



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

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The Welfare State and the demographic dividend: A cross-country comparison

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Abstract

The sustainability of the welfare state is in doubt in many developed countries due to population aging. The extent of the problem and the margin for reforms depend crucially on the size of both the aging process and the public transfer system. We wish to contribute to the debate on the effects of Demographics on economic growth, trying to decompose the different factors driving demographic dividends. We develop a general equilibrium Overlapping Generations (OLG) model with realistic demography and realistic public transfers from the National Transfer Accounts database. We look at the evolution of the general equilibrium support ratio, investigating the impact of different configurations of welfare state – Sweden, US and Spain. At the beginning of population transition purely demographic support ratio grows and this positive effect is extended by the composition changes in the age structure of workers. Once this first demographic dividend vanishes, the second one arises. The total net effect varies depending on the strength of the aging process and the size of the welfare transfer system. In the three countries analyzed, a sizable increase in savings and capital is observed while the baby boomers are saving. Nevertheless, the second demographic dividend has some permanent effects in the US and Sweden, while it is temporary in Spain. Our results are driven by the modeling strategy. Further research is needed in order to investigate the interplay between public and private transfers and capital accumulation in the presence of demographic changes.

Keywords

ageing, demographic dividend, intergenerational transfers, national transfer accounts, overlapping generations models, welfare state

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Contents

1	Introduction.....	4
2	Measuring the demographic dividend: Concepts and methods	5
3	The NTA data set and the welfare state models	11
4	The second demographic dividend in general equilibrium: The effect of transfers	17
5	Final remarks.....	39
6	Bibliography	42

1 Introduction

The sustainability of the welfare state is in doubt in many developed countries due to the drastic population ageing process. The negative impact of this demographic process on the welfare state not only depends on the speed of change in the population age structure (Mason, Lee and Miller, 2001), but also on the size and age structure of the transfer system. Indeed, the transfer system plays a crucial role in the extent to which the first demographic dividend – an increase in the growth rate of income per capita due to the higher ratio of workers to consumers at the early stages of the demographic change - will turn into a permanent second demographic dividend – an increase in the growth rate of income per capita due to higher savings and capital at the late stages of the ageing process.

So far, several methods have been employed to measure these dividends. The recent literature has shown that computable general equilibrium models with overlapping generations (OLG) can give the same results concerning the size of the first demographic dividend as those of the convergence models (Sanchez-Romero, 2013; Williamson, 2013). An important characteristic of OLG models is that they explicitly consider savings and capital accumulation, which are crucial variables for the second demographic dividend, as endogenous, providing an important tool to obtain a better understanding of the interplay between demographics, economics and intergenerational transfers. The analysis of intergenerational transfers is in itself an interdisciplinary issue. In fact, the need for the government to intervene in private intergenerational transfers has not yet been fully resolved in the economic literature, as it crucially depends on the motivations of private transfers. The complexity of this issue involves several levels. Besides the difficulties of analyzing an interdisciplinary issue, there is a lack of longitudinal micro and macro data, preventing a thorough analysis.

In this article we implement a general equilibrium overlapping generations model (OLG) with realistic demography, following Bommier and Lee (2003) and Sanchez-Romero et al. (2013). Data on transfers come from the National Transfer Accounts Project, which has developed a methodology – currently

applied to more than 40 countries — to measure how resources are redistributed across age groups through either private transfers, public transfers, or the market¹. In particular, we extract from the NTA data set the size and age pattern of the welfare state transfers of three countries representative of three different welfare state models – Sweden, United States and Spain - and simulate the impact of these transfers on savings and capital accumulation in each country, deriving counterfactual scenarios.

Moreover, we study the marginal impact on the second demographic dividend that would result in each country if the welfare regime of the other two countries were implemented. Our contribution to the existing literature stems mainly from the fact that consumption and saving are endogenously determined in a general equilibrium framework which, in turn, influences production factor prices. In this setting, we decompose the demographic dividend into several components, reflecting the role of demography and the labor market and the impact of capital accumulation on the growth rate of income per capita.

The paper is organized as follows. Section 2 revises the different concepts and methods developed to measure the demographic dividend. Section 3 describes the content of the National Transfer Accounts data set, in order to use these estimates to analyze the structure of the welfare state transfers. Section 4 contains the analysis, describing both the model and results, ending with the decomposition of the demographic dividend. Finally, section 5 is devoted to final remarks.

2 Measuring the demographic dividend: Concepts and methods

In this Section, we outline the different concepts and methods employed to obtain empirical estimates of the so-called demographic dividend. The question of how economic growth can be affected by demographic changes has been a

¹ See www.ntaccounts.org and Lee and Mason (2011) for the results of the first 20 countries involved in the project and UN (2013) for details on the methodology.

subject of investigation in recent decades. The concept of demographic dividend arose from Bloom and Williamson's (1998) analysis of the relationship between population age structure and economic growth. Starting from the following breakdown of the income per capita at year t :²

$$\frac{Y(t)}{N(t)} = \frac{L(t)}{N(t)} \frac{Y(t)}{L(t)} \quad [2.1]$$

where Y stands for income, N is total population and L is working population, one can observe that income per capita (a measure of economic growth) depends both on the so-called support ratio (SR , proportion of working population with respect to total population) and productivity (l , income per potential worker). Using logarithms and differentiating with respect to time, we can obtain Eq. [2.1] in growth rates (g):

$$g\left(\frac{Y}{N}\right) = g(SR) + g(l) \quad [2.2]$$

Eq. [2.2] implies that the evolution of income per capita depends on both the demographic support ratio and the productivity growth rate. The most direct impact of demographics is captured by the first term on the right-hand side of the Equation. This was first analyzed by Bloom and Williamson (1998).

Mason (2005) and Mason and Lee (2006) distinguish between the so-called first and second demographic dividend. The first is defined as the growth rate of the Support Ratio, obtained in a slightly different manner. Specifically, they transform total population (N) into the number of effective consumers (C). In fact, they obtain both the numerator and the denominator by weighting demographic variables with the consumption and labor income age profiles estimated in National Transfer Accounts. In this way, total population (N) is transformed into the number of effective consumers (N^*), while working population (L) is estimated in terms of effective producers (L^*):³

² See also Williamson (2013) for a thorough literature review on the demographic dividend.

³ As we will see later, working population L can be measured in different ways.

$$N'(t) = \sum_x N(x, t) \cdot \theta(x) \quad [2.3]$$

$$L'(t) = \sum_x N(x, t) \cdot \rho(x) \quad [2.4]$$

The number of effective consumers is obtained adding up the product of the population size (N) and the age-specific coefficient (θ), capturing the differences in consumption, at each age (x). Similarly, effective producers are obtained by weighting the population at each age by an age-specific coefficient (ρ), capturing variations in productivity related to age. Therefore, the demographic support ratio (SR) is transformed into an economic support ratio (SR^E), by taking into account not only pure demographic effects of population age structure, but also its effects in terms of consumption and labor income.⁴

The first demographic dividend is positive when effective producers grow more than effective consumers. This is what happens when, because of a previous fertility decline, workers are raising fewer children, while old dependents are still less numerous because life expectancy has not yet grown. However, at a later stage of the demographic transition, low fertility reduces working age population, while gains in life expectancy increase the number of elderly dependents, so the first dividend becomes negative. Estimations of the first dividend are available for many countries (Mason, 2005; Mason and Lee, 2006; Prskawetz and Sambt, 2014), showing that it has different starting points and duration depending on demographic characteristics. In many industrialized countries, for example, it started in 1970 and lasted about 30 years. For Spain, as the baby boom started with a certain delay, the first demographic dividend was positive between 1982 and 2009 (Patxot et al., 2011).⁵

However, we should take into account that the support ratio is not the only factor affecting the evolution of per capita income, since demography may

⁴ Cutler et al. (1990) proposed a similar measure. In fact, they obtained four ratios combining the economic and demographic numerators and denominators.

⁵ Given the lack of data, the consumption and labor income profiles are usually taken from a base year and kept constant, which limits the explanatory power of the procedure.

induce changes in productivity. Lee et al. (2000) introduced the concept of second demographic dividend, which operates through the productivity growth rate, by inducing the accumulation of wealth and, hence, capital. When the first dividend ends, the challenge of providing consumption for an increasing proportion of older people (also with longer life) arises. Lee et al. (2000) argue that this leads to an increase in the demand for life cycle wealth at old age.⁶ This second dividend depends crucially on the behavior of consumers and policymakers. Life cycle wealth at old age can be allocated mainly through two different resource allocation mechanisms: increasing saving rates and accumulating wealth and capital (of course this should start much earlier than first dividend ends) or using pay-as-you-go (PAYGO) transfer systems (both public and/or private). Capital accumulation and transfers are similar as both reallocate resources across ages. However, the effects on economic growth might be different, also depending on agent's preferences regarding altruism. Policies promoting capital accumulation are more likely to yield a second demographic dividend (See Lee, Mason and Miller, 2003, for US and Taiwan). Interestingly, while the first demographic dividend is transitory, the second one could be permanent if capital per capita remains at a higher level. In order to estimate the second demographic dividend, Mason (2005) computes the life cycle wealth growth, life cycle wealth in year t being the difference between net present value of future consumption and future labor income. This is done in a partial equilibrium setting, stressing the importance of life cycle savings and ignoring other reasons such as uncertainty and bequests.⁷

Moreover, the fact that the demographic transition is often coupled with an educational transition introduces an additional factor that may affect the estimates of the influence of demography on income per capita. Recent studies

⁶ See also Kelley and Schmidt (2005), who distinguished a "translations component" and a "productivity component". The former, similar to the first demographic dividend, captures the effect of variations of the proportion of working-age population with respect to total population. The authors use the working hours in the breakdown instead of the total working age population. The latter, the productivity component, collects the effect of demographics on output per worker (the second term on the right-hand side in Eq. [2.2]).

⁷ In order to obtain life cycle wealth, age profiles of consumption and labor income are used.

by Lutz et al. (2008) and Crespo-Cuaresma et al. (2014) suggest a greater role of educational attainment on economic growth. By developing a growth regression model using a global panel of 105 countries, Crespo-Cuaresma et al. (2014) found that improvements in educational level are the key factor explaining per capita income growth, while no evidence exists that changes in population age structure affect productivity. Interestingly, the effect of education on the demographic dividend acts through changes in productivity, the second term in Equation [2.1], but it tends to be contemporaneous to the first demographic dividend.

An alternative approach to this kind of econometric analysis is to derive simulations using realistic demography general equilibrium Overlapping Generations Models (OLG) to evaluate the relative weight of factors affecting the demographic dividend. The main advantage of these models is the possibility of deriving experiments to break down the impact of different factors, taking into account the possible behavioral reactions. Results of empirical OLG models have not always gone in the same direction. Some studies did not find a significant effect of demography on the national saving rate (Chen et al. 2006, 2007, for Japan), while others found a small effect of demography on economic growth becoming progressively more important with ageing (Braun et al., 2009, also for Japan).⁸ Recently Sanchez-Romero (2013), using an OLG model with realistic demography for Taiwan, found two interesting conclusions. First, the effect of demography on economic growth has been underestimated in previous OLG models due to the lack of realistic demographic data. In particular, he concludes that it is necessary to use demographic data at least one generation before the period analyzed. Second, he finds that results of OLG models become similar to those obtained using growth regression models when realistic demography is incorporated into the analysis.

⁸ Moreover, Lee et al. (2000, 2001) also found a significant effect of demography on Taiwan's saving rate, using a dynamic simulation model based on the life cycle theory in partial equilibrium. The interest rate is assumed to be constant (and hence the way that demography affects productivity), while it was endogenous in the abovementioned studies.

