LUND UNIVERSITY
School of Economics and Management

Master programme in Economic Demography

The fiscal impact of population aging in Sweden: 2015-2060

Oleksandr Pavlov
oleksandr.pavlov@gmail.com

Abstract: This study analyses the fiscal impact of population aging in Sweden from 2015 to 2060. We consider the three main areas of public spending in the demographic context: education, health care and pension. A separate analysis is performed for each of the three alternative macroeconomic scenarios, which are the status quo, the pension reform and the health care reform. Our results indicate that the old pension system, entirely financed by the state, is not sustainable, and thus the pension reform of 1994 was justified and is not likely to be changed in the future. The new pension system, however, is sustainable, since increase in the medical costs can be covered by pension savings and the GDP growth. Furthermore, we show that under the assumption of technological progress in medicine the current health care system will become unsustainable in the presence of population aging. Therefore, a health care reform decreasing the share of state financing appears as a necessary solution to keep the fiscal balance in the long run.

Key words: Population aging, public expenditures, pension reform, health care reform

EKHM51
Master thesis (15 credits ECTS)
June 2016
Supervisors: Tommy Bengtsson, Haodong Qi
Examiner: Luciana Quaranta
Word Count: 14354

Contents

List of Figures

List of Tables

1. Introduction

Countries all around the world are nowadays undergoing different stages of demographic transition. Some of them are facing the pitfalls of population aging already now, while others will be dealing with it only by the end of this century. Ultimately, all countries will need to deal with the problem of changing population structure. Population aging is particularly painful for welfare states. The reason behind it is that expenditures for health care and social security, which are consumed mainly by seniors, are paid from tax money of working age population. These expenses are already consuming more than a third of the state budget in the USA (Lee & Edwards, 2002). The USA is not an excellent example of the welfare state, however. There are many countries which spend a higher proportion of GDP on social expenditures. Therefore, we address the issue of population aging in Sweden, which is a perfect example of the welfare state. We are interested in the implications of population aging for the state budget, and whether the current generous policies are sustainable in the long run.

The aim of this study is to evaluate the fiscal impact of population aging in Sweden for the year 2060. This requires forecasting of a number of demographic and fiscal indicators, such as fertility and mortality rates, net migration, inflation, and GDP growth. We could have built our own projections of these indicators using historical data, but this is being done by Statistics Sweden, and we prefer to rely on their forecasts. These are the same projections of macroeconomic indicators that are being used by the Swedish policy makers, so it makes sense to utilize them in the present study to avoid the uncertainty and arbitrariness in the inputs.

We are interested in the marginal effects of population aging on the three core areas of public spending, namely education, health care and pension (EHP). It is important to consider education expenditures simultaneously with health care and pension spending, as they are targeting the opposing age groups. Health care and retirement programs are influenced most by population aging. On the other hand, the absolute increase in the elderly population is often combined with the absolute decrease in the young population (Gist, 2011). This phenomenon has two implications. Theoretically, expenditures on education can be reduced to subsidize the increased cost of health care and pensions of the elderly population. Alternatively, spending on education can remain the same or even increase, leading to a higher per capita spending on education and increased productivity of the labor force in the future, which can finance elderly population as well (IMF, 2009).

We examine three alternative scenarios for the year 2060, by combining different projections of population and consumption. The first scenario is “status quo”, assuming that macroeconomic policies will remain the same in the future, and therefore, the changes in public

spending as a share of GDP are the result of the demographic phenomena only. This scenario allows to evaluate how sustainable the current fiscal system is. The remaining two scenarios involve modifications of the current policies in health care and pension schemes. In the pension reform scenario, we assume that Sweden will reintroduce the pay-as-you-go (PAYG) system, which will cover the whole amount of retirement benefit for everyone. This will lead to an increase in per capita pension expenditures. In the health care reform scenario, we assume that technological improvement will result in the increase of per capita expenditures on health care for every age group. At the same time, per capita expenditures on health care will be increased additionally for the elderly population to reflect the higher cost of long-term care. A detailed description of scenarios and methodology will be provided in the data and method section of the study.

To summarize, this study addresses the fiscal impact of population aging in Sweden under the alternative scenarios of no macroeconomic policy adjustments, the pension reform and the health care reform.

There are several papers investigating the fiscal impact of population aging for other countries (Narayana, 2014; Kudrna, Tran & Woodland, 2015; Kluge, 2013), but none look at Sweden. Bengtsson and Scott (2011) is the closest study for the Swedish economy, and they examine the consequences of population aging on the life-cycle deficit. This study is meant to fill the existing gap in the research about the fiscal impact of population aging on the core public expenditures in Sweden.

The remainder of the thesis is structured as follows. Section 2 presents the theoretical background of the population aging problem. It introduces the reader to the current status of the EHP in Sweden, and describes the short and long-term solutions for population aging in the context of fiscal balance. Section 3 presents the literature review, which outlines the existing research for other countries. We also provide a brief overview of research on the connection between population aging and fiscal balance, as well as research on the current state of the Swedish EHP system. Section 4 presents the data and methods, where a reader can find a comprehensive description of scenarios and their assumptions. The results of the empirical analysis are discussed in section 5. Finally, section 6 concludes the thesis.

2. Theoretical background

Generational economy

Global changes in the population structure began in 1950. Until recently, they have been favorable for most economies. Due to a generation of baby boomers in most Western societies, more and more population was concentrated in the working ages. The peak occurred in 1975, when on the global level there were 125 children under the age of 25 for every 100 adults of the age of 25 years and older. As a result, starting from the mid-1980s, in many countries working-age population outnumbered the combined population of children and elderly people.

At the moment, the proportion of the workforce to the older people of above 60 is four to one on the global scale. By 2050, this ratio will change to two to one. This phase of the demographic transition will be something entirely new for our society. Of course, there are significant differences between countries and regions. Population aging will affect the industrialized nations of Europe and North America first, followed by Latin America's countries. In South Asia, many countries still have a relatively young population and will not experience the impact of population aging in the following years. The same is valid for most African countries, which are in the early stages of the demographic transition.

Why will population aging have a substantial impact on national economies? The answer is that people change their economic behavior in systematic ways during their lifetime. Generally speaking, people consume more at the beginning and at the end of their lives, while saving more during their working ages. The balance between saving and consumption is reached by transfers. It is the generational economy that handles this kind of economic activity. We proceed with the formal definition of generational economy:

"Generational economy is

(1) the social institutions and economic mechanisms used by each generation or age group to produce, consume, share, and save resources;

(2) the economic flows across generations or age groups that characterize the generational economy;

(3) explicit and implicit contracts that govern intergenerational flows;

(4) the intergenerational distribution of income or consumption that results from the foregoing" (Lee & Mason, 2011).

In other words, generational economy handles activities such as working, saving, consuming, and sharing. As previously mentioned, work productivity is not constant over time. It depends on many factors, the most important being the need to consume, health, culture, and institutions. Since people do not produce at young and old ages, their lifetime consumption is balanced due to higher production than consumption during the working years. There are two instruments for balancing consumption and production. These are saving and sharing, which are

counterparts of the economic lifecycle. Only these two tools can fill the gap between consumption and production for the young and the old generation.

Saving can be used in two ways. Firstly, one can use their savings to finance shortage of production in the old ages. An example of such strategy can be buying a house, investing in the own business, participating in defined pension plans, savings accounts etcetera. Secondly, one can use borrowed savings. Young people can finance their shortage of production this way. Examples of this method include student loans, consumer credits etcetera. Concluding, we can state that savings are a tool, which allows using assets not at the time they were produced, but at some other time in the future.

Sharing goes hand in hand with savings. It is a lot more convenient for a person to make asset transfer between generations in the family than to borrow assets from the outside of the household. Parents often provide for their children. Grandparents often provide for their grandchildren. It works in the other direction as well. In many countries without universal pension systems elderly population relies financially on their children. Sharing is not limited to family only. Sharing causes intergenerational transfers in many forms. For example, tax payers are concentrated mostly in the working-age population. Through their tax contribution, the state pays for many public services for young and old generations. It includes but is not limited to school funding, pay-as-you-go pension systems, long-term health care for the elderly, and many other public services.

