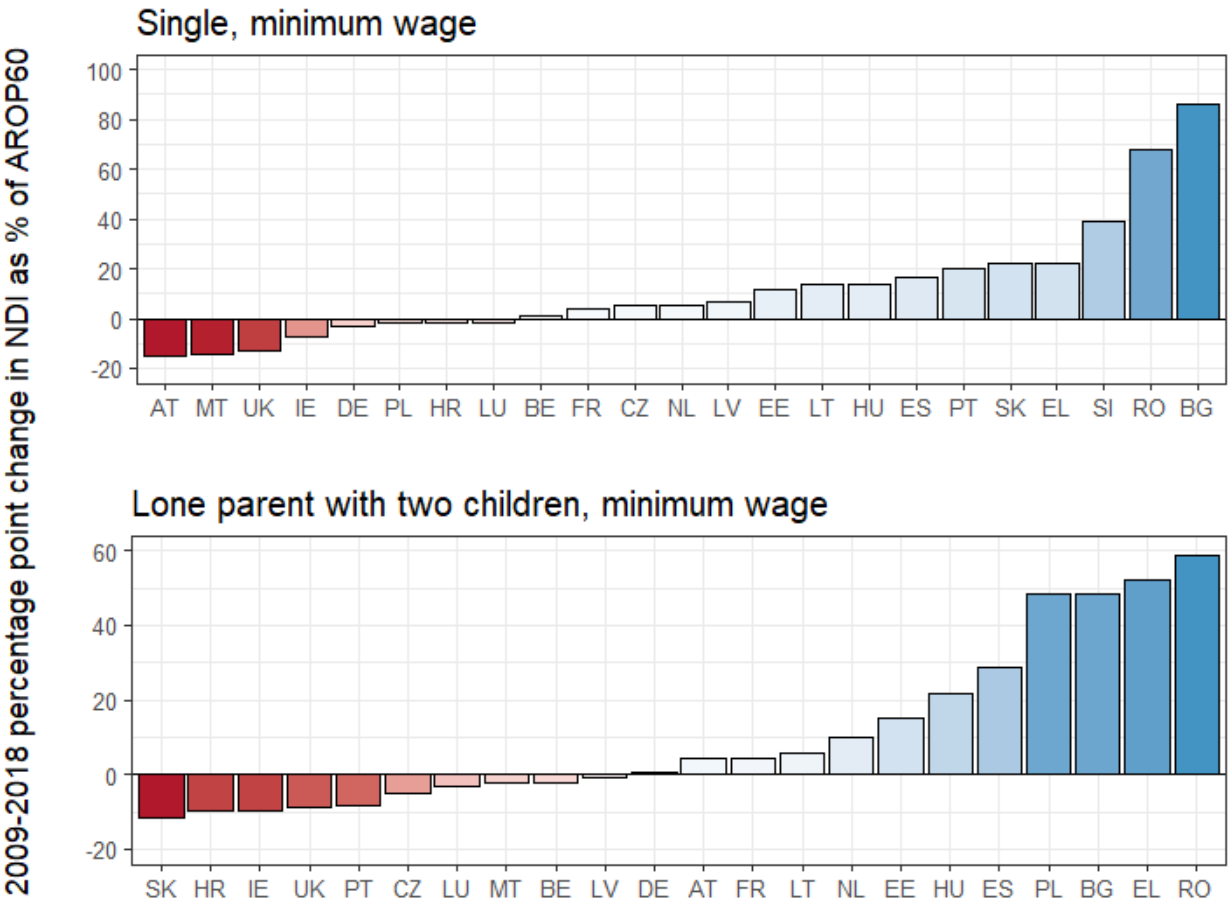
We now turn to a discussion of the trends in income packages for the 2009-2018 time period. Figures 4-6 display the percentage point change in net disposable incomes relative to the poverty threshold. To give a briefer overview, we focus here on single and lone-parent households for active age households, and on single and couple households in the old age case.

Minimum wage-earning households

A first important development regarding the adequacy of legally guaranteed MIP for working families is the introduction of a minimum wage in Austria and Germany. First, Austria implemented its *Mindestlohn* in January 2009, constituting an agreement between trade unions and employers. More recently, Germany has become the latest EU country to implement a statutory minimum wage. Against a backdrop of increasing inequality and preponderance of low-paid jobs the social democratic SPD campaigned for a minimum wage in the 2013 federal election, and it formed a core demand in the coalition agreement with Christian democratic CDU. The previous system of sectoral, collectively bargained agreements had been weakened by decreasing trade union enrolment since the mid-90s, increasing inequality and in-work poverty and a significant growth of the low-wage sector in the form of e.g. 'mini-jobs' (Marx, Marchal and Nolan, 2013; Carlin et al., 2017; Bosch, 2018). After its implementation, recent assessments indicate that the minimum wage has been successful in increasing earnings on the lower end of the wage distribution but that this often has come along with fewer working hours and lower work intensity, leaving monthly net earnings similar to pre-reform levels for many low-earners (Caliendo et al., 2017; Bruttel, Baumann and Dütsch, 2018). From Figure 4, it is apparent that the net disposable income a single minimum wage earner has eroded slightly in Germany since its introduction, whereas it eroded substantially in Austria where the non-statutory minimum wage has seen no nominal increases since its 2009 introduction.

For over half of the countries included in Figure 4 however, the situation of a minimum wage household improved. In single-person households this trend is particularly notable in some Eastern European states, with both Romania and Bulgaria having significantly increased their minimum wages. The substantial increases of net disposable incomes of a lone parent working at a minimum wage in Poland, and to a lesser extent also in Spain and Estonia, are chiefly attributable to the new or increased child benefits rather than real increases in minimum wages. For both households, Greece presents a divergent case: minimum wages were cut by about 20% in 2012 following crisis measures in the Great Recession, and nominal minimum wages remain lower in 2018 than prior to the crisis. However, with decreases in general wages and living standards in Greece at the same time, the poverty threshold is also lower. The increases in Greece are therefore not necessarily indicative of improved living conditions or an improved situation in the country as a whole.

Figure 4. Percentage point changes in NDI as a percentage of 60% poverty threshold for two minimum wage-earning households, 2009-2018.



Note: Only countries with statutory minimum wages (and Austria, as per discussion above) included in graph. Note that comparisons for Germany are 2015-2018 due to recent introduction of statutory minimum wage, and Croatia 2013-2018 for data availability reasons due to their late EU accession.
Source: AROP60 thresholds retrieved from Eurostat.

The more modest increases in France, Latvia, the Czech Republic, the Netherlands and Hungary mainly follow increases in minimum wages. For France and the Netherlands minimum wages are generally set by indexation against other economic indicators to ensure steady increases (Visser, 2016; cf. Askenazy, 2014: 3 for France). Latvia has also seen steady increases in the minimum wage following successful tripartite negotiations (Eurofound, 2018). Hungary and the Czech Republic see less gradual but nevertheless significant minimum wage increases, increasing nominal minimum wages by 77% and 52.5% respectively in the 2009-2018 period.

Trends for households with children are broadly similar in France, where child benefits and social assistance payments increased over time, and in Hungary, where the impact of lower child benefits was compensated for by lower social insurance contributions. In the Netherlands, Latvia and the Czech Republic, households with children did fare differently. Whereas the hypothetical lone parent family did experience a relative increase similar to the single person household thanks to a means-tested 'child-related budget' benefit introduced in the

Netherlands in 2015, the couple with children is not eligible for this benefit, causing their income to remain stagnant in relative terms. In Latvia child benefits remained stable throughout the period leading to small gains for the single household but decreases for households with children, whereas in the Czech Republic the 2011 abolition of a means-tested child benefit was only partially compensated by a higher social assistance top up, causing higher overall increases for the household without children. A smaller increase in Lithuania reflects the fact that social assistance rates for this household were progressively cut to 0 between 2009 to 2016. However, in 2018 the child allowance was taken out of the means-test, once again qualifying the household for additional social assistance payments. Portugal also sees increases in minimum wages, but families with children still experienced decreases in their net disposable income since 2009 – cuts of social assistance following the Great Recession have meant that benefit packages which made up a significant amount of household income in 2009 have not yet been recuperated in 2018, even amidst slow recovery.

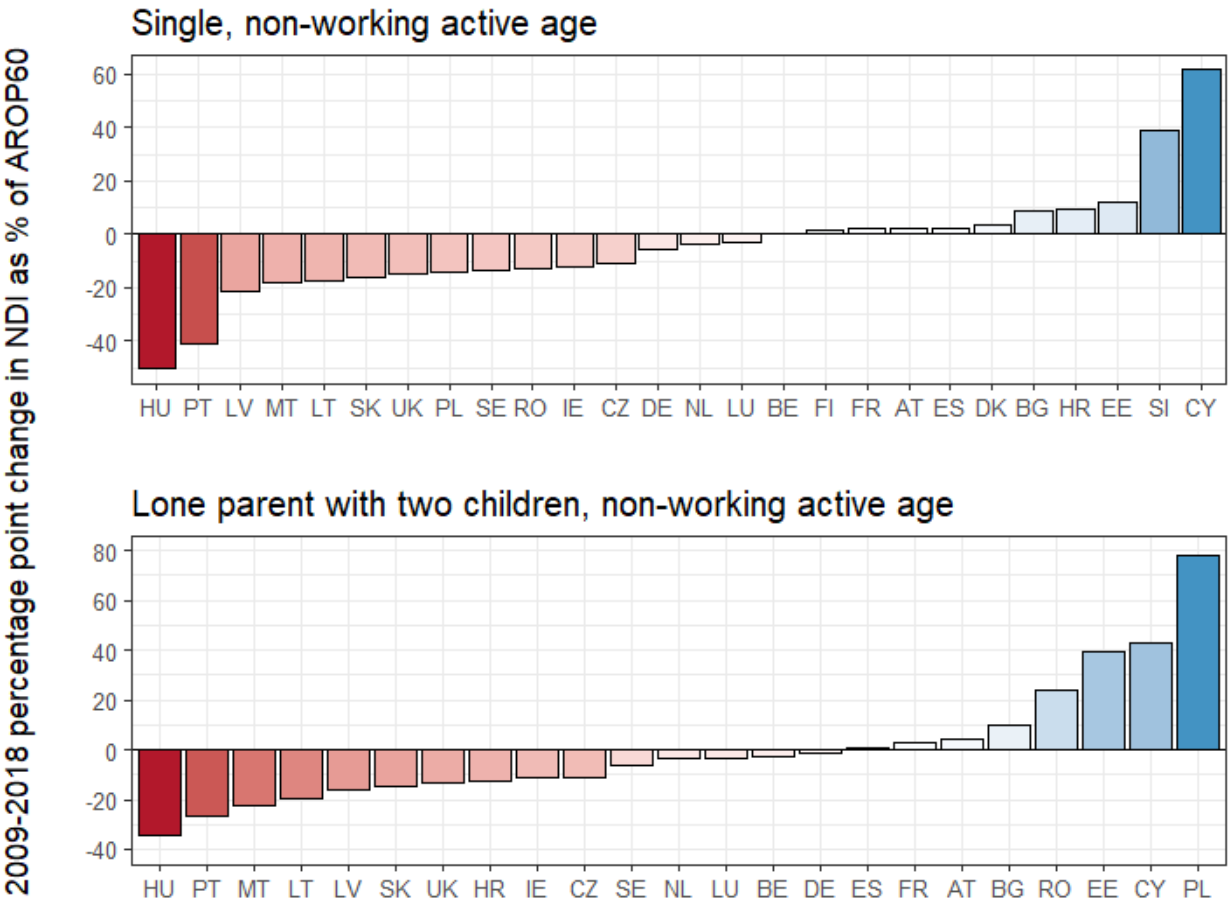
In the United Kingdom minimum wages have risen but net incomes still decreased as base rates of Working Tax Credit have not increased since 2015, leading to a decrease in benefit incomes as wages rise. Decreases relative to the poverty threshold are caused by weak minimum wage development relative to other wages in Austria, Ireland, and Malta, as well as for single households in Croatia. Decreases for lone parents in the Czech Republic and Slovakia are due to social assistance not rising in line with minimum wages, thus being phased out as earnings increased and leaving net incomes relatively steady. Lone parents in Croatia also suffered from the weak wage development. Nevertheless, their household per capita income rises sufficiently in 2017 and 2018 to move them up one income band in the child benefit means-test, hence decreasing benefit payments, and causing the stark decrease in net disposable income evident in Figure 4.

Finally, we find that trends for couples with two children diverge from those of lone parents in only a few cases (Austria, Lithuania, Malta, the Netherlands, Portugal and Spain), often related to less generous social assistance top-ups for this family type.

Non-working active-age households

Figure 5 shows a more concerning picture for the changes in MIP adequacy for non-working active age households. While levels remain steady in Belgium, Denmark, Finland, France, Luxembourg, the Netherlands and Spain, in more than half of the EU Member States single and lone parent households' income decreased in relation to the poverty threshold over time. In some cases this came as a response to external pressure. In Portugal, the generosity of social assistance programmes decreased drastically in 2011 following economic crisis and the requirement to reform and reduce government spending to access international lending (Karger, 2014). In Spain, despite crisis-driven cutbacks, non-working household incomes remain steady compared to the poverty threshold due to falling incomes in the wider economy and a comparatively generous regional benefit in the Spanish region of Catalonia, which may not be reflective of the wider country.

Figure 5. Percentage point changes in NDI as a percentage of 60% poverty threshold for two active-age, non-working households, 2009-2018.



Note:. Italy excluded as no rights-based social assistance scheme was in place prior to 2018, preventing comparison over time. Greece excluded as national scheme only introduced in 2017, and then still bolstered by temporary, one-off benefits. Comparisons for Croatia are 2013-2018 due to later EU accession.
Source: AROP60 thresholds retrieved from Eurostat.

Latvia and Lithuania, both affected badly by the Great Recession, also saw a reduction in social spending and, in Lithuania's case, retrenchment of government programmes (Aidukaite, 2013). In the United Kingdom the austerity reforms put forward by the Conservative-Liberal Democrat coalition in response to the Great Recession saw, among other measures, a benefit cap be put in place. As a result the extent to which social transfers protect against income poverty has decreased. In Croatia, Subsistence Support was replaced in 2014 by the Guaranteed Minimum Benefit, a more restrictive programme which tightened asset tests, decreased the contribution of children to households' assessed need and increased conditionality for able-bodied, working-age individuals, while also incorporating separate, smaller programmes for long-term unemployed and for war veterans and their families (Bejaković and Mrnjavac, 2016).

Reforms in Hungary throughout the 2010s have similarly tightened access to their main social assistance programme. In particular, 2015 reforms saw the imposition of stricter behavioural

conditions and, for those fit to work, to be available for participation in public employment programmes (Scharle and Szikra, 2015). This comes against a background of general cutbacks and moves towards a 'punitive workfare system' in Hungary in the 2010s (Vidra, 2018). However, for most countries which here see decreases, the cause can be found in benefit rates and programmes not increasing with wages and living costs, either because of inadequate statutory indexation, or because of the active skipping of indexation in the wake of the crisis (Van Mechelen and Marchal, 2013; Marchal, Marx and Van Mechelen, 2014). This is the case for a wide range of states, from established welfare states like Sweden, Germany, Luxembourg and the Netherlands, which all see minor decreases, to less-generous ones like the Czech Republic, Ireland, Slovakia and Malta.

Still, some countries improved the MIP arrangements for the non-working of active age throughout the 2009-2018 period. Most notably, Greece and Italy have both seen the introduction of general minimum income protection schemes. In Greece this process started with the trial of a Social Solidarity Income in 2015 which was expanded and revised in 2016, and rolled out on a national level in 2017 (Marini et al., 2019; Matsaganis, 2018). This reform followed a significant increase in poverty and deprivation in post-Recession Greece. The rationalization of benefits and introduction of a general social assistance scheme was also expressly asked by the 'troika' of the IMF, the European Union and the ECB (Perez and Matsaganis, 2017; International Monetary Fund, 2012). As the national-level Social Solidarity Income was only in place from 2017, in which year a one-off social dividend was also paid out, Greece is not included in Figure 5.

While Greek pilot minimum income protection programmes came relatively recently, Italy has a longer experience with such ventures. A main 'minimum insertion income' was introduced in 1998 by the centre-left Prodi government, and again abolished on national level due to the incoming, right-wing government's non-support of national social-assistance programmes (Natili, 2018). Some regions and municipalities retained their own schemes after this reform, forming part of the regionally varied patchwork of social assistance benefits experienced by Italy in the 2000s (Madama, Jessoula and Natili, 2014). The government also introduced a heavily means-tested 'social card' for certain household purchases in the aftermath of the Great Recession in 2009 (Marchal, Marx and Van Mechelen, 2014). Nevertheless, a nationally present minimum income scheme remained missing until the 2018 implementation of the 'Reddito di Inclusione' (ReI), a means-tested, non-categorical social assistance scheme available in the whole country (Baldini et al., 2018). This benefit was in turn replaced by the 'Reddito di Cittadinanza', or 'citizen's income' in 2019. While more generous than the ReI it has some restrictions, being available only to Italian or European citizens and to those who seek work or otherwise participate in integration activities (Italy Ministry of Labour, 2019).

Elsewhere, in order to upgrade the effectiveness of the social protection system in a time of economic contraction, Cyprus replaced the public assistance benefit with a more generous guaranteed minimum income in 2014 (Koutsampelas, 2016), and the net disposable income of Polish households with children increased markedly following the 2017 introduction of the Family 500+ child care benefit. Increases relating to children in the household also occurred in Estonia and Romania following a rise in rates of the existing social assistance and means-

tested family benefits, respectively. However, due to a weak development of social assistance rates, Poland and Romania see a decrease relative to the poverty threshold for single households. France introduced the RsA (*Revenue de Solidarité Active*) in 2009 to supplement the income of in-work poor, although the 2016 introduction of the *Prime d'Activité* activity allowance has largely taken its role, leaving the rSa for those not in work. In Slovenia, single households in particular saw an increase in net income following an increase in social assistance base rates in 2018.

Finally, reforms in Austria in 2010 and 2011 aimed to introduce a unified social assistance programme (the *Bedarfsorienterte Mindestsicherung*) to replace the regionally administered minimum income programmes, leading to steady rates or modest increases. However, concern has been raised in regional disparities in receipt – indicating lingering discrepancy in who receives the benefit – and non-take-up, with a disproportionally large number of recipients in Vienna compared to other *Länder* (Dimmel and Pratscher, 2014; Dimmel and Fuchs, 2014).

The development of MIP for the non-working is not as linear as it is for working households. In both Lithuania and Portugal, the income decrease for families with children compared to 2009 was until recently larger than indicated in the 2009-2018 comparison. Subsequent reforms in 2017 and 2016 respectively raised the income levels of these households. Some divergences in the trajectories between couples with children and lone parents should also be noted. In Croatia both these households suffered a decrease in income in 2013 following more restrictive social assistance terms. For couples with children the rates recovered almost to their original level in 2016, whereas lone parents' incomes remain at the lower level. Similarly, the incomes for couples with children in Romania have increased more compared to the poverty threshold than those of lone parents in the 2009-2018 period.

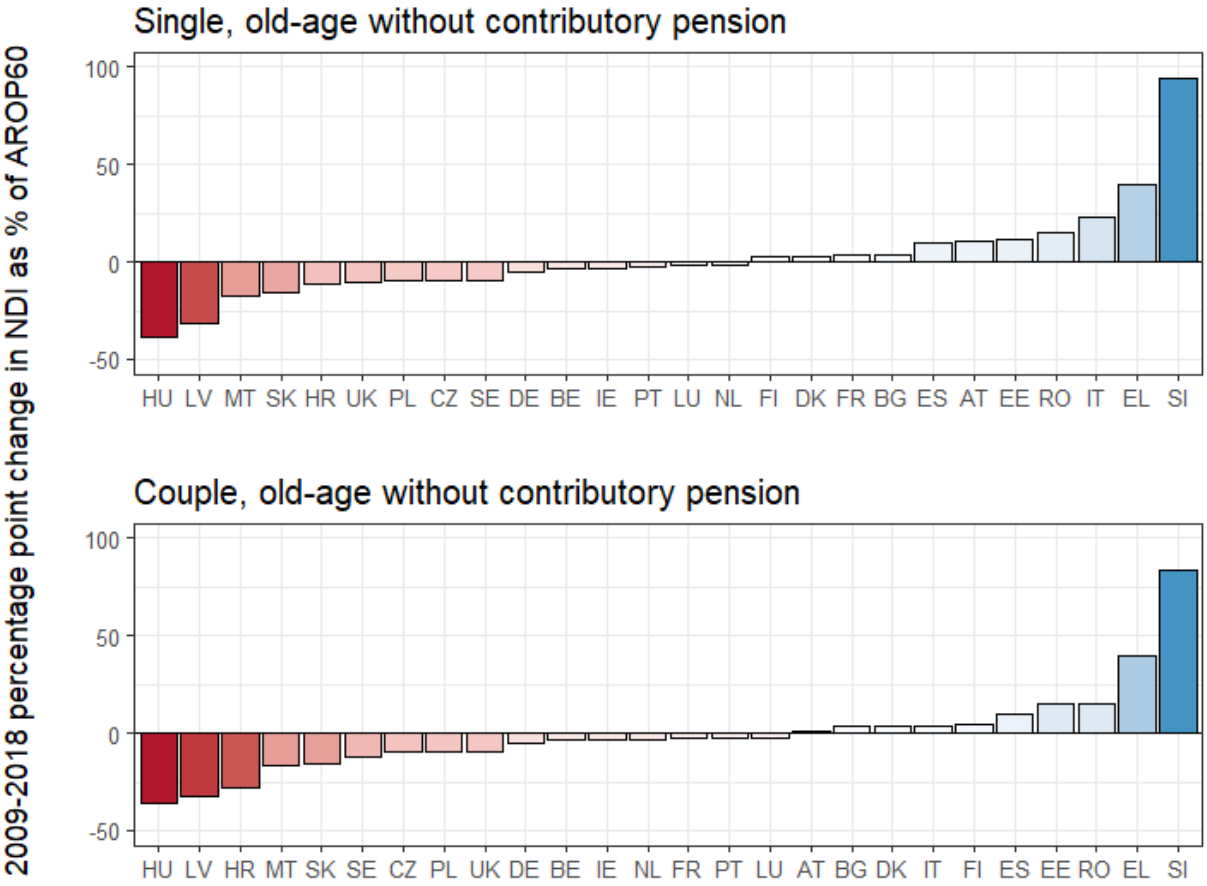
Old-age, non-insured households

Finally, we consider the old-age case for pensioners without access to contributory pensions or benefits. As in the non-working case of active age, the broad picture is concerning and shows a decrease relative to the poverty threshold in most countries, and significant increases only for a few. Decreases can be either due to cuts to or retrenchment of social programmes, or due to a lack of indexation increases in line with living standards. Hungary, where the most significant decrease is found, combines the two: the social pension rate has remained unchanged since 2009 and, additionally, the home maintenance allowance for housing costs was abolished in 2014. Croatia likewise sees no indexation in the social assistance programme received by the households, and couples saw a cut in its level in 2014.

For remaining countries with decreases, these are due to no or low increases in the benefit rates. In Latvia no cuts to existing benefits occurred, but the benefits received by the two households have remained largely static in nominal terms throughout 2009-2018. The Czech Republic, Germany, Malta, Poland, Slovakia, Sweden and the United Kingdom see small increases in nominal household income, but due to low indexation or weak increases they are outstripped by the growth in incomes elsewhere in the economy and decrease their position relative to the poverty line. A collection of chiefly continental welfare states remain on relatively steady levels throughout the period. For Austria, Belgium, Denmark, France, Luxembourg and the Netherlands, this is due to requisite increases in rates, whereas for Bulgaria, Ireland and

Portugal increases are modest, but weak growth elsewhere in the economy does not worsen their position relative to the poverty line. For Ireland and Portugal in particular, this is linked to the after effects of the Great Recession.

Figure 6. Percentage point changes in NDI as a percentage of 60% poverty threshold for two active-age, non-working households, 2009-2018.



Note: Old-age households defined as those who are of requisite age to access age-specific benefits (cf. Marchal, Siöland and Goedemé, 2019: 9, 42 for elaboration). Note that comparisons for Croatia are 2013-2018 and Finland 2011-2018.
Source: AROP60 thresholds retrieved from Eurostat.

Some of the increases are also less significant than they appear in

Old-age, non-insured households

Finally, we consider the old-age case for pensioners without access to contributory pensions or benefits. As in the non-working case of active age, the broad picture is concerning and shows a decrease relative to the poverty threshold in most countries, and significant increases only for a few. Decreases can be either due to cuts to or retrenchment of social programmes, or due to a lack of indexation increases in line with living standards. Hungary, where the most significant decrease is found, combines the two: the social pension rate has remained unchanged since 2009 and, additionally, the home maintenance allowance for housing costs

was abolished in 2014. Croatia likewise sees no indexation in the social assistance programme received by the households, and couples saw a cut in its level in 2014.

