Economic Support Ratios and the First and Second Demographic Dividend in Europe

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Abstract

Low fertility rates, increasing survival to old age and moderate levels of migration are rapidly changing the population age structure in Europe towards the elderly. To measure the challenge of population ageing for economic development, the dependency ratio or support ratio are often applied. Both of these indicators are based on a comparison of the working age population with the dependent population (elderly and young) where fixed age limits are used to distinguish between those population groups. However, not all people of certain age group are productive and the remaining ones unproductive. Furthermore, not all productive individuals are equally productive. On the other hand, not all individuals consume the same, which is implicitly assumed in the dependency and support ratio. The National Transfer Accounts (NTA) provide a new method for comprehensively analysing economic flows across age groups. In particular NTA provide detailed profiles of consumption and labour income by age. By combining these age profiles with population projections we simulate the development of an NTA based support ratio and its growth rate (the first demographic dividend) from 1960 through 2050. Depending on how elderly finance their consumption an increasing share of elderly in an economy can elevate savings, which through capital deepening increases the productivity in the economy (second demographic dividend). Based on estimates of NTA wealth flows we show that the second demographic dividend is negligible in most of the European countries we consider, except Germany, Spain and the UK.

1 Introduction

Persistent low fertility and increasing survival to older ages, in combination with the ageing of the baby boom generation, are the key determinants of the changing age structure in many European countries. As a consequence, natural population growth is negative and only positive net migration sustains stable or growing population growth in the coming decades in many of the European countries. An increasing share of elderly people has to be sustained by an ageing and shrinking working age population. Faced with population ageing, the welfare state system (including pension, health and elderly care system) has to be reformed. Most urgently labour market participation has to increase at the intensive and extensive margin to sustain economic productivity in the future.

To assess the consequences of the current and future demographic structure on the reallocation of resources across generations, demographic dependency ratios or alternatively (economic) support ratios are calculated. The former indicator relates the dependent age groups (the youth and elderly) to the working age population. Fixed age limits for the various age groups are imposed. Most commonly the young dependent population refers to the age group less than 20 years of age, while the old age dependent population refers to the age group 60 years or older. The remaining age group between age 20 and age 60 comprises the working age population. Unfortunately such strict inflexible age limits do not allow for differing and changing age profiles of consumption and income across time and across countries as they are shaped by prevailing institutional settings. The concept of the support ratio partially tries to account for these shortcomings by relating a weighted share of the working age population in the numerator to the weighted sum of all consumers in the denominator. Age specific labour force participation and wages multiplied with the age structure of the population are applied in the numerator. For the denominator consumption needs (commonly only distinguishing between three broad groups – children, adult, retired persons) are multiplied with the age structure of the population to yield the potential dependent population.

An ideal indicator should take into account single years of age specific consumption and labour market characteristics and combine these characteristics with the changing age structure of the population. The age profiles of the economic activities, in contrast to fixed age specific limits, will then define the economic support ratio. The recent National Transfer Accounts (NTA) project (http://www.ntaccounts.org) provides the necessary data to build such an indicator for several European countries. Based on a common methodology the NTA project aims to describe the reallocation of resources across age. Currently there are 36 countries included in the NTA project (among which 10 are European countries). The age profiles of consumption and income that are derived in the NTA project together with the recent demographic projections of Eurostat from 2011 can then be applied to yield a new set of economic support ratios. These indicators will then best represent the consequences of demographic change on the reallocation of resources across age, if the current status quo of the country specific social security system and economic activities continue to prevail in the future.

Data provided by the NTA project can also be used to estimate the first and second demographic dividend that might materialize if the age structure of a population changes. The first demographic dividend refers to the difference between the growth rate of the working age and the total population. We introduce a modified first demographic dividend that takes into account single years of age specific weights of income and consumption in the numerator and denominator respectively. A positive first demographic dividend only refers to a temporary economic gain. In contrast, the second demographic dividend, that relates to savings and hence capital accumulation, might have an impact on the long run economic growth potential. However, whether a second demographic dividend materializes will depend on the prevailing social security system. Only if old age retirement induces an increase in savings that induces productive capital accumulation, a second demographic dividend will arise.

In the following we build upon the NTA project to propose an alternative set of (economic) support ratios together with estimates on the first and second demographic dividend for 9 (8[1]) European countries. The paper is structured as follows. We start with a review of the data and methodology used in section 2. First we introduce the recent demographic projections of Eurostat, followed by a brief introduction to the NTA methodology and a summary of key age profiles of consumption and labour. We continue with the definition of economic support ratios and the introduction of the first and second demographic dividend. In section 3 we combine the age profiles of consumption and labour income with age specific population projections to simulate the development of the economic support ratio, as well as the first and second demographic dividend during the next decades. Our simulations are based on a cross-sectional pattern of age specific consumption and labour profiles and do not take into account changing behavioural effects caused by demographic and institutional changes. Nevertheless such a shift-share analysis helps to highlight the implications of demographic change if we stick to today's life cycle patterns and institutional arrangements. Section 4 concludes with a discussion.

2 Data and methodology

2.1 Population projections

To project the future economic support ratio and demographic dividends we apply the most recent population projections by Eurostat EUROPOP2010. The projections are available for EU-27 member states and countries of the European Free Trade Association (EFTA) and cover the projection period 2010-2060. We choose Eurostat instead of United Nations or national specific projections since the European context is taken care of in more detail in the Eurostat projections and compared to national projections Eurostat projections are more synchronized among countries regarding the assumptions and technical procedures. The projections EUROPOP2010 are based on the "convergence scenario" assuming convergence of fertility (to a value of 1.85) and mortality (assuming a life expectancy at age zero of 92.2 for males and 96.3 for females) across all considered nations by 2150. However, projections were prepared only for the period until 2060.

[1] For France not all data are available to calculate the second demographic dividend.

In Figure 1 we plot the changing age structure as projected by Eurostat for the NTA countries we consider in this paper. To increase visibility we present the results for two separate groups of countries. Five countries with a rather low fertility (Figure 1a: Austria, Germany, Hungary, Slovenia, Spain) and four countries with relatively high fertility (Figure 1b: Finland, France Sweden and the United Kingdom).[2] All countries experienced a decline in the share of young population in the past, especially during the 1980s and 1990s. In the future the share is expected to stabilize at the current level of about 20% in the low-fertility group of countries (Figure 1a) and slightly above 20% in the high-fertility group of countries (Figure 1b). The share of elderly people (aged 65+) in 2010 is around 17% in all countries except Germany where it exceeds 20%. In all countries the share of elderly is projected to increase in the future. In the low-fertility group (Figure 1a) an increase to about 30% or more is projected while in the high-fertility group (Figure 1b) it is expected to increase to about 25%. Consequently the share of the working age people (aged 20-64 years) will shrink in the future.

For the projections of the economic support ratio and the first demographic dividend we will apply the demographic projections up until 2060. However, for calculating the second demographic dividend we need to extend the population projections until 2300. For this purpose we assume that after 2150 fertility, mortality and migration remain constant at the level obtained in 2150. The purpose for this prolongation of the projection period is only a technical requirement for the calculations of the second demographic dividend.

2.2 NTA methodology

The changing age structure of a population will have a profound impact on intra- as well inter-generational transfers. Age reallocation of resources will also depend on the underlying life cycle profiles of consumption needs and earned income. A typical life cycle pattern starts with economic dependency at younger ages, where consumption needs exceed labour income, followed by a period of a negative life cycle deficit with labour income exceeding consumption needs and ending again in a period of economic dependency of a positive life cycle deficit during retirement. The length and extend of periods of economic dependency and economic surplus over the life cycle will vary across countries and over time. Institutional settings including the welfare system, labour market setting, etc. as well as the overall economic performance of a country will profoundly shape these life cycle profiles. In addition, individual characteristics of productivity, ageing, etc. will also determine the life cycle age profiles of consumption and production.

[2] Table A1 in Appendix gives an overview of the change in the age structure.

Figure 1a: Age structure in European NTA countries 1960-2050 (actual data for 1960-2010 and projections for 2011-2060); in percentages

