Ageing Europe – An Application of National Transfer Accounts for Explaining and Projecting Trends in Public Finances

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1 Introducing the National Transfer Accounts

This manual describes how the National Transfer Accounts (NTA) for Europe have been generated. The 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.

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

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

Numerous aspects of the economy are captured fairly well by the key aggregates of the SNA, yet, other concepts and aspects of the economy remain outside its reach (System of National Accounts, 2009). Namely, standard national accounts do not offer information on how people at different stages of the life cycle are affected by various economic events, public policies or demographic changes. This represents a major gap in the statistical systems of both developing and developed countries (Mason & Lee, 2011b;United Nations, 2013).

Age is a fundamental factor that has a considerable effect on the patterns of economic behaviour. In general, people experience three different phases in the course of their life: working-age individuals are able to finance themselves by producing more than they consume (Hammer, Prskawetz, & Freund, 2014). In contrast, at the youngest and oldest ages, individuals are economically dependent on others in the sense that their consumption exceeds their labour income. The gap between consumption and inadequate labour income can be financed in the form of private transfers (such as financial transfers within a family), public transfers (pensions, publicly financed education, etc.) or (private and public) asset-based reallocations that result from participation on capital and financial markets (Mason, Lee, Tung, Lai, & Miller, 2006). The transfers are called intergenerational because they represent flows among different generations (among young, working-age and old population).

Measurement of these flows among different age groups is useful for understanding the intergenerational economy and the organization of intergenerational support (how the gap between consumption and labour income is financed in childhood and old age). Both young and elderly people depend

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heavily on transfers they receive mostly from the working-age population (Mason et al., 2006). Due to a prolonged education period and increased longevity of the elderly, these periods of economic dependency are gradually becoming longer in contemporary societies.

Introducing the age dimension into the conventional national accounts 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 can put the system of intergenerational flows under substantial 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 et al., 2014). 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, as well as to support consumption needs of children and the elderly in the form of private and public transfers (Mason & Lee, 2011b).

Demographic changes occur as a consequence of countries moving through the demographic transition, characterized by shift from high to low fertility, the extended longevity of elderly population and the ageing of the so-called baby boom generation (Mason & Lee, 2011b). These transitions have taken place at different time periods in the past and will continue for decades to come (Mason & Lee, 2011b).

The age structure of European population is expected to change significantly over the coming decades. Eurostat's main scenario for population projections assumes low fertility and mortality rates also in the future. Combined with the baby boom generation entering into retirement, the relative importance and weight of the elderly population will rapidly increase. The proportion of the EU-28's population aged 65+ will rise from 18.6% to 28.1% from 2014 to 2050. An even faster increase will be noticeable for the oldest old (aged 80+). In the same time period, their share in the population will more than double (from 5.2% to 10.9%, respectively). On the other hand, the percentage of working-age population is expected to fall from 65.9% to 56.9%. In absolute numbers, working-age population will shrink by 40 million people. As a result of these changes, the ratio between the working-age population and those aged 60+ will change dramatically: from having almost four working-age persons for one person aged 60+, this ratio is expected to fall to 2:1 until 2050 (Eurostat, 2014).

Population ageing will most likely have significant social and economic consequences since individuals' 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, 2011b). This gradually affects the aggregate levels in the economy, as well as the patterns of intergenerational flows among people (Mason & Lee, 2011b;Prskawetz & Sambt, 2014).

Population ageing requires reforms of the public intergenerational transfers. A detailed dataset is a foundation for development of effective policies. Some government policies can be beneficial for some generations, but extensively burdening for others. However, systems such as the SNA do not offer enough

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information about the age and generational aspect of the aforementioned changes, which limits our ability to fully grasp the consequences of demographic transition. The National Transfer Accounts have been developed to fill this gap (United Nations, 2013).

The NTA extend the SNA by introducing the age dimension. The focus of the NTA is not on institutions, but rather on individuals and age groups. Therefore, the NTA improve 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 capturing the age dimension, the NTA help shed light on questions such as the effect of the changing age structure on different macroeconomic categories. They are therefore 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 the age-specific averages of different economic flows and activities.

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2 The Basic Principles of the NTA

2.1 The Flow Identity

The patterns of people's production vary with age due to numerous factors: biological characteristics, cultural background, institutional environment, individual preferences, experience or physical strength, etc. (Mason & Lee, 2011b). Furthermore, different labour market participation rates during the periods of young adulthood, prime and old ages influence the pattern of labour income. The changing patterns of production and consumption throughout people's life characterize the economic life cycle. The shape of the economic life cycle (consumption exceeding production in young and old ages) requires the so-called age reallocations which can occur in the form of transfers or asset-based reallocations. Sharing of resources with other generations is reflected in intergenerational transfers. Asset-based reallocations are intertemporal since they represent resources which are accumulated in one time period (at one age) and can be used at later ages (Mason & Lee, 2011b).

The NTA concept can be described with a central flow identity which also serves as a basis for the methodology. The basic underlying assumption of the flow identity is 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). Rearranging these categories gives us the flow identity, first introduced by Lee (1994):

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

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, 2011b). The excess of consumption over production is called the life cycle deficit in the NTA framework. In contrast, individuals whose consumption is below their production experience a life cycle surplus (i.e. a negative life cycle deficit) (United Nations, 2013). The life cycle deficit must equal flows in the form of net transfers and asset-based reallocations. The equality is assumed to hold on individual, as well as aggregate level (for all age groups and for the total economy). Net transfers of a specific age group are 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, $[Y^A(a) - S(a)]$. (Mason & Lee, 2011b).

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

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

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 government transfers, Y^{Af} is private asset

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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 in more detailed components. Private transfers (inflows and outflows) are divided into two types: inter-household (i.e., between households) and intra-household (i.e., within households). Inter-household transfers are additionally split up by purpose, distinguishing education, health and other transfers. Public transfers are divided by type of transfer programmes (i.e., publicly financed educational programmes, health services, pensions, long-term care, etc.) Private asset income is also further divided into the following components: return on capital, dividends, interest, rent, royalties and the imputed rental income from owner-occupied housing. The inflows in the form of public asset income are the return on publicly owned capital, while the outflows are the interest paid on public debt. Saving is divided into private and public part.

An important contribution of the NTA is measurement of private transfers across age, which is possible because the methodology relies on individual, rather than household data (R. Lee, Lee, & Mason, 2008). An individual is the basic unit of analysis in NTA since all institutions are considered only as intermediaries among different individuals (United Nations, 2013). Especially valuable is the quantification of intra-household transfers which had been commonly neglected in economic analyses since it is impossible to measure them 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 total intergenerational reallocations (i.e. private/public net transfers and asset-based reallocations). In underdeveloped countries, total transfers mainly flow downward from older to younger population. The opposite holds for most of the 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 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 (R. Lee & Mason, 2011a;R. Lee, 2003).

2.2 Representing the Basic NTA Methodology

The NTA are organized around the concept of the economic life cycle. As already mentioned, the economic life cycle is characterized by dependency of young and elderly population whose consumption exceeds their production. On the other hand, working-age individuals produce enough for their own consumption, as well as for the dependent members of the society (United Nations, 2013, p. 31). As a consequence, economic flows arise among individuals of different ages. The NTA measure these economic flows, disaggregated by age. The flows are presented in form of age profiles, containing the age-specific averages of different economic

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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 the 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 activities, as defined and measured in the SNA and other related sources.

The next step is to calculate the age-specific averages of different economic activities, 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 apply the smoothing procedure to eliminate random variation.

The last step is to adjust the age profiles proportionally so, that the NTA aggregate estimates match the value of previously calculated macro controls. This is done by calculating the necessary adjustment factors and multiplying them with the age profile. 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 profile) of labour income would be multiplied by 1.2 at each age.

In general, the NTA methodology uses individual rather than household data. 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 Sections 4.1.4 and 7.1.2.1 for more details about household head). By assumption, all inter-household transfers are assigned to the household head. Additionally, the household head is assumed to own all of the household's assets (asset income and savings).

At first glance, some of the concepts used in the NTA methodology (such as the concept of a life cycle deficit) may resemble the life cycle hypothesis. The main assumption of the life cycle hypothesis is that people aim to smooth consumption throughout their entire life. To achieve that, they maximize their lifetime utility (consumption) with respect to their lifetime income (Samuelson & Nordhaus, 2002). The life cycle hypothesis is a longitudinal model in which an individual is observed over the entire life. It should be noted that the NTA methodology does not observe individuals over their entire lifetime, but rather represents 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 (R. Lee & Mason, 2011b). The age profiles do not represent individuals over their lifetime, but rather how individuals are involved in the system of intergenerational reallocations. To conclude, one should be careful when interpreting the NTA results since great differences exist between the life cycle hypothesis and the NTA methodology.

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

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3 NTA and European System of Accounts

3.1 The European System of Accounts

The NTA definitions and concepts are broadly consistent with those of a European System of Accounts (ESA). ESA is the European Union's (EU) accounting framework which is also 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 the new information in a way which 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 of transfers between age-groups. For providing age-specific information some adjustments and aggregation of ESA quantities have to be made. This relation between ESA aggregates and NTA is explained in this section.

To estimate the NTA main categories (e.g. labour income, asset income, net transfers, consumption and savings) the yearly ESA sector accounts are used. These 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, the generation of income accounts, the redistribution of income accounts and the use of income accounts. The ESA uses double-entry accounting: transactions between sectors are recorded as a resource of one sector and the use of the other sector. Resources are flows received by the sector, while uses are flows paid. When transactions are happening within the sector, they 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. The combination of transactions at the end leads to a meaningful balancing item, which corresponds to the difference between total resources and uses. Each balancing item is used in a next sequence of the overall accounts (Eurostat, 2016b). The sequence of accounts is described below.

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 for the further generation of income account (Eurostat, 2016b).

The generation of income account shows how value added (resource) translates into primary incomes and taxes on production. The counterparts are 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 for the other sectors the balancing item is operating surplus.

The allocation of primary income account captures then the remaining part of the primary distribution of income and records, for each sector, different types of property income receivable and payable, and 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

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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.

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.

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

Next, the use of 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).

The last in the sequence of non-financial accounts is capital account. The capital account is divided into a change in net worth due to saving and capital transfers account and an acquisition of non-financial assets account. The first one shows the sum of savings and net receipts of capital transfers. The second one 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 a capital account is net lending/borrowing. If savings and net capital transfers are more than enough to cover 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 financial transaction accounts and thus the link between non-financial and financial transaction account. The 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

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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 a cross border transactions without transactions among the EU member states (Eurostat, 2016a). The sum of non-financial, 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 the different units of analysis and differences in the different classification of sectors. The NTA records transactions between individuals rather than between institutional units (e.g. between households). Without these distinctions it would not be possible to capture many of the transfers between age groups since 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, the NTA distinguish only between the public sector (general government) and the private sector including households, corporations and NPISH.

Selected ESA current account transactions are presented for each of the ESA sector in Table 1.

Table 1: Annual non-financial transactions, Austria, 2010

SECTOR	Total economy		Non-financial corporations		Financial corporations		General government		Households; non-profit institutions serving households		Households		Non-profit institutions serving households		Rest of the world	
TRANSACTION	Paid	Received	Paid	Received	Paid	Received	Paid	Received	Paid	Received	Paid	Received	Paid	Received	Paid	Received
Gross domestic product at market prices	285,165	285,165	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross value added (at basic prices)	257,651	257,651	147,349	147,349	12,632	12,632	32,124	32,124	65,547	65,547	61,221	61,221	4,326	4,326	0	0
Consumption of fixed capital	45,730	45,730	30,150	30,150	1,703	1,703	3,655	3,655	10,222	10,222	9,880	9,880	342	342	0	0
Gross operating surplus and gross mixed income	111,584	111,584	60,282	60,282	4,219	4,219	3,398	3,398	43,685	43,685	43,343	43,343	342	342	0	0
Gross operating surplus	84,348	84,348	0	0	0	0	0	0	16,448	16,448	16,106	16,106	0	0	0	0
Gross mixed income	27,237	27,237	0	0	0	0	0	0	27,237	27,237	27,237	27,237	0	0	0	0
Gross national income at market prices	285,373	285,373	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross disposable income	282,982	282,982	40,305	40,305	6,800	6,800	54,385	54,385	181,492	181,492	0	0	0	0	0	0
Gross adjusted disposable income	0	0	0	0	0	0	21,931	21,931	213,945	213,945	0	0	0	0	0	0
Gross saving	70,538	70,538	40,305	40,305	5,881	5,881	-1,149	-1,149	25,500	25,500	0	0	0	0	0	0
Net lending (+) /net borrowing (-)	10,463	0	5,529	0	6,675	0	-12,828	0	11,086	0	0	0	0	0	-10,463	0
Final consumption expenditure	212,444	0	0	0	0	0	55,534	0	156,910	0	152,827	0	4,083	0	0	0
Final consumption expenditure of households, total	189,364	0	0	0	0	0	32,454	0	156,910	0	152,827	0	4,083	0	0	0
Collective consumption expenditure	23,080	0	0	0	0	0	23,080	0	0	0	0	0	0	0	0	0
Gross capital formation	60,258	0	39,768	0	1,396	0	3,163	0	15,931	0	15,404	0	527	0	0	0
Gross fixed capital formation	57,499	0	38,565	0	1,388	0	3,163	0	14,382	0	13,855	0	527	0	0	0
Changes in inventories and acquisitions less disposals of valuables	2,760	0	1,203	0	8	0	1	0	1,548	0	1,548	0	0	0	0	0
Compensation of employees	142,621	142,591	84,167	0	8,025	0	27,806	0	22,623	142,591	18,882	142,591	3,741	0	1,560	1,590
Gross wages and salaries	115347	115,418	69662	0	6142	0	20665	0	18877	115,418	15740	115,418	3137	0	1403	1,332
Employers' social contributions	27275	27,173	14505	0	1883	0	7141	0	3746	27,173	3142	27,173	604	0	156	258
Taxes on production and imports	42,069	41,433	5,899	0	545	0	920	41,433	1,866	0	1,624	0	242	0	0	636
Taxes on products	32,840	32,204	0	0	0	0	0	32,204	0	0	0	0	0	0	0	636
Other taxes on production	9,230	9,230	5,899	0	545	0	920	9,230	1,866	0	1,624	0	242	0	0	0
Subsidies	9,911	11,110	0	3,000	0	157	9,911	0	0	2,628	0	2,628	0	0	1,199	0
Subsidies on products	5,271	5,326	0	0	0	0	5,271	0	0	0	0	0	0	0	55	0
Other subsidies on production	4,641	5,784	0	3,000	0	157	4,641	0	0	2,628	0	2,628	0	0	1,143	0
Property income	75,837	75,513	34,568	19,537	30,736	32,531	7,569	3,525	2,963	19,919	0	0	0	0	27,145	27,469
Interest	40,842	36,852	6,802	2,623	23,509	26,855	7,569	1,349	2,963	6,025	0	0	0	0	14,161	18,151
Total interest before FISIM allocation	39,163	37,101	7,574	1,885	19,531	29,900	7,684	1,195	4,375	4,121	0	0	0	0	15,082	17,144
Distributed income of corporations	28,338	31,006	24,274	14,280	4,065	4,418	0	1,883	0	10,425	0	0	0	0	9,158	6,491
Reinvested earnings on direct foreign investment	2,827	3,826	3,200	2,409	-373	1,255	0	0	0	162	0	0	0	0	3,826	2,827
Property income attributed to insurance policy holders	3,536	3,536	0	224	3,536	4	0	0	0	3,307	0	0	0	0	0	0
Rents	294	294	294	0	0	0	0	294	0	0	0	0	0	0	0	0
Current taxes on income, wealth, etc.	36,286	36,397	5,016	0	809	0	4	36,397	30,457	0	0	0	0	0	120	9
Social contributions and benefits	145,418	145,519	1,063	1,063	982	2,808	88,818	46,588	54,554	95,060	0	0	0	0	1,102	1,001
Social contributions	50,371	50,559	0	1,063	0	2,808	0	46,588	50,371	100	0	0	0	0	476	288
Social benefits other than social transfers in kind	58,510	58,423	1,063	0	982	0	56,365	0	100	58,423	0	0	0	0	627	713
Social transfers in kind	36,537	36,537	0	0	0	0	32,454	0	4,083	36,537	0	0	0	0	0	0
Other current transfers	23,066	20,462	1,813	1,884	6,255	6,023	7,040	3,932	7,958	8,623	0	0	0	0	1,066	3,670
Net non-life insurance premiums	5,583	5,705	1,500	0	28	5,705	0	0	4,055	0	0	0	0	0	156	34
Non-life insurance claims	5,705	5,543	0	1,473	5,705	28	0	0	0	4,043	0	0	0	0	11	172
Other current transfers, n.e.c. (excl. transfers within general government)	11,778	9,214	313	411	522	291	7,040	3,932	3,903	4,580	0	0	0	0	899	3,463
Current international cooperation	346	219	0	0	0	0	346	219	0	0	0	0	0	0	219	346
Miscellaneous current transfers	11,432	8,995	313	411	522	291	6,694	3,713	3,903	4,580	0	0	0	0	680	3,117
GNP based fourth own resource	2,092	0	0	0	0	0	2,092	0	0	0	0	0	0	0	0	2,092
Adjustment for the change in net equity of households in pension funds reserves	919	919	0	0	919	0	0	0	0	919	0	0	0	0	0	0
Capital transfers	9,255	9,607	267	5,475	14	2,204	8,742	179	232	1,749	0	0	0	0	961	608
Acquisitions less disposals of non-financial non-produced assets	169	0	216	0	0	0	-47	0	0	0	0	0	0	0	-169	0

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

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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 correspond basically to net national income in the ESA. NTA labour income includes the compensation of employees, asset income net operating surplus plus the net property income from the rest of the world. Mixed income and other taxes less subsidies on production are divided between labour income and capital income, which is described below.

