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Measuring the lifecycle impact of welfare state policies in the face of ageing

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ABSTRACT

This research investigates how the interplay between demographics, economics and welfare state transfers affects the impact of the ageing process on income redistribution, at both intra and intergenerational levels. We combine different EU comparable data sources with microsimulation techniques in order to measure how agents resort to the three available resource allocation devices over their lifecycle (asset market and public and private transfers), extending the National Transfer Accounts (NTA) methodology at the micro level. Agents are heterogeneous in age, gender, education level and family type. Simulating population dynamics at the micro level allows us to capture not only the ageing process but also the educational transition and the change in family structures occurring in parallel. The resulting projection model allows us to simulate the lifetime net transfers received by individuals from the government and the family, and to compute the adjustment needed to keep the sustainability of the welfare system.

The analysis is applied to four European countries representing different welfare state regimes (Spain, Austria, Finland and the United Kingdom). We find differences in the role of private and public transfers in intra and intergenerational redistribution across countries, which can be linked to the various welfare state regimes. Apart from the expected differences observed by gender and by education level, there are significant differences in the interplay between private and public transfers related to parenthood. While parents privately transfer substantially more than childless people in all studied countries, the Austrian welfare state is the only one that compensates high and medium education groups for these differences through higher public transfers to parents. Such compensation is much weaker and more targeted towards the lower educated in the other countries.

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1. Introduction

Major changes in the Western world have characterized the past century. From an economic perspective, technological progress and the extension and globalization of markets have become the primary drivers of development. In parallel with these changes, there has been a steady improvement in life expectancy coupled with a decline in birth rates, which has altered the population's age structure. During this process, at the political level, the consolidation of democracy led to the expansion of social policies, starting with public education – a key element in the overall process –, and creating what nowadays is known as the welfare state. These three axes of development (economic, demographic and political) are closely connected, although the interaction among them is not always straightforward. A central element is linked to each of these processes: the changes in family structures that have taken place over the last hundred years. The economic literature is developing in this direction. On the one hand, the literature on Family Economics focuses on the role of the family in microeconomic decisions. On the other hand, the literature on Population Economics focuses on the macro aspects of the interaction between economics and demographics, while more recently the need to integrate changes in family structure into standard dynamic macroeconomic models has been stressed (Doepke and Tertilt, 2016).

During this process, the welfare state has been extending its action from mere monetary transfers for poverty reduction to more comprehensive programs, such as providing basic social goods (education and health) and income substitution programs, such as unemployment or pensions, with a high insurance component. Interestingly, this process leads to the gradual substitution of private family intergenerational transfers, which are moved to the public sphere and – to some extent – the market. Government intervention, in this case, goes beyond intragenerational redistribution, introducing, as long as pay-as-you-go funding is predominant, public intergenerational redistribution. A proper evaluation of the redistribution impact of welfare policies needs to consider the interaction of the three resource allocation devices (family, public sector and markets) over the lifecycle. At the same time, understanding how these three devices interact is crucial to face the current threats challenging the welfare state's sustainability.

This research contributes to understanding how the interplay between demographics, economics and welfare state transfers affects the impact of the ageing process on income redistribution, at both intra and intergenerational level. To that end, we combine different comparable data sources with microsimulation techniques in order to be able to measure how agents resort to the three resource allocation devices over their lifecycle. In this respect, our work is an extension of the National Transfer Accounts (NTA) methodology, which precisely aims at giving a comprehensive picture of how resources are reallocated by age using the market, the government or the family.[1] This method introduces the age and usually the gender dimension into the System of National Accounts (SNA), also adding an estimation of private transfers. In this paper, we take another step forward by further disaggregating the estimations to consider the role of education and family structure.[2] Additionally, given that most of the data employed come from cross-sectional sources, we use microsimulation techniques to simulate the whole lifecycle of individuals and the foreseeable changes as the population ages. More specifically, we build a projection model where individuals are considered heterogeneous by age, gender, level of education and family type. The simulated population dynamics, including birth, emancipation, fertility and couple formation by education level, allows us to assess the effects of ageing while also taking into account changes in all those dimensions. The NTA accounting logic allows us to capture the interaction between the three resource allocation devices. The simulation results allow us to estimate the lifetime transfers (net of taxes) obtained by individuals from the public coffers over their lifecycle. Moreover, they also allow us to study to what extent the status quo public and private transfers are sustainable over the ageing process. In this respect, our approach is an extension of Lee et al. (2017), who in turn extend the Generational Accounting technique – focused on public sector sustainability – including private transfers. Apart from investigating intergenerational redistribution, our results shed light on the size of intragenerational redistribution captured by education level and by gender. Besides, we find significant differences in the net lifetime transfers received by parents and childless individuals.

Our analysis also contributes to the literature on welfare models, extending previous modelizations. As highlighted by Istenič et al. (2019), by estimating family transfers NTA is the first attempt to obtain a comprehensive measure of the degree of familialization of the welfare state, highlighted by Saraceno and Keck (2010). We go further in this effort, disaggregating NTA by additional dimensions, and projecting the impact of ageing. Furthermore, the analysis is carried out for four European countries, representatives of the four welfare state regimes: Spain (Mediterranean), Austria (Continental or conservative), Finland (Nordic or social-democratic) and the UK (Anglo-Saxon or liberal).

The rest of the paper is organized as follows. It starts by posing the method employed in the context of the literature on projection models. Section 3 describes the data and methods employed in more detail. The following sections are devoted to the presentation of the results (Section 4) and to the final remarks (Section 5).

[1] NTA is a collaborative project that started around 2000 and now includes more than 90 countries in the world (www.ntaccounts.org). Lee and Mason (2011) show a comparative analysis for the first 20 countries. The general methodology is documented in UN (2013) while, as we will see later, the methodology applied in the AGENTA project to produce EU estimates based on comparable EU data sources is documented in Istenič et al. (2016).

[2] The following disaggregation is primarily based on the previous NTA literature, which shows that economic categories such as income, transfers, savings, etc. differ significantly by age, gender (see, e.g., Istenič et al. (2019), and education (Rentería et al., 2016). Since one of the most important contributions of the NTA methodological framework is the estimation of private transfers within the household, which also strongly depend on the parenthood status, this status was also taken into account.

2. Combining NTA and GA: A microsimulation approach

There exists an extensive and quite disperse literature on projection models intended to assess the budgetary impact and the redistributive consequences of population ageing on public finance.[3] Models vary according to their focus, some concentrating on specific items of public expenditure (especially pensions), while others aim to capture all welfare state transfers. Having either a micro or a macroeconomic orientation, both theoretical and applied models – especially the latter – usually need to integrate micro and macroeconomic aspects. In this case, they can follow a top-down (macro) or a bottom-up (micro) approach. Prominent examples of macroeconomic models are dynamic general equilibrium overlapping generation (OLG) models, where individuals make optimal choices regarding savings and possibly labor supply and other variables. At the other extreme, dynamic microsimulation models are based on detailed micro-data, reproducing observed behavior by statistical modeling, rather than being based on optimization as structural models. A typical trade-off between the two types of model lies in consistency versus applicability. OLG models make it possible to capture consistently, in a stylized way, the general equilibrium effects of the demographic change. In contrast, microsimulation models are typically chosen whenever intragenerational redistribution is particularly relevant to the research question.

A third type of models, located somewhere in the middle of this bottom-up versus top-down continuum, are the so-called aggregated accounting models, usually designed for a very specific purpose or to exploit a particular database. Similarly, within the literature on dynamic fiscal policy, the Generational Accounting (GA) methodology was proposed by Auerbach et al. (1991) as an applied partial equilibrium technique derived from OLG models.[4] The primary purpose of standard GA is to evaluate the extent to which the intertemporal budget constraint of the public sector holds under the current fiscal policy; in other words, whether a debt accumulated in the base year would be covered by the payments (net of transfers) to be made by current and future generations, keeping the current public policies. The estimation procedure starts from the aggregate net payments of living generations, obtained by imputing the base year budget aggregates by age and gender. The assumption of a constant fiscal policy allows these net payments to be maintained constant for future generations and, hence, the implicit debt (or wealth) is obtained as the intertemporal debt not covered (or more than covered) by net payments of any generation. This stylized and transparent model structure gave way to the development of internationally comparable studies of welfare state sustainability (Auerbach et al., 1991, 1999 and European Commission, 1999).

The National Transfer Accounts (NTA) estimates open a window of opportunities to improve projection models, offering new inputs for the calibration. More importantly, it widens the perspective by accounting not only for public finance, but also for the other two resource assignment devices (family and asset markets). NTA was developed to obtain a comprehensive measure of the inter-age reallocation of resources. To that end, the method disaggregates National Accounts (NA) into age profiles reflecting tax payments and transfer receipts, also including an estimation of private transfers (both within and between households) by age. More specifically, the first step is to obtain per capita age profiles of labor income and consumption (including both private and public consumption). Then, by subtracting consumption from income at any age, the age profile of the so-called lifecycle deficit (LCD) is obtained, identifying the age at which children stop and old adults start having a deficit (due to their lack of labor income). In a second step, the extent to which the three available mechanisms are suitable to move surpluses at working ages to both dependent sides of the lifecycle is measured. To do that, public transfers received and taxes paid are estimated, leading to net public transfers (TG). Then, private inter and intrahousehold transfers are obtained, after imputing household private consumption to all its members. Private transfers, as defined by the NTA, refer to *inter vivos* transfers, excluding the measurement of bequests and other capital transfers. Finally, the age profile of asset income is computed, while the age profile of savings is estimated as a residual.

NTA share some essential elements with GA. In particular, the age profiles of taxes and transfers employed as inputs in GA are similar to the NTA profile of net public transfers. GA is mainly a projection method, while NTA offers more detailed information on age reallocations from a cross-section perspective. Technically, our exercise benefits from both approaches and goes one step further. Some previous efforts have been made to combine GA and NTA in order to look at the interaction between economic and demographic change. Patxot et al. (2011, 2012) made a first attempt to integrate the information provided by NTA in the GA projection logic. They presented an application to Spain in this direction, analyzing the relative importance of public and private transfers for both sides of dependent life (children and the elderly). More recently, Lee et al. (2017) completed that integration, obtaining Full Generational Accounts (FGA), including private transfers.

Our paper follows the strategy of Lee et al. (2017), constructing FGA. However, we extend it in two directions. First, our analysis enriches the projection results with the microsimulated population dynamics. Second, disaggregated NTA by gender, level of education and family type, estimated in Abio et al. (2021a), are incorporated. We thus aim to disentangle the effects of crucial social characteristics, other than age, in the projection. This also allows us to approach not only the inter but also the intragenerational income redistribution posed by welfare state models.

[3] See Jimeno et al. (2008) for a survey on approaches related to social security expenses.

[4] Generational Accounting indicators can also be obtained using general equilibrium OLG models. See Börstinghaus and Hirte (2001) for a comparison of results based on partial versus general equilibrium and Sánchez-Romero et al. (2019) for an example of an OLG model calibrated to some NTA profiles.

3. Data and methodology: The model and the welfare regimes

This Section explains the data and methods employed to combine the more disaggregated NTA accounting with projection techniques in the GA tradition, going deeper at the micro level. In this respect, the model developed for our analysis – microWELT – builds on the dynamic microsimulation tradition. It is a time-based interacting population model; thus, all actors are simulated simultaneously and can interact at any moment of time. The choice is based on the requirement to support the implementation of policy responses for balancing budgets over time, and the need to allow (optional) model alignments to external targets. This also permits linking individuals to nuclear families, a key unit of analysis for our purpose.[5] The model incorporates education as the key socioeconomic variable, which affects all the succeeding life events (emancipation of young adults, partnership formation, fertility, family type and mortality).[6]

The model is applied to four European countries (Spain, Austria, Finland and the UK) representative of the four welfare models. The classical typology of welfare states (initiated by (Esping-Andersen, 1990)) identified three welfare regimes: conservative (Continental European), liberal (Anglo-Saxon), and social-democratic (Nordic), based on the concepts of de-commodification and social stratification. The latter refers to its redistributive potential (mainly at the intragenerational level). De-commodification is a more complex concept: the extent of the immunization from market dependency, which turns out to be deeply connected with the NTA approach, as first pointed out by Istenič et al. (2019). Quite intuitively, the extent of independence from the market relies on the availability of alternative resource allocation devices, namely the public sector and the family. The initial classification of Esping-Andersen (1990) was extended by Leibfried (1993) and Ferrera (1996), who stressed the need to differentiate Mediterranean countries (like Spain and Italy) from the Continental regime.

Below we describe the population dynamics (Section a), while Section b explains how the NTA accounting and data are incorporated into the model.

(a) Population dynamics

As abovementioned, the model designed in this research simulates the population dynamics at micro level. To that end, it is necessary to establish how the main transitions over the lifecycle occur: birth, educational process, emancipation, partnership formation, fertility, parenthood status and mortality. Here we outline the main features, while specific details can be found in Spielauer et al. (2020b).