Both sharing and savings are used to fill the gap between production and consumption of the young and the old. They can be used to meet the lifecycle needs of the working population as well. It is not rare that people in the working ages consume more than produce during some periods (childbirth, illness, and other occasions).

The consumption of young people is financed in Sweden more or less equally from the public (58.3%) and private (41.7%) transfers (Lee & Mason, 2011, p. 16). On the other hand, more than 100% of consumption by people over 65 years is financed from public sources (Lee & Mason, 2011, p. 21). It means that government covers all the needs of the elderly population in Sweden, and they have money left to help their children and grandchildren through family transfers. This situation is about to change due to population aging. There are several ways to sustain the current fiscal balance during the period of changing population structure, and we will consider several of them in the next section.

Population aging and the fiscal balance

There are numerous ways to tackle the problem of population aging in the context of fiscal balance. Some of them work in the short or medium term, and others work in the long term (Bengtsson & Scott 2010). We will give a brief description of the most promising methods.

The first is an increase in fertility rate. The essence of this approach is to have a stable population distribution by age over an extended period. Theoretically, this should work and provide the state with steady income and expenses, and will lead to the long-term fiscal balance. However, for this method to work the total fertility rate (TFR) should be 2.1, which is the replacement level, or higher. At the 2.1 TFR level, population will be stable all else equal, while with TFR above 2.1 population will gradually increase. At the moment, TFR in Sweden is 1.89, and there are no signs of the future increase in fertility. The more likely scenario will be that fertility level in Sweden will be stable or will decline to the level of the neighboring countries. Fertility at or above the replacement level is the long-term solution to population aging. In the short and medium term it will cause an even bigger problem for fiscal stability, due to a higher child dependency ratio. At the same time, the number of days spent by working population on parental leave will increase as well. These two factors will cause high pressure on the fiscal balance in the short and medium run.

Another short and medium term solution is migration. Given that Sweden can attract well educated and highly adapting migrants, who can join the Swedish job market from day one, it may appear more attractive than increased fertility in the short and medium term. However, in the long run, all these migrants will become old, making the population aging problem even more severe. At the moment, Sweden has problems with integrating all new migrants to the job market, which leads to a worse fiscal situation even in the short and medium term. It is the opposite to how migration is supposed to work.

The last demographic solution to population aging is the mortality level change. Population aging is a problem for the welfare state because the government pays for the majority of expenses of the elderly population. If the mortality level is high (the same or lower life expectancy), the amount of seniors to support will be less. Hence, the fiscal pressure on the state will be lower. Unlike high fertility and high net migration, high mortality will not work in the short/medium run. However, it will work in the long term. The combination of the high mortality level and fertility below the replacement level will cause a sharp decrease in population in the medium term. At the moment, nothing predicts that high mortality scenario is possible in the observable future.

We looked at the three demographic solutions to population aging in the context of fiscal stability. Let us now consider the policy solutions. The first and the simplest way is to decrease

the standard of living. It is very straightforward. The proportion of the elderly people in the population is irrelevant, if the state does not spend money on them. This option is very unpopular among voters. Therefore, it is highly unlikely that Sweden will transform from the welfare state to the state which does not support the elderly at all. However, under high fiscal pressure the Swedish government can try to reduce its support for the older population. Ultimately, it means that part of the financing will have to come from the private transfers. The first step towards the mixed composition of support was made in 2004 with the implementation of the new pension scheme.

In the case of continuing public support for the elderly, the government will need additional financing in order to cover the excess state expenditures due to the changed population structure. There are two ways to raise the extra funding. Firstly, a policy can be introduced, which will increase either the number of working hours, or the retirement age. This will ultimately lead to more financing available to spend per capita of the elderly population. Secondly, changes in the population structure can be supported by an increase in productivity growth per worker. The right amount of productivity growth can cover the fiscal gap caused by population aging. Fewer workers will support more dependent people, but under a higher productivity they will be able to produce enough to sustain a new dependence ratio.

In this study, we will focus both on the possible policy changes and demographic changes. For policy changes, we will run two scenarios under different policy assumptions regarding benefit generosity. To evaluate the demographic impact, we will do sensitivity checks of the underlying demographic variables. By calculating the amount of GDP necessary to support different scenarios, we will estimate the necessary productivity growth for each scenario.

Current EHP situation in Sweden

Let us finish this section with a brief overview of the current situation of education, health care, and pension systems in Sweden.

We will begin the overview of the core public expenditures with the Swedish educational system. A child can be admitted to a preschool from the age of 1 year old. Education in Sweden is mandatory for children between 7 and 16. After that, there are options of three years of upper secondary school, followed by graduate and postgraduate programs. Due to generous benefits, most people use preschools, which means that most children have up to 15 years of public schooling. 16% of pupils stop their education at this level, 47% finish only upper secondary school, 14% get the post-secondary education of fewer than three years, and 23% complete the post-secondary education of three years or more (Statistics Sweden, 2016a). Swedish students of the post-secondary cycle (and equated to them) have the right for the government financial help.

It consists of two parts: allowance of 2812 SEK/month and a voluntary loan part (up to 10 000 SEK/month). Since there are no tuition fees, the government spends a substantial amount of the GDP on this section of the state budget.

Let us go on to the health care system. Even though private health care exists in Sweden, the Swedish health care system is mainly government funded and decentralized. In 2013, health and medical care comprised 12% of the GDP (Statistics Sweden, 2015a). During the last two years, this number increased even further, with the total cost of health care constituting 12.5% of the GDP in 2015. The government finances 85% of the total costs, while the remaining 15% are covered by households via patient fees and other charges (Statistics Sweden, 2015a). The health care system is divided and managed at the three levels: national, regional, and local. Sweden has one of the highest proportions of the elderly population in Europe. With female life expectancy of 83.7 years and male life expectancy of 80.1, Sweden had 19.8% of the country's population of age 65 or older in 2015.

The elderly care is mainly a municipal task in Sweden. It is regulated by the Swedish Social Services Act and financed mostly by local taxes. A steady rise in the health care costs both in absolute and per capita terms is disturbing. Between 2001 and 2013, the share of health care costs in the GDP increased from 8% to 12% (Statistics Sweden, 2015a). Around a third of this sum goes to the elderly care at the moment, and the proportion has been increasing. Health care costs, and the elderly care, in particular, pose the biggest threat to the current welfare system in Sweden. Population aging will put more and more pressure on the Swedish health care during the coming decades.

Let us finish the overview of the Swedish public expenditures with the pension scheme. "Four dates contain more or less the entire Swedish pension history: 1913, 1946, 1960 and 1994. Its history can be described as a circle; it starts with a defined contribution, funded system, makes a detour over defined-benefit, pay-as-you-go systems and then largely comes full-circle, back to the current defined-contribution systems, albeit mainly unfunded, i.e. pay-as-you-go" (Kruse & Bengtsson, 2010, p. 47). The latest version of the pension system in Sweden was introduced in 1994, and launched in 1999. It began operating at full capacity for all age groups in the year 2004. At the moment, pension consists of four parts: the guaranteed part (pay-as-you-go part), the premium part, the occupational part, and the personal savings. The first three categories are financed through taxes and employee's contributions. Out of 18.5% of pension taxes, 16% goes to the guaranteed part, and 2.5% is allocated to the premium part. A person chooses in which management fund to place this part. All people born after 1953 belong to this pension scheme since 2004.

Pension cost of the state was 7.5% of the GDP in 2015 (Swedish Pensions Agency, 2016). It is has decreased slightly from 8% of the GDP in 2012. However, it is expected to increase gradually in the short term future. This has two implications. Firstly, the state should not worry about the influence of population aging on the pension system at the moment. Secondly, population aging will cause a decline in the size of the per capita pension in the case of aging, which will not be covered by the corresponding growth in the GDP. In the medium and long run, pension expenditures are expected to reach a bit less than 12% of the GDP, which is the upper limit on government spending imposed by the current pension system. The reason behind it is that the balancing mechanism includes both average salary and the underlying population distribution. The balance ratio (BR) is calculated in the following way:

$$BR = \frac{capitalised\ value\ of\ contributions + buffer\ funds}{pension\ liabilities} \tag{1}$$

With the balance ratio equal to one, the fiscal balance is stable. If it is lower than one, the liabilities of pension system exceed the assets, which causes automatic decrease in pensions until the balance ratio reverts back to one. Since demographic structure influences pension liabilities and average salary impacts contributions, the current system should work with any population structure. Due to political reasons, the implementation lag was introduced into this formula in 2009. That is the reason why current pension expenditures are slightly lower as the percentage of the GDP than they should be.