Mixed income contains the return to labour and the returns 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), the NTA allocates 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 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 – VAT – 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 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 European sector accounts 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.

The labour and capital incomes are in the NTA measured before assessment of taxes less subsidies, therefore we need to adjust them upwards (i.e. we need to add taxes less subsidies).

In NTA consumption is measured in terms of basic prices, thus as price the producer receives from the purchase of his/her products. In NTA the taxes on products and production less subsidies are an outflow from consumers paid to the public sector (a public transfer outflow), and therefore not part of the individual's adjusted disposable income.

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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 in proportion of 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

The public and private resources and uses related to the taxes on products and production less subsidies are presented in Table 2. Taxes are paid by the private sector and represent uses for the private sector. On the other hand, taxes are received by the public sector and present resources for the public sector. Just the opposite is true in the case of subsidies since they are paid by the public sector or the ROW but received by the private sector. The difference between taxes and subsidies received and paid by the total economy (private + public sector) equals to the taxes less subsidies received from the ROW (i.e. paid minus received by the ROW).

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 the 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 the 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

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. While asset income is distributed between both, public and private sector, the labour income corresponds only to the private sector. 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

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capital share of mixed income and capital share of taxes less subsidies. The NTA generally uses 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 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 The NTA net disposable income

The secondary redistribution of incomes is at the very core of the NTA since this type of redistribution constitutes to a large degree the redistribution between age groups. Accounting for these flows between ages is reflected in the name Transfer Accounts.

The public transfers in the NTA refer to the flows between the public sector and private sectors in the ESA and/or the public sector and the ROW. Private transfers in NTA consist of the transfers/flows within the private sectors and/or 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 consists mainly of social benefits in-cash and in-kind. Please 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 sum of 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 payable by the total (national) economy. Since we need disposable income of public and private sector separately, the total disposable income should be separated between these two sectors.

Table 4 shows public and private transfers. The ESA includes information for each sector on the value of resources which are received/paid 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 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 pay also benefits. In the 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.

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Table 4: The 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

However, two parts of other current transfers can be classified without any further calculations. Both, the current international cooperation and gross national product (GNP) based fourth own resource (flows received by the EU budget from the EU member states), refer to the 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 defined.

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Table 5: Direction of Public and Private sectors, 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**
				Sum Column

Net Non-Life Insurance Claims				
from/to	public	private	ROW	**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**
				Sum Column

Miscellaneous Current Transfers				
from/to	public	private	ROW	**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**
				Sum Column

Social Contributions				
from/to	public	private	ROW	**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**
				Sum Column

Social Benefits other than Social Transfers in Kind				
from/to	public	private	ROW	**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**
				Sum Column

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 matrices 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. The black cells 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 premia 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.

To get the measure for adjusted disposable income (including in-kind transfers) we add public and NPISH's transfers in-kind. In NTA public consumption consists of not only individual consumption (social transfers in-kind) but also of collective

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consumption. Both components are treated as in-kind transfers. Consumption of NPISH's is treated as private in-kind transfer.

3.2.3 The NTA use of disposable income

The net adjusted disposable income is used for consumption and saving. Private and public consumption are distinguished. 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 (net) saving measure equals net saving in the ESA which is equal to the difference between (net) disposable income and consumption. The use of net disposable income is presented in Table 6 and the saving account in 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 C			184,930		
Private Consumption at Basic Prices CF			129,396		
Public Consumption CG			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

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

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**	
		SG		**SF**	
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

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[2].

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

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3.3 The Life cycle Account

Since the ESA and the NTA serve for different purposes[3], not all the variables can be retrieved directly from the ESA. Some variables are unique to the NTA and thus do not have a direct counterpart in the ESA (e.g. intra-household transfer inflows and outflows).

The NTA accounts are divided into three sub-accounts: the life cycle account, the transfer account and the asset-based reallocations account. In next 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 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 distinguished by purpose (function). Public and private consumption are separately divided into education, health and other public or private[4] consumption. The distinction is motivated by the huge age–specific variation regarding these components.

The ESA does not directly include specific disaggregation of private and public final consumption. The aggregate values for the private consumption subcategories are based on consumption data disaggregated according to the Classification of Individual Consumption by Purpose (COICOP). More specifically we are using the data on Domestic Household Consumption Expenditures disaggregated by COICOP classification. On the other hand, the aggregates for public consumption expenditure are based on consumption expenditure according to the Classification of the Functions of Government (COFOG). The COFOG classification of government final consumption can be directly used for disaggregation of the public consumption (COFOG is a satellite account to the ESA). The subcategories of private consumption are adjusted to match the aggregate value of the private consumption from the ESA.

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

[3] While the ESA focus on production, income, consumption, investment and financial issues, the NTA objective is to measure transfers/flows between generations with which individuals finance their consumption (van Tongeren, 2013).
[4] We separately estimate part of other private consumption – owner occupied housing, since it is further needed for the estimation of intra-household transfers.

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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 (inc	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 (inc	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 + actual and imputed employer's social contributions[5]). The self-employment labour income consists of two thirds of gross mixed income adjusted (upwards) 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. If the LCD is negative, it is called a life cycle surplus. In the Table 9 we present the aggregate values for labour income, consumption and the life cycle deficit.

[5] Employer's social contributions are part of earnings; however its aggregate value separated from wages/salaries. This is needed since 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	Labor Income	162,481
YLE	Earnings	144,127
YLS	Self-employment Labor 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 demand for the age reallocations in form of public and private transfers and 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. The public transfer inflows in-kind consist of public individual and collective consumption expenditure. Public transfer inflows in-cash are monetary transfers received from the government.

Total public transfer inflows are derived using the ESA. Total public cash transfer inflows are the sum of resources received by the private sector in a 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.

In NTA public transfers are distinguished by purpose (function). Public transfer inflows are divided into the subcategories education, health and pensions. The remaining parts of in-kind and in-cash 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 transfers, etc.

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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.

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 ESA and those using ESSPROS are not completely the same, the ESSPROS fits well with 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.

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In Table 11 we present the total public transfer inflows, public transfer inflows in-cash and in-kind by purpose.

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 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 Portection Survivor	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 public transfer inflows, public asset income (if negative, e.g. interest on public debt) or they are used for 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 form of public transfer outflows are too small to finance all of the public transfer inflows and the 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 in a form of taxes, social contributions and other revenues stem from the ESA data. The taxes paid by individuals (private sector) equal to the sum of outflows in a form of net indirect taxes less subsidies and the other current 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.

To complete the estimation of the public transfer outflows we need to distinguish taxes by their source – the activity that is being taxed. The total taxes are classified into taxes on capital income (TGFYA), labour income (TGFYL), property income (TGFP) and consumption (TGFC). The information on the source of the taxes is taken from the 'Taxation Trends in the European Union 2012' data. The

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Eurostat Statistical book on taxation trends among the other data includes the information about the taxes paid out of labour, capital, property income and consumption as a percentage of gross domestic product (GDP). The percentage share in the GDP gives us information about the share of each of the tax subcategories in the total taxes - presented in Table 12.

Table 12: Derivation of taxes subcategories, Austria, 2010

Variable Abbreviation	Variable name	% of GDP	Share in total taxes
TGFYA	Taxes on income, profits, and capital gains	5.9	0.215
TGFYL	Taxes on payroll and workforce	9.2	0.336
TGFP	Taxes on property	0.5	0.018
TGFC	Taxes on goods and services	11.8	0.431
	Total Taxes	27.4	1.000

Source: Eurostat, 2015: *Non-financial transactions*, *Social protection expenditure, General government expenditures by function,* (http://ec.europa.eu/eurostat/data/database); Taxation Trends in the European Union 2012; Authors' own calculations.

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, 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's 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.

While ESA can be used to construct all the 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), the category that in a major part include 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 use a standard NTA procedure and keep the inter-household transfer inflows, while outflows are estimated as a difference between inter-household transfer inflows and the net private transfers from the ROW. The aggregate value of the intra-household transfers equals zero, as intra-household

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transfers present transfers within the same household. 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, Inflows	1,553
TFWI	Inter-household, Inflows	na*
TFO	Private Transfers, Outflows	1,025
TFBO	Inter-household, Outflows	1,025
TFBO	Intra-household, 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

3.5 The Asset-based Reallocations Account

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

Asset-based reallocations (ABR) are divided into public and private asset-based reallocations. ABR equals the asset income (a sum of capital and property income) less saving. Generating additional asset income means an inflow for individuals, in the meaning that asset income constitutes of resources which 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.

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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 (public transfer inflows to the residents and net public transfers to the ROW). The government therefore have to cover the public transfer deficit or surplus through asset-based reallocations. If asset income is sufficient to cover the transfer deficit, the residual is saved. On the other hand, if asset income is insufficient to cover the deficit, the public sector must dissave.

Public asset income is a sum of the net operating surplus (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 a form of taxes, other current transfers, social contributions and benefits in-kind and not in-kind (from the ESA). Public saving is calculated as a difference between asset income and the RAG and equals the net saving by the general government reported in 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 to the capital in form of the dwellings owned by households[6]. Only two components (i.e. capital income of 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 in the proportion to the share of gross values of the components.

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). On the other hand, the capital income of households and NPISHs includes operating surplus and mixed income combined. The consumption of fixed capital is thus excluded from the

[6] The UN Manual requires combining gross operating surplus of financial and non-financial corporations and NPISHs in order to get capital income of corporations and NPISHs, while capital income of owner-occupied housing should only include operating surplus of households. Since in some of the countries (explicitly in the DK, IE, LU, NL, DE and UK) the European sector accounts do not offer us flows presented for households and NPISHs 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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capital income of owner-occupied housing (household operating surplus) and capital share of mixed income in a proportion to their gross value (before taxes less subsidies included in the mixed income part).

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

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.

The ESA property income includes interest, distributed income of corporations, reinvested earnings on 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 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.

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

Variable abbreviation	Variable Name	Value (mill. of national currency)
R	Reallocations	22450*
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

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4 The Economic Life Cycle

4.1 Some additional methodological notes before starting

The NTA age profiles are based on three different types of data: data from national accounts, population data and administrative/survey data. We retrieve population data on January 1[7] from Eurostat webpage.

The main source of survey data is European Union Statistics on Income and Living conditions (EU-SILC). We estimate the age profiles for EU countries for 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 more than 80 years old.

The use of survey data has some disadvantages compared to administrative data. A problem can arise when using surveys with small sample size 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. For example, respondents typically overestimate the value of their property since they are emotionally attached to it. 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 the smoothing procedure to minimize the random variation of the age-specific estimates which 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 not to lose the information on real age differences. The age patterns of public education consumption are not a consequence of random variation, but reflect mainly the age differences in participation rates.

[7] 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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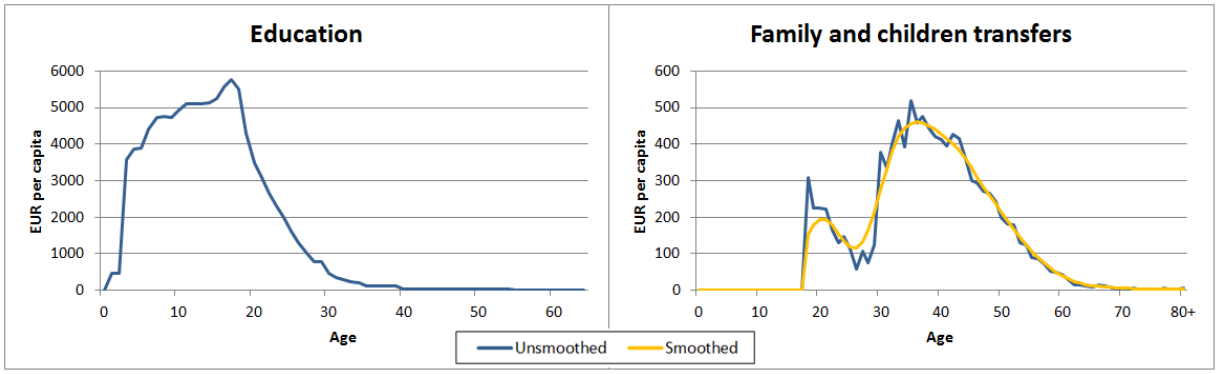
Figure 1: Public consumption by category, Germany, 2010



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

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 former constitutes a part of public consumption other than education and health. The age profile of public education consumption is not smoothed in order not to lose variation across different ages, while the age profile of public family and children transfers in-kind is smoothed to reduce noise in the data.

To smooth the age profiles we use Friedman's SuperSmoother which is a nonparametric regression estimator (Luedicke, 2015). In the smoothing procedure, we incorporate the number of observations (in each age group) as weights. Hence, greater weight is given to the age-specific averages based on more observations, while age-specific averages based on fewer observations are given less weight. Age-profiles which are a composite of 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 the smoothed age profiles which are slightly negative at some ages (where they shouldn't be). This occurs when unsmoothed age profiles are very close to 0. This can be solved by replacing the negative smoothed values with the original unsmoothed ones.

To avoid double smoothing, we do not smooth the 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 which equal 0 by definition. For example, the age profile of labour income equals 0 for individuals who are less than 15 years old 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.

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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 assure that the estimated aggregate value matches the value of 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 θ 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 activity. The calculated adjustment factor is then used to finalize the age profile by shifting the unadjusted age profile downward or upward by the same factor for each age group a:

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

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

where $\bar{x}(a)$ and $\bar{X}(a)$ represent the finalized 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. 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 Normalizing

Smoothing and adjusting are used to finalize 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 normalizing the age profiles. To compare the values of the age profiles over time and across countries, the NTA

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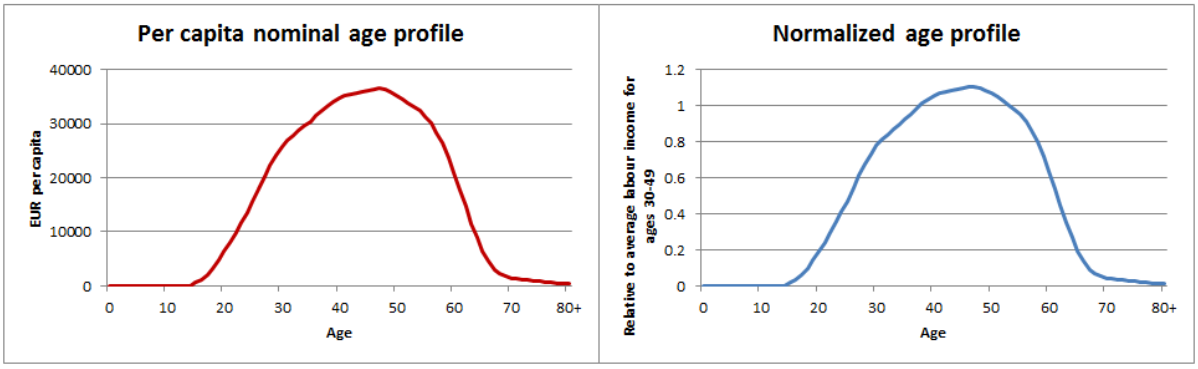
averages are divided by a simple average of per capita labour income for age groups between 30 and 49 years old. A simple (i.e. non-weighted) average is used so that the normalization process is not affected by the age distribution of the population between 30 and 49 years of age. We choose labour income 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 the wages between both genders.

Figure 2 presents per capita nominal and normalized age profiles of labour income for Germany in 2010. Normalized age profile is of the same shape as 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 30-49 age group).

Figure 2: Labour income, Germany, 2010



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

4.1.4 Household head and adult variable definition

In the survey, some data are reported on the individual level while some on 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. Household head is defined as a 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 household head becomes the older one. As in the calculation of the total income also the self-employment income is included, there is a probability that the total income is negative in a 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 a 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

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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 that an individual adult represents in this household.

4.2 Creating labour income variables

The age profile for total labour income represents one of the main NTA age profiles. It includes earnings of employees working in the formal sector, returns on labour of the self-employed workers and employer's social contributions.

The age profiles for labour income are estimated using the EU-SILC survey data. In EU-SILC age is reported as age at the end of income reference period (except for the childcare variables where the age refers to the age at the time of interview). In case that the variable age is not reported, it is calculated from the variable year of birth.

For labour income data the annual income is most commonly adoptedFor most EU member states the records are available for the tax year (most direct taxation is usually based on the annual accounting framework), which is normally the calendar year preceding the time of the interview. The problem with such system of gathering income data is that the other variables (e.g. on social conditions) may not relate well to the income data.

Wages, salaries and self-employment income are reported separately for each individual.

4.2.1 Earnings

Age profiles for earnings are calculated as weighted averages of relevant income components.

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 among individuals properly we distinguish between young persons who are 15 years old and children below 15 years, because 15-year-olds can already earn some income as opposed to younger children. 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 individual.

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 her labour input, like holiday leave payment, compensation for food and transportation to work or any other payment that is provided from the organisation in which she works. Besides, non-cash employee income (e.g. private use of a company car) are included.

