European National Transfer Accounts

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The European National Transfer Accounts can be accessed on:

www.wittgensteincentre.org/ntadata

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1 Introduction: National Transfer Accounts

This manual describes the methodology and data sources used to generate National Transfer Accounts (NTA) for Europe. National Transfer Accounts measure important aspects of age-specific economic behaviour, in particular the generation of income, the redistribution of income between age groups and its use for consumption and saving.

To understand how the economy works, it is crucial to be able to observe and analyse the economic interactions among actors in the economy. National Accounts (NA) are a framework for quantitatively describing important aspects of the market economy and the interaction between the state, corporations and households. The development of NA gained momentum in the 1930s when the severity of the economic crisis sparked interest in better measurement and deeper understanding of macro-economic processes. Nowadays, national accounts provide estimates of economic activities for a series of time periods (United Nations, 2013).

Providing a continuous flow of harmonised and consolidated information is a prerequisite for rational and effective decision-taking and policymaking. The System of National Accounts (SNA), coordinated by the United Nations, is a collection of internationally agreed recommendations on how to measure economic activity at the level of individual economic agents, groups of agents or at the level of the total economy (System of National Accounts, 2009).

Numerous aspects of the economy are captured fairly well by the key aggregates of the SNA, however, some concepts and aspects of the economy remain outside its reach (System of National Accounts, 2009). For instance, the SNA does not offer information on how people are affected by economic events, public policies or demographic changes at different stages of their life cycle.

Age is one of the main determinants of individuals' economic behaviour. In general, people experience three economically different phases in their life course. Working-age individuals are able to finance their own consumption by producing more than they consume (Lee & Mason, 2011a), while at the youngest and oldest ages individuals' consumption exceeds their labour income. The gap between consumption and labour income can be financed by 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 on capital and financial markets (Mason, Lee, Tung, Lai & Miller, 2006). These transfers are called intergenerational because they capture flows between different generations (between young, working-age and old people).

Measurement of these flows across age groups 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 old age. Both young and elderly people depend heavily on transfers from the working-age population (Mason et al., 2006). In contemporary societies, these periods of economic dependency are gradually extending because of a prolonged education period of young and increased longevity of the elderly.

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Introducing the age dimension into the SNA is especially relevant in the light of the unprecedented demographic changes that Europe has been facing in the past few decades (Mason et al., 2006). These changes have dramatically affected the population age structure. Population ageing puts the system of intergenerational flows under pressure due to an increasing share of the elderly inactive population whose costs of pensions, healthcare and long-term care have to be financed by a shrinking labour force (Hammer, Prskawetz & Freund, 2015). Current standards of living can only be maintained if the working-age individuals are able to generate enough income to provide for their own needs, to save enough funds for their retirement years and also to support consumption needs of children and the elderly in the form of private and public transfers (Mason & Lee, 2011; Patxot, Rentería, Sánchez-Romero & Souto, 2012).

The age structure of the European population is expected to further change significantly over the forthcoming decades. Eurostat's main scenario of population projections assumes below-replacement fertility and declining mortality rates to continue also in the future. Combined with the baby boom generation entering into retirement, the share of elderly people will rapidly increase. The proportion of the EU-28's population aged 65+ will increase from 18.9% in 2015 to 28.5% in 2050. In the same period, the percentage of working-age population (aged 15–64) is expected to decrease from 65.5% to 56.7%. In absolute numbers, the working-age population will shrink by approximately 34 million people, while the population aged 65+ will increase by approximately 55 million people. Consequently, the ratio between the working-age population and those aged 65+ will change dramatically: it is expected to decrease from 3.5:1 in 2015 to merely 2:1 in 2050 (Eurostat, 2015).

Population ageing will have significant social and economic consequences since individual behaviour varies with age. Changes in the population age structure affect the proportion of people at different life cycle stages that are associated with different economic behaviour, i.e. how much they produce, consume, save etc. (Mason & Lee, 2011). This gradually affects the aggregate levels in the economy, as well as the patterns of intergenerational flows among people. For the analysis of the demographic dividend in partial equilibrium see Mason & Lee (2011), Patxot et al. (2011), and Prskawetz & Sambt (2014); for the analysis of the role of education Rentería et al. (2016), and for the analysis based on a general equilibrium model Sánchez-Romero et al. (2013) and Sánchez-Romero et al. (2017).

Population ageing requires reforms of the public intergenerational transfers. Understanding the age patterns of production, consumption and intergenerational reallocation of resources is necessary for analysing the effectiveness of alternative policies. Some government policies can be advantageous for some generations, but burdensome to others. However, systems such as the SNA do not offer information on age and generational aspect of the aforementioned changes. The ability to assess the consequences of population ageing is therefore very limited. The National Transfer Accounts (NTA) have been developed to fill this gap (United Nations, 2013).

The NTA extend the SNA by introducing the age dimension. Their focus is not on institutions, but rather on individuals and their age. Therefore, the NTA improve

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our understanding of the generational economy by estimating flows across age groups (United Nations, 2013). Concepts and definitions applied in the NTA are consistent with those in the SNA.

By introducing the age dimension, NTA shed light on the effect of the changing age structure on macroeconomic categories. Therefore, they are a valuable tool in addressing some of the major challenges of modern societies (United Nations, 2013). In the following pages, we present the NTA methodology used to calculate age-specific averages of different economic flows and activities.

2 Basic Principles and Accounting Identities

2.1 The Flow Identity

The patterns of people's production and labour force participation vary with age due to numerous factors: biological characteristics, cultural background, institutional environment, individual preferences, experience or physical strength, and people's desire to consume (Mason & Lee, 2011). The economic life cycle is characterised by the changing patterns of production and consumption throughout people's lives. Consumption exceeding production in young and old ages requires the reallocation of resources between age groups. This can occur in the form of transfers between generations or through asset-based reallocations. Asset-based reallocations are intertemporal since they represent resources that are accumulated in one time period (at certain age) to be used at later ages (Mason & Lee, 2011).

The NTA framework is governed by an accounting identity, which states that inflows at every age (i.e., labour income, transfer inflows and asset income) equal outflows at every age (i.e. consumption, transfer outflows and savings). The equality holds not only at the individual level, but also at the aggregate level (for all age groups and for the total economy). Rearranging these categories gives us the flow identity (Lee & Miller, 1994):

$$\underbrace{C(a) - Y^l(a)}_{Life\ cycle\ deficit} = \underbrace{\tau^+(a) - \tau^-(a)}_{Net\ transfers} + \underbrace{Y^A(a) - S(a)}_{Asset-based\ reallocations}. \quad (1)$$

Consumption $C(a)$ and labour income $Y^l(a)$ represent the most important characteristics of the economic life cycle at each age a (Mason & Lee, 2011). The term 'life cycle deficit' is used to describe the difference between consumption and production. A negative life cycle deficit, characterised by production exceeding consumption, is also called 'life cycle surplus'. The life cycle deficit must equal the sum of net transfers and asset-based reallocations. Net transfers of a specific age group are defined as the difference between transfer inflows and transfer outflows, $[\tau^+(a) - \tau^-(a)]$. Asset-based reallocations represent the difference between asset income and savings of a specific age group, $[Y^A(a) - S(a)]$.

NTA distinguish between two economy sectors, private and public. If the flows are disaggregated by sector, the flow identity can also be written in the extended form as:

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$$C^f(a) + C^g(a) - Y^l(a) = \\ = \tau^{inter}(a) + \tau^{intra}(a) + \tau^g(a) + Y^{Af}(a) + Y^{Ag} - S^f(a) - S^g(a). \quad (2)$$

In Equation 2, C^f represents total private consumption, C^g *is* total public consumption, Y^l is labour income, τ^{inter} are net inter-household transfers, τ^{intra} are net intra-household transfers, τ^g are net public (government) transfers, Y^{Af} is private asset income, Y^{Ag} represents public asset income, while S^f and S^g represent private and public savings, respectively, at a specific age a.

All these variables are split up into more detailed components. Private transfers are divided into two types: inter-household (i.e. between households) and intra-household (i.e. within households). Intra-household transfers are additionally split up by purpose, distinguishing transfers for education, health and other purposes. Public transfers are divided by type of transfer programmes, of which publicly financed pensions, educational programmes and health services are the most important. Private asset income is also further divided into private capital income and private property income. The inflows in the form of public asset income are the returns on publicly owned capital, while the outflows are the interests paid on public debt. Saving is divided into private and public sectors as well.

The basic unit of analysis in NTA is an individual, while all institutions are considered only as intermediaries between different individuals. An important contribution of the NTA is measuring private transfers across age, including transfers within households. These transfers are not captured in the SNA as it measures only flows between institutional units (such as households) and not within them. The quantification of intra-household transfers had been commonly neglected in economic analyses as it is impossible to measure intra-household transfers directly. However, their importance for the society is significant. Based on data for 23 countries, Lee and Donehower (2011) estimate that intra-household transfers actually represent around 90% of all private transfers, while the rest of transfers (only around 10%) is in the form of inter-household transfers.

Relying on the NTA methodology, it is also possible to analyse the direction of transfers between generations (i.e. private/public net transfers and asset-based reallocations). In underdeveloped countries, total transfers mainly flow downward from the elderly to the young. The opposite holds for most European countries where the direction of intergenerational flows is reversed: the dominant flow is upwards from working-age to dependent elderly population. This trend seems to be even stronger as the population continues to age and also due to generous pension systems in European countries. A changing population age structure thus has a strong effect on the direction of flows (Lee & Mason, 2011a; Lee, 2003).

2.2 Basic NTA Methodology

NTA are organised around the concept of the economic life cycle. As already mentioned, the economic life cycle is characterised by the fact that consumption exceeds labour income at young and old-age. On the other hand, an average person in working age produces enough for its own consumption and for

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transferring resources to the dependent members of the society (United Nations, 2013). As a consequence, there are economic flows from the working-age population to children and elderly people. NTA measure these economic flows, disaggregated by age. The flows are presented in the form of age profiles, containing the per-capita values of different economic activities. The methodology on how to calculate the age profiles is described in detail in the following chapters.[1] In this chapter, we present the general outline.

To calculate age profiles, the first step is to derive the so-called macro controls for each economic activity we wish to estimate. The macro controls are aggregate measures of different economic categories, as defined and measured in the SNA and other related sources. Among the most important macro controls are total labour and asset income, total consumption, saving, total taxes and social contributions and public benefits.

The second step is to calculate the age-specific averages of different economic categories, using survey and/or administrative data. To ensure that age profiles are representative of the population, we use sample weights to calculate accurate age-specific averages from the sample. The third step is to eliminate random variation by applying a smoothing procedure.

In a last step, the age profiles are adjusted proportionally, so that the NTA aggregate estimates match the value of previously calculated macro controls. This is done by calculating the necessary adjustment factors that are used to multiply the age profiles. For example, if the macro control for labour income is 1200 units but the estimated NTA aggregate value is 1000 units, the age averages (age profiles) of labour income need to be multiplied by 1.2 at each age.

The unit of analysis in NTA is an individual. Therefore, whenever possible we use survey data reported at the individual level. However, some of the age profiles are calculated by relying on household data, assuming that the household head serves as the representative of a household (see Section 4.1.4 for more details about the household head). Thus, by assumption, all inter-household transfers are assigned to the household head. Additionally, the household head is assumed to own all the household's assets (asset income and savings).

It should be noted that the NTA methodology shows a cross-sectional snapshot of a population in a certain time period. The estimated age profiles (for a single survey year) are calculated as averages of all people in a specific age group. Thus, the age profiles do not represent individuals over their lifetime, but rather how individuals are involved in the system of intergenerational reallocations in a given year. Therefore, one should be careful when interpreting the NTA results since important differences exist between a longitudinal analysis and the NTA methodology.

[1] The NTA methodology is presented in detail in the book edited by Lee and Mason (2011b) and also described in the United Nations (2013) manual.

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3 NTA Macro Controls and European System of Accounts

3.1 The European System of Accounts

The NTA definitions and concepts are broadly consistent with those of the European System of Accounts (ESA). ESA is the European Union's (EU) accounting framework which is compatible with the rules in the System of National Accounts (Eurostat, 2013).

NTA are satellite accounts of the ESA. Satellite accounts are linked to the central system, but provide new information in a way that does not interfere with the results in the core accounts (System of National Accounts, 2009). While NTA do not include economic quantities as detailed as the ESA, they contain age-specific information of the most central economic quantities as well as information on transfers between age groups. To provide age-specific information some adjustments and aggregation of the ESA quantities have to be made. This relation between ESA aggregates and NTA is explained in this section.

The European National Transfer Accounts (ENTA) use data from the yearly ESA sector accounts to derive the aggregate controls for the NTA main categories (e.g. labour income, asset income, net transfers, consumption and savings). The ESA accounts record the value of transactions between economic subjects within a calendar year. The transactions are presented as a sequence of accounts including production accounts, generation of income accounts, redistribution of income accounts, and use of income accounts. The ESA uses double-entry accounting: transactions between sectors are recorded as a resource from one sector and the use by another sector. Resources are flows received by the sector, while uses are flows paid. Transactions within a sector are recorded as both, resource and use of the same sector. For each type of transaction, the total resources of all sectors and the rest of the world (ROW) equals to total uses. At the end, the combination of all transactions leads to a meaningful balancing item for each sector, which corresponds to the difference between total resources and total uses. Each balancing item is used in the next item in the sequence of the overall accounts (Eurostat, 2016b). The sequence of current accounts is described in Table 1 below.

Table 1: The sequence of non-financial accounts

Sequence of non-financial accounts	
Name of account	**Balancing item**
1. Production account	Value added
2. Generation of income account	Operating surplus
3. Allocation of primary income account	Gross national income
4. Secondary distribution of income account	Disposable income
5. Redistribution of income in kind account	Adjusted disposable income
6. Use of disposable income accounts	Saving
7. Capital account	Net lending/borrowing

Source: based on Eurostat, 2016b.

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1. The production account records the value of the produced goods and services as resources, while uses refer to intermediate consumption. The balancing item is the value added—a resource in the subsequent generation of income account (Eurostat, 2016b).

2. The generation of income account shows how value added (resource) translates into primary incomes and taxes on production. Primary incomes include the compensation of employees, mixed income (when households act as producers), gross operating surplus (mainly belonging to the corporations) and taxes on production and imports less subsidies. While for the household sector the balancing item of the generation of income account is mixed income, the balancing item for other sectors is operating surplus.

3. The allocation of primary income account then captures the remaining part of the primary distribution of income and records, for each sector, different types of property income receivable and payable, as well as compensation of employees and taxes, less subsidies, on production and imports (System of National Accounts, 2009). It accounts for incomes which are paid to or received from the ROW. The balancing item of the allocation of primary income account is gross national income. The next account in the sequence is the secondary distribution of income account.

4. The secondary distribution of income account shows how the primary income of an institutional sector changes because of current transfer flows (in cash), such as current taxes on income and wealth, social contributions and benefits, and other current transfers (e.g. non-life insurance premiums and claims). The balancing item of the secondary distribution of income account is disposable income.

5. The redistribution between households, government and non-profit institutions serving households (NPISH) through transfers in kind is captured by the redistribution of income in-kind account. The balancing item is called adjusted disposable income.

6. Next, the use of the disposable income account shows how adjusted disposable income is used for consumption and savings. The account includes final consumption of households, NPISHs, and government; the balancing item is saving (Eurostat, 2016b).

7. The last in the sequence of non-financial accounts is the capital account. The capital account is divided into the change in net worth due to saving, the capital transfers and the acquisition of non-financial assets. The change in net worth due to saving shows the sum of savings and net receipts of capital transfers. The capital transfers account records gross fixed-capital formation (i.e. investments in non-financial assets, e.g. roads, buildings, equipment), changes in inventories, net acquisitions of valuables, and other non-produced, non-financial assets (e.g. land and other natural sources). The balancing item of the capital account is net lending/borrowing. If savings and net capital transfers are more than enough to cover the non-financial investment, the sector becomes a net lender to other sectors and/or to the ROW. For the total economy the net lending/borrowing shows the resources that an economy is able to lend to the ROW and it presents the balancing item of the financial transaction accounts and

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thus the link between the non-financial and the financial transaction account. A positive balance means an investment in financial assets (to the ROW) and/or redemption of liabilities (Eurostat, 2016b).

For each of the balancing items gross and/or net values can be derived. The gross flows are flows before deduction of consumption of fixed capital (i.e. depreciation). The net values are used in national accounts because they better reflect that capital goods need to be replaced at a certain stage (Eurostat, 2016b).

The ESA combines institutional units with broadly similar characteristics into institutional sectors such as non-financial corporations, financial corporations, government, households and NPISHs. Additionally, the transactions between residents and non-residents are recorded in the ROW account. The household sector includes households and unincorporated firms, like sole proprietorships. NPISHs include non-profit institutions such as charities and trade unions. The non-financial corporations sector includes private and public corporates that produce goods and services to the market. The financial corporations sector includes all private and public corporations dealing with financial intermediation (e.g. banks, investment funds, insurance corporations, pension funds). Since public enterprises are part of non-financial and financial corporations the government sector only consists of central, regional and local government and social security funds. The rest of the world account includes cross-border transactions (Eurostat, 2016a). The sum of non-financial corporations, financial corporations, government, households and NPISHs is called total (national) economy. The counterpart of the national economy is the ROW (van Tongeren, 2013).

3.2 Calculating NTA Aggregate Controls from ESA

Among the most important differences between the ESA and NTA framework are different units of analysis and differences in the classification of sectors.[2] The NTA records transactions between individuals rather than between institutional units (e.g. between households). Without these distinctions it is not possible to capture many of the transfers between age groups, because these flows occur between individuals within the same institutional unit, e.g. within the same household. Institutions are only intermediaries between individuals. In contrast to the ESA, NTA distinguish only between the public sector (general government) and the private sector. The private sector includes households, corporations and NPISH.

3.2.1 The NTA Net National Income

Income in NTA is divided into two main components: labour income and asset income. These two components together are similar to the net national income in the ESA. NTA labour income includes the compensation of employees, while asset income is the sum of net operating surplus plus the net property income

[2] The ESA current account transactions, used as a basis for the NTA, can be directly retrieved from the Eurostat database (http://ec.europa.eu/eurostat/data/database) under the 'Annual sector accounts'.

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from the rest of the world. Mixed income and other taxes (less subsidies) on production are divided between labour income and capital income. Mixed income contains the return to labour and the return to capital in unincorporated enterprises. It consists of remuneration for work by the members of the household and the return to the owner as an entrepreneur (System of National Accounts, 2009). Based on empirical evidence (e.g. Gollin, 2002), NTA allocate two-thirds of gross mixed income to the labour income and the remaining one-third to the capital income.

