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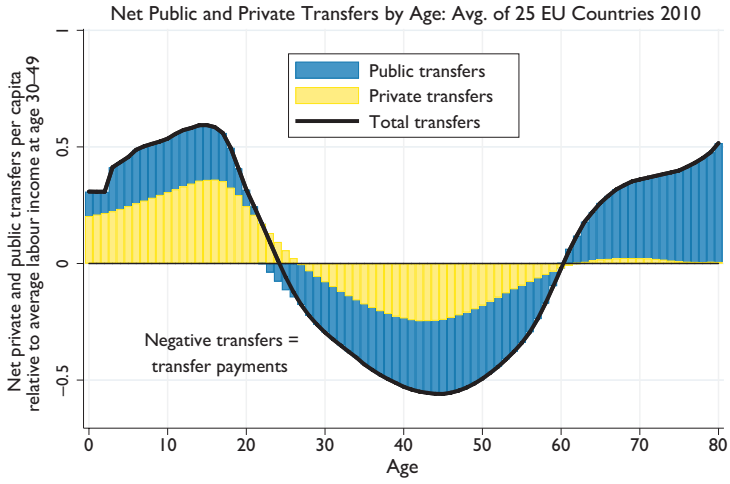

"Population Ageing and Intergenerational Redistribution"

Guest Editors: Bernhard Hammer, Ronald Lee, Alexia Prskawetz, Miguel Sánchez-Romero

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Guest editors:
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Miguel Sánchez-Romero

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Analyzing population ageing and intergenerational redistribution: NTA and AGENTA

Ronald Lee[1,*] ***and Andrew Mason***[2]

This special issue of the Vienna Yearbook contains chapters derived from the EU-funded AGENTA project, which uses and extends the methods of the National Transfer Accounts (NTA) project to shed light on the ways in which the families and governments of Europe draw on the earnings of the working-age population to support both children and the elderly. Before turning to the fascinating studies included in this Yearbook, we will provide some context regarding support systems, global demographic change, NTA, and AGENTA.

Support systems

The market economy allocates incomes to individuals according to their contributions to production through working or investing. But although children neither work nor invest, they have consumption needs. While some elderly people work and can depend partly on their savings, these resources are insufficient to meet their consumption needs in many countries. The gap between consumption and labor and asset income is filled through public and familial support systems that reallocate income from people who work and hold wealth to the young and the old. We call these reallocations "intergenerational transfers." Unlike market exchanges, these transfers are much like gifts, as they come with no explicit *quid pro quo*. The support systems of countries vary. Across countries, we see differences in the mix of public and private transfers to the young and the old, the degree to which the elderly generate labor and asset income, and the consumption needs of children and the elderly. Over the course of a country's economic development, there tends to be a shift away from relying on family-based support systems and toward relying

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on the public sector to provide support through public pensions, health care, and education.

Global demographic change

Over the past 200 years, the populations of the world have been experiencing a process that has been called the "demographic transition." This term refers to a period of demographic change during which a population undergoes a transition from having high fertility and high mortality to having low fertility and low mortality. Typically, this change is initiated by mortality decline, particularly at young ages. This decline causes an acceleration of population growth, an increase in the share of children in the population, and a rising ratio of dependents to workers. This stage is soon followed by a decline in fertility, which ushers in many decades of slowing population growth and falling dependency ratios. These developments generate a so-called "demographic dividend," which boosts economic growth. The dividend phase ends when fertility levels off, survival rates at old ages increase, and the share of elderly in the population begins to rise. These developments lead to a long phase of rising dependency ratios and population aging. Moreover, these changes in a country's population age distribution interact with its support system. They generate benefits or stresses, depending on whether the numbers of people who are at ages when transfers to others are usually made grow or shrink relative to the numbers of people at ages when transfers are typically received. The economic consequences of these changes can be quite significant, and can give rise to enthusiastic hopes while the country is enjoying a demographic dividend, and to grave concerns while the country is experiencing population aging. How can we better understand these consequences, assess them in advance, and develop policies that influence and accommodate population change? How realistic are widely held perceptions about the consequences of the changing age structure?

National Transfer Accounts

The NTA project has produced a set of rigorous and consistent methods for measuring the flows of resources to and across ages and generations through the market, the family, and the public sector. The NTA framework provides a detailed numerical description of the support system of each country. These methods have been described and applied in Lee, Mason et al. (2011), and are presented in detail in a UN manual (United Nations 2013). The NTA project does not carry out any special surveys. Rather, it uses existing data sources, such as surveys, censuses, National Accounts, and administrative data. A distinctive feature of the NTA project is that it applies the same methods to all countries, regardless of whether they are rich and poor, are in the pre-transition or the dividend stage, or are experiencing population aging. This framework makes comparative analysis possible.

The international NTA project was launched by Lee and Mason in 2004, initially together with collaborators in seven countries. By 2019, the project had grown to include research teams in more than 60 countries distributed across Europe, North America, South America, Africa, Asia, and Oceania. A project website (http://ntaccounts.org) serves as a repository for the accounts generated for the countries, secondary measures generated using NTA data, working papers, and many other aspects of the project. NTA have been used extensively to study the demographic dividend, the consequences of population aging, and the support systems themselves. The organization of the project is decentralized, with each continent having a regional leader; though the core governing functions of the project are based at the East-West Center in Hawaii and at the University of California at Berkeley.

Over the past decade, the NTA framework has been extended in important ways. These include breaking down NTA by socioeconomic status; using NTA to study generational wealth; and constructing longitudinal NTA using multiple surveys going back in time. Of particular importance for this Yearbook is the extension of NTA to include "time transfers" based on the analysis of time use surveys. This extension permits the construction of NTA by gender, including time spent caring for children and the elderly, and on activities such as cooking, cleaning, shopping, home repair, and household administration. When the NTA framework includes the time/gender accounts, it is called National Time Transfer Accounts, or NTTA. Given that in most – or possibly all – societies women do the majority of work in the home, it would not make sense to construct NTA by gender without including home production. In the NTTA framework, the productive use of time in the home is valued according to its cost in the labor market, which is assessed by referring to the cost of hiring either a generalist housekeeper or, more typically, a worker to perform each type of activity, such as caring for children or preparing a meal. If a household member prepares a meal for a family of three, the cost (including time cost) of the meal is allocated to all three members, including the preparer. It is assumed that the preparer is making time transfers to the others, but not of the full time spent preparing the meal, since part of the time is consumed by the preparer him/herself.

AGENTA

The AGENTA project (http://www.agenta-project.eu) was started by the leadership of the European NTA: namely, Alexia Prskawetz (Austria), Hippolyte d'Albis (France), Robert Gál (Hungary), Agnieszka Chlon-Dominczak (Poland), Jože Sambt (Slovenia), Concepció Patxot (Spain), Tommy Bengtsson (Sweden) and David McCarthy (UK). These scholars successfully applied for four-year funding for the project from the European Union. AGENTA uses the NTA approach and NTA methods to describe and analyze the support systems in the countries of Europe, and to assess and project the consequences of population aging. One important task of this project has been to estimate the accounts based on harmonized

data from Eurostat. Such estimates were eventually generated for 26 of the 28 countries in the EU. Before this could be done, each country team estimated its NTA using the particular data available for that country. It is likely that this effort to create a harmonized regional dataset will remain unique within the NTA project, since in no other region of the world are the countries as closely knit as they are in Europe, which has a shared statistical agency. Interestingly, comparisons of these harmonized AGENTA estimates with those based on each country's own data have sometimes revealed discrepancies. Nonetheless, the harmonized NTA have permitted the extension of the accounts beyond the dozen or so EU countries that have teams. The broad, harmonized base of European NTA data can be used for comparative analysis, as we will see in some of the papers in this Yearbook. The project completed its work and ended with a conference in Vienna in December of 2017. Earlier versions of many of the papers in this volume were presented at that meeting.

With that background in mind, we can now turn to describing the chapters in this Yearbook. The chapter by Sánchez-Romero, Abío, Botey, Prskawetz, Sambt, Juvés, Souto, Vargha, and Patxot uses a computable OLG model with realistic demography to assess the consequences of population aging, while drawing on both NTA and NTTA. The results of this analysis show that without policy changes, there will be a large increase in the share of GDP going to public transfers. In their comparison of transfers in Spain, Austria, and France, they find that the public sector in Spain redistributes the most income to older individuals, while Austria redistributes the least. They simulate two policy options for coping with the fiscal pressures of population aging: raising the retirement age, which effectively reduces benefits for the elderly; and raising taxes, which effectively increases the transfer of income from working-age adults to the elderly.

The chapter by d'Albis and Badji assesses gender and intergenerational inequalities in France using a measure (i.e., the mortality-adjusted disposable income), which reflects both length of life and income. They find that although this measure has increased substantially over time, its growth is entirely due to increases among women, while progress among men has stagnated for the generations born after 1946.

The chapter by Chlon-Dominczak, Abramowska-Kmon, Kotowska, Łątkowski, and Strzelecki uses the harmonized NTA to investigate the welfare state typologies in the literature and the differences in welfare state structures across the EU. They find that countries fall into one of three groups: most of the countries in the middle are quite similar; but the Scandinavian countries plus Luxembourg have more generous public transfers, particularly to the elderly; while some of the Central and Eastern European countries have less generous transfers. As we discussed above, population aging interacts with the support system – which in this context is the welfare state – to exacerbate or to relieve fiscal pressures. But how does the state respond? An important finding in this paper is that the Scandinavian countries tend to raise taxes and maintain benefit rates in the face of population aging, while Central and Eastern European countries tend to cut their benefits. We don't know

how countries will respond to aging in the future, but this chapter shows us two of the possible paths.

In Sweden, raising the retirement age has been the main strategy for meeting the challenges of population aging due to rising life expectancy, according to the paper by Bengtsson, Qi, and Scott. They describe how increases in the retirement age affected different social groups in the Swedish population from 1980 to 2011.

Several of the chapters use NTTA and time transfer data to address a range of questions. A chapter by Šeme, Vargha, Istenič, and Sambt looks at the age patterns of unpaid household work by gender, and at how these patterns have changed over time. They find that although these trends differ by gender, certain patterns remain the same: i.e., time transfers are mainly from women to men, and from the working-age population to children and – albeit to a lesser extent – to the elderly.

One important question, which is addressed in the chapter by Zannella and De Rose, is how the recent recession affected time use and time transfers. They find that it was not until the recession reduced the market work hours of men that the hours of unpaid work performed by men in the home began to increase.

A chapter by Dukhovnov and Zagheni analyzes time transfers in the U.S., and examines how these transfers differ across population subgroups. They also introduce a new measure, the Care Support Ratio (CSR), which indicates how household time budgets vary depending on household composition. They use this measure to show that population aging in the U.S. will put pressure on informal care giving.

Taken together, these seven papers illustrate the wide range of topics and approaches that can be drawn from the NTA.

Finally, the last contribution in the data section summarizes the basic principles and data used to set up the European National (Time) Transfer Accounts, and illustrates the age profiles of selected variables for the EU-25 average.

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Welfare state winners and losers in ageing societies

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Abstract

In this paper, we analyse the impact of population ageing on the sustainability and the intergenerational fairness of public fiscal policy in three selected European countries (Austria, France, and Spain). We use NTA and NTTA data, and introduce these data into a large-scale general equilibrium OLG model with realistic assumptions regarding demographic trends and changes in population structure. The results for sustainability show a sharp increase in the share of public expenditure to GDP for the main programmes of the welfare state. In the three countries analysed, public policies (e.g. education, health care, and pension benefits) redistribute income from younger individuals to older individuals. Our findings indicate that these policies redistribute more resources to older individuals in Spain and fewer resources to older individuals in Austria. We consider the effects of several reform scenarios, including simulations in which the statutory retirement age is raised and the tax base for financing health care expenditures are changed. We also describe the consequences of the population having a fixed level of educational attainment.

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1 Introduction

It is widely acknowledged that population ageing poses a challenge to the welfare state by exerting severe fiscal pressure on its sustainability. Indeed, the age composition of the population directly affects the three main pillars of the welfare state: namely, pensions, education, and health. Over the course of the 20th century, European countries have introduced public pension systems that mainly operate on a pay-as-you-go (PAYG) basis, and that are financed through social contributions. Meanwhile, public education systems are mostly financed through general taxes, usually also on a (non-explicit) PAYG basis. The financing of public health care systems varies across countries. Social security health care models are mainly financed through contributions, while national health systems tend to be financed through general taxes. However, regardless of the method used, the financing of most of these programmes is not balanced from an intertemporal point of view. Given that tax payments are concentrated at working ages whereas public benefits are received primarily at dependent ages, the rapid ageing of the European population could threaten the long-term viability of these programmes.

The Overlapping Generations Model (OLG) is a framework that can be used to investigate the impact of population changes on the sustainability of public budgets. In this model, households make their lifecycle decisions at different ages, while interacting with other agents. In this paper, we follow the accounting framework in Bommier and Lee (2003), who studied the static and dynamic properties of a productive market economy in a continuous time OLG model with a general age schedule of mortality. These authors discussed the dimensions of the sustainability accounting scheme, and examined the dynamic link between cross-sectional and longitudinal accounts. From a cohort lifecycle perspective, they measured the net contribution of each cohort to the public coffers using the present value of net expected benefits at birth. This present value is defined as the survival-weighted discounted sum of benefits received minus taxes paid at each age for each generation along its entire lifecycle. If the present value equals zero for every birth cohort, the transfer system is said to be "lifecycle balanced". From a cross-sectional perspective, they defined the population-weighted average flow of a transfer system in a given year as the sum at each age of the net benefits received from the transfer system by all individuals of that age, divided by the size of the population in the corresponding year. If the average flow is equal to zero for every year, it is said to be "population balanced"; i.e. all of the transfer system's flows aggregate to zero at any time. While this would be the case in a perfectly balanced PAYG system, the government can escape this constraint by issuing public debt or accumulating wealth. Interestingly, in a context in which the population structure is changing, intertemporal sustainability is not guaranteed, even when these two conditions are met.

An extensive list of indicators of the sustainability of a public budget can be found in the literature. Gal and Monostori (2014) distinguished between cross-sectional and long-term (or intertemporal) indicators. Cross-sectional indicators

refer to variables (mainly taxes and benefits) of the same year (as in the population-balanced case mentioned above), while long-term indicators refer to variables of many periods. A measure that synthetises these two types of indicators is the intertemporal budget constraint of the government, which takes into account not only the explicit debts of the past, but the implicit (and perhaps unfunded) future compromises that affect current and future generations. A clear example of such a measure is social security wealth (debt); i.e. the implicit wealth (debt) accumulated by a PAYG pension system. When referring to the whole public budget, the sustainability gap indicator is often used. In the generational accounting literature, this indicator refers to the residual in the intertemporal budget constraint of the government; i.e. to the portion of the current plus the foreseeable debt that is not covered by foreseeable taxes.[1] These kinds of indicators can then be translated into necessary tax or transfer adjustments (like the tax gap indicator).

Computing sustainability indicators requires a considerable amount of data. Fortunately, the recent development of National Transfer Accounts (NTA), which introduce the age dimension to National Accounts (NA), has significantly improved data availability (Lee and Mason 2011). NTA provide age profiles (in a given year) for all the NA categories, including taxes and transfers.[2] Moreover, as National Time Transfers Accounts (NTTA) incorporate time transfers, they provide a complete picture of all of the economic flows that are taking place in the economy (through both market and non-market activities) in a given year (Donehower 2014). The availability of these data opens up the possibility of investigating how changes in the age structure of the population affect the sustainability of the welfare state.

Bommier et al. (2010) used the NTA data to measure the net present value of monetary transfers in a partial equilibrium framework. In this paper, we take a similar approach, using a large-scale general equilibrium OLG model based on realistic assumptions regarding demographic trends and changes in population structure. In particular, we use the model developed in Sánchez-Romero et al. (2017) to derive results on the sustainability and the intergenerational fairness of public transfers in three European countries (Austria, France, and Spain). These countries differ in terms of the strength of their demographic transition, their path of development, and the generosity of their welfare state programmes.[3]

In order to undertake a comprehensive sustainability analysis that includes the cohort perspective, we rely on both NTA and NTTA data. Using NTTA data allows us to consider the labour supply decision, while taking into account the cost of raising children. Specifically, we start with the historical reconstruction of past NA

[1] See Bonin (2001). See also Lee et al. (2017), who developed a full generational accounting method that also includes private transfers.

[2] NTA data are available at www.ntaccounts.org, and more data for EU countries are also available at the AGENTA EU project web page http://www.agenta-project.eu and at the AGENTA Data Explorer http://dataexplorer.wittgensteincentre.org/nta/. For more information on the methodology, see UN (2013).

[3] See the Appendix for details.

data, and combine these data with the age profiles obtained from NTA and NTTA. This approach allows us to assess where past, present, and future generations are in the demographic transition process.

Interestingly, the strength of the effects of ageing on welfare state sustainability depends on a characteristic that has long been overlooked: namely, the extent to which social transfers are directed to people in the two stages of economic dependency along the lifecycle (childhood and old age). Indeed, upward transfers (from younger to older ages) suffer from lower returns as the population ages, while the opposite is the case for downward transfers (from adult to younger ages) like education. By introducing NTA age profiles, the model allows us to assess the consequences of the age composition of these social transfers.

The paper is organised as follows. Section 2 briefly describes the model and presents the general trends in sustainability. Section 3 is devoted to cohort analysis. The intergenerational fairness of public fiscal policy is evaluated by comparing the net contributions to public coffers of subsequent cohorts, who are affected differently by the tax adjustments that are likely to become necessary as the population structure changes. Section 4 considers the effects of several reform scenarios. In particular, we simulate the impact of delaying the retirement age and the impact of modifying the tax base for health care expenditures. We also look at the effects of a shift in the educational attainment levels of the population. Finally, Section 5 concludes with a final discussion.

2 Sustainability of welfare state programmes

2.1 The model

In the standard OLG model, individuals who differ only by age decide how to distribute their lifetime resources between consumption and savings along their lifecycle. The model we use differs from the standard model in several respects.[4] It is a large-scale model[5] that incorporates realistic demography[6] (Bommier and Lee 2003), with households consisting of an adult who may live up to a maximum of 105 years, facing mortality risk as in Yaari (1965), and having a number of dependent children. The composition of each household varies by age and across cohorts based

[4] Technical details are explained in Sánchez-Romero et al. (2017). See also Sánchez-Romero et al. (2018) for an earlier version of the model measuring the past impact of demographic dividends in Spain.

[5] The starting point for the literature on large-scale OLG models is Auerbach and Kotlikoff (1987). Large-scale OLG models are simulations with detailed age groups, usually broken down by single years. By contrast, the models used in theoretical analysis usually simplify the lifecycle to three periods of life (childhood, adulthood, and old age).

[6] This expression refers to the existence of dispersion of the age at death.

on the observed and projected fertility and mortality patterns. Household heads are assumed to be heterogeneous in terms of their level of education, which is randomly assigned to each individual at birth. The level assigned is one of three ISCED levels developed by UNESCO: ISCED 0–2 (lower secondary education or less), ISCED 3–4 (upper secondary education), and ISCED 5+ (tertiary education).[7] Hence, in each year, individuals differ according to their age, fertility, mortality, and educational attainment.

Individuals derive utility from consumption goods, leisure, and the time they spend taking care of their children. Consumption goods can be produced in the market (using physical and human capital as input factors) or at home (combining time and intermediate market goods). In addition to consuming home-produced and market goods, the households in our model decide how much time they spend on work (in the market and at home), on childcare, and on leisure.

The government in our model provides public education, health care, pension benefits to retirees, and other public programmes; and distributes accidental bequests to surviving individuals. Both public in-kind and in-cash transfers are financed through a balanced PAYG system via consumption taxes, capital income taxes, labour income taxes, and social contributions.

We explicitly consider not only public transfers, but family transfers to children, including time transfers. Age profiles of all transfers are taken from the NTA and the NTTA datasets (Istenič et al. 2016, 2017). Using historical NA data and NTA-NTTA profiles, the model produces a complete age-time matrix of benefits and taxes for each year and birth cohort, which we then use to develop an analysis from both a cross-sectional and a longitudinal point of view. In particular, the model allows us to trace the annual evolution of expenditures affected by the age structure of the population, while taking into account the evolution of transfers to the past, the current, and the future population.[8] These transfers affect the tax levels that are required to balance the public budget every year. The model therefore captures the annual tax adjustments that will be needed in the future to meet the projected increase in expenditures caused by the ageing of the population. Hence, we are able to gauge the overall sustainability of the public finances by obtaining a cross-sectional annual version of the tax gap indicator.

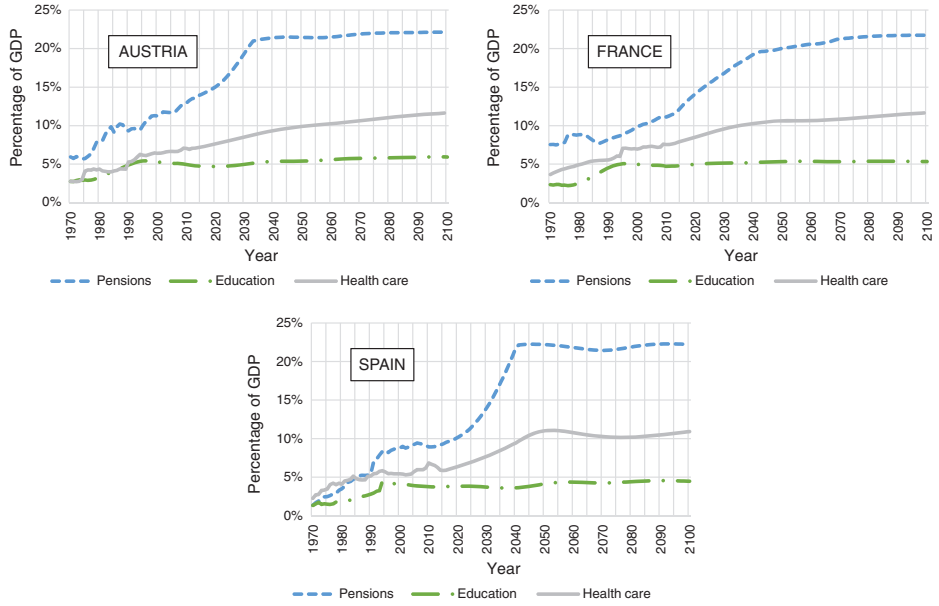
2.2 Cross-sectional analysis

In this section, we focus on cross-sectional sustainability indicators. In particular, we analyse the annual evolution of public benefits, which we obtain by combining

[7] The assignment is done in order to reproduce the observed educational distribution taken from the Wittgenstein Centre Database (2015).

[8] Population projections are derived to replicate those used by the Ageing Working Group of the European Commission coming from EUROSTAT. See Sánchez-Romero et al. (2017). Figure A.2 in the Appendix shows the resulting evolution of the dependency ratio.

Figure 1:
Public expenditures as a share of GDP in Austria, France, and Spain



Source: Authors' calculations using data from OECD (2017).

NTA profiles with the observed historical aggregates of public expenditures, and the tax adjustments needed to achieve an annual balance of a budget with PAYG constraints.[9]

Figure 1 shows the historical evolution (for 1970–2015) and the projected evolution of the ratio of public expenditures to GDP in Austria, France, and Spain through the 21st century. As populations age, an increasingly large share of resources will be devoted to the three main welfare state programmes (retirement pensions, education, and health care). In the three countries, the largest increases in expenditures will be for pensions, which are projected to account for more than one-fifth of GDP by the time members of the baby boom generation have reached retirement ages.[10] Indeed, under current models (see Sánchez-Romero et al. 2017), social security contributions will adjust each year to guarantee that the level of pension benefits is maintained for all retired individuals, but only up to a maximum contribution tax rate of 35%. After this value is reached, benefits are adjusted downwards in order to balance the budget. This adjustment will prevent pension

[9] The NTA age profiles of public expenditures are summarised in the Appendix.

[10] Only contributory retirement pensions are considered.

expenditures as a share of GDP from reaching even higher values in the second half of the century. Health care expenditures as a share of GDP are also projected to more than double in the three countries, reaching values of around 11–12% in 2100. Spending on the other main pillar of the welfare state, education, is not projected to change substantially over the 21st century: i.e. education expenditures will remain at roughly 5–6% of GDP, with slightly lower values in Spain.

Not surprisingly, the programmes involving transfers to the elderly are expected to grow relative to the national income as populations age. In the case of health care, the age profiles have similar shapes in the three countries considered, with higher expenditures at birth and very high expenditures at older ages.[11] The projection that the youth dependency ratio will shrink as the old-age dependency ratio rises further confirms that total expenditures are highest at higher ages. Hence, budgets are expected to increase as a consequence of the demographic transition.[12] For education, it appears that the effects of the educational transition compensate for the decline in the number of children. Thus, the weight of education programmes is projected to remain rather constant over time.

It is assumed that all public programmes are financed through a balanced PAYG system. Apart from the pension system's budget constraint, there is another key constraint on government budgets: namely, that most public expenditures are financed through general taxes (i.e. consumption, capital income, and labour income taxes). Although it would seem more realistic to account for the possibility of public debt, and to introduce debt into the model by considering the government's intertemporal budget constraint, here we stress the demographic dependency of expenditures by imposing an annually balanced system in all programmes.[13] Table 1 shows the weight of each public expenditure programme and the value of the different tax rates needed to balance the budget of the programme at three moments in time for the three countries considered: namely, in the year 2015; 30 years earlier (1985), when the ageing process had just begun; and 30 years later (2045), when the effects of the ageing process have spread throughout the economy.

Table 1 highlights the fact that the welfare state was developed later in Spain than in the other two countries. Thus, in 1985, the shares of pension and education expenditures in GDP were lower in Spain than in Austria and France (4.9 and 2.3 in Spain versus 9.1 and 4.1 in Austria and 8.0 and 3.4 in France, respectively). The differences in pension expenditures had shrunk by 2015 and are projected to reverse by 2045. This is largely because even though Spain has relatively low benefit levels, its population is ageing more rapidly than the populations of France and Austria. Moreover, because the educational transition started later in Spain and is projected

[11] See Figure A.2 in the Appendix.

[12] Interestingly, the NTA estimates indicate that in most countries, transfers to older people exceed those to children, even in per capita terms (see Patxot et al. (2012) and Abío et al. (2015)).

[13] For comparability reasons, we opt for this stylised simulation, while ignoring the differences in the health care financing models in the three countries.

Table 1:
Public expenditures relative to GDP and tax rates in Austria (AUT), France (FRA), and Spain (ESP)

Year	1985			2015			2045		
Country	**AUT**	**FRA**	**ESP**	**AUT**	**FRA**	**ESP**	**AUT**	**FRA**	**ESP**
Public expenditure to GDP (%)									
Pensions	9.1	8.0	4.9	14.0	12.3	9.3	21.5	19.7	22.2
Education	4.1	3.4	2.3	4.7	4.8	3.7	5.4	5.3	3.8
Health	4.0	5.4	4.8	7.2	7.9	5.9	9.6	10.5	10.5
Other[a]	8.8	11.5	6.2	6.3	8.9	8.3	6.2	8.6	8.2
Tax rate (%)									
Social sec. contributions	17.6	15.4	7.6	25.3	21.5	14.7	35.0	33.0	35.0
Consumption	14.2	18.2	9.7	14.0	19.2	12.6	17.2	23.3	17.6
Capital income	15.7	20.0	18.2	16.2	28.4	31.3	17.9	29.2	35.9
Labour income	10.4	12.1	7.4	12.7	12.0	9.4	15.0	13.9	12.0

Note: [a]Other expenditures include in-kind expenditures on defense, justice, and administration. However, other social benefits provided in cash are excluded from our analysis.

to continue through the latter decades of the 21st century, public expenditures on education in 2045 are projected to be lower in Spain than in the other two countries. With respect to health care, Austria is the country with the lowest expenditure levels in both 2015 and 2045. This is mainly because in the Austrian age profile, the level of public health benefits relative to labour income is lower than it is in Spain and France.

Regarding tax rates, we assume that the weight of each tax rate (on consumption, labour income, and capital income) observed in the baseline year is held constant in the future, and that this tax mix is adjusted proportionately every year thereafter to fund government consumption. In the case of social security contributions, the differences between the three countries in 1985 again reflect the distinct stages of development of the pension system at that point in time: i.e. the contribution levels in Spain were less than half the levels in the other two countries. Based on the modelling assumptions, social security contributions are projected to reach the upper limit of 35% in Austria and Spain by 2045 (specifically, this limit is reached in 2034 in Austria and in 2041 in Spain); while in France, which is ageing more slowly, contributions are not projected to reach this limit until 2069. In Spain, consumption and labour income taxes were systematically lower in 1985 and 2015 than they were in the other two countries. However, the consumption tax is not projected to be lower in 2045, as larger adjustments are expected to become necessary in Spain as the population ages. Meanwhile, the capital income tax rate is highest in Spain

over most of the study period, and is lowest in Austria throughout the period. In Section 4.2, the effects of future changes in the tax bases are discussed.

As Table 1 shows, tax rates are projected to increase in all three countries as the effects of ageing spread throughout the economy. This finding illustrates the challenges facing current public expenditure programmes, as it is clear that these transfer systems would become unsustainable if tax rates remained constant. The next section shows how these tax adjustments are projected to affect different generations.[14]

3 Cohort analysis

In this section, we assess the intergenerational impact of public transfers by measuring the levels of financial redistribution expected to occur through the public pension, education, and health systems. To do so, we take a longitudinal and cohort perspective, and calculate the lifetime-discounted survival-weighted benefits received and the lifetime-discounted survival-weighted taxes paid during the lifetime of each generation born between 1900 and 2100.[15] The difference between these two figures is referred to as the net present value at birth of the transfer system. If this value is zero, the transfer system is actuarially fair. If it is the same for all birth cohorts, the system does not allow for any intergenerational redistribution. We first compute the present value of benefits and taxes at birth for each public programme separately, and then calculate the net present value for pension, education, and health care benefits combined. These present values are expressed relative to the present value of survival-weighted lifetime earnings, as this makes it easier to compare the values over time and to discern the relative cost of the system for each birth cohort.

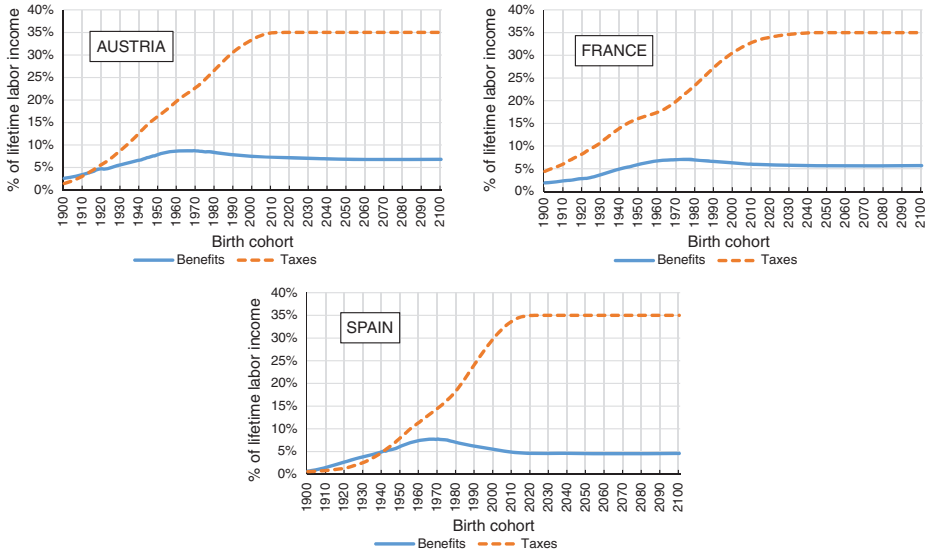
3.1 Present value of public benefits and taxes

Figure 2 shows the present value at birth of pension benefits and taxes (i.e. social contributions) for cohorts born during the 21st century in Austria, France, and Spain. The three countries exhibit similar patterns for both series, with taxes reaching much higher values than benefits, and the gap between taxes and benefits widening for cohorts born further in the future. In France, this difference is always negative; which means that all generations have paid or are expected to pay more than they have received or are expected to receive over their lifecycle from the pension system. In Austria and Spain, however, there is a small positive gap between the present

[14] Further results on the evolution of key variables can be found in Sánchez-Romero et al. (2017).

[15] It should be noted that although we were able to capture the historical evolution of transfers in successive cohorts, we were unable to completely capture the time path of taxes by abstracting from the evolution of debt.

Figure 2:
Present value at birth of public pension benefits and taxes



value of pension benefits and social security contributions for generations born during the 1900–1912 (Austria) and 1900–1940 (Spain) periods. These generations received a windfall gain from the public pension system. Because the system did not exist in the early 20th century, these cohorts did not have to pay contributions during all of their working years. However, by the time these cohorts retired, the system was in place, and they were eligible to receive pension benefits. The cohorts born in 1900 in Austria and in 1924 in Spain received the largest gains, corresponding to 1.3% and 1.4% of lifetime labour income, respectively.

When analysing transfers from younger to older individuals, as in the case of the pension system, it is generally found that the present value of taxes paid is higher than that of benefits. This standard result is partly due to the effect of discounting.[16] To understand the intuition of this effect, consider a transfer system in which an individual pays a fixed amount of money for 20 years during his/her working life, and then receives exactly the same amount of money during the following 20 years. When computing the present value at birth of taxes and benefits for this transfer system, we obtain a higher discounted value of tax payments than of transfer receipts, even though the monetary amount paid by an individual during his/her lifecycle is the same as the total amount s/he receives at the end of his/her life. This

[16] This is also because the economy is subject to dynamic efficiency, which implies that the returns to savings are higher than the returns of the PAYG-financed public system.

is because in an upward transfer system, tax payments occur earlier in life than transfer receipts, and are thus less discounted.

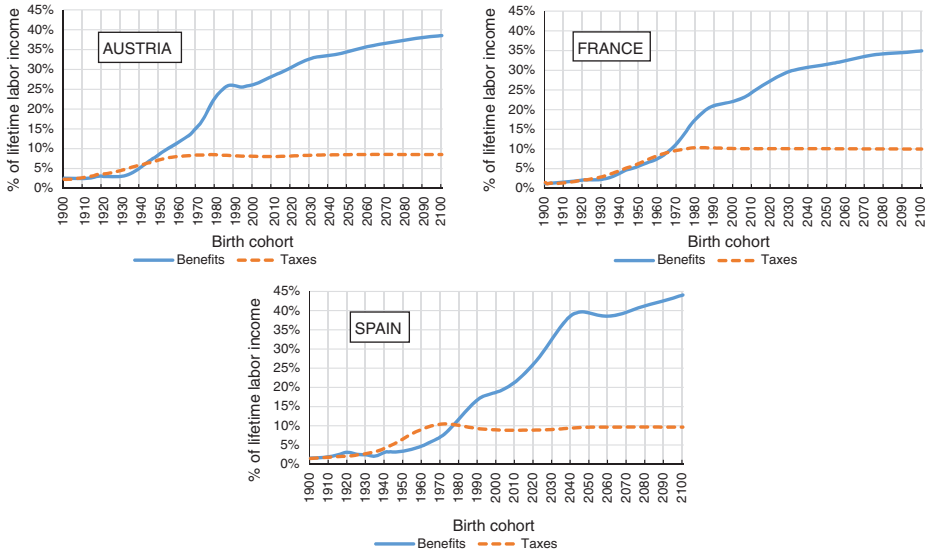
The finding that the gap between taxes and benefits is growing over birth cohorts is attributable to the share of beneficiaries increasing (due to population ageing) relative to the share of contributors, together with the assumption that the PAYG system is balanced annually by adjusting social security contributions, up to the maximum level of 35%. In an ageing population, the decline in the support ratio implies that each generation of young individuals has to support an increasing number of elderly people. Hence, the net present value of pension benefits becomes smaller, and the rate of return in a PAYG pension system is reduced.

Figure 3 displays results for a public education system financed with the tax mix mentioned above. Since education benefits represent a transfer from parents to children, whereas pension benefits represent a transfer from children to parents, the picture changes completely, and the lifecycle accounts are mostly positive and increasing for future cohorts. The cohorts born between 1907 and 1943 in Austria and between 1927 and 1977 in Spain pay more in taxes for education than they receive in transfers, and thus have a negative net present value at birth for this programme. The largest losses correspond to 1.6% and 4.4% of lifetime earnings for the cohorts born in 1933 in Austria and in 1961 in Spain, respectively. The largest gains in these two countries are achieved by the cohorts born in 2100, amounting to 30.0% and 34.4% of lifetime labour income, respectively. In France, cohorts born before 1968 are almost in lifecycle balance, with a net present value near zero. The largest gains from public education in this country amount to 25% of lifetime earnings for the cohort born in 2100. In all three countries, cohorts born further in the future increasingly benefit from higher education, which translates into higher wages.

The lifetime-discounted survival-weighted benefits received from the health system and the corresponding taxes paid are displayed in Figure 4. As is the case for the pension system, the present value of taxes for this public programme is above the present value of benefits received by the majority of cohorts and countries. This is because the age profiles for health expenditures, derived from the NTA data report, show substantially higher values for the elderly. The only groups who do not follow this pattern of a higher present value of taxes are a few generations born at the beginning of the 20th century in Austria and France; although the maximum positive gap found for these cohorts is only 0.4% of lifetime labour income. In all countries, the present value at birth of benefits and taxes increases at a faster pace up to the 1970 birth cohort, and more gradually for the later cohorts.

In the case of Spain, the evolution of both benefits and taxes is less smooth due to the effects of the ageing of the baby boom generation and the lower fertility rate in the 21st century. In Spain, the highest present values of benefits (18.0%) and taxes (24.5%), and the largest gap between them, are reached in the generation born in 2009, who are projected to suffer a loss equivalent to 11.3% of lifetime labour income. Spaniards born between 1990 and 2020 are projected to suffer the greatest

Figure 3:
Present value at birth of public education benefits and taxes

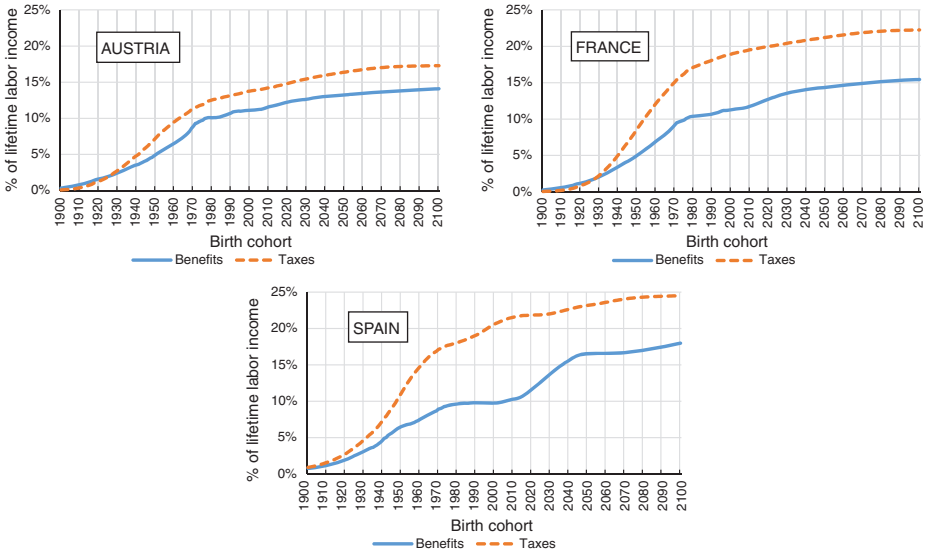


losses, as they will have to pay larger tax bills to fund the health care needs of the Spanish baby boomers.

In France, the present value at birth of health benefits rises up to 15.4% of lifetime earnings for the 2100 birth cohort, while the corresponding value for taxes in 2100 reaches 22.2% of lifetime labour income. The generations born after 1980 suffer similar losses (the difference between taxes paid and health benefits received), amounting to around 7% of lifetime earnings. Earlier generations have smaller gaps between health benefits and taxes. The maximum loss is observed for the 2007 birth cohort (7.8% of lifetime labour income). The lower rate of ageing in France explains these results.

The Austrian public health system achieves the highest degree of intergenerational fairness. As Figure 4 shows, the differences between the benefits received and the taxes paid for each cohort are relatively small (and rather similar within cohorts), ranging from 2% to 3.3% of lifetime labour income for all generations born in the 1950s onwards. The present value at birth of taxes paid to fund public health in Austria reaches a maximum of 17.3% of lifetime earnings for the 2100 birth cohort, while the analogous figure for benefits is 14%. These values are lower in Austria than in the other two countries because the scale of the Austrian age-specific health care profile is smaller.

Figure 4:
Present value at birth of public health care benefits and taxes



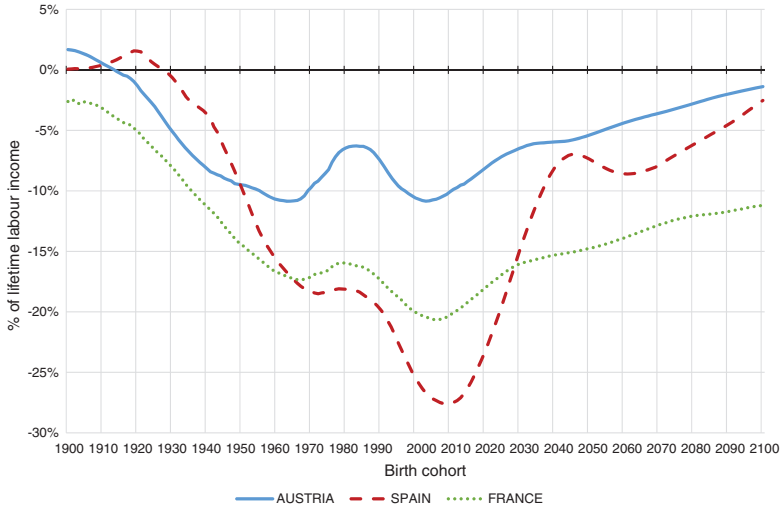
3.2 Net present value of public benefits

So far, we have analysed the net contributions of each generation relative to lifetime earnings for the three main pillars of the welfare state – pensions, education, and health care – that are of varying importance for different age groups. Next, we sum up the lifecycle accounts obtained for each public programme, and focus on the total net impact of those public transfers.

Figure 5 shows the present value at birth of net benefits received from the public sector for cohorts born in the 1900–2100 period in Austria, France, and Spain. In all three countries, the generations born at the beginning of the 20th century have the highest values. In general, these cohorts were not responsible for funding the expansions of the public pension, education and health care systems. The initial positive values for Austria are due to the modest net benefits obtained from the pension and health care systems. In the case of Spain, these early cohorts benefited greatly from the introduction of the social security programme, as they received pension benefits despite having contributed little or nothing to the system. Moreover, while these cohorts paid taxes to support the health care system, the combined net effect for these cohorts is positive. Positive values are observed in Austria and Spain for the birth cohorts up to 1913 and 1927, respectively.

Cohorts born in later years have lower net present values, mainly because benefit costs rose as the pension and health care systems were introduced and expanded.

Figure 5:
Net present value at birth of public pensions, education, and health transfers



The decline is larger in Spain because it is amplified by the rapid change in the population structure and by the expansion of the educational system (see Figure 3). The downward tendency continues in all countries up to the cohorts born in 1963 (Austria), 1967 (France), and 1972 (Spain). For the cohorts born in the 10–20 years thereafter, the net effect increases because the benefits they receive from public education help to offset their losses attributable to pensions and health care. In Spain, where the expansion of the education system was delayed, an increase in the net effect is not observed. In all three countries, the subsequent birth cohorts have decreasing net present values, primarily as a result of the large increase in lifetime-discounted social security contributions and the modest decrease in corresponding pension benefits. The peak loss is observed for the 2003 birth cohort in Austria, amounting to 10.8% of lifetime labour earnings. The analogous figures for the other countries are a loss of 20.7% for the 2006 birth cohort in France and a loss of 27.6% for the 2009 birth cohort in Spain. For the later cohorts, relative gains in education and health benefits can be seen in all three countries, most notably in Spain; and the net impact of public transfers becomes decreasingly negative for each successive generation. For the cohort born in 2100, the net losses due to public transfers are estimated at 1.4%, 11.1%, and 2.5% of lifetime labour income in Austria, France, and Spain, respectively.

In line with the observed differences within countries in the present value of benefits and taxes of each public programme displayed in Figures 2–4, the shape of the total net effect by birth cohort follows a similar pattern in all three countries. In Spain, however, the evolution is much more volatile because the country's demographic transition has been more dramatic. This pattern suggests that in Spain,

the higher degree of redistribution of income from younger to older generations is induced by public policy. Another distinct feature of the evolution of the Spanish present values is that they occur later than in the other two countries. This pattern reflects both the later introduction of the welfare state and the more gradual expansion of public programmes in Spain. In particular, the positive effects of public education are postponed in Spain, even though they reach higher values once they are achieved. In France, there seems to be a greater degree of intergenerational fairness, as the fluctuations in net present values are smaller. However, as Figure 5 shows, public programmes provide lower returns for future generations in France than in the other two countries. Of all of the generations in all three countries, the Spanish cohorts born between 2000 and 2017 suffer the greatest losses, amounting more than 25% of lifetime labour income.

Overall, our results indicate that the positive effect of public education never offsets the negative effects of public pensions and health care for the generations born after 1927 in the three countries we focus on. This finding contrasts with the results obtained in Bommier et al. (2010) for the US, who found that cohorts born between 1947 and 2060 attain positive net present values. The differences in these findings can be explained in part by the lower benefit levels of the American pension system. Moreover, when comparing our results with those of Bommier et al. (2010), it is important to note that we included general equilibrium effects in our analysis. For example, the future interest rate used in the calculation of the present value at birth of benefits and taxes is not constant in our framework, but instead results from the general equilibrium model, and evolves according to the demand and the supply of capital in each year. The rate oscillated quite a bit in the past due to capital accumulation, which was driven in part by demographic change. From 2060 onwards, the rate stabilises at around 5%, with slight differences between countries. Higher interest rates give more weight to downward transfers like education, as they imply that the benefits people receive earlier in life have higher values than the taxes they pay later in life. The opposite pattern is observed for a transfer system that redistributes from young to old, such as the pension system. Therefore, a higher interest rate improves the net present value at birth for downward transfers, and worsens it for upward transfers.[17]

4 Reform scenarios

As we outlined in the previous sections, our projections indicate that the welfare state system has a substantial fiscal imbalance in the long run if it is to be maintained as assumed in the benchmark scenario. Hence, substantial tax adjustments are required to make the system sustainable. However, such adjustments will lead to

[17] Moreover, whereas Bommier et al. (2010) based their analysis on the assumption that health expenditures grow more quickly than productivity, we assume that health costs grow at the same rate as productivity.

a deterioration in the fiscal balance between generations, and thus to higher levels of intergenerational redistribution and lower levels of intergenerational fairness. In this section, we present different reform scenarios, and assess their capacity to balance the sustainability of the public programmes of the welfare state with intergenerational fairness.

4.1 Delay in retirement age

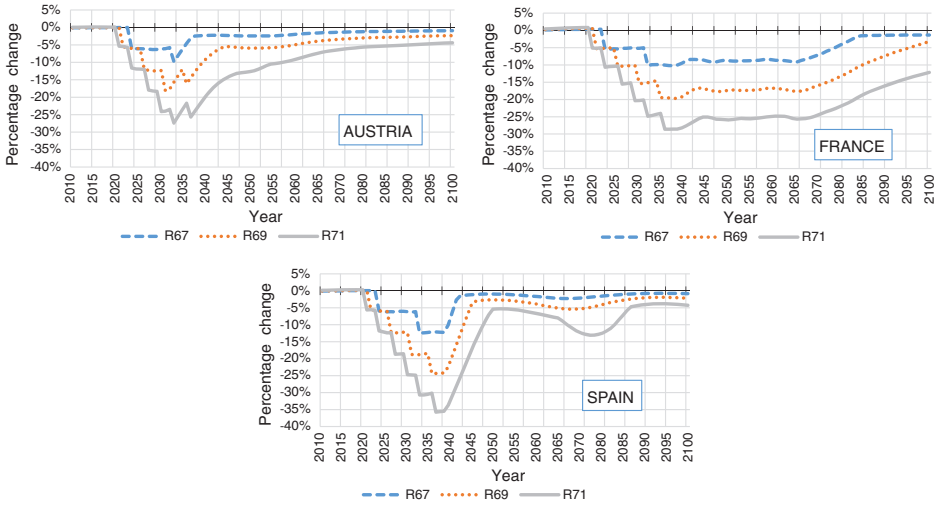
There is a large body of literature on pension system reform. Besides decreasing pension benefits and increasing contributions — both of which are reflected in our baseline scenario — most studies have argued for the postponement of the statutory retirement age. This policy appears to be very effective, as it affects both the revenue side and the expenditure side of the system by increasing the period when people are making contributions and decreasing the period when people are receiving pension benefits. This measure is likely to be especially effective if it is implemented at a time when relatively large numbers of baby boomers are retiring. Moreover, raising the retirement age seems desirable given that people are living longer and entering the labour market later as they spend more time in education (see Lee (2016)).

We have simulated the effects of delaying the retirement age from 65 to 67, and from 69 to 71. The increase in the retirement age is implemented step-wise from the year 2020 to the year 2040. Figure 6 reflects the variation in the pension expenditure to GDP ratio with respect to the baseline in the three counterfactual scenarios. After 2020, the year in which the reform is first introduced, public pension expenditures decrease in the three countries as a percentage of GDP. Further reductions are observed in the following 20 years as the policy change is being implemented. After 2040, the difference with respect to the baseline shrinks progressively into the distant future, although a negative net effect still remains. The pattern varies somewhat across the three countries. For example, the changes are the smallest in Austria, and are the longest lasting in France.

The sequences are similar for the three chosen retirement ages within each country, with the later ages always having a stronger effect. When retirement is delayed by two years, the ratio decreases up to 10–12% in the most critical years. Moreover, the ratio decreases up to 18–24% if retirement is delayed by four years, and up to 27–36% if the new retirement age is set at 71. The largest effects occur in Spain, where the percentage change in pension expenditure to GDP is further reduced in the 2070s if retirement is postponed to age 71. This pattern is attributable to the dissipation of the effects of the baby boom generation in that decade.

These changes derived from the postponement of the retirement age translate into variations in the net present value of public programmes presented in the previous section. Figure 7 displays the change in the total net present value of the combined pensions, education, and health systems for cohorts born from 1950 to 2100 relative to the baseline scenario. Although the main impact of a policy of delaying retirement is expected to be on the present value of taxes paid and benefits

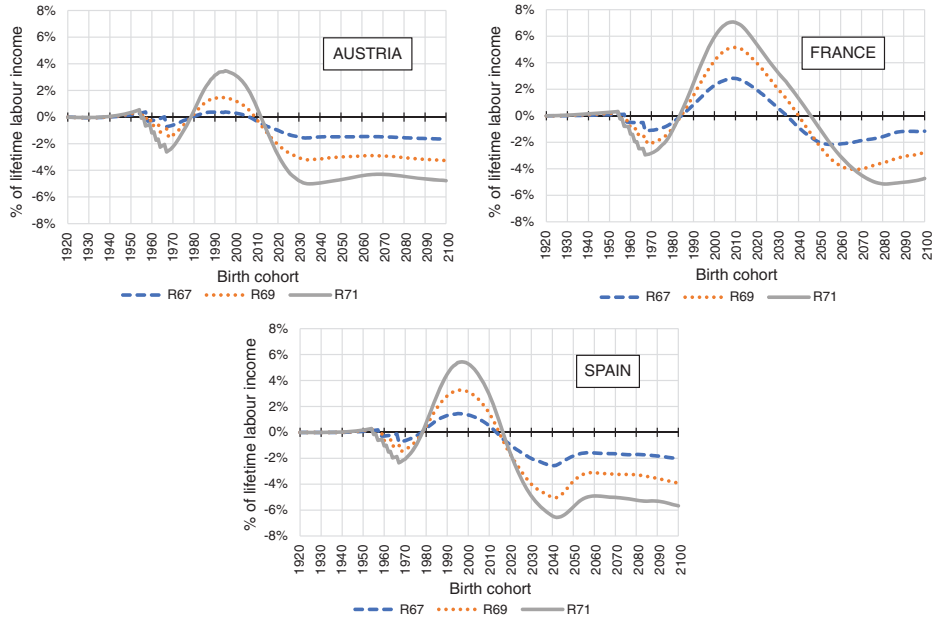
Figure 6:
Changes in pension expenditure/GDP by delaying the retirement age



received from the pension system, several effects on pensions and contributions may offset each other, and could thus minimise the net result for this programme. On the one hand, delaying retirement implies that pension benefits are received for a smaller number of years and contributions are paid for a larger number of years. Both factors push down the net present value at birth of participating in the pension system. On the other hand, the general equilibrium nature of the model, together with the assumption that the system is balanced every year on a PAYG basis, entail a reduction of the contribution rates and a potential increase in benefits received. In this case, the result is an improvement in the net present value of public pensions.

The evolution of the variations in the different reform scenarios shown in Figure 7 also reflects the changes in the other public programmes (education and health care) due to general equilibrium effects. Overall, for any postponement of retirement, members of the older generations who are near the end of their working lives at the time the policy is implemented — roughly, those born between 1950 and 1980 — lose as a result of the reform. Future generations — or those who are very young when the reform is first implemented in Austria and Spain — also lose from the delay in retirement. However, the younger generations benefit, as they obtain a higher net present value at birth compared to the baseline. How large these changes in benefits and losses are depends on the number of years the age of retirement is postponed. In the most extreme scenario (retirement at age 71), the maximum losses for the earlier generations are between 2% and 3% of lifetime labour income, and are larger for the future generations (around 5% in Austria and France, and around

Figure 7:
Change in net present value of public transfers under different retirement regimes



7% in Spain). The largest gains amount to 3.5% of labour earnings for the 1995 birth cohort in Austria; 5.4% for the 1997 birth cohort in Spain; and 7.1% for the generation born in 2009 in France.

When we compare the three countries, we see differences not only in the levels of maximum gains and losses with respect to the baseline, but in the time paths when these changes occur. In Austria, the generations who gain from the increase in the retirement age are those born from 1980 to 2006 in the age 67 scenario, those born from 1979 to 2009 in the age 69 scenario, and those born from 1979 to 2011 in the age 71 scenario. In France, the corresponding cohorts who gain from the reform are those born from 1985 to 2034 (spreading to 5–6 more years for each additional step in the retirement age increase). In Spain, the corresponding cohorts who benefit from the reform are those born between 1978 and 2013 (1979–2014 and 1979–2016, respectively). Hence, the benefits of the reform are spread out across more generations in France than in other countries. Recall that the maximum contribution rate for the social security system is set at 35%, and that once that limit is reached, any adjustments that are made must come from reducing pension benefits. Because France is ageing more slowly than the other two countries, this limit is reached later in France (and is never reached in the age 71 scenario), which explains the previous results.

Table 2:
Changes in tax rates from financing health using different tax bases

Change in share of GDP of tax revenues of	Year	Tax financing health					
		Consumption tax			Labour income tax		
		Austria	France	Spain	Austria	France	Spain
Consumption	2050	5.9	5.9	6.4	−4.7	−5.7	−5.4
	2100	7.0	6.5	6.2	−5.6	−6.3	−5.4
Labour income	2050	−5.1	−4.4	−4.3	5.6	7.3	7.5
	2100	−6.0	−4.8	−4.3	6.9	8.2	7.7
Capital income	2050	−1.1	−2.1	−2.5	−1.1	−2.2	−2.5
	2100	−1.3	−2.2	−2.5	−1.3	−2.2	−2.5

4.2 Changing the tax base

While public expenditures mainly flow to children and the elderly, taxes are mostly paid by the working population; although some taxes are paid by children (consumption tax through parents) and the elderly (consumption and capital income tax). This suggests that one way to alleviate the pressures governments are facing as a result of the ageing process is to make changes to the tax bases. As Table 1 shows, the tax bundle used to finance public health and education differs to some extent in each of the countries in our study. Since this may be among the factors that influence the results we obtained, we developed two alternative scenarios that we use to investigate to what extent the choice of a different tax mix alters our results so far. To keep things simple, we focus on only one public programme, and implement a gradual reform by using one tax base as the funding source, instead of a mix of the three, as we assume in the baseline.

In particular, the policy reform we analyse consists of changing the tax base to finance future health care spending from the year 2020 onwards, and it is implemented progressively over a period of 20 years. We consider two policy options: financing future health expenditures using only taxes on consumption; and, alternatively, using only taxes on labour income. In both policy options, the specific tax rate chosen increases while the other two tax rates decrease. We decided not to use the capital income tax in these counterfactuals because of the high deadweight losses this policy would imply.

Table 2 reports the percentage change in all tax revenues (of consumption, capital income, and labour income) as a share of GDP and with respect to the baseline as a result of changing the tax base for financing health care. The results are displayed for the years 2050 and 2100; i.e. at two points in time after the reform has been fully carried out and the strongest effects have been realised. If health is financed

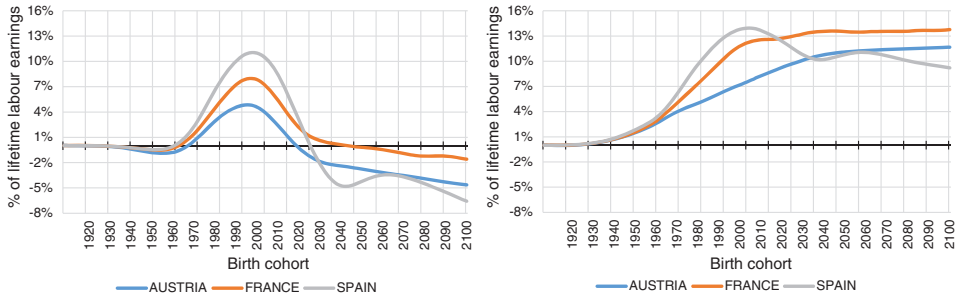
by taxing only consumption goods, the corresponding tax revenues on consumption are projected to increase compared to the baseline scenario in which a mix of the three tax bases is used by 5.9% of GDP in Austria and France and by 6.4% of GDP in Spain in 2050. The analogous values in 2100 are somewhat higher for the first two countries and are slightly lower for Spain. Both the capital income and the labour income tax revenues decline relative to the benchmark case in the decades following the full implementation of the reform. The labour income tax revenues decrease from between 4.3% of GDP in Spain to 6.0% of GDP in Austria; while the adjustments in capital income tax revenues are smaller, ranging from 1.1% of GDP in Austria to 2.5% of GDP in Spain.

