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

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Sustainability of Inter-Generational Public Transfers in EU-Countries: A New Indicator Based on Projections of National Transfer Accounts

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Abstract

We evaluate the sustainability of the public transfer systems in 25 EU countries using a new indicator based on age-specific economic data from the European National Transfer Accounts database. Virtually none of the commonly used indicators takes explicitly into account that inter-generational support and transfers are based on a mutual exchange between generations: the parental generation invests in children, who in turn use part of their income to finance pensions and care for the generation of their parents. Old age provision through transfers requires sufficient investments into the young generation in the first place. Our indicator contrasts the expected public benefits of the now elderly population with the expected contributions of the generation of their children. The results show a considerable human capital investment gap: the current level of public benefits in old age is appropriate for the parental generation of the baby-boomers, but hardly sustainable for generations with low fertility.

1 Introduction: Monitoring Population Ageing

Population ageing is related to fundamental changes in the life course and lifestyles of individuals. Among the most remarkable changes are higher levels of formal education, postponement of childbearing, a lower number of children, better health at all ages and a higher life expectancy. These changes in individuals' lives have a considerable effect on societies and their institutions. Among the institutions which are most affected by demographic change is the public transfer system, which constitutes largely a redistribution from the population in employment to the retired elderly. Public transfers are in virtually all European countries the main source of income in old age. Increasing life expectancy together with pension systems that are tied to fixed age borders has led to an extensive period of retirement, while declining fertility resulted in an increase in the number of older persons relative to the size of younger generations. As a consequence of these developments the population in employment has to finance longer periods of economic dependency for an increasing number of persons.

Most components of intergenerational public transfers are regulated by law and rather inflexible to adjust to changing circumstances. A change of these regulations requires the consensus among a wide variety of actors, which is often impossible to obtain. Tepe and Vanhuysse (2009) describe it as "double fiscal-electoral straitjackets" that reign pension policies. Several other authors emphasize that policies at the disadvantage of the large and growing group of elderly are increasingly difficult to implement (e.g. Bovenberg, 2008; Sinn and Uebelmesser, 2003). There are concerns that these difficulties to adjust public transfers to the changing demographic

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environment and the changing economic conditions result in a large burden on the young generations and limit the capacity of the state in other areas. The economic and social consequences of population ageing are therefore closely monitored.

Policy makers in Europe take the topic very seriously. The European Commission established the Working Group on Ageing Populations and Sustainability (AWG) to improve the quantitative assessment of the long-term sustainability of public finances and economic consequences of ageing populations of the EU Member States.[1] The AWG carries out age-related budgetary projections and contributes to the development of the assessment of long-term sustainability of public finances. Reports with the results of the evaluation are regularly published.[2] The economic and fiscal implications of ageing are also the topic of the Fiscal Sustainability Report of the European Commission (European Commission, 2016). Both, the Ageing Report and the Fiscal Sustainability Report include a range of indicators describing the consequences of ageing, in particular for the government budget.

The indicator developed in our paper contrasts the net transfers that are expected by a generation in old age with the intergenerational transfers that are provided by the children of this generation. It thereby takes into account that the transfer based old age provision through the public sector relies on the investment in children and the ability of the young generation to pay such transfers. As this indicator shows a considerable gap between the transfers expected by the elderly and those that are provided by the generation of their children we use the term *human capital investment gap* (HKIG). The advantage of the HKIG compared to other commonly applied indicators is that it takes into account the investments in the young generation as essential part of the inter-generational transfer system and the main determinant of the systems' sustainability.

Outline

In Section 2 we discuss desirable properties of sustainability indicators and present several indicators that are commonly used for monitoring the public transfer system under demographic change. Section 3 provides an overview of the intergenerational public transfer flows in 2010 using the European National Transfer Accounts data. The human capital investment gap is introduced in Section 4. The values for 25 European countries indicate that there is a considerable gap between the transfers expected by the elderly and the transfers that are provided by the younger gen-

[1] http://europa.eu/epc/working-group-ageing-populations-and-sustainability_en.

[2] Ageing reports have been published for 2009, 2012 and 2015. They can be downloaded from http://ec.europa.eu/economy_finance/publications/european_economy/ageing_report/index_en.htm. (Accessed 21 October 2016)

erations given the current age-specific transfer pattern.[3] We conclude in Section 5 that the current age-specific transfer patterns are appropriate for the parents of the baby-boom generations who receive a share of the income of their numerous offspring. However, these transfer patterns are unsustainable given the low fertility rates of later generations.

2 Sustainability Indicators for the Public Transfer System

Indicators are best defined as operational representations of certain attributes of a system. They contain information on the condition of attributes and/or their trend (Gallopin, 2005). Most of the indicators for the public transfer system that provide information on the consequences of population ageing focus on the attribute *sustainability*. The definitions of sustainability in the context of public transfers differ, but all these definitions require that public transfer benefits can be financed through contributions without excessively cutting the benefits or increasing the contributions. Put differently, the sustainability definitions require that the public transfer system does not lead to ever-growing debt levels in relation to GDP if the current rules that determine transfer benefits and contributions persist. In some contexts, financial sustainability may also require the complete or partial pay-off of currently existing debts. For a discussion and comparison of sustainability definitions see e.g. Langenus (2006).

A smaller group of indicators is used to evaluate how the burden and the benefits of public transfers are distributed between generations. It is remarkable, however, that there are virtually no indicators that could be used for a cost-benefit analysis of the public transfer system. For example, to evaluate the consequences for wellbeing of beneficiaries and the contributors, or to evaluate the loss in wellbeing due to the mandatory age-reallocation of resources over the life course. This critique applies in particular to the pension system. Originally, it has been introduced as insurance against the inability to work in old age. With the increase in healthy life expectancy, retirement emerged as period of inactivity that is largely enjoyed in good health. An average 65 year old person in the European Union can expect almost 9 more years of healthy life.[4] Pensions are still regarded as part of the social insurance, but they largely lost their function as insurance against a social risk. It is therefore not clear according to which criteria it can and should be evaluated. However, there is consensus that the pension system and the public transfer system as a whole should be sustainable. Consequently, most of the indicators focus on this attribute.

[3] Included are all EU countries except Malta, Croatia and the UK. For Croatia and Malta we lack the information on public transfers, because these two countries are not included in the European NTA dataset. For the UK there are no employment projections because of inconsistencies between the education-specific population projections and the labour force survey.