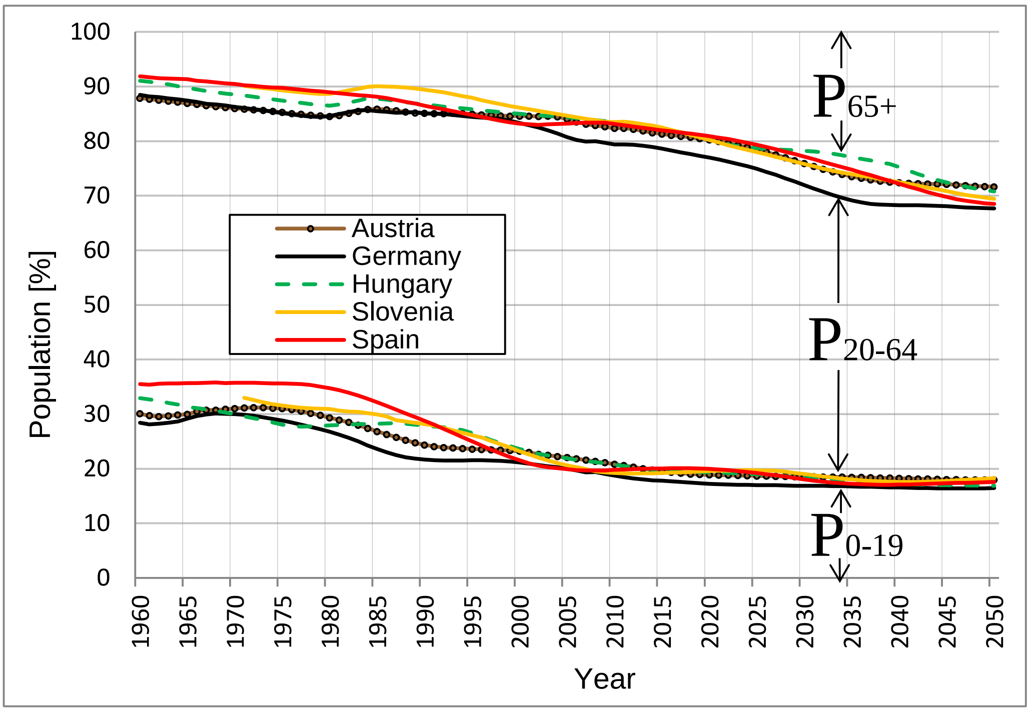
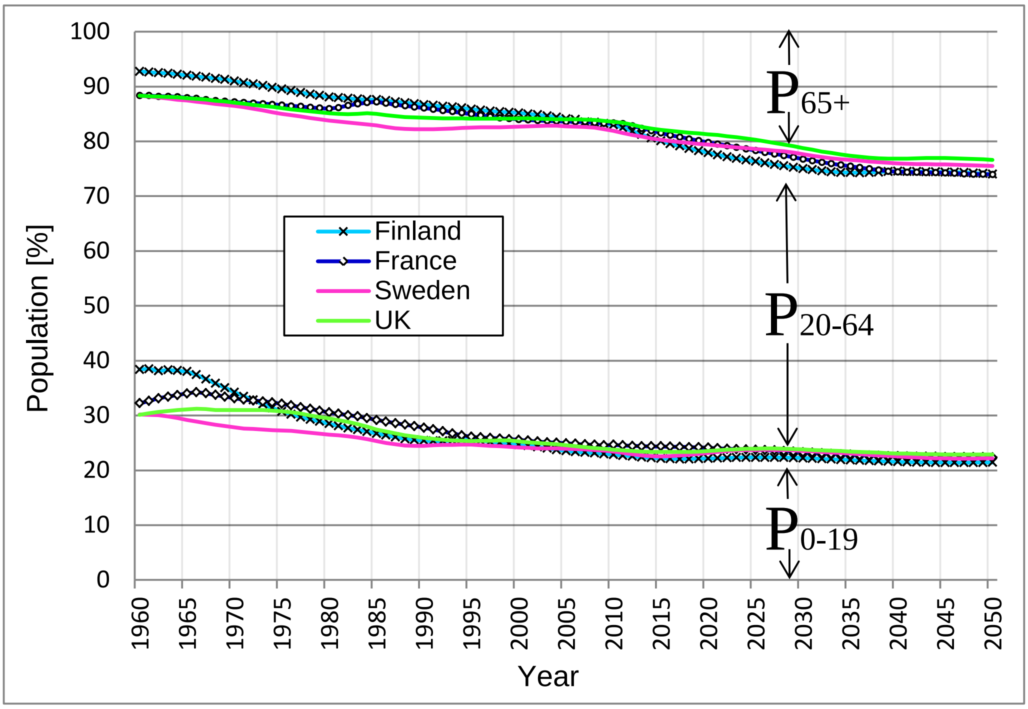


Figure 1b: Age structure in European NTA countries 1960-2050 (actual data for 1960-2000 and projections for 2010-2060); in percentages



Source: Eurostat, 2011.

The National Transfer Account (NTA) project documents the means by which those age groups with lifecycle deficits (young and the old) draw on the surplus resources from persons in the prime working ages (Mason, Lee, Tung, Lai, & Miller, 2009).[3] Inter-age economic flows through which the lifecycle deficit has to be financed can be of three different forms: 1) public transfers (like publicly provided health, unemployment benefits, pensions etc.), 2) private transfers (for example, parents financing the consumption of their children), or 3) asset reallocation (savings, interests on bonds, selling the house etc.). These flows are mediated by public or private institutions with the family being the most important private institution.

The premise of the NTA project is the synchronization of the age specific profiles of consumption, income and reallocation of resources with the worldwide standardized and well established System of National Accounts (SNA). This fact greatly increases data availability and its international comparability of the results. Aggregate controls for the NTA categories are thus predominantly taken from SNA.

The common approach of NTA is to obtain relative age profiles from surveys and adjusting these profiles by age specific population numbers to match the aggregate controls taken from the SNA. Categories for which the aggregate controls are not available within SNA are estimated directly from the survey data. However, serious under- or overestimation can occur in this case since we do not have any information about the actual aggregate values.

The unit of analysis in the NTA is an individual, therefore all inflows and outflows are assigned to individuals. For private consumption within a household the data are available only at the household level. To allocate total consumption of the household to individual household members various methods are used including regression methods and equivalence scales. In the former case, the total household expenditures are regressed on the number of household members in each age group. The relative size of the regression coefficients (representing weights for individuals of different age) is used for allocating household expenditures to individual members within the household. Alternatively the latter method of applying equivalence scales follows Deaton (1997) assuming an equivalence scale of 0.4 for children aged 4 or below, a linear increase from 0.4 to 1 between age 4 and age 20 and 1 for adults aged 20 or older. Some categories of public consumption are allocated according to the observed age patterns of consumption (e.g. public education and health), while others are equally distributed over all ages (e.g. police and defence). Public and private consumption add up to the estimate of total consumption.

[3] The NTA methodology is being developed in an international project that includes 35 countries (as of August 2011). It was initiated by Ronald Lee from Berkeley, UC, and Andrew Mason from East-West Center, Hawaii. For further information see also www.ntaccounts.org.

For labour earnings we have data available by age group. However, 'mixed income' (production of unincorporated enterprises[4] owned by households) is not reported by individuals and it includes both: returns to labour and returns to capital. Based on past research (Gollin, 2002) the NTA assign two thirds of the mixed income to labour and one third to capital. From survey data we also know the persons who are engaged in unpaid family labour. Assuming the labour income of self-employed and unpaid workers being proportional to the labour income of employed workers of the same age, we can derive the age profile of the labour returns for the category of mixed income.

Public transfers can be in-kind (e.g. public education and health, defence etc. – representing the counterpart of public consumption) or in-cash (e.g. public pensions and child allowances). While some transfers are assigned to the individuals who are receiving them (pensions, public education and public health for example), others are assigned to the household head (e.g. child allowances, for example) with the rationale that the household head can choose how to spend these transfers. By assumption, the household head is also the one who gives and receives inter-household transfers – i.e. the private transfers that household receives gives/receives to/from other households – like gifts, aliments etc.

Private consumption of some household members exceeds their disposable income – which consists of individual's labour income plus inter-household transfers (in the case of household heads) and public cash transfer inflows less taxes paid. The difference between disposable income and consumption, the life cycle deficit, of these household members is covered through the intra-household transfers from household members who have surpluses of disposable income over their private consumption. It is assumed that all household members with a surplus, i.e. a negative life cycle deficit, help to cover the positive deficit of other household members proportionally to their surpluses. If the total disposable income of all households members is insufficient to finance total household consumption, the household head provides additional intra-household transfers out of asset income and if necessary by dis-saving. On the contrary, if disposable income exceeds household consumption, the excess is transferred to the household head and saved. Hence, it is assumed that the household head owns all household assets. Therefore, all income generated by the flow of assets is given to the head and he/she is also the one who dis-saves. Using this approach of covering the life cycle deficit we indirectly obtain estimates on private transfers for which usually the data do not exist otherwise. Through this approach we also obtain the age profile of net asset-based reallocation.

Like in the SNA (or following the accounting practices of companies) the various categories in the NTA have equalization counterparts. Inflows and outflows should match at the individual level, household level, for the whole economy, but also for each age group. The following balance equation summarizes the basic flows considered in the NTA:

[4] A privately owned business that is not legally registered as a company.

$$YL + YA + T_g^+ + T_f^+ = C + S + T_g^- + T_f^- \tag{1}$$

The left-hand side of equation (1) represents the inflow of labor income (*YL*), returns to assets (*YA*), transfer income from the public sector (T_g^+) and transfer income from the private sector (T_f^+). Total outflows on the right-hand side of equation (1) comprise the total (private and public) consumption (*C*), net savings (*S*), transfer payments to the government (T_g^-) and transfers to the private sector (T_f^-). Inflows from the left-hand side of equation (1) have to match the outflows from the right-hand side of equation (1).

Rearranging equation (1) shows the three sources through which the lifecycle deficit (excess of consumption over the labor income) can be financed:

$$\underbrace{C(a) - YL(a)}_{\text{Lifecycle deficit}} = \underbrace{\underbrace{\underbrace{T_g^+(a) - T_g^-(a)}_{\text{Net public transfers}} + \underbrace{T_f^+(a) - T_f^-(a)}_{\text{Net private transfers}}}_{\text{Net transfers}} + \underbrace{YA(a) - S(a)}_{\text{Asset-based reallocations}}}_{\text{Age reallocations}} \tag{2}$$