Our model creates its starting population from the EUROMOD version of the 2010 wave of the European Union Statistics on Income and Living Conditions, EU-SILC,[7] while newborn individuals are subsequently added to the sample in future years. In the simulated individual life-courses, the earliest modeled transitions concern education. The model parameterization starts from the observed distribution in the base year and from estimated patterns of intergenerational transmission of education.[8] Three levels of education are distinguished: Low (ISCED 0–2), Medium (ISCED 3–4), and High (ISCED 5+). The estimation results indicate that the impact of parents' education on the transition from low to medium education is the weakest in Finland and the highest in Spain, with Austria and the UK falling in between. The ranking of countries changes a little when analyzing the transition from medium to high education. However, Finland maintains its position, followed by Austria, Spain, and the UK. Accordingly, in Finland, the young have the most universal education opportunities, a central characteristic of Nordic welfare states.[9] Our estimations also reveal the characteristics of the liberal welfare regimes, where public expenditure for education is high, especially at primary levels, whereas not so much at later educational levels (West and Nikolai, 2013). When analyzing the transition from medium to high education, the universal rights in the UK disappear. Still, the transition rates from medium to high education are lower in Austria and Spain than in the UK. This can be explained by the socially stratified schooling system, with high academic selection in Continental and Mediterranean countries. While in the latter the selection only occurs later in school life, it is earlier in Continental countries (West and Nikolai, 2013). The high academic selection at younger ages in Austria explains the much lower share of highly educated individuals in Austria as compared to the other analyzed countries.

The projections result in different evolutions of the educational composition of population in the four countries, as shown in Fig. 1. Finland and the UK show the smallest changes, while Austria, and especially Spain, show the highest. In Austria, where the initial proportion of the high educated is the lowest, there is a substantial increase in this share at the expense of the medium and the low educated. In Spain, with an initial share of the low educated which more than

[5] See Spielauer et al. (2020a) for a detailed discussion on the design and structure of the model in relation to the literature on dynamic microsimulation. The model has been designed in the framework of a collaborative project (www.weltransim.eu) and is fully documented in an online platform (www.microwelt.eu) in order to make it fully portable to other EU countries. See also Spielauer et al. (2020c) for a preliminary version of the results.

[6] West and Nikolai (2013) highlight the role of education in characterizing the impact of welfare models, as it is crucial for later individuals' outcomes.

[7] EUROMOD is a static tax-benefit microsimulation model. Based on the EU-SILC database, it aims to incorporate a detailed account of all taxes and transfers in the base year.

[8] Spielauer et al. (2020b) offer a detailed account of the parameterization of the model, i.e., how the main sociodemographic transitions (education, fertility and partnership formation) have been estimated for the four countries simulated in the project. In this case, the estimations are performed from the 2009 ad-hoc module of the European Labour Force Survey.

[9] Nordic countries are characterized by high public expenditure on education, resulting in high reading scores at the age of 15, and a lower proportion of early school leavers (West and Nikolai, 2013).

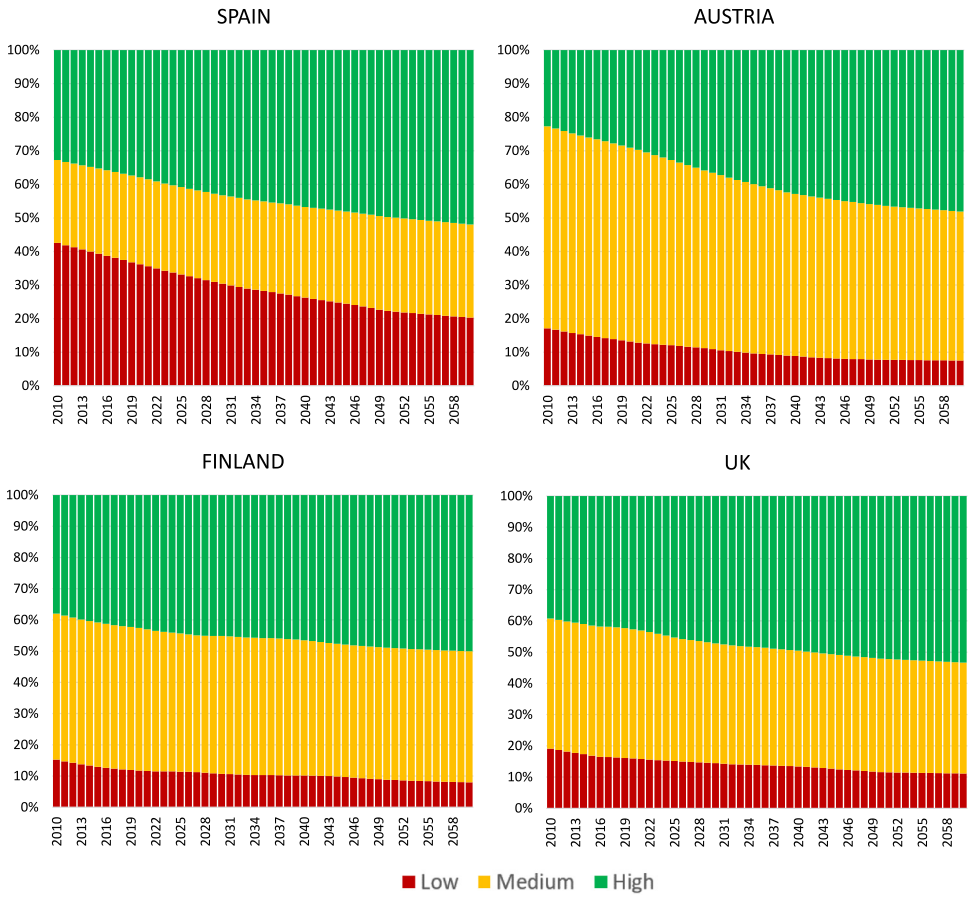

Fig. 1. Estimated education composition of population (20–59) by calendar year.
Source: Authors' calculations.

doubles that of the other countries, the reduction in the lowest educated translates basically into an increase in the high educated, while the medium group remains almost constant.

The second modeled life transition affected by education is the age of economic emancipation and leaving the parental home, which also has a potential link with the welfare regimes' typology. While children in social-democratic countries, like Finland, leave their home earlier (at age 21.9 on average in 2010 according to Eurostat), Spain is the country in which young people leave home the latest (in their late 20s), relying more on the family. The UK and Austria are in between, with children in the UK leaving their home earlier (at ages 23.9 and 25.5, respectively). This is in line with the liberal welfare model's characteristics, where non-dependent individuals rely to a greater extent on the market as compared to other countries.

Third, microWELT's parameterization of fertility trends incorporates childlessness by education level, where there are sizable differences for all countries. The UK and Finland have the lowest level of childless women, while Finland has experienced a reversal in the education gradient: for cohorts born after the 1950s, low educated childlessness has been increasing, overtaking that corresponding to the other two education levels. Although investigating the causes of these trends and their interaction with partnership formation is beyond the scope of this paper, it is crucial to understand the interaction between the design of the welfare state, including education outcomes, and the evolution of fertility, which in turn affects the sustainability of the welfare state itself. Interestingly, Esping-Andersen and Billari (2015) find some signs of a reversal in the education gradient of fertility, which could have been the result of reaching a more gender-egalitarian partnership mode, accompanied by policies.

Despite the fact that in our model fertility varies with age, education and parity, the results presented here take the fertility observed in 2010 and reproduce age-specific fertility rates used in the EUROSTAT projections.[10] The initial values highlight the paradox that fertility remained relatively high in countries with very different social protection levels, like

[10] Individual variation (first birth by age, education and total childlessness by birth cohort and education) and EUROSTAT fertility targets (total and age-specific fertility rates) are made compatible by randomly distributing second and higher order births to mothers of the required age.

the UK and Finland (with a fertility rate of 1.9 in 2010). Nevertheless, the UK's fertility has fallen slightly to 1.7 in the last decade, while Finland's has experienced a dramatic drop, becoming even lower than Austria's from 2017 on. On the other hand, the Mediterranean and conservative countries seem to be trapped in low fertility levels (1.3 in Spain and 1.4 in Austria in 2010). This is the case even though the family's traditional role is emphasized in Mediterranean countries like Spain, and the state extensively supports motherhood, especially in conservative countries like Austria (Esping-Andersen, 1990, 1999).

Fourth, education also impacts the likelihood of a woman to live in a partnership, together with age, the presence of children in the family, and the youngest child's age. For simplicity and given data availability, the simulation is driven by female transitions (education and fertility, subsequent partnership). Male partners are matched by observed distributions by age and education. Persons are linked to nuclear families (our modeling unit). These links are maintained, responding to events such as union formation, new partnerships, leaving home, and death. We found pronounced differences in partnership patterns, with some features linkable to welfare state regimes. An example is the very high proportion of single mothers among young mothers with low education in the UK.

Fifth, we model both projected mortality improvements reproducing EUROSTAT projections, while simultaneously accounting for the mortality differentials by education. All studied countries show differences in mortality by education level, which impact on both the sustainability and the redistributive effects of public pension systems.

Finally, we include net migration flows, following Eurostat's basic population projections. This allows us to consider the net contribution of migrants in the population, as they are typically younger than the native population. For reasons of feasibility, however, only net migration is considered and thus no differentiation is made according to educational level.

(b) NTA profiles by age, gender, education and family type

The model implements a parallel parameterization of NTA variables by three levels of disaggregation: by age, by age and sex, and by age, sex, education and family type (Abio et al., 2021a). The latter were newly created for that purpose starting from the age and gender-specific estimates previously obtained in the AGENTA project.[11] Starting from these parameters, the model implements individual longitudinal accounts and mechanisms to balance public and private budgets over time, as the ageing process changes the relative size of the cohorts.

Building NTA estimates requires information at micro level of consumption, income, taxes and transfers, which often implies the combination of the information provided by several datasets (UN, 2013). The procedure starts by obtaining a profile of labor income and consumption (from the same or different data sources). Consumption, usually registered at the household level, is imputed to all the household members distinguishing education, health and other consumption. Labor income, taxes and cash transfers are estimated from income surveys, while in-kind transfers need to be obtained from complementary data sources, typically at the national level. Information on interhousehold family transfers is also present in household income surveys. Once all these elements are incorporated, the profiles for private intrahousehold transfers (among household members in order to cope with their consumption) can be computed. The final step is estimating the asset income profile and obtaining private savings as a residual.

The AGENTA project produced the first wave of NTA estimates by age and sex for 2010 for EU countries, mainly using two comparable European datasets: EU-SILC and the Household Budget Survey (HBS) for 2010. In this paper, however, we employ NTA profiles further disaggregated by level of education and family structure. A few studies have estimated NTA distinguishing the level of education (Hammer, 2015; Rentería et al., 2016; Abio et al., 2017). Recently, Gál et al. (2020) estimated transfer profiles for working-age individuals, distinguishing parents and non-parents, to produce an indicator of the transfer cost of parenthood. In this paper, we use the NTA profiles estimated by Abio et al. (2021a). In this case, profiles are computed for all the NTA variables over the whole lifecycle, also disaggregating by level of education and considering a deeper classification of family types. Family types are constructed according to partnership and parenthood status. The latter is defined according to the presence of offspring in the household (for individuals up to age 59) and according to a specific childlessness imputation (for ages 60+). All children up to age 16 and students up to age 25 when living with their parents are considered as dependent children.

An important methodological issue that we need to bear in mind is the difficulty in reconciling the cross-sectional nature of NTA estimations with the longitudinal character of the lifecycle we are trying to grasp. This question is always present when building NTA but it is especially important when incorporating further disaggregation other than age and sex, which creates some methodological issues that need to be tackled. First, to estimate NTA profiles by level of education, the question arises as to whether children should be classified according to their own education level, as in Hammer (2015) and Rentería et al. (2016), or according to their parents' education (Abio et al., 2017). Each option has its advantages and shortcomings, and the choice depends on the purpose of the analysis. Our analysis follows the latter approach, including children in their parents' home with their parents' education level. However, the projection considers the cost of the educational level in which children are actually enrolled.

Second, to estimate NTA by family type, it is necessary to consider that family structure is not constant over the individual's lifecycle. Moreover, the way household surveys are constructed does not always allow a correct differentiation of the individual family characteristics in which we are interested, like parenthood status (differentiating parents from

[11] AGENTA: Ageing Europe, An application of National Transfer Accounts for explaining and projecting trends in Public Finances. Collaborative research project financed by 7th Framework Programme (FP7), period 2014–2017. Results are available at http://dataexplorer.wittgensteincentre.org/nta/. AGENTA estimates are described in detail in the manual created to that effect (Istenič et al., 2016).