For remaining countries with decreases, these are due to no or low increases in the benefit rates. In Latvia no cuts to existing benefits occurred, but the benefits received by the two households have remained largely static in nominal terms throughout 2009-2018. The Czech Republic, Germany, Malta, Poland, Slovakia, Sweden and the United Kingdom see small increases in nominal household income, but due to low indexation or weak increases they are outstripped by the growth in incomes elsewhere in the economy and decrease their position relative to the poverty line. A collection of chiefly continental welfare states remain on relatively steady levels throughout the period. For Austria, Belgium, Denmark, France, Luxembourg and the Netherlands, this is due to requisite increases in rates, whereas for Bulgaria, Ireland and Portugal increases are modest, but weak growth elsewhere in the economy does not worsen their position relative to the poverty line. For Ireland and Portugal in particular, this is linked to the after effects of the Great Recession. , and need to be qualified. Most notably, the apparent increase for pensioners in Greece is not reflective of even nominal increases in the households' net disposable income, but rather of the Greek poverty line's shift following a collapse in median wages as a result of the country's prolonged economic crisis (Matsaganis and Leventi, 2014). In difference to most other observed countries the curve for the full time period varies significantly, as pensioners in the country have benefited from temporary benefits in the studied time period, including housing benefits in 2015 and 2016 and the various social assistance programmes in force since 2014. Increases in Spain are similarly inflated, although social pensions here have increased over time.

Increases elsewhere require less qualification. Slovenia sees the most significant increase following the introduction of a permanent social assistance scheme for the elderly and others in need of permanent support. Romania's minimum social pension has increased markedly, increasing by over 70% while Estonia sees similar income increases relative to the poverty threshold after the introduction of new benefits in the form of a social pension top-up for pensioners living alone was introduced in 2017. Increases are also seen for single households in Italy as their household incomes are sufficiently low to benefit from the guaranteed minimum income implemented in 2018. Couples – which are better off relative to the poverty threshold throughout the time period due to receiving two pension incomes – do not receive that increase.

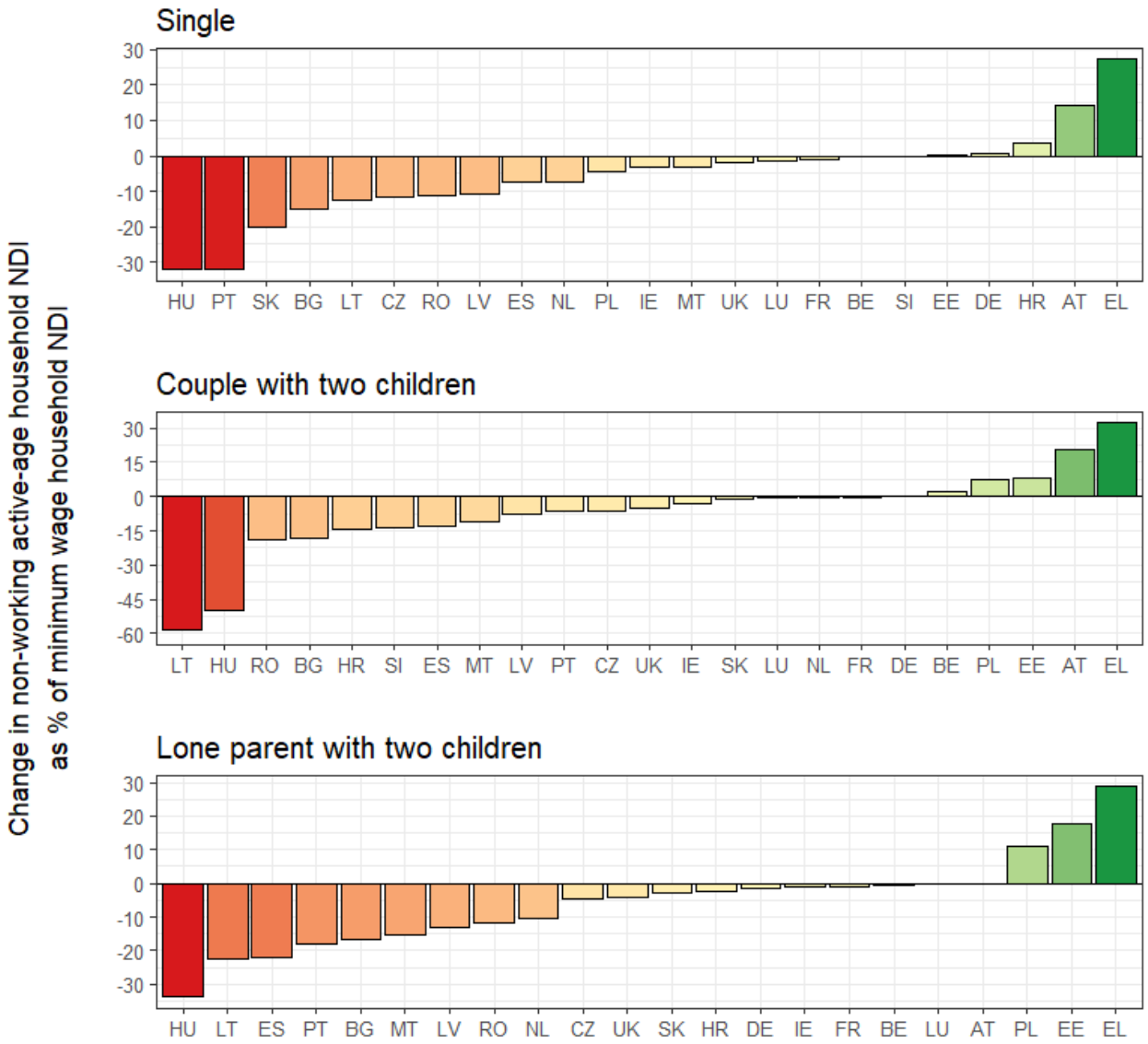
In sum, over the latest decennium, we observe relatively positive trends in the adequacy of minimum income protection for the working population, which often increased in line with or even above living standards in the large majority of countries. Minimum income protection for the non-working population, both of active age and for the elderly, lagged in a substantial majority of countries behind the median equivalent disposable income.

In the next section, we look into these trends relative to one another. First, we compare the trends in out-of-work and in-work assistance. Second, we assess whether the elderly have seen more favorable trends than the non-working of active age, and, if they have, how this has impacted their relative position vis-à-vis the working part of the population.

Non-working households' income in relation to working households

Figure 7 shows the individual country trends in the ratio between net minimum income for the non-working and for the working population. As do Cantillon et al. (2018), we find a nearly universal increase in the gap between net disposable income at social assistance and net disposable income at a full time minimum wage (which could be seen as a very crude indicator of financial incentives). There are only a few exceptions: in Belgium, Slovenia, Estonia, Germany and Croatia the gap between social assistance and the net income at minimum wage remains stable or decreases slightly for a single person household. Only in Greece and Austria does the gap between both decrease substantially. In both countries this is due to an atypical trend in minimum wages (the Greek minimum wage was cut in the aftermath of the crisis, whereas the Austrian quasi-minimum wage did not increase in nominal terms since 2009) in combination with a reform of the social assistance benefit: an introduction and further out roll of social assistance in Greece and a centralization of social assistance in Austria.

Figure 7. Change in NDI of non-working active-age households as a percentage of minimum wage-earning households' NDI, 2009-2018.



Note: Countries without statutory minimum wages – Cyprus, Denmark, Finland, Italy and Sweden – are not included in comparison. Comparison for Germany is 2015-2018 due to recent adoption of statutory minimum wage, 2014-2018 for Greece due to recent introduction of rights-based social assistance schemes, and 2013-2018 for Croatia due to their later EU accession.

For families with children, the gap between out-of-work and in-work assistance also decreased in Poland, where an increasing minimum wage made working families ineligible for the means-tested housing allowance whereas social assistance families benefited from a revalorization of the nominal benefits, and in Estonia, where social assistance benefits for families with children increased. In Austria, due to the low (and eroding) minimum wage, working families rely heavily on social assistance top-ups for a guaranteed minimum in-work income. Hence, net disposable income for lone parents is equal whether in-work or out-work throughout the entire period. For the breadwinner family, depending on the importance addressed to the work willingness of the spouse, in-work income may be even below out-of-work minimum income protection.

It is noteworthy that it is not the countries with initially the lowest financial incentives that predominantly aimed to increase the gap between out-of-work and in-work minimum income protection, at least not for single person households. If anything, it is rather the other way around, with countries that already initially had high financial incentives further pursuing increases in the income gap. (The correlation – excluding Greece – between the ratio in 2009 and the percentage point and percentage change in the period 2009-2018 amounts to respectively 0.27 and 0.44 for single person households).

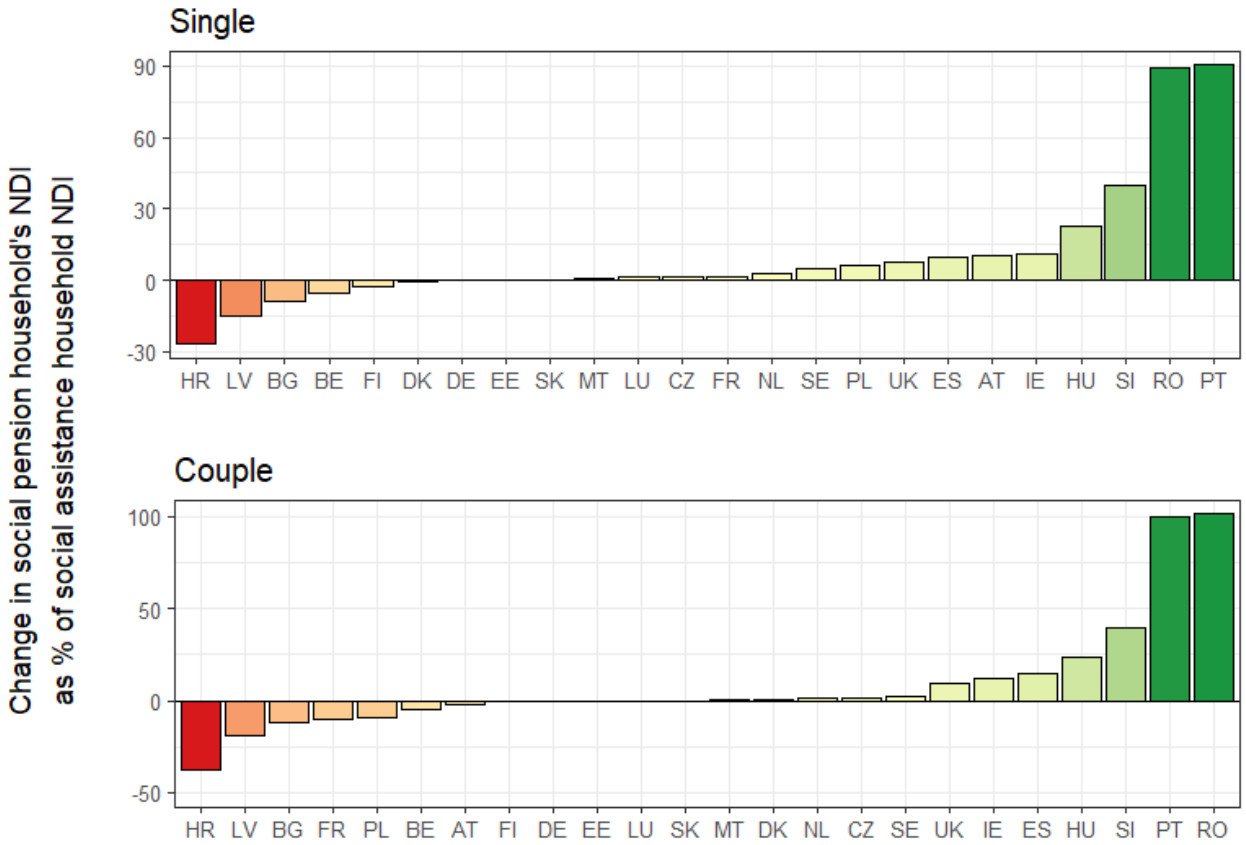
Households with children on the other hand do not show a clear association: with Greece excluded there is no correlation whatsoever for lone parent households, whereas for couple households we note a negative correlation, with generally higher decreases in the ratio social assistance – minimum wage in countries where this ratio was relatively high to begin with. It hence appears safe to say that there is a common trend towards higher financial incentives, but that the actual focus on this trend differs from country to country and family type to family type.

As discussed above it has been suggested that in principle, it should be easier for countries where the gap between social assistance and minimum wage income is high to increase their net social assistance benefits. We do indeed find a weak negative correlation (around -0.3) in the ratio between social assistance and minimum wage in 2009, and the subsequent trend in the adequacy of social assistance benefits, at least for the families with children included in our data. For a single person household, such a correlation is absent.

Old-age households' incomes in relation to non-working, active-age households

Figure 8 shows the trends in minimum income protection for the elderly relative to minimum income protection for the non-working of active age. In the previous section, we found minimum income protection to be decreasing in adequacy for both target groups in most countries. We ask here whether the decreases were more pronounced for active age minimum income beneficiaries than for the elderly.

Figure 8. Change in the NDI of old-age households not in receipt of contributory benefits as percentage of social assistance households' NDI, 2009-2018.



Note: Countries without social pension payments, or significant missing benefits in EUROMOD, not included. Additionally Italy is excluded as their social assistance scheme only has been in place since 2018, and no over-time comparison is possible. Comparison is 2011-2018 for Finland due to data availability in EUROMOD, and 2013-2018 in Croatia due to their later EU accession.

We can distinguish three groups: a group where minimum income protection for the elderly moves in tandem with minimum income protection for the non-working of active age, a group where the elderly saw their net minimum incomes increase faster than the non-working of active age did, and finally a group where minimum income protection for the elderly decreased relative to active age provisions. The first group includes Denmark, Germany, Estonia, Slovakia, Malta, Luxembourg, France and the Czech Republic, and couples in Austria. With the exception of Denmark and France, where old age minimum income protection is higher than active age, the ratio between old age and active age minimum income protection was constant at 100 throughout the entire period.

A large number of countries saw minimum income protection for the elderly improve relative to MIP for active age. This was (though only to a very limited extent) the case in the Netherlands, Sweden and Poland, all three countries where minimum income protection for the elderly was over the entire period more generous for the elderly. Likely, the (minimally) increasing gap between both does not reflect a conscious policy change, but rather the impact of different indexation rules. The improvement of the relative position for the elderly was more outspoken in the United Kingdom, Spain, single households in Austria, Ireland, Hungary,

Slovenia and – especially – in Romania and Portugal. In Hungary and the United Kingdom, this was surprisingly coupled with substantial decreases in social pension adequacy due to a nominal standstill in the former, and only limited indexation in the latter.

Minimum income protection for the non-working of active age fared however worse, in Hungary in line with a longer-term trend towards financial incentives and in the UK as a consequence of austerity measures. In Ireland, Spain and Portugal, social pension adequacy was relatively stable or saw small increases, which, relative to cutbacks in the adequacy of minimum income protection of the working age led to an improvement in the elderly's relative position. In Romania the relative improvement attributable to an actual increase in the minimum social pension, while for singles in Austria the MIGE has increased gradually at a higher pace than active-age social assistance. In Slovenia the improvement stems from the introduction of the permanent social assistance (income support) in 2012: in the years prior to this, households in the two income cases received the same social assistance income, whereas old-age households now receive more.

Finally, we saw a relative deterioration of MIP for the elderly in Croatia, Latvia, Bulgaria, Belgium and Finland (and, for couples, also for France and Poland). Croatia failed to index their MIP for the elderly throughout the period. Also in Latvia, benefit levels for the elderly remained virtually the same, whereas social assistance for active age persons became more generous: whereas there previously was a time limit on the number of months one could receive a benefit, this was abolished in 2010. Bulgaria and Finland, MIP for those of active age increased (somewhat) more than MIP for the elderly did. After welfare adjustments in Belgium focused on minimum income protection for the elderly throughout the first decade of the 2000s, recent revalorizations focused on the minimum income protection for those of active age.

All in all, we do find that in a substantial number of EU MSs MIP for the elderly developed more favourably or in line with MIP for those of active age. Where the ratio between both decreased, this was often due to a revalorization of MIP for those of active age rather than a cut in benefit levels for the elderly (although there are exceptions, most notably Croatia and Latvia).

This assessment does not show why that is the case. Deservingness perceptions likely play a role. Also, concerns about financial incentives are less pressing for the target group of the elderly. Still, whereas MIP for the elderly is more generous than MIP for the non-working of active age, it only rarely is more generous than MIP for the working. Of the countries with a statutory minimum wage, only the UK has slightly more favorable MIP for the elderly for single person households. For couples, slightly more countries show a more generous position for the elderly. Overall, gaps between net disposable income for the elderly and the working are common, but they are also relatively small, and in most countries, this gap remained steady.

4.1.3 Conclusions and recommendations

This study provided an in-depth discussion of recent trends in minimum income protection for those of active age and the elderly, building on new data developed specifically to gauge the adequacy of minimum income protection for three different target groups. We found overall relative generous trends in MIP for the working population, through changes in minimum wages and additional benefits. These generous trends only rarely went hand in hand with more generous MIP for the non-working active age population. Rather, the focus of countries appears to have been on increasing the gap between MIP for the non-working and the working of active age. This confirms for a more recent period and a larger group of countries the findings of Cantillon et al. (2018). Exceptions to this rule are especially Austria and Greece, whereas also in Belgium, Slovenia, Estonia, Germany and Croatia (and Estonia and Poland for families with children) the gap remained stable or decreased slightly. It would be interesting to see why these countries did not follow this general trend. Some first explorations already showed that there is no clear relation with the level of initial financial incentives or adequacy. We furthermore assessed how MIP for the elderly fared relative to provisions for those of active age. Whereas also for the elderly decreases occur in a substantial number of countries, these decreases are often less pronounced. MIP for the elderly overall fared better than MIP for those of active age. In line with our observations on the focus on financial incentives for those of active age, this could be because this consideration weighs less heavily for this target group.

The EU has identified minimum income protection as one of the routes towards a more social Europe in its European Pillar of Social Rights, stressing the policy relevance of the last safety net. We observed substantial variation in design and adequacy of MIP for the elderly. While earlier research found relatively positive trends in terms of adequacy of MIP for the elderly throughout the 1990s and 2000s, this appears to be far less the case for the decade studied here. While MIP for active age working individuals improved over the past decade, this has been far less the case for non-working individuals at active age and for the elderly. These results suggest a shift in policy orientation: the focus of countries appears to have been on increasing the gap between MIP for the non-working and the working of active age, thus increasing financial incentives to work. In terms of deservingness, it may be surprising that also for the elderly we find this lagging behind (be it less pronounced).

Means-tested MIP schemes are likely to grow in importance as access to insurance-based schemes is tightened. This is true for MIP schemes for the non-working of active age, as there are indications that access to unemployment insurance benefits is made more stringent. But also access to contributory pensions depends on minimum contribution periods. In such a context policy makers do well to continuously assess the adequacy of the means-tested schemes. They should not solely take account of the means-tested minimum benefits themselves, but also assess the extent to which they can be combined with other benefits, such as housing and heating allowances.

4.2 Old age pensions and taxation

We now present our empirical investigation of how the pension and tax system interact with each other from a social inequality perspective for a broad set of European countries. We do this by first presenting the key characteristics of the pension systems and their tax treatment. We then compare average tax levels between pensioners and workers overall and over income quintiles, as a measure of horizontal equity. Next, we analyse the degree of vertical equity, using two indicators. On the one hand we look at the extent to which pensioners are taxed into poverty, while on the other hand we calculate the contribution of taxes on pension incomes to overall progressivity of the tax system as compared to other income components.

4.2.1 Key characteristics of pension systems and their tax treatment

Table 7 summarizes the key characteristics of pension systems and their tax treatment. In line with Fuest et al. (2010), we group countries according to the welfare state typology in the following six categories:

1. Nordic: Denmark, Finland, Sweden and the Netherlands[2]
2. Anglo-Saxon: Ireland and the United Kingdom
3. Continental: Austria, Belgium, France, Germany and Luxembourg
4. Baltic: Estonia, Latvia and Lithuania
5. Central Eastern European: Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia and Croatia
6. Southern: Cyprus, Greece, Italy, Portugal, Spain and Malta.

In the group of countries based on the insurance-principle (Continental, Baltic, CEE and Southern countries), the most common pension system combines a public earnings-related pension, with DB rules (or a points-based system in some cases). In most countries, this is complemented with some kind of minimum income protection for individuals without the necessary contribution years to qualify for the earnings-related pension; these first tier pension policies often take the form of a social pension (i.e. means-tested) (Goedemé, 2013; Marchal & Siöland, 2019). The exceptions are Austria, Luxembourg, the Czech Republic, Poland, Romania, Slovakia and Croatia. While these countries do have a public earnings-related pension, they do not have specific minimum income protection schemes for the elderly, although pensioners can rely on social assistance (Marchal & Siöland, 2019). In insurance-based countries, contributions and pension benefits are clearly linked, but public pension systems often also contain additional redistributive elements, such as benefit ceilings (Been, Caminada, Goudswaard, & van Vliet, 2017).

Other countries within the Bismarckian group have a different pension system. Several CEE countries adopted a multi-pillar pension system (or made reforms to this system) before joining the EU (Zaidi, Grech and Fuchs, 2006). Estonia, Bulgaria, Romania and Croatia combine a public earnings-related pension with a private earnings-related pension. The private earnings-

[2] We categorize the Netherlands here among the Nordic countries because of its Beveridgean-inspired pension system (Hinrichs & Lynch, 2010) and because of similarities between these countries in the design of old-age minimum income schemes.

related pension is based on DC rules. Compared to DB rules, the link between contributions and pensions is stronger in such DC pension policies. In addition, the individual accounts at the base of DC schemes shift financial risks to the individual, while these risks are shouldered by the state in DB pension policies (Zaidi, Grech, & Fuchs, 2006). Italy, Latvia and Poland have also integrated DC rules into their pension system, in their public earnings-related pensions. In a sense, the insurance-principle is more present in countries with DC policies at the centre of the earnings-related pension policies than in countries with DB rules.

The solidarity principle that is central in the Nordic and Anglo-Saxon countries is also visible in their pension systems. Essentially, in all these countries, the state assumes responsibility for providing a minimum income level, while individuals are responsible for maintaining their living standards in old age through private (occupational) pension schemes (Zaidi, Grech and Fuchs, 2006). Although reforms have been made in several of these countries, in general the public first tier pension policy is the cornerstone of the pension system. The United Kingdom and Ireland provide a social pension (means-tested), in line with the liberal logic of means-tested benefits. The Nordic countries originally provided basic pensions in line with the logic of universal, equal benefits. Nowadays the non-contributory pension policies in the Nordic countries also include (some) means- or income-testing, so that a pure basic pension only remains in the Netherlands, while it is still partially in place in Denmark (Goedemé & Marchal, 2016). Finland and Sweden chose to supplement their basic pension with a public, rather than private, pillar, effectively turning them into Bismarckian countries (Hinrichs & Lynch, 2010). Individuals can, in most countries, supplement their incomes through pensions in the private sector, which is often extensively regulated. In the Netherlands, Denmark and Sweden, participation is quasi mandatory and the coverage is almost universal (Hinrichs and Lynch, 2010; OECD, 2019). Following the logic of individual responsibility to maintain living standards, in Denmark and, to a certain extent Sweden, the private contribution-based policies are fully funded (FDC).

In line with the logic of minimum income protection, in these countries generous first tier pension policies would be expected. Marchal and Siöland (2019) have analysed for different model families whether first tier pension policies provide income levels that exceed the country poverty threshold. Within the group of Beveridgean countries, for an elderly couple minimum pension policies are above the poverty threshold only in Denmark and Ireland. If other benefits are also taken into account, then income levels are sufficient also in the Netherlands, Finland and the United Kingdom. In Sweden, the income level provided by first tier pension policies is not sufficient to lift the couple nor the individual out of poverty. For both model families, disposable income represents around 75% of the poverty threshold. As these are model family simulations, the outcomes may be different when analysing real-world data. Using micro-data, rather than model family simulations, Figari et al. (2013) have examined the relationship between old-age minimum income protection schemes and poverty. Their results show that Denmark, the Netherlands and the United Kingdom achieve a great deal of poverty reduction, due to their generous minimum pension schemes. They are, however, less successful in supporting pensioners to maintain the living standards they obtained during working life.

In sum, pension systems have two main objectives: to provide an adequate standard of living for the elderly (and thereby alleviating old age poverty) and to smooth consumption over a lifetime. We have discussed that which of the main pension objectives dominates (and therefore which tier dominates) within a country will be closely related to the welfare state design. We have argued that in Beveridgean countries, such as the Nordic and Anglo-Saxon countries, generous minimum income schemes can be expected since the main aim in these types of countries is to prevent poverty. In continental and Southern countries, a Bismarckian logic applies, where benefits (such as pensions) are related more strongly to past contributions. Consequently, we would expect a stronger relative importance of second and third tier benefits in these countries. Similarly, we have argued that the insurance-principle is even more present in countries with defined contributions policies, where the link between contributions and benefits is even stronger.

Table 7 also includes information on the tax treatment of each tier of the pension system. The information regarding second and third-tier tax expenditures is provided by Barrios et al. (2020), while information on first tier tax expenditures is derived from the underlying documentation of EUROMOD. A first observation is that first tier pension policies are tax exempt in a substantial number of countries. However, first tier benefits are included in taxable income in four out of six of the Beveridgean countries. This appears to suggest that the tax system might be interfering with the goals of the pension system. We return to this question in the analysis, and show that this is not necessarily true. In addition, Barrios et al. (2020) point out that first tier benefits might be part of taxable income, but can be below taxable level. The only country in our set of countries where both second- and third-tier pension benefits are fully taxed is Poland. In Denmark, second-tier pension benefits are also fully taxed, but private pension (third-tier benefits) are tax exempt. In all other countries, tax expenditures affect second-tier or third-tier benefits (or both).