There is a myriad of alternative models analyzing this topic, but all methods have their drawbacks. On the one hand, simulations derived using OLG models are just a stylized representation of the economy, their main advantage being the possibility to analyze the interplay between different factors in an isolated way. On the other hand, as has been well documented, growth regressions may be subject to the important drawback of potential endogeneity in some regressors. Panel data models have been commonly used in the literature to deal with endogeneity problems in this context (Feyrer, 2007; Crespo-Cuaresma et al., 2014). This method allows use of lags of the endogenous variable as instruments. This technique does, however, have to be carefully implemented. It is notorious that empirical results can be greatly affected by the choice and number of instruments used to tackle the endogeneity problem. Moreover, in a panel data context where instruments can be easily constructed using lags, it is known that a large instrument set typically arises in the Generalized Method of Moments (GMM) estimation of these models (e.g. Arellano and Bond, 1991). In this sense, it has been argued that it is not good practice to use the whole set of available instruments (e.g. see Roodman, 2009). Consequently, there are no clear guidelines to choose among models with different sets of identifying restrictions.

In this paper, we employ a large-scale computable OLG model with realistic demography, taking one more step to investigate the effect of different configurations of the welfare state on the second demographic dividend. The reason for using an OLG model stems from the fact that the accumulation of capital is expected to be influenced by behavioral changes due to the longer life expectancy after retirement and the way consumption is financed. Therefore, we analyze below the structure of different configurations of welfare state transfers – in Sweden, Spain and the United States – on savings and capital accumulation.

3 The NTA data set and the welfare state models

In this section, we briefly describe the content of the National Transfer Accounts⁹ data set, in order to use these estimates to analyze the structure of the welfare state transfers in selected countries. NTA estimates the flows of resources moving among age groups in an economy in a given year, consistently with National Accounts (NA). The age profiles obtained inform about how resources are transferred across generations through family transfers, public sector reallocations and capital markets.

NTA starts from the following transformation of the NA identity:

$$YL + YA + TG^+ + TF^+ = C + S + TG^- + TF^- \quad [3.1]$$

Where YL is labor income, YA is asset income, C is consumption, S is saving and TG and TF represent public and private transfers, respectively, inflows being (+) and outflows (-).¹⁰ The left-hand side in Equation [3.1] represents income sources (income and received transfers), while the right-hand side represents its uses (consumption, saving and paid transfers). This expression holds both for the whole economy and for each age group in particular. Rearranging, we can obtain the main identity of NTA:

$$C - YL = (TG^+ - TG^-) + (TF^+ - TF^-) + (YA - S) \quad [3.2]$$

The left-hand side of Equation [3.2] represents the so-called Life Cycle Deficit (LCD), which measures the excess of consumption – both public and private – over labor income. LCD can be positive or negative for each age group. In general, the age consumption profile is mostly flat – for some countries increasing in old age – while labor income is concentrated at working ages. Hence, a deficit should be expected for children and the elderly, while it will be a surplus during a good part of the working period. In any case, LCD should be

⁹ For a good compilation of the NTA methods and first results obtained, see Lee and Mason (2011).

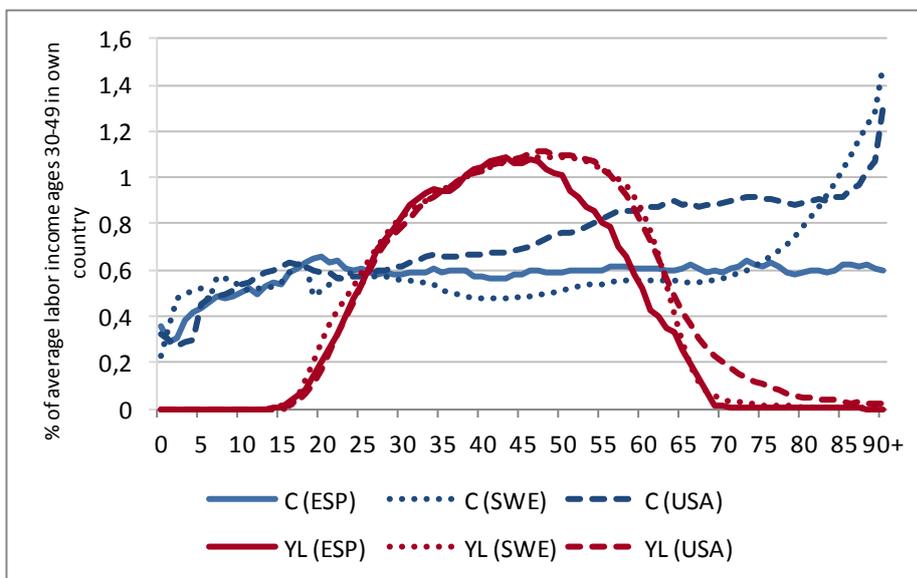
¹⁰ Private transfers are not visible in national accounts except for the aggregate immigrant remittances, but they are estimated from microeconomic data sets.

financed through three possible ways as expressed in the right-hand side of Equation [3.2]: public transfers (TG), private transfers (TF) or asset-based reallocations (ABR), that is:

$$LCD = TG + TF + ABR \tag{3.3}$$

At present, the complete set of National Transfer Accounts is publicly available for at least one year in 17 countries worldwide.¹¹ Moreover, many other countries have partial estimations of the NTA profiles.

Figure 3.1 Consumption and labor income per capita profile in Spain, Sweden and the USA



Note: Available NTA data for USA and Sweden refer to 2003, while data for Spain refer to 2000. Source: Authors' elaboration using NTA data (<http://www.ntaccounts.org>.)

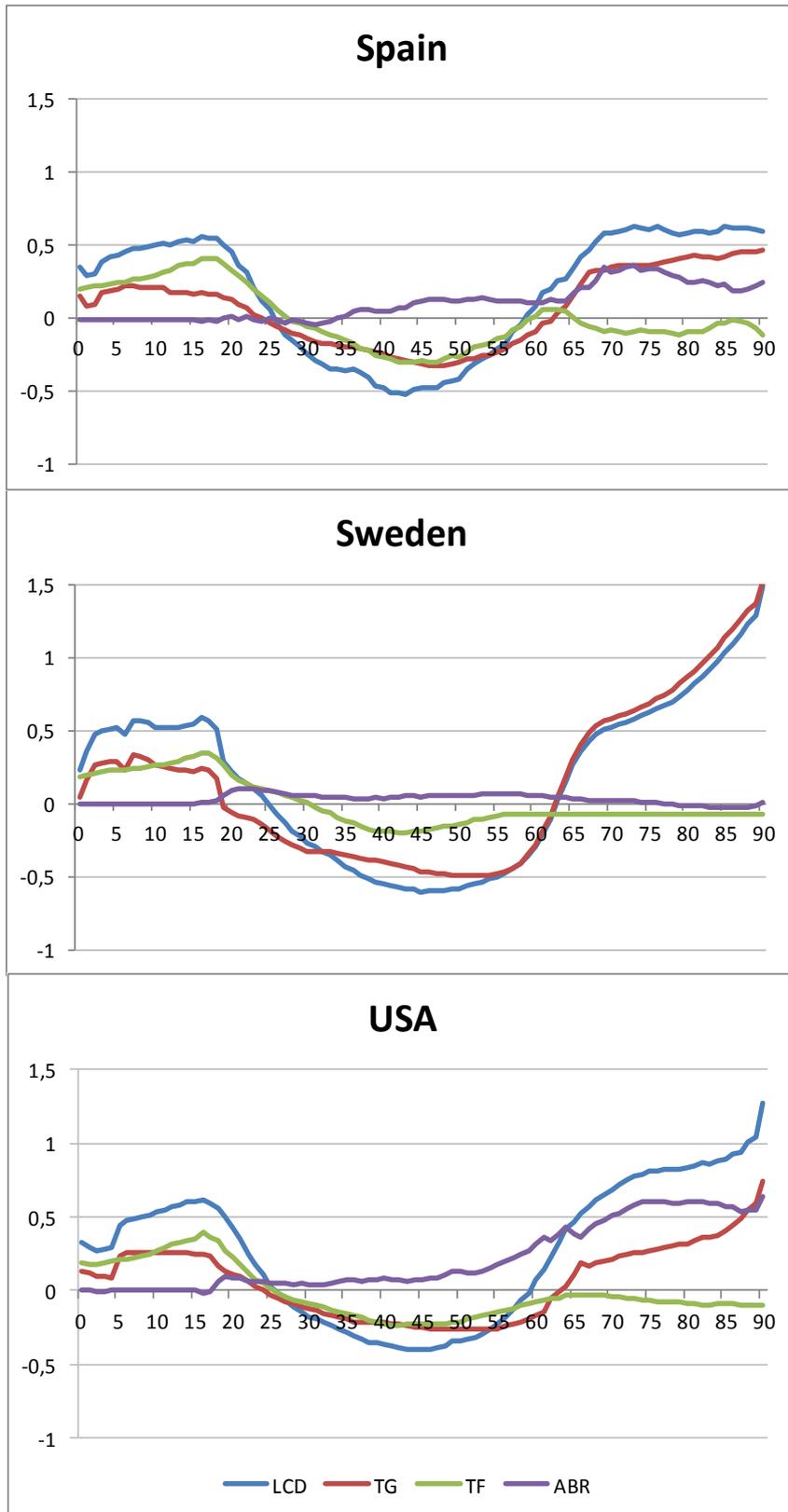
Figure 3.1 shows the per capita LCD profile – broken down into consumption and labor income as on the left hand side of Eq. [3.2] – for three selected countries: Spain, Sweden and the USA. Certain remarkable differences can be observed. Both consumption and labor income are normalized using the average labor

¹¹ Data are publicly available in <http://www.ntaccounts.org>. Data for this study were retrieved in September 2014 for Spain, Sweden and the United States.

income for ages 30-49 in each country, as is usually carried out in NTA for easy comparison. First, the consumption age profile is quite stable over the life cycle in the case of Spain, while for USA and especially Sweden a sharp increase takes place during old age. Second, regarding the labor income profile, Sweden and USA present higher levels than Spain after age 45 and, interestingly, USA presents a delayed retirement age.

Figure 3.2 shows the four age per capita profiles present in Equation [3.3] for three selected countries: Spain, Sweden and the USA. As can be observed, in the three cases *LCD* is positive during most of the working age period (26-58 for Spain, 26-62 for Sweden and 26-59 for the USA), while a deficit occurs before and after. The *LCD* of the young is mainly financed through private transfers (family). Public transfers also play a relevant role, mainly due to public education. On the contrary, asset-based reallocations are practically non-existent. By contrast, private transfers are negative for the elderly, implying that they give money back to their offspring, and finance their consumption needs through public transfers and asset-based reallocations (in this order). It is worth mentioning certain differences observed among the three countries. First, the *LCD* profile is almost constant for the elderly in Spain, while it is clearly increasing with age in the USA, but especially in Sweden. Second, the increase in the *LCD* of the elderly is mainly driven by public transfers. Finally, the role of asset-based reallocations to finance consumption during old age is very important in the USA (*ABR* are higher than *TG*), quite important in Spain (*ABR* are equal to *TG* until age 75 and lower after), but practically non-existent in the case of Sweden. This is because, in Sweden, consumption after age 65 is financed exclusively through public transfers.