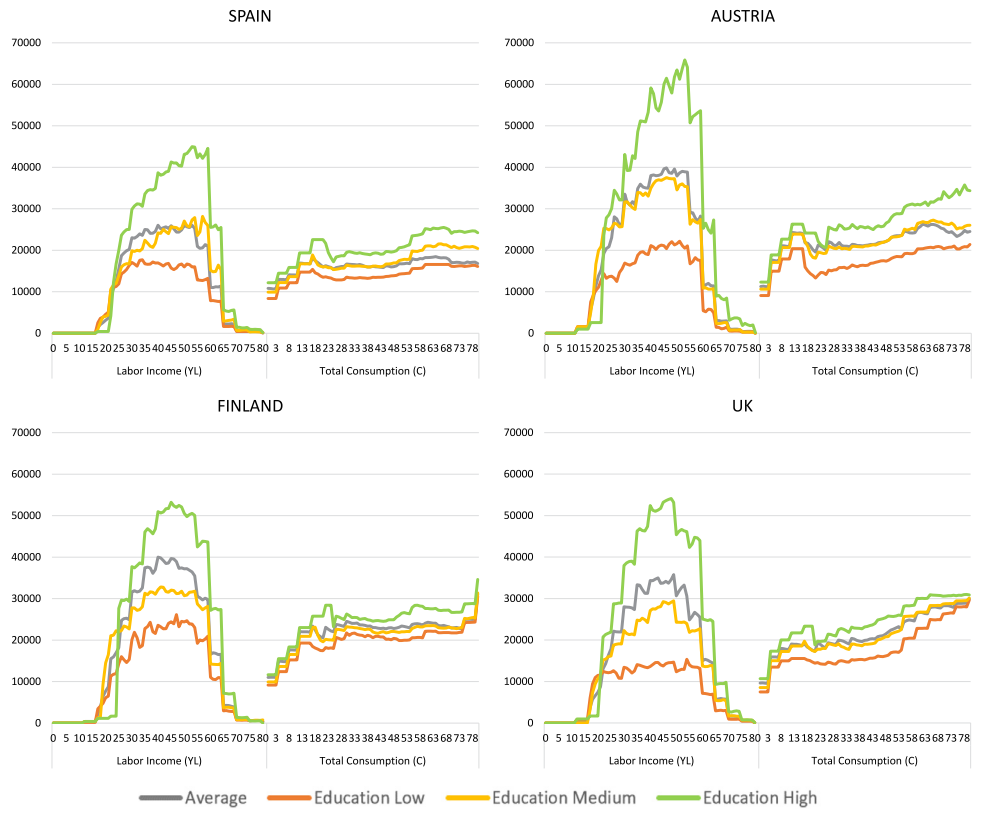

Fig. 2. NTA age profiles of labor income (YL) and consumption (C) by level of education (2010).
Note: data expressed in € per capita in year 2010.
Source: Produced with data from Abio et al. (2021a).

nonparents). To overcome the problem that people are not identified as parents once children leave home, we used the Survey of Health, Ageing and Retirement in Europe (SHARE), containing information on parenthood status, irrespective of household composition, for the population aged 50+. From the information contained in SHARE, we derived an imputation method that allows us to identify parenthood status from age 50 — see Abio et al. (2021b) for further details.

Figs. 2 and 3 summarize the NTA age profiles introduced in our model. In this case, we display the data disaggregated only by level of education in order to ease its visualization. Fig. 2 displays labor income and total consumption (for children and students up to 25, education refers to their parents' education). Labor income profiles show the typical inverted U-shape, with income concentrated in working ages. The high educated reach higher incomes, especially later in their work career, and work until older ages.

Fig. 2 reveals that the transfer system (both public and private) enables consumption differences among individuals with different levels of education to be much smaller than those for labor income. This is partially due to tax progressivity, and to the fact that public consumption crowds out private consumption over the individuals' lifecycle. At the age of 40, when individuals are in the middle of their most active working period, high educated people in the UK earn 3.9 times the income of the low educated, while they consume only 1.5 times more. The differences are less important in the other three countries, although they do exist. In Austria, labor income for the high educated is 2.8 times that of the low educated, while consumption is 1.4 times. Finland and Spain show the lowest ratios between the high and the low educated, both in labor income (2.2 and 2.3, respectively) and in consumption (1.2 and 1.4).

The difference between labor income and consumption generates transfers – both private and public – and asset reallocations (asset income plus dissaving). Fig. 3 depicts the age profiles of net private and public transfers by level of education. In all the analyzed countries, the young are, on average, net recipients of both public and private transfers, whereas prime working-age individuals are net payers. While the elderly are to a large extent net receivers of public transfers, the net private transfers they receive are negligible. A comparison between the transfers in the four countries reveals similar patterns and absolute magnitudes (in €) for family transfers, the differences by education level being smaller in the UK. Regarding public transfers, similar patterns are observed again, although Austria and Finland show higher absolute values, especially for the high educated and the very old. Interestingly, the low educated group in the UK presents a slightly positive profile of net public transfers for ages 20–50 (they are net recipients), while this is not the

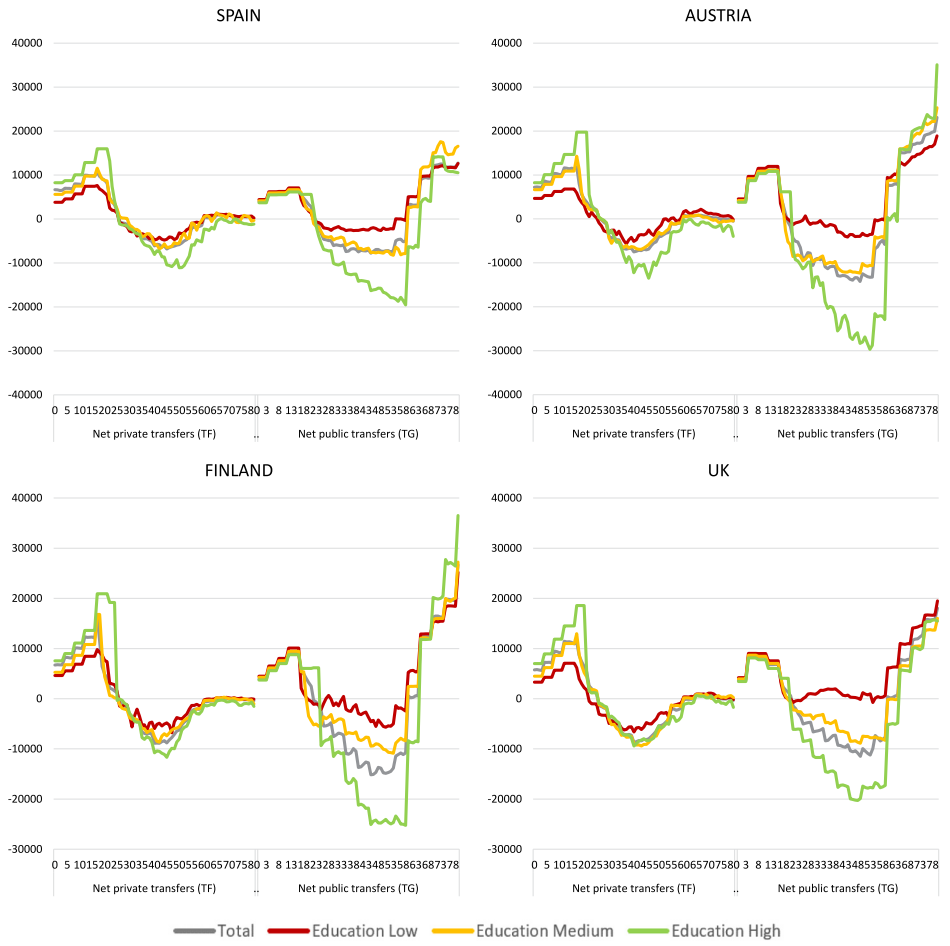

Fig. 3. NTA age profiles of public and private net transfers by education level. Note: data expressed in € per capita in year 2010. *Source:* Produced with data from Abio et al. (2021a).

case in the rest of countries.[12] This is consistent with the welfare state literature stating that in the liberal countries the government takes responsibility primarily for those with lower income.

Furthermore, the average value of private transfers reveals that they remain high until relatively higher ages in Spain as compared to other countries. This is explained by an extended role of the family in the Mediterranean countries. While in Spain positive net private transfers start to decrease sharply only at the age of 22, this decrease occurs much earlier in Austria, Finland and the UK (at age 18 in all three cases). The differences in redistribution through public transfers are even higher than through private transfers. The public welfare provision for the elderly is most visible in Austria and Finland, and smaller in Spain, and particularly in the UK, where net public transfers for the elderly are even higher for the less educated. This is in line with the previous literature connecting welfare regimes and transfer systems (Istenič et al., 2019).

The next figures provide additional information on the NTA profiles used in our model, in this case distinguishing by parenthood status. Fig. 4 shows the average age profiles of net public transfers received by parents and childless people. As observed, non-parents pay more taxes (net public transfers more negative) until age 40 in Spain and Finland, 45 in Austria and 60 in the UK. Only in Spain and Finland do parents pay slightly more than non-parents from ages 40–60, while in the other two countries both groups pay similarly. From age 60, net public transfers received become positive in all four countries, and the differences between parents and non-parents practically disappear.

Fig. 5 focuses on net private transfers by parenthood status. In this case, the differences between parents and non-parents are much more visible than for public transfers. On the one hand, in all four countries young childless individuals receive private transfers (basically from their families) until a later age than parents. On the other hand, the total amount of private transfers given by parents (from age 25–30 on) is much higher than those given by childless individuals. This

12 See Abio et al. (2021a) for further details on the creation of disaggregated profiles used in this simulation.

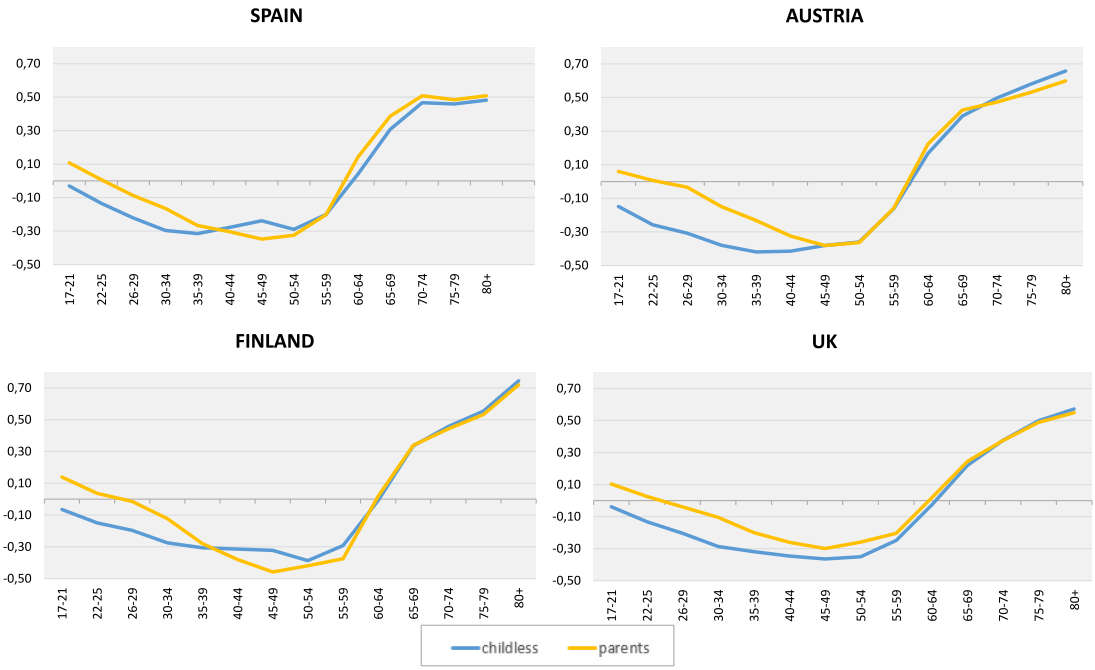

Fig. 4. NTA age profiles of public transfers by parenthood status.
Note: data expressed as a share of average labor income for ages 30–49 in year 2010.
Source: Produced with data from Abio et al. (2021a).

is completely consistent with the fact that parents need to transfer resources to their children, while non-parents do not have this responsibility. Indeed, the age profile of private transfers for childless people remains close to zero from age 30–60 in Finland and Austria, and slightly negative in Spain and the UK. At older ages, however, profiles for parents and non-parents become very similar in each country, as also occurred with public transfers.

Overall, looking at Figs. 4 and 5 together, it is clear that parents make a stronger effort over their working lives, transferring the resources they produce.

4. Results on intra and intergenerational income redistribution

The main purpose of our analysis is to capture the public and private net transfers received by individuals over their lifecycle. These data will allow us to investigate how sustainable the current schemes of public and private transfers are over the ageing process, and also how they affect income redistribution. This section presents and discusses our results. Besides the NTA profiles and demographic projections, our projection model requires an assumption of economic growth to project future transfer receipts and payments, and an appropriate discount factor to value future flows in the present (Appendix A presents a sensitivity analysis on the effects of discounting). Following Lee et al. (2017), we use a discount factor of 3%, and we set the annual productivity growth rate to 1.5%. Moreover, we perform the calculations in several scenarios. On the one hand, a scenario where projections are based on age and gender-specific NTA profiles (taken from AGENTA project) is compared with a scenario based on further disaggregated NTA profiles (by level of education and family type). On the other hand, projections are computed with and without the necessary adjustments in public and private transfers to keep their net value balanced in the corresponding budget constraints. That is, in a first scenario (unadjusted) we project all incomes and transfers assuming they all grow at the same rate.[13] In doing so, we follow the methodological framework of GA and assume that there is no limit on public debt. Then, in an adjusted scenario, we consider that both public transfers received and taxes paid are linearly adjusted in order to keep the public budget balanced (taxes are increased and benefits are reduced) following a pay-as-you-go logic. A similar procedure is also applied for private transfers, though adjustments are applied to net values, as only these were reported in AGENTA data.

Following the GA logic, most results show the present value of net public and private transfers received by a representative individual of a cohort over their lifecycle. In the case of public transfers, this figure is equivalent to the GA with the opposite sign, as the latter is usually measured as net taxes. For the sake of clarity, we will start with a panoramic

[13] By using a constant adjustment factor to growth, we might be overstating future pension rights, as pensions are not fully adjusted to wage growth.