Taxes on products and production less subsidies (i.e. taxes on production and imports less subsidies as defined in the ESA) are divided into three parts: taxes less subsidies on labour income, taxes less subsidies on capital income and taxes less subsidies on consumption. The idea and assumption behind this approach is that the tax burden falls on one of these groups depending on the exact type of the tax. The taxes less subsidies on products (with value-added tax as most important component) are assumed to be paid by consumers. The taxes less subsidies on production (i.e. other taxes on production as defined in the ESA) are assumed to be paid out of labour and capital income. Unfortunately, there is no detailed information about the 'other taxes and subsidies on production' in the ESA in order to allocate them between labour and capital income according to the way the tax is levied. Therefore, we allocate the taxes less subsidies (ITLS) related to the labour and capital income in the following way:

$$\text{Labour share of ITLS} = \frac{\text{compensation of employees} + \frac{2}{3}\text{ of gross mixed income}}{\text{total income}}, \tag{3}$$

$$\text{Capital share of ITLS} = \frac{\text{gross operating surplus of corporations and NPISHs} + \frac{1}{3}\text{ of gross mixed income}}{\text{total income}}, \tag{4}$$

where total income equals the sum of compensation of employees, gross operating surplus of corporations and NPISHs, and gross mixed income.

In NTA, labour and capital incomes are measured before assessment of taxes less subsidies, therefore we need to adjust them by adding taxes less subsidies.

Consumption is measured in terms of basic prices, i.e. prices the producer receives from selling his/her products. The taxes on products and production less subsidies are treated as an outflow from consumers paid to the public sector (a public transfer outflow), and therefore not part of the individual's adjusted disposable income.

The public and private resources and uses related to the taxes on products and production less subsidies are presented in Table 2.[3] Taxes represent uses for the private sector and resources for the public sector. Just the opposite is true in the

[3] In the following sections we present calculations/results for different countries. However, in order to easily follow the calculations of NTA macro controls in this section, the same country, Austria, is used as an example. The tables in this section are used directly from the Excel file including macro controls estimation. The example of the file can be retrieved from Agenta Webpage (Agenta DataExplorer).

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case of public subsidies since they are paid by the public sector or the ROW (EU) but received by the private sector.

Table 2: Allocation of taxes less subsidies on production and imports, Austria, 2010

Allocation of Taxes on Production and Imports less Subsidies on Production and Imports

Description: The private sector Taxes and Subsidies on Production are assigned to capital and labour income proportionally to the capital and labour income; the public sector Taxes and Subsidies on Production are assigned to asset income as the public sector does not have labour income, taxes less subsidies on products are assigned to the consumption.

	Public		Private		Net from ROW
	Uses	Resources	Uses	Resources	
Taxes on Products	0	32,204	32,840	0	-636
Subsidies on Products	5,271	0	0	5,326	55
Other Taxes on Production	920	9,230	8,310	0	0
Other Subsidies on Production	4,641	0	0	5,785	1,143
Labour Share of Taxes less Subsidies on Production				1,732	
Capital Share of Taxes less Subsidies on Production		920		793	
Consumption Share of Indirect Taxes less Subsidies				27,514	

Source: Eurostat, 2015: *Non-financial transactions* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

Table 3 shows the ESA allocation of primary income account adjusted for the NTA purposes. Resources (flows received = inflows) and uses (flows paid = outflows) are presented for each flow needed to estimate private and public asset and labour income.

Table 3: The NTA net national income and its components, Austria, 2010

NTA Aggregate Allocation of Primary Income Account

Description: The NTA Allocation of Primary Income Account allocates incomes and Taxes less Subsidies on Products to either asset- or labour income. The sum of asset and labour income is denoted as NTA Net National Income. It corresponds to Net National Income (SNA Definition) with the exception that it excludes net Taxes less Subsidies on Products paid by the ROW and Taxes on Products.

	Public		Private		Net from ROW
Asset Income	Uses	Resources	Uses	Resources	
Gross Operating Surplus		3,398		80,949	
Property Income	7,569	3,525	68,267	71,987	-324
Capital Share of ITLS		920		793	
Capital Share of Mixed Income				9,079	
Consumption of Fixed Capital	3,655		42,075		
NTA Asset Income		**-3,381**		**52,466**	
		YAG		**YAF**	
Labour Income					
Labour Share of ITLS				1,732	
CoE			142,621	142,591	-30
Earnings				115,418	
Social Contributions				27,173	
Labour Share of Mixed Income				18,158	
NTA Labour Income				**162,481**	
				YL	
NTA Net National Income / Pre-Transfer Income	**-3,381**		**214,947**		

Source: Eurostat, 2015: *Non-financial transactions* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

While both the public and the private sector receive asset income, only the private sector receives labour income. Gross asset income includes gross operating surplus, net property income (property income received minus paid by the total economy, i.e. net property income received from the ROW), the capital share of mixed income and capital share of taxes less subsidies. NTA generally use net concepts, i.e. after deduction of consumption of fixed capital. In order to get net asset income and later on net national income, we subtract consumption of fixed capital from the gross asset income. Furthermore, the labour income

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includes compensation of employees (sum of earnings and employer's social contributions), labour share of mixed income and labour share of taxes less subsidies.

The NTA net national income corresponds to the ESA net national income with the exception that it excludes taxes less subsidies on products and net taxes less subsidies received from the ROW.

3.2.2 NTA Net Disposable Income

The secondary redistribution of income is at the very core of NTA because this category captures most of the redistribution across age groups. This inter-age redistribution is also reflected in the name 'Transfer Accounts'.

Public transfers in NTA refer to the flows between the public sector and private sectors in the ESA and also to the flows between the public sector and the ROW. Private transfers in NTA consist of the transfer flows within the private sectors and the transfers between private sectors and the ROW. It is assumed that transfers within the public sector do not include any age reallocations. Transfers from the private to the public sector consist mainly of taxes and social contributions, the transfers from the public to the private sector consist mainly of social benefits in cash and in kind. Note that institutions play only a role of intermediaries between individuals.

To get the aggregate value of NTA net disposable income for the total economy, the net transfers from the ROW are added to the net national income. The net transfers from the ROW are the current taxes, social contributions and benefits, and current transfers net from the ROW. Net transfers from the ROW also equal to the transfers receivable minus the transfers payable by the total (national) economy. Since we need disposable income of public and private sectors separately, the total disposable income should be separated between these two types of sectors.

Table 4 shows public and private transfers. The ESA includes information on the value of resources which are received/paid by each sector but no information on the exact direction. For most of the flows the direction is clear: taxes are paid by the private sector and received by the public sector or by the ROW (in case of taxes paid to supranational institutions such as the EU). However, for some flows this is not clear: social contributions are paid by households to the general government but also to corporations who in turn also pay benefits. In NTA we need more detailed information about the direction of flows, meaning the exact amount and who transfers to whom. Therefore, in the case of other current transfers and social contributions more detailed calculations are needed.

However, two parts of other current transfers can be classified without any further calculations: the current international cooperation and gross national product (GNP) based fourth own resource (flows received by the EU budget from the EU member states), which both refer to transfers between public sector and the ROW. Other parts of other current transfers (net non-life insurance premiums and claims and miscellaneous current transfers), social contributions and social benefits other than social transfers in kind need further calculations in order to be explicitly defined.

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Table 4: Aggregate National Transfer Accounts, Austria, 2010

Aggregate National Transfer Accounts

Description: The Aggregate National Transfer Account records size and direction of public as well as private non-intra-household transfers.

	Public		Private		Net from ROW
	Uses	Resources	Uses	Resources	
NTA Net National Income / Pre-Transfer Income		**-3,381**		**214,947**	
Public Transfers					
Notes: Public Transfers contain the flows from and to the public sector					
Taxes on Products		32,204	32,204		
Subsidies on Products	5,271			5,271	
Other Taxes on Production	920	9,230	8,310		
Other Subsidies on Production	4,641	0		4,641	
Net ITLS		30,602	30,602		
Current Taxes on Income Wealth etc	4	36,397	36,282	0	111
Taxes Total TGF			**66,884**		
Other Current Transfers	7,040	3,932	**3,713**	4,602	-2,219
Net non-life insurance premiums	0	0	0	0	0
Non-life insurance claims	0	0	0	0	0
Current international cooperation	346	219			-127
GNP based fourth own resource	2,092				-2,092
Miscellaneous current transfers	4,602	3,713	3,713	4,602	0
Social Contributions		46,588	**46,149**		439
Social Benefits other than Social Transfers in Kind	56,365			55,677	-687
Consumption	55,534			55,534	
Social Transfers in Kind (Individual Consumption)	32,454			32,454	
Collective Consumption	23,080			23,080	
Total Public Transfers	**118,943**	**117,519**	**116,746**	**115,813**	**-2,356**
		1,424	**118,170**	**TGI**	**TGNF**
		RAG	**TGO**		
Private Transfers					
Notes: Private Transfers contain only the private - private and private - ROW flows					
	Public		**Private**		**Net from ROW**
	Uses	**Resources**	**Uses**	**Resources**	
Taxes on Products			636		-636
Subsidies on Products				55	55
Other Taxes on Production					
Other Subsidies on Production				1,143	1,143
Other Current Transfers			12,313	11,929	-384
Non-life insurance premia			5,583	5,705	122
Non-life insurance claims			5,705	5,544	-161
Miscellaneous current transfers			1,025	680	-345
Social Contributions			4,222	3,971	-251
Social Benefits			2,145	2,746	601
Consumption of NPISH			4,083	4,083	
Adjustment for the change in pension entitlements			919	919	0
Total Private Transfers			**24,318**	**24,846**	**528**
					TF
Total Transfers	**118,943**	**117,519**	**141,064**	**140,659**	**-1,828**
					T
Net Disposable Income at Basic Prices	**-4,805**		**214,542**		

Source: Eurostat, 2015: *Non-financial transactions* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

In Table 5 we present the direction of flows for components of the secondary distribution of income account. The row and column totals of each intersectoral flow matrix present transfers received/paid by a certain sector retrieved directly from the ESA. To make the estimation of the amount and the direction of flows between sectors feasible some assumptions are needed. Blank cells (cells with diagonal stripes) indicate that flows between two sectors do not exist. The ROW/ROW transfers are clearly excluded, since external transactions are not recorded in the national accounts. Public to public transfers are also excluded since we assume they do not result in age reallocations. Also some other flows can be excluded. For example, there are no transfers to the public sector in the form of non-life insurance premium and no flows from the public sector in the form of social contributions. After excluding these options in the table we are able to determine the direction of flows exactly.

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Table 5: Direction of public and private transfers, Austria, 2010

Net Non-Life Insurance Premia				
from/to	TO public	TO private	TO ROW	**TO total**
FROM public		0	0	**0**
FROM private		5,549	34	**5,583**
FROM ROW		156		**156**
FROM total	**0**	**5,705**	**34**	**5,739**
Net Non-Life Insurance Claims				
from/to	TO public	TO private	TO ROW	**TO total**
FROM public				**0**
FROM private	0	5,533	172	**5,705**
FROM ROW	0	11		**11**
FROM total	**0**	**5,544**	**172**	**5,716**
Miscellaneous Current Transfers				
from/to	TO public	TO private	TO ROW	**TO total**
FROM public		4,602		**4,602**
FROM private	3,713	0	1,025	**4,738**
FROM ROW		680		**680**
FROM total	**3,713**	**5,282**	**1,025**	**10,020**
Social Contributions				
from/to	TO public	TO private	TO ROW	**TO total**
FROM public				**0**
FROM private	46,149	3,934	288	**50,371**
FROM ROW	439	37		**476**
FROM total	**46,588**	**3,971**	**288**	**50,847**
Social Benefits other than Social Transfers in Kind				
from/to	TO public	TO private	TO ROW	**TO total**
FROM public		55,677	687	**56,365**
FROM private		2,119	26	**2,145**
FROM ROW		627		**627**
FROM total	**0**	**58,423**	**713**	**59,137**

Source: Eurostat, 2015: *Non-financial transactions* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

To get the measure for adjusted disposable income (including in-kind transfers) we add public and NPISHs' transfers in kind. In NTA, public consumption consists not only of individual consumption (social transfers in kind) but also of collective consumption. Both components are treated as in-kind transfers. Consumption of NPISHs is treated as private in-kind transfer.

3.2.3 The NTA Use of Disposable Income

The net adjusted disposable income (including income and the net transfers in cash and in kind) is used for evaluating consumption and saving. NTA distinguish between private and public consumption. The private consumption includes final consumption expenditures of households and NPISHs at basic prices—meaning that taxes less subsidies on products are subtracted from (private) consumption. The NTA measure of net saving equals the corresponding value in the ESA. Net saving is the difference between (net) disposable income and consumption. The use of net disposable income is presented in Table 6 and the saving account in

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Table 7.

Table 6: The use of disposable income account, Austria, 2010

Use of Disposable Income Account	Public		Private		Net from ROW
	Uses	Resources	Uses	Resources	
Net Disposable Income at Basic Prices		**-4,805**		**214,542**	
Consumption at Basic Prices			184,930		
Private Consumption at Basic Prices			129,396		
Public Consumption			55,534		
Individual Consumption			32,454		
Collective Consumption			23,080		
Net Saving	**-4,805**		**29,612**		

Source: Eurostat, 2015: *Non-financial transactions* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

Table 7: The use of saving account, Austria, 2010

Saving Account	Public		Private		Net from ROW
	Uses	Resources	Uses	Resources	
Net Saving		**-4,805**		**29,612**	
		Public Saving		**Private Saving**	
Gross Capital Formation	3,163		57,095		
Gross Capital Formation Households and NPISH			15,931		
Gross Capital Formation Corporations			41,164		
Consumption of Fixed Capital		3,655		42,075	
Capital Transfers	8,742	179	513	9,428	353
Net Non Produced, Non Financial Asset Inflows	-47		216		
Net Lending	-12,828		23,290		
	-1		**1**		

Source: Eurostat, 2015: *Non-financial transactions* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

Having information about incomes, transfers, consumption and savings provides us with most of the information needed for constructing the NTA macro controls.

The value saved by public and private sectors can be used for net capital formation: investment (i.e. gross capital formation less consumption of fixed capital), net capital transfers (received less paid), net non-produced, non-financial assets, and the net lending to the other sectors and the ROW.[4]

3.3 The Life Cycle Account

Since the ESA and the NTA serve different purposes,[5] not all the variables can be retrieved directly from the ESA. Some variables are unique to NTA and thus do not have a direct counterpart in the ESA (e.g. intra-household transfer inflows and outflows).

[4] For the total economy only net lending/borrowing to the ROW counts.

[5] While the ESA focusses on production, income, consumption, investment and financial issues, the NTA objective is to measure inter-generational transfers/flows that are used by individuals to finance their consumption (van Tongeren, 2013).

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The NTA accounts are divided into three sub-accounts: the life cycle account, the transfer account and the asset-based reallocations account. In the following three subsections we explain variables using the 'NTA language' and explain the detailed calculations of variables using ESA and non-ESA data.

The economic life cycle consists of consumption, labour income and life cycle deficit. Life cycle deficit is defined as a difference between consumption and labour income.

3.3.1 Consumption

According to the NTA, consumption includes private and public consumption. Public and private consumption are both analysed separately by purpose (function) and are divided into education, health and other public or private[6] consumption. The distinction is motivated by the huge age-specific variation of these components.

The ESA does not include aggregate values of the subcategories of private and public final consumption. Therefore, Classification of Individual Consumption by Purpose (COICOP) is used to calculate aggregate values for the private consumption subcategories and Classification of the Functions of Government (COFOG) to calculate aggregate values of the public consumption subcategories. Whereas the COFOG classification can be directly used for disaggregation of the public consumption (COFOG is a satellite account to the ESA), the aggregate values of the subcategories of private consumption based on COICOP are adjusted to match the aggregate value of the total private consumption from the ESA (see Table 8).

NTA private consumption expenditures correspond to domestic consumption expenditures, including expenditures of resident households abroad. Additionally, private consumption as defined in NTA also includes final consumption of the NPISHs and is defined at basic prices, which means that taxes less subsidies on products are excluded. Table 8 presents the aggregate subcategories of the private consumption using the shares of those subcategories in the Domestic Household Consumption Expenditures.[7]

[6] We separately estimate owner-occupied housing, a part of other private consumption, since it is further needed for the estimation of intra-household transfers.

[7] The difference between Domestic Household Consumption Expenditure and Private Consumption at Basic prices (used in NTA) results from the fact that the former includes expenditure of non-resident households abroad and excludes expenditure of resident households abroad, whereas the latter represents total expenditure at basic prices of resident households (in the economy and the ROW) and NPISH.

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Table 8: Derivation of private consumption subcategories, Austria, 2010

Derive the Aggregates for Subcategories of Private Consumption		
Domestic Household Consumption Expenditure (COICOP)		
Education	1,073	Includes expenditure of non-resident households in the economy; excludes expenditure of resident households abroad.
Health	5,694	
Other	135,548	
Imputed Rents (included in "Other")	16,247	
Total	**158,562**	
Private Consumption Expenditure at Basic Prices (National Concept)		
Education	875	Total consumption expenditure at basic prices of resident households (in the economy and in the ROW) and NPISH. Aggregates for subcategories are calculated using their shares in Domestic Household Consumption Expenditure
Health	4,646	
Other	110,615	
Imputed Rents (included in "Other")	13,259	
Total	**129,396**	

Source: Eurostat, 2015: *Non-financial transactions*, *Final consumption expenditure of households by consumption purpose* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

3.3.2 Labour Income

Labour income includes labour earnings of employees (including employer's social contributions) and returns on labour of the self-employed workers. We get the first part of labour income, earnings, by adding the share of other taxes less subsidies on production (on earnings) to the compensation of employees (wages and/or salaries in cash and in kind plus actual and imputed employer's social contributions).[8] Self-employment labour income consists of two-thirds of gross mixed income adjusted by the proper share of other taxes less subsidies on production.

3.3.3 Life Cycle Deficit

The life cycle deficit (LCD) is the difference between consumption and labour income. When the LCD is negative, it is called a life cycle surplus, since labour income exceeds consumption. In Table 9 we present the aggregate values for labour income, consumption, and the life cycle deficit.

[8] Employer's social contributions are part of earnings; however, their aggregate value is given separately from wages/salaries. This is necessary since the age profile of employer's social contributions is in some countries substantially different from the age profile of wages/salaries.