3. Previous research

One of the earliest publications devoted to the fiscal impact of population aging was made by Ridler in 1984. He examined five selected OECD countries and looked at pension and health care expenditures. He argued that reduced public spending for youth should offset the fiscal burden caused by population aging. He also argued that population aging will not cause a severe financial impact at least to the end of the century. Even though he was incorrect in predicting that society will decrease expenditures on youth, he was correct in predicting that population aging will not lead to serious problems in the 20-th century.

The problem of the population aging and its fiscal impact was brought up to public attention not so long ago. Main reason for this is the fact that only one country faces severe consequences of population aging problem at the moment. The country is Japan, which had 26% share of the population over 65+ in the year 2014. Compared to Japan, the second (Italy) and the

third (Germany) countries are in a much better situation at the moment with 22% and 21% of the elderly population correspondingly. Since this problem is emerging and will become global in the future, there were several global international institutions which started to discuss it: UN, OSCE, IMF, World Bank and many others. A recent report "The IMF on the Fiscal Impact of Population Aging" (2009) had shown that "public commitments to old-age pensions and health services (disproportionately consumed by the elderly), undertaken at a time when demographic balances were economically favorable, become increasingly hard to sustain". The report stated that adjustments in public expenditures should be made in the nearest future. Park (2012) draws similar conclusions in his report.

In this research, we will rely heavily on National Transfer Accounts (NTA) data. All methodology and assumptions of this database are covered extensively by Lee & Mason (2011) in their book "Population aging and the generational economy: a global perspective". Overall research about the fiscal impact of population aging covers two areas. Several pieces of research are dedicated to the global perspective and look at the connection between age and economy in general. Others are country specific research with the same aim but looking at the specific country cases.

Comparative analyses of age and the macroeconomy are crucial because, unlike studies focusing on a single country, they allow to compare multiple countries either at the same or different levels of age transition. Matching countries on the same level of development can lead to the discovery of significant regional differences, which can result in serious differences in future policies. Careful matching of countries on the different level of age transition can give us a good estimate of what to expect from the country, which lies behind. Of course, matching should be done carefully, and there are several assumptions need to be made to make a reliable forecast for the country falling behind.

There are several studies of population aging and its implication for economy available. Lee and Donehower (2011), Mason et al. (2011), and Miller (2011) are focused on sources of financing consumption. Mason et al. (2011) discussed how assets are used in the generational economy while Lee and Donehower (2011) examined private transfers. Miller (2011) used a similar approach and produced comparable estimates of private transfers. They arrived at the same conclusion that in generational economy both savings and sharing are equally important in financing consumption.

Lee and Ogawa (2011) in their work about labor income over lifecycle found that some governments have considered policies aimed at mitigation of the economic impact of population aging. It was reached by changing policies which lead to changing of consumption and production patterns. Ultimately it will raise support ratios if the demographic pattern will not

change much from forecasted. A good example of this can be government policy which will be an incentive for later retirement. As Lee & Ogawa states even though older population will be more important in upcoming decades we need to continue to provide an incentive for younger people to obtain a better education. Later entrance to the workforce will be outweighed by higher productivity, which can be one of the solutions to lifecycle deficit caused by population aging.

In his work Tung (2011) performed an international comparison of consumption over the lifecycle. He used a sample of 23 economies on four continents. It indicated several related points. Firstly, consumption profiles are very different in developing and developed countries. Developed countries have a lot higher consumption of education and health care services. Secondly, for all countries public consumption profile exhibits a hump at the younger ages, it is flat in the middle ages and has a rising tail at the older ages. Lastly, he proved empirically conventional wisdom, that public spending plays the critical role for redistribution between different age groups.

All research devoted to global perspective and connection between population aging and the economy in general conclude that both savings and sharing are vital in financing lifecycle deficit. It is also evident that developed and developing countries have different consumption profiles at the moment, but the gap between them become narrower since developing countries consumption profiles converge to profiles of developed countries. Now we will proceed to country studies of population aging and its fiscal impact.

We can divide the previous country-specific research into three parts. The first part handles countries which are facing the fiscal impact of population aging now or will face shortly. It includes Japan and most European countries. Faruqee & Mühleisen (2003) looked at the case of Japan in 2003. Their paper develops a general equilibrium framework to examine the economic implications of population aging in Japan. They also looked at key fiscal policy options possible and evaluated the consequences of their impact on growth and welfare. Related work was done in Germany by Kluge (2013), Nuta (2014) for Romania and others. Conclusions were similar to international institutions reports from the past. Researchers have identified that if the structure of public spending will not change, it will become unsustainable shortly due to change of population structure caused by population aging.

The second part handles countries which will face consequences of population aging on the financial system from short to medium-term. These studies include research about the USA, China, and remains of European countries. Several studies have investigated cases of the USA. Here we should mention interesting papers of Felix and Watkins (2013) as well as Lee and Edwards (2002). For Australia economic effects were investigated by Kudrna, Tran, and Woodland (2015). They all looked at the current state of corresponding countries (the USA and

Australia), and their inference was similar to the conclusion for countries with the older population. If nothing is changed in public expenditures, the system will become unsustainable in the future. It holds for the USA as well, even though they spend less on health care at the moment than countries with universal health care systems. The only difference they found is that countries from this group have more time to adjust their policies before the fiscal impact of population aging hits them.

Last part includes research on countries which have not faced population aging problem yet, but undoubtedly will face it in long-term. The reason for this confidence is the fact that all the people who will retire in 2050-2060 have been already born. This cohort includes most countries of Latin America and Asia. Good research for India was published by Narayana in 2012 and was followed and updated in 2014. In the first paper, he estimated when and how population aging would impact financial system of India by using projections approach. In the second paper, he extended his work by using a generational accounting approach to receive a more precise estimation of fiscal impact. Ten Latin America countries' cases were covered by Miller, Mason and Holz (2009) in their research while Brazil case was investigated separately by Miller and Castanheira (2010). Not surprisingly conclusions were very similar to all other studies in this field. Population aging is inevitable, and it will cause a severe fiscal impact. Only modification is that for these countries, it will be in more distant future, and impact will be lower than in developed countries. It is because developing countries do not have such generous public support systems at the moment.

The remains of the countries (mostly in Africa) are not covered by previous research because they will not suffer from population aging problems and its fiscal implications in the foreseeable future.

There is no previous research on the fiscal impact of population aging in Sweden, but there are various studies on related topics. Bengtsson and Scott (2011) examine the consequences of population aging regarding life-cycle deficit. They also discuss how population aging can be a threat to the welfare state. Kruse and Bengtsson (2010) paid attention specifically to the Swedish pension system and concluded that it is stable in the long-run with the underlying assumption that share of the elderly will not change much. All researchers agree that Swedish system is balanced and steady at the moment, but with growing proportion of elder population, it will become unbalanced and adjustments will need to be made.

4. Data and methodology

Data

The data for this study was obtained from two databases. The first is the National Transfer Accounts (NTA), and the second is the Statistiska Centralbyrån (SCB – Statistics Sweden) database. We use the data on age-specific expenditures on three public services (education, pension, health care), produced by the NTA project. The driving force behind these projections is the demographic transition. Although demographic change can explain a substantial part of the future cost projections, public policies play a significant role as well.

”The purpose of National Transfer Accounts (NTA) is to measure at the aggregate level how those at each age acquire and use economic resources. The work is motivated in large part by a fundamental feature of all societies – the economic lifecycle, i.e., the mismatch between material needs and the ability to satisfy those needs through labor. The economic lifecycle is quantified in National Transfer Accounts by comparing consumption and labor income. The young and the old have a lifecycle deficit because they produce less through their labor than they consume. Working-age adults have a lifecycle surplus because they produce far more through their labor than they consume” (National Transfer Accounts Project, 2016a). The NTA database consists of a little less than 100 variables. In this study, we are mostly interested in the following three: Public Transfers, Education, Inflows (TGEI); Public Transfers, Health, Inflows (TGHI); and Public Transfers, Pensions, Inflows (TGSOAI). They are presented both at the aggregate level and on the age basis (a separate value per each one-year age group). The values are available both in nominal currency (SEK – Swedish crownes), and in normalized currency (USD – United States dollars).