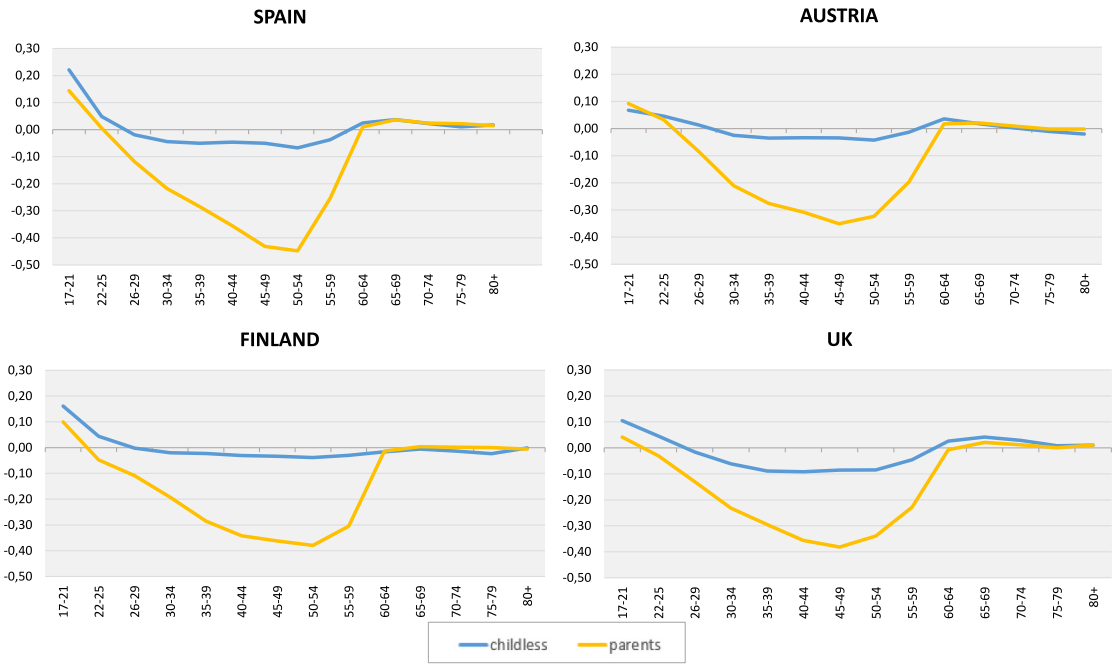

Fig. 5. NTA age profiles of private transfers by parenthood status.
Note: data expressed as a share of average labor income for ages 30–49 in year 2010.
Source: Produced with data from Abio et al. (2021a).

view of public transfers, showing the results for the newborn generation in the base year — the first one projected over their whole lifecycle. The results are shown for the cohorts born in 2010 or 2011, the latter when results are adjusted, as the adjustment starts in this year. Then, we will show the evolution of these numbers for future cohorts, for both public and private transfers, to see the extent of the adjustment needed for each future cohort as population ages. Afterwards, we will present a detailed analysis of public and private transfers in relation to lifetime labor income. The results will be shown by gender, education level and family type whenever relevant. Full Generational Accounts for all the cohorts alive in the base year (before the projection starts) are compiled in Appendix B.

Fig. 6 depicts the estimated net present value (NPV) at birth of net public transfers corresponding to the cohorts born in 2011 and 2040. Note that this is equivalent, with the opposite sign, to the GA (net taxes) of the representative individual of the corresponding cohort. To ease its interpretation, the NPV is shown as a share of the estimated present value of the lifetime labor income for the same cohort.

Fig. 6 gives an interesting first picture about the future role of public transfers in the economy. Overall (without adjustments to keep the public budget balanced and without distinguishing by level of education) it is observed that the NPV of public transfers received by the generation born in 2011 is positive in all four countries, meaning that, by keeping the currently observed structure of the welfare state transfers, individuals would on average be net receivers. However, when using disaggregated NTA the values decrease, slightly in Finland (from 12% to 10% of the lifetime labor income for the same cohort), moderately in Austria (from 14% to 10%) and remarkably in Spain (from 16% to 7%) and in the UK (from 11% to 5%), advancing the different impact of education and family structures across countries. On the other hand, when the adjustments to balance the public budget are introduced, results change dramatically. In all four countries, the NPV of public transfers received tends to zero, remaining slightly positive in the UK and Spain (in the latter only with aggregated NTA), while negative in the rest. The values are significantly worse for the generation born in 2040. For example, in Finland that generation would pay 9.8% of its labor income to the public sector over its life course (net of the transfers received). In the UK, however, the values for the future generation are close to zero.

Looking at the results disaggregated by level of education, interesting features are observed. As expected, the low educated group presents the highest NPV of net public transfers received in all cases. By contrast, the high educated are always net payers of public transfers, with the exceptions of Austria and Finland when no adjustments to balance public budget are applied. This is also an expected result, showing that public transfers do indeed work as an intragenerational redistribution device (from the most to the least educated). Our results show that this redistribution is particularly important in the UK, where the low educated group receives net public transfers amounting to over 50% of their labor income for both the 2011 and the 2040 birth cohorts. This is consistent with the liberal welfare model, where the government takes care of the poorest. On the other hand, Finland shows the lowest differences in net public transfers

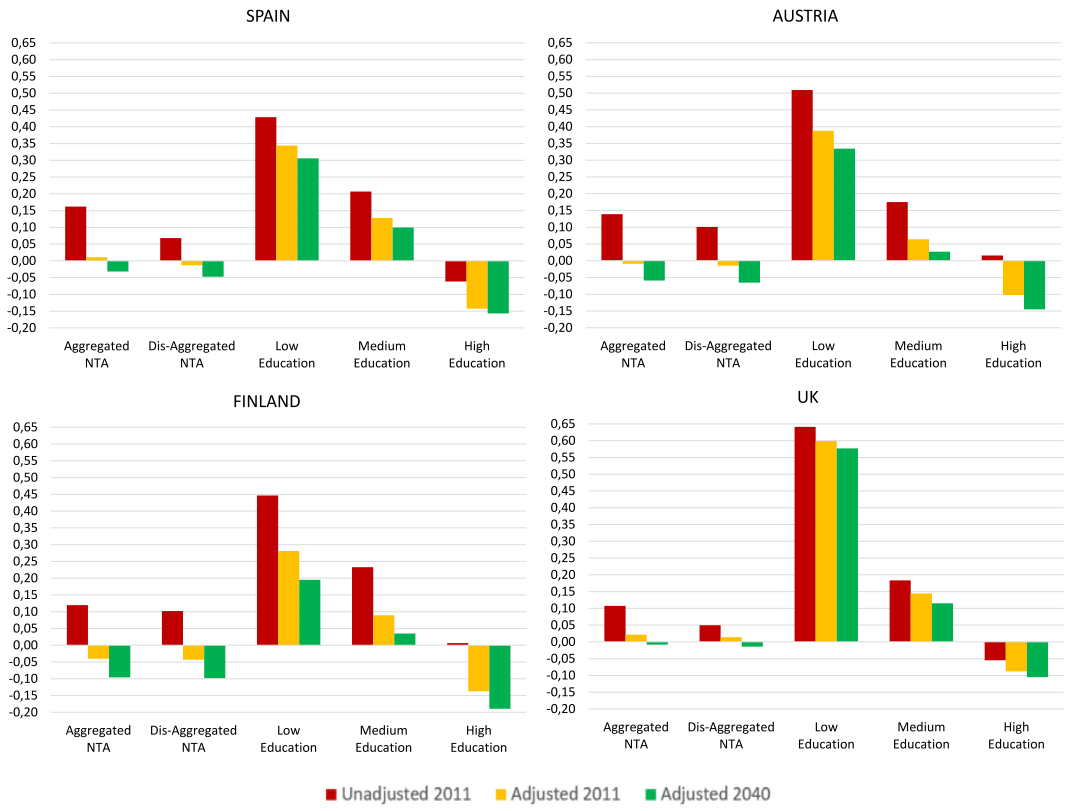

Fig. 6. Lifetime net public transfers received as a share of lifetime labor income for cohorts born in 2011 and 2040 (aggregated versus disaggregated NTA and by level of education).
Note: Net present value (NPV) at birth of lifetime public transfers as proportion of the present value of their lifetime labor income. For the cohort born in 2011 both values – adjusted to balance public budget each year and unadjusted – are shown. For the cohort born in 2040 only the adjusted estimation is displayed.
Source: Authors' calculations.

among education groups, which also fits in with the welfare literature stating that social welfare rights tend to be universal in social-democratic countries.

Thanks to the rich information provided by NTA, we can extend the analysis of the Generational Accounts (or NPV of public transfers) to private transfers (TF). Fig. 7 displays the evolution of the estimated NPV at birth of the public and private transfers, for each single cohort born between 2011 and 2040. In this case, we show only the adjusted scenario results. It is worth noting that public transfers need to be adjusted to a greater extent than private transfers. As previously shown in Fig. 2, the age profile of private transfers implies that these mainly go from parents at working ages to young children, and they are not therefore as affected by the ageing process.

From Fig. 7, it is observed that the NPV of private transfers remains positive for every cohort in all four countries, even when they are adjusted in the future to close the gap between future needs and transfers. That is, each cohort privately receives more than it gives. Our results are consistent with those previously obtained by Lee et al. (2017) for the US and Taiwan. Interestingly, the NPV of private transfers computed with aggregated NTA data slightly decreases for future cohorts, while it tends to be almost constant using disaggregated NTA profiles, showing a lower need for adjustment as education improves. The exception is Finland, where a timid increase is observed in both cases.

By contrast, the adjusted value of average public transfers starts by being negative in Austria and Finland, while positive in the other two countries using aggregated NTA data (as previously shown in Fig. 3). Nevertheless, in all cases, it decreases steadily across cohorts, with particular intensity in Austria and Finland. In the UK, it remains not far from zero for the last observed cohort, born in 2040. The decrease is even more pronounced in the event of using NTA data disaggregated by educational level (in this case, Spain also departs from a negative value).

Fig. 8 again shows the net present value of transfers by birth cohorts (adjusted scenario), now distinguishing by education level. As can be observed, the values of total transfers differ substantially among the three education groups, the difference being particularly high in the UK. In this country, the low educated in the 2011 cohort would receive total net transfers near 80% of their labor income over their lifetime. This amount is significantly lower in Spain (53%), Finland (51%) and Austria (50%). By contrast, the high educated in the same cohort receive net transfers close to zero in all four

Fig. 7. Lifetime net transfers (public, private and total) received as a share of lifetime labor income by birth cohort (aggregated versus disaggregated NTA).
Note: Net present value at birth of lifetime public (TG), private (TF) and total (T) transfers as a proportion of the present value of lifetime labor income. All results are adjusted to keep both public and private transfers balanced.
Source: Authors' calculations.

countries. However, it is interesting to note that these differences by level of education are almost entirely explained by public transfers, while the NPV of private transfers is similar for the three levels of education. Only in Finland and the UK do the least educated receive a little more private transfers than the other two education groups, which do not differ between them. The evolution across cohorts shows that the NPV of public transfers tends to decrease for any level of education in Austria and Finland, while it remains stable in Spain and the UK. As for private transfers, they remain stable across generations in any country and for any level of education. Appendix C presents a sensitivity analysis to evaluate the impact of mortality differences by level of education.

Overall, our results show that the present value of total transfers received by future cohorts would decrease slightly, due to the same trend in the evolution of net public transfers, while private transfers would remain almost constant. The current differences observed in the amount of transfers received according to the level of education will remain in the future: the low educated will receive a considerable net amount of transfers (public and private), which is over 70% of their lifecycle labor income in the UK, 50% in Spain and Austria and a little lower in Finland. As abovementioned, this would be consistent with the theory that a liberal welfare state addresses the special protection of the most vulnerable. By contrast, the amount of total transfers received by high-educated future generations remains close to zero in Spain and the UK, and has growing negative values in Finland and to a lower extent in Austria.

We will now focus on the results disaggregated by gender, level of education and parenthood status, one of the main novelties of our analysis. Fig. 9 presents the net present value of public and private transfers in absolute values for the average individual in each of these categories. The PV of labor income (YL) is also displayed, which is subsequently used in Fig. 10 to present the same results in relative terms. The NPV of both public and public transfers is computed with and without the necessary adjustments to keep budgets balanced each year, following the abovementioned procedure.