If health care is financed by taxing only labour income, the increases in tax revenues for this specific tax are slightly lower than in the first reform using consumption taxes in Austria, but are higher in Spain and in France in particular, reaching 8.2% of GDP in 2100. Tax revenues from consumption taxes are reduced by between 4.7% and 6.3% of GDP, with a stronger effect in France. The effects on revenues from capital income are similar to those in the previous scenario.

The effects on the total net present value at birth of pensions, health, and education are shown in Figure 8, which displays the changes with respect to the baseline. For all three countries, there are large gains for all generations if public health is financed exclusively through labour income. This is because a tax on labour income depletes more capital per worker than a tax on consumption. As a consequence, the interest rate increases, which gives more weight to transfers received earlier in life (education) than later in life (pensions and health care), and thus increases net benefits. In Austria, these benefits monotonically increase with birth cohorts, and the maximum gains amount to 11.7% of lifetime labour income for the generation born in 2100. In France, the benefits increase up to the 2048 birth cohort (with net gains of 13.5% of lifetime earnings compared to the baseline), and then remain rather constant, reaching 13.8% of lifetime labour income for the last cohort born in 2100. The evolution of net present values is somewhat different in Spain, where a maximum difference of 14% is observed for the generation born in 2011. Thereafter, the difference decreases to 10.2% for the 2042 birth cohort, increases modestly to 11.1% for the 2061 birth cohort, and then decreases again to 9.2% for the 2100 birth cohort.

Alternatively, if the tax base used to finance public health care consists of consumption taxes, the generations born between 1976 and 2023 in Austria gain compared to the baseline. Similarly, the 1972–2047 birth cohorts in France and the 1979–2030 birth cohorts in Spain benefit from this policy scenario. The largest gains are observed for the generations born in 2002–2004 (depending on the country), and are highest in Spain (11% of lifetime earnings) and lowest in Austria (4.9% of lifetime earnings). In France, the maximum gains correspond to 8% of lifetime labour income. The other generations lose, and the future generations in particular. The losses for the 2100 birth cohort amount to 4.6%, 1.6%, and 6.6% of lifetime earnings in Austria, France, and Spain, respectively. The losses for the previous cohorts are much smaller, reaching less than 1% (in absolute terms) in all cases.

Figure 8:
Difference in the net present value of public transfers when changing tax bases. Financing health care with consumption taxes (left) and with labour income taxes (right)



4.3 Fixed education

One of the most distinguishing features of the model we used to derive the previous results is the degree of heterogeneity with respect to the educational level of the population. There are important differences in the educational composition of workers across countries, which generate diverse patterns of behaviour, and which in turn lead to distinct patterns of economic development.

Table 3 reports information on the actual and predicted educational composition for several birth cohorts in Austria, France, and Spain. We consider three levels of education based on the UNESCO classification: ISCED 0–2 (lower secondary education or less), ISCED 3–4 (upper secondary education), and ISCED 5+ (tertiary education). The pace of the educational transition differs in each country. The share of the 1980 birth cohort who have attained tertiary education is 44% in France, 24% in Austria, and 33% in Spain. The shares of the 1980 birth cohort with ISCED 0–2 and ISCED 3–4 educational levels are, respectively, 15% and 61% in Austria, 15% and 41% in France, and 28% and 39% in Spain. This pattern reflects the fact that the modern educational system was introduced later in Spain than in Austria and France. These differences between the three countries shrink by 2040, and it is assumed that by the end of the century, all individuals will attain at least upper secondary education. The share of the 2100 birth cohort projected to attain tertiary education is five points higher in France than in Austria, and is two points higher in Austria than in Spain.

In order to assess the impact of education on our results, we develop a scenario in which the educational attainment is held constant. In the experiment, we simulate the effects of stopping the educational transition by fixing the educational levels achieved by the 1980 cohort, who completed their education in the base year.

Table 3:
Percentage of population by educational level by birth cohort in Austria, France, and Spain

Country	Austria			France			Spain		
Education level (ISCED)	**0–2**	**3–4**	**5+**	**0–2**	**3–4**	**5+**	**0–2**	**3–4**	**5+**
Birth cohort									
1980	15	61	24	15	41	44	28	39	33
2040	1	30	70	0	23	77	1	31	68
2100	0	22	78	0	17	83	0	24	76

Source: WIC Data Explorer (2015).

Figure 9:
Difference in net PV of public transfers with fixed education

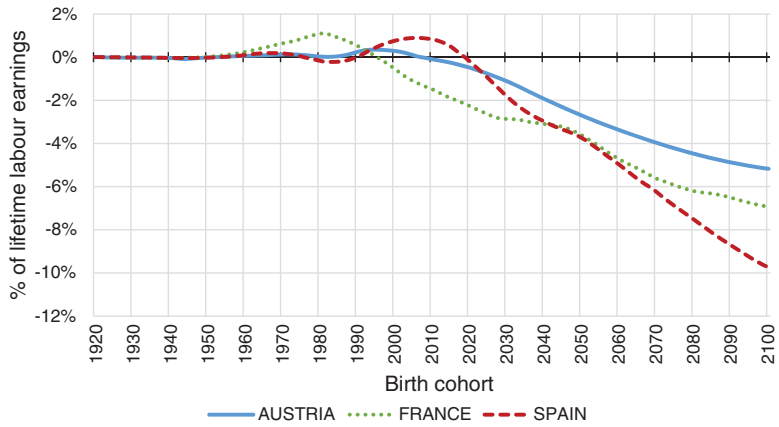


Figure 9 shows the impact of the fixed-education scenario on the net present value at birth of public programmes for cohorts born between 1920 and 2100 in Austria, France, and Spain. In all three countries, some cohorts realise net fiscal gains from this scenario (those born between 1952 and 2007 in Austria, between 1949 and 1995 in France, and between 1990 and 2018 in Spain), but the positive effects are small.[18] If educational attainment is fixed at the 1980 birth cohort levels, these generations will have to pay lower taxes for the education of their descendants, but they will

[18] For the 1954-1975 birth cohorts in Spain, a very small (less than 0.2%) positive change in the net present value can be observed.

also lose some benefits, as they will have received less education. In this case, the former effect dominates. For previous generations, there is little variation with respect to the benchmark scenario. Future generations are projected to lose from the interruption of the educational transition in all three countries, as they will have lower educational levels, and thus will receive lower returns from education in the labour market. The largest losses are in Spain and France. For the cohort born in 2050, the loss in the present value of lifetime labour income is 2.7% in Austria, 3.6% in France, and 3.7% in Spain. For the cohort born in 2100, the corresponding loss is 5.2% in Austria, 6.9% in France, and 9.7% in Spain.

5 Discussion

In this paper, we have analysed the impact of population ageing on the sustainability of public fiscal policy, and we have explored the implications of several reform scenarios, including a delay in the statutory retirement and a change in the tax base for financing health care expenditures.

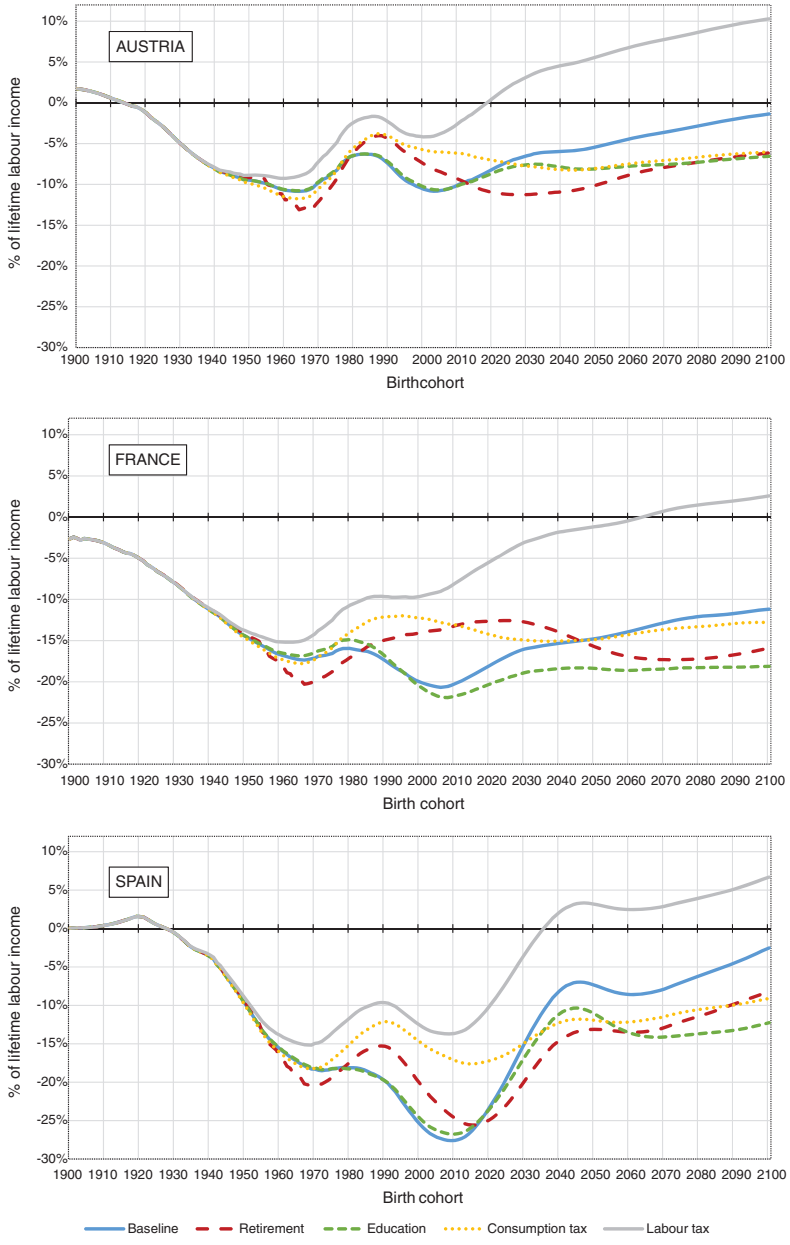
We have also described the consequences of having different levels of educational attainment in order to assess the effects of education on the results. The analysis focuses on three European countries (Austria, France, and Spain), which differ in terms of the strength of their demographic transition, their path of development, and the generosity of their welfare state programmes.

The results for sustainability show a drastic increase in the shares of public expenditure to GDP for the three main programmes of the welfare state (pensions, education, and health care). The total expenditures on these programmes range from 26% (Austria), 25% (France), and 19% (Spain) in 2015 to 36–37% in 2050. This shift is mostly driven by the change in the ratio of benefit recipients to taxpayers, which is directly linked to the demographic dependency ratio. The tax adjustments needed to ensure the sustainability of these programmes affect different generations very differently.

Figure 10 summarises the main results, showing the net present value of public transfers (pensions, education, and health care) for the distinct scenarios. We have included only one of the reform scenarios for delaying the retirement age (namely, the most extreme one in which retirement is postponed from age 65 to age 71; see the red line). The other two simulations (from age 67 to age 69) yielded milder effects in the same direction. We have also included the scenarios in which health care is fully financed through consumption (yellow dotted line) and labour income taxes (solid grey line) in the future; and, finally, the fixed education scenario (dashed green line).

We found that in the three countries, the best scenario for improving the net present value at birth of public transfers is financing health care with labour income taxes. All generations gain from this policy reform. In the scenario in which public health is funded with consumption taxes, the results are less clear, as there are winners and losers from the reform in terms of net present value at birth. In all

Figure 10:
Net present value of public transfers under different scenarios



of the other scenarios (different from the "labour tax"), we found that the reform is good for some cohorts, but that future generations always lose compared to the baseline.

In terms of intergenerational fairness, our results suggest that Spain is the country in which public policies in the benchmark scenario generate the highest levels of intergenerational redistribution from younger to older individuals, and Austria is the country in which this redistribution effect is minimal. The reforms that involve changing the tax base seem to improve intergenerational fairness in France and in Spain in particular, as they flatten the evolution of present values across cohorts.

Acknowledgments

This project has received institutional support from the European Union's Seventh Framework Programme for research, technological development and demonstration (AGENTA project, grant agreement no: 613247), the Spanish Science and Technology System (Project number ECO2016-78991-R MINECO/FEDER and the *Red de excelencia* SIMBIEN ECO2015-71981-REDT), the Catalan Government Science Network (Project number SGR2014-1257) and the network *Xarxa de Referència en R+D+I en Economia i Polítiques Públiques* (XREPP).

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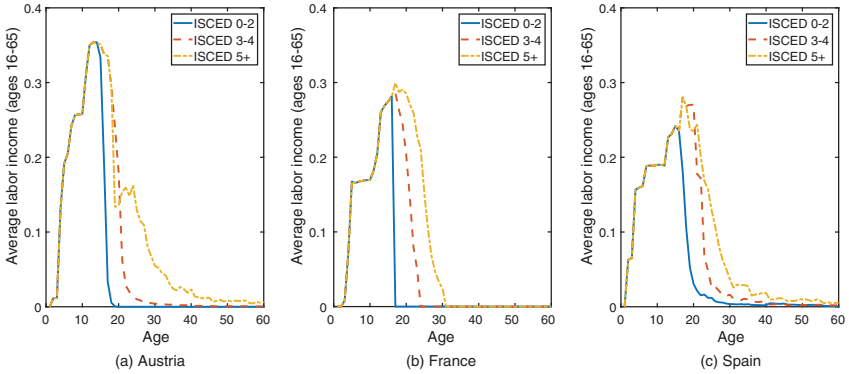
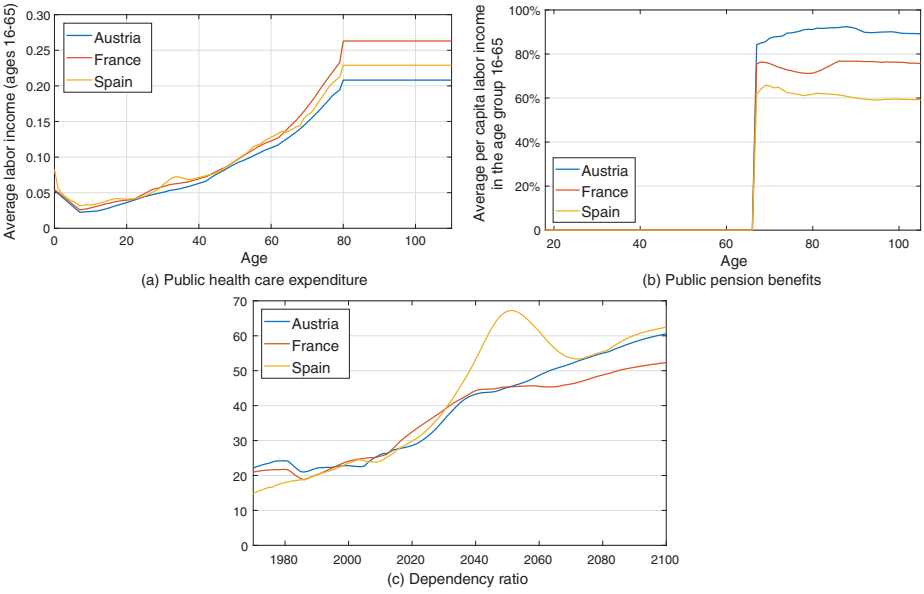
Appendix: Key inputs of the projection model

Figure A.1:
NTA age cross-sectional profiles of public education expenditure by educational level for Austria, France, and Spain (year 2010)



Source: Istenič et al. (2016, 2017) and author's calculations.

Figure A.2:
NTA age cross-sectional profiles (year 2010) and demographic dependency ratio for Austria, France, and Spain



Source: (a–b) Istenič et al. (2016, 2017); (c) author's calculations following European Commission (2018) assumptions.

The figures above summarise some of the key inputs of the projection model. Figure A.1 shows public expenditures on education by age in the year 2010 in the three countries. The level of expenditures is higher in Austria, reflecting that country's distinct educational transition path. Panels (a) and (b) in Figure A.2 show the NTA age profiles for public health and pension expenditures. The age patterns look quite similar in the three countries, although there are significant differences in levels. France has the highest health expenditures, followed by Spain. In the case of pensions, public benefits are more generous in Austria and less generous in Spain. Panel (c) summarises the differences in demographic patterns by showing the annual evolution of the dependency ratio. France has the best situation in terms of demographic dependency, in part because it has a higher fertility rate than the other two countries. A large baby boom effect can also be observed in Spain.

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Intergenerational inequalities in mortality-adjusted disposable incomes

Hippolyte d'Albis[1,*] ***and Ikpidi Badji***[2]

Abstract

This article analyses the development of inequalities between the generations in France using a composite indicator including income and life expectancy. Mortality-adjusted disposable income has greatly increased over the generations. However, a breakdown by sex shows that this increasing trend is attributable to rapid growth in women's income, while men's income has stagnated for all cohorts born since 1946.

1 Introduction

The economic position of young people is a recurring topic in public debate. It is often said that today's younger cohorts are less well off than their parents were at the same ages. This supposed inequality between the generations is likely to affect the design of policies that involve intergenerational transfers. In previous research for France, we showed that there was no decline in living standards between the generations; and, in particular, that the baby boom generation did not enjoy a more favourable position than the generations that followed them (d'Albis and Badji 2017). The various indicators of living standards we used are, however, only economic indicators. Such indicators are obviously imperfect measures of well-being, as they may fail to capture an individual's perception of his or her position. In this article, we continue our analysis of inequalities between the generations in France by adding two specifically demographic dimensions.

The first dimension we include is life expectancy. As it is clear that improvement in this variable is a barometer of progress and a source of well-being (Deaton 2013), it is often included in composite indicators used to measure well-being. However, linking an economic variable to a demographic variable is not a simple process. As Deaton (2013) has pointed out, it would be inappropriate to merely multiply

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annual income by life expectancy. For a given permanent income level, an increase in lifespan may indeed be accompanied by a reduction in consumption per period of time. In the following, we use recent literature (Becker et al. 2005; Fleurbaey and Gaulier 2009; Jones and Klenow 2016; d'Albis and Bonnet 2018) based on agents' preferences to incorporate differences in life expectancy into comparisons of income levels between countries. Following the literature on computing the Value of a Statistical Life, the idea behind our approach is to define how much an individual would be willing to pay in exchange for a higher life expectancy. We could, for example, ask how much income an individual would agree to forego in order to enjoy a life expectancy equal to that of the country with the highest average lifespan (d'Albis and Bonnet 2018). The income net of this willingness to pay for a longer life is referred to as "mortality-adjusted income". In this article, we adapt this procedure in order to examine inequalities between the generations. We determine the willingness to pay for each age and each cohort as a function of the life expectancy at that age for a cohort distant in time. For example, we calculate the reduction in income a young person of the baby boom generation might have agreed to forego in exchange for enjoying the life expectancy of their children.

The second dimension we include is gender. Men and women have widely differing incomes and life expectancies, with men, on average, having higher incomes but shorter lives than women. Including this dimension in comparisons of generations has two advantages. First, since variations by gender change over time, examining these differences is one way to better understand average developments. Second, the intergenerational comparisons made by the ordinary person may be implicitly gendered: i.e. a son may compare himself to his father, while a daughter is likely to compare herself to her mother. Even if such gendered comparisons are not universal, this tendency could help to explain the perceptions expressed in surveys.

We used the seven waves of the main French survey of household living conditions to create pseudo cohorts. Unfortunately, we were unable to analyse real cohorts because the survey is not panel-based. The respondents' total incomes were individualised and adjusted using National Accounts. Our econometric modelling is designed to evaluate the effects of age, cohort, and period on disposable income and mortality-adjusted disposable income. To address the problem of collinearity between the explanatory variables, we have adopted Deaton and Paxson's (1994) strategy.

The results are as follows. With the inclusion of increased life expectancy, the relative situations of generations improved considerably during our period of observation. In particular, all of the cohorts born after 1960 enjoyed a level of mortality-adjusted disposable income that was significantly higher than that of the cohort born in 1946. For example, from the 1946 cohort to the 1966 cohort, income rose 28.6%. However, this increase reflects widely differing trends between the sexes. Women's mortality-adjusted income rose quickly (+38.8% from the 1946 to the 1966 cohort, and +76.6% from the 1926 to the 1946 cohort), while men's income stagnated starting with the 1946 cohort. These findings clearly indicate that women's income levels have been catching up to those of men. Moreover, these

results are in line with our previous research that focused on men alone (Lefranc 2018, Alesina et al. 2018). We can also see that mortality-adjusted disposable income generally increased over the course of an average lifetime, rising 53% from ages 27 to 47, 7.3% from ages 47 to 62, and 50.1% from ages 62 to 82. This means that inequalities between ages did not involve inequalities between generations. As d'Albis and Badji (2017) have suggested, economic growth benefits everyone.

The rest of the paper is organised as follows. Section 2 presents the methods we use to obtain our mortality-adjusted incomes, and our econometric strategy. Section 3 presents our results. Section 4 concludes.

2 Data, measures, and estimation strategy

Our indicator combines an economic variable that measures living standards and a demographic indicator that measures longevity. There is no consensus on this choice of economic variable. It is true that in most theoretical economic studies, consumption is used as the main element in an individual's utility function. This variable has, for example, been used by Jones and Klenow (2016) to compare levels of well-being between countries, and by d'Albis and Badji (2017) to compare well-being between generations. In this article, however, we use disposable income. Unless one accepts the Keynesian theory of a linear connection between consumption and income, this is not a neutral choice. Consumption is both a more extensive variable because it depends on total income received over a life-cycle, and a more restricted variable because it does not include any bequests transmitted to children. d'Albis and Badji (2017) showed, however, that comparisons between generations do not differ qualitatively depending on which variable is used, with the exception that the improvement in living standards between generations is more marked when consumption is used. We have redone this comparison for the present paper (see Appendix B), and found that this conclusion still holds. But our decision to use the disposable income in the current analysis is largely a pragmatic one: i.e. since we are constructing variables for both sexes, income is the more appropriate choice because it is more individualised in surveys. Consumption is, by contrast, generally recorded for the household as a whole. When consumption is individualised, the tendency is to divide it equally among adults. While this approach can generate accurate results, it masks the important dimension of gender inequality. The reduction in the income gap between the sexes, which has undoubtedly led to improvements in women's well-being, would not be discernible if well-being were measured by average household consumption.

2.1 Disposable income by age and cohort

Disposable income is defined as an individual's income after the deduction of taxes and social security contributions. It includes: (i) working income: salaries,

self-employed income, etc.; (ii) income from household worth: dividends, interest, rent, etc., to which we add the imputed rents; (iii) social security benefits, including pension and unemployment benefits; and (iv) current transfers, particularly insurance indemnities minus premiums and transfers between households.

We first compute disposable income using data from the French Household Expenditure Survey (*Budget de famille*, referred to hereafter as BdF) waves conducted in 1979, 1984, 1989, 1995, 2000, 2005, and 2010. With more than 10,000 participating households, the aim of these surveys was to reconstitute all household accounts by gathering information on the respondents' income and expenditure levels. It is worth noting that in the BdF, a household refers to any group of people who ordinarily share a dwelling and a budget, and who may or may not be related.

We estimate each household's disposable income by adding up all sources of income and deducting any direct taxes paid (income tax, council tax, property tax). As the BdF surveys conducted between 1979 and 1995 did not provide figures for imputed rents, these figures were estimated using the characteristics of housing; as in d'Albis and Badji (2017). All of the variables are deflated using the consumer price index.

Unlike in d'Albis and Badji (2017), in the current analysis we individualise the disposable income following the recommendations made by the National Transfer Accounts (United Nations 2013). The BdF surveys provide some income data at the household level (such as property income, imputed rents, family benefits, transfers between households, and direct taxes paid), and other income data at the individual level. The household-level data are allocated between the members of the household using a sharing rule. Property income, transfers between households, direct taxes, and family benefits[1] are allocated equally between the household reference person and his or her spouse. Imputed rents are allocated using the NTA rule.

To enable us to compare data within a consistent time frame, we adjust the survey data to the French System of National Accounts aggregates. This adjustment, which is similar to the adjustment carried out for the National Transfer Accounts (d'Albis et al. 2015; 2017), ensures that the aggregate disposable income of individuals is equal to the National Accounts aggregates. Our sample is restricted to ordinary households residing in Metropolitan France. Finally, the rescaled individual variables are split by sex.

Figure 1 shows the disposable income by age for 16 generations. These generations are established using the seven cross-sectional databases we created from the seven BdF surveys. We first built 79 annual cohorts, defined according to the reference individual's date of birth. The first cohort was born in 1901, while the last cohort was born in 1979. The generations are then defined using the mean of five consecutive cohorts (except for the first generation, which consists of four cohorts). Each line in Figure 1 represents a generation (e.g. 1947 represents all cohorts

[1] We do not allocate them to the children, as is recommended by the NTA, because here we are considering only individuals over age 25.

Figure 1(a):
Disposable income by age and cohort groups, constant euros, whole population

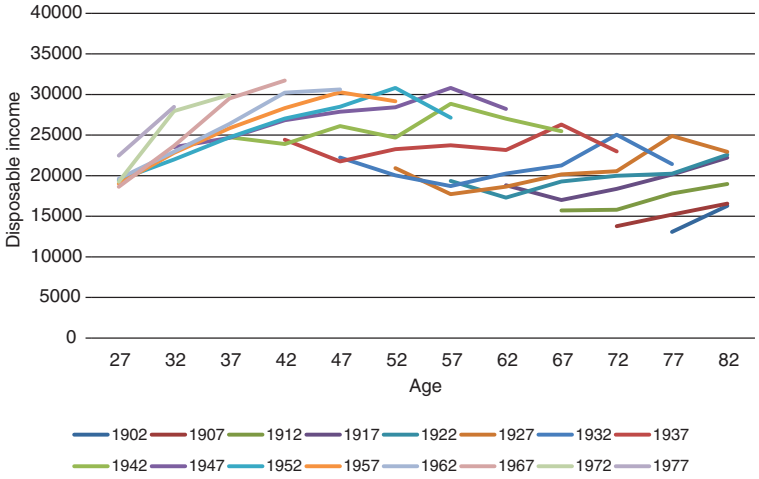
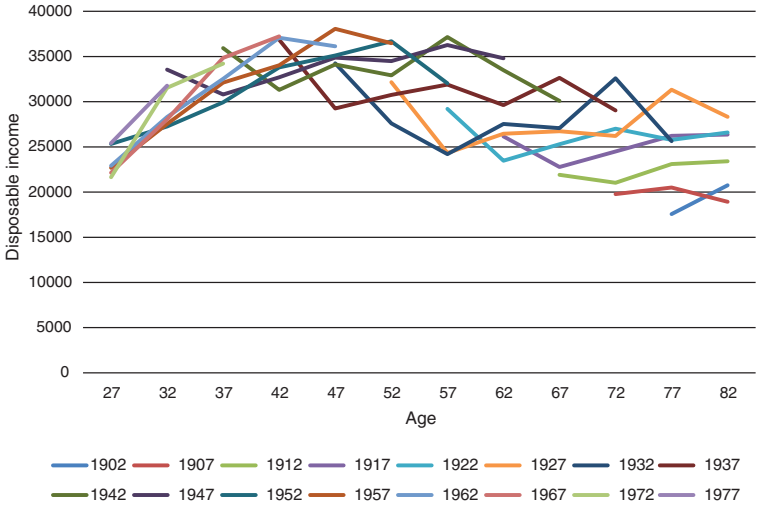


Figure 1(b):
Disposable income by age and cohort groups, constant euros, men



born between 1945 and 1949) at different ages (e.g. 57 represents the 55–59 age bracket).

Both for the whole population (Figure 1(a)) and for men alone (Figure 1(b)), income over the life-cycle forms an inverted U. Moreover, since the curves often

Figure 1(c):
Disposable income by age and cohort groups, constant euros, women

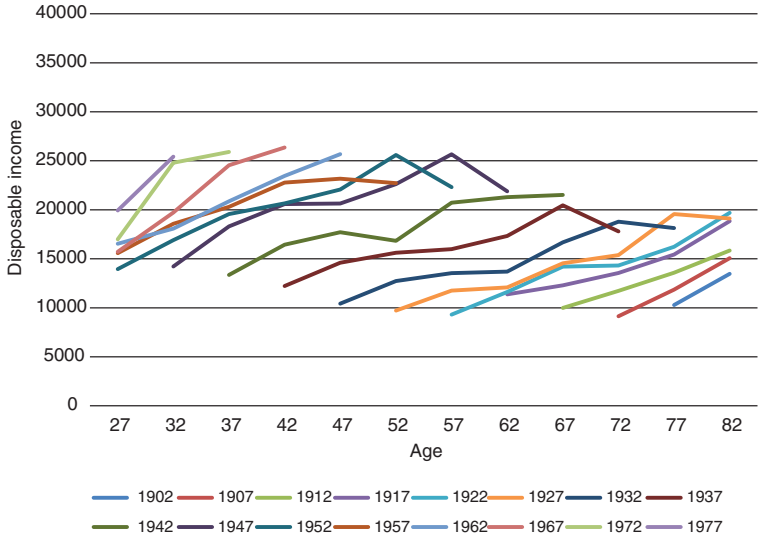
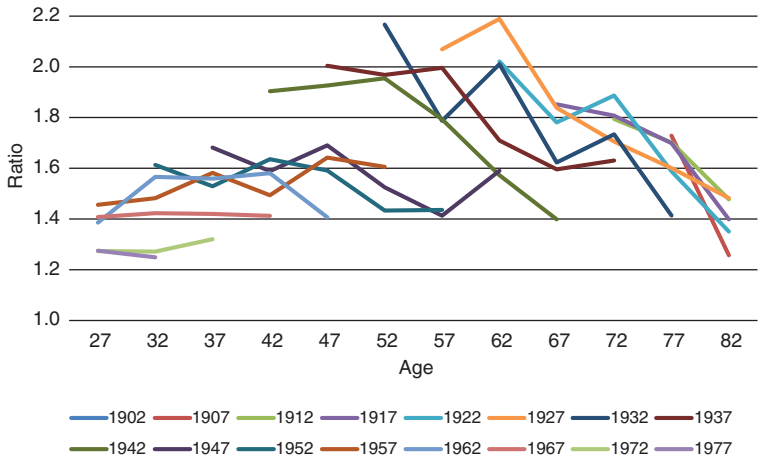


Figure 1(d):
Sex ratio of disposable incomes by age and cohort groups



cross, it is hard to come to any conclusion about income variation from one generation to the next. However, for women alone (Figure 1(c)), income appears to rise throughout an individual's lifetime, and clearly improves from generation to generation. But regardless of the age or generation, women's income is lower than

men's income. Figure 1(d) shows the ratio between men's and women's disposable income obtained from the data presented in Figures 1(b) and 1(c), except for the data from the 1979 survey. We can see that, for all ages and for all generations, this ratio is greater than one. Inequalities appear to decline from one generation to the next, with a sharp division emerging between those born before and after the Second World War.

2.2 Mortality-adjusted disposable income by age and cohort

The mortality-adjusted disposable income indicator is designed to include longevity gains by assigning them a monetary value. This value is determined by the reduction in income that would theoretically be accepted in exchange for enjoying a longer lifespan. Here, we adapt the method described in d'Albis and Bonnet (2018) by calculating the willingness to pay for a longer life at each age, and not just at birth.

Let us start with a life-cycle model with an uncertain lifespan, like those developed by Yaari (1965) and Barro and Friedman (1977), among others. The program of a representative agent of age $a = \{0, 1, \ldots, T\}$ at date t is to maximise an intertemporal utility:

$$V_{a,t} = \sum_{i=a}^{T} \frac{1}{(1+\theta)^{i-a}} \frac{l_{i,t}}{l_{a,t}} u(c_{i,t+i-a}), \tag{1}$$

subject to an intertemporal budget constraint:

$$\sum_{i=a}^{T} \frac{1}{(1+r)^{i-a}} \frac{l_{i,t}}{l_{a,t}} c_{i,t+i-a} = w_{a,t} + \sum_{i=a}^{T} \frac{1}{(1+r)^{i-a}} \frac{l_{i,t}}{l_{a,t}} y_{i,t+i-a}. \tag{2}$$

Variables $c_{a,t}$, $y_{a,t}$, and $w_{a,t}$ represent consumption income and wealth at age a and date t. Moreover, $l_{i,t}/l_{a,t}$ is the probability of surviving to age i for an individual of age a, which is here approximated with period life tables. Finally, θ and r are the discount rate and interest rate, respectively. Assuming $\theta = r$, zero initial wealth and $y_{i,t+i-a} = y_{a,t}$, we find that the optimal consumption is constant and equal to income. The intertemporal utility can thus be written as:

$$V_{a,t} = u(y_{a,t}) a\left(\frac{l_{i,t}}{l_{a,t}}\right), \tag{3}$$

which corresponds to the product of the utility of income and the value of an annuity calculated using survival functions,

$$a\left(\frac{l_{i,t}}{l_{a,t}}\right) = \sum_{i=a}^{T} \frac{1}{(1+r)^{i-a}} \frac{l_{i,t}}{l_{a,t}}. \tag{4}$$

Following Fleurbaey and Gaulier (2009) and d'Albis and Bonnet (2018), we defined a mortality-adjusted income. The principle behind this approach is to calculate a willingness to pay, denoted $x_{a,t}$, by comparing for a given date the life expectancy at age a with the life expectancy that prevails at a late date, denoted t^*. This willingness to pay corresponds to the income an individual at date t would be willing to forego in order to enjoy the life expectancy at date t^*. It is calculated as follows:

$$u(y_{a,t})a\left(\frac{l_{i,t}}{l_{a,t}}\right) = u(y_{a,t} - x_{a,t})a\left(\frac{l_{i,t^*}}{l_{a,t^*}}\right), \tag{5}$$

where $y_{a,t} - x_{a,t}$ corresponds to our mortality-adjusted income, which solves:

$$y_{a,t} - x_{a,t} = u^{-1}\left(\frac{u\left(y_{a,t}\right)a\left(\frac{l_{i,t}}{l_{a,t}}\right)}{a\left(\frac{l_{i,t^*}}{l_{a,t^*}}\right)}\right). \tag{6}$$

The greater the gap in life expectancy between t and t^*, the lower the mortality-adjusted income. Like Becker et al. (2005) and d'Albis and Bonnet (2018), we use a Constant Relative Risk Aversion utility function:

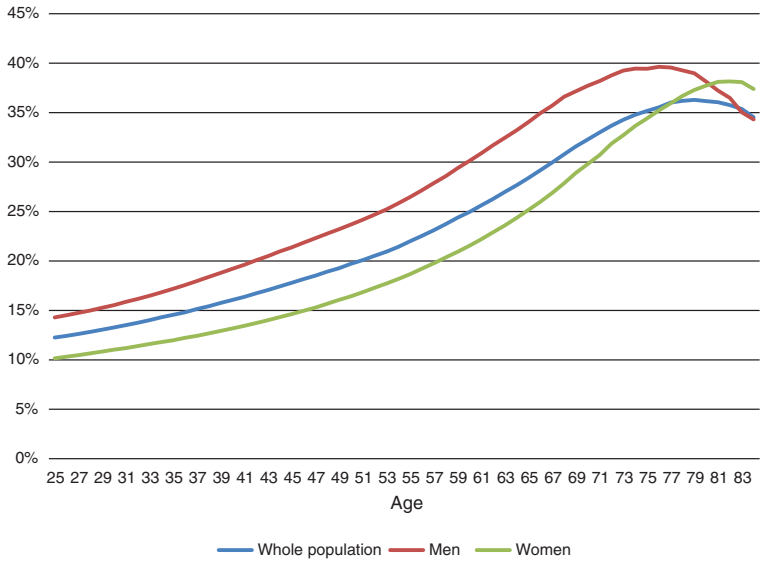
$$u(c) = \frac{c^{1-\frac{1}{\gamma}}}{1-\frac{1}{\gamma}} + \alpha, \tag{7}$$

and choose the following parameter values: $r = 0.03$, $\gamma = 1.25$, and $\alpha = -16.2$. The last two parameters are used in Becker et al. (2005), and enable us to match Murphy and Topel (2003)'s estimates of the Value of a Statistical Life. A robustness check for an alternative set of parameters reveals that the evaluation of the willingness to pay is sensitive to those parameters, but that estimations of age and cohort effects remain qualitatively robust (see Appendix B). Moreover, the dates we consider are those of the BdF surveys; i.e. $t = 1979, 1984, \ldots, 2010$; while the ages are: $a = 25, 26, \ldots, 84$.

The life expectancy by age statistics come from the Human Mortality Database. For reasons of data availability, we use the cross-sectional data. This approach probably underestimates the rise in life expectancy, and, consequently, the benefit to the youngest generations of this rise in life expectancy. As we shall see below, this approach does not undermine our econometric results. Indeed, because it is based cautious assumptions, it strengthens them.

Figure 2 shows the increase in life expectancy at each age from 1979 to 2010 for the whole population, men alone, and women alone. In line with recent mortality trends in most other developed countries, life expectancy in France rose with age, reaching 77 for men and 82 for women (Wilmoth and Horiuchi 1999). The increase was close to 40% by these ages, and then declined. At all ages between 25 and 80, the increase was significantly greater for men than for women.

Figure 2:
Increase in life expectancy at each age between 1979 and 2010



As calculated, willingness to pay was higher for men than for women, most likely because women's life expectancy increased less than that of men. Furthermore, although the willingness to pay declined from one survey to another, it was relatively constant from one age group to another. For example, the share of disposable income men said they were willing to pay in exchange for enjoying a 2010 life expectancy was around 20% in 1979, and more than 10% in 1995. The corresponding shares for women were just over 9% and 4%. Figures 3(a), 3(b), and 3(c) show mortality-adjusted disposable income for, respectively, the whole population, men alone, and women alone. While the age profiles for income do not differ greatly from those in Figures 1(a), 1(b), and 1(c), the differences between the generations are clearer. Figure 3(d) also shows that the differences between men and women are smaller.

2.3 Estimation with pseudo panel data

Individual data can be used to distinguish the effects of age, cohort, and period, provided these are panel data that follow individuals throughout their entire life-cycle. Since our data are cross-sectional, we have built pseudo panels that group individuals belonging to the same cohort. We defined our cohorts using the "date of birth" variable, which resulted in 79 annual cohorts. The first cohort is made up of individuals who were born in 1901, and the last cohort cohort is made up

Figure 3(a):
Mortality-adjusted disposable income by age and cohort groups, constant euros, whole population

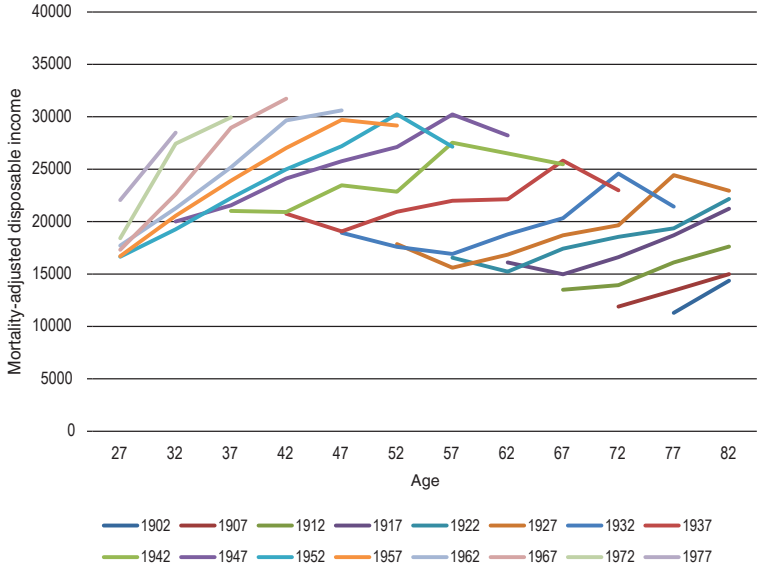


Figure 3(b):
Mortality-adjusted disposable income by age and cohort groups, constant euros, men

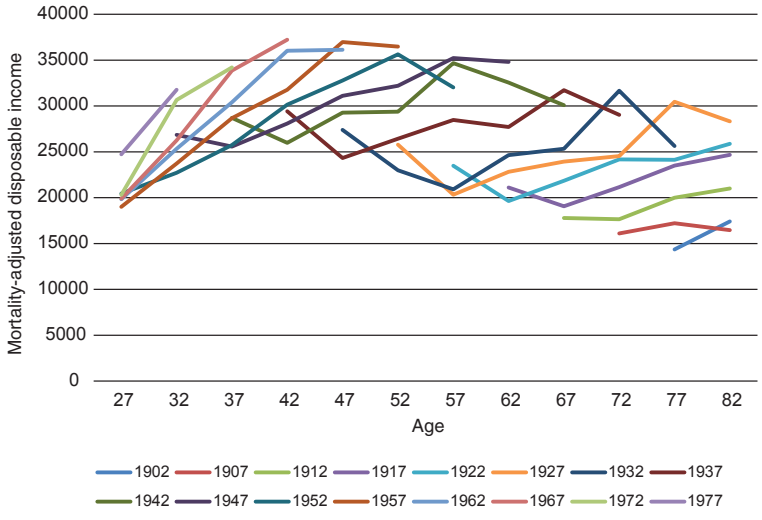


Figure 3(c):
Mortality-adjusted disposable income by age and cohort groups, constant euros, women

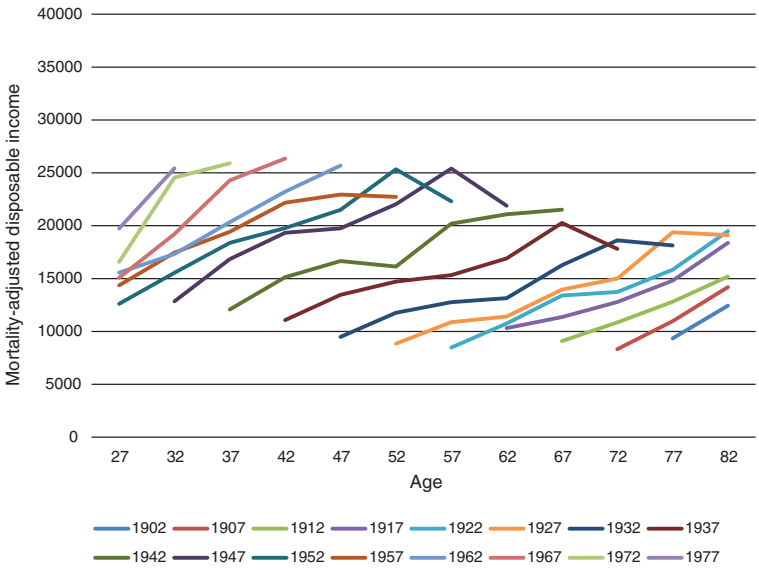


Figure 3(d):
Sex ratio of moratlity adjusted disposable incomes by age and cohort groups

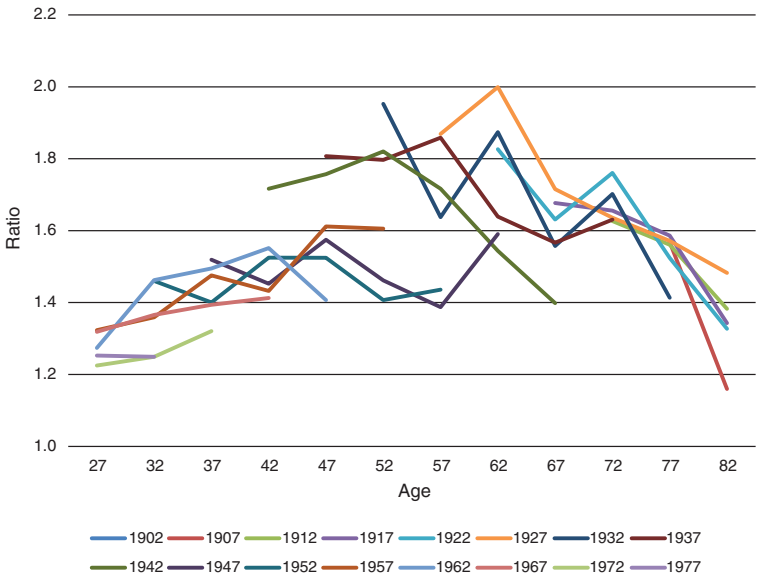


Table 1:
Size of observed cohorts

	All population	Women	Men
Number of cohort observations	407	407	407
Mean size of cohorts	288	150	138
Minimal size	39	24	15
Maximal size	574	305	277
Proportion of cohorts whose size is greater than 100	94%	80%	72%

of individuals who were born in 1979. Our pseudo panel includes 407 observations of our cohorts, because not all cohorts were observed in each survey, and the sizes of cohorts depended on the samples used (see Table 1). The observation numbers were small mainly for the older cohorts, and particularly for men, as their life expectancy was lower.

The simultaneous introduction of the "age", "cohort", and "period" variables in the estimation creates a collinearity problem because the survey year is equal to the sum of the "age" and "cohort" variables. As was noted in d'Albis and Badji (2017), various solutions to this problem have been proposed in the literature. We have chosen to follow the most common strategy: namely, that of Deaton and Paxson (1994). This approach imposes restrictions on the estimated parameters based on the assumption that period effects sum to zero, and are orthogonal to the long-term trend.

We assume that the three effects (age, cohort, and period) that we are seeking to estimate are additive. The model equation is written as follows:

$$\log \bar{y}_{jt} = \mu + \sum_i \alpha_i 1_{a_{jt}} + \sum_c \beta_c 1_{j=c} + \sum_t \gamma_t 1_{t=p} + \bar{\varepsilon}_{jt} \tag{8}$$

where $\bar{y}_{jt}$ represents the explained variable related to cohort $j = 1901, 1902, \ldots, 1979$ and survey dates $t = 1979, 1984, \ldots, 2010$, 1_{ajt} represent the indicators of the five-year age brackets from 25–29 years old to 80–84 years old associated with cohort j at date t, $1_{j=c}$ represent the indicators of the cohorts, and $1_{t=p}$ represent the indicators associated with survey dates t.

We estimated our equation for each of the variables of interest: disposable income and mortality-adjusted disposable income, both for the whole population and for men and women separately. Looking at Table 2, we can see that in all instances, the tests for fixed individual effects (which in our case are cohort effects, given by the term $\sum_c \beta_c 1_{j=c}$) were positive, which justifies our choice of a fixed effects model. More precisely, we estimated a Least Square Dummy Variable type fixed effects model.

Table 2:
Test for fixed individual effects and Hausman test

	Individual effects test		**Hausman test**	
	F-statistic	**P-value**	**F-statistic**	**P-value**
Disposable income				
All population	17.15	0.00	300.80	0.00
Men	5.76	0.00	229.98	0.00
Women	28.22	0.00	329.92	0.00
Mortality-adjusted disposable income				
All population	30.01	0.00	334.58	0.00
Men	14.13	0.00	286.38	0.00
Women	35.84	0.00	341.83	0.00

3 Results

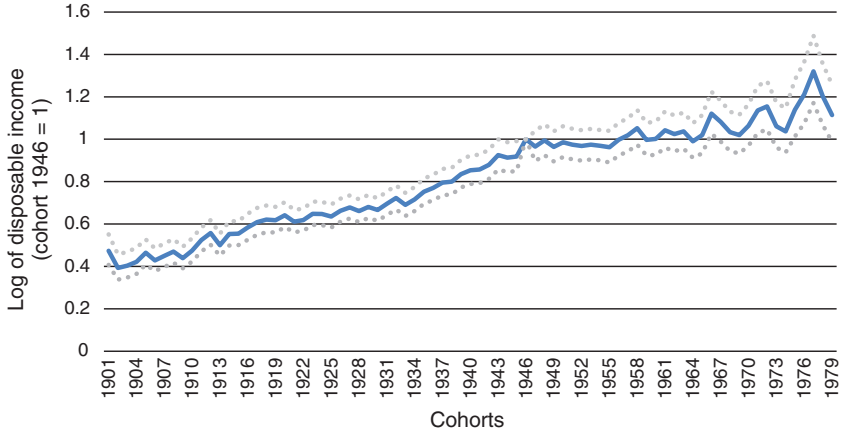
We now present our results by analysing in turn the cohort and the age effects on the two income measures presented above. We then provide a general discussion of the results. Period effects are not discussed here because they are not directly related to the research question of this article. All estimates are given in Appendix A.

3.1 Comparisons of incomes across cohorts

Figures 4, 5, and 6 represent the logarithm of the two incomes we consider as functions of the birth date when we control for age and period effects. Figure 7 covers the whole population, whereas Figures 8 and 9 refer to men and women, respectively. In each figure, panel (a) is the logarithm of the disposable income, and panel (b) is the logarithm of the mortality-adjusted disposable income. The results are expressed as a deviation from a reference cohort; i.e. the cohort born in 1946. Moreover, the grey lines delimit the confidence interval at the 5% level.

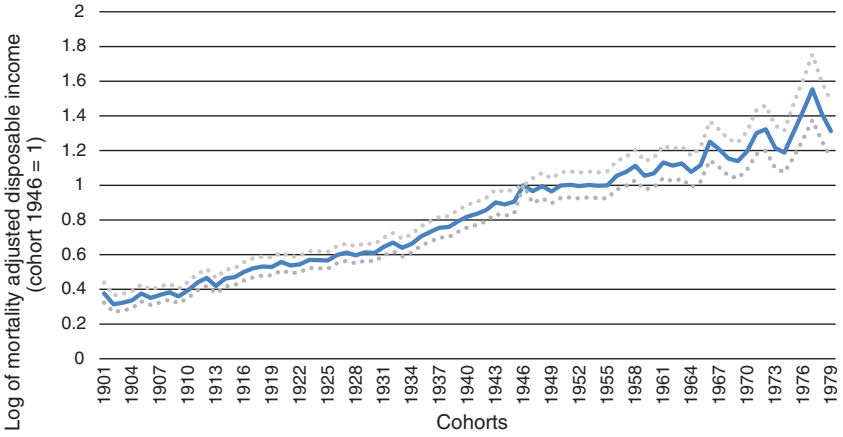
When we consider the whole population (Figure 4), we can discern two major periods in the development of disposable income by date of birth. Among the cohorts born before the Second World War, incomes increased significantly from generation to generation: from the 1926 cohort to the 1946 cohort, incomes rose 40%. But among the post-war cohorts, there were no significant changes. A slight increase can be observed for the latest cohorts. However, since there is less information on these cohorts in our databases, this finding should not be given too much importance. The observation that disposable income has stagnated suggests that that the baby boom cohorts in particular have not had higher living standards

Figure 4(a):
Log of disposable income (values relative to cohort 1946) as a function of the date of birth, whole population



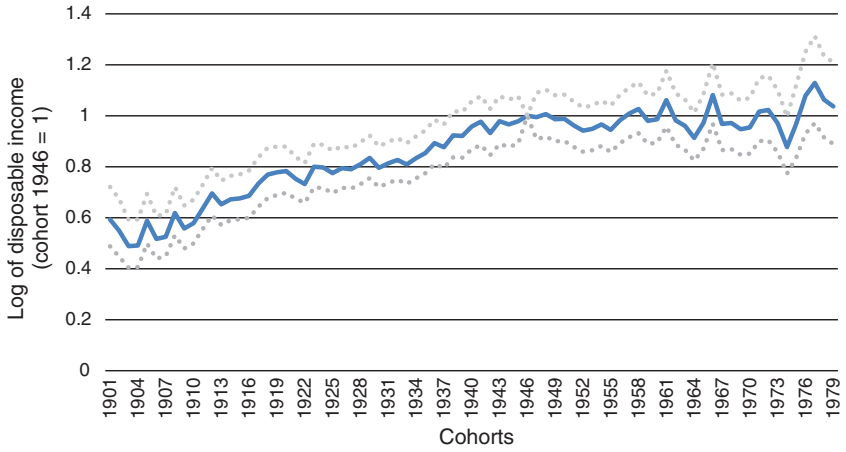
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period.

Figure 4(b):
Log of mortality adjusted disposable income (values relative to cohort 1946) as a function of the date of birth, whole population



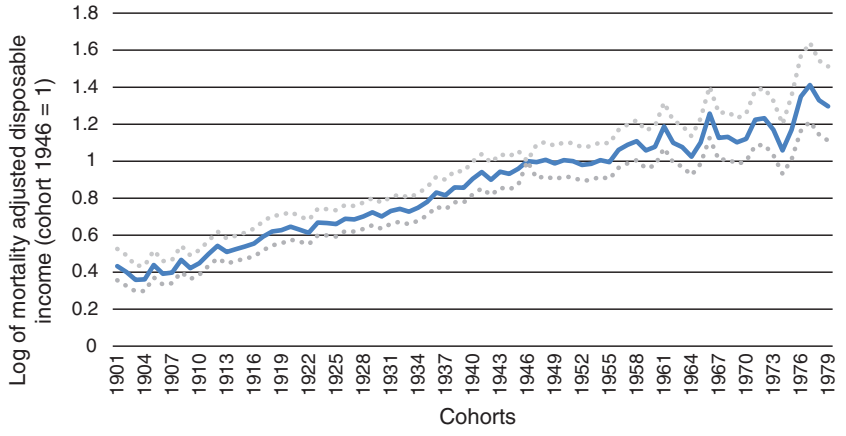
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period.

Figure 5(a):
Log of disposable income (values relative to cohort 1946) as a function of the date of birth, men



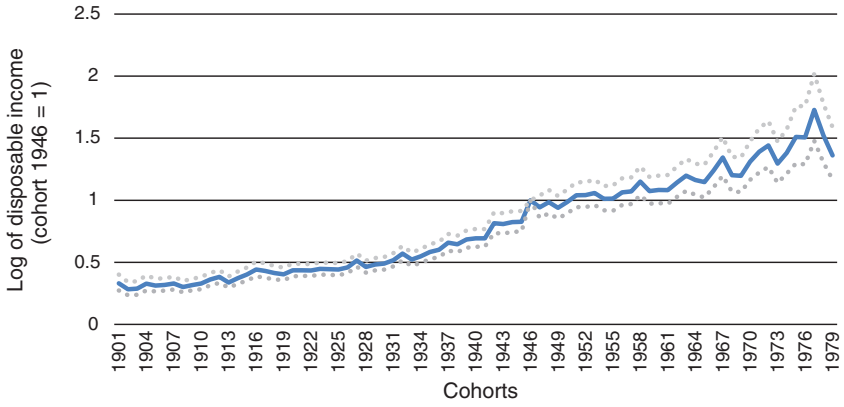
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period.

Figure 5(b):
Log of mortality adjusted disposable income (values relative to cohort 1946) as a function of the date of birth, men



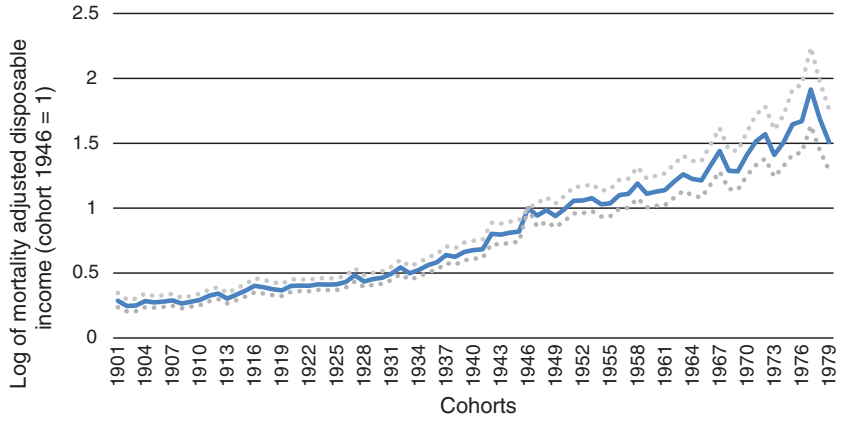
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period.

Figure 6(a):
Log of disposable income (values relative to cohort 1946) as a function of the date of birth, women



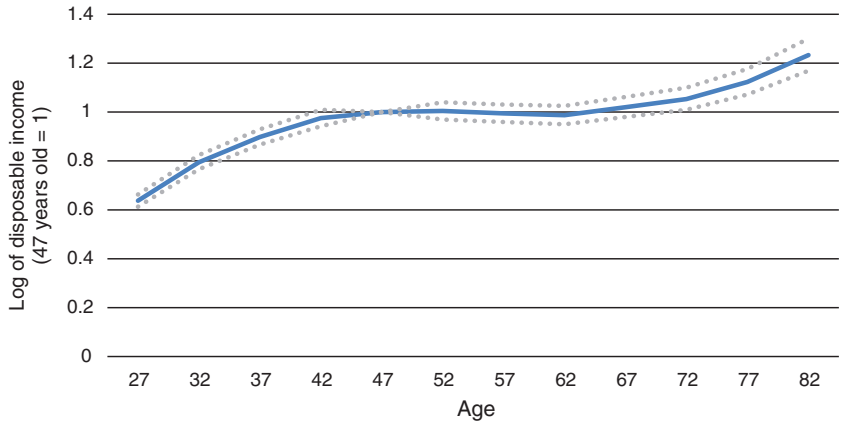
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period.

Figure 6(b):
Log of mortality adjusted disposable income (values relative to cohort 1946) as a function of the date of birth, women



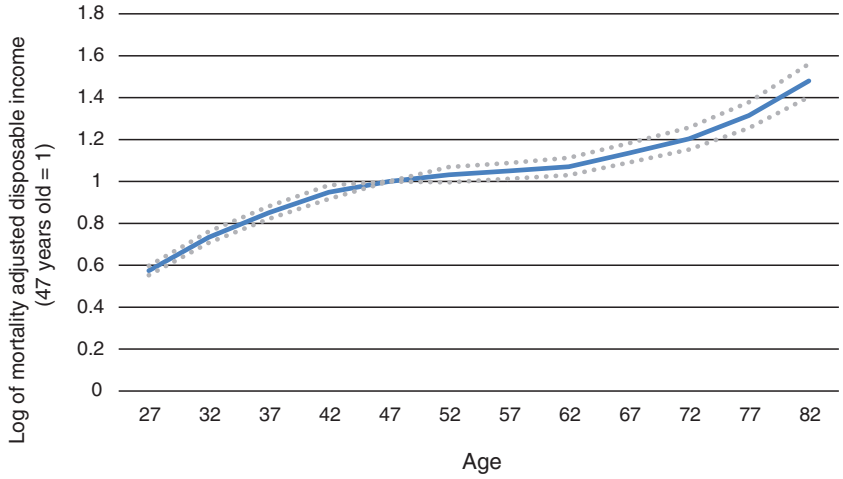
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period.