The NTA earnings also include employer's social contributions (benefits). Usually the employer's social contributions (benefits) represent a constant proportion of

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earnings. Even though they present a component of earnings, they are showed separately in EU-SILC. Therefore, there is no need to use a constant proportion, as the data on employer's social insurance contributions and employer's optional social insurance contributions are readily available from the survey.

4.2.2 Self-employment labour income

EU-SILC contains data on cash benefits or losses from self-employment on an individual level. The self-employment labour income includes reported income from farming, income of entrepreneur, salary of entrepreneur, reimbursement for annual leave of entrepreneur, and compensation for food and transport to work.

4.2.3 Labour income

Total labour income of an individuals composed 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.

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, the age profile of labour income also takes the same shape. Earnings of employees represent the largest part of total labour income, while labour income of self-employed is much smaller in size.

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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 Creating Private Consumption Variables

The results for 2010 are preliminary, since at the moment the Household Budget Survey (HBS) for constructing private consumption age profiles is still not available. In the absence of HBS data, we took most recent per capita age profiles of the national NTA teams calculated in the past and we adjusted them to the actual aggregate values in 2010. For other EU countries we have used the average age profiles of all NTA-EU countries combined and adjusted to the actual aggregate values.

4.4 Creating 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 the different public programmes. We distinguish between individual (when beneficiaries of a specific programme are known) and collective public 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. As 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 also use data from research groups and organizations (such as 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

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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 on how to compile the age profile of public education consumption in three steps.

First step: In the first step, we calculate the average cost of public education per enrolled for each educational level. First, we obtain the data on public education expenditures (in national currency) from Eurostat database. Expenditures are disaggregated by level of education according to Classification of the Functions of Government. There are eight main categories in 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 education levels as defined by ISCED. However, for now we leave pre-primary and primary educational levels combined, as well as lower and upper secondary levels combined (as defined in COFOG data)[8]. 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 proportional to the share of students enrolled in each level. We retrieve the data on number of enrolled students by ISCED levels from Eurostat. Calculations are presented in the second table in Figure 4 (data in green are given hypothetical data, while data in yellow are calculations).

Finally, we calculate public education expenditures by ISCED levels, also disaggregated by pre-primary, primary, lower secondary and upper secondary level (see the calculations in the third table in Figure 4). 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 governments spend for each educational level using United Nations Educational, Scientific and Cultural Organization (UNESCO) database. We do the same for lower and upper secondary education. To calculate the unit cost per enrolled for each educational level, the level-specific public education expenditures are divided by the number of pupils enrolled in this educational level. The underlying assumption is that the unit cost of public education is equal for all pupils enrolled in a specific level, regardless of their age.

[8] In COFOG, data on expenditures are given for pre-primary and primary level combined (the same holds for lower and upper secondary level), while these two categories represent two separate levels in ISCED. Our task is to divide these COFOG expenditures into two parts (pre-primary and primary level separately), however, for now we leave the data combined.

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Figure 4: First step in calculating public education consumption

Total public expenditures on education (in national currency) divided by COFOG categories								
Pre-primary & primary education	Secondary education	Post-secondary non-tertiary education	Tertiary education	Education not defineable by level	Subsidiary services to education	R&D Education	Education n.e.c.	TOTAL
25000	45000	500	20000	2000	5000	2000	500	**100000**
				9500				

Total public expenditures on education (in national currency) assigned to ISCED educational levels									
	Pre-primary education (level 0)	Primary education (level 1)	Lower secondary education (level 2)	Upper secondary education (level 3)	Secondary	Post-secondary non-tertiary education (level 4)	Tertiary education (levels 5 and 6)	Unknown	TOTAL
Number of students enrolled	75	110	95	110		10	100	/	**500**
Share of students enrolled	0.15	0.22	0.19	0.22		0.02	0.2		
Public education expenditures*	28515				48895	690	21900		**100000**

* 25000+(0.15+0.22)*9500=28515

Public education expenditures per enrolled by ISCED educational levels									
	Pre-primary education (level 0)	Primary education (level 1)	Lower secondary education (level 2)	Upper secondary education (level 3)	Secondary	Post-secondary non-tertiary education (level 4)	Tertiary education (levels 5 and 6)	Unknown	TOTAL
Share of public expenditure on education	0.1	0.15	0.2	0.25	0.45	0.1	0.2		
Public education expenditures**	11406	17109	21731	27164		690	21900		**100000**
Expenditures per enrolled	152.08	155.54	228.75	246.94		69.00	219.00		

** (0.1/(0.1+0.15))*28515 = 11406

Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

Second step: In the second step, we calculate the number of enrolled pupils for each educational level and age group. Eurostat offers level-specific data on the number of enrolled pupils 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+ (hypothetical data are shown in the first table in Figure 5)[9].

[9] For some countries it may occur that Eurostat offers aggregated data for 5-year age groups already for people between 30 and 34 years of age. In this case, we use the same methodology to disaggregate the data into 1-year age groups as described here for the age group 35-39.

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Figure 5: Second step in calculating public education consumption

Number of enrolled pupils by age groups and educational level - Eurostat data								
AGE/ISCED97 LEVEL	TOTAL	Pre-primary education (level 0)	Primary education (level 1)	Lower secondary education (level 2)	Upper secondary education (level 3)	Post-secondary non-tertiary education (level 4)	Tertiary education (levels 5 and 6)	Unknown
Less than 3 years	10	10						
3 years	30	30						
...	...							
34 years	40			10	19	1	10	
From 35 to 39 years	80			25	35	3	17	
40 years or over	50			18	10	2	20	
TOTAL	**500**	**75**	**110**	**95**	**110**	**10**	**100**	**0**

Adults participation rates in education						
Original data		Recalculated data				
Age group	Participation rate	Age group	Participation rate	Population	Number of enrolled adults*	Share of enrolled adults**
		From 35 to 40 years		1000		
From 35 to 44 years	45	From 40 to 44 years	45	1500	675	0.27
From 45 to 54 years	40	From 45 to 54 years	40	3000	1200	0.48
From 55 to 64 years	20	From 55 to 64 years	20	3000	600	0.24
			TOTAL	**7500**	**2475**	
*	0.45*1500 = 675					
**	675/2475 = 0.27					

Number of enrolled pupils by age and educational level - recalculated									
Age/ISCED level	TOTAL	Pre-primary education (level 0)	Primary education (level 1)	Lower secondary education (level 2)	Upper secondary education (level 3)	Post-secondary non-tertiary education (level 4)	Tertiary education (levels 5 and 6)	Unknown	Population
0	0	0	0	0	0	0	0	0	180
1	5	5	0	0	0	0	0	0	150
2	5	5	0	0	0	0	0	0	200
3	30	30	0	0	0	0	0	0	...
...	...								
34	40	0	0	10	19	1	10	0	
35*	24.0	0.0	0.0	7.5	10.5	0.9	5.1	0.0	300
...	...								...
40**	2.3	0.0	0.0	0.8	0.5	0.1	0.9	0.0	250
...	...								...
64***	1.6	0.0	0.0	0.6	0.3	0.1	0.6	0.0	400
TOTAL	**500**	**75**	**110**	**95**	**110**	**10**	**100**	**0**	
*	80*(300/1000) = 24								
**	50*0.27*(250/1500) = 2.3								
***	50*0.24*(400/3000) = 1.6								

Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

For people who are between 0 and 34 years of age, 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 who represent the first age group. For them, we assume that children aged 0 are not yet enrolled into educational programmes, so we distribute the number of enrolled pupils uniformly between children aged 1 and 2.

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For the age group 35-39, Eurostat offers level-specific data on the number of enrolled pupils only for the whole (5-year) age group, but not specifically for one-year age groups. Thus, we need to distribute the original level-specific data on number of enrolled pupils into one-year age groups proportional to the share of population in each age group. Detailed calculations are shown in the third table in Figure 5.

Data need to be disaggregated into one-year age groups also for the age group 40+. For them, we set the upper limit at 64 years of age. We assume that population aged 65+ has already or will soon retire and is therefore not enrolled in educational programmes anymore. To disaggregate the data into one-year age groups, we first retrieve the data on participation rates of adults from Eurostat using Adult Education Survey (AES)[10]. We take into account participation rates in formal education[11]. Relying on Eurostat data, we form three subgroups in the 40-64 age group: those aged from 40 to 44 years, from 45 to 54 years and from 55 to 64 years of age (see the second table in Figure 5). For each subgroup, we calculate the number of enrolled adults by multiplying the participation rate with the population size in this subgroup. Next, we calculate the share of enrolled adults for each subgroup in the total number of enrolled adults in the three subgroups. Proportional to these shares, we divide the original Eurostat level-specific data on number of enrolled adults for the age group 40-64 among the three subgroups. Next, we use the same methodology as before. For each subgroup, we know the level-specific data on the number of enrolled adults, which we allocate to one-year age groups proportional to the share of population at each age compared to the total population size in each subgroup (calculations are illustrated in the third table in Figure 5).

Third step: In the third step, we calculate the age profile of public education consumption. We start by calculating age-specific total public education consumption. For each age, we multiply the number of pupils enrolled at a specific level with the unit cost per enrolled 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. Calculations in the third step are illustrated in Figure 6.

[10] AES is a household survey which is conducted every 5 years. We use the data on participation rates from AES 2011 (since it is the closest to year 2010) and population data from 2010.

[11] For some countries we cannot obtain data only on formal education participation rates, so we use participation rates in formal and non-formal education (combined).

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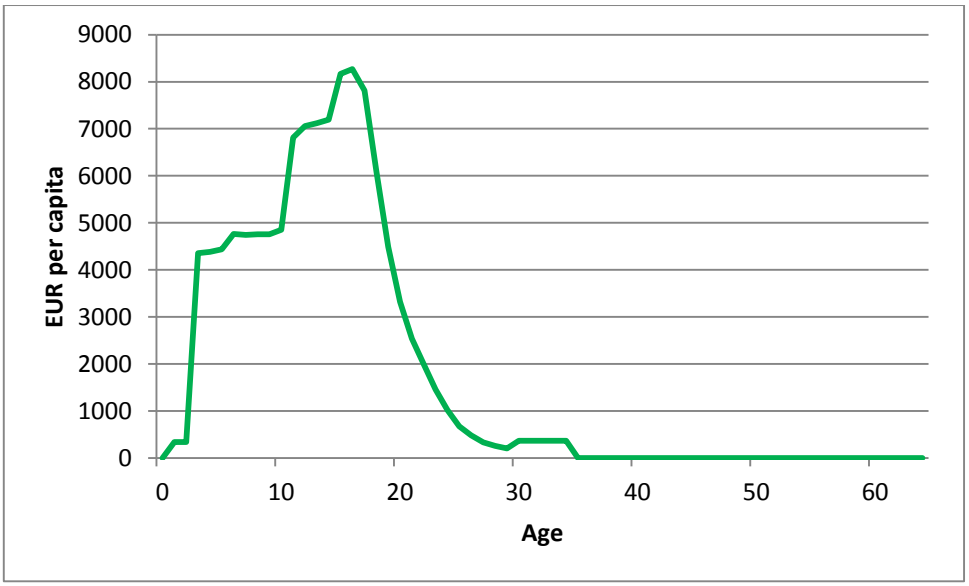
Figure 6: Third step in calculating public education consumption

Public education consumption by age			
Age	Total public education consumption	Population	Per capita public education consumption
0	0	180	0
1	760.4	150	5.07
…	…		
64**	359	400	0.90
**	0*152.08+0*155.54+0.6*228.75+0.3*246.94+0.1*69+0.6*219 = 359		

Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

In Figure 7, we show the finalized age profile of public education consumption for France for year 2010. Please note that we do not smooth the age profile of education consumption in order not to lose real variability in the data. In all of the countries per capita education consumption is low in kindergarten years, but starts to increase rapidly before the 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.

Figure 7: Unsmoothed age profile of public education consumption, France, 2010



Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

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4.4.2 Health

Public health consumption consists of two parts: health and long-term care consumption. There is no administrative data source which would offer comparable data on public health expenditures for all EU countries. Thus, we received the already calculated age profiles of health and long-term care consumption from the Ageing Working Group (AWG), which was appointed by the Economic Policy Committee (EPC). Their aim is to prepare projections of budgetary consequences of an ageing European population over the time period 2010-2060 (report AWG).

AWG calculated the age profiles of public health care by summing all of the 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.

Publicly financed long-term care was calculated by AWG as the sum of the following categories: 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 to dependent people and include a range of different services, such as help with basic activities of daily living (i.e. ADL activities) and instrumental activities of daily living (i.e. IADL activities). ADL activities include bathing, getting dressed, eating, getting in and out of bed, moving around and using bathroom, while IADL activities include housework, preparation of meals, taking medications, shopping, use of telephone etc.

We decided to use only health care, but not long-term care age profiles to calculate public health consumption. Namely, the long-term care age profiles are defined for too broad age groups (only for 10-year instead of 1-year age groups). Furthermore, publicly financed long-term care includes social services of long-term care which we do not consider as part of public health consumption.

We got 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, Luxemburg, Malta, the Netherlands, Slovakia, Slovenia, Sweden and the United Kingdom. For these countries, we use the age profiles calculated by the AWG. We take the profiles for year 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 for year 2015 instead of 2012 due to extremely large values of the age profile for 2012 (compared to the other countries), especially for very young children. We do not smooth the received age profiles since they were already previously smoothed.

We could 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 calculate the average age profile from data for 19 countries (for which we have 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 of the countries' public health expenditures at each age. Using simple average, we

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assign equal weight to all of the countries and do not take into account their population size.

For Romania, the original AWG age profile was not calculated from country-specific data, but rather estimated as an average of the data for other countries. Since AWG profile does not match the average profile that we calculated, we rather use our average age profile and adjust it to the value of a macro control. In this way, we are consistent in our methodology since we use the same method as for countries for which we do not have permission to use the profiles.

4.4.3 Public Consumption Other Than Education and Health

Education and health are two fundamental components of total public consumption. They 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 variable.

Other public consumption than education and health can be classified into 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. Collective consumption includes consumption on public goods, such as national security, public administration, public infrastructure, street lightning, justice, etc.

We divide public consumption other than education and health into three parts: old age consumption, consumption of social protection other than pensions and other consumption. In Table 17, we present these categories in more detail and show whether we classify them as individual or collective consumption.

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

Category	Subcategory	Individual/ collective consumption
Old age (pensions)		individual
Social protection other than pensions	Unemployment	individual
	Family and children	individual
	Housing	individual
	Miscellaneous social protection	collective
Other consumption		collective

Source: EU-SILC 2011

In European countries, great differences exist in age patterns of public consumption other than education and health. Thus, whenever possible and justified, we treat consumption as individual and allocate it by age. Since there are no specific administrative data on individual public consumption, we calculate its components by taking the (unsmoothed) age profiles of the corresponding cash categories of public transfer inflows (explained in more detail in Section 5.1.1)

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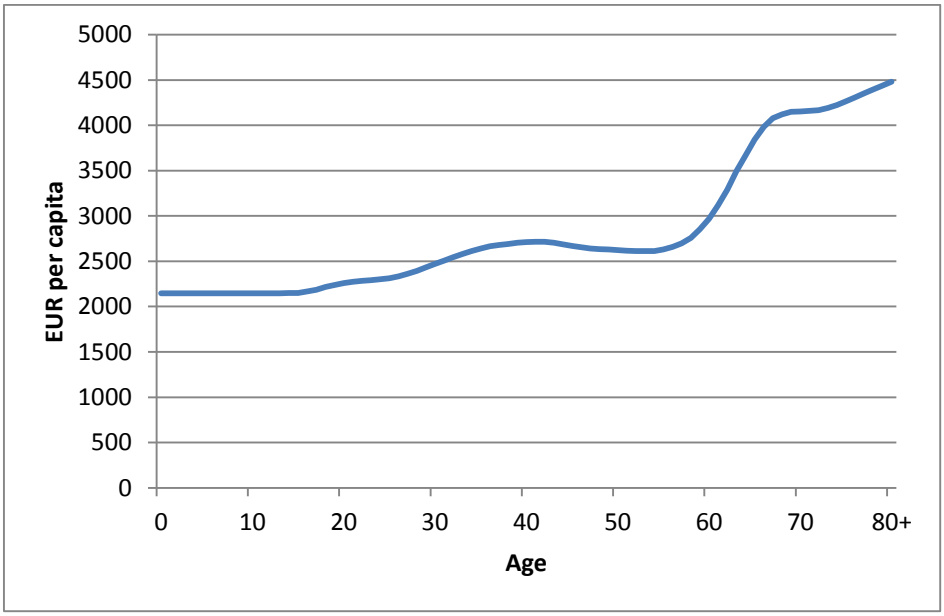
and adjust them to the value of the macro control of the corresponding consumption category. For instance, we estimate the age profile of public unemployment consumption by taking the age profile of in-cash public unemployment transfer inflow and adjust it to the aggregate value of public consumption for unemployment. Thus, we first need to calculate in-cash public transfer inflows to derive the age profiles of individual public consumption.

We treat some categories (miscellaneous social protection and other consumption) as collective public consumption. Since all individuals are beneficiaries of collective consumption, the per capita age profiles of these categories are assumed to be constant for all ages, i.e. the age profile is a horizontal line. We determine its level by the value of a macro control.

In Figure 8, we show the per capita age profile of public consumption other than education and health for Germany for year 2010. The age profile is increasing with age and reaches the highest values at oldest ages (due to old age in-kind public consumption). Another hump occurs around the age of 40, mainly due to the public consumption expenditure for families and children.