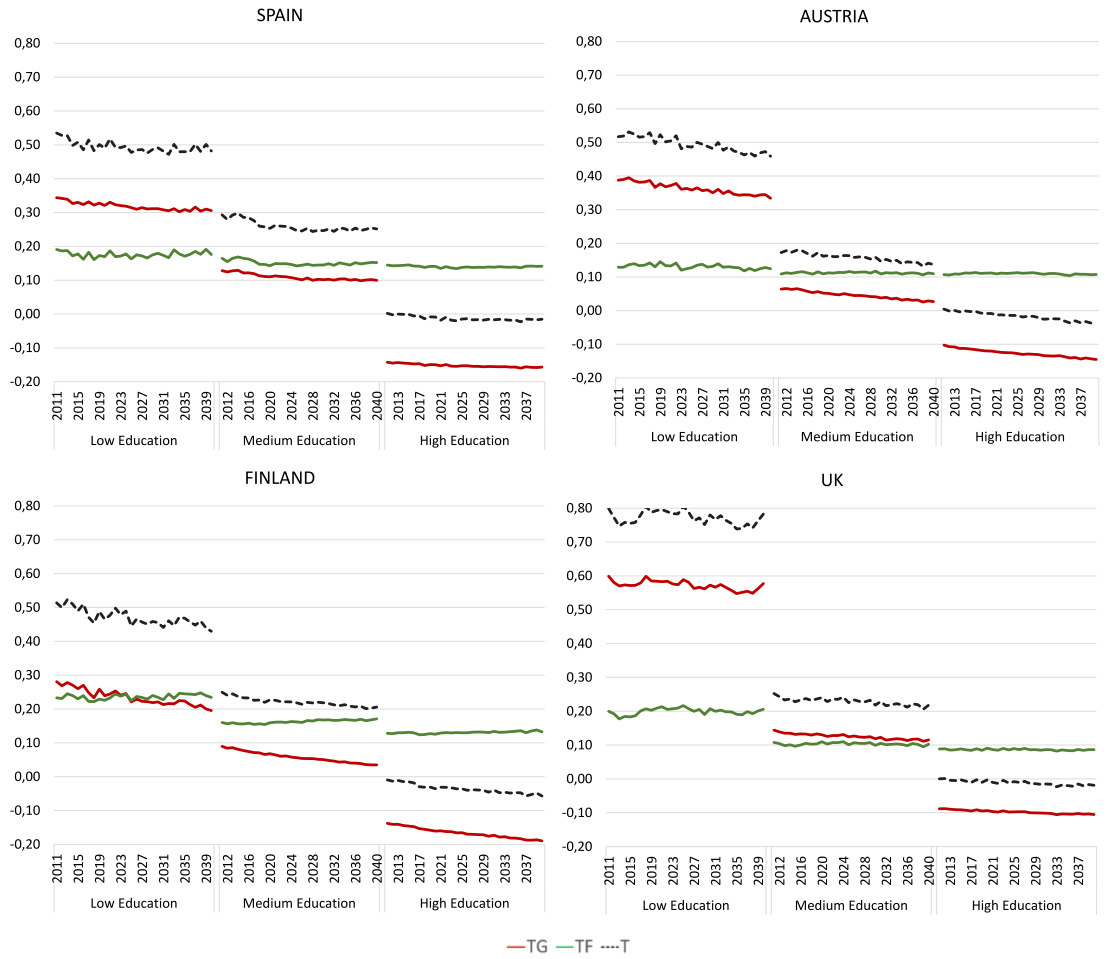

Fig. 8. Lifetime net transfers (public, private and total) received as a share of lifetime labor income by birth cohort and educational level.
Note: Net present value at birth of lifetime of public (TG), private (TF) and total (T) transfers as proportion of the present value of lifetime labor income.
Source: Authors' calculations.

In Fig. 9, we observe that, as expected, labor income increases with the level of education, being higher for males. The gender gap in labor income is observed in all four countries, whatever the educational level or parenthood status. As shown in Table 1, which summarizes results for the cohort born in 2011, the gender gap in labor income is always larger for parents (indicating market/non-market labor division), especially in the UK and Austria. This probably results from the low concern about gender equality in the liberal welfare state (UK), and from the traditional family norms emphasized in the continental welfare state model (Austria). On the opposite side, the lowest gender income gaps are observed for non-parents in Finland and Spain, where childless males' labor income represents 102% and 104% of females in the same country, respectively.

Besides the gender gap, our results make it possible to observe the existence of a *parenthood gap*, capturing the differences in labor income between parents and non-parents for both genders. Interestingly, as shown in Table 1, in all four countries fathers earn more labor income than childless men at any level of education, while just the opposite occurs to women: mothers at any level of education earn less labor income than childless women. The lower participation of mothers in the labor market is probably the main explanation. The UK and Finland present the highest parenthood gap for men, while Austria displays the lowest. However, the picture is exactly the opposite for women, Austria showing the highest differential between mothers and non-mothers, and Finland the lowest. This can again be linked to the welfare states' literature, relating the conservative welfare state with the traditional role of the family (and particularly, women caring for children), whereas in the social-democratic model the state takes responsibility for children to a greater extent, promoting full employment of women.

Regarding transfers, in Fig. 9 (absolute terms) and 10 (in relation to labor income) it can be appreciated that the importance of public and private transfers varies across countries. Overall (without distinguishing by education, sex and

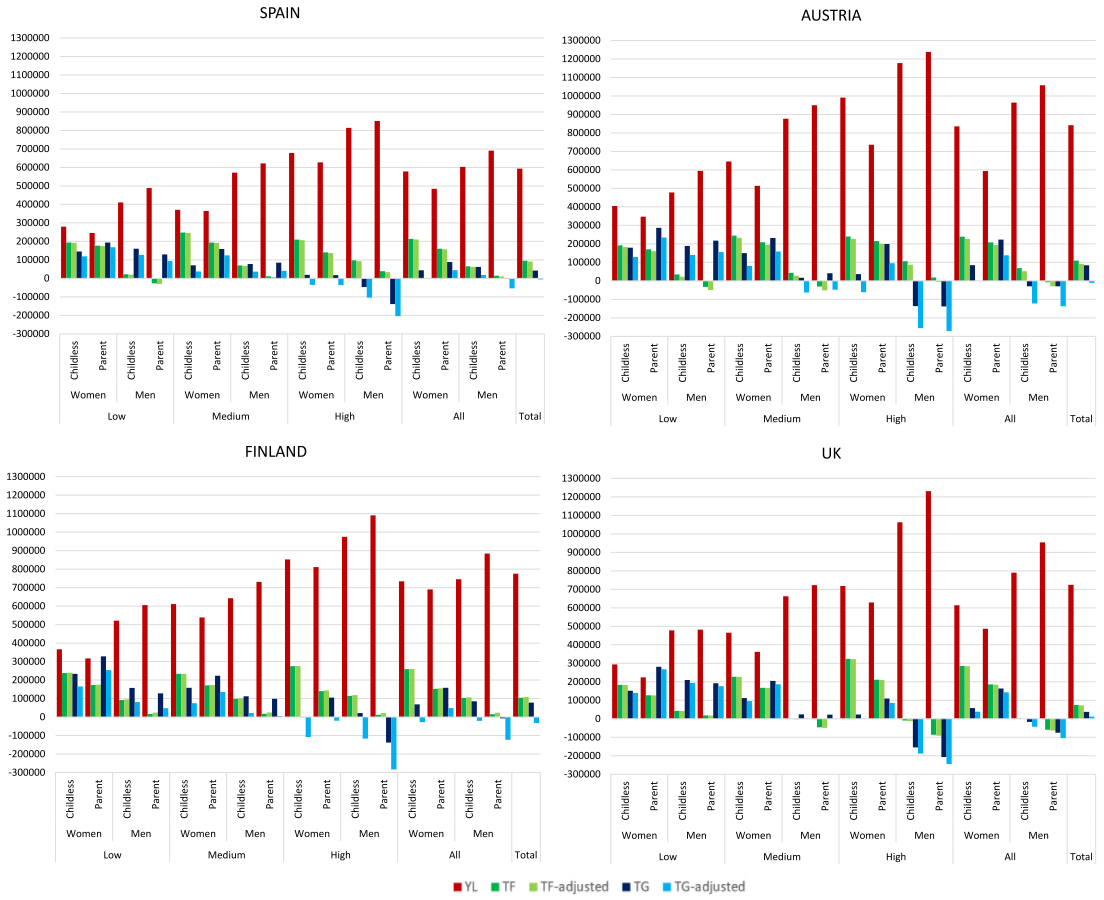

Fig. 9. Lifetime labor income (YL) and net public (TG) and private (TF) transfers received for representative individuals born in 2011.
Note: Present value (in €) of labor income (YL), net private transfers (TF), and net public transfers (TG) adjusting or not balancing budgets.
Source: Authors' calculations.

Table 1
Differences in lifetime labor income by gender and parenthood status (cohort born in 2011).
Source: Author's calculations.

	Gender gap (men/women)		Parenthood gap (parents/non-parents)	
	Parents	Non-parents	Men	Women
ES	143%	104%	115%	84%
AT	178%	115%	110%	71%
FI	128%	102%	119%	94%
UK	196%	129%	121%	79%

parenthood status), net public transfers are higher than private transfers in Finland (13% vs 10% of the labor income, respectively, in Fig. 10). The situation is just the opposite in the other three countries: Spain shows the highest value for private transfers (16%), followed by Austria (13%) and the UK (10%), while TG are 7%, 10% and 5%, respectively. Our results clearly show the North-South gradient of the welfare states: in Mediterranean countries, dependents rely more on private than on public transfers, whereas in social-democratic countries just the opposite occurs. It is important to note, however, that considering the adjustments to keep the public budget balanced dramatically changes the amount of public transfers received, as it is drastically reduced until turning negative, except in the UK. In this respect, it is particularly interesting to look at the differences by educational level and by gender.

As for the educational level, it is worth mentioning that the low and medium educated are always net recipients of public transfers, women receiving more than men. For the high educated, the gender difference becomes even more visible, as men become net payers, while women remain as net recipients. Hence, women are net receivers of public transfers in the four countries in relation to any characteristic, these transfers being more beneficial for mothers than for childless women. This parenthood gap in public transfers received is especially high in Austria and the UK, while Spain

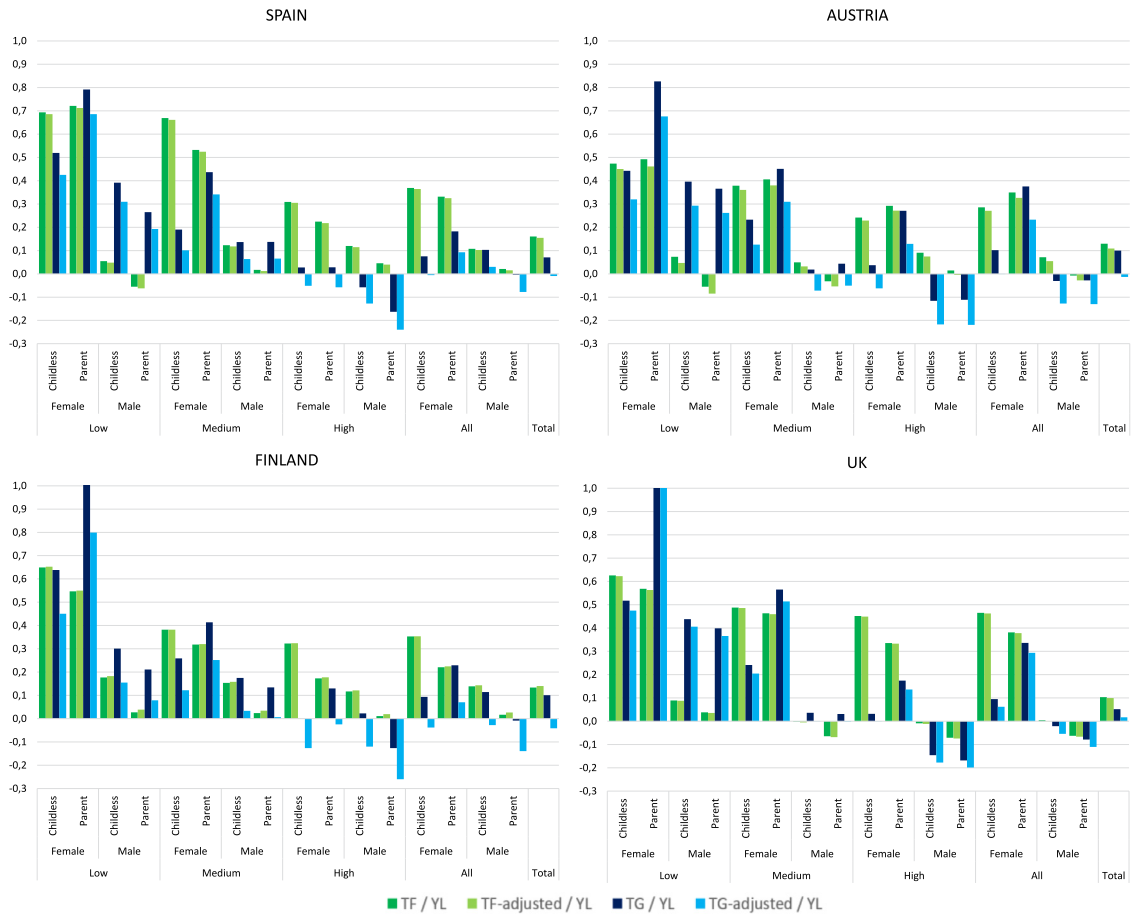

Fig. 10. Lifetime net transfers (TF, TG) as a share of lifetime labor income (YL) for representative individuals born in 2011.
Note: Net present value of private and public transfers as proportion of labor income adjusting or not balancing budgets.
Source: Authors' calculations.

shows the lowest figure. Results in total values (Fig. 9) again exhibit the lowest amount of public transfers received by mothers in Spain, revealing the weakness of family policies in this country.

Even when the annual adjustments are applied to keep the public budget in equilibrium, women continue to be net recipients of public transfers, except for childless women in Spain and Finland, where they become net payers (although very close to zero). In the case of men, however, we observe that they are net payers in Austria and the UK, but net receivers in Spain and Finland. Interestingly, with the exception of Austria, the difference in this case is in favor of childless men, who receive more public transfers than fathers (Spain and Finland) or pay less (UK). When adjustments are applied, men always become net payers, with the sole exception of childless men in Spain, who remain as net recipients.