Figure 7(a):
Log of disposable income (values relative to age 47) as a function of the age group, whole population



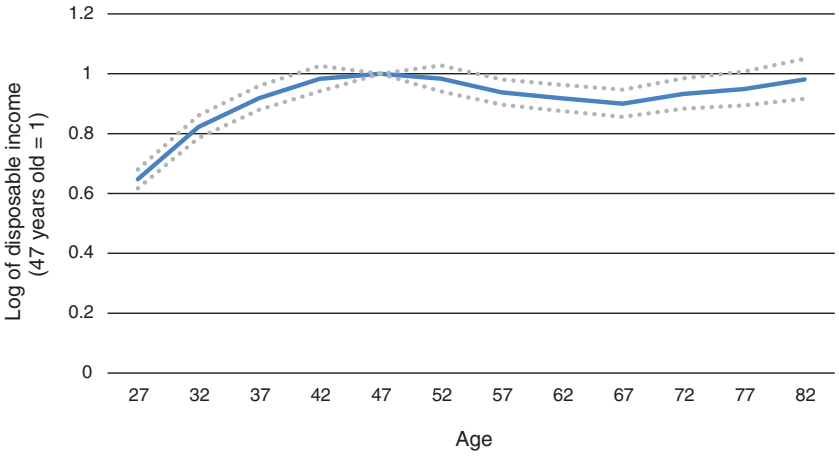
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the date of birth and the period.

Figure 7(b):
Log of mortality-adjusted disposable income (values relative to age 47) as a function of the age group, whole population



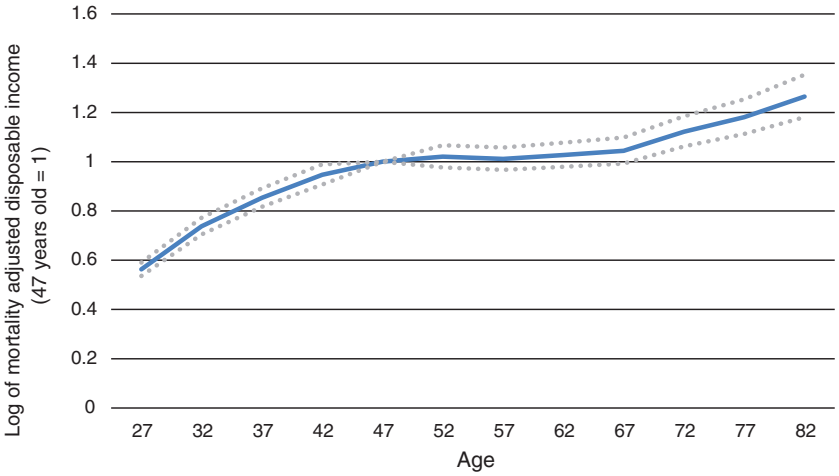
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the date of birth and the period.

Figure 8(a):
Log of disposable income (values relative to age 47) as a function of the age group, men



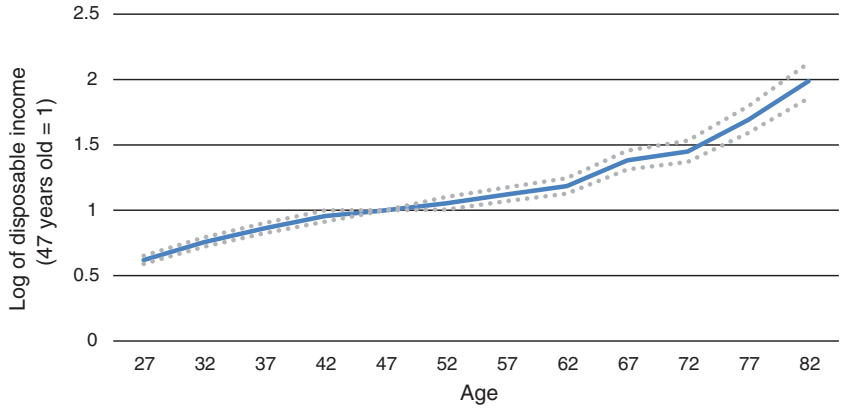
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the date of birth and the period.

Figure 8(b):
Log of mortality-adjusted disposable income (values relative to age 47) as a function of the age group, men



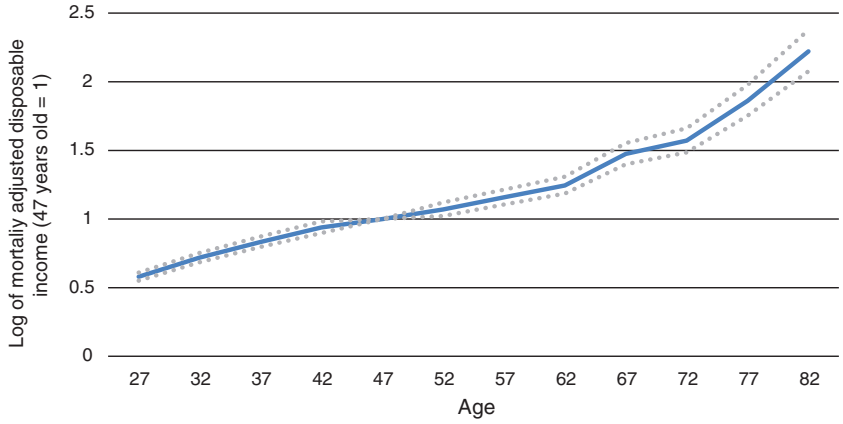
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the date of birth and the period.

Figure 9(a):
Log of disposable income (values relative to age 47) as a function of the age group, women



Note: The dotted curves show the confidence intervals at 95%. Model controlled for the date of birth and the period.

Figure 9(b):
Log of mortality-adjusted disposable income (values relative to age 47) as a function of the age group, women



Note: The dotted curves show the confidence intervals at 95%. Model controlled for the date of birth and the period.

than subsequent cohorts (d'Albis and Badji 2017). When the gains from higher life expectancy are added, the distinction between these two periods becomes much less clear. Mortality-adjusted disposable income increased throughout the study period. In particular, we can see that all of the cohorts born after 1960 have enjoyed significantly higher incomes than the cohort born in 1946. We find, for example, that mortality-adjusted disposable income rose 28.6% from the 1946 cohort to the 1966 cohort, compared to 49.4% from the 1926 to the 1946 cohort. It thus appears that, ultimately, all of the post-baby boom cohorts had a higher adjusted income than the baby boomers. Note that our results are reinforced when using private consumption rather that disposable income (see Appendix B).

The breakdown by sex is also highly instructive. The variation in disposable income has been much flatter for the male population (Figure 5) than for the population as a whole. The increase observed among the pre-war cohorts is less pronounced, and no further relative improvement can be seen from the 1946 cohort to the 1970s cohorts. Including life expectancy gains hardly alters this observation, although we do find that the increase was greater for the pre-war cohorts, and that some post-baby boom cohorts had a significantly higher mortality-adjusted income than the 1946 cohort.

The results for the female population differ dramatically from those for the male population (Figure 6). Even before we include life expectancy gains, we see a considerable increase. For example, we find that disposable income for women rose 27% from the 1946 cohort to the 1966 cohort, compared to 71.9% from the 1926 cohort to the 1946 cohort. Furthermore, we can see that all of the cohorts born after 1961 had significantly higher incomes than the 1946 cohort. When life expectancy gains are included, these increases are slightly greater: i.e. mortality-adjusted disposable income for women rose 38.8% from the 1946 cohort to the 1966 cohort, and 76.6% from the 1926 cohort to the 1946 cohort.

It is of interest to note that recent studies of intergenerational mobility have focused on men alone. Lefranc (2018) has shown that the intergenerational persistence of income has increased starting with the cohorts born in the 1950s; while Alesina et al. (2018) has found that the French, like other Europeans, are pessimistic about intergenerational mobility. Our results suggest that the positions of men are not representative of the positions of the population as a whole; and, thus, that focusing on men's experiences conceals the improvements women have enjoyed. Moreover, as those two studies used data from the same survey (*Formation et Qualification Professionnelle*), which does not contain explicit information on income, the authors had to estimate income. Using the same survey to study intergenerational mobility through social classes, Vallet (2017) concluded that mobility increased for the younger cohorts, and that improvements were larger for women than for men; while Ben-Halima et al. (2014) showed that the degree of intergenerational persistence was less pronounced for daughters than for sons. The

findings of both of these studies complement our results, which highlight the role of education in the reduction in intergenerational inequalities.

3.2 Comparisons of incomes across age groups

Figures 7, 8, and 9 represent the logarithm of the two incomes we consider as functions of the age when we control for cohort and period effects. Figure 7 covers the whole population, whereas Figures 8 and 9 display the findings for men and women, respectively. In each figure, the left panel is the logarithm of the disposable income, and the right panel is the logarithm of the mortality-adjusted disposable income. The results are expressed as a deviation from a reference age group of 45–49-year-olds. As above, the grey lines delimit the confidence interval at the 5% level.

Looking at the population as a whole (Figure 7), we can see that disposable income by age increased sharply (+43.7%) from ages 27 to 47,[2] levelled out up to age 62, and then rose moderately (+27.9%) up to age 82. Note that this general increase in disposable income differs greatly from the pattern implied by the descriptive statistics in Figure 1(a). After controlling for cohort and period effects, the perceived dip in income after age 50 disappears, and indeed turns into an improvement. The rise in income after age 62 may be explained by a composition effect similar to the one described in the literature on the missing poor in the poverty statistics (Kanbur and Mukherjee 2007). Since longevity correlates with income, the proportion of low-income people tends to decline from one higher age group to the next.

When longevity gains are included, we find that income growth was continuous over a lifetime; and, indeed, rose later in life. Adjusted growth was 53% from ages 27 to 47, 7.3% from ages 47 to 62, and 50.1% from ages 62 to 82. Thus, we can see that the gains have been particularly large for the oldest people. These observations are in line with evidence indicating that since the late 1970s, life expectancy gains in France have occurred mainly at higher ages.

The breakdown of these results by sex uncovers wide disparities between men and women. Men's disposable income (Figure 8) stopped rising after age 52, and was even significantly lower from ages 57 to 77 than at age 47. By age 67, men's income had declined 9.5%. By contrast, women's disposable income (Figure 9) rose continuously, increasing 46.3% from ages 27 to 47, 20.3% from ages 47 to 62, and 123% from ages 62 to 82. Including longevity gains greatly alters the curve of men's income by age, which was significantly higher after age 67 than it was at age 47. Taking these gains into account also increases the slope of the curve of women's income.

[2] For ease of viewing, we have named each age group after its median. Thus, the 25–29 age group is named 27.

3.3 Discussion

A number of conclusions may be drawn from our estimates. The first is that there can be inequality between age groups without any generation losing out. None of the income by age curves presented in Section 3.2 slopes downwards: in most cases, the slopes rise, and a few level out (or fall slightly) during part of the life-cycle. This observation implies that, on average, a person of a given age has an income that is higher than or equal to that of a younger person, after controlling for cohort and period effects. But the finding that young people are less rich than current seniors does not mean that they lose out: in all of our estimates, their income was always found to be higher than or equal to that of members of previous generations at the same age. d'Albis and Badji (2017) attributed this pattern to economic growth. Although the growth in real per capita GDP was less vigorous between 1979 and 2010 than it was during the 30 years that followed the Second World War, it still increased 50% over this period.

Including longevity gains only supported this observation. After these gains were added, hardly any periods of stagnation in mortality-adjusted disposable income remained: in all of our models, that indicator rose as a function both of age and year of birth. This is likely because life expectancy at birth rose from 1979 to 2010 (10% to 40%, depending on age and sex), which added to the effect of economic growth. Thus, it is clear that well-being, which was measured here by combining an economic and a demographic indicator, improved both over a lifetime and from one generation to the next. If we assume that equity between generations is ensured as long as their well-being does not deteriorate (Stavins et al. 2003; Arrow et al. 2004), we can conclude that the relative positions of the French cohorts born from 1901 to 1979 have been equitable.

However, our breakdown of the population into men and women has led us to qualify this observation. It is clear that most of the gains in mortality-adjusted disposable income have gone to women, whose economic positions greatly improved over this period. Conversely, the mortality-adjusted disposable income levels of men varied little for all of the cohorts born after the Second World War. Thus, while men's well-being has not worsened, it has not improved as much as that of women. This point in no way detracts from the reality that men continue to have much higher disposable income than women (for example, among 52-year-olds in 2010, men's income levels were 60% higher than women's). Our observations merely reveal that women's earnings are catching up to those of men.

4 Concluding remarks

In this article, we examined the variation in well-being across the generations and across different ages in France. We constructed a composite indicator that assigns a monetary value to life expectancy gains in order to obtain mortality-adjusted disposable income. We showed that, generally speaking, this indicator has increased

from generation to generation. However, a breakdown by sex revealed that the position of women has improved considerably, while that of men has stagnated for all of the cohorts born after the Second World War. Over a life-cycle, this indicator has generally risen. From a public policy perspective, these results suggest that reducing the benefits of the elderly based on the assumption that they are advantaged relative to young people is not well grounded. Thus, reducing the living standards of baby boomers may not be equitable.

This research could be improved by including other dimensions of well-being. Leisure is obviously a major constituent of well-being (Jones and Klenow 2016). It is likely that the centuries-long reduction in working hours that has occurred across the developed countries (Boppart and Krusell 2016) has led to an increase in leisure time from one generation to the next. This would tend to support our basic conclusions that the well-being of generations has not declined, and that equity between the generations has been preserved. It would, however, be useful to examine how these developments have differed for men and women by taking into account the time spent on domestic production. This cannot be done with BdF survey data alone. Unfortunately, the main time use survey in France, the *Emploi du Temps*, covers a much shorter period (d'Albis et al. 2016). An additional avenue for future research would be income inequality. Here it would be useful to distinguish between general inequality and inequality by age, and to determine which of these forms of inequality has the greatest impact on individual well-being. Similarly, we may want to decompose our estimation by socio-economic status. These further questions are on our research agenda.

Acknowledgments

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Appendix A: Estimation results

We present our estimation results below. The explanatory variables are the age, the cohort, and the period, while the independent variable is the logarithm of the disposable income (Model M1) and the logarithm of the mortality-adjusted disposable income (Model M2). Data sources are the authors' own calculations using waves 1979, 1984, 1989, 1995, 2000, 2005, and 2010 of the French Household Expenditure survey (*enquêtes Budget de famille*) from the Insee. In all tables, standard errors are in parentheses, and significance is denoted as follows: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

	Whole population		Women		Men	
Variables	**M1**	**M2**	**M1**	**M2**	**M1**	**M2**
			Age effects			
25–29	−0.45***	−0.55***	−0.48***	−0.55***	−0.43***	−0.57***
	(0.020)	(0.020)	(0.026)	(0.026)	(0.025)	(0.025)
30–34	−0.23***	−0.31***	−0.28***	−0.33***	−0.20***	−0.30***
	(0.019)	(0.019)	(0.024)	(0.024)	(0.023)	(0.023)
35–39	−0.11***	−0.16***	−0.15***	−0.18***	−0.08***	−0.16***
	(0.018)	(0.018)	(0.023)	(0.023)	(0.022)	(0.022)
40–44	−0.03	−0.05***	−0.05**	−0.06***	−0.02	−0.05**
	(0.018)	(0.018)	(0.023)	(0.023)	(0.022)	(0.022)
45–49	Ref	Ref	Ref	Ref	Ref	Ref
50–54	0.00	0.03*	0.05**	0.07***	−0.02	0.02
	(0.018)	(0.018)	(0.023)	(0.023)	(0.022)	(0.022)
55–59	−0.01	0.05***	0.11***	0.15***	−0.06***	0.01
	(0.018)	(0.018)	(0.024)	(0.024)	(0.023)	(0.023)
60–64	−0.01	0.07***	0.17***	0.22***	−0.09***	0.03
	(0.019)	(0.020)	(0.025)	(0.025)	(0.024)	(0.024)
65–69	0.02	0.13***	0.32***	0.39***	−0.11***	0.04*
	(0.020)	(0.021)	(0.026)	(0.026)	(0.026)	(0.026)
70–74	0.05**	0.19***	0.37***	0.45***	−0.07**	0.12***
	(0.022)	(0.022)	(0.028)	(0.028)	(0.028)	(0.028)
75–79	0.12***	0.27***	0.53***	0.62***	−0.05*	0.17***
	(0.024)	(0.024)	(0.031)	(0.031)	(0.030)	(0.030)
80–84	0.21***	0.39***	0.69***	0.80***	−0.02	0.23***
	(0.027)	(0.027)	(0.034)	(0.034)	(0.035)	(0.035)
Observations	407	407	407	407	407	407
R-squared	0.90	0.92	0.91	0.92	0.81	0.87
			Cohorts effects			
1901	−0.75***	−0.98***	−1.11***	−1.25***	−0.52***	−0.84***
	(0.077)	(0.078)	(0.098)	(0.098)	(0.099)	(0.099)
1902	−0.94***	−1.16***	−1.26***	−1.40***	−0.60***	−0.91***
	(0.076)	(0.077)	(0.094)	(0.094)	(0.104)	(0.105)
1903	−0.91***	−1.13***	−1.25***	−1.39***	−0.72***	−1.02***
	(0.076)	(0.077)	(0.097)	(0.097)	(0.097)	(0.097)
1904	−0.86***	−1.09***	−1.11***	−1.26***	−0.71***	−1.02***
	(0.074)	(0.074)	(0.093)	(0.093)	(0.096)	(0.096)
1905	−0.77***	−0.98***	−1.16***	−1.30***	−0.53***	−0.82***
	(0.065)	(0.065)	(0.082)	(0.082)	(0.084)	(0.084)

Continued

	Whole population		Women		Men	
Variables	**M1**	**M2**	**M1**	**M2**	**M1**	**M2**
			Cohorts effects			
1906	−0.85***	−1.05***	−1.15***	−1.27***	−0.66***	−0.94***
	(0.063)	(0.063)	(0.079)	(0.079)	(0.082)	(0.082)
1907	−0.80***	−1.00***	−1.11***	−1.24***	−0.64***	−0.92***
	(0.063)	(0.063)	(0.080)	(0.080)	(0.079)	(0.080)
1908	−0.76***	−0.96***	−1.20***	−1.33***	−0.48***	−0.76***
	(0.061)	(0.061)	(0.077)	(0.077)	(0.078)	(0.078)
1909	−0.82***	−1.02***	−1.15***	−1.28***	−0.58***	−0.86***
	(0.058)	(0.059)	(0.073)	(0.073)	(0.077)	(0.077)
1910	−0.75***	−0.93***	−1.11***	−1.23***	−0.55***	−0.80***
	(0.059)	(0.060)	(0.076)	(0.076)	(0.075)	(0.075)
1911	−0.65***	−0.82***	−1.02***	−1.12***	−0.45***	−0.70***
	(0.055)	(0.055)	(0.070)	(0.070)	(0.069)	(0.069)
1912	−0.58***	−0.76***	−0.96***	−1.07***	−0.36***	−0.61***
	(0.053)	(0.054)	(0.068)	(0.068)	(0.068)	(0.068)
1913	−0.69***	−0.87***	−1.09***	−1.19***	−0.43***	−0.67***
	(0.052)	(0.053)	(0.067)	(0.067)	(0.067)	(0.067)
1914	−0.59***	−0.77***	−0.99***	−1.10***	−0.40***	−0.64***
	(0.053)	(0.053)	(0.068)	(0.068)	(0.066)	(0.066)
1915	−0.59***	−0.75***	−0.91***	−1.01***	−0.39***	−0.62***
	(0.052)	(0.052)	(0.066)	(0.066)	(0.066)	(0.066)
1916	−0.54***	−0.69***	−0.82***	−0.91***	−0.38***	−0.59***
	(0.054)	(0.054)	(0.068)	(0.068)	(0.069)	(0.069)
1917	−0.50***	−0.65***	−0.84***	−0.94***	−0.31***	−0.52***
	(0.053)	(0.053)	(0.069)	(0.069)	(0.067)	(0.067)
1918	−0.48***	−0.63***	−0.88***	−0.98***	−0.26***	−0.48***
	(0.052)	(0.052)	(0.067)	(0.067)	(0.065)	(0.065)
1919	−0.48***	−0.64***	−0.91***	−1.00***	−0.25***	−0.47***
	(0.049)	(0.050)	(0.064)	(0.064)	(0.062)	(0.062)
1920	−0.44***	−0.58***	−0.83***	−0.91***	−0.24***	−0.44***
	(0.047)	(0.047)	(0.060)	(0.060)	(0.059)	(0.059)
1921	−0.49***	−0.62***	−0.83***	−0.91***	−0.28***	−0.46***
	(0.044)	(0.044)	(0.056)	(0.056)	(0.055)	(0.055)
1922	−0.48***	−0.61***	−0.83***	−0.91***	−0.31***	−0.49***
	(0.043)	(0.043)	(0.056)	(0.056)	(0.054)	(0.054)
1923	−0.43***	−0.56***	−0.80***	−0.88***	−0.22***	−0.40***
	(0.043)	(0.043)	(0.056)	(0.056)	(0.054)	(0.054)
1924	−0.43***	−0.56***	−0.81***	−0.89***	−0.23***	−0.41***
	(0.043)	(0.043)	(0.056)	(0.056)	(0.054)	(0.054)

Continued

	Whole population		Women		Men	
Variables	**M1**	**M2**	**M1**	**M2**	**M1**	**M2**
			Cohorts effects			
1925	−0.45***	−0.57***	−0.82***	−0.88***	−0.25***	−0.42***
	(0.043)	(0.043)	(0.056)	(0.056)	(0.054)	(0.055)
1926	−0.41***	−0.51***	−0.78***	−0.84***	−0.23***	−0.37***
	(0.042)	(0.042)	(0.054)	(0.054)	(0.052)	(0.052)
1927	−0.39***	−0.49***	−0.66***	−0.73***	−0.24***	−0.38***
	(0.041)	(0.041)	(0.053)	(0.053)	(0.051)	(0.051)
1928	−0.41***	−0.52***	−0.77***	−0.83***	−0.21***	−0.35***
	(0.041)	(0.041)	(0.053)	(0.053)	(0.051)	(0.052)
1929	−0.39***	−0.49***	−0.73***	−0.79***	−0.18***	−0.32***
	(0.041)	(0.041)	(0.053)	(0.053)	(0.051)	(0.051)
1930	−0.41***	−0.50***	−0.71***	−0.77***	−0.23***	−0.35***
	(0.041)	(0.041)	(0.053)	(0.053)	(0.051)	(0.051)
1931	−0.36***	−0.44***	−0.66***	−0.70***	−0.21***	−0.31***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1932	−0.32***	−0.40***	−0.56***	−0.61***	−0.19***	−0.30***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1933	−0.37***	−0.45***	−0.65***	−0.70***	−0.21***	−0.32***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1934	−0.33***	−0.41***	−0.60***	−0.65***	−0.18***	−0.29***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1935	−0.28***	−0.35***	−0.54***	−0.58***	−0.16***	−0.25***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1936	−0.26***	−0.31***	−0.51***	−0.54***	−0.11**	−0.19***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1937	−0.23***	−0.28***	−0.42***	−0.45***	−0.13***	−0.20***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1938	−0.22***	−0.27***	−0.44***	−0.47***	−0.08	−0.15***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1939	−0.18***	−0.23***	−0.38***	−0.41***	−0.08*	−0.16***
	(0.040)	(0.040)	(0.052)	(0.052)	(0.049)	(0.050)
1940	−0.16***	−0.20***	−0.37***	−0.39***	−0.04	−0.10**
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1941	−0.15***	−0.18***	−0.37***	−0.38***	−0.02	−0.06
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1942	−0.13***	−0.15***	−0.21***	−0.22***	−0.07	−0.11**
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1943	−0.08**	−0.10***	−0.21***	−0.23***	−0.02	−0.06
	(0.039)	(0.040)	(0.052)	(0.052)	(0.049)	(0.049)

Continued

	Whole population		Women		Men	
Variables	**M1**	**M2**	**M1**	**M2**	**M1**	**M2**
			Cohorts effects			
1944	−0.09**	−0.12***	−0.19***	−0.21***	−0.03	−0.07
	(0.039)	(0.039)	(0.051)	(0.051)	(0.048)	(0.049)
1945	−0.09**	−0.10**	−0.19***	−0.20***	−0.02	−0.04
	(0.039)	(0.039)	(0.051)	(0.051)	(0.049)	(0.049)
1946	Ref	Ref	Ref	Ref	Ref	Ref
1947	−0.04	−0.03	−0.06	−0.06	−0.01	−0.01
	(0.037)	(0.038)	(0.049)	(0.049)	(0.046)	(0.046)
1948	−0.01	−0.00	−0.02	−0.02	0.01	0.01
	(0.037)	(0.038)	(0.049)	(0.049)	(0.046)	(0.046)
1949	−0.04	−0.04	−0.06	−0.06	−0.01	−0.01
	(0.037)	(0.038)	(0.049)	(0.049)	(0.046)	(0.047)
1950	−0.01	−0.00	−0.01	−0.01	−0.01	0.01
	(0.038)	(0.038)	(0.049)	(0.049)	(0.047)	(0.047)
1951	−0.03	0.00	0.04	0.06	−0.04	0.00
	(0.038)	(0.038)	(0.049)	(0.049)	(0.047)	(0.047)
1952	−0.03	−0.00	0.04	0.06	−0.06	−0.02
	(0.038)	(0.038)	(0.049)	(0.049)	(0.047)	(0.047)
1953	−0.03	0.00	0.06	0.07	−0.05	−0.01
	(0.038)	(0.038)	(0.049)	(0.049)	(0.047)	(0.047)
1954	−0.03	−0.00	0.01	0.03	−0.03	0.01
	(0.037)	(0.038)	(0.049)	(0.049)	(0.047)	(0.047)
1955	−0.04	−0.00	0.01	0.04	−0.06	−0.01
	(0.039)	(0.040)	(0.051)	(0.051)	(0.049)	(0.049)
1956	−0.00	0.05	0.06	0.10*	−0.02	0.06
	(0.039)	(0.039)	(0.051)	(0.051)	(0.049)	(0.049)
1957	0.02	0.07*	0.07	0.10**	0.01	0.08*
	(0.039)	(0.039)	(0.051)	(0.051)	(0.049)	(0.049)
1958	0.05	0.11***	0.14***	0.17***	0.03	0.10**
	(0.039)	(0.040)	(0.051)	(0.051)	(0.049)	(0.049)
1959	−0.00	0.05	0.07	0.11**	−0.02	0.06
	(0.039)	(0.039)	(0.051)	(0.051)	(0.049)	(0.049)
1960	0.00	0.07*	0.08	0.12**	−0.01	0.08
	(0.040)	(0.040)	(0.052)	(0.052)	(0.050)	(0.050)
1961	0.04	0.12***	0.08	0.13**	0.06	0.17***
	(0.042)	(0.042)	(0.054)	(0.054)	(0.052)	(0.053)
1962	0.02	0.11**	0.13**	0.19***	−0.02	0.09*
	(0.042)	(0.042)	(0.054)	(0.054)	(0.052)	(0.052)

Continued

	Whole population		Women		Men	
Variables	**M1**	**M2**	**M1**	**M2**	**M1**	**M2**
			Cohorts effects			
1963	0.04	0.12***	0.18***	0.23***	−0.04	0.07
	(0.042)	(0.042)	(0.055)	(0.055)	(0.052)	(0.052)
1964	−0.01	0.07*	0.15***	0.20***	−0.09*	0.02
	(0.042)	(0.042)	(0.055)	(0.055)	(0.052)	(0.052)
1965	0.02	0.11**	0.14**	0.19***	−0.03	0.10*
	(0.045)	(0.045)	(0.058)	(0.058)	(0.056)	(0.056)
1966	0.11**	0.22***	0.21***	0.28***	0.08	0.23***
	(0.045)	(0.045)	(0.059)	(0.059)	(0.056)	(0.056)
1967	0.08*	0.19***	0.30***	0.36***	−0.03	0.12**
	(0.045)	(0.046)	(0.059)	(0.059)	(0.057)	(0.057)
1968	0.03	0.14***	0.18***	0.25***	−0.03	0.12**
	(0.046)	(0.046)	(0.059)	(0.059)	(0.057)	(0.057)
1969	0.02	0.13***	0.18***	0.25***	−0.05	0.10*
	(0.045)	(0.046)	(0.059)	(0.059)	(0.057)	(0.057)
1970	0.06	0.18***	0.27***	0.34***	−0.05	0.11*
	(0.046)	(0.047)	(0.060)	(0.060)	(0.058)	(0.058)
1971	0.13**	0.26***	0.33***	0.42***	0.02	0.20***
	(0.050)	(0.050)	(0.065)	(0.065)	(0.062)	(0.062)
1972	0.14***	0.28***	0.37***	0.45***	0.02	0.21***
	(0.050)	(0.050)	(0.065)	(0.065)	(0.063)	(0.063)
1973	0.06	0.20***	0.26***	0.34***	−0.03	0.16**
	(0.051)	(0.051)	(0.065)	(0.065)	(0.064)	(0.064)
1974	0.04	0.17***	0.32***	0.41***	−0.13**	0.06
	(0.051)	(0.051)	(0.066)	(0.066)	(0.064)	(0.064)
1975	0.13**	0.27***	0.41***	0.50***	−0.03	0.16**
	(0.060)	(0.060)	(0.077)	(0.078)	(0.074)	(0.075)
1976	0.19***	0.35***	0.41***	0.51***	0.08	0.30***
	(0.061)	(0.061)	(0.079)	(0.079)	(0.075)	(0.076)
1977	0.28***	0.44***	0.55***	0.65***	0.12	0.34***
	(0.061)	(0.062)	(0.079)	(0.079)	(0.076)	(0.077)
1978	0.18***	0.35***	0.42***	0.52***	0.06	0.28***
	(0.061)	(0.061)	(0.079)	(0.079)	(0.076)	(0.076)
1979	0.11*	0.27***	0.31***	0.41***	0.04	0.26***
	(0.061)	(0.062)	(0.079)	(0.079)	(0.078)	(0.078)
Constant	10.29***	10.21***	9.98***	9.93***	10.50***	10.39***
	(0.029)	(0.030)	(0.038)	(0.038)	(0.037)	(0.037)
Observations	407	407	407	407	407	407
R-squared	0.90	0.92	0.91	0.92	0.81	0.87

Continued

	Whole population		Women		Men	
Variables	**M1**	**M2**	**M1**	**M2**	**M1**	**M2**
			Period effects			
1979	Omm	Omm	Omm	Omm	Omm	Omm
1984	Omm	Omm	Omm	Omm	Omm	Omm
1989	−0.01	−0.01	0.06***	0.06***	−0.05***	−0.05***
	(0.009)	(0.009)	(0.012)	(0.012)	(0.012)	(0.012)
1995	−0.03***	−0.03***	−0.02	−0.02	−0.02	−0.03**
	(0.009)	(0.010)	(0.012)	(0.012)	(0.012)	(0.012)
2000	−0.00	0.00	0.02*	0.03**	−0.02	−0.01
	(0.009)	(0.009)	(0.012)	(0.012)	(0.011)	(0.011)
2005	0.06***	0.06***	0.05***	0.05***	0.06***	0.07***
	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.011)
2010	−0.02***	−0.03***	−0.07***	−0.07***	−0.01	−0.01
	(0.008)	(0.008)	(0.010)	(0.010)	(0.010)	(0.010)
Observations	407	407	407	407	407	407
R-squared	0.90	0.92	0.91	0.92	0.81	0.87

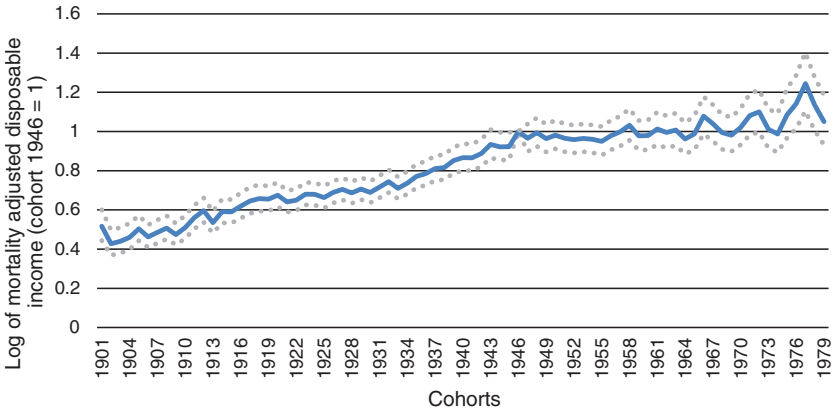
Appendix B: Robustness exercises

We have rerun our estimations of Model M2 (mortality-adjusted disposable income for the whole population) for an alternative set of parameters of the utility function: $\gamma = 0.5$, and $\alpha = 0$, which are still consistent with the value of the statistical life provided by Murphy and Topel (2003). Although those parameters may appear to be more "realistic", they lead to unpleasant findings, as the computed willingness to pay appears to be negative at all ages and dates. Put differently, those parameters are associated with a willingness to be paid in exchange for enjoying a long lifespan, which is clearly "unrealistic".

Figures B.1 and B.2 are the counterparts of Figures 4(b) and 7(b), estimated with the new parameters. We see that the profiles are still increasing but are much flatter, which is explained by the fact that the increase in life expectancy translates into a lower adjusted income.

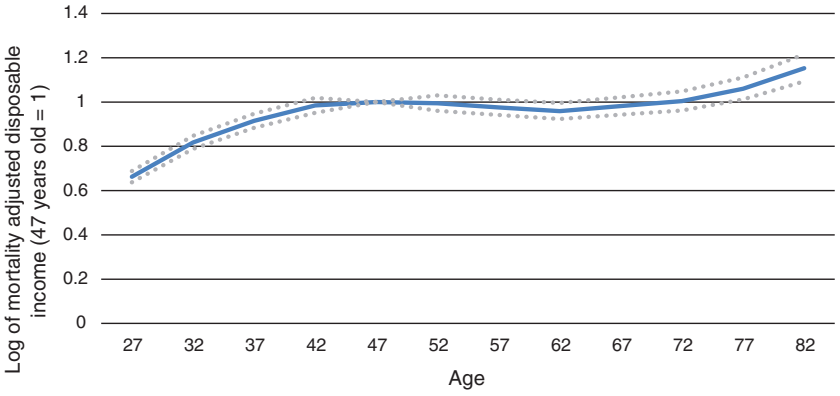
Another robustness check can be provided by using the consumption data (see d'Albis and Badji 2017 for details) rather than disposable income. Figures B.3 and B.4 are the counterparts of Figures 4(a) and 4(b). The slopes of the profiles are steeper than those obtained with income, but the profiles are qualitatively the same.

Figure B.1:
Log of mortality adjusted disposable income (values relative to cohort 1946) as a function of the date of birth, whole population, for alternative parameters of the utility function



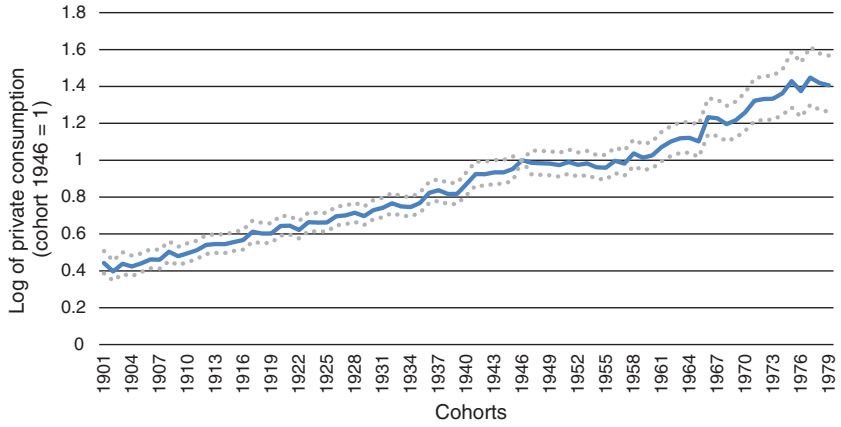
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period

Figure B.2:
Log of mortality adjusted disposable income (values relative to age 47) as a function of the age group, whole population, for alternative parameters of the utility function



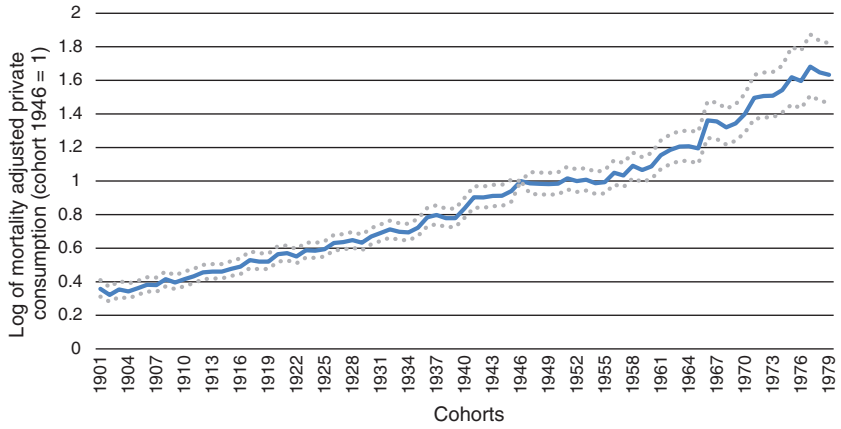
Note: The dotted curves show the confidence intervals at 95%. Model controlled for the date of birth and the period.

Figure B.3:
Log of private consumption (values relative to cohort 1946) as a function of the date of birth, whole population



Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period.

Figure B.4:
Log of mortality adjusted private consumption (values relative to cohort 1946) as a function of the date of birth, whole population



Note: The dotted curves show the confidence intervals at 95%. Model controlled for the age group and the period.

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Welfare state and the age distribution of public consumption and public transfers in the EU countries

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Abstract

The article extends the discussion of the welfare state in the literature by presenting a quantitative assessment of the age distribution of public resources. It investigates the differences in the distribution of public transfers between age groups in different European welfare state regimes using the National Transfer Accounts approach. There are two groups of countries that stand out in terms of the age patterns of their public transfers: three Scandinavian countries and Luxembourg have relatively high transfer levels, particularly for the older age group; while some of the Central and Eastern European countries have relatively low transfer levels. In the other European countries, the age profiles of public transfers are close to the EU average. Total public expenditures and revenues in the two distinct groups are changing in response to population ageing: i.e. they are expanding in the Scandinavian countries, and they are contracting in the CEE countries. These developments may lead to the further divergence of these welfare regimes.

Introduction

Our aim in this article is to broaden the current discussion on welfare regimes in Europe by providing additional evidence on the similarities and the differences in public consumption and transfer levels from an intergenerational perspective across welfare regimes. We extend the analysis of welfare states typology based on the main macroeconomic approach that has been used in other studies (e.g. Schut et al. 2001; Powell and Barrientos 2004; Arcanjo 2011) by adding the generational

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dimension using National Transfer Accounts data. We are thus able to investigate how public transfers to different age groups vary by welfare state type.

The starting point for our analysis is the Esping-Andersen welfare state typology (Esping-Andersen 1990, 1999). In recent years, developments in European welfare states have been influenced by the impact of the Great Recession, which led to the deterioration of public finances, and, as a result, to the implementation of austerity measures that have affected social transfers. Another important development in these countries is population ageing, which has also triggered welfare system reforms. In addition, to address the existing and the emerging social challenges European countries face, we extend the analysis by covering not just developed economies, for which there is a substantial body of welfare state research; but the new EU member states, which first started developing their welfare states in the early 1990s after the transition to a market-based system.

Using the National Transfer Accounts (NTA) approach, we provide a quantitative assessment of the age distribution of public consumption of education, health, and other items in the EU countries; as well as of public transfer inflows and outflows by age groups. The NTA age profiles of public consumption serve as a tool for investigating how public consumption and public transfers are distributed across three age groups: young (0–19 years old), working-age (20–64 years old), and senior (65 years old and older). The findings on public consumption and transfers by age groups are then used to identify distinct groups of countries by applying a cluster analysis, which enables us to determine whether the age distribution of transfers differs substantially across the welfare state types identified in the literature.

Our approach builds on the existing literature on welfare regimes and methods, and on the research areas covered by welfare analysis. We contribute to the debate on welfare state regimes in several ways. We use the combined macro and micro approach, while taking into account all public transfers and forms of consumption, including those for education and health, which are usually not covered in welfare regime classifications. We focus on the quantitative outcomes of welfare regimes, as measured by public inflows and outflows, which reflect the designs of the tax benefit systems in different welfare state regimes. Thus, we also account for de-commodification and labour market outcomes.

Our focus in this paper is on redistribution that is related to age. As our interest is in exploring the generational aspects, we do not consider income redistribution. Esping-Andersen and Myles (2009) discussed how redistribution under three different types of welfare states affects income inequality. The authors demonstrated the differences between these welfare regimes by referring to empirical evidence from the cross-country comparisons of spending profiles at the macro level, while also examining the role of private welfare and social services, and the degree to which transfers are targeted. Finally, they suggested that research on the effects of redistribution on income inequalities under different welfare regimes should refer to demographic developments, especially those related to the population's age composition and family structures. In our study on the redistribution of public consumption and public transfers, we provide a different perspective on redistribution under different welfare state types by looking at differences in the

age-related profiles of consumption and transfers. The main focus of our analysis is the distribution of public transfers by age, which explains the majority of public redistribution (see, for example, Gál and Medgyesi 2017).

Given the research objectives, we formulate the following hypotheses:

H1: In countries with a social democratic regime (with a developed welfare state), there are high public transfer levels for all age groups.
H2: In the majority of Eastern European countries, the welfare regime is still being developed, and public transfer and public consumption levels are still relatively low.
H3: The welfare models of countries are converging, especially in response to macroeconomic shocks and population ageing.
H4: In recent decades, and especially after the onset of the financial crisis, public expenditures and revenues, as well as social protection spending, evolved differently across countries depending on their welfare regime type.

The article starts with a brief discussion on the welfare state typologies developed in the literature. We then describe the NTA approach, as well as the data used. Next, we present our findings on levels of public consumption and public transfers in the intergenerational context. We then perform a cluster analysis to group countries by their patterns of public transfers and consumption for the young, prime-age, and senior generations. Finally, we analyse how the public expenditures in the clusters are linked to changes in the age structure of the population. We conclude with the verification of our four hypotheses.

1 Typologies of welfare states

There is a growing body of literature that focuses on the classification of developed countries by welfare regime. Scholars have used a range of approaches to classify countries into relatively homogenous groups. One of the most commonly cited approaches is the typology proposed by Esping-Andersen (1990), elaborated for democratic developed countries. His analysis of welfare regime types was based on de-commodification and social stratification, which are linked to different employment levels and patterns This approach resulted in the identification three types of welfare state: conservative, liberal, and social democratic. Esping-Andersen then clustered countries according to this typology.

The conservative welfare regime is characterised by a moderate level of de-commodification. The social rights of individuals, and, consequently, most social benefits, are differentiated on the basis of class and status. The family is the main provider of care and support, and the state steps in when families are not able to fulfil their obligations to their members. In these societies, both employment and women's labour market participation rates are relatively low. This type of welfare regime was initially found in Italy, France, Germany, Austria, and Belgium.

In the liberal welfare state, levels of de-commodification and of market differentiation of welfare are low, while both employment and women's labour market

participation rates are relatively high. The market is the main source of social benefits and services, and state support is provided only to those who cannot purchase such services on the market. The benefits provided by the state are, in general, mean-tested, and the eligibility requirements are strict.[1] This type of welfare regime was said to characterise Australia, Canada, the United States, Switzerland, and Japan.

The social democratic type of welfare state is distinguished by its high level of de-commodification, universal benefits, and high degree of benefit equality. The employment rates are the highest among all the regime types, including for women. Based on the social democracy principles, which emphasise the importance of social equality and economic redistribution, the state provides a wide range of social benefits aimed at enhancing universal solidarity. This cluster was originally comprised of the following countries: Denmark, Finland, Norway, Sweden, and the Netherlands.

In reaction to criticism of the concept of three "worlds of welfare", and especially the charge that it neglected the gender dimension (i.e. Lewis and Ostner 1994; Korpi and Palme 1998), Esping-Andersen (1999) revised his approach. The conceptual framework was extended by placing more emphasis on labour market regulations, and on the family and household economy. In particular, more attention was given to the increase in women's labour force participation and its effects on the family, and to family policy measures. This new approach was based on the same classification system as the primary classification system of Esping-Andersen (1990). Thus, while the three types of welfare states were maintained, the descriptions of these types were considerably enriched with more insights into labour markets structures, women's employment patterns, and family social rights (familialist versus non-familialist countries).[2] However, this extended typology was still criticised. It was, for example, pointed out that the Mediterranean countries were incorrectly identified as immature continental welfare states, while the Antipodean states were erroneously assigned to the liberal group (i.e. Arts and Gelissen 2002; Arcanjo 2006). Moreover, the way gender was incorporated into the typology was still subject to criticism (Daly and Lewis 2000; Leira 2002). Consequently, alternative classifications of welfare states have been proposed, including approaches that focus on the Mediterranean countries and the Central and Eastern European countries, and approaches that concentrate on different aspects of social policy (e.g. social services and care transfers, and their gender-related aspects) (i.e. Ferrara 1997; Arts and Gelissen 2002; Powell and Barrientos 2004; Arcanjo 2006, 2011; Fenger 2007, Cerami and Vanhuysse 2009; Kammer et al. 2012).

Generally, the typology of welfare regimes refers to the institutional design of welfare policies. However, efforts to classify countries according to their real social

[1] For example, the United States is an exception.

[2] Austria, Germany, Italy, Japan, the Netherlands, Portugal, Spain (and, less so, Belgium and France) were included the familialist group; while Australia, Canada, Denmark, Finland, New Zealand, Norway, Sweden, the UK, and the United States constituted the non-familialist group (Esping-Andersen 1999: 86).

policy outcomes tend to be based on different approaches, statistical techniques, and data (mostly macro-data). Thus, such classification efforts generate different results, which are, inter alia, manifested in differences in the number of clusters, and in the countries that make up these clusters. Some scholars have also reflected on the difference between "ideal" and "real" welfare states. As Kammer et al. (2012) pointed out, a majority of studies on this topic have extended or criticised the categorisation of welfare regimes on qualitative grounds. Moreover, the use of macro-data to test empirically proposed typologies does not allow researchers to capture the effective distribution or redistribution of resources across households or age groups. Hence, the use of micro-data is recommended. Kammer et al. (2012) have extended the current literature using micro-data from the EU-SILC. Moreover, the outcomes of their micro-data analyses on the distributional effects of different welfare regimes are mostly in line with Esping-Andersen's typology.

Another aspect that tends to be neglected in these studies is the intergenerational effects of different welfare regimes. Chauvel and Schroder (2014) looked at intergenerational inequalities across existing welfare regimes by applying the age-period-cohort model to micro-data from the Luxembourg Income Study Database (LIS 2012, years 1985–2005). Intergenerational inequalities – expressed in terms of disposable income, youth unemployment, and investments in younger generations – were found between the 1945–1955 birth cohorts and other cohorts. The biggest inequalities were detected in conservative welfare regimes.

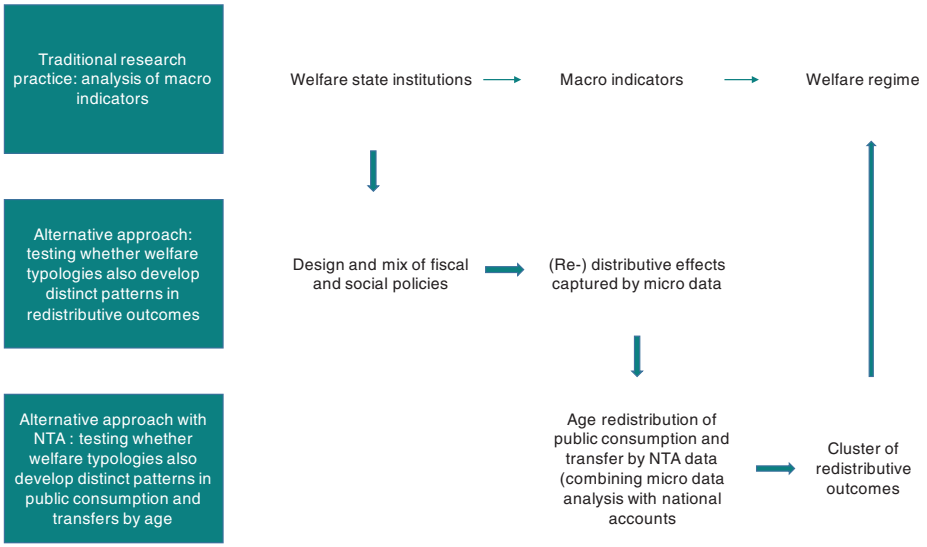
There are also approaches to classifying welfare regimes that refer to the intergenerational exchange of care (Saraceno and Keck 2010) and to welfare services (Stoy 2014). The latter approach extended Esping-Andersen's clusters (1999) by including information on health care and social care, and by defining a new cluster made up of Eastern and Southern countries.

Our approach attempts to provide a new clustering of countries that takes into account both the institutional framework and the patterns of transfers and public consumption across generations, while making use of both macro- and micro-data. In addition to contributing knowledge about how different welfare regimes shape the intergenerational distribution of transfers and public consumption, we aim to explore the question of whether the welfare measures implemented over two last decades – and especially those imposed following the 2008 financial crisis – have resulted in the different welfare regimes diverging or converging (in terms of their distributional effects). As Powell and Barrientos (2004) concluded in their analysis of the development of welfare regimes over time, welfare states are changing in response to macroeconomic shocks; and these changes are, in turn, causing welfare regime typologies to evolve.

2 Analytical approach and data sources

In our analysis, we aim to provide a quantitative assessment of welfare state typologies based on the age profiles of public consumption and public transfers.

Figure 1:
Research design: macro-level, micro-level, and National Transfer Accounts approaches to analysing welfare regimes



Source: Own modification of Kammer et al. (2012).

To that end, we use the National Transfer Accounts (NTA) approach proposed by Lee and Mason (see, for example, Lee and Mason (2011a,b); Lee (2013)). The application of the NTA combines the macroeconomic approach, which is traditionally used in studies on welfare regimes; with the microeconomic approach, which allows us to determine the direction of public transfers to different age groups. We examine public transfers, including public consumption (e.g. health and education services) by age, and seek to identify the distributional outcomes of the institutions that comprise the welfare state regimes of EU countries.

Our analytical approach extends the approach proposed by Kammer et al. (2012), who added the assessment of the patterns of redistributive outcomes to the analysis of welfare state institutions and macroeconomic indicators. We further extend this approach in our analysis by taking into account the age patterns of the distribution of public transfers, as shown in Figure 1.

In the NTA approach, at each age (x), individuals have a certain level of consumption. Those who are economically active finance their consumption from their labour income (Y^l). If their labour income is not sufficient, a life-cycle deficit (LCD) appears. The LCD is financed from transfers (public and private), which are the difference between transfers received and paid ($\tau^+(x) - \tau^-(x)$) by age, as well as the reallocation of resources ($Y^A(x) - S(x)$). This is expressed by the following

equation:

$$LCD(x) = C(x) - Y^l(x) = \tau^+(x) - \tau^-(x) + Y^A(x) - S(x), \quad (1)$$

where:

$LCD(x)$ – life-cycle deficit;
$C(x)$ – consumption, comprising public and private consumption that is used for health care, education, and other purposes;
$Y^l(x)$ – labour income;
$\tau^+(x)$ – transfers received (public and private);
$\tau^-(x)$ – transfers paid (public or private);
$Y^A(x)$ – income from assets; and
$S(x)$ – savings.

Members of the working-age generation earn income, which is used to finance their consumption, but also to generate transfers that are used to finance the consumption of both children and the senior generation; either directly through private transfers, or indirectly through public transfers. The public transfer and public consumption levels are determined to a large extent by the existing welfare state institutions.

We take into account the age profiles of public transfer inflows and outflows according to the NTA manual (UN 2013: 113). Public transfer inflows refer to flows received by the beneficiaries of all public programs, broadly measured to include cash transfers and all in-kind transfers considered to be equivalent to public consumption. In-kind transfers include both public goods and services that can be readily assigned to individuals; e.g. public education (from pre-school to higher education) or publicly-provided health care; and collective goods and services, including government administration, public safety, and national defence. Public transfer outflows are defined as the current flows from each age group (or the rest of the world) that fund public transfer inflows. Public transfer outflows are funded by taxes, social contributions, and grants to the government. If these funding sources are insufficient, a balancing item, or the transfer deficit, funds the shortfall. If taxes, social contributions, and grants exceed transfer inflows, a transfer surplus is generated. By definition, transfer inflows and outflows must be equal for public transfers to occur, both in general and for each type of public program.

Our analysis focuses on public transfers, which include both in-kind transfers, which are equivalent to public consumption, and cash transfers. In the welfare state regimes, cash transfers are important for the purposes of de-commodification. We also separately investigate public consumption of education and health services, which are mainly used by the younger and the senior generations, and which vary between welfare regimes.

We use the European NTA database, which was developed within the project "Ageing Europe: An application of National Transfer Accounts (NTA) for explaining and projecting trends in public finances (AGENTA) financed under the 7th Framework Programme" (Istenič et al. 2017). The NTA database was prepared through the extensive calculation of data from existing administrative, demographic,

and survey data, including harmonised Eurostat data from the income (EU-SILC) and the household budget surveys for 2010. The harmonisation of these data ensures that the estimated age profiles are comparable, and reflect differences in the public institutions and welfare regimes of countries.

The analysis covers 24 EU countries, including the new member states that joined the EU in 2004 or later.[3] The inclusion of this group of countries should add to our knowledge of welfare state regimes, as the new member states and their welfare models have been under-investigated in previous research on this topic. This approach will allow us to determine whether there is a distinct Central and Eastern European welfare regime model, or whether there are some similarities between the welfare states of the old and the new EU member states, as formulated in the first two research hypotheses.

The per capita public transfers, and, separately, the public consumption age profiles, are aggregated for three age groups: the young (0–19 years); the working-age (20–64 years), and the senior (65 years or older) generations. Using per capita age profiles, we examine the levels of public transfers paid and received, as well as the levels of public consumption, in an average representative of each age group. This approach allows us to avoid the population size bias in our analysis.

We use fixed age limits, but the NTA age profiles reflect country-specific characteristics that affect the public consumption and public transfer levels of these age groups. It should be noted that the age limits of economic dependency (that is, the ability to finance consumption from labour income) vary between countries, and that these limits are, in turn, outcomes of the differences between welfare regimes. This point has been discussed by, for example, Loichinger et al. (2017). In the analysis, the application of fixed age limits is needed to ensure the comparability of indicators.

The country-level assessment (section 3) is followed by the grouping of countries according to the similarities and differences in the levels of public consumption and of the transfers received and financed by different age groups (section 4). The conclusions from these two sections are used to verify the first three hypotheses.

With regard to the fourth hypothesis, the panel regression of public expenditures, with demographic dependency as the explanatory variable, is estimated to investigate whether in countries that belong to different clusters, public expenditure and ageing trends develop differently (section 5).

3 Public consumption and transfers at different ages

This section presents comparisons of public consumption and public transfer levels by age. First, we show the average age profiles of the levels and the structure of public consumption, as well as the public transfer levels for all EU 24 countries covered

[3] These are: Austria, Belgium, Bulgaria, Cyprus, Czechia, Denmark, Estonia, Germany, Greece, Spain, Finland, France, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, and the United Kingdom. Due to the lack of data on public health consumption, Italy is excluded from the analysis.

by the analysis. Then, we take a closer look at consumption and transfer patterns by age group for different countries. Finally, we analyse the distribution of selected public consumption and public transfer patterns in the three selected age groups.

The per capita age profiles of public transfers inflows (Figure 2(a)) show that individuals at younger ages and at older ages receive more public transfers than their working-age counterparts. These profiles include public consumption, which measures public in-kind services (Figure 2(c)–(e)) that tend to be equally directed to the young and the senior generations. Public transfer inflows are especially high for the senior age group. This means that cash transfers (particularly pensions) are mainly received by older people. The pattern for public transfer outflows per capita, shown in Figure 2(b), is rather different. These outflows are higher for those in the working-age generation, who tend to pay taxes, mainly on their labour income. It is worth noting that there is a large gap between the minimum and the maximum per capita public transfer outflows for the older age groups, which reflects the different national approaches to taxing social transfers. The net transfers are higher for those in the older age group, who receive large public transfer inflows, particularly in the form of pensions and health care consumption. At the same time, older people have lower public transfer outflows.

At the country level, there are differences in the total level of per capita public transfers (Figure 3). The aggregated per capita public transfer inflows for all ages are highest, exceeding 40 annual labour incomes, in the 30–49 age group in Luxembourg. They are lowest (less than 28 annual wages) in Romania, Slovenia, Bulgaria, and Germany. It should be noted that these are relative values, which helps to explain the comparatively low position of Germany, where the average income of prime-age workers is high. Together with public finance reforms introduced in Germany in the past decade, this may account for the (relatively) low level of public transfer inflows, including of public consumption, in that country.