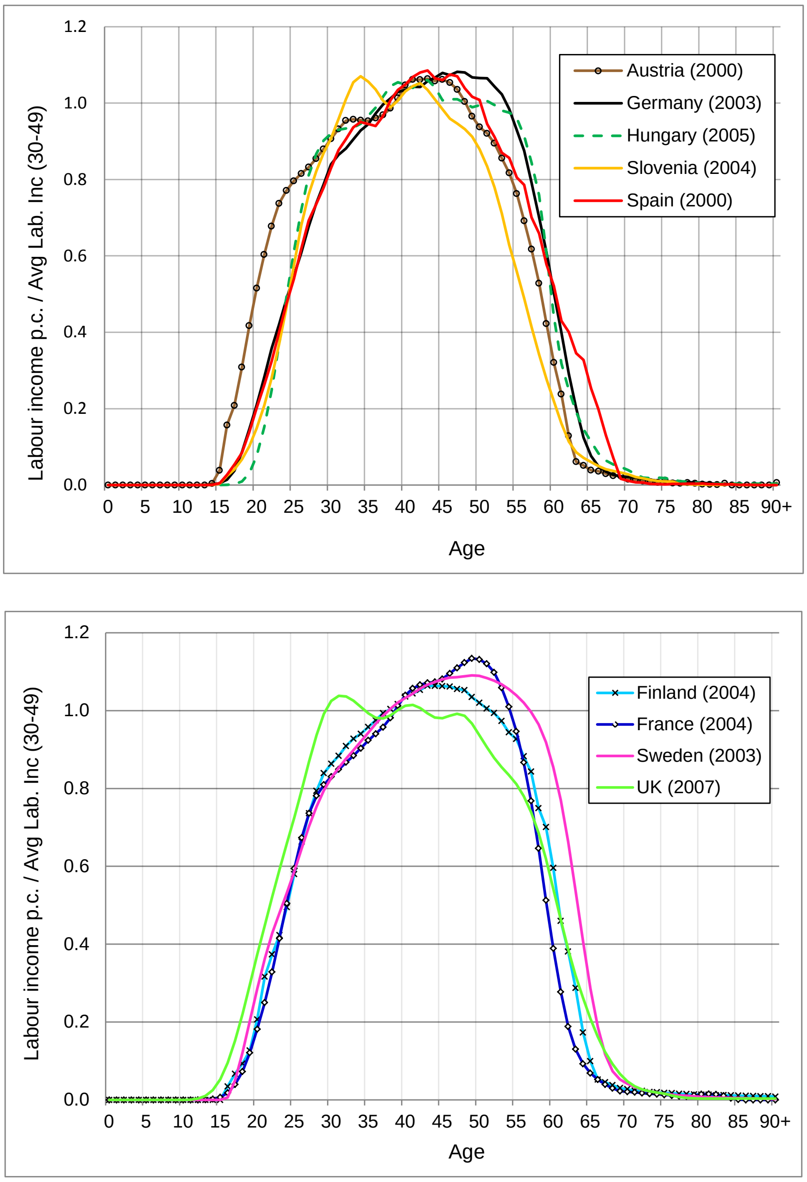
The last two elements on the right-hand side of equation (2) represent the asset-based reallocation. It is special in the sense that it can involve an inter-temporal ‘exchange’. An asset is accumulated by saving, generating asset outflows. Asset inflows are generated by assets yielding income and by selling assets (dissaving). Asset-based reallocations thus consist of two flows: asset income, representing an inflow; and saving, representing an outflow. Thus, individuals can shift resources from one age group to another also by shifting resources through time. This shift can be in both directions: ‘upward’ – by saving first and consuming later; or ‘downwards’ – through a credit one can consume first and pay it off later in time.

2.3 NTA age profiles of labour income, consumption and lifecycle deficit

In Figure 2 through 4 we present the age profiles of labour income, consumption and the life cycle deficit for all 9 European countries that have been analysed in the NTA project so far. The results refer to different years for different countries as indicated in the legends next to the country names. For comparability of age profiles across countries we present relative per capita age profiles using the average of labour income in the 30-49 age group as the reference category. Similar to Figure 1 we present the results for two separate groups of countries that differ in their level of fertility.

Figure 2 exhibits the characteristic hump shaped age profile of labour income. Austria clearly stands out for its early entry into the labour market as indicated by the steep increase in labour earnings already at younger ages. On the other side of the age profile, Slovenia exhibits the earliest decrease of labour income at higher ages as a result of its early exit from the labour market. In Sweden people exit the labour market at distinctively later ages than in the other countries as represented by their rather high labour income profile at higher ages.

Figure 2: Labour income age profile for European NTA countries; presented as labour income per capita relative to the average labour income in 30-49 age group

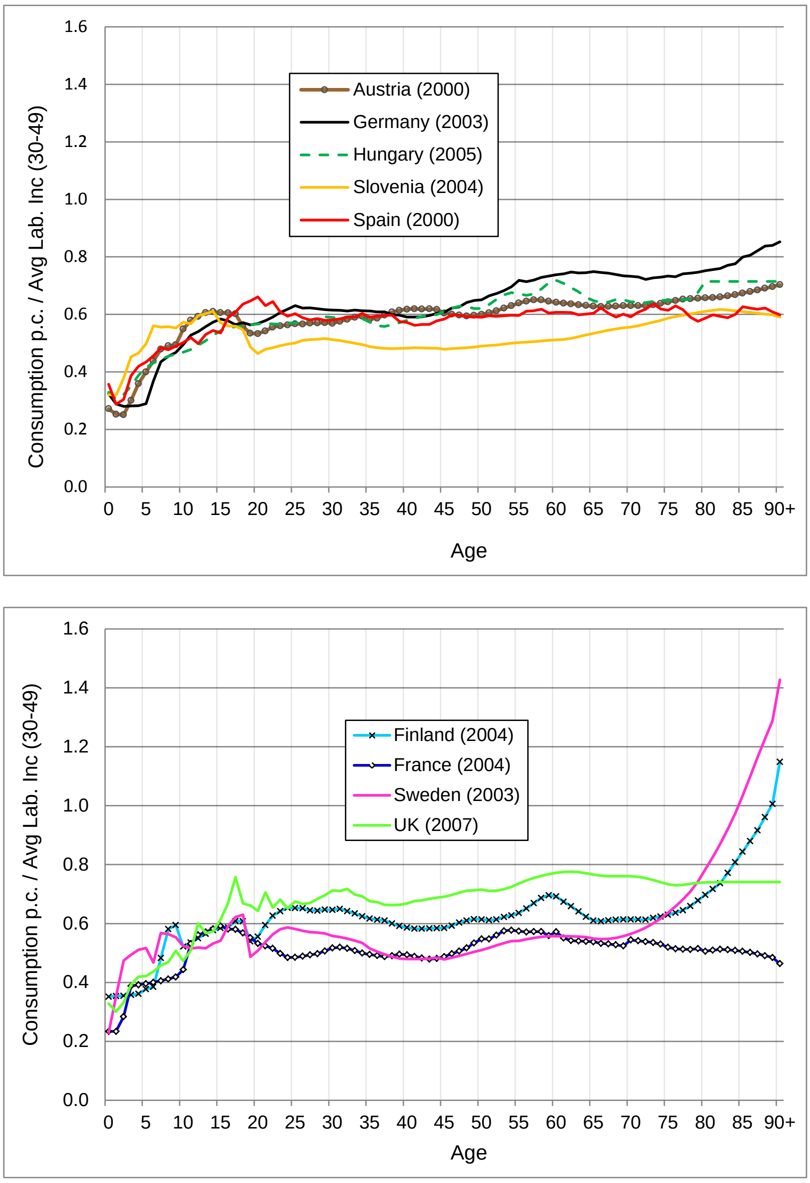


Source: NTA project, internal data.

Figure 3 presents the age profile of consumption, again in two panels for the same groups of countries as before. The lower consumption among children is mainly driven by the applied equivalence scale which linearly increases from 0.4 for the age group of 4 years up to 1 for the age group of 20 years. Thereafter the consumption age profile is relatively stable. Finland

and Sweden are exceptional with rather high consumption levels in the highest age groups as caused by high levels of public health and in particular extensive long-term care consumption in Sweden. In all countries the consumption for ages between 20-30 and 50-60 years is higher as compared to age groups in between. This can be explained by the composition of the household. At earlier ages (20-30 years) people do not have children yet while at later age groups (50-60 years) their children already moved out, forming their own households. Consequently some relatively fixed categories of consumption of the households (especially housing) are assigned to a smaller number of household members and therefore their per capita consumption is higher.

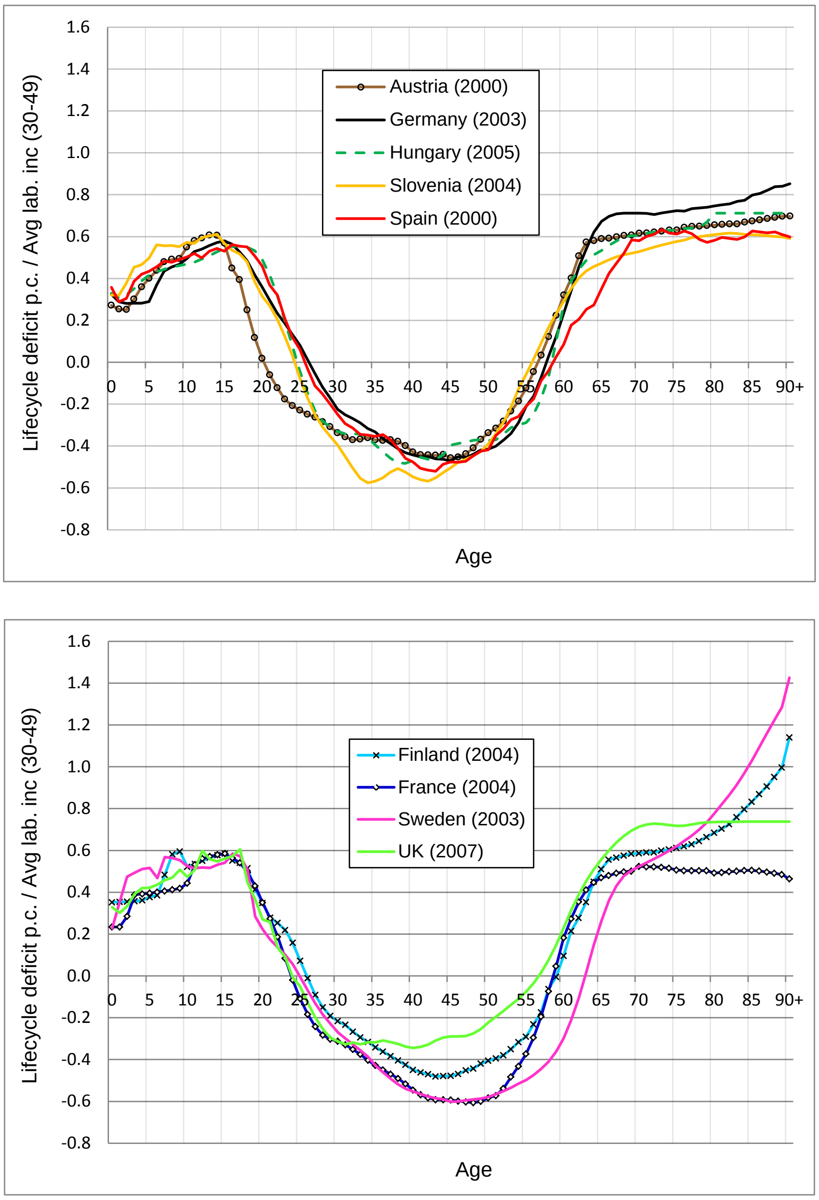
Figure 3: Consumption age profile for European NTA countries; as consumption per capita relative to the average labour income in 30-49 age group



Source: NTA project, internal data.