To better illustrate the results by gender and parenthood status, Table 2 details the disaggregated value of public transfers received (inflows, TGI) and paid (outflows, TGO) by an average man (panel a) and an average woman (panel b) born in 2011. In absolute values, fathers receive more public transfers (TGI) than childless men, but they also pay more (TGO). In relative terms, the results are the opposite in most cases: fathers receive less TGI as a share of the present value of their labor income in all cases except in Austria, where fathers receive slightly more. Mothers benefit more from public transfers (TGI) than childless women, except in total terms in Spain. Regarding their payments (TGO), as a share of their labor income mothers pay more than childless women, but this is mainly due to their lower labor income, as in total terms mothers pay less than childless women except in Finland (precisely the country with the lowest labor income gap between mothers and non-mothers).

To understand the differences between countries, the last rows in each panel of Table 2 are particularly helpful. For example, in Spain, fathers pay public transfers (TGO) 22% more than childless men, while they receive (TGI) only 6% more. A similar situation is observed in Finland and the UK. By contrast, Austria seems to be more father-friendly, as they receive 12.8% more in public transfers than childless men, paying 12.2% more. The picture is completely different for women: only in Finland is the present value of public transfers paid by mothers higher than for childless women (3.5% more). However,

Table 2
Detailed public transfers for the cohort born in 2011, by gender and parenthood status (not adjusted).
Source: Author's calculations.

	ES		AT		FI		UK	
	€	%YL	€	%YL	€	%YL	€	%YL
Childless men								
Present Value YL at birth	603,003		963,845		745,443		790,624	
Present Value TGI at birth	489,899	81.2%	707,859	73.4%	778,436	104.4%	572,546	72.4%
Present Value TGO at birth	427,645	70.9%	737,568	76.5%	693,019	93.0%	589,040	74.5%
Net present Value (NPV) TG	62,253	10.3%	−29,709	−3.1%	85,416	11.5%	−16,494	−2.1%
Fathers								
Present Value YL at birth	691,326		1,057,629		884,404		953,819	
Present Value TGI at birth	520,104	75.2%	798,458	75.5%	794,338	89.8%	610,409	64.0%
Present Value TGO at birth	522,369	75.6%	827,791	78.3%	801,451	90.6%	685,560	71.9%
Net present Value (NVP) TG	−2,265	−0.3%	−29,333	−2.8%	−7,112	−0.8%	−75,151	−7.9%
Ratio Fathers/Childless men								
PV YL	114.6%		109.7%		118.6%		120.6%	
PV TGI	106.2%		112.8%		102.0%		106.6%	
PV TGO	122.1%		112.2%		115.6%		116.4%	
Childless women								
Present Value YL at birth	578,232		835,848		734,354		613,817	
Present Value TGI at birth	502,838	87.0%	708,782	84.8%	716,423	97.6%	520,360	84.8%
Present Value TGO at birth	459,195	79.4%	624,011	74.7%	647,649	88.2%	462,076	75.3%
Net present Value (NPV) TG	43,642	7.5%	84,771	10.1%	68,774	9.4%	58,284	9.5%
Mothers								
Present Value YL at birth	484,617		594,193		690,143		486,950	
Present Value TGI at birth	501,779	103.5%	770,106	129.6%	828,297	120.0%	576,477	118.4%
Present Value TGO at birth	413,478	85.3%	547,225	92.1%	670,290	97.1%	412,640	84.7%
Net present Value (NVP) TG	88,300	18.2%	222,881	37.5%	158,008	22.9%	163,837	33.6%
Ratio Mothers/Childless women								
PV YL	83.8%		71.1%		94.0%		79.3%	
PV TGI	99.8%		108.7%		115.6%		110.8%	
PV TGO	90.0%		87.7%		103.5%		89.3%	

it is also in Finland where mothers receive more public transfers than non-mothers (15.6% more). Spain is at the other extreme, as mothers in this country receive even less than childless women.

Finally, regarding private transfers (TF) in absolute terms (Fig. 9), their present value is higher for childless individuals, which is perfectly consistent with the fact that they receive transfers from their parents while young, but they do not transfer resources to their children during their working age. For Austrian females, the difference is small and the opposite in relative terms (Fig. 10).

Fig. 11 shows the net present value of private and public transfers by education and parenthood status for the 2010 birth cohort, the youngest living cohort in the simulation model, exposed to the currently observed welfare state transfer with no adjustment. As noted above, net public transfers are highly redistributive among different educational groups — the low and medium educated being net receivers of public transfers, whereas the higher educated are net payers. The differences between low and high-educated individuals are more pronounced in Austria and the UK. In the UK, net public transfers for the low educated are substantially higher than in the other countries, especially for parents, again confirming that in liberal countries the state mainly takes care of low-income individuals. Moreover, the figure reveals that private transfers are the highest in Spain, which results from the important role of the family in Mediterranean countries. The exception is high educated childless individuals in the UK, who are the ones receiving the highest amount of private transfers, which could be explained by the lower coverage of public education and, hence, the higher private cost of education in this country (although this is also true for parents, childless individuals do not transfer money to their own children).

Presenting results by parenthood status and education, but not distinguishing by gender (as previously done in Fig. 10), allows us to observe that individuals are net recipients of private transfers over their whole lifecycle. This holds for all four countries, whatever their level of education and their parenthood status. This result is partly attributable to the discount effect in computing the present value: individuals are net recipients of private transfers at young ages and net givers at older ages, later transfers being discounted to a greater extent.[14] On the other hand, Fig. 11 also reveals that net private transfers are higher for non-parents in all the countries, independently of their level of education. This is mainly explained by the higher amount of private transfers that parents give when raising their children.

[14] See Appendix A for a discussion of the effect of discounting.

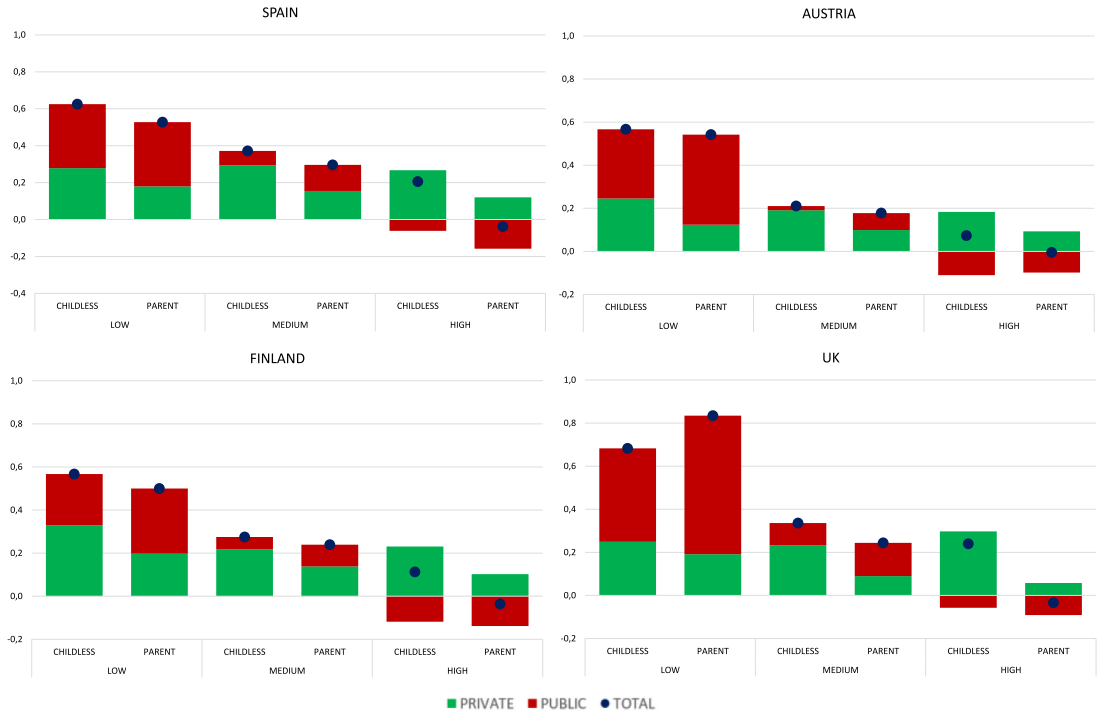

Fig. 11. Lifetime net transfers (TF, TG) as a share of lifetime labor income (YL) for representative individuals born in 2010 (by educational level and parenthood status).
Note: Results for the non-adjusted scenario, computed for the 2010 birth cohort.
Source: Authors' calculations.

The question arises as to whether, as a result of welfare state policies, lower net private transfers for parents are at least partially offset by a higher amount of public transfers received. The difference between parents and non-parents could result from family tax deductions, family benefits and different labor market participation rates, among other factors. However, this only holds for low and medium educated parents, who receive more public transfers than non-parents with the same educational level. Nevertheless, the higher amount of TG received by parents does not fully offset the lower level of TF, with the sole exception of the low educated in the UK.

Regarding the high educated, both parents and non-parents are net payers of TG but, in this case, parents pay more than non-parents with the sole exception of Austria (which again proves to be the parent-friendly country). At the other extreme, high-educated parents in Spain pay the highest TG and the difference with non-parents is the biggest, emphasizing the lack of family policies in this country.

Overall, Fig. 11 shows that, with the exception of the lowest educated group in the UK, the higher public net transfers addressed to parents (with respect to non-parents) are not enough to compensate for the lower net private transfers they received over their lifecycle. Interestingly, this result is understated by the effect of discounting, as child-related public transfers received early in life have a higher weight than old age transfers received at the end of life (see Appendix A).

5. Summary and discussion

In this paper, we aimed to analyze the inter and intragenerational income distribution across future generations in the face of ageing. Our study consisted of an extension of the National Transfer Accounts (NTA) methodology, using microsimulation techniques to project the future evolution of public and private transfers for both current and future cohorts, for heterogeneous agents in terms of education and parenthood status. We built indicators of future sustainability in the spirit of Generational Accounting (GA), also including private transfers. We started with the estimation of NTA (typically by age and gender) further disaggregated by level of education and family type. By doing so, we analyzed whether the effects of ageing can, to some extent, be offset or exacerbated by these other two characteristics of social organization, which are also experiencing deep changes. Then, NTA data for the base year (2010) were incorporated into a dynamic microsimulation model which produced the future evolution of the main variables of interest (income, consumption, and public and private transfers) for both the living and future cohorts (born from 2011 on). The model has been applied to four European countries (Spain, Austria, Finland and the UK), representative of the different welfare state models in Europe, in order to account for an eventual role of the welfare state design.

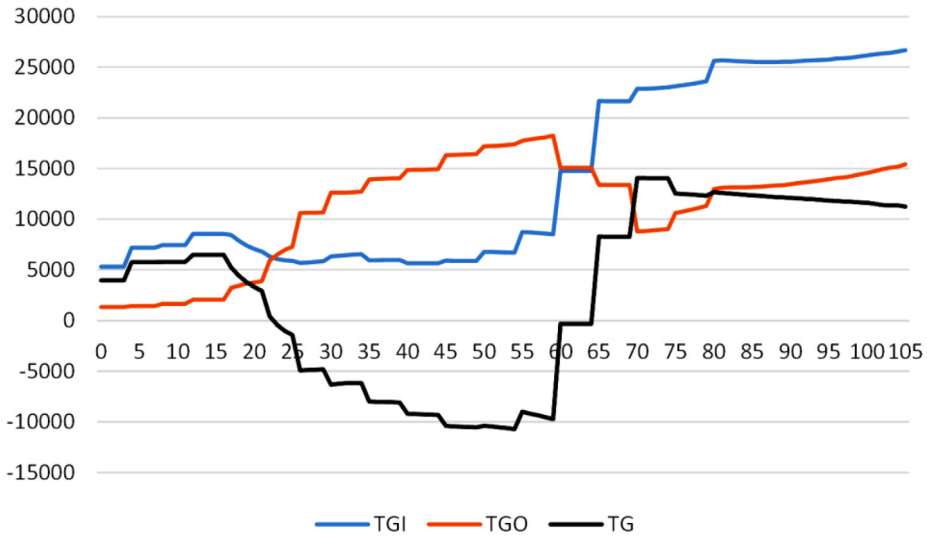

Fig. A.1. Estimated longitudinal age profiles of public transfers received (TGI), paid (TGO) and net (TG) for the representative individual of the cohort born in 2010 in Spain.
Note: values expressed in annual euros in the year when the cohort reaches the specific age. For example, age 0 corresponds to year 2010, age 1 to year 2011, and so on.
Source: Authors' calculations.

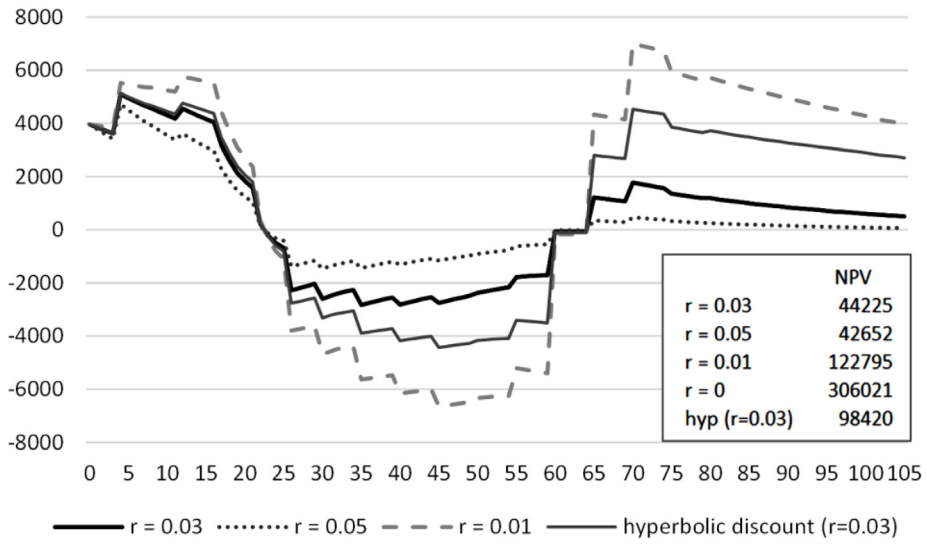

Fig. A.2. Estimated longitudinal age profiles of net public transfers received (TG) by the representative individual of the cohort born in 2010 in Spain using different discount rates.
Note: Annual values in euros of year 2010 (age 0). The box summarizes the net present value (NPV) at age 0 of the total lifetime transfers received (the sum of the age profile).
Source: Authors' calculations.