[4] *Source:* EUROSTAT, healthy life years and life expectancy at age 65. (accessed 7 December 2016)

2.1 Desirable Properties of Sustainability Indicators

The ultimate aim of indicators is the improvement of decisions through the provision of relevant information. According to Gallopin (1996) the most important functions of indicators are the assessment of conditions and trends; the comparison across places and situations; the anticipation of future conditions and the provision of early warning information. He considers the most desirable indicators those that summarize the relevant information, make the phenomena of interest visible and perceptible, and quantify, measure, and communicate the relevant information. Most of the indicators aggregate information from primary data in complex ways. It is therefore not easy to develop and find indicators that fulfill all of these functions. In order to facilitate the choice of indicators, several desirable properties of indicators have been identified.[5] Most of these properties are desirable for any kind of indicators; some are of particular importance for sustainability indicators. Good and effective indicators should be *easy to understand and interpret*, since their purpose is the communication of the relevant information. This includes for example that they measure the state of the associated attribute in meaningful units. Furthermore, indicators used to monitor a system should be *relevant* and *informative*, in the sense that they provide information about an important attribute of a system. They should provide information how good the system is working and help to identify and fix the problem in case it is not working well. Furthermore, good indicators should be *leading indicators*, in the sense that they provide information at a time when it is still possible to react on problems. This property is of particular importance regarding sustainability, since avoiding the collapse of the systems is what the indicators are used for. In addition, indicators should be *reliable*, the users should be able to trust what the indicator shows. This implies for example that cross-country differences in the value of the indicators and differences across time should represent differences in the represented attribute. To summarize: good indicators provide understandable, relevant and trustworthy information in sufficient time.

2.2 Sustainability Indicators for Public Transfers

There is a wide range of indicators that are used to obtain insights into the consequences of ageing for the funding of the public sector. Virtually all of these indicators are based on projections and simulations of future developments, of which employment rates of the elderly and retirement ages are among the most important. Usually several scenarios of possible future developments are calculated. The purpose of these scenarios is to show how sensitive an indicator is to the underlying

[5] A nice discussion on sustainability indicators is found on `http://www.sustainablemeasures.com`. (Accessed 18 October 2016).

assumptions, to explore the range of values the indicator possibly can take or to evaluate specific policies. The public sector sustainability indicators are usually very similar. All of them are based on age-specific projections of public contributions and benefits in the future. A comprehensive comparison of sustainability indicators is presented in Gál and Monostori (2016). They distinguish indicators that are based on cross-section data and indicators based on data over a long-time horizon. Indicators based on cross-section data use information from a certain period (usually a year), while indicators with a long-time horizon sum up information of several periods in one indicator.

Indicators Based on Cross-Section Data

Important and widely used examples of cross-section indicators are dependency- and support ratios. The economic dependency ratio for example relates the number of non-employed persons to the number of employed persons. More generally, dependency ratios are built up by defining for each individual a measure for the degree of its dependency and its ability to support others. The value of these measures depend on characteristics of the individual, such as age, gender, activity status or other economic quantities such as income and consumption. Dependency ratios are calculated by summing up the dependency measure and the support measure over the whole population and by relating total dependency to total support. For example, the dependency measure for the economic dependency ratio takes the value of 1 if a person is not in employment and 0 otherwise. The corresponding support measure takes the value of 1 if a person is employed and 0 otherwise. Consequently, the economic support ratio measures the number of non-employed persons per employed person. Several types of dependency ratios are compared in Loichinger et al. (2014). They show that the results depend very much on the definition of the indicators. Their findings suggest that it is incorrect to use general ageing indicators (e.g. the demographic dependency ratio or the economic dependency ratio) for monitoring subsystems of the economy such as public transfers. Cross-section indicators are undoubtedly easy to understand. Many of the cross-section indicators are based on widely used high quality data. They can be regarded as reliable and can be projected by making few and justified assumptions. However, dependency ratios might not be relevant and informative for monitoring the public transfer system.

Indicators with a Long-Time Horizon

The indicators with a long-time horizon have mostly an explicit focus on the public sector. They take into account that the promises of public benefits payable in the future constitute an implicit liability for the public sector while the expected

contributions constitute an asset. Virtually all of the public sustainability indicators constitute measures of the difference between total assets and liabilities. The indicators in this group are consequently close relatives; they differ mainly in the time horizon they consider and in the components of public transfers they focus on. A wide range of such public sustainability indicators have been suggested and regularly applied by the research community, think tanks, international, supranational and government agencies. Indicators accounting for implicit government liabilities are undoubtedly of high relevance: citizens have enormous interest in understanding if the state can fulfill its promises of future transfers, e.g. pensions and health services. If they have doubts, or if it becomes obvious that these promises cannot be fulfilled, they have to adjust their plans. Most likely this includes saving and the accumulation of assets to provide for old age.

In the following we present examples of indicators with a long-time horizon used in the literature. A straightforward way to measure official and implicit government debt in a given year is the *inter-temporal net worth* (INW) indicator. It is for example used in the Fiscal Sustainability Report of the European Commission (European Commission, 2016) and calculated as the present value of future primary balances (assuming the perpetuation of current fiscal policies and rules) less the value of current net assets of the government. The INW can be interpreted as a measure of government's net financial wealth, taking into account the projected implicit future liabilities due to ageing. The concept of the INW is used in an identical or very similar form under different names, such as the *true government debt* (Raffelhüschen, 1999), the *intertemporal public liabilities* (Raffelhüschen and Gokhale, 2000), the *intertemporal budget gap* (Cardarelli et al., 2000) and the *sustainability gap* (Bonin and Raffelhüschen, 1999).

Several indicators measure government debt in an indirect way. Blanchard (1990) and Blanchard et al. (1990) developed the concept of a tax gap. They define the tax gap as the difference between the sustainable tax rate – the tax rate that would leave the debt to GNP ratio unchanged under current fiscal rules – and the current tax rate. The tax gap is calculated for short term (a year), medium term (5 years) and a long-term (40 years) horizon. Other indicators are the S1 and S2 indicators applied in the Financial Stability Report of the European Commission (European Commission, 2016). The S1 indicator measures the required adjustment in the primary balance of the public budget for achieving a 60 percent public debt-to-GDP ratio by 2030. Long-term fiscal sustainability is evaluated using the S2 indicator. It measures the required adjustment in the primary balance to stabilize the debt-to-GDP ratio over the infinite time horizon, no explicit criteria on the debt-to-GDP level is set.

An alternative, but closely related approach is generational accounting (Auerbach

et al., 1991; Bonin, 2001). This method breaks down public contributions and benefits by age. By projecting the age-specific values into the future, estimates of contributions and benefits over time are derived for currently living as well as future cohorts. Generational accounts (GAs) are the differences between the present value of public contributions expected to be paid by a generation throughout their remaining lifetime and the present value of the public benefits they receive. By delivering a value for each cohort GAs allow an assessment how resources are redistributed between generations. While contributions (taxes) and benefits for the living generations are calculated using the current rules, the tax burden of future generations is calculated by assuming that they bear current debt as well all potential future deficits. The tax rate of future generations is chosen so that the present value of future net contributions of current and subsequent generations is equal to the present value of current government debt and future government expenditures. Its calculation requires population projections as well as additional assumptions about productivity growth and the discount rate. The *generational imbalance* (GI) indicator is derived by comparing the GAs of the newborn with that of future generations. The GI measures how much the future generations have to contribute in relation to their benefits compared to the generations that pay taxes and receive benefits under the current rules. The current organization of public transfers is sustainable if the GI is small.