Figure 8: Public consumption other than education and health, Germany, 2010



Source: 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 9 presents the age profile of total public consumption for Italy for year 2010. We can observe several distinctive characteristics in the age patterns of public consumption: consumption at young ages is mainly driven by education expenditures, while old ages are characterized by high health care expenditures. Public consumption is the lowest at working ages when individuals mainly consume collective public goods and services.

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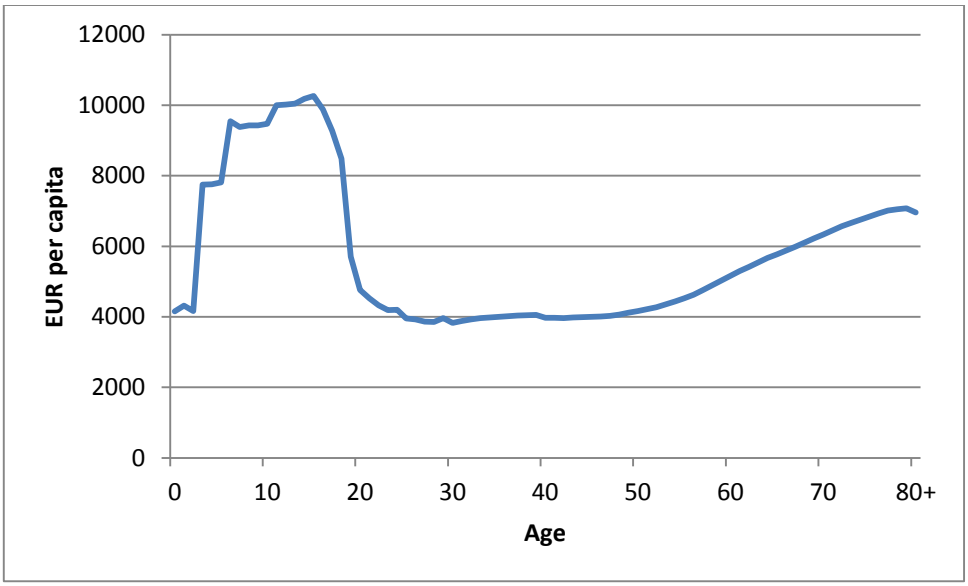
Figure 9: Total public consumption, Italy, 2010



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

4.5 Creating Life Cycle Deficit Variables

We start by briefly summing up the process on how to calculate the components of the life cycle deficit:

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

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

$$LCD(a) = \mathrm{C}(a) - Y^{l}(a) \tag{8}$$

where LCD is the life cycle deficit, C is consumption and Y^l is labour income, at age a. When life cycle deficit is a negative value, we call it life cycle surplus.

Figure 10 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 over age. This results in a typical shape of the age profile of the life cycle deficit. 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 starts to decline and the life cycle deficit again turns positive.

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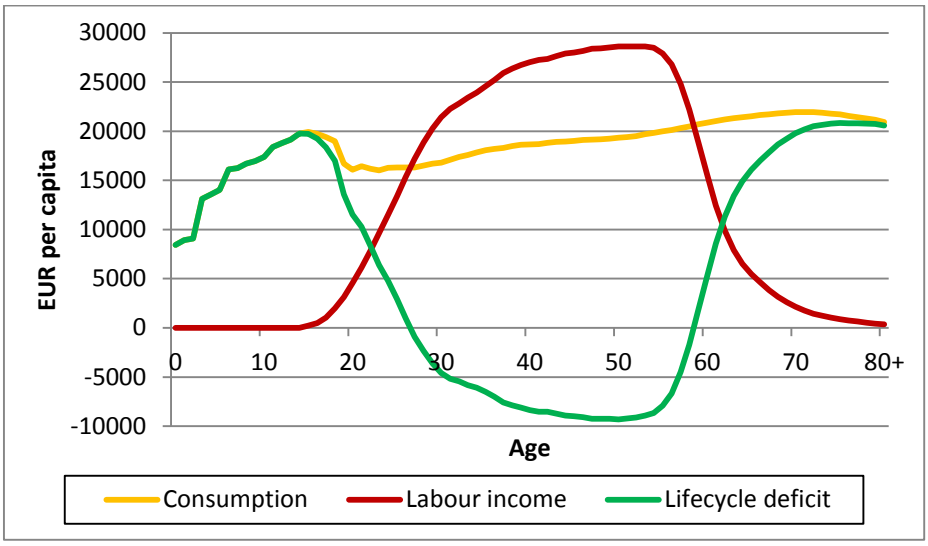
Figure 10: Life cycle deficit and its components, Italy, 2010



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

The difference between different levels of consumption and production is covered by inter-age flows. The gap can be filled by economic flows in the form of public and private transfers and public and private asset-based reallocations. The life cycle deficit must equal the sum of net transfers and asset-based reallocations. In the next sections, we present the methodology on how to calculate these flows using NTA methodology.

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5 Public Reallocations

Inter-age reallocations are defined as flows of current resources across age. 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, successful development of children depends heavily on public education system, while the elderly are important beneficiaries of public health system. The NTA do not enable the analysis of these flows only in aggregate terms, but also on the individual level. It is possible to analyse the direction of inter-age flows, as well as which generations are receiving them and which generations are paying for them.

We distinguish between two mechanisms how inter-age reallocations occur: resources are shifted across age in the form of transfers or asset-based reallocations. Public age reallocations are calculated as the sum of public transfers and public asset-based reallocations which we further describe in this section.

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 assumption, public transfers in-kind are equal to public consumption and are therefore calculated in the same way. For more details on how to compute the age profile of public transfers in-kind and its components, please refer to the 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 which can be used for different purposes (f.e. a pension received by an elderly person). Similar to public transfers in-kind, we divide them 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 the age averages of these transfers are based on EU-SILC data which is shown in more detail in Table 18. Remember that most of these categories are used for calculation of public consumption and public transfer inflows in-kind.

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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	Mainly other current transfers

Source: EU-SILC 2011

Public health transfers in-cash are calculated taking into account the value of reported sickness benefits. Pensions are the sum of old age, survivors' and disability benefits.

The age profile of social protection other than pensions is composed out of four micro-level age profiles (family and children, unemployment, housing and miscellaneous social protection). For all micro-level age profiles except unemployment, data are given only 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 household head, while family and children related allowances are assigned to all adults in the household (see Section 4.1.4 for definition of 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[12].

Figure 11 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 the elderly. Public pensions are negligible until the age of around 40 and mainly include survivors' benefits. At

[12] 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. Namely, we obtain the data on macro controls for public transfers in-cash from ESSPROS, but there is no macro control for education.

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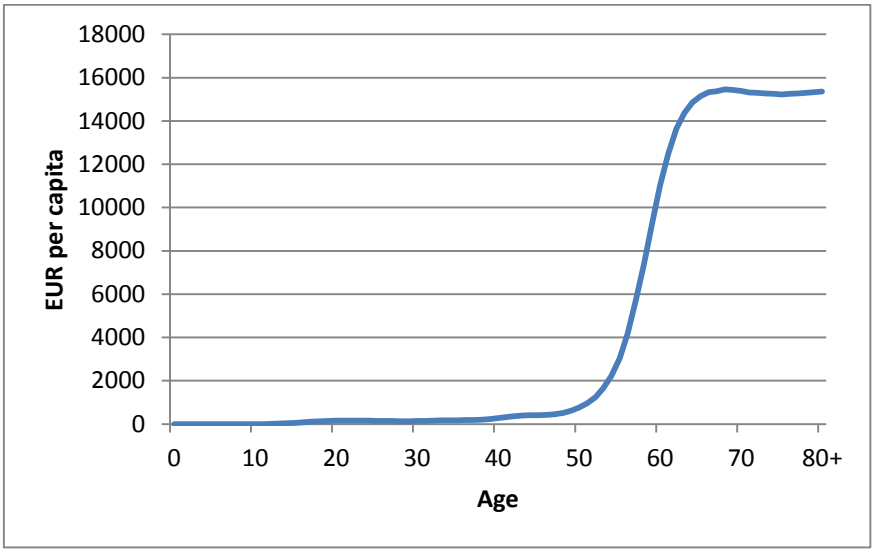
around 50 years of age, the value of public pensions starts to increase rapidly and reaches its peak in the late 60s when most of people have already retired. At later ages, public transfers in-cash in the form of pensions are rather constant.

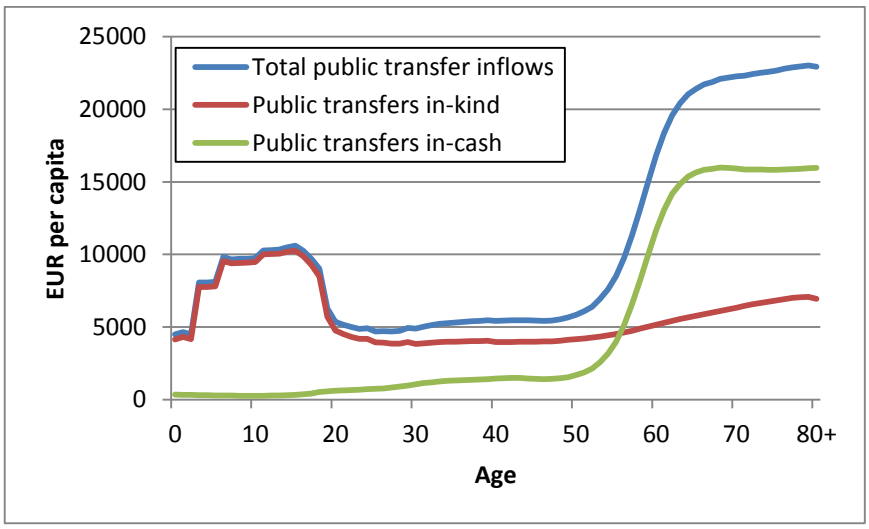
Figure 11: Smoothed age profile of public transfer inflows in-cash for pensions, Italy, 2010



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

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 12.

Figure 12: Age profiles of total public transfer inflows and its subcategories, Italy, 2010



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

The age patterns of total public transfer inflows vary a lot with age. At young ages, total public inflows closely follow the age pattern of in-kind public inflows (the

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prevailing component is education). During working ages, inflows stabilize mainly due to constant public collective consumption. Old ages are characterized by high transfer inflows in-cash (especially in the form of pensions), as well as rather significant public transfers in-kind (mainly in the form of health transfers).

5.1.2 Public Transfer Outflows

Public transfer outflows are defined as resources which flow away 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 are of different age than the main funders of these flows.

Public transfer outflows are funded by taxes, social security contributions and other current transfers. If these flows are insufficient to finance inflows, a public transfer deficit is generated and represents a balancing item. On the other hand, transfer surplus is generated when taxes, social contributions and other current transfers exceed public inflows. To assure that public accounts are balanced, the difference between public inflows and outflows is covered by public asset-based reallocations (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 how to construct the age profiles of public transfer outflows in the form of taxes, social security contributions and other current transfers. The age patterns of these categories may come from survey data or from the age profile of economic activity being taxed.

We divide taxes into five subcategories: taxes on asset income, profits and capital gains; taxes on property income; taxes on payroll and workforce; taxes on goods and services (consumption) and other taxes. The first two subcategories of taxes are constructed by using EU-SILC variables on income. The age profile of taxes on asset income, profits and capital gains is calculated by summing up all types of capital income, including interest, dividends, profit from capital investments in unincorporated business and income from rental of a property or land, while property income equals the value of imputed rent (see Table 19 for more details). Asset income, profits, capital gains and property income are all reported on the household level and are assigned to the household head[13].

Table 19: Calculation of taxes from EU-SILC variables

Tax subcategory	EU-SILC variable	Description
Asset income, profits and capital gains	hy090g	Interest, dividends, profit from capital investments in unincorporated business
	hy040g	Income from rental of a property or land
Property income	hy030g	Imputed rent

[13] By assumption, the household head is the owner of these assets and consequently also pays the taxes.

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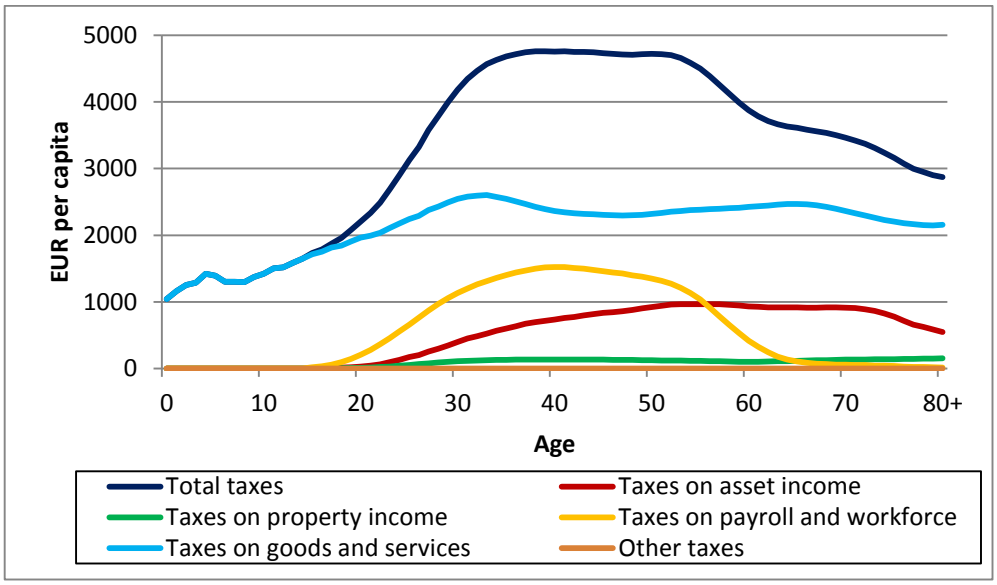
Source: EU-SILC 2011

On the other hand, the age patterns of the other types of taxes are based on the already defined age profiles. 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. Taxes which cannot be assigned to a certain source (other taxes) are assumed to be independent of age, the age profile is therefore a horizontal line. Total taxes are calculated as the sum of the five subcategories. The age profile of total taxes and its subcategories for Slovenia for year 2010 is shown in Figure 13.

Figure 13: Smoothed age profile of total taxes and its subcategories, Slovenia, 2010



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

In addition to taxes, we estimate social security contributions and other current transfers. The age profile of social security contributions is based on the age profile of labour income, 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 14 presents the age profile of total public transfer outflows and its subcategories for Slovenia for 2010.

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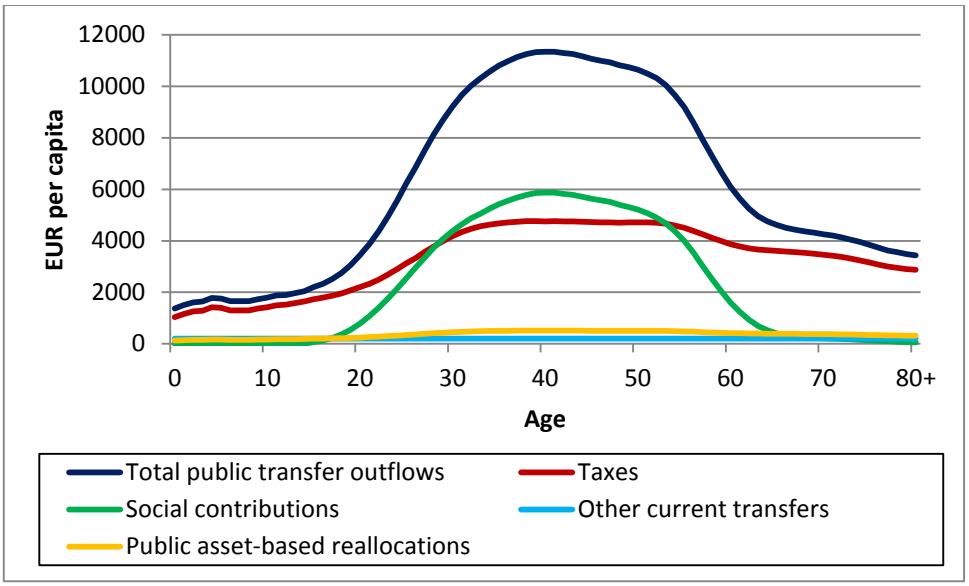
Figure 14: Smoothed age profile of total public transfer outflows and its subcategories, Slovenia, 2010



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

The age profile of total public transfer outflows start to increase rapidly at around the age of 20 when most of young adults decide to enter the labour market. The peak occurs at working ages when public outflows are high due to social security contributions and taxes paid (especially taxes on goods and services, as well as on payroll and workforce). Public outflows are lowest at youngest ages and are mainly in the form of taxes on goods and services. At old ages, outflows are in the form of taxes, especially taxes on consumption of goods and services. Elderly people usually own more asset income than any other age group, therefore taxes on asset income also represent an important outflow at these ages.

5.1.3 Net Public Transfers

Net public transfers are calculated as the difference between public transfer inflows and public transfer outflows. Figure 15 reveals the age patterns of net public transfers in Slovenia for 2010. In general, net public transfers are positive for young and elderly population, while negative net public transfers are characteristic of working-age population.