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Table 9: The life cycle account, Austria, 2010

Variable abbreviation	Variable Name	Value (mill. of national currency)
LCD	Life Cycle Deficit	22,449
C	Consumption	184,930
CG	Public Consumption	55,534
CGE	Public Consumption, Education	14,258
CGH	Public Consumption, Health	15,611
CGX	Public Consumption, Other	25,665
CF	Private Consumption	129,396
CFE	Private Consumption, Education	875
CFH	Private Consumption, Health	4,646
CFR	Private Consumption, Housing	13,259
CFX	Private Consumption, Other	110,615
YL	Labour Income	162,481
YLE	Earnings	144,127
YLS	Self-employment Labour Income	18,354

Source: Eurostat, 2015: Non-financial transactions, Final consumption expenditure of households by consumption purpose, General government expenditures by function, (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

The LCD indicates the demand for the age reallocations in the form of public and private transfers and in the form of public or private asset-based reallocations. In the next subsections we present a more detailed description on how the transfer and asset-based reallocation variables are created from the ESA and non-ESA data.

3.4 The Transfer Account

3.4.1 Public Transfers

Net public transfers are the difference between public transfer inflows and public transfer outflows. Public transfer inflows refer to the flows that are mediated by the government, including both in-kind and in-cash transfers received by individuals. Public transfer inflows in kind consist of public individual consumption (e.g. publicly provided health) and collective consumption expenditure (e.g. street lighting). Public transfer inflows in cash are monetary transfers received from the government (e.g. public pensions).

Total public transfer inflows are derived using the ESA. Total public in-cash transfer inflows are the sum of resources received by the private sector in the form of other current transfers and social benefits other than social transfers in kind. Total public in-kind transfers include social transfers in kind (individual consumption) and collective consumption.

Similar to consumption, public transfers are given separately by purpose (function). Public transfer inflows are divided into the three subcategories: education, health and pensions. The remaining parts of in-kind and in-cash

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public transfers (not disaggregated into the subcategories) are called other in-kind and other in-cash transfer inflows. The 'other in-kind' and 'other in-cash' transfers are separated into the categories unemployment, family and children, housing, other social protection, and other transfers.

The aggregate values of public transfer inflows by purpose are based on data from COFOG for estimating public transfer inflows in kind, and on data from the European System of Integrated Social Protection Statistics (ESSPROS) for estimating cash transfers. Even though the total cash transfers from the ESA and those from ESSPROS are not exactly the same, the ESSPROS fits well to the ESA (Eurostat, 2007). To calculate the public transfer inflows in cash by subcategories, we multiply the share of specific subcategory in the ESSPROS total by the total ESA cash transfers. The estimation of public transfer inflows in-cash subcategories is shown in Table 10.

Table 10: Public transfer inflows in cash, Austria, 2010

ESSPROS Cash Transfers

Description: Adjust the cash transfers by function from ESSPROS to the SNA-total of Social Benefits (NIK)

	ESSPROS Cash benefits	Cash Benefits Adjusted	NTA - Category
Adjustment Factor		0.94180	
All functions	**59,118**	**55,677**	
Sickness/Health care	**3,071**	**2,892**	TGH
Invalidity	**4,933**	**4,646**	TGSD
Old age	**34,792**	**32,767**	TGSOA
Survivors	**5,584**	**5,259**	TGSS
Family/Children	**6,653**	**6,266**	TGSF
Unemployment	**3,621**	**3,410**	TGSU
Housing	**0**	**0**	TGSH
Social exclusion n.e.c.	**465**	**438**	TGSX

Source: Eurostat, 2015: *Non-financial transactions*, *Social protection expenditure* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

In Table 11 we present the total public transfer inflows, public transfer inflows in cash, and public transfer inflows in kind,[9] separately by purpose.

[9] Note that subcategories of social protection in kind are not available for Belgium, Cyprus, Romania, Slovakia and Spain. The shares of subcategories of the total social protection are calculated using the average share for other countries.

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Table 11: Public transfer inflow subcategories, Austria, 2010

Public Transfer Inflow Subcategories

Description: Public In-Kind (Public Consumption) and Cash Transfers (ESSPROS) are added up by function

		Public Consumption = Transfers In-kind	Public In-cash Transfers; Source: SNA, ESSPROS	**Total**
Total	TGI	55,534	60,279	**115,813**
Education	TGEI	14,258		**14,258**
Health	TGHI	15,611	2,892	**18,503**
Social Protection: Old Age	TGSOAI	277	32,767	**33,044**
Other Cash	TGXCI	0	4,602	**4,602**
Other In-kind	TGXII	21,805		**21,805**
Social Protection Total	TGSI	3,584	20,018	**23,602**
Social Protection Survivors	TGSSI	0	5,259	**5,259**
Social Protection Disability and Sickness	TGSDI	957	4,646	**5,603**
Social Protection Family and Children	TGSFI	294	6,266	**6,559**
Social Protection Unemployment	TGSUI	440	3,410	**3,850**
Social Protection Housing	TGSHI	13	0	**13**
Social Protection Other	TGSXI	1,880	438	**2,318**
Collective Consumption	TGCI	23,080		**23,080**

Source: Eurostat, 2015: *Non-financial transactions*, *Social protection expenditure, General government expenditures by function,* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

Public transfer outflows measure the flows of economic resources from the private sectors to the public sector. They are used to finance either public transfer inflows, public asset income (if negative, e.g. interest on public debt) or public saving. Public transfer outflows consist of taxes, social contributions and other revenues paid by the private sector to the government. In most European countries the public revenues in the form of public transfer outflows do not cover all of the public transfer inflows and public interest payments. In this case the difference is financed through dissaving—a component of public asset-based reallocations, described in the next section.

The aggregate values for the public transfer outflows (i.e. taxes, social contributions and other revenues) are taken from the ESA data. Taxes paid by individuals (private sector) are comprised of net indirect taxes less subsidies and taxes on income, wealth, etc. Social contributions and other current transfers (i.e. other revenues) are estimated as a part of social contributions and other current transfers that are paid from the private sector to the general government and estimated using the intersectoral matrices explained in the previous section (Table 5).

To complete the estimation of the public transfer outflows we need to differentiate taxes by their source, i.e. the activity that is being taxed. Total taxes are classified into taxes on asset income (TGFYA), labour income (TGFYL) and consumption (TGFC). The information on the source of the taxes is taken from the Eurostat data on 'Structure of taxes by economic function'. The Eurostat data include the information about taxes paid on capital income and taxes paid on consumption as a percentage of gross domestic product (GDP). Additionally, they also include information on 'taxes and social contributions on labour' paid by employers and employees as well as non-employed individuals (predominantly pensioners). The percentage share in the GDP is informative for

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the share of each of the tax subcategories in the total taxes (presented in Table 12).

Table 12: Derivation of taxes and social contributions subcategories, Austria, 2010

Taxes and social contributions		
Variable abbreviation	**Variable name**	**% of GDP**
TGFYA	Taxes on asset income	6.4
TGFYL	Taxes on labour income	7.7
TGFC	Taxes on consumption	11.8
TGPYL	Social contributions, labour	13.6
TGPPEN	Social contributions, pensioners	2.6
Total		42.1

Source: Eurostat, 2015: *Structure of taxes by economic function,* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

However, in order to separate 'share of taxes on labour income' and 'social contributions' (which are both included in taxes and social contributions on labour) we calculate the difference between 'taxes and social contributions on labour' (reported by Eurostat) and 'total social contributions' (calculated previously, see Section 3.2.2). Total social contributions are further divided into social contributions paid by pensioners (TGPPEN[10]) and social contributions paid by employers and employees (TGPYL).

Public transfer inflows received by the residents less public transfer outflows paid by the residents must equal to the net public transfers received from the ROW (if negative, paid to the ROW).

3.4.2 Private Transfers

Private transfers include transfers between households (inter-household) and transfers within households (intra-household). The NTA private transfers refer to *inter vivos* transfers, thus excluding capital transfers such as bequests. Inter-household transfers include direct transfers between households (e.g. alimony payments and gifts) as well as indirect household transfers mediated by the NPISHs (e.g. donations). Inter-household transfer inflows include also the private transfers from and to the ROW. The difference between inter-household transfer inflows and outflows are net private transfers from/to the ROW.

The aggregate value for the net inter-household transfers includes the ESA categories taxes less subsidies on products and production less subsidies (e.g. taxes paid by the resident corporations to the ROW), other current transfers, social contributions and benefits other than in kind, and social transfers in kind (those that correspond to the expenditures of NPISHs) net from the ROW.

[10] We treat social contributions paid by non-employed (pensioners) as a fixed percentage of GDP. The difference between total social contributions and those paid by non-employed (TGPPEN) are social contributions paid by employers and employees (TGPYL).

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While the ESA can be used to construct aggregates for public transfer flows, the information about private transfer flows is limited. The inter-household transfer inflows and outflows are estimated using the miscellaneous current transfers (a subcategory of other current transfers), which mainly includes the transfers between households. Since miscellaneous current transfers received and paid are only a part of private transfer inflows and outflows we need to adjust them in a way that the difference between them equals net inter-household transfers (retrieved from the ESA). We keep the inter-household transfer outflows constant (given), while inflows are estimated as a sum of inter-household transfer ouflows and the net private transfers from the ROW.

The aggregate value of intra-household transfers equals zero, as intra-household transfers present transfers within the same household. The intra-household transfer inflows equal intra-household transfer outflows, therefore net intra-household transfers equal to zero at the aggregate level. The public and private transfers and their subcategories are presented in Table 13.

Table 13: The NTA transfer account, Austria, 2010

Variable abbreviation	Variable Name	Value (mill. of national currency)
T	Transfers	-1,828
TG	Public Transfers	-2,356
TGI	Public Transfer, Inflows	115,813
TGIC	Public Transfer Inflows, in cash	60,279
TGII	Public Transfer Inflows, in kind	55,534
TGO	Public Transfer, Outflows	118,169
TGF	Taxes	66,884
TGP	Social Contributions	46,149
TGX	Other Revenue	3,713
(TD)	Transfer deficit/surplus	1,423
TF	Private Transfers	528
TFB	Inter-household Transfers	528
TFW	Intra-household Transfers	0
TFI	Private Transfers, Inflows	1,553
TFBI	Inter-household transfers, Inflows	1,553
TFWI	Intra-household transfers, Inflows	na*
TFO	Private Transfers, Outflows	1,025
TFBO	Inter-household transfers, Outflows	1,025
TFWO	Intra-household transfers, Outflows	na*

na* = not applicable

Source: Eurostat, 2015: *Non-financial transactions*, *General government expenditures by function,* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

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3.5 The Asset-Based Reallocations Account

Assets are of special interest, since they present a way of shifting economic resources across time and age. Observing asset-based reallocations combined with transfers provides a comprehensive picture of financing the life cycle deficit.

Asset-based reallocations (ABR) are divided into public and private asset-based reallocations. ABR equals asset income (the sum of capital and property income) less saving. Generating additional asset income means an inflow for individuals, given that asset income consists of resources that can be used for consumption or transfers in the accounting period. In contrast, positive saving represents an outflow. Dissaving (negative saving) can generate an inflow for individuals.

3.5.1 Public Asset-Based Reallocations

Public asset-based reallocations equal the (public) transfer deficit/surplus. A public transfer deficit is generated when taxes, social contributions and other current transfers paid by the residents are not enough to cover public transfer inflows to the residents and net public transfers to the ROW. The government therefore has to cover the public transfer deficit or surplus through asset-based reallocations (i.e. issuing new debt). If asset income is sufficient to cover the transfer deficit, the residual is saved. If asset income is insufficient to cover the deficit, the public sector must dissave.

Public asset income is the sum of net operating surplus of the government (gross operating surplus less consumption of fixed capital) and net property income of the government (received less paid). Because most public capital does not generate an operating surplus, the net operating surplus is usually very small. Public property income consists of interest, reinvested earnings on direct foreign investment, and rents.

Public asset-based reallocations (RAG) are the difference between the transfers received minus transfers paid by the government in the form of taxes, other current transfers, social contributions and benefits in kind and not in kind (from the ESA). Public saving is calculated as the difference between asset income and the RAG and equals net saving by the general government reported in the ESA.

3.5.2 Private Asset-Based Reallocations

Private asset-based reallocations also consist of two flows, asset income (a sum of capital and property income) and saving. The NTA gross capital income includes gross operating surplus of households and corporations, capital share of mixed income and taxes less subsidies on capital income. The operating surplus of households consists mainly of the return on the capital in the form of dwellings owned by households.[11] Only two components (i.e. capital income of

[11] The UN Manual requires combining the gross operating surplus of financial and non-financial corporations and NPISHs in order to obtain the capital income of corporations and NPISHs, while capital income of owner-occupied housing should only include operating surplus of households. Since in some countries (explicitly in DK, IE, LU, NL, DE and UK) the European sector accounts do not include flows for households and NPISHs

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corporations and capital income from mixed income) are adjusted to include the capital share of taxes less subsidies on production. The share of taxes less subsidies is allocated to these components according to the share of the gross values of these two components.

Table 14: The subcategories of asset income, Austria, 2010

Derive the Aggregates for Subcategories of Asset Income	Private	Public	Net from ROW
Asset Income	52,466	-3,381	
Net Capital Income (incl. Capital Share of ITLS)	48,746	663	
Gross Capital income, corporations	64,501		
Capital income, owner-occupied housing	16,448		
Gross Capital income from mixed income (HH and NPISH)	9,079		
Gross Capital income, corporations, incl. ITLS	65,196		
Capital income, owner-occupied housing	16,448		
Gross Capital income from mixed income (HH and NPISH) incl. ITLS	9,177		
Net Capital income, corporations, incl. ITLS	33,343		
Capital income, owner-occupied housing	9,862		
Net Capital income from mixed income (HH and NPISH) incl. ITLS	5,541		
Net Property Income	3,720	-4,043	324
Property Income Inflows	71,987	3,526	27,469
Property Income Outflows	68,270	7,569	27,145
Other Property Income Inflows	36,484	2,177	9,318
Other Property Income Outflows	34,996	0	12,984
Interest Inflows	35,503	1,349	18,151
Interest Outflows Corporations	30,311	7,569	14,161
Interest Outflows HH	2,963		

Source: Eurostat, 2015: *Non-financial transactions* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

In the next step the proper share of consumption of fixed capital is subtracted from the gross values in order to get the net values of all three capital income components. Since capital income of corporations includes only operating surplus the proper value of consumption of fixed capital can be directly retrieved from the ESA (difference between gross and net operating surplus). However, the capital income of households and NPISHs includes operating surplus and mixed income combined. The consumption of fixed capital is thus excluded from the capital income of owner-occupied housing (household operating surplus) and from the capital share of mixed income proportionally to their gross value (before taxes less subsidies included in the mixed income part). The derivation of the aggregates for the subcategories of the asset income is given in Table 14.

Property income consists of flows generated by financial assets, such as interest, dividend and rent. In order to calculate primary income only, net property income from the ROW is included. The (public and private) property income inflows and outflows are the same as ESA property income received and paid.

separately, we rather differentiate between capital income of corporations and capital income from owner-occupied housing for households and NPISHs combined. This should not be a problem since NPISHs sector has a really limited role in the total economy.

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The ESA property income includes interest, distributed income of corporations, reinvested earnings from direct foreign investment, property income attributed to insurance policy holders, and rents. The NTA distinguishes interest from other parts of property income. However, it also distinguishes between interest outflows from corporations and households (consumer credit).

Private saving in the NTA equals the difference between private disposable income and consumption (public and private) from the ESA. Next, private asset-based reallocations are the difference between private asset income and saving. Public and private asset-based reallocations and also total reallocations (sum of transfers and asset-based reallocations = life cycle deficit) are presented in Table 15.

Table 15: Asset-based reallocations Account, Austria, 2010

Variable abbreviation	Variable Name	Value (mill. of national currency)
R	Reallocations	22,450*
T	Transfers	-1,828
RA	Asset-based Reallocations	24,278
RAF	Private Asset-based Reallocations	22,854
YAF	Private Asset Income	52,466
YKF	Private Capital Income	48,746
YPF	Private Property income	3,720
SF	Private Saving	29,612
RAG	Public Asset-based Reallocations	1,424
YAG	Public Asset Income	-3,381
SG	Public Saving	-4,805

* Table additionally includes total reallocations (sum of net transfers and asset-based reallocations)

Source: Eurostat, 2015: *Non-financial transactions* (http://ec.europa.eu/eurostat/data/database); Authors' own calculations.

4 The Economic Life Cycle

4.1 Additional Methodological Notes

The NTA age profiles are based on three different types of data: data from national accounts for the aggregate values, population data and administrative/survey data to estimate the distribution over age groups. We use data on population by age on 1 January[12] from the Eurostat webpage.

The main source of data to estimate the age distribution of income-related economic quantities is the European Union Statistics on Income and Living Conditions (EU-SILC) and the main source to estimate the age distribution of private consumption variables is the Household Budget Survey (HBS). We

[12] We retrieve the population data for the beginning of the year for which we estimate the age profiles (year 2010 for basic NTA age profiles).

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estimate the age profiles for EU countries for the year 2010. The age profiles are presented from age 0 to 80+, in line with how the age limits are defined in EU-SILC. The age limit of 80+ is set due to the small number of respondents who are older than 80 years.

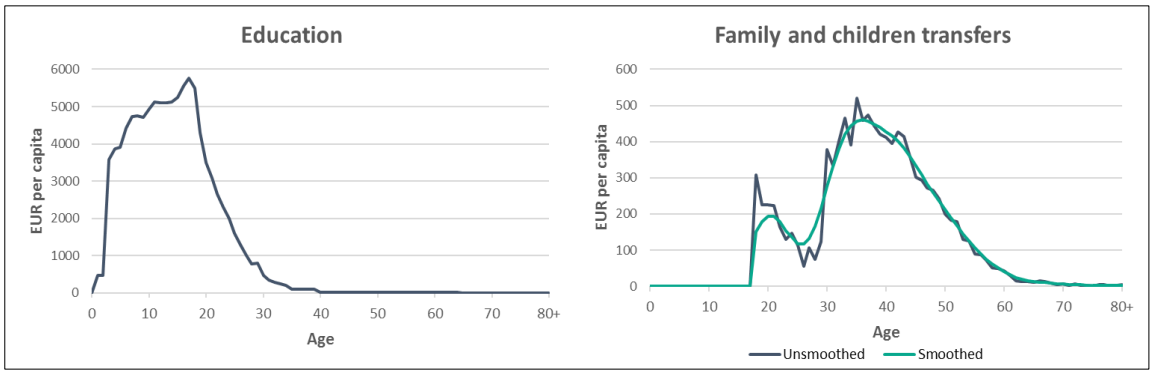
The use of survey data has some disadvantages compared to administrative data. A problem can arise when using surveys with small sample sizes or when analysing the economic activities (variables) with a very small number of observations. In such cases, outliers can have a very large effect on the results. Furthermore, for some economic activities over- or underreporting is very common. Using survey data directly can therefore lead to over- or underestimation of the aggregate values. In NTA we correct for these issues by smoothing the age profiles and by adjusting them to the aggregates derived from the SNA/ESA.