The difference between labour income and consumption, the life cycle deficit, is plotted in Figure 4. It is predominantly the labour income age profile that determines the age span for which the lifecycle deficit is negative (Figure 5) and a surplus of labour income over consumption exists. The age span of the negative life cycle deficit varies from 31 years in Germany (between age 27 and 57) and Slovenia (between age 25 and 55) to 38 years in Sweden (from age 25 to age 62). Obviously the labour market entry and exit ages are key determinants of the economic surplus (negative life cycle deficit) in a country.

Figure 4: Lifecycle deficit age profile for European NTA countries; as lifecycle deficit per capita relative to the average labour income in 30-49 age group



Source: NTA project, internal data.

2.4 Support ratio

To capture the reallocation of resources across generations within one indicator, the ratio of the share of the working age population to the overall population can be calculated. This indicator is commonly referred to as the (economic) support ratio as it relates the population who is supporting the whole economy to the consumption needs of all people in the economy. A comprehensive analysis of the support ratio and its relation to the changing age structure from 1960 to 2065 for the US case was presented by Cutler et al. (1990). They presented four alternative measures of the support ratio that differed with respect to the weights used in the numerator and denominator of the ratio.

In a first version they assigned the same weights to all consumers and all producers. The effective labour force (LF1) is set equal to the number of people aged 20–64 years assuming that all age groups are equally productive. Assuming that each age group has the same consumption needs, the effective number of consumers (*CON1*) equals the total number of the population.

$$LF1 = \sum_{a=20}^{64} N_a \tag{3}$$

$$CON1 = \sum_{a=0}^{\omega} N_a \tag{4}$$

where N_a represents the number of people in age group a, and ω denotes the maximum length of life. The change in the ratio of the effective number of consumers (CON1) to the effective number of the labour force (*LF1*) is therefore equal to the difference in the population growth rate and the growth rate of the working age population.

In a second version Cutler et al. (1990) propose an alternative measure of the effective labour force (*LF2*) and the effective number of consumers (*CON2*). To obtain *LF2* individuals between 15 and 80 years of age were weighted by the a) average age specific (in 5-year age groups) earnings of people in the labour force and b) forecasts of age-specific labour force participation rates. To build up *CON2* consumption, weights for three broad age groups (0-19, 20-64 and 65+) using specific equivalence scales were applied.

Based on the alternative measures of effective consumers and effective labour force, Cutler et al. (1990) simulated four different versions of the support ratio – *LF1/CON1*, *LF1/CON2, LF2/CON1*, *LF2/CON2* - for the time period 1960 to 2065. They concluded that the projected demographic change in the US is expected to be beneficial (as evidenced by an increase in the support ratio) till about 2010. Thereafter the changing age structure and in particular the fact that the baby boom will leave the labour force would induce a reduction of the support ratio. From about 2030 to 2060 a moderate further deterioration of the support ratio is predicted (Cutler, et al., 1990, p. 14). Measures of the support ratio that are based on CON2 show a much more pronounced decline as compared to using an unweighted measure of effective consumers.

In our analysis, we apply NTA age profiles for labour income and consumption to obtain the effective labour force (*LF2*) and the effective number of consumers (*CON2*). Compared to Cutler et al. (1990) we can base our measures on single years of age profiles. Moreover the NTA age profiles we use are more comprehensive as compared to the weights used in Cutler et al. (1990) and based on a rich set of disaggregated sub-categories.

$$LF2 = \sum_{a=0}^{\omega} \gamma(a) P(a,t) \tag{5}$$

$$CON2 = \sum_{a=0}^{\omega} \alpha(a) P(a,t) \tag{6}$$

where $P(a,t)$ represents the number of people aged a in year t; $\alpha(a)$ is a vector of the NTA consumption age profile; $\gamma(a)$ is a vector the NTA labour income age profile; and ω, again, denotes the maximum length of life. We therefore obtain an improved version of the support ratio, taking into account detailed consumption needs and the productive capacity at each age. We name this improved version of support ratio 'NTA support ratio'.

2.5 The first and second demographic dividend

To measure the effect of the population age structure on per capita income growth, the first and second demographic dividend can be calculated. The concept of the first demographic dividend is related to the NTA support ratio and is represented by the growth rate of the support ratio. The first demographic dividend will be positive (negative) when the effective number of producers is growing faster (slower) than the effective number of consumers.

Typically, during the intermediate phase of the demographic transition when the fertility rate starts to fall, there are fewer dependent children who have to be supported. In that period, the number of working age people grows relatively faster than the number of children and the share of old dependent people has not yet increased. During this phase more resources for investment in economic development and family welfare are available. With all other things being equal, per capita income grows faster (Lee & Mason, 2006). That is the period when the first demographic dividend is positive.

A positive first demographic dividend is limited to a certain period. After some time when the cohorts born during the fertility decline start to enter the labour market, labour force growth slows down and eventually even starts to decline. At the same time pre-transitional, more numerous cohorts that also experience increased life expectancy over time lead to an increase in the share of elderly people. Consequently, if the labour force participation rates are not adjusted accordingly, per capita income growth will slow down; and the first demographic dividend becomes negative.

However, there is another impact of changing population structure that has until recently gone almost unnoticed by researchers who have concentrated on the effects of the first dividend (Mason, 2005). During the ageing process the labour force is increasingly concentrating in higher age groups. Rapidly increasing longevity can be a strong incentive for people to accumulate assets for their retirement. The second demographic dividend is related to the concept of the lifecycle wealth and its relation to the population age structure. First, there are compositional effects, reflecting the growing share of the population who is approaching retirement or who have completed their productive years. Second, there are behavioural effects: increasing life expectancy and the accompanying increase in retirement duration lead to an upward shift in the age-profile of wealth (Mason, 2005).

The second demographic dividend depends on the prevailing institutional context. Only if retirement and longer lives induce an increase in savings and consequently capital accumulation, will a second demographic dividend materialize. If the social security system in old age is low or missing, people will save to support their consumption at old age, to finance bequests and to be able to finance other uncertain events. The second demographic dividend is a consequence of investment in assets such as personal savings, housing, funded pensions etc. Hence people of working age contribute to capital accumulation. However, in some countries the consumption of elderly can be predominantly financed through familial or public transfer programs. With this option, the incentive to build up asset wealth is reduced or even vanishes. Relying on transfer wealth for financing consumption in older age does not yield corresponding benefits in the form of the second demographic dividend. Mason and Lee (2006, p. 3) put these arguments nicely together “The mechanism by which assets are shifted across age groups is important because it determines whether population aging leads to the accumulation of assets or to the expansion of public and private transfer programs.”

As suggested by their names, the first and second demographic dividends appear in sequence. While the first one is still positive, the second one may start and for some period they may even overlap (Lee & Mason, 2006). Eventually the first demographic dividend turns negative. If the second demographic dividend is already positive it may partially offset the negative effect of the first dividend. Unlike the first demographic dividend, the (positive) effect of the second demographic dividend on per capita assets and income is permanent (Mason & Lee, 2007a). The second demographic dividend thus challenges the argument that population ageing only effects economic growth negatively. However, there is no free lunch since the current generations have to reduce their consumption to increase their wealth for higher consumption in future periods (Mason & Lee, 2006). *Ceteris paribus* income per equivalent consumer rises.

The first and second demographic dividend can formally be derived starting from the following decomposition of consumption per capita (Lee and Mason 2006, p. 4ff):

$$\frac{C(t)}{N(t)} = \frac{C(t)}{Y(t)} \cdot \frac{Y(t)}{L(t)} \cdot \frac{L(t)}{N(t)} \qquad (7)$$

where $C(t)$ denotes total consumption, $Y(t)$ is total labour income. $L(t)$ and $N(t)$ are the effective number of producers and the effective number of consumers, respectively. Note that $L(t) = LF2$ from Equation (5) and that $N(t) = CON2$ from Equation (6).

The first demographic dividend is captured by the growth rate of the support ratio *L*/*N*, i.e. the last term in equation (7). In case that the first two product terms on the right hand side of (7) would not be affected by demographic change, a change in the support ratio would translate into a proportional change of consumption per capita. However, as argued in Lee and Mason (2006), a change in the age structure of a population will also affect the consumption per output level (*C*/*Y*). In case that *C*/*Y* decreases when the support ratio increases, savings will increase and a second demographic dividend may materialize.

We can write equation (7) in growth terms

$$\hat{C}_N = \hat{C}_Y + \hat{Y}_L + \hat{L}_N \tag{8}$$

where a hat on top of a variable denotes the growth rate and the subscript denotes the numerator of the variable under consideration, e.g. C_N indicates consumption per capita.
The second demographic dividend is measured by the rate of growth of consumption relative to income:

$$\hat{C}_Y = (\hat{C}_N - \hat{Y}_L) - \hat{L}_N \tag{9}$$

The term in brackets on the right hand side of equation (9) is termed the consumption index by Lee and Mason (2006, p.13) and gives the "extent to which consumption per equivalent consumer C_N rises relative to productivity changes Y_L induced by technological innovation." The growth rate of L_N constitutes the first demographic dividend.

Estimating the second demographic dividend requires to estimate the accumulation of wealth which is intrinsically forward-looking (Mason, 2005)[5]. The demand for wealth is determined by the difference between the present value of future consumption and production of all adults alive in year t and is denoted by *W(t)*. According to Lee and Mason (2006, p.7) life cycle wealth *W(t)* consists of assets A(t) (private savings, funded pensions, etc.), transfer wealth to children $T_k(t)$ (the present value of the current and future costs of childrearing) and pension transfer wealth $T_P(t)$ (the present value of public pension programs such as the pay as you go system, public health care, etc.):

$$W(t) = A(t) + T_k(t) + T_P(t) \tag{10}$$

[5] As described in Lee and Mason (2006, p.10) two methods can be used to solve for the time path of asset accumulation.