Depending on their design, the existence of tax expenditures related to pension-benefits might go against the ideas of horizontal and vertical equity and the principles underlying the welfare state. There is, however, very little empirical evidence that estimates how these pension-benefit related tax expenditures affect patterns of tax progressivity and tax burdens between pensioners and workers. In addition, there is little information on how the tax expenditures interfere with or enhance the objectives of the pension system. This is especially relevant, because existing research has shown that the redistributive effects of tax expenditures are related to many factors, such as the type of expenditure, but also the characteristics of the tax systems and features of the underlying distributions (Verbist, 2007; Avram, 2018).

Table 7: Key elements of the pension system and their tax treatment in 28 European countries, 2019

Group	Country	First tier		Second tier			Third tier
		Minimum income protection	**Tax treatment**	**Public system**	**Private system**	**Tax treatment**	**Tax treatment**
Nordic	Denmark	Basic pension	taxable	FDC	FDC(q)	taxed	taxed
	Finland	Conditional basic pension	taxable	DB		partially taxed	taxed
	Sweden	Conditional basic pension	exempt	DB/NDC + FDC	FDC(q)	partially taxed	taxed
	Netherlands	Basic pension	taxable		DB(q)	partially taxed	taxed
Anglo-Saxon	Ireland	Social pension	taxable			partially taxed	taxed
	UK	Social pension	exempt	DB		partially taxed	taxed
Contin.	Austria	/	/	DB		partially taxed	taxed
	Belgium	Social pension	taxable	DB		partially taxed	taxed
	France	Social pension	exempt	DB + points		partially taxed	taxed
	Germany	Social pension	exempt	Points		partially taxed	partially taxed
	Luxembourg	/	/	DB		partially taxed	partially taxed
Baltic	Estonia	Conditional basic pension	taxable	DB/Points	FDC	partially taxed	partially taxed
	Latvia	Social pension	exempt	DB/NDC + FDC		partially taxed	exempt
	Lithuania	Social pension	exempt	DB/Points		exempt	taxed
CEE	Bulgaria	Social pension	exempt	DB	DC(compulsory)	exempt	exempt
	Czech Rep.	/	/	DB		partially taxed	taxed

	Hungary	Social pension	exempt	DB		partially taxed	exempt
	Poland	/	/	DB/NDC		taxed	exempt
	Romania	/	/	DB	DC(compulsory)	partially taxed	No info
	Slovakia	/	/	points		exempt	taxed
	Slovenia	Social pension	exempt	DB		partially taxed	taxed
	Croatia	/	/	DB	DC(compulsory)	partially taxed	exempt
South.	Cyprus	Conditional basic pension	taxable	DB		partially taxed	taxed
	Greece	Social pension	exempt	DB		taxed +	partially taxed
	Italy	Social pension	exempt	DB + NDC		partially taxed	partially taxed
	Portugal	Social pension	taxable	DB		partially taxed	Exempt
	Spain	Social pension	taxable	DB		partially taxed	Taxed
	Malta	Social pension	exempt	DB		partially taxed	Taxed

Note: Information on minimum income protection concerns only non-contributory benefits and comes from Goedemé (2013) and Marchal and Siöland (2019). Basic pensions are pensions without means- or income-test, conditional basic pensions are pension-tested and social pensions are means- or income-tested. Second tier system from OECD (2019). (q) = quasi mandatory based on collective agreement with a high coverage rate; DB = Defined benefit; DC = Defined contribution FDC = Funded defined contribution; NDC = notional defined contribution. Information on tax treatment of first tier pensions from EUROMOD Country Reports: https://euromod-web.jrc.ec.europa.eu/resources/country-reports/latest. Tax treatment of second and third tier pensions from Barrios et al. (2020).

4.2.2 Horizontal equity characteristics of the taxation of pensions

To provide a broad picture of how pension benefits are treated differently (or not) from employment income, we start by showing the average tax burden for pensioners and employees in Table 8. We have expressed the amount of taxes and SIC due on employment and retirement income, as a percentage of the respective pre-tax component income (including possible components that are tax exempt). It is immediately clear that in all countries the total tax burden (PIT and SIC together) is relatively smaller for old-age individuals than for employees, but we see large differences across countries both in terms of the gap in overall tax burden between the two groups, as in the tax burden on pensions across countries. The gap in overall tax burden between workers and pensioners is especially low in Nordic and South-European countries, and much higher in CEE and the Baltics. This is mainly (but not only) due to the lower SIC rate on pensions.

The disaggregation of the total tax burden into the tax burden of PIT and SIC shows that old-age individuals pay less PIT than employees in the majority of countries. The difference in PIT burden between retirement and employment income is in some cases quite substantial, for example in Belgium and Germany. In other countries, such as Austria and Cyprus, the average tax burden is very similar to the average tax burden of PIT on employment income. There are only five countries where PIT on retirement income are relatively larger than taxes on employment income (France, Italy, Luxembourg, Poland, Sweden). In Italy, pensioners with a yearly pension income above 100 000 euros have to pay a solidarity contribution (which we have added in the definition of personal income taxes, though it is simulated as a pension cut in EUROMOD). In addition, personal pensions are taxed through a capital income tax, which further adds to the average tax burden of old-age individuals. In France, though there are several allowances and tax credits aimed at old-age individuals, it appears that tax expenditures geared towards child-related expenses and the *quotient familial* might explain why the tax burden for employees is lower. With regards to the *quotient familial*, it is likely that pensioners will gain less advantage from this than employees, as they generally live in smaller households. Similarly, in Luxembourg other tax expenditures might explain the lower tax burden of employees. Poland is the only country where contributory pension benefits (second tier) are fully taxed, meaning that there are no specific old-age tax expenditures. There are tax expenditures for other sources of income, which explains the higher tax burden for old-age individuals. In Sweden, finally, the results appear to be partially related to the 'Earned income tax credit', which is larger (in absolute terms) on average for the workers than for pensioners.

In most countries, no SIC are due on pension income. Exceptions are the continental countries, Cyprus, Greece and Croatia. With the exception of the Netherlands, in these countries the tax burden of SIC on retirement income is smaller than that on employment income. This is in line with the prevailing logic to use SIC to finance social security systems. In many countries, SIC are levied to insure individuals against the risk of health issues, unemployment and old age (pension contributions). Old-age individuals often only have to pay for certain types of these insurances. For example, pensioners in Croatia, Cyprus and Greece pay SIC at substantially lower rates than workers. The Netherlands is the only country where the average SIC rate for

pensioners is higher than the average rate paid by workers (5.1 and 3.6%, respectively). This can, at least partially, be explained by the way health insurance contributions are levied. While for employees, health insurance contributions are paid by their employer, individuals with pension income have to pay these themselves. Given that southern welfare states are sometimes classified as 'rudimentary' conservative states (Kammer et al., 2012), we might expect that pensioners are liable to SIC in Italy, Portugal, Spain and Malta as well. However, in these countries SIC are more geared toward employment-related risks (for example, in Italy, SIC are insurances against sickness, maternity, redundancy and severance pay, among others). As it can be argued that these risks are no longer relevant for pensioners, it is not illogical that pensioners don't have to pay SIC. Similarly, Central Eastern European and Baltic states are in some ways similar to conservative and Southern welfare states, but smaller in size (Fuest et al., 2010). In this sense, it is perhaps not surprising that SIC are levied on employment income, but not on retirement income. For Nordic and Anglo-Saxon countries, social security is more often financed out of taxes (rather than SIC) (Kammer et al. 2012).

Table 8: Tax burden as % of pre-tax income (i.e. employment income for workers (W), pre-tax pensions for old age (OA)), 28 European countries, 2019

		Total		PIT		SIC	
Group	Country	W	OA	W	OA	W	OA
Nordic	Denmark	20.3	9.3	9.5	9.3	10.8	0
	Finland	28.5	15.1	18.3	15.1	10.2	0
	Sweden	24.7	19.4	18.1	19.4	6.6	0
	Netherlands	7.8	5.9	4.2	0.7	3.6	5.1
Anglo-Saxon	Ireland	17.2	1.7	13.6	1.7	3.5	0
	UK	18.3	3.6	9	3.6	9.3	0
Continental	Austria	25	15	9.8	9.7	15.3	5.3
	Belgium	31.7	12.5	18.5	10.2	13.2	2.3
	France	23.4	10.1	2.8	3	20.7	7.1
	Germany	30.9	14.2	14.4	4.2	16.5	9.9
	Luxembourg	23.2	16.1	11.4	11.8	11.8	4.3
Baltic	Estonia	15.1	1	11.8	1	3.3	0
	Latvia	24.6	3.8	13.6	3.8	11	0
	Lithuania	37.6	0	15.8	0	21.8	0
CEE	Bulgaria	20.5	0	8.5	0	12	0
	Czech Rep.	19.1	0.1	7.8	0.1	11.3	0
	Hungary	32	0.4	14.3	0.4	17.7	0
	Poland	19.6	7.7	5.9	7.7	13.7	0
	Romania	40.7	0.3	5.7	0.3	35	0
	Slovakia	21.4	0	7.9	0	13.5	0
	Slovenia	31.9	0.7	9.8	0.7	22.1	0
	Croatia	25.1	1.9	4.8	1.6	20.3	0.4
Southern	Cyprus	12.1	3.3	2.2	1.7	9.9	1.6
	Greece	21.3	9.9	5.2	3.6	16.2	6.3
	Italy	21.8	14.7	13.9	14.7	7.9	0
	Portugal	19.6	5.3	8.6	5.3	11	0
	Spain	21	5.8	10.1	5.8	10.9	0
	Malta	16.5	2.7	8.3	2.7	8.2	0

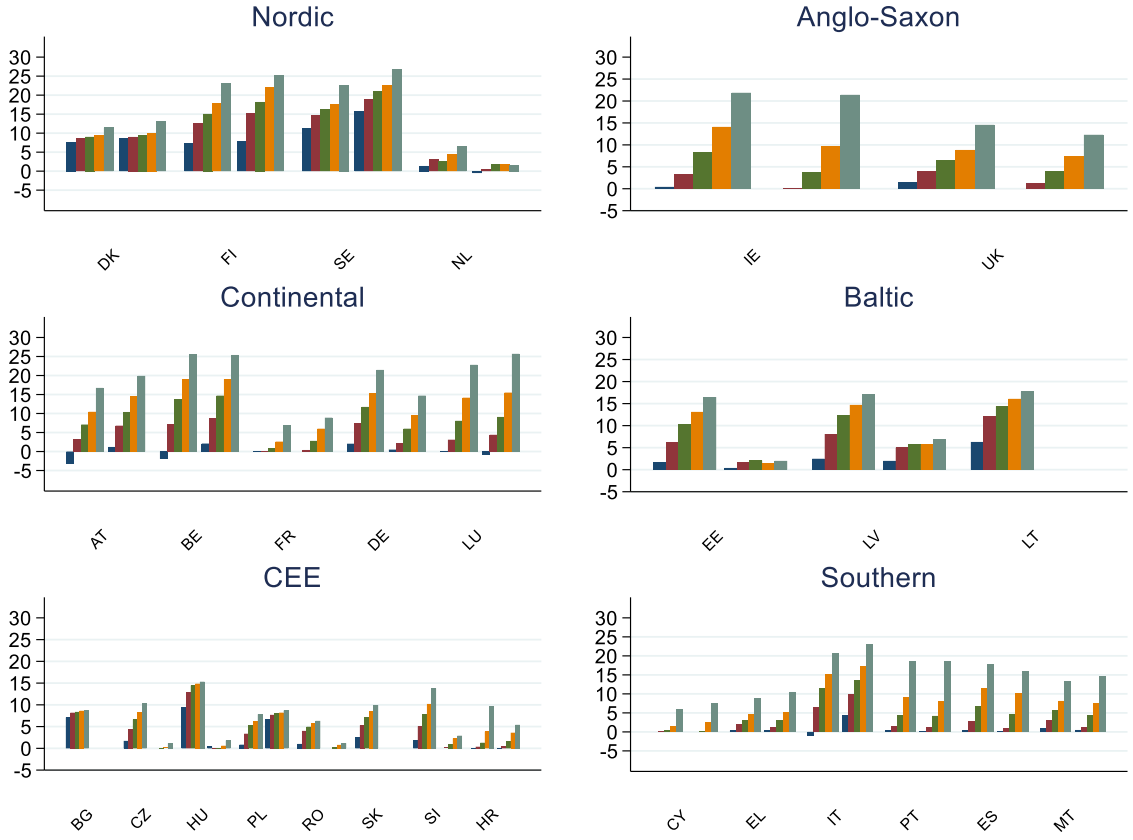
Source: EUROMOD, own calculations

While Table 8 confirms that there are differences in tax rates for pensioners and employees, it does not yet provide evidence that the principle of horizontal equity is violated. The reason is that the average level of pensions is generally smaller than the average level of employment income, and when a tax system is progressive in its rate structure, this alone may explain the lower burden on pension. To minimize the effect of differences in income between both groups, we use the distribution of pre-tax equivalised income to determine equals. We show average tax rates for pensioners and employees across quintiles of this distribution. This implies that we are comparing the tax burden of old-age individuals and employees with similar pre-tax income levels, after taking household composition into account. This sheds some light on the extent to which the principle of horizontal equity is maintained or violated through the existence of pension-related tax expenditures. By looking at quintiles we are not entirely able to compare equals, as even within the same quintile of the distribution, pensioners can have smaller

incomes than employees, leading to smaller tax burdens. Nevertheless, it gives a reasonable approximation.

Figure 9 shows the average tax burden of personal income taxes (proportional taxes as a percentage of pre-tax component income) across the quintiles of the equivalized pre-tax distribution for each country, for workers on the left and old-age individuals on the right. Countries are ordered by welfare state type. In the Nordic and Anglo-Saxon countries, PIT rates across quintiles are quite similar for employees and pensioners. This is also the case for most continental and Southern countries. As expected, in most CEE and Baltic countries, taxes on retirement income are clearly much lower than taxes on employment income, throughout the distribution.

Figure 9: Average PIT rates for workers (left) and pensioners (right), expressed as a % of pre-tax income across quintiles of equivalised pre-tax income, 28 European countries, 2019



Source: EUROMOD, own calculations

While Table 8 shows that there is wide variation in the overall difference between PIT on employment and on retirement income, Figure 9 adds several interesting insights about the extent to which there is horizontal (in)equity in the tax system. First, it illustrates that the difference in average PIT burden is partially determined by a composition effect (i.e. the position of pensioners in the income distribution) and partially by tax expenditures. In Ireland, for example, the difference in average PIT rate between pensioners (1.7%) and employees (13.6%) is large, yet across quintiles these rates are similar. This indicates that there is a

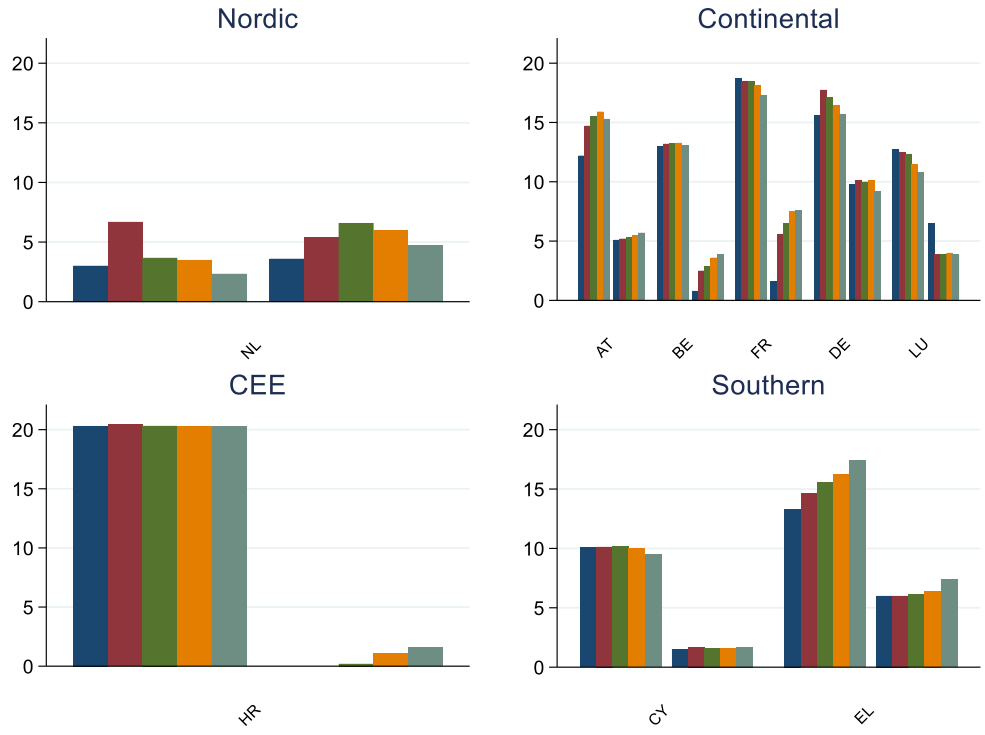
similar treatment of pension and employment income and that the difference in average PIT rate is related to the fact that pensioners are concentrated more in the lower quintiles of the distribution. In other countries, such as Slovenia, the difference in average PIT burden translates into smaller average PIT rates for pensioners in all quintiles. This implies that pension-related tax expenditures induce horizontal inequity between pensioners and employees.

A second insight worth highlighting is that horizontal inequity is often the result of measures to ensure vertical equity (for example, tax expenditures aimed at the lower end of the distribution), both for employees and pensioners. As a result, horizontal equity might be violated especially in the lower quintiles of the distribution and, depending on how tax expenditures for employees and pensioners compare in size, might lead to lower or to higher tax burdens for pensioners as compared to employees. Poland is a nice illustration of this point. In Poland, all retirement income is fully taxed, which results in comparatively high average PIT rates on retirement income over all quintiles. Similarly, in some continental countries, such as Austria and Belgium, across quintiles PIT rates for pensioners are higher than (or equal to) those of employees, despite the existence of pension-related tax expenditures. Moreover in the bottom quintile, employees have negative PIT rates, while the PIT rates of pensioners are positive. In Belgium the effect of substantial pension-related tax expenditures is offset by tax expenditures for professional expenses for employees. As a result, there is horizontal inequity between pensioners and employees, but at the expense of pensioners.

In most countries with DC elements in their second-tier public pensions system (Sweden, Poland, Denmark, Italy), average tax rates across quintiles are quite similar for pensioners and employees (in some cases even higher). In DC schemes the link between contributions and benefits is stronger, linking them to an insurance logic. Consequently, we would expect that the tax systems in countries with DC pension schemes emphasize horizontal equity. The fact that pensioners are treated similarly to workers is in line with this reasoning. Latvia, however, is the only exception. There is a DC element in their pension system, but the average tax rates for pensioners is in all quintiles lower than those for employees. In countries with DB systems, the insurance principle is also at play, so to a certain extent we expect equal treatment. For these countries, the picture is actually mixed: e.g. in Germany average tax rates are lower in all quintiles. In contrast, the tax burden on pensioners in Luxembourg is similar to the burden on workers (and even slightly higher in the four highest quintiles), and slightly lower in the bottom quintile, which is more in line with our expectations.

In sum, these results for PIT only partially follow our expectations. In the group of Beveridgean countries, we expected horizontal equity to be relatively less important. Yet, in the Nordic countries tax rates for retirees are similar to those of employees. In the Anglo-Saxon countries, tax rates for pensioners in the bottom quintiles are lower than those of employees. This could be the result of attaching more importance to vertical equity, which will be explored in the following section. In the group of insurance-based countries, the picture is mixed. In CEE and Baltic countries there is clearly no horizontal equity, in Southern countries (except Italy) tax rates for pensioners are also lower (although the difference is smaller than in CEE countries). Only in continental countries does horizontal equity seem to be present to a greater extent.

Figure 10: Average SIC rates for workers (left) and pensioners (right) across quintiles of equivalised pre-tax income, expressed as % of pre-tax income, 28 European countries, 2019



Source: EUROMOD, own calculations

Figure 10 shows the average level of social contributions for workers and old-age individuals across quintiles, only for those countries where retirement income is liable to SIC. In most countries we find, as one would expect lower SIC rates for pensioners across quintiles. As explained earlier, the exception here is the Netherlands, where SIC rates paid by pensioners are relatively higher than those paid by employees, and this is especially the cases for the higher quintiles.

4.2.3 Vertical equity

We now turn our attention to how the tax treatment of pensions induces differences in the poverty effects of taxation, on the one hand, and tax progressivity, on the other hand. Both of these measures can be seen as indicators of vertical equity as they are concerned with the tax treatment of unequal individuals (in terms of income) and how ability-to-pay plays a role.

Poverty

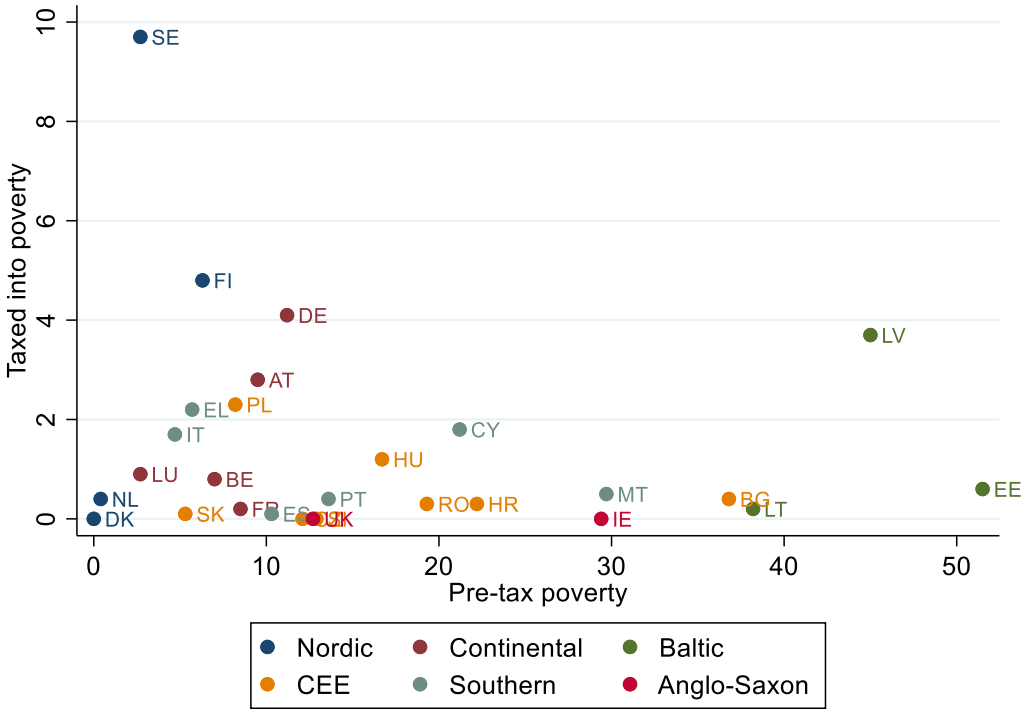
We first examine the poverty effect of taxes on pension income. We expect that in solidarity-based systems the taxation of pensions is not distortive to any poverty minimising efforts of the pension system. Secondly, we turn to the tax treatment of the different pension tiers. Here, we expect that within each country, first tier benefits are taxed to a much lesser extent than second and third tier benefits, given that the first tier benefits are aimed at poverty reduction.

To understand how the poverty rates are influenced by taxes on pensions, we introduce the measure of 'taxed into poverty'. The relationship between the poverty effects of the tax system on the one hand (percentage of elderly that are taxed into poverty) and of the pension system on the other hand (pre-tax poverty risk) is summarised in Figure 11.

Figure 11 hints at the complex interplay between the characteristics of the pension system (in terms of adequacy of benefits) and the tax system. Pre-tax poverty rates among the elderly (horizontal axis), show a lot of variation between countries. In general, old age pre-tax poverty rates are quite low in the Nordic and Continental countries, where they are usually below 10% (slightly higher in Germany, with 11.2%). In contrast, poverty rates are very high in the Baltic countries, ranging between 38.5% in Lithuania and 51.5% in Estonia, in line with results for 2017/2018 of Ebbinghaus (2021). Within the group of Southern and Eastern European countries, there is more variation. Pre-tax poverty in old-age ranges between 5 and 30% in the Southern countries. Greece and Italy perform quite well, with poverty rates of 5.7 and 4.7%, respectively. On the other end are Cyprus (21.2%) and Malta (29.7%). In the group of CEE countries, Poland and Slovakia stand out because of their comparatively low poverty rates (8.2 and 5.3%, respectively). The highest poverty rate is observed in Bulgaria, which is closer to Baltic countries with its 36.8%. In the remaining CEE countries, poverty rates range between 12 and 23%. Quite notable is also the high rate of pre-tax poverty in Ireland (29.4%), and the lower poverty rate in the UK (which is still higher at 12.7% than that of the worst-performing continental country).

There is less variation across countries in the extent to which pensioners are taxed into poverty. With the exception of Sweden, in all countries less than 5% of old-age individuals are poor after deduction of PIT and SIC on pension income. It appears that the tax system does not counteract in great deal the poverty-reducing effects of the pension system (small as these poverty-reducing effects may be in certain countries). At the same time, there seems to be an inverse pattern between pre-tax poverty and the share of pensioners that are taxed into poverty, though the pattern is not clear cut. For example, in the Baltic countries and Bulgaria pre-tax pension levels are often inadequate, but the tax system does not further deepen this low income position because of the many tax exemptions on pensions that are in place in these countries. A similar case can be made for most other CEE countries (except for Poland) and Southern countries, though pre-tax poverty rates tend to vary more. Continental countries combine relatively low poverty rates with varying levels of pensioners that are taxed into poverty.