4.1.1 Smoothing

We use a smoothing procedure over age to minimise the random variation of the age-specific estimates that occurs due to random sampling of survey participants. The objective is to reduce sources of random variation without eliminating the 'real' variation between age groups. For instance, we do not smooth the age profiles of public education in order to keep the information on real age differences. The age variations in the public education consumption age profile are not a consequence of random variation, but reflect mainly the differences in participation rates by age.

In Figure 1 we present two subcategories of public consumption: education and in-kind transfers in the category family and children (e.g. public child care facilities). The latter constitutes a part of public consumption other than education and health. The age profile of public education consumption is not smoothed so as not to lose variation across different ages, while the age profile of public transfers in the category family and children is smoothed to reduce noise in the data.

Figure 1: Public consumption by category, Germany, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations.

To smooth the age profiles we use Friedman's SuperSmoother which is a nonparametric regression estimator (Luedicke, 2015). In the smoothing

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procedure, we use the number of observations in each age group as weights. Hence, greater weight is given to age-specific averages that are based on more observations, while age-specific averages based on fewer observations are attributed less weight. Age profiles which are a composite of (smoothed) sub-profiles (e.g. total consumption as a sum of education, health and other consumption) are not smoothed.

Sometimes using Friedman's SuperSmoother can result in smoothed age profiles being slightly negative at some ages (where they shouldn't be). This occurs when unsmoothed age profiles are very close to 0. The issue can be resolved by replacing the negative smoothed values with the original unsmoothed ones.

To avoid double smoothing, we do not smooth age profiles composed of several other components (age profiles) which have already been smoothed and adjusted to match the value of a macro control. For example, the age profile of the life cycle deficit, which is calculated as the difference between consumption and labour income, is not smoothed.

For some age profiles we do not smooth specific age intervals where the analysed quantity equals to 0 by definition. For example, the age profile of labour income equals to 0 for individuals younger than 15 years since only individuals aged 15+ can officially enter the labour market and generate labour income. When smoothing such age profiles, we should exclude the age groups which take the value of 0 by definition and smooth only over the other age groups.

4.1.2 Adjusting

As previously mentioned, most of the age profiles are based on survey data which might result in under- or overestimation of aggregate values of different economic activities. To ensure that the estimated aggregate value matches the value of the previously calculated macro control, the age profile (smoothed and/or unsmoothed) is adjusted, so that the estimated aggregate value (sum over the total population) equals the aggregate value derived from the ESA. To adjust each age profile, the first step is to find the adjustment factor which is calculated in the following way:

$$\theta = \frac{X}{\sum_{a=0}^{80+} x(a)N(a)}. \tag{5}$$

In the above formula, X represents the value of a macro control, $x(a)$ is the per-capita estimated (unadjusted) age profile at age a and $N(a)$ is the population count at age a. To calculate the adjustment factor, we therefore divide the value of a macro control (for a specific country and year) by the unadjusted aggregate value of estimated economic quantity. The calculated adjustment factor is then used to finalise the age profile by shrinking or expanding the unadjusted age profile by the same factor for each age group a:

$$\bar{x}(a) = \theta x(a), \tag{6}$$

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$$\bar{X}(a) = \bar{x}(a)N(a), \tag{7}$$

where $\bar{x}(a)$ and $\bar{X}(a)$ represent the finalised per-capita and aggregate age profiles at each age a, respectively.

Note that the value of the adjustment factor gives important information about the quality of the estimated age profile. The estimated age profile is supposed to be nationally representative, so the aggregate value of the estimated economic activity should be close to the value of macro control. We would expect the adjustment factor θ to be close to 1. An adjustment factor substantially different from 1 implies serious over- or underestimation in the survey data or exclusion of important components (or vice versa, inclusion of components that should not be included).

4.1.3 Normalising

Smoothing and adjusting are used to finalise the NTA age profiles. To better understand the age patterns and their significance, we compare the age profiles of a specific economic activity over time and across countries. To enable the comparison for different years and countries, the age-specific values have to be measured in comparable units. This is necessary because the values of per-capita and aggregate age profiles vary differently across countries and over time, according to the differences in productivity or levels of income, exchange rates and numerous other factors.

We eliminate the impact of these factors by normalising the age profiles. To compare the values of the age profiles over time and across countries, the NTA averages are divided by a simple average of per-capita labour income for age groups between 30 and 49 years old. A simple (i.e. non-weighted) average is used so that the normalisation process is not affected by the age distribution of the population between 30 and 49 years of age. We choose labour income because it represents one of the key categories in the NTA. The age group 30–49 is used because it is the least affected by lifetime decisions, such as leaving school, entering the labour market or entering into retirement. However, it should be borne in mind that the 30–49 age group is affected by decisions on female employment and differences in wages between both genders, important for creating NTA by gender (see Section 7).

Figure 2 presents per-capita nominal and normalised age profiles of labour income for Germany in 2010. The normalised age profile is of the same shape as the per-capita nominal age profile since it is obtained by dividing the age patterns with the same value in the denominator (average labour income for the 30–49 age group).

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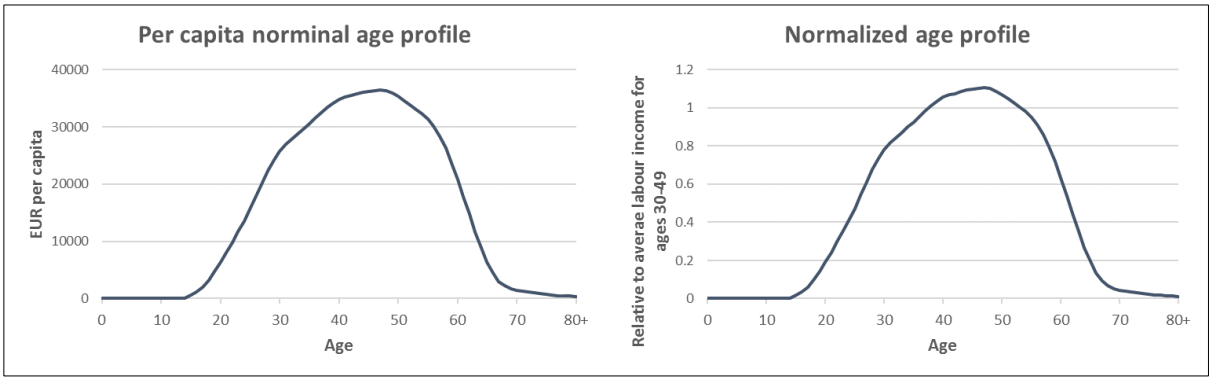
Figure 2: Labour income, Germany, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations.

4.1.4 Definition: Household Head and Adults

In the survey, some data are reported at the individual level, others at the household level. Therefore, a single person representing the whole household is needed within the analysis to assign household-related attributes to that person, the household head, who is then considered to dispose of the household common data. The household head is defined as the person with the highest total personal income (i.e. the sum of the following EU-SILC variables: employee cash or near cash income, non-cash employee income, company car, employer's social insurance contributions, optional employer social insurance contributions, cash benefits or losses from self-employment, unemployment benefits, old-age benefits). If two persons in the same household have earned the same amount of labour income, the older one is deemed to be the household head. As in the calculation of the total income, self-employment income is also included, and there is a probability that the total income is negative in the case of loss from self-employment. Thus, there can arise a situation where a child from such a household can have higher total personal income than the adult persons. In order to prevent children from being identified as household heads there is a control check that a person younger than 16 years cannot be identified as the household head.

Not all household-level variables are assigned to the household head. For family and children-related allowances, for example, it is assumed that the adult persons dispose of these benefits as in most countries these allowances are allotted to both parents. Therefore, we also need to define a variable 'adult' that represents a share of all adult persons which an individual adult represents in this household. We define adults as all individuals above 30, as well as those above 18 who are not enrolled in any level of formal education.

4.2 Labour Income Variables

The age profile for total labour income represents one of the main NTA age profiles. It includes earnings of employees, returns to labour of self-employed workers and employer's social contributions. The age profiles for labour income are estimated using the EU-SILC survey data. Wages, salaries and self-

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employment income as well as employers' social contributions are reported separately for each individual.

For most EU member states the income is recorded for the calendar year preceding the interview. The problem with such a system of gathering income data is that other variables (e.g. on social conditions), which are reported at the time of the interview, may not relate well to the income data. Regarding the use of EU-SILC data in NTA, special attention needs to be paid to the variable age: in EU-SILC age is usually reported as the age at the end of income reference period. In the case that the variable age is not reported, it is calculated from the variable year of birth. In what follows, the most important labour income categories are described in more detail.

4.2.1 Earnings

Age profiles for earnings are calculated as weighted averages of the income components, including earnings as well as the employers' social contributions.

For persons older than 15 years the main earning category from the survey data are gross wages. Additionally, earnings also include the employer's social contributions, all the payments that a worker receives as the result of his or her labour input, like holiday leave payment, compensation for food and transportation to work or any other payment that is provided by the organisation in which he or she works. Besides, non-cash forms of employee income (e.g. private use of a company car) are included.

For persons younger than 16 years the income data are available only at the household level, including income from work and survivor pensions (EU-SILC variable 'hy110g': gross income received by people aged under 16). In order to distribute it properly among individuals we distinguish between young persons who are 15 years old and children below the age of 15. We run a linear regression of total household income received by people aged under 16 years on the number of all people aged under 16 years and the number of people aged 15. We take regression coefficients as weights for distributing the whole sum among individuals.

4.2.2 Self-Employment Labour Income

EU-SILC contains data on cash benefits or losses from self-employment at the individual level. The self-employment labour income as defined in the EU-SILC includes operating profit or loss of working owners of the unincorporated enterprise or the partners in the unincorporated enterprise less interest on business loans.

4.2.3 Labour Income

Total labour income of individuals consists of earnings of employees (including benefits and employer's social contributions) and labour income of self-employed people. The age profiles are calculated separately for wages and/or salaries, employer's contributions and self-employment income. Detailed components of labour income are shown in Table 16.

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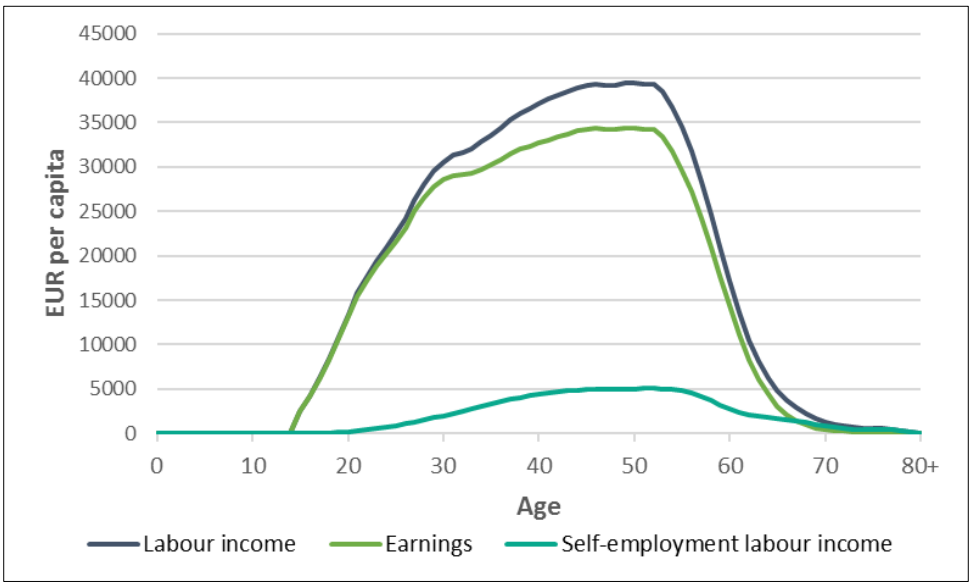
Table 16: Components of labour income

Category	Subcategory	EU-SILC variable	Description
Earnings of employees	Wages and/or salaries	py010g	Employee cash or near cash income (gross)
		py020g	Non-cash employee income (gross)
		py021g	Company car (gross)
	Employers' social contributions	py030g	Employers' social insurance contributions
		py031g	Optional employers' social insurance contributions
Labour income of self-employed		py050g	Reported income: cash benefits or losses from self-employment

Source: EU-SILC 2011.

Figure 3 reveals that as the sum of inverted U-shaped curves for earnings and self-employment income, the age profile of labour income takes a similar shape itself. Earnings of employees represent the largest part of total labour income, while labour income of self-employed is much smaller in size.

Figure 3: Age profile of total income and its subcategories, Austria, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations.

4.3 Private Consumption Variables

The private consumption age profiles are mainly based on the Household Budget Survey (HBS). The HBS contains harmonised data on essential variables of household budget surveys at the EU level (Eurostat, 2017). The HBS reference year is 2010. For Austria we use the consumption expenditure survey from

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2009/2010.[13] Even though consumption variables are reported only at the household level, the HBS includes the main characteristics for all the household members—such as age, gender, relationship to the reference person, completed level of education, country of birth etc. The downside of Eurostat's HBS dataset for constructing NTA is that age of household members is only available in five-year rather than one-year range groups. The highest age group reported in the HBS is 85+. However, as in the case of income-related variables, we present age profiles of private consumption for the combined last two age groups, making 80+ the oldest age group.

Data on private consumption expenditures are collected at the household level. Therefore, allocation rules have to be introduced to allocate consumption among household members. We calculate the average per-capita consumption for each component of consumption. Age profiles for every type of consumption are then adjusted to the aggregate values, using the population age distribution.

4.3.1 Education

HBS includes detailed data about household expenditures at different levels of education: expenditures on pre-primary and primary, secondary, post-secondary non-tertiary, and tertiary education. Additionally, education expenditures that are not differentiated by the level of education are included. To allocate household private 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 (and if he or she is enrolled at all). We divide level-specific private consumption of the household by the number of pupils/students enrolled in this educational level within the household. According to this assumption, unit costs are equal for all household members enrolled in a specific level of education, regardless of their age. Finally, education expenditures that are not differentiated by the level of education are equally distributed among all household members enrolled in any level of education. We sum up education expenditures over all levels of education to calculate per-capita education consumption at each age.

In the case of Germany, Spain, Finland, France, Italy, Romania and Sweden the variable 'Level of studies currently being followed by the household members' is not reported in the HBS. In this case we use the average age profile of all other NTA-EU countries with available data and adjust this average age profile to the aggregate education expenditure in each country. We create the average age profile by calculating a simple (unweighted) average of all EU countries with available data. Thus, we give equal weights to all countries regardless of their population size.

[13] The HBS provided by Eurostat does not include survey data for Austria. Therefore, in the case of Austria we use results based on the consumption expenditure survey provided by the Austrian national research team. Age profiles of private consumption in Austria are estimated in a way to be comparable with other Agenta results based on the HBS.

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4.3.2 Health

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 health expenditures of a household j (CFH_j) on the number of household members $M_j(a)$ of a specific age group a in household j. Treating each age group from 0 to 80+ separately would mean losing too many degrees of freedom. Therefore, we use ten-year age groups, represented by the index a. The sum over a in Equation (8) represents the sum over all age groups represented in household j. The coefficients of the linear regression show to what extent health consumption of a household would change on average if there was an additional household member of the age group a. To ensure complete allocation of household consumption expenditure the regression function does not contain a constant term.

$$CFH_j = \sum_{a=0}^{80+} \beta(a) * M_j(a) + \varepsilon_j \tag{8}$$

The $\beta(a)$ represent estimates for the health expenditure of a household member from age group a. The regression coefficient is equal for all individuals from the same age group. For age groups with very little health expenditure, the regression coefficient can become negative. To avoid negative expenditure, we replace the negative coefficients with zeros. Next, we calculate shares of expenditure for each member i within total household expenditure as predicted health expenditure $(\hat{\beta})$ relative to the predicted expenditure for the household as a whole based on the regression function. These shares are then used as weights when allocating total household expenditure for health to individual members, as presented in Equation (9). In the last step, we calculate age profiles in a standard manner.

$$CFH_{ij} = CFH_J * (\hat{\beta}(a_i) / \sum_{a=0}^{80+} \hat{\beta}(a) * M_j(a)) \tag{9}$$

4.3.3 Private Consumption Other Than Education and Health

Other private consumption is allocated using the *ad-hoc* allocation rule. This rule is based on the equivalence scale, using the modified Deaton's (1997) equivalence scale. The rule assumes that people aged 20 or older have the same consumption share, which is set to 1. For children below the age of 4, it is assumed that they consume 0.4 of the consumption of an adult. For children from the age of 4 up to 20 the consumption share increases linearly from 0.4 to 1.0 of the consumption of an adult.

Other private expenditure of the household (CFX_j) is thus allocated to the household member *i* in the following way:

$$CFX_{ij} = CFX_j * (\alpha(x) \ / \ \sum_{a=0}^{80+} \alpha(a) M_j(a)), \tag{10}$$

where $\alpha(x)$ represents the scale of household member *i*, $M_j(a)$ is the number of members aged a in the household j and $\alpha(a)$is their age-specific scale.

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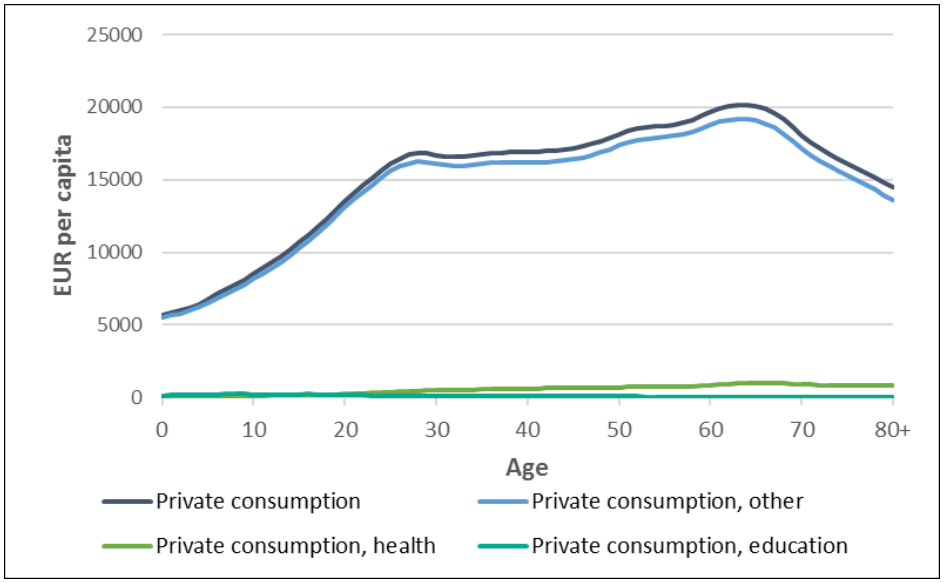
Consumption other than education and health is usually further divided into two subcategories, 1) housing consumption ('owner-occupied housing') and 2) other consumption (excluding education, health and housing). This division is also of practical use: it is needed for calculating intra-household transfers. For 'owner-occupied housing' we use EU-SILC data. We prefer EU-SILC to HBS data because in EU-SILC age is reported for one-year age groups and data are available for all EU-countries.[14]

4.3.4 Total Private Consumption

We calculate total private consumption as the sum of previously calculated components: private education consumption, private health consumption and private consumption other than education and health. Figure 7 shows the age profile of total private consumption and its subcategories for Austria in 2010. The shape of total private consumption strongly resembles the shape of private consumption other than education and health (including expenditures on food, clothing, actual rents, etc.). Private consumption rises sharply until the late 20s. During working age it is rather constant, but starts to increase again in 50s and 60s. A reason for the latter is a lower number of household members, and thus a higher consumption per member.