Figure 1 below helps to illustrate why population aging can cause severe pressure on the Swedish financial system in the future.

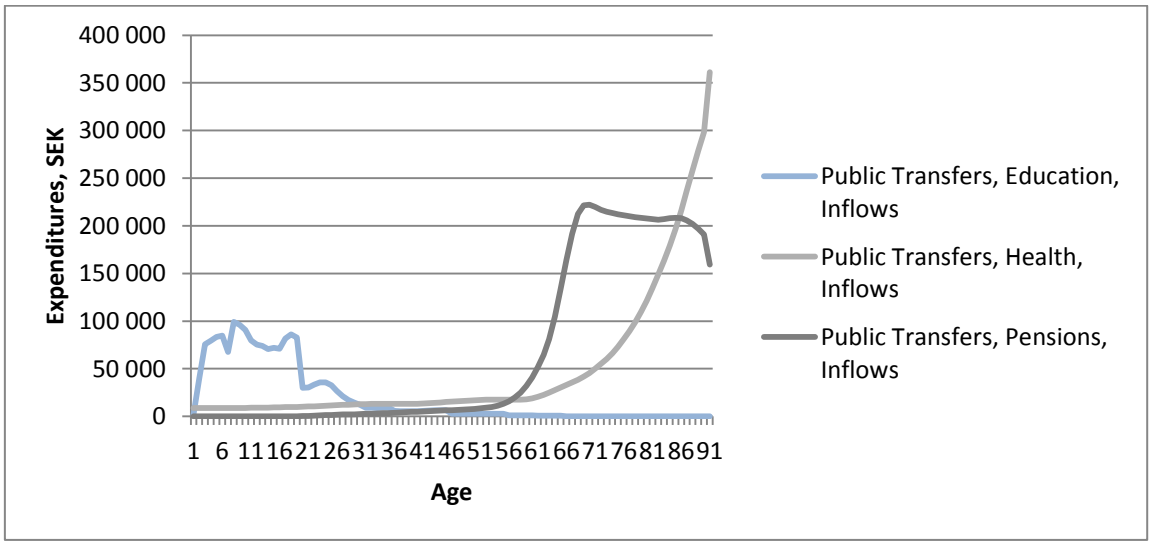

Figure 1. Expenditures by age and category for Sweden in 2003
Data source: National Transfer Accounts Project, 2016b

We can see clearly that Swedish public consumption profiles are highly age dependent. Other important observations are the high amount of pension expenditures per capita, and the exponential growth of the per capita health care cost for the elderly population.

SCB provides the macroeconomic data, which is used for population projections. They provide a population prognosis for each year from 2015 to 2100. We are going to use the data for the years 2015-2060, obtained from the latest prognosis "The future population of Sweden 2015-2060", which was published on May 19, 2015. There is a clear tradeoff between the length of the time horizon and the accuracy of any prediction. Capping the horizon in 2060 ensures that all the population that will be old in 2060 has been already born by now, which improves the accuracy of our projections. The data is available both on the aggregate level (total population) and by categories (TFR, net migration, life expectancy, sex distribution etcetera).

SCB uses the following underlying assumptions for the base case scenario:

- Every year during the entire forecast period, more births than deaths are expected.
- More people will immigrate than emigrate.
- During the next few years, a significant population increase is projected to be close to 150 thousand individuals per year (mostly due to Syrian immigrants).
- In the long term, immigration is expected to be around 50 thousand per year.

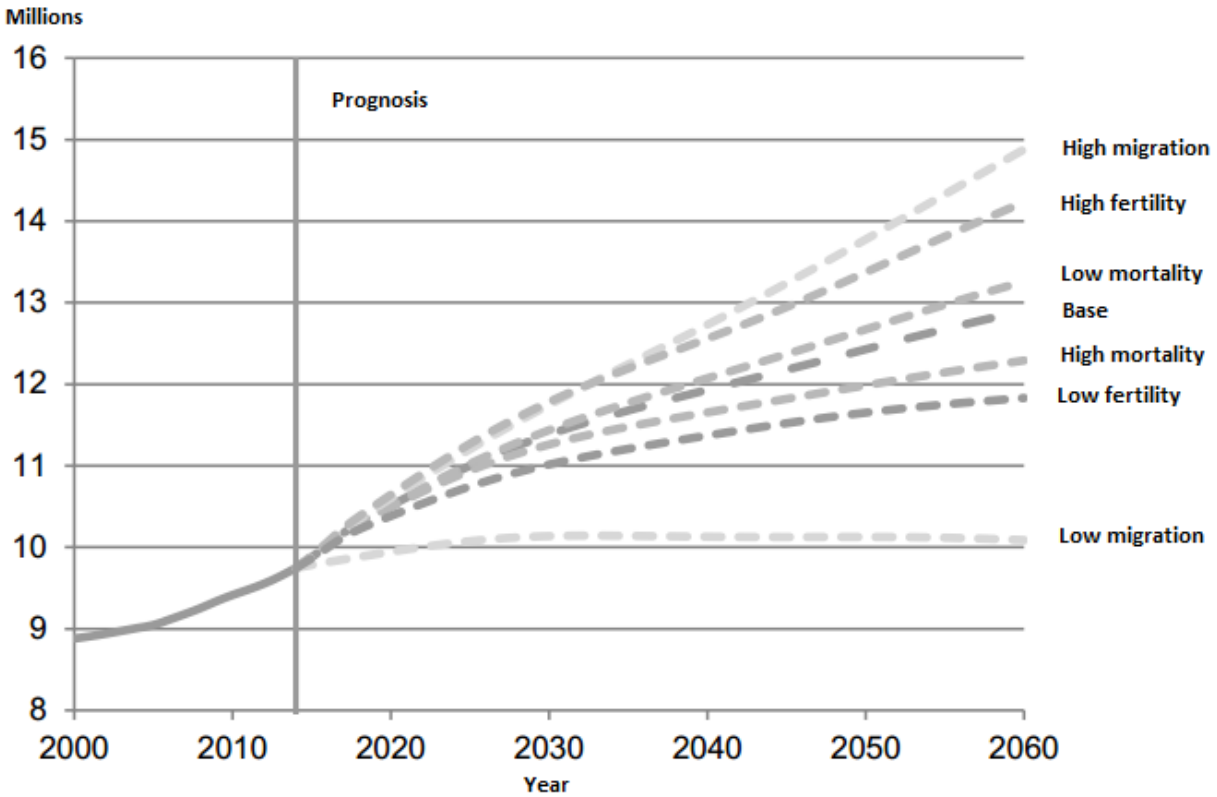

Figure 2. Population forecast for Sweden, years 2015-2060
Source: Statistics Sweden, 2015b

Given these assumptions, SCB forecasts that population of Sweden will increase from current 9.7 to 12.9 million in the year 2060. This forecast is the base prognosis in Figure 2. Scenarios with different underlying input variables assumptions are depicted as well. We will use the alternative estimates for sensitivity checks. We will combine the data from NTA and SCB to construct different projections for three macroeconomic scenarios (status quo, pension reform and health care reform).

Methodology

Research design adopted in this study is attractive for building projections of the fiscal impact of population aging. It follows Miller, Mason and Holz (2009), Miller and Castanheira (2010), and Narayana (2012).

The three public expenditures (health care, pension, and education) can be decomposed further. Each of them consists of a demographic component and a policy component. First, any type of public spending in general can be decomposed as follows:

$$\frac{E}{GDP} = \frac{E/P}{GDP/W} * \frac{P}{T} * \frac{T}{W}, \tag{2}$$

where *E* stands for expenditure, *GDP* is the Gross Domestic Product, *W* is the working age population (20-64 years old), *P* is the number of participants actually receiving the benefits, and *T* is the population at risk of treatment (potentially eligible for receiving the benefits).

Eq. (2) tells us that a share of a certain expenditure in the GDP is the product of three terms: the cost of benefits per participant, the participation rate, and the demographic dependency ratio.