Our results allow us to observe current and future income distribution from different dimensions. First, within each cohort (intragenerationally), results reveal how resources are produced and shared differently according to vital characteristics such as gender, the level of education and the parenthood status of individuals. Moreover, we have identified some cross-country differences which can be linked to the welfare state models' literature.

Second, we have simulated the expected changes in labor income and transfers (both public and private) given and received by future cohorts over their lifecycle (intergenerational dimension), and analyzed how the different characteristics of each cohort (age composition, level of education and family structure) impact on that evolution.

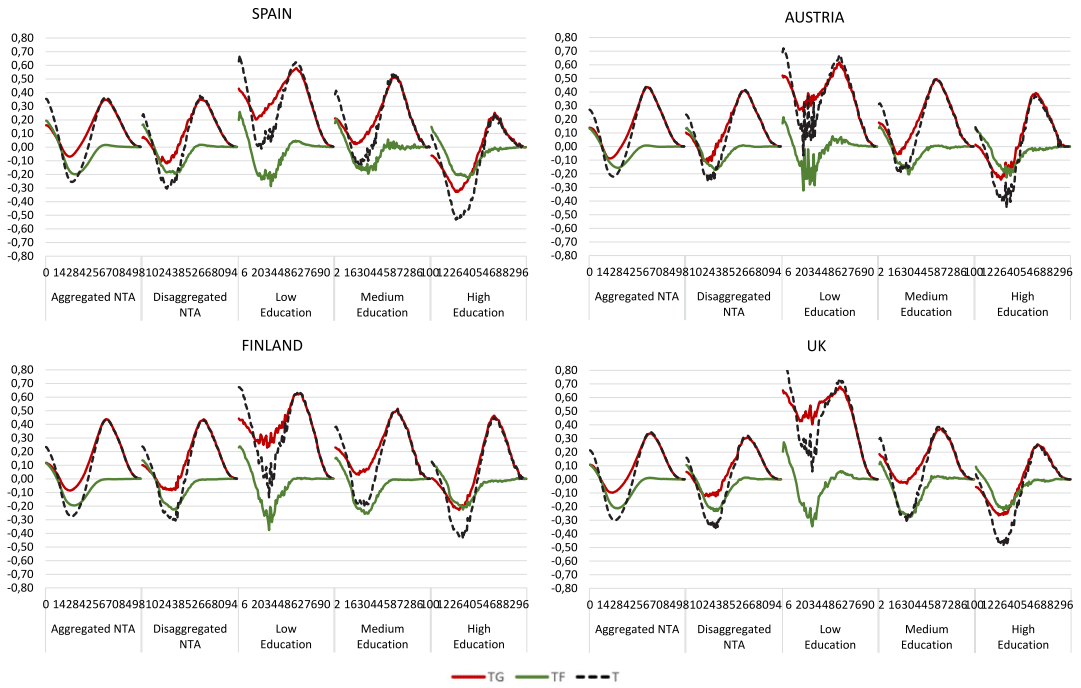

Fig. B.1. Full Generational Accounts for the generations alive in 2010, by level of education.
Note: Full Generational Accounts = net present value in 2010 of future lifetime transfers received by cohorts alive in 2010, as proportion of the present value of the labor income earned by the cohort born in 2010. Each age represents a different cohort, according to the age they have in 2010. Results do not include adjustments to balance budgets.
Source: Authors' calculations.

Starting with the youngest of the living generations, the cohort born in the base year of the simulations, our results predict that public transfers would be highly redistributive among the three educational groups, the low and medium educated being net receivers while the high educated are net payers. This is an expected result, confirming public transfers as an important device to protect low-income individuals (given the high correlation between education and income). Nevertheless, differences among countries arise. Interestingly, the lowest educated group in the UK receives substantially higher net public transfers as compared to the rest of countries, which is consistent with a liberal welfare state mainly geared towards protecting the poorest. As for parenthood status, the obvious difference for any level of education is that parents receive lower private transfers (over their whole lifecycle) than childless people. This is due to the fact that parents, in the middle of their life, must share their income with their children, while childless people do not. We observed that only low and medium educated parents receive more public transfers than non-parents with the same education, which partially offset the costs of raising children. The only exception is the lowest educated group in the UK, where parents receive more total transfers thanks to public benefits. By contrast, the high educated are net payers to the public sector, as abovementioned, but in this case parents contribute more than non-parents. The exception is Austria, which was shown to be the parent-friendly country in our analysis. This is consistent with the conservative welfare state model, highly focused on the traditional family role. At the other extreme, high-educated parents in Spain pay the most to the public sector and show the biggest difference with non-parents, emphasizing the lower generosity of family policies in this country.

Besides the usual gender gap in labor income (always in favor of men), here measured in lifecycle terms, we have also identified a *parenthood income gap*. In all four countries, fathers earn higher labor income than childless men, while the opposite occurs with women: mothers earn less labor income than childless women (for any level of education). The UK and Finland present the highest differences in labor income between fathers and non-fathers, while Austria has the lowest. However, the picture is exactly the opposite for women, Austria showing the highest differential between mothers and non-mothers, while Finland has the lowest. This can again be linked to the welfare state literature, relating the conservative welfare state (Austria) with the traditional role of the family, while in the social-democratic model the state takes responsibility for children to a greater extent, promoting full employment of women. In any case, women seem to be double harmed in the labor market: on the one hand, they earn less labor income and, on the other, parenthood reduces their labor income even more, while the opposite occurs for men.

Regarding public transfers, results show a clear North-South gradient: in Spain, dependents (especially children) rely more on private transfers, while in Finland the reverse occurs. It is worth mentioning that, when adjustments are applied

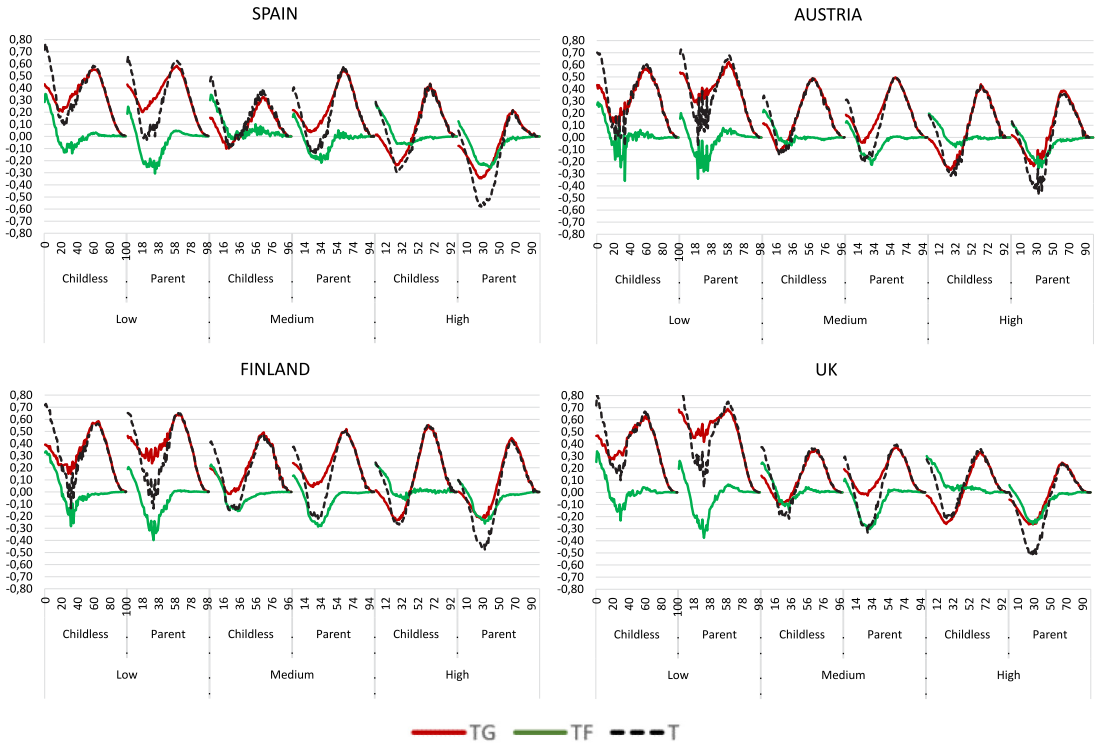

Fig. B.2. Full Generational Accounts for living generations by family type and education level.
Note: Full Generational Accounts = net present value in 2010 of future lifetime transfers received by cohorts alive in 2010, as a proportion of the present value of the labor income earned by the cohort born in 2010. Each age represents a different cohort, according to the age they have in 2010. Results do not include adjustments to balance budgets.
Source: Authors' calculations.

to keep the public budget balanced, the amount of public transfers received by the 2011 cohort is reduced to such an extent that it becomes negative, except in the UK where it remains positive although very close to zero. However, it is interesting to distinguish what happens specifically by level of education, gender and parenthood status. First, women are always net recipients of public transfers, with a parenthood gap (in favor of mothers) especially high in Austria and the UK. By contrast, Spain shows the lowest value of public transfers received by mothers, indicating the weakness of its family policies. Second, the low and medium educated are also net recipients of public transfers, while only high-educated men are net payers. With respect to private transfers, they show the same pattern observed in the base year: parents give much more than non-parents as they need to share their resources with their children. The question arises as to whether welfare state policies are able to compensate, at least partially, for the big effort made by parents by transferring a higher amount of public transfers to them. According to our results, this does not seem to be the case in general. Only the low and medium educated receive a higher amount of public transfers if they are parents, but not enough to fully offset the high amount of private transfers they make to their children, with the exception of the low educated in the UK.

As for the rest of future generations (those born after 2011), our simulation projected that all of them will remain as net recipients of private transfers, regardless of their level of education, gender and parenthood status. The differences in the amount received would depend mainly on being or not being a parent, while the level of education would have a limited effect. Nonetheless, results for public transfers are substantially different. On reducing public benefits received and increasing taxes paid to keep the public budget balanced, the amount of net public transfers received by the unborn cohorts starts to be slightly negative in Austria and Finland and steadily decreases for future generations. The trend is repeated in the other two countries, which start from slightly positive values, but these turn negative for later cohorts. Summarizing, future cohorts are expected to receive lower public transfers the later they are born. However, they will receive a similar amount of private transfers, which are also very similar across levels of education, while they differ by parenthood status. We can conclude that, as private transfers show a high gap between parents and non-parents which public transfers cannot offset (and they are progressively more limited), the parenthood gap will remain, or even increase, for future generations.

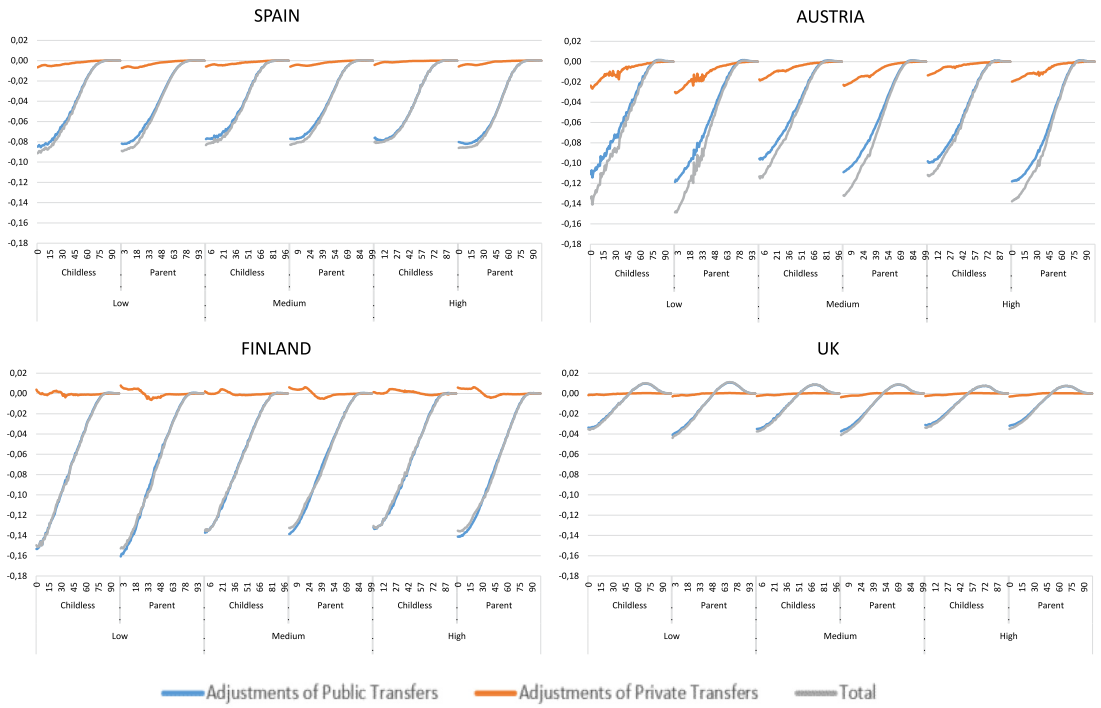

Fig. B.3. Required budget adjustments in the lifetime private and public transfers as a share of lifetime labor income, cohort born in 2010.
Note: For each cohort alive in 2010 (according to its age in that year) required adjustments in the net present value of private and public transfers to keep budgets annually balanced, expressed as a share of the present value of the 2010 newborns labor income.
Source: Authors' calculations.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. The impact of discounting

Computing indicators in Generational Accounting implies using a discount rate in order to properly aggregate monetary values corresponding to the different years over the lifecycle. However, the effect of the discount rate used is not neutral, as long as the age profiles of the magnitudes relevant in this study (public and private transfers) have a particular shape. Net public transfers are typically positive during the first stage of life, as children receive some public benefits such as education while they pay low taxes. Moreover, they are particularly high at old ages, when participation in the labor market finishes and most individuals receive important public benefits as retirement pensions, health assistance, long-term care, etc. By contrast, during central working ages, the net public transfers for the representative individual are negative, as taxes paid are higher than the public transfers received.