Figure 4: Total private consumption and its subcategories, Austria, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

4.4 Public Consumption Variables

To estimate the age profile of public consumption and its components, it is necessary to understand how much each age group profits from different public programmes. We distinguish between individual public consumption (when beneficiaries of a specific programme are known) and collective public

[14] The only exception is Belgium where data on "owner-occupied housing" are reported in HBS but not in EU-SILC.

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consumption (beneficiaries are people in general). By definition, public consumption is equal to in-kind public transfer inflows, which are further mentioned in Section 5.1.1. Like private consumption, public consumption is divided into three main categories: education, health, and public consumption other than education and health.

Data on public consumption are not available from household surveys and are usually found using administrative data, government reports etc. To estimate age-specific public consumption for EU countries, we use a wide range of data, mainly from EU organisations such as the Ageing Working Group.

4.4.1 Education

To create the age profile of public education consumption we divide total public education expenditures among different educational levels and combine these data with enrolment data, disaggregated by age and level. We distinguish among the following educational levels: pre-primary, primary, secondary (lower and upper), post-secondary non-tertiary, and tertiary level using the International Standard Classification of Education (ISCED). In the following pages, we describe the methodology in three steps. First, we derive the aggregate consumption expenditure by education level and calculate the expenditure per enrolled person for each level. Second, we calculate enrolment rates by level at each age. And third, we calculate the average expenditure per person in each age group.

In the first step, we calculate expenditure per enrolled person by level. Total consumption per enrolled person is mainly based on data of public consumption expenditures for education from Eurostat database. Consumption expenditures are disaggregated by level of education according to Classification of the Functions of Government (COFOG). There are eight main categories into which total education expenditures in COFOG are divided: pre-primary and primary education, secondary education, post-secondary non-tertiary education, tertiary education, education not definable by level, subsidiary services to education, R&D education, and education n.e.c. (not elsewhere classified).

Next, we assign the COFOG expenditures to ISCED education levels. We can assign the first four COFOG categories to ISCED educational levels in a straightforward manner. The latter four COFOG categories represent government expenditures that are not targeted at particular age groups, so we allocate them to all ISCED educational levels proportionally to the share of students enrolled in each level. Moreover, we split the combined data for pre-primary and primary level into two parts (pre-primary and primary level separately) based on the share of total public education expenditures that government spends for each educational level using United Nations Educational, Scientific and Cultural Organization (UNESCO) database (2014). We do the same for lower and upper secondary education.

We retrieve the data on numbers of enrolled students by ISCED levels from Eurostat. To calculate the unit cost per enrolled person for each educational level, the level-specific public education expenditures are divided by the number of students enrolled in this educational level. The underlying assumption is that

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the unit cost of public education is equal for all students enrolled in a specific level, regardless of their age.

In the second step we calculate the number of enrolled students for each educational level and age group. Eurostat offers level-specific data on the number of enrolled students by one-year age groups until the age of 34. After this age, data are available only for the age groups 35-39 and 40+.

For people who are between 0 and 34 years old, we take the original Eurostat data. These data are already broken down into one-year age groups, except for those aged less than 3 years. For them, we assume that children aged 0 are not yet enrolled into educational programmes, so we distribute the number of enrolled students uniformly between children aged 1 and 2.

For the age group 35-39 we distribute the original level-specific data on number of enrolled students into one-year age groups proportionally to the share of population in each age group. To distribute the students in the age group 40+ to single-year age groups we use the data on participation rates in formal education of adults from Eurostat using Adult Education Survey (AES).[15]

In the third step we calculate average public education consumption by age groups. For each age, we multiply the number of students enrolled in a specific educational level with the unit cost per enrolled person for this educational level. Summing over all educational levels for each age, we get age-specific total public education consumption. Finally, dividing age-specific total public education consumption by population size for this age, we get the per-capita public education consumption.

In Figure 5, we show the finalised age profile of public education consumption for Austria for the year 2010. Please note that we do not smooth the age profile of education consumption so as not to lose real variability in the data. In all countries per-capita education consumption is low in kindergarten years, but starts to increase rapidly before primary school. Consumption stays high during primary education due to mandatory enrolment. The peak in education consumption is reached at different ages in different countries. After completing secondary education, enrolment rates start to fall which results in lower per-capita consumption. After the age of 30, public education consumption is almost negligible.

[15] AES is a household survey which is conducted every five years. We use the data on participation rates from AES 2011 (since it is the closest to year 2010) and population data from 2010.

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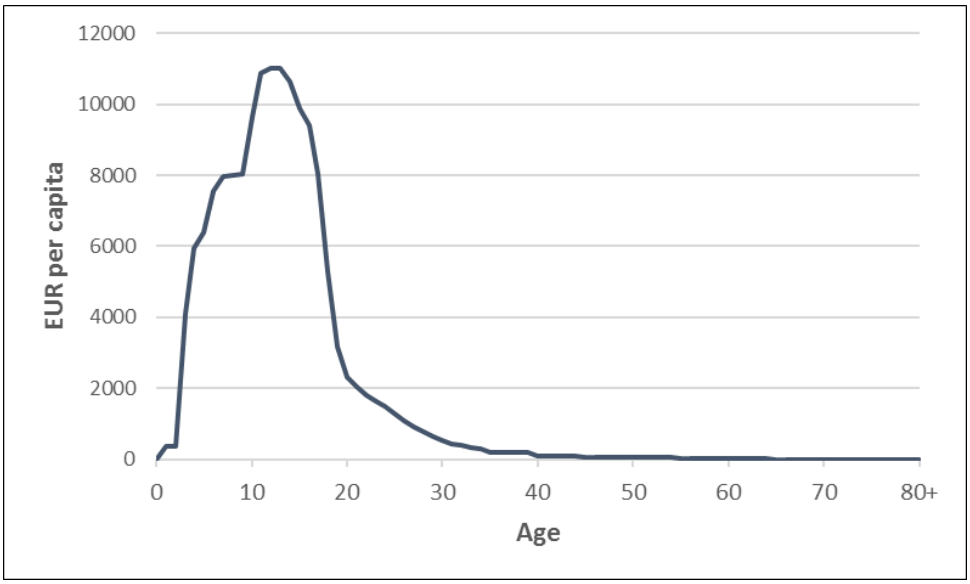
Figure 5: Unsmoothed age profile of public education consumption, Austria, 2010



Source: Eurostat (Population data, general government expenditures by function); UNESCO, 2014; Authors' own calculations.

4.4.2 Health

There is no available administrative data source offering comparable data on public health expenditures for all EU countries. We received the pre-calculated age profiles of health care consumption for one-year age groups from the Ageing Working Group (AWG), which was appointed by the Economic Policy Committee (EPC).[16] Their aim is to prepare projections of budgetary consequences of an ageing European population over the time period 2010–2060 (Ageing Report 2015).

AWG calculated the age profiles of public health care by summing up basic health care categories as defined in the System of Health Accounts (SHA). These categories are: services of curative care, services of rehabilitative care, ancillary services to health care, medical goods dispensed to outpatients, prevention and public health services, health administration and health insurance, services not allocated by function and investments in medical facilities.

We obtained permission to use the age profiles in our calculations for the following European countries: Austria, Belgium, Bulgaria, Cyprus, Denmark, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Slovakia, Slovenia, Sweden and the United Kingdom. For these countries, we use the age profiles provided by the AWG. We take the profiles from AWG report 2012 and adjust them to the country-specific macro control for 2010. The only exception is the United Kingdom where we use the age profile from AWG report 2015 instead of 2012 due to extremely large values of the age

[16] We did not get permission from the Italian AWG team to show their health care age profiles as a separate category. Therefore the Agenta Data explorer does not include public health consumption for Italy.

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profile in AWG report 2012 (compared to the other countries), especially for new-borns. We do not smooth the received age profiles since they were already smoothed.

We did not get access to the age profiles for the following countries: Czech Republic, Estonia, Poland, Portugal and Spain. Additionally, Ireland and Greece were not part of the research by AWG. For these countries, we use the average age profile calculated from the data of those 19 countries for which we have the permission to use their profiles and adjust it to match the value of a corresponding macro control. We create the average age profile by calculating a simple average of all countries' public health expenditures at each age. Using a simple average, we assign equal weight to all countries and do not take into account their population size.

For Romania, AWG already used an average of the age profiles for other countries. Therefore for Romania we used the same approach as for countries for which the data are not available—i.e. the average age profile of other EU-NTA countries adjusted to the value of the macro control for Romania in 2010.

4.4.3 Public Consumption Other Than Education and Health

Education and health are two fundamental components of total public consumption that vary significantly with age, so we present their age profiles separately. The rest of public consumption, i.e. 'public consumption other than education and health', is combined into one NTA variable.

Other public consumption than education and health is composed of two categories: individual and collective consumption. By definition, public individual consumption is allocated by age (to beneficiaries of public programmes), while public collective consumption is allocated equally to all individuals in all the age groups. Collective consumption includes consumption on public goods, such as national security, public administration, public infrastructure, street lightning, justice etc.

In Table 17 we present categories included in public consumption other than education and health in more detail and show whether we classify them as individual or collective consumption.

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Table 17: Components of public consumption other than education and health

Category	Subcategory	Individual/ collective consumption
Social protection functions	Old age	individual
	Sickness and disability	individual
	Unemployment	individual
	Family and children	individual
	Housing	individual
	Miscellaneous social protection	collective
Other consumption		collective

Source: COFOG, 2010.

In European countries, there are large differences in age patterns of public consumption other than education and health. Whenever possible, we treat consumption as individual and allocate it by age. However, there are no administrative data available on individual public consumption for all EU countries.

Therefore, we assume that the COFOG categories *old age* and *sickness and disability* have the same age distribution as publicly financed long-term care. Long-term care age profiles are calculated by combining AWG data on the number of beneficiaries of long-term care and expenditures per beneficiary from AWG report (European Commission Ageing Report 2015). Data are available by five-year age groups.

Long-term care expenditures provided by AWG are the sum of 'services of long-term nursing care' and 'social services of long-term care' (i.e. assistance services). These two broad categories consist mainly of in-kind benefits received by the dependent people and include a range of different services, such as help with basic Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs). ADLs include bathing/showering, getting dressed, eating, getting in and out of bed, moving around and using the bathroom, while IADL activities include housework, preparation of meals, taking medications, shopping, use of telephone etc.

Due to data limitations (i.e. we did not get permission from all AWG national teams) we cannot estimate long-term care age profiles for the following countries: Denmark, Czech Republic, Estonia, Greece, Spain, Ireland, Poland, Portugal and Austria.[17] For these countries, we calculate the average age profiles

[17] In the case of Austria, age profile of long-term care was retrieved by national NTA research team.

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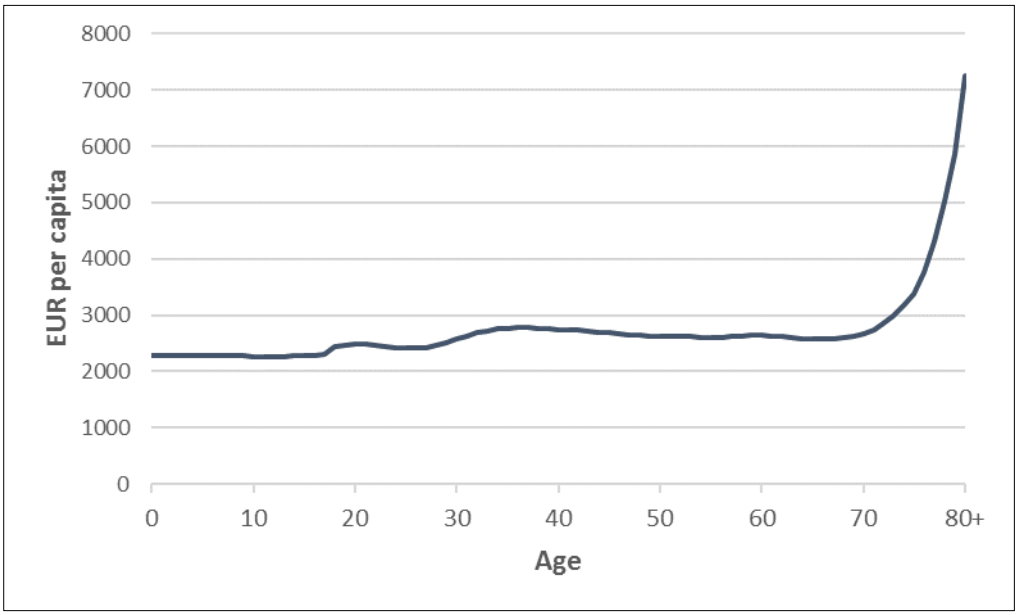
from the data for those 16 EU countries for which we have the permission to use their profiles, and adjust them to match the value of a corresponding macro control.

'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 (explained in more detail in Section 5.1.1) and adjusted to the value of the macro control of the corresponding consumption category. For instance, we estimate the age profile of public unemployment consumption by taking the age profile of in-cash public unemployment transfer inflows and adjusting the age profile to the aggregate value of public consumption for unemployment. Thus, we first need to calculate in-cash public transfer inflows to derive the age profiles of individual public consumption.

We treat the 'miscellaneous social protection' and 'other consumption' as collective public consumption. Since all individuals are beneficiaries of collective consumption, per-capita age profiles of these categories are assumed to be uniform across all ages, i.e. the age profile is a horizontal line. The level is determined by the value of a macro control.

In Figure 6, we show the per-capita age profile of public consumption other than education and health for Germany for the year 2010. The age profile is increasing with age and reaches the highest values at the oldest ages (due to 'old age' and 'sickness and disability' in-kind public consumption).

Figure 6: Public consumption other than education and health, Germany, 2010



Source: AWG report 2012/2015; Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations.

4.4.4 Total Public Consumption

We calculate total public consumption as the sum of previously calculated components: public education consumption, public health consumption, and public consumption other than education and health. Figure 7 presents the age

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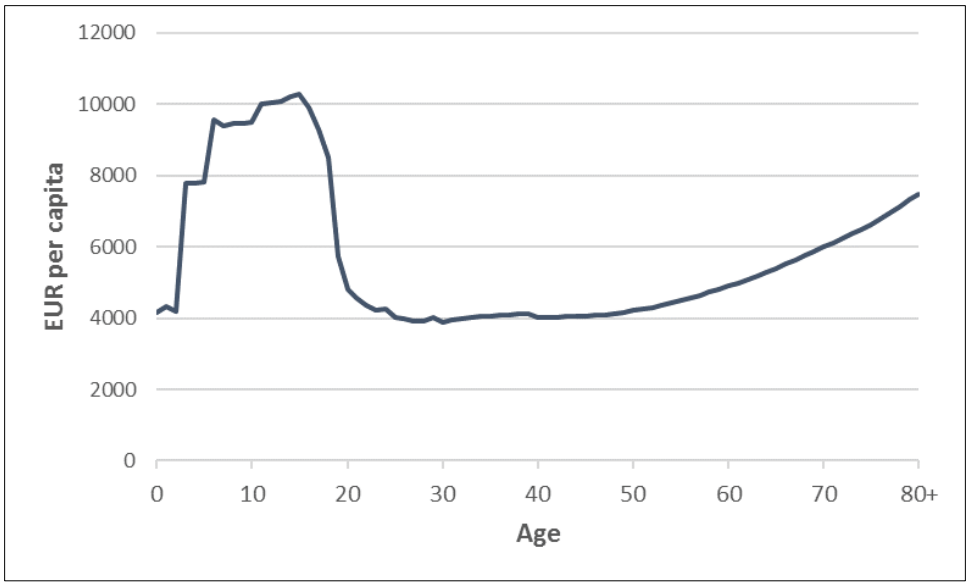
profile of total public consumption for Italy for the year 2010. We can observe several distinctive characteristics in the age pattern of public consumption: consumption at young ages is mainly driven by education expenditures, while old ages are characterised by high health care and long-term care expenditures. Public consumption is lowest at working ages when individuals mainly consume collective public goods and services.

Figure 7: Total public consumption, Italy, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations.

4.5 The Life Cycle Deficit Variables

We start by briefly summing up the process on how to calculate the components of the life cycle deficit, which is defined as the difference between consumption and labour income, in three steps:

1. Calculate the macro controls for labour income and public and private consumption, as well as their components, described in Section 3.
2. Estimate per-capita age profiles using survey and administrative data.
3. Finalise the results by smoothing and adjusting the age profiles to match the value of a macro control.

After finalising the age profiles, we compute the life cycle deficit as the difference between consumption and labour income:

$$LCD(a) = \mathrm{C}(a) - Y^{l}(a), \tag{11}$$

where $LCD(a)$ is the life cycle deficit at age a, $\mathrm{C}(a)$ represents consumption and $Y^{l}(a)$ labour income. When the life cycle deficit is a negative value, we call it life cycle surplus.