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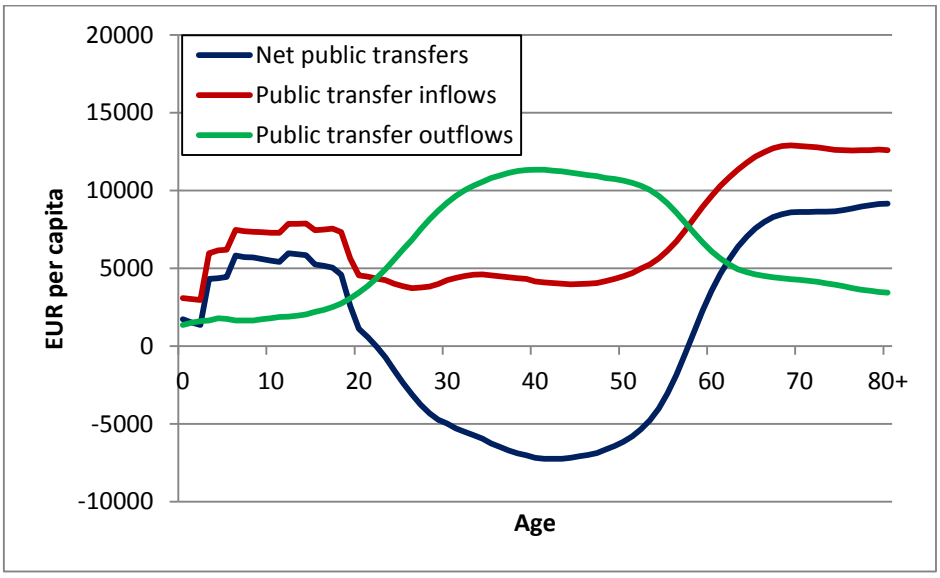
Figure 15: Net public transfers and its subcategories, Slovenia, 2010

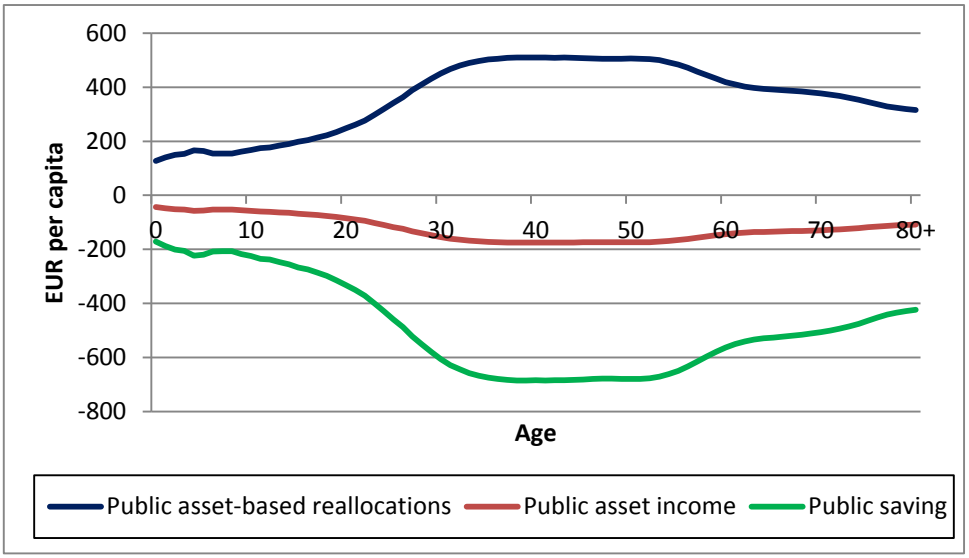


Source: Eurostat (Population data, aggregate controls); EU-SILC 2011; Authors' own calculations

5.2 Public Asset-based Reallocations

Public asset-based reallocations are calculated as public asset income less public saving. To calculate the age profile of public asset-based reallocations, we first sum two categories of public transfer outflows: taxes and other current transfers. Next, we use this combined age-profile as a base for the age profiles of public asset income and public saving. Public asset-based reallocations are then calculated as the difference between public asset income and savings.

Figure 16: The age profile of public asset-based reallocations and its components, Slovenia, 2010



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

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As mentioned earlier, public asset-based reallocations are used to balance transfer deficit or transfer surplus. When government generates transfer deficit, the gap between public inflows and insufficient outflows is financed by positive public asset-based reallocations, i.e. government earns public asset income or dissaves (borrows). On the other hand, public transfer surplus results in negative public asset-based reallocations, i.e. government saves or pays interest on public debt etc. Figure 16 represents the age patterns of public asset-based reallocations, as well as their components for Slovenia for 2010.

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6 Private reallocations

Some of the important properties of private 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 ROW,
- private asset–based reallocations are equal to private asset income less private saving.

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 flow, meaning that there is no (explicit) exchange for goods or services in the opposite direction.

Asset based reallocation capture the use of assets to reallocated resources over time and age. A reallocation 'upwards' to older ages occurs when disposable income is not fully used for consumption but saved/invested instead. These resources are made available for use later in life through asset income and dis-saving. Asset based reallocations can also be used for a 'downward' shift of resources to younger age by taking up a credit.

6.1 Creating private transfers variables

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

6.1.1 Private inter-household transfers

As there are no data available on individual level inter-household transfers NTA assumes that all inter-household transfer inflows are to the household head and all outflows are from the household head.

In EU-SILC data on 'Regular inter-household cash transfer received' (TFBI) and 'Regular inter-household cash transfer paid' (TFBO) are available, representing inter-household inflows and outflows, respectively.

We obtain age profiles for the two variables by calculating the age-averages using all household heads.

Net inter-household transfers are the difference between inter-household inflows and outflows.

6.1.2 Private intra-household transfers

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The age profiles for inter-household transfers are directly estimated using the survey data. For the intra-household transfers an indirect estimation method is used.

The calculation of the intra-household transfer age profiles is based on household structure from EU-SILC. As there are no micro data on intra-household transfers, we estimate them indirectly as 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 in 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 is in (personal) deficit if his or her private consumption (excluding consumption on owner-occupied housing) exceeds his or her cash income in form of labour income public cash transfers and inter-household transfers. If the disposable cash income is higher than consumption the household member generates a (personal) surplus. The personal current deficit of a household member is therefore calculated as a sum of labour income (YL), public transfers in-cash (TGIC), and inter-household transfers (TFB), and subtract taxes (on labour income (TGFYL), consumption (TGFC), and other taxes (TGFX)), social contributions (TGP), and other public revenues (TGX):

$$INC = YL + TGIC - TGFYL - TGFC - TGFX - TGP - TGX + TFB \tag{9}$$

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

$$CONS = CF - CFR \tag{10}$$

The private intra-household transfer is then calculated as the difference between the individual disposable income and the individual consumption. The household members with personal deficit receive then intra-household transfers from the household member(s) with personal surplus.

Next, we compute the total household deficit and total household surplus as a sum of the individual deficits of the members. If the household total deficit exceeds the household total surplus this shortfall is financed by household heads through asset based reallocations. It is assumed that the household head owns all household assets and that he or she receives consequently all the income from these assets. If the disposable income of the household exceeds household consumption, the individual surpluses from all members are assigned to the household head to save the residual resources.

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

$$TAXHH = \frac{DEFHH}{SURHH} \tag{11}$$

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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 mebers with a deficit.

The last step is to calculate intra-household transfer outflows (TFWO). For non-household heads it is equal to the product of the transfer rate and the individual surplus:

$$TFWO = TAXHH * SURIN \tag{12}$$

while for the household head it equals to the sum of the product of transfer rate and household head individual surplus and total remaining deficit of the other household members after the intra-household transfers made by the members which are not household head. Any shortfall is financed through asset-based reallocations:

$$TFWO_{HH} = TFWO + (SHORTFALL - DEFIN) \tag{13}$$

Taxed surplus is then transferred to all household members in deficit.

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 and adjust the two if needed.

Figure 17 presents an example of age profiles for intra-household inflows and outflows for Austria in 2010. The resulting age profile for net intra-household transfer is then shown in Figure 18, together with the net inter-household transfer.

While net inter-household transfers are more or less around 0 throughout the life cycle, with a slight increase around age 20 or 30, there are high net intra-household inflows in childhood which are paid for by the age groups between around 30 and 60.

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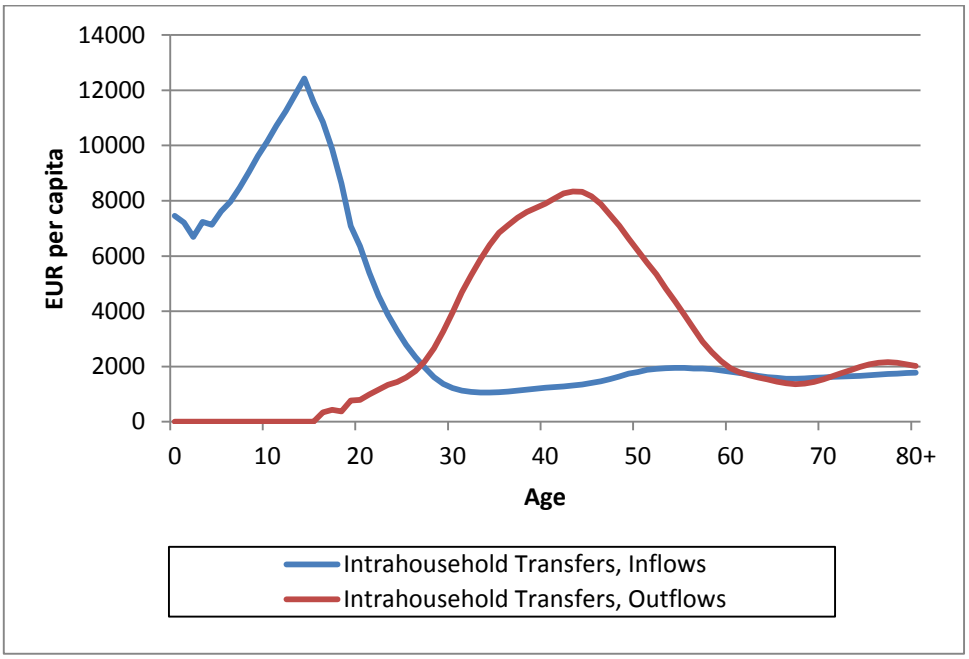
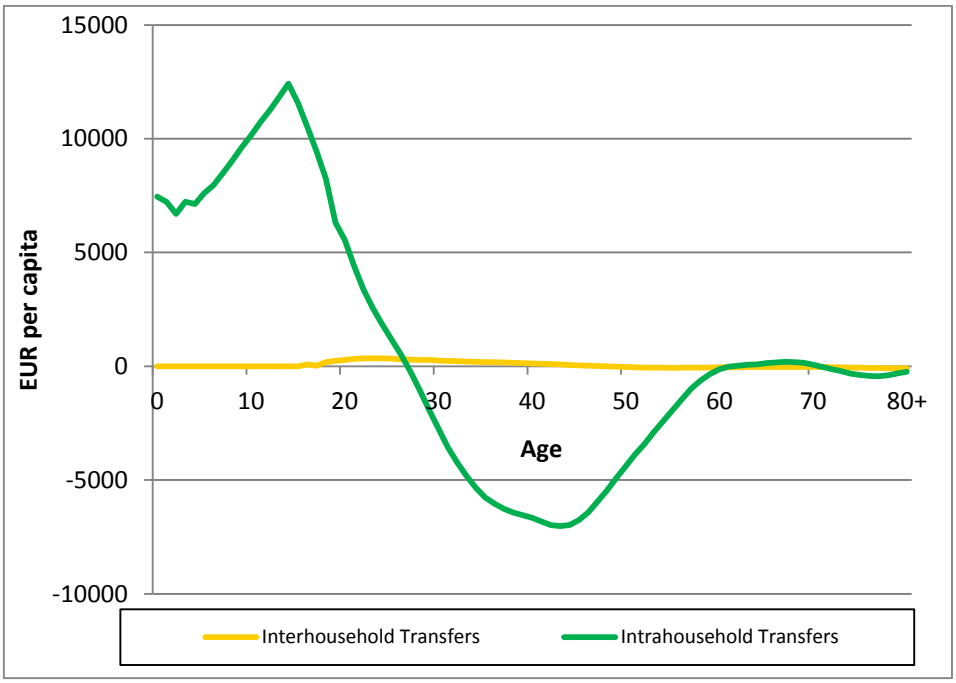
Figure 17: Age profile of intra-household inflows and outflows, Austria, 2010



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

Figure 18: Age profile of intra- and inter-household net transfers, Austria, 2010



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

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6.2 Creating private asset-based reallocations

Within the first major component of asset-based reallocations two kinds of asset income are distinguished in NTA: capital income and property income.

Private capital income consists of capital income of corporations, capital income from owner occupied housing, and unincorporated enterprise income (i.e. capital share of mixed income).

Private property income consists of flows generated by financial assets, such as interest, dividend, rent (more details in section **Error! Reference source not found.**).

The second major component of asset-based reallocations is saving. In most countries, life cycle saving occurs in the private sector as workers participate in employment-based retirement plans or accumulate assets such as a home or personal savings. Young adults can also rely on an alternative form of behaviour to smooth consumption over their lifetime. They can increase consumption when young, beyond what is available from labour income and net transfers by accumulating debt. Later, when their labour income is sufficiently high, they can save in order to pay off their debt taken up for education, housing, etc.

The age profiles of private asset income are estimated using estimates of age averages based on micro data and macro controls from ESA. Private saving is estimated as the final balancing item in NTA and equals disposable income (labour income, asset income, net-transfers) less consumption. If the reallocations from other sources (except saving) exceed the life cycle deficit, the difference is saved. If the reallocations from other sources are insufficient to fund the life cycle deficit, the age group must generate additional resources by dissaving, either by selling assets or going into debt.

Age profiles of asset income are based on the EU-SILC. All the asset income is by assumption assigned to the household head.

From EU-SILC we take the data on imputed rents representing returns to capital for owner occupied housing. For other variables used in calculation of capital and property income we use profiles based on the pre-existing age profiles of taxes.

Capital income (YKF) is a sum of capital income of corporations (YKFC), income from owner occupied housing (YKFH), and unincorporated enterprise income (YKFB):

$$YKF = YKFC + YKFH + YKFB \tag{14}$$

For the age-profile of capital income we use, like for the taxes on asset, the age-averages of asset income from EU-SILC, while for unincorporated enterprise income we take the age profile of earnings from self-employment. The reasoning behind using the taxes on asset income age profile for the corporate income is that the taxes are generally proportional to asset income and have thus the same age profile shape.

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Property income (YPF) is calculated as a sum of private interest (YMF) and other property income (YPFX):

$$YPF = YMF + YPFX \tag{15}$$

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):

$$YMF = YMFI - (YMFOC + YMFOHH) \tag{16}$$

Again, age profiles of taxes on asset income are taken for all the variables used with the same explanation as above for corporate income.

Private asset income is then simply the sum of private capital income and private property income.

Private saving presents the final balancing item in NTA:

$$S^f(a) = Y^l(a) - C(a) + \tau^g(a) + \tau^{inter}(a) + \tau^{intra}(a) + Y^{Af}(a) + \\ + Y^{Ag}(a) - S^g(a) \tag{17}$$

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

Figure 19 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 after a period of taking loans, and reach their peak also at ages between 50 and 60. Afterwards private savings start decreasing much faster than private asset income resulting in growing private asset-based reallocations. Consequently, the asset-based reallocations drop significantly during the sixth decade indicating that in those ages people are the most well off and can therefore afford to save more.

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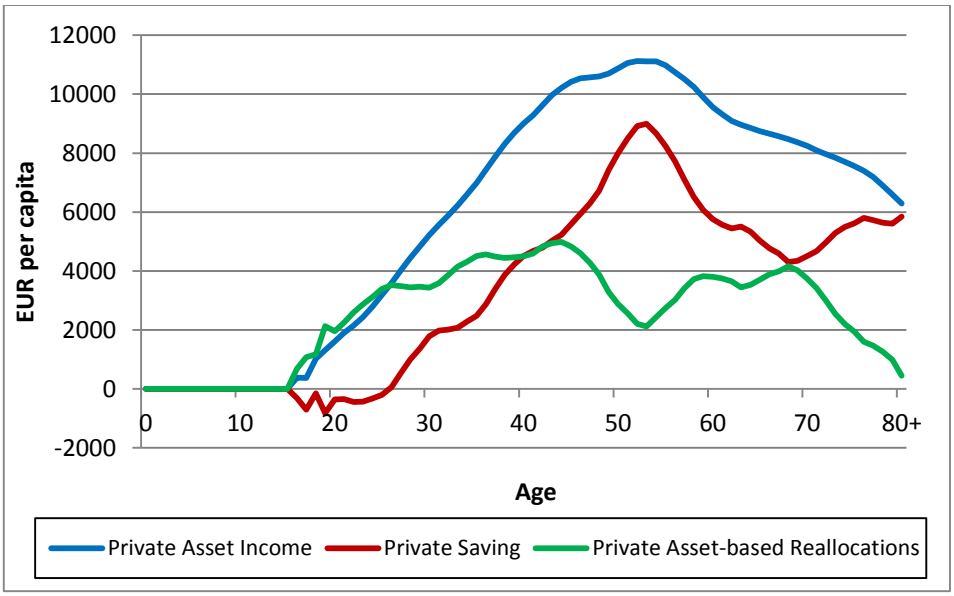
Figure 19: Age profile of private asset income, saving and asset-based reallocations, Austria, 2010



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

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7 Extensions

In this section, we describe how to extend the basic NTA methodology into further directions. We explain four extensions: NTA by gender, NTA by educational level, NTA by country of birth and retrospective NTA (i.e. NTA over time).

