Population ageing and its economic consequences in EU countries: analysis based on National (Time) Transfer Accounts

Tanja Istenič

University of Ljubljana, School of Economics and Business

Address: Kardeljeva ploščad 17, 1000 Ljubljana, Slovenia

E-mail: tanja.istenic@ef.uni-lj.si

Abstract

In the coming decades, the European population will be older than ever before. Therefore, it is of great importance to measure and analyse the age decomposition of economic activities, such as income, transfers, consumption, and savings. The paper uses fully comparable results of National Transfers Accounts (NTA) for 25 EU countries in 2010 that are extended by including gender dimension as well as monetary values of unpaid household labour – i.e. the results of National Time Transfer Accounts (NTTA). Based on the combined NTA and NTTA data, we make a cross-country comparison of the effect of population ageing on the sustainability of the public finance systems; additionally, we propose possible strategies that could at least partially mitigate the effect of population ageing in the short term.

Key words: National Transfer Accounts, economic life cycle, public transfers, private transfers, European Union

Acknowledgment

This project has received funding from the European Union's Seventh Framework Programme for Research, Technological Development and Demonstration under grant agreement 613247. We also acknowledge that this project is based upon work from COST Action IS1409, supported by COST (European Cooperation in Science and Technology).

1 Introduction

Age is one of the main determinants of people's economic behaviour. Therefore, change in the population structure has numerous economic consequences that bring challenges but also opportunities for both private and public institutions. European countries are currently facing severe changes in their population age structure. According to the current population projections, the proportion of the European Union's (EU) population aged 20–64 is expected to decrease from 60.0% in 2016 to 51.9% in 2050. In the same period, the proportion of the population aged 65+ is expected to increase from 19.2% to 28.1%, whereas the proportion of the population aged 0–19 is projected to be fairly stable over the period (at approximately 20.0%) (Eurostat, 2016).

The aggregate economic data, such as the System of National Accounts (SNA) data, includes limited information about age-specific economic categories such as income, transfers, consumption, and savings. The lack of information on age-specific economic activities profoundly limits our understanding of the economic consequences of population ageing, as well as the interactions between private and public systems in the reallocation of income among age groups (United Nations, 2013).

Intergenerational transfers (i.e. transmission of goods and services among members of different generations) strongly influence the development and well-being of individuals in all societies. During their lives, individuals go through two periods of economic dependency: when they are young and when they are old. In these two stages, an individual's consumption exceeds his or her labour income. To cover this excess of consumption, dependent individuals rely on the working-age population, which earns more than it consumes and faces a period of economic independence. The gap between consumption and labour income is possible only because different institutions – families, governments, and markets – play the role of intermediaries in reallocating resources across different age groups. Familial transfers are crucial at young ages, especially those flowing from parents to their children. Furthermore, governments collect taxes from those of working age and support young and old individuals through publicly funded education, health care, pensions, etc. Moreover, financial markets enable individuals to accumulate assets at one age and spend those assets later in life (Lee & Mason, 2011).

In past decades, great progress in the modelling and estimating of intergenerational transfers has been made on both micro and macro levels (Mason, et al., 2006). Nevertheless, the majority of analyses remain partial. A huge step in measuring intergenerational transfers has been made by generational accounting researchers (e.g., Auerbach, Gokhale, & Kotlikoff, 1994; Kotlikoff & Summers, 1981; Leibfritz, Kotlikoff, & Auerbach, 1999). However, these authors focused only on economic flows through the public system. To deeply understand how a changed population structure affects societies, private transfers should be considered as well. Some researchers have recognised the importance of private transfers in the welfare provision for the dependent population (e.g., Albertini & Kohli, 2013; Albertini, Kohli, & Vogel, 2007; Attias-Donfut, Ogg, & Wolff, 2005), but they mainly focused on private intergenerational transfers. Only a few authors have connected public and private transfers (e.g. Brandt & Deindl,

2013, Mudrazija, 2016), but they focused only on specific age groups. To fully understand societies' arrangements of intergenerational reallocation of resources, flows among all age groups should be taken into account.

The National Transfer Accounts (NTA) were developed to better understand the economic consequences of population ageing and to provide a systematic and comprehensive analysis of the economic aspects of intergenerational relations. By introducing the age dimension into the SNA, the NTA helps to understand how individuals in different societies arrange their production, consumption, and reallocation of resources over their lifetimes. The NTA enables the measurement and analysis of age reallocations in a comprehensive manner by including private and public transfers and private and public asset-based reallocations (resulting from interactions with capital and financial markets).

In the past, ten research teams from EU countries provided full NTA results for their countries, but for different reference years and using different data sources, which to some extent limits the comparability of existing NTA results. This paper includes NTA results for 25 EU countries (all the EU member states except Croatia, the Netherlands, and Malta) that are estimated as comparably as possible by using the same micro- and macro-level data sources for the same reference year, 2010. Furthermore, to analyse the economic consequences of population ageing and possible solutions that would decrease the burden of population ageing on the sustainability of the public finance system in EU countries, we combine standard NTA estimates with those disaggregated by gender. The gender-specific NTA results are further combined with the results of National Time Transfer Accounts (NTTA) – the monetized values of unpaid household work. All the NTA and NTTA data, on which the analysis of this paper is based, is publically available through the Agenta project dataexplorer (http://dataexplorer. wittgensteincentre.org/nta/).