Figure 8 represents the life cycle deficit and its components for Italy for 2010. Labour income is of the usual U-shape, while consumption is rather constant

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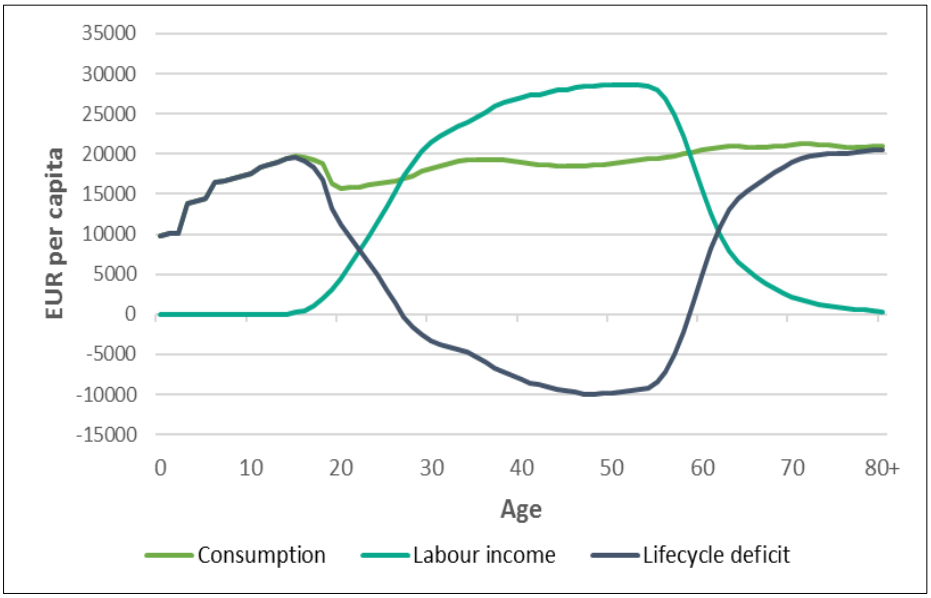
over the life cycle. This results in a typical shape of the life cycle deficit age profile. At young ages, children do not earn any income so the life cycle deficit is positive. After around the age of 15, labour income starts to increase and the life cycle deficit soon turns negative. Working-age people are on average able to finance their consumption by their own production. At older ages, people exit the labour market and enter into retirement. As a consequence, their labour income declines and the life cycle deficit turns positive again.

Figure 8: Life cycle deficit and its components, Italy, 2010



Source: AWG report 2012/2015; Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

The difference between different levels of consumption and production is covered by economic flows in the form of public and private transfers and public and private asset-based reallocations. The life cycle deficit equals the sum of net transfers and asset-based reallocations. In the following sections, we present the methodology on how to calculate these flows using the NTA methodology.

5 Public Age Reallocations

Inter-age reallocations are defined as current flows of resources across age, for example from parents to children or from the working-age population to pensioners. We distinguish two mechanisms of inter-age reallocations: shifting resources across age in the form of transfers or in the form of asset-based reallocations. These flows are classified as public when government plays the role of an intermediary among different individuals. Governments are usually heavily involved in the system of inter-age flows. For example, children profit from publicly financed education services, while elderly persons are important beneficiaries of the public health system. NTA enable the analysis of these flows not only in aggregate terms but also on age-group level. They measure the amount that each age group receives and pays. Therefore, by using NTA results, it is also possible to analyse the direction of inter-age flows. Public age reallocations are calculated as the sum of public transfers and public asset-based reallocations, which we further describe in this section.

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5.1 Creating Public Transfers Variables

5.1.1 Public Transfer Inflows

To calculate public transfer inflows, we assign transfers from a specific public programme to the age groups which are the beneficiaries of these transfers. Public transfer inflows are divided into two groups: in-kind and in-cash transfers. By definition, public transfers in kind are equal to public consumption (described in Section 4.4).

In this section, we explain how to calculate public transfers in cash. Public transfers in cash are direct payments from the government to individuals that can be used for different purposes (i.e. a pension received by an elderly person). Similar to public transfers in kind, we divide the cash transfers into several categories: education, health, pensions, social protection other than pensions, and other public transfers in cash. Social protection other than pensions further consists of the following subcategories: family and children, unemployment, housing and miscellaneous social protection. The estimates of averages of these transfers by age are based on EU-SILC data. The variables are shown in detail in Table 18.

Public health transfers in cash are calculated taking the value of reported sickness benefits into account. Pensions are the sum of old age, survivors' and disability benefits. The age profile of social protection other than pensions is composed of four micro-level age profiles (family and children, unemployment, housing, and miscellaneous social protection). For all four micro-level age profiles, except for unemployment, the data are given on the household level rather than on individual level. Therefore, we assign the value of variables, reported on household level, to specific household members. We assign miscellaneous and housing transfers to the household head, while family and children-related allowances are assigned to all adults in the household (see Section 4.1.4 for definition of the household head and an adult household member).

The age profile of other public transfer inflows in cash is calculated by assuming uniform distribution across all ages. Its level is determined by the value of a macro control.[18]

[18] Public transfer inflows also consist of education transfers. The age profile of education is measured using education-related allowances reported in the EU-SILC. However, it should be noted that although we calculate the age profile, the profile is then adjusted to the value of a macro control which is currently set at 0 (i.e. we take the data on macro controls for public transfers in-cash from ESSPROS, where no macro control for education is reported).

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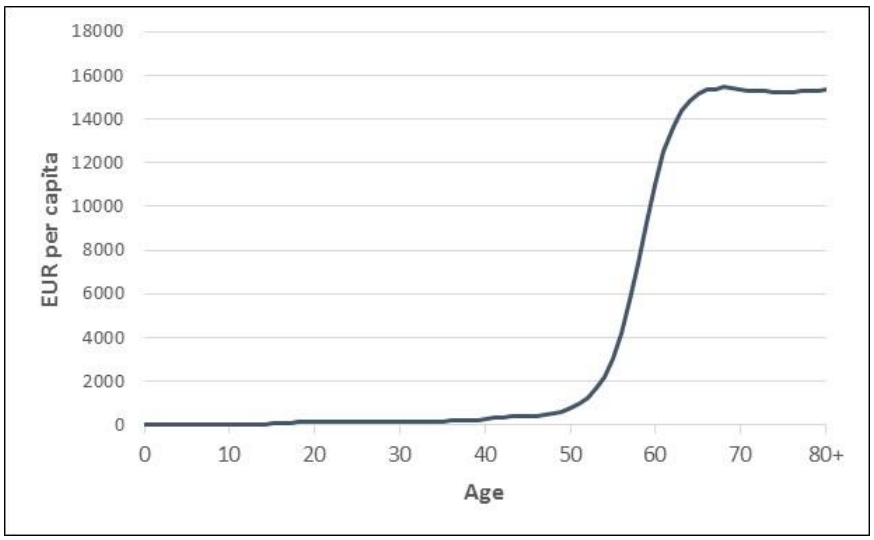
Table 18: Public transfer inflows in cash

Public transfers in cash category	Subcategory	EU-SILC variable	Description
Education		py140g	Education-related allowances
Health		py120g	Sickness benefits
Pensions		py100g	Old-age benefits
		py110g	Survivors' benefits
		py130g	Disability benefits
Social protection other than pensions	Family and children	hy050g	Family/children-related allowances
	Unemployment	py090g	Unemployment benefits
	Housing	hy070g	Housing allowances
	Miscellaneous social protection	hy060n	Social exclusion not elsewhere classified
Other		Assume uniform distribution	Other current transfers

Source: EU-SILC 2011.

Figure 9 depicts the age profile for pensions, which represent the largest part of public transfer inflows in cash. The results are shown for Italy for 2010. The main beneficiaries of pension transfers in cash are elderly people. Public pensions are negligible until the age of around 40 when they mainly represent survivors' benefits. At around 50 years of age, the value of public pensions starts to increase rapidly and reaches its peak in the late 60s when most of people have already retired. At later ages, public transfers in cash in the form of pensions are rather constant.

Figure 9: Smoothed age profile of public transfer inflows in cash for pensions, Italy, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations.

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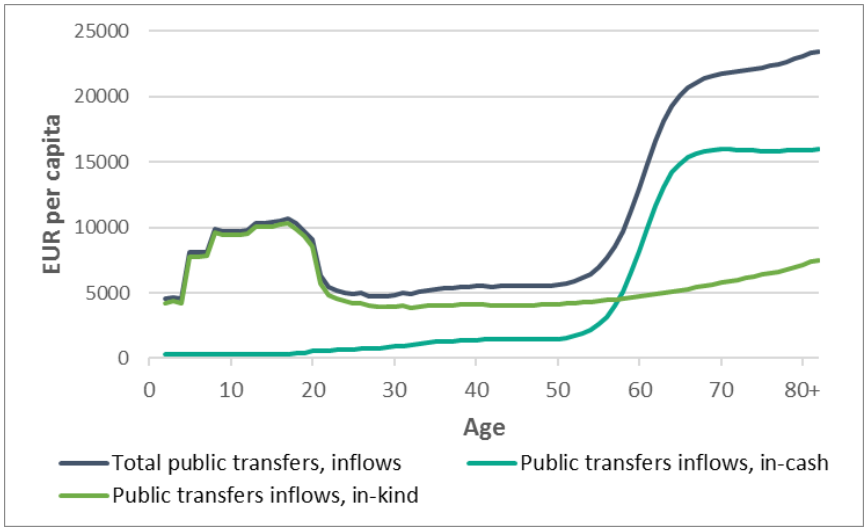
The last step is to add up in-kind and in-cash public transfer inflows to obtain total public transfer inflows. The results for Italy for 2010 are presented in Figure 10.

Figure 10: Age profiles of total public transfer inflows and its subcategories, Italy, 2010



Source: AWG report 2012/2015; Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations.

The level of total public transfer inflows varies a lot with age. At young ages, total public inflows closely follow the age pattern of in-kind public inflows (the prevailing component being education). During working ages, public transfer inflows are mostly in the form of collective consumption and therefore rather constant. Old age is characterised by high transfer inflows in cash in the form of pensions, as well as rather high public transfers in kind in the form of health and long-term care transfers.

5.1.2 Public Transfer Outflows

Public transfer outflows are defined as resource flows from the private sector to the public sector. The age profiles of public transfer inflows and outflows differ greatly in their shape since the age of the beneficiaries of public transfers is different from that of taxpayers and payers of social contributions.

Public transfer outflows consist of taxes, social security contributions and other current transfers. If these flows are insufficient to finance inflows, a public transfer deficit is generated. A transfer surplus, on the other hand, is generated when taxes, social contributions and other current transfers exceed public inflows. The transfer deficit is covered by public asset-based reallocation, i.e. public asset-based reallocations equal transfer deficit/surplus. Public asset-based reallocations are described separately in Section 5.2. In this section, we describe the construction of age profiles for public transfer outflows in the form of taxes, social security contributions and other current transfers. The age patterns of these categories come from survey data and from the age profile of taxed economic activities.

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We divide taxes into three subcategories: taxes on asset income, profits and capital gains (taxes on asset income); taxes on payroll and workforce (labour taxes); taxes on goods and services (taxes on consumption). The age distribution in the first group of taxes is estimated using EU-SILC variables on asset income,[19] including interest, dividends, profit from capital investments in unincorporated business, and income from rental of a property or land (see Table 19 for more details). Asset income, profits, capital gains and property income are all reported at the household level and assigned to the household head.[20]

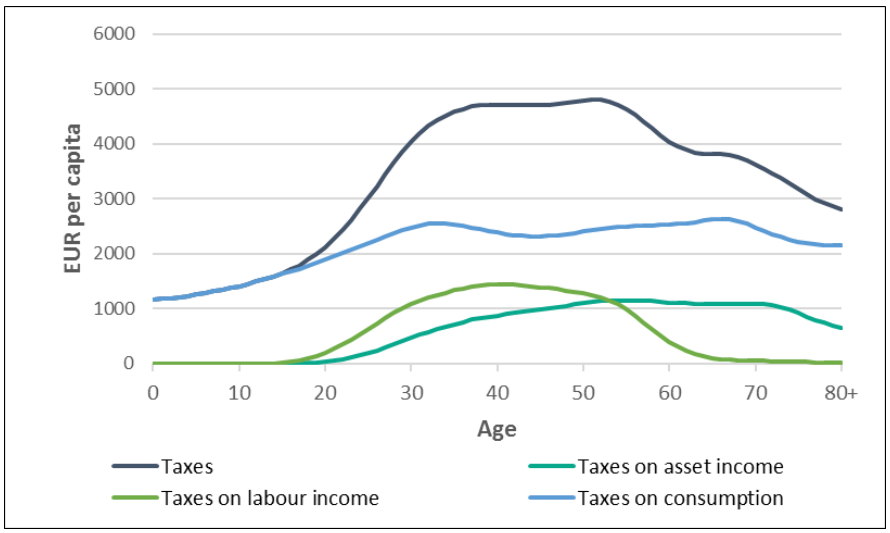
Table 19: Calculation of taxes from EU-SILC variables

Tax subcategory	EU-SILC variable	Description
Asset income, profits and capital gains	hy090g	Interest, dividends and profit from capital investments in unincorporated business
	hy040g	Income from rental of a property or land

Source: EU-SILC 2011

On the other hand, the age patterns of the other types of taxes are based on the already defined age profiles for the corresponding quantities. The age profile of taxes on payroll and workforce is based on the age profile of labour income, while the age profile of taxes on consumption of goods and services is based on the age profile of private consumption. Total taxes are calculated as the sum of the three subcategories. The age profile of total taxes and its subcategories for Slovenia for year 2010 is shown in Figure 11.

Figure 11: Smoothed age profile of total taxes and its subcategories, Slovenia, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

[19] For Denmark, asset income is reported after interest paid on private debt, which is not the case in other countries. Therefore, we use average asset-income age profiles of other countries to estimate the asset income age profile for Denmark.

[20] By assumption, the household head is the owner of these assets and consequently also the tax payer.

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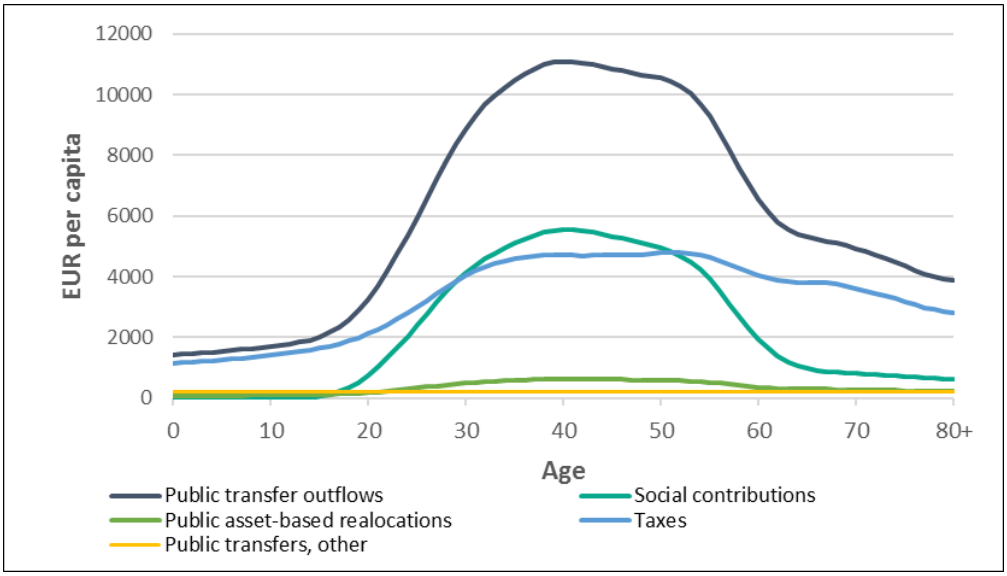
In addition to the taxes, we estimate age profiles of social security contributions and other current transfers. The age profile of social security contributions is based on the age profiles of labour income and pensions, while uniform distribution is assumed for the age profile of other current transfers. The age profile of total public transfer outflows is the sum of taxes, social security contributions, other current transfers and transfer deficit/surplus at each age. As mentioned before, transfer deficit/surplus equals the value of public asset-based reallocations which we describe in more detail in Section 5.2. Figure 12 presents the age profile of total public transfer outflows and its subcategories for Slovenia for 2010.

The age profile of total public transfer outflows starts to increase rapidly around the age of 20, when most young adults begin entering the labour market. The peak occurs at prime ages when public outflows are high due to social security contributions and taxes paid on payroll and workforce. Public outflows at young ages are mainly in the form of taxes on consumption of goods and services. At old ages, outflows are in the form of taxes on consumption of goods and services, taxes on asset income as well as taxes and social contributions on pensions.

Figure 12: Smoothed age profile of total public transfer outflows and its subcategories, Slovenia, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

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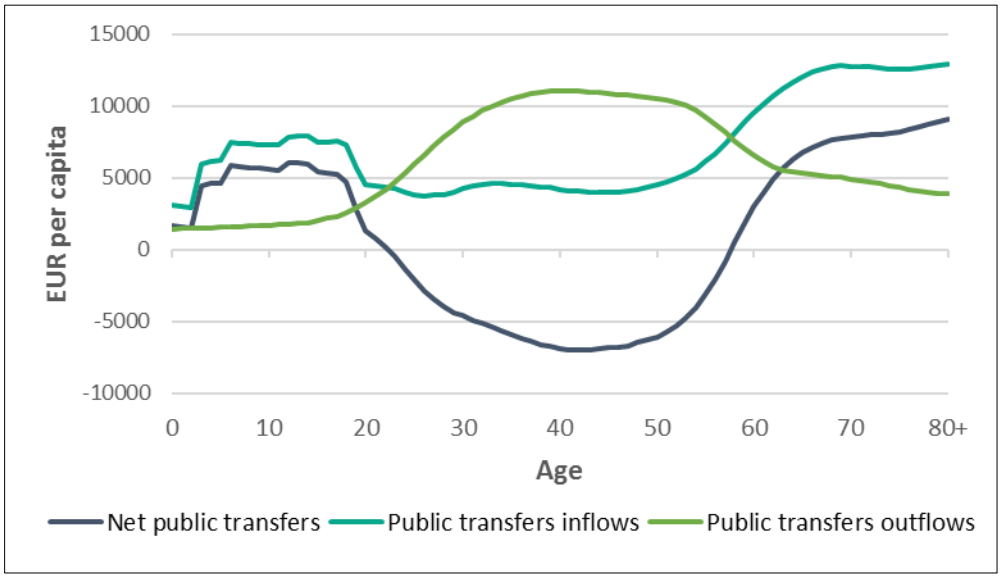
5.1.3 Net Public Transfers

Net public transfers are calculated as the difference between public transfer inflows and public transfer outflows. Figure 13 reveals the age patterns of net public transfers in Slovenia for 2010. In general, net public transfers are positive for the young and the elderly, while negative net public transfers are characteristic for the working-age population.