Figure 11: Scatter plot of pre-tax poverty rate and percentage taxed into poverty, pensioners only, 28 European countries, 2019



Source: EUROMOD, own calculations
Note: Pre-tax poverty rates are based on equivalised pre-tax income.

A striking finding is the difference in shares of pensioners that are taxed into poverty within Beveridgean countries, more specifically between Sweden and Finland and the other countries. These are all countries where poverty reduction traditionally is at the centre of the pension system. In line with results of Figari et al. (2013), pre-tax poverty rates indicate that especially Denmark and the Netherlands are successful in achieving adequate living standards for pensioners, while Ireland and the UK are less successful. Interestingly, Denmark and the Netherlands are the two countries with (partial) basic pensions. At the same time, in the UK, Ireland, Denmark and the Netherlands the share of pensioners that is taxed into poverty is (nearly) zero, even though in the Beveridgean countries first tier pension benefits are exempt only in the UK and Sweden. In Sweden and Finland, in contrast, the tax system counteracts to a certain extent the efforts of the pension system to keep pensioners out of poverty. In Sweden, 9.6% of pensioners are taxed into poverty, while in Finland almost 5% of pensioners are poor due to taxes on pension benefits. The result is even more surprising as Sweden is the only Nordic country where first tier pension benefits are tax exempt. Although it might be argued that these numbers are not extremely high, it is striking that the comparatively highest shares of pensioners that are taxed into poverty are found in countries where poverty reduction is one of the central aims of the welfare state.

In what follows, we analyze further to what extent the pensioners that are taxed into poverty could be the result of taxes on minimum pensions, rather than because of taxes on pension

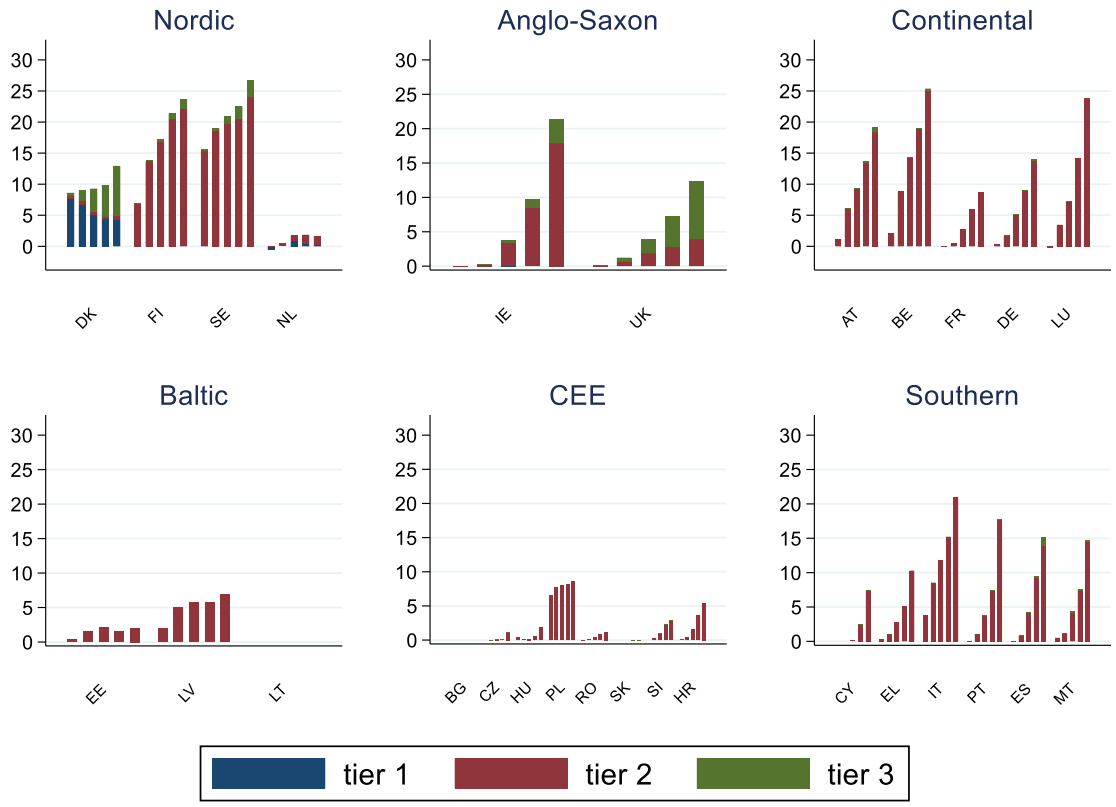
benefits from the second or third tier. In the majority of countries first tier pension benefits are tax exempt. Yet, there are still pensioners that are taxed into poverty. This implies that there are individuals with second or third tier benefits that become poor because of taxes on pension income.

Average tax rates over quintiles

In this section we turn to the progressivity of taxes, our second indicator of vertical equity. We first look at average tax rates over quintiles, as presented in Figure 1. In nearly all countries PIT on employment and retirement incomes are progressive (i.e. increase over the distribution), though to various degrees. The only exceptions are the Netherlands, Estonia and Hungary, where PIT on retirement income is not progressive over the full distribution. Especially in the Baltic and CEE countries, progressivity of taxes on retirement income is quite different from progressivity of taxes on employment income. In the Nordic, Anglo-Saxon, continental and several Southern countries, the difference in progressivity appears to be smaller. We return to these differences in progressivity at a later stage.

We now go into more detail on the average tax rate on pensions in Figure 12, where we show the tax burden on the different pension tiers. We focus here on taxes on pensions that can be linked clearly to one of the pension tiers, meaning that taxes on pensions from the “other pensions’ category are not considered (in contrast to Figures 9 and 10). Taxes on the first tier contribute significantly to the total tax burden on pensions only in Denmark. This is unsurprising, since first tier pensions are the most important source of total pre-tax pension income in Denmark. Tax rates are especially high in the first quintiles, with decreasing importance for the next quintiles. This is a consequence of the fact that the higher quintiles rely relatively more on third tier benefits.

Figure 12: Average PIT rates per pension tier across quintiles of equivalised pre-tax income, expressed as % of pre-tax pension income, 28 European countries, 2019

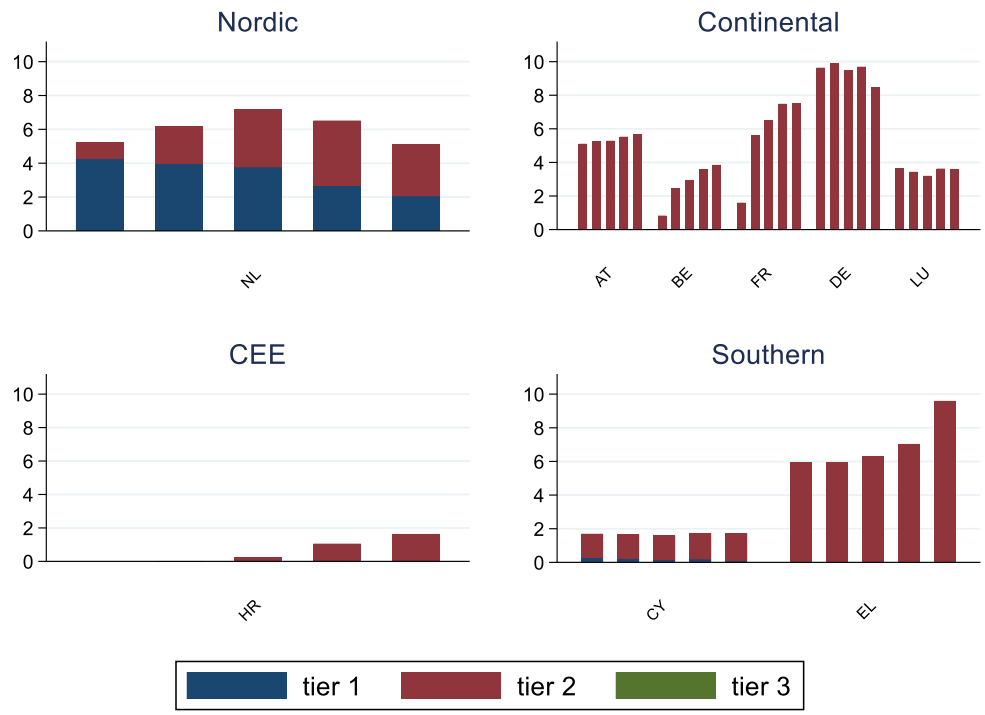


Source: EUROMOD, own calculations

Additionally, Denmark and the Netherlands are the two countries with (close to) zero pre-tax old age poverty. However, as discussed in the previous section, in the Netherlands some poor pensioners are still taxed into poverty as a result of pension taxation, whereas this is not the case in Denmark. The results in Figure 12 show that this is not due to a tax exemption on first tier benefits in Denmark (actually, PIT rates on first tier pensions are very similar in terms of levels across all quintiles in both countries). Consequently, though in Denmark pensions on all tiers are fully taxed, the government still manages to take taxation rules into account when designing the minimum pension scheme. Our earlier reasoning that especially in the countries where the pension system is based on a solidarity principle (and that therefore will have a well-developed first tier), we would expect very low tax rates on first tier benefits does not necessarily hold, since the two countries with a large first tier do levy taxes on this tier. However, Cyprus and Ireland do provide examples of countries where average first tier pensions make up a relatively large part of total pensions (at least compared to many of the other countries), but only very small tax rates on this tier apply. The fact that PIT on pensions of the first tier are not considerable in any of the other countries is in line with the argument from Barrios et al. (2020) that in most countries pensions from this tier are either tax exempt or below taxable level. It is also simply a consequence of the fact that in these countries, first tier pensions do not make up a large part of the average total pension. Turning to third tier pensions, Denmark and the United Kingdom are the only countries where this tier plays an

important part in total pensions. Figure 12 shows clearly that for these two countries the tax rate for this tier is quite high, especially in the higher quintiles. In most other countries, this tier is not (yet) important for current retirees.

Figure 13: Average SIC rates per pension tier across quintiles of equivalised pre-tax income, expressed as % of pre-tax pension income, 28 European countries, 2019



Source: EUROMOD, own calculations

The average SIC rate for each pension tier across quintiles is shown in Figure 13 for those countries where pensioners pay SIC. Two conclusions emerge. Firstly, no country levies SIC on pensions from the third tier. Second, there are only two countries where pensioners pay SIC because of first tier pensions: the Netherlands and Cyprus. In Cyprus, only a very small (nearly negligible) average rate applies. In the Netherlands, the average SIC rate on first tier pensions is regressive, as the average rate decreases with income. In some (solidarity-based) countries, we expected that first tier pensions are taxed at a smaller rate than in insurance-based countries. This is in general the case, but mostly because the first tier is so small (or completely absent) that taxes on these pensions do not contribute to the total tax burden on pensions. In insurance-based countries, the second tier is clearly the most important (which is in line with the insurance logic). In most countries average SIC rates on second tier pensions tend to increase with income (e.g. in Belgium and France) or are the same across quintiles (e.g. in Cyprus).

Decomposing total progressivity

Across countries, there are differences in the overall progressivity of the tax system (taking together PIT and SIC on all income components), as shown by the black dot in Figure 6. In line with the results of Verbist & Figari (2014) for the EU-15 in 2008, progressivity of the full

tax system is largest in Ireland (Kakwani of 0.297), though the estimate is lower than the one for 2008 (which was 0.320). The countries where the tax system redistributes the least are Denmark (Kakwani of 0.079) and Poland (Kakwani of 0.08). For most countries, our estimates of progressivity are slightly larger than those provided by Verbist & Figari (2014). Both PIT and SIC on employment income are in all countries in our analysis progressive (with the exception of SIC in the Netherlands). The same cannot be said for PIT and SIC on pension income: in eight countries (Denmark, Finland, Sweden, Belgium, Estonia, Lithuania, Hungary and Poland), PIT on retirement income is regressive. In the other countries, taxation on pension income is progressive, but the value of the Kakwani index for pension taxes is almost everywhere smaller than the Kakwani of PIT on employment income (exceptions are the Netherlands, Luxembourg, Cyprus and Portugal). In addition, only in Luxembourg and Croatia are SIC on pension income progressive. In the remaining countries where pension income is liable to SIC (the Netherlands, Austria, Belgium, France, Germany, Cyprus and Greece), they are regressive.

In Figure 14, we decompose the Kakwani index for total taxes into the progressivity contributions of the different tax types (PIT and SIC) on the different income components on which they are levied (employment, pension from all tiers and all other incomes), where $\prod_T$ is the Kakwani index for total taxes, *t* is the average tax rate of total taxes, t_i is the average tax rate of the specific tax component and $\prod_{T_i}$ is the Kakwani index of each specific tax component (Kakwani, 1977; Verbist & Figari, 2014).

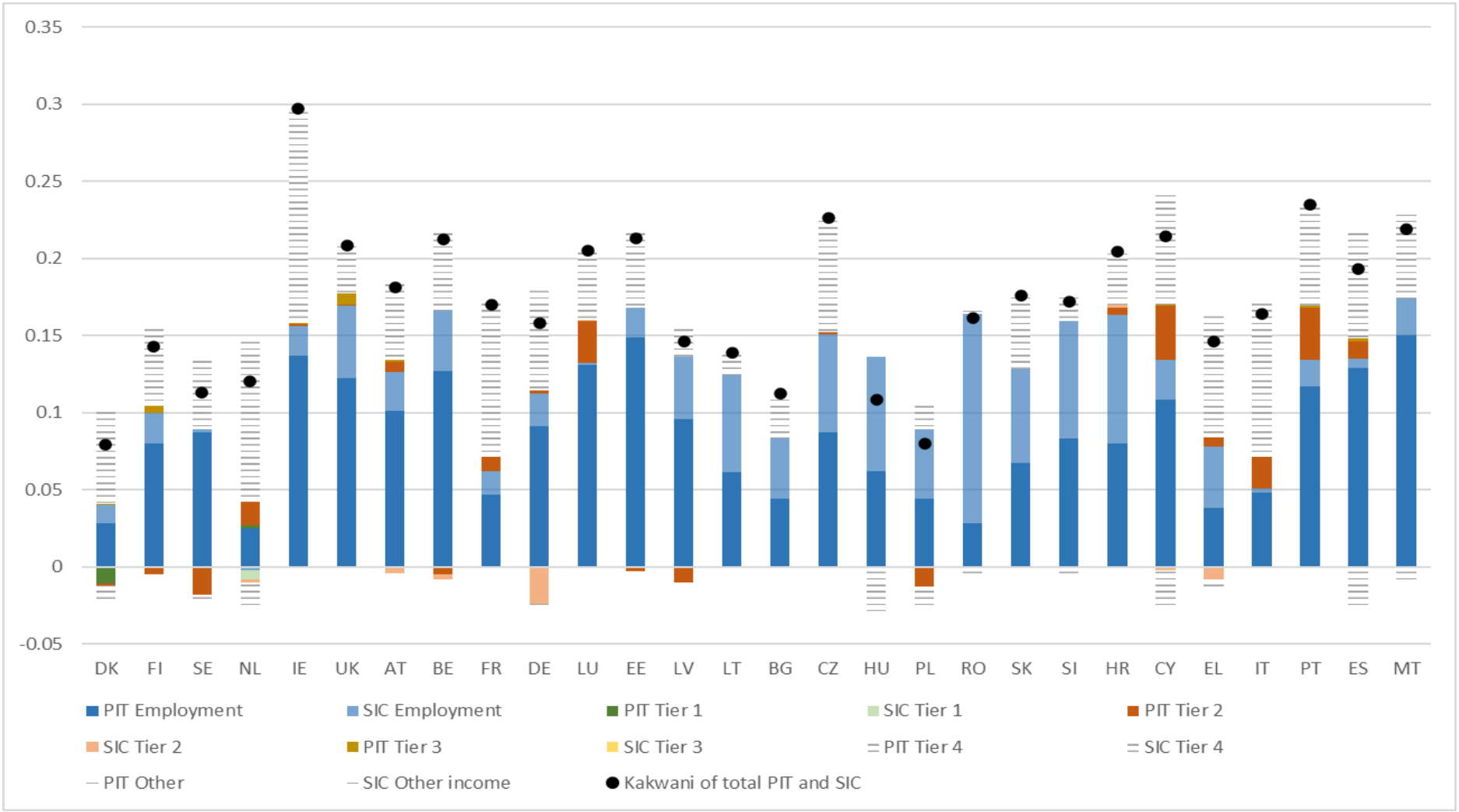
There is cross-country heterogeneity in the way PIT and SIC on employment and retirement income contribute to the overall progressivity of the tax system. The biggest contribution to total progressivity comes from PIT and SIC on employment income. In almost every country (except in Greece and in France) the progressivity of these two taxes accounts for more than half of total progressivity. In nearly all continental and southern countries (with exception of France, Greece and Italy) and the United Kingdom, Finland, Sweden and Estonia, PIT on employment income contributes quite substantially to overall progressivity. In the Baltic and CEE countries, with the exception of Estonia, the contribution of SIC on employment income is similar to the contribution of PIT on employment income, and in some cases even larger (for example, Romania). In some countries, like in Denmark and the Netherlands, the contribution of PIT on income from other sources is also substantial; given the heterogenic character of this component, we do not discuss it further.

In all countries, the contribution of PIT and SIC on retirement income to overall tax progressivity is quite different from the contribution of PIT and SIC on employment income, in the sense that it is much smaller. As the contribution of a specific tax on overall progressivity depends on both the relative size of the tax component and its progressivity, this finding can partially be explained by the relatively smaller size of taxes on retirement income as compared to taxes on employment income. In addition, whereas taxation on employment income is always progressive, this is not the case for pension income. The regressivity of PIT and/or SIC on retirement income explains the negative contributions to overall tax progressivity in certain countries (e.g. Germany and Greece).

In most countries where PIT and SIC on pensions contribute to overall progressivity (be it positively or negatively), it is mainly due to PIT and/or SIC on second tier pension benefits. In most countries, PIT on second tier benefits contribute positively to the overall Kakwani index. Exceptions are the Nordic countries (without the Netherlands), Belgium, Estonia, Latvia and Poland. Regardless of whether their contribution is positive or negative, in all countries the contribution of taxes on second tier benefits to overall progressivity is limited, which is again partially due to the limited size of PIT on second tier pension benefits. SIC on second tier pensions contribute negatively to overall progressivity, in a very limited way in nearly every country in which they are levied, except in Luxembourg and Croatia. The negative contribution is a result of the negative Kakwani of SIC on second tier pension benefits. PIT and SIC on first and third tier pension benefits have an impact on overall progressivity in a limited number of countries. Taxes on tier one pensions contribute to total progressivity to a very limited extent only in Denmark and in the Netherlands. In Denmark, the contribution is negative, meaning that the overall effect of these taxes is inequality increasing. In contrast, the contribution of PIT on first tier pensions to total progressivity is slightly positive in the Netherlands, which means that they have a small inequality decreasing effect. SIC on first tier benefits only contribute slightly to total progressivity in the Netherlands and to a lesser extent in Cyprus. Again, these taxes have a negative effect on the index, meaning that they are regressive. Taxes on the third tier have a negligible impact on total progressivity in eight countries. This is a result of the fact that the size of this tier is very small in most countries or non-existent. However, though the contribution is often small, it is everywhere positive as PIT on third tier pensions are progressive. The largest contribution to total progressivity can be observed in Finland and the United Kingdom.

Especially the results regarding the regressive effects of second tier benefits in a select number of countries might appear counterintuitive and even contradictory to the results presented in previous sections. Although PIT on pension income increase across the distribution when considering pensioners alone, the same taxes are regressive when considering the entire population. This finding is related to the position of old-age individuals in the overall distribution of income. For example, in Belgium, the percentage of individuals with (second tier) pensions in the highest quintile is very small, so that even the richest pensioners (who carry a larger tax burden than poorer pensioners) are located somewhere in the middle of the distribution. Since we here consider tax progressivity across the entire population, this results in an overall regressive effect. This serves as an important reminder that the underlying characteristics of the income distribution, in this case the position of pensioners, influence outcomes of progressivity of the tax system. While pension benefit related tax expenditures might lower the tax burden of pensioners, this does not necessarily imply that taxes on pension income will have an inequality decreasing effect when the whole income distribution is considered.

Figure 14: Decomposition of progressivity of total taxes over PIT and SIC on different income components, 28 European countries, 2019



Source: EUROMOD, own calculations
Note: Kakwani index calculated over the entire population, using equivalised incomes and taxes, using the modified OECD scale.

4.2.4 Conclusions and recommendations

In this study, we have studied the interaction between the pension system and the tax system across the EU-27 countries and the United Kingdom. Following the work of Kammer et al. (2012) and Feher and Jousten (2018), we have started from the assumption that the underlying principle of the welfare state (solidarity or insurance) would influence key elements of both the pension and the tax system. Very broadly, we assumed that in solidarity-based countries the concern with vertical equity within the tax system would be relatively more important than the horizontal equity concern. In insurance-based countries, we expected that governments would attach relatively more importance to the horizontal equity concern. These hypotheses provided the framework for the empirical analysis, in which we attempted to answer the following questions. Do governments in Europe use the tax system as a social policy tool when it comes to the elderly, e.g. by treating (minimum) pensions and old-age benefits in a favourable way? To what extent are elderly persons taxed into poverty? Do pensioners face a similar tax burden as workers? Are taxes on old-age benefits stronger or weaker pro-poor than those on workers?

Almost all countries clearly use the tax system as a social policy tool for pensioners. From our results on the average burden of PIT and SIC, and on the percentage of pensioners that are taxed into poverty, it might seem that governments use the tax system in a way that is beneficial for pensioners. However, this conclusion should be nuanced, given that both findings are related to the position of pensioners in the income distribution. On average, the rate of PIT and SIC paid by pensioners is lower than that of employees in every country in our analysis. In addition, with the exception of Sweden, in every country less than 5% of pensioners become poor because of PIT and SIC on retirement income. At the same time, pre-tax old-age poverty levels vary across the different countries in our analysis. Because of the relatively worse income position of pensioners compared to workers, it is challenging to determine how much of the difference in tax burden result from pension-related tax expenditures and how much is a consequence of the tax structure.

Figure 15 brings together our results regarding vertical and horizontal equity. On the horizontal axis, we show the average of the difference in PIT rate between pensioners and employees across quintiles. A positive value indicates that, on average, pensioners have higher PIT rates than employees. This measure is positive (or slightly negative) for Poland and for most continental, Southern and Nordic countries. On the other hand, pensioners pay on average less PIT than employees in the Anglo-Saxon, Baltic and CEE countries (without Poland), Germany and the Netherlands. On the vertical axis, we plot the difference in the Kakwani of PIT on pensions and the Kakwani of PIT employment income. In this case, negative values indicate that PIT on pensions are less progressive than PIT on employment income, which is the case for the majority of countries. The only country where it is substantially larger than zero is the Netherlands, while the measure is around zero for Cyprus, Portugal and Luxembourg.

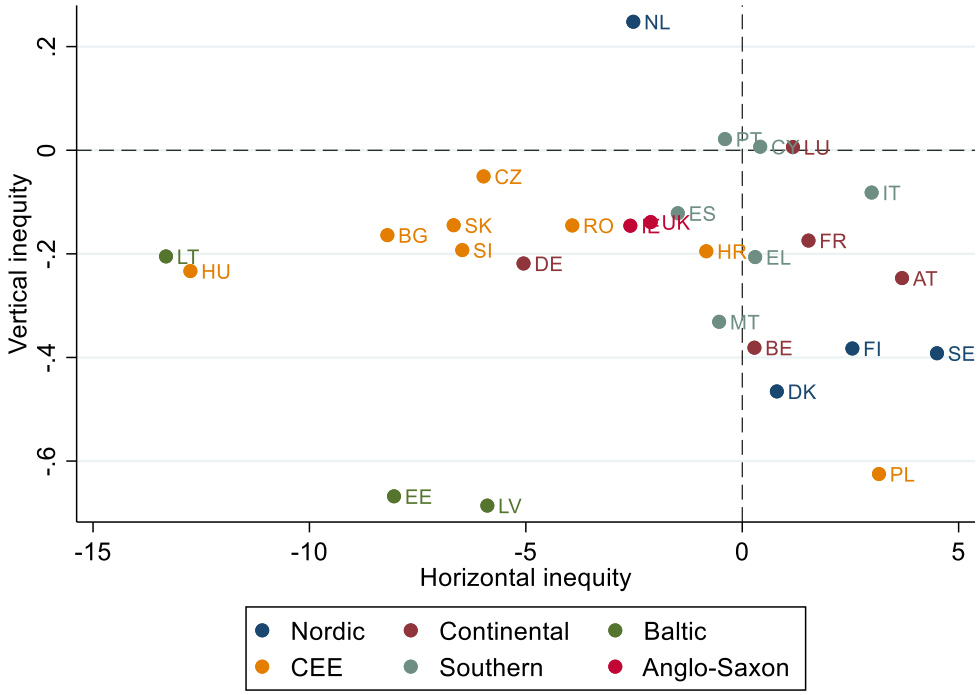
Four groups of countries can be identified. The first group, containing the Anglo-Saxon, Baltic, most of the CEE countries, Germany and Spain have negative measures of both horizontal and vertical equity. In these countries, taxes on retirement income have a lower level and are less progressive than employment income. This is most pronounced in the CEE and Baltic countries, and this is mainly a result of pension related tax expenditures (i.e. pensions being (nearly) tax exempt). The second group, composed of the Nordic countries and nearly all Continental and Southern countries,

combines a negative measure of vertical equity with a positive measure of horizontal equity. In these countries, progressivity of PIT on retirement income is smaller than progressivity of PIT on employment income and pensioners pay on average more PIT than employees. The position of Sweden, Denmark and Finland in this group, goes against our expectations, with regards to both the regressive nature of taxes on pensions and the similar tax burdens for employees and pensioners. For the continental and Southern countries, the results regarding horizontal equity follow expectations, given the insurance logic in their pension system. However, it is notable that in some of these countries (e.g. Belgium), the effect of tax expenditures regarding pension benefits (which substantially lower the tax burden of pensioners) are offset by tax expenditures aimed at employees. The third group consists of the Netherlands, where PIT on retirement income is more progressive than PIT on employment income, even when considering the position of pensioners in the distribution. At the same time, pensioners pay on average less PIT than employees. In the final group, composed of Luxembourg, Portugal and Cyprus, both the measure of vertical and horizontal equity is close to zero, implying that employees and pensioners are treated in very similar ways.