We start by presenting the design of the NTA and NTTA results used in this paper. Furthermore, we make a cross-country comparison of the age periods in which individuals are net supporters (i.e. their labour income exceeds consumption). Section 4 focuses on the size of the excess of consumption over the labour income for the elderly and the sources through which this gap is financed. The section presents the current economic situation, as well as projections for the future. In Section 5, we analyse the possibility of the increased labour market participation rate as a possible instrument for mitigating the effect of population ageing on the sustainability of the public finance system. In Section 6, we discuss the results and provide possible policy implications of the paper.

2 National (Time) Transfer Accounts data

2.1 National Transfer Accounts

The NTA methodology is briefly presented in the book *Population Ageing and Generational Economy*, edited by Lee and Mason (2011), which also includes results for 23 countries around the world. The methodology is presented in detail in the *National Transfer Accounts Manual*

(United Nations, 2013). The specifics of the European NTA are presented in the European NTA Manual (Istenič et al., 2017).

The NTA methodological framework is based on an individual's budget constraint, where inflows (i.e. labour income, asset income, and transfer inflows) at each age equal outflows (i.e. transfer outflows, consumption, and savings). By rearranging these terms, we get the NTA flow identity. The flow identity consists of the 'life cycle deficit' (LCD) that describes the difference between consumption and labour income. The LCD equals the sum of net transfers (defined as the difference between transfer inflows and transfer outflows) and asset-based reallocations (defined as the difference between asset income and savings). All the flows, compounding the flow identity, are further disaggregated into more detailed components and also, whenever applicable, disaggregated by sectors (i.e. into the public or private sector).

Analysing economic life cycle and the channels through which economic life cycle is financed requires the estimation of a large set of age profiles. The age profiles represent the age-specific weighted averages of the variables compounding the flow identity. To calculate age profiles, we first need to derive the macroeconomic aggregates, based on the European System of Accounts (ESA) and other related sources. In the second step, we calculate the age distribution of different economic categories, using survey and/or administrative data. The main survey data sources for constructing European NTA results are EU Statistics on Income and Living Conditions (EU-SILC) – for constructing income-related variables – and the Household Budget Survey (HBS) for constructing private consumption age profiles. Both surveys include harmonized data for European countries. Administrative data is mainly used to calculate the flows that are mediated by the public sector. In the final steps, the majority of the age profiles are smoothed using Friedman's SuperSmoother (Luedicke, 2015) and adjusted to match the macroeconomic aggregates.

2.1.1 Labour income, consumption, and economic life cycle

The labour income age profile includes gross earnings of employees (including employer's social contributions) as well as self-employment labour income. While macroeconomic aggregate for earnings can be directly estimated using ESA, national accounts data include only the value of gross mixed income, containing both the return to labour and return to capital of unincorporated enterprises. To estimate the aggregate value of the self-employment labour income, two-thirds of gross mixed income are used. The age profiles for labour income are estimated using EU-SILC survey data that includes information on wages, salaries, employers' social contributions, and self-employment income on the individual level. To estimate the income-related variables for the year 2010, we use EU-SILC 2011, where income is reported for the calendar year preceding the interview and variable age is reported at the end of the income reference period (i.e. for the year 2010).

The consumption as defined in the NTA includes private and public consumption, both further divided into education, health, and other private or public consumption. Because ESA does not include aggregate values of the subcategories of private and public consumption, Classification of Individual Consumption by Purpose (COICOP) is used to calculate macro controls for the

private consumption subcategories and Classification of the Functions of Government (COFOG) to calculate macro controls of the public consumption subcategories.

The private consumption age profiles are mainly based on the HBS 2010 survey data. Because data on private consumption expenditures are collected only at the household level, we need to use different allocation rules to allocate household expenditures among the household members. HBS includes detailed data about household expenditures on education. To allocate household expenditures on education among the household members, data on level-specific expenditures are combined with the educational enrolment data of the household members. To estimate age-specific private consumption on education, we therefore divide level-specific private expenditures of the household by the number of household members enrolled at a specific educational level. By doing this, we assume that the unit costs are equal for all household members enrolled at a specific level of education, independently of their age.

The age profile of private health consumption is estimated using a regression function, where we regress household health expenditures on the number of household members of a specific age group. Not to lose too many degrees of freedom, ten-year age groups are used. The regression coefficients are used as a weight for the allocation of total household expenditures for health among the individual members.

The private consumption other than education and health is allocated using the modified Deaton's (1997) equivalence scale. By using the equivalence scale, we assume that individuals aged 20+ have the same consumption share, equal to 1. For children below the age of 4, we assume that they consume 0.4 of the consumption of an adult. For children between ages 4 and 20, we assume a consumption share that increases linearly from 0.4 to 1.0 of the consumption of an adult.

Furthermore, to estimate the age profiles of public consumption, we use administrative data, government reports, etc. We distribute government consumption among those individuals who are beneficiaries of a specific public programme. Like private consumption, public consumption is also divided into three main subcategories: education, health, and other public consumption.