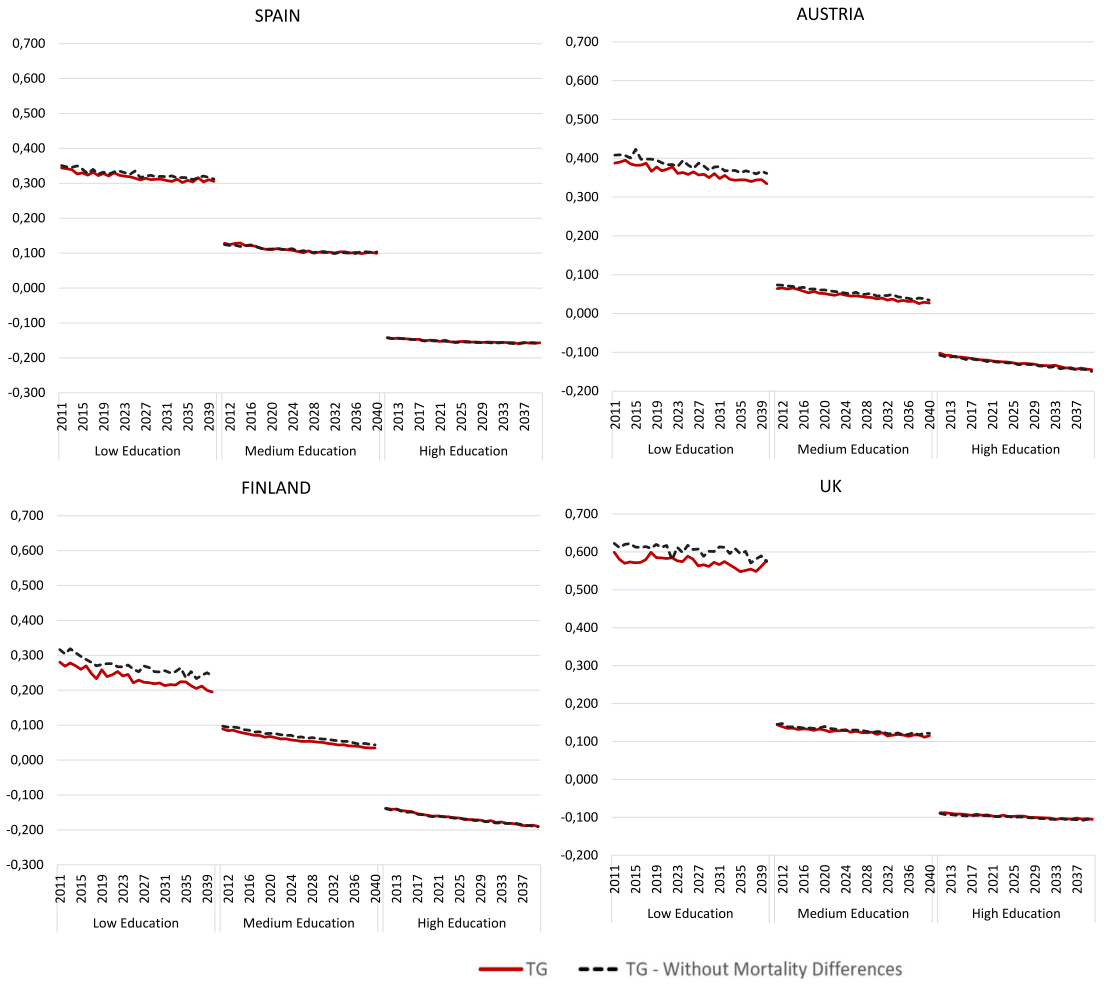

Fig. C.1. The effect of mortality differences by education on the net present value of public transfers (TG).
Note: Net present value of lifetime net public transfers received as a share of the present value of lifetime labor income by birth cohort, base scenario vs a scenario without mortality differences by education.
Source: Authors' calculations.

As an illustration, Fig. A.1 shows the estimated longitudinal profile of public transfers that the representative individual of the cohort born in 2010 in Spain will receive (inflows, TGI) and pay (outflows, TGO), over their lifetime, together with the net public transfers profile (TG = TGI - TGO).

The shape of the net public transfers profile observed in Fig. A.1 is exactly as expected: positive during childhood and older ages, but negative for most of working ages, specifically between ages 23 and 64. Note that the representative individual pays taxes to the public sector throughout their lifecycle, although they are particularly high during central working ages. Regarding transfers received, they become especially important after age 60, coinciding with the beginning of retirement (and the increase in health care needs).

Since these magnitudes correspond to different periods over the lifetime, a discount procedure is necessary to compute the total value of the longitudinal profiles represented in A.1, in order to obtain Generational Accounting indicators. However, it is clear that the choice of the discount factor applied will significantly impact the resulting amount. As the most positive transfers are concentrated at the end of life (after age 60), their present value (at age 0) will be lower the higher the discount rate applied. By contrast, the modest positive transfers received during childhood will have a higher weight. Fig. A.2 illustrates this by displaying the age profile of net public transfers for the representative individual born in 2010 in Spain, discounted using different rates. A discount rate of 3%, as used in the results presented in this paper, produces TG profiles with higher amounts received during childhood than during old age, just the opposite to that observed without discounting. A discount rate of 1%, however, would allow us to maintain a certain importance of the transfers received by the elderly. Fig. A.2 also presents the results obtained applying hyperbolic discounting (with an initial discount rate of 3%). There is increasing literature arguing that people are time inconsistent, and hence do not

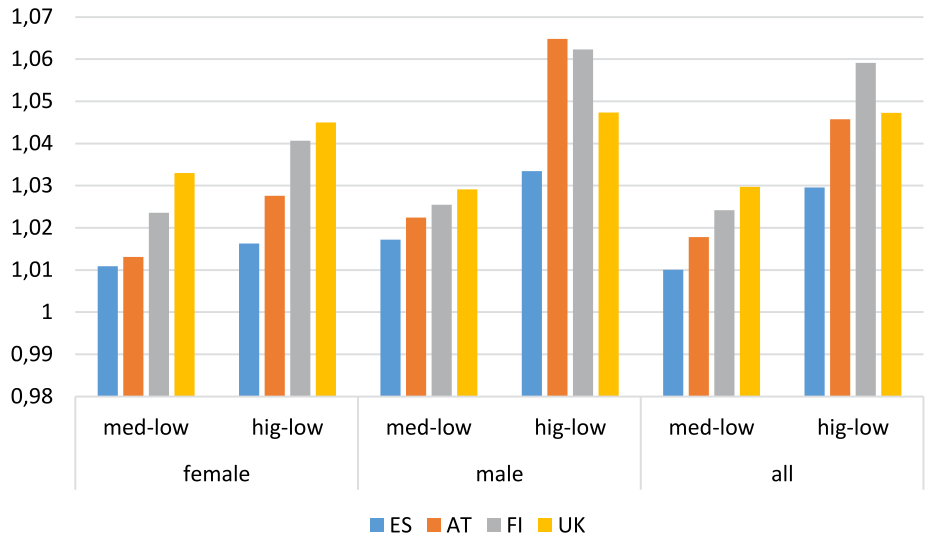

Fig. C.2. Differentials in life expectancy between medium and low educated; and between high and low educated in the base year (2010). *Source:* Murtin et al. (2017) and Requena (2017) for Spain.

apply a constant discount rate to the future (Ainslie and Haslam, 1992). With hyperbolic discounting the actual discount rate applied decreases over time. As shown in Fig. A.2, the scenario with constant and hyperbolic discount is closer at the beginning and becomes more distant progressively. The resulting present value is mitigated with respect to the constant discounting at a 3% rate.

Appendix B. Full Generational Accounts (FGA) for living cohorts in the base year

While the results presented in the paper mainly focus on newborns and future generations, in this Appendix we show the projection results for those cohorts already alive in 2010, before our projection starts, according to their age in that year. Fig. B.1 shows the NPV of public transfers (Generational Accounts, GA) together with the corresponding figure for private and total transfers (Full Generational Accounts, FGA) in 2010. It is worth noting that only the values for age 0 (those born in 2010) include the full lifecycle flows. For all the rest of the cohorts, the values refer to their remaining lifetime transfers, which explains the age shape. Net private transfers are in general positive for children and negative for cohorts of working age, tending to zero afterwards. Public transfers are also positive for children and negative at working ages, while they become strongly positive for the elderly.

For the average individual born in 2010, the net present value of transfers received is positive for both public and private transfers, with both aggregated and disaggregated NTA data and for the three levels of education. When children start growing up, two forces interact. On the one hand, the transfers still to be received are lower, and this reduces their NPV. On the other hand, the payments to be made during working age become closer, reducing the NPV of the net transfers as well. Both effects explain the decreasing trend observed for the first ages (which are, in fact, different cohorts). When young adults enter the labor market, the payments to the public sector start, as well as transfers to their own children a little later, and therefore the remaining payments to the public sector start decreasing. This explains the increasing path of the NPV for both TF and TG observed for those cohorts in their late 20s. The NPV of private transfers tends to zero, while an additional effect occurs for public transfers. As adults age, the future pension receipts (and other positive transfers like health) become closer, and the NPV continues increasing until they retire and start receiving pensions, and therefore the transfers left decrease, again tending to zero. The age path of total transfers follows this evolution, in the end mainly being driven by public transfers, as private transfers become close to zero. This age pattern is reproduced at all educational levels. The shape of the NPV of private transfers is quite similar by education level, while substantially different for public transfers. In the four countries, the low educated in every cohort are net recipients of public transfers. Likewise, in Finland and Spain, the medium educated are also net receivers. However, the high educated are always net donors in all countries (up to the cohort aged 43 in the base year in Finland, 46 in Austria, 49 in UK and 52 in Spain).

Fig. B.2 shows the same results further disaggregated by parenthood status. The pattern of private transfers differs clearly between parents and childless people — the former giving substantially more during their working lives. In the case of public transfers, there are visible differences by educational level. The low and medium educated parents receive more net TG than non-parents in the same group, while the opposite occurs for the high educated. This result repeats for almost every cohort.

Previous Figs. B.1 and B.2 show the projected net present value of transfers received for cohorts alive in 2010 without considering adjustments needed to keep public and private budgets balanced year by year. Fig. B.3 completes the picture

by showing the necessary annual adjustments to maintain the balance in both cases. As observed, the adjustments are in general low for private transfers while sizeable for public transfers. Understandably, the magnitude of the adjustment is lower for older cohorts (tends to zero for those aged 90+ in 2010). For the youngest, however, it reaches a considerable size in Finland and Austria and a little less in Spain, while the UK shows the lowest adjustments in public transfers.

Appendix C. Sensitivity scenario: effects of mortality differences by level of education on public transfers

Our analysis has benefited from incorporating into the projection model NTA data disaggregated by level of education (among other categories). Education plays a key role in most lifetime events, including fertility and mortality. In particular, life expectancy grows with the level of education, and we wonder how this fact could affect our estimations. In order to properly evaluate this, we performed an exercise computing the net present value of public transfers received by future cohorts, eliminating the differences in the mortality rates by level of education (Fig. C.1). However, we maintain the differences by level of education observed in the age profiles estimated for the base year (Figs. 2 and 3 in the text).

In the presence of mortality differentials by level of education, an increase in average pensions is expected, since those with higher pensions, on average, live longer. The pension is received for a longer period, as well as other in-kind or cash transfers, like health and long-term care benefits. Consequently, a higher adjustment of public transfers is required to balance budgets in the future, which negatively affects all education groups. For the less educated, both their shorter life and the required additional adjustments have a negative impact on the NPV of their public transfers. For the high education group, longer lives and additional adjustments have opposite effects. Fig. C.1 shows that the effects cancel each other out in the high and medium education groups (only a very limited impact is observed for medium educated in Finland). In contrast, the low educated group would receive a lower level of net public transfers. In Finland and the UK, the low educated lose more than 2 percentage points of their public transfers in proportion to the PV of their lifetime labor income, and a little less in Austria. In Spain, the negative effect is very limited, due to the lower mortality differentials by level of education in this country, as shown in Fig. C.2.

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