A point of criticism of generational accounting is that the distribution of liabilities between generations is actually an assumption. A large GI carries not much more information than that the current system is not sustainable. Such information is also provided by simply calculating implicit tax rates for the whole population. In general, the family of indicators with a longer time horizon has several disadvantages. Although the basic concept is straightforward and understandable, the exact value is hard to interpret. One of the reasons is the application of rather arbitrary discount rates to calculate the present values. The actual value of these indicators is also very sensitive with respect to the initial situation and required assumptions. Changes in the value of the indicators do not necessarily reflect a change in the long-run sustainability of the public system. Nevertheless, the indicators accounting for implicit government debt can be useful instruments in the evaluation and comparison of policy reform scenarios, where the relative value and the change of the value is more relevant than the absolute value.

The most frequent application of cross-section indicators and indicators with a long-time horizon is to quantify the effect of population ageing on economic quantities, in particular the public revenues and expenditure. Usually this is done by combining the current age pattern of public transfers with the future changes in the age composition. The aim of these indicators is not the accurate projection of the

future but the evaluation of the current system. There are two fundamental problems with such an approach. First, demographic developments such as declining fertility rates are treated as exogenous. However, raising the next generation and the associated transfers are an essential part of the inter-generational transfer system. These transfers to the next generation enable and secure the transfer-based old age provision through the public sector. Second, the method ignores positive developments related to population ageing that could reduce the pressure of ageing for the government budget even under the assumption of persisting current rules: growing levels of education and improving health conditions are associated not only with longevity but also with higher employment rates and consequently with higher taxes and lower benefits. With the indicator developed in this paper we try to address these two fundamental problems.

2.3 The Generational Contract

Raising the next generation is an essential part of the inter-generational transfer system. These transfers create the human capital that finances the public transfer-based old age provision. However, contrary to the flows directed to the elderly, transfers to children are in form of services, goods and money mainly organized by households (see e.g. Gál et al., 2016). These private transfers are largely ignored in the organization of the public transfer system.[6]

The reciprocal transfer flows between children and the generation of their parents can be described as a generational contract: the parental generation provides resources for children until they are able to support themselves and enter the labour force. The children in turn pay a share of their income for funding transfers to the elderly in form of pensions, health care and long-term-care. A contract is defined as *agreement with specific terms between two or more persons or entities in which there is a promise to do something in return for a valuable benefit known as consideration.*[7] The consideration is the promise made that induces the other party to enter the contract. We can regard the transfers from the parents as consideration for children and public transfers in old age such as pensions and health services as consideration for the parents. It is clear that the generational contract is not a contract in the legal sense, as it is not voluntary. However, intergenerational relations have many characteristics of contractual relationships; a contract is therefore an exceptionally well fitting metaphor. Within the concept of the generational contract the intergenerational flows have to be described in terms of investments rather than

[6] Estimates for the value of intergenerational transfers in form of services can be found in the AGENTA data-explorer on `http://witt.null2.net/shiny/agenta`.

[7] Contract. (n.d.) Collins Dictionary of Law. (2006) Retrieved July 28 2016 from `http://legal-dictionary.thefreedictionary.com/contract`.

transfers.[8] The parental generation invests in the human capital of the society in form of children and their education and receives the returns to this investment in form of pensions, health- and long-term-care. Because the term transfers is commonly used to describe flows between generations, we will use both, ”transfers to children” and ”investments into children” interchangeably.

The conceptualization of intergenerational transfer flows between the parental generation and the generation of their children in terms of a contract provides important insights: the investments in children in the form of having children, nurturing and educating them are the contribution of the parental generation to the contract. They are a necessary elements which enable and justify the benefits received by the parental generation in retirement. One of the main questions regarding sustainability of public sector transfers is therefore if these investments are, and have been, large enough to enable transfers to the elderly at the current level.

Accounting for human capital investments in children is not only a question of sustainability. Raising children is associated with considerable personal costs in terms of leisure, income and consumption. The expenditure on children makes it in particular also more difficult to save funds for retirement while the reduction of working time and associated pension contributions reduces own pension entitlements in the public system. It is therefore not only a question of sustainability, but also of fairness, to treat individuals and generations differently, depending on their investment in children and the associated costs.

3 European National Transfer Accounts – Public Transfers in 2010

The indicator presented in this paper is based on data from the 2010 National Transfer Accounts (NTA) for Europe.[9] NTA measure for a given year the age-specific averages of labour- and asset income, the redistribution of income between age groups through transfers and the age-specific use of disposable income for consumption and saving. The data set contains a detailed set of age-specific averages (age profiles) of income, transfers, consumption and saving. NTA constitute an extension of the System of National Accounts (SNA): the aggregate values (i.e. the sum over the whole population) of income, consumption, saving, public transfer payments and public benefits are consistent with the values in the SNA. The European NTA

[8] A transfer is defined as a transaction in which one institutional unit provides a good, service or asset to another unit without receiving from the latter any good, service or asset in return as a direct counterpart (SNA, 2009). Contracts on the contrary are agreements about mutual exchanges with well described counterparts.

[9] The generation of NTA is coordinated by the global NTA project. The lead institutions are the Center for the Economics and Demography of Aging, University of California at Berkeley and the East-West Center at Hawaii. More information and data can be found on the NTA web page at `www.ntaccounts.org`.

dataset and the methodology is described in detail in Istenič et al. (2016).[10] An nice overview of the NTA methodology and results for countries around the world is provided in Lee and Mason (2011).

Components of Public Transfers

Our analysis uses the detailed age-specific information of the different types of public transfer flows in the NTA. We use the term *public contributions* for the transfer flows from individuals to the public sector and *public benefits* for the flows from the public sector to individuals.[11] Public contributions and benefits are used to define the different life stages: childhood and old age are characterized by the age-specific averages of public benefits exceeding contributions, working age by contributions exceeding the benefits. With the term *public net transfers* we refer to the difference between public benefits and public contributions. The public net transfers are positive in childhood and old age and negative during working age. The term *public net benefits* refers to the positive net transfers in childhood and old age. *Public net contributions* refer to the public contributions less the benefits (=negative net transfers) of the working age population.

The public contributions consist mainly of taxes and social contributions and are distinguished by the source: taxes and social contributions paid on labour income, taxes and social contributions paid on public benefits (e.g. pensions), taxes on asset income, taxes on consumption as well as other taxes and revenues. Public benefits consist of in-kind transfers (public consumption) and cash transfers. A large part of the public in-kind transfers cannot be assigned to individuals or age groups, such as expenditure for internal security, defense or general administration. In this case, it is assumed that each person consumes the same amount, independent of his/her age. Individual public consumption as well as cash benefits are assigned to the age group that benefits from these transfers. NTA make a further distinction by the main purpose and function of public benefits: the most important components of individual public consumption are education and health services; the most important components of public cash transfers to individuals are pensions, followed by unemployment benefits and benefits related to family and children.

[10] The European NTA data set consists of NTA for all European countries except Croatia and Malta. Not all components of public transfers are available for all of the countries, in few cases approximations are used. The NTA age profiles for health consumption are based on the 2015 Ageing Report (European Commission, 2015). Because for CZ, EE, IE, EL, ES, PL, PT and RO it was not possible to use these data the age-pattern of health consumption was imputed using the average over all the other countries.