Due to the variety of elements that influence the distributive effects of preferential tax treatment of pensions, the effects of using the tax system as a policy tool are heterogenous across countries. Our results highlight, once more, that the position of pensioners in the income distribution is an important driver of the results regarding tax progressivity. In addition, while pension income is granted preferential treatment in nearly all countries, the existence of tax expenditures in other policy fields can (and do) impact the extent to which the principle of horizontal equity between pensioners and employees is maintained or violated.

Our study showed that almost all European countries studied here clearly use the tax system as a social policy tool for pensioners. The results highlight the importance of studying the tax and pension system jointly. Given the complex interactions, changes in, for example, minimum income protection policies might generate important changes in the effects of the tax system. Also the reverse applies: changes in the tax treatment of old age incomes may generate adverse poverty outcomes if pension levels are left unchanged. Similarly, our results show that the interplay between tax expenditures in different fields might yield unexpected results. These effects are likely to go unnoticed if the focus is only on one specific field, giving further relevance to undertaking a comprehensive analysis of the effects of possible changes in tax and/or benefit systems. Finally, there is scope for policy makers to further clarify the main aim of granting tax expenditures to certain types of income. While it is possible to gauge how tax expenditures regarding pension benefits affect old-age poverty and inequality, it is challenging to establish whether and to what extent such effects are intended.

Figure 15: Scatter plot of measures of vertical inequality and horizontal inequality, 28 European countries, 2019



Source: EUROMOD, own calculations
Note: The measure of vertical inequity is the difference in Kakwani index of PIT on pensions and the Kakwani of PIT employment income. Negative values indicate that PIT on retirement income is less progressive than PIT on employment income. The measure of horizontal inequity is the average difference in PIT rates of pensioners and employees across quintiles. Negative values indicate that PIT rates of pensioners are lower than PIT rates of employees.

4.3 Intergenerational solidarity in multigenerational households

We now turn to the empirical analysis of intergenerational solidarity in multigenerational households. We first present a descriptive analysis of the prevalence of MGHs and poverty rates for children and the elderly. Next, we gauge the direction of this solidarity. We then estimate the importance of MGH membership for child poverty. Finally, we assess the impact of the income of the elderly under different hypotheses with regard to resource and cost-sharing.

To facilitate the presentation of our results, we cluster the countries in our sample in five groups on the basis of geography and, to some extent, their history (the former communist countries that are now (candidate) EU members constitute one cluster).

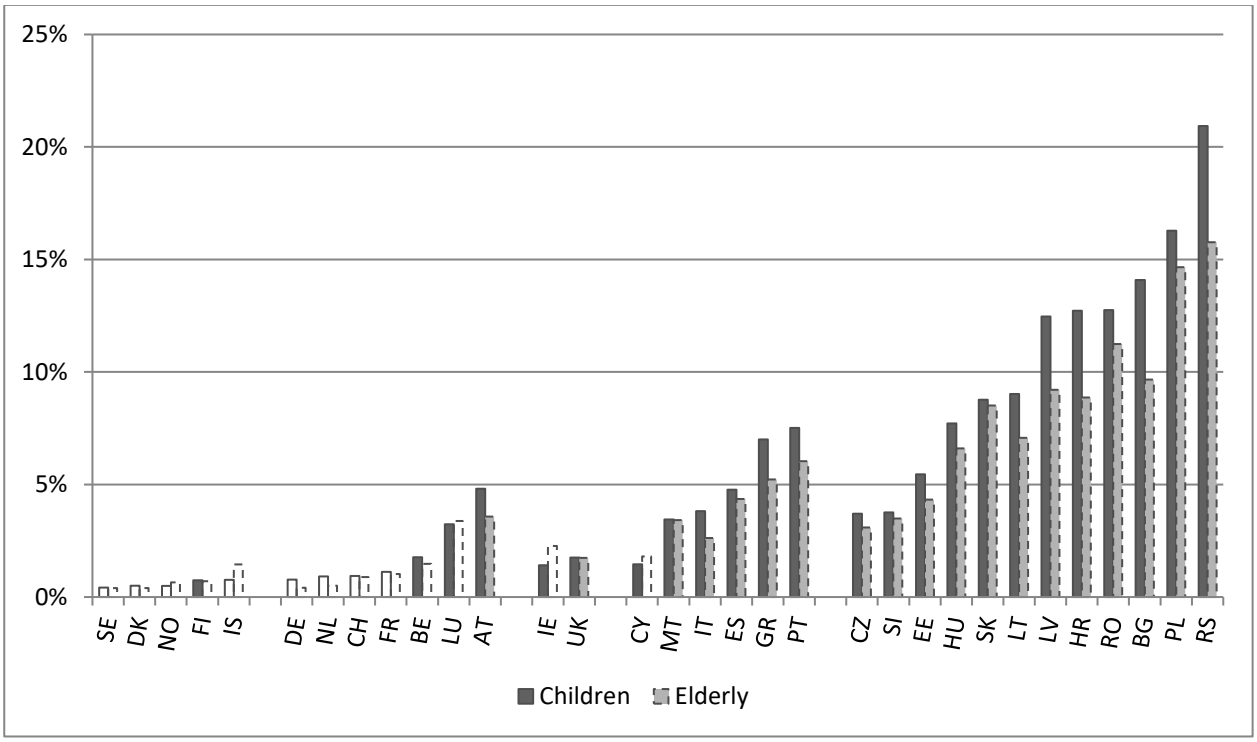
1) Nordic: Denmark, Finland, Iceland, Norway, Sweden;
2) Continental: Austria, Belgium, France, Germany, Luxembourg, the Netherlands, Switzerland;
3) Anglo-Saxon: Ireland, United Kingdom;
4) Southern: Cyprus, Greece, Italy, Malta, Portugal, Spain;
5) Eastern: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia, Serb Republic.

The countries in some of these geographical-historical clusters share certain features (e.g. mature and rich welfare states and a very low prevalence of MGHs in the Nordic cluster), but we do not pretend that these clusters are delineated by clear-cut differences with regard to the dynamics of household formation and intergenerational solidarity.

4.3.1 Children and elderly people in multigenerational households in Europe: prevalence and poverty outcomes

Figure 16 shows the share of children and elderly people living in an MGHs, with countries grouped into the regions defined earlier. There is considerable cross-country variation. In the Nordic, Anglo-Saxon and most continental countries, the share of children and elderly people living in MGHs is often below 1%. Austria provides an exception, with close to 5% of children living with two other generations, and a somewhat smaller share of elderly individuals. In Southern Europe, the prevalence of children living in MGHs is close to or above 5%, with the exceptions of Cyprus and Malta, where it is less. It is well over 5% in most Eastern countries, with particularly high levels in Poland and the Serb Republic. In most countries, the share of children living in MGHs is larger than that of elderly individuals, as the typical MG household contains more children than elderly people.

Figure 16: Share of children and elderly individuals living in MGHs in Europe, 2013.



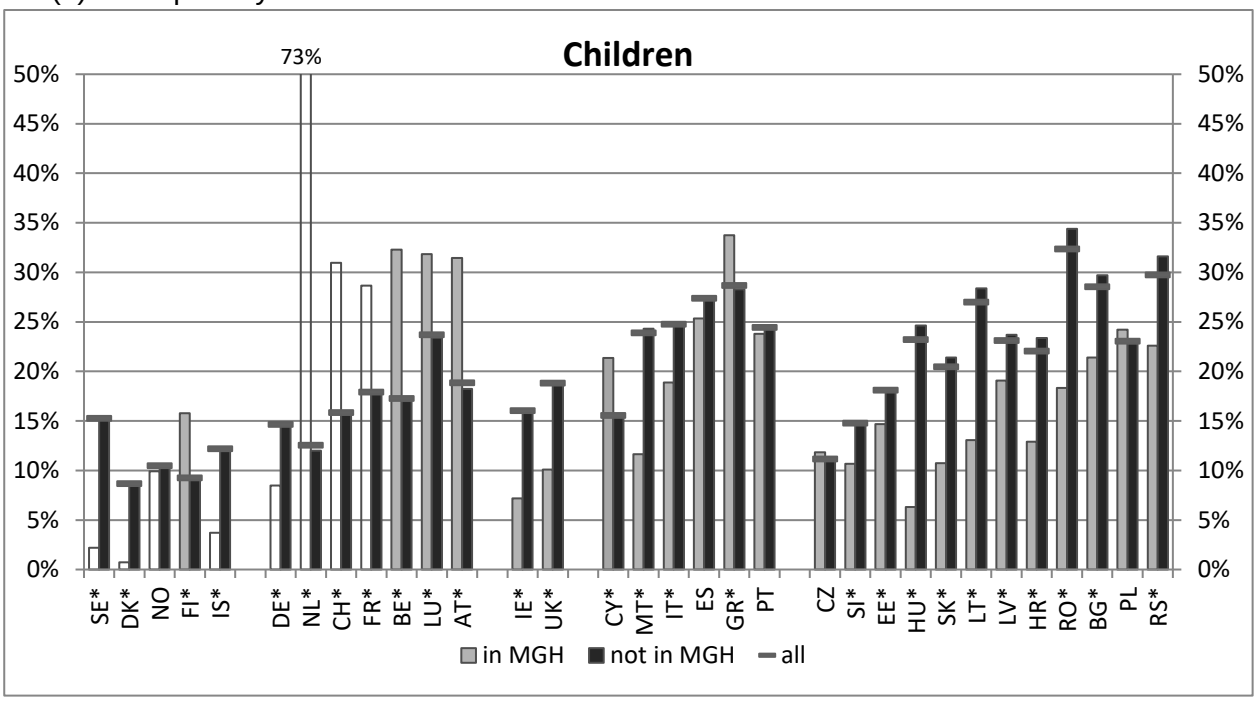
Notes: 1) Within each country group, countries are ranked from low to high share of children living in MGH.
2) Countries with less than 60 children, resp. elderly people living in MGH in the sample are in white.
Source: own calculations EU-SILC 2013.

On average the EU child poverty rate amounts to 19.7%, and the rate for children in MGHs is slightly higher (20.4%). There is, however, wide variation across countries (Figure 17a). For most countries the difference between the poverty rate for children living in MGHs and those not living in MGHs is statistically significant (exceptions are Norway, Spain, Portugal, the Czech Republic and Poland). For countries with statistically significant differences, poverty rates for children living in MGHs are higher than those for children in non-MGHs in the group of continental welfare states. For instance, in Belgium children in MGHs are almost twice as much at risk of being poor (32%) compared to children in non-MGHs (17%). It should be noted that the number of MGHs is very small in these countries. Since this household form is so rare, it is not surprising that those MGHs that exist are a very particular subgroup. In these countries they only seem to form in families whose financial circumstances are especially dire. The Netherlands offers the most extreme example of this, with a child poverty rate of 73% for MGHs, versus 12% for all other households.

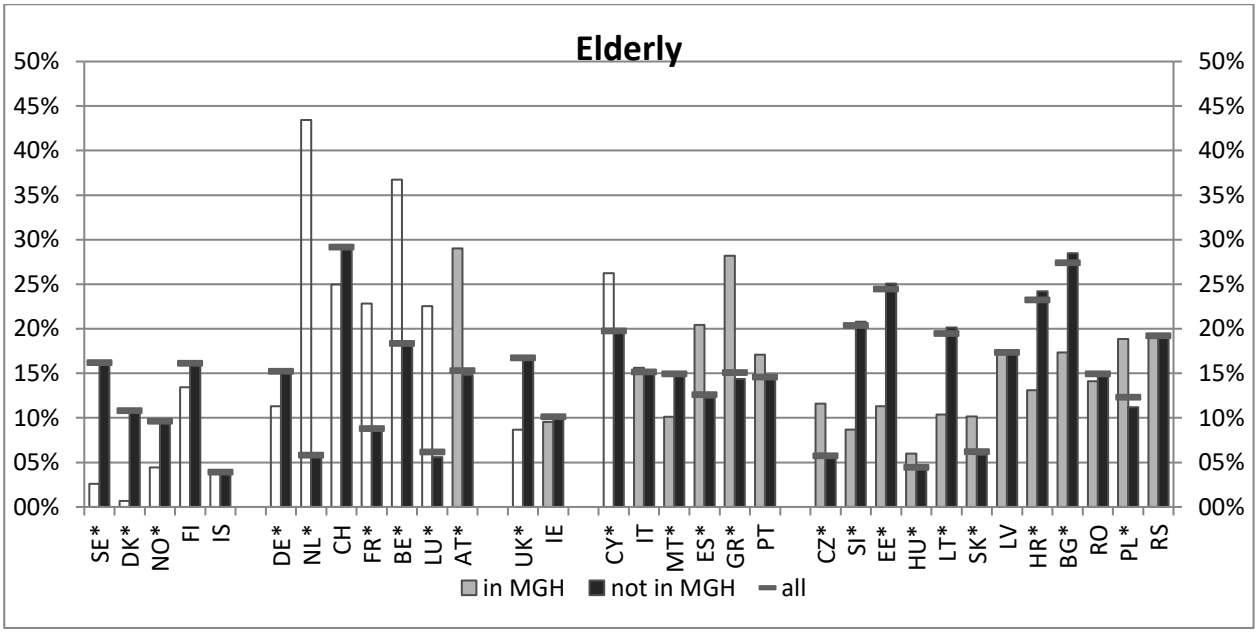
In contrast, in Anglo-Saxon and Eastern countries, we find much lower poverty rates for children in MGHs compared to other households. The difference in at-risk-of-poverty rate between both groups of children amounts to more than 10 percentage points in Hungary (18 percentage point difference), Romania (16%p) and Lithuania (15%p). For the Southern European countries, outcomes are mixed; in Italy and Malta children in non-MGHs are relatively more at risk of being poor, while in Cyprus and Greece children in MGHs have a higher poverty risk.

Figure 17: Poverty rates in Europe, according to membership of MGH, 2013.

(a) Child poverty



(b) Elderly poverty



Notes: 1) Within each country group, countries are ranked from low to high share of children, resp. elderly people living in MGH. 2) Countries with less than 60 children, resp. elderly living in MGH in the sample are in white. 3) * behind country name indicates significant difference in poverty rate between 'in MGH' and 'not in MGH' (at 95% confidence interval). 4) see Appendix Table A.5 for numbers.
Source: own calculations EU-SILC 2013.

We find marked differences across countries for elderly poverty rates as well. In Belgium, Spain and Greece, for example, elderly poverty rates in MGHs are well above those for the elderly living in non-MGHs (Figure 17b). However, in the Eastern European countries, the reverse applies. Especially in Bulgaria, Croatia, Estonia, Lithuania and Slovenia, we find that elderly individuals in MGHs have a

much lower poverty risk than their counterparts in non-MGHs. When comparing poverty rates between children and elderly people in MGHs, children face a higher poverty risk in most countries. This is due to a composition effect, i.e. there are relatively more children in poor MGHs than elderly individuals in those households.

4.3.2 Direction of financial solidarity

These poverty outcomes are an indication of the fact that the financial benefit of MGH formation likely differs across countries, or across generations. Table 9 uses the formulae presented in the Methodology Section to calculate the direction of solidarity of MGH formation. Most children appear to benefit from living in an MGH: in all countries, more than half of the children live in a household where the direction of solidarity is 'pro-child' or 'mutual'. In countries with higher shares of children living in MGHs, these figures are generally substantially higher. The share of children living in a 'pro-elderly' household is relatively small, especially in the Eastern European countries. For instance, the direction of solidarity is pro-child for 90% of children living in MGHs in Croatia and Slovenia, and for more than 80% of children living in Bulgaria, Estonia, Lithuania, Poland and Slovakia. MGHs tend to be relatively more pro-elderly in Southern Europe. For around 40% of elderly people living in these households, there is a (direct) benefit from their formation, compared to around 15-20% in Eastern countries. Hence, while the general direction is consistently pro-child, there are strong differences in the degree across countries.

When we look at the final three columns of Table 9, the pattern is very similar. This is not surprising, as the only differences accrue due to compositional effects in the number of children vs. the number of elderly people in MGHs. Hence, we can conclude that financial solidarity among MGHs predominantly goes in the direction of the children. This cross-sectional observation matches with an analysis of trends in the prevalence of grandparents living with grandchildren by Glaser et al (2018), highlighting the fact that grandparents in such households are increasingly being supportive rather than supported. Given this result, we focus in the remainder of the empirical analyses on children and the impact of the resources that the elderly bring into the household on child poverty.

Table 9: Direction of solidarity of MGH formation in Europe, represented by share of children, resp. elderly people, for which the direction of solidarity is either pro-child, pro-elderly or mutual, 2013.

	Share of children in …			Share of elderly in…		
Direction solidarity	Pro elderly	Mutual	Pro child	Pro elderly	Mutual	Pro child
SE	29.0%	20.0%	51.0%	31.7%	17.1%	51.2%
DK	34.8%	9.0%	56.2%	20.3%	9.8%	69.9%
NO	13.6%	23.3%	63.1%	18.4%	26.0%	55.6%
FI	6.7%	25.3%	68.0%	9.7%	23.8%	66.5%
IS	16.6%	39.5%	43.9%	26.1%	35.6%	38.3%
Avg	***20.2%***	***23.4%***	***56.4%***	***21.2%***	***22.5%***	***56.3%***
DE	6.4%	10.5%	83.1%	8.4%	15.5%	76.1%
NL	6.7%	12.3%	81.0%	17.1%	27.0%	55.9%
CH	24.8%	19.2%	55.9%	28.0%	23.6%	48.4%
FR	26.4%	11.0%	62.6%	28.2%	14.1%	57.7%
BE	40.2%	12.4%	47.4%	35.5%	25.9%	38.6%
LU	38.8%	0.4%	60.8%	29.5%	0.4%	70.1%
AT	25.2%	13.0%	61.8%	19.6%	18.4%	62.0%
Avg	***24.1%***	***11.2%***	***64.7%***	***23.7%***	***17.8%***	***58.4%***
IE	25.2%	4.4%	70.3%	34.3%	3.3%	62.4%
UK	29.4%	4.0%	66.5%	30.7%	7.4%	61.8%
Avg	***27.3%***	***4.2%***	***68.4%***	***32.5%***	***5.4%***	***62.1%***
CY	38.8%	8.8%	52.4%	46.0%	5.1%	48.9%
MT	39.7%	6.2%	54.1%	41.0%	7.0%	52.0%
IT	24.1%	15.0%	60.9%	23.0%	18.1%	58.9%
ES	25.1%	13.3%	61.6%	28.1%	17.7%	54.2%
GR	23.5%	15.4%	61.1%	26.1%	14.6%	59.3%
PT	18.4%	11.3%	70.3%	19.3%	12.9%	67.8%
Avg	***28.3%***	***11.7%***	***60.1%***	***30.6%***	***12.6%***	***56.9%***
CZ	21.2%	10.9%	67.9%	28.8%	11.2%	60.0%
SI	3.5%	5.7%	90.8%	5.8%	3.8%	90.4%
EE	8.9%	9.4%	81.6%	12.3%	12.6%	75.1%
HU	10.8%	15.2%	73.9%	14.0%	20.3%	65.7%
SK	12.7%	4.5%	82.7%	15.6%	8.1%	76.3%
LT	12.6%	6.0%	81.5%	20.1%	7.1%	72.8%
LV	13.7%	12.4%	73.9%	18.5%	15.7%	65.8%
HR	7.3%	3.5%	89.2%	10.3%	5.8%	83.9%
RO	8.0%	8.8%	83.1%	10.7%	12.8%	76.4%
BG	11.2%	5.8%	83.0%	9.6%	7.0%	83.4%
PL	8.1%	6.7%	85.1%	9.0%	11.2%	79.7%
RS	19.9%	8.2%	72.0%	19.2%	11.2%	69.6%
Avg	***11.5%***	***8.1%***	***80.4%***	***14.5%***	***10.6%***	***74.9%***

Note: Country group averages are unweighted.

Source: own calculations EU-SILC 2013.

4.3.3 Membership of an MGH as an explanatory factor in child poverty

We now enrich the outcomes presented in Figure 17(a) by applying a logistic regression for child poverty, controlling for different household characteristics. Table 10 presents the average marginal effect (ME) for the independent variables of interest, notably whether the child lives in an MGH (Model 1) and from which elderly person the income originated (Model 2). In more than half of the countries, Model 1 yields a statistically significant negative ME for the MGH variable. This means that children in MGHs are less likely to be poor (e.g. in Romania these MGH children are 21 percentage points less likely to be poor as compared to those in other living arrangements, given the same background characteristics). This is especially the case in all Eastern European countries. In Denmark and Austria, we find a statistically significant positive ME, meaning that MGH membership is linked to a higher likelihood of being poor. Note however, that the prevalence of MGHs is very low in this group, and that MGHs probably constitute a very particular subgroup. In the other Nordic and continental countries, size and statistical significance of MEs for MGH membership is typically low. This implies that the higher child poverty risks in MGHs that we observed in Figure 17(a) are explained by differences in background characteristics, which are controlled for in the logistics analysis.

Model 2 looks at the impact of income brought into the household by the elderly, separately for grandmothers, grandfathers and jointly. In the countries where the elderly income MEs are statistically significant, they generally have negative signs, both for income coming from men only, from women only and from men and women jointly. Hence, the presence of old-age incomes in the household reduces the risk of poverty for these children. As such, the income from the elderly overcomes their addition to the equivalence scale, also for elderly women who typically bring in less pension income. Exceptions are provided by Austria and Norway, where old-age income from women (Austria) or from men and women jointly (Norway) exhibits a positive (conditional) correlation with child poverty. In other words, the extra income brought in does not appear to cover the increase in living expenses through the equivalence scale in these cases. In France, Cyprus and Greece, Figure 2(a) shows higher poverty rates for children in MGHs than in non-MGHs. However, in these countries, being a member of an MGH reduces the risk of poverty: the regression shows that children in MGHs have a lower poverty risk than other children, when controlling for other background characteristics of their household. For most of the Eastern European countries, children in MGHs have a lower poverty risk than other children, both when we do not control for other background characteristics (as in Figure 17a) and when we do; when we control for background characteristics, the difference typically becomes larger. In other words, child poverty in MGHs is lower in these countries, although these MGHs are characterised by a lower socio-economic status, which would in itself lead to a greater poverty risk.

In the Eastern countries, we find that the effect of incomes from elderly men is stronger than that from elderly women. This is probably linked to the higher pensions that men on average receive and can contribute to household income. Interestingly, in some countries (Malta, Spain and Greece) the effect of a woman-only income is larger than that of a man-only one. Having an income from both an elderly man and an elderly woman present is also associated with a reduction in child poverty. In the majority of cases, however, this effect is lower than the sum of the separate effects for grandfathers and grandmothers. This result shows that the ‘second’ elderly person typically brings in comparatively less income. In Cyprus, Greece, Estonia, Latvia and Poland, we even observe that

the effect of two incomes is lower than at least one of the other effects, indicating that the second elderly person does not bring enough to compensate for his or her increase in the equivalence scale. In most countries, however, the effect of two incomes is still somewhat higher than each of the individual effects. Hence, while the second elderly person typically brings in comparatively less income, this is still more than a compensation for the increased living cost in most countries.

These outcomes suggest that MGH formation has different underlying reasons depending on the group of countries. We already mentioned that several factors can play a role, such as preferences, cultural patterns, care needs of the elderly, lack of adequate social protection and the socio-economic context. Our outcomes indicate that for the Nordic and Continental countries, other factors are at play than for the other three country groups. For these countries, we generally identify statistically insignificant MEs, which is largely driven by the low prevalence of MGHs. Other possible factors may include care needs of the elderly or specific individual choices, but our data do not allow us to provide more insights into these other determinants. For the Southern and especially the Eastern European countries it is very likely that an anti-poverty strategy is part of the considerations in the formation of MGHs. Pensions are relatively high in some of these countries, notably when compared to other cash transfers, which implies that the elderly can bring in a substantial income share. Given the higher prevalence of MGHs in these countries, the outcomes of these countries carry more weight. We aim to provide more insight into this anti-poverty strategy in the next section by performing a simulation analysis.

Table 10: Logistic regression on child poverty, average marginal effects (M.E.), 2013.