To estimate the age profile of public education consumption, we first divide total public education expenditures among different levels of education. The age profiles are then calculated by combining the data on level-specific expenditures and the data on age- and level-specific enrolment rates. As in the case of private consumption on education, we assume that the unit cost of education is equal for all students enrolled at a specific level, independently of their age.

Because there is no administrative data source with comparable data on public health expenditures for all EU countries, the age profiles of public health consumption are calculated based on the pre-calculated age profiles of health care consumption received from the Ageing Working Group (AWG). The age profiles are generally estimated by using the AWG report from 2012 (European Commission, 2012) and are further adjusted to match the country-specific macroeconomic aggregate for 2010.

Other public consumption consists of two categories: individual and collective consumption. Public collective consumption includes consumption of public goods, such as public defence, street lighting, etc., and is allocated equally among all individuals, regardless of their age. On the other hand, whenever possible, we treat public consumption as individual and distribute it by age. To do so, we assume that 'old age' and 'sickness and disability' benefits have the same distribution as publically financed long-term care (also based on AWG data). Next, we assume that 'unemployment', 'family and children', and 'housing' benefits are distributed in the same way as the corresponding public transfer inflows in cash, further explained below. Finally, we estimate the life cycle deficit as the difference between age-specific (public and private) consumption and age-specific labour income.

2.1.2 Public reallocations

Net public transfers present the difference between public transfer inflows and public transfer outflows. Public transfer inflows consists of in-kind and in-cash transfers received by individuals from the government. Public transfer inflows in kind equal public consumption explained above, whereas public transfer inflows in cash are monetary transfers received from the government (e.g. public pensions, unemployment benefits, etc.). Because public transfers in cash are direct payments to individuals, they are reported in the EU-SILC survey data mainly at the individual level. Family and children and housing benefits are exceptions, given only at the household level. We assign family and children benefits to all the adults within the household and housing benefits to the head of the household.

Public transfer outflows mainly consist of taxes and social contributions paid by the private sector (individuals or firms) to the government. We distinguish public transfer outflows by their source (i.e. the activity that is being taxed). Specifically, we distinguish among taxes on asset income, taxes on labour income, taxes on consumption, social contributions paid by pensioners, and social contributions paid by employers and employees. The age profiles of public transfer outflows are based on the pre-calculated NTA age profiles; 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 consumption is based on the age profile of private consumption.

Whenever taxes, social contributions, and other current transfers paid by individuals and firms are not enough to cover public transfer inflows (including net public transfers to the rest of the world), a public transfer deficit is generated, and *vice versa*, a public transfer surplus. The government covers the public transfer deficit through positive asset-based reallocations (ABR), for example by issuing public debt. Public ABR therefore equal the public transfer deficit or public transfer surplus and further present the difference between public asset income and public savings. The age profiles of public asset income and public savings are based on the age profile of public transfer outflows.

2.1.3 Private reallocations

Private ABR also consist of two flows, asset income and savings. Asset income includes capital and property income. The age profiles of capital and property income are based on the EU-SILC survey data; however, as reported only at the household level, we assume that all the asset

income is received by the household head. Private savings are estimated as a residual component of the individual's flow identity.

Private transfers include inter-household transfers (i.e. transfers between households) and intra-household transfers (i.e. transfers within households). Inter-household private transfers are direct transfers between households, such as alimony payments and gifts, reported in the EU-SILC survey data. Because survey data include transfers received or given at the household level only, it is assumed that all the inter-household transfer inflows/outflows flow to/from the household head.

The intra-household transfers equal zero at the aggregate level, because these flows are happening within the same household. However, there is a huge age variation of intra-household transfers. The intra-household transfers are estimated indirectly using the household structure from the EU-SILC and the previously calculated age profiles. To estimate intra-household transfers, we assume that a household member whose private consumption exceeds his or her disposable income is in deficit and has to receive transfers from other household members who face the surplus. If the total deficit of the household exceeds the total household's surplus, the household head has to finance the gap by, for example, borrowing assets.

2.1.4 Gender disaggregation

The gender-specific NTA results are estimated in a similar way to those of the standard NTA. The procedures are based on the method of Donehower (2014). When we use the survey data, the only difference is that we need to calculate age- and gender-specific averages, instead of only age-specific averages. Furthermore, to calculate public expenditures on education, we use age- and gender-specific enrolment rates. The data on public health expenditures, which we received from the AWG, are also disaggregated by gender. Finally, we adjust the gender-specific age profiles so that they match the standard NTA age profiles. Even though we have estimated publicly available NTA results by gender for all 25 countries, in this paper, we use the data for only 14 countries, for which fully comparable NTTA results are estimated as well.

2.2 National Time Transfer Accounts

The market approach of estimating economic flows is clearly important and provides answers to many questions regarding population ageing and its economic consequences. However, whenever we include the gender dimension into the analysis, we should be cautious, because the SNA and consequently the NTA do not include the value of unpaid household work. Because women are still the main providers of unpaid household work (Miranda, 2011), the market approach gives a puzzling picture of gender differences in production and other contributing activities to household members' welfare (e.g. caring for children, cleaning, cooking, etc.). To correct for the gender bias, the results of NTA by gender are combined with the NTTA results. The estimation of the NTTA results is based on the work of Donehower (2014), whereas specifics of the European NTTA results are given in the European NTTA Manual (Vergha et al., 2016).