The second demographic dividend depends on (a) the share of family transfers to children $\tau_k(t)=T_k(t)/W(t)$ and (b) on how much of the old age consumption is supported by transfers as opposed to assets $\tau(t)=T_P(t)/(A(t)+T_P(t))$ (where $A(t)+T_P(t)$ is denoted as pension wealth). The higher the share of family transfers to children (as opposed to public transfers) the more wealth is required from people for financing consumption of their children. Analogously, if elderly finance a large share of their consumption through asset based reallocation, people need to accumulate more wealth during their active life for the time of retirement.

As argued in Lee and Mason (2006, p. 5) it is important for the macroeconomy "whether that wealth is created by expanding transfer programs or accumulating assets." Only in the latter case will a second demographic dividend materialize. Similar to Lee and Mason (2006) we assume the share of private asset accumulation among family and old age consumption to be exogenously given. In Table 1 we present those two shares by countries together with the age span where the life cycle deficit is negative, i.e. where consumption exceeds income.

Table 1: Age span in which LCD is negative; the share of private transfers in total transfers to children and the share of asset based reallocation in financing the consumption of elderly

Country	Age span in which LCD is negative	Children τ_k	Elderly τ
Finland (2004)	26-59	44	11
Germany (2003)	27-57	63	46
Hungary (2005)	25-58	49	0
Spain (2000)	26-58	69	51
Sweden (2003)	25-62	61	3
Austria (2000)	21-56	57	14
Slovenia (2004)	25-55	65	15
UK (2007)	24-56	72	69

Source: NTA calculations.

The age span of a negative LCD, as well as the reallocation of private resources across generations is quite heterogeneous across the European countries we consider (Table 1). Private transfers to children are lowest in Finland with a share of 44 and highest in UK reaching 72 per cent of the total transfer wealth. On the other end of the life cycle it is again the UK who exhibits the highest share of private transfers with 69 per cent out of the total pension wealth financed through private asset reallocation. Hungary and Sweden are the countries where only a negligible part of the retirement is covered by private pension transfer wealth.

3 Results

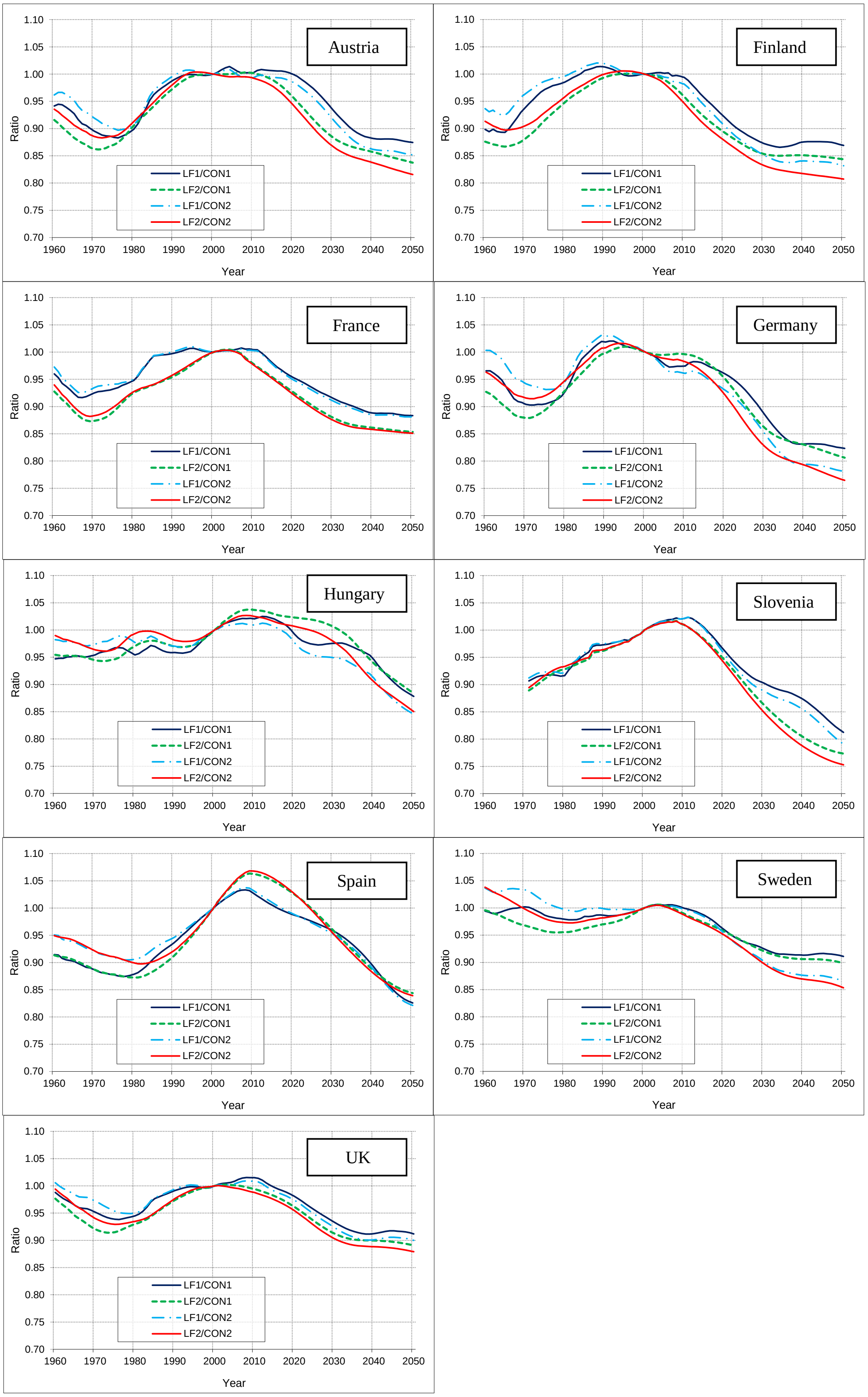
Using the cross sectional age profile of NTA consumption and income together with the recent demographic projections of Eurostat we present results of the support ratio and the first and second demographic dividend for 9(8) European countries.

3.1 Support ratio

Following Cutler et al. (1990) in Figure 5 we present the four variants of the support ratio: *LF1*/*CON1*, *LF2*/*CON2*, *LF1*/*CON2* and *LF2*/*CON1*. The NTA support ratio, *LF2*/*CON2*, which applies the actual NTA labour income and consumption profile by countries, constitutes our preferred measure. However, we also plot *LF1*/*CON1* to show how this widely used indicator – the conventionally defined support ratio – differs from the NTA support ratio. By also presenting the support ratios where only the numerator or denominator are weighted, *LF1*/*CON2* and *LF2*/*CON1*, we aim to separate the contribution of each component. We have chosen 2000 as a reference year for calculating changes in support ratios through time. The improvement or deterioration in the support ratio is therefore expressed relative to the situation in 2000.

For all countries, except Hungary and Sweden (and partly the UK), the support ratio during the last decades did show up a downturn followed by an increase. Obviously this was the consequence of the baby boom generation that was born in the 1960s increasing the denominator of the support ratio through increased consumption needs. Once the baby boom generation entered the labour force and cohorts of lower fertility followed, the support ratio started to increase again. In Hungary the baby boom in the 1950s was followed by a fertility decline during the 1960s, and a further baby boom (an echo from the 1950s) during the 1970s. For Hungary the support ratio did therefore not decline during the 1960s as there were no baby boomers that put pressure on the consumption needs (the denominator of the support ratio). As the baby boomers of the 1950s entered the labour force, a second baby boom in the 1970s put pressure on consumption needs. These two forces neutralize each other and explain why Hungary did not experience a pronounced increase in the support ration as we observe for the other countries. Consequently, the development of the support ratio between 1960 and 2000 is relatively smooth for Hungary. Late and repeated (echo) episodes of high fertility also smooth out the support ratio in Sweden and partially in the UK. Projections up to 2050 indicate that the support ratio will decline in all countries during the next decades as a consequence of the changing age structure and given the current age profiles of effective consumption and labour income. The drop in the support ratio will be strongest for Germany and Slovenia where a decline by almost 25% up to 2050 is projected. France, Hungary, Sweden and the UK are the countries that will experience the lowest drop of the support ratio by 2050 of about 15% compared to 2000. In between are Austria, Finland and Spain.

Figure 5: Four alternative measures of the support ratio (relative to 2000); European NTA countries



Source: EUROSTAT, EUROPOP2008; NTA project, internal data.

With the exception of Spain, the conventional measure of the support ratio that applies fixed age limits ignoring age specific consumption needs and labour input, would underestimate the decline in the support ratio. Moreover the timing of the decline in the support ratio changes when age profiles of consumption and income are taken into account. Hence, in addition to the projected demographic change, the country specific age patterns of consumption and labour income will furthermore depress the support ratio in the coming decades. A comparison of the support ratios LF1/CON2 and LF2/CON1 that alternatively apply weights for age specific consumption or labour indicates the importance of those two profiles. In Finland, Germany, Hungary, Spain and Sweden it is mainly the consumption age profile that intensifies the demographic pressure. For Austria, France, Slovenia, and the UK, the current age specific pattern of effective labour mainly amplifies the demographic burden.