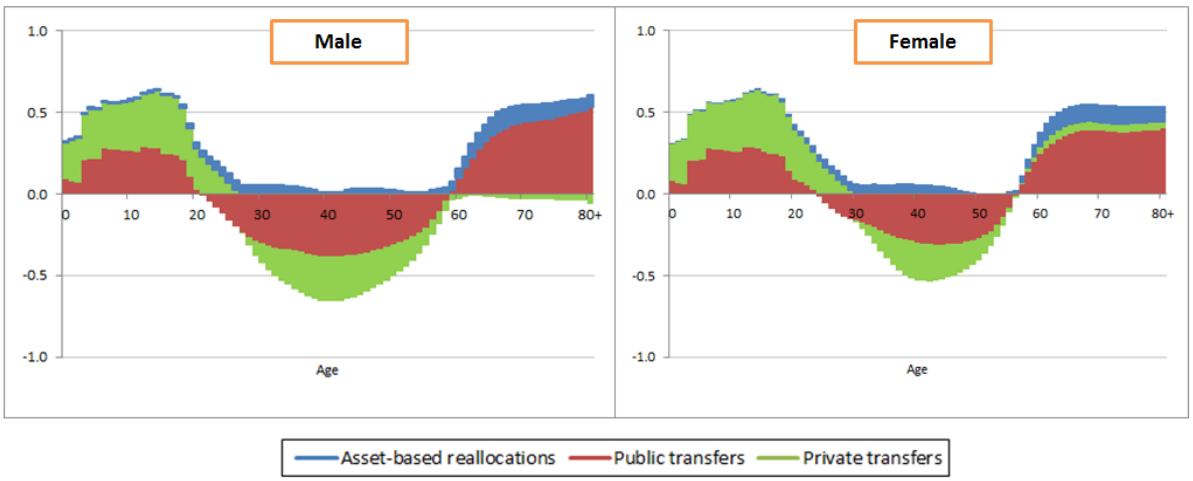
7.1 NTA by Gender

7.1.1 Introduction

The aim of the NTA is to analyse economic behaviour at different ages: how much people produce and consume, as well as how the gap between consumption and labour income is financed with age reallocations. Besides age, gender is a fundamental factor that greatly influences the patterns of economic behaviour. Adding the gender component into the NTA analysis is therefore a logical extension.

Higher employment rates of males compared to females imply sizeable market reallocations which flow from males to females. However, in the past few decades, a 'male breadwinner – female caregiver' family model has widely declined due to changing attitude towards females (Lewis, Cambell, & Huerta, 2008). A shift from traditional gender ideology to a more liberal one has resulted in new employment opportunities for females. Flexible arrangements have provided an opportunity for females to participate in labour market in larger numbers (Swiebel, 1999). Indeed, female employment rates in Europe have risen dramatically in the past few decades (Eurostat, 2015). 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 20, we present the measurement of inter-age and inter-gender flows for Slovenia for 2010.

Figure 20: Financing of the life cycle deficit, normalized age profiles, Slovenia, 2010



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

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In this section, we present how to estimate NTA categories by gender. We obtain separate age profiles for males and females (so-called gender-specific age profiles). 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.

7.1.2 Data Limitations

There are no severe data limitations for calculation of the NTA profiles by gender. We can estimate gender-specific profiles for as many EU countries as for single-gender profiles (i.e. non-decomposed age profiles).

In general, all of the NTA age profiles which are estimated using survey data can easily be disaggregated by gender. Usually, survey includes data on gender along with age. If data are given on individual level, we use the same variables as for the single-gender age profile 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 of the variables are given only on the household level. To estimate the NTA single-gender profiles, we typically assign household values to the household head or to all adults in a specific household. We follow this approach also for the age profiles, disaggregated by gender. This is necessary because we adjust the gender-specific age profiles to single-gender age profile, therefore the definitions and methodological approach must be the same for the total (single-gender profile), as well as for its subcategories (male and female profiles).

7.1.2.1 Adjustment

Availability of macro controls represents the only data limitation to estimate the age profiles by gender. This influences the adjustment process which we describe 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. Single-gender profiles are adjusted to match the macro controls obtained from the ESA. However, the ESA does not contain gender-specific information about aggregate values for different economic activities. Thus, we do not adjust the gender-specific age profiles to the value of a macro control from the ESA, but rather adjust them so they are consistent with the single-gender age profiles (which have previously been macro-adjusted). In this way, the sum of the product of gender-specific per capita age profile and gender-specific population equals the value of the single-gender age profile multiplied by total population.

More specifically, we show the adjustment process in equation form. 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:

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$$\tilde{x}(a,g) = \theta(a)x(a,g) \tag{18}$$

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

$$\theta(a) = \frac{\tilde{x}(a)}{x(a,m)N(a,m)/N(a) + x(a,f)N(a,f)/N(a)} \tag{19}$$

where $\tilde{x}(a)$ is macro-adjusted single-gender age profile, $N(a)$ is population count at age *a* and $N(a,g)$ is 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 single-gender macro-adjusted age profile 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:

$$\tilde{X}(a,g) = N(a,g)\tilde{x}(a,g) \tag{20}$$

Please note that it is necessary to obtain gender-disaggregated data on population size to be able to complete adjustment process. Data on population size for males and females can be retrieved from Eurostat.

7.1.2.2 Sensitivity Test

The NTA methodology uses several assumptions which could have important implications for the gender estimates of different economic activities. For instance, assigning several household-level variables to household head may greatly influence gender-specific age profiles since males are more commonly the main earners in the family and are therefore more often selected to be household heads. Household heads are assumed to be the only one in the household who can own all of the household assets, give and receive inter-household transfers, etc. The age profiles of certain NTA categories could therefore change severely if we adjusted the definition of the household head or assigned some of the household-level variables also to other household members.

We can test the sensitivity of the NTA results to the assumption of household head. Once the gender-specific age profiles are estimated as described in this section, we can implement different definitions and see how the results change. One possibility is to test the assumption of equal headship: instead of assigning certain household-level variables only to the household head, we rather assign them to all adults in a household. Currently, a sensitivity test is a part of an on-going research of the NTA team.

7.1.3 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:

$$LCD(a,g) = C(a,g) - Y^{l}(a,g) \tag{21}$$

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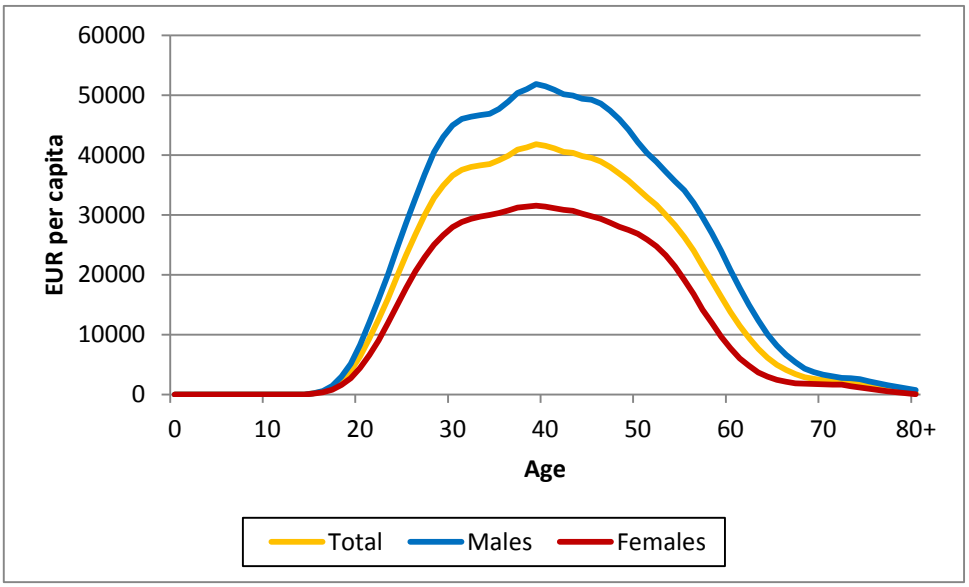
where $LCD(a,g)$ represents life cycle deficit, $C(a,g)$ is the sum of private and public consumption and $Y^l(a,g)$ is labour income, for gender *g* and age *a*. In this section, we present how to calculate gender-specific components of life cycle deficit.

7.1.3.1 Labour Income

To calculate male and female age profiles of labour income, we use the same EU-SILC variables as for the single-gender profile. The differences in labour income between males and females for Poland for 2010 are shown in Figure 21.

Figure 21: Smoothed age profiles of labour income by gender, Poland, 2010



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

7.1.3.2 Private Consumption

Lacking the HBS data we assume the same private consumption age profiles for both genders. The findings of the national NTA teams from the past suggest that men and women have about the same private consumption, therefore our assumption should be acceptable in the case of gender. However, the assumption of equal consumption is very unrealistic when decomposing the NTA results by education and country of birth presented below.

7.1.3.3 Public Consumption

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

a) Public education consumption is derived in three steps: first, we calculate unit costs of public education per enrolled pupil for each education level (educational levels are defined by ISCED classification). Secondly, we disaggregate the enrolment data for each age group and education level for males and females separately. The third and final step is to combine data on unit costs

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with gender-specific enrolment data to calculate the per capita public education consumption for males and females.

The first step (calculation of unit costs) is the same as for the basic NTA and is presented in Section 4.4.1. We assume equal unit costs per enrolled no matter his or her educational attainment and gender. The second step (disaggregation of enrolment data) is similar to the method discussed in Section 4.4.1, but some adjustments are needed to incorporate the gender component. In the next lines, we describe the second step in more detail.

We retrieve the data on the number of enrolled pupils for different age groups and educational levels from Eurostat. We obtain the data for both genders combined, as well as for males and females separately. In the following figures, we show in more detail how to calculate the number of enrolled males and females for the United Kingdom for year 2010.

For ages where data are given in one-year age groups, the methodology is the same as for calculation of single-gender age profile of public education consumption. The difference arises for ages where data are given for more than 1-year age groups (f.e. for age group 30-34, 35-39, 40+). Figure 22 shows the example of a given data for the number of enrolled adults by gender and educational level for the age group 30-34.

Figure 22: Number of enrolled adults aged 30-34 for each educational level, disaggregated by gender, the United Kingdom, 2010

Number of enrolled adults aged 30-34	TOTAL	Pre-primary education (level 0)	Primary education (level 1)	Lower secondary education (level 2)	Upper secondary education (level 3)	Post-secondary non-tertiary education	Tertiary education (levels 5 and 6)	Unknown
Both genders	261840	0	0	22682	41110	5346	192701	0
Males	109932	0	0	8327	18954	1196	81454	0
Females	151908	0	0	14355	22156	4150	111247	0

Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

To disaggregate the data into 1-year age groups we additionally need the population data for each 1-year age group, as well as for the total 5-year age group. Figure 23 shows the data for the United Kingdom for 2010.

Figure 23: Population data for several age groups, disaggregated by gender, the United Kingdom, 2010

Population	1-year age group		5-year age group	
	30 years	40 years	30-34 years	40-44 years
Both genders	850368	917036	4002981	4675243
Males	425512	453924	2001720	2314337
Females	424856	463112	2001261	2360906

Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

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Following the same methodology as for single-gender age profile, we distribute Eurostat level-specific data into 1-year age groups according to the share of population in each 1-year age group compared to the total population size in the 5-year age group (see Figure 24 for calculations)[14]. Additionally, we multiply this number with the adjustment factor so that the level-specific number of enrolled adults combined for males and females equals the number of all adults enrolled at this level.

Figure 24: Calculation of enrolled adults for age group 30, disaggregated by gender, the United Kingdom, 2010

Number of enrolled adults aged 30	TOTAL	Pre-primary education (level 0)	Primary education (level 1)	Lower secondary education (level 2)	Upper secondary education (level 3)	Post-secondary non-tertiary education (level 4)	Tertiary education (levels 5 and 6)	Unknown
Both genders	55624	0	0	4818	8733	1136	40936	0
Males*	23371	0	0	1770	4029	254	17317	0
Females	32253	0	0	3048	4704	881	23619	0

* 109932*(425512/2001720)*(55624/((109932*(425512/2001720))+(151908*(424856/2001261)))) = 23371

Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

Eurostat data are also given for the 40+ age group. As already mentioned, we assume the upper age limit of 64. We disaggregate the enrolment data into 1-year age groups similarly as for the 30-34 and 35-39 age group with one additional step: first, we must divide the 40-64 age group into three subgroups based on the Eurostat data on adult participation rates. These subgroups are 40-44, 45-54 and 55-64 age groups. Detailed calculations are shown in Figure 25.

[14] This means that we assume the same enrolment rate for each 1-year age group in the 5-year age group.

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Figure 25: Calculation of enrolled adults for age group 40, disaggregated by gender, the United Kingdom, 2010

Adults participation rates in education						
Original data		Recalculated data				
Age group	Participation rate	Age group	Participation rate	Population	Number of enrolled adults	Share of enrolled adults
From 35 to 44 years	16.4	From 40 to 44 years	16.4	4633457	759887	0.32
From 45 to 54 years	13	From 45 to 54 years	13	8688920	1138249	0.48
From 55 to 64 years	6	From 55 to 64 years	6.1	7397347	451238	0.19
			TOTAL	**20719724**	**2349374**	

Number of enrolled adults aged 40-64	TOTAL	Pre-primary education (level 0)	Primary education (level 1)	Lower secondary education (level 2)	Upper secondary education (level 3)	Post-secondary non-tertiary education (level 4)	Tertiary education (levels 5 and 6)	Unknown
Both genders	**479853**	0	0	39315	73116	4567	362855	0
Males	**171860**	0	0	14081	26938	1062	129779	0
Females	**307993**	0	0	25234	46178	3506	233076	0

Number of enrolled adults aged 40	TOTAL	Pre-primary education (level 0)	Primary education (level 1)	Lower secondary education (level 2)	Upper secondary education (level 3)	Post-secondary non-tertiary education (level 4)	Tertiary education (levels 5 and 6)	Unknown
Both genders	**30443**	0	0	2494	4639	290	23020	0
Males**	**10902**	0	0	893	1709	67	8233	0
Females	**19541**	0	0	1601	2930	222	14788	0

** 171860*0.32*(453924/2314337)*(30443/((171860*0.32*(453924/2314337))+(307997*0.32*(463112/2360906)))) = 10902

Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

Finally, we combine the level- and gender-specific enrolment data for each age with the unit costs per enrolled for each level to obtain gender-specific education expenditures at each age. After dividing these expenditures with gender-specific population data, we obtain male and female profiles of public education (see Section 4.4.1 for further explanation). In Figure 26, we present the gender-specific age profiles for Slovakia for 2010.

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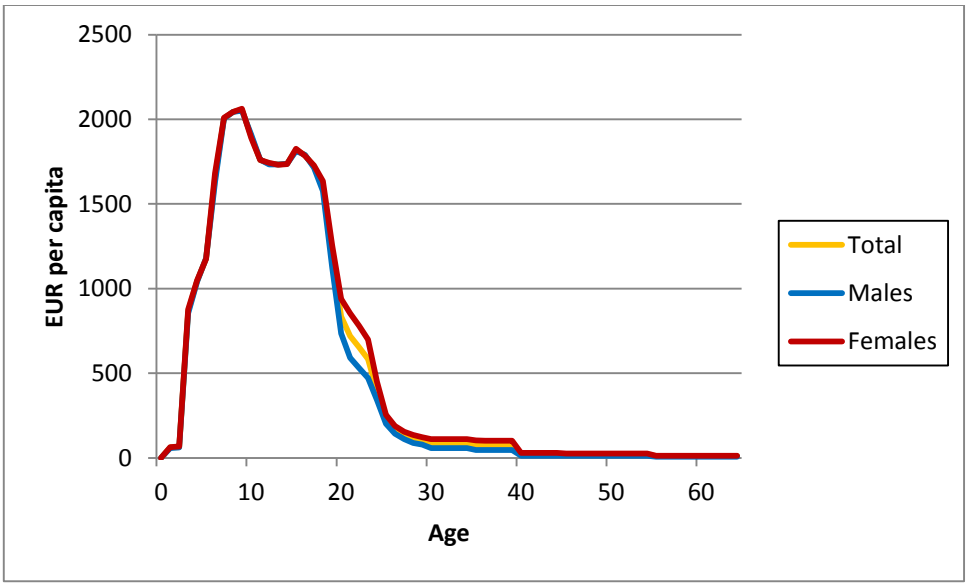
Figure 26: Unsmoothed age profiles of public education consumption by gender, Slovakia, 2010



Source: Eurostat (Population data, General Government Expenditures by Function); UNESCO; Authors' own calculations

b) We receive male and female age profiles of **public health consumption** from the AWG. As for the single-gender profiles, we have permission to use data for 19 EU countries. For other countries (for which we do not have permission or are not included into the AWG research plus Romania), we calculate the gender-specific age profiles as a simple average of countries who granted us permission. We use male age profiles to calculate the average age profile for males and female age profiles for calculation of average age profile for females. For the UK, we again use the age profiles from year 2015.

c) **Public consumption other than education and health** is calculated in the same way as the single-gender age profile. 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.

7.1.4 Public reallocations

7.1.4.1 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 calculated in the same way.