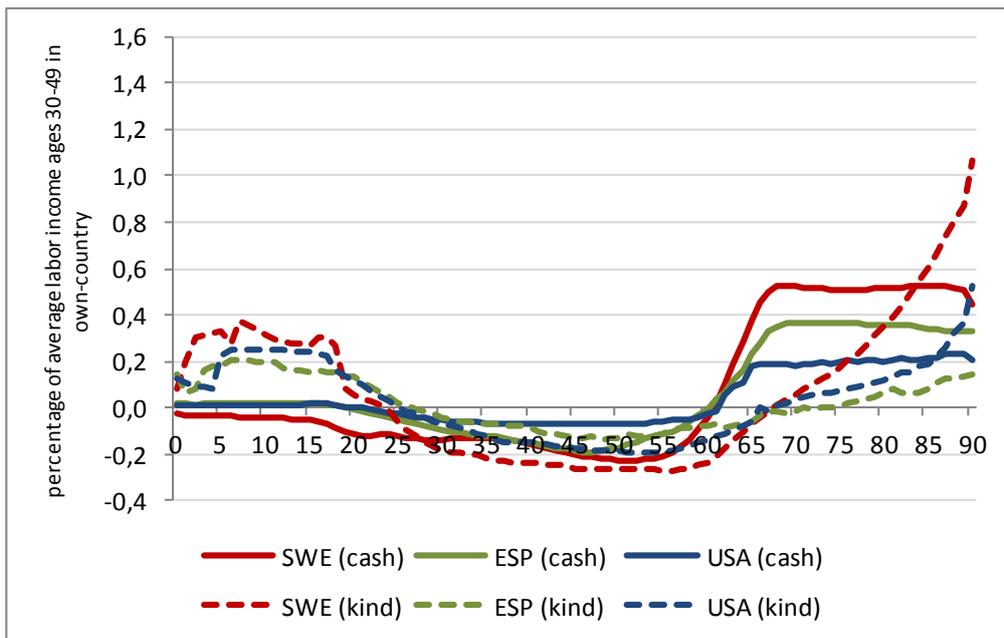
Figure 3.2 Life cycle deficit financing in Spain, Sweden and the USA



Source: Authors' elaboration using NTA data (<http://www.ntaccounts.org>)

The importance of each of these financing devices depends, in the end, on the level of public transfers. Figure 3.3 further distinguishes the public transfer profiles by in-cash and in-kind for the three countries considered. It confirms no big differences in public transfers to the young, but shows large discrepancies both at working ages and especially for the elderly. In Sweden, people start to pay more than they receive (negative *TG*) before age 20, while in Spain and the USA this age is close to 25. Moreover, the amount of taxes paid (negative *TG*) is considerably bigger in Sweden. In-cash transfers for the elderly (mostly pensions) start in the three countries at the same age (around 62). The level of benefits increases until 65 and remains quite stable from there, but it is considerably higher in Sweden, while Spain has the lowest net benefits. In Sweden, the dramatic increase in public transfers after age 75 is driven by the in-kind public programs (health and long-term care), while the in-cash benefits remain practically constant throughout old age. Also in the USA, an important increase in the in-kind public transfers is observed from age 85, but much more moderate than in Sweden. On the contrary, the in-kind public transfer profile in Spain hardly increases and never surpasses the in-cash transfer profile.

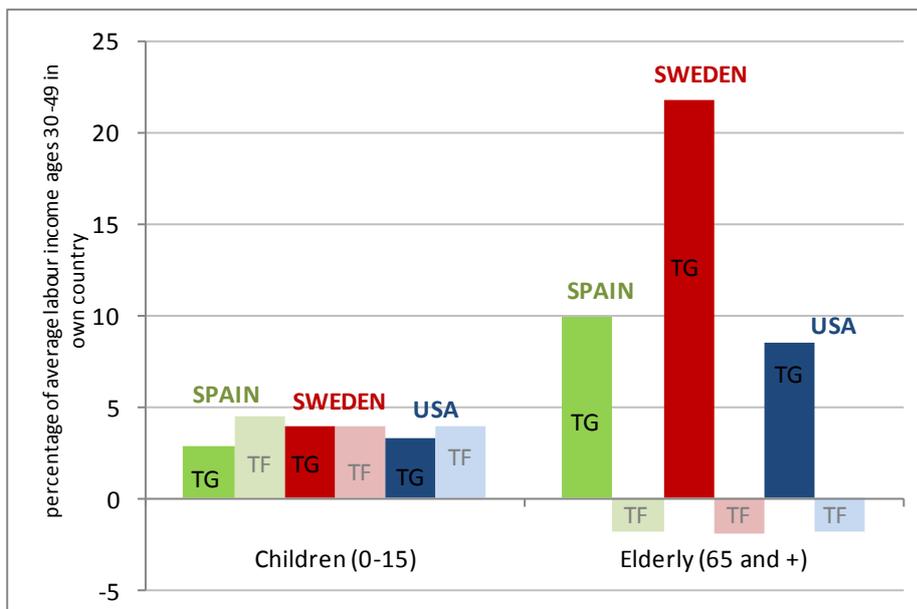
Figure 3.3 Per capita age profile of public transfers in Spain, Sweden and the USA



Source: Authors' elaboration using NTA data (<http://www.ntaccounts.org>)

Figure 3.4 completes the illustration of the different structures of the welfare estate in the three countries selected. In particular, Figure 3.4 shows the contribution of both public and private transfers to the financing of life cycle deficit on both sides of dependent life: childhood (ages 0-15) and the elderly (ages 65 and over). First, Sweden is the country with the largest public transfer system among OECD countries, although these public transfers are mainly directed to the elderly. Second, USA presents a lower generosity of the public transfer system to the elderly, but no big differences in the case of children. Spain is somehow in the middle of the two previous cases. Public transfers to the young are slightly lower than those of Sweden and USA, while higher private transfers offset this fact. Moreover, public transfers to the elderly are considerably lower in Spain than in Sweden, but a little higher than in USA. Interestingly, the extent to which transfers are balanced on the two dependent sides of the life cycle is a relevant but often ignored feature of the welfare state system, which requires more investigation.

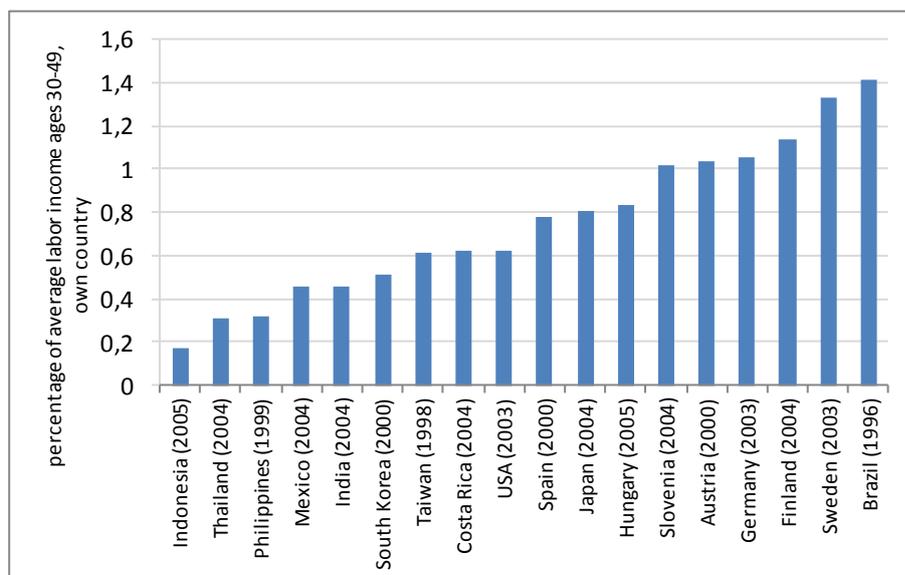
Figure 3.4 Public (TG) and private (TF) transfers to the young and the elderly in Sweden, Spain and USA



Note: data for Sweden and USA refer to 2003 and for Spain to the year 2000.
 Source: Authors' elaboration using NTA data (<http://www.ntaccounts.org>)

In short, the three countries analyzed somehow represent different levels of development of the welfare state. As is usually understood, Sweden has the largest size of the welfare state, while USA and Spain have the smallest size among developed countries. This is confirmed in Figure 3.5, showing the total size of the welfare state transfers – measured as total transfers paid by the public sector as a share of total labor income. For social and historical reasons, the welfare state in Spain developed considerably later than the rest of Europe, mixing characteristics of the different models previously existing on the continent (Esping-Andersen, 1990).

Figure 3.5 Total size of the welfare state system (Total public transfers to individuals as share of total labor income)



Source: Authors' elaboration using NTA data (<http://www.ntaccounts.org>)

4 The second demographic dividend in general equilibrium: The effect of transfers

4.1 The OLG economy

The model employed is an OLG model with certain simplifying assumptions. The model is simple since only consumption and savings are endogenously

determined. Transfers and the demographic information are exogenously given, though the level of transfers is scaled so as to guarantee a balanced government budget. Below we describe the special features of the model, detailing the equations that deviate from the standard specifications.

Following Sanchez-Romero (2013), we use realistic demography in order to better capture the interaction of demography and the economy. To make the demographic information match a one-sex economic model, we reconstruct the population by single years of age for each country. Our reconstructions are based on historical records from the human mortality database (HMD, 2014) and data from national statistics institutes from 1800 up to 2010 (INE, several years, and Bureau of the Census, 1949). From 2010 to 2050, we use Eurostat demographic assumptions for Spain and Sweden and UN Population Division for USA. Before 1800 and after 2050, the vital rates are considered constant. This implies building a large-scale overlapping generations model (OLG) from age 0 to 110, though children's consumption is decided by the household head. To highlight the effects of mortality, the mortality risk is considered in the utility function as in Yaari (1965), according to the following expected utility function:

$$U = \sum_{x=0}^{\Omega} \beta^x \pi_x u(c_x, \eta_x) \quad [4.1]$$

where c stands for consumption and the parameter η stands for the number of equivalent adult consumers in the household. The time subscripts are omitted for simplicity. The discount factor is composed of time preference (reflected in β) and survival probability (π). Regarding the instantaneous utility, a constant risk aversion (σ) function is assumed,

$$u(c, \eta) = \frac{\eta}{1 - \sigma} \left[\left(\frac{c}{\eta} \right)^{1 - \sigma} - 1 \right] \quad [4.2]$$

Note that the parameter η - the number of equivalent adult consumers - increases utility, once the household consumption is adjusted in per capita terms. In this way, we assume that adults make decisions for their own wellbeing, as well as for their dependent children, following Lee et al. (2000).

This utility function implies that unexpected bequests might arise, as long as individuals have no bequest motive and life is uncertain. For simplicity, bequests are collected by the government, easing the budget constraint. The household budget constraint that individuals face is as follows:

$$w_x(1 - \tau_x^{SS})(1 - \tau_x^l) + (1 - \tau_x^l)p_x + (1 + r_x)a_x = c_x + a_{x+1}$$

for $x=0, \dots, \Omega$

$$a_0 = 0$$

$$a_x \geq 0 \tag{4.3}$$

w being the wage, p the pensions, a the assets and r the interest rate. Agents are taxed both by a social security tax (τ^{SS}) intended to pay retirement pensions and a labor tax (τ^l) intended to pay other government expenditure, consisting of in-kind transfers. Note that taxes do not distort the labor supply decision, as long as it is inelastic. Pensions are levied by income tax, while wages are levied by both taxes.

Firms operate in competitive markets, so that wages and capital rents equate to their marginal product. The firm operates with a constant elasticity of substitution technology,

$$Y_t = F(K_t, H_t) = \left[\alpha K_t^{\frac{\mu-1}{\mu}} + (1 - \alpha) H_t^{\frac{\mu-1}{\mu}} \right]^{\frac{\mu}{\mu-1}} \tag{4.4}$$

where $H=AL$, A being the labor-augmenting technological progress, which is assumed to grow at an exogenous constant rate of 2% in all countries for comparability reasons, L the labor force - measured using the NTA labor income profile -, K physical capital, α the capital share and μ the elasticity of substitution between the production factors.

The following two equations define the government budget constraint. The first stands for the social security pensions system and the second for the in-kind transfers. We assume a defined benefit pensions system, adjusting the social

contribution rate in each period in a pay-as-you-go (PAYG) manner. The same happens in the other equation where we also assume PAYG financing, so that the government does not accumulate debt.

$$\tau_t^{SS} w_t L_t = P_t = \sum_{x=0}^{\Omega-1} p_t(x) N_{t+1,x+1} \quad [4.5]$$

$$G_t = \tau_t^l (1 - \tau_t^{SS}) w_t L_t + \tau_t^l P_t + B_t \quad [4.6]$$

where G stands for the total in-kind government expenditure, P and p stand for the total and per capita pensions and B is the total annual accidental bequests, which are levied at a 100% tax rate by the government.

The NTA data set is incorporated as follows. Since the transfer structure has a correspondence with the labor income profile, all transfers are normalized according to the average labor income of those aged 30-49 – as is usually done in the NTA methodology. Moreover, we distinguish between cash transfers (pensions) and in-kind transfers, so that the profiles shown in Figure 3.3 are introduced in the model.

Regarding private transfers, as seen in Figure 3.4 the age pattern is quite similar in the three countries analyzed, especially in transfers to the young. These are modeled using the equivalence scale shown in Eq 4.2. Quite interestingly, transfers to the old are negative, but they are fairly small, so we ignore them for simplicity.