The NTTA age profiles are estimated in the following way: first, we need to define the time spent on household production by age and gender using time use surveys. The age profiles for

14 EU countries are calculated based on the Harmonized European Time Use Survey (HETUS) Web application. Three different age profiles of household production are distinguished: general housework, childcare, and inter-household labour. General housework includes all household production activities other than childcare, whereas inter-household labour includes household activities carried out for other households. Secondly, we estimate the consumption of goods and services produced through household labour. To allocate the goods and services produced among the household members, we used an imputation method. The age profiles based on time use surveys are imputed into the representative samples, such as EU-SILC dataset. For the imputation, the information on the age and gender of the household members is used, as well as the information about the household composition. Thirdly, the net time transfers are estimated as a difference between individual's consumption and production in the form of household labour and present a non-market counterpart of the LCD from the NTA.

To combine the NTA and the NTTA results, the NTTA results are usually, aside from being presented in minutes per day, also presented in monetary values. However, the Agenta database includes the NTTA for the year 2002 only. To make the NTA and NTTA results as comparable as possible, we monetize the time spent on production and consumption using country-specific gross hourly wages of elementary occupations in 2010 (Eurostat, 2017).

3 Consumption, labour income, and economic life cycle

The economic consequences of population ageing result from the degree of population ageing and the design of the economic life cycle. The economic life cycle exists due to differences in the patterns of consuming and producing over the life cycle. Figure 1 shows the age patterns of consumption and labour income as an average for all 25 EU countries. To achieve comparability among countries, the values are presented relative to the average labour income for ages 30–49.

The age profile of labour income starts to increase after the age of 15, when individuals start entering the labour market. After the peak during prime ages, labour income starts to decrease primarily due to lower labour market participation rates for the elderly. Whereas the labour income age profile has a typical bell-shaped distribution, the total consumption is rather stable across all ages, with exception of two peaks: the first one at young ages due to high public education expenditures and the second one for the elderly due to high public health care and long-term care expenditures.

Due to higher consumption as compared to labour income, individuals at young and old ages face an LCD. On the other hand, during working ages, individuals produce more than they consume and therefore face a life cycle surplus (LCS). Figure 1 reveals that in EU countries, the labour income of an average individual exceeds his or her consumption only between ages 27 and 57 (accounting for the age span of 31 years). This is much less than what is usually assumed in economic analysis, where the age period in which individuals are net supporters of others is usually defined as between ages 20 and 64 (accounting for 45 years), independently of the country, year, etc.

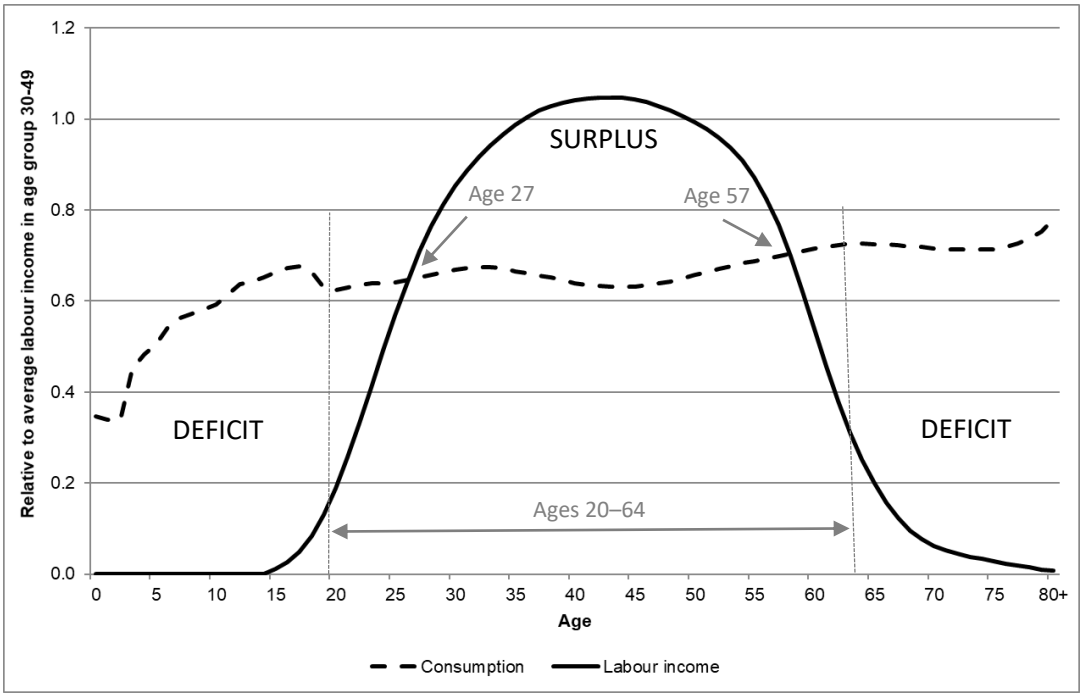

Figure 1: Age profiles of consumption and labour income, EU-25 average, 2010

Sources: Istenič et al., 2017; author's own calculations.

Even though the pattern of the economic life cycle is generally similar across countries, there are still huge cross-country differences (1) in the age span at which individuals are net supporters, (2) in the size of the positive LCD, and (3) in the importance of the sources through which the LCD is financed.