[11] In NTA all flows are assigned to individuals dependent on their age. NTA distinguish only two sectors: the government and the private sector, which includes households, corporations and non-profit organisations serving households. Public contributions include all flows from private sector to the government and public benefits all flows from the government to the private sector.

The general age pattern of public net transfers are illustrated in Figure 1, which plots the age averages for 25 European countries[12] and the age averages for the three most populated countries in our analysis (Germany, France, Italy). To make these flows comparable, the net transfers are measured as share of the average labour income of a full-time worker (YLFT).[13] Public net transfers are positive at young age until about age 23. The comparable small consumption taxes are the only flow from children to the public sector, whereas with education children receive rather expensive services through the public sector. The net transfers are negative during working age when individuals pay social contributions and taxes on their labour income. In old age (about from age 60) average public net transfers are again positive as retired persons do not have labour income but receive public pensions, health care and long-term-care services. Although there are only small differences among Germany, France and Italy, this is not the case for other countries. The differences are well visible in the plot of the age-specific public net transfers for each country in Figure A-4 in the Appendix.

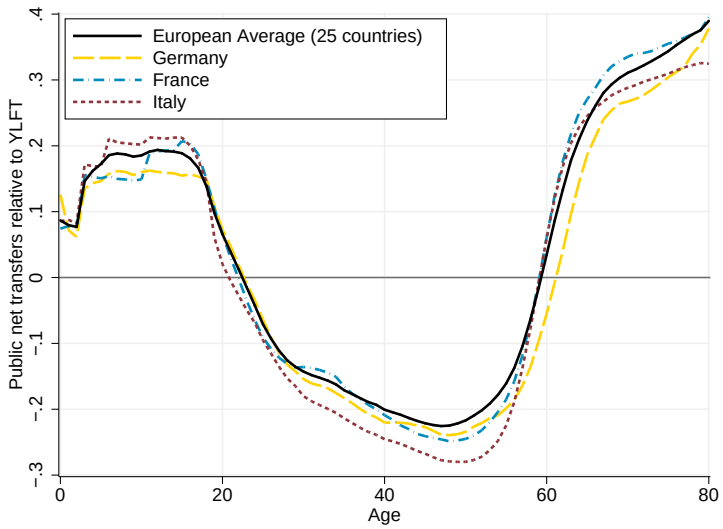

Figure 1: Public Net Transfers: European Average and Most Populated Countries

Aggregate Public Net Transfers Between Generations

By multiplying the age-specific averages of public net contributions and net benefits with the corresponding population we get estimates for the total net-flows between age groups in the year 2010, reported in Table 1. All these aggregate quantities are

[12] To calculate the the age-specific averages for the 25 countries the age- and country-specific values are weighted with population size.

[13] The average income of a full-time worker is calculated by dividing the total labour income (YL) in the economy (European NTA data) with the number of workers in full-time equivalents (estimates from the Labour Force Survey).

measured as percentage of total labour income in the economy. Column 1 reports the public net contributions of the working age population. These contributions correspond to 7.8 percent of total labour income in Slovakia to 30.2 percent in Luxembourg and Italy. The low values in Slovakia and Ireland are a consequence of the economic crisis; the public sector in both countries financed in 2010 a large part of transfer benefits through dissaving and an increase of government debt (Column 2). Some of the public contributions are not directly used for the own population but transferred to the rest of the world (ROW), mostly in form of EU-taxes. For completeness, these values are reported in Column 3. The sum of net contributions of the working age population, asset based reallocations (defined as asset income less saving) and the net transfers from the ROW correspond to the amount of the public net benefits of children and the elderly (Column 4). Total benefits in childhood and old age correspond to 20 percent of total labour income in Bulgaria and 30.1 percent in Lithuania. The values for the other countries lie in between. Of the total public net transfers between generations between 42.5 percent (Cyprus) and 78.1 percent (Greece) are directed to the elderly (Column 5). Column 6 shows the amount of net transfers to the elderly in terms of total labour income. It ranges between about 10 percent in Cyprus, Ireland and Luxembourg to around 20 percent and more in Italy and Greece.

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Table 1: Intergenerational Public Net Transfers in Percent of Total Labour Income

Country	**(1) Net contrib. working age**	(2) Asset income less saving	(3) Net transfers from ROW	**(4) Net benefits young & old**	(5) Net benefits old in % of total net benefits	(6) Net benefits old in % of labour income
Austria (AT)	**28.1**	0.9	-1.4	**27.5**	68.2	18.8
Belgium (BE)	**26.3**	1.7	-1.8	**26.1**	56.2	14.7
Bulgaria (BG)	**18.6**	2.6	-1.2	**20.0**	68.0	13.6
Cyprus (CY)	**23.4**	0.8	-0.5	**23.7**	42.5	10.1
Czechia (CZ)	**20.6**	8.8	-0.9	**28.5**	62.2	17.8
Germany (DE)	**22.3**	0.7	-1.5	**21.6**	69.3	15.0
Denmark (DK)	**21.9**	3.3	-3.4	**21.8**	54.6	11.9
Estonia (EE)	**22.8**	2.7	0.2	**25.8**	59.9	15.4
Greece (EL)	**22.0**	12.3	-1.3	**32.9**	78.1	25.7
Spain (ES)	**15.4**	9.3	-1.1	**23.5**	62.5	14.7
Finland (FI)	**21.4**	9.2	-2.0	**28.5**	67.4	19.2
France (FR)	**22.7**	8.1	-2.1	**28.7**	63.7	18.3
Hungary (HU)	**23.8**	5.3	-0.7	**28.4**	65.1	18.5
Ireland (IE)	**8.6**	15.2	-2.2	**21.5**	48.2	10.4
Italy (IT)	**30.2**	0.3	-1.6	**28.9**	68.4	19.8
Lithuania (LT)	**15.9**	13.9	0.3	**30.1**	56.3	16.9
Luxembourg (LU)	**30.2**	-4.4	1.1	**27.0**	40.4	10.9
Latvia (LV)	**14.8**	13.3	0.7	**28.8**	53.9	15.5
Netherlands (NL)	**19.1**	7.1	-1.1	**25.1**	54.3	13.6
Poland (PL)	**20.8**	7.3	-1.5	**26.7**	64.1	17.1
Portugal (PT)	**14.6**	11.7	-1.2	**25.1**	61.2	15.4
Romania (RO)	**18.5**	5.1	1.2	**24.8**	75.2	18.7
Sweden (SE)	**25.7**	0.9	-2.6	**24.0**	59.4	14.3
Slovenia (SI)	**23.0**	3.7	-0.9	**25.8**	64.9	16.8
Slovakia (SK)	**7.8**	13.2	0.8	**21.8**	67.9	14.8

Source: Authors' own calculations based on the European NTA database, Istenič et al. (2016)

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4 The Human Capital Investment Gap