Figure 13: Net public transfers and their subcategories, Slovenia, 2010



Source: AWG report 2012/2015; Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

5.2 Public Asset-Based Reallocations

Public asset-based reallocations are calculated as public asset income less public saving. As mentioned earlier, public asset-based reallocations are used to balance a transfer deficit or transfer surplus. When the government generates a transfer deficit, the gap between public inflows and insufficient outflows is financed by positive public asset-based reallocations, i.e. by public asset income or dissaving. On the other hand, a public transfer surplus results in negative public asset-based reallocations, i.e. the government saves or pays interest on public debt. To compile the age profiles of public asset income and public saving we use the age profile of public transfer outflows (generated as the sum of taxes, social contributions and other government revenues). Public asset-based reallocations are then calculated as the difference between public asset income and savings. Figure 14 represents the age patterns of public asset-based reallocations as well as their components for Slovenia for 2010. Both asset income and savings are negative, but since dissaving exceeds the negative asset income, asset-based reallocations result in a positive inflow of resources for each age group.

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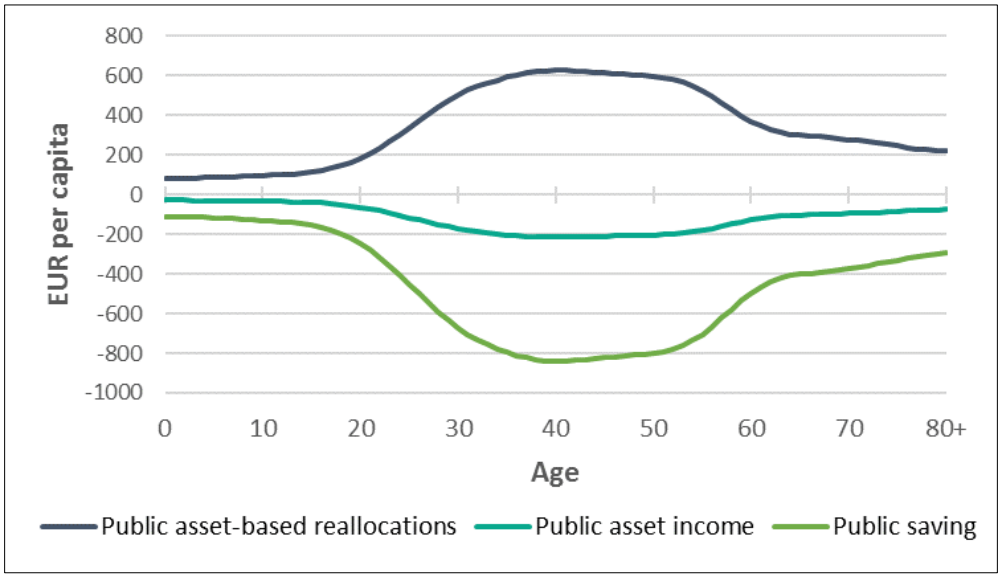
Figure 14: The age profile of public asset-based reallocations and their components, Slovenia, 2010



Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

6 Private Age Reallocations

Within private age reallocations two types of economic flows are distinguished: private transfers and private asset-based reallocations. Private transfers are flows between individuals within the same household or between individuals from different households. Transfers are considered as one-directional flows, meaning that there is no (explicit) exchange of goods or services in the opposite direction.

Asset-based reallocations capture the use of assets to reallocate resources over time and/or age. An 'upward' reallocation to older ages occurs when disposable income is not fully used for consumption and is saved/invested instead. These resources are made available to be used later in life through asset income and dissaving. Asset-based reallocations can also be used for a 'downward' shift of resources to younger ages, for example by taking out a loan.

Some important properties of private age reallocations are the following:

- private age reallocations equal private transfers plus asset-based reallocations,
- intra-household transfers always balance; inflows are equal to outflows,
- inter-household transfers for residents are equal to net transfers from the ROW,
- private asset–based reallocations are equal to private asset income less private saving.

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6.1 Private Transfers Variables

Within private transfers two types of transfers are distinguished, inter- and intra-household transfers. Inter-household transfers are flows between different households while intra-household transfers are flows within the same household.

6.1.1 Private Inter-Household Transfers

As there are no data available at the individual level the NTA assumes that all inter-household transfer inflows flow to the household head and all outflows flow from the household head. In EU-SILC data on 'Regular inter-household cash transfer received' and 'Regular inter-household cash transfer paid' variables are available, representing inter-household inflows and outflows, respectively. We obtain age profiles for the two variables by calculating the age averages using all the household heads. Net inter-household transfers are the difference between inter-household inflows and outflows.

6.1.2 Private Intra-Household Transfers

For the intra-household transfers an indirect estimation method is used, based on the household structure from EU-SILC and the age profiles that have already been calculated. As there are no micro data on intra-household transfers, we estimate them indirectly as the difference between age-specific disposable income and age-specific consumption. These age-specific values are imputed into the household structure from the age profiles which have been estimated so far. We compute intra-household transfers by the following four steps:

First, we compute the current deficit or surplus of each household member. The current deficit is defined in the following way: a household member has an individual deficit (DEFIN) if his or her private consumption (excluding consumption on owner-occupied housing) exceeds his or her cash income in the form of labour income, public cash transfers and inter-household transfers. If the disposable cash income is higher than consumption, the household member generates individual surplus (SURIN). The disposable income is calculated by summing up labour income (YL), public transfers in cash (TGIC) and inter-household transfers (TFB), and subtracting taxes (on labour income (TGFYL) and consumption (TGFC)), social contributions (TGP) and other public revenues (TGX):

$$INC = YL + TGIC - TGFYL - TGFC - TGP - TGX + TFB. \tag{12}$$

The consumption of an individual member of the household is private consumption (CF) less imputed rents (CFR):

$$CONS = CF - CFR. \tag{13}$$

The private intra-household transfer inflows for the members that have a deficit and who are not the household head is then calculated as the difference between the individual disposable income (INC) and the individual consumption (CONS). They receive intra-household transfers from the household member(s) with personal surplus or from the household head.

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To ensure that the transfers from household members with a surplus equal to the total size of the individual deficits (household deficit, DEFHH), we calculate, in a next step, the household-specific tax rate or transfer rate (TAXHH), as a ratio between the household deficit (DEFHH) and household surplus (SURHH):

$$TAXHH = \frac{DEFHH}{SURHH}. \tag{14}$$

The transfer rate (TAXHH) is equal for all members with a surplus and it is imposed on their individual surplus (SURIN). The transfer rate corresponds to the share of the individual surplus, which is transferred to the members with a deficit.

Next, we compute the total household deficit and total household surplus as a sum of the individual deficits/surpluses of the members. If the household total deficit exceeds the household total surplus, the remaining individual deficits are financed by household heads through asset-based reallocations. It is assumed that the household head owns all household assets and consequently receives all the income from these assets.

The last step is to calculate intra-household transfer outflows (TFWO). For non-household heads they are equal to the individual surplus. A part of the surplus is transferred to other non-head members. These transfers correspond to the product of the transfer rate and the individual surplus:

$$TFWO = TAXHH * SURIN. \tag{15}$$

The remaining individual surpluses from non-head members are transferred to the household head to save the residual resources. For the household head the outflows equal to the sum of the product of the transfer rate and the household head individual surplus and total remaining deficit of other household members, after the intra-household transfers made by the members which are not household heads. Any shortfall is financed through asset-based reallocations:

$$TFWO_{HH} = TFWO + (SHORTFALL - DEFIN). \tag{16}$$

Finally, we calculate intra-household transfers (inflows and outflows separately) by function, e.g. education, health, other. At the end we impose a control for equality of intra-household outflows and inflows, adjusting the two if necessary.

Figure 15 presents an example of age profiles for intra-household inflows and outflows for France in 2010. The resulting age profile for net intra-household transfers is then shown in Figure 16, together with the net inter-household transfers. While net inter-household transfers are relatively small throughout the life cycle, there are high net intra-household inflows in childhood which are mainly paid for by the age groups between around 30 and 60.

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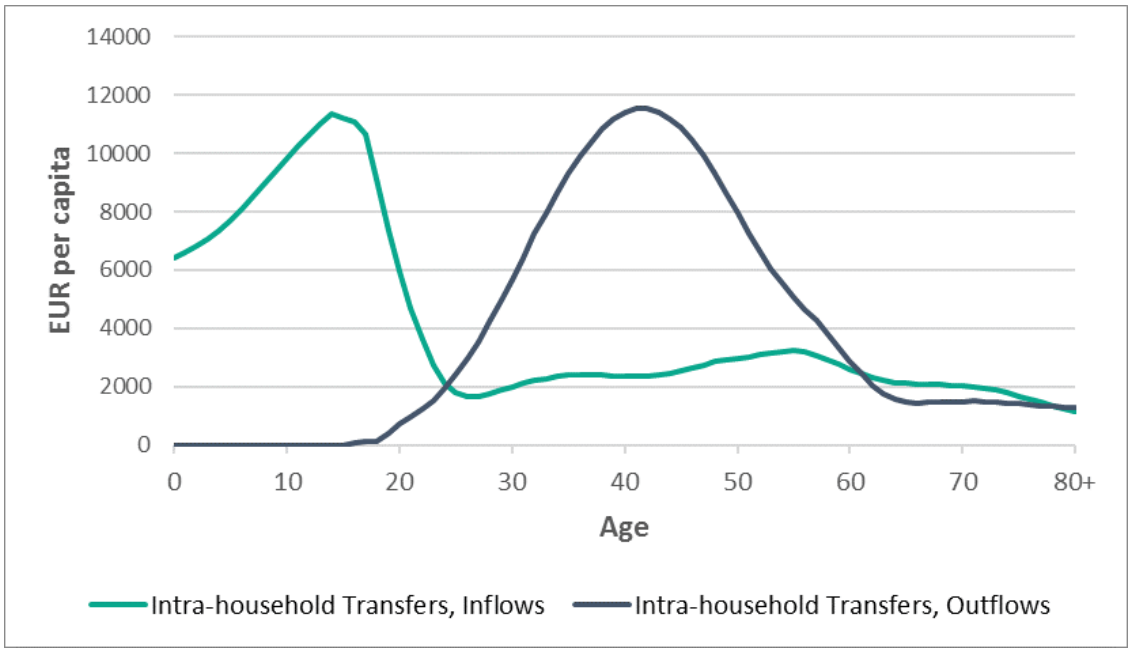
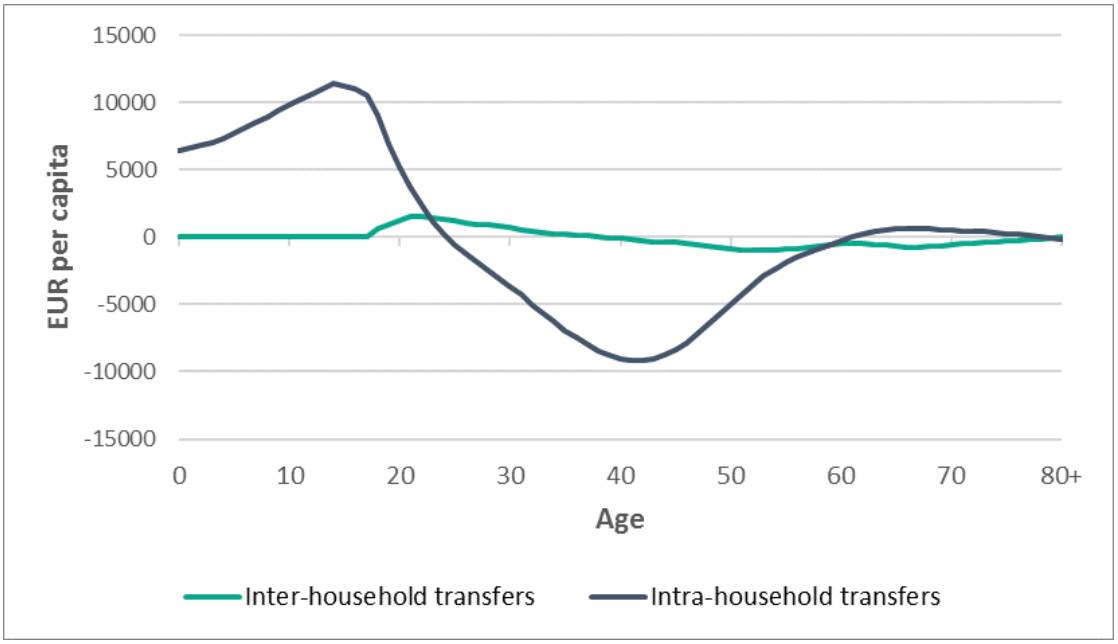
Figure 15: Age profile of intra-household inflows and outflows, France, 2010



Source: AWG report 2012/2015; Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

Figure 16: Age profile of intra- and inter-household net transfers, France, 2010



Source: AWG report 2012/2015; Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

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6.2 Private Asset-Based Reallocations

Asset-based reallocations consist of two components: asset income and saving. Private asset income in NTA consists basically of the return on capital owned by domestic institutional units in the private sector. In NTA this is captured as capital income plus the net property income from the ROW. The age profile of private asset income is estimated using data on asset income in EU-SILC.

Capital income is a sum of capital income of corporations, income from owner-occupied housing and unincorporated enterprise income. For the age profile of capital income of corporations we use, just as for the taxes on assets, the age averages of asset income from EU-SILC (for more details see Section 5.1.2). For the income from owner-occupied housing we use the age profile of imputed rents (for more details see Section 4.3.3), whereas for the unincorporated enterprise income we take the age profile of earnings from self-employment (see Section 4.2.2).

Property income is calculated as the sum of private interest (YMF) and other property income, where private interest is the difference between private interest inflow (YMFI) and private interest outflow that consists of interest expenditure of households (YMFOHH) and corporation interest outflows (YMFOC):

$$YMF = YMFI - (YMFOC + YMFOHH). \tag{19}$$

Again, asset income variables reported in EU-SILC are taken to estimate private property income age profiles.

The second major component of asset-based reallocations is saving. Private saving is estimated as the final balancing item in NTA:

$$S^f(a) = Y^l(a) - C(a) + \tau^g(a) + \tau^{inter}(a) + \tau^{intra}(a) + Y^{Af}(a) + \tag{20}$$

$$+ Y^{Ag}(a) - S^g(a).$$

Private saving at age a is the difference between disposable income (in the form of labour income, asset income and net transfers) and consumption (less government saving).

Figure 17 presents the example of age profiles for private asset income, private saving and the resulting private asset-based reallocations for Austria in 2010. Private asset income starts rising at about age 15 and reaches its peak between age 50 and 60. Savings, on the other hand, start rising only around age 25 but also reach their peak at ages between 50 and 60. Afterwards, private savings start decreasing much faster than private asset income, resulting in growing private asset-based reallocations. Asset-based reallocations drop significantly during the 70s.

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Figure 17: Age profile of private asset income, saving and asset-based reallocations, Austria, 2010

Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations.

7 Gender Extension

The aim of the NTA is to analyse economic behaviour at different ages: how much do people produce and consume at each age and how do they finance the gap between consumption and production in childhood and old age? Besides age, gender is one of the fundamental factors that greatly influence the patterns of economic behaviour. Adding the gender component into the NTA analysis is therefore a logical extension.

7.1 Introduction

Higher employment rates of males compared to females imply sizeable market reallocations and transfer flows from males to females. However, in the past few decades, the 'male breadwinner–female caregiver' family model has widely declined due to a changing attitude towards females (Lewis, Cambell & Huerta, 2008). This change resulted in new employment opportunities for females. Flexible arrangements have provided an opportunity for females to participate in the labour market in larger numbers (Swiebel, 1999). Indeed, female employment rates in Europe have risen dramatically in the past few decades (Eurostat, 2017). By adding gender as an additional characteristic into the NTA analysis, it is possible to observe not only inter-age, but also inter-gender reallocations. In Figure 18 we present the measurement of inter-age and inter-gender flows for Slovenia for 2010.

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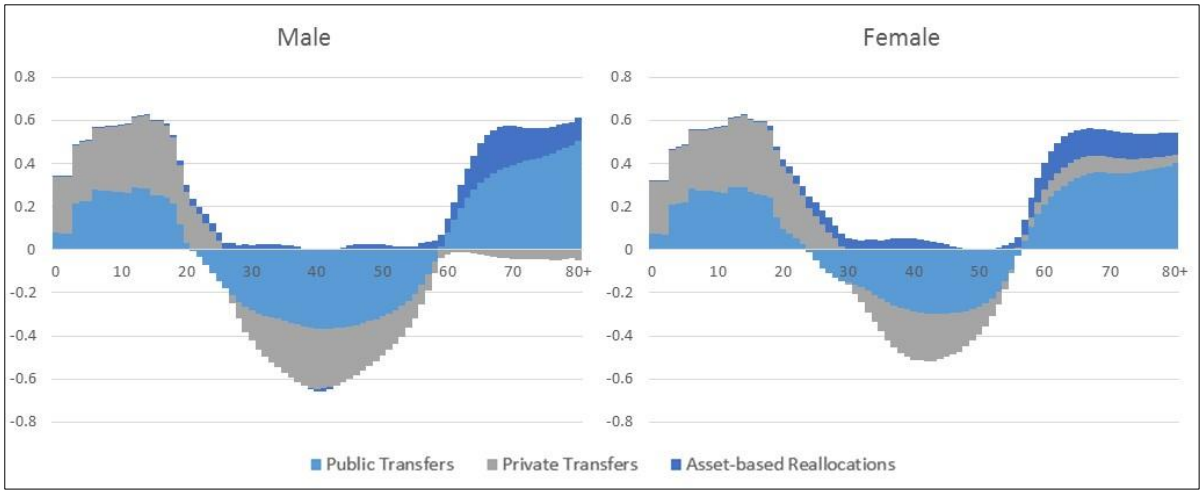
Figure 18: Financing the life cycle deficit, normalised age profiles, Slovenia, 2010



Source: AWG report 2012/2015; Eurostat (Population data, aggregate controls); EU-SILC 2011; HBS 2010; Authors' own calculations.

In this section, we present the estimation of NTA categories by gender. We obtain separate age profiles for males and females. The general procedure follows the basic NTA methodology which we adjust in order to derive gender-specific age profiles. We point out the main differences and methodological steps, but one should always refer to the basic NTA methodology for more detailed explanations.

7.2 Limitations

In general, all NTA age profiles which are estimated using survey data can easily be disaggregated by gender. Usually, surveys include data on gender along with age. If data are given at the individual level, we use the same variables as for the total age profile (age profile of both genders combined) to estimate male and female age profiles. Instead of calculating only the age-specific averages of a particular economic activity, we calculate age-and-gender-specific averages from the survey data.

Some variables are given only at the household level. To estimate the NTA profiles we typically assign household values to the household head or to all adults in a specific household. We follow this approach for the gender-specific age profiles as well. This is necessary because we adjust the gender-specific age profiles to the age profile not differentiated by gender (i.e. total age profile). Therefore, the definitions and methodological approach must be the same for the total and for the gender-specific age profiles.