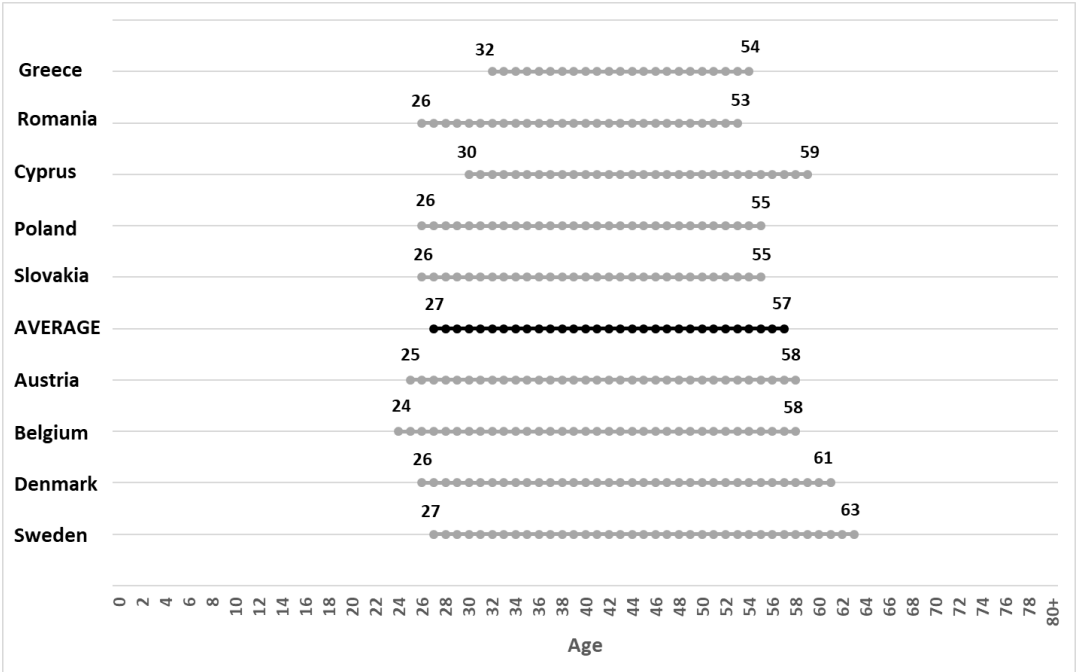

Figure 2: Age span in which individuals are net supporters (they produce more than they consume), EU countries, 2010

Sources: Istenič et al., 2017; author's own calculations.

In Figure 2, we show the age span in which individuals are net supporters (i.e. the age span of positive LCS) in the selected EU countries. In Belgium and Austria, the young already start to be economically independent at the ages of 24 and 25, the youngest among all EU countries. In contrast, in Greece, the economic independence of the young starts only at the age of 32. Relatively low employment rates in Greece in 2010 as compared to the other EU countries (Eurostat, 2019), as well as the high consumption relative to the average labour income, results in the shortest age span of LCS in Greece, accounting for only 23 years (between ages 32 and 54). A relatively short age span of LCS is also characteristic of Romania, mainly resulting from relatively low ages at which the elderly become dependent. Relatively early retirement is also characteristic of post-socialist EU countries, such as Poland and Slovakia. In contrast, individuals stay economically dependent up to higher ages in Cyprus, Denmark, and Sweden. Denmark and Sweden are also those countries in which the age span of LCS is the longest among the EU countries, accounting for 36 and 37 years, respectively.

4 The life cycle deficit and its financing for the elderly: current and future situation

In the next decades, due to increased share of the elderly and the decreased share of working-age population, the European population will become older than ever before. Because the share of those younger than 20 will stay stable over time, in this section, we will focus on the size of the LCD and the sources through which it is financed for the elderly only.

In Figure 3, we show the size of the aggregate LCD for the elderly, where the aggregate LCD presents the sum of products between age-specific positive LCD and the age-specific population. To make results cross-country comparable, we compare the aggregate LCD for the elderly with the aggregate labour income. The indicator shows how much of the total labour income is needed to finance the consumption of the elderly that is not covered by the elderly's labour income. Aside from showing the size of the LCD in year 2010, we also show its projected values in 2050. The values are projected by assuming that the characteristics of the economic life cycle would stay the same as in 2010; the only change would be in the population age structure.

Figure 3 reveals that there are huge cross-country differences in the magnitude of the LCD for the elderly. In 2010, the LCD of the elderly accounted for 16-19% of the total labour income in Cyprus, Ireland, and Estonia and up to 36-39% of the total labour income in Greece and Romania. The highest projected values of LCD in 2050 are characteristic of Romania and Greece, accounting for around 75% of the total labour income. Such values are certainly not possible to maintain in the long run and will require changes in the patterns of the economic life cycle (Sambt, Istenič, & Hammer, 2017). On the other hand, high employment rates for the old, combined with the relatively favourable population projections, lead to the lowest projected LCD in Sweden, accounting for 30% of the total labour income. A similar statistic holds for Denmark. Furthermore, the ranking of some countries with respect to the magnitude of the LCD changes substantially over time. For example, a relatively moderate change in the

population age structure in Belgium and France will cause only a moderate increase in the LCD, whereas rapid population ageing will cause a sharp increase of the LCD in Slovakia, Spain, Poland, and Germany.