Before making decomposition based on age groups, which will be our final model, we proceed with a general model. First, we construct the Benefit Generosity Ratio (BGR), which is defined as the relative cost of benefits per person at risk. Then we multiply it by the dependency ratio, which is defined as the proportion of the population at risk of treatment (pension, health care, education) to the working-age population:

$$\frac{E}{GDP} = \frac{E/T}{GDP/W} * \frac{T}{W}, \tag{3}$$

where the first term in the product is the BGR, and the second term is the dependency ratio.

Let us now refine this decomposition further, disaggregating on the age level:

$$\frac{E(t)}{GDP(t)} = \sum_{x=0}^{100} \frac{b(x,t) \ * \ P(x,t)}{P(20-64,t)}, \tag{4}$$

where *E(t)* stands for aggregate expenditures in year *t*, *b(x,t)* is the BGR for population of age *x* in year *t*, *P(x,t)* is population of age *x* in year *t*, and *P(20–64,t)* represents the working-age population in year *t*.

"That is, the proportion of GDP spent on education, health care, or pensions equals the sum over all ages of the expenditure per person of age *x* relative to GDP per working-age population multiplied by the ratio of people age *x* to the working-age population" (Miller, Mason & Holz, 2009).

To project *E(t)/GDP(t)*, we specify scenarios in terms of *b(x,t)* for *x* taking values from 0 to 100 (since the proportion of the population over 100 years old is too little to have a significant impact on the rest of the population), and *t* taking values from 2015 to 2060. We use the latest official SCB population forecast for the values of *P(x,t)*. For Sweden, initial *b(x,t)* values are readily calculable from the data collected by the NTA Project and the dependency ratio calculated from the SCB forecast.

The model, which we derived, decomposes public spending into the economic and the demographic component. It is useful due to several reasons. Firstly, one can evaluate generosity of the country's government spending compared to other nations by measuring benefits relative to the GDP per working-age adult. Secondly, it allows to address the age structure by transforming the aggregate spending to individual expenditures. Lastly, it allows to compare different types of government spending. We are going to use this model for the three different scenarios. Let us proceed with the detailed description of scenarios.

Status quo scenario

This is the central scenario, which will provide policymakers with the lower bound of the impact of population aging on EHP public spending. We will apply the model from Eq. (4) for the status quo scenario without adjustments. We are going to use *b(x,t)* for the year 2060 equal to *b(x,t)* from the year 2003 for education and health care expenditures from NTA database with pension expenditures predicted by the new balancing mechanism. For the year 2015, we will use actual data for EHP expenditures. In this scenario, the only change will be allowed is the change of the age structure in Sweden. We assume that age-specific benefits will increase at the rate of productivity growth; therefore, age-specific public spending will remain constant relative to GDP per working-age adult. Next, two scenarios will use several reasonable assumptions. It will provide benchmark data of possible future reforms in pension and health care sectors for policymakers (since educational sector will not cause severe fiscal problem in aging society).

Pension reform scenario

The additional assumption of this model is the following: there will be pension reform in the foreseeable future, which will change the pension system in Sweden. There are two reasons

for us to believe this will happen. Firstly, there were pension reforms every 25-35 years in Sweden during the last century. Every time government tries to adjust the retirement system to the changing population structure. We see no reason why current pension scheme should exist longer than previous ones. Secondly, given the current format of the pension plan, per capita pension payment will continue to decline due to the self-balancing mechanism (Eq. (1)). There are three ways to avoid further decrease of per capita pension. In the first case, the government will change rebalancing mechanism. Consequently, it will increase the upper limit amount of pension as the percentage of GDP to the higher number. The second option is to improve current pension system, by changing shares of guaranteed part and premium part. At the moment, the public part of pension is 7.5%, and private part is 1.3%. Therefore Swedish government will aim for the higher share of private part of the pension. A good example of this kind of system is the Netherlands, where the public part of pension is 5.4%, and private part is 3.9%. The total amount of expenditures is comparable. It is 8.8% of GDP in Sweden and 9.3% of GDP in the Netherlands. At the same time, Netherland's government spends almost two times less on the pension than Swedish. The third option is to reverse pension reform of 1994 and reintroduce pay-as-you-go system, which was partly abolished in 2004. We assume in this scenario that Sweden will choose the latter option and will reintroduce old pay-as-you-go system in the full amount for everyone. It is most consistent with common welfare state policies and has the highest support among voters. To make a projection of this simulation we are going to use b(x,t) for the year 2060 equal to $b(x,t)$ from the year 2003 from NTA database. For the year 2003, we will use $b(x,t)$ from the year 2003 from NTA database as well. Effectively it will provide us with the same result as no pension reform of 1994 ever exists. Other assumptions remain the same as in status quo scenario.

Health care reform scenario

Sweden spends more than 12% of GDP on health care already. Most of this sum is financed by public expenditures. It is one of the highest percentages of health care spending in the world along with the USA, the Netherlands, and Switzerland. Even Japan with a higher proportion of the elderly population (26% compare to 20% in Sweden) spends less (8% of GDP). It leads us to the conclusion that health care reform in Sweden is inevitable in the nearest future. The government will either increase the yearly self-risk for medical expenses from the current level of approximately 2000 SEK to a higher amount, simultaneously introducing compulsory health insurance, or abolish universal health care system at all. The latter option is highly unlikely since it will mean the end of "welfare state". Therefore, we will model this scenario, with increased health care expenditures and will evaluate which GDP growth will be able to support this growth in health care costs. Under this scenario, we assume that due to technological

progress health care cost per capita will be increased. They will grow only by 10% for the age group with the best health (age 11-49). The increase will be 20% for younger population below 11 years, to make infant mortality nonexistent. Expenditures will gradually increase for older population: 20% for ages 50-69, 30% for ages 70-79, 40% for ages 80-89 and increase by 50% for population 90+ ages. It will simulate the increase in long term care cost. We will change b(x,t) for the year 2060 accordingly in this scenario. Other assumptions remain the same as in status quo scenario.

We begin with pension reform scenario. Since NTA database has profiles of production and consumption for Sweden for the year 2003 our pension reform scenario will be based on projections from 2003 to 2060. This method will allow us to perform robustness check later in status quo scenario by inserting the actual data for the year 2015. If data expenditures predicted by NTA will provide us with good estimates of actual EHP expenditures for the year 2015 it will mean that consumption profiles did not change dramatically. It will give us ideas about other situations we should evaluate as well. Another benefit of the pension reform scenario is the possibility to assess the accuracy of previous SCB estimates compare to the actual outcome in 2015. Additionally a comparison of EHP expenditures predicted by NTA profiles and actual values will give us the ideas for sensitivity check. We will continue with status quo scenario, which will evaluate the current situation. We will conclude our analysis with health care reform scenario. Next subsection is a brief description of the limitations of the design followed by empirical analysis section.

Limitations of the design

The current research design has several limitations. First of all, reliance on the secondary data raises potential measurement error problem in the inputs to the analysis. However, both NTA and SCB produce reliable data, and their assumptions are in line with our study.

The second limitation concerns the methodology. Our main assumption is that currently observed consumption-production profiles during the lifetime will not change dramatically. Otherwise, current NTA profiles will not be representative of future spending. However, this assumption is only key to the status quo scenario, and its violation is tested in the health care reform scenario. We can reasonably assume from the past development of NTA consumption profiles that even if they change substantially, consumption will become skewed towards older ages, not otherwise. This is implied by status quo forecast serving as the reliable lower bound.

To address these limitations, we will perform the sensitivity checks for all primary input variables (TFR, mortality rate, and net migration) to population projections in each scenario.

Production and consumption values by age, and the GDP will be discounted back to the year 2003, to make the results comparable across all the scenarios and sensitivity checks.

5. Empirical analysis

Results

Pension reform scenario

In all scenarios, we will use Eq. (4) from the methodology part to evaluate what impact on fiscal balance would have different government policies. In pension reform scenario we will evaluate what impact on fiscal balance would have population aging if no pension adjustments were introduced in 1994 or if PAYG system will be used again for the whole amount of pension in the future. The only factor important here is the change of population structure. We can see clearly in Figure 3 below that population distribution by year will change significantly in the year 2060.