We argued above that a sustainability indicator for public transfers has to take into account investments into the younger generation. These human capital investments deliver a return to the generation of parents in form of public net contributions once the young generation enters the labour force. The share of these contributions transferred to the elderly together with the level of benefits in old age determine the transfer systems' sustainability. Using simulations of public contributions and benefits over lifetime, we contrast the value of the public net benefits that a member of a certain generation (or age group) is expected to receive in old age with the expected net contributions of their children's generation over the entire working life. We refer to these two generations as Generation t (denoting the generation that receives the old age net benefits) and child generation (the generation that pays the net contributions). With the term parental generation we refer to the parents of Generation t. Obviously, we adopt a cohort perspective and follow Generation t through retirement and the child generation over working life. The difference between the old age net benefits of Generation t and contributions of the child generation represents the *human capital investment gap (HKIG)* of Generation t. A positive HKIG is a sign that the net benefits expected in old age are higher than the expected contributions of the child generation given the current tax rates and the current share of taxes transferred to the elderly. It is a sign that the system is not sustainable and requires adjustments, either through increasing the contributions of the child generation, through a decrease in the benefits of the parental generation or through net migration. The transfer system can cope with a short-lived positive HKIG, but not with a "structural" human capital investment gap that endures over a larger number of cohorts.

The concept of the HKIG and its measurement for a Generation t are illustrated in Figure 2.[14] The transfers from the parental generation to the members of Generation t in period t-1 constitute the human capital investments of the parental generation. The return of these investments are the transfers from Generation t to its parents during working age (period t). During this period the Generation t also uses resources for investments into its own children. In old age (period t+1) the members of Generation t receive the returns to these investments in form of transfer benefits from the child generation. What we observe are the flows in period t. However, our interest is in the future (period t+1) transfers from the child generation to Generation t. We simulate these transfers by assuming that the employment-specific level of the net contributions paid by the child generation to Generation t in period t+1 is the same as of the net contributions from Generation

[14] The figure is an adaptation of Figure 1 in Rangel (2000).

t to its parents in period t. We also derive a measure of the expected benefits of Generation t in old age (period t+1) by assuming that the benefits per capita as share of YLFT are the same as for their parents in period t. The HKIG of Generation t is the difference between the expected net benefits in old age and the net contributions of the child generation. The system is more sustainable when the HKIG is small (or even negative) and the contributions paid by the child generation are large enough to finance the old age benefits of their parents.

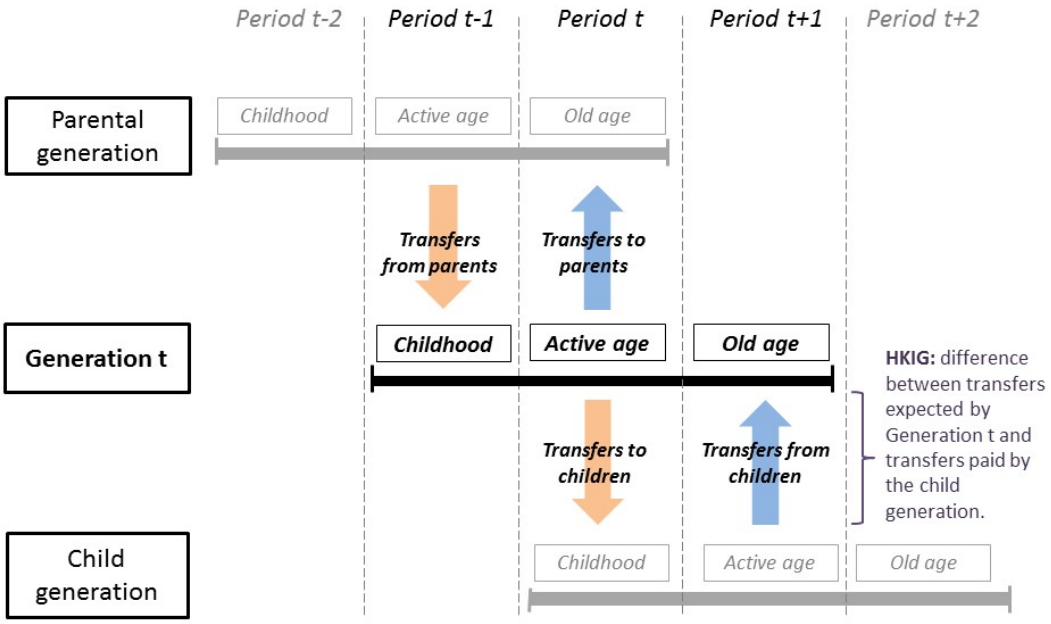

Figure 2: Illustration of Transfers to/from Generation t

Because of data availability, we calculate the HKIG only for one cohort, namely for persons who were born in 1950 and who turned 60 in 2010. As representative members of the child generation we take an average person born in 1980 who turned 30 in 2010. We use the NTA cross-section data for 2010 to calculate the current transfers (representing period t). To make the transfer flows comparable over time and countries we measure all the quantities in terms of average labour income of a full time worker in the respective year (YLTF). In the simulations of future net contributions and net benefits over time we keep the age- and employment-specific public net contributions and net benefits measured as share of YLFT constant at the level observed in 2010. For calculating life-course values, i.e. total contributions over working life and the benefits in old age, we simply add up the values at each age. We can interpret this sum as the 2010 present value of old age net benefits with future net benefits discounted by the growth rate of labour income per fulltime worker.

The public transfer system will change as the population ages, even when the rules

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and levels characterizing the transfer system persist. The reason are the differences in the characteristics of the parental- and the child generation. An important cohort-specific characteristic that influences employment and consequently public contributions and benefits is the educational composition. As employment rates are positively correlated with formal education, we expect that the better education of young cohorts will have a positive effect on their employment rates, especially in older age groups. We account for these differences between the 1950 cohort and the 1980 cohort by allowing for higher employment rates of the younger generation at older ages.

4.1 Public Benefits in Old Age

To get estimates for the expected public net benefits of the 1950 cohort members we assume that age-specific net benefits in terms of YLFT correspond to the cross-section age pattern we observe in the year 2010. That is, we interpret the cross-section age pattern of public old age net benefits in 2010 to represent the life course values of the generation born in 1950. For pensions as most important component of public old age benefits this is definitely a reasonable choice: the pension level remains rather constant as share of YLFT once a person is retired if there are no pronounced changes in income growth.[15] For health the assumption of constant age-specific benefits is rather strong. There is evidence for the so called ”red herring hypothesis”, which states that health expenditure is less driven by age than by mortality and the proximity of death (e.g. Zweifel et al., 2004; Seshamani and Gray, 2004). If this were true, the age-specific values will change with mortality and the increasing life expectancy. Longevity would lead to a ”flattening” of the public benefits age profile, i.e. to a slight reduction of the level and a shift of the peak towards higher ages. However, although public health benefits are strongly increasing with age until about 80, they are found to stay rather constant after this age (European Commission, 2015), despite huge increases in mortality. We therefore think that the use of the 2010 cross-section age pattern for the simulations of the cohort values is a very reasonable choice. To obtain estimates of the expected net benefits in old age for members of the 1950 cohort we weight the age-specific estimates of public net benefits with survival probabilities.[16]

[15] In most countries pensions are uprated with an increase of consumer prices but not with income growth. A strong increase in growth rates would therefore lead to a reduction of pension in terms of YLFT.