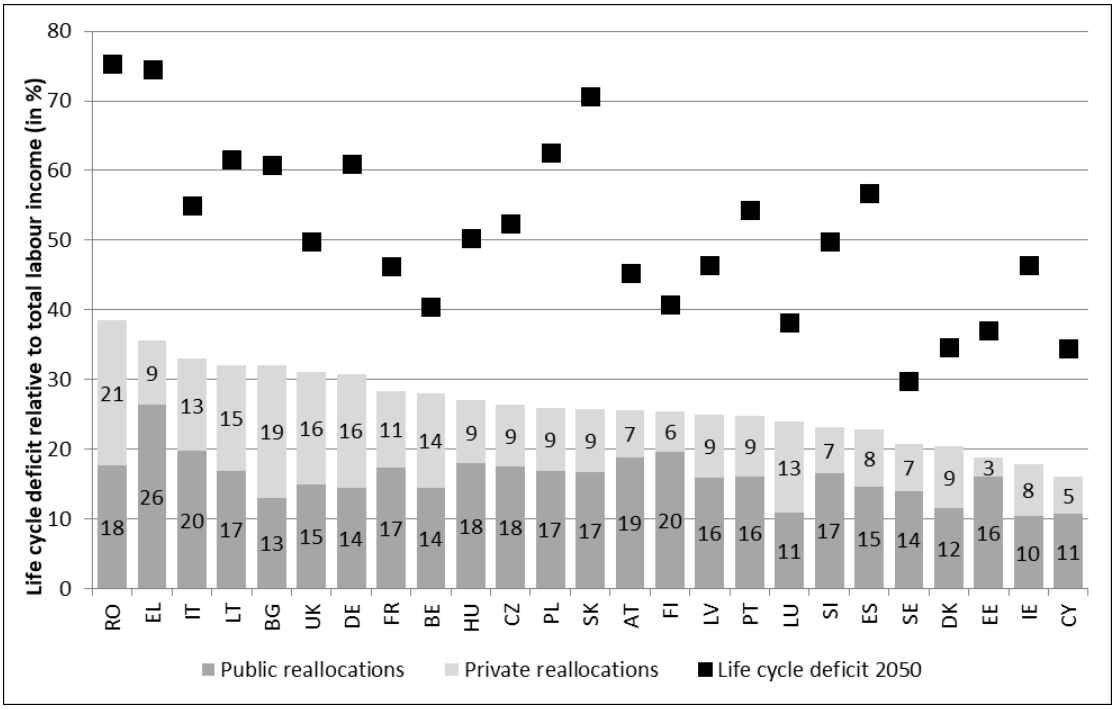

Figure 3: Financing the difference between consumption and labour income of the elderly, EU countries, 2010 and 2050

Sources: Istenič et al., 2017; Sambt et al., 2017; author's own calculations.

**Note: RO = Romania, EL = Greece, IT = Italy, LT = Lithuania, BG = Bulgaria, UK = United Kingdom, DE = Germany, FR = France, BE = Belgium, HU = Hungary, CZ = Czech Republic, PL = Poland, SK = Slovakia, AT = Austria, FI = Finland, LV = Latvia, PT = Portugal, LU = Luxembourg, SI = Slovenia, ES = Spain, SE = Sweden, DK = Denmark, EE = Estonia, IE = Ireland, CY = Cyprus.*

To measure the economic consequences of population ageing, we also have to analyse the sources through which the LCD is financed. In European countries, the elderly mainly rely on public transfers (especially in the form of public pensions) and private ABR. On the other hand, private transfers present a relatively negligible source of LCD financing for the elderly in the majority of countries. The exceptions are Lithuania, Romania, Latvia, and Bulgaria, where private transfers present 6%, 8%, 9%, and 15%, respectively, of the total reallocations for the elderly (Istenič & Sambt, 2019). In Figure 3, we separate public reallocations (primarily consisting of public transfers) and private reallocations (primarily consisting of private ABR) as sources of LCD financing for the elderly. In countries where the elderly primarily rely on private reallocations, the sustainability of the public finance system is much less jeopardized by population ageing. Such examples are the UK, Germany, and Luxembourg. In contrast, in countries such as Greece, Austria, and Estonia, public reallocations prevail, meaning that in these countries, the public sector is much more vulnerable to population ageing.

5 The increased labour market participation rates as a measure for promoting public sector sustainability

The strategies that could already in the short run reduce the negative consequences of population ageing, particularly its effect on the sustainability of the public finance system, are especially 1) to increase the labour market participation rate of the elderly and 2) to increase the ability of the working-age population to support others (i.e. by increasing the magnitude of the LCS) (Hammer, Prskawetz & Freund, 2015; Loichinger et al., 2017; Sambt, et al., 2017). It turns out that EU countries could practically mitigate the effect of population ageing by undertaking the labour income age profile of Sweden, where old age individuals stay in the labour market for around 5 years longer than in the majority of other EU countries (Loichinger et al., 2017; Sambt et al., 2017). Furthermore, public policies could strive to increase the size of the LCS of the working-age population and increase their ability to support the dependent population, as well as increase their own savings, which could be used to finance their own consumption in the future.