With the exceptions mentioned above, the model is standard. We assume a closed economy, which implies that factor prices are determined within the economy. Thereby, changes in the population structure will have a direct influence on the factor prices, reinforced by changes in taxes needed to keep the welfare state transfer system. Note that public expenditure – in-kind transfers – is treated as unproductive, as it has no effect on utility or production. Consequently, it produces a deadweight loss. On the contrary, pension expenditure enters the budget constraint as a monetary transfer, so that a

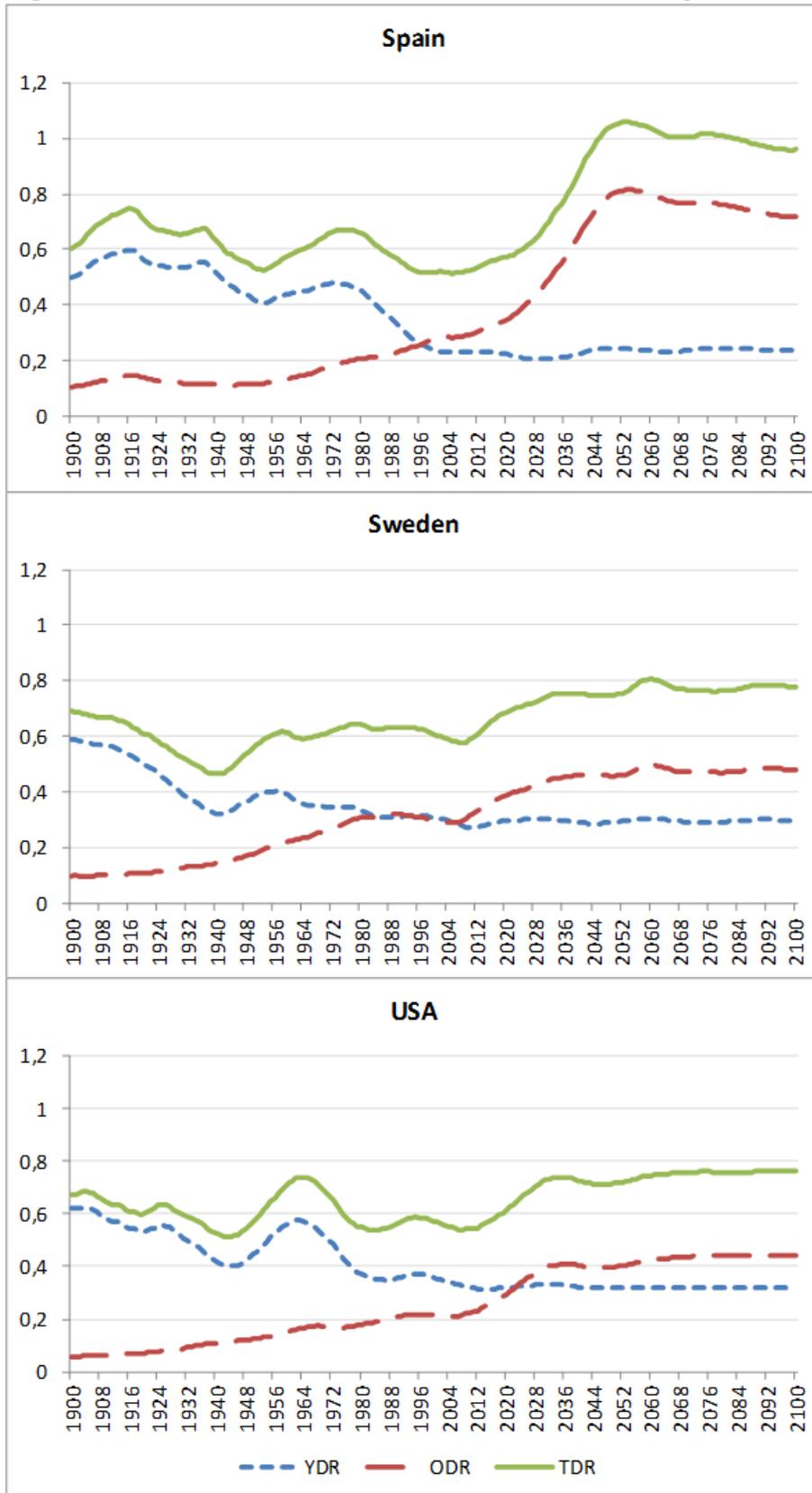
negative impact on savings (crowding-out) can be expected as long as the economy is dynamically efficient.

4.2 Baseline results

In this section we discuss the results of the simulation exercises. It is worth starting by looking at the main inputs: the demographic evolution and the public and private transfer structure. Figure 4.1 summarizes the demographic inputs, by showing the evolution of the dependency ratio since 1900 in the three countries analyzed. Over the 20th century, the young dependency ratio falls notoriously while the old dependency rate increases to a lesser extent. 21st century demography is driven by the ageing of baby-boomers, the process being especially strong in Spain. Although the Spanish dependency ratios were the lowest at the beginning of the period, both the old dependency ratio and the total dependency ratio increase dramatically in the 21st century and the situation is reversed. The young dependency ratio drops to a lower figure in the case of Spain compared to the other two countries. US and Sweden show a similar pattern in the 21st century, with slightly higher old and total dependency ratios in the Swedish case.

With respect to transfers, these were shown in Section 2. In this subsection we present the baseline results for the three countries, though we will primarily focus on the results for Spain, given that it is the country experiencing a more pronounced demographic transition.

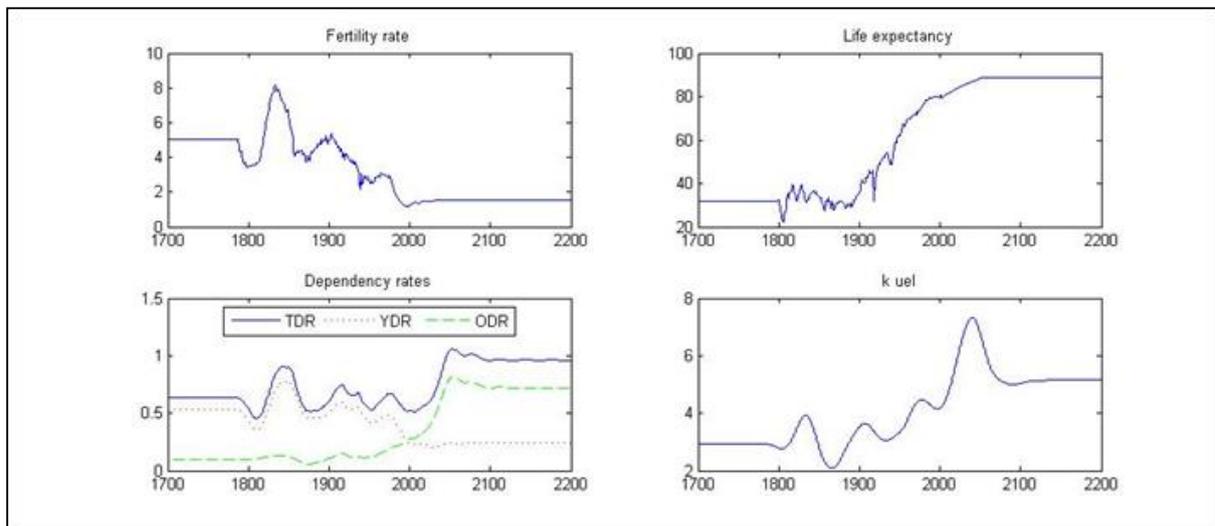
Figure 4.1 Past and future evolution of the dependency rate



Note: YDR = young dependency rate; ODR = old dependency rate; TDR = total dependency rate
 Source: Author's elaboration from HMD and Eurostat

Figure 4.2 shows the evolution of the main demographic parameters – fertility and life expectancy –, together with the expected evolution of the main demographic and economic outcomes: the demographic dependency ratio and the capital measured in efficiency units of labor. We deliberately start and end the simulation from a stable population steady state, as usual in realistic demography OLG models.

Figure 4.2 Fertility, life expectancy, dependency rate and capital (Spain baseline)



Source: Author's elaboration from HMD (2014) and INE (several years)

As shown in Panel a) in Figure 4.2 referring to Spain, the fertility rate shows three main peaks, first after Spain’s Independence War (1808-12), second due to Spanish flu (1918) and, finally, the most recent baby boom, implying more than 600 thousand newborns per year from 1957 to 1977. Life expectancy – in panel b) - fluctuates below age 40 until 1900 and increases sharply during the 20th century, surpassing age 80 in the year 2000. As a result of the evolution of fertility and mortality, the total dependency rate (TDR) – in Panel c) - varies greatly. The first oscillations occur around the initial value (0.6), but the increase due to the last baby boom is stronger, reaching a higher final value (slightly below 1) once the last demographic transition is completed. It is interesting to

see how the evolution of the TDR is, first, driven by the YDR, while since the last baby boom – where life expectancy played a role - it is mainly driven by the evolution of the ODR.

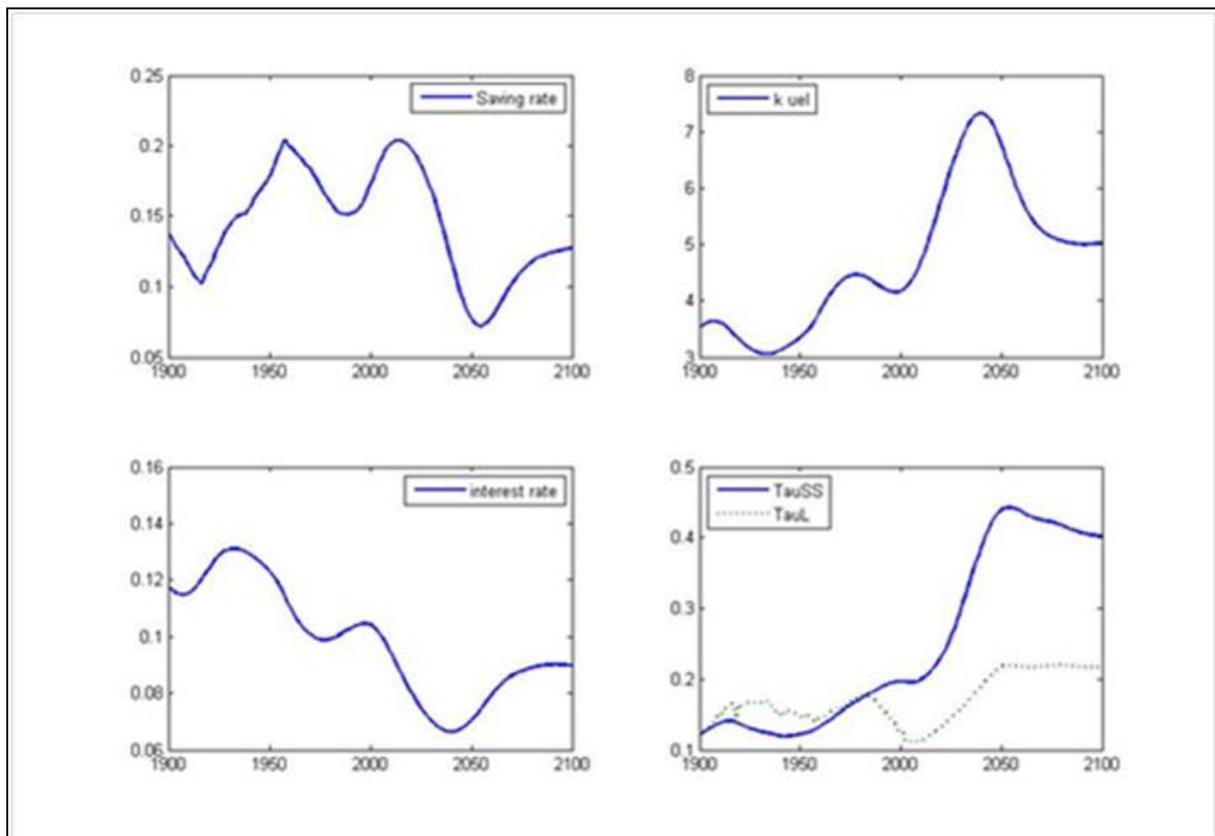
Panel d) in Figure 4.2 shows the evolution of capital measured in efficient units of labor. The simulations imply that capital starts accumulating when the joint effect of fertility and life expectancy fosters savings. This occurs both in the 1900s and the 1960s exactly after the baby booms, the latter being the most pronounced increase, as we will see later. Obviously, the model abstracts from many relevant issues, especially before the year 1900, when capital accumulation and productivity growth did not play a great role in real economies. Hence, we will focus below on results starting from 1900 to observe the effect of the 1960s baby boom and the transition to the final stable population. Note that, as it is designed, the model mainly captures the impact of demographic changes on savings, given the set of currently observed transfers. As said above, the model is kept as simple as possible in order to allow for inter-country comparisons. Similarly, given that we keep the currently observed transfers, simulations should be interpreted as an “as if” or counterfactual experiment.