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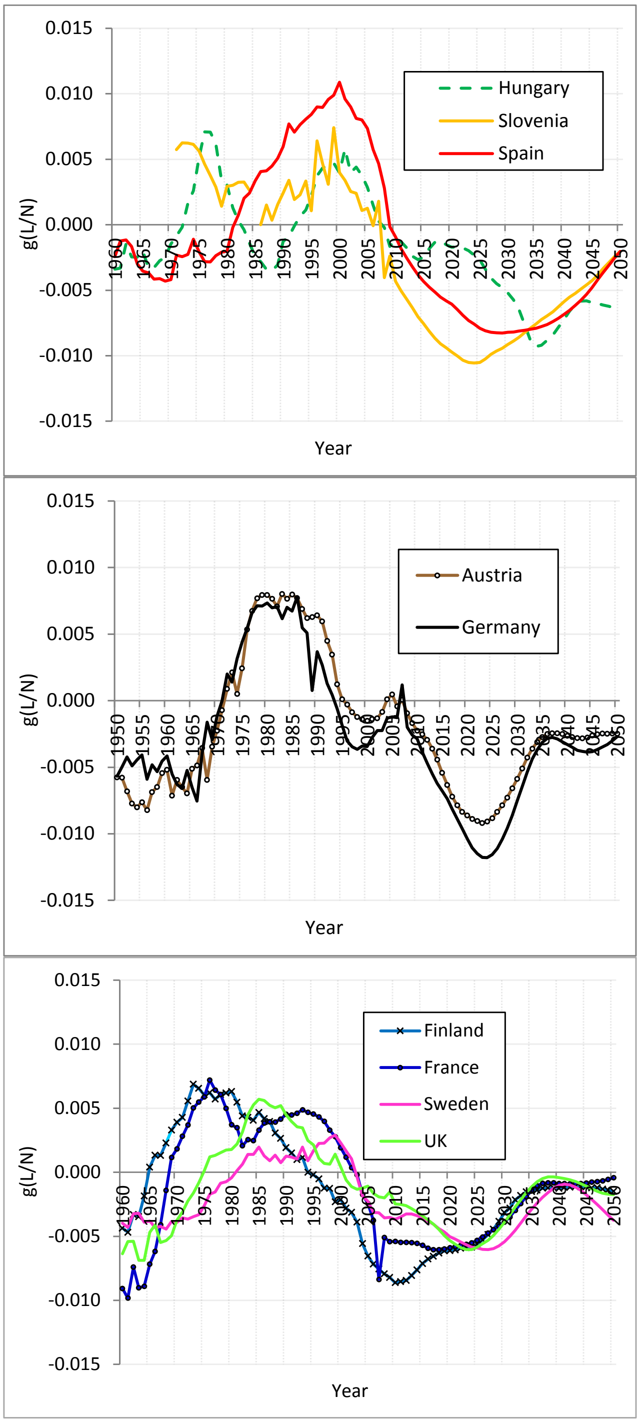
In Figure A1 (Appendix) we present simulations of support ratios for each country where we assume a gradual adjustment (until 2060) of age specific labour income profiles (from the base year given in Figure 2) towards the profile we observe in Sweden in 2003. In particular, we postulate for each age group a linear adjustment between the base year and 2060. For those age groups where individual countries already have higher values of labour income than Sweden (these are mainly the lower age groups), we keep these values. Similar to Figure 5 we present the development of the support ratio relative to the base year 2000. Solid lines indicate these new support ratios while dashed lines refer to the support ratio where we keep the country specific patterns of labour income as in Figure 5.
For all countries, except Germany, the newly calculated support ratios would not decrease by much more than 5 per cent until 2060 compared to 2000. The change in the labour income profile will also postpone the onset of the decline in the support ratio for countries like Slovenia, Spain, Hungary, and Austria by 10 to 20 (in case of Austria) years. Hence, by increasing the labour income profile, the challenge of population ageing would be mitigated and countries would gain time to adjust their welfare policies accordingly. For Finland, France, UK and Germany, the increase in the labour income profile would however not be sufficient to counteract the already ongoing decline in the support ratio during the next years.

3.2 First demographic dividend

In Figure 6 we plot the first demographic dividend, i.e. the annual rate of change of the effective number of workers minus the effective number of consumers (the rate of change of the NTA support ratio, *LF2*/*CON2*, as given in Figure 5 above) for all European NTA countries. We present the results for high-fertility countries as well as German-speaking countries, separately. All countries show up pronounced fluctuations of the first demographic dividend. During the 1950s and 1960s, the birth of the baby boom generation together with the small cohorts being born during and after the second world war, induced a negative first demographic dividend. Starting in the early 1970s when the baby boom generation entered the labour force and small cohorts of children followed, the first demographic dividend became positive for most countries, except for Sweden and Spain where it turned positive only by the early 1980s.

For Hungary the pattern is quite diverse with a short period of a positive first demographic dividend during the 1970s and becoming negative again in the early 1980s before getting positive again in the early 1990s. Slovenia is also specific, showing a positive first demographic dividend up to 2005.[6]

Figure 6: First demographic dividends by European NTA countries



Source: EUROSTAT, EUROPOP2008; NTA project, internal data.

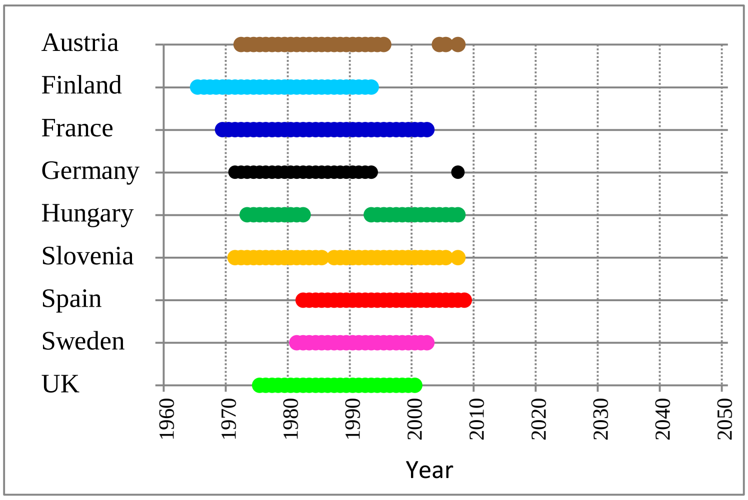
By the end of the 1990s/beginning of the 2000s, the first demographic dividend turned negative for all countries. Higher consumption needs of the ageing baby boom generation, the

[6] In Slovenian the high variation of the first demographic dividend for the past period is partly due to data problems. We therefore removed the 'spike' in 1985 from Figure 6.

moving up of the small birth cohorts in the 1990s into the labour market and the retirement of the baby boom generation in the near future will result in a negative first demographic dividend also during the next decades. In terms of the quantitative extend, Sweden has experienced the smallest and Spain the strongest first demographic dividend.

In Figure 7 we summarize the results plotting the time window for which the first demographic dividend is positive. Though there is an obvious variation in the beginning and end of the first demographic dividend across Europe as well as in its length and quantitative extend, Figure 7 also indicates that in the next four decades all countries have to face a negative demographic dividend.

Figure 7: Years, in which the first demographic dividend was positive; European NTA countries



Note: For Slovenia only the data from year 1971 on are availabe, the absence of the line in the period 1960-1970 does not imply a negative nor positive first demographic dividend.
Source: Figure 7.

3.3 Second demographic dividend

For the subsequent simulations we applied the program used also in Mason & Lee (2007b) fixing the parameters as summarized in Table 1 (section 2.5) and assuming a discount rate of 3%, an interest rate of 6% and technological growth of 1.5% (all measured as annual growth rates). All simulations are based on the time horizon from 2010 to 2300. In Figure 8 we present results only for the time period 2010 to 2050.[7]

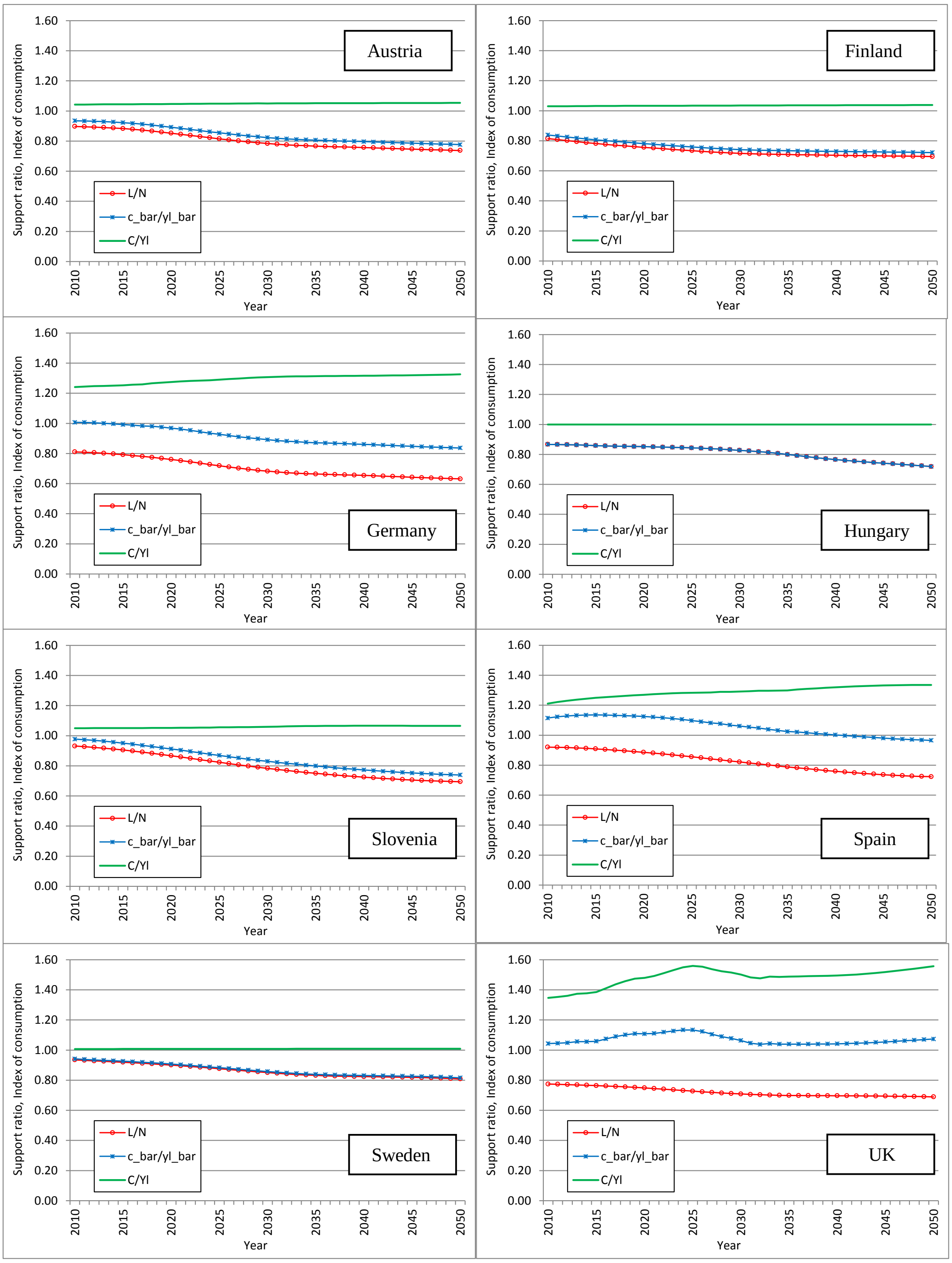
For each country we present 2 panels. In the first panel (a) we plot the time series of the level of the consumption index, as given by the ratio $(C/Y)/(Y/L)$, together with the support ratio

[7] For France, the required data about the private and public transfers are not available, therefore we could not calculate the second demographic dividend.