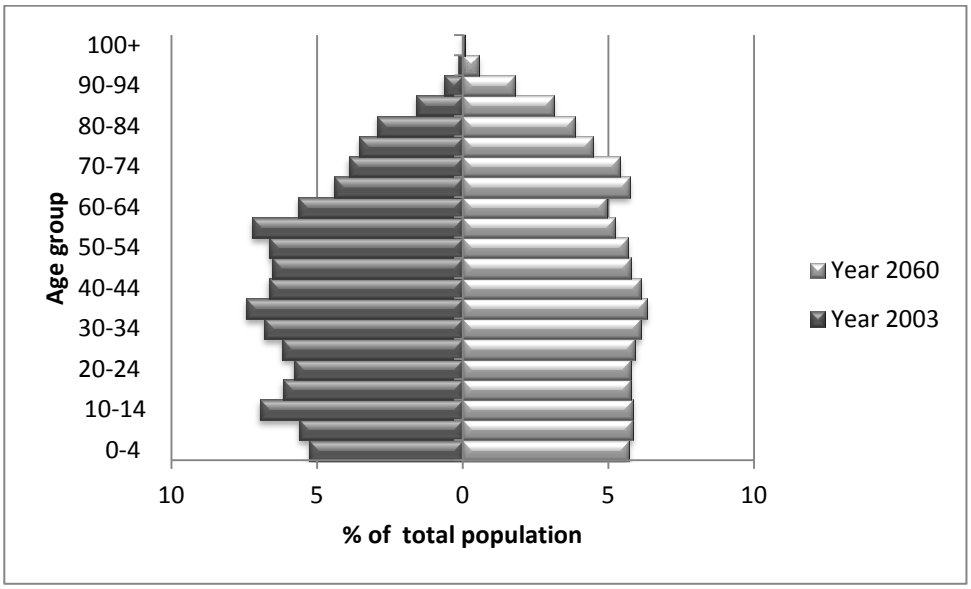

Figure 3. Population distribution by age groups in Sweden, years 2003 and 2060
Data source: Statistics Sweden, 2016b

A number of children will be about the same, but working age population will decline, and consequently elderly population will increase. Since there will be fewer people of working age to support growing share of the old one can assume that it will put a high amount of pressure on the fiscal system.

In Table 1 we provide findings of pension reform scenario:

Table 1. EHP expenditures under 100% pay-as-you-go scenario.

Public expenditures	Year 2003	Year 2060	Difference

Education	7.5%	7.2%	-0.3%
Healthcare	10.2%	14.4%	4.2%
Pension	14.8%	**19.6%**	**4.8%**
Sum of EHP expenditures as % of GDP	32.5%	41.2%	**8.7%**

As we can see population aging will cause an increase in these public expenditures from 32.5% to 41.2% of GDP between 2003 and 2060 due to the change in demographic distribution. Is it big amount or not? We can compare Sweden to other European countries. The fact is that in the year 2003 Sweden was spending the highest proportion of GDP on social protection expenditures in the whole EU (Statistics Sweden, 2013), followed by Denmark and France. For Sweden, this number was 30.4% of GDP. Education is not included in this figure, but pension and healthcare constitute 82% of these expenditures.

Swedish spent 3% more than average costs of richest top-15 EU countries. If we consider new EU members difference even more striking. Sweden spent 13% more than these new EU members on average. Education expenditures as the percentage of GDP were also very high at that moment. We can draw an inference that in the year 2003 Sweden already has spent an enormous proportion of GDP on education, healthcare and pension compare to other countries.

Population aging would cause an increase of these expenditures even more. By the year 2060, these three areas will consume 41.2% of GDP, the difference between 2003 and 2060 is 8.7%. Due to decreasing share young population expenditures on education will even decline slightly from 7.5% to 7.2%. Highest increase would cause pension expense amounting to 4.8% of GDP (an increase from 14.8% to 19.6%), followed by healthcare expenditures of 4.2% of GDP (an increase from 10.2% to 14.4%). Was that situation sustainable? Theoretically yes. To keep those expenses as stable 32.5% of GDP, it should grow at the average real rate (adjusted for inflation) of 1.06% per year. If GDP would grow at this level and all growth would be used for expenses only in these three areas than in the year 2060 even with the different demographic structure, they will remain only 32.5% of GDP. Is this realistic? No. The more plausible option is that GDP growth will be shared between all the areas necessary for proper functionality of state. It means that roughly third of future GDP growth will be used for education, healthcare, and pensions. Consequently, under this more realistic assumption, we need annual average real GDP growth of 3.24% to sustain expenditure structure of 2003 in the year 2060. Let us look at the real GDP growth in short and medium past. If we look at the years, 2003-2015 average real GDP growth was only 2%. We can use this as a robustness check, and it shows us that situation in pension reform scenario is not sustainable. It is because 2% growth is significantly lower that necessary growth of 3.24%. If we look at wider time frame (to adjust data for the crisis of 2008-2009), for the years 1993-2015 average real GDP growth was 2.39%. This number is

substantially higher but not even close high enough to sustain structure of the year 2003 public expenditures up to the year 2060.

We proceed to sensitivity check. For all scenarios, we use the same base assumptions about three main population drivers (fertility, mortality, net migration). In the year 2060, TFR is expected to be 1.89 children per women, net migration is projected to be 21 thousand people, and life expectancy is supposed to be 89.1 years for females and 86.7 years for males. Detailed assumptions on the annual basis can be found in Appendix 1.

Under alternative assumptions we will change fertility, mortality, net migration one at a time and will see what impact will it have on population and consequently on the financial state of Sweden in 2060. TFR is 1.65 under the low assumption and 2.17 under the high assumption. For mortality upward shift is three years and the downward shift is 5.5 years. Low net migration assumes 7 thousand per year, and high expects 62 thousand per year. Excerpt of information about the development of alternative assumptions for the years 2015-2060 can be found in Appendix 2.

Table 2. Sensitivity check of population input variables for pension reform scenario.

	Education	Health care	Pensions	Education	Health care	Pensions	Education	Health care	Pensions
Mortality	Low			Base			**High**		
% GDP combined	44.0			41.2			**37.0**		
% GDP by expenditure	7.0	16.3	20.6	7.2	14.4	19.6	7.5	11.9	**17.6**
Fertility	Low			Base			High		
% GDP combined	43.2			41.2			39.2		
% GDP by expenditure	6.5	15.4	21.3	7.2	14.4	19.6	8.0	13.4	17.8
Net migration	**Low**			Base			High		
% GDP combined	**45.1**			41.2			39.1		
% GDP by expenditure	6.6	16.3	**22.2**	7.2	14.4	19.6	7.4	13.4	18.2

Under the scenario of old pension system or if the pension reform of 1994 will be reversed in the nearest future highest fiscal impact will have mortality and net migration. Education expenditures will be very stable regardless of which input variable of the total population will we change. Health care costs will vary significantly under different inputs of independent variables, but under this scenario we will focus on pension expenditures, leaving medical expenses for our last scenario. We can see in Table 2 that the lowest percentage of retirement expenditures is achievable under either high mortality rate (17.6%) or high fertility rate (17.8%). Since the decline in death rate is highly unlikely, we can assume that if old pension

system will be reinstalled the most promising way to lower pension cost as the proportion of GDP is high fertility rate. While it will increase dependency ratio in the short run, because of the greater number of children in the long term it can solve the problem of pay-as-you-go systems, particularly in Sweden. From the table above we can also see that high migration is not so as high fertility rates in the long run, since all the migrants eventually, will become a part of the pension beneficiary as well.

Now we will explore what variable can influence an increase in pension cost the most? Surprisingly, in the case of Sweden, it is not low mortality rates, but small net migration. One explanation of this surprise can be very conservative SCB assumptions of low mortality rate. Nevertheless, if net migration will be close to zero, in the long run, it will increase pension expenses from 19.6 to 22.2% of GDP. The reason behind this change is the pattern of migration processes in Sweden. It is mostly young males who are immigrating in Sweden. Emigration is not relevant, since even if all emigrants are seniors, they will be receiving their pension abroad regardless. If net migration is positive it will mean that dependency ratio will decrease (implicitly assuming that these immigrants will be well integrated into Swedish job market). Small net migration has a higher impact on pension expenditures because migrants are supposed to work and support pay-as-you-go system from the day one. Therefore, lower number of migrants means lower taxes right away while lower fertility means lower taxes in 20+ years.