	Model 1			Model 2: income present of old-aged person								
	Member of MGH			Only old-aged female (OAF)			Only old-aged male (OAM)			Both female and male old-aged (OMF)		
	M.E.	Std err		M.E.	Std err		M.E.	Std err		M.E.	Std err	
SE	***-0.127***	*0.016*		*(omitted)*			***-0.125***	*0.017*		*(omitted)*		
DK	***0.158***	*0.052*		*0.101*	*0.157*		*0.048*	*0.039*	*c*	*0.342*	*0.198*	
NO	*0.062*	*0.052*		*(omitted)*			(omitted)			***0.505***	*0.241*	
FI	**-0.044**	0.019		-0.023	0.041		-0.043	0.027		(omitted)		
IS	*(omitted)*			*(omitted)*			(omitted)			*(omitted)*		
DE	*-0.061*	*0.04*		***-0.123***	*0.004*		*-0.019*	*0.078*		*(omitted)*		
NL	*0.067*	*0.057*		*0.183*	*0.116*	*b*	*-0.010*	*0.050*		*(omitted)*		
CH	*0.026*	*0.059*		*0.100*	*0.160*		*0.036*	*0.073*		*(omitted)*		
FR	***-0.117***	*0.020*		*-0.042*	*0.066*		***-0.130***	*0.019*		*(omitted)*		
BE	-0.051	0.035		(omitted)			**-0.185**	0.005		(omitted)		
LU	0.033	0.053		**-0.134**	0.060		**-0.152**	0.057		(omitted)		
AT	**0.231**	0.054		**0.401**	0.088	a	0.098	0.068		0.060	0.192	
IE	**-0.112**	0.025		**-0.137**	0.026		***-0.108***	0.039		-0.033	0.107	
UK	**-0.070**	0.035		-0.045	0.055		*-0.073*	0.062		**-0.107**	0.053	
CY	**-0.065**	0.031		0.017	0.057	a	**-0.123**	0.027		-0.034	0.070	
MT	**-0.142**	0.029		**-0.195**	0.030		**-0.136**	0.039		(omitted)		
IT	**-0.069**	0.022		**-0.061**	0.030		**-0.090**	0.031		**-0.121**	0.034	
ES	-0.041	0.022		**-0.123**	0.026	a	0.023	0.035	c	**-0.153**	0.032	
GR	-0.051	0.032		**-0.116**	0.040	a	0.012	0.051		-0.043	0.060	
PT	-0.037	0.036		0.012	0.047	b	-0.089	0.062		**-0.180**	0.042	
CZ	**-0.053**	0.015		0.000	0.029	a	**-0.073**	0.019		(omitted)		
SI	**-0.059**	0.012		-0.028	0.017	a,b	**-0.081**	0.016		**-0.106**	0.012	
EE	**-0.084**	0.023		**-0.068**	0.029		**-0.133**	0.029		**-0.087**	0.039	
HU	**-0.164**	0.024		**-0.142**	0.030	b	**-0.183**	0.038		**-0.230**	0.027	
SK	**-0.094**	0.024		**-0.071**	0.032		(omitted)			-0.077	0.046	
LT	**-0.152**	0.026		**-0.131**	0.033		**-0.161**	0.034		**-0.219**	0.044	
LV	**-0.096**	0.026		**-0.070**	0.031		**-0.144**	0.037		**-0.110**	0.042	
HR	**-0.062**	0.027		-0.050	0.032	b	**-0.109**	0.039		**-0.193**	0.033	
RO	**-0.211**	0.032		**-0.161**	0.040	b	**-0.246**	0.038		**-0.308**	0.035	
BG	**-0.131**	0.028		-0.064	0.039	a,b	**-0.158**	0.034		**-0.241**	0.032	
PL	**-0.042**	0.016		-0.030	0.020		**-0.078**	0.026	c	-0.011	0.033	
RS	**-0.067**	0.020		**-0.085**	0.024	b	**-0.104**	0.025	c	**-0.209**	0.027	

Notes: 1) Numbers in bold are significant at 95% confidence interval. 2) Countries with less than 60 children living in MGHs are put in italics. 3) Statistically significant difference between coefficients a=between OAF and OAM; b=between OAF and OMF; c=between OAM and OMF

Source: own calculations on EU-SILC 2013.

4.3.4 The impact of elderly income on child poverty: a pre-post analysis

We now calculate child poverty rates for the different scenarios explained in Section 3.3.3 and compare them with the baseline scenario in column (0), which is the standard approach of full sharing. Column (1) in Table 11 shows that income security of children in MGHs is to a very large extent due to the presence of elderly income. In almost all countries, poverty among this specific group of children would be more than twice as high if these incomes were not there. On average,

poverty would increase from less than 20% (with elderly incomes) to around 50% (without these incomes). While the 'no sharing' scenario is not a realistic one, it illustrates the high importance of elderly income for MGHs as a substantial part of these households cannot pass the poverty threshold with only market income and non-pension transfers. Removing elderly incomes from household income is only part of the story as it ignores the impact of old-aged individuals on the equivalence scale: even if these elderly people do not, or only partially, share income with the rest of the household, one can suppose that they will contribute to covering (at least a part of) their own costs; hence, including them in the equivalence scale probably overestimates child poverty rates when their incomes are not shared with the younger generation in the household.

By construction, the impact of removing the old-aged person(s) from the equivalence scale (column (2)) leads to a drop in poverty rates compared to the simulation, which only removes elderly incomes (compare columns (1) and (2)). One could consider scenario (2) as an alternative benchmark, as this pertains to the situation where no MGH would be formed. In most countries, and especially those where there is a high prevalence of MGHs, poverty rates still remain at a much higher level than in the current situation where old-age incomes and their recipients are included in the household (income). Child poverty rates remain particularly high in all countries in Southern Europe and in Estonia, Hungary, Latvia, Poland, Romania and Serbia.

In column (3), we conduct the simulation where resources are not shared, but both households continue living under the same roof (thus benefiting from economies of scale). By construction, we find lower overall child poverty rates than under the previous scenario, as income for the child remains the same while the equivalence scale reduces. The size of these reductions in child poverty is often substantial. In many countries (especially the Eastern European countries), child poverty rates come close to those in the current situation (column (0)), indicating that not only elderly income but also the economies of scale play an important role in poverty outcomes of MGHs. In several of these Eastern countries, however, poverty rates under this scenario are still higher than in the current situation, pointing to the importance of the elderly income itself as part of an instrument to avoid poverty.

Finally, column (4) of Table 11 gives the outcomes for the case where (a plausible) part of elderly income would be shared. Though not as extreme as in the 'No sharing' scenario, this more plausible scenario shows that there are important consequences for child poverty in MGHs: e.g. in Greece 56.8% of children in MGHs would be poor when the old-aged person contributes only part of their pension to the household budget, as compared to 33.7% in the current situation. In the group of Southern countries as a whole, we see an increase in poverty risks of around 13 percentage points as compared to the baseline. In Eastern countries, this is around 6.7 percentage points. This difference largely reflects the higher degree of sharing in the latter group of countries.

We can conclude from these numbers that, for a sizeable share of children, the presence of elderly individuals in the household is an important element in preventing poverty. The benefits largely accrue by the addition of substantial income streams from pensions, but also partly through the economies of scale that MGHs bring. Especially in Eastern European countries, children living in MGHs benefit. This is confirmed by a longitudinal analysis that shows that MGHs are often formed in the year after substantial reductions in income from work. Our analysis also strongly suggests that

traditional poverty indicators may underestimate the reality of child poverty, since they overestimate the degree of income sharing in households.

Table 11: Poverty rate of children living in an MGH, current situation and different scenarios, 2013.

Sharing:	Full sharing	No sharing			Part of elderly income shared
Equivalence scale:	Unchanged (0)	Unchanged (1)	No elderly (2)	Split (3)	Unchanged (4)
SE	*2.2%*	*71.0%*	*52.7%*	*33.7%*	*22.9%*
DK	*0.7%*	*34.3%*	*24.9%*	*14.3%*	*0.7%*
NO	*9.9%*	*54.8%*	*34.9%*	*19.4%*	*26.3%*
FI	15.8%	26.7%	18.8%	15.9%	20.8%
IS	*3.7%*	*36.0%*	*17.8%*	*14.1%*	*3.7%*
Nordic	***6.5%***	***44.6%***	***29.8%***	***19.5%***	***14.9%***
DE	*8.5%*	*38.7%*	*17.9%*	*17.1%*	*10.6%*
NL	*72.8%*	*87.6%*	*86.9%*	*81.9%*	*81.1%*
CH	*31.0%*	*59.9%*	*44.6%*	*43.1%*	*40.3%*
FR	*28.7%*	*81.7%*	*59.3%*	*45.5%*	*33.7%*
BE	32.3%	54.4%	38.6%	28.8%	34.9%
LU	31.8%	51.5%	24.9%	14.0%	49.6%
AT	31.4%	51.6%	32.7%	29.2%	38.6%
Continental	***33.8%***	***60.8%***	***43.6%***	***37.1%***	***41.3%***
IE	7.2%	38.7%	32.4%	18.3%	32.1%
UK	10.1%	49.2%	21.6%	14.8%	12.3%
Anglo-Saxon	***8.6%***	***43.9%***	***27.0%***	***16.5%***	***22.2%***
CY	21.4%	50.3%	37.7%	31.8%	32.1%
MT	11.6%	63.0%	42.3%	26.8%	33.4%
IT	18.9%	54.7%	37.4%	32.6%	31.0%
ES	25.3%	61.4%	46.6%	39.1%	32.5%
GR	33.7%	71.6%	62.6%	56.0%	56.8%
PT	23.8%	55.8%	42.9%	38.5%	29.7%
Southern	***22.5%***	***59.5%***	***44.9%***	***37.5%***	***35.9%***
CZ	11.8%	45.0%	25.3%	20.6%	21.2%
SI	10.7%	34.2%	20.1%	14.5%	17.6%
EE	14.7%	48.2%	32.7%	23.5%	25.0%
HU	6.3%	43.7%	31.0%	24.2%	13.5%
SK	10.7%	34.6%	20.0%	18.1%	16.2%
LT	13.0%	40.9%	27.4%	20.8%	15.8%
LV	19.1%	43.7%	32.6%	25.1%	24.9%
HR	12.9%	35.3%	18.0%	13.4%	19.0%
RO	18.3%	52.6%	39.5%	29.0%	26.7%
BG	21.4%	37.2%	28.1%	27.2%	23.7%
PL	24.2%	52.0%	38.3%	32.5%	32.6%
RS	22.6%	48.8%	35.5%	32.8%	29.6%
Eastern	***15.5%***	***43.0%***	***29.1%***	***23.5%***	***22.2%***
Total	**19.0%**	**50.3%**	**35.2%**	**28.0%**	**27.8%**

Notes: 1) Countries with less than 60 children living in MGHs are put in italics. 2) Country groups averages are unweighted.
Source: own calculations on EU-SILC 2013.

4.3.5 Conclusions and recommendations

Evidence on co-residence of younger and older generations mostly refers to the United States, though recently we also see an increase in studies on European countries. Most of the literature on MGHs has focused on their prevalence and on the impact of MGH formation on labour supply, on time spent on (in)formal care, and on different dimensions of child well-being, typically through country-specific studies. We contribute to the literature by providing empirical evidence for a wide range of European countries on how the sharing of incomes within MGHs – which are mainly pension incomes – affects child poverty. We have established that this form of intergenerational solidarity is dominantly beneficial for the children in MGHs and that the presence of the elderly and their income significantly affects child poverty rates within this group of households. Our pre-post analysis clearly illustrates the relevance of the formation of MGHs as a strategy to cope with poverty, thus giving empirical operationalisation of the theoretical concept of this form of intergenerational solidarity. In doing so, we have also critically tested the role of equivalence scales and the classical full resource-sharing assumption in standard poverty analysis, using EU-SILC data in a novel way. We found, on the one hand, that the hypotheses on the basis of which equivalence scales are constructed are of crucial importance and, on the other hand, that the full-sharing hypothesis probably yields a picture that is too rosy: the less sharing of resources, the more child poverty.

We observe significant differences between subgroups of European welfare states. Unsurprisingly, MGHs are most prevalent in Southern and Eastern European countries. Especially in these countries children in MGHs have lower poverty risks than other children, even when we control for socio-economic circumstances. The solidarity from older to younger generations that we find in these countries is likely related to the fact that the prevalence of MGHs is mainly high in welfare states where the social protection of working age families by cash transfers is relatively limited (notably when compared to the relative generosity of pension benefits in some of these countries). Although not designed for this purpose, the pensions in these countries thereby also alleviate child poverty. This is far less the case in the more mature welfare states, which are characterised by higher degrees of what Saraceno and Keck (2010) called ‘de-familialisation’.

Although we establish a beneficial effect of MGH formation with regard to child poverty in a number of EU welfare states, the conclusion cannot be that policy should stimulate MGH formation. MGH formation is a short-term ‘coping strategy’, which in several countries is directly related to inadequate social protection safety nets. In the European context, this coping strategy may have negative consequences for children in important non-financial dimensions of their personal development (e.g. they are less likely to have an own room for study in an extended household). Moreover, in modernising societies, MGHs are presumably rather a strategy of the past than a strategy of the future. However, policy-makers should consider the short-term beneficial impact of pensions on child poverty when implementing pension reform; even if we drop the assumption of ‘full sharing of resources’, pension incomes provide tangible support for children in MGHs. Hence, when pension spending is – for good reasons – rationalised in pension-heavy welfare states, there must be a parallel development of adequate family support systems, both in terms of cash benefits and social services. The fact that ‘full sharing’ is too optimistic as a hypothesis does not diminish the urgency of that conclusion: it implies that we underestimate how severe child poverty is in countries with a significant share of MGHs.

Our study showed that elderly incomes are an important coping instrument for households to avoid poverty. Indeed, our analysis shows that for a sizeable share of children, the presence of elderly in the household is an important element in preventing poverty. Especially in Eastern and South-Eastern countries, children living in MG households benefit. The solidarity from older to younger generations that we find in these countries is likely related to the fact that the prevalence of MGHs is mainly high in welfare states where the social protection of working-age families by cash transfers is relatively limited (notably when compared with the relative generosity of pension benefits in some of these countries). Although not designed for this purpose, the pensions in these countries thereby also alleviate child poverty. This is far less the case in the more mature welfare states, which are characterized by higher degrees of 'de-familialization'. However, although we establish a beneficial effect of MG household formation with regards to child poverty in a number of EU welfare states, the conclusion cannot be that policy should stimulate MG household formation. MG household formation is a short-term 'coping strategy', which is in several countries directly related to inadequate social protection safety nets. This coping strategy may have negative consequences for children in important non-financial dimensions of their personal development (e.g. they are less likely to have an own room for study in an extended household). Moreover, in modernizing societies, extended families are presumably rather a strategy of the past than a strategy of the future. However, policy-makers should consider the short-term beneficiary impact of pensions on child poverty when implementing pension reform; even if we drop the assumption of 'full sharing of resources', pension incomes provide tangible support for children in extended families. Hence, when pension spending is – for good reasons – rationalized in pension-heavy welfare states, there must be a parallel development of adequate family-support systems, both in terms of cash benefits and social services. The fact that 'full sharing' is too optimistic qua hypothesis does not diminish the urgency of that conclusion: it implies that we underestimate how severe child poverty is in countries with a significant share of MG households.

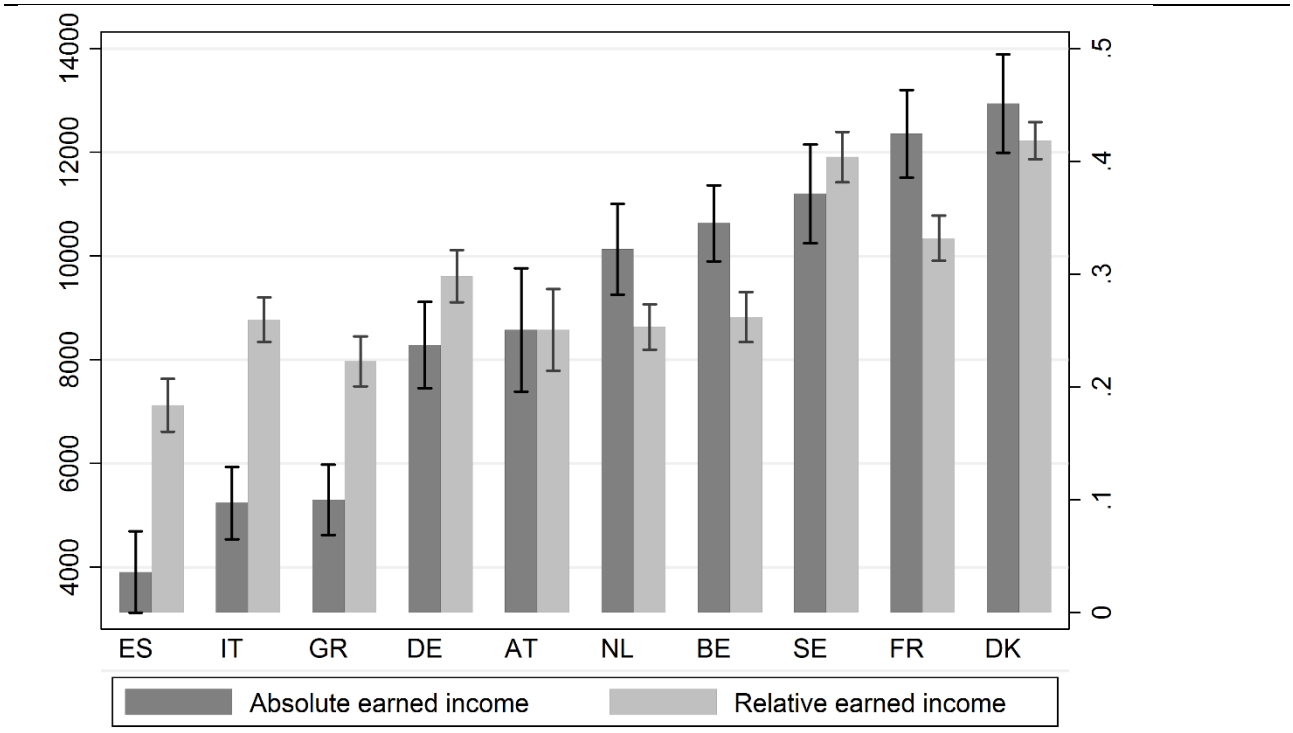
4.4 Long-term effects of maternity-related job interruptions on mothers' income in 10 European countries

In our empirical analysis on the long-term effects of maternity-related career interruptions, we test the following hypotheses, based on the literature overview (see section 2). The first hypothesis (H1) is that the longer a mother abstains from work due to maternal responsibilities, the lower her (a) absolute and (b) relative income will be in later life. However, considering important structural and cultural differences in the countries under consideration, we also anticipate cross-national differences in the effects of job interruptions in mothers' later life, which we discuss in the following section. The second hypothesis (H2) is that in countries where maternity and parental allowances are generous, the long-term effects of work interruptions should be smaller, also in terms of income inequalities within couples. This should be the case for Denmark and Sweden and, to a smaller extent, Germany, France and Austria. The third Hypothesis (H3) is that in countries that have a high contributory year criterion coupled with scant redistribution toward minimum income pensions the long-term effects of work interruption should be greater, with women more dependent on their partner's income. This should be the case in Italy, Spain, Greece and Germany.

4.4.1 Results

Figure 18 reports the predicted values of absolute and relative earned income in the ten countries. The predictions and confidence intervals are obtained with two models that only include country fixed effects. The figures reflect well-known cross-national differences in maternal earnings: mothers in southern Europe are the ones who have the lowest levels of earned income (Greece, Spain and Italy), followed by mothers in the continental group (Germany and Austria, followed at a distance by the Netherlands and Belgium). Older mothers do considerably better in Sweden, France and Denmark. The results for relative income also mirror previous findings: mothers' share of earned income is below the ideal line of 0.50 in all the countries, but it is closest to equality in the two northern European countries (Sweden and Denmark). It is particularly low in Greece (0.18) and Spain (0.22).

Figure 18: Predicted values of absolute and relative earned income by country with 95% confidence intervals



Moving to the results from the multivariate models, Table 12 reports the results for absolute income (Model 1). Starting from the upper part of the table, the coefficients for short work interruptions after the birth of the first child are mostly non-significant, indicating that short interruptions have little if any effect on mothers' long-term absolute income. An interesting exception is Belgium, where short interruptions have a positive and significant effect. Work interruptions that lasted over a year are negatively associated with long-term income in Austria, Belgium, France and Germany, but the coefficients are rather small and, at best, significant at 90%.

Table 12. GLM results for mothers' absolute income (Model 1). Standard errors in parentheses

	Austria	Belgium	Germany	France	Netherlands
Job interruption after 1st child (r.c. no stop)					
<1	-0.078	0.393*	0.141	0.007	-0.289+
	(0.102)	(0.163)	(0.091)	(0.070)	(0.168)
>1 year	-0.195+	-0.469	-0.072	-0.172+	-0.413**
	(0.101)	(0.410)	(0.092)	(0.104)	(0.149)
Never returned to work	-0.543**	-0.238	-0.259+	-0.517*	-0.807***
	(0.169)	(0.252)	(0.144)	(0.213)	(0.224)
No job at the time	-0.256+	-0.294*	-0.054	-0.178*	-0.323*
	(0.132)	(0.146)	(0.140)	(0.079)	(0.145)
Constant	14.554	7.637**	7.898	6.272	6.162***
	(17.947)	(2.646)	(13.770)	(3.818)	(1.637)
N	371	977	754	732	684
BIC	7644.634	22323.223	15870.353	15606.667	15065.093
Log-lik	-3777.945	-11109.978	-7888.799	-7753.865	-7483.587
Sig.	0.000	0.000	0.000	0.000	0.000

	Italy	Spain	Greece	Sweden	Denmark
Job interruption after 1st child (r.c. no stop)					
<1	-0.145	-0.060	-0.419***	0.163	0.070
	(0.101)	(0.118)	(0.116)	(0.140)	(0.067)
>1 year	-0.750+	-0.329	-0.032	0.211	0.103
	(0.398)	(0.244)	(0.181)	(0.141)	(0.092)
Never returned to work	-0.668**	-0.288	-0.520+	-0.029	-0.140
	(0.256)	(0.363)	(0.305)	(0.213)	(0.144)
No job at the time	-0.389***	-0.316**	-0.483***	0.126	0.136+
	(0.091)	(0.122)	(0.115)	(0.148)	(0.077)
Constant	7.081***	5.632***	7.799***	7.746***	7.912***
	(0.982)	(0.702)	(0.867)	(0.650)	(1.570)
N	1071	859	1140	577	581
BIC	22038.658	17310.509	23724.489	11974.972	11979.375
Log-lik	-10967.006	-8604.586	-11809.454	-5939.802	-5941.952
Sig.	0.000	0.000	0.000	0.000	0.000

Note: r.c. = reference category. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

In contrast, never returning to work appears to be negatively associated with long-term income in Austria (-0.543, p<0.01), France (-0.517, p<0.05), Germany (-0.259, p<0.10) and the Netherlands (-0.807, p<0.001), whereas the effect is negative but non-significant in Belgium.

Moving to the lower part of the table, a failure to return to work and not being employed prior to the birth of the first child are negatively associated with long-term income in Greece and Italy. In Greece, short work interruptions are detrimental for mothers' future economic revenue, and in Italy the negative effect is also visible for work interruptions longer than one year. In Spain, only the coefficient for not being employed at the time is negative and significant (-0.316, p<0.001), and work interruptions have no effect whatsoever in Sweden and Denmark. In Denmark, we observe a small but positive and significant (p<0.10) association between long-term income and not working before giving birth to the first child.

The results for relative income (Table 13) once again show that short work interruptions are not associated in a statistically significant manner with mothers' income relative to their partners. However, mothers who stayed at home more than a year experience a significant penalty in Austria (-0.519, p<0.05) and France (-0.356, p<0.01), while the reduction in relative earned income for German and Dutch mothers is negative but non-significant. Never returning to work is the situation that entails the strongest penalty in Austria (-1.487, p<0.001), Belgium (-0.731, p<0.05), France (-1.222, p<0.001), Germany (-1.087, p<0.001) and the Netherlands (-0.379, p<0.05). Finally, not being employed at the time is a significant predictor of lower relative earned income in Belgium (-0.841 p<0.001), France (-0.601, p<0.001) and Germany (-0.887, p<0.001). The coefficient is large in Austria as well, although non-significant (-0.609, p >0.10), whereas it is small and non-significant in the Netherlands.

Short work interruptions do not appear to affect long-term relative earned income in the countries displayed in the lower part of Table 3, despite the coefficients being rather large in southern Europe. An interruption longer than one year negatively affects long-term relative income in Italy (-0.630, p<0.05), and a failure to return to work entails a large penalty in both Greece (-0.739, p<0.10) and Italy (-0.933, p<0.001). The coefficients for Spain are also negative but not statistically significant. Finally, not being employed at the time is strongly and negatively associated with the outcome in Greece (-1.034 p<0.001), Italy (-0.739 p<0.001) and Spain (-0.514, p<0.10). In contrast, Danish and Swedish mothers do not experience significant long-term penalties for work interruptions or for not returning to work after the birth of their first child.

Table 13. GLM results for mothers' relative income (Model 2). Standard errors in parentheses.