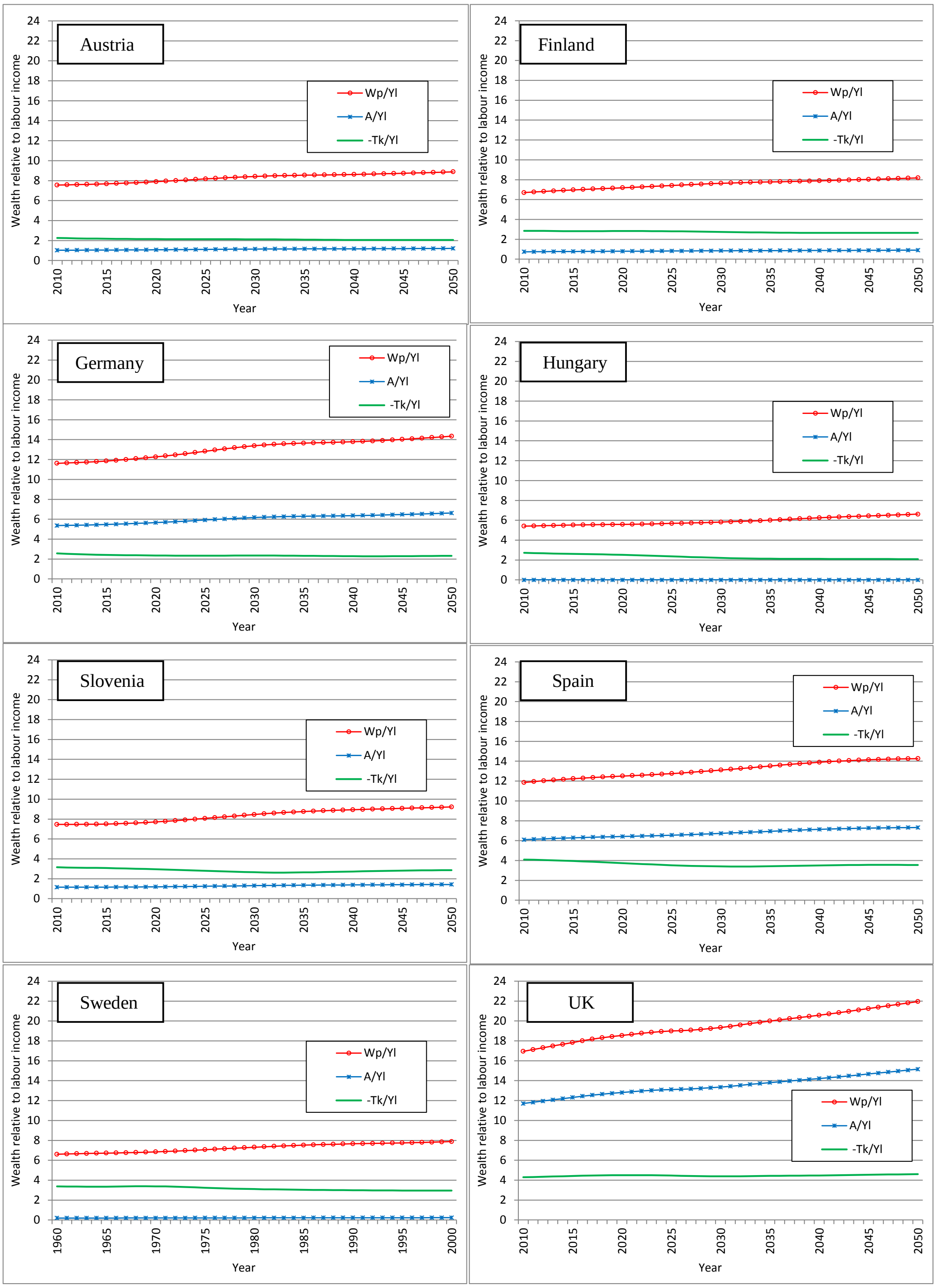
L/*N* and the share of consumption in total income C/*Y*. We always base the calculation of C and Y on the effective number of consumers and effective number of producers respectively. In the second panel (b) we plot the underlying asset accumulation that generates the time series of wealth.

Figure 8: Components of consumption per capita and wealth flows; European NTA countries

Panel (a)



Panel (b)

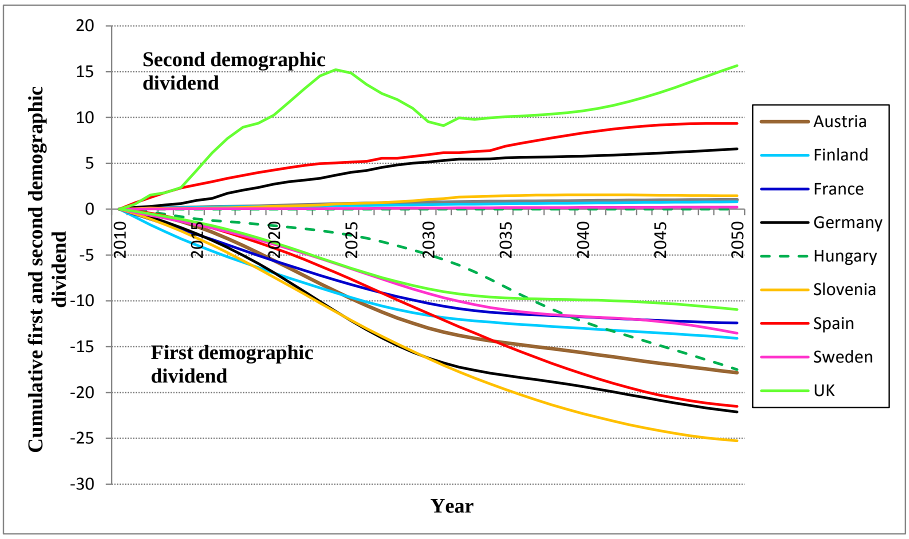


For most countries the level of the consumption index is proportional to the level of the support ratio (panel (a)) implying a negligible increase in the level of consumption to income (C/Y). Only for Germany, Spain and the UK, the growth rate of the consumption index exceeds the growth rate of the support ratio pointing towards the potential for a second demographic dividend. For Germany the first demographic dividend turns negative around the beginning of the 1990s and this is also the time when the second demographic dividend becomes positive. For Spain, the second demographic dividend sets in already during the late 1980s, a time when the first demographic dividend in Spain is still positive. While the first demographic dividend turns negative starting by the end of the first decade of the 21st century, the second demographic dividend stays positive though at a lower value compared to the time when both dividends were positive. The UK shows up the largest second demographic dividend (starting from around 2008) among all our countries. Especially during the next decade (2012-2022) when the first demographic dividend is negative, the second demographic dividend will be highest.

Transfer wealth to children has decreased in all countries (Panel b in Figure 8) and will continue to decrease. At the same time pension transfer wealth continuously increases over time. However, the increase in pension transfer wealth has not resulted in a corresponding increase of asset accumulation in most countries except for Germany, Spain and the UK.

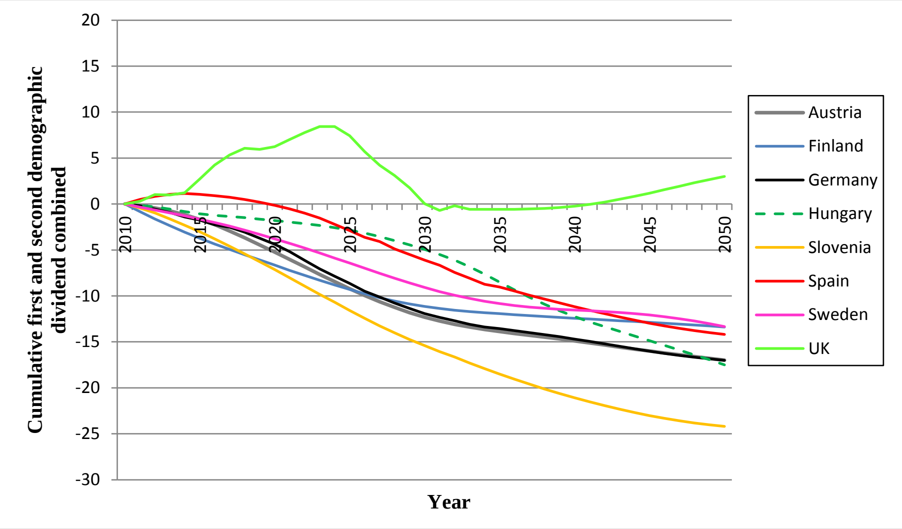
In Figure 9a we present the cumulative effect of the first and second demographic dividend on per capita consumption starting from 2010 onwards. The net effect of both dividends, i.e. the sum of both dividends is given in Figure 9b. For all countries the first demographic dividend has turned negative and will continue to drop. In the medium term (until around 2020) the difference across countries is in the order of 5 percentage points but increases up to 15 percentage points in the year 2050.

Figure 9a: Cumulative effect of the first (negative values) and second (positive values or zero) demographic dividend on economic growth in 2010-2060 period for European NTA countries



Source: EUROSTAT, EUROPOP2008; NTA project, internal data.

Figure 2b: Cumulative effect of both demographic dividends combined on economic growth in 2010-2060 period by European NTA countries



Source: EUROSTAT, EUROPOP2008; NTA project, internal data.

For countries like Slovenia, Germany and Spain it will become increasingly difficult – given the current age profiles of consumption and labour – to counteract the negative first demographic dividend. Indeed as Figure 9b shows, though Spain and Germany experience a second demographic dividend in the coming decades, it will not be sufficient to countervail the decline in the first demographic dividend. The situation is most severe in Slovenia where also the second demographic dividend is almost negligible. Only in the UK will the second demographic dividend help to allow for a growth in the consumption index (which is given by the sum of the first and second demographic dividend) since it will overturn the negative first demographic dividend. In all other countries the second demographic dividend will only dampen the first demographic dividend.

4 Conclusions and Discussion

In this paper we have applied recent age profiles of economic activity (consumption and income) as estimated in the National Transfer Accounts (NTA) project to forecast the role of a changing age structure on the allocation of resources across ages. Instead of using fixed age specific limits for consumption and labour income, the application of single years of age specific economic activities take into account the variation of economic life cycles across countries. Hence, the dependent versus active population is defined by the observed data and not by fixed age limits as usually done in demographic dependency ratios.

First we have applied age profiles of labour income and consumption for European NTA countries to improve the widely used indicator of the support ratio. Instead of using arbitrary defined weights and age groups we applied detailed one year specific age profiles of actual production and consumption. The difference between this 'NTA support ratio' and the conventional support ratio turned out to be substantial for the European countries we have analysed. In general, the NTA support ratio projects a greater decline as compared to the conventional support ratio for the coming decades. Germany and Slovenia are the countries with the strongest drop in the support ratio. Low labour force participation together with population aging explains these results.

The growth rate of the support ratio, the first demographic dividend, is shown to be negative for the next five decades in all countries we considered. The cumulative effect is projected to be in the range of -11% for UK down to -28% for Slovenia. Though population ageing could induce a second demographic dividend, this opportunity is almost negligible except for the UK, Germany and Spain. So far, the opportunity of a second demographic dividend does not exist in most parts of Europe since consumption of the elderly is predominantly financed through public transfers. There is not much incentive to accumulate assets for financing consumption for elderly.

When interpreting the results we have to bear in mind that the NTA age profiles rest on the data from one year only. Results can be distorted due to specific situations or events in that particular year. Since the base year to which the cross sectional profiles of consumption and income refer to differ among our countries this problem is even more relevant – countries can be in different phases of the business cycle, for example.

Furthermore it needs to be emphasized that our simulations are based on constant age profiles of consumption and labour income. Constructing actual age profiles for individual years in the past and projecting changes into the future would improve the realism of our simulations. Although historical NTA have already been constructed for some countries, this is a challenging task for future research.

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Appendix

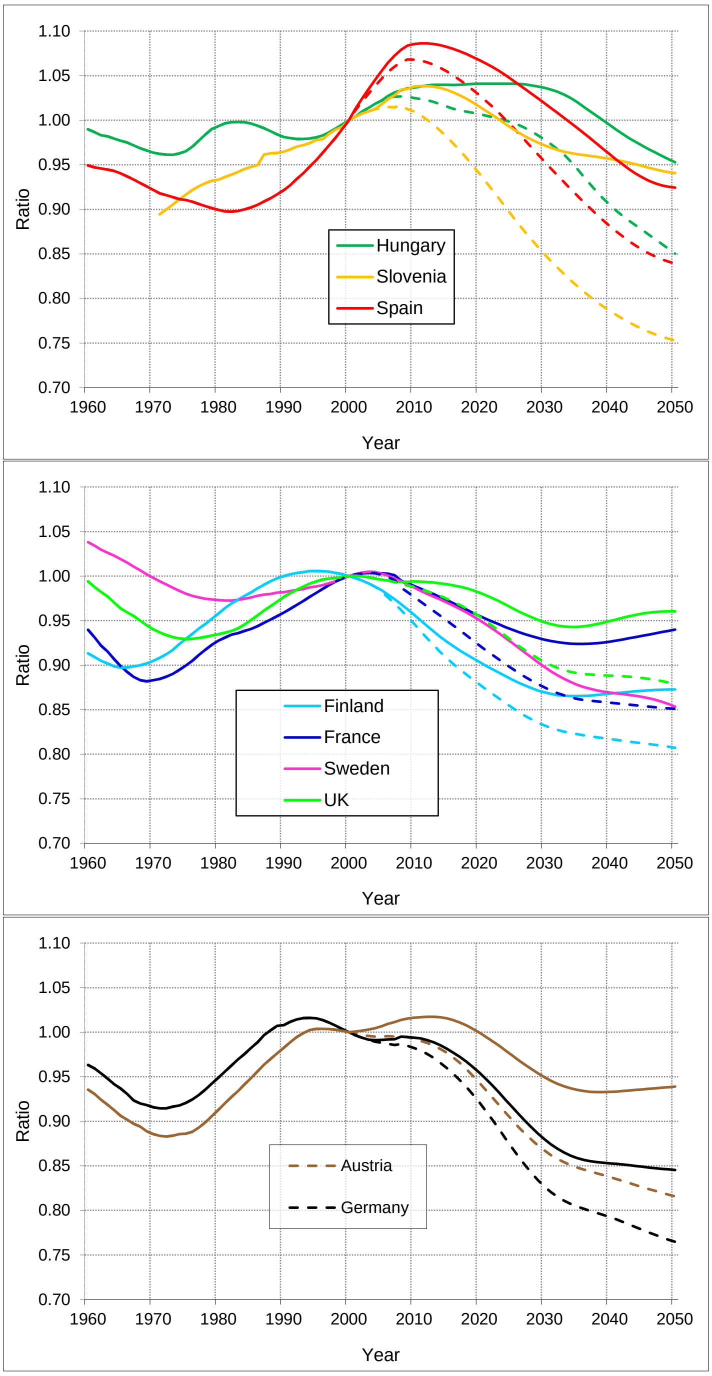
Table A1: Age structure of the population in European NTA countries in selected years (actual data for 1960-2000 and projections for 2010-2060); in percentages

	Age group	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050
Austria	0-19	30.1	31.0	29.3	24.4	23.2	20.8	18.9	18.6	18.2	18.0
	20-64	57.8	55.0	55.2	60.7	61.4	61.5	61.4	57.3	54.1	53.7
	65+	12.1	14.0	15.5	14.9	15.4	17.6	19.8	24.1	27.6	28.4
Finland	0-19	38.4	34.3	28.5	25.4	24.7	22.9	22.2	22.2	21.6	21.4
	20-64	54.4	56.7	59.6	61.3	60.5	60.1	55.8	52.8	53.0	52.6
	65+	7.2	9.0	11.9	13.3	14.8	17.0	22.1	25.0	25.5	26.0
France	0-19	32.3	33.2	30.6	27.8	25.6	24.7	24.1	23.3	22.5	22.3
	20-64	56.1	54.1	55.4	58.3	58.4	58.7	55.7	53.5	51.9	51.6
	65+	11.6	12.8	14.0	13.9	16.0	16.6	20.2	23.2	25.6	26.0
Germany	0-19	28.4	30.0	26.8	21.7	21.1	18.8	17.2	16.9	16.6	16.5
	20-64	60.1	56.3	57.8	63.4	62.2	60.6	59.7	55.0	51.7	51.2
	65+	11.5	13.7	15.4	14.9	16.6	20.6	23.0	28.1	31.7	32.3
Hungary	0-19	33.0	30.0	27.9	27.9	23.6	20.8	19.4	18.4	17.2	16.9
	20-64	58.1	58.6	58.5	58.8	61.4	62.6	60.9	59.9	58.0	53.9
	65+	8.9	11.5	13.5	13.3	15.0	16.6	19.7	21.8	24.8	29.2
Slovenia	0-19		33.0*	30.9	28.2	23.2	19.2	19.6	19.0	17.6	18.3
	20-64		57.1*	57.7	61.3	62.9	64.3	60.6	56.8	54.9	51.1
	65+		9.9*	11.4	10.6	13.9	16.5	19.8	24.2	27.5	30.6
Spain	0-19	35.5	35.7	34.8	28.8	21.5	19.8	20.0	18.0	17.1	17.6
	20-64	56.4	54.7	54.2	57.7	61.7	63.3	60.9	59.1	55.1	50.9
	65+	8.1	9.6	11.1	13.5	16.8	16.8	19.1	22.8	27.8	31.5
Sweden	0-19	30.2	27.8	26.5	24.5	24.2	23.4	23.2	23.5	22.5	22.2
	20-64	58.2	58.6	57.3	57.7	58.5	58.5	56.2	54.1	53.4	53.3
	65+	11.7	13.5	16.2	17.8	17.3	18.1	20.6	22.3	24.0	24.5
UK	0-19	30.1	31.0	29.5	25.9	25.3	23.8	23.5	23.8	23.1	22.9
	20-64	58.2	56.1	55.7	58.4	58.9	59.8	57.8	55.0	53.7	53.7
	65+	11.7	12.9	14.9	15.7	15.8	16.4	18.7	21.2	23.2	23.4

* The data are for 1971

Source: Human mortality database; Eurostat, EUROPOP2010; National statistical offices (Germany, Slovenia).

Figure A2:


1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
0.70
Ratio
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
Year
Hungary
Slovenia
Spain
Finland
France
Sweden
UK
Austria
Germany