Previously we found that Sweden will need stable annual growth of real GDP of 3.24% to sustain the same share of these expenditures in the relation of total GDP in the year 2060 as in the year 2003. While mortality rates and fertility rates are unlikely to change dramatically overnight, it is possible that migration politics will be modified. For example, if in 2018 Swedish Democrats will win the election and will seriously limit immigration into Sweden required annual growth of real GDP to sustain current fiscal balance will be 2.4% instead of 3.24%. In the opposite scenario if Green party will win and open borders it will require annual growth of real GDP 3.73% to sustain current fiscal balance. This inference sounds counterintuitive and can be explained by the fact that immigration is the short and medium term solution of population aging problem. In the long run, all the immigrants who were supporting elderly population will become elderly population themselves. Hence, they will increase pressure on the pension system over the long term.

As we saw from projections and sensitivity check under the pay-as-you-go system, it is pension expenditures which can be the main contributor of fiscal deficit in the future due to the population aging. It could cost almost as much as education and health care expenses combined. Therefore, it was much expected that pension system would be changed, and it was changed. It leads us to the current situation and our status quo scenario.

Status quo scenario

As we mentioned before in 2004 new pension system was fully implemented in Sweden. The main feature of this scheme is that it is self-balanced. It does not matter what is dependency ratio at the moment in the country. In any case, pension expenses are limited by the percentage of GDP because it rises and falls along with average wages in the economy. It is expected that under worth demographic dependency ratio, which is also built in the self-balanced mechanism, public pension expenses will not exceed 12% of GDP. The government current expenditures on pension are only 7.5% of GDP, due to the economic outcome and demographic structure of the recent years. While in 2003 education, health care, and pension constitute 32.5% of GDP in 2015, due to the new pension system this number has decreased to 25.3% in 2015. There were no significant changes in expenditures on health care or education; consequently, the total fiscal savings are attributed to pension decrease. Summary of the findings for this scenario are in Table 3 below:

Table 3. EHP expenditures under status quo scenario.

Public expenditures	Year 2015 predicted from 2003 NTA	Year 2015 actual	Year 2060	Difference
Education	7.2%	7.3%	7.2%	-0.1%
Healthcare	10.6%	10.6%	**14.4%**	**3.8%**
Pension	16.5%	7.5%	11.4%	**3.9%**
Sum of EHP expenditures as % of GDP	34.4%	25.4%	33.0%	**7.6%**

Most important finding from this table is that actual values of the year 2015 and predicted by NTA profiles are identical for health care expenditures and almost the same for educational expenses. It means that our underlying assumption for projection about the stability of NTA profiles still holds. Apparently predicted values for pension expenditures are very different to actual outcomes. The reason for this is the new pension system, fully implemented after NTA profiles were constructed.

With the new pension scheme situation is sustainable at the moment. Since we discount back everything to the year 2003 and in the year 2003 all the expenditures combined were 32.5% and in 2060 under status quo they will be 33% the annual real GDP growth necessary to achieve this is less than 0.1%. It also means that at the moment Swedish government has a big amount of money they can spend, which became available after introducing new pension system in 2004. They freed more than 7% of GDP from new pension reform and spent only 0.6% on education and health care (0.2% on education and 0.4% on health care). The current situation is temporary. Balancing mechanism has overcompensated for the negative conjuncture of 2008-2009 financial crises. In the medium run, it expected to rise back to 10% of GDP with a gradual increase to the upper limit in 2030th. If the government will not be willing to finance future health care and

pension expenditures increase with savings they obtained due to the new pension system it will pose a serious burden on the fiscal system. If they want to keep EHP expenditures at 25.4% of GDP instead of 33%, it will require annual growth of real GDP 3.42% until the year 2060. This level of GDP growth is not reachable in the foreseeable future, therefore, in our opinion, they will change expenditures structure, and EHP expenditures will constitute roughly third part of GDP in the future. This way increase in health cost expenses will be covered by pension costs savings obtained from new pension reform. This way the fiscal system will be balanced in the long term as it was intended by introducing this pension reform.

Now we can proceed to the sensitivity check. It is unlikely that nothing will be changed in policies concerning education, health care, and retirement during next 45 years. Therefore, it is critical to perform the sensitivity check for the status quo scenario, since different outcomes of population structure will lead to different possible future reforms.

Table 4. Sensitivity check of population input variables for status quo scenario.

	Education	Health care	Pensions	Education	Health care	Pensions	Education	Health care	Pensions
Mortality	**Low**			Base			**High**		
% GDP combined	**35.0**			33.0			**30.4**		
% GDP by expenditure	7.0	**16.3**	11.6	7.2	14.4	11.4	7.5	**11.9**	11.0

Fertility	Low			Base			High		
% GDP combined	33.4			33.0			32.5		
% GDP by expenditure	6.5	15.4	11.5	7.2	14.4	11.4	8.0	13.4	11.1

Net migration	Low			Base			High		
% GDP combined	34.2			33.0			32.4		
% GDP by expenditure	6.6	16.3	11.3	7.2	14.4	11.4	7.4	13.4	11.5

We will pay attention to all three population input variables in status quo scenario. We can see in Table 4 that compare to pension reform scenario variability of expenditures as % of GDP decreased. It varied from 8.1% in the previous scenario (between 37 and 45.1%). Now it is only 4.6% (between 30.4 and 35%). It confirms again that pension reform created in 1994 was positive from the financial balance point of view. It also proves that system a lot more stable at the moment and less dependable on different shocks in underlying population structure changes.

From the table above we can see that education expenditures do not vary much. Compare to the current 7.2% of GDP they can be increased to 8% under very high fertility or decrease to 6.5 under low fertility. Either possibility will not impact fiscal balance significantly.

Pension under current circumstances is also not a problem. With balancing mechanism which depends on average salary and population structure, it does not matter how population variables will vary in the future. Under any assumptions with current pension system public expenditures will be lower than 12% of GDP. Therefore, from the fiscal point of view population aging will not cause any additional pressure in the long run. Sure, in the short term (like in the situation we are experiencing at the moment) public expenditures on pension can be significantly lower and provide a source of finance for another government spending. Unfortunately, it is not a sustainable source of financing in the long run, since population aging through self-balancing mechanism will drive balance to the upper limit.

In no new policies scenario, highest fiscal impact due to population aging will have health care system. We can see from the different scenarios that system is very stable at the moment with the small magnitude of change in any population input parameters. As in the case of pension reform scenario, the highest absolute amount of change in total expenditures can be observed in high mortality case. Again, it is highly unlikely that scenario will be realized in reality. The overwhelming majority of medical research state that life expectancy will continue to increase. However in the case if this is not true, and life expectancy in 2060 will be the same as now (84.1 for women and 80.5 for men) this will decrease total expenditures for 2.6% of GDP. Most of this decline will be attributed to lower expenditures on health care (2.5%) since pension rebalancing mechanism will keep pension expenses close to the upper limit with projected population structure in 2060.

What can be the biggest threat to the current system at the moment? Before 2004 greatest threat to the fiscal stability, in the long run, was low net migration. Under current condition, the biggest threat is low mortality. The impact will be similar in size to the high mortality, but direction will be the opposite. If life expectancy would be higher than expected, it will increase total expenditures by 2% of GDP and this growth will be attributed almost exclusively to health care expenses grow (1.9%). We can conclude that if no policy is changed until 2060 even with lower than expected mortality rates situation will be sustainable, and Sweden will not have problems with fiscal balance.

Health care reform scenario

As we saw in the status quo scenario, it is health care which contributes to highest public expenditures in Sweden at the moment. This trend of increasing expenditures on health care will continue. There are two reasons for this. As we mentioned before medical technology development is driving health care expenditures per capita up for every age group. Additionally long term health care will continue to increase due to population aging. It will increase both in

absolute and proportional amount. At the moment, long-term health care constitutes little less than 30% of total health care expenditures. By the year 2060, it will reach more than 40% due to the change in population structure. Results of future projections can be found in Table 5 below:

Table 5. EHP expenditures under health care reform scenario.