Public transfer inflows in-cash are divided into several subcategories (education, health, pensions, social protection other than pensions and other public transfers in-cash). For most of the subcategories, we use EU-SILC variables to calculate them. Gender-specific age profiles are calculated using the same variables as for single-gender age profiles. Using these variables, we do not calculate only age-specific, but also gender-specific averages for different transfer inflows

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in-cash. For more details on which EU-SILC variables to use, please refer to the 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 appropriately adjust to the single-gender age profile.

7.1.4.2 Public Transfer Outflows

Public transfer outflows are divided into three categories: taxes, social security contributions and other current transfers. Taxes are further divided into taxes on asset income, profits and capital gains, taxes on property income, taxes on payroll and workforce, taxes on goods and services and other taxes.

We need to estimate several micro-level age profiles to calculate total public transfer outflows. These profiles can be based on: survey data, already existing age profiles or on the assumption of equal distribution among individuals.

When using survey data, we follow the same methodology as for single-gender age profiles (see Section 5.1.2), however, we need to calculate gender-specific averages.

When estimating male and female micro-level profiles based on other age profiles, we use the already existing age profiles, disaggregated by gender. For example, the age profile of taxes on payroll and workforce for males is based on the already 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 people – the age profiles are therefore a horizontal line.

7.1.4.3 Public Asset-based Reallocations

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

$$RAG(a,g) = YAG(a,g) - SG(a,g) \tag{22}$$

where RAG are public asset-based reallocations, YAG is public asset income and SG is public saving, for gender *g* and age *a*. Public asset income and savings are calculated on the already calculated gender-specific profiles of taxes and other current transfers.

7.1.5 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.

7.1.5.1 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

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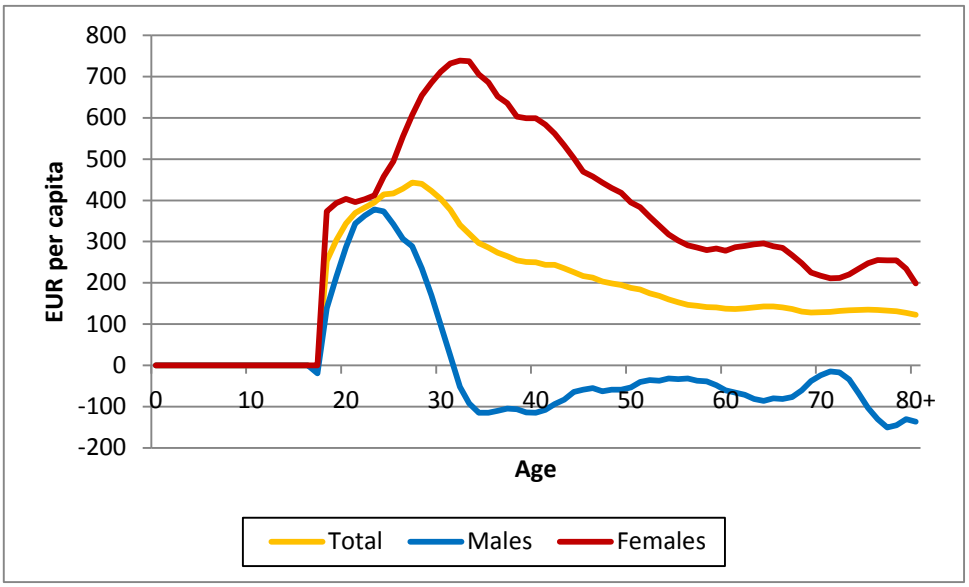
variables. We show the gender differences in inter-household transfers for Latvia for 2010 in Figure 27.

Figure 27: Net inter-household transfers by gender, Latvia, 2010



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

7.1.5.2 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 for both genders combined.

7.1.5.3 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 single-gender profile, but are estimated for both genders separately. By assumption all private asset income is owned by the household head.

Private saving is a residual category from household head's identity flow. 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 separate age profiles of private saving for males and females, we take into account the above mentioned categories, disaggregated by gender. The age profile of private saving for males is based on the already calculated male profiles, while the age profile for females is based on female age profiles.

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7.2 NTA by Educational Level

Another aspect that has a considerable impact on different economic behaviour is also completed level of education. Similarly as with gender, we produced specific age profiles for different educational levels as well. Generating the specific age profiles proceeds following almost the same logic as with gender extension, therefore in this section only the specifics related to educational levels are pointed out.

Educational attainment levels are usually presented for three main categories:

- less than primary, primary and lower secondary education (ISCED 2011 levels 0-2),
- upper secondary and post-secondary non-tertiary education (ISCED 2011 levels 3 and 4), and
- tertiary education (ISCED 2011 levels 5-8).

To analyse age profiles from the educational level point of view, we need data on population by age and the level of education, which unfortunately does not exist for 2010 for one-year age groups. We have two possibilities, or we can estimate that data on the 2010 survey basis or we can take 2011 census data. The data we were using were the census data, as we considered them more exact and reliable compared to survey data. The data on population by completed level of education were retrieved from 2011 Census Hub (Eurostat). As we thus disposed of the educational level specific data for year 2011 but needed the data for 2010 reference year, we needed to adjust the data to the total population from 2010. Under the assumption that age is the main explanatory factor for educational level and that its influence remained unchanged from 2010 to 2011, we took the education level specific proportions for every age group from 2011 and transferred them to 2010 by multiplying them by the total population at the corresponding age group in 2010.

However, from the Census Hub we were not able to obtain the census data for all the analysed countries. Due to missing population data that could not be done for Germany, France and Finland. The extension to education level specific age profiles was possible for 20 countries: Austria, Bulgaria, Cyprus, Czech Republic, Estonia, Greece, Spain, Hungary, Ireland, Italy, Latvia, Luxemburg Lithuania, Netherlands, Poland, Portugal, Sweden, Slovenia, United Kingdom, and Slovakia[15].

Another issue that needed to be addressed was the fact that the attained educational level depends very much on age. Therefore, we considered the data on aiming educational level more appropriate when estimating public consumption for education divided between different levels of education. When estimating expenditure for certain education level we took into account those persons who had already completed that level, as well as those still enrolled in the programme leading to completion of that level. As we do not dispose of such data we estimated the data on aiming educational level from EU-SILC survey, taking into account age

[15] It might be possible to produce the age profiles also for Belgium, Romania and Denmark in the future. However, resolving issues of missing and imperfect data are increasingly difficult and time consuming.

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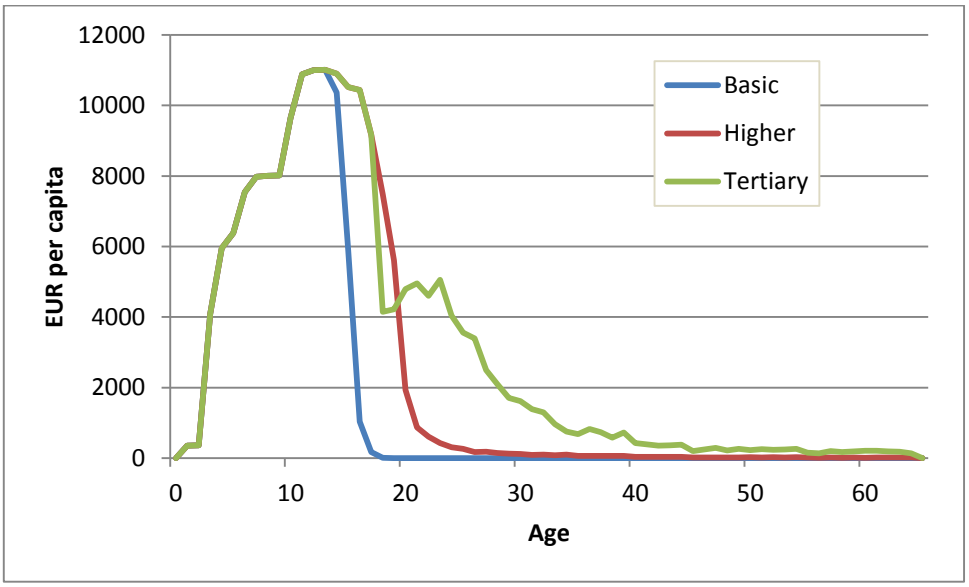
and current participation in certain educational level, assuming that the person enrolled in a certain education will actually finish that level.

It has to be kept in mind that there are large differences in public expenditure on education between different educational levels. Public expenditure is thus calculated in such a way that, first, average spending per enrolled person for each educational level is obtained as already described in basic methodology section **Error! Reference source not found.**. Then, these age-and-education-specific averages are multiplied by the number of students enrolled to obtain the total expenditure, and divided by the total number of persons in the corresponding educational group to finally generate the age profile. Here, we assume that those people that have completed some higher level of education (or are aiming at completing it) had to attend also all lower levels of education in the past. The age profiles are thus actually generated for the cumulative expenditure on education.

Finally, education-level-specific age profiles need to be consistent with the base (general) profiles. Adjustment is made such that the sum of the education-specific aggregate age profiles (i.e. age profiles by education level multiplied by the population in the corresponding educational level) across all educational levels has to be equal to the total aggregate profile (NTA age profile multiplied by total population). In Figure 28 we present an example of age profiles for public expenditure on education for all three educational levels.

Figure 28: Unsmoothed age profiles of public education expenditure for three different educational levels, Austria, 2010



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

From Figure 29 it is also clearly evident that the differences between the three educational levels are very large from the labour income point of view, whereas the consumption is much more similar for all three educational levels. The similarity of consumption also stems from the fact that we lack the data on private consumption divided by different educational levels; besides, there are no data on public consumption on health divided by different education al levels, either.

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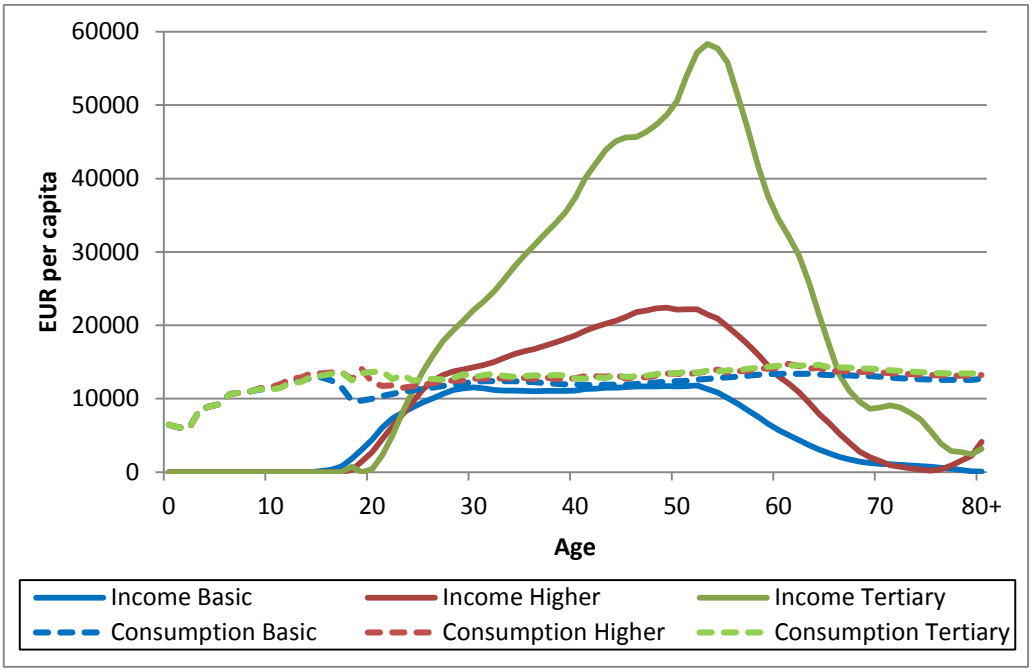
Figure 29: Age profiles of labour income and consumption for three different educational levels, Portugal, 2010



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

7.3 NTA by Country of Birth

Besides gender and completed educational level, country of birth was one more attribute we looked at in more detail. We analysed separately age profiles for natives and foreign-born individuals. The extensions were incorporated into the analysis in a similar manner as for gender and educational level. Also in this section we explicitly point out only those specifics in generating age profiles separately by country of birth which are different compared to generating age profiles separately by gender.

However, it is more problematic to obtain population data by country of birth than by gender or educational level as in previous section. To produce age profiles separately by country of birth we would need the data on country of birth for all residents in 2010, which we do not dispose of. Again, one possibility is to take census data from 2011 or survey data from 2010. As with NTA by educational level, we considered census data more exact and reliable, so we used the data from Census Hub 2011 (Eurostat). With country of birth analysis we needed to pay attention also to the fact that the NTA reference year was 2010 and the year of census 2011. In the case of foreign-born individuals we cannot simply assume that the age structure of the foreign-borns is the same, as we are able to do with the educational level issue. Namely, migrations are often triggered by some structural changes (e. g. wars, natural catastrophes, major political changes, etc.) and thus the between-country migrations in one year cannot be generalized. The solution we adopted was to take the observations from the 2011 census and consider them as one year younger to approximately obtain the proportion

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between foreign-born individuals and natives within each age in the year 2010, if those individuals were living in the host country already in the year 2010. For example, the proportion of foreign-borns vs. natives from 2011 census within the age group of 20-year-old population was applied to the age group of 19-year-old population in our 2010 reference year data.

Some countries are not reported in Census Hub 2011. But even if the country was included in Census Hub 2011, for many the number of observations on foreign-born individuals within each age group was way too small for any reliable analysis. We decided to conduct the analysis only for those countries where we were able to collect at least around 1500 observations[16] in all age groups together: Austria, Cyprus, Estonia, Spain, Ireland, Italy, Luxemburg, Latvia, Netherlands, Sweden and United Kingdom.

To declare a person being a foreign-born we combined two variables: one indicator for being foreign-born is country of birth (if it is different from the current resident country), and the other is year of immigration. Some respondents answer to both, while the others only to one of them. To increase the sample size we decided to consider both options.

Another issue concerning NTA analysis by country of birth was estimating public expenditure on education. As the public expense on education per capita differs according to the educational level we need to incorporate the information on the corresponding enrolment rate structure within each age group. The census data on enrolment rates by age and educational level is available only for the whole population, not separately for natives and foreign-borns. We only have the data available for age- and level-specific enrolment rates, so what we need is to estimate the native vs. foreign-born structure within each age and level of education. It is inappropriate to apply the same structure also to the foreign-born part of population as it usually has different educational age pattern compared to the native population. Therefore, we used survey data to estimate the more suitable enrolment rates. However, in the survey data there were usually too few observations to be able to obtain meaningful enrolment rates within each age group and each level of education. Thus, we first merged one-year age groups to broader age groups of different widths depending on differences in enrolment rates between individual ages: the first 15 years of age were put in one group for primary education, later 3- and 5-year brackets were formed for ages up to 24 and 64, respectively). Then, we estimated the enrolment rates for those broader age groups and applied these same enrolment rates to each one-year age group that was contained in the corresponding broader age group. Then, of course, we assumed equal expenditure per enrolled person within the same educational level, no matter what the country of birth is.
Figures Figure 30 and Figure 31 show some of the age profiles that are substantially different for natives compared to the foreign-born individuals. Figure 30 represents age profiles for labour income and consumption. We can observe much higher natives' income during the prime active ages (for Italy from around age 25 to 60) along with fairly similar consumption behaviour. Concerning consumption, there is private consumption (HBS) again not yet included.

[16] The only exception is the Netherlands with 1255 observations. We decide to include the Netherlands in the analysis because the age profile shows only limited amount of random effects.

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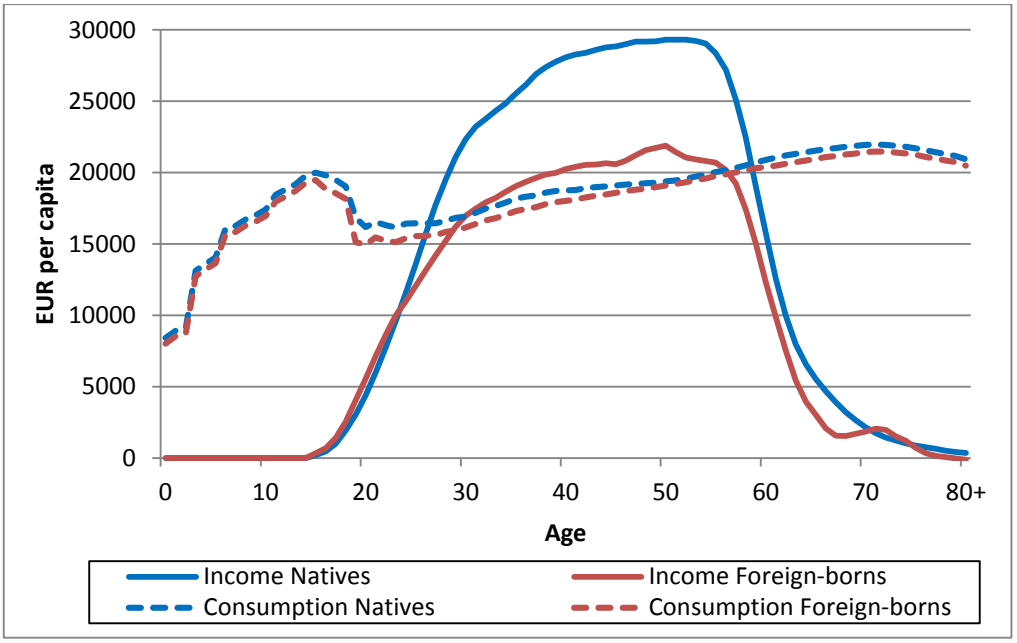
However, one part of private consumption can be estimated anyway. Namely, the EU-SILC gathers data on imputed rents on which the estimates for private consumption on (owner-occupied) housing are based. As many more natives own their dwellings compared to foreign-born individuals, especially in younger ages, the private consumption on housing is therefore necessary lower for people whose country of birth is different from the country of residence.