The effects of the baby boom generation are especially visible in Spain, where the last stage of the demographic transition was more pronounced. In Panel a) in Figure 4.3, the savings rate decreases while the baby boom is being born and it recovers later – from the mid-eighties - when they start saving. From 2015, the saving rate starts falling, due to the pressure of maintaining the welfare state during the retirement of the baby boomers. The evolution of savings and labor force translates into the evolution of capital in Panel b). Capital (in effective units of labor) decreases slightly while baby boomers start to enter the labor market, while it recovers once their savings start to be sizable. This secular increase in capital implies a sustained decrease in interest rates (Panel c).

The effect of the baby boom retirement on the welfare state is clearly visible in Panel d) Figure 4.3. It shows the evolution of the two taxes financing the pensions system and the in-kind transfers system. The tax financing in-kind transfers is affected both by the evolution of the young (YDR) and the old (ODR)

dependency ratio, since these transfers nearly cover the two stages of dependency. It decreases with the fertility decline, while it recovers later on with the increase in transfers to the elderly, due to the considerable increase in life expectancy. The size of the social security tax is similar at the beginning – when ODR is still very low - but it jumps to more than double due to the increase in life expectancy and, later, due to the retirement of baby boomers. The adjustment of social security tax is also stronger because this tax is not levied on pensions while income tax is.

Figure 4.3 Saving rate, capital, interest rate and taxes (Spain baseline)

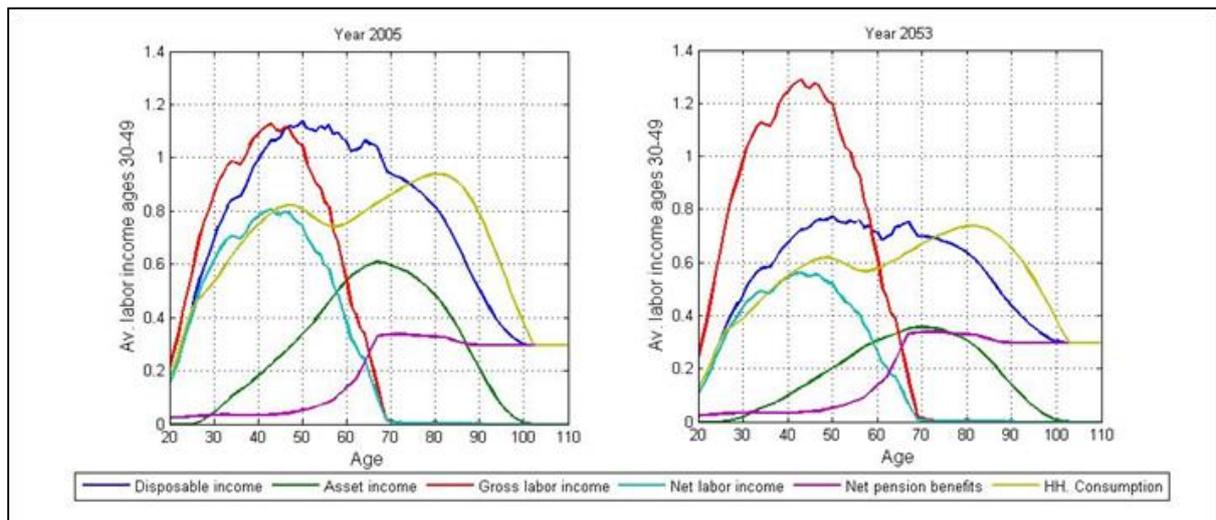


Source: Authors' elaboration.

Figure 4.4 shows how the age profiles for consumption, income and transfers are affected by the pressure on the welfare state due to the baby boomers' retirement. The two panels show the cross-section profiles in the best year

(2005) and the worst year (2053). First, by looking at 2005, we can see the expected hump shape of consumption, given that utility is weighted by the survival probability and no private annuities are introduced (Hansen and Imrohoroglu, 2008). Consumption falls at the very end of the life cycle up to the value of the pension, which is in fact acting as an annuity. Second, by looking at the profiles for 2053, the effects of the sharp increase in taxes shown in Panel d) in Figure 3.3 are visible in the distance between gross labor income and disposable income. Capital income and consumption shrink accordingly.

Figure 4.4 Cross-section profiles in 2005 and 2053 in Spain

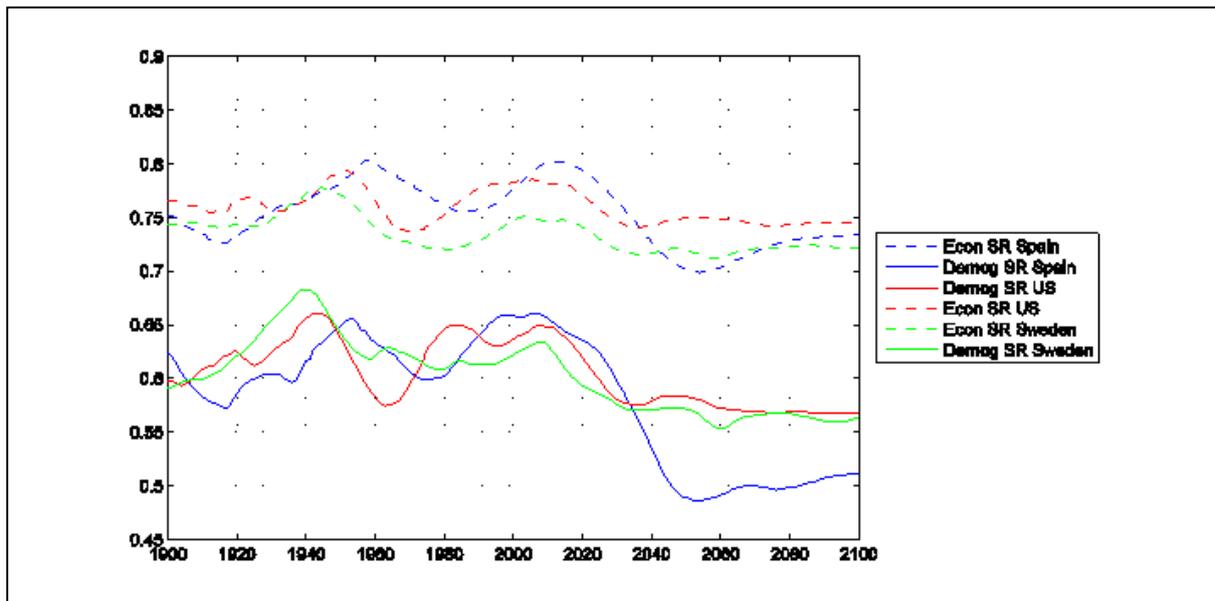


Source: Authors' elaboration

Figure 4.5 shows the evolution of the Demographic Support Ratio, together with the Economic Support Ratio obtained using the general equilibrium model. As seen above, there are previous estimations of the Economic Support Ratio based on a partial equilibrium framework. After the first estimations by Cutler et al. (1990), cross-country comparative measures have been derived using the NTA consumption profiles. In particular, the number of equivalent consumers (workers) is obtained by weighting the population with the NTA consumption (labor income) profiles. If constant profiles are used – as has been the case – the only changes come from variations in the age structure, so that the economic

support ratio evolves the same way as the demographic support ratio, but on a different scale. On the contrary, the economic support ratio resulting from the general equilibrium model captures the necessary adjustments in consumption and labor income occurring in the face of demographic changes. Note that its oscillations are lower. In particular, when the support ratio goes down, the demographic part of the ratio goes down – producers (in the numerator) decrease and consumers (in the denominator) increase. Economic variables adjust asymmetrically. When capital starts decreasing due to decrease in workers and dissaving of the baby boomers, labor income (in the numerator) goes down and, consequently, private consumption (in the denominator) decreases. The former reinforces the decrease in the Support Ratio, but the latter partially offsets it. The increase in taxes during the baby boom retirement reinforces this process. As a result, even though per capita public consumption remains constant, the oscillations in the general equilibrium support ratio are smoother than those of the demographic support ratio.

Figure 4.5 Demographic and Economic Support Ratios in Spain, Sweden and USA



Source: Authors' elaboration

Below we investigate the impact of configuration of the welfare state model on savings and the demographic dividend. Thanks to how the model is designed, it is possible to change the transfer scheme from one country to another. This counterfactual exercise is of interest because the three countries chosen show quite different transfer schemes, as shown in Section 3. The Swedish welfare state is clearly the highest, in terms of both in-kind and in-cash transfer. Spain and the US have a different composition, pensions being higher in Spain and in-kind transfers higher in the US. For coherence, both the set of transfers and the labor income profile are switched in the counterfactual exercises. This is especially relevant in the case of pensions, as the pension profile follows the fall in the labor income profile at retirement. This is remarkably later in the US with respect to Sweden and Spain, as shown in Figure 3.1.