[16] The survival probabilities are calculated using the EUROPOP2013 population projections. *Source:* EUROSTAT, EUROPOP2013, no migration variant.

4.2 Public Contributions in Working Life

As second part of the HKIG indicator, we simulate the net contributions to the elderly of a person born in 1980 throughout his/her working life. It is assumed that the age- and employment specific net contributions as share of YLFT remain at the level observed in 2010. Furthermore, we assume that the share of public net contributions that are transferred to the elderly remain at the 2010 level (Table 1, Column 5). However, we take into account that the 1980 cohorts differ in important characteristics from the cohorts that determine the cross-section pattern of public contributions in 2010. One of the important differences is educational attainment, which is found to be positively related with employment. In virtually all European countries educational attainment as well as employment rates of older persons (age 55–age 65) have been increasing in the last years (see e.g. Hammer et al., 2016). We expect therefore that age-specific employment rates and consequently the public net contributions will be higher for the 1980 cohorts compared to the rates observed in the 2010 cross-section data. To take these changes into account the employment specific measures of public contributions and benefits from the NTA are combined with employment projections. For this purpose, we calculate the measures for public transfers by employment status. While contributions and benefits of employed and non-employed persons are kept constant as share of YLFT, changing employment rates translate into changes in average contributions/benefits.

NTA by Employment Status

For the calculation of employment-specific NTA we distinguish public contributions and benefits according to the employment status of the group that is targeted. Public contributions are divided into three groups: taxes and social contributions paid by employed persons, taxes and social contributions paid on benefits received by the non-employed population and taxes independent of employment status. The public benefits are distinguished into those that are directed to the population independent of the employment status and the benefits directed to non-employed persons. The first group includes public consumption other than education as well as cash transfers in the category family and children. Transfers directed to the non-employed population include public expenditure on education, pensions, disability benefits and unemployment benefits. The distinction is not always clear-cut: some components of public consumption other than education (e.g. in-kind services for unemployed persons) as well as components of the cash transfers in the category family and children are directed to non-employed persons.[17] However, these are

[17] In some countries child benefits are paid to compensate caregivers for the loss of labour income due to the absence from the job while they are taking care of their young children.

comparable small amounts and even from the micro data sources it is not always possible to distinguish different types of transfers within the same category.

We then use the employment-specific age profiles and the corresponding population numbers to calculate the total (i.e. total economy) amounts of public transfer components in 5-year age groups. The aggregation to 5-year age groups is necessary because the employment projections are not available on a more detailed level. The employment- and age-specific aggregate quantities are then divided by the number of persons in each of these groups[18] to obtain average values of public contributions and benefits by age and by employment status. Of the transfers that are not directly dependent on employment status we calculate 5-year age-averages, independent of employment.

Combining Employment-Specific NTA with Employment Projections

For the simulations of the net transfers over working age we combine the employment specific transfer estimates with age-specific employment projections. These projections are based on education-specific trends observed in the past[19] and population projections by education[20]. They are described in detail in Hammer et al. (2016). Thereby we get age-specific estimates of public contributions and benefits from the year 1995 up to 2050 in 5-year steps. The distinction between childhood, working age and old age requires estimates for the net transfers in single year age groups to determine the period with positive net contributions. For this purpose we assume the 5-year averages for the mid of the age groups and use a linear interpolation for the values in between. By adding the net contributions at each age, we get the life time public net contributions of the cohort born in 1980.

In virtually all countries there are discussions about reforming the pension system and increasing retirement age. We therefore use a second scenario to evaluate the effect of increasing employment rates at higher age groups. The highest employment rates[21] of the 1980 cohort at age 60-69 are expected in Sweden. We evaluate how the lifetime net contributions change if the employment rates of the 1980 cohort achieve the Swedish levels at age 60-69 in all of the countries. Figure 3 plots the age-specific public net contributions of the 1980 cohort according to the two scenarios. The cross-section age-profile is plotted for comparison. The lines represent age-averages of the 25 countries.[22] Obviously, already the base scenario assumes a considerable increase in employment rates from age 45 on-

[18] Estimates based on LFS and population data.
[19] *Source:* European Labour Force Survey
[20] Wittgenstein Centre for Demography and Global Human Capital, (2015). Wittgenstein Centre Data Explorer Version 1.2. Available at: `www.wittgensteincentre.org/dataexplorer`.
[21] Measured in fulltime equivalents.
[22] Again, the country-specific age-profiles are weighted with population size.

ward compared to the cross-section data from 2010. The assumption of Swedish employment rates in Scenario 2 results in a peak of contributions after age 60. The reason are the generally high employment rates in Sweden. Even for age group 60-64 the rates are expected to be higher than the employment rates of the prime working age population in many other countries.

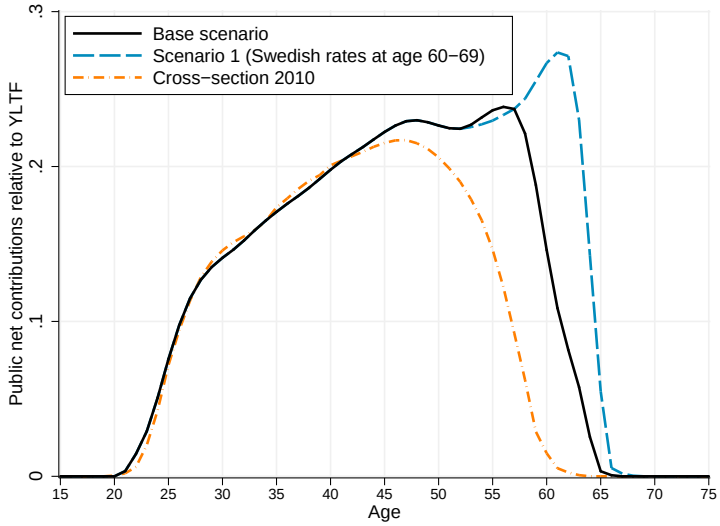

Figure 3: Public Net Contributions by Age for the 1980 Cohort in 2 Scenarios and the Cross-Section Data 2010

4.3 The Human Capital Investment Gap Across Europe

The results of our calculations are summarized in Table 2. The value of public net benefits in old age that can be expected by a person born in 1950 is listed in Column 1. These transfers correspond to less than 5 YLFT in Bulgaria and more than 10 YLFT in Slovakia and Greece. The expected net-contribution of a person born in 1980 throughout his/her working life is much lower in all the countries (Column 2), ranging from less than 3 YLFT in Cyprus, Spain, Ireland, Lithuania, Portugal and Slovakia to almost 7 YLFT in Austria. By dividing the old age benefits in Column 1 with the expected contributions in Column 2 we get a measure for the number of net contributors that would be required to finance the transfers to the elderly (Column 3). In all the countries it requires clearly more than one contributor to finance the average transfers to an older person, given the current share of labour income transferred to the elderly and given the employment rates assumed in the projections. The average number of children of a member of the 1950 cohort (Column 4) is in most of the countries around 1 and contrasts with the required