	Austria	Belgium	Germany	France	Netherlands
Job interruption after 1st child (r.c. no stop)					
<1	-0.460	0.036	0.033	-0.121	-0.152
	(0.290)	(0.166)	(0.161)	(0.113)	(0.217)
>1 year	-0.519*	0.219	-0.279	-0.356**	-0.063
	(0.257)	(0.200)	(0.151)	(0.122)	(0.150)
Never returned to work	-1.487***	-0.731*	-1.088***	-1.222***	-0.379*
	(0.437)	(0.286)	(0.175)	(0.244)	(0.165)
No job at the time	-0.609	-0.841***	-0.876***	-0.601***	-0.157
	(0.392)	(0.159)	(0.194)	(0.124)	(0.155)
Constant	18.518	-2.239**	11.963	-24.816	-5.493***
	(39.326)	(0.800)	(27.406)	(18.566)	(0.682)
N	200	704	551.000	649	551
BIC	243.421	693.117	564.759	665.318	518.177
Log-lik	-81.973	-297.383	-238.197	-284.093	-211.751
Sig.	0.000	0.000	0.000	0.000	0.000

	Italy	Spain	Greece	Sweden	Denmark
Job interruption after 1st child (r.c. no stop)					
<1	0.074	0.388	-0.320	-0.177	-0.088
	(0.142)	(0.339)	(0.249)	(0.341)	(0.088)
>1 year	-0.630*	0.320	-0.387	-0.279	-0.045
	(0.284)	(0.491)	(0.410)	(0.341)	(0.112)
Never returned to work	-0.933***	-0.387	-0.759+	-0.499	-0.101
	(0.251)	(0.515)	(0.440)	(0.426)	(0.148)
No job at the time	-0.739***	-0.514+	-1.034***	-0.075	-0.023
	(0.121)	(0.273)	(0.247)	(0.348)	(0.102)
Constant	14.917	-15.270	-5.995	-19.163	2.462
	(24.755)	(37.471)	(37.197)	(22.116)	(15.467)
N	742	601	686	481	619
BIC	718.458	522.196	638.613	569.187	671.471
Log-lik	-309.659	-213.108	-270.325	-238.274	-287.525
Sig.	0.000	0.000	0.000	0.000	0.000

Note: r.c. = reference category. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

The raw coefficients for the GLMs are not immediately interpretable. Therefore, to clarify the results we report the predicted values with 95% confidence intervals for absolute income (Figure 19) and relative income (Figure 20). A first consideration regards the widths of the confidence intervals. Indeed, probably as a result of the small sample sizes, the estimates produce predicted values that are highly uncertain. Therefore, we are cautious in drawing conclusions from the analysis. However, some considerations can be made. Figure 19 shows that regardless of the length of work interruptions mothers' income is lower in the southern countries than elsewhere. Second, the longer the work interruption, the lower the predicted income in the long run. However, the decline in income appears more abrupt in continental and southern countries than in northern ones. Third, mothers in continental and northern countries who took short breaks seem to have somewhat higher earnings compared to those who did not interrupt at all. While this result could very well be a casualty of the data, it might also reflect some type of selection that was not captured by our measure of earned income at the time of the birth, as mothers with lower incomes might have been less likely to interrupt their jobs and to have high incomes in the future. Fourth, mothers in southern Europe who never returned to work or were not employed at the time have roughly the same predicted income. In contrast, those who were not working at the time fare somewhat better in continental and northern European countries. This might be either because they had greater chances of re-entering the labour market at some point after the birth of the child or, especially in the northern cluster, the welfare state might be more effective in protecting long-term incomes even in the case of interrupted labour market careers. This clearly emerges from Figure 20, which shows the results for relative income. As can be seen, relative earned incomes for mothers in the northern group are basically untouched by work interruptions. In contrast, mothers in both southern and continental countries (except for the Netherlands) see their relative earned income plummet as time away from the labour market increases.

How do our findings map against the hypotheses? In general terms, our first hypothesis is confirmed: the longer the work interruption, the lower mothers' long-term absolute and relative incomes are. Moreover, important cross-national differences in the results bring some support to our second and third hypotheses. Indeed, the negative consequences of job interruptions for childbearing and childrearing appear minimal in the two northern European countries – Sweden and Denmark – where maternity and parental leave allowances have historically been more generous (Gauthier 2011) and where the universalistic pension system offers some form of economic compensation even to workers with highly fragmented work trajectories (Esping-Andersen 1990). In contrast, job interruptions for childbearing and childrearing have more serious effects in southern European countries (with the exception of Spain) and continental ones. The results for relative income are even more clear-cut, with the northern countries being exempt from the negative long-term consequences of job interruptions.

Figure 19: Predicted values of absolute earned income by length of work interruptions and country. The predictions are adjusted by mean setting the values of all covariates in Model 1.

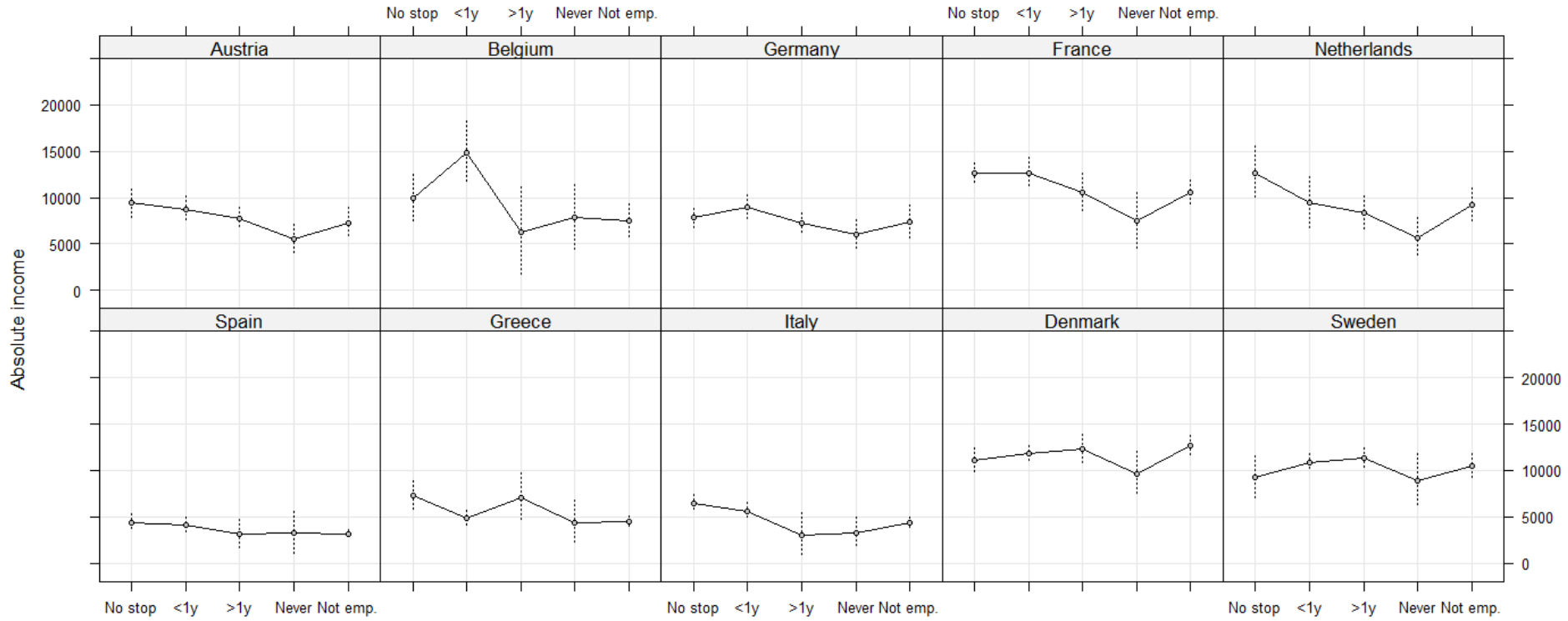
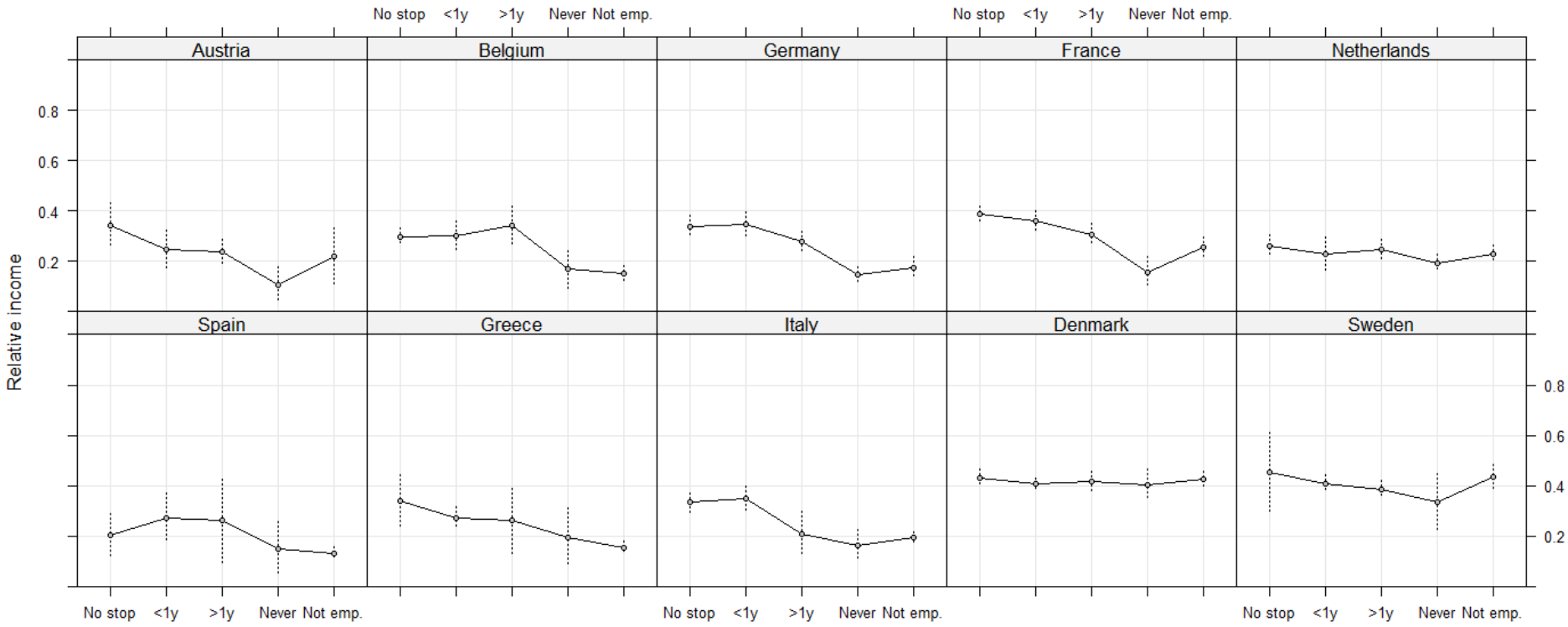


Figure 20. Predicted values of relative earned income by length of work interruptions and country. The predictions are adjusted by mean setting the values of all covariates in Model 2.



4.4.2 Conclusion

In this study, we have addressed the long-term effects of job interruptions for childbearing and childrearing on mothers' absolute and relative income in a comparative European perspective. The study makes three contributions to the literature. First, by looking at mothers in later stages of the life course (i.e. aged 45 and above) the article moves beyond previous studies that focused on the short- and medium-term effects of job interruptions on employment and income. Indeed, older women, especially those living on their own, are a social group at high risk of poverty. Therefore, understanding how family and career histories interact in determining mothers' income in old age is crucial to the development of policy tools to prevent poverty among future generations (Peeters and De Tavernier 2015). Second, the article takes a comparative approach and focuses on ten countries belonging to different welfare and gender regimes (Esping-Andersen 1990; Korpi et al. 2013; Leitner 2003), thus offering a more comprehensive picture compared to previous single-country studies. Third, by looking at both absolute and relative earned income, we have explored two different aspects of income inequality: on the one hand, the focus on absolute income has allowed analysis of the risks that older mothers face in terms of deprivation and poverty; on the other hand, by looking at relative income we have shed light on the balance of earnings and therefore on the power dynamics of a subpopulation that is not often the object of studies of gender inequalities.

The analysis has revealed that short work interruptions do not have negative consequences on mothers' absolute or relative earned income in later life. Indeed, in all the countries considered it is longer work interruptions, that is of one year or more, or a failure to return to work completely that have the largest impact on mothers' long-term economic wellbeing. However, there are some important exceptions to this general rule: mothers in Sweden and Denmark, in fact, are largely unaffected by the length of work interruptions, both in absolute and in relative terms. These results support our hypothesis that the negative effect of work interruptions will be more modest in countries where the welfare state effectively decommodifies its citizens. Indeed, our results suggest that countries with mixed or low support – in terms of pension schemes or maternity leave − partially fail to limit mothers' long-terms income penalties.

Three limitations of the study must be acknowledged. First, the retrospective data we use cover a very long period and therefore might not be fully accurate due to recall bias, in particular concerning income. However, ex-post analysis checking for internal consistency of SHARELIFE data, and comparing recall information with external cross-country historical information leads to the conclusion that scepticism about SHARELIFE data quality is not warranted (Havari and Mazzonna 2011). Second, our estimates are fairly uncertain given the relatively small size of our national samples. Third, and related to this last concern, our results are confined to a sub-sample of countries that were chosen on the basis of data availability and are therefore hardly generalizable to a larger or different pool of countries. Thus, overall, the results should be interpreted cautiously. Nevertheless, the findings suggest that institutional characteristics and life course events are intertwined key factors in an analysis of gender inequalities, especially as far as the cumulative temporal dimension is concerned.

To conclude, we argue that the long-term effects of job interruptions on mothers' income should not be considered only as a product of individual historical legacies, but should be included in a broader reasoning about present and future challenges posed to welfare states. In the EU countries, women dominate the oldest age cohort, and are highly exposed to poverty risks (Peeters and De Tavernier 2015). Additionally, population ageing, decreased fertility, shrinking family sizes, increasing retirement ages and decreasing pension incomes are changing demographic structures and are threatening the social sustainability of welfare systems as we know them (Zaidi et al. 2010). Considering that women are both 'passive' beneficiaries of social benefits and 'active' pivotal elements in intergenerational families, ensuring adequate economic support to older mothers in later life through a correct calibration of family and pension policies is a task that welfare states cannot avoid.

5. DISSEMINATION AND VALORISATION

Output of CIRCLE has been disseminated (besides through publications, see next section) in the form of a set of Newsletters, through its website and at several presentations at conferences and workshops.

CIRCLE Newsletters:

CIRCLE Newsletter 1, December 2017

CIRCLE Newsletter 2, June 2018

CIRCLE Newsletter 3, December 2018

CIRCLE Newsletter 4, December 2019

CIRCLE Newsletter 5, April 2021

Available at https://circle-cerp.carloalberto.org/category/news-events/

Activities targeted at policy makers

Results from CIRCLE Working Paper 8 have been used in the expert group to advise the Belgian federal Minister of Finance on a new tax reform (2021-2022).

Outcomes have been disseminated to policy makers through a series of CIRCLE Policy Briefs:

Circle PB 1 “Ensuring adequate economic support to older mothers”

Circle PB 2 “Measuring the incidence, intensity and inequality of income losses (or gains) by age groups”

Circle PB 3 “Solidarity between generations in extended families: a “coping strategy” against inadequate social protection”

Circle PB 4 “The fiscal and distributional impact of pension-related tax expenditures in the EU”

Circle PB 5 “The uneven impact of women’s retirement on their daughters’ employment”

Circle PB 6 “Does the safety net hold?”

Circle PB 7 “Youth living arrangements and household employment deprivation”

Circle PB 8 “Old age social protection through taxes? Distributive effects of taxes on pensions and income in the EU”

Available at https://circle-cerp.carloalberto.org/category/output/

Presentation of CIRCLE output at conferences, workshops, seminars, …

Ella-Marie Assal, Sakura Panagamuwa Gamage and Gerlinde Verbist (2021) Old age social protection through taxes? A comparison of the distribution effects of taxes on pensions and income from work in the EU, presentation at International Microsimulation Association 8th World Congress (online) on December 1-3, 2021.

Workshop "Why Financial Literacy is increasingly important and increasingly multifaceted" Organized by CeRP-Collegio Carlo Alberto, 28-29 October 2021 (on-line)

Online seminar 'Welfare, wellbeing and demographic change: Understanding welfare models', 07 October 2020, final seminar of JPI MYBL's second joint transnational call, Presentation of CIRCLE results

Ella-Marie Assal 'Old age social protection through taxes? A comparison of the distribution effects of taxes on pensions and income from work in the EU', presented at: ESPAnet Online PhD seminar (Stream 12: Preparing pension systems for the future: employment, retirement and wellbeing in later life), 4 September 2020.

Verbist, G., Diris, R. & Vandenbroucke, F. (2018), 'Solidarity between generations in extended families. Direction, size and intensity' presented at the 16th ESPAnet Conference Vilnius, Lithuania, 30 August – 1 September

Verbist, G., Diris, R. & Vandenbroucke, F. (2018), 'Solidarity between generations in extended families. Direction, size and intensity'presented at the 25th FISS Conference, Sigtuna, Sweden, June 6-8.

JPI MYBL Conference and Networking meeting, 13th February 2018, Brussels, Presentation of CIRCLE results

Workshop "Household Finance and Retirement Savings", Collegio Carlo Alberto, 19-20 October 2017, Presentation of CIRCLE output

Results from CIRCLE Working Paper 8 have been used in the expert group to advise the Belgian federal Minister of Finance on a new tax reform (2021-2022).

6. PUBLICATIONS

See also https://circle-cerp.carloalberto.org/category/output/

CIRCLE Working Papers

CIRCLE WP N. 1 Giulia M. Dotti Sani and Matteo Luppi (2018) "How long is too long? Long-term effects of maternity-related job interruptions on mothers' income in 10 European countries"

CIRCLE WP N. 2 Ainhoa Aparicio Fenoll (2018) “The uneven impact of women’s retirement on their daughters’ employment”

CIRCLE WP N. 3 Elena Bárcena and Olga Cantó (2018) “A simple subgroup decomposable measure of downward (and upward) income mobility”

CIRCLE WP. N 4 Salvador Barrios, Flavia Coda Moscarola, Francesco Figari and Luca Gandullia (2018) “Size and distributional pattern of pension-related tax expenditures in European countries”

CIRCLE WP N. 5 Gerlinde Verbist, Ron Diris and Frank Vandenbroucke (2018) “Solidarity between generations in extended families. Direction, size and intensity”

CIRCLE WP N. 6 Sarah Marchal and Linus Siöland (2019) A safety net that holds? “Tracking minimum income protection adequacy for the elderly, the working and the non-working of active age”

CIRCLE WP N. 7 Olga Cantó, Inmaculada Cebrián and Gloria Moreno (2021) “Youth living arrangements and household employment deprivation: evidence from Spain”

CIRCLE WP N. 8 Ella-Marie Assal, Sakura Panagamuwa Gamage and Gerlinde Verbist (2021) “Old age social protection through taxes? A Comparison of the Distributive Effects of Taxes on Pensions and Income from Work in the EU”.

CIRCLE WP N. 9 Francesco Figari and Andrea Riganti (2021) “The anti-poverty effects of minimum pension schemes in the European Union”.

CIRCLE WP N. 10 Elisa Castagno, Flavia Coda Moscarola, Francesco Figari, Elsa Fornero and Mariacristina Rossi (2021) “Pension reforms and intergenerational conflicts: What is the role of information and education strategies?”

Publications in scientific journals

Verbist, G., Diris R., Vandenbroucke, F. (2020) “Solidarity between generations in extended families. Direction, size and intensity”, *European Sociological* Review 36(2), 317–332.

Dotti, G., Luppi, M. (2020), “Absence from Work after the Birth of the First Child and Mothers’ Retirement Incomes: A Comparative Analysis of 10 European Countries”, 2021, *Work, Employment and Society*, Vol 35 (3), 470-489.

Ella-Marie Assal, Sakura Panagamuwa Gamage and Gerlinde Verbist (2021) “Old age social protection through taxes? A Comparison of the Distributive Effects of Taxes on Pensions and Income from Work in the EU” (submission to Journal of European Social Policy in preparation).

7. ACKNOWLEDGEMENTS

The project “Care and Income Redistributive Cycles in the Lives of the Europeans” (CIRCLE) has received support from the CIRCLE-project, funded by Belgian Science Policy BELSPO (Contract BR/165/A4/CIRCLE_JPIMYBL) and supported by the Joint Programming Initiative ‘More Years, Better Lives’ (Part of Horizon 2020, Grant Agreement 643850). This support is gratefully acknowledged. The authors of CIRCLE Working Paper 6 also gratefully acknowledge funding from the Research Foundation – Flanders (No. G027717N). They would further like to thank Ive Marx for comments and feedback on the manuscript, and Paola de Agostini, Diego Collado, Michael Fuchs, Patricia Gallego-Granados, Nataša Kump and Michal Myck for advice on the operation of various countries’ welfare policies. The results presented are based on EUROMOD version I1.0+. EUROMOD was maintained, developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex, in collaboration with national teams from the EU member states. CIRCLE Working Paper 1 uses data from SHARE Waves 2, 3 (SHARELIFE), 4 and 5 (DOIs: 10.6103/SHARE.w2.500, 10.6103/SHARE.w3.500, 10.6103/SHARE.w4.500, 10.6103/SHARE.w5.500). See Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through the FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N°211909, SHARE-LEAP: N°227822, SHARE M4: N°261982). Additional funding from the German Ministry of Education and Research, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064) and from various national funding sources is gratefully acknowledged (see www.share-project.org).”

We thank the organizers of the Workshop “Household Finance and Retirement Savings”, held in Collegio Carlo Alberto in Turin (October 19-20, 2017), and Professor Manos Matsaganis for comments and suggestions, as well as participants of ESPAnet conferences where results have been presented. We also thank the input of the members of the follow-up committee, which advised on the activities of the entire CIRCLE consortium. It was chaired by the coordinator of CIRCLE, prof. Dr. Elsa Fornero (CeRP, Torino, Italy). Members were Bea Cantillon (University of Antwerp), Alain Jousten (University of Liège), André Masson (Paris School of Economics), Manos Matsaganis (Politecnico di Milano) and Pierre Pestieau (University of Liège).

REFERENCES

Adamczyk A., De Agostini P., Myck M. and Trzcinski K. (2018) 'Poland 2015-2018'. EUROMOD Country Reports, University of Essex. Colchester.

Ældre Sagen. (2014) 'Folkepension – 2014'. Ældre i tal, Ældre Sagen. Copenhagen. Available at: https://www.aeldresagen.dk/presse/pressemateriale/dokumentation/2014-folkepension.

Ældre Sagen. (2016) 'Supplerende ydelser 2014 – Boligydelse, varmetillæg og ældrecheck'. Ældre i tal, Ældre Sagen. Copenhagen. Available at: https://www.aeldresagen.dk/presse/pressemateriale/dokumentation/2018-aeldre-i-tal-supplerende-ydelser-2016.

Aidukaite J. (2013) 'Social Policy Changes in the Three Baltic States Over the Last Decase (2000-2012)'. Ekonomika 92(3): 89-104.

Askenazy P. (2014) 'The Parameters of a National Minimum Hourly Wage'. IZA Policy Paper No. 85.

Atalay, K. and Barrett, G.F. (2015) The Impact of Age Pension Eligibility Age on Retirement and Program Dependence: Evidence from an Australian Experiment, The Review of Economics and Statistics. 97, 1, 71–87.

Atkinson A.B., Cantillon B., Marlier E. and Nolan B. (2002) Social Indicators: the EU and Social Inclusion, Oxford: Oxford University Press.

Bahle T., Hubl V. and Pfeifer M. (2011) The last safety net. A handbook of minimum income protection in Europe, Bristol: Policy Press.

Baldini M., Casabianca E.J., Giarda E. and Lusignoli L. (2018) 'The impact of ReI on Italian households' income: A micro and macro evaluation'. Politica Economica / Journal of Economic Policy 24(2): 103-134.

Barrios, S., Coda Moscarola, F., Figari, F., & Gandullia, L. (2020). Size and distributional pattern of pension-related tax expenditures in European countries. *International Tax and Public Finance, 27*(5), 1287-1320.

Baum, C.L. (2002) The Efffect of Work Interruptions on Women's Wages, Labour. 16, 1, 1–37.

Beatty C. and Fothergill S. (2018) 'Welfare reform in the United Kingdom 2010-16: Expectations, outcomes, and local impacts'. Social Policy & Administration 52(5): 950-968.

Been, J., Caminada, K., Goudswaard, K., & van Vliet, O. (2017). Public/private pension mix, income inequality and poverty among the elderly in Europe: An empirical analysis using new and revised OECD data. *Social Policy & Administration*, *51*(7), 1079-1100.

Bejaković P. and Mrnjavac Ž. (2016) 'The role of the tax system and social security transfers in reducing income inequality: The case of the Republic of Croatia'. Ekonomski Pregled 67(5): 399.

Boeckmann, I., Misra, J. and Budig, M.J. (2015) Cultural and institutional factors shaping mothers' employment and working hours in postindustrial countries, Social Forces. 93, 4, 1301–33.

Bonoli, G. (2003). Two worlds of pension reform in Western Europe. *Comparative politics*, *53*(4), 399-416.

Bosch G. (2018) 'The making of the German minimum wage: A case study of institutional change'. Industrial Relations Journal 49(1): 19-33.

Bosch G. and Weinkopf C. (2008) Low-Wage Work in Germany, New York: Russel Sage Foundation.

Bouvard L. and Tammik M. (2018) 'France 2015-2018'. EUROMOD Country Reports, University of Essex. Colchester.

Bradshaw J. and Finch N. (2002) 'A comparison of child benefit packages in 22 countries'. Research Report, UK Department for work and pensions. Norwich: pensions UDfwa, 248.