Public expenditures	Year 2015	Year 2060	Difference
Education	7.3%	7.2%	-0.1%
Healthcare	10.6%	**19.1%**	**8.5%**
Pension	7.5%	11.4%	3.9%
Sum of these expenditures as % of GDP	25.4%	37.7%	**12.3%**

In this scenario, it is not surprising that difference is significantly higher than in previous (12.3% against 8.7% in pension reform and 7.6% in status quo scenario). The reason behind increased gap was mentioned before. Both technologic improvement and change of population structure (by growing number of people requiring long-term health care) will move expenditures in the same direction. Through this synergy, we can expect almost doubling of health care costs by the year 2060 (from 10.6 to 19.1% of GDP). We can break down this increase in two parts. If medical expenses increase evenly by 10% for the whole age groups, total expenditures in the year 2060 will be 15.9% of GDP. Consequently, 8.5% overall increase in health care costs can be explained by 5.3% due to increase attributed to technology improvement and 3.2% due to the increase in the expense of the long-term care. Technological progress is inevitable therefore this scenario is very plausible. The only question is who will bear the cost of increased health care. There are two options. If we assume that pension reform savings will be diverted to cover an increase in health care expenditures, it will require 2.19% annual real GDP growth to finance this grow (from 32.5% of EHP expenditures in 2003 to 37.7% in 2060). If the government will not be willing to relocate these funds and will want to keep EHP spending on the current level of 25.4% of GDP, it will require 4.6% annual real GDP growth to reach this by the year 2060. As in status quo scenario, we assume that government will choose to relocate the budget expenditures and will try to keep EHP expenditures around 33% of GDP. This way increase in health care cost can be funded by the current scheme of 85% paid by government and 15% out of pocket in the long run.

Now we can proceed to sensitivity check. Summary is in Table 6 below:

Table 6. Sensitivity check of population input variables for health care reform scenario.

	Education	Health care	Pensions	Education	Health care	Pensions	Education	Health care	Pensions
Mortality	**Low**			Base			**High**		
% GDP combined	**40.6**			37.7			**34.0**		
% GDP by expenditure	7.0	**22.0**	11.6	7.2	19.1	11.4	7.5	**15.5**	11.0

Fertility	Low			Base			High		
% GDP combined	38.5			37.7			36.8		
% GDP by expenditure	6.5	20.5	11.5	7.2	19.1	11.4	8.0	17.7	11.1

Net migration	Low			Base			High		
% GDP combined	39.8			37.7			36.6		
% GDP by expenditure	6.6	21.9	11.3	7.2	19.1	11.4	7.4	17.7	11.5

With education expenses varying from 6.5 to 8% of GDP and pension costs moving around 11.4% only serious threat at the moment can be an increase in health care expenditures. Hence, we will focus on the health care spending in this sensitivity check. To sustain current fiscal balance, Sweden will require annual real GDP growth of 2.19%. This goal is achievable under current GDP growth rate.

Lowest amount of total expenditures will be possible in case of high mortality. Instead of 37.7% of GDP, it will be only 34%. These entire savings for fiscal costs will be attributed to the decrease in health care cost. Namely, long-term care expenditures will be reduced substantially compare to basic assumptions about mortality. Both high fertility and high net migration will not contribute to reducing health care costs significantly. The reason for this is that disproportionally large amount of expenditures is attributed to the older population. High fertility and high net migration will undoubtedly increase GDP but not enough to compensate for this disproportionality.

If we look at worse case assumption for fiscal stability, it is low mortality closely followed by small net migration. It was expected, given the disproportionality of health care expenditures per capita by age that low mortality will have the highest impact on total costs. One of the reasons for this can be underestimating of the growth rate of life expectancy. According to Appleby (2013), life expectancy calculated by government agencies for the last 50 years were in most cases underestimated, which leads to reduces estimates of health care and pension costs. Low sensitivity to fertility levels can be explained by the fact, that all population which will be 65+ years old in the year 2060 was already born. So the change in fertility level will influence the nominator only in the Eq. (1) while changes in mortality level and net migration influence both nominator and denominator of the balance ratio.

We must stress that this low mortality assumption is not something very unlikely. Given conservative assumptions which are usual for SCB population forecasts and the fact that their previous projections underestimated life expectancy, we need to take the possibility of low mortality very seriously. To sustain current fiscal balance, Sweden will require annual real GDP growth of 2.88% with rebalanced budget to 2003 proportions. It is substantially higher, given the

compounding for 45 years than the current growth rate of 2.39%. Thus, in case if mortality will be lower than expected Swedish government will be forced to shift part of the cost of health care to the end users. In this case, probably, will be increased annual limits out of pocket for everyone. Otherwise, quality of health care will be lower than the quality of peer countries. Without budget rebalancing with the current structure of 25% of EHP expenditure required annual GDP growth is 5.4%. In this case, the substantial part of health care costs will be passed on the patients.

Discussion

Sweden is well-known for being a welfare state. History of the welfare state goes back to 1936, when an agreement between trade unions and large corporations was made. Since then, Sweden adopts the social-democratic welfare state model. It is based on the principle of universalism, which is granting access to public services and benefits by citizenship. This system limits dependence of an individual on the family and market conditions, by providing a relatively high degree of citizen autonomy. During 1990s, the welfare state in Sweden reached its peak. Sweden has become one of the top three countries by share of social expenditures in the GDP, which exceeded 30%.

Population aging is one of the greatest threats to the welfare state. The foundation of the welfare state is that working age population supports those population groups that cannot support themselves. The welfare state functions best when the total population is growing. This way, dependency ratio usually decreases. It can operate well under the stable population as well, after the initial adjustment to the change in the demographic structure by age. However, the welfare state cannot function properly with declining population. Under this scenario, the labor force usually declines faster than the non-working population, which raises the dependency ratio and leads to insufficient funds to support the dependent population.

Starting from 1968, Sweden has not been able to sustain its population by itself. It was the first year when TFR dropped below the replacement level. With exceptions of 1990 and 1991, situation has remained stable, with the TFR ranging between 1.5 and 2.1. For the stability of the welfare system, migration was utilized to cover this population gap. During this time of low fertility, Sweden had positive net migration, which covered the population gap and even increased the total population slightly. Since migrants eventually become older, and will contribute to the population aging problem themselves, the Swedish welfare state is not very stable at the moment, unless the government expects to always have positive net migration. This study examines sustainability of the current welfare state in Sweden.

Combining NTA production/consumption age profiles with population variables from SCB database allows us to obtain projections of production and consumption by the age groups in 2060. We calculate the present values to make results comparable between different scenarios. Summary of the results is presented in Table 7 below.

Table 7. Summary of EHP expenditures under different scenarios.

EHP expenditures under 100% pay-as-you-go scenario			
Public expenditures	Year 2003	Year 2060	Difference
Education	7.5%	7.2%	-0.3%
Healthcare	10.2%	14.4%	**4.2%**
Pension	14.8%	**19.6%**	**4.8%**
Sum of EHP expenditures as % of GDP	32.5%	41.2%	**8.7%**
EHP expenditures under status quo scenario			
Public expenditures	Year 2015	Year 2060	Difference
Education	7.3%	7.2%	-0.1%
Healthcare	10.6%	**14.4%**	**3.8%**
Pension	7.5%	**11.4%**	**3.9%**
Sum of EHP expenditures as % of GDP	25.4%	33.0%	**7.6%**
EHP expenditures under health reform scenario			
Public expenditures	Year 2015	Year 2060	Difference
Education	7.3%	7.2%	-0.1%
Healthcare	10.6%	**19.1%**	**8.5%**
Pension	7.5%	11.4%	3.9%
Sum of these expenditures as % of GDP	25.4%	37.7%	**12.3%**

In 1994, a new pension reform was introduced, which gradually changed the Swedish pension system from a pure pay-as-you-go to a mixed system. This new scheme was perceived ambiguously. While it lowers fiscal pressure by effectively limiting the upper limit of public expenditures on pension to the percentage of the GDP, at the same time, it contradicts the idea of the welfare state. For the foreseeable future, the per capita amount of public pension will be declining. Our analysis starts in 2003, just one year before the new pension system was fully implemented. This allows to compare the pre-reform and post-reform states, and assess the fiscal impact of