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Table 2: Public Contributions in Working Age, Benefits in Old Age and the Human Capital Investment Gap

Country	(1) Benefits Old	(2) Contribution Workers	(3) Contributors required	(4) Number of children	**(5) HKIG in number of children**	**(6) HKIG in labour income of ft-worker**
AT	9.8	6.9	1.4	1.0	**0.5**	**3.2**
BE	5.8	5.0	1.2	0.8	**0.3**	**1.6**
BG	4.8	4.0	1.2	1.1	**0.1**	**0.3**
CY	7.7	2.7	2.9	1.2	**1.7**	**4.5**
CZ	9.7	4.9	2.0	1.1	**0.9**	**4.4**
DE	6.6	5.7	1.2	0.9	**0.3**	**1.6**
DK	6.2	5.3	1.2	0.8	**0.4**	**2.0**
EE	6.8	4.6	1.5	1.1	**0.4**	**1.7**
EL	11.1	4.6	2.4	1.2	**1.3**	**5.9**
ES	7.0	2.8	2.5	1.1	**1.4**	**3.9**
FI	9.5	5.2	1.8	0.9	**0.9**	**4.7**
FR	8.5	5.4	1.6	1.1	**0.5**	**2.6**
HU	6.3	4.7	1.3	1.1	**0.3**	**1.3**
IE	6.3	1.5	4.3	1.6	**2.7**	**3.9**
IT	7.2	6.1	1.2	1.0	**0.2**	**1.1**
LT	5.7	2.2	2.6	1.1	**1.4**	**3.2**
LU	6.6	4.0	1.7	0.7	**0.9**	**3.7**
LV	5.6	2.4	2.3	1.2	**1.2**	**2.8**
NL	6.6	3.6	1.8	0.9	**0.9**	**3.2**
PL	8.9	4.4	2.0	1.1	**0.9**	**4.0**
PT	7.3	2.8	2.6	1.1	**1.5**	**4.2**
RO	6.7	3.8	1.8	1.3	**0.5**	**1.8**
SE	7.5	6.0	1.2	1.0	**0.2**	**1.4**
SI	8.9	5.1	1.8	0.9	**0.9**	**4.6**
SK	11.6	2.0	5.8	1.2	**4.6**	**9.2**

number of contributors, which is considerably higher.[23] The HKIG can be measured as difference between the required contributors (Column 3) and the actual number of children (Column 4). Alternatively, it can be expressed in YLTF (Column 6). The HKIG in YLTF is calculated by multiplying the net contribution of a young person throughout working life (Column 2) with the actual number of children (Column 4) and by subtracting this value from the expected old age benefits (Column 1). The high values of the HKIG show that in most of the countries the investments of the 1950 cohort into the child generation were by far too low to finance public old age benefits similar to the level observed in 2010.

Clearly, high values of the HKIG indicate a combination of high net benefits for the elderly and low net contributions of the child generation. The difference between benefits and contributions is most pronounced in Slovakia and Greece, where the government financed a large part of public benefits through public dissaving. This

[23] The average number of children is alculated using data on completed cohort fertility. *Source:* Human Fertility Database. Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria). Available at www.humanfertility.org (data downloaded 4 November 2016). For countries not included in the Human Fertility Database we use the total fertility rates in 1980 from EUROSTAT.

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translates into a high share of benefits relative to contributions and consequently into a high HKIG. Greece is additionally characterized through a high share of benefits relative to YLFT and a high share of benefits that is directed to the elderly. The lowest HKIG is observed for Bulgaria, a country where the public net benefits in relation to YLFT are extremely low. Also Italy and Hungary have a quite low HKIG. One explanation are the rather large net contributions to the elderly observed in 2010, which correspond to about 19 percent of YLFT in 2010 (Table 1).

Table 3 shows the results with the assumption that the employment rates in the age group 60-69 are as high as in Sweden. We clearly see that under this scenario the HKIG decreases considerably in most of the countries. In Hungary the HKIG is even negative. Increasing retirement age is clearly a powerful instrument to adapt the public transfer systems to ageing populations. However, we also see that even under this ”optimistic” scenario a considerable HKIG remains in most of the countries. This gap has to be covered through a decrease in net benefits, an increase in contributions of through net migration. We conclude that in most European countries the public transfer system is adjusted to large cohorts being in working age and contributors to the system. It will require a lot of effort and a mix of different strategies to bring the public transfer system in line with economic-demographic developments such as the retirement of low fertility cohorts and longevity.

Table 3: Public Contributions in Working Age, Benefits in Old Age and the Human Capital Investment Gap - Scenario with Swedish Employment Rates

Country	(1) Benefits Old	(2) Contribution Workers	(3) Contributors required	(4) Number of children	**(5) HKIG in number of children**	**(6) HKIG in labour income of ft-worker**
AT	9.8	8.0	1.2	1.0	**0.3**	**2.1**
BE	5.8	6.2	0.9	0.8	**0.1**	**0.6**
BG	4.8	4.3	1.1	1.1	**0.0**	**0.1**
CY	7.7	3.0	2.6	1.2	**1.3**	**4.0**
CZ	9.7	5.4	1.8	1.1	**0.7**	**3.9**
DE	6.6	5.7	1.2	0.9	**0.3**	**1.6**
DK	6.2	5.5	1.1	0.8	**0.3**	**1.9**
EE	6.8	4.9	1.4	1.1	**0.3**	**1.4**
EL	11.1	5.1	2.2	1.2	**1.0**	**5.3**
ES	7.0	3.4	2.1	1.1	**1.0**	**3.3**
FI	9.5	5.5	1.7	0.9	**0.8**	**4.4**
FR	8.5	6.3	1.3	1.1	**0.3**	**1.7**
HU	6.3	6.1	1.0	1.1	**0.0**	**-0.2**
IE	6.3	1.9	3.3	1.6	**1.7**	**3.3**
IT	7.2	7.2	1.0	1.0	**0.0**	**0.0**
LT	5.7	2.6	2.2	1.1	**1.0**	**2.7**
LU	6.6	5.2	1.3	0.7	**0.5**	**2.8**
LV	5.6	2.7	2.1	1.2	**0.9**	**2.4**
NL	6.6	3.9	1.7	0.9	**0.8**	**3.0**
PL	8.9	4.9	1.8	1.1	**0.7**	**3.5**
PT	7.3	3.2	2.3	1.1	**1.2**	**3.8**
RO	6.7	4.3	1.6	1.3	**0.3**	**1.2**
SE	7.5	6.0	1.2	1.0	**0.2**	**1.4**
SI	8.9	5.7	1.6	0.9	**0.7**	**4.0**
SK	11.6	2.3	5.0	1.2	**3.8**	**8.8**

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4.4 Strengths and Weaknesses of the HKIG