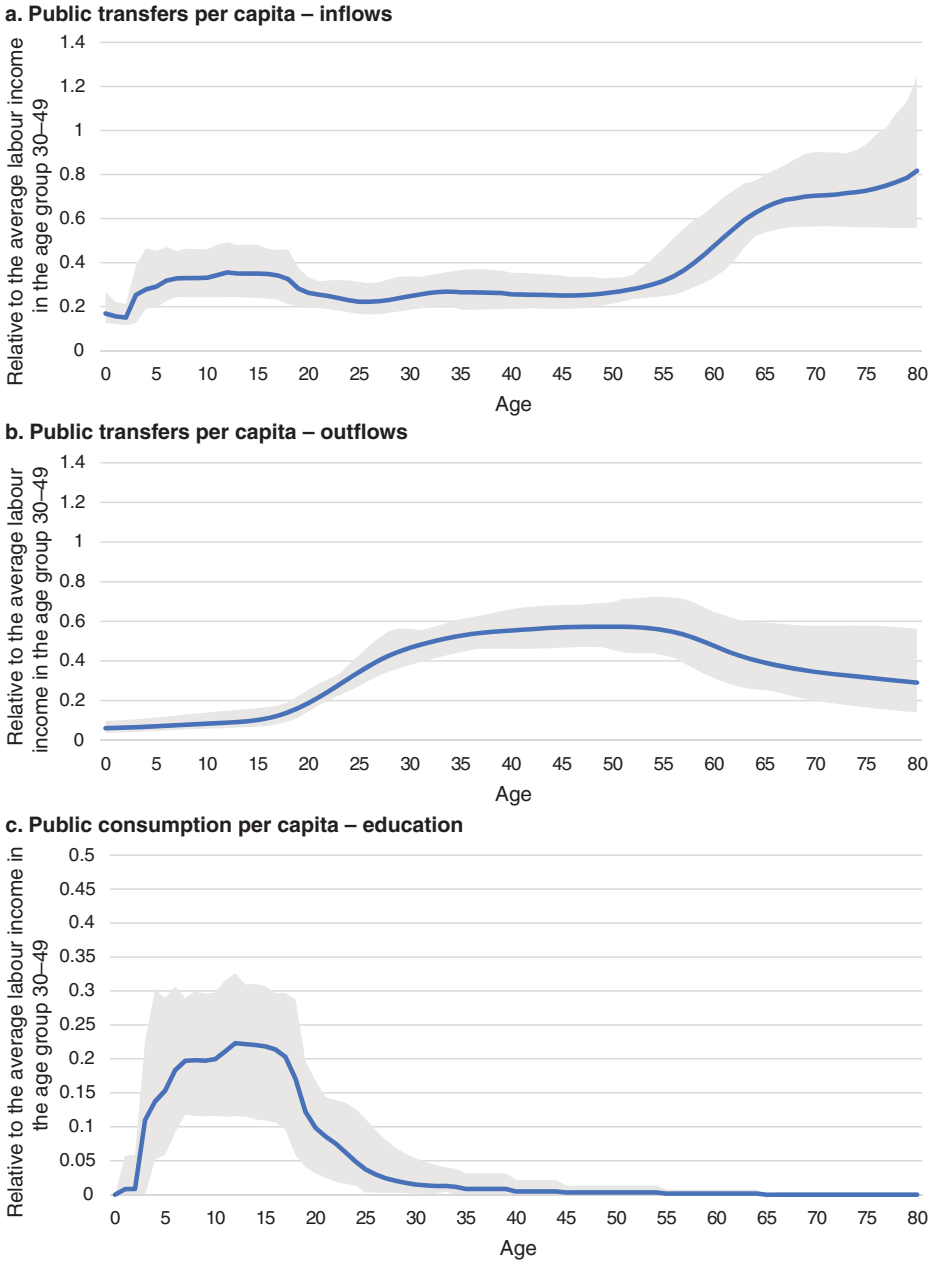
Public consumption and transfers by age groups

The per capita public consumption aggregated by age groups differs across countries. Table 1 presents a summary of public consumption by type of consumption and selected age group.

For the young age group and the working-age group, the largest (relative) spread, measured as the ratio between the maximum and the minimum consumption levels, is for public education consumption. The country with the lowest public education consumption level for people in the 20–64 age group (the United Kingdom) spends seven times less on public education than the country with the highest consumption level (Sweden). In the senior age group, the ratio between the maximum and the minimum observed public transfer levels is the highest for public health consumption, and is twice as high as it is for the rest of public consumption.

Figure 4 shows the aggregated per capita public consumption, public transfers inflows, and public transfers outflows for each age group. The overall public consumption level (Figure 4(a)) is highest for the working-age group, which covers the largest number of single age cohorts (45). However, in Cyprus, Austria, and

Figure 2:
Average age profiles of per capita public consumption and public transfers in 24 EU countries



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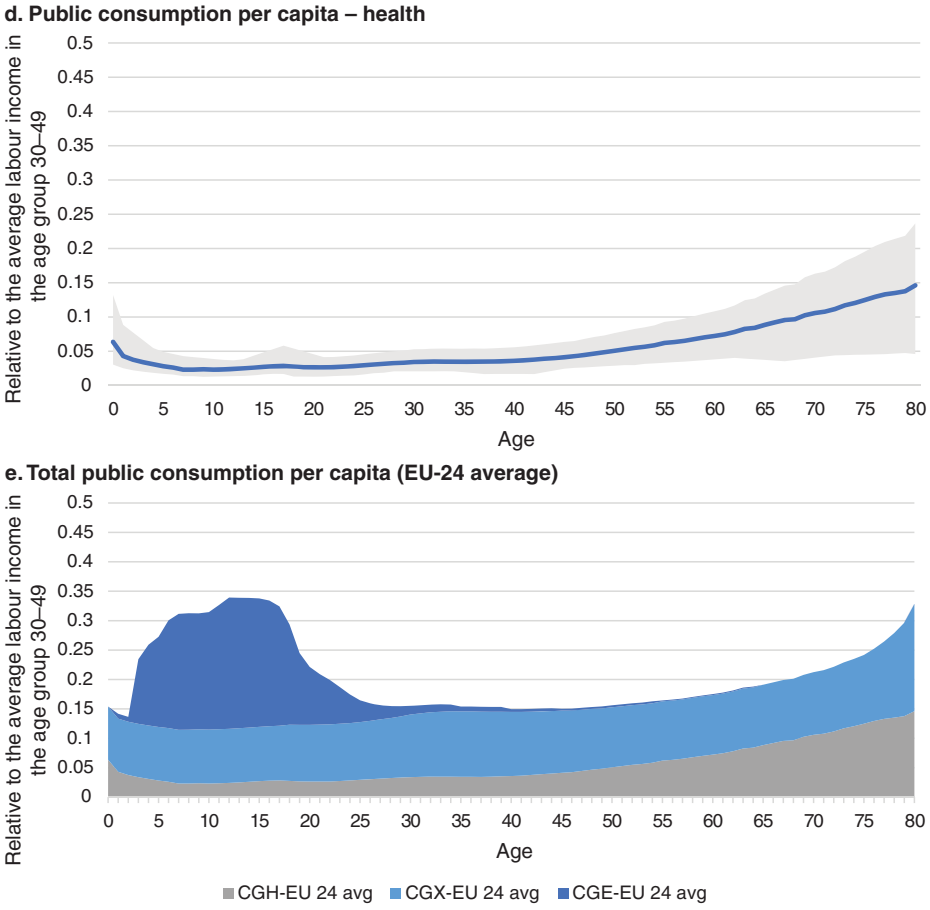


Note: (1) The areas in Figures 2(a)–2(d) show the minimum and the maximum per capita values across the 24 countries, and the lines depict the EU-24 average.

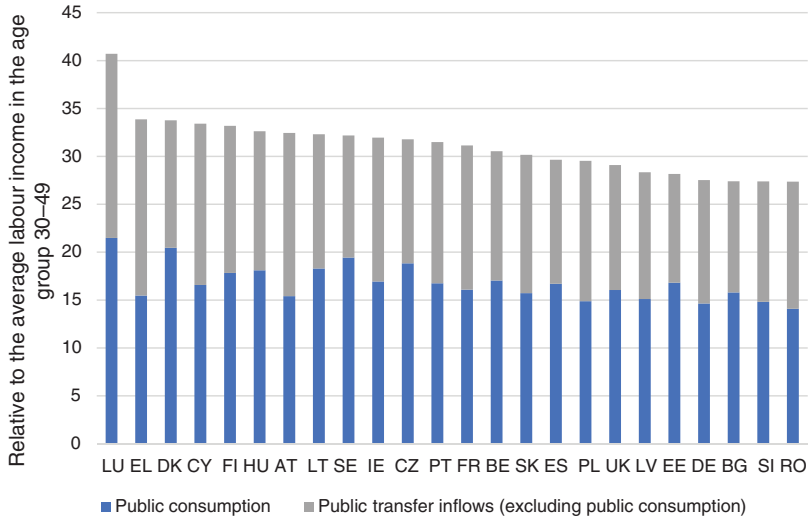
(2) CGE – public consumption of education, CGH – public consumption of health, CGX – other public consumption.

Source: Authors' estimations based on Istenič et al. (2017), European National Transfer Accounts. Available at: http://www.wittgensteincentre.org/ntadata.

Latvia the public consumption level of the young age group (20 cohorts) is similar to that of the working-age group. By contrast, in Finland, Sweden, Ireland, the UK, Germany, and Romania, the public consumption level of the young age group is close to that of the senior age group (15 cohorts between ages 65 and 80).

The total public transfer inflows (Figure 4(b)) also differs between age groups. Of the age groups, the senior age group receives the largest amount of transfers

Figure 3:
The total level of per capita public consumption in the 24 EU countries (summed for ages 0–80)



Source: Authors' estimation based on Istenič et al. (2017), European National Transfer Accounts. Available at: http://www.wittgensteincentre.org/ntadata.

Table 1:
Public consumption by type of expenditure and age group in the EU-24 (expressed in relation to average annual earnings for 30–49-year-old workers)

	Young (0–19)			Working-age (20–64)			Senior (65–80)	
	CGE	CGH	CGX	CGE	CGH	CGX	CGH	CGX
EU-25 country average	3.23	0.60	1.84	0.67	2.07	4.65	1.86	1.92
Min	1.74	0.37	1.28	0.25	1.22	3.48	0.68	1.33
Max	4.82	0.86	2.41	1.76	3.11	6.14	2.88	2.88
max/min	2.77	2.34	1.89	7.00	2.56	1.77	4.25	2.17

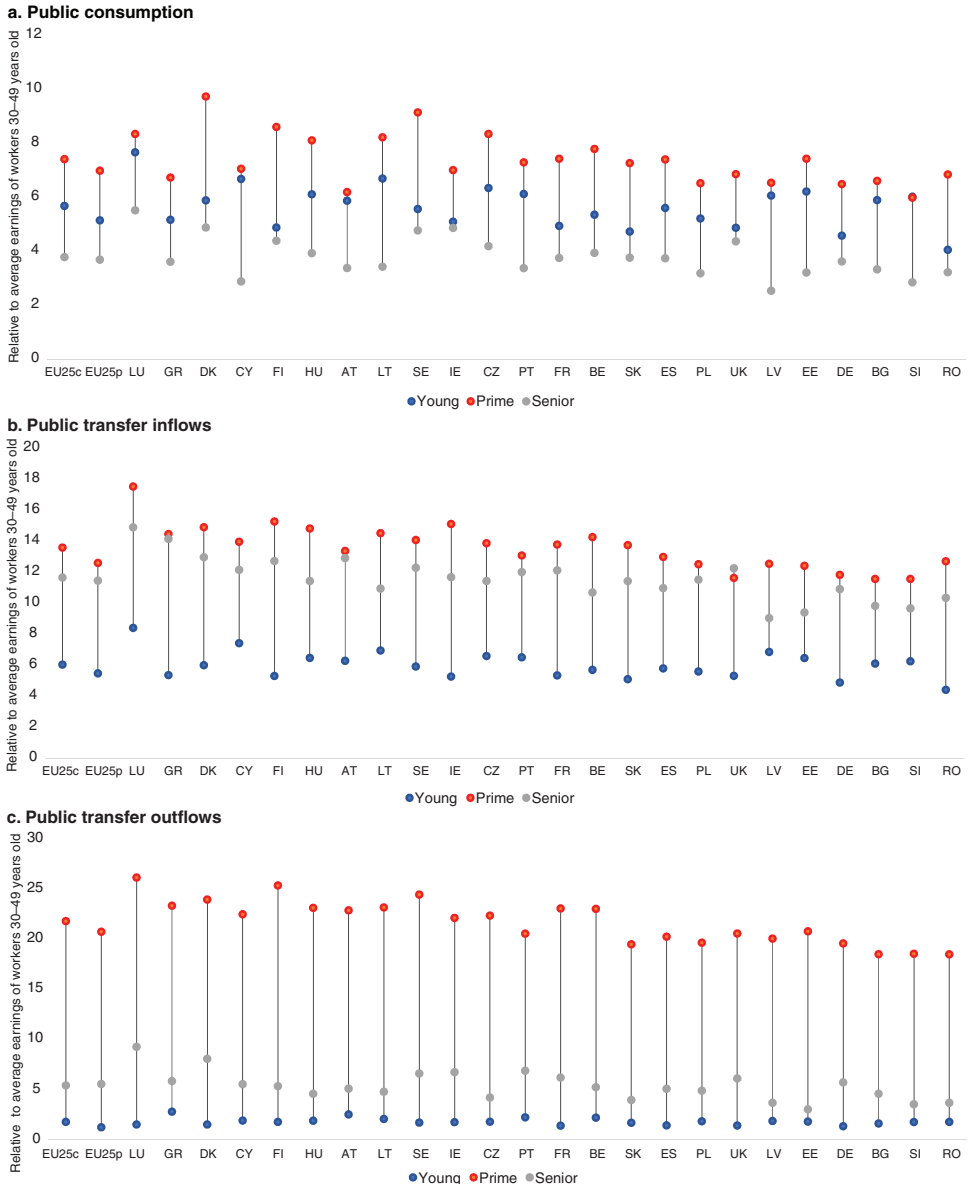
Notes: (1) CGE – public consumption, education, CGH – public consumption, health, CGX – public consumption, other

(2) The public consumption of each age group is measured as a sum of per capita values for one-year age groups included in the respective age group.

Source: Authors' estimation based on Istenič et al. (2017), European National Transfer Accounts. Available at: http://www.wittgensteincentre.org/ntadata.

in Luxembourg, Greece, Denmark, and Austria. Moreover, in the UK, the transfer amounts received by the senior age group even exceed these of the working-age group, and are similar those in Greece, Austria, and Germany. On the other hand, in Latvia and Estonia, the transfer inflows for the senior age group are lower, and are

Figure 4:
Public consumption, public transfer inflows, and outflows by age groups, aggregated by age per capita relative values



Source: Authors' estimation based on Istenič et al. (2017), European National Transfer Accounts. Available at: http://www.wittgensteincentre.org/ntadata.

much closer to those for the young age group. Not surprisingly, we see that across countries, the age distribution of public transfer outflows is very similar, with the largest amounts paid by those in the working-age group (Figure 4(c)). The public transfer outflow levels are lowest in Romania, Bulgaria, and Slovenia; while they are highest in Luxembourg, Finland, and Denmark.

Age distribution of public spending and consumption

The age distribution of public consumption and public transfers in the countries is summarised in the form of ternary graphs in Figure 5. The figures show average per capita public transfer inflows and outflows, and public consumption per one cohort in the analysed age groups.

The public services for education and health have a clear age bias. As public consumption of education (Figure 5(a)) is concentrated in the young age group corner, and is distributed between the working-age group and the young age group, public education consumption is spread along the young-prime age group axes. Public consumption of health (Figure 5(b)) is more concentrated in the senior age group. There is also a slight bias towards the senior age group for public transfer inflows (Figure 5(c)). Public transfer outflows (Figure 5(d)) are mainly funded by the working-age group, and to some extent by the senior age group. The young age group is barely involved in financing public transfer outflows.

4 Are public transfers for different age groups welfare regime-specific?

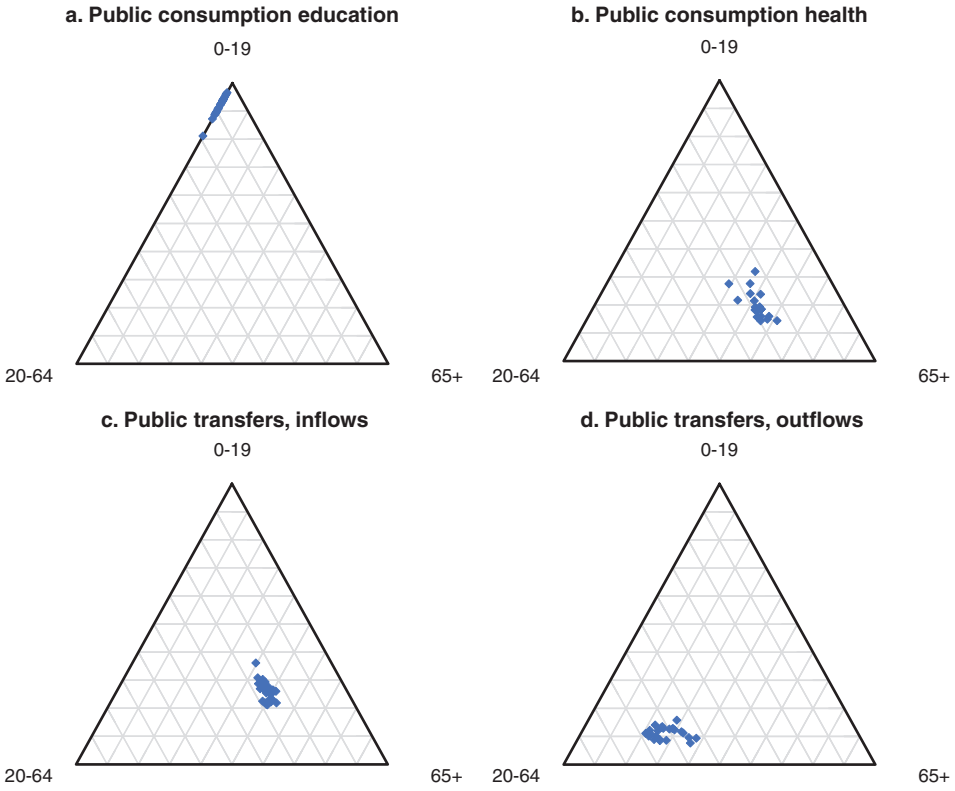
The differences and the similarities in the total levels of public transfers and public consumption, and in their age distributions, can be seen as the outcomes of existing welfare policies. In this section, we present the results of the cluster analysis that aims to determine whether the types of welfare regimes proposed by Esping-Andersen (1990, 1999) are also reflected in the outcomes of these policies with respect to public consumption and transfer levels by age groups, as observed in 2010.

In order to select the groups of countries, we performed a cluster analysis, which is an exploratory statistical technique applied to distinct groups of observations (in our case, countries) with a high degree of intra-class similarity and a low degree of inter-class similarity.

We start the analysis by including all variables for all age groups. In the first step, we used the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy to select the variables for the model.[4] Based on this test, the following variables were

[4] The KMO test measures sampling adequacy for each variable in the model and for the complete model. The statistic is a measure of the proportion of variance among variables that might be common variance.

Figure 5:
Public and private consumption of education and health, and other consumption in selected EU countries by age groups



Note: The blue points represent countries. The closer the points are to the selected corners of the triangle; the more the consumption or the transfer is oriented towards the age group assigned to the corner.
Source: Authors' estimation based on Istenič et al. (2017), European National Transfer Accounts. Available at: http://www.wittgensteincentre.org/ntadata.

included in the analysis:

- public consumption of health for people in the age group 65+ (CGH 65+),
- other public consumption for people in the age group 65+ (CGX 65+),
- total public inflows for people in the age group 20–64 (TGI 20–64),
- total public inflows for people in the age group 65+ (TGI 65+),
- total public outflows for people in the age group 20–64 (TGO 20–64),
- total public outflows for people in the age group 65+ (TGO 65+).

The remaining variables were excluded from the analysis because the low value of the KMO indicated that there was too much common variance between variables.[5] For the first five variables, the KMO level exceeds 0.8; and for the last variable, it is close to that level. For the entire model, the KMO level is equal to 0.81, which indicates that the sampling is adequate.

To select the country groups, we applied the principal component analysis (PCA), which enabled us to reduce the number of variables.[6] We then conducted a hierarchical cluster analysis using components that were established in the PCA.

In the analysis, three groups of countries emerged:

- **Cluster 1–European**, in which the age profiles of public transfers are close to the EU average. This cluster is comprised of both liberal and continental welfare regimes that seem to exhibit similar age patterns for public transfers, including for levels of public consumption. This cluster is the largest of the three, and includes 14 countries: Austria, Belgium, Cyprus, Czechia, Germany, Greece, Spain, France, Hungary, Ireland, Lithuania, Poland, Portugal, Slovakia, and the United Kingdom.
- **Cluster 2–Underdeveloped**, which is characterised by below-average transfers by age. This cluster is made up of five new member states: Bulgaria, Estonia, Latvia, Romania, and Slovenia.
- **Cluster 3–Scandinavian**, which is characterised by above-average public transfer and consumption levels by age. This cluster is comprised four countries, including three Nordic social democratic states: Denmark, Finland, Sweden, and Luxembourg.

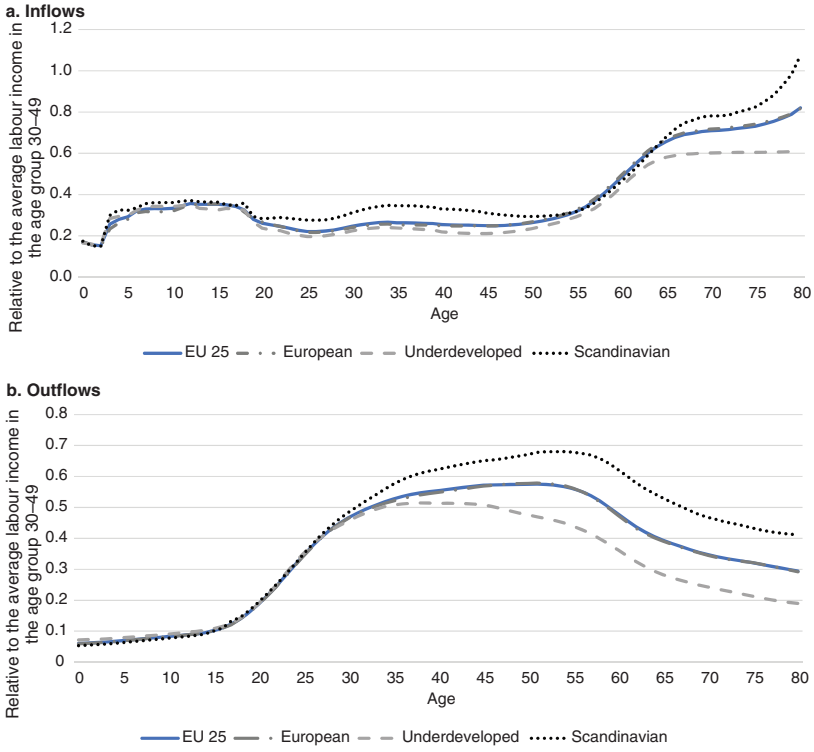
The clusters are distinct with regard to their public transfer and public consumption patterns, as Figures 6 and 7 make clear. The average public transfer amounts (both inflows and outflows) in the largest cluster 1 (European) are close to the all-country average (Figure 6), which is partially because it is the largest group of countries. The countries in cluster 2 (underdeveloped) have both lower public inflow levels, particularly for the 60+ age group, and lower outflow levels for the 30+ age group. The countries in cluster 3, which include the Scandinavian countries, have higher outflows for the same age group. The public inflows in this cluster are higher for both the older age group and the prime-age group.

The situation for public consumption (Figure 7) is similar. Countries in cluster 1 are at the European average. The countries in cluster 2 have lower public consumption levels, particularly of health. The countries in cluster 3 have higher public health consumption levels for the older age groups. The pattern of public education consumption in the cluster 3 countries is distinct: i.e. levels of public

[5] These are: public education consumption (CGE 0–19, CGE 20–64), public health consumption (CGH 0–19, CGH 20–64), other public consumption (CGX 0–19, CGX 20–64), and public transfers inflows and outflows for the young age group (TGI 0–19, TGO 0–19).

[6] The PCA results show that the first two components explain more than 80% of the observed variance.

Figure 6:
Public transfers by clusters

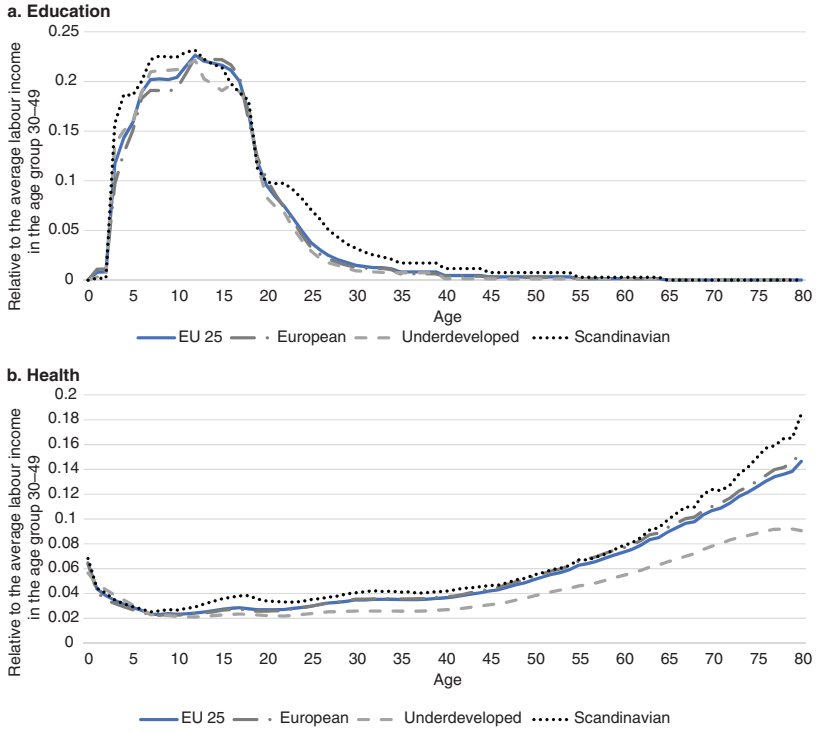


Source: Authors' estimation based on Istenič et al. (2017), European National Transfer Accounts. Available at: http://www.wittgensteincentre.org/ntadata.

education consumption are higher for children in pre-school education and for adults aged 20 to 40.

The observed age profiles of public consumption and transfers averaged for the three groups of countries show that there are important differences in the allocation of per capita transfers across age groups, and that the senior generation is especially distinct. These patterns confirm the existence of different welfare state regimes in Europe, albeit with a different composition than the one initially presented by Esping-Andersen. This new clustering of welfare regimes provides empirical evidence in support of the first hypothesis, which states that countries with a social democratic regime (i.e. with a developed welfare state) have high public transfer levels directed at all age groups. Similarly, in support of the second hypothesis, which states that the majority of Eastern European countries are still developing their welfare regimes, and thus have relatively low public transfer and public

Figure 7:
Public consumption by clusters



Source: Authors' estimation based on Istenič et al. (2017), European National Transfer Accounts. Available at: http://www.wittgensteincentre.org/ntadata.

consumption levels, the analysis showed that five of the new member states can be assigned to cluster 2, which is comprised of underdeveloped welfare regimes.

Last but not least, the large number of countries assigned to cluster 1 supports the third hypothesis: namely, that the welfare models of liberal and continental countries are converging with regard to the age distribution of public transfers, including of public consumption.

Summing up, we find that the evolution of welfare states – particularly after the turn of the century and the onset of the financial crisis – has led to some, but not full convergence in the direction and the scale of public transfers by age. The most important differences are observed in the senior age groups, and are particularly large between older people in Scandinavian countries and in Central and Eastern European countries. This finding implies that as the population ages and the share of older cohorts in the total population increases, these differences will translate into different pressures on additional increases in public transfers. In the next section, we investigate whether the first signs of such pressures are already being observed.

5 Demographic change, welfare regimes, and public expenditures

Following the cluster analysis, our aim in this section is to verify whether the clusters of countries differ in terms of the age structures of their populations, and in terms of their public expenditures (including their social protection expenditures) and revenues in the last two decades (between 1995 and 2014).

As Figure 8 shows, the three groups (clusters) of countries have different population age structures, as measured by the total support ratio (TSR), which indicates the number of people in the 20–64 age group per 100 people below or above these age limits. A declining TSR might result from more advanced population ageing and a shrinking working-age population.

Overall, in the countries in cluster 1 and cluster 2, the TSR was increasing between 1995 and 2008, which means that the demographic structures in these groups of countries still provided conditions that enabled financing transfers to the young and to the senior generations. There are, however, some differences between these two clusters that can be pointed out. The countries in cluster 2 have a higher TSR than the countries in cluster 1. This is because the Central and Eastern countries had higher fertility than the developed countries in the 1970s and 1980s, which resulted in large inflows of young people to the working-age generation in the 1990s and at the beginning of the century. After 2010, the TSR started to decline in both clusters, largely because the inflows of people to working ages were lower, and the outflows of people to working ages were higher, as members of the post-war baby boom generation started to reach age 65.

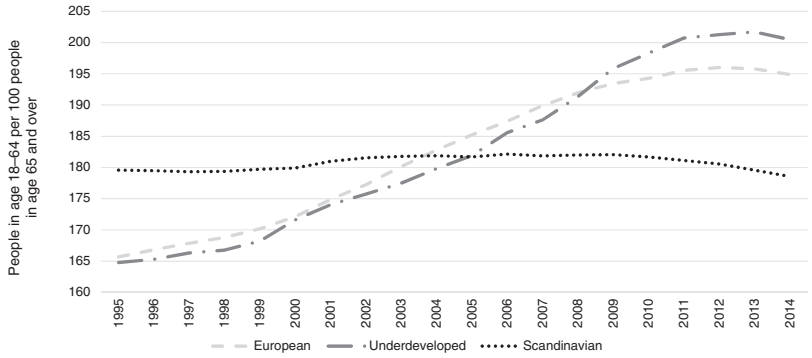
The decline in the TSR in cluster 3 is observed from the beginning of the 21st century, with the share of people aged 65+ in the population increasing, and the share of young people in the population remaining relatively stable. As the share of children in the population is high in this group of countries, the TSR is lower than it is in the two other clusters.

From 2010 onwards, the TSR declines in all groups of countries, mostly due to advances in population ageing.

The central government expenditure (CGE) patterns differ between the three groups (Figure 9). The countries in cluster 2 have a relatively low ratio of expenditures to GDP, and with a slightly increasing trend on average. After the onset of the crisis in 2008, public expenditure levels rose in all three clusters, primarily as a result of declining GDP and increasing public spending in response to needs caused by the crisis and post-crisis policies. However, since 2010, public expenditures have declined to almost pre-crisis levels in the cluster 1 countries. In contrast, in the cluster 3 countries, central government expenditures have remained at higher levels since the financial crisis.

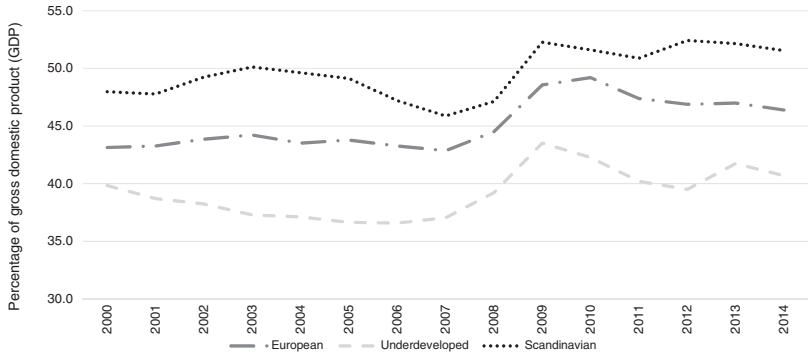
The clusters also differ with respect to central government revenue (CGR) levels, which are shown in Figure 10. The average CGR level in cluster 3 is 10 p.p. higher than it is in cluster 1, and is almost 15 p.p. higher than it is in cluster 2. The CGR level remains relatively stable over time.

Figure 8:
Total support ratio by clusters



Source: Authors' analysis based on the EUROSTAT data.

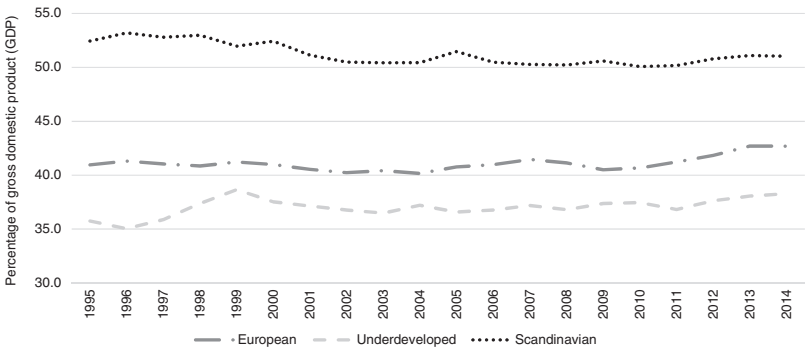
Figure 9:
Central government expenditures by clusters (% GDP)



Source: Authors' analysis based on the EUROSTAT data.

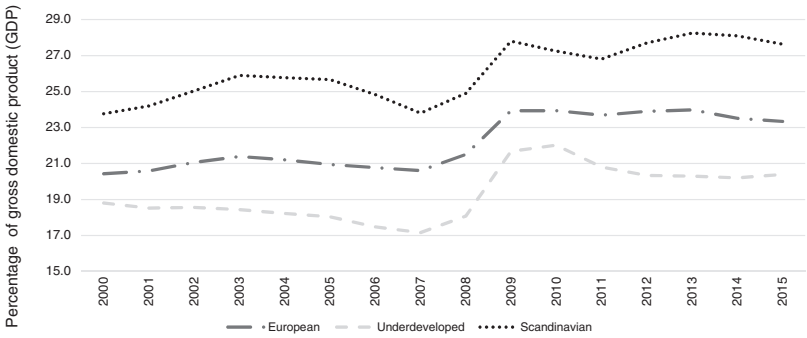
The three groups of countries also differ in terms of social protection expenditure (Figure 11) levels, which are lowest in the cluster 2 countries and are highest in the cluster 3 countries. The level of social protection spending relative to GDP increased after the crisis, and has since remained stable in all three clusters. The difference between cluster 2 and cluster 3 in the average of the social protection expenditures amounts to 7 p.p. of GDP. This means that around two-thirds of the difference in the overall level of public expenditures is due to differences in social expenditure levels.

Figure 10:
Central government revenues by clusters (% GDP)



Source: Authors' analysis based on the EUROSTAT data.

Figure 11:
Social protection expenditures by clusters (% GDP)



Source: Authors' analysis based on the EUROSTAT data.

Summing up, our analyses provide arguments consistent with the third hypothesis regarding cluster-specific developments in public expenditures and revenues, and in social protection spending, in the past two decades.

6 Welfare regimes and public expenditures in response to ageing

Finally, in seeking to answer the question of whether changes in public finances in response to demographic developments differ between the proposed groups

(clusters) of countries, we use the panel regression models with the variables introduced in the previous sections. The analysis is performed for the total sample of 24 countries, and then separately for each cluster. We apply the standard random effects panel regression, whereby the observations of the dependent variable y_{it} for each country i and time t are described by the observations of the explanatory variable x_{it} in the linear regression model, defined in equation (2) as follows:

$$y_{it} = \mu + x'_{it}\beta + u_{it}, \quad \text{where } u_{it} = \alpha_i + \varepsilon_{it}. \tag{2}$$

The error term u_{it} in the panel regression model contains effects specific to the countries α_i and the pure error term ε_{it}.

In the panel regression below, there are three possible dependent variables y_{it}: central government expenditure (CGE), central government revenue (CGR), and social protection expenditure (SPE). We considered in all cases the same explanatory variable x_{it}; that is, the change in the total support ratio (TSR).

The first model, based on the full sample of 24 European countries ($i = 1, \ldots, 24$), shows that in the past two decades (between 1995 and 2014), there was no consistent and significant relationship between the TSR and the public revenue and the expenditure variables (Table 2).

The coefficients are not significant for the regressions with the full sample of countries if the robust method of estimation parameters is applied.

Some significant results for variables CGR and SPE are obtained in the models for the selected clusters of countries introduced in section 3. This suggests that the reactions of public finances to the demographic changes measured by TSR are more homogenous within clusters. In the "European" cluster 1 (15 countries), the panel regression does not find a significant association of the dependent variables with population ageing.

In the "underdeveloped" cluster 2 (Bulgaria, Estonia, Latvia, Romania, Slovenia), the regression coefficient is positive both for the revenue variable (CGR) and the social expenditure variable (SPE). This means that as the population ages (and the TSR decreases), central government revenues and public social expenditures are also declining. Decreases in central government revenues can indicate that the stability of public finances is at risk. On the other hand, these countries have managed to reduce the ratio of social expenditures to GDP, which suggests that they are able to stabilise the situation.

In the "Scandinavian" cluster 3 (Denmark, Finland, Sweden, Luxembourg) the regression coefficient for central government revenues is negative, which means that as the population ages, central government revenues are, on average, increasing. This could be the result of the policies implemented in these countries aimed at extending working life (for example, increasing the retirement age). The negative (though not significant) regression coefficient for public expenditures and social protection expenditures illustrates that public spending is increasing as the population ages. Taken together, these results indicate that the current trends related to population ageing are leading countries to make adjustments, like reduced transfers

Table 2:
Results of panel regression analysis (RE): central government expenditure (CGE), revenue (CGR), and social protection expenditure (SPE), explained by the total support ratio (TSR), 1995–2014

	Full sample	Cluster 1 countries	Cluster 2 countries	Cluster 3 countries	Before crisis* All countries (1995–2007)	After crisis* All countries (2008–2014)
Dependent var: CGE						
TSR	−0.00282	0.00347	0.0844	−0.212	−0.110**	−0.0657
	(0.0584)	(0.0709)	(0.0674)	(0.138)	(0.0526)	(0.112)
Dependent var: CGR						
TSR	−0.0199	−0.0238	0.0372**	−0.0728*	−0.0235	−0.123**
	(0.0400)	(0.0485)	(0.0178)	(0.0389)	(0.0515)	(0.0547)
Dependent var: SPE						
TSR	0.0301	0.0290	0.0652**	−0.00719	−0.00984	−0.0412
	(0.0235)	(0.0284)	(0.0272)	(0.0516)	(0.0172)	(0.0550)
Observations	460	280	100	80	312	192
Number of countries	24	14	5	4	24	24

Note: Panel regressions with random effects (confirmed by Hausman test): in the final results parameters β of the regressions (robust estimates).
Source: Authors' calculations.

in cluster 2 countries and increased transfers in cluster 3. If these trends continue, the further divergence of the welfare systems can be expected.

Another source of the shift in the relationship between the total support ratio and public policies is the change in conditions before and after the onset of the financial crisis in 2008. In this analysis, two panel regressions are considered: first, for all countries and for the 1995–2007 period; and, second, for all countries and for the 2008–2014 period. In the pre-crisis sample, there is a significant negative regression coefficient for the total support ratio in the model of central government expenditures, and an insignificant regression coefficient in the model of revenues. This could mean that the pressure created by demographic change led to increasing expenditures, but did not necessarily affect the revenue side in the pre-crisis period, when there were relatively easy opportunities to increase the public debt.

For the period after the crisis, the panel regression results suggest that the pressure to increase central government revenues grew despite the ageing of the population. This may have been an effect of austerity measures, which halted the expansion of public expenditures and put pressure on the revenue side at at a time when there were fewer opportunities to react to demographic changes by increasing public debt.

7 Conclusions

The application of the NTA age profiles allowed us to examine the outcomes of socioeconomic policies, measured by the public consumption and transfer levels of different age groups, which account for the distribution of consumption of education, health, and other public goods. All European countries direct a significant share of public consumption to the young and the senior age groups. However, the distribution of public consumption by age differs significantly between countries.

We identified three clusters of countries that have different patterns of public transfers to the young and the senior age groups, and of taxes levied on the working-age group.

These are countries with:

(i) close to average levels of public transfers and public consumption for all age groups (15 countries representing all of the welfare regime types, according to the Esping-Andersen typology);
(ii) low public transfer and public consumption levels (five Central and Eastern European countries); and
(iii) higher public transfer levels directed at all age groups, and especially at older people, and higher public expenditures (Luxembourg and three Scandinavian countries).

The results of the clustering show that the countries with conservative and liberal regimes, according to the Esping-Andersen typology, together with several new member states, converged to show similar patterns for the age distribution of public transfers and consumption. The social democratic countries remain a distinct group,

with more generous transfers to people of all ages, but with a focus on the older group. Finally, some of the new member states in Eastern and Southern Europe form a cluster of underdeveloped welfare regimes with lower levels of public consumption and transfers, including of public health consumption, for older people in particular. These findings confirm the first and the second hypotheses.

Our results indicate that the outcomes of different types of welfare regimes lead to similar outcomes with regard to the average age profiles of public transfers and public consumption. This means that there has been a convergence of transfers to selected age groups in the continental and the liberal welfare regimes, which confirms our third hypothesis. This development may be attributable to social reforms and austerity measures introduced in reaction to the 2008 economic crisis, which led to reductions in public expenditures and public transfers inflows (benefits). Our analysis does not take into account the distribution within age groups (i.e. from higher-income groups to lower-income groups), which may be distinct between the countries.

In countries with different welfare regimes, the development of public expenditures in general and of social protection expenditures in particular has also differed. The countries with higher age-related public transfers have tended to increase their public revenues and expenditures in recent years in response to changing population age structures, which has, in turn, reduced the effects of the total support ratio. On the other hand, the group of countries that have lower per capita public age transfers and public consumption levels seem to have reduced their general government revenues and expenditures, including their social protection expenditures. This may point to a further divergence in public transfer and consumption levels by age in the EU, with progressive changes occurring in the population age structures of the two groups of countries that have different public transfer levels for different age groups. This observation confirms our fourth hypothesis.

Our NTA-based study on links between public finances (central government expenditures and central government revenues) and the ageing of the population from a comparative perspective (24 EU countries) extends research on the economic consequences of ageing in several ways. First, we have taken into account the economic flows related to consumption and labour income that are driven by socioeconomic developments, as well as by the existing welfare systems in Europe. Second, we have applied new approaches to depicting past developments in ageing and economic flows. These approaches have allowed us to assess the outcomes of welfare policies through the age distribution of public transfers. The research results presented in this article indicate the importance of analysing the age distribution of public transfers. These transfers are also complemented by private transfers within and between households, as well as by asset-based reallocations and savings. Therefore, we propose using an approach in future research that includes private transfers and individual funding when analysing the financing of consumption at young and senior ages. Such an approach could bring greater nuance to the question of how each country deals with population ageing, and could uncover differences between the countries in the largest, European cluster.

Acknowledgements

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Extending working life: experiences from Sweden, 1981–2011

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Abstract

Population ageing is making it increasingly difficult for countries to sustain their current levels social welfare transfers from the economically active population to the dependent elderly. To meet this challenge, the Swedish government has implemented various reforms since the 1990s aimed at reducing incentives to take early retirement. However, a critical question has emerged in response to these reforms: namely, whether members of certain socially and demographically disadvantaged groups will, in practice, be able to work longer. This paper provides a detailed overview of retirement trends in Sweden, disaggregated by educational attainment, health status, and country of birth. Our results show that the growth pattern in the average effective retirement age since the mid-1990s was shared by individuals regardless of their educational level, health status, or country of birth. This shared growth pattern suggests that it is possible to extend the working lives of all groups of individuals, regardless of their socio-economic and demographic characteristics.

1 Introduction

The age at which an average worker retires has been rising in many developed countries over the past two decades (OECD 2017). Sweden is no exception. Since the mid-1990s, and after a period of decline lasting several decades, the average effective retirement age in Sweden has increased from 62.9 to 64.6 for women and from 63.6 to 65.2 for men (Bengtsson and Qi 2018). While these trends are

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promising, they are not large enough to counteract the increasing share of lifetime spent in retirement (Bengtsson and Scott 2011). Thus, sustaining current levels social welfare transfers from the economically active population to the dependent elderly is becoming more difficult. To meet this challenge, working life needs to be further prolonged.

In 2019, the Swedish parliament approved a plan to gradually increase the minimum age for receiving old-age pension benefits from 61 years currently to 64 years, and to increase the minimum age for receiving guaranteed pension benefits (a portion of the national retirement pension entitlement that is paid to those who have had little or no pension-qualifying income) from 65 years currently to 67 years in 2026. At the same time, the age at which individuals have the right to continue to work was also raised. The aim of these new policies is to increase the average effective retirement age. However, a critical question has emerged in response to these reforms: namely, whether these adjustments will have adverse welfare consequences for older individuals who struggle to continue to work. To address this question, it is useful to examine whether the pattern of growth in the effective retirement age since the mid-1990s was similar for individuals with different characteristics. Surprisingly, there has been little research analysing these retirement trends by socio-economic and demographic groups. In this paper, we provide a detailed overview of recent retirement trends in Sweden, disaggregated by educational attainment, health, and country of birth. We also discuss how institutional changes in the country's pension systems and retirement policies, as well as in its levels of human capital investment, might have differential effects on older workers with different socio-economic and demographic backgrounds.

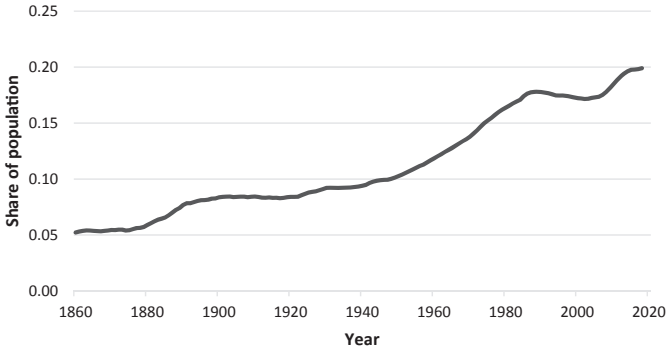
2 Background

2.1 Population ageing in Sweden

The world population is expected to age rapidly during the 21st century. Current projections indicate that by 2050, the share of the population over age 60 will reach 20% worldwide, and will be as high as one-third in Europe (UN 2015). For Sweden, this figure is expected to be around 30%, or somewhat lower than the European average (SCB 2018).

This ageing process is not, however, new. Sweden was the second country in the world to join the group of countries considered "aged" by the United Nations. To join this club, the percentage of a country's population aged 65 or older must be 7% or higher. In Sweden, this milestone was passed in 1888, and the share of the elderly in the population has increased almost monotonically since then. Figure 1 shows the share of the population aged 65 or older from 1860 to 2018. An aspect of this process that is new in this century is that the ageing population is becoming more diverse than ever before. Today, 15% of all men and 17% of all women aged 60–69 are foreign-born (SCB 2017), and these shares are expected to grow in the future.

Figure 1:
The share of the Swedish population aged 65 years or older, 1860–2018



Source: Population by age and sex, 1860–2018, Statistics Sweden.

Moreover, we have entered into a new stage of population ageing in terms of its causes, which have, in turn, altered the consequences of ageing. In the first stage, which lasted until the second part of the 20th century in developed countries, the sole cause of population ageing was the decline in fertility, with Sweden being commonly used as an example of this trend (Coale 1957; Bengtsson and Scott 2010; Lee and Zhou 2017). During this stage, increases in life expectancy were primarily driven by declines in infant and child mortality. This process moved in the opposite direction of the decreasing trend in fertility. Thus, the population became younger as more years of life were added before than after retirement (Coale 1957; Lee 1994). In the second stage of population ageing, which we are currently experiencing, the process is driven by declining old-age mortality. As a result, more years of life are being added after retirement than at working ages (Lee 1994), and the share of the elderly in the population is growing, while the share of the population who are of working ages is declining. Could immigration or an upswing in fertility reverse this change in the dependency ratio? The short answer is that they most likely cannot. The effect of migration on population ageing is generally regarded as minor (Murphy 2017); and, since population ageing is a global phenomenon, the movement of people from one country to another will not alter the overall ageing process. Similarly, a rapid increase in fertility is improbable. Moreover, even if fertility started increasing today, it would take some 25 years for the labour force to grow, and the dependency ratio would increase in the meantime. For these reasons, scholars and policy-makers are focusing their attention on how our social systems can be adapted to meet the challenges associated with an increasing trend in the number of elderly people per worker – especially as increases in the pensioner-to-worker ratio are being accompanied by rising per capita costs for institutional care, home care, and general health care for the elderly.

2.2 The current Swedish pension system

The current Swedish old-age pension system, which provides benefits that are based primarily on an individual's actual contributions during his/her working life, was approved by the Swedish parliament in 1994, and was first implemented in 1999. Unlike the previous defined benefit system, the current system is financially stable, and provides strong incentives for postponing retirement. These incentives were created through a new way of calculating benefits that is based on a worker's contributions over his/her entire working life. To calculate pension entitlements, an individual's accumulated contributions, plus interest-based returns, are essentially divided by his/her remaining life expectancy at the age of retirement. The purpose of this approach is to encourage workers to work longer, as additional years of work may be expected to both increase the total amount of pension wealth and reduce the estimated remaining life expectancy. These adjustments should, in turn, result in higher monthly benefit payments for retirees.

The pension system has three pillars: old-age pensions administrated by the Swedish Pension Agency, occupational pensions administered through private funds, and individually invested pension accounts. The benefits provided by this system are supplemented with state-guaranteed pension benefits, as well as with housing and old-age allowances. These supplemental schemes are paid for directly from the state budget, and correspond to 11% of public pension benefits (Pensionsmyndigheten 2018). The disability pension system, which was previously part of the state pension system, became part of the social insurance program in 2003.

While the Swedish old-age pension system is very flexible, with provisions for early and partial retirement (albeit with financial penalties in the form of lower pension income), the majority of workers retire at age 65, when they become eligible to receive guaranteed pension benefits, housing allowances, and old-age support. Moreover, individuals rarely return to market work after they begin receiving pension benefits. In 2017, just 0.3% of recipients of old-age pension benefits were engaged in labour market activities (Pensionsmyndigheten 2018).

Occupational pensions in Sweden are generally based on agreements between trade unions and employers, with a very small number of exceptions that are negotiated on an individual basis. These schemes play an important role in supplementing old-age pension entitlements, which are usually low due to an upper ceiling on benefits. As having a private pension outside of the broad occupational pension schemes is rare in Sweden, most retirees rely solely on public pension programs, occupational pensions, and/or guaranteed pensions. In 2017, old-age and occupational pension benefits accounted for around 65% of the annual income of an average retiree. Currently, postponing retirement by one year will increase an individual's annual pension income by about 5%, since the remaining life expectancy at age 65 is roughly 20 years. An additional incentive for postponing retirement until reaching age 65 is that the tax rate for workers is reduced after age 65.

Supplemental old-age allowances, in addition to pensions and housing allowances, are paid out to approximately 10% of the Swedish-born population aged 69+.

Immigrants from non-EU countries have the lowest pension benefits; a pattern that has been observed all over Western Europe (Heisig et al. 2017). For this reason, migrants tend to be more reliant on these allowances than the native-born population. Pension entitlements are based on an individual's contributions over his/her working life. In many cases, a migrant will have a combination of a relatively short work history and relatively low wages, both of which decrease his/her eligibility to receive a full pension (Sjogren Lindquist 2017). Indeed, almost all old-age support allowances are paid out to immigrants (Gustafsson et al. 2018). However, while immigrants tend to have lower old-age and occupational pension benefits than natives, there are differences between immigrant groups.

The early retirement/disability pension scheme has undergone various reforms in recent years. Initially, this benefit program was intended purely as a support for disabled individuals. But starting in the 1970s, it was used as an early retirement program for older workers who became unemployed and found re-entering the labour market very difficult. In the first decade of this century, the disability pension system was reformed to lower the number of individuals who were eligible to take advantage of it. In 2003, the unemployment condition was removed, and the requirements for receiving disability pension benefits became increasingly stringent. Currently, a disability pension is only available to individuals who have limited working capacity for medical reasons.

2.3 The effective retirement ages

Although the age at which an average worker in Sweden effectively retires has increased for both men and women, since the mid-1990s, the observed rate of increase has not been sufficient to counteract the increasing number of years people live after retirement (Bengtsson and Scott 2011). This trend is making it increasingly challenging for Sweden to sustain current levels of social welfare transfers from the economically active population to the dependent elderly. To meet this challenge, the average working life needs to be further prolonged. In 2019, the Swedish parliament approved a plan to gradually increase the minimum age for receiving old-age pension benefits from 61 years currently to 64 years, and to increase the minimum age for receiving guaranteed pension benefits from 65 years currently to 67 years in 2026. At the same time, the age at which individuals have the right to continue to work was also raised. The aim of these new reforms was to further increase the effective retirement age. However, a critical question was posed in response to these reforms: namely, whether workers who are engaged in physically demanding occupations will be able to work longer. To address this question, we have to look at whether the increasing trend in the effective retirement age over the past two decades has been shared by individuals with different levels of health and human capital. An area of research that has received little attention from scholars is the retirement behaviour of ageing immigrants. Immigrants in Sweden tend to receive lower pension benefits than natives, usually due to a combination of having shorter

working histories, lower wages, and/or being ineligible to receive guaranteed pension benefits if they have resided in Sweden for less than 40 years (Sjogren Lindquist 2017). These disadvantages were exacerbated by the 1994 old-age pension reform, as the current old-age pension system calculates a worker's pension benefits based on his/her earning history throughout his/her entire working life (whereas the previous system defined benefits based on the best 15 years of a worker's earning history). While natives usually spend their entire economic life-cycle in Sweden, migrants do not. Thus, on average, the pension benefits migrants receive in the current pension system are lower than those of natives, largely because they spent fewer years contributing to the system, and had lower average life-time earnings. Moreover, immigrants tend to rely on disability pension benefits more than natives. However, as the eligibility rules for the disability pension program have become increasingly stringent, immigrants' reliance on this early retirement pathway has been reduced. One strategy immigrants can use to respond to these institutional changes is to maximise the number of years they contribute to the system by postponing retirement – perhaps to an even greater extent than native-born Swedes. However, the question of whether immigrants are able to work longer has yet to be answered.

3 Data

The analyses in this paper mainly rely on data from the Swedish Interdisciplinary Panel (SIP), which consists of individual-level data from several different administrative registers, including the income and taxation register, the inpatient register, the educational register, and the total population register. These multiple registers have been merged to create a longitudinal database covering roughly 12 million unique individuals born between 1930 and 1980 who resided in Sweden sometime during the 1968–2011 period. The database allows researchers to examine from a life course perspective the labour supply behaviour of individuals towards the end of their careers.

In calculating the effective retirement age, we use data on each individual's labour income and pension income, obtained from the income and taxation register, to determine his/her participation in the labour force (more details below). Information from the inpatient register, the educational register, and the total population register are used to identify each individual's socio-economic and demographic characteristics. This information allows us to disaggregate the labour force participation rates, as well as the effective retirement age, by gender, education, health, and country of birth.

4 Calculating the average effective retirement age

The average effective retirement age is defined as the expected age of withdrawal from the labour force, which is computed based on the static method (Scherer

2002). In our analysis, we calculate this indicator by different socio-economic and demographic groups based on gender, education, health status, and country of birth.

We start by computing the intensity of labour force participation for each individual i, in group j, at age x. An individual's labour force participation is measured by his/her annual labour income, as a share of total income (including labour income, and the sum of old-age and disability pension benefits), which can be written as:

$$L(i, j, x) = \frac{Y(i, j, x)}{Y(i, j, x) + B(i, j, x)}$$

where Y is labour income, B is the sum of old-age and disability pension benefits. The labour force participation rate for group j, at age x, can be calculated by,

$$L(j, x) = \frac{\sum_i^{N_{j,x}} L(i, j, x)}{N_{j,x}} = \frac{\sum_i^{N_{j,x}} \frac{Y(i,j,x)}{Y(i,j,x)+B(i,j,x)}}{N_{j,x}}$$

where, $N_{j,x}$ is the number of individuals in group j, at age x.

These group-specific labour force participation rates by age are then used to calculate the average effective retirement age for each group j. Hence, the group-specific average effective retirement age, $A(j)$, is computed by

$$A(j) = \sum_{x=55}^{70} \frac{L(j, x-1) - L(j, x)}{L(j, x=54)} \times x$$

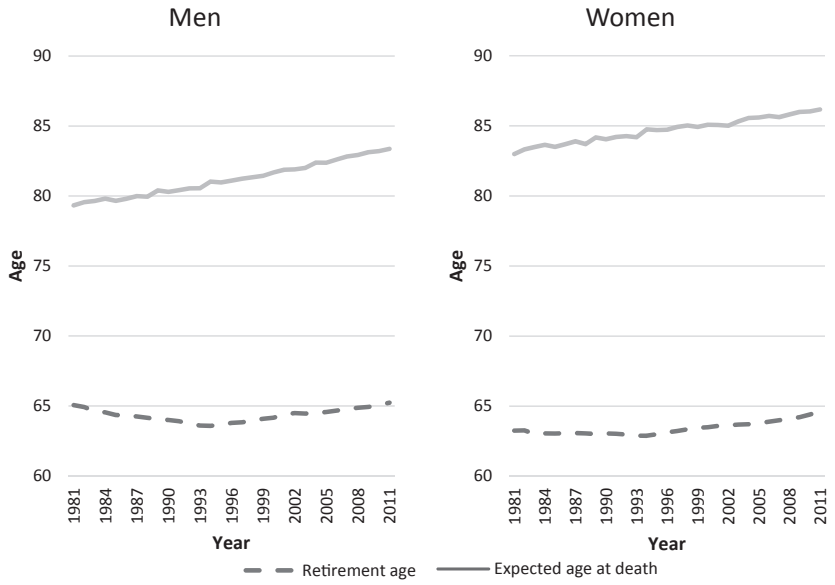
Note. We assume that all individuals are still working at age 54; hence, $L(j, x = 54) = 1$. We also assume that no individuals are still working at age 70; hence, $L(j, x = 70) = 0$.

5 Trends in the average effective retirement age

5.1 The overall trends

Figure 2 shows the effective retirement age for men and women between 1981 and 2011. For women, the effective retirement age in 2011 was even higher than it was in 1981, as there was an obvious increase after the mid-1990s that erased the decreases in the preceding years. Men had roughly the same effective retirement age in 1981 and in 2011, but the decreases in the early period and the subsequent increases were more dramatic for men than they were for women. What is even more interesting to note here is that the gaps between the effective retirement age and the remaining life expectancy at age 65 were large and increasing. In 1981, men were expected to live 14 years after retirement, and women were expected to live close to 20 years. By 2011, this gap had expanded to 18 years for men and to 21 years

Figure 2:
Effective retirement age and expected age at death for those surviving to age 65, 1981–2011, women and men



Source: Own calculations on the effective retirement ages using the Swedish Interdisciplinary Panel (SIP) from 1981 to 2011. The expected age at death is the remaining life expectancies for those survived to age 65, which are extracted from Statistics Sweden.

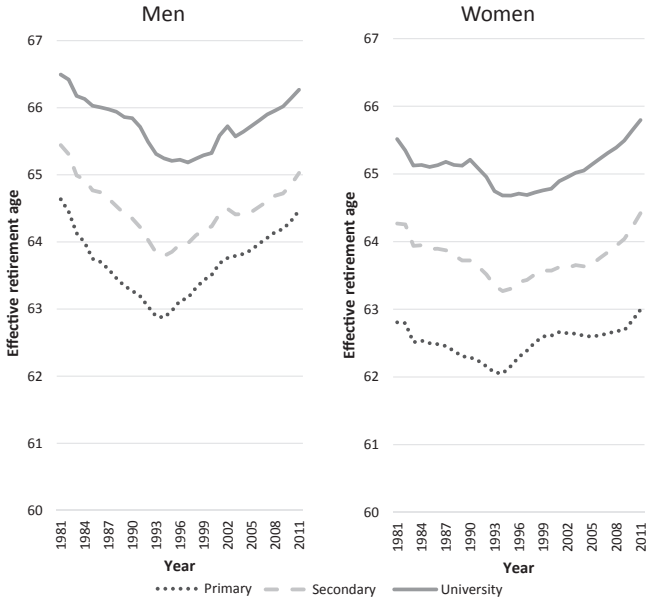
for women, even though the retirement age had increased by almost two years. This diagram underscores the options for – as well as the necessity of – increasing the legal retirement age. However, a critical question has been raised in response to these proposed changes: Will members of disadvantaged groups be able to adapt to policies that encourage people to work longer, and particularly those who have limited human capital, poor health, and/or are foreign-born?