However, assigning household-level variables to the household head may greatly influence gender-specific age profiles since males are more commonly the main earners in the family—and therefore more often selected to be household heads. The household head is assumed to be the only one in the household who can own all household assets, give and receive inter-household transfers, etc. The age profiles of certain NTA categories could therefore change substantially if we

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adjusted the definition of household head or assigned some of the household-level variables also to other household members.

7.2.1 Adjustment

Additionally, the availability of macro controls represents the limitation to estimate the age profiles by gender. This influences the adjustment process described in more detail in the following lines, based on Donehower (2013).

After the smoothing procedure is applied, each age profile has to be adjusted to match the value of a corresponding macro control from the ESA. However, the ESA does not contain gender-specific information about aggregate values for several economic activities. Therefore we do not adjust the gender-specific age profiles to the value of a macro control from the ESA, but rather adjust them in a sense that they are consistent with the total NTA age profiles (presented in previous sections). In this way, the sum of the product of gender-specific per-capita age profile and gender-specific population for both genders must equal the value of the total NTA age profile multiplied by total population.

We denote gender-specific age profiles which have not yet been adjusted as $x(a,g)$, where a represents age and g represents gender. The adjusted gender-specific age profiles are denoted as $\tilde{x}(a,g)$.

We implement the adjustment in the following way:

$$\tilde{x}(a,g) = \theta(a)x(a,g). \tag{21}$$

The adjustment factor is denoted as $\theta(a)$ and calculated as:

$$\theta(a) = \frac{\tilde{x}(a)}{x(a,m)N(a,m)/N(a) + x(a,f)N(a,f)/N(a)}, \tag{22}$$

where $\tilde{x}(a)$ is the macro-adjusted total age profile, $N(a)$ is the population count at age a and $N(a,g)$ the population count at age a and for gender g (m for male and f for female). For each age a, the adjustment factor represents the ratio between macro-adjusted age profile for both genders combined and the weighted average of male and female unadjusted age profiles. Note that the adjustment factor varies with age, but is the same for both genders at a specific age a.

We calculate the aggregate gender-specific age profiles $\tilde{X}(a,g)$ as follows:

$$\tilde{X}(a,g) = N(a,g)\tilde{x}(a,g). \tag{23}$$

Data on population size for males and females can be retrieved from Eurostat.

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7.3 The Economic Life Cycle

The age profile of the life cycle deficit is based on the already existing age profiles. The gender-specific life cycle deficit is calculated in the following way:

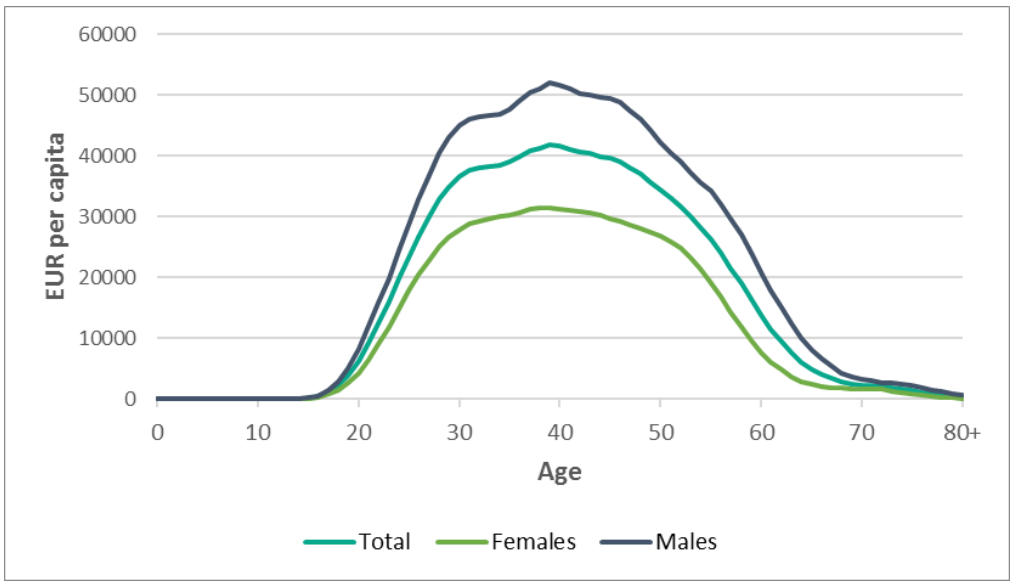
$$LCD(a,g) = C(a,g) - Y^l(a,g), \tag{24}$$

where $LCD(a,g)$ represents the life cycle deficit, $C(a,g)$ is the sum of private and public consumption and $Y^l(a,g)$ is labour income for gender g and age a. In this section, we present the calculation of gender-specific components of the life cycle deficit.

7.3.1 Labour Income

To calculate male and female age profiles of labour income, we use the same EU-SILC variables as for the age profile of the total population. The differences in labour income between males and females for Poland for 2010 are shown in Figure 19.

Figure 19: Smoothed age profiles of labour income by gender, Poland, 2010



Source: Eurostat (Population data, aggregate controls);
EU-SILC 2011; Authors' own calculations.

7.3.2 Private Consumption

To calculate private consumption by gender, we need to estimate gender-specific age profiles of education, health and consumption other than education and health.

We estimate gender-specific private education consumption in the same way as the age profile of private education consumption for both genders combined. The only difference is that we calculate age- and gender-specific averages instead of age-specific averages only.

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When applying regression model to measure private health consumption age profiles, the gender dimension should be taken into account. Therefore, we take separate regressors (the number of individuals in each age group) for males and females to estimate shares of household members in the total household's expenditures on health.

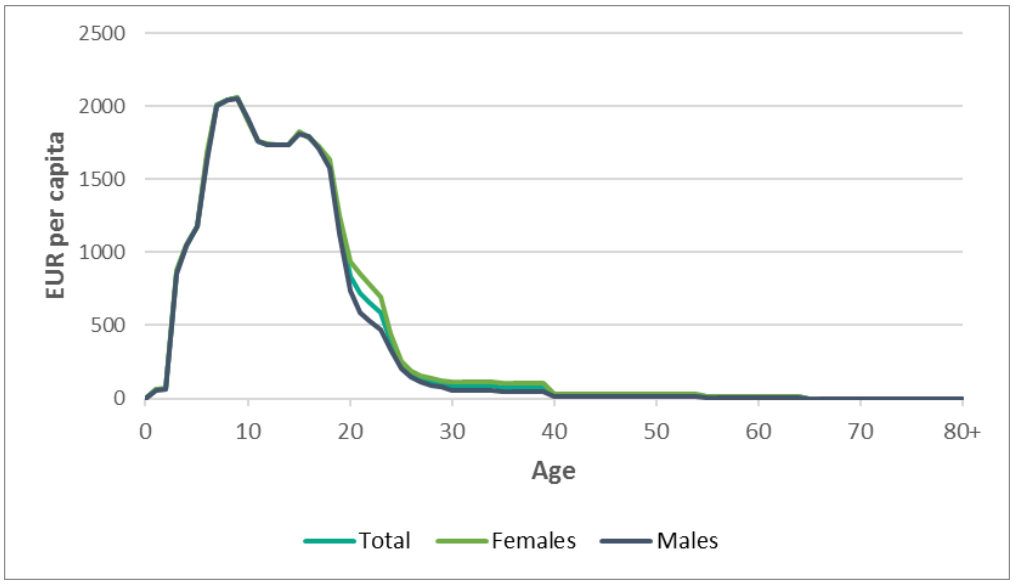
To estimate private consumption other than education and health, the same equivalence scale is used for both genders. Even though we use the same equivalence scale for both genders, the obtained age profiles of other private consumption are not same for both genders—they reflect the difference in age and gender decompositions of households.

7.3.3 Public Consumption

Similar to private consumption, we need to estimate gender-specific age profiles of public consumption on education, health, and consumption other than education and health, to obtain total public consumption by gender.

The age profiles of public education are based on data of aggregate public expenditures on education by educational level and enrolment data by educational level. The gender-specific profiles are calculated in the same way as the age profiles of the total population with the only difference that gender-specific enrolment data by age and by education level are used. In Figure 20, we present the gender-specific age profiles for Slovakia for 2010.

Figure 20: Unsmoothed age profiles of public education consumption by gender, Slovakia, 2010



Source: Eurostat (Population data, General government expenditures by function); UNESCO, 2014; Authors' own calculations.

We receive male and female age profiles of public health consumption from the AWG. As for the age profiles of the total population, we have permission to use gender-specific data for 19 EU countries. For other countries (where we do not have that permission or which are not included in the AWG research, plus for Romania) we calculate the gender-specific age profiles as a simple average of

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the countries who granted us permission. We use male age profiles to calculate the average age profile for males and female age profiles to calculate that for females.

Public consumption other than education and health is calculated in the same way as the age profile of the total population. Collective public consumption is assumed to be equal for all individuals, while the age profiles of individual public consumption are based on the corresponding gender-specific age profiles of public transfer inflows in cash. Unfortunately, the age profiles of long-term care received by AWG are not gender-specific, thus we assume the same age profile for both genders.

7.4 Public Reallocations

7.4.1 Public Transfer Inflows

Public transfer inflows are divided into public transfer inflows in kind and in cash. By assumption, public transfer inflows in kind are equal to public consumption and are thus calculated in the same way.

Public transfer inflows in cash are divided into several subcategories (health, pensions, social protection other than pensions, and other public transfers in cash). For calculation of most subcategories we use EU-SILC variables. Gender-specific age profiles are calculated using the same variables as for the total NTA age profiles. Using these variables, we do not calculate only age-specific, but also gender- and age-specific averages for different transfer inflows in cash. For more details on which EU-SILC variables to use, please refer to Section 5.1.1.

For some of the in-cash subcategories we assume equal distribution among all individuals. The age profile is therefore a horizontal line, which we need to adjust appropriately to the age profile of the total population.

7.4.2 Public Transfer Outflows

When using survey data we follow the same methodology as for age profiles of the total population (see Section 5.1.2), but calculate gender- and age-specific averages. Moreover, when estimating gender-specific age profiles of public transfer outflows that are based on pre-calculated age profiles, we need to use pre-calculated results that are disaggregated by gender. For example, the age profile of taxes on payroll for males is based on the pre-calculated age profile of labour income for males (similarly for females). Finally, some subcategories of public transfer outflows are assumed to be equally distributed among individuals—the age profiles are therefore a horizontal line.

7.4.3 Public Asset-Based Reallocations

Public asset-based reallocations are used to balance transfer deficit or surplus. Gender-specific age profiles are calculated as follows:

$$RAG(a,g) = YAG(a,g) - SG(a,g), \tag{25}$$

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where $RAG(a,g)$ are public asset-based reallocations, $YAG(a,g)$ is public asset income and $SG(a,g)$ is public saving, for gender g and age a. Public asset income and savings are calculated on the pre-calculated gender-specific profiles of public transfer outflows.

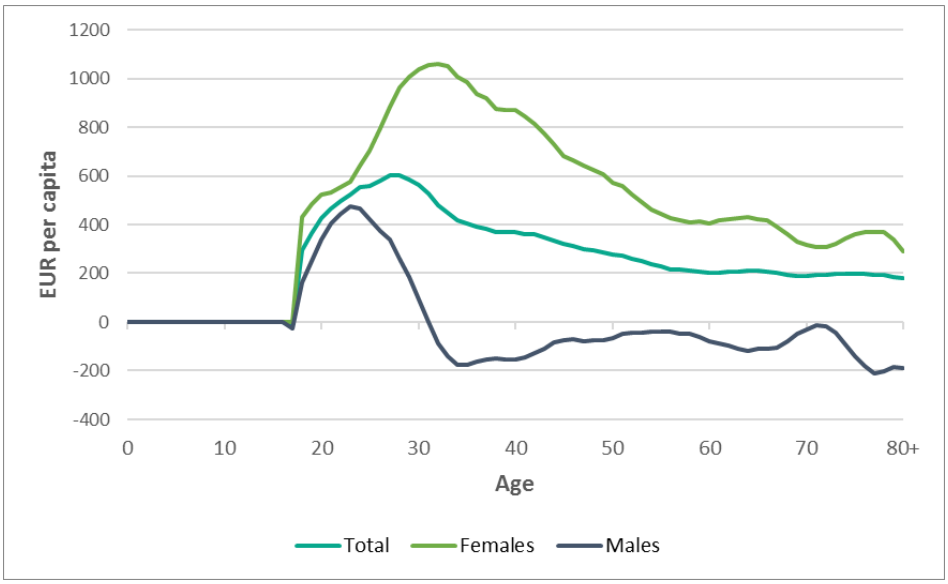
7.5 Private Reallocations

Private reallocations are composed of transfers and asset-based reallocations. Private transfers are further decomposed into inter- and intra-household transfers, while private asset-based reallocations consist of private asset income and private saving.

7.5.1 Inter-Household Transfers

Inter-household transfer inflows and outflows can be estimated directly from the survey data by calculating the age- and gender-specific averages of EU-SILC variables. We show the gender differences in inter-household transfers for Latvia for 2010 in Figure 21.

Figure 21: Net inter-household transfers by gender, Latvia, 2010



Source: Eurostat (Population data, aggregate controls);
EU-SILC 2011; Authors' own calculations.

7.5.2 Intra-Household transfers

Intra-household transfer inflows and outflows are estimated only indirectly, based on the relation between disposable income and private consumption. We define disposable income and consumption for males and females separately to calculate gender-disaggregated age profiles. Otherwise, the methodology is the same as for the age profile of both genders combined.

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7.5.3 Asset-Based Reallocations

Private asset-based reallocations represent the difference between private asset income and private saving. Gender-specific age profiles of asset income are computed using the same EU-SILC variables as for the age profile of the total population, but are estimated for both genders separately. By assumption, all private asset income is owned by the household head.

Private saving is estimated as a residual category from accounting identity. The age profile is based on the already existing age profiles of labour income, consumption, net transfers, private asset income and public asset-based reallocations. When calculating age profiles of private saving separately for males and females, we take into account the above categories, disaggregated by gender. The age profile of private saving for males is based on the pre-calculated male profiles, while the age profile for females is based on the corresponding female age profiles.

Acknowledgement

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APPENDICES

Appendix a: List of Abbreviations and Acronyms

ADL	Activities of Daily Living
AES	Adult Education Survey
AGENTA	Ageing Europe: An Application of National Transfer Accounts for Explaining and Projecting Trends in Public Finances
AWG	Ageing Working Group
COFOG	Classification of the Functions of Government
COICOP	Classification of Individual Consumption by Purpose
ESA	European System of Accounts
ESSPROS	European System of Integrated Social Protection Statistics
EU	European Union
GDP	Gross Domestic Product
HBS	Household Budget Survey
EPC	Economic Policy Committee
EU-SILC	European Union Statistics on Income and Living conditions
GNP	Gross National Product
HBS	Household Budget Survey
IADL	Instrumental Activities of Daily Living
ISCED	International Standard Classification of Education
ITLS	Indirect Taxes less Subsidies
NA	National Accounts
NPISH	Non-profit Institutions Serving Households
NTA	National Transfer Accounts
ROW	Rest of the World
SHA	System of Health Accounts
SNA	System of National Accounts
UNESCO	United Nations Educational, Scientific and Cultural Organization
VAT	Value-Added Tax

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Appendix b: The Main Improvements of European National Transfer Accounts

The main purpose of the European National Transfer Accounts is to provide highly comparable NTA results for EU countries. In general the methods and data used follow the global National Transfer Accounts Manual (United Nations, 2013). However, in some cases we took advantage of more detailed data at the EU level. This section briefly describes the main improvements due to more detailed data available.

1. In most of the past NTA estimates all **public consumption other than education and health** has been treated as collective public consumption and therefore the per capita age profile was assumed to be constant – i.e. goods and services were allocated uniformly among all individuals.

In the European NTA "public consumption other than education and health" is composed of two categories: public individual consumption and public collective consumption. 1) Public individual consumption includes categories such as in-kind social protection for old age, sickness and disability, housing, family and children. Public individual consumption is allocated by age to beneficiaries of public programmes – which varies across ages. 2) Public collective consumption includes expenditures on public defence, administration, street lightening, etc. and is allocated equally to all individuals and therefore it is uniformly distributed across age. Whenever possible, we treat consumption as individual consumption and allocate it by age. For more details about the age profiles (i.e. distribution of categories by age) see Section 4.4.3.

2. In the SNA the data on private transfers are limited. The global NTA manual suggests, to use the net private transfers from the rest of the world (ROW) as an aggregate control for NTA net private transfers. The value of ROW transfers therefore determines (i.e. equals) **net** private inter-household transfers. However, using this approach, there are no aggregate controls for private inter-household transfer **inflows and outflows** separately (we just know the "net" value, which is the difference between inflows and outflows). The global NTA methodology suggests to adjust the inflows and outflows in the way that net transfers from the ROW match the difference between inflows and outflows estimated from the survey data.

However, in surveys the inter-household transfer inflows and outflows are usually highly under-reported. Therefore, instead of estimating aggregate controls for inter-household transfer inflows and outflows from the survey data we use slightly different approach for the European data. We derive inter-household inflows and outflows from the European System of Accounts (ESA). Specifically we use a part of ESA category "Other current transfers, not elsewhere classified" called "Miscellaneous current transfers" that includes

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transfers flowing between households. Since miscellaneous current transfers received/paid are only a part of private transfer inflows/outflows we adjust them in a way that the difference between inflows and outflows equals the net inter-household transfers. To do so we keep the inter-household transfer outflows constant (given), while inflows are estimated as the sum of inter-household transfer outflows and the net private transfers from the ROW. For more details about deriving the aggregate controls see Section 3.2.2. and Section 3.4.2.

3. Public transfer outflows consist of taxes, social contributions, and other revenues. The taxes are further differentiated by their source, i.e. the activity that is being taxed. The age profiles of taxes paid on these subcategories are proportional to the age profile of that particular subcategory that is being taxed. For example taxes on goods and services are distributed by age using the age profile of private consumption of goods and services.

In the case of **social contributions** the suggested NTA tax source is labour income. However, the ESA enables us to differentiate between social contributions paid by employees and social contributions paid by non-employed. For the age-specific distribution of social contributions paid by employees we use labour income age profile which is in line with NTA calculations in the past. For the age-specific distribution of social contributions paid by non-employed we use the age profile of public pensions since a large majority of social contributions are paid by the pensioners. Compared to NTA calculations in the past our approach implies that elderly have less public resources (pensions) available once the outflows in form of paid contributions on pensions are taken into account. Our approach therefore results in higher asset-based reallocation to finance the consumption of the elderly. For more details about aggregate controls and their age-specific distributions see Sections 3.4.1 and 5.1.2.

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