Among the advantages of the HKIG and other long-time horizon indicators is the relevance of the provided information: can the public sector fulfill its promises regarding transfer benefits given the current tax rates? These indicators are leading indicators and allow answering this question in time. No matter which indicator is used, the answer is a clear ”no”. The HKIG has additional strengths compared to other indicators. One of these strengths is certainly the measurement in terms of income of a full-time worker. The measurement in YLTF facilitates the interpretation of the outcome on one hand. On the other hand, it makes the measurement more reliable, as the outcome does not depend on rather arbitrary choices of growth- and discount rates. The biggest strength of the HKIG as indicator is certainly in being informative: it shows the fundamental relation between the generosity of the public transfer system to the elderly and their human capital investments into the generation of children. Thereby it identifies the source of the problems regarding public sector funding in ageing populations: transfer based old age provision is based on investments into the young generation, while the rules determining the benefits ignore these investments into young generation. New in our paper and advisable also for the calculation of other indicators are the employment-specific projections of public transfers and benefits. They are a straightforward method to simulate, project and analyse the effect of changing employment rates on public transfers. The HKIG shares some of the disadvantages with other public sustainability indicators based on a long-time horizon. One of them is the limited reliability due to its dependence on assumptions about future developments. Another weakness is the sensitivity with respect to the conditions in the base year.

5 Conclusion

The economic exchange between children and the generation of their parents is at the very heart of societies and their most important institutions, including the family and the public welfare system. This mutual exchange can be described as generational contract: the parental generation provides resources for children until they are able to support themselves and enter the labour force. The children in turn pay a share of their income for funding transfers to the elderly in form of pensions, health care and long-term-care. The investments in children in the form of having children, nurturing and educating them are necessary elements, which enable and justify the transfer benefits received by the parental generation in retirement. The crucial question regarding public transfers is therefore if these investments have been high enough to finance the expected old age transfers of the parental generation.

Using age-specific data on public transfers, we compare the expected net public transfers received by a person born in 1950 and the expected amount of public transfers paid by the children (approximated by an individual born in 1980). We find a considerable gap between the expected net benefits of elderly and the expected contributions of the child generations. We therefore call our indicator *human capital investment gap*. In virtually all European countries it would require fertility rates well above 2 to finance transfers to the elderly at the current level. Currently the new entrants in the pension system profit from the high investments in human capital of the parents of the baby-boomers. However, given their own low fertility and the corresponding low investments in the young generation this system is unsustainable in the future. The level of transfers that is enjoyed by the parents of the baby boomers is inappropriate for generations with low fertility. Their investments in the child generation was simply too low to justify and enable such generous transfers.

Public transfers require therefore a re-adjustment to be in-line with the investments into the young generation. A reform of public transfers towards a sustainable organization has to address the pivotal defect in the design of public transfers: the transfers to the elderly rely on the level of investments in children, nevertheless are these investments ignored in the calculation of the benefits. In a robust system the rules determining public transfer benefits have to depend on the investments in the young generation, i.e. on the size of the younger generations and their ability to provide for the elderly.

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A Appendix

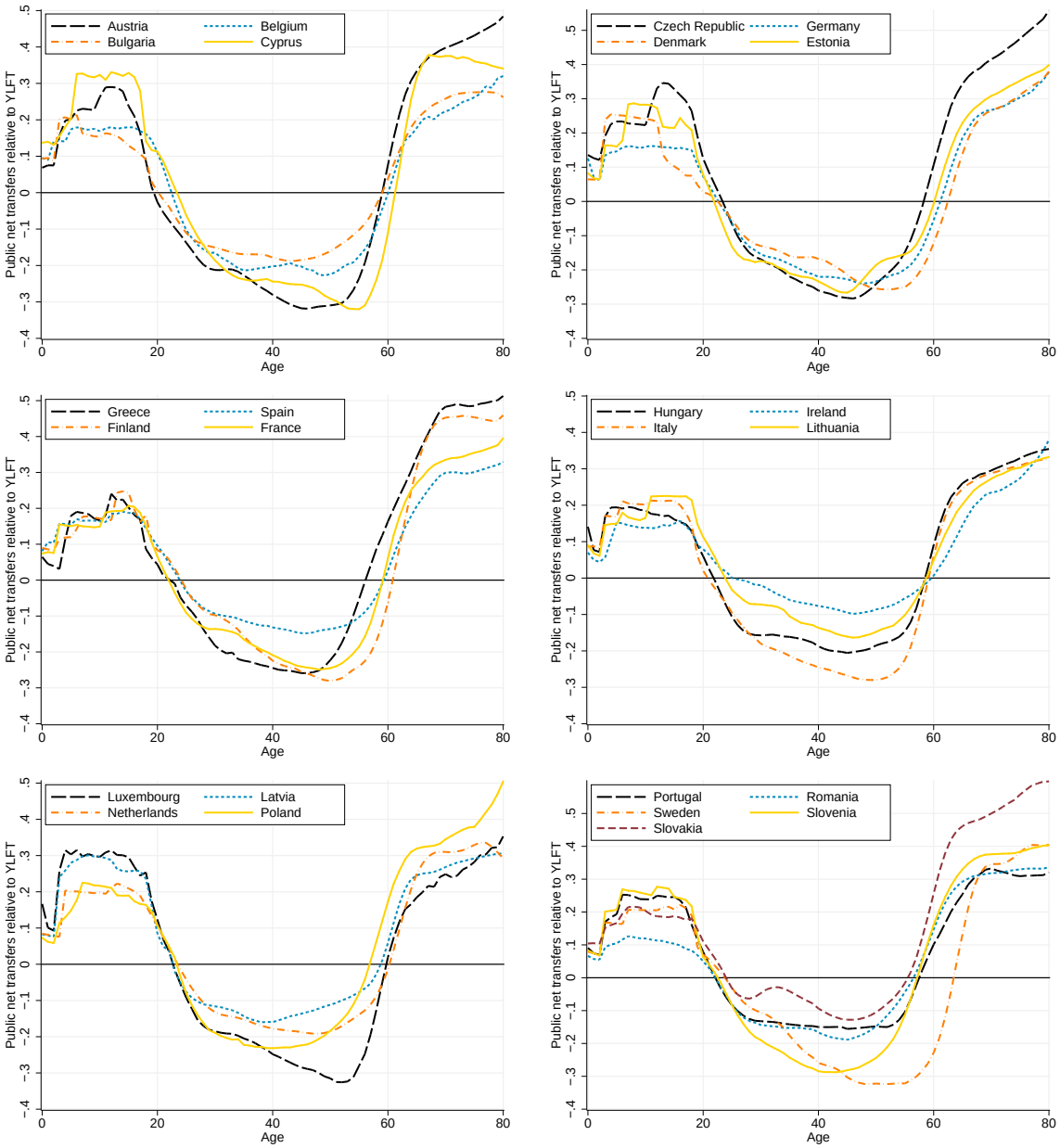

Figure A-4: Public Net Transfers in Relation to the Avg. Income of a Full-Time Worker

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