Brady D. and Biegert T. (2017) 'The Rise of Precarious Employment in Germany'. SOEP Papers 936. Berlin: SOEP.

Bray J.R. (2013) 'Reflections on the Evolution of the Minimum Wage in Australia: Options for the Future'. SPI Working Paper, Crawford School of Public Policy. Canberra, 144.

Brown, R. L., & Prus, S. G. (2004). Social transfers and income inequality in old age: A multinational perspective. *North American Actuarial Journal, 8*(4), 30-36.

Bruttel O., Baumann A. and Dütsch M. (2018) 'The new German statutory minimum wage in comparative perspective: Employment effects and other adjustment channels'. European Journal of Industrial Relations 24(2): 145-162.

Budig, M.J. and England, P. (2001) The wage penalty for motherhood, American Sociological Review. 66, 2, 204–25.

Budig, M.J. and Hodges, M.J. (2010) Differences in disadvantage variation in the motherhood penalty across white women's earnings distribution, American Sociological Review. 75, 5, 705–28.

Burkevica, I., Humbert, A.L., Oetke, N. and Paats, M. (2015) Gender gap in pensions in the EU.

Caliendo M., Fedorets A., Preuss M., et al. (2017) 'The Short-Term Distributional Effects of the German Minimum Wage Reform'. IZA Discussion Paper No. 11246.

Cantillon B. (2019) 'Na 75 jaar sociale zekerheid: nood aan Europese samenwerking om structurele tekorten te overwinnen [After 75 years of social insurance: need for European collaboration in order to overcome structural limits]'. In: Somers M (ed) Fundamenten. Sociale zekerheid in onzekere tijden. . Sint-Gillis: Denktank Minerva, 64-85.

Cantillon B. and Vandenbroucke F. (2015) Reconciling Work and Poverty Reduction: How Successful are European Welfare States?, Oxford: Oxford University Press.

Cantillon B., Marchal S. and Luigjes C. (2019) 'Towards Adequate Minimum Incomes: Which Role for Europe?'. In: Cantillon B, Goedemé T and Hills J (eds) Decent incomes for the poor? Improving policies in Europe. Oxford: Oxford University Press.

Cantillon B., Parolin Z. and Collado D. (2018) 'Rising inequalities and welfare generosity: structural constraints on the adequacy of minimum incomes in European and American welfare states'. CSB Working Paper, Herman Deleeck Centre for Social Policy. Antwerp, 34.

Cantillon B., Van Mechelen N., Marx I. and Van den Bosch K. (2004) 'The evolution of minimum income protection in 15 European Countries, 1992-2001'. CSB-berichten, Herman Deleeck Centre for Social Policy, University of Antwerp. Antwerp.

Card D. and Krueger A.B. (1994) 'Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania'. American Economic Review 84(4): 772-793.

Carlin W., Hassel A., Martin A. and Soskice D. (2017) 'The Transformation of the German Social Model'. In: Dølvik JE and Martin A (eds) European Social Models from Crisis to Crisis. Oxford: Oxford University Press.

Cochran M (1993) International handbook of child care policies and programs. Greenwood Publishing Group.

Collado D., Cantillon B., Van den Bosch K., et al. (2019) 'The end of cheap talk about poverty reduction : the cost of closing the poverty gap while maintaining work incentives'. In: Cantillon B, Goedemé T and Hills J (eds) Decent incomes for all: improving policies in Europe. Oxford: Oxford University Press.

Cribb, J., Emmerson, C. and Tetlow, G. (2014) How does increasing the early retirement age for women affect the labour supply of women and their husbands?, Netspar Discussion Papers. DP 01/2014-003.

de Vos K., De Agostini P. and De Poli S. (2018) 'Netherlands 2015-2018'. EUROMOD Country Reports, University of Essex. Colchester.

De Wilde M., Cantillon B., Vandenbroucke F. and De Bie M. (2016) 40 jaar OCMW en bijstand, Leuven: Acco.

Dimmel N. and Fuchs M. (2014) 'Im toten Winkel des Wohlfartsstaates: Am Beispiel der Nichtinanspruchnahme von Sozialhilfeleistungen'. In: Dimmel N, Schenk M and Stelzer-Orthofer C (eds) Handbuch Armut in Österreich. Innsbruck: Studienverlag, 406-424.

Dimmel N. and Pratscher K. (2014) 'Bedarfsorienterte Mindestsicherung (BMS) – eine Zwischenbilanz'. In: Dimmel N, Schenk M and Stelzer-Orthofer C (eds) Handbuch Armut in Österreich. Innsbruck: Studienverlag, 944-976.

Dolado J., Felgueroso F. and Jimeno J. (2000) 'The role of the minimum wage in the welfare state: an appaisal'. IZA Discussion paper, IZA. Bonn.

Dolado J., Kramarz F., Machin S., et al. (1996) 'The economic impact of minimum wages in Europe '. Economic Policy 11(23): 319-372.

Dotti Sani, G.M. (2015) Within-Couple Inequality in Earnings and the Relative Motherhood Penalty. A Cross-National Study of European Countries, European Sociological Review. 31, 6, 667–82.

DWP. (2016) 'Income-Related Benefits: Estimates of Take-up, 2014/15 – Pension Credit'. HM Department of Work and Pensions. London. Available at: https://www.gov.uk/government/collections/income-related-benefits-estimates-of-take-up--2.

Eardley T., Bradshaw J., Ditch J., et al. (1996) 'Social assistance in OECD countries: synthesis report'. Research Report, HSMO Department of social security. London.

Ebbinghaus, B. (2021). Inequalities and poverty risks in old age across Europe: The double-edged income effect of pension systems. *Social Policy & Administration*, *55*(3), 440-455.

Ebbinghaus, B., Nelson, K. E., & Nieuwenhuis, R. (2019). Poverty in old age, LIS Working Paper Series, No. 777, Luxembourg Income Study (LIS), Luxembourg

Ejrnæs, M. and Kunze, A. (2013) Work and Wage Dynamics around Childbirth, Scandinavian Journal of Economics. 115, 3, 856–77.

Elkins, D. (2006). Horizontal equity as principle of tax theory*. Yale Law & Policy Review, 24*(1), 43-90.

England, P., Bearak, J., Budig, M. and Hodges, M. (2016) Do Highly Paid, Highly Skilled Women Experience the Largest Motherhood Penalty?, American Sociological Review. 81, 6, 1161–89.

Erhag T. (2016) 'Under Pressure? – Swedish residence-based social security and EU citizenship'. European Journal of Social Security 18(2): 207-231.

Esping-Andersen, G. (1990) The Three Worlds of Welfare Capitalism. Princeton: Princeton University Press.

Esping-Andersen, G. (1999) Social Foundations of Postindustrial Economies. Oxford: Oxford University Press.

Eurofound. (2018) 'Statutory minimum wages 2018'. Publications Office of the European Union. Luxembourg.

European Commission. (2016) 'Pillar of social rights'. European Commission. Available at: http://ec.europa.eu/social/main.jsp?catId=1226&langId=en.

Eurostat. (2019) Database by themes, version. Available at: https://ec.europa.eu/eurostat/data/database.

Fasang, A.E., Aisenbrey, S. and Schömann, K. (2013) Women's retirement income in Germany and Britain, European sociological review. 29, 5, 968–80.

Feher, C., & Jousten, A. (2018). Taxation and pensions: An overview of interplay. In Holzmann, R., & Piggott, J. (Eds.). *The Taxation of Pensions*. MIT Press.

Fenger, M. (2007). Welfare regimes in Central and Eastern Europe: Incorporating post-communist countries in a welfare regime typology. *Contemporary issues and ideas in social sciences, 3*(2), 1-30.

Figari, F., Matsaganis, M., & Sutherland, H. (2013). The financial well-being of elderly people in Europe and the redistributive effects of minimum pension schemes. *Rivista italiana degli economisti*, *18*(2), 149-174.

Folbre, N., Shaw, L. and Stark, A. (2007) Warm hands in cold age: gender and aging. Routledge.

Formby J., Bishop J. and Kim H. (2005) Minimum wages and poverty: an evaluation of alternatives, Amsterdam: Elsevier.

Freeman R. (1996) 'The minimum wage as a redistributive tool'. Economic Journal (106).

Fuest, C., Niehues, J., & Peichl, A. (2010). The redistributive effects of tax benefit systems in the enlarged EU. *Public Finance Review*, *38*(4), 473-500.

Gauthier, A. (2011) Comparative Family Policy Database, Version 3 [computer file].

Ginn, J. (2003) Parenthood, partnership status and pensions: Cohort differences among women, Sociology. 37, 3, 493–510.

Goedemé T. (2012) Essays on poverty and minimum income protection for Europe's elderly, PhD dissertation, Antwerp: University of Antwerp.

Goedemé T. (2013) 'Minimum Income Protection for Europe's Elderly: What and How Much has been Guaranteed during the 2000s?'. In: Marx I and Nelson K (eds) Minimum Income Protection in Flux. Hampshire: Palgrave Macmillan, 108-136.

Goedemé, T., & Marchal, S. (2016). Exploring a blind spot in comparative pension reform research: Long-term trends in non-contributory pensions in Europe. *International Journal of Social Welfare*, *25*(2), 161-175.

Goedemé T., Penne T., Hufkens T., et al. (2019) 'What Does it Mean to Live on the Poverty Threshold? Lessons From Reference Budgets'. In: Cantillon B, Goedemé T and Hills J (eds) Decent incomes for the poor? Improving policies in Europe. Oxford: Oxford University Press, forthcoming.

Gornick, J.C., Sierminska, E. and Smeeding, T.M. (2009) The income and wealth packages of older women in cross-national perspective, The Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 64, 3, 402–14.

Gough I., Bradshaw J., Ditch J., et al. (1996) 'Social assistance in OECD countries'. Journal of European Social Policy 7(1): 17-43.

Gough, O., & Adami, R. (2011). Welfare systems and adequacy of pension benefits in Europe. *Social Policy and Society*, *11*(1), 41-53.

Havari, E. and Mazzonna, F. (2011) Can We Trust Older People's Statements on Their Childhood Circumstances? Evidence from Sharelife, SHARE, Survey of Health, Ageing and Retirement in Europe. Working Paper Series 05-2011.

Hills J. (2014) Good times, bad times: the welfare myth of them and us, Bristol: Policy Press.

Hinrichs, K. (2000) Elephants on the move. Patterns of public pension reform in OECD countries, European Review. 8, 03, 353–78.

Hinrichs, K., & Lynch, J. F. (2012). Old-age pensions. in Castles, F. G., Leibfried, S., Lewis, J., Obinger, H., & Pierson, C. (Eds.). *The Oxford handbook of the welfare state*. OUP Oxford.

Hufkens T., Leventi C., Rastrigina O., et al. (2016) 'HHoT: a new flexible Hypothetical Household Tool for tax-benefit simulations in EUROMOD'. HIVA. Leuven. Available at: http://anet.uantwerpen.be/docman/irua/3d2c38/132957.pdf.

Immervoll H. (2007) 'Minimum wages, minimum labour costs and the tax treatment of low-wage employment'. IZA Discussion paper series, IZA. Bonn.

Immervoll H. (2012) 'Minimum-Income Benefits in OECD Countries'. In: Besharov D and Couch K (eds) Counting the Poor: New Thinking About European Poverty Measures and Lessons for the United States. Oxford: Oxford University Press.

Immervoll H. and Scarpetta S. (2012) 'Activation and employment support policies in OECD countries. An overview of current approaches'. IZA Journal of Labor Policy 1(9).

International Monetary Fund. (2012) 'Greece: Request for extended arrangement under the extended fund facility - staff report'. IMF Country Report, International Monetary Fund. Washington.

Italy Ministry of Labour. (2019) Reddito di cittadinanza 2019 – Requisiti, ISEE e modulo di domanda. Rome: Italian Ministry of Labour and Social Policies,. Available at: https://www.redditodicittadinanza.gov.it/, accessed 28 May 2019.

Jefferson, T. (2009) Women and Retirement Pensions: A Research Review, Feminist Economics. 15, 4, 115–45.

Jeliazkova M. and Minev D. (2014) 'Bulgaria'. European Minimum Income Network Country Reports, European Commission. Brussels.

Kahn, J.R., Garcia-Manglano, J. and Bianchi, S.M. (2014) The Motherhood Penalty at Midlife: Long-Term Effects of Children on Women's Careers, Journal of Marriage and Family. 76, 1, 56–72.

Kakwani, N. (1977). Measurement of tax progressivity: An international comparison. *Economic Journal, 87*(345), 71–80.

Kakwani, N. (1984). On the measurement of tax progressivity and redistributive effect with applications to horizontal and vertical equity. *Advances in Econometrics, 3*, 149–168.

Kammer, A., Niehues, J., & Peichl, A. (2012). Welfare regimes and welfare state outcomes in Europe. *Journal of European Social Policy*, *22*(5), 455-471.

Karger H. (2014) 'The Bitter Pill: Austerity, Debt, and the Attack on Europe's Welfare States'. Journal of Sociology & Social Welfare 41(2): 33-53.

Kela. (2018) 'Statistical Yearbook of the Social Insurance Institution'. The Social Insurance Institution of Finland (Kela). Helsinki. Available at: https://helda.helsinki.fi/bitstream/handle/10138/270222/Kelan_tilastollinen_vuosikirja_2017.pdf.

Killewald, A. (2013) A reconsideration of the fatherhood premium: marriage, coresidence, biology, and fathers' wages, American Sociological Review. 78, 1, 96–116.

Klesment, M. and Van Bavel, J. (2017) The Reversal of the Gender Gap in Education, Motherhood, and Women as Main Earners in Europe. European Sociological Review.

Korpi, W., & Palme, J. (1998). The paradox of redistribution and strategies of equality: Welfare state institutions, inequality, and poverty in the Western countries. *American sociological review*, *63*(5), 661-687.

Korpi, W., Ferrarini, T. and Englund, S. (2013) Women's opportunities under different family policy constellations: Gender, class, and inequality tradeoffs in western countries re-examined, Social Politics: International Studies in Gender, State & Society. 20, 1, 1–40.

Koutsampelas C. (2016) 'The Cypriot GMI scheme and comparisons with other European countries'. Cyprus Economic Policy Review 10(1): 3-26.

Lalive, R. and Zweimüller, J. (2009) How does parental leave affect fertility and return to work? Evidence from two natural experiments, The Quarterly Journal of Economics. 124, 3, 1363–402.

Lefèbvre, M. (2007). The redistributive effects of pension systems in Europe: A survey of evidence, LIS Working Paper Series, No. 457, Luxembourg Income Study (LIS), Luxembourg

Leibfried S. (1992) 'Towards a European welfare state? On integrating poverty regimes into the European Community'. In: Ferge Z and Kolberg JE (eds) Social policy in a changing Europe. Frankfurt am Main: Campus Verlag, 245-279.

Leitner, S. (2003) Varieties of familialism: The caring function of the family in comparative perspective, European Societies. 5, 4, 353–75.

Madama I., Jessoula M. and Natili M. (2014) 'Minimum income: The Italian trajectory – One, no one and one hundred thousand minimum income schemes'. Working Paper-LPF n. 1 2014. Torino: Centro Einaudi, Laboratorio di Politica Comparata e Filosofia Pubblica.

Magda I., Kiełczewska A. and Brandt N. (2018) 'The "Family 500+" child allowance and female labour supply in Poland'. IBS Working Paper 01/2018. Warsaw: Instittue for Structural Research (IBS).

Marchal S. and Marx I. (2018) 'Stemming the tide: What have European Union countries done to support low-wage workers in an era of downward wage pressures?'. Journal of European Social Policy 28(1): 18-33.

Marchal S., Marx I. and Van Mechelen N. (2014) 'The Great Wake-Up Call? Social Citizenship and Minimum Income Provisions in Europe in Times of Crisis'. Journal of Social Policy 43(2): 247-267.

Marchal S., Siöland L. and Goedemé T. (2018) 'Methodological working paper: Using HHoT to generate institutional minimum income protection indicators'. CSB Working Paper, Centre for Social Policy Herman Deleeck. Antwerp.

Marchal S., Siöland L. and Goedemé T. (2019) 'Using HHoT to generate institutional minimum income protection indicators'. EUROMOD Working Paper 4/19. Colchester: Institute for Social and Economic Research, University of Essex.
Marchal, S. & Siöland, L. (2019). A safety net that holds? Tracking minimum income protection adequacy for the elderly, the working and the non-working of active age, CIRCLE Working Paper no. 6
Marini A., Zini M., Kanavitsa E., et al. (2019) 'A Quantitative Evaluation of the Greek Social Solidarity Income'. The World Bank Social Protection and Jobs Global Practice, World Bank.
Marx I. and Nelson K. (2013) Minimum Income Protection in Flux, Houndmills: Palgrave Macmillan.
Marx I., Marchal S. and Nolan B. (2013) 'Mind the Gap: Net Incomes of Minimum Wage Workers in the EU and the US'. In: Marx I and Nelson K (eds) Minimum Income Protection in Flux. Basingstoke: Palgrave Macmillan, 54-80.
Marx I., Vanhille J. and Verbist G. (2012) 'Combating in-work poverty in continental Europe: the potential impact of higher minimum wages and targeted tax relief'. Journal of Social Policy 41(1): 19-41.
Matsaganis M. (2018) 'The contorted politics of guaranteed minimum income in Greece'. DAStU Working Papers n. 2/2018. Milano: Politechnico di Milano.
Matsaganis M. and Leventi C. (2014) 'Poverty and Inequality during the Great Recession in Greece'. Political Studies Review 12(2): 209-223.
Mincer, J. and Ofek, H. (1982) Interrupted work careers: Depreciation and restoration of human capital, Journal of Human Resources. 7, 1, 3–24.
Natili M. (2018) 'Explaining different trajectories of minimum income schemes: Groups, parties and political exchange in Italy and Spain'. Journal of European Social Policy 28(2): 116-129.
Nelson K. (2007a) 'Introducing SaMip: The social assistance and minimum income protection interim dataset'. S-WpPEc, Swedish institute for social research.
Nelson K. (2007b) 'Universalism versus targeting: The vulnerability of social insurance and means-tested minimum income protection in 18 countries, 1990-2002'. International Social Security Review 60(1): 33-58.
Nelson K. (2013) 'Social Assistance and EU Poverty Thresholds 1990–2008. Are European Welfare Systems Providing Just and Fair Protection Against Low Income?'. European Sociological Review 29(2): 386-401.
Neumark D. and Wascher W.L. (2007) 'Minimum wages and employment'. Foundations and Trends in Microeconomics 3(1+2): 1-182.
Noël A. (2018) 'The Politics of Minimum Income Protection in OECD Countries'. Journal of Social Policy 48(2): 227-247.
OECD. (2012) 'Labour losing to capital: What explains the declining labour share?'. Technical Report, OECD Employment Outlook 2012.
OECD. (2014) 'Benefits and Wages: country specific files'. Paris.
OECD. (2015) 'Minimum wages after the crisis: Making them pay'. Directorate for Employment, Labour and Social Affairs. Paris. Available at: www.oecd.org/social/Focus-on-Minimum-Wages-after-the-crisis-2015.pdf.
OECD. (2017a) 'Country profile: Denmark'. Pensions at a Glance 2017, OECD. Paris.
OECD. (2017b) Social Recipients (SOCR) database, version. Paris: OECD. Available at: https://stats.oecd.org/Index.aspx?DataSetCode=SOCR.
OECD (2019). Pensions at a Glance 2019: OECD and G20 Indicators, OECD Publishing, Paris
Officer, L. (2017) Exchange Rates Between the United States Dollar and Forty-one Currencies. [Online]. 2017.
Pedersen, A. W. (2004). The privatization of retirement income? Variation and trends in the income packages of old age pensioners. *Journal of European Social Policy*, *14*(1), 5-23.

Peeters, H. and De Tavernier, W. (2015) Lifecourses, pensions and poverty among elderly women in Belgium: interactions between family history, work history and pension regulations, Ageing & Society. 35, 6, 1171–99.

Pension Watch. (2018) 'Social Pensions Database'. Pension Watch. Available at: http://www.pension-watch.net/social-pensions-database/social-pensions-database--/.

Pensionsmyndigheten. (2019) 'Statistik om äldreförsörjningsstöd'. Pensionsmyndigheten. Stockholm. Available at: https://www.pensionsmyndigheten.se/statistik-och-rapporter/statistik/statistik-for-aldreforsorjningsstod.

Perez S.A. and Matsaganis M. (2017) 'The Political Economy of Austerity in Southern Europe'. New Political Economy 23(2): 192-207.

Phipps, S., Burton, P. and Lethbridge, L. (2001) In and out of the labour market: long-term income consequences of child-related interruptions to women's paid work, Canadian Journal of Economics. 34, 2, 411–29.

Pierson P. (1994) Dismantling the welfare state? Reagan, Thatcher, and the politics of retrenchment, Cambridge: Cambridge University Press.

Scharle Á. and Szikra D. (2015) 'Recent Changed Moving Hungary Away from the European Social Model'. In: Vaughan-Whitehead D (ed) The European Social Model in Crisi: Is Europe Losing Its Soul? Cheltenham: Edward Elgar.

Schulten T. (2014) 'Contours of a European Minimum Wage Policy'. Friedrich Ebert Stiftung. Berlin, 19.

Scruggs L. and Hayes T.J. (2017) 'The Influence of Inequality on Welfare Generosity:Evidence from the US States'. Politics & Society 45(1): 35-66.

Scruggs, L., Detlef, J. and Kuitto, K. (2014) Comparative Welfare Entitlements Dataset 2. Version 2014-03

Sefton, T., Evandrou, M., Falkingham, J. and Vlachantoni, A. (2011) The relationship between women's work histories and incomes in later life in the UK, US and West Germany, Journal of European Social Policy. 21, 1, 20–36.

Sigle-Rushton, W. and Waldfogel, J. (2007) Motherhood and women's earnings in Anglo-American, Continental European, and Nordic Countries, Feminist Economics. 13, 2, 55–91.

Statistisches Bundesamt (2018). '1.4 million minimum wage jobs in April 2017.' Berlin: Institution, Available at: <https://www.destatis.de/EN/Press/2018/06/PE18_231_621.html>.

Staubli, S. and Zweimüller, J. (2013) Does raising the early retirement age increase employment of older workers?, Journal of Public Economics. 108, C, 17–32.

Stier, H. and Mandel, H. (2009) Inequality in the family: the institutional aspects of women's earning contribution, Social Science Research. 38, 594–608.

Sutherland H. (2001) 'The national minimum wage and in-work poverty'. DAE Working Papers, University of Cambridge. Cambridge.

SVB. (2019) AOW: Voluntary insurance. Amsterdam: Sociale Verzekeringsbank. Available at: https://www.svb.nl/int/en/vv/nieuw_in_nederland/u_komt_in_nl_wonen_of_werken/, accessed 4 July 2019.

Trlifajová L. and Hurrle J. (2019) 'Work must pay: Does it? Precarious employment and employment motivation for low-income households'. Journal of European Social Policy 29(3): 376-395.

Uunk, W., Kalmijn, M. and Muffels, R. (2005) The Impact of Young Children on Women's Labour Supply A Reassessment of Institutional Effects in Europe, Acta Sociologica. 48, 1, 41–62.

Van Mechelen N. (2010) Barriers to adequate social safety nets, PhD thesis, Antwerp: University of Antwerp.

Van Mechelen N., Marchal S. (2013) 'Struggle for Life: Social Assistance Benefits, 1992-2009'. In: Marx I and Nelson K (eds) Minimum Income Protection in Flux. Basingstoke: Palgrave Macmillan, 28-53.

Van Mechelen N., Marchal S., Goedemé T., et al. (2011) 'The CSB-Minimum Income Protection Indicators dataset (CSB-MIPI)'. CSB Working Paper Series, Herman Deleeck Centre for Social Policy, University of Antwerp. Antwerp, 104.

Van Vliet O. and Wang J. (2019) 'The political economy of social assistance and minimum income benefits: a comparative analysis across 26 OECD countries'. Comparative European Politics 17(1): 49-71.

Vaughan-Whitehead D. (2010) The Minimum Wage Revisited in the Enlarged EU, Cheltenham: Edward Elgar.

Verbist, G. (2007). The distribution effects of taxes on pensions and unemployment benefits in the EU-15. In O. Bargain (Ed.). *Micro-Simulation in Action: Policy analysis in Europe using EUROMOD*. Elsevier.

Verbist, G. & Figari, F. (2014). The redistributive effect and progressivity of taxes revisited: An international comparison across the European Union. *FinanzArchiv / Public Finance Analysis, 70*(3), 405-429.

Vidra Z. (2018) 'Hungary's punitive turn: The shift from welfare to workfare'. Communist and Post-Communist Studies 51(1): 73-80.

Visser J. (2016) The ICTWSS Database, version 5.1. Amsterdam Institute for Advanced Labour Studies, University of Amsterdam. Available at: http://uva-aias.net/en/ictwss.

Wang J. and van Vliet O. (2016) 'Social Assistance and Minimum Income Benefits: Benefit Levels, Replacement Rates and Policies across 26 Oecd Countries, 1990–2009'. European Journal of Social Security 18(4): 333-355.

Zaidi, A., Grech, A. G., & Fuchs, M. (2006). Pension policy in EU25 and its possible impact on elderly poverty, LSE STICERD Working Paper CASE/116

Zaidi, A., Gasior, K. and Sidorenko, A. (2010) Intergenerational solidarity: policy challenges and societal responses, Policy Brief, European Centre Vienna.