Figure 30: Age profiles of labour income and consumption for natives and foreign-borns, Italy, 2010



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

In Figure 31 we observe age profiles for public transfers. Inflows are more or less the same for natives and foreign-borns for most of the ages, except for older ages when natives receive much higher public transfer inflows in a form of pensions. Outflows, on the other hand, are much higher for natives, as higher income for natives results in higher public transfers outflows for natives.

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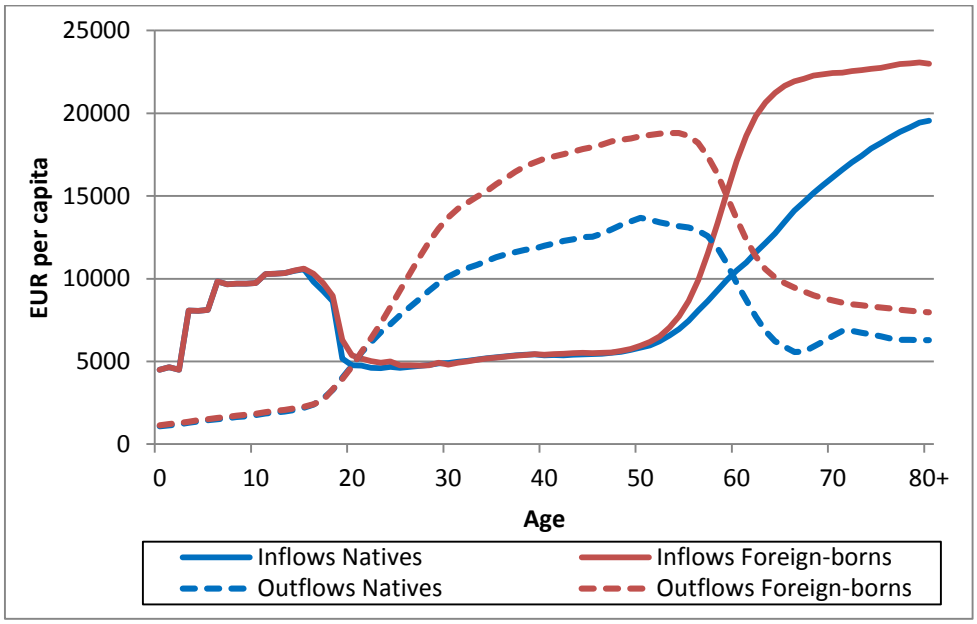
Figure 31: Age profiles of public transfers for natives and foreign-borns, Italy, 2010



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

7.4 Retrospective NTA

7.4.1 Introduction

To analyse the evolution of NTA age profiles over time we perform the procedures described in previous chapters separately for each calendar year for a longer period of time.

The EU-SILC survey, on which NTA for the 2010 reference year is based, has been conducted only since 2004, covering data from 2003 onwards (in the EU-SILC as well as in the ECHP survey the reference period is always the previous calendar year in order for all the data to be available). For previous years we took the data from the ECHP (European Community Household Panel). This panel survey has been running for 8 consecutive years, from 1994 until 2001, covering conditions from 1993 until 2000. As ECHP was replaced by EU-SILC only in 2004, there are data in the historical sequence missing for two years, 2001 and 2002.

Besides, due to some methodological differences between the two panel surveys the age profiles are not directly comparable across the two parts of the time series. Nevertheless, the development of the estimated age profiles for different variables can be clearly observed separately before and after the break in the time series, i.e. until the year 2000 and after the year 2003.

In ECHP not all the analysed countries took part from the beginning. Therefore, for some countries the NTA profile time series can be much shorter than for the others. And even for the same countries the set of the observed variables changed over time as well (being usually shorter before than after, even within the same

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design of a survey)[17]. In a situation that an age profile based on a 'missing' variable was needed for further calculations we assumed that the age profile was quite similar to the one in the following year for which we already disposed of the appropriate data, based on a newer version of the panel survey. In such case these same age profiles needed to be adjusted to the different macro control levels.

The methodological approach for retrospective NTA is similar to the one for the base year of our analysis (2010). All the differences in the variables (and consequently in the code) described in the following sections are therefore with respect to the 2010 base year code.

7.4.2 Availability of data

A pre-requisite for creating a complete NTA for a specific country is availability of good-quality data for macro controls, as well as a micro-data survey. A complete set of NTA age profiles can be calculated for the following countries: Belgium (1995-2009), Denmark (1999-2009), Finland (1995-2009), Germany (1995-2009), Italy (1993-2009), Portugal (1995-2009), Sweden (1996-2009) and the United Kingdom (1998-2009)[18]. In case one of the two conditions is not satisfied (i.e. no micro-data survey or no data/bad-quality data to calculate macro controls) we estimate historical age profiles for as many years as possible for only two categories (and their components): labour income and public transfer inflows in-cash[19]. According to the previous results of national NTA research teams these two categories are highly affected by changing population age structure. We show the age profiles of labour income and public transfer inflows in-cash and their evolution in time in Figure 32 and Figure 33.

Due to missing data from National Accounts, we cannot calculate macro controls and therefore estimate historical NTA age profiles for Croatia and Malta. For other EU countries, specifics on calculating macro controls and using micro-data surveys to construct historical NTA profiles are given in the following sections.

[17] As the set of observed variables as well as the set of countries taking part in EU-SILC and ECHP surveys changed from year to year, the code was prepared separately for each calendar year covering all the specifics.
[18] Complete NTA cannot be calculated for the whole time series since there is always a break in the data due to the gap in years between EU-SILC and ECHP.
[19] Details on which NTA results are available for specific years are presented in Appendix B.

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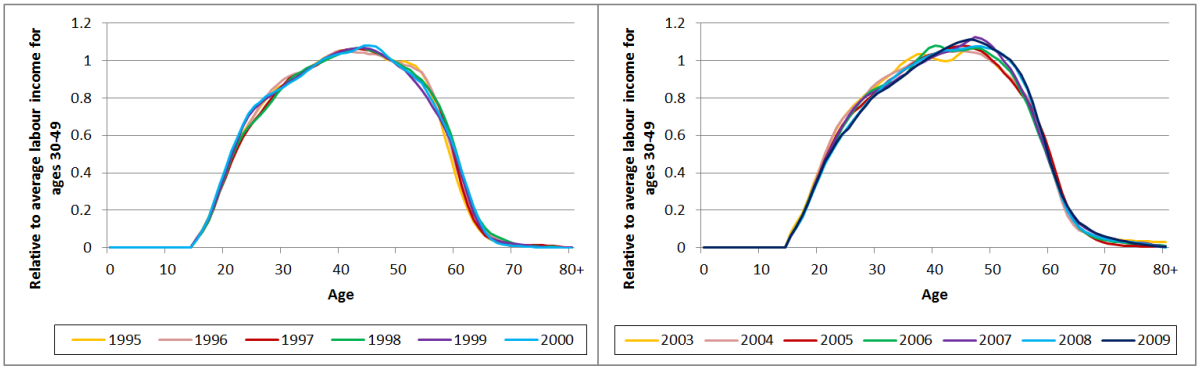
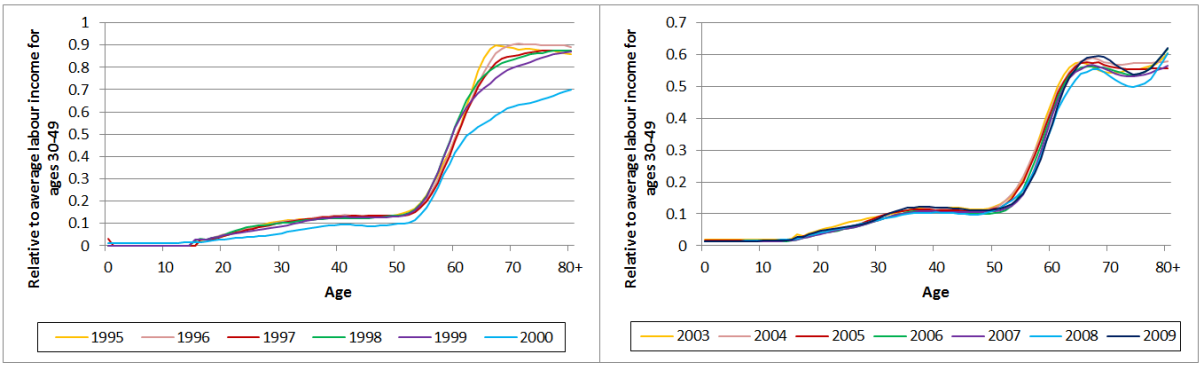
Figure 32: Normalized age profiles of labour income, based on ECHP (left) and EU-SILC data (right), Austria, 1995-2009



Source: Eurostat (Population data, aggregate controls); EU-SILC 2004-2010; ECHP 1996-2001; Authors' own calculations

Figure 33: Normalized age profiles of public transfer inflows in-cash, based on ECHP (left) and EU-SILC data (right), Austria, 1995-2009



Source: Eurostat (Population data, aggregate controls); EU-SILC 2004-2010; ECHP 1996-2001; Authors' own calculations

7.4.3 Macro controls

To calculate aggregate controls for years prior to 2010, we use the same methodological approach and data as for year 2010. The earliest year for which we can obtain data from Annual Sector Accounts is 1993, however, for most of the EU countries data are available for years from around 1995 onwards. We cannot calculate the age profiles for years prior to that since no (harmonized) data exist to calculate macro controls.

7.4.4 Preparing the micro-level dataset

One of the main methodological differences between ECHP and EU-SILC is that the ECHP survey design was based on a pure panel. The sample of people selected for the first year of the survey (sample persons) were followed-up throughout the entire 8-year duration of the survey, wherever they may have moved. Children born to women in the sample were included as sample persons and followed-up. The cross-sectional and longitudinal data came from the same survey and were collected and processed at the same time.

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As improving timeliness has been one of the new survey's core objectives, and because it is recognised that the longitudinal dimension takes more time in data production, EU-SILC provides two types of annual data: cross-sectional and longitudinal data that are treated according to different timetables. In this way, the cross-sectional and longitudinal data can come from separate sources, i.e., the longitudinal dataset does not need to be 'linkable' with the cross-sectional dataset at the micro-level. Under the new design, that aims to be the most cost effective and efficient for satisfying both the cross-sectional and the longitudinal requirements, the minimum panel duration was reduced from 8 years to 4 years (the number of years of observations necessary for building the longitudinal common EU indicators). Consequently, the impact of cumulative attrition is expected to be lower and the cross-sectional data derived from this design richer than data derived from a pure panel.

The number of target variables covered with EU-SILC is much lower than the number of variables observed in ECHP. Anyway, countries are free to include additional variables in their national surveys.

Table 20 represents the EU-SILC – ECHP variable counterparts. In the following sections we describe the specifics of individual variable replacements when switching from ECHP panel survey to EU-SILC in more detail.

Table 20: Variable replacements due to the household survey design change from ECHP to EU-SILC

Code EU-SILC	**Description EU-SILC**	**Code ECHP**	**Description ECHP**
hhid	household ID	hid	household ID
pers_id	personal ID	pid	personal ID
rx020	age at the end of income reference period	pd003, age	age (pd003), age at time of interview (age)
db090	household cross-sectional weight	weight_h	household cross-sectional weight
py010g	employee cash or near cash income	pi111	wage and salary earnings
py020g	non-cash employee income	-	
py021g	company car	-	
py030g	employer social insurance contributions	-	
py031g	optional employer social insurance contributions	-	
py050g	cash benefits or losses from self-employment	pi112	self-employment income
py090g	unemployment benefits	pi131	unemployment related benefits
py100g	old-age benefits	pi1321	old-age related benefits
py110g	survivors' benefits	pi1322	survivors' benefits
py120g	sickness benefits	pi134	sickness/invalidity benefits
py130g	disability benefits	included in pi134	

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py140g	education-related allowances	pi135	education-related allowances
hy030g	imputed rent	-	
hy040g	income from rental of a property or land	pi122a	assigned property/rental income
hy050g	family and children related allowances	pi133	family-related allowances
hy060n	social exclusion n.e.c.	pi137a	assigned social assistance
hy070g	housing allowances	pi138a	assigned housing allowance
hy080g	regular inter-hh cash transfer received	pi123	private transfers received
hy090g	interest, dividends, profit from capital investments in unincorporated business	pi121	capital income
hy110g	income received by people aged under 16	-	
hy130g	regular inter-hh cash transfer paid	-	
		pi136	any other personal benefits

Source: EU-SILC, ECHP

7.4.5 The economic life cycle

In EU-SILC the income at component level is recorded gross, while in the ECHP the income components were recorded net. We assumed that the age-average of the net value was just a fixed proportion of the age-average of the gross value. In that case the age profiles are supposed not to be affected due to different gross/net income reporting. Therefore, we considered the income components interchangeable from the gross/net value aspect.

For four sources of employee income (non-cash income, company car, employer's social insurance contributions and optional employer's social insurance contributions) there were no data in ECHP survey (that was the case also in the first three years of EU-SILC). As these sources of income represented minor contribution to the overall income (especially company car and optional employer social insurance contributions that had missing or 0 values in most of the later years as well), they were just left out in the preceding years. Also the employer's social insurance contributions were simply left out from summation, as they usually represent a constant proportion of gross wage and have therefore negligible effect on the age profile shape. Therefore, we calibrate the net wage profile to the macro control that consists of gross wages and/or salaries in employer's social contributions, including labour share of indirect taxes less subsidies.

Another difference in summing up the labour income variable was also that the EU-SILC takes into account negative values of self-employment income which were previously set to 0 in the ECHP.

As there was no proxy for income received by people aged under 16 in ECHP we had to leave this source of income out as well.

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Besides labour income, economic life cycle deficit consists of private and public consumption. For private consumption, we took the age profiles from 2010 and adjusted them to the corresponding value of a macro control. Public consumption equals public transfer inflows in-kind for which we describe the methodology in the following subsection. Life cycle deficit variables were then calculated on the basis of the adjusted income and consumption variables in the same manner as in the 2010 reference year.

7.4.6 Public reallocations

We calculated public health transfer inflows in-kind profile by adjusting the age profile from 2010 to the corresponding macro control.

Age profiles of public education transfer inflows in-kind were calculated in the same way as for year 2010 (for more detail, see Section 4.4.1). However, in some cases it was not possible to retrieve data on level-specific government education expenses (COFOG) and on percentage share of level-specific expenditures in total public education expenditures (ISCED). Thus, it was not possible to calculate the expenditures per enrolled for each educational level. We solved this problem by assuming the same level-specific expenditures per enrolled as in the previous year. To finalize the calculated age profile, we adjusted it to the value of a macro control in that specific year.

Data on sickness and invalidity benefits were reported as an undivided sum in ECHP. Without any additional information on the proportion of the two income sources the sickness benefits profiles were calculated out of this sum, while for disability benefits the old-age social protection profile was adopted.

7.4.7 Private reallocations

The main difference considering variables describing private transfers (inter-household and intra-household) between ECHP and EU-SILC is that in the ECHP survey the values are given for individuals while in the EU-SILC the sum for the whole household is assigned to the household head. Therefore, whenever we used ECHP we needed to add to the code also this additional step of summing up the transfers of all members of the household, assigning the sum to the household head and finally setting the variable values of the rest of the household members to 0.

In the ECHP there is no information on imputed rent. Even within EU-SILC the imputed rent was not observed by all the participating countries, while in the ECHP there was no such variable at all. To come across the shortage of information on this source of capital income we needed to use average age profile of imputed rents of other NTA countries[20].

One final drawback when using ECHP for the years previous to EU-SILC panel survey design was that there was not even a distant proxy for transfers paid to

[20] For countries when the age profile of imputed rents was available for 2010, we used that age profile and adjusted it to the value of a macro control in a specific year.

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other households (that were introduced later in EU-SILC). The solution we chose was to use the household outflow transfer profile from the first year available (e.g. the profile for 2003, calculated from the EU-SILC 2004 data) also for all the previous analysed years.

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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
ECHP	European Community Household Panel
ESA	European System of Accounts
ESSPROS	European System of Integrated Social Protection Statistics
EU	European Union
GDP	Gross Domestic Product
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

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UNESCO United Nations Educational, Scientific and Cultural Organization

VAT Value-added Tax

Appendix B: Availability of results for retrospective NTA

COUNTRY	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
BE									Gap between EU-SILC and ECHP								
BG																	
CZ																	
DK																	
DE																	
EE																	
IE																	
EL																	
ES																	
FR																	
HR																	
IT																	
CY																	
LV																	
LT																	
LU																	
HU																	
MT																	
NL																	
AT																	
PL																	
PT																	
RO																	
SI																	
SK																	
FI																	
SE																	
UK																	

Legend:

	Complete historical NTA		Problems with macro controls/results (but data exist)
	Partly historical NTA: age profiles of labour income and public transfer inflows in-cash		Not possible to create historical NTA (no data)

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