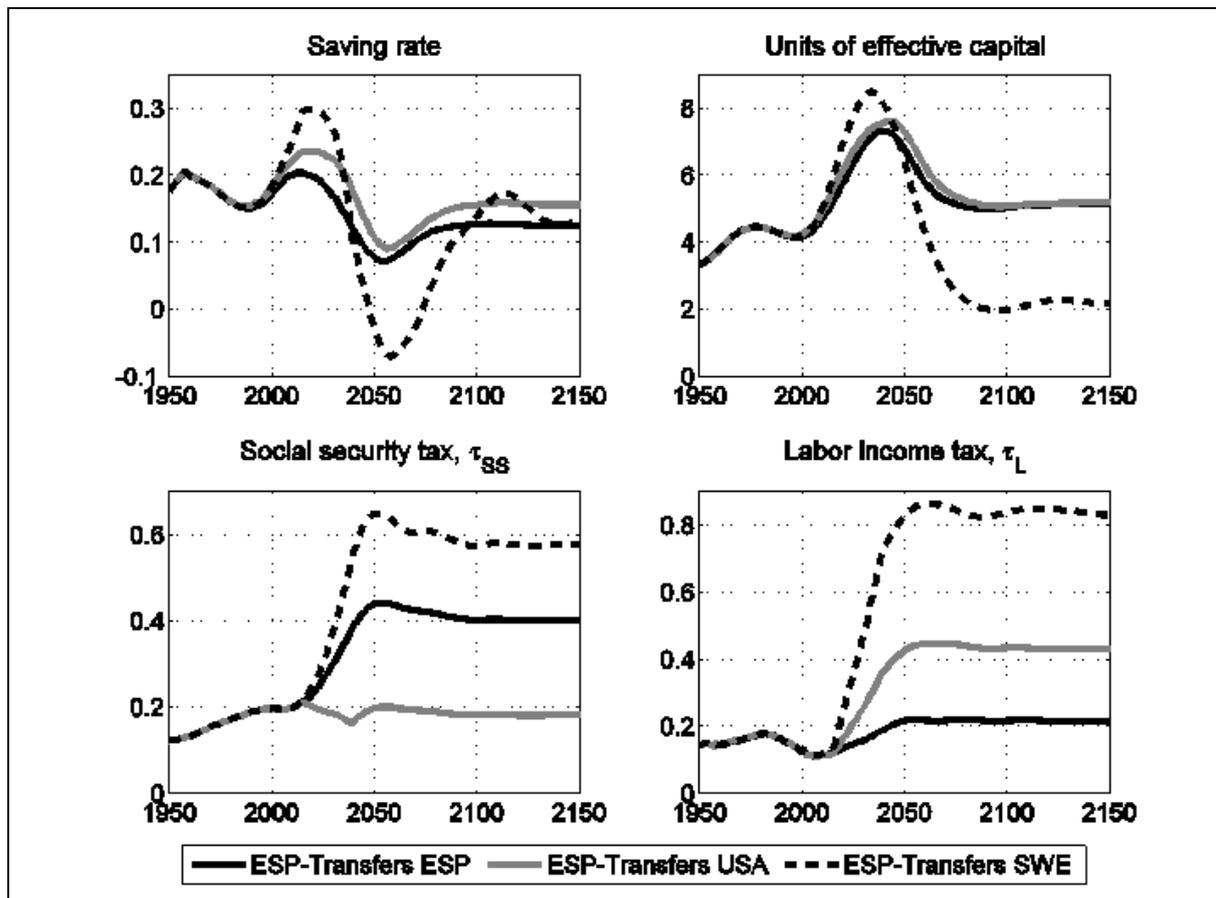
4.3 Counterfactual scenarios

To shed light on how the demographic dividend is affected by different welfare state schemes, we run alternative counterfactual scenarios combining the demography of each country with the NTA public transfers and labor income profiles of the remaining countries. Next, we show the results of these scenarios, in which the transfer system and labor income profiles are gradually modified between 2015 and 2040. Figures 4.6 to 4.8 show the results of these counterfactual exercises. Figure 4.6 refers to Spain, the country with the most radical adjustment due to the drastic ageing process. As seen before, the economic variables shown in Figure 4.6 capture the effects of the current demographic transition. The first panel shows the evolution of saving in the baseline case, compared to what it would have been if transfers were as in Sweden or in the US. The social security tax also reflects this pattern: the baseline is in the middle of the tax resulting from the Swedish transfers and that resulting from the US transfers. This result directly follows the level of pensions shown in Section 3 (Figure 3.3). Similarly, in the case of the tax on labor, the baseline is the lowest value, as it is the level of in-kind transfers. When US transfers are introduced, the saving rate is higher, probably because the decrease in social security tax is higher than the increase in labor income tax.

Nevertheless, this increase in savings only has a temporary positive effect on capital. This might seem surprising but a more careful look at the labor income profile sheds light on it. The US profile shows a substantially higher participation rate at old age (Figure 3.1). This increase in labor force counteracts the increase in savings, leaving the capital per worker almost unchanged. Note that the labor income profile in the US implies delayed retirement. Given the big size of the baby boomers, delayed retirement has a sizable impact. When Swedish transfers are introduced, there is a clear decrease in capital. Despite the fact that the labor income profile implies more labor participation, the increase in both taxes is high enough to lead to a permanent decrease in capital. Nevertheless, there are sizable transitional effects in both savings and capital, because of the huge changes suffered by some generations. Note that an increase in taxes implies a reduction in the lifetime disposable income, which reduces both the size of savings of workers and dissaving of retirees. Hence, the aggregate effect on savings depends upon the population age structure. In this simulation, during the transition, the decrease in savings of workers is temporarily dominated by the decrease in dissaving of the retirees who are also affected by the increase in labor income tax. As a result, the evolution of savings and capital is not straightforward. This pattern will be reproduced whenever we use Swedish transfers. Both cash and in-kind transfers are very high and individuals need to adjust their consumption plans.

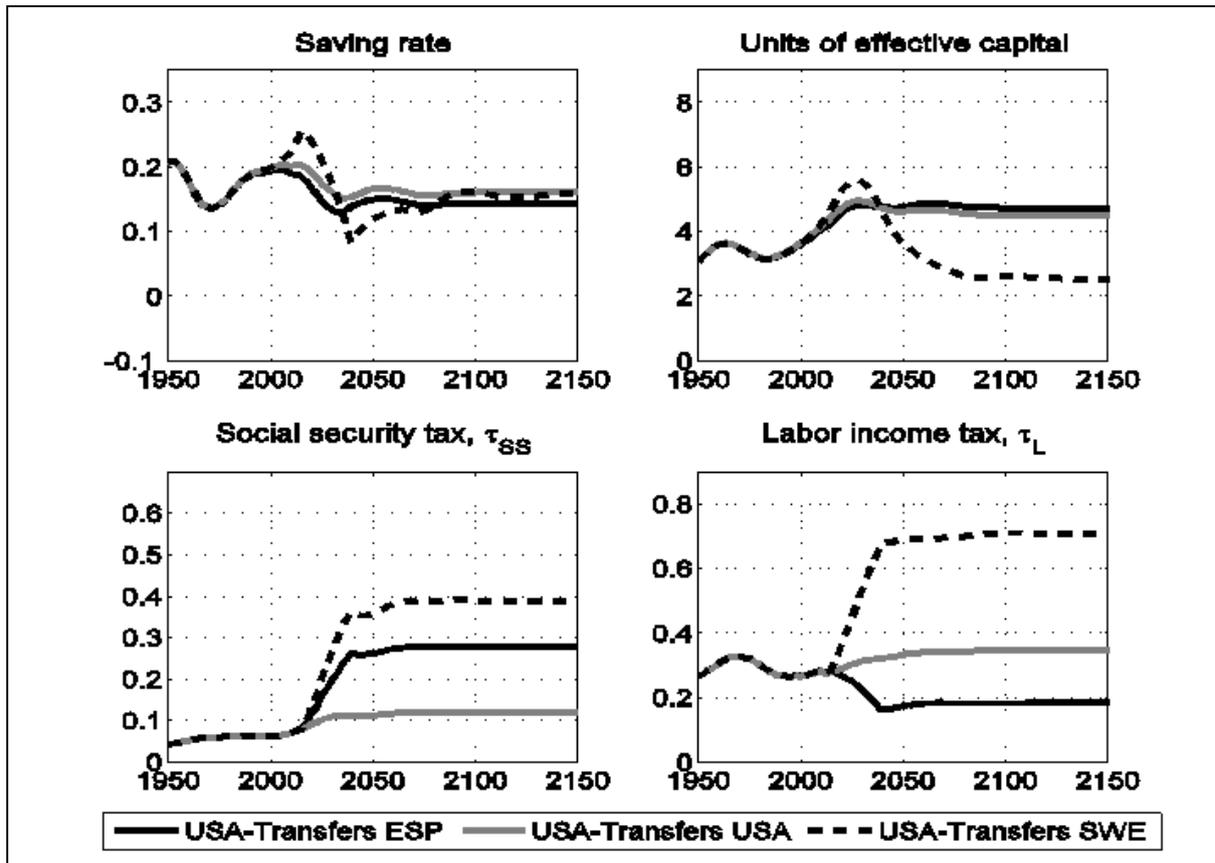
Figure 4.7 shows the simulation scenario of the US when changing the welfare state transfers. As in the case of Spain, adding Swedish transfers always implies an increase in taxes, while switching to Spanish transfers decreases labor income tax and increases social security tax. In the latter case, the final effect is a decrease in the savings rate. Nevertheless, capital increases, due to the decrease in labor supply – remember that the labor income profile implies a lower participation rate in the case of Spain. The transition to the Swedish transfers is again so strong that capital shrinks, while savings fluctuate again due to the anticipation of the strong transition.

Figure 4.6 Counterfactual scenarios (Spain baseline)



Source: Authors' elaboration

Figure 4.7 Counterfactual scenarios (USA baseline)

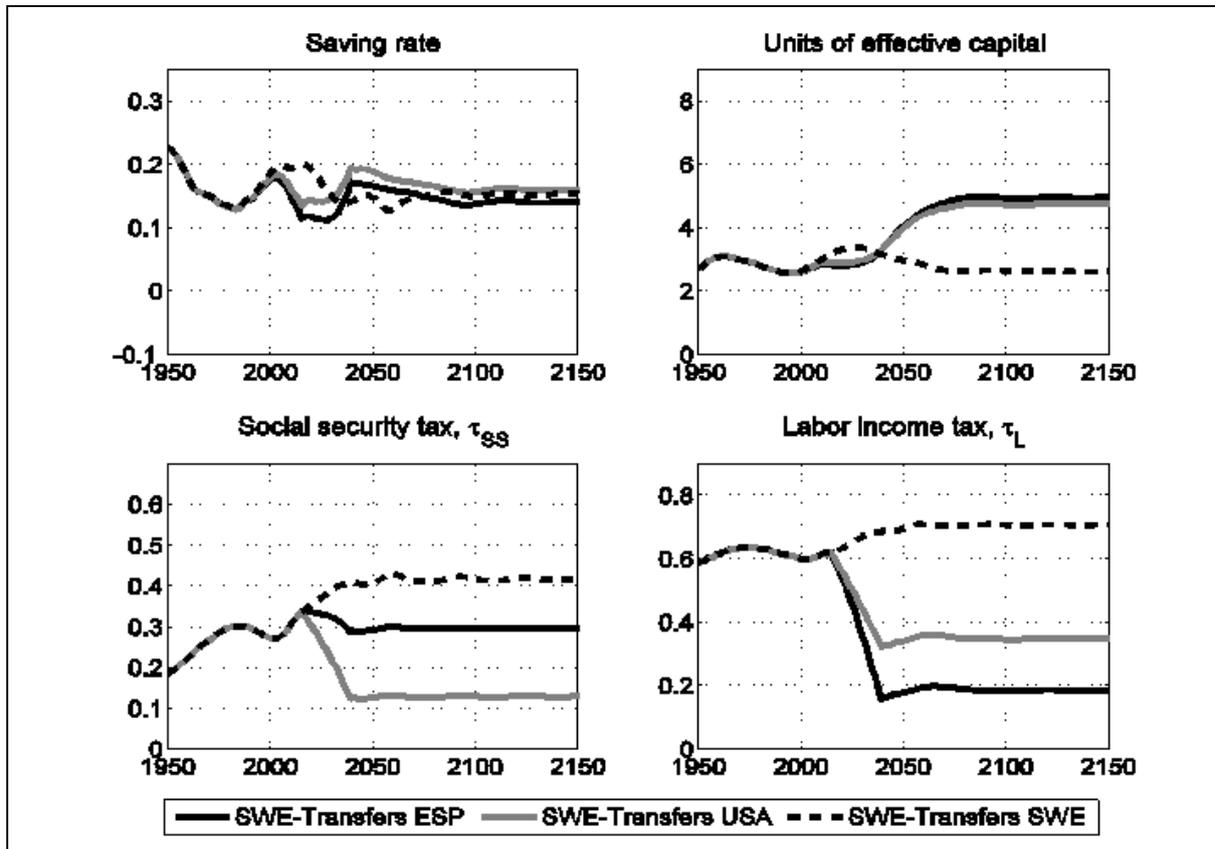


Source: Authors' elaboration

Finally, Figure 4.8 shows the simulation scenarios with the population and transfers of Sweden as baseline. In this case, both taxes are reduced as a result of lower cash and in-kind transfers. Capital is also higher, the increase being slightly higher with Spanish transfers, given that the Spanish labor profile is lower. Again, there are sizable transitional effects both in savings and capital.

Summarizing, higher transfers imply a decrease in savings and capital in the long run, while in the short run there are transitional effects due to the age structure. Interestingly, when moving from the USA or Swedish to the Spanish transfers, savings and capital evolve in the opposite direction. In both cases, savings are reduced while capital increases, showing the sizable effect of having a lower participation rate.