Past NTA research shows that the size of the LCS is particularly high in countries where women's contribution to the total LCS is higher (Hammer et al., 2015; Sambt et al., 2017). These are countries in which women's labour market employment rates are higher. In EU countries, the employment rate of women is still much lower than that of men. In 2017, 66.5% of women and 78.0% of men aged 20–64 were employed in EU-28 countries (Eurostat, 2019). Therefore, as a possible measure to increase the sustainability of the public finance system, we can see the promotion of women's labour market participation (Sambt et al., 2017). However, we should be careful when making conclusions. Even though an average EU man earns more on the market then an average woman, women on average spends more time performing unpaid household work than men do (Hammer et al., 2015; Istenič et al., 2017). Therefore, we claim that an increased participation rate of women in the labour market is a meaningful measure only in those countries where the gender difference in labour income is not compensated by the gender difference in unpaid household work contribution.

Figure 4 shows the income and consumption by age and gender for the two selected countries, Sweden and Spain, reflecting institutional differences between the northern and southern EU countries. In the figure, we show the market values of labour income and consumption, as well as the total production and total consumption, calculated as a sum of market values and the monetary values of unpaid household work.

In both countries, women's labour income is lower than that of men. The gender difference in the labour income results from lower employment rates of women, as well as the gender wage gap, presenting the differences in the wages of fully employed men and women. The gender difference in the labour income is smaller in Sweden, where gender equality is traditionally promoted. Although there are substantial gender differences in the labour income in both countries, the gender difference in the consumption is less pronounced, mainly appearing during the child-bearing period as a result of higher health expenditures of women. The gender difference in the LCS thus mainly results from the gender differences in the labour income.

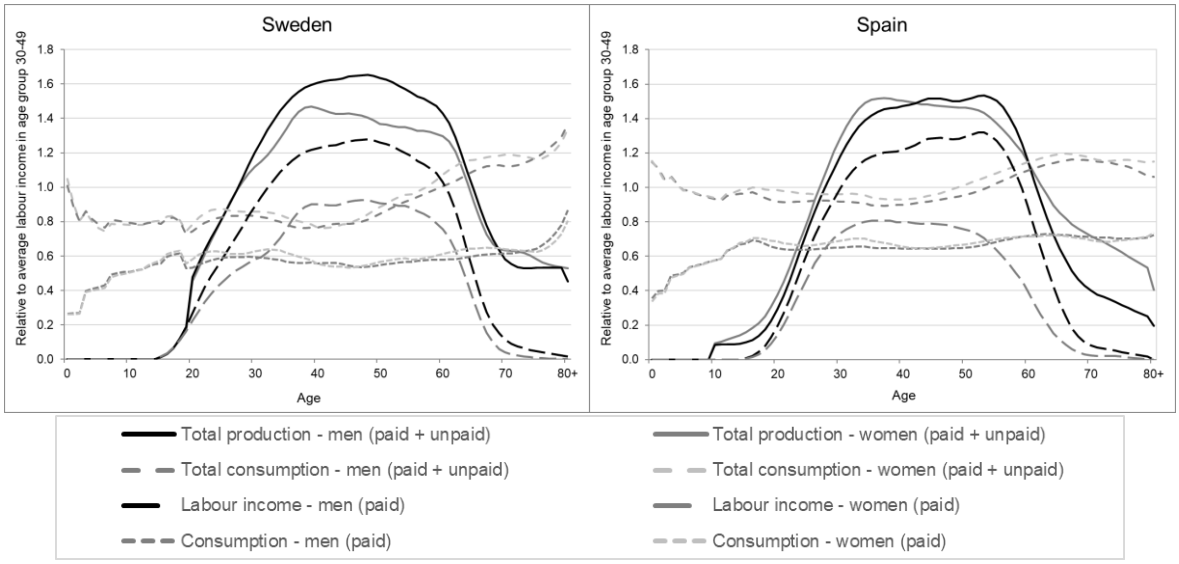

Figure 4: Consumption and production by age and gender, Sweden and Spain, 2010
Sources: Istenič et al., 2017; Vargha et al., 2016; Eurostat, 2017; author's own calculations.

After including the monetary values of unpaid household labour, the gender differences in the total production (income) become smaller in both countries. However, there are significant differences between countries. Whereas in Sweden, the gender differences in production remain large even after unpaid household work inclusion, the gender differences in Spain practically disappear. This means that in Spain, lower labour income of women is practically compensated with their higher contributions in the form of unpaid household work.

Table 1 shows the gender-specific aggregate LCS for 14 EU countries, for which both NTA and NTTA data are disposable. The gender-specific aggregate LCS is a product between the gender-specific population[1] and gender-specific per capita LCS for the ages at which the average income exceeds consumption. The aggregate LCS is expressed relative to the aggregate labour income and shows the total labour income that can be used to support the dependent population, separately estimated for both genders. The results are first presented without the monetary values of unpaid household work (denoted as LCS) and then by including it (denoted as total LCS).