5.2 Trends by education

Figure 3 shows the actual average retirement age from 1981 to 2011, broken down by educational level and sex. The most obvious point worth noting here is that there is a clear educational gradient in the age at retirement for both men and women. Thus, individuals with higher educational levels also had higher effective ages at retirement. Although women had a consistently lower retirement age at all educational levels, the pattern observed for women is largely the same as that for men.

Across educational levels, both men and women had fairly high effective retirement ages in 1981. Thereafter, these ages declined steadily until the beginning of the

Figure 3:
Effective retirement age by education, 1981–2011, women and men



Source: Own calculations on the effective retirement ages using the Swedish Interdisciplinary Panel (SIP) from 1981 to 2011.

mid-1990s, when they started to gradually recover. During this period of recovery, the effective retirement ages of both men and women with primary and secondary education, and of men with higher education, returned to levels that were prevalent in the early 1980s. However, the effective retirement ages of women with higher education increased to a greater extent, reaching levels in 2011 that exceeded than those in the early 1980s.

The findings presented in this diagram give us reasons to be optimistic about the ability of individuals with physically demanding jobs to postpone retirement. As lower educated individuals do indeed retire earlier, the question of whether they are able to cope with working longer – and, thus, whether they are negatively affected by retirement policies that encourage workers to prolong their labour force participation – clearly arises. However, the increases in retirement age observed for these groups in the 1990s and the 2000s seem to suggest that having a low educational level is not a barrier to working longer.

5.3 Trends by health status

In addition to a lack of human capital (schooling), impaired health is another potential reason why some individuals may be unable to work longer. Impaired

health can be an outcome of strenuous working conditions, but it can also be exogenous to working life. In either case, it is important to examine how different health patterns affect the age at retirement.

Figure 4 shows the changing effective age at retirement for men and women with different health statuses, measured as the number of hospital stays each person had while approaching age 60. The line denoted no admissions indicates fully healthy individuals, defined as those individuals who did not have a hospital stay while between the ages of 55 and 59. The next two categories show progressively less healthy individuals, with the group having one stay, and the group having two or more stays. While it might be intuitively interesting to look at those individuals who had a higher number of stays, the small numbers of these cases make such an analysis impossible. For example, only 2% of the population aged 55–59 had two or more hospitalisations. If we added another category for individuals with three or more hospitalisations, we would have groups with such small numbers that any results would have to be discounted as random. Additional caveats worth mentioning here are that we only have information on illnesses and injuries that required hospitalisation, and that we only have data from the late 1980s onwards.

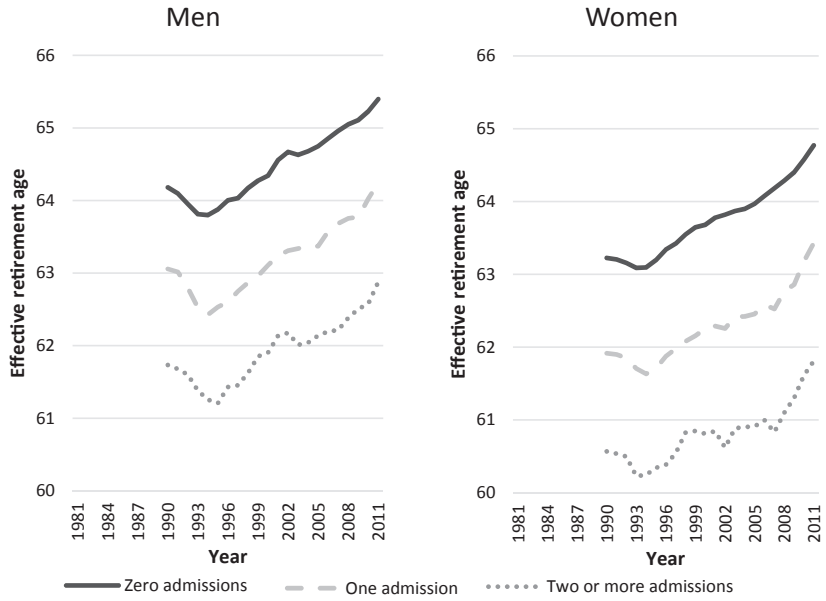
As expected, we observe a gradient in the retirement age that is negatively related to health. Those individuals with more hospital stays tended to retire at younger ages, with retirement occurring one to 1.5 years earlier for each level of decrease in health status. However, the steady increase in the retirement age starting in the early 1990s that was shown in Figure 3 is also apparent here. Unfortunately, a lack of health data for the entire period makes it impossible to examine the pattern during the 1980s, as we can with educational data. Our observation that those individuals with the worst health have considerably lower retirement ages than those individuals with the lowest education may confound our understanding of the ability of people with strenuous employment to continue working at higher ages. However, even here we see a steady increase over the past two decades.

5.4 Trends by countries of birth

Figure 5 shows the employment rates among older immigrants with different countries of birth in Sweden (vertical axis), and among the populations of the same ages population in the origin countries (horizontal axis). Immigrants' employment rates are calculated based on Swedish register data, and comparable figures from the origin countries are obtained from the OECD (2019), with employment rates by age group. These rates are the average over the 2005–2011 period. As Figure 4 shows, the levels of employment at older ages varied substantially depending on where the immigrants came from. Those who were from Greece had the lowest levels, while those who were from North America had the highest levels.

When we look at Figure 5, we can see that older immigrants' employment rates tended to be positively correlated with those of their non-migrant counterparts in their respective country of origin. If we assumed that the immigrants and their

Figure 4:
Effective retirement age by health, 1989–2011, women and men



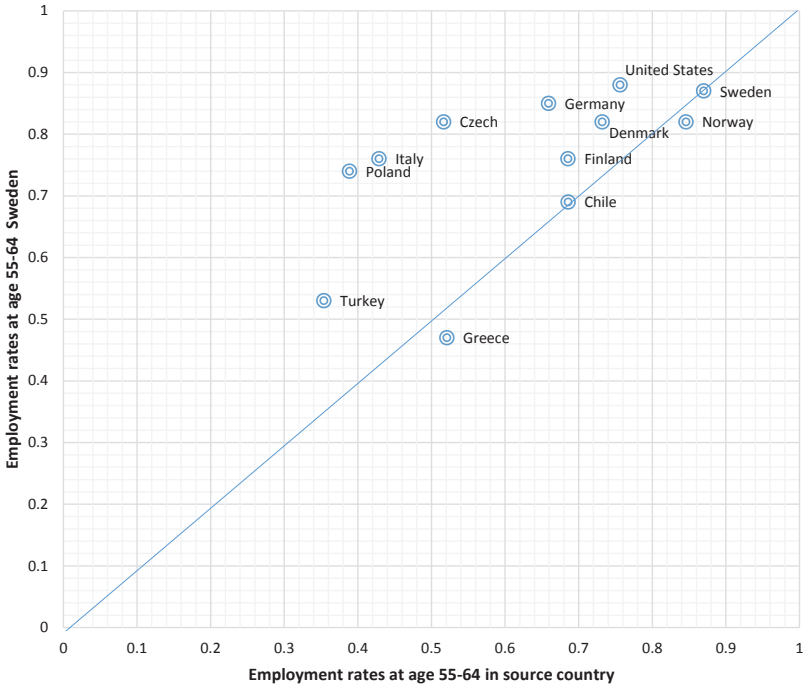
Note: Health is measured by the number of hospital admissions for each person while between the ages of 55 and 59, categorised by no admission, one admission, and two or more admissions.
Source: Own calculations on the effective retirement ages using the Swedish Interdisciplinary Panel (SIP) from 1981 to 2011.

counterparts who did not migrate were comparable in all their characteristics (such as age, gender, and education), this correlation would imply that immigrants' human capital endowment played a role in shaping their employment in later life. In other words, the low level of employment observed for some foreign-born groups might be attributable in part to some initial disadvantages that immigrants accumulated prior to leaving their country of origin. However, these disadvantages do not seem to prevent them from working longer. As Figure 6 shows, a recovery in the effective retirement age since the mid-1990s occurred not only among native-born Swedes and immigrants from high-income countries, but also among immigrants from Africa, Asia, the Balkan countries, the Middle East, and South America. Indeed, the growth trend for workers from low-income countries is even steeper.

6 Mechanisms driving the growth in the effective retirement age

While the growth in the old-age labour supply could help to mitigate the consequences of population ageing, the mechanisms that underlie this growth are poorly

Figure 5:
Employment rates for immigrants in Sweden compared to employment rates for non-migrants in the source countries, 2005–2011



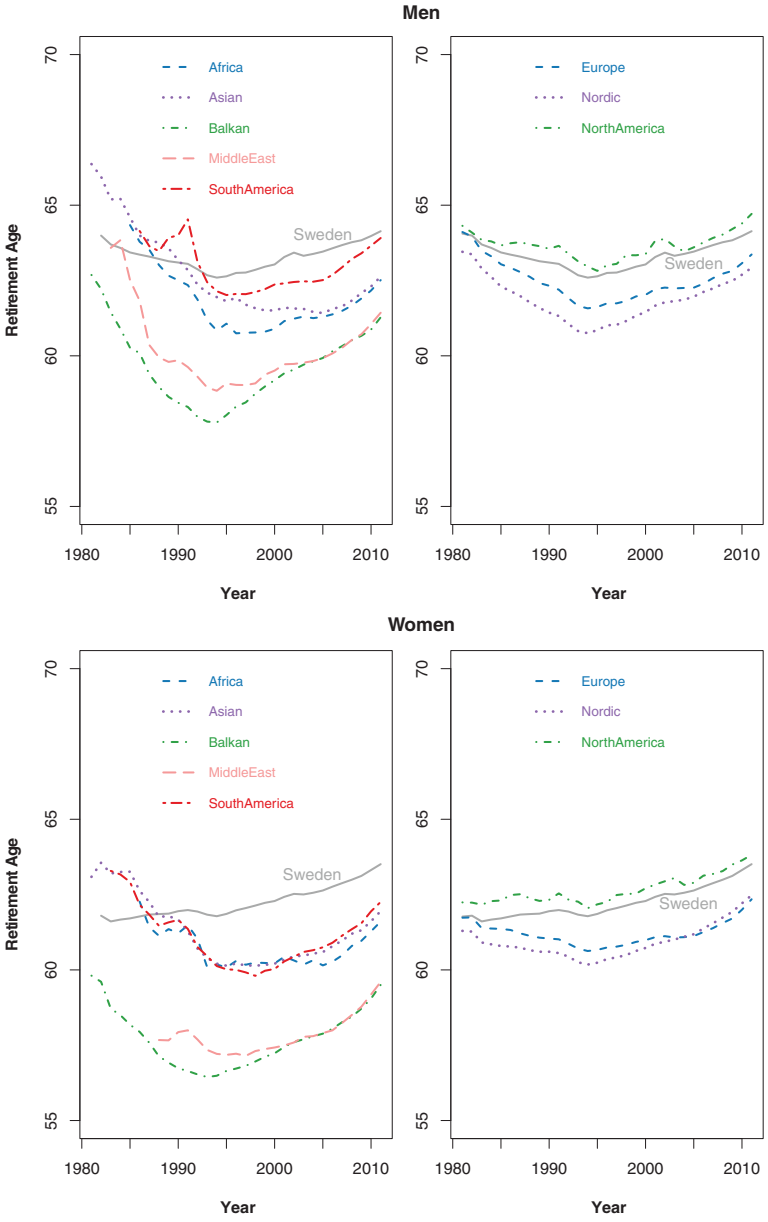
Source: Own calculations on immigrants' employment rates in Sweden using the Swedish Interdisciplinary Panel (SIP). Employment rates for the immigrants' home countries were obtained from the OECD (2019).

understood. Moreover, there is no generalisable research on how the mechanisms and the incentives for extending working life may vary across different socio-economic and demographic groups. In this section, we discuss the potential explanations for the increase in the effective retirement age at the aggregate level, as well as at the group level.

6.1 Explanations for the aggregate growth in the retirement age

It has been argued that moving from a defined benefit to a defined contribution pension system and/or increasing the statutory retirement age might be effective measures for delaying entry into retirement. Many developed countries have indeed experienced these effects, with an increase in the elderly labour supply following the introduction of retirement legislation that discourages early retirement (Atalay and Barrett 2015; Staubli and Zweimuller 2013).

Figure 6:
Effective retirement age by country of birth, men and women, 1981–2011



Source: Own calculations on the effective retirement ages using the Swedish Interdisciplinary Panel (SIP) from 1981 to 2011.

Between 1970 and 1991, older workers in Sweden retired prior to reaching the statutory retirement age by claiming early retirement/disability pension benefits for non-health reasons, such as unemployment. This new use of the early retirement option was the prime reason for the decline in the effective retirement age (Hagen 2013). As we discussed above, the Swedish government eliminated the option of claiming disability pension benefits for labour market reasons, as well as the favourable rules for workers aged 60–64. This reform had a positive impact on the elderly labour force participation rate (Karlström et al. 2008).

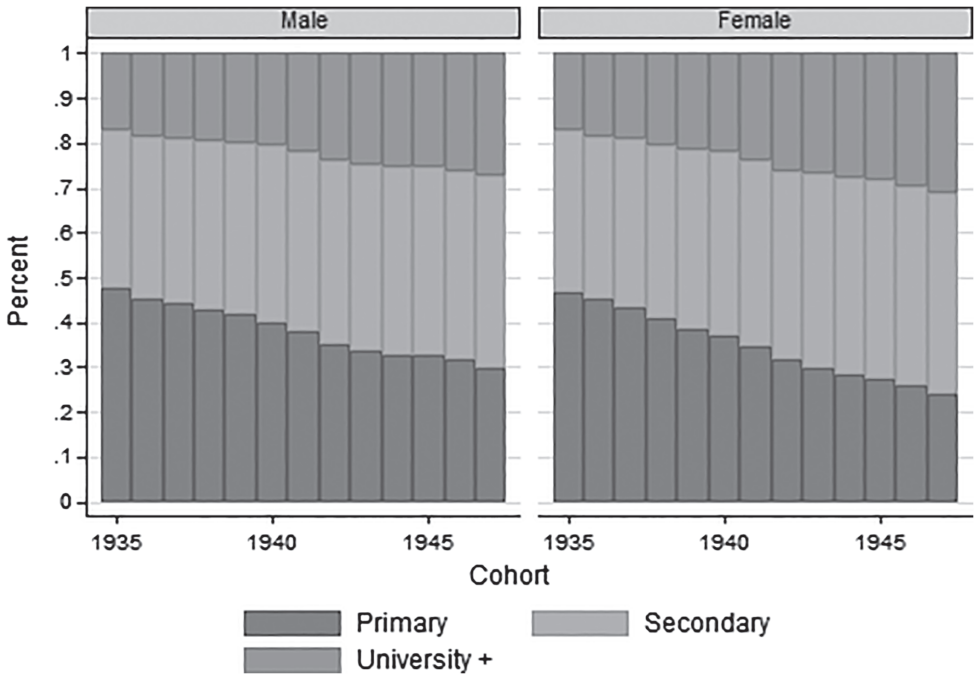
The defined contribution system that came into effect in 1999 created even greater incentives to work longer, with benefits increasing in line with the number of years worked. Although some scholars predicted an overall increase of 2.5 years in the effective retirement age in response to the new system (Laun and Wallenius 2015), this impact has so far not been reported. The primary reason why the full effect of the new pension system has yet to be observed is that the shift from the old system to the new system has been gradual. Under the transition rules, the oldest cohort to be fully vested in the new system was born in 1954. Thus, the members of this cohort have not yet reached age 67, which is the age at which the guaranteed right to continued employment ends.

Recent evidence for Sweden has, however, suggested that the labour supply effect of the new system might be smaller than expected. An examination of members of the 1944 cohort, whose pension benefits were reduced by 10% for men and 6% for women because half of their pension benefits were converted to the new system, found that the increase in the effective retirement age was just 0.15 for men and 0.03 years for women (Qi et al. 2018). This finding implies that the 1994 Swedish pension reform played a minor role in driving the growth in the effective retirement age since the mid-1990s. Similar evidence has been reported for the US. It has, for example, been shown that the gradual increase in the full retirement age from 65 to 67 and the increase in pension credit after full retirement age that were announced in 1983 could account for only one-sixth of the increase in the labour force participation of men aged 65–67 between 1998 and 2004 (Maestas and Zissimopoulos 2010).

This evidence casts doubt on the explanatory power of pension reforms for the increase in the effective retirement age. Thus, the question of why older people have started working longer remains open. Some scholars have argued that the change in the pension rules provides only a secondary explanation for why older people have begun to work longer, and that the primary reason is the change in the human capital composition of the labour force (Maestas and Zissimopoulos 2010).

University education was expanding in many developed countries during the second half of the 20th century (Altbach et al. 2009). Many birth cohorts who were the early beneficiaries of these expansions have reached pensionable ages over the past two decades, resulting in a noticeable increase in the educational attainment of the retirement-age population. This growth in educational attainment has accounted for between one-third and one-half of the increase in older men's labour force participation in the UK, the US, and Canada since the mid-1990s (Schirle 2008; Blau and Goodstein 2010).

Figure 7:
Educational composition, birth cohorts 1935–1947, Sweden



Source: Qi et al. (2016).

While the expansion in tertiary education was a worldwide phenomenon during the second half of the 20th century, Sweden was a country that exemplified this process. Enrolment and completion rates not only increased in Sweden; the number of higher education institutes in the country grew (Chudnovskaya and Kolk 2015). These developments resulted in higher educational attainment levels among those who reached retirement age from the mid-1990s onwards. Looking at Figure 7, we can see that for those born in 1935–1947 (the cohorts who reached age 60 in 1995–2007), the share of the population with university-level education increased, while the fraction with primary education declined (Qi 2016; Qi et al. 2016). This compositional change explained about a quarter of the growth in employment rates for women born in 1935–1947, but very little of the increase in labour force participation for their male counterparts.

In Sweden, there have been noticeable health improvements in the old-age population, with many diseases being diagnosed at higher ages than was the case in the past. For example, the average age of the first myocardial infarction increased by about three years between 1995 and 2010 (Modig et al. 2012; Modig et al. 2013), with a similar postponement being observed for hip fractures (Karampampa et al.

Figure 8:
Health composition, birth cohorts 1935–1947, Sweden

Note: Health is measured by the number of hospital admissions that each person had while between the ages of 55 and 59; categorised by no admission (0 Adm.), one admission (1 Adm.), and two or more admissions (2+ Adm.).
Source: Qi et al. (2016).

2013; Karampampa et al. 2014). However, these health improvements are unlikely to be the main factors that explain the increase in old-age labour supply, as they are mostly concentrated among the oldest-old. The majority of people approaching retirement (aged 55–59) are in consistently good health. As Figure 8 shows, roughly 90% of those individuals born in 1935–1947 (the cohorts who reached age 60 in 1995–2007) have never been hospitalised. This high level of population health also gives us reason to believe that the extension of working life is not just desirable; it is quite possible.

6.2 Explanations for the group-specific growth in the retirement age

Our finding that there is a shared growth pattern in the average effective retirement age suggests that having a lack of human capital, impaired health, or an immigrant

background are obstacles to extending working life. There is, however, little understanding about whether and, if so, how the mechanisms that underlie this pattern might differ across individuals with different socio-economic and demographic characteristics.

Some researchers have argued that changes in disability insurance and old-age pension benefits are significant factors in the increase in the old-age labour supply since the mid-1990s (Karlström et al. 2008; Johansson et al. 2015; Laun and Palme 2017). The critical question that arises is whether these reforms had the same impact on all older individuals.

The stricter rules for qualifying for disability insurance benefits might be having disproportionally adverse impacts on workers with low levels of human capital and impaired health, as they tend to rely on these benefits to a greater extent than other workers. Hence, the increases we observed in the effective retirement age for those individuals with primary education, and for the 10% of the population who were hospitalised between the ages of 55 and 59, might be more attributable to the disability insurance reforms than they are for individuals with higher levels of education and health.

For immigrants, and particularly for those from low-income countries, the mechanisms might be more complex than they are for native-born Swedes. As Figure 6 indicates, for most immigrant groups, the effective retirement age declined more steeply than it did for native-born Swedes prior to the mid-1990s, but it increased more sharply thereafter. This pattern may be attributable to foreign-born individuals having been more reliant than natives on disability pension benefits in the past, which in turn led to a more pronounced increase in their retirement age after the eligibility rules for disability pensions become stricter.

It is, moreover, likely that immigrants were more affected than natives by the old-age pension reform. The current old-age pension system calculates pension benefits based on an individual's earning history over his/her entire working life (whereas the previous system defined benefits based on the best 15 years of the worker's earning history). While natives usually spend their entire economic life-cycle in Sweden, migrants often do not. Thus, on average, the pension benefits migrants receive in the current pension system tend to be lower than those of natives, largely because they spend fewer years contributing to the system. One potential solution to this problem is for migrants to postpone retirement in order to increase the number of years they contributed to the system. If this is the strategy immigrants who have short working histories in Sweden tend to use, the impact of the pension reform may explain why the effective retirement age has increased more among immigrants than it has among natives. In addition to this institutional explanation, human capital reinvestment in mid- and late-life might be another factor that has contributed to the increase in the effective retirement age among low-skilled workers. In the 1997–2002 period, adult continuing education was radically expanded as part of the "Knowledge Lift" initiative, which had the goal of enhancing the human capital of workers with low to medium skill levels. More than 10% of the Swedish labour force participated in various adult training programs during this period (Bergemann and Van den

Berg 2014). Since immigrants, particularly those from low-income countries, tend to have low skill levels, they might have benefited more than natives from this adult education expansion.

While some scholars have argued that workers with low initial levels of education benefit little from adult educational training (Heckman et al. 1999), there is evidence that the effect of this initiative on employment and wage levels among low-skilled mothers was positive (Bergemann and Van den Berg 2014). These findings imply that the impact of the "Knowledge Lift" in the 1990s might help to explain why the effective retirement age increased for less-educated and low-skilled workers. Moreover, if immigrants were indeed overrepresented in adult training programs, the impact of the initiative might also explain why the effective retirement age increased more among immigrants than among natives.

In addition, some scholars have argued that the increase in human capital investment for mid- and late-life workers might have been a side effect of the pension reform. Specifically, it has been suggested that the increased financial incentives for postponing retirement, coupled with the expectation of living longer, has prolonged the payback period for human capital reinvestment, and has therefore encouraged middle-aged workers to participate in training (Brunello and Comi 2015; Montizaan et al. 2010; Fouarge and Schils 2009). This argument essentially implies that pension reforms have played an important role in increasing the effective retirement age, albeit through an indirect mechanism mediated by human capital reinvestment. Such a mechanism might be particularly relevant for immigrants, at least up until age 65, because, as a result of their shorter working histories, immigrants tend to have lower pension benefits than natives.

7 Summary and discussion

In Sweden, as in many other developed countries, the average age at retirement has increased for both men and women since the 1990s. Although these increases are helping to mitigate the consequences of population ageing, their magnitude has so far been too small to offset the general ageing trend. Thus, the average number of years spent in retirement is still increasing. This pattern, combined with the shrinking of the workforce, suggest that it will be difficult to sustain current levels social welfare transfers from the economically active population to the dependent elderly. To meet this challenge, working life needs to be further prolonged.

The current contribution-based old-age pension system in Sweden, which is only 20 years old, is already being modified. In February 2019, a proposal for a new pension reform was approved by legislators in the Swedish parliament. This reform mandates three major changes. First, the minimum age for receiving public old-age pension benefits will be gradually increased from 61 years in 2019 to 64 years in 2026. Second, the right to retain employment will be increased from age 67 currently to age 69 in 2023. Third, the age of eligibility for receiving guaranteed pension benefits (for those individuals who have little or no pension-qualifying

income) will be gradually increased from 65 years in 2019 to 67 years in 2026. The purpose of these new policies is to further increase the average effective retirement age. However, the critical question that has arisen is whether certain disadvantaged groups – such as those who have low levels of human capital or poor health, or who are immigrants from low-income countries – will be able to adapt to the new policy environment, and work longer.

In this paper, we have demonstrated that the increasing trend in the average effective retirement age since the mid-1990s has occurred across all socio-economic and demographic groups. The individuals who postponed retirement were not just the highly-educated/skilled, the healthy, and the native-born; they were also workers with less human capital, impaired health, and immigrant backgrounds. Indeed, men with the lowest educational levels had the steepest increases in the effective retirement age. This finding implies that the extension of working life is feasible for all groups, regardless of their socio-economic and demographic characteristics.

In terms of the incentives for late retirement, we believe that they are likely to vary across groups. For highly-educated and healthy workers, delaying retirement might simply be a response to the old-age pension reform. For low-skilled and unhealthy workers, working longer might also be a response to stricter eligibility rules for disability pensions. For immigrants, a combination of having relatively short work histories and low lifetime earnings might be an additional contributing factor. Moreover, human capital reinvestment, such as adult training programs, might play a role in extending the working lives of immigrants who have low skill levels and are from low-income countries.

Although this paper focuses on the Swedish experience in extending working life, it might be of interest for other ageing societies where concerns have been raised about whether workers engaged in physically demanding occupations will be able to work longer. Our figures suggest that increasing the statutory retirement age and/or removing early retirement incentives is possible even for the least educated, for those who have been hospitalised before the age of 60, and for immigrants born in low-income countries. The next question that arises is which policies and conditions are needed to enable people to work longer. Providing a concrete answer to this question would require us to have a thorough understanding of the factors that have driven the increase in the effective retirement age. More importantly, whether and, if so, how these underlying mechanisms might differ across population groups are questions to be addressed in future research.

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Historical patterns of unpaid work in Europe: NTTA results by age and gender

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Abstract

This paper presents an analysis of the age patterns of production, consumption, and net transfers in the form of unpaid work by gender *over time*. Using the National Time Transfer Accounts (NTTA) methodology, we briefly analyse complete historical results for several European countries. Our main aim is to introduce historical NTTA results, which are freely available to the public for further usage on the AGENTA database. The results of our analysis show that the evolution of age patterns over time differed between men and women, and was highly affected by different demographic trends, as well as by the specific institutional background of each country. Our findings indicate that despite the differences in age patterns over time and across countries, two main characteristics of these patterns did not change: i.e. transfers of unpaid work flowed first from women to men, and second from the working-age population to children and – to a lesser extent – to the elderly.

1 Introduction

The well-being of societies and individuals relies greatly on the system of intergenerational exchange, which consists of transfers among different generations: i.e. across the young, working-age, and elderly populations. Private and public transfers (such as private cash transfers from parents to their children, or public pensions and education) are often mediated by the market, and are therefore called market

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transfers. Levels of intergenerational support in the form of market transfers are very high in European countries (Lee and Mason 2011; Istenič et al. 2017), but these transfers are always complemented by another form of economic production: namely, unpaid work. Large amounts of unpaid work (such as cleaning, cooking, shopping, care, and voluntary work) are transferred within the private sphere of the home, and are therefore referred to as private non-market transfers.

The inclusion of household production when analysing the age patterns of economic activity is justified by the considerable amount of time spent on unpaid household labour, and the value produced by these activities (Goldschmidt-Clermont and Pagnossin-Aligisakis 1995; Giannelli et al. 2011; Miranda 2011; Altintas and Sullivan 2016). In addition, as Gershuny (2011) has argued, the conventional GDP measure takes a view of labour that is too narrow to accurately reflect cross-country differences and historical changes in economic activity. Since household production is mostly carried out by women, the calculation of the value of unpaid work is crucial for efforts to make women's total economic contributions more visible. Folbre (2008) demonstrated that this issue is particularly salient in the case of labour devoted to childrearing. In EU countries, the elderly are supported mainly by public transfers, whereas children are mainly supported by private non-market transfers (Gál et al. 2016; Hammer et al. 2018). Therefore, neglecting age-specific private non-market transfers can result in distorted inferences being made about public policy issues, such as the pension system.

Despite their importance and size, private non-market transfers tend to be an overlooked part of the economy, mainly because they are invisible in the official statistics. The System of National Accounts – which provides a basis for the analysis of economic activities – essentially neglects unpaid work, and the Household Satellite Accounts captures unpaid work in aggregate terms only (Ironmonger 1996; Holloway et al. 2002; Soupourmas and Ironmonger 2002; Ahmad and Koh 2011). However, to gain deeper insights into the patterns of unpaid work at different stages of life, disaggregated data are required. Adding the gender and the age dimension is essential for understanding the intergenerational resource reallocation patterns of different economies. In this paper, we apply the National Time Transfer Accounts (NTTA) methodology, which provides a conceptual and a statistical basis for the calculation of the production and the consumption of unpaid work, as well as of net non-market transfers by age and gender (Donehower 2014). The main novelty of our research is that we present full accounts over time for six European countries.

Shifts in female employment, the timing of childbearing, and family and household structures also affect the age patterns of the production and the consumption of unpaid work and private non-market transfers for both genders. Therefore, the main aim of this research paper is to describe historical differences in gender-specific patterns of unpaid work, and in gender-specific provisions of private non-market transfers. In order to observe recent shifts in the variables of interest, disaggregation by one-year age groups is necessary. We present full accounts of comparative historical NTTA results for the following European countries: Denmark, Germany,

Italy, the Netherlands, Spain, and the UK. Please note that our focus is on countries with longer time series (the Netherlands and the UK). Thus, we introduce European historical NTTA accounts that are freely available to the public for further usage on the AGENTA database.[1]

We start this paper with a short description of recent demographic and economic changes in the European countries in our sample, followed by a discussion of past research related to the paper's topic. Next, we explain the data and the methods used. After presenting our results on the production and the consumption of unpaid work, and on the net private non-market transfer amounts, we present our conclusions.

2 Background

Demographic and economic changes that have occurred in the last few decades have had a profound impact on how people allocate their time to different daily activities. Consequently, how much unpaid work people produce, consume, and transfer has changed at both the aggregate and the individual level (i.e. at the *per capita* level for each age group). In this section, we point out the main trends that have contributed to the changes in individuals' time allocation decisions in Europe.

In many industrialised countries, family dynamics have undergone significant changes. By the end of the 20th century, the once-prevailing 'male breadwinner–female caregiver' household model had declined in importance in European countries. Until that time, a lack of public policies aimed at helping parents combine work and family led to a system in which the burdens of paid and unpaid work were unequally distributed between men and women. In line with traditional gender ideology, men were dominant in the labour market, while women typically performed a disproportionally large share of unpaid work. Thus, levels of female participation in the labour market were far below current levels (Haas 2005; OECD 2018).

The emergence and spread of new household models – such as the 'one-and-a-half earner model' (i.e. the man working full time and the woman working part time) and other types of dual-breadwinner models (Lewis 2001) have led to increases in women's labour market participation and employment rates. Eurostat data (Eurostat 2016a) indicate that from 1993 onwards, the employment rates of women aged 20–64 have risen in all of the observed countries, with the smallest increase being reported in Denmark (three percentage points), where female employment rates are among the highest in Europe; and the largest increases being reported in Spain and the Netherlands (22.6 and 17.3 percentage points, respectively).[2]

[1] http://dataexplorer.wittgensteincentre.org/shiny/nta/

[2] In 1993, the female employment rate was 69.6% in Denmark, 33.8% in Spain, and 53.5% in the Netherlands.

These increases in female employment rates can be attributed to the implementation of numerous public policies, and to changing attitudes towards women. In recent decades, European countries have introduced initiatives on gender equality, working-time regulations, and public policies aimed at helping parents reconcile family and work life (Pascall and Lewis 2004). Flexible working arrangements, stronger social security systems, increased provision of childcare and elderly care services, parental leave benefits, and family and child allowances are among the public policies and programs that have given families more freedom to choose how they participate in paid and unpaid work (Lewis et al. 2008; Saraceno and Keck 2008).

In Europe, fertility rates have declined and families have become smaller in size (Apps and Rees 2005). It has been posited that the active participation of women in the labour market has influenced couples' decisions about the number of children they want to have; and that, conversely, lower fertility rates have led women to increase their participation in the labour market. Furthermore, many couples are delaying having children until later in life. The average ages of women at first birth and at subsequent births have increased in all the analysed European countries in the last few decades (Eurostat 2016b).

The implication of these trends is that the amount of time women spend on unpaid work has been declining (Kan et al. 2011). Spending more time at work has limited the time women have available for other activities, including performing unpaid work. It is also probable that women have lowered their domestic standards because they are tired after spending long hours in paid employment. Other factors appear to have contributed to the changing patterns of unpaid work as well, such as improvements in the efficiency of housework equipment, and the increased ability to outsource unpaid work activities as a result of having a higher disposable income (Dex 2009). As women decide to spend more time in paid employment and less time in unpaid work, the need for men to take a more active role in unpaid work has grown. Thus, it appears that the gender gap in the production of unpaid work is becoming smaller over time (Kan et al. 2011).

A large number of historical time use studies (cf. Apps and Rees 2005; Kan et al. 2011; Gimenez-Nadal and Sevilla 2012; Altintas and Sullivan 2016) have analysed the effects of the above-mentioned trends on unpaid work and its components in the European context, but have neglected the age dimension (or use very broad age groups and/or limited age boundaries). The concept of observing unpaid work across more narrow age groups using NTTA methodology is rather new in the academic literature, but is gaining increasing attention (Kluge 2014; Hammer et al. 2015; Gál et al. 2015; Zannella 2015; Rentería et al. 2016). However, historical analysis in the NTTA context has lagged behind. A limited branch of research (Zagheni et al. 2015) has included the age dimension of gender-specific historical estimates, but focused only on the evolution of production patterns. We keep the gender aspect over time, and go one step further by exploring the historical changes not only in production patterns, but in complete age patterns of consumption and net transfers in the form of unpaid work.

3 Data and methodology

3.1 Data

We used several datasets to compute the age- and gender-specific profiles of production, consumption, and net transfers in the form of unpaid work. The Multinational Time Use Survey dataset (MTUS) served as our main source of historical time use data. MTUS contains cross-nationally harmonised data on how people allocate their time among different activities in a given day. Currently, the collection includes nationally representative micro-data from more than 20 – mainly European – countries (for more details about MTUS data collection, see Fisher and Gershuny (2016)). Based on data from the MTUS database, we estimated the production of unpaid work for the following countries and years: Denmark (1987, 2001), Germany (1992, 2001), Italy (1988, 2002), the Netherlands (1975, 1980, 1985, 1990, 1995, 2000, 2005), Spain (2003, 2010), and the United Kingdom (1974, 1983, 1987, 1995, 2001, 2005).

Depending on which time periods they cover and which countries they include, we used four additional datasets to estimate the age profiles of consumption and net transfers of unpaid work. We drew our data for the 1990s from the EU Statistics on Income and Living Conditions (EU-SILC) or the European Community Household Panel (ECHP), and created older age profiles (from the mid-1970s to around 1990) using data from the Integrated Public Use Microdata Series (IPUMS) or the Labour Force Survey (LFS).

3.2 Methodological approach

We followed the NTTA methodology based on Donehower (2014) and Vargha et al. (2015), and applied additional methodological steps to account for the specifics of the MTUS data. In this section, we present only the general NTTA methodology; a detailed description of the specific methodological steps we used for the MTUS data is presented in the AGENTA NTTA manual (Vargha et al. 2016).

The MTUS dataset contains harmonised data and includes variables (i.e. daily activities) that are defined identically in all time use surveys for all countries. Therefore, the first step was to identify the daily activities that we would categorise as unpaid work. We split total unpaid work into two parts: childcare and housework. Childcare consists of the following activities: physical or medical childcare; teaching, reading, talking to, or playing with a child; helping a child with homework; supervision; childcare-related travel; and other childcare activities. Housework consists of all other unpaid work activities, such as cooking, domestic work (cleaning, doing laundry, etc.), pet care, adult care, voluntary work, gardening, and domestic travel. After defining which activities are considered unpaid work, the next step was to estimate the age profiles of production. As the MTUS dataset

contains information on time use, age, and gender for all respondents, we were able to calculate the average production of unpaid work for each age and gender directly from the MTUS micro-data (following the standard NTTA assumption that unpaid work equals zero for children under age 10).

MTUS provides information about the producers of unpaid work only, and not about the consumers who are the beneficiaries of household production. To estimate consumption by age and gender, we relied on several assumptions and allocated the total household production of unpaid work among the household members. We assumed that all housework produced in a specific household was allocated equally among all household members, while childcare was allocated only among children (who are the beneficiaries of childcare services). If there were more children in one household, total household childcare production was not allocated equally among them, but was instead divided into different shares based on the equivalence scale generated separately for each country.

As we mentioned above, the consumption profiles were not estimated from the MTUS dataset, but from one of the other surveys (EU-SILC, ECHP, IPUMS, or LFS). We chose this approach because the MTUS database provides data on the respondents, but does not contain information about all of the household members. Thus, we were unable to calculate the total household production, or to allocate it among the household members in order to estimate their consumption, using the MTUS data alone. Meanwhile, the four surveys contain information on the full household structure (i.e. data about the age and the gender of all household members), but do not include information on the time use of individuals. To overcome these gaps in the data, we first imputed production averages (estimated from the MTUS) to one of the four surveys based on three characteristics of individuals: age, gender, and household type.[3] Thus, all household members of a specific age, gender, and household type were assigned an average level of production of unpaid work. We could then calculate the total household production, and allocate it among all household members in order to measure consumption by age and gender.

The final step was to calculate the age profiles of net transfers as the difference between consumption and production at each age, and for both genders. If a person's consumption of unpaid work was higher than his/her production, the gap was filled by receiving net transfers from others, and the value of net transfers was therefore positive. If, on the other hand, a person produced more than s/he consumed, s/he could transfer the surplus of produced unpaid work to other individuals, and the value of net transfers was therefore negative.

[3] Household types were defined according to different combinations of the following characteristics: gender of the respondent, household size, number of children in the household, and the age of the youngest person in the household.

4 Results

In the following section, we present historical estimates of the age profiles of unpaid work for Denmark, Germany, Italy, the Netherlands, Spain, and the UK. The observed time period is different for each country, depending on the availability of time use data. For most categories of unpaid work, we present the results for the Netherlands and the UK (for which the analysis was possible for the longest time period, of around 30 years), as well as the findings for other selected countries. The results for all of the countries can be accessed on the AGENTA project webpage.

4.1 Production

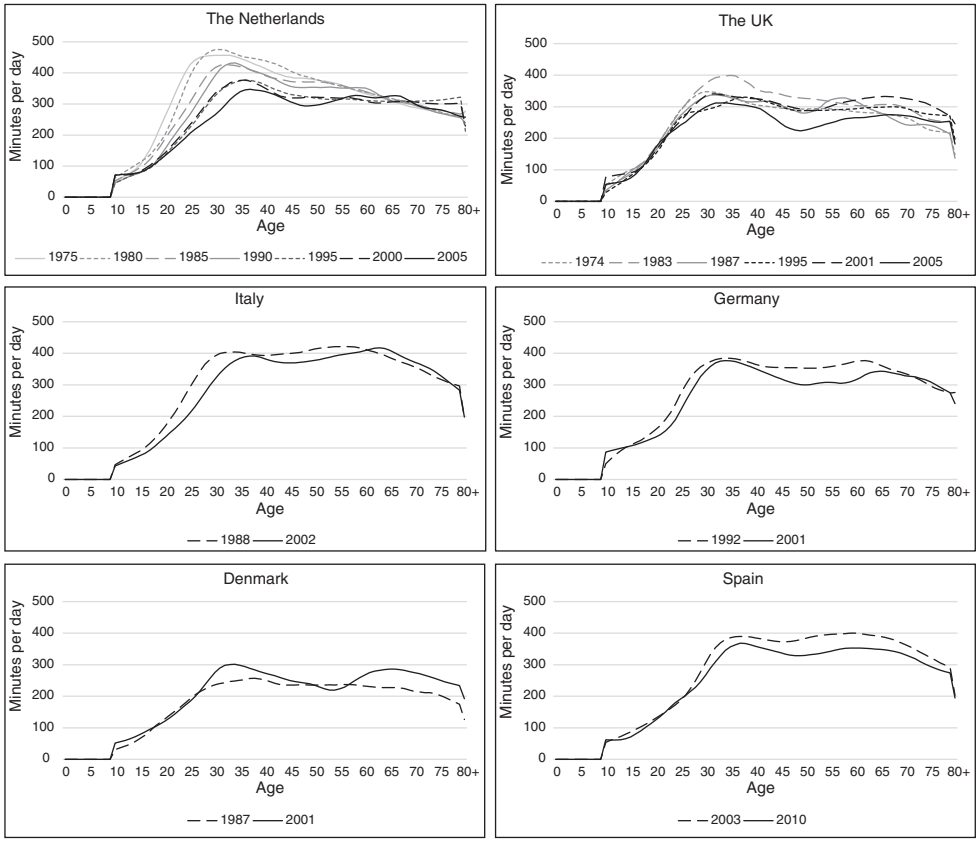
Our NTTA results reveal that the changes in production patterns over time differed substantially between men and women. Over the past few decades, as new employment opportunities and flexible work arrangements increasingly allowed women to participate in the labour market, women reduced the time they spent on unpaid work (Figure 1). Compared to the initial levels, production of unpaid work declined over the study period for almost all of the age groups in the analysed countries, except in Denmark during 1987 and 2001. This finding is in line with the results of previous studies of time use surveys, which showed that the amount of time women time devote to unpaid work has declined continuously (Kan et al. 2011; Altintas and Sullivan 2016).

Figure 1 shows that among Dutch women, the number of minutes per day they spent doing unpaid work declined sharply, especially around the peak childbearing ages. For example, the time Dutch women devoted to unpaid work at age 26 decreased from 441 minutes in 1975 to 219 minutes in 2005. These results were expected, as in recent decades, the female employment rate has increased more in the Netherlands than in most other European countries (from 53.5% in 1993 to 70.8% in 2015) (Eurostat 2016b). The introduction of new work, family, and taxation policies in the Netherlands resulted in large increases in female part-time employment (Pascall and Lewis 2004), and, conversely, in sharp declines in the amounts of unpaid work women – and especially women of working ages – were performing.

Due to different combinations of institutional factors, social norms, and attitudes, the decreasing trend in unpaid work production has varied considerably across countries. While the Netherlands experienced a gradual decline in production starting in the 1970s, the trend in the UK over the same period was not continuous (see also Zagheni et al. (2015)). Furthermore, the decreasing trend in levels of unpaid work in Italy was characterised by a shift of the age profile to the right (explained in more detail below).

Figure 2 shows that as women were spending less time on unpaid work, men were starting to compensate for this decline by spending more time on unpaid

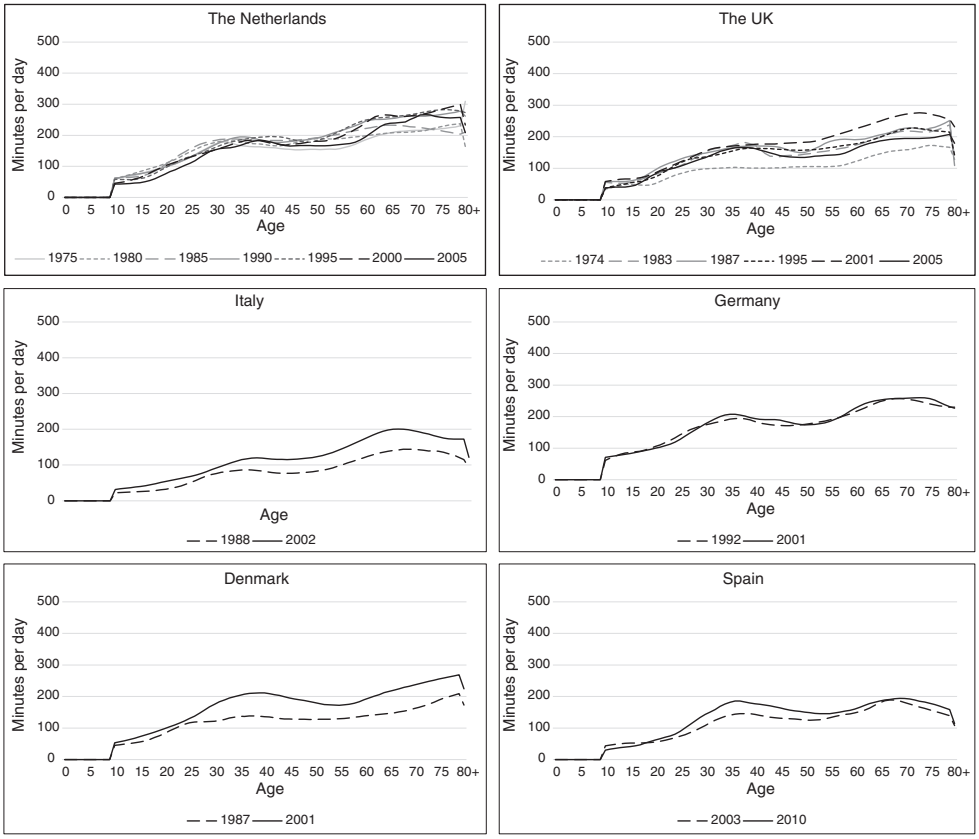
Figure 1:
Production of unpaid work, women, the Netherlands (1975–2005), the UK (1974–2005), Italy (1988–2002), Germany (1992–2001), Denmark (1987–2001), and Spain (2003–2010)[a]



Note: [a]The historical evolution of production patterns and the corresponding trends in unpaid work in the Netherlands and in the UK have been previously discussed by Zagheni et al. (2015).
Source: Multinational Time Use Study; Eurostat; Authors' own calculations.

work activities in general. The upward trend was most pronounced in Italy, where, on average, the time men at age 65 devoted to household activities increased by 60 minutes; and in Denmark, where the time men at age 40 spent on household activities increased by 75 minutes. However, this increasing trend was not observed in all countries and in all age groups. The increases were largest among men at ages when men usually become fathers (e.g. in Denmark and Spain) and at retirement ages (e.g. Italy). This finding implies that men were devoting more time to childcare activities and were more active in the production of unpaid work after retirement

Figure 2:
Production of unpaid work, men, the Netherlands (1975–2005), the UK (1974–2005), Italy (1988–2002), Germany (1992–2001), Denmark (1987–2001), and Spain (2003–2010)



Source: Multinational Time Use Study; Eurostat; Authors' own calculations.

than they were in the past. One exception is Germany, where men did not become more involved in unpaid work to compensate for the decline in female production. Furthermore, in the UK and in the Netherlands, it seems that the upward trend levelled off at the turn of the century.

The redistribution of unpaid work responsibilities between men and women implies that there is a trend towards gender convergence: i.e. because women have been performing less and men have been performing more unpaid work than in the past, the gap between male and female production has been getting smaller over time (see also Altintas and Sullivan 2016). However, in our study period, the

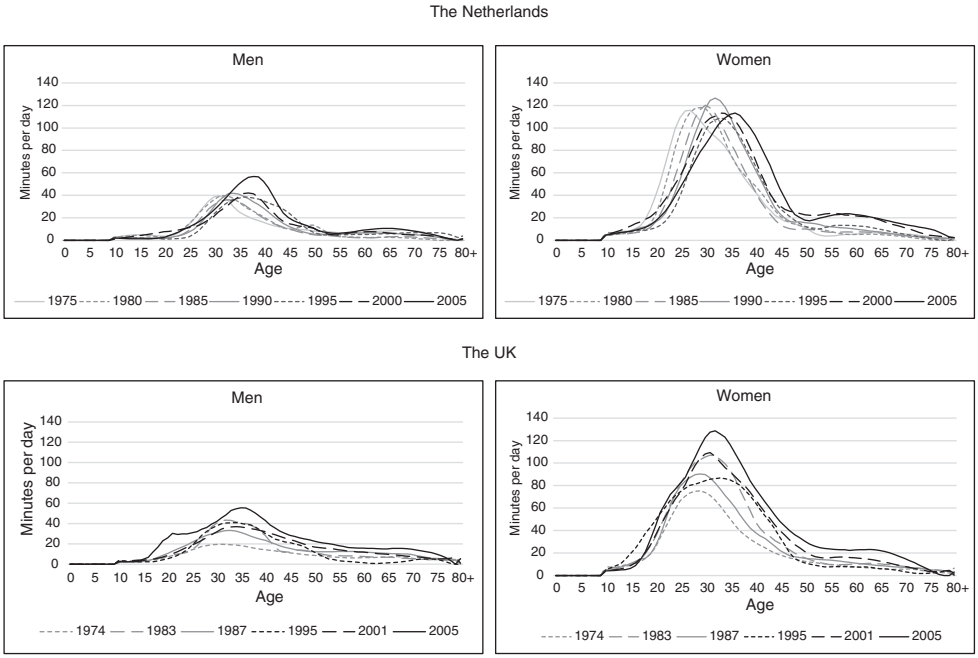
decrease among women at working ages was greater than the increase among men. Thus, it appears that gender differences persist, and remain extremely large in some countries. For example, in Italy in 2002, women aged 30 to 60 spent an average of 3.5 to five more hours per day on unpaid work than their male counterparts. The Italian gender gap is among the largest in Europe, and is driven by the very large amounts of unpaid work performed by women on the one hand, and the very small amounts of unpaid work performed by men on the other. People are much more likely in Italy than in most other European countries to be religious, family-oriented, and committed to traditional gender roles. Additionally, after Italian women have children, many never return to the labour market due to labour market rigidities and the lack of state support for working mothers. It thus appears that there is a strong division of labour in Italy, with women being expected to be responsible for the majority of unpaid work (Anxo et al. 2007; Vargha et al. 2015; Zannella 2015).

Another trend in production patterns has arisen as a result of recent changes in the timing of lifetime events. In many industrialised countries, young adults have been spending more time in education and have been entering the labour market at higher ages than in the past, and have thus been delaying parenthood (Sobotka 2010). Because the production of unpaid work (especially in the form of childcare) is highly affected by the birth of children, the phenomenon of delayed parenthood is clearly visible in our age profiles. Over time, the age profiles of childcare production have moved to higher ages, and the age profiles of total unpaid work production have moved to higher ages as well.

In Figure 3, the shift of childcare age profiles to later ages is presented for the Netherlands. In the observed time period, the peak moved to the right for both men (by around seven years) and women (by around nine years), which is in line with the increasing average age of Dutch women at childbirth (Eurostat 2016b). However, this pattern was not observed in all of the analysed countries. In most countries, the shift was more pronounced for women and was less pronounced (or was not visible at all) for men. Furthermore, although men were spending more time on childcare than in the past, childcare remained highly gender-segregated. In all of the analysed countries, mothers were still spending around two to three times more time taking care of their children than fathers.

As Figure 3 shows, parents have been investing increasing amounts time in the development of their children. This trend was most pronounced in the UK for both genders and at almost all ages, and even included large increases in the grandparenting years. In the Netherlands, the average amount of time spent on childcare among women aged 20–50 increased slightly over time (the age profile became somewhat wider), even though the peak of the age profile did not increase among working-age women. The increase among working-age Dutch men was more obvious. Moreover, there were relatively large increases in the grandparenting years among both women and men.

Figure 3:
Childcare production, men and women, the Netherlands (1975–2005) and the UK (1974–2005)



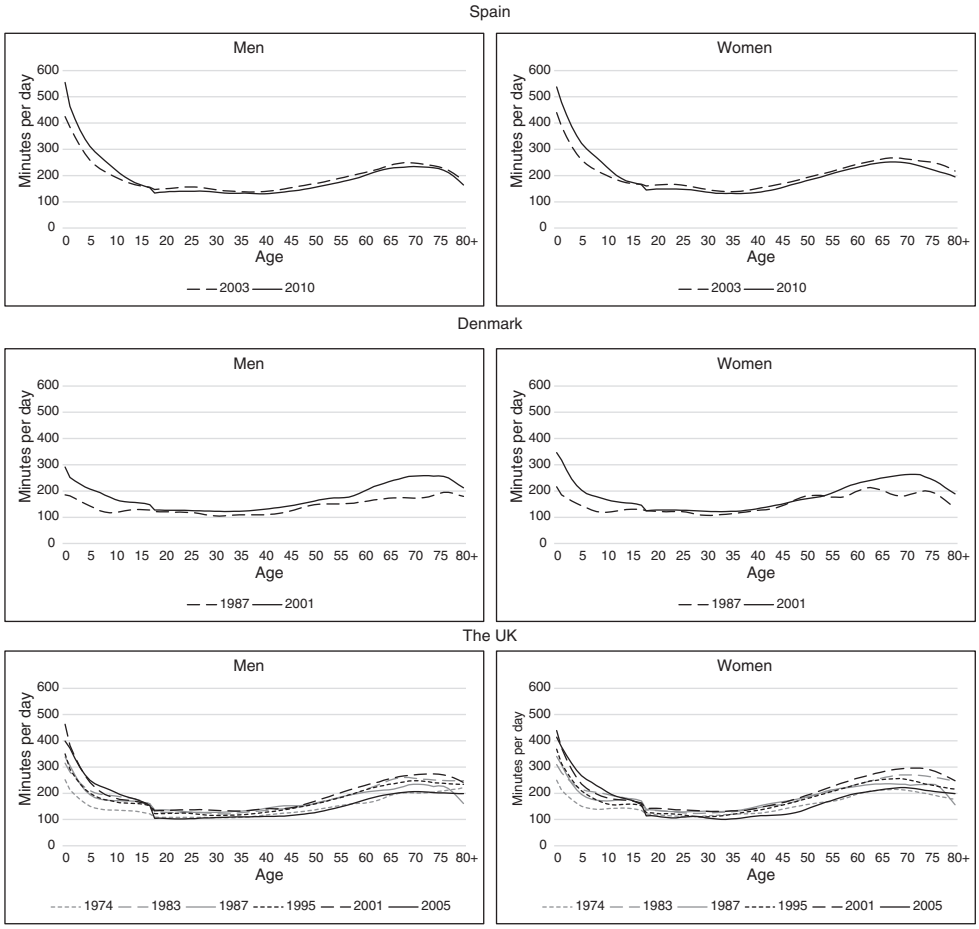
Source: Multinational Time Use Study; Eurostat; Authors' own calculations.

4.2 Consumption

In addition to being producers of unpaid work, household members are consumers of unpaid work. Figure 4 shows male and female age profiles of consumption of unpaid work for Spain, Denmark, and the UK.

In contrast to the production levels, the consumption levels were very similar among men and women, with differences arising only because of differences in household structures. Furthermore, age patterns of consumption did not vary greatly across countries and over time. In all of the observed countries, the shape of the age profile of consumption did not change significantly over time: i.e. consumption levels remained highest at young ages (mainly due to high levels of consumption of childcare services) and lowest from around the twenties to the fifties. It is at these ages that people tend to become parents, and that large shares of the unpaid work people perform are consumed by their children rather than by themselves.

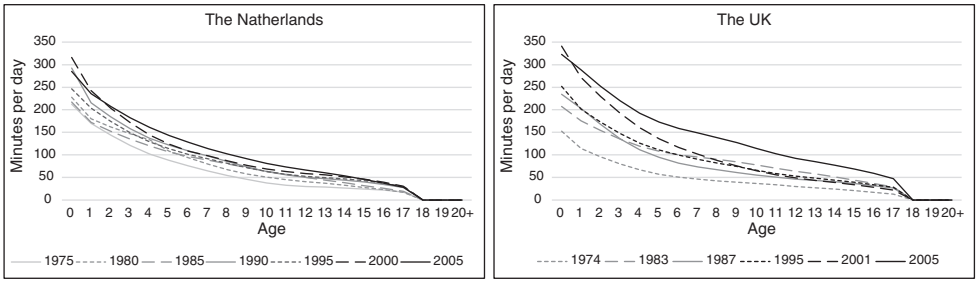
Figure 4:
Consumption of unpaid work, men and women, Spain (2003–2010), Denmark (1987–2001), and the UK (1974–2005)



Source: Multinational Time Use Study; Eurostat; EU Statistics on Income and Living Conditions; European Community Household Panel; Integrated Public Use Microdata Series; Labour Force Survey; Authors' own calculations.

The most important change in the age patterns of consumption occurred among children: i.e. per capita consumption at young ages increased over time (see Figure 5). This means that over time, parents were devoting more time to each of their children, which led to an increase in per capita human capital investment in children. Since parents in the UK were having fewer children (the total fertility rate dropped from 1.92 to 1.76 between 1974 and 2005, according to Eurostat (2018)) even as they were spending more time on childcare, per capita consumption of

Figure 5:
Childcare consumption, the Netherlands (1975–2005) and the UK (1974–2005)



Source: Multinational Time Use Study; Eurostat; EU Statistics on Income and Living Conditions; European Community Household Panel; Integrated Public Use Microdata Series; Labour Force Survey; Authors' own calculations.

childcare in the UK increased considerably (for a discussion of the relationship between fertility and human capital investments in the form of childcare, see Vargha and Donehower (forthcoming)). In the Netherlands, fertility also decreased between 1975 and 1995, but it increased somewhat up to the 2000s. Nonetheless, per capita consumption of childcare in the Netherlands increased steadily over time.

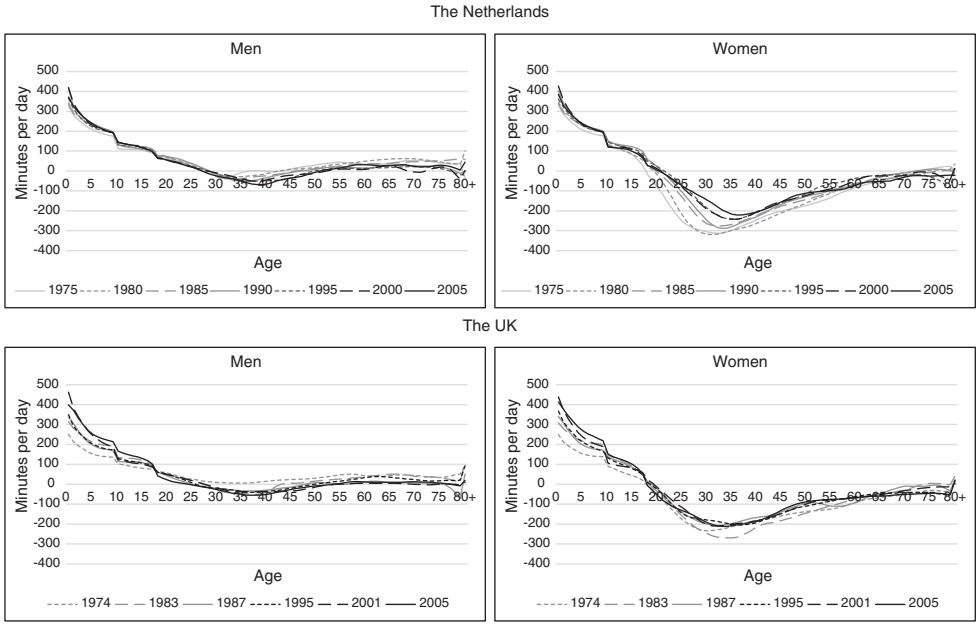
In contrast, Figure 4 shows that there were no clear changes in consumption patterns among the working-age and elderly populations. In general, consumption at working ages was rather constant, with only small changes over time. Figure 4 illustrates this pattern for the UK over a 31-year period, showing that even though there were small year-by-year changes in the consumption of unpaid work among the working-age population, the level of overall change was negligible. A similar pattern was observed in the other countries studied.

Historical changes in consumption patterns at old ages differed across countries. Our findings indicate that the main factor that drove consumption changes among the elderly in each country was the change in production levels. If the elderly remained active in retirement and dedicated some of their extra free time to unpaid work (i.e. if they performed more work), then they could also consume more at these ages. For example, men and women in Denmark intensified their participation in unpaid work at retirement ages, and this trend was accompanied by higher consumption levels among the elderly.

4.3 Net transfers

Net transfers represent the difference between consumption and production at each age. As such, many trends that can be observed for production and consumption can also be seen in the age profiles of net transfers. Typically, net transfers are positive for young and elderly people who are not able to support their total

Figure 6:
Net transfers of unpaid work, men and women, the Netherlands (1975–2005) and the UK (1974–2005)



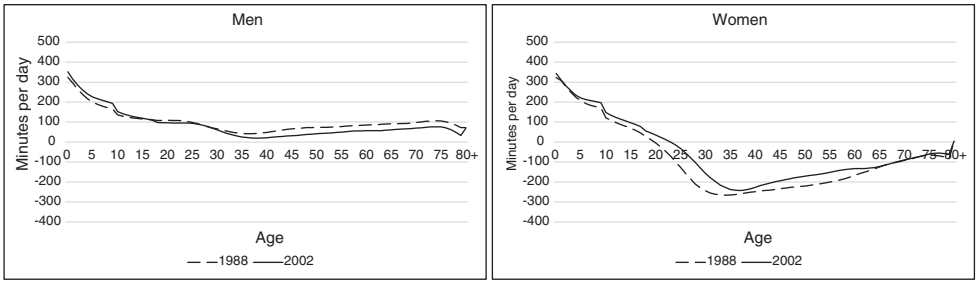
Source: Multinational Time Use Study; Eurostat; EU Statistics on Income and Living Conditions; European Community Household Panel; Labour Force Survey; Authors' own calculations.

consumption solely through their own production. In contrast, working-age people usually produce more unpaid work than they consume, and are thus able to transfer a portion of the unpaid work they produce to others; mainly to their children. Their net transfers are typically positive.

Because the production of children under age 10 equals zero or is very low, the age patterns of net transfers for children closely follow the age patterns of consumption. In all of the analysed European countries, the consumption levels of children have increased over time, but their production levels have been rather constant. Therefore, over time, children have been receiving increasing transfer amounts to satisfy their consumption needs. Figure 6 shows this trend for the Netherlands and the UK.

In their parenthood years, Dutch and British men transferred more and Dutch and British women transferred less in the form of unpaid work at the end than at the beginning of the observed time period. Thus, the gap in the amounts of unpaid work men and women were transferring to others was getting smaller over time. These results are in line with findings on the gender convergence in production levels, and apply not only to trends in the Netherlands and the UK, but to developments in other European countries. Another shift in production trends can be seen in the age

Figure 7:
Net transfers of unpaid work, men and women, Italy (1988–2002)



Source: Multinational Time Use Study; Eurostat; EU Statistics on Income and Living Conditions; European Community Household Panel; Labour Force Survey; Authors' own calculations.

profiles for the Netherlands, which indicate that the negative peak of net transfers for both men and women moved to the right due to delayed parenthood.

Changes in net transfers at older ages varied across countries. In general, among older women, the amounts of unpaid work transferred decreased slightly over the observed time period, or did not change significantly. Older men, by contrast, generally remained net recipients of transfers. However, in most of the observed countries, the transfer amounts older men received declined over the study period. This finding could be partly attributable to the development of public facilities for the elderly.

Italy stands out as the country where men remained net recipients of transfers even in their parenthood years, when people usually become net givers. However, Figure 7 reveals that their level of dependency on transfers from others decreased over time. Italy was also unusual in another way: even though their production levels decreased over time, women in Italy were still transferring much more unpaid work than women in other European countries, especially at old ages. This pattern in Italy is likely attributable to the persistence of traditional gender norms and the level of government support received by the elderly. We expected to find that familial transfer amounts were larger in countries where government support was weak and public facilities for the elderly were in limited supply. This was indeed the case in Italy, where families have long borne the primary responsibility for their elderly relatives, both by law and by tradition (Bettio and Verashchagina 2012). While similar levels of unpaid work transfers were observed in Spain, the levels were found to be much lower in the other analysed countries.

Despite these differences between countries, two main characteristics of the age patterns of net transfers did not change in the observed countries over time: i.e. transfers of unpaid work flowed first from women to men, and second from the working-age population to children and – to a lesser extent – to the elderly. While children were becoming more dependent on non-monetary transfers in the form of

unpaid work, older people were becoming less dependent on these transfers in most of the analysed countries.

5 Conclusions

How time is allocated among different daily activities, and especially between paid and unpaid work activities, differs greatly between men and women and across age groups. The aim of our paper was to present publicly available historical NTTA estimates for six European countries. The analysis included the age and the gender dimension. It extended previous research by analysing changes over time not only in the age patterns of production, but of consumption and net transfers in the form of unpaid work.

Over the past half-century, gender differences in the production of unpaid work have become smaller. As women spent more time participating in the labour market, the amount of time they spent performing unpaid work decreased. Meanwhile, men started devoting more of their time to unpaid work. We found only one exception to this pattern: namely, in Germany, where this trend was ambiguous. Our results also indicated that the first peak in the production age profile shifted to higher ages, in line with the tendency in European countries to postpone the birth of children. This shift was shown to be more pronounced for women than for men.

The age patterns of consumption were found to be very similar across countries and between women and men. Historical NTTA estimates showed that consumption patterns did not change significantly over time. The largest change was observed for children, because their consumption levels have increased over time. This finding implies that parental investment in children's human capital has been growing over time.

As levels of consumption and of production differed by age, net transfers emerged to fill this gap. Historical data on the evolution of net transfers show that due to increasing consumption, net transfers at young ages have also been increasing. We discovered that at parenthood ages, women were transferring less and men were transferring more of their unpaid work production than they were in the past. The negative peak of the age profiles shifted to higher ages as young people increasingly decided to delay parenthood. We also found that over our study period, older people became less dependent on net transfers, but that at these ages, men were still more likely than women to be net recipients, while women were still more likely than men to be net givers.

Although the amounts of unpaid work that were transferred changed over the study period, the direction of these transfers remained the same. First, unlike in the market economy, net transfers of unpaid work flowed from women to men. Second, transfers flowed from working-age people to their children (who were becoming more dependent on transfers of unpaid work over time), as well as to the elderly (who were becoming less dependent on these transfers over time).

One of the main advantages of using the NTTA results was that doing so allowed us to estimate the consumption of unpaid work, which was not reported in the time use surveys. However, in order to estimate the time consumed, we needed to assume that all of the adult members of the household consumed the same amount of unpaid services produced. Another limitation of our results is that we needed to impute the time devoted to unpaid household activities using information from databases, rather than from time use surveys. These auxiliary databases were selected based on their availability in the specific year and country. It should also be noted that the NTTA age profiles were age- and gender-specific averages. While estimating the confidence intervals of the estimates might have provided us with some additional insights, this would have been difficult to do using only one-year age groups, which are needed to show historical differences in the amounts of time allocated to unpaid work. Finally, as the consumption age profiles mainly reflected differences in the household structure over time, changes in the household structure may explain differences in both the consumption and the production of unpaid work over time. Thus, future research should attempt to isolate the effect of changes in the household structure, and to analyse how these changes affect the historical NTTA results.

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Italians' use of time during the economic crisis: implications for the gender division of labour

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Abstract

This article builds on time use micro-data for Italy to analyse the evolution of individuals' time allocation during the 2002–2014 period, with a gender-specific focus. We are particularly interested in comparing changes that occurred between the years prior to and after the onset of the recent economic crisis. We use regression analysis to measure differences between years in the average use of time of men and women for personal care, education, paid work, unpaid work, and leisure over the considered period(s). In order to gain more insight into gender differences in time use behaviours, we further break down unpaid work and free time into detailed activities. We document a decrease of about two hours per week in female housework coupled with a similar increase in male unpaid work over the entire period. However, while signs of this gender convergence were already evident for women in the years before the recession, we do not find any significant change in male unpaid work between 2002 and 2008. It was only after the onset of the economic crisis, and the consequent losses in paid work hours, that men started spending more time on housework and family care.

1 Introduction

How did individuals allocate their forgone hours of market work during the recent economic recession? Was the Great Recession a "Great Vacation"? These are among the questions posed by Aguiar et al. (2014) in their study on Americans' use of time during the recent economic crisis. Results, based on data from the American Time Use Survey for the 2003–2010 period, showed that leisure absorbed more than 50% of the foregone market work hours, with sleeping and television

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watching accounting for most of the increase in the amount of time spent on leisure. About 30% of the foregone market work hours were reallocated to housework, and about 5% were reallocated to child care. The remaining time was absorbed by increasing investments in education, health care, and civic activities (about 12%); whereas a smaller, but still significant, fraction of the foregone working hours were devoted to job search activities (between 2% and 6%). By contrast, Lahart and Zhao (2010) found support for the "Great Vacation" narrative, as they reported evidence for the United States that the unemployed were frittering away their time by devoting 80% of their forgone market work hours to leisure, while barely increasing the amount of time they spent on unpaid work. Folbre (2011) stressed the role of household production as a market substitute for consumer expenditures, noting that in times of economic hardship, individuals can save money by, for example, spending their time preparing meals instead of going to restaurants, cleaning the house instead of hiring a maid, or doing home repairs rather than paying a professional. Individuals can also save money by obtaining help from family members: e.g. grandparents, uncles, and aunts can care for children instead of a paid baby-sitter. In addition, parents can exchange favours, such as driving children to school.

A large body of literature has demonstrated that the effects of the recent and past economic crises differed by gender (for the effects of past crises, see, for example, Rubery 1988). The term "mancession" has been coined to describe the greater employment losses among men than among women during the recent recession (Sierminska and Takhtamanova 2011). According to Karamessini and Rubery (2014), the gendered dimension of the European recession changed over time, moving from being a "he-cession" to a "she-austerity". In other words, as the initial stages of the crisis mainly hit the manufacturing and construction economic sectors, more men than women lost their jobs, and the gender gap narrowed through the deterioration of the position of men. Yet because the later stages of the crises were dominated by austerity policies, the recession ultimately had a more negative impact on the demand for female labour and on social policies – which, in turn, had negative implications for gender equality. However, according to Périvier (2014), the mancession was particularly acute in Mediterranean countries (including Italy), where, unlike in other European countries, women experienced more favourable employment conditions than men throughout the crisis.

Most existing studies on this topic have analysed the implications of the economic crisis for gender equality from a labour market perspective, whereas only a limited number of studies have examined the impact of the economic crisis on time use among men and women. For example, Aguiar et al. (2014) documented that American men and women responded similarly to market work reductions during the economic downturn, with the exceptions that women were more likely to reallocate time to home production and sleep, whereas men tended to spend more time on education and TV watching. Hofferth and Goldscheider (2010) argued that the reaction of today's fathers to recessions may differ from those of men

in the Great Depression, when male unemployment challenged the paternal role. They observed that given the relatively recent changes in attitudes towards gender roles, fathers who spend less time on paid work activities may become increasingly involved in family tasks. At the European level, there has been a lack of research on the effects of the economic crisis on time allocation, primarily due to data limitations. As Time Use Surveys (TUS) are not conducted regularly in many European countries, comparing time allocation patterns over recent years is difficult. Based on time use observations for Italy, Slovenia, Turkey, and Spain, Bettio et al. (2012) have suggested that unpaid work may have increased during the crisis in European countries characterised by very large gender disparities in domestic and care activities, thus slowing down the pre-recession trend towards the narrowing of the gender gap in home production. However, at the time the study was conducted, the most recent time use data available for the four countries were for the years around 2009, which did not allow the authors to evaluate the effects of the recession on the gender division of family work over the longer term.

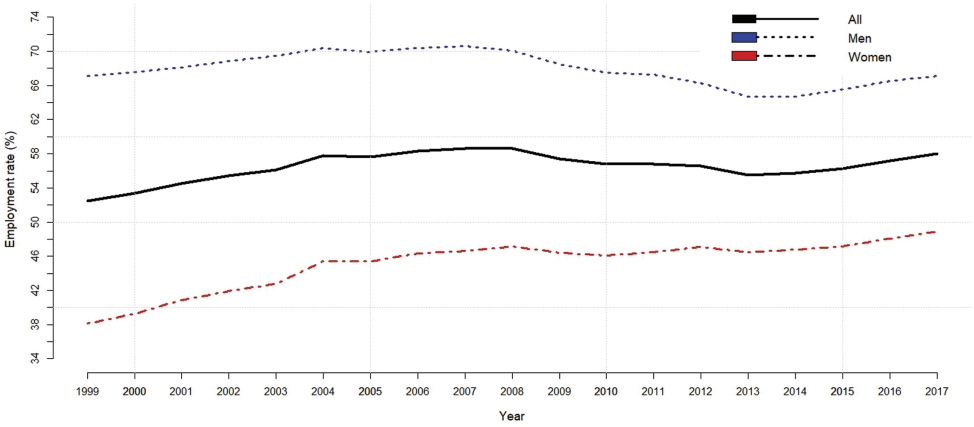
This article draws on Italian time use micro-data to investigate the evolution of gender-specific patterns in the use of time over three years (2002/3, 2008/9, and 2013/4). In particular, we aim to analyse whether and, if so, to what extent the economic crisis has led to reductions in paid work hours, and has thus affected the allocation of time to paid/unpaid work, education, and leisure activities among Italian men and women. The focus on Italy is of considerable interest for several reasons. First, among Western industrialised countries, Italy stands out as having the widest gender gap in household labour (Bloemen et al. 2010; Menniti et al. 2015). Second, Italy is among the European countries that have experienced the most severe consequences of the economic crisis, and, unlike in other European countries, these consequences have been particularly adverse for men during all stages of the recession. Last but not least, as Italy is one of the few European countries where time use surveys are conducted on a regular basis, recent data on time use for the Italian population are available.

The rest of the article is organised as follows. We start with an overview of the Italian context by briefly describing the recent evolution of the country's main male and female employment/unemployment indicators. Then, we outline the data and methods used to measure changes in gender-specific time use behaviours over the considered period. Our main results are presented and discussed in section four. The last section concludes.

2 Country context: recent labour market dynamics

Figure 1 shows the evolution of the employment rate in Italy during the period from 1999 to 2017. Before the recession, Italy's labour market situation was favourable, as the country registered an overall increase of six percentage points (p.p.) in the employment rate between 1999 and 2008. Over this period, levels of employment

Figure 1:
Italy - Employment rate by year and gender



Source: Eurostat, Labour Market Statistics.

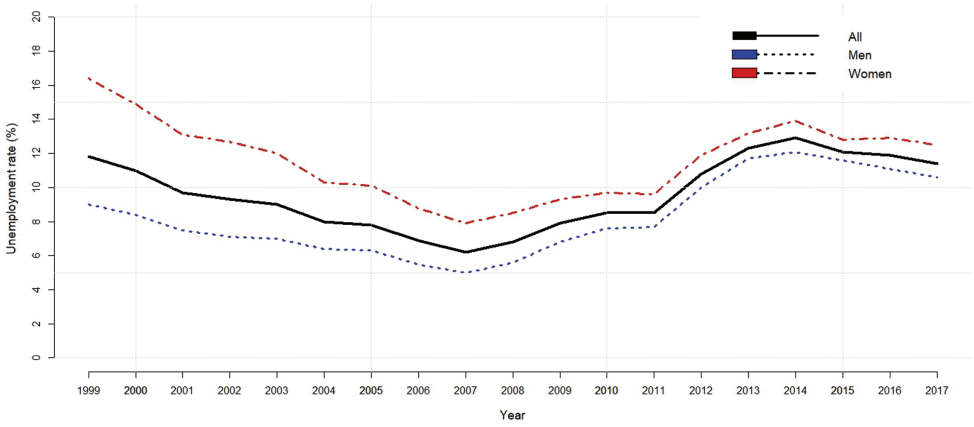
rose by three p.p. for men (from 67.1% to 70.6%), while progress for women was even greater, with levels of female employment growing nine p.p. (from 38.1% to 47.2%). However, despite these improvements in the labour market participation of women, Italy was (and continues to be) far from reaching the Lisbon target of 60% female employment.

Starting in 2008, the employment rate decreased for both men and women, although the decline was greater and more prolonged for men than it was for women. Male employment, which had been fairly stable at the European average of 70%, declined to 64.7% in 2015. By contrast, only a slight decrease in the female employment rate was recorded between 2008 and 2010 (46.1%).

Meanwhile, the female unemployment rate (despite being generally higher) grew less than the male unemployment rate, indicating that women had a relative advantage during the Great Recession (Figure 2). Between 1999 and 2007, the unemployment rate fell from 9% to 5% for men and from 16.4% to 9% for women. The first signs of the recession were already visible in 2008, when the declining trend started to reverse. Unemployment rose to 6.6% for men and 9.3% for women in 2009, and peaked in 2014 at 11.6% for men and 13.8% for women.[1]

[1] The increase in female labour market participation is partly attributable to the implementation of the 2008 law on the regularisation of illegal workers in the care sector (the great majority of whom were foreign women).

Figure 2:
Italy - Unemployment rate by year and gender



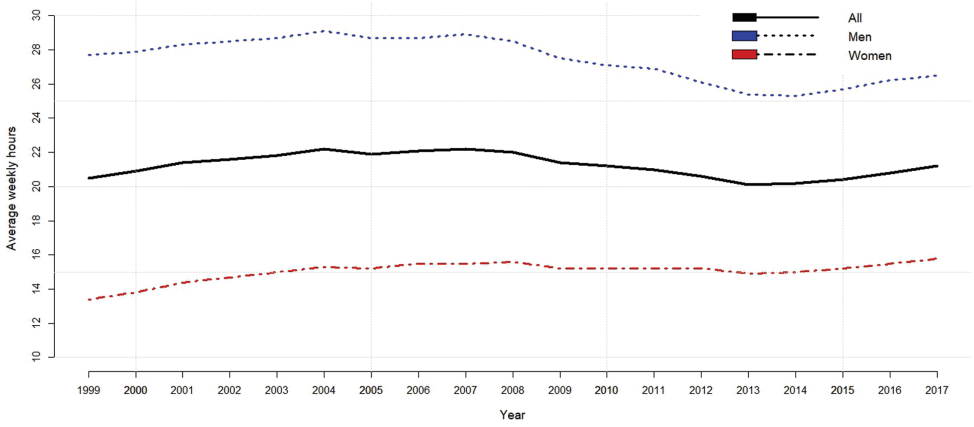
Source: Eurostat, Labour Market Statistics.

The combined effect of decreasing employment and increasing unemployment is also visible in the number of average weekly hours devoted to paid work by the working-age population (Figure 3).

In 1999, men aged 15–64 spent, on average, 28h per week working in the market; compared to 14h per week for women of the same ages.[2] The number of hours worked was fairly stable for men (about 29 hours per week) and women (15 hours per week) in the following years, until 2008, when it started to decline slightly (although it should be noted that, as in the case of the employment and unemployment rates, the effects of the recession were more visible starting in 2009). Between 2007 and 2014, the average number of hours worked dropped by more than 3h per week for men, but by less than 1h per week for women. The reduction in hours worked at the population level may be attributable not only to the effect of declining employment levels, but to an increase in part-time work. Indeed, in times of economic hardship, a reduction in the working time of employees can be used as an alternative to lay-offs. This observation seems to be confirmed by Eurostat data, which indicate that in Italy, part-time work as a percentage of total employment increased from 4.6% in 2007 to 8.3% in 2017 for men, and from 26.8% to 32.5% for women. During the same period, the share of total part-time employment in the 15–64 age group that was involuntary increased by 24.8 p.p. (from 54% to 78.8%) for men and by 21.3 p.p. (from 35.6% to 56.9%) for women.

[2] According to Eurostat's calculations, the number of hours worked during the reference week includes all hours (including extra hours, either paid or unpaid), but excludes the travel time between home and the place of work, as well as the main meal breaks.

Figure 3:
Italy - Average weekly hours worked by the population aged 15–64 by year and gender



Source: Eurostat, Labour Market Statistics.

To sum up, the gender gap in employment and unemployment narrowed considerably after 2008, as male workers were hit harder than female workers during the economic crisis. A similar pattern could be observed in virtually all European countries, although the gendered impact of the crisis was stronger in Mediterranean countries, such as Greece, Italy, and Spain (Perévier 2014). In these countries, women had an employment advantage relative to men throughout the economic crisis; whereas in most European countries, employment conditions were more favourable for women than for men only during the first stage of the recession (or the "collapse stage"), when there were more job losses in traditionally male economic sectors. Women's employment was sheltered not only by sectoral segregation, but by an "added work effect" (e.g. Eydoux et al. 2014). According to the added worker theory, women's economic behaviour is counter-cyclical: i.e. female labour market participation is likely to increase during recessions, when the main (male) breadwinners experience (or are at risk of experiencing) employment losses; but these women (or the added workers) are likely to exit the labour force again after the economy recovers (e.g. Finegan and Margo 1993).

Based on the statistical information analysed and on the existing literature on the gendered nature of the current economic crisis, we focus in this article on two main research hypotheses. The first hypothesis is that the economic crisis reduced the amount of time men and women spent on paid work, and that this reduction, in turn, affected the time they allocated to other activities. The second hypothesis is that in terms of time use behaviour, Italian men and women responded differently to

the economic crisis. The next section describes the data and methods used to verify these hypotheses.

3 Data and methods

The study builds on micro-data from the Italian Time Use Survey for the years 2002/3, 2008/9, and 2013/14. More specifically, the surveys were carried out during the following periods: from 1 April 2002 to 31 March 2003, from 1 February 2008 to 31 January 2009, and from 1 November 2013 to 3 October 2014. In both the 2002/3 and the 2008/9 editions of the survey, more than 75% of the interviews were conducted in the first year (i.e. in 2002 and 2008, respectively); whereas in the 2013/4 edition, most of the interviews were conducted in 2014 (see Table A.1 in the Appendix). We will therefore refer to 2002, 2008, and 2014 as the years of analysis.

We limit our analysis to the population of working ages (between 15 and 64), which provides us with a total sample size of 114,585 individuals (41,931/33,855/38,779 for 2002/2008/2014). The first step in this study was grouping time use activities into meaningful larger categories that are in line with the Harmonised European Time Use Surveys (HETUS, Eurostat 2009) classification, and with the purposes of our analysis. We have identified five main time use categories that are of interest for this study: personal care, education, paid work,[3] unpaid work, and leisure. In addition, we have identified a sixth residual category for other or unspecified use of time. Given that the great majority of time devoted to personal care (as well as a considerable share of individuals' time) is used for sleeping, we further break down personal care into the sub-categories of sleep and other personal care (including activities such eating, relaxing, washing, and dressing). Similarly, unpaid work is broken down into core family work and care activities: namely, housework, child care, and adult care. We know from previous studies that the gender gap in unpaid work is often reflected in leisure inequality between men and women (i.e. women have less free time than men), and that this phenomenon is particularly relevant for Italy (Zannella et al. 2018). In order to gain more insight into gender differences in the allocation of free time, the leisure category is broken down into civic and religious participation, social life, cultural life, TV, other media, hobbies, and sports. Thus, in total, the time use classification adopted in this study includes six main time use categories and 11 sub-categories.[4]

Our goal is to examine how the time devoted to these time use categories/subcategories changed in the study period, with a gender-specific focus. We

[3] Paid work refers to time spent working in the individual's main and second jobs, including coffee breaks and travel during/for work.

[4] Weighted sample estimates of the average use of time of individuals aged 15–64 years for the considered activities are reported in Table A.2 in the Appendix.

are particularly interested in changes that occurred between the pre-recessionary (2002–2008) and the recessionary (2008–2014) years. However, the shifts in time use patterns may be attributable not only to behavioural changes, but to the structural effects of the composition of the population in each of the three years of analysis. We used a χ^2 test to evaluate whether the distribution of the main socio-demographic variables changed significantly between the years. The results of the test show a statistically significant relationship between the distribution of the variables and the survey years (see Table A.3 in the Appendix). Therefore, to measure how the use of time differed over the study period, we regressed the time used by an individual for different time use activities on different years and socio-demographic controls.[5] Specifically, we used the number of weekly hours devoted to the time use activities under study as dependent variables in our regression analysis. Our explicative variables are year and gender. We are particularly interested in examining the interaction between the period and the time use behaviours of men and women. For this reason, we allow all parameters to differ across years by including an interaction term. The use of time of an individual i is, thus, expressed as follows:

$$\begin{cases} T_{ki} = \alpha_k + \sum_{j=1}^{3} \beta_{kj} Y_{ji} + \sum_{h=1}^{2} \gamma_{kh} X_{hi} + \sum_{r=1}^{m} \delta_{kr} Z_{ri} + \sum_{j=1}^{3} \sum_{h=1}^{2} \lambda_{kjh} Y_{ji} X_{hi} \\ \qquad + \sum_{j=1}^{3} \sum_{r=1}^{m} \varphi_{kjr} Y_{ji} Z_{ri} + \varepsilon_{ki} \\ \sum_{k=1}^{6} T_{ki} = 168 \\ i = 1, 2, \ldots, n \end{cases} \tag{1}$$

where n is the total sample size, T_{ki} are the weekly hours an individual i devoted to a main time use category k ($k = 1, 2, \ldots, 6$) (i.e. to personal care, education, paid work, unpaid work, leisure, and other use of time); Y_j is a dummy variable for the year ($j = 1, 2, 3$); X_h is a dummy variable for gender ($h = 1, 2$); Z_r are the dummy control variables ($r = 1, 2, \ldots, m$); α_k is the intercept for the time use category k; β_{kj} is the simple effect of the year j; γ_{kh} is the simple effect of the gender h; δ_{kr} is the simple effect of the control variable r; λ_{kjh} is the interactive effect of the year j with the gender h; φ_{kjr} is the interactive effect of the year j with the control variable r.

[5] We include the following demographic controls in the model: the geographical area of residence; the age group; the educational level; marital status; the presence of a child.

Similarly, the weekly hours devoted by an individual i to a sub-category s of the time use activity k is estimated as follows:

$$\begin{cases} T_{ksi} = \alpha_{ks} + \sum_{j=1}^{3} \beta_{ksj} Y_{ji} + \sum_{h=1}^{2} \gamma_{ksh} X_{hi} + \sum_{r=1}^{m} \delta_{ksr} Z_{ri} + \sum_{j=1}^{3} \sum_{h=1}^{2} \lambda_{ksjh} Y_{ji} X_{hi} \\ \qquad + \sum_{j=1}^{3} \sum_{r=1}^{m} \varphi_{ksjr} Y_{ji} Z_{ri} + \varepsilon_{ksi} \\ \sum_{s=1}^{S_k} T_{ksi} = T_{ki} \end{cases} \tag{2}$$

where $S_k = 2$ (sleep, personal care other than sleep) for k = personal care; $S_k = 3$ (housework, child care, adult care) for k = unpaid work; $S_k = 6$ (civic and religious participation, social life, cultural life, TV, other media, hobbies, and sports) for k = leisure.

4 The multivariate results

Regression estimates of the differences between years in the average use of time for detailed activities are shown Table 1 (both genders), Table 2 (men), and Table 3 (women).[6] For the population aged 15–64, the amount of time spent on paid work grew substantially in Italy during the pre-recessionary period, increasing by 1.21 hours per week between 2002 and 2008 (equal to 1h 13 min per week). The largest gains were made by women (+1h 30 min); while the amount of time men spent on market work increased slightly, but the change was not statistically significantly. Men and women spent their free time in similar ways. The amount of time spent on personal care other than sleeping decreased by about 1h per week for both genders. In total, the amount of time spent on leisure did not undergo a statistically significant change due to the combination of two different trends. On the one hand, our estimates show a large increase of more than two hours per week spent by both men and women on sports and hobbies, as well as on TV watching. These results are in line with the literature documenting that the time devoted to watching television has increased significantly in recent decades. For example, Gimenez-Nadal and Sevilla (2012) found an almost universal increase in the time spent watching television from the 1970s to the beginning of the 2000s in seven industrialised countries (Australia, Canada, Finland, France, the Netherlands, Norway, and the UK). On the other hand, we observe an overall reduction of more than two hours in the time

[6] Additional results of the regression analysis on the average use of time by period are reported in Tables A.4–A.6 in the Appendix.

Table 1:
Changes in the average use of time for detailed activities - Both genders

	2008–2002				2014–2008				2014–2002			
Time use activity	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**
Personal care	−0.55	0.167	−3.269	0.003	1.04	0.155	6.704	<0.001	0.49	0.164	2.992	0.008
Sleep	0.40	0.136	2.948	0.009	0.24	0.126	1.879	0.145	0.64	0.134	4.767	<0.001
Other	−0.95	0.097	−9.738	<0.001	0.80	0.090	8.887	<0.001	−0.15	0.096	−1.528	0.278
Paid work	1.21	0.344	3.528	0.001	−3.77	0.319	−11.819	<0.001	−2.55	0.338	−7.547	<0.001
Education	0.20	0.150	1.336	0.375	0.94	0.139	6.738	<0.001	1.14	0.148	7.706	<0.001
Unpaid work	−0.58	0.216	−2.678	0.020	0.79	0.200	3.959	<0.001	0.21	0.212	1.007	0.573
Housework	−0.39	0.190	−2.039	0.103	0.31	0.176	1.739	0.191	−0.08	0.187	−0.434	0.901
Child care	0.28	0.076	3.747	0.001	0.49	0.070	7.024	<0.001	0.78	0.075	10.426	<0.001
Adult care	−0.48	0.031	−15.238	<0.001	−0.01	0.029	−0.286	0.956	−0.48	0.031	−15.761	<0.001
Leisure	−0.08	0.246	−0.339	0.939	1.02	0.228	4.461	<0.001	0.93	0.242	3.858	<0.001
Civic & rel. part.	−0.52	0.081	−6.391	<0.001	0.23	0.075	3.053	0.006	−0.29	0.079	−3.621	0.001
Social life	0.24	0.128	1.873	0.147	−0.16	0.119	−1.322	0.383	0.08	0.126	0.659	0.787
Cultural life	−0.37	0.061	−6.121	<0.001	−0.16	0.057	−2.836	0.013	−0.54	0.060	−8.894	<0.001
TV	1.07	0.121	8.795	<0.001	−0.12	0.112	−1.109	0.508	0.94	0.119	7.896	<0.001
Other media	−1.70	0.035	−48.030	<0.001	−0.16	0.033	−4.812	<0.001	−1.86	0.035	−53.362	<0.001
Hobbies & sports	1.20	0.158	7.582	<0.001	1.39	0.147	9.463	<0.001	2.59	0.156	16.622	<0.001
Other time use	−0.21	0.035	−5.863	<0.001	−0.18	0.033	−5.543	<0.001	−0.39	0.035	−11.182	<0.001

Note: Estimates are reported in hours per week, whereby decimals represent hundredths of an hour (e.g. 1.75 should be read as 1 hour and 45 minutes; 0.20 should be read as 12 minutes).

Source: Authors' calculations based on Time Use Surveys. Istat 2002/3, 2008/9, and 2013/4.

Table 2:
Changes in the average use of time for detailed activities by period – Men

	2008–2002				2014–2008				2014–2002			
Time use activity	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**
Personal care	−0.75	0.205	−3.660	0.003	0.92	0.198	4.659	<0.001	0.17	0.204	0.839	0.960
Sleep	0.20	0.167	1.171	0.851	0.21	0.161	1.332	0.767	0.41	0.166	2.465	0.135
Other	−0.95	0.119	−7.925	<0.001	0.71	0.115	6.140	<0.001	−0.24	0.119	−2.006	0.338
Paid work	0.88	0.423	2.081	0.297	−5.09	0.408	−12.485	<0.001	−4.21	0.421	−10.002	<0.001
Education	0.20	0.185	1.055	0.899	1.03	0.179	5.756	<0.001	1.22	0.184	6.633	<0.001
Unpaid work	0.50	0.266	1.884	0.412	1.87	0.256	7.302	<0.001	2.37	0.265	8.962	<0.001
Housework	0.56	0.234	2.380	0.163	1.35	0.226	5.981	<0.001	1.91	0.233	8.179	<0.001
Child care	0.26	0.093	2.732	0.069	0.53	0.090	5.852	<0.001	0.78	0.093	8.408	<0.001
Adult care	−0.31	0.038	−8.104	<0.001	0.00	0.037	−0.129	1.000	−0.32	0.038	−8.257	<0.001
Leisure	−0.63	0.303	−2.083	0.296	1.32	0.292	4.517	<0.001	0.69	0.301	2.283	0.201
Civic & rel. part.	−0.45	0.099	−4.509	<0.001	0.42	0.096	4.371	<0.001	−0.03	0.099	−0.293	1.000
Social life	0.20	0.157	1.247	0.814	−0.24	0.152	−1.581	0.611	−0.04	0.157	−0.280	1.000
Cultural life	−0.57	0.075	−7.598	<0.001	−0.11	0.073	−1.543	0.636	−0.68	0.075	−9.118	<0.001
TV	1.00	0.149	6.732	<0.001	−0.14	0.144	−0.961	0.930	0.86	0.148	5.825	<0.001
Other media	−1.94	0.043	−44.721	<0.001	−0.20	0.042	−4.672	<0.001	−2.14	0.043	−49.399	<0.001
Hobbies & sports	1.13	0.195	5.829	<0.001	1.59	0.188	8.441	<0.001	2.72	0.194	14.022	<0.001
Other time use	−0.19	0.044	−4.468	<0.001	−0.20	0.042	−4.835	<0.001	−0.40	0.043	−9.165	<0.001

Note: Estimates are reported in hours per week, whereby decimals represent hundredths of an hour (e.g. 1.75 should be read as 1 hour and 45 minutes; 0.20 should be read as 12 minutes).

Source: Authors' calculations based on Time Use Surveys. Istat 2002, 2008, and 2014.

Table 3:
Changes in the average use of time for detailed activities by period – Women

	2008–2002				2014–2008				2014–2002			
Time use activity	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**	**Diff.**	**StdErr**	***t* value**	**Pr (>|*t*|)**
Personal care	−0.34	0.203	−1.671	0.551	1.15	0.192	5.992	<0.001	0.81	0.202	4.017	0.001
Sleep	0.61	0.166	3.653	0.004	0.26	0.156	1.653	0.563	0.86	0.164	5.257	<0.001
Other	−0.95	0.118	−7.980	<0.001	0.89	0.112	7.981	<0.001	−0.05	0.117	−0.454	0.998
Paid work	1.55	0.419	3.688	0.003	−2.44	0.396	−6.161	<0.001	−0.89	0.416	−2.144	0.265
Education	0.21	0.184	1.128	0.870	0.85	0.173	4.917	<0.001	1.06	0.182	5.817	<0.001
Unpaid work	−1.66	0.263	−6.290	<0.001	−0.29	0.249	−1.153	0.859	−1.94	0.261	−7.442	<0.001
Housework	−1.33	0.232	−5.742	<0.001	−0.74	0.219	−3.364	0.010	−2.07	0.230	−8.993	<0.001
Child care	0.31	0.093	3.391	0.009	0.46	0.087	5.277	<0.001	0.78	0.092	8.442	<0.001
Adult care	−0.64	0.038	−16.817	<0.001	−0.01	0.036	−0.328	1.000	−0.65	0.038	−17.274	<0.001
Leisure	0.46	0.300	1.544	0.636	0.72	0.283	2.528	0.116	1.18	0.298	3.963	0.001
Civic & rel. part.	−0.58	0.099	−5.934	<0.001	0.04	0.093	0.411	0.999	−0.55	0.098	−5.594	<0.001
Social life	0.28	0.156	1.814	0.456	−0.07	0.147	−0.499	0.996	0.21	0.155	1.355	0.754
Cultural life	−0.18	0.075	−2.378	0.164	−0.21	0.070	−2.977	0.035	−0.39	0.074	−5.231	<0.001
TV	1.13	0.148	7.635	<0.001	−0.11	0.139	−0.795	0.968	1.02	0.147	6.944	<0.001
Other media	−1.45	0.043	−33.679	<0.001	−0.12	0.041	−2.933	0.039	−1.57	0.043	−36.760	<0.001
Hobbies & sports	1.27	0.193	6.558	<0.001	1.19	0.182	6.536	<0.001	2.46	0.192	12.835	<0.001
Other time use	−0.22	0.043	−5.110	<0.001	−0.16	0.041	−3.942	0.001	−0.38	0.043	−8.905	<0.001

Note: Estimates are reported in hours per week, whereby decimals represent hundredths of an hour (e.g. 1.75 should be read as 1 hour and 45 minutes; 0.20 should be read as 12 minutes).

Source: Authors' calculations on Time Use Surveys. Istat 2002, 2008, and 2014.

spent on civic participation and using media other than TV. In particular, according to our regression estimates, the time devoted to other mass media (the majority of which is time spent reading the newspaper and listening to the radio) dropped from about 3h to less than 1h per week for men and from almost 2h to 30 min per week for women. The time spent on cultural life declined by 34 min for men, and decreased slightly for women (−11 min), although the change was not statistically significant. Thus, even though the amount of time devoted to leisure was fairly stable between 2002 and 2008, its composition changed considerably. These findings clearly show that to avoid incomplete (or even misleading) interpretations of time use behaviours, it is important to look at the detailed composition of time use categories, rather than relying on broad classifications.

Women and men displayed different unpaid work patterns. While women reduced the time they spent on family work by 1h 40 min per week, there was no statistically significant change in the time men devoted to family work.

As expected, a comparison of time use regression estimates for 2008 and 2014 points to the existence of a statistically significant negative effect of the recessionary period on paid work (about 3h 45 min less for the total population). In line with the mancession hypothesis, the magnitude of this effect was greater for men than for women (respectively, about 5h and 2h less per week). Indeed, in 2014, paid working hours for women had nearly returned to the pre-crisis level of an average of 17h per week. For men, by contrast, paid working hours continued to be far lower in 2014, at an average of 32h per week, than the initial level of 36h per week. This reduction in time spent on paid work was accompanied by an upward trend in time spent on personal care other than sleep and education for both genders. A statistically significant increase in the time spent on leisure is observed only for men, who devoted considerably more time to hobbies and sports, and slightly more time to religious and civic participation (about 1h 30 min and 25 min more per week, respectively). While female time spent on hobbies and sports grew by more than one hour per week during the 2008–2014 period, this was the only category of leisure activities for women in which there was a significant change in the recessionary years. It is worth noting that during the entire period of observation (from 2002–2014), an upward trend was recorded in the time spent on hobbies and sports, from approximately 11h to 14h per week for men, and from 8h to 11h per week for women. Men and women displayed different unpaid work behaviours during the recessionary years, with the time spent on unpaid work increasing by about two hours per week for the former, while showing no statistically significant change for the latter. The positive association between the recessionary period and male levels of unpaid work can be explained by the increase in the time men spent on child care and housework (approximately 30 min and 1h 20 min more per week, respectively). The increase in the time women devoted to child care was comparable to that among men, whereas the time women spent on housework decreased in the 2008–2014 period. The results for child care are in line with the findings of previous time use studies, which indicate that the employed mothers of today devote roughly the same number hours to child care as the "golden era housewives"

(Bianchi and Milkie 2010); and with the literature on intensive parenting (e.g. Craig et al. 2014). Summarising, our results highlight the existence of a downward trend in female housework during the entire study period, with women spending about 2h less per week on household chores in 2014 than they did in 2002. However, the magnitude of this decline was greater between 2002 and 2008, when the number of hours women spent on paid work was rising. For men, by contrast, the changes in the amount of time spent on unpaid work were concentrated in the recessionary years, whereas differences in household and family care activities were not statistically significant in years prior to the crisis.

5 Concluding remarks

This article draws on micro-data from three different editions of the Italian TUS to study the evolution of the use of time among Italian men and women over the 2002–2014 period, while paying specific attention to changes that occurred in the years before and after the beginning of the Great Recession. Our findings indicate that there was a narrowing of the gender gap in unpaid work during the entire period of observation, with men spending about 2h more per week on unpaid family time, and women spending around 2h less per week on housework between 2002 and 2014. However, while signs of this gender convergence were already visible for women before the recession, it was not until after the beginning of the crisis and the consequent losses in paid work hours that men started to become more involved in household and family care activities.

For women, we observed an increase of about 1h and 30min per week devoted to paid work time that was mirrored by a similar decline in the number of hours spent on housework during the pre-recessionary period; whereas for men, we found no significant increase in the number of hours spent on family work between 2002 and 2008. Earlier empirical evidence demonstrated that Italian men spent an average of 18 minutes more per day (about 2h per week) on unpaid work in 2002/3 than in 1988/9 (Romano 2008). A positive trend in male unpaid work was found in virtually all of the industrialised countries from the 1970s to the early 2000s (e.g. Gimenez-Nadal and Sevilla 2012). According to Fisher et al. (2007), the amount of unpaid work performed by American men significantly rose between 1965 and 2003; however, this change was concentrated within the first decades of the observation period. Our results corroborate the argument made by the scholars that there was a "no change moment" in the time men spent on family work from the late 20th century until the early 2000s.

As expected, we found that the economic crisis negatively affected the time spent on paid work, with an overall decline of about 4h per week, leaving both genders with more time available to devote to personal care. Consistent with the mancession literature, our results showed that the paid work losses were greater for men (−5h per week) than for women (−2h 30 min per week). Whereas the results of Bettio et al. (2012) suggest that the gender gap in unpaid work widened during

the economic crisis, we found that men performed more and women performed less family work during this period. Specifically, we found that between 2008 and 2014, men reallocated some of their foregone market work hours to housework (+1h 20 min) and to child care (+32 min), which led to an overall increase of about 2h per week spent on unpaid work; while the time women spent on housework declined by an average of 44 minutes per week. However, our finding that the reduction in the number of hours women devoted to family time during the recessionary years was smaller in magnitude than it was in the previous period suggests that the more relevant decrease in the number of hours women were spending on unpaid work took place before the onset of the Great Recession.

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Appendix

Table A.1:
Number of time use diaries by year and month

Month/Year	*N*	Frequency (%)	Cumulative frequency (%)
2002/3			
04/2002–06/2002	11,997	24.3	24.3
07/2002–09/2002	13,071	26.5	50.7
10/2002–12/2002	12,149	24.6	75.3
01/2003–03/2003	12,184	24.7	100.0
Total	**49,401**	**100.0**	
2008/9			
02/2008–04/2008	10,652	26.7	26.7
05/2008–07/2008	10,073	25.2	51.9
08/2008–10/2008	10,022	25.1	77.0
11/2008–01/2009	9,196	23.0	100.0
Total	**39,943**	**100.0**	
2013/4			
11/2013–01/2014	10,745	26.6	26.6
02/2014–04/2014	10,268	25.4	52.0
05/2014–07/2014	9,743	24.1	76.2
08/2014–10/2014	9,626	23.8	100.0
Total	**40,382**	**100.0**	

Source: Authors' calculations based on Time Use Surveys. Istat 2002/3, 2008/9, and 2013/4.

Table A.2:
Weighted sample estimates of the average of use of time by gender, activity, and survey year

Time use activities	Both genders			Men			Women		
	2002	**2008**	**2014**	**2002**	**2008**	**2014**	**2002**	**2008**	**2014**
Personal care	78.57	77.87	78.73	78.81	77.95	78.71	78.32	77.78	78.74
Sleep	57.31	57.69	57.85	57.24	57.44	57.59	57.39	57.93	58.10
Other	21.25	20.18	20.88	21.57	20.51	21.12	20.93	19.85	20.64
Paid work	26.16	28.23	24.81	35.63	37.21	32.46	16.76	19.27	17.27
Education	4.33	4.34	5.05	4.18	4.16	4.98	4.48	4.52	5.11
Unpaid work	24.15	23.07	23.47	11.02	11.10	12.50	37.19	35.00	34.29
Housework	20.27	19.74	19.82	8.60	9.16	10.25	31.86	30.29	29.27
Child care	3.06	2.97	3.31	1.81	1.62	1.95	4.30	4.32	4.65
Adult care	0.82	0.35	0.34	0.60	0.31	0.30	1.03	0.39	0.37
Leisure	34.33	34.19	35.65	37.91	37.26	39.08	30.78	31.13	32.28
Civic & rel. part.	2.19	1.82	2.05	1.66	1.37	1.78	2.73	2.27	2.31
Social life	7.68	7.86	7.86	8.50	8.67	8.61	6.87	7.06	7.11
Cultural life	2.41	2.00	1.90	2.52	1.87	1.82	2.31	2.12	1.99
TV	10.58	11.37	11.34	11.72	12.51	12.46	9.44	10.24	10.22
Other media	2.01	0.66	0.52	2.46	0.85	0.67	1.56	0.48	0.37
Hobbies & sports	9.46	10.47	11.99	11.04	11.99	13.75	7.88	8.96	10.26
Other time use	0.46	0.30	0.13	0.45	0.31	0.12	0.47	0.30	0.15

Note: Estimates are reported in hours per week, whereby decimals represent hundredths of an hour (e.g. 1.75 should be read as 1 hour and 45 minutes; 0.20 should be read as 12 minutes). Estimates refer to an average day of the week.

Source: Authors' calculations based on Time Use Surveys. Istat 2002/3, 2008/9, and 2013/4.

Table A.3:
Sample size and Chi Square Independence Test by year and socio-demographic variables

	2002		2008		2014	
	N	*%*	*N*	*%*	*N*	*%*
Geographic area						
North	15,218	45.7	11,121	43.3	10,890	42.5
Centre	5,985	18.0	4,451	17.3	4,607	18.0
South	12,124	36.4	10,103	39.3	10,154	39.6
Independence test	**χ^2 = 92.10**		**d.f. = 4**		**P < 0.001**	
Age group						
15–24	5,458	16.4	3,933	15.3	3,859	15.0
25–34	6,918	20.8	4,618	18.0	4,146	16.2
35–44	8,046	24.1	6,401	24.9	5,775	22.5
45–54	6,862	20.6	5,706	22.2	6,577	25.6
55–64	6,043	18.1	5,017	19.5	5,294	20.6
Independence test	**χ^2 = 436.95**		**d.f. = 8**		**P < 0.001**	
Educational level						
High	2,956	8.9	3,131	12.2	4,040	15.7
Medium	13,100	39.3	10,371	40.4	10,894	42.5
Low	17,271	51.8	12,173	47.4	10,717	41.8
Independence test	**χ^2 = 919.44**		**d.f. = 4**		**P < 0.001**	
Couple						
Yes	19,734	59.2	13,943	54.3	12,714	49.6
Not	13,593	40.8	11,732	45.7	12,937	50.4
Independence test	**χ^2 = 548.36**		**d.f. = 2**		**P < 0.001**	
Child						
Yes	11,269	33.8	8,286	32.3	8,118	31.6
Not	22,058	66.2	17,389	67.7	17,533	68.4
Independence test	**χ^2 = 33.81**		**d.f. = 2**		**P < 0.001**	

Source: Authors' calculations based on time use surveys. Istat 2002/3, 2008/9, and 2013/4.

Table A.4:
Regression estimates of the average use of time by activity and survey year - Both genders

	2002		2008		2014	
Time use activities	**Mean**	**StdErr**	**Mean**	**StdErr**	**Mean**	**StdErr**
Personal care	78.01	0.124	77.46	0.111	78.50	0.107
Sleep	57.16	0.101	57.56	0.091	57.79	0.087
Other	20.85	0.072	19.90	0.065	20.70	0.062
Paid work	26.98	0.256	28.20	0.230	24.43	0.221
Education	5.55	0.112	5.75	0.100	6.69	0.097
Unpaid work	22.92	0.161	22.34	0.144	23.13	0.139
Housework	18.12	0.142	17.73	0.127	18.04	0.122
Child care	4.01	0.057	4.29	0.051	4.79	0.049
Adult care	0.79	0.023	0.31	0.021	0.30	0.020
Leisure	34.01	0.183	33.92	0.164	34.94	0.158
Civic & rel. part.	2.13	0.060	1.62	0.054	1.85	0.052
Social life	7.48	0.095	7.72	0.085	7.56	0.082
Cultural life	2.61	0.046	2.23	0.041	2.07	0.039
TV	9.78	0.090	10.85	0.081	10.72	0.078
Other media	2.38	0.026	0.68	0.024	0.52	0.023
Hobbies and sports	9.63	0.118	10.83	0.106	12.22	0.102
Other time use	0.54	0.026	0.33	0.024	0.15	0.023

Note: Estimates are reported in hours per week, whereby decimals represent hundredths of an hour (e.g. 1.75 should be read as 1 hour and 45 minutes; 0.20 should be read as 12 minutes). Estimates refer to an average day of the week.

Source: Authors' calculations based on time use surveys. Istat 2002/3, 2008/9, and 2013/4.

Table A.5:
Regression estimates of the average use of time by activity and survey year - Men

	2002		2008		2014	
Time use activities	**Mean**	**StdErr**	**Mean**	**StdErr**	**Mean**	**StdErr**
Personal care	78.22	0.149	77.47	0.140	78.39	0.139
Sleep	57.06	0.122	57.26	0.114	57.48	0.114
Other	21.16	0.087	20.21	0.082	20.92	0.081
Paid work	36.37	0.308	37.25	0.290	32.15	0.287
Education	5.27	0.135	5.47	0.127	6.49	0.126
Unpaid work	10.13	0.194	10.63	0.182	12.50	0.181
House work	6.74	0.170	7.29	0.160	8.64	0.159
Child care	2.81	0.068	3.06	0.064	3.59	0.063
Adult care	0.59	0.028	0.27	0.026	0.27	0.026
Leisure	37.48	0.220	36.85	0.207	38.17	0.206
Civic participation	1.61	0.072	1.16	0.068	1.58	0.068
Social life	8.24	0.115	8.43	0.108	8.19	0.107
Cultural life	2.68	0.055	2.11	0.052	1.99	0.051
TV	10.96	0.109	11.96	0.102	11.82	0.101
Other media	2.82	0.032	0.87	0.030	0.68	0.030
Hobbies and sports	11.18	0.142	12.31	0.133	13.90	0.132
Other time use	0.53	0.032	0.33	0.030	0.13	0.030

Note: Estimates are reported in hours per week, whereby decimals represent hundredths of an hour (e.g. 1.75 should be read as 1 hour and 45 minutes; 0.20 should be read as 12 minutes). Estimates refer to an average day of the week.

Source: Authors' calculations based on Time Use Surveys. Istat 2002/3, 2008/9, and 2013/4.

Table A.6:
Regression estimates of the average use of time by activity and survey year - Women

	2002		2008		2014	
Time use activities	**Mean**	**StdErr**	**Mean**	**StdErr**	**Mean**	**StdErr**
Personal care	77.79	0.150	77.45	0.137	78.60	0.134
Sleep	57.25	0.122	57.86	0.112	58.11	0.109
Other personal	20.54	0.088	19.59	0.080	20.48	0.078
Paid work	17.59	0.310	19.14	0.283	16.70	0.277
Education	5.83	0.136	6.04	0.124	6.89	0.121
Unpaid work	35.71	0.195	34.05	0.177	33.76	0.174
Housework	29.50	0.171	28.17	0.156	27.43	0.153
Child care	5.21	0.068	5.53	0.062	5.99	0.061
Adult care	0.99	0.028	0.35	0.026	0.34	0.025
Leisure	30.53	0.222	31.00	0.202	31.71	0.198
Civic & rel. part.	2.66	0.073	2.07	0.066	2.11	0.065
Social life	6.73	0.115	7.01	0.105	6.94	0.103
Cultural life	2.53	0.055	2.35	0.050	2.14	0.049
TV	8.61	0.109	9.74	0.100	9.63	0.098
Other media	1.93	0.032	0.48	0.029	0.36	0.028
Hobbies and sports	8.08	0.143	9.34	0.125	10.53	0.122
Other time use	0.54	0.032	0.32	0.029	0.16	0.029

Note: Estimates are reported in hours per week, whereby decimals represent hundredths of an hour (e.g. 1.75 should be read as 1 hour and 45 minutes; 0.20 should be read as 12 minutes). Estimates refer to an average day of the week.

Source: Authors' calculations based on Time Use Surveys. Istat 2002/3, 2008/9, and 2013/4.

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Transfers of informal care time in the United States: the role of demographic differentials in intergenerational flows by age, sex, and racial and national background

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Abstract

Recent work based on the American Time Use Survey (2011–2013) provided estimates matrices of "who provides care to whom" by age and sex within care activities in the U.S. In this paper, we build on that line of research by evaluating the strength of race, ethnicity, and national origin as proxy indicators of cultural propensities to engage in informal care. Our results point to several key differences and similarities between groups based on their characteristics. For example, we find that compared to other groups, native-born African American men exhibit the lowest child care participation and transfer rates, whereas foreign-born Hispanics of any race have significantly higher rates of daily participation in child care. Moreover, we find that the propensity to provide adult care is largely dependent on socio-economic characteristics and household structure. However, our models indicate that neither race/ethnicity nor nativity are strong predictors of the observed differences when household composition and socio-economic factors are taken into account. Thus, we believe that more complex cultural factors are at play. As an illustrative example of the consequences of demographic change, we introduce the care support ratio (CSR), which is a measure of macro-level dependency for non-market transfers. The application of the CSR indicates that future informal care time deficits may result from the growing care needs of the ageing population.

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1 Introduction

The scope and the distribution of non-market household production throughout the population is culturally determined. While a large number of studies have examined this issue, most have restricted their focus to unidirectional care arrangements (e.g. adult children to parents, or parents to young children only), with relatively few considering the cultural propensities of caregivers to engage in broader simultaneous social network transfers. Cultural values often set specific expectations that can influence the caregiver's perceptions of the strain associated with his/her care-related workload. Taking these expectations into account is especially important given that people of different nationalities, races, and ethnicities are influenced to varying degrees by labour market fluctuations and economic instability on the one hand, and by culturally-defined living arrangements on the other (Cravey and Mitra 2011). There is evidence suggesting that although caregivers who belong to racial and ethnic minority groups tend to be more economically challenged than white caregivers, they are two to three times more likely to provide direct care, primarily to younger generations. By contrast, compared to their non-white counterparts, white caregivers are more likely to provide indirect care, such as the coordination of care-related tasks; and to spend less time on care activities overall (Fredriksen-Goldsen and Farwell 2005).

The present paper contributes to the literature on intergenerational economy and family relations by offering a perspective on differences in informal care time transfers by age, sex, race, and ethnicity in the United States. By giving additional consideration to factors beyond race/ethnicity and nativity, this paper sheds light on the extent to which race/ethnicity and national origin could be effectively used as substitutes for cultural affinity to transfer time in the form of informal care. In Section 2, we begin our treatment of the subject matter with a review of the existing research on racial, ethnic, and cultural aspects of informal care. Based on this review, we then formulate several hypotheses that we aim to test throughout our analysis. In Sections 3 and 4, we discuss the relevant features of our data, as well as our methodological approaches and considerations. In Section 5, we present our results, and propose a practical application of the informal care transfers matrix profiles as an extension to the set of metrics used to describe macroeconomic dependency. Finally, in Section 6 of the paper, we draw conclusions in light of our initial hypotheses, and discuss the implications of our results.

2 Background

Cultural belonging can be measured by a variety of indicators, all of which have strengths and weaknesses, depending on the socio-economic context and the completeness of the data used. Scholars generally recognise that race/ethnicity and national origin are strong predictors of an individual's behavioural patterns, including his/her levels of participation in informal care activities. There is evidence

that the cultural and national backgrounds of whites and African Americans direct their sense of duty with respect to family and communal obligations in very different ways (Powers and Whitlatch 2016). Hispanic and Latino caregivers may also find that their care burden increases as the intensity of care they feel obliged to provide based on their perceived family obligations increases (Mendez-Luck et al. 2016). One meta-analysis of prior research has suggested that cultural belonging affects the outcomes of informal care transfers in part through the structure of the household, the number of generations co-residing in it, and the number of household members (Peek et al. 2000). For example, as the multigenerational living arrangements of African Americans are more conducive to reliance on family support and the distribution of caregiving tasks across family members, the load on specific individuals in these families is diminished.

Although child care remains the dominant component of informal care in terms of per capita time consumption, the prevalence of elder care is increasing due to the influx of "baby boomers" into the care market. Demographic transition processes that have been driving the decline in fertility and lifestyle changes have led to a modest decline in the propensity of spouses and adult children to provide care for older adults (Janus and Doty 2018). While the authors speculated that this shift may reflect the decreased availability of institutionalised care, it could also suggest that there has been a move away from an individual response to care needs, and towards a communal response, especially when care is needed for elderly people with cognitive impairments. As the extent to which individuals are prepared for such a shift is likely to vary across sub-populations for both economic and cultural reasons, the impact of this change on the health and well-being of caregivers may also be expected to differ.

There are a number of overarching cultural themes that transcend the boundaries of race, ethnicity, and national origin in a non-uniform manner. For instance, many Hispanic caregivers of elderly people with dementia are committed to providing their relatives with home-based care as part of their perceived normative responsibilities to family members (Neary and Mahoney 2005). This commitment is reflective of the broader spectrum of values that Hispanic/Latino cultural norms of familism and collectivism emphasise. These values engender social expectations on the part of care recipients, as well as culturally-induced compliance on the part of family caregivers (Padilla and Villalobos 2007). It is also important to note that whereas members of non-Hispanic white families tend to associate receiving care with a loss of independence, and thus often report having negative emotions when faced with the prospect of accepting care; family members of the Latino ethnic group in the U.S. tend to regard their caregiving duties as self-evident and morally unavoidable. In the U.S., the cultural value systems of both East Asian and Hispanic immigrant groups emphasise familism to a greater degree than the value systems of African Americans, and to a much larger extent than the value systems of white Americans (Knight and Sayegh 2010). In particular, the southeast Asian child-rearing culture is often perceived by Americans as being familial, controlling, and overly nurturing (Morrow 1989). Indeed, preferences for familism and maintaining

multigenerational households have been shown to permeate Indian, Chinese, and Japanese and other Asian cultures. In these societies, a general dependency on help and care from relatives is ingrained in the cultural fabric (Yunus 2005).

A comparison of child care arrangements among disadvantaged African American, Hispanic, and non-Hispanic white mothers revealed that Hispanic single mothers were more likely to rely on kin networks to meet their children's care needs, whereas single non-Hispanic white mothers were less likely to seek child care support from family members (Radey and Brewster 2007). Of the groups studied, married Hispanic mothers had by far the greatest reliance on maternal relatives for child care, while married non-Hispanic white mothers turned to paternal kin for child care support slightly more than the other two racial/ethnic groups. African Americans tended to have more cultural justifications for caregiving than whites, even though the likelihood of providing certain types of care, such as spousal care, differed between these two groups; with whites being slightly more likely to provide spousal care (Dilworth-Anderson et al. 2005).

While the values of familism and filial piety clearly play a role in patterns of caregiving across sub-populations, a qualitative study involving a wide spectrum of racial and ethnic minorities found that culturally-specific phenomena, such as group identity and barriers to service use, can also affect the extent to which different groups take advantage of care support options (Scharlach et al. 2006). The authors argued that language barriers and a lack of knowledge of available resources, which are especially common among first-generation immigrants, as well as mistrust of outside service providers and prejudice against their use, all reinforce the functional and cultural barriers to the utilisation of external help and resources by racial/ethnic minorities, while increasing their reliance on family or within-group care provision. However, when caregivers attempt to uphold cultural norms by avoiding reliance on formal and outside care support, they may find themselves in a precarious situation when they have full responsibility for providing care to elderly relatives with major impairments, such as dementia (Cox and Monk 1993).

Different life situations trigger different emotional responses, and caregiving is no exception. Generally, the existing research has shown that people tend to be happier and their overall life satisfaction improves when they are paying for goods and services that help them save time they otherwise would have to spend on routine tasks (Whillans et al. 2017). Thus, families with disposable income or savings may choose to outsource at least some of the care needs of family members. Having the option to outsource care can improve a caregiver's psychological and, by extension, physical health. However, the caregiver's appraisal of his/her burden largely depends on the orientation of his/her cultural values. It is, therefore, likely that a family care provider in an obligation-centred culture that emphasises filial piety will experience negative changes in health and well-being, whereas a family caregiver in a culture that focuses on familial support will experience improvements in health (Knight and Sayegh 2010).

As an illustrative example, Chinese caregivers for dementia patients tend to experience more strain than their American counterparts because cognitive impairment is stigmatised in the Chinese culture. Thus, to avoid exposure and/or because of

lingual isolation, Chinese caregivers are more likely than American caregivers to attempt to provide care themselves, and to avoid seeking out formal care services and help from the community (Sun et al. 2012). By contrast, African American and Hispanic/Latino caregivers of any race tend to rely on collective effort, and therefore often have broader social support networks than white caregivers (Dilworth-Anderson et al. 2002). As a direct result of this orientation, African American and Hispanic/Latino informal care providers tend to report that their individual caregiver burden is relatively light, and that their life satisfaction has increased since taking on the caregiver role.

We therefore believe that exploring these differences in the caregiving patterns of various racial/ethnic and national groups will enable us to quantify the cumulative effect of cultural and family expectations on the amount of non-tangible resource production, regardless of its directionality *vis-à-vis* different generations and its daily incidence. The findings of this analysis could help to inform social policies in the U.S., where the population is ageing. This research is especially relevant given that the absolute effect sizes of various drivers of non-monetary transfers are far less documented than the market transfers and flows of capital that are registered in transnational and global projects, such as the National Transfer Accounts (Lee and Mason 2011) and the United Nations System of National Accounts.

To shed light on the personal and the economic consequences of the impact of cultural factors on informal care patterns in the United States, we formulate and test several hypotheses that could confirm and expand on evidence from prior research:

1. Women, on average, provide more care of all forms across all racial/ethnic groups and nationalities. This may appear to be an obvious assumption given that in every country, women provide most of the child care. However, the quantity of care women provide varies across racial, ethnic, and national background groups, as women who belong to different groups with unique attributes are exposed to socio-economic contexts that tend to either increase or reduce their involvement in informal care. Identifying the levels of commitment women have to caregiving in various cultural situations is essential for understanding the potential social and economic consequences of non-monetary support in areas where certain cultural groups are prevalent.
2. Overall, we expect to find that non-Hispanic Asians and Hispanics of any race in the U.S., and first-generation immigrants in particular, to be more responsive to family care needs than other major racial/ethnic groups. These two groups are projected to follow divergent demographic growth paths in the future, because even though their mortality outcomes are similar, there is a sizeable gap in fertility between them. Members of both groups are increasingly likely to live in multigenerational households, and share an affinity for collective effort within the family. Examining how race/ethnicity and nativity affect informal care arrangements can help us disentangle the competing explanations for the effects of similar cultural propensities and contrasting demographic trends.

3. Family income is inversely associated with the amount of time spent providing informal care. This follows from the assumption that care can be outsourced when disposable income is present. In one sense, household income can be thought of as the by-product of increased labour force participation, especially among women, who partially or fully substitute personally carrying out their child care duties with paid work, despite conflicting cultural demands. Alternatively, working-age adults who have spare income may prefer to hire formal services to care for their disabled and elderly dependents, especially if caring for their relatives offers them few emotional returns, while creating significant psychological and physical burdens. It is thus essential that we understand the role of family income in the allocation of caregiving tasks in different cultural and contextual settings.
4. Accounting for race, ethnicity, and national origin, in combination with demographic and socio-economic attributes and living arrangements, should be sufficient to allow us to isolate distinct patterns of informal care. If we assume that these factors capture the broad cultural characteristics of familism, communal support, filial piety and reciprocity, or individualism that are associated with cultures from different parts of the world, then only a minimal set of variables is needed to predict the likelihood and the intensity of intergenerational flows of time.

3 Data

In this study, we examine the effects of culturally proximal factors on caregiving patterns by building on our previous results and the methodology of non-monetary time transfers obtained from the American Time Use Survey (Dukhovnov and Zagheni 2015). We disaggregate the matrices of time transfers by age and sex in terms of racial/ethnic belonging and national origin groups. To measure the flows of time from and to different age/sex groups, we analyse child care and adult care activities as part of household production.

The American Time Use Survey (ATUS) is a cross-sectional, nationally representative survey of Americans aged 15 and older. It is conducted annually by the U.S. Bureau of Labor Statistics, which draws the sample from participants who completed all waves of the Current Population Survey. The purpose of the ATUS is to capture in a diary form how Americans spend their time. The participants are required to maintain detailed records of their personal activities, including information for each activity on the time of day, duration, location, and people present. The response rates have been declining in recent years, but are close to the 50 per cent mark, thus yielding an annual sample of about 12,000 observations. The advantage of the ATUS over other non-diary-based studies is that the care flows captured are not restricted by relationship categories of caregivers or care recipients. Thus, using ATUS data, it is possible to explore some of the less common care arrangements that different ethnic and cultural groups may engage in. The main

questionnaire provides variables detailing the respondents' age, sex, race, ethnicity, national origin by country, citizenship status, family income, level of education, and employment status. It also includes variables on other basic personal and household characteristics, including for individuals outside of the respondents' immediate household. To ensure adequate representation of transfers across racial, ethnic, and national minorities, we combine samples of the five consecutive years of data, from 2011 through 2015.

4 Method

As part of a series of papers on non-monetary intergenerational transfers, we have developed a set of numerical matrices that characterise the mean flow of care time; in its most basic form by the age and the sex of the caregivers and the care recipients, and further disaggregated by race and ethnicity. We consider two types of care that are unpaid and that are not part of a respondent's professional activities: child care and adult care. The economic and psychological burdens associated with each of these types of care are theoretically distinct. Hence, the two forms are computed separately prior to their concatenation in a matrix. For the present analysis, only transfers that took place between the caregiver respondents and the care recipients within their household were considered for the construction of matrices. Non-household transfers – i.e. transfers between caregiving respondents and care recipients who were not sharing a household – cannot be estimated directly or with a high degree of certainty, since most potential care recipients living outside of the respondents' household were not assigned even the most basic demographic attributes in the ATUS, such as age, sex, or race. Another important methodological point is that the matrices reflect caregiving patterns conditional on positive caregiving status. This allows for a more intuitive visual group comparison of caregiving intensity. Importantly, beyond providing a visualisation of these patterns, we use for the remainder of the analysis matrices that represent transfers as national averages, regardless of the caregiving status.

The analysis proceeds in three stages. First, we map the mean daily amount of care time transferred by the members of various age, sex, and racial/ethnic groups who indicated in the course of the interview that they had participated in at least one care activity. To map these transfers, we create a set of matrices for caregivers by aggregating the time spent on each type of care activity (i.e. child care and adult care) by age and sex for every major racial/ethnic group in the United States. For example, if during a child care activity lasting 10 minutes one child under age 18 was present, that child – whose age and sex are known – will be considered the recipient of the 10 minutes of care. If, however, multiple children were present during the activity, the 10 minutes of care are split between all of the children equally. An analogous allocation procedure is followed for adult care before all of the values are weighted and aggregated into matrices for each race/ethnicity by the age and the sex of the caregivers and of the "implied" care recipients. We calculate, but do not show, a

similar set of matrices for respondents by national origin, since the vast majority of the caregivers were born in the United States. Providing the estimated values for foreign-born residents would lead to sparsity with many missing values within a matrix, and would thus produce uninterpretable results based on the low cell counts in the immigrant-linked set of matrices. These matrices will nevertheless be further summarised in the profiles of informal care time production and consumption by age that represent marginal sums for each racial/ethnic and national origin group.

Next, we attempt to explain the care patterns by running a set of logistic models to estimate the odds of providing each form of care. We then run an analogous set of hierarchical ordinary least squares (OLS) models to estimate the average amount of time in minutes per day that members of demographic sub-groups spend on care activities relative to the reference group. Due to the highly skewed distribution of values of care time per day, the outcome variable is log-transformed for the OLS models. In addition to demographic, racial/ethnic, and national background attributes, we consider a number of socio-economic predictors: namely, family income, number of adults and own children under age 18 in the household, employment status, decade of immigrant entry to the U.S., presence of a spouse or partner, level of education, and current school enrolment. These variables were chosen to represent socio-economic status, potential social support structure, and non-care time commitments; and to approximate the relative cultural assimilation of immigrant respondents. Moreover, these variables uniquely describe individual characteristics without inducing collinearity.[1] For the purpose of modelling the impact of general characteristics, we treat nationality (nativity) using seven broad regional groups of countries: namely, the U.S. and Canada, Europe, West/Central Asia, East Asia, South and Central America including Mexico, Africa, and Australia and New Zealand. East and West/Central Asia are demarcated by the western borders of China, Myanmar, Thailand, and Indonesia in order to broadly represent a contingent of countries with a majority or a substantial Muslim population. Such broad groups obviously overlook finer cultural differences (e.g. between Mexicans and Cubans). However, based on a review of the past literature, we expect to find that the effects on both the intensity and the prevalence of care of broad cultural values, such as familism, filial piety, individualism, and collectivism, transcend national boundaries. We therefore believe that the classification of nativity by wide regional groups should be sufficient to explain the overall propensity of individuals to engage in various forms of non-market activities.

The main purpose of the logistic models is to show the overall probability of providing any amount of child care, adult care, or one or the other. For each form, we run a pair of logistic models. The first is a fully specified model with interactions by sex and race/ethnicity, sex and nativity, as well as sex and decade

[1] As per Fox and Monette (1992), the version of generalised-variance inflation factors (GVIF) method is comparable across multidimensional categorical factors, with $GVIF^{1/2df} < 2$, indicating only a weak factor association, except for continuous correlated age and age-squared.

of immigration. The second model excludes race and ethnicity, as well as nativity factors and the respective interactions. Thus, our aim in running these models is to test the effects of cultural proxy variables on the probability of providing various types of informal care.

After we have identified the group propensities to engage in care, the OLS estimation aims to shed light on the factors that affect the intensity of this care. We run a series of six nested models beginning with the simplest specification, which includes age (transformed to represent the minimum of 15 years at baseline), age-squared, and sex. We then gradually add race/ethnicity, nativity, and decade of immigration with race/ethnicity and nativity interactions by sex (model 2). In the OLS model 3, we add interactions of decade of immigration by sex to evaluate its effect on the two cultural proxies we test. In model 4, we add socio-economic variables, such as school enrolment, family income, work status, and work time commitment. Finally, in model 5, we add social support and household structure variables, such as the presence of a spouse, children, and other adults in the household. As in the case of the logistic model comparisons, the OLS model 6 is added at the end to test the effects of race/ethnicity and nativity in the fully-specified model through their exclusion. We run an analogous set of models for adult care.

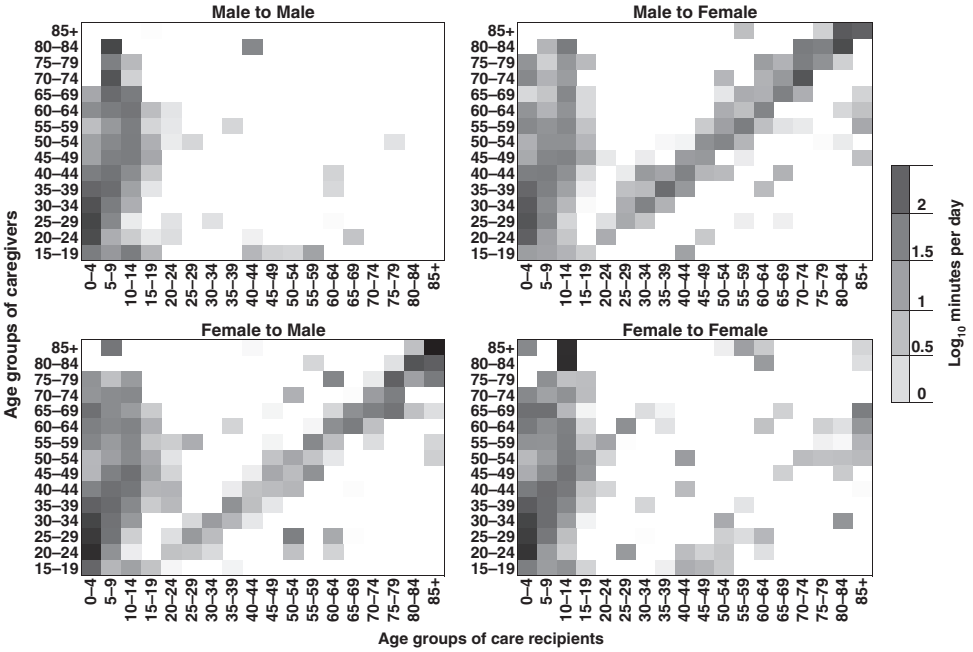
Finally, we present the care support ratio (CSR) as an application of the results we obtain over the previous steps. We discuss the methodological details and the computation of this measure in the dedicated sub-section of the results. As we explain later, the CSR is a useful measure of non-market transfers designed to complement the macro-scale economic indicators of surplus and deficit of value of goods produced or consumed. In this case, we consider the availability of informal care time.

5 Results

5.1 Informal care time transfers

Early child care, typically administered by parents and grandparents, is the most salient type of informal care. As indicated by the hotspots representing transfers to children aged 14 and under in Figure 1, the average amount of time committed to child care activities among the U.S. caregivers is about two hours per transfer day. Spousal care is another typical form of care. In Figure 1, spousal care is indicated by the diagonal patterns between the matrices of transfers between opposite sexes. The time spent on spousal care by caregivers peaks at older ages, when the average caregiver spends slightly more than an hour per day caring for his/her significant other. This set of matrices has been decomposed into several sets to additionally show the patterns of time flows by race and ethnicity. The decomposed matrices describing these patterns of care time transfers by age, sex, and race/ethnicity are shown in Figure A.1 in a simplified format. Among the caregiving parents, Asians

Figure 1:
Mean national daily care time transfer matrices in $\log_{10}$ minutes by age and sex for transfers from caregivers to care recipients, conditional on providing care



Note: Values below one minute per day are masked to add visual clarity.

spend the most time caring for their children – peaking at over two hours per day, on average – followed by Hispanics of any race, and by non-Hispanic whites and African Americans. Grandparental care is another prevalent form of caregiving for all racial/ethnic categories, although it is quite concentrated within same-sex transfers. Spousal care is very prevalent among white caregivers, and among older adults in particular. This pattern is shown in Figure 1 as a consistent diagonal trend. Among African Americans, spousal care is equally prevalent, but with greater variation in the ages of spouses. Among Asians – more so than among the caregivers of other racial categories – the prevalence of spousal care seems to intensify during the childbearing ages.

The decomposition of the national results by age, sex, race/ethnicity, and national origin offers some interesting insights into the levels of intensity and engagement in child care and adult care. Table 1 shows the average daily rates of participation in child care and adult care activities by race/ethnicity and broad national origin groups. Unfortunately, the ATUS methodology has no provisions that would allow for the calculation of the general prevalence, but states that it is likely to be higher than the daily rates. As expected, we observe that both child care participation rates and

Table 1:
Daily household informal care participation rates and mean care time commitment by race/ethnicity and nativity groups, by care type and the period total fertility rate

Place of birth	Non-Hispanic white	Non-Hispanic black	Non-Hispanic Asian	Hispanic, any race
		Daily participation rates		
		Child care		
U.S. & Canada	0.178	0.157	0.165	0.214
Europe	0.195	0.290	0.196†	0.092†
Asia	0.246	0.208†	0.294	0.256†
Latin America & Mexico	0.314	0.199	0.234	0.314
Africa	0.308	0.315	0.193†	0†
Australia & New Zealand	0.450	–	0†	–
		Adult care		
U.S. & Canada	0.042	0.042	0.036	0.057
Europe	0.035	0†	0†	0.043†
Asia	0.079	0.122†	0.033	0.020†
Latin America & Mexico	0.073†	0.048	0.232†	0.035
Africa	0.044†	0.033†	–	0.731†
Australia & New Zealand	0.075†	–	0†	–
		Mean time production in minutes per day		
		Child care		
U.S. & Canada	25.7	20.4	21.2	29.8
Europe	29.3	29.7	26.9†	10.1†
Asia	41.7	20.9†	44.4	20.2†
Latin America & Mexico	47.8	29.1	37.6	46.3
Africa	46.8	39.0	54.7†	0†
Australia & New Zealand	92.8	–	0†	–
		Adult care		
U.S. & Canada	3.1	3.1	2.4	3.9
Europe	3.7	0†	0†	6.1†
Asia	7.7	9.9†	2.3	0.2†
Latin America & Mexico	8.5†	4.7	13.9†	3.3
Africa	2.7†	4.6†	–	65.7†
Australia & New Zealand	4.6†	–	0†	–
Total Fertility Rate (TFR)§	1.72	1.83	1.69	2.09

Note: †indicates N < 10.

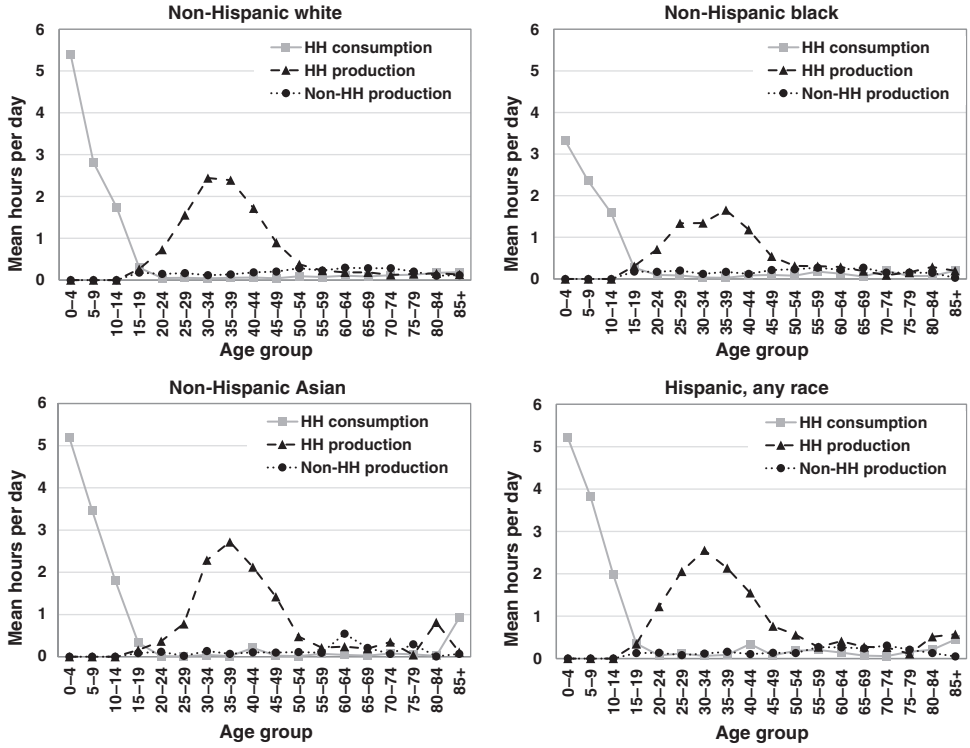
Source: §NVSS (31 January 2018). "Birth rates, by age of mother: United States, 2010–2016, and by age and race and Hispanic origin of mother, 2016". *National Vital Statistics Reports* 67(1), p.18.

intensity levels are substantially greater for foreign-born individuals across the four racial/ethnic categories. Only around 16–18 per cent of native-born and Canadian-born Americans are caregivers for their children, with a slightly higher share among the Hispanic sub-population (21.4 per cent). For the foreign-born Hispanics, the participation rate is 46.7 per cent higher than it is for their native-born counterparts. This is not too surprising, given that the number of children in the average Hispanic immigrant family is higher than the number of children in the average U.S.- or Canadian-born Hispanic family. Yet this relationship does not hold for Australian and New Zealander immigrants, among whom the child care participation rate and the average child care intensity are 2.5 and 3.6 times greater, respectively, than they are in native-born whites, even though the period total fertility rates (TFR) of Australians and New Zealanders are comparable to the TFR of American-born whites (i.e. in 1.72–1.87 range). However, this result should be interpreted with extreme caution, as the five-year sample for the Australia and New Zealand group is very small, as Table A.1 shows. Similarly, African- and Latin American-born non-Hispanic whites are found to be about 75 per cent more likely to provide child care than native-born whites. As expected, foreign-born Asian Americans are 1.78 times more likely to be the primary caregivers for their children than native-born Asians, with 29.4 per cent of those born in Asia providing child care on a typical day. By contrast, African Americans have the lowest child care participation rate of all racial/ethnic and national origin groups, with only around 15.7 per cent providing care for their children. Meanwhile, their foreign-born counterparts from Africa and Latin America have child care participation rates that are on par with those of other foreign-born groups.

For adult care, trends in participation rates and intensities do not vary nearly as much between native and foreign-born groups. The adult care patterns do not differ greatly between native-born groups, as at least 3.6–5.7 per cent of Americans provide adult care on a daily basis. Interestingly, native-born Hispanics are more likely than their foreign-born counterparts to provide adult care. However, the national average adult care intensity among all racial/ethnic and national origin categories is low, on an order of magnitude of less than 10 minutes per day. Of all coefficients that could be interpreted with a fair amount of certainty, the intensity for non-Hispanic whites born in Asia is the highest, at 7.7 minutes of adult care per day. In relative terms, this result aligns with the findings of the literature on informal care traditions by national origin, which has shown that familial duties toward parental and elder generations are emphasised in this group.

By summarising the findings in the form of marginal profiles by race/ethnicity derived from the respective national mean care transfers matrices, Figure 2 allows us to easily observe not only the age pattern of production of informal care time across the life course, but the stages of life at which the greatest amounts of care are received. The youngest children, ages 0–4, are the primary recipients of informal care time, receiving just over five hours of care on average from their white, Asian, and Hispanic caregivers. In stark contrast, young African American children receive on average about two hours less care per day than the other groups. This outcome is

Figure 2:
Profiles of mean daily care time, household production, consumption, and non-household production by race and ethnicity



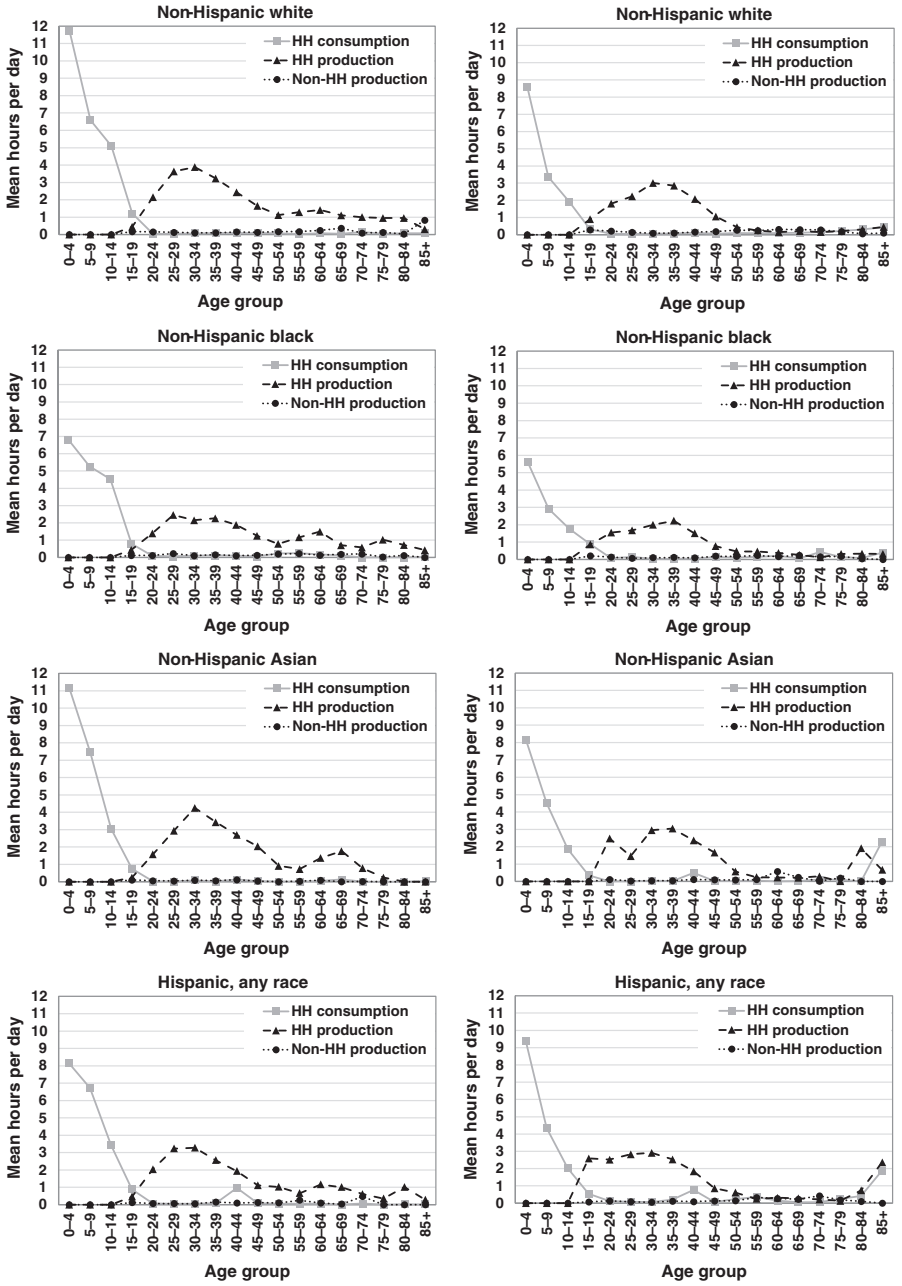
consistent with the results of Table 1, which shows that the low consumption of time corresponds to the low production of time. Second, the characteristic hump in the working-age range reflects the peak in the average care time production, and is thus akin to the surplus economic value produced by the working-age population. Given the rather subdued pattern of production and consumption of household informal care at all other ages, it is not difficult to see that the lion's share of all transfers made by working-age parents and other adults within a household are allocated to early child care.

Indeed, such macro patterns exist predominantly within a caregiver's household. The amount of time caregivers spend on non-household production, included for comparison, is small, and is spread thinly across all adult ages, peaking at about 20 minutes per day on average around early retirement. The need for this type of production mainly arises when caregivers have multiple, and occasionally simultaneous, responsibilities to provide care for a spouse/partner and grandchildren. Because of a lack of information on healthy non-household adult care recipients, care

consumption by younger adults is not well understood. It may, however, be assumed that such transfers are relatively rare, and involve low intensities of caregiver time commitment.

Next, we take a closer look at the effect of the presence of potential care recipients on the average intensity of informal care flows. Figure 3 presents the matrix marginal profiles by race/ethnicity of the average amounts of household care time production and consumption and non-household production; conditional on the presence of children under age 18 in the household and potential spousal support. The two principal features of these profiles are immediately apparent. First, the amount of time spent on child care increases, as consumption doubles relative to the overall average for the youngest group among all racial groups except Hispanics, among whom the increase is somewhat modest. A possible explanation for this pattern is that Hispanic families have more children on average than other racial/ethnic groups, which could lead to reduced per capita care support when the care demands are greatest and the production flows are split among multiple children. However, as soon as children reach the ages of 5–9 and 10–14, the gap between the racial/ethnic groups narrows. When we look at the production of child care, we see that, conditional on the presence of children in the household, grandparenting patterns become quite distinctive. It appears that African Americans and Hispanics rely on household grandparental care for two generations of children, as two smaller care production peaks of about 1–1.5 hours at ages 60–64 and 75–84 are observed; although it is possible that a small portion of this time is spent on spousal care. Among non-Hispanic whites, some grandparental child care is also provided. However, the finding that the production of grandparental child care is uniformly distributed across pre- and post-retirement ages in this highly heterogeneous population suggests that childbearing ages vary considerably among white Americans. By contrast, among non-Hispanic Asians, the range of ages at which care is given and received tends to be much narrower. However, this observation implies that in this group, the level of care commitment at those ages tends to be relatively intensive and concentrated around child care and spousal care during the childbearing years, as the matrices in Figure A.2 show. This pattern could be the result of a group-specific cultural/normative trait, or an artefact of the sparse sample. When we look at adult care consumption conditioned on the presence of a spouse or unmarried partner, no racial/ethnic group stands out. The average level of consumption is generally no more than half an hour per day, and does not intensify until people reach very old age, when a partner's frailty may oblige the other partner to provide care support. The finding that this pattern is more common among Hispanics and Asians – and, albeit to a lesser extent, among whites – than among African Americans may be attributable to these groups having greater longevity, and thus being more likely than African Americans to experience degenerative health conditions associated with old age.

Figure 3:
Profiles of mean daily care time in hours, household production, consumption, and non-household production by race/ethnicity; conditional on the presence of household children (left column) and a spouse or unmarried partner (right column)



5.2 Models of informal care prevalence and intensity

In this section, we evaluate the effects of race/ethnicity and nativity as cultural proxy variables on the probability of engaging in informal care activities on an average day. Table 2 presents the results of a set of logistic models that predict the log odds of providing household care in general, child care, and adult care. The odd-numbered models are fully specified, and are compared to the even-numbered complements that exclude the effects of race/ethnicity and nativity on the chances of providing the two forms of care. The overall model 1 significantly predicts that relative to women, Asian and Hispanic men have 57 per cent lower odds of providing care and African American men have 68 per cent lower odds of providing care. While this effect is largely sustained for both child care models, no significant difference is found between men and women in the propensity to provide adult care; except in the Central Asian group, among whom men have 42 per cent lower odds than women of providing adult care. These patterns are displayed in matrices in Figure A.1. Looking at these patterns, it becomes clear that focusing on the main effects of national origin offers no additional insights for U.S.- and Canadian-born child care providers. We can, however, see crossover interaction effects, which suggests that there is a significantly larger gap in the odds of care participation between men and women born in African and Latin American countries and Mexico. This finding may be related to the strong cultural tradition in these countries of dividing up household labour by gender, with women doing more of the child care and men being more likely to work outside of the home. As expected, we find that household structure, and the presence of a spouse or partner in particular, contributes a great deal to the fit of all three pairs of models. The effect of household structure is quite profound, especially on adult care, for which the odds of participation are increased 5.1 times relative to the baseline. This result supports the supposition that a substantial proportion of adult care transfers within a household are associated with spousal care. Age and socio-economic effects are significant in predictable ways for the overall and the child care models. For instance, in the child care model, age increases the odds of providing care by 20.1 per cent curvilinearly for every year over the baseline. The odds then decrease by one per cent with increasing age, as child care responsibilities diminish after the childbearing years. For adult care, the odds decrease significantly with age, by 4.9 per cent; which may suggest that upward adult care transfers are more prevalent (e.g. that adult children tend to provide care for their elderly parents, while older people are less likely to provide care for a spouse or sibling). For all logistic models, most socio-economic and household structural factors significantly predict that the odds of providing care are higher among those who are more educated, have stronger social support (that is, those who share a household with a spouse or partner or other adults), and who are unemployed or work relatively few hours. At the same time, family income is positively associated with child care participation and negatively associated with adult care. This pattern is foreseeable, as given the physical and emotional burdens that adult care imposes on caregivers, family members may prefer outsourcing

Table 2:
Log odds of providing various forms of household informal care

	Overall		Child care		Adult care	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
(Intercept)	−3.31***	−3.38***	−3.49***	−3.59***	−4.44***	−4.42***
Age	0.17***	0.17***	0.19***	0.19***	−0.05**	−0.05**
Age squared	−0.01***	−0.01***	−0.01***	−0.01***	0**	0**
Sex (female ref.)						
Male	−0.85***	−0.88***	−0.92***	−0.96***	−0.04	−0.04
Race/ethnicity (non-Hispanic white ref.)						
Non-Hispanic black	−0.21***		−0.25***		0.15	
Non-Hispanic Asian	−0.17		−0.15		−0.38	
Hispanic of any race	−0.14*		−0.17*		0.09	
Nativity (U.S./Canada ref.)						
Born in Europe	0.03		0.12		0.42	
Born in West/Central Asia	0.25		0.19		1.02*	
Born in East Asia	0.05		0.11		0.22	
Born in Latin America or Mexico	0.20		0.30		−0.08	
Born in Africa	0.20		0.33		−0.24	
Born in Australia or New Zealand	−0.21		−0.15		2.30	
Decade of immigration (native-born ref.)						
Prior to 1950	–	–	–	–	–	–
1950–1959	7.27	7.21	7.13	7.17	−7.68	−7.90
1960–1969	0.05	0.10	−0.10	0.02	0.12	0.32
1970–1979	−0.22	−0.18	−0.33	−0.22	−0.09	0.22
1980–1989	−0.13	−0.05	−0.18	−0.03	−0.07	−0.06
1990–1999	−0.14	−0.05	−0.19	−0.03	−0.42	−0.30
2000 onward	−0.06	0.03	−0.09	0.06	−0.51	−0.32*
Family income ($25,000 increments)	0.01	0.03*	0.03*	0.04***	−0.06*	−0.06**
Educational attainment (<high school ref.)						
High school	0.59***	0.62***	0.66***	0.68***	0.03	0.08
Some college/college	0.85***	0.90***	0.91***	0.96***	0.22	0.27*
Professional/Ph.D.	1.06***	1.12***	1.12***	1.19***	0.27	0.32*

Continued

Table 2:
Continued

	Overall		Child care		Adult care	
	(1)	(2)	(3)	(4)	(5)	(6)
School enrolment (not in school ref.)						
Enrolled	−0.41***	−0.42***	−0.44***	−0.46***	−0.05	−0.03
Employment status (employed ref.)						
Unemployed	0.35***	0.33***	0.33***	0.31***	0.24*	0.26*
Not in labour force	0.34***	0.34***	0.32***	0.33***	0.15	0.15
Hours spent working	−0.02***	−0.02***	−0.02***	−0.02***	−0.04***	−0.04***
Presence of spouse or partner	0.84***	0.86***	0.72***	0.74***	1.63***	1.59***
Num. of HH children under 18	1.01***	1.01***	1.11***	1.11***	−0.06*	−0.04
Num. of other HH adults	−0.16***	−0.17***	−0.32***	−0.32***	0.47***	0.47***
Interactions						
Male × Non-Hispanic black	−0.28***		−0.30**		−0.21	
Male × Non-Hispanic Asian	0.22		0.26		0.23	
Male × Hispanic of any race	−0.18		−0.31**		0.21	
Male × Born in Europe	−0.35		−0.50		−1.17	
Male × Born in West/ Central Asia	−0.51		−0.57		−1.56*	
Male × Born in East Asia	−0.19		−0.46		0.14	
Male × Born in Latin America or Mexico	−0.63		−0.76*		−0.50	
Male × Born in Africa	−0.45		−0.87*		0.77	
Male × Born in Australia or New Zealand	0.78		0.69		−1.35	
Male × Immigrated prior to 1950	–	–	–	–	–	–
Male × Immigrated in 1950–1959	–	–	–	–	–	–
Male × Immigrated in 1960–1969	0.29	0.19	0.78	0.50	−0.39	−0.98
Male × Immigrated in 1970–1979	0.55	0.10	0.90*	0.25	0.11	−0.45
Male × Immigrated in 1980–1989	0.54	0.09	0.85*	0.17	−0.52	−0.66

Continued

Table 2:
Continued

	Overall		Child care		Adult care	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Male × Immigrated in 1990–1999	0.41	−0.14	0.58	−0.17	0.86	0.47
Male × Immigrated in 2000 onward	0.40	−0.10	0.53	−0.17	0.83	0.43
Hosmer-Lemeshow GOF test (df = 8)	579.95***	647.43***	814.76***	896.06***	66.28***	67.46***
AIC	28919	29610	27354	28027	9963.5	10244
Likelihood ratio test (df = 18)	86.041***		113.425***		35.550**	

Note: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

their care work to performing it themselves. The intensity of such transfers must also be considered. Of key importance to the logistic models is the evaluation of the contributions of race/ethnicity and nativity to the fit of all of the models. All three models demonstrate practical insensitivity to the exclusion of race/ethnicity or nativity. The overall fit of all of the models is rather poor, even if the likelihood ratio test and the Hosmer-Lemeshow goodness of fit statistic indicate that the changes in the fit are statistically significant when race/ethnicity and nativity are included.

The hierarchical OLS models for the intensity of child care and adult care are presented in Tables 3(a) and 3(b), respectively. Compared to non-Hispanic whites, African Americans consistently spend 8–15 per cent less time providing child care, whereas Hispanic men spend 14 per cent more time providing child care than Hispanic women. This finding is interesting, as it shows that among Hispanics, the odds of providing child care are lower among men than among women, but that those men who are caregivers tend to spend more time providing care than women. The results also show that, on average, foreign-born Mexicans and Latino Americans spend 5.1 more minutes per day on child care than U.S.- and Canadian-born Americans. Although this difference is insubstantial in practical terms, it provides some support for our hypothesis 2. A similar effect is observed in the adult care models for African American men, as these men provide up to 72 per cent, or 14 additional minutes, of the adult care provided on an average day (this is likely spousal or sibling care, given the corresponding pattern observed in Figure A.1). The patterns for Asians are not significantly different from the patterns for non-Hispanic whites, once the socio-economic and household structure effects are controlled for in models 4 and 5. All else being equal, non-Hispanic men spend 15–17 per cent significantly less time caring for children than women. However, no significant gender gap is found in the adult care models, except among African

Table 3(a):
Ordinary Least Squares models predicting $\log_e$ minutes per day of child care (coefficients exponentiated). Coefficients represent ratios relative to the baseline

	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	89.71***	92.87***	92.87***	57.73***	56.89***	56.14***
Age	1.02***	1.02***	1.02***	1.07***	1.06***	1.06***
Age squared	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***
Sex (female ref.)						
Male	0.74***	0.72***	0.72***	0.84***	0.82***	0.85***
Race/ethnicity (non-Hispanic white ref.)						
Non-Hispanic black		0.85***	0.86***	0.89**	0.92*	
Non-Hispanic Asian		0.84*	0.84*	0.88	0.91	
Hispanic of any race		0.90**	0.90**	0.93*	0.94	
Nativity (U.S./Canada ref.)						
Born in Europe		1.10	1.14	1.10	1.11	
Born in West/Central Asia		1.37*	1.42*	1.20*	1.19	
Born in East Asia		1.12	1.17	1.22	1.20	
Born in Latin America or Mexico		1.06	1.10	1.09*	1.09*	
Born in Africa		0.87	0.89	1.07	1.04	
Born in Australia or New Zealand		1.55	1.59	1.92	1.79	
Decade of immigration (native-born ref.)						
Prior to 1950		0.78	0.78			
1950–1959		0.70	0.64			
1960–1969		0.79	0.89			
1970–1979		1.01	0.88			
1980–1989		1.05	1.02			
1990–1999		0.94	0.90			
2000 onward		1.18	1.15			
Family income ($25,000 increments)				1.01*	1.01	1.01
Educational attainment (<high school ref.)						
High school				1.11**	1.15***	1.11***
Some college/college				1.25***	1.28***	1.22***
Professional/Ph.D.				1.46***	1.48***	1.43***
School enrolment (not in school ref.)						
Enrolled				0.71***	0.72***	0.70***

Continued

Table 3(a): Continued

	(1)	(2)	(3)	(4)	(5)	(6)
Employment status (employed ref.)						
Unemployed				1.23***	1.24***	1.22***
Not in labour force				1.36***	1.31***	1.30***
Hours spent working				0.95***	0.95***	0.95***
Presence of spouse or partner					1.07*	1.10***
Num. of HH children under 18					1.09***	1.09***
Num. of other HH adults					0.94***	0.94***
Interactions						
Male × Non-Hispanic black		1.09	1.09	1.01	1.01	
Male × Non-Hispanic Asian		1.33*	1.32*	1.30	1.28	
Male × Hispanic of any race		1.21**	1.21**	1.14*	1.14*	
Male × Born in Europe		0.75*	0.67	0.81	0.81	
Male × Born in West/ Central Asia		0.68**	0.62*	0.78	0.80	
Male × Born in East Asia		0.89	0.81	0.86	0.87	
Male × Born in Latin America or Mexico		0.90	0.82	1.04	1.04	
Male × Born in Africa		0.93	0.85	0.89	0.88	
Male × Born in Australia or New Zealand		0.75	0.69	0.71	0.76	
Male × Immigrated prior to 1950			–			
Male × Immigrated in 1950–1959			1.19			
Male × Immigrated in 1960–1969			0.72			
Male × Immigrated in 1970–1979			1.42			
Male × Immigrated in 1980–1989			1.09			
Male × Immigrated in 1990–1999			1.14			
Male × Immigrated in 2000 onward			1.06			
R^2	0.039	0.047	0.048	0.136	0.146	0.142
Adjusted R^2	0.039	0.045	0.045	0.134	0.144	0.141
F	202.2***	25.6***	21.2***	69.9***	68.8***	155.9***

Note: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

Table 3(b):
Ordinary Least Squares models predicting $\log_e$ minutes per day of adult care (coefficients exponentiated). Coefficients represent ratios relative to the baseline

	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	19.00***	17.97***	18.12***	25.47***	19.40***	20.89***
Age	1.01	1.01	1.01	0.99	1.01	1.02
Age squared	1.00	1.00	1.00	1.00	1.00	1.00
Sex (female ref.)						
Male	0.99	0.93	0.92	0.86	0.86	0.91
Race/ethnicity (non-Hispanic white ref.)						
Non-Hispanic black		1.17	1.16	0.96	0.94	
Non-Hispanic Asian		0.79	0.79	0.96	0.91	
Hispanic of any race		0.95	0.95	0.98	0.92	
Nativity (U.S./Canada ref.)						
Born in Europe		1.08	1.42	1.14	1.15	
Born in West/Central Asia		1.47	2.01	1.73	1.73	
Born in East Asia		0.95	1.27	1.03	0.93	
Born in Latin America or Mexico		1.14	1.50	1.35	1.49	
Born in Africa		0.96	1.35	0.77	0.80	
Born in Australia or New Zealand		0.81	1.06	0.40	0.50	
Decade of immigration (native-born ref.)						
Prior to 1950		0.90	0.23			
1950–1959		1.10	1.05			
1960–1969		1.79	1.38			
1970–1979		1.38	1.12			
1980–1989		1.22	1.06			
1990–1999		1.22	0.87			
2000 onward		1.24	0.88			
Family income ($25,000 increments)				0.93*	0.92**	0.92**
Educational attainment (<high school ref.)						
High school				1.22	1.07	0.96
Some college/college				1.15	1.05	0.95
Professional/Ph.D.				0.91	0.84	0.80
School enrolment (not in school ref.)						
Enrolled				0.92	0.94	0.91

Continued

Table 3(b): Continued

	(1)	(2)	(3)	(4)	(5)	(6)
Employment status (employed ref.)						
Unemployed				1.13	1.11	1.11
Not in labour force				0.75*	0.78*	0.76*
Hours spent working				0.96***	0.96***	0.96**
Presence of spouse or partner					1.12	1.17
Num. of HH children under 18					0.91**	0.92*
Num. of HH adults					1.13**	1.14**
Interactions						
Male × Non-Hispanic black		1.46*	1.46*	1.76*	1.72*	
Male × Non-Hispanic Asian		1.40	1.53	1.51	1.49	
Male × Hispanic of any race		1.08	1.06	0.91	0.93	
Male × Born in Europe		0.98	0.57	0.65	0.74	
Male × Born in West/Central Asia		1.04	0.47	1.42	1.65	
Male × Born in East Asia		1.02	0.41	1.23	1.55	
Male × Born in Latin America or Mexico		1.06	0.52	1.28	1.09	
Male × Born in Africa		0.67	0.30	1.10	1.02	
Male × Born in Australia or New Zealand		0.45	0.20	1.28	1.34	
Male × Immigrated prior to 1950			14.97*			
Male × Immigrated in 1950–1959			0.99			
Male × Immigrated in 1960–1969			1.65			
Male × Immigrated in 1970–1979			1.90			
Male × Immigrated in 1980–1989			1.49			
Male × Immigrated in 1990–1999			2.36			
Male × Immigrated in 2000 onward			2.36			
R^2	0.021	0.040	0.043	0.060	0.076	0.052
Adjusted R^2	0.020	0.029	0.029	0.037	0.051	0.042
F	18.1***	3.65***	3.11***	2.67***	3.12***	5.03***

Note: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

Americans. Overall, the child care intensity diminishes from about 1.5 hours per day on average at baseline in models 1–3 to just under one hour as soon as the socio-economic and household structure factors are introduced in models 4–6. As predicted, we see that the propensity to provide child care grows with age. In a slightly curvilinear pattern, these odds decline 0.2 per cent per year of age above age 15. This finding is expected given the tendency for care time commitment levels to increase during the reproductive years, and then to decline slowly but steadily through retirement. Models 2 and 3 of both child care and adult forms of care test the effect of the duration of stay in the U.S. for immigrants. Neither the main effects, nor the interactions with the decade of immigration, are found to have any impact on the model and its fit, and are thus excluded from consideration in models 4–6 shown in Tables 3(a) and 3(b). This finding suggests that the temporal aspect of cultural assimilation to the informal care arrangements of U.S. is not sufficiently strong to set immigrants apart from the native-born population, while holding the rest of the demographic, socio-economic, and household structural attributes fixed. As predicted, the effects of household structure, employment, and educational factors are significant. For example, people who work longer hours spend 5 per cent less time providing child care per hour of work than those who are unemployed or out of labour force, whereas people who have advanced degrees or professional education spend nearly 48 per cent more time on child care than those without a high school diploma. Like in the logistic model, most of the results are rendered insignificant for adult care, except for the effects of occupational and household structure characteristics. Occupational characteristics are negatively associated with involvement in adult care, perhaps because people who are working tend to outsource the adult care tasks they are unable or unwilling to perform. By contrast, the number of adults in the household is positively associated with involvement in adult care. On the other hand, unlike in the child care models, the presence of a spouse or a partner does not appear to be a significant predictor of providing adult care, regardless of the individual's racial/ethnic or national background. However, family income is one of the primary predictors in the adult care models, with income being negatively associated with the amount of time transferred. This pattern may be attributed to these individuals having less time to provide adult care because they are spending more time working. Educational characteristics do not seem to affect the likelihood of providing adult care.

Looking at the OLS model fit, we see that adding individual and family socio-economic variables increases the fit of both the child care models and, to lesser extent, the adult care models. The comparison of the child care and the adult care models 3 and 4, and 5 and 6 demonstrates that race/ethnicity and nativity factors make no substantial contributions to explaining the variance. The fully specified models 5 and 6, excluding race/ethnicity, nativity, and pertinent interactions, predict 56.9 and 56.1 minutes of child care and 19.4 and 20.9 minutes of adult care, respectively, at the baseline; with few changes in the common model coefficients or standard errors. The inclusion and the subsequent exclusion of race/ethnicity and nativity leave the model fit largely unaltered. The observed increases in R-squared

from model 2 to model 3, and its subsequent decreases from model 5 to 6, are negligible. These findings are additional evidence contradicting hypothesis 4; i.e. that race/ethnicity and nativity are cultural proxy variables that are as important as socio-economic and household structure factors in explaining caregiving patterns.

5.3 Care support ratio

The matrices discussed above depict several distinct caregiving patterns. Although these patterns provide a nice quantitative summary of transfers by age, sex, and race/ethnicity, they could also shed light on the ongoing discussion in developed countries about how to deal with increasing levels of economic dependency. Considerable efforts have been made to study the allocation and the redistribution of tangible resources across various sub-populations within the National Transfer Accounts (NTA) framework (Lee and Mason 2011). It is not difficult to deduce from these analyses that the availability and the use of non-monetary resources depend on the availability and the use of economic resources. However, non-market transfers, such as time spent on routine household chores and caregiving, have been largely overlooked in these studies because they are difficult to measure. We propose adding a complementary measure of economic dependency to the NTA Support Ratio (SR) that relates the sum value of goods and services produced in a country to the sum value of the goods and services consumed. In this case, we define the care support ratio (CSR) as the ratio of the aggregate care time produced through informal activities to the aggregate care time consumed in a year. The key difference between the SR and CSR is that, unlike money, time cannot be saved for later use, and is consumed at the time of its production by very specific groups of individuals. Using this approach, we construct profiles of household consumption and production by age for all racial and ethnic groups that allow us to calculate the CSR value of the care that is given and received within American households. We then project the calculated metric into the future by applying the rates of care time production and consumption to the dynamic population structure by age, sex, race, and ethnicity over time using published population projection estimates (U.S. Census Bureau 2014). We thus compare the CSR of household transfers to the overall country-level CSR calculated in our previous work (Dukhovnov and Zagheni 2015).

To calculate the CSR, we begin with the matrices analogous to those shown in Figures 1 and A.1, except that the cell values are changed to represent the national averages, unconditional on the caregiving status. While this approach makes the matrix appear bleaker and less informative, it is useful for this task. The matrices containing the national averages of time transferred by age, sex, race, and ethnicity are then aggregated into marginal sum profiles, which are exhibited in Figures 2, 3, and A.2. The equivalent profile set by national origin group is shown in Figure A.2 in the Appendix, but it is not used here for the purposes of CSR calculation due to the sparse matrix structure and the high standard errors associated with small sample sizes for immigrant groups. As we discussed earlier in Section 5.1, the

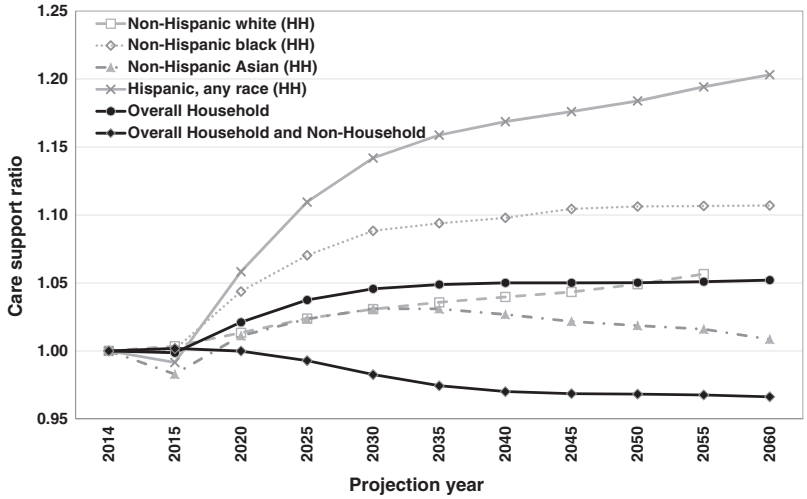
basic message that these profiles convey is that the per capita productivity of informal care time production increases during the reproductive years, and that most care is consumed during the early childhood years. The underlying assumption here is that the total care time produced must be equal to the total care time consumed. Thus, to ensure the exact matching of the total production with the total consumption for the current estimates, we need to adjust the production by a small factor that is equal to the ratio of the total average production to the total average consumption. This is necessary to even out the small differences caused by rounding and the errors introduced by the assumptions made when allocating the time equally across multiple potential care recipients who are were simultaneously present during a single care activity. Then, to approximate the aggregate amount of care time produced and consumed in a country, we multiply the averages by group (i.e. the profile values) by the population size in the respective age groups and racial/ethnic categories. The ratio of the resultant two quantities, adjusted for parity of production and consumption in the base year (2014), equals the care support ratio. Finally, to project the future CSR, we apply the same adjusted rates of average care time production and consumption to the medium-fertility U.S. Census projected population counts (U.S. Census Bureau 2014) by age and race/ethnicity for each year of our projection, while assuming that the future rates will remain fixed at current levels.

Figure 4 shows the comparison of various CSRs. All group CSRs based on household production are estimated to remain above the value of one, indicating the excess care time generated by caregivers at present rates of production and the consumption by care recipients. Hispanics appear to be especially productive, as the CSR for this group is projected to increase over the next half-century until it reaches a value of around 1.2 by 2060. Among African Americans, the increase in the CSR is projected to be half that of Hispanics. This discrepancy is mainly attributable to the higher prevalence of multigenerational households among Hispanics (Pew Research Center 2016).

However, even though Asians have a comparable probability of living in a multigenerational household, they have fewer children on average, and thus produce less care time per capita. Whites and Asians have similar socio-economic characteristics, and neither group shows a marked increase in output within households. The care support ratios of these groups are projected to be just 1.06 and 1.01 by 2060, respectively; although neither group has a production deficit. However, this picture remains incomplete without the proper consideration of both household and non-household transfers – which, as we discussed earlier, is difficult to do because of data limitations. It should be noted that at present, the vast majority of all transferred care time is produced and consumed within households.

The overall CSR of approximately 0.97 – which includes both places where time is transferred – indicates that there is a small but persistent total future deficit. Without being able to construct an accurate non-household measure of consumption based on ATUS data, it is difficult to pinpoint the cause of this shrinkage. Such a trend could reflect increased care demands by older people who typically reside

Figure 4:
Projected overall and household care support ratios (CSR) for every major racial/ethnic group, 2014–2060



Note: The non-household care support ratio is not decomposed by race/ethnicity, since it requires several strong assumptions regarding the distribution of time to children of others and to non-household adults for whom the demographic information is often missing, as noted in Section 4. Some plausible assumptions were made in Dukhovnov and Zagheni (2015) about the overall transfers by age and sex. However, extending these assumptions to the disaggregation by race/ethnicity would not only increase uncertainty in our estimates due to the small size of the sample of non-household transfers; it would require us to assume that all racial/ethnic categories deliver care to specific groups outside of the caregiver household in the same manner. We have many reasons to doubt such generalisations.

outside of the caregiver's household, or decreased consumption of care due to the ongoing decline in fertility, especially among non-Hispanic whites and Asians. However, these explanations do not appear to hold for all racial/ethnic groups, such as Hispanics, whose cultural traditions predispose them to live in multigenerational households, and who are projected to remain younger and to continue to have more children on average. If, however, the Hispanic population sub-group undergoes further demographic changes, it is plausible that by the middle of the century the pool of middle-aged individuals in this group will increase. This development would in turn generate a sort of demographic dividend by increasing the potential aggregate amount of care Hispanics are capable of providing during their peak production years. On the other hand, the observed increases in the CSR may not materialise if fertility levels fall below those forecasted by the U.S. Census, or if caregiving rates change as a result of cultural, technological, or normative changes. We also need to be cognisant of the fertility differentials between the racial/ethnic groups. For example, Hispanics, who had the highest TFR (2.09) of any racial/ethnic group in the United States in 2016, are projected to to make up more

than one-quarter of the U.S. population by 2050. As our CSR decomposition shows, it is likely that Hispanics will contribute a substantial share of the overall household CSR increase in the coming decades, although the nature of these transfers will likely change as their fertility is projected to decline. Moreover, as mortality is increasingly postponed and post-retirement lifespans grow longer among Hispanics, the incidence of adult care transfers in this group is expected to increase (Ortman et al. 2014).

6 Discussion

In this concluding section, we will address the hypotheses that we presented at the beginning of this article. In Dukhovnov and Zagheni (2015), we showed that in the U.S., women are the primary child care providers, as, on average, women produce larger daily amounts of care time than men in every ethnic/racial group – even though, conditional on their involvement, Hispanic men provide a few more minutes of child care per day on average than Hispanic women. However, sex is not a significant predictor of adult care participation or intensity, except among African Americans, as African American men transfer more time on average than African American women to adult care recipients of similar ages (e.g. spouses and siblings). The further decomposition of the time transfers matrices by race and ethnicity confirms our hypothesis 1 qualitatively, albeit with sizeable differences between the racial/ethnic and nativity groups in the cumulative amount of time spent providing care. It is, moreover, clear that foreign-born women are far more likely than their male counterparts to be responsible for providing care. This gender gap in caregiving is especially evident among immigrants born in Central and West Asia. Therefore, we expect that in the future, the response trajectories for increases in female labour force participation will vary by racial/ethnic and national background. For some groups, and especially for native-born Hispanics, the gender line will likely blur, as men gradually become more involved in child care. For foreign-born African Americans and Hispanics, the differences may persist due to the strong gender norms and stereotypes that continue to dominate in their countries of origin.

The regression models offered further insights into the differences between groups in the prevalence and the intensity of care. The results of the logistic models partly contradict our second hypothesis, which states that Asian Americans and Hispanics have varying care patterns depending on their nativity status. In fact, we found that individuals who belong to different racial/ethnic or nativity groups differ little from American-born whites in their propensity to provide care, provided they have the same levels of education, occupational attributes, and household structures. It is plausible that the differences we observed in the matrices are the result of communal efforts; i.e. that Hispanics, Asians, and – albeit to a lesser extent – African Americans spend less time per capita for some transfers, mainly because they are more likely to rely on broader social support networks than non-Hispanic whites. Indeed, survey selection bias could also impact the estimates of the fit. For example, in multigenerational households, there may be several caregivers, such

as parents, siblings, and grandparents, each of whom provides only a fraction of the care time that a young child living in the household needs. Such residential arrangements contrast sharply with those of single-parent households, in which the ratio of caregivers to care recipients is low. However, as the ATUS interviews only one person per household, no activity diary information could be obtained from the other household members. Despite our best efforts to account for the presence of various household members in our models, we were unable to ascertain whether any of these individuals took part in any care activities that might have reduced the probability or the intensity of the provision of either form of care by the respondent. As has been noted in the literature, family networks and communal supports are important culturally-specific sources of care. Future studies may be able to produce more accurate representations of the average informal care frequency and duration, while controlling for the presence, function, and time commitment of specific household members.

Next, we discuss several differences for which family income was found to be a significant predictor of the odds of providing child care and adult care. Increasing family income raises the odds of providing care for children somewhat, but it decreases the odds of providing care for adults slightly. The estimate for adult care is consistent with our expectations. As adult care is often physically and psychologically taxing, families may choose to avoid it if their income permits. The finding that income positively predicts the odds of providing child care may be linked to the enhanced ability of higher-income families to support children. Nevertheless, as the results of the OLS models demonstrate, prevalence does not necessarily translate into intensity. Unlike providing adult care, providing child care is generally seen as a happy and fulfilling experience. Thus, child care responsibilities are almost universally accepted by people of all ethnicities and income levels. Moreover, in many cases, the income of an older adult is not as important as his/her lifetime savings. The old-age consumption profiles presented in this paper appear to be rather shallow largely because in the U.S., elderly people often tap into the formal care market and public services to obtain necessary care. Hence, although we found support for our hypothesis 3, we think that personal income and savings might have a greater impact on both the probability and the volume of adult care flows.

In discussing our final hypothesis, we reiterate that it is doubtless the case that cultural values and traditions play a substantial part in differentiating the patterns of the prevalence and the intensity of child care and adult care activities. It appears, however, that race, ethnicity, and national origin only partly explain the consequences of the cultural effects of care we observed in our matrices and marginal transfer profile plots. These effects are described by our models to a very limited degree. In support of this claim, we showed by the exclusion at various points of race/ethnicity and nativity factors that the model fit in both the logistic and the OLS regressions scarcely changes, with no adverse effects on the remaining coefficients. Moreover, we did not detect any sign of resistance to assimilation among immigrants depending on the decade of their arrival in the U.S. We therefore believe that the patterns observed in the matrix figures may be the artefact of

some other unmeasured behaviours, health conditions, preferences, or attitudes that could not be accurately modelled using conventional factors. While the ATUS has a number of advantages, including the flexibility and the granularity of its time use data, because it is a large cross-sectional national survey, it inevitably overlooks many details about the respondents, their social networks, and their household characteristics. Future research, perhaps using panel data, could aim to disentangle these issues by exploring individual characteristics, as well as less common factors and behaviours in the daily lives of individual group members, which could affect how they provide or use informal care within the household, and beyond.

The contribution of the present paper is thus two-fold. First, we documented the differences in informal care patterns between the major racial/ethnic and national origin groups in the U.S. We decomposed these transfers by age, sex, race/ethnicity, and national origin, and began to explore the possibilities for the development of tailored predictive models of non-monetary resource transfers in sub-populations. Second, we introduced the care support ratio (CSR) as a non-market metric that complements the economic support ratio (SR). At present rates, the future household informal care time surplus will be driven by Hispanics and non-Hispanic African Americans. However, given that the population is ageing rapidly and fertility is expected to decline through the middle of the century, we can reasonably expect the CSR to fall below one, indicating an overall care deficit. Such a deficit may arise due to shifts in demand from the large numbers of elderly people living outside of the households of working-age adults, and to the relative scarcity of care time production, given present rates. Future advances in technology, medicine, and changes in lifestyle all have the potential to bring the supply and the demand structure of informal care into balance. Our approach has significant implications for economic policy and research in the areas of public and private transfers, as well as for the ways in which they factor in economic and social support systems for the growing older population. We believe the application of our method to the care support ratio calculations will be seen as valuable by the global community of NT(T)A researchers who are studying macro-level flows of resources by incorporating previously unmeasured value into the models.

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Appendix

Figure A.1:
Matrices of care time transfers in $\log_{10}$ minutes per day, by age, sex, race, and ethnicity; conditional on positive caregiving status

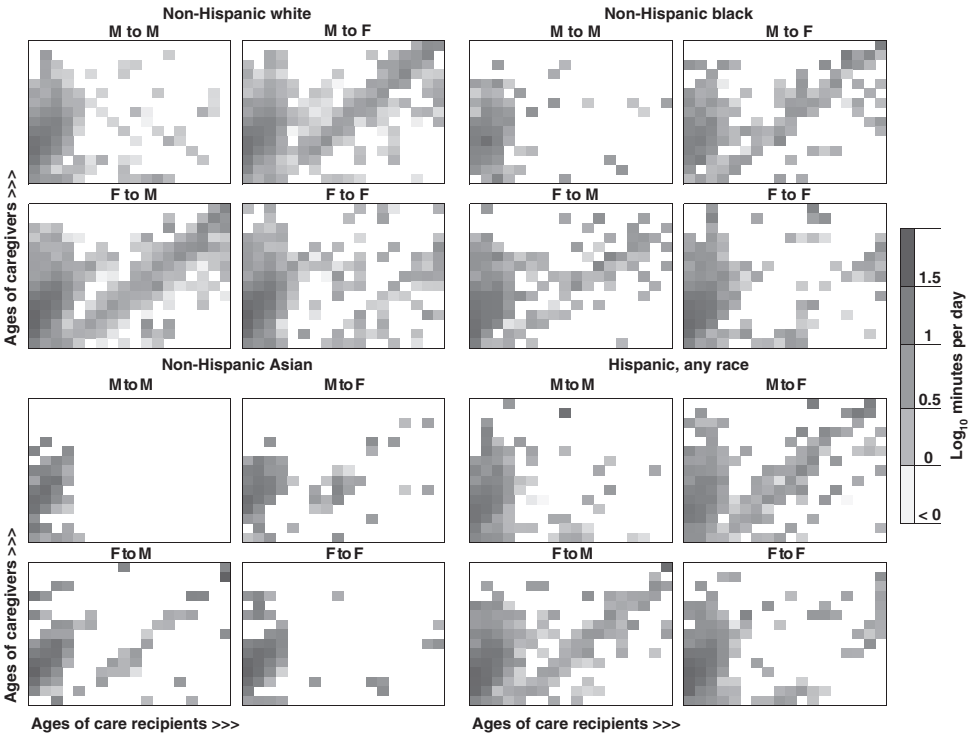

Figure A.2:
Profiles of mean daily care time in hours: household production, consumption, and non-household production, by nativity

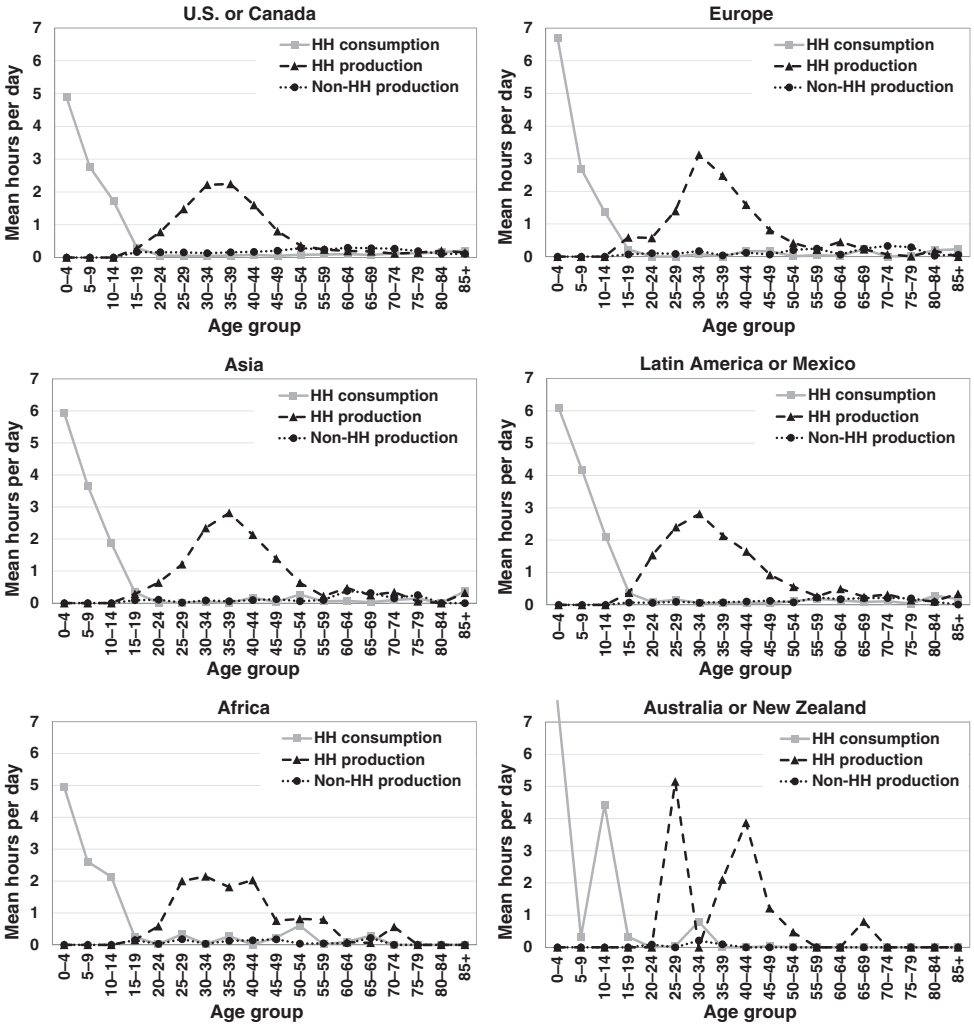

Table A.1:
2011–2015 ATUS total sample sizes by race and ethnicity and national origin

	Race and ethnicity					
Place of birth	**Non-Hispanic white**	**Non-Hispanic black**	**Non-Hispanic Asian**	**Hispanic of any race**	**Undefined**	**Total**
U.S. & Canada	36703	7699	491	4229	960	50082
Europe	1082	29	14	46	11	1182
West/Central Asia	273	20	642	6	4	945
East Asia	66	16	1055	13	48	1198
Latin America & Mexico	150	411	23	4246	8	4838
Africa	98	370	13	4	5	490
Australia and New Zealand	20	0	2	0	1	23
Undefined	10	6	6	5	19	46
Total	38402	8551	2246	8549	1056	58804

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European National (Time) Transfer Accounts

***Tanja Istenič*[1], *Bernhard Hammer*[2] *and Alexia Prskawetz*[2,3,*]**

1 Introduction: The generational economy and National Transfer Accounts

The goal of the National Transfer Accounts (NTA) project is to improve our understanding of the economic consequences of demographic changes by introducing demographic information into the System of National Accounts (SNA). As part of the AGENTA research project (http://www.agenta-project.eu/), NTA datasets were compiled for 25 European countries and the base year 2010. The aim of this paper is to introduce the general concept of NTA, and to provide an overview of the European NTA data and the data explorer at www.wittgensteincentre.org/ntadata.

Age is one of the main determinants of individuals' economic behaviour. In general, people experience three different economic phases in their life course. Working-age individuals are typically able to finance their own consumption by producing more than they consume. In contrast, at the youngest and oldest ages, people's consumption usually exceeds their labour income (Lee and Mason 2011b). The gap between consumption and labour income can be financed by age reallocations in the form of private transfers (e.g., transfers from parents to children), public transfers (e.g., publicly financed pensions and education), or asset-based reallocations resulting from participation in capital and financial markets (Mason et al. 2006). In contemporary societies, periods of economic dependency are gradually being extended as the young are spending more time in education and the elderly are living longer.

Measuring age reallocations is useful for understanding the intergenerational economy and the organisation of intergenerational support; i.e., how the gap between consumption and labour income is financed in childhood and in old

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age. Introducing the age dimension into the SNA is especially relevant in light of the unprecedented demographic changes that Europe has been facing in the past few decades. Population ageing puts the system of intergenerational flows under pressure, as the share of the population made up of inactive elderly people whose pensions, health care, and long-term care have to be financed by a shrinking labour force increases (Hammer et al. 2015). Therefore, population ageing requires changes in both the public and the private intergenerational reallocation of resources. Understanding the age patterns of production, consumption, and intergenerational reallocations is necessary when analysing the effectiveness of alternative policies, as some government policies can be advantageous for certain generations, but burdensome for others.

Accounting systems such as the SNA do not offer information on age or the generational aspects of the aforementioned changes. Our ability to assess the economic consequences of population ageing is, therefore, very limited. The National Transfer Accounts (NTA) have been developed to fill this gap (United Nations 2013). NTA constitute an accounting framework that provides information on the allocation of income among age groups. NTA data consist of age profiles, which are the age-specific averages of labour and asset income, transfer benefits and contributions, consumption, and savings. By focusing on the age dimension, NTA shed light on the effect of the changing age structure on different macroeconomic categories. Thus, NTA can be seen as a valuable tool for addressing some of the major challenges of modern societies (United Nations 2013). An overview of the NTA methodology and data is provided in Lee and Mason (2011a), d'Albis & Moosa (2015), and in the United Nations (2013).

Although the services provided through unpaid household labour make up a large share of intergenerational reallocations, they are neither included in National Accounts, nor in the basic NTA framework. The production and transfer of unpaid services within households are included in the NTA framework through the so-called National Time Transfer Accounts (NTTA) (Donehower 2019).

The compilation of NTA is organised within the global NTA project, which is a collaboration of research teams in more than 60 countries. Usually, the NTA for each country are compiled by country-specific research groups. However, European members of the NTA project joined forces to launch the AGENTA project, which aims to explain past developments and to forecast future trends in taxes and public transfers in light of the demographic changes in the European Union. A primary goal of the project has been to set up gender-specific NTAs for all EU countries using publicly available and harmonised data from Eurostat. The European NTA 2010 data provide comprehensive and detailed age- and gender-specific economic data on income, transfers, consumption, and savings. A detailed description of the European NTA and NTTA data is found in Istenič et al. (2016) and Vargha et al. (2016). The data can be accessed at www.wittgensteincentre.org/ntadata (see the Appendix).

2 European National Transfer Accounts (NTA) 2010

European National Transfer Accounts (NTA) for 2010 have been set up for 25 EU countries. NTA could not be created for Croatia, Malta, or the Netherlands because of missing data.

Three distinct steps are distinguished in the calculation of NTAs. The first step is to derive the values of income, transfers, consumption, and savings for the total economy from the European System of Accounts (ESA) and related sources. The second step is to calculate the age- and gender-specific averages of different economic categories using survey and/or administrative data. We use EU Statistics on Income and Living Conditions (EU-SILC) as the main survey data source for estimating income-related variables, and Household Budget Survey (HBS) data for creating private consumption age profiles. As the unit of analysis in NTA is an individual, we use survey data reported at the individual level whenever possible. Administrative data sources are primarily used to calculate flows mediated by the public sector. The third step involved in compiling NTA consists of estimating the intra-household transfers (i.e., transfers flowing within the same household). NTA rely on the indirect estimation of intra-household transfers, because these transfers are not captured in National Accounts or survey data. The European NTA Manual (Istenič et al. 2016) describes the steps, procedures, and assumptions used in obtaining the NTA results, which can be downloaded at . In the following, we review the main methodology and the data sources used in compiling the European NTA data.

NTA measure the reallocation of resources between age groups. In the NTA context, the term "life-cycle deficit" (LCD) is used to refer to the difference between the age-specific averages of consumption and labour income. Children and elderly individuals have a positive LCD, as their consumption exceeds their labour income. The working-age population has a life-cycle surplus, as their labour income exceeds their consumption. The NTA accounting identity states that the LCD equals the sum of net transfers plus asset income less savings. Asset income less savings are usually combined to form a single component, called asset-based reallocations. Net transfers are defined as the difference between transfer inflows and transfer outflows.

2.1 Labour income

Labour income makes up the largest share of aggregate income, and varies considerably by age. It includes employee compensation (combined with the employer's social contributions) and the returns to labour of self-employed workers. The latter are assumed to account for two-thirds of mixed income. The gender-specific age profiles for labour income are estimated using EU-SILC survey data, in which each worker's wages, self-employment income, and employer-provided social contributions are reported separately for each individual. For most EU member states, the income is recorded for the calendar year preceding the interview. Thus, to

estimate the income-related variables for the year 2010, we use data from EU-SILC 2011, in which the variable age is reported at the end of the income reference period (i.e., for the year 2010).

2.2 Consumption

Consumption is separated into private and public consumption. Both private and public consumption are further divided into education, health, and other forms of private or public consumption. These distinctions are motivated by the huge age-specific variation in these components. The private consumption aggregate controls are calculated using the ESA 2010 and consumption expenditure by the Classification of Individual Consumption by Purpose (COICOP). For public consumption, data on expenditure according to the Classification of the Functions of Government (COFOG) are used to calculate the aggregate values of the public consumption subcategories.

The gender-specific age profiles for private consumption are mainly based on the HBS survey data, with the reference year of 2010. The HBS includes the main characteristics for all the household members, but the data on consumption expenditures are collected at the household level only. Therefore, the allocation rules are used to allocate consumption among the household members. Private consumption other than for education and health is allocated within households using the ad-hoc allocation rule, based on the modified Deaton's (1997) equivalence scale. This rule assumes that people aged 20 or older have the same consumption share, which is set to one. For children younger than age four, a consumption share of 0.4 of that of an adult is assumed. For children between the ages of four and 20, the consumption share increases linearly from 0.4 to 1.0 of the consumption of an adult.

The age allocation of private health consumption within a household is based on an equivalence scale estimated with a regression function. The equivalence scale of health consumption is calculated by regressing the health expenditures of a household on the number of household members of a specific age group. As treating each age group from zero to 80+ separately would mean losing too many degrees of freedom, 10-year age groups are used. The regression coefficient is equal for all individuals of the same age group, and is used as a share when allocating total household expenditures on health to individual members.

To allocate household expenditures on education among the household members, we combine data on level-specific expenditures with the information on the level of education in which an individual is enrolled. To do so, we assume that the unit costs are equal for all household members enrolled in a specific level of education, regardless of age.

The age profiles for public consumption are estimated by distinguishing between individual public consumption and collective public consumption. Collective public consumption includes consumption of public goods such as national security, public

administration, public infrastructure, and street lighting. These components are allocated equally to all individuals in all of the age groups. Like private consumption, public consumption is divided into three main categories: education, health, and areas other than education and health.

To create the age profile of public education consumption, we allocate total public education expenditures among the different educational levels and combine these data with enrolment data; disaggregated by age and level. We distinguish the educational levels using the International Standard Classification of Education (ISCED). As in the case of private education consumption, the underlying assumption is that the unit cost of public education is equal for all students enrolled at a specific level, regardless of age.

There is no administrative data source that offers comparable data on public health expenditures for all EU countries. Therefore, we use the pre-calculated age profiles of health care consumption for one-year age groups from the Ageing Working Group (AWG) to estimate the public health consumption age profiles. We take the profiles from the AWG report 2012 (European Commission 2012) and adjust them to the country-specific macro controls for 2010.

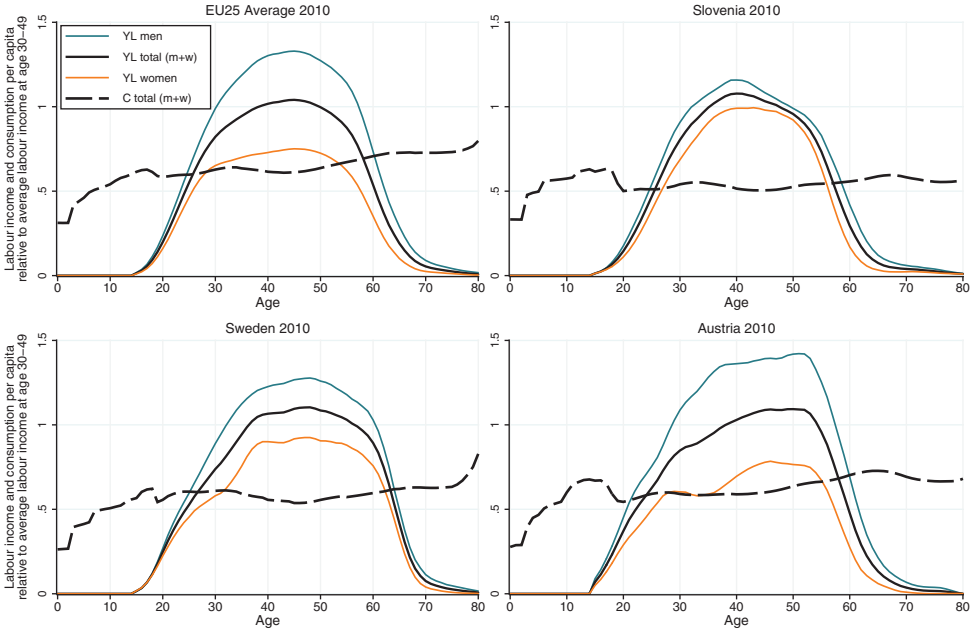
Next, we assume that the COFOG categories "old age" and "sickness and disability" have the same distributions as publicly financed long-term care; also based on AWG data. By contrast, "unemployment", "family and children", and "housing" public consumption age profiles are calculated by taking the age profiles of the corresponding cash categories of public transfer inflows, as explained below.

In Figure 1, we present gender-specific labour income and total consumption age profiles. To enable us to compare the results across the countries, the data are presented relative to the average labour income of individuals between the ages of 30 and 49. The generation of labour income (YL) is concentrated at ages 20–60, albeit with considerable differences between men and women in most of the countries. The gender differences are mainly attributable to differences in the participation rates of men and women, as well as to the gender pay gap. Whereas the labour income age profile has a typical inverted U-shaped curve, the consumption (C) profile is rather stable across ages – with the exception of a peak around age 15 due to high levels of consumption of public education, and another peak in old age due to high levels of consumption of public health services. Figure 1 also shows that the gender patterns differ markedly across countries. For example, in Slovenia, women generate almost the same average labour income as men; while in Austria, women generate only about one-third of total labour income, as the large differences in the labour income levels for men and women in that country clearly illustrate.

2.3 Public transfers

Public transfer inflows refer to the flows that are mediated by the government, including both in-kind and in-cash transfers received by individuals. By definition, public transfers in kind are equal to the public consumption explained above.

Figure 1:
Age- and gender-specific labour income and consumption, EU25 average, Slovenia, Sweden and Austria, 2010

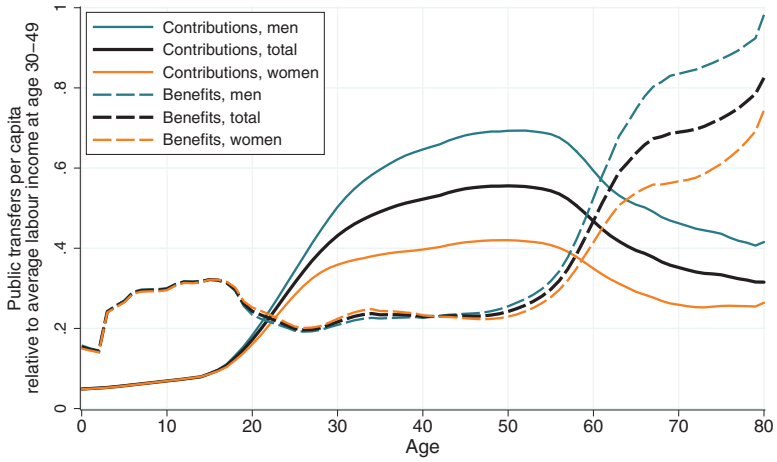


Source: Istenič et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

Public transfer inflows in cash include monetary transfers from the government to individuals, such as public pensions. Public transfers are divided by function into the three subcategories: education, health, and pensions. The remaining types of in-kind and in-cash public transfers (not disaggregated into the subcategories) are aggregated into one category of other in-kind and other in-cash transfer inflows. This category includes transfers related to unemployment, family and children, housing, and other benefit programs.

The aggregate values of public transfer inflows in cash by purpose are based on data from the ESA 2010 and the European System of Integrated Social Protection Statistics (ESSPROS). Public transfers in cash are direct payments from the government to individuals, and are therefore reported in the survey data. Whereas sickness, disability, old age, survivors', and unemployment benefits are reported at the individual level in the EU-SILC, family and child benefits and housing benefits are reported at the household level, and are therefore distributed among the household members. The family- and child-related allowances are assigned to all adults in the household, whereas the housing allowances are assigned to the household head only.

Figure 2:
Age- and gender-specific public transfer inflows (benefits) and public transfer outflows (contributions), EU25 average, 2010



Source: Istenič et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

Public transfer outflows measure the flows of economic resources from the private sector (individuals or firms) to the public sector. They are used to finance public transfer benefits, public asset income (if negative; e.g., interest on public debt), or public savings. Public transfer outflows consist of taxes, social contributions, and other revenues paid to the government. In the NTA, public transfer outflows are distinguished by their source; i.e., the activity that is being taxed. We thus distinguish between taxes on asset income, labour income, and consumption; and between social contributions paid by pensioners and social contributions paid by employers and employees. The aggregate controls for public transfer outflows are estimated based on the Eurostat data on "Structure of taxes by economic function". The age patterns of these categories come from the age profiles of taxed economic activities. For example, the age profile of taxes on labour income is based on the labour income age profile, and the age profile of taxes on the consumption of goods and services is based on the private consumption age profile.

Figure 2 shows the age- and gender-specific public transfer inflows and outflows for the EU-25 countries. The results are again normalized (i.e., presented relative to the average labour income for ages 30–49). At young ages, the total public inflows closely follow the age pattern of in-kind public inflows (with the prevailing component being education). At working ages, the public transfer inflows are mostly in the form of collective consumption, and are therefore rather constant. At old ages, the public transfer inflows are especially high, and include in-cash transfers in the form of pensions, as well in-kind transfers in the form of health and long-term care.

The shapes of the age profiles of public transfer inflows and outflows differ greatly, as the ages of the main beneficiaries of public transfers differ from the ages of most taxpayers and payers of social contributions. The age profile of total public transfer outflows increases rapidly starting around the age of 20, when young adults are entering the labour market. The peak is observed at prime ages, when the public outflows are high due to social security contributions and payroll and workforce taxes. The public outflows at young ages are mainly in the form of taxes on the consumption of goods and services. At old ages, the public outflows are largely in the form of taxes on the consumption of goods and services, taxes on asset income, as well as taxes and social contributions paid on pension benefit. As the transfer outflows are higher for men than for women, men tend to receive higher transfer inflows, mostly in the form of pensions, at higher ages.

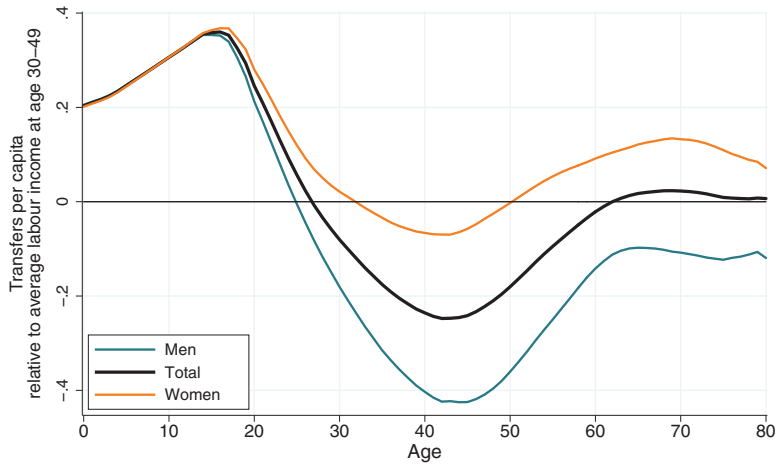
Net transfers are defined as the difference between transfer inflows and transfer outflows, and are positive at young and old ages, when individuals are net dependents on private and public transfers. By contrast, at working ages, individuals are net supporters of both public and private transfers. In the following, we present the methodological framework for constructing private transfer age profiles.

2.4 Private transfers

Private transfers include transfers between households (inter-household transfers) and transfers within households (intra-household transfers). The NTA private transfers refer to *inter vivos* transfers, and thus exclude capital transfers such as bequests. Inter-household private transfers include direct transfers between households (e.g., alimony payments and gifts) as well as indirect household transfers mediated by the non-profit institutions serving households (e.g., donations). At the aggregate level, the difference between inter-household transfer inflows and outflows is defined as the net private transfers from the rest of the world (ROW). The age profiles of inter-household transfers are based on the EU-SILC data. As there are no available survey data on the transfers received or given at the individual level, we assume that all of the inter-household transfer inflows flow to the household head, and that all of the inter-household transfer outflows flow from the household head.

Among the main contributions of the NTA methodology are the estimates of intra-household private transfers**.** The aggregate value of net intra-household private transfers equals zero, as intra-household transfers represent transfers within the same household. Therefore, at the aggregate level, the intra-household transfer inflows equal the intra-household transfer outflows. As there are no micro-data on intra-household transfers, we estimate them indirectly using the household structure from the EU-SILC and the age profiles that have already been calculated. In general, intra-household transfers represent the difference between age-specific disposable income and age-specific consumption. The household member whose consumption exceeds his/her disposable income is in deficit, and has to receive transfers from other household members who have a surplus. If the total deficit of all of the

Figure 3:
Age-specific private transfers, EU25 average, 2010



Source: Istenič et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

household members exceeds the household's total surplus, the household head has to finance this gap through asset-based reallocations; for example, by borrowing assets.

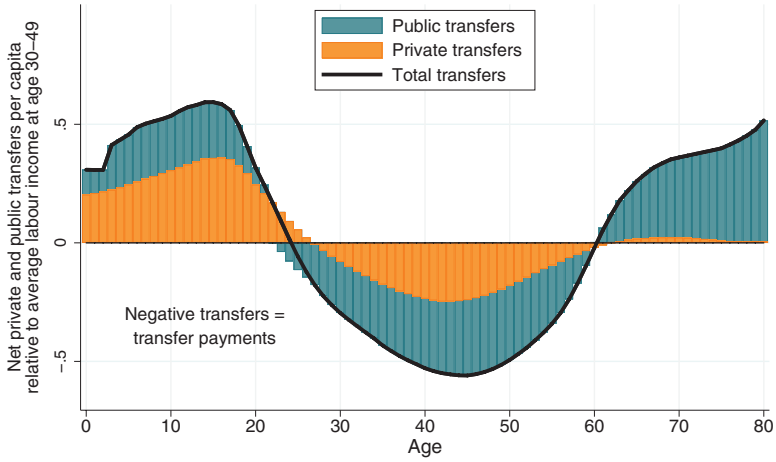
Figure 3 shows private transfer patterns by age and gender. The main direction of private transfers is from parents to their children. Net private transfers to and from the elderly population are close to zero. In all of the adult age groups we observe transfers from men to women. As we will see in the next section, women tend to focus on unpaid work, while men tend to specialise in paid work. A man may compensate his female partner for her "unpaid" work via intra-household transfers.

Figure 4 combines public and private transfers. Children finance their life cycle deficit through private transfers from their parents and through public transfers, such as publicly provided education. For elderly individuals, private transfers play a negligible role. Older people are the main recipients of public transfers, primarily in the form of pensions.

2.5 Asset-based reallocations

The LCD that is not covered by transfers is financed by asset-based reallocations (ABR). ABR are calculated as asset income (the sum of capital and property income) less savings. Individuals with asset income have an inflow that can be used for consumption or transfers in the accounting period. Dissaving (negative savings) has the same effect, and increases individuals' consumption or transfer payments in the accounting period.

Figure 4:
Age-specific net public and private transfers, EU25 average, 2010



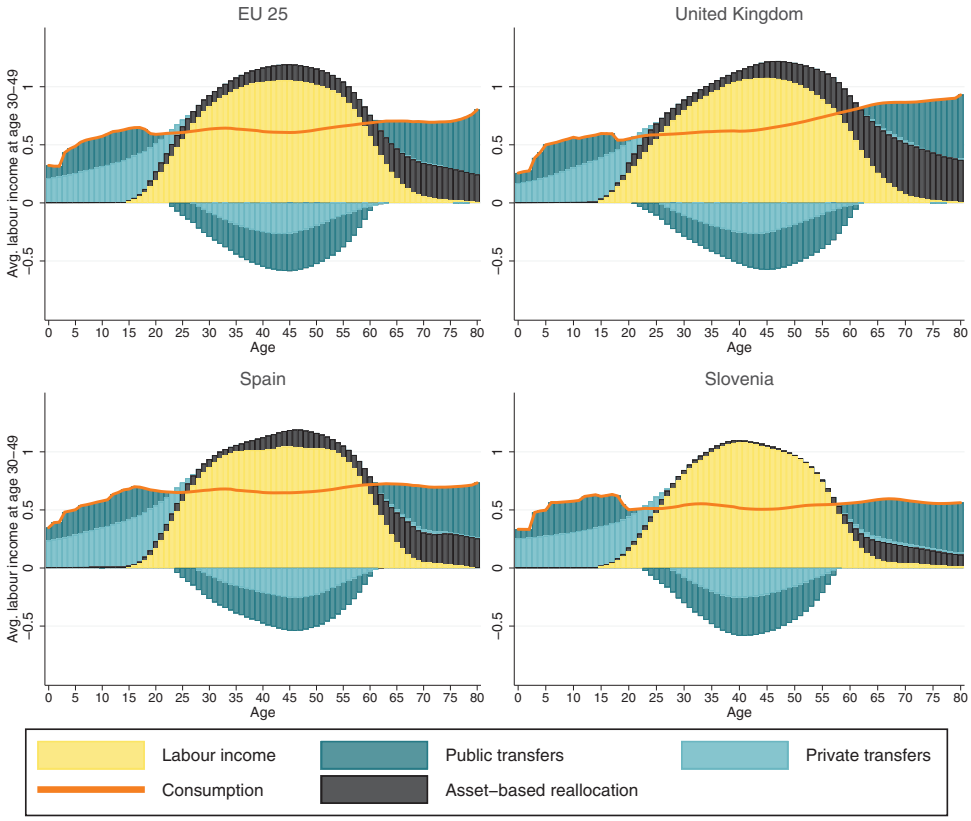
Source: Istenič et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

Public ABR equal the public transfer deficit or surplus. A public transfer deficit is generated when the taxes, social contributions, and other current transfers paid by the residents are not sufficient to cover the public transfer inflows to the residents and the net public transfers to the ROW. The government therefore has to cover the public transfer deficit through positive ABR (i.e., issuing new debt). When the transfers received by the government are high enough to cover its expenses, a transfer surplus is generated. To compile the age profiles of public asset income and public savings, we use the age profile of public transfer outflows (generated as the sum of taxes, social contributions, and other government revenues). The logic behind this assumption is that taxpayers are defined as those individuals whose payments cover the public deficit, or who benefit from the surplus.

Private ABR include the net operating surplus of households and corporations, the capital share of mixed income, and taxes less subsidies on capital income. They also include property income, such as income from interest, dividends, and rents. For the age profiles of the capital income of corporations and the property income, we use the age averages of asset income variables reported in EU-SILC. For the income from owner-occupied housing, we use the age profile of imputed rents. Finally, for the unincorporated enterprise income, we take the age profile of earnings from self-employment.

Figure 5 gives an overview of the main NTA components. The yellow area represents labour income, while the orange line represents consumption. The difference between labour income and consumption in childhood and in old age is financed by transfers and by ABR. Likewise, the surplus of labour income over

Figure 5:
Labour income, consumption, transfers and asset-based reallocations, 2010

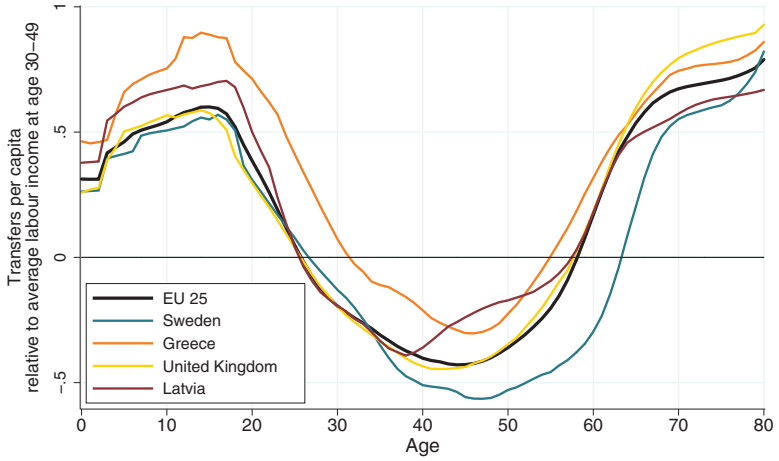


Source: Istenič et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

consumption at working ages is used for transfers or ABR. The figures for the UK, Spain, and Slovenia show the differences between countries in the relative importance of assets for old-age provision. In the UK, a large share of the LCD is covered by private ABR, while in Slovenia, this share is extremely small.

Figure 6 shows the age profiles of the LCD that equal the total reallocations received or paid by an average individual of a specific age group. The term total reallocations refers to the sum of net transfers and ABR. Countries are selected based on their geographical positions and institutional characteristics. The country with the shortest period in which individuals are net supporters is Greece, as, on average, labour income in that country exceeds consumption only between ages 32 and 54. The prolonged period of dependency among young people in Greece is enabled by high net private transfers. In Sweden, by contrast, the average period of time people stay in the labour market is five years longer than it is in most

Figure 6:
Life cycle deficit, 2010



Source: Istenič et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

other EU countries. Thus, workers in Sweden are able to support the young and the elderly over a longer age span than their counterparts in any other EU country; i.e., between the ages of 27 and 63. Moreover, while public pensions are modest relative to the average labour income in Latvia, they are high relative to the average labour income in Greece. The large net transfers received by the elderly in the UK are mainly the result of high levels of public health consumption, whereas the hump at the highest ages in Sweden is mainly attributable to the generous long-term care benefits Swedish individuals receive.

3 Measuring transfers through unpaid household work: National Time Transfer Accounts

Services provided to other household members, such as care, cooking, shopping, and cleaning, represent a large share of production and intergenerational transfers. Household satellite accounts extend the measures of national income by providing the value of services produced by households for their own consumption. Production in the household is not recorded in official statistics or by surveys, and there is no market mechanism that values it. Therefore, the output of unpaid household production is usually measured by valuing time as the most important input in household production. NTTA incorporate age, intergenerational transfers, and consumption of services produced by unpaid work into the Household Satellite Accounts framework (Donehower 2019). Thus, NTTA extend the basic NTA framework by adding

age- and gender-specific estimates of production, transfers, and consumption of services produced by unpaid work. Because the bulk of household production is carried out by women, and because it is not included in national accounts, these calculations are crucial to making women's total economic contribution and the resources flowing to children more visible.

The main steps involved in estimating NTTA are (1) measuring the time spent on household production activities in time use surveys; (2) finding appropriate wages to impute the value of the time spent on the chosen activities; and (3) estimating consumption of household labour by allocating the goods and services produced through unpaid work to the members of the household.

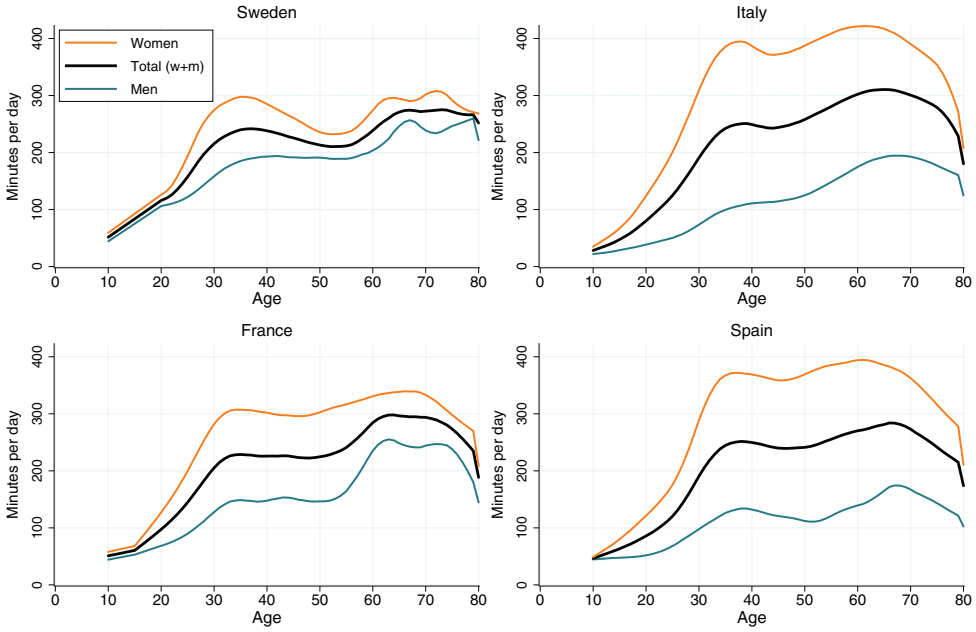
Based on two publicly available European harmonised sources of data – the Harmonised European Time Use Survey (HETUS) Web Application and the Multinational Time Use Study (MTUS) – we compiled a comparative dataset on National Time Transfer Accounts (NTTA). For 14 EU countries, the age profiles are calculated based on the HETUS data. NTTA for three more countries are based on MTUS data. Our dataset comprises cross-sectional harmonized comparative European NTTA age profiles for 17 European countries representing about 84 per cent of the population of the European Union. For selected European countries we also provide historical NTTA data. To obtain NTTA age profiles in monetary terms we also introduce the pricing of household production.

We use the advantage of HETUS, where activities and other important variables are already standardized. However, the HETUS data enables users to calculate user defined statistical tables, but it is not a micro-database *per se*. To estimate the consumption of household labour requires the use of additional assumptions and thus a bit modified Donehower's (2019) methodology. The European NTTA Manual (Vargha et al. 2016) describes the steps, procedures and assumptions applied in creating the NTTA results and can be downloaded at http://www.agenta-project.eu/Jacomo/upload/publications/d-2.3-submitted.pdf.

3.1 Household production

The activities included in the household production are selected based on the third-person principle, presenting those activities that can be done by a third person on behalf of the respondent. Such activities are cleaning, cooking, caring etc. For those countries for which results are based on HETUS data three different age profiles of household production are estimated: general housework, childcare and inter-household labour. General housework includes all the household production activities except childcare, while inter-household labour includes household activities carried out for other households, such as caring a person living in another household. For those countries for which results are based on MTUS data, we separately estimate the age profiles of general housework and childcare only, as inter-household production is not reported separately in the MTUS data, but already included in the household and childcare variables.

Figure 7:
Age- and gender-specific time spent on household production, Sweden, Italy, France and Spain, early 2000s

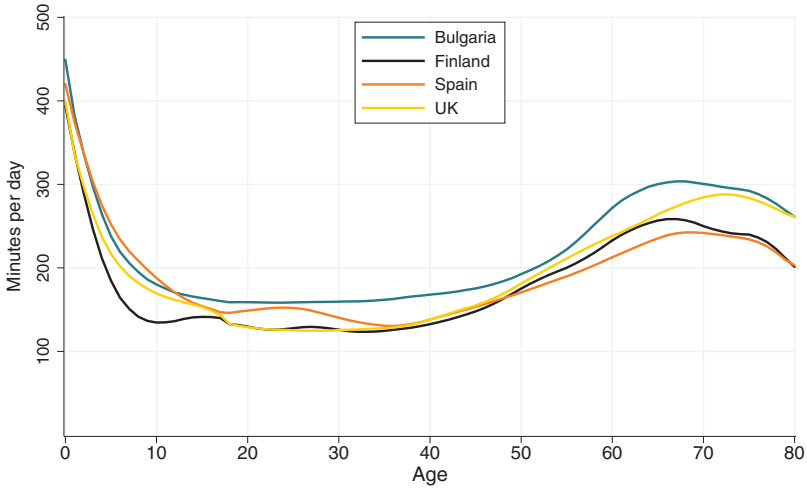


Source: Vargha et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

After selecting the appropriate household activities in HETUS, the age- and gender-specific time spent on each activity during an average day can be directly retrieved from the HETUS dataset. When using MTUS data the gender-specific age profiles are estimated as age- and gender-specific averages of time spent on different household activities reported in the survey data. While the MTUS does not include information on the time spent on different activities for children under age 10, we can assume that these young children do not perform household activities. Even though the purpose of the NTTA is to estimate household production, the AGENTA Data Explorer also includes the time spent on other household activities, such as on paid work, education, leisure, and personal care.

Figure 7 shows the gender-specific age profiles of unpaid household work for four selected countries. We can see that in all of the countries, women devote considerably more time than men to unpaid household work, but that the gender differences vary greatly across the countries. For example, the differences are relatively small in Sweden, are relatively large in Italy and Spain, and are of moderate size in France. The average amount of time devoted to unpaid work peaks at childbearing ages (between ages 30 and 40), as people spend more time on child

Figure 8:
Age-specific consumption of household labour, selected EU countries, early 2000s



Source: Vargha et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

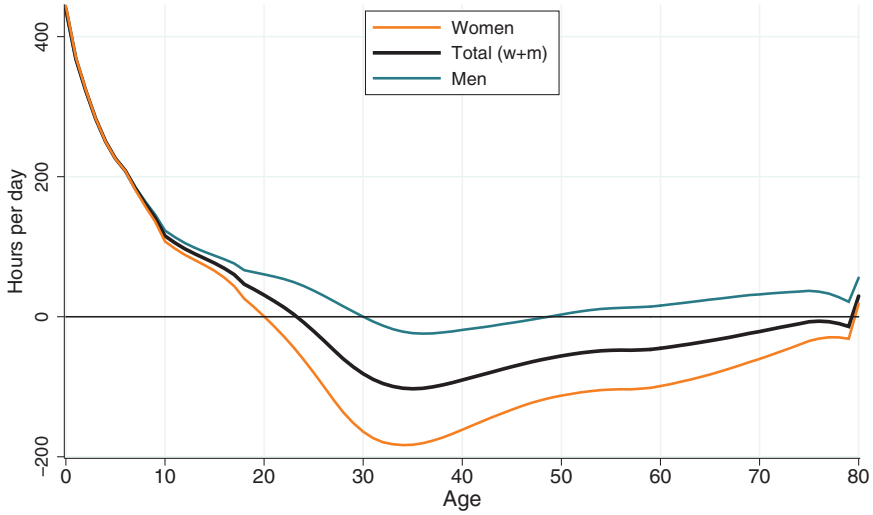
care; and increases again at younger retirement ages, as people spend more time on household work.

3.2 Consumption age profile

The main contribution of the NTTA is that they allow for the estimation of the consumption of the goods and services produced through unpaid household labour. Because there are no survey data on the amounts of goods and services consumed that are generated by unpaid household labour, we need to allocate the goods and services produced using different allocation rules. We assume that all the household production, with exception of care, is consumed equally among the household members; and that care is distributed among the household members by age. Child care is consumed only by children. When there is only one child in the household, the allocation is straightforward. If there is more than one child in the household, the equivalence scale is used to allocate child care among the children. The equivalence scale is country-specific, and is generally based on the age of the youngest child living in the household. In the equivalence scale, the weights used to allocate child care within the household typically decrease by age, but depend on the number and the ages of the children. We assume that the equivalence scale is the same for both genders.

Figure 8 shows the age profiles of consumption of unpaid household work in four selected countries. In all of the countries, consumption levels are lowest during the

Figure 9:
Daily per capita net time transfers by age and gender in hours in 14 European countries in early 2000s



Source: Vargha et al. 2016 (retrieved from www.wittgensteincentre.org/ntadata).

prime ages, and are highest for new-borns. A peak is observed at young ages due to high levels of child care consumption, and again at retirement ages due to high levels of housework consumption (cleaning, cooking etc.). Bulgaria has the highest consumption levels at almost all ages. In Spain, consumption levels are relatively high at young ages, but are relatively low at older ages. This pattern is reversed in the UK. Among the selected countries, children consume the least amount of child care in Finland.

3.3 Age profile of time transfers

Time transfers in NTTA are a non-market counterpart of the LCD in the NTA dataset. They are defined as the difference between age-specific consumption and production of unpaid household work. The negative net transfers of unpaid household labour show the number of minutes of household labour that an individual transfers to other individuals (usually to the other household members). Thus, these transfers reflect the minutes an individual spends on household production that are not consumed by the individual him/herself. Figure 9 reveals that children and the elderly are net receivers of time transfers, whereas working-age individuals are net givers of time transfers. Since the level of household production is higher for women than for men,

while levels of consumption are similar for men and women, in all of the countries, women are net givers of time transfers for a longer age span.

3.4 Pricing household labour

Another aim of the NTTA is to provide the monetary values of home production to allow for a direct comparison between the NTA and the NTTA estimates. The time spent on different economic activities is converted into monetary values using the input approach. Thus, we assign to different household activities the wages workers would receive for performing those activities on the market. These "specialist replacement wages" apply to different occupations and are country-specific. The wage levels are based on the 2002 wave of the structural statistics on earnings (SES). In the MTUS data, for which the estimated NTTA results go back to the 1970s, wage data from the "World Bank's World Development Report 2013: Occupational wages around the world" are used.

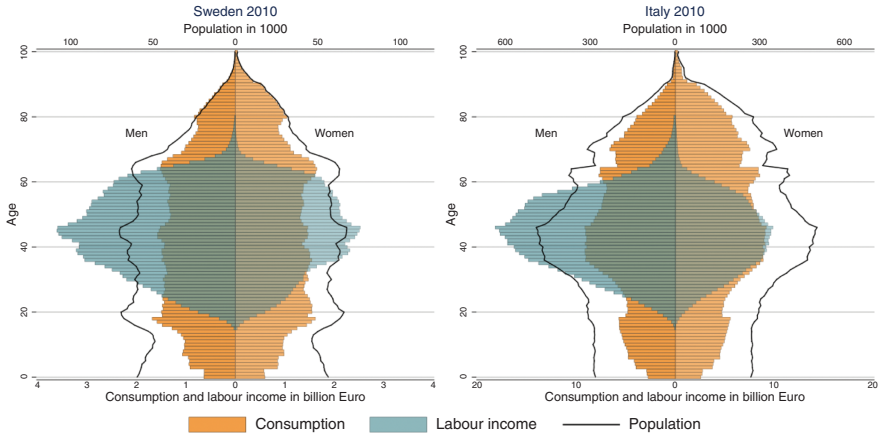
4 Economic population pyramids

The European NTA data can be used to visualise the relationship between age- and gender-specific economic behaviour, the demographic structure of the population, and the macro-economy. Economic population pyramids show the distribution of economic quantities by age groups and by gender. They reflect the size of the population, as well as the differences in economic behaviour across age groups and genders. Such population pyramids can be plotted using the data explorer at www.wittgensteincentre.org/ntadata.

Figure 10 shows an economic population pyramid for Sweden and Italy using consumption and labour income. To highlight the underlying age structure, the black line represents the shape of the demographic population pyramid. We can see that Italy has a pronounced baby boom at ages 40–45, while the population structure in Sweden is more balanced. The figure also shows that baby boomers generate a large share of total labour income in Italy, and that women are much more likely to be engaged in paid work in Sweden than in Italy. Because the retirement age is higher in Sweden than in other countries, the Swedish population aged 60+ contributes a much larger share of total labour income than their counterparts elsewhere.

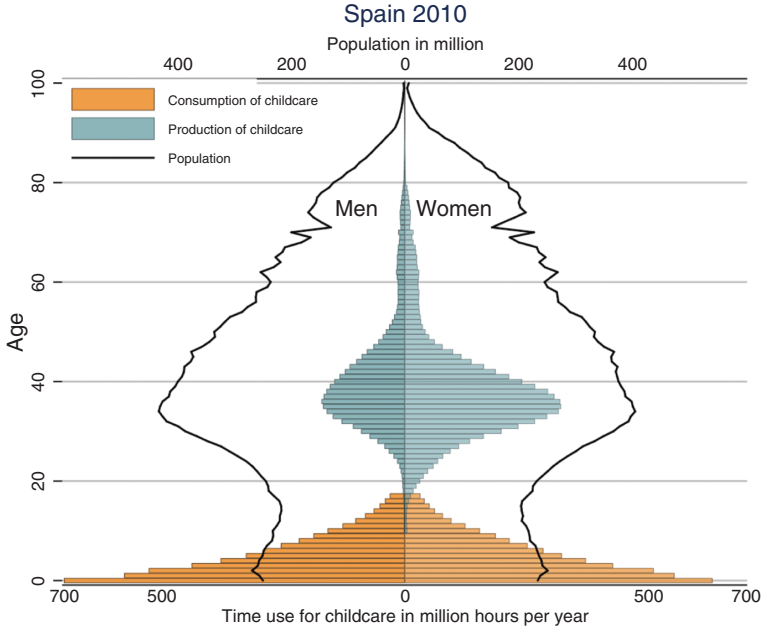
Figure 11 shows the production and consumption of child care in Spain 2010 in terms of time. Children consume most of the child care they receive in their first years of life. Child care is mainly provided by the parents, most of whom are in the 30–40 age group. While women are less involved in paid work than men, they provide a much larger share of child care than men.

Figure 10:
Consumption and labour income by age and gender in Sweden and Italy 2010



Source: www.wittgensteincentre.org/ntadata and Eurostat population data.

Figure 11:
Production and consumption of childcare by age and gender in Spain 2010



Source: www.wittgensteincentre.org/ntadata and Eurostat population data.

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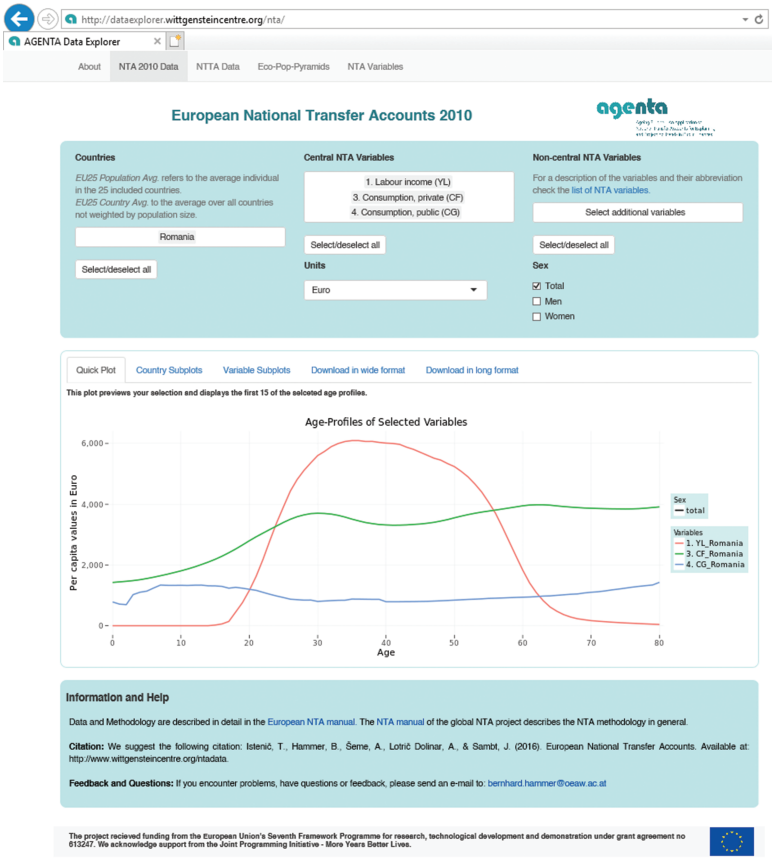
Appendix

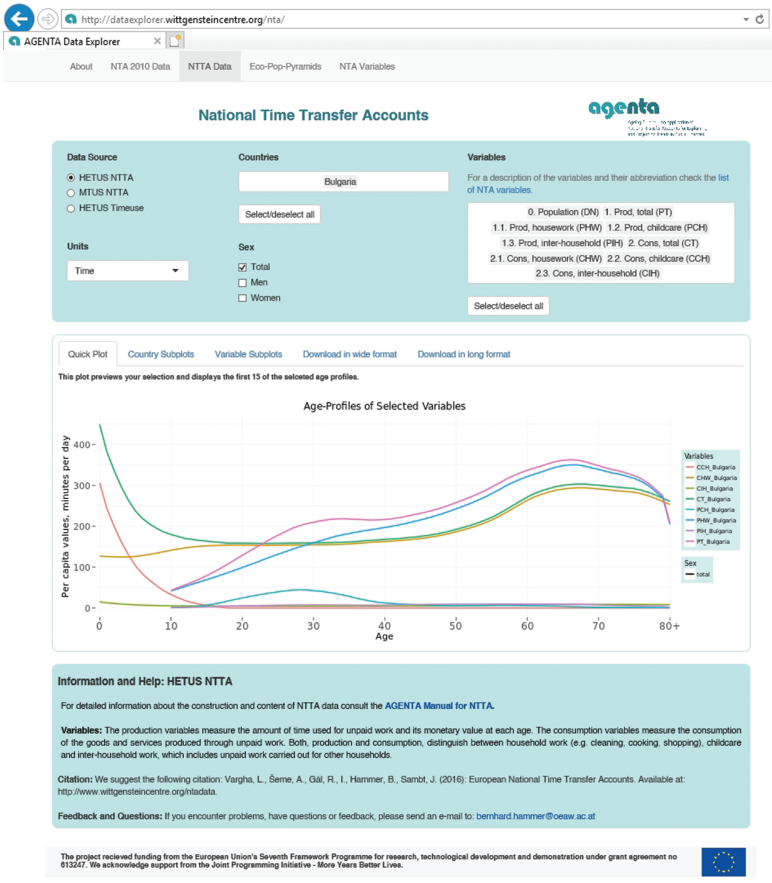
The European NTA 2010 data provide comprehensive and detailed age- and gender-specific economic data on income, transfers, consumption and saving in the year 2010 for 25 EU countries. These data are predestined to study the relationship between age, economic activity and the organization of intergenerational transfers. Explore and download European NTA with the NTA 2010 data explorer (see Figure A.1) available at http://dataexplorer.wittgensteincentre.org/nta/.

Figure A.1:
The NTA Data Explorer



National Time Transfer Accounts (NTTA) include age- and gender-specific data on the production, consumption and transfers of services that are produced through unpaid work and not captured in National Accounts. European NTTA are based on time use data from the Harmonized European Time Use Survey (HETUS) and the Multinational Time Use Survey (MTUS). Explore and download European NTTA using NTTA data explorer (see Figure A.2) available at http://dataexplorer.wittgensteincentre.org/nta/.

Figure A.2:
The NTTA Data explorer



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