Figure 4.8 Counterfactual scenarios (Sweden baseline)

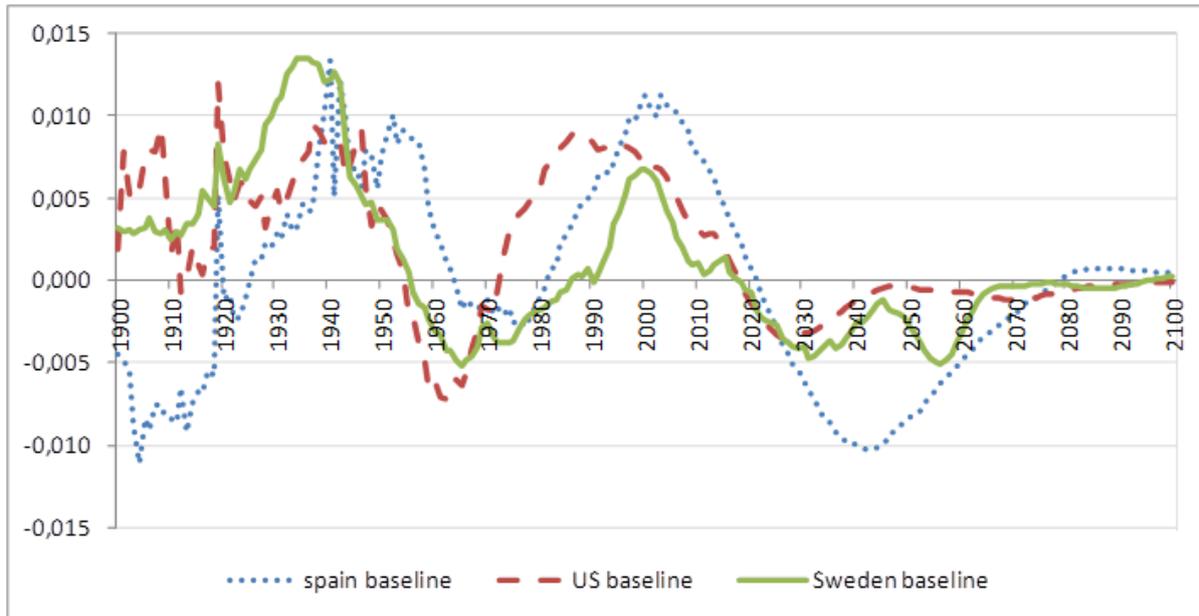


Source: Authors' elaboration

4.4 Decomposing the demographic dividend

In this section we analyze the resulting growth rate of per capita income in units of effective labor. Figure 4.9 shows the total growth rate of income per capita for the three countries during the 20th and 21st centuries. The increase in income due to the baby boom is clearly visible in all three cases, while the Spanish one shows the biggest effect, especially after the post baby boom decline – recall that the Spanish fertility rate is still far below replacement.

Figure 4.9 Total growth rate of per capita income (measured in units of effective labor)



Source: Authors' elaboration

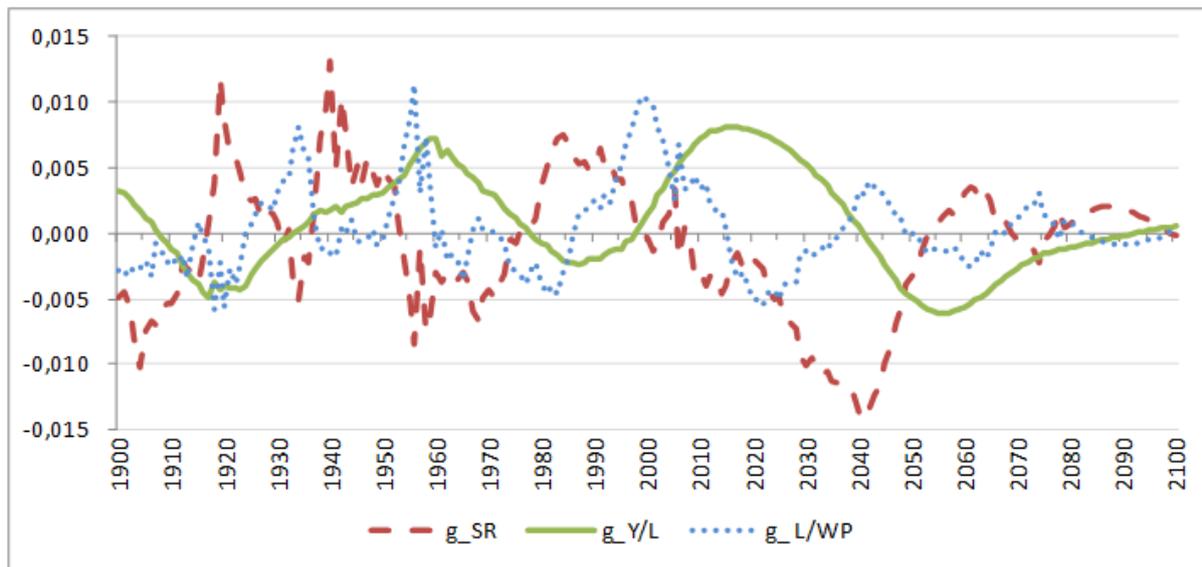
Given the sizable effect of demographics on the evolution of income per capita, it seems worthwhile trying to disentangle the different factors producing it. These factors driving economic growth – the so-called demographic dividend – can be broken down into several components. In particular, following Kelley and Schmidt (2005), we opt for stressing the difference between demographic and economic elements. Starting from Equation [2.1], the following decomposition can be obtained by introducing the working age population (WP):

$$\frac{Y}{N} = \frac{WP}{N} \frac{L}{WP} \frac{Y}{L} \tag{4.8}$$

The first term on the right-hand side is the pure demographic support ratio (SR^D), in contrast to the attempts mentioned in Section 2 based on the economic support ratio in a partial equilibrium setting. The second term isolates the effect of demography on the labor market by comparing the total working age population (population 16-64 in the denominator) to the employed (population 16-64 weighted by the labor income profile in the numerator). The sum of the first two components gives the first demographic dividend, measured as the

“translation effect” in Kelly and Schmidt (2005), while the third term is what they call the “productivity component”. Note that this term reflects the increase in income per worker – the one through which the second demographic dividend operates (Mason and Lee, 2006). In the model it changes with capital intensity, given that the productivity growth rate is assumed to be constant. For simplicity below we refer to them, respectively, as the first and second demographic dividends.

Figure 4.10 Decomposing the demographic dividend in Spain

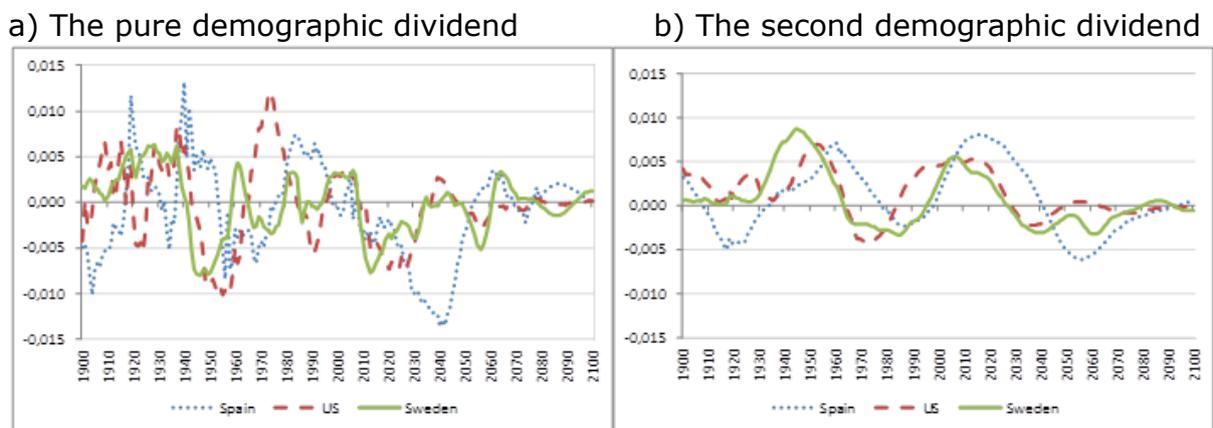


Source: Authors' elaboration

Figure 4.10 shows the decomposition proposed in Equation [4.8] in the case of Spain, de-trended by the exogenous productivity growth rate. The growth rate of the support ratio is negative from 1955 to 1976, when baby boomers are born. It becomes positive from 1977 to around 2000, when these bigger cohorts enter the labor market. After that, the growth rate of the support ratio becomes negative and the second demographic dividend starts. This second demographic bonus occurs while baby boomers accumulate savings and vanishes when all baby boomers are retired. Moreover, similarly to Sánchez-Romero et al. (2013), we also find that the second demographic dividend is transitory.

Notice that the factor capturing the effect of demography on the labor market also has a sizable impact. In particular, this ratio only changes due to the age composition of the labor force. It increases from the end of the 1980s up to the mid-2010s due to the higher relative size of these bigger cohorts in total labor income. This factor follows a similar path to the support ratio, although it comes a few years later.

Figure 4.11 Decomposing the demographic dividend in Spain (baseline scenarios)



Source: Authors' elaboration.

Figure 4.11 shows the growth rate of the support ratio and the second demographic dividend for the three countries analyzed. Interestingly, the area of the growth rate of the support ratio is negative for all countries from 1900 to 2100, because the old-age support ratio increases relative to its initial value. This is especially true for the case of Spain, due to the fact that the fertility rate went far below replacement and is assumed to stay low in the future.

From the mid-20th century, the increases in the growth rate of the support ratio are primarily driven by the baby boom. The highest increase occurs in the US, followed by the Spanish baby boom, which is delayed more than one decade with respect to the other countries. In contrast, the growth rate of the support ratio becomes negative around 2010 when the baby boomers start retiring. In Spain, the decline lasts longer and is more pronounced because of the baby-

bust. In the case of Sweden, the time path of the demographic transition is considerably smoother.

Figure 4.11b shows that the second demographic dividend is less pronounced than the growth rate of the support ratio because it incorporates the economic adjustments. Moreover, the second demographic dividend has the characteristic that it is delayed and bigger in the case of Spain. Nevertheless, it becomes transitory for this country, while it is more permanent for US and Sweden.

Table 4.1 shows the results of the counterfactual scenarios explained above, introducing different welfare state schemes into each country, breaking down the demographic dividend in Spain, USA and Sweden for the period 1975-2100. The table rows are divided into three blocks that differ in the baseline demography. The first column shows the growth rate of the demographic support ratio – which does not differ across scenarios. Counterfactuals with changing transfers are shown in the following three blocks of columns. The first block corresponds to Spain, the second to the USA, and the third to Sweden. Therefore, the shaded areas show the baseline for each country, while the non-shaded areas correspond to the counterfactual experiments. The results in Table 4.1, which complement those in Figure 4.11, are shown in 25-year periods in order to smooth the short-term variations.

Being exclusively demographic, the first factor is not altered by these simulation scenarios, while the factor capturing the composition effects of the labor market basically reflects the changes in the labor income profile over the transition. The size and time path of the second demographic dividend is mostly driven by the evolution of capital per capita in panel b) in Figures 4.6-4.8. When a transition from the Spanish welfare state to the US is carried out – or vice versa –, the second demographic dividend is almost unaltered, while strong effects arise when the Swedish transfers are downsized, converging to the Spanish or the US case.

Looking at the Spanish demography (first block of rows) with the transfers of USA and Sweden, we observe in columns II-III that the negative consequences of population aging on the labor market lessen due to the extension of the

productive working years, as a result of plugging the labor income profile of USA and Sweden to the Spanish workers. In contrast, the effect of the transfers on the second demographic dividend is mixed. Initially there is a positive effect, because agents react to the expected increase in future taxes by reducing consumption and hence increasing savings. Later, as shown in Figure 4.7, higher taxes lead to a progressive reduction in savings, especially when using the Swedish transfers.

In the case of USA, when we switch the public transfers and labor income profiles to those of Sweden, we find an overall negative impact on both the first and the second demographic dividend. Recall from Figure 3.1 that the labor income profile at older ages in USA is higher than that of Sweden. Consequently, the growth rate of the labor force to the working age population decreases (cf. columns IIb and IIc). Also, from Figure 3.3, both in-kind and cash public transfers are higher in Sweden relative to those of USA. Hence, we observe a negative effect on savings (cf. columns IVb and IVc).

The results of the counterfactual experiments in the lower diagonal are inversely symmetric in the direction of effects, though the size of the effects differs, as it is driven by demographic change. This can easily be observed by calculating the difference in growth rates between the counterfactual and the baseline scenario.