The LCS of men ranges from 8.3% of the total labour income in Lithuania up to 30.3% of the total labour income in Germany. The LCS of women ranges from 0.6% of the total labour income in Italy to 14.3% of the total labour income in Slovenia. Even though in all countries, the LCS of men is higher than that of women, there are pronounced cross-country variations in the gender differences in LCS. The contribution of women as compared to men accounts for 2.5% and 2.9% in Italy and the UK and to 49.1% and 62.0% in Lithuania and Slovenia. When the monetary values of unpaid household work are included, the gender differences in LCS are reduced in all the countries. Although the gender difference remains high in the UK even after including unpaid work (women contribute 37% of what men do), in Italy, the contribution of

[1] To facilitate comparison among countries, the standard European population is used (Eurostat, 2013).

women as compared to men increases substantially (accounting for 86.1%). Lithuania and Slovenia remain at the top of the ranking with the highest relative contributions of women. Lithuania and Slovenia also represent countries in which women's contribution is even higher than the contribution of men after including monetary values of unpaid household labour.

Table 1: Gender-specific life cycle surplus, EU countries, 2010

Country	Life cycle surplus as % of labour income			**Total** life cycle surplus as % of labour income		
	Men	Women	Contribution of women compared to men	Men	Women	Contribution of women compared to men
Belgium	28.1	7.7	27.4	29.1	19.0	65.2
Bulgaria	15.1	1.7	11.6	14.1	9.8	69.4
Estonia	23.5	5.4	22.8	23.6	13.3	56.3
Finland	20.3	7.9	39.0	21.9	18.8	85.6
France	26.3	6.4	24.2	26.7	17.5	65.5
Germany	30.3	2.2	7.3	31.4	12.6	40.1
Italy	24.6	0.6	2.5	20.6	17.7	86.1
Lithuania	8.3	4.1	49.1	8.0	10.3	128.8
Latvia	16.3	3.9	24.0	14.9	10.1	68.0
Poland	23.8	3.0	12.5	24.7	14.9	60.5
Slovenia	23.1	14.3	62.0	23.3	24.4	104.7
Spain	23.8	3.6	14.9	20.8	18.7	89.7
Sweden	25.5	10.3	40.5	29.2	20.2	69.2
UK	27.4	0.8	2.9	28.3	10.5	37.0

Sources: Istenič et al., 2017; Vargha et al., 2016; Eurostat, 2017; author's own calculations.

6 Discussion and conclusions

In times of rapid population ageing, the age decomposition of economic activities becomes increasingly important. The changing population structure challenges the sustainability of the public finance system and puts into question the level of public support for dependent generations. The age-specific values of income, transfers, consumption, and saving help researchers and policy makers better understand the economic consequences of population ageing. Moreover, to provide a sufficient level of well-being to dependent individuals, both public and private transfer systems should be analysed and linked.

In this paper, we present fully comparable NTA results for 25 EU countries. The standard NTA estimates are extended by including the gender dimension as well as monetary values of unpaid household labour. The paper uses the NTA concepts of the LCD (defined as a positive difference between individual's consumption and labour income) and the LCS (defined as a positive difference between individual's labour income and consumption) to define the periods in which individuals are net dependents and in which they are net supporters. We show that an

average EU citizen's labour income exceeds his/her consumption between ages 27 and 57, which accounts for only 31 years. However, there are huge cross-country differences in the length of LCS, accounting for only 23 years (between ages 32 and 54) in Greece up to 37 years (between ages 27 and 63) in Sweden. Furthermore, we analyse the size of the LCD for the elderly in 2010 as well as its projected values in 2050. The paper shows that to fill the gap between consumption and labour income of the elderly, between 16% of the total labour income is needed in Cyprus, whereas 39% of the total labour income is needed in Romania. In the future, the relatively favourable population projections, together with relatively low LCD for the elderly in Sweden, will lead to the smallest projected LCD in Sweden, accounting for only 30% of the total labour income. In contrast, the highest projected LCD for the elderly is characteristic of Romania and Greece, accounting for around 75% of the total labour income. Such values are clearly impossible to maintain in the long run and will force public and private institutions to make appropriate changes. The economic consequences of population ageing on the sustainability of the public finance system are more severe in countries in which the elderly primarily rely on public transfers. Such countries are, for example, Austria, Estonia, and Greece. On the other hand, the effect of population ageing is less severe in countries in which individuals at the higher extent rely on private asset-based reallocations (for example, their own savings). Such countries are Germany, Luxembourg, and the UK.

To partially mitigate the effect of population ageing in the short term, two main strategies are identified. The first is to increase the labour market participation rate for the elderly – i.e. to follow the Swedish system as a role model. Second is to increase the ability of the working-age population to support dependent individuals – i.e. by increasing the magnitude of the LCS. The latter can be partially achieved by increasing women's labour market participation rates. However, we claim that increased women's labour market participation is an effective measure to ensure the sustainability of the public finance system only in countries in which the contribution of women compared to men remains low even after inclusion of monetary values of unpaid household work. This applies, for example, to Germany, the UK, Estonia, and Poland. On the other hand, such a measure is problematic in countries where the overall contribution of women is high, especially Lithuania and Slovenia, but also Finland, Italy, and Spain. In these countries, the burden of women is already high, meaning that higher participation in the labour market would probably lead to less time spent on unpaid household labour by women. Because traditional patterns of division of labour between men and women within the households can hardly change in the short term, such a measure can substantially decrease the welfare of the population in these countries.

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