WP/N	Counterfactuals												
	ESP (Transfers)				USA (Transfers)				SWE (Transfers)				
	L/WP	1st DD	2nd DD, Total DD	Y/L ¹	L/WP	1st DD	2nd DD, Total DD	Y/L ¹	L/WP	1st DD	2nd DD, Total DD	Y/L ¹	
I	IIa	IIIa=I+IIa	IVa	IIIa+IVa	IIb	IIIb=I+IIb	IVb	IIIb+IVb	IIc	IIIc=I+IIc	IVc	IIIc+IVc	
Baseline demography	ESP												
1975-2000	0,50	0,02	0,52	-0,10	0,42	0,02	0,52	-0,07	0,45	0,02	0,52	-0,08	0,43
2000-2025	-0,17	0,03	-0,14	0,66	0,52	0,29	0,13	0,73	0,85	0,24	0,07	0,99	1,06
2025-2050	-0,97	0,02	-0,95	0,12	-0,83	0,45	-0,52	0,13	-0,39	0,27	-0,71	-0,30	-1,01
2050-2075	0,07	-0,04	0,02	-0,43	-0,41	-0,07	0,00	-0,49	-0,49	-0,03	0,03	-1,44	-1,40
2075-2100	0,11	-0,02	0,09	-0,04	0,05	-0,03	0,08	-0,09	-0,01	-0,01	0,10	-0,35	-0,25
Baseline demography	USA												
1975-2000	0,25	0,34	0,59	0,13	0,71	0,34	0,59	0,16	0,74	0,34	0,59	0,14	0,73
2000-2025	-0,23	-0,23	-0,47	0,44	-0,03	-0,02	-0,26	0,46	0,20	-0,06	-0,30	0,65	0,35
2025-2050	-0,09	-0,30	-0,39	-0,01	-0,40	0,01	-0,08	-0,10	-0,18	-0,03	-0,12	-0,61	-0,73
2050-2075	-0,11	0,02	-0,09	0,02	-0,07	0,03	-0,08	-0,01	-0,09	0,01	-0,10	-0,47	-0,57
2075-2100	0,00	0,00	0,00	-0,03	-0,03	0,00	0,00	-0,03	-0,03	0,00	0,00	-0,08	-0,08
Baseline demography	SWE												
1975-2000	0,12	0,14	0,26	-0,17	0,09	0,14	0,26	-0,16	0,10	0,14	0,26	-0,15	0,11
2000-2025	-0,26	-0,19	-0,45	0,13	-0,32	0,04	-0,23	0,16	-0,06	-0,01	-0,27	0,38	0,10
2025-2050	-0,08	-0,32	-0,40	0,53	0,13	0,02	-0,06	0,46	0,41	-0,04	-0,12	-0,19	-0,31
2050-2075	-0,05	0,03	-0,01	0,30	0,28	0,03	-0,02	0,26	0,24	0,02	-0,03	-0,18	-0,21
2075-2100	-0,03	0,02	-0,01	0,02	0,01	0,02	-0,02	0,02	0,01	0,01	-0,02	0,00	-0,02

Source: Authors' calculations. WP/N is the working age population to total population ratio, L/WP is the labor force (measured according to the NTA profile) to the working age population ratio, and Y/L is the de-trended output per worker.

¹ We de-trend the output by the labor-augmenting technological progress that increases exogenously at an annual rate of 2%.

Table 4.1: Breaking down the Demographic Dividend (DD) in Spain, Sweden, and USA (1975-2100), average annual growth rates in percentage

5 Final remarks

Given the sizable effect of demographics on the evolution of income per capita, it seems worthwhile trying to disentangle the different factors which produce it. So far, several attempts have been made along these lines. On the one hand, growth regression models were employed and have recently been improved by using panel data. On the other hand, dynamic simulation models – in either partial or general equilibrium - have been used. Overlapping Generations (OLG) models with realistic demography try to approach the issue by looking at the evolution of a general equilibrium support ratio, including the tax adjustments necessary to keep the welfare state transfers. In this paper we follow this approach, going one step further in order to investigate the impact of different configurations of the welfare state transfers on the second demographic dividend.

One of the main advantages of this modeling approach is allowing simulation exercises taking into account general equilibrium effects on factor prices. On the one hand, the model is employed to decompose the effect of the demographic dividend into different factors. On the other hand, the cross-country comparison potentialities of the National Transfer Accounts (NTA) project are explored by introducing three different configurations of the welfare state transfers by choosing three representative countries – Sweden, USA and Spain. In particular, counterfactual experiments are derived to disentangle the separate impact of demography and the welfare state model.

Regarding the decomposition of the demographic dividend, we opt to stress the difference between demographic and economic factors. The growth rate of per capita income is broken down into three terms. The first term is the purely demographic support ratio, in contrast with other attempts to estimate the economic support ratio in a partial equilibrium setting. The second term isolates what refers to the labor market, by comparing the total working age population (population 16-64 in the denominator) with the employed (population 16-64 weighted by the labor income profile in the numerator). Finally, the third term

collects the increase in income per worker, due to changes in capital intensity. This is basically due to the increase in baby boomers' savings, given that the productivity growth rate is assumed to be constant in the model.

What has been labeled as the first demographic dividend would include the first two terms. In the three countries analyzed, the purely demographic support ratio grows first, followed by the composition changes in the age structure of the labor market. Once this first demographic dividend vanishes, the second arises, having a different strength in each country. In fact, the three effects are first positive and later become negative. The total net effect varies depending on the strength of the ageing process and the size of the transfers system.

Regarding the cross-country comparison, we use the NTA data set to introduce realistic transfers into the OLG model. In particular, three countries representing different levels of development of the welfare state are chosen. The big size system is represented by Sweden and the small size by the USA, while Spain represents the Mediterranean model, which is somewhere in the middle. Differences also arise in terms of demography. Spain is affected by the sharpest ageing process, while the process is less severe in Sweden and USA, where fertility fell less and recovered sooner. As a result, the inter-country comparison shows that, despite its huge transfers system, Sweden still has a smoother fluctuation of the general equilibrium support ratio when compared to Spain. In all three countries, the general equilibrium support ratio fluctuates less than the purely demographic one, as the former takes into account the adjustment of economic variables to the tax increase produced to keep the welfare state transfers.

The counterfactual experiments illustrate the distinct impact of demography and welfare state transfers. Quite interestingly, the impact of transfers on capital accumulation is similar in Spain and USA. When US transfers are introduced in Spain, the savings rate is higher. Nevertheless, this increase in savings only has a temporary positive effect on capital. The reason is that the US income profile shows a substantially higher participation rate at old age. This increase in labor force counteracts the increase in savings, leaving the capital per worker almost unchanged. On the contrary, when Swedish transfers are applied to Spain and

USA - the small size welfare state countries -, capital shrinks and hence the second demographic dividend. However, the opposite effect is found in the medium term when agents adjust their behavior to the new policy.

These results are clearly driven by the way the welfare state transfers are modeled – in-kind transfers are considered as unproductive public expenditure and public pension schemes crowd out savings. Further research is needed in order to investigate the role of government intervention on intergenerational private transfers, the effect of each particular transfers system on capital accumulation and on the welfare of agents.

6 Bibliography

- Arellano, M. and S. Bond (1991) "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 58, 277-297.
- Bloom, D.E. and J.G. Williamson (1998). "Demographic Transitions and Economic Miracles in Emerging Asia". *The World Bank Economic Review*, 12(3), 340-375.
- Bommier, A., and R. Lee (2003). "Overlapping Generations Models with Realistic Demography". *Journal of Population Economics*, 16, 135-160.
- Braun, A.R., D. Ikeda and D.H. Joines (2009). "The Saving rate in Japan: Why it has fallen and why it will remain low". *International Economic Review*, 50 (1), 291-321.
- Chen, K., A. Imrohoroglu, and S. Imrohoroglu (2006). "The Japanese Saving rate". *The American Economic Review* 96 (5), 1850-1858.
- Chen, K., A. Imrohoroglu, and S. Imrohoroglu (2007). "The Japanese saving rate between 1960 and 2000: Productivity, Policy Changes, and Demographics". *Economic Theory*, 32, 87-104.
- Crespo-Cuaresma, J., W. Lutz and W. C. Sanderson (2014). "Is the Demographic Dividend an Education Dividend?". *Demography*, 51, 299-315.
- Cutler, D., J. Poterba, L. Sheiner and L. Summers (1990). "An Ageing Society: Opportunity or Challenge", *Brookings Papers on Economic Activity*, 1, 1-74.
- Esping-Andersen, G. (1990). *The Three Worlds of Welfare Capitalism*. Princeton University Press, Princeton, New Jersey.
- Hansen, G. D. and S. Imrohoroglu (2008). "Consumption over the life cycle: The role of annuities". *Review of Economic Dynamics*, 11, 566-583.

- HMD (2014) Human Mortality Database. University of California, Berkeley (USA), and Max Planck Institute for Demography Research (Germany). Available at www.mortality.org or www.humanmortality.de.
- INE, INSTITUTO NACIONAL DE ESTADÍSTICA. INEbase, Censos de Población del período 1857-1970. Madrid: INE (<http://www.ine.es/inebaseweb/71807.do?language=0>)
- INE, INSTITUTO NACIONAL DE ESTADÍSTICA. INEbase, Censos de Población y Viviendas (1981, 1991, 2001 and 2011). Madrid: INE (http://www.ine.es/inebmenu/mnu_cifraspob.htm)
- Kelly, A. C. and R. M. Schmidt (2005). "Saving Dependency and Development". *Journal of Population Economics*, 9 (4), 365-386.
- Lee, R. and A. Mason (2011). *Population Ageing and the Generational Economy. A Global Perspective*. Edward Elgar, USA.
- Lee, R., A. Mason and T. Miller (2000). "Life Cycle Saving and the Demographic Transition: The Case of Taiwan". *Population and Development Review*, 26, 194-219.
- Lee, R., A. Mason and T. Miller (2001). "Population Change and Economic Development. Challenges Met, Opportunities Seized", Chapter Saving, Wealth, and the Demographic Transition in East Asia, 155-184. *Contemporary Issues in Asia and the Pacific*. Stanford University Press.
- Lee, R., A. Mason and T. Miller (2003). "Saving, Wealth and the Transition from Transfers to individual Responsibility: The cases of Taiwan and the United States". *The Scandinavian Journal of Economics*, 105, 339-357.
- Lutz, W., J. Crespo-Cuaresma and W.C. Sanderson (2008). "The Demography of Educational Attainment and Economic Growth". *Science*, 319, 1047-1048.
- Mason, A. (2005). *Demographic Transition and Demographic Dividends in Developed and Developing Countries*, United Nations Expert Group

meeting on Social and Economic Implications of Changing Population Age Structure, Mexico, UN/POP/PD/2005/2.

Mason, A. and R. Lee (2006). "Reform and Support Systems for the Elderly in Developing Countries: Capturing the Second Demographic Dividend". *GENUS LXII(2)*, 11-35.

Patxot, C., E. Rentería, M. Sánchez-Romero and G. Souto (2011). "Results for GA and NTA: The Sustainability of the Welfare State in Spain". *Moneda y Crédito*, 231, 7-51.

Prskawetz, A. and J. Sambt (2014). "Economic support ratios and the demographic dividend in Europe", *Demographic Research*, 30 (34), 963-1010.

Roodman, D. (2009) "A Note on the Theme of Too Many Instruments," *Oxford Bulletin of Economics and Statistics*, 71, 135-158.

Sánchez-Romero, M. (2013). "The role of demography on per capita output growth and saving rates". *Journal of Population Economics*, 26(4), 1347-1377.

Sánchez-Romero, M., C. Patxot, E. Rentería and G. Souto (2013). "On the effects of public and private transfers on capital accumulation: some lessons from the NTA aggregates". *Journal of Population Economics*, 26(4), 1409-1430.

UN (2013). *National Transfer Accounts Manual: Measuring and Analyzing the Generational Economy*. Population Division, Department of Economic and Social Affairs, United Nations, New York.

Williamson, J.G. (2013). "Demographic Dividends Revisited". *Asian Development Review*, 30(2), 1-25.

Yaari, M. (1965). "Uncertain Lifetime, Life Insurance and the Theory of the Consumer". *Review of Economic Studies*, 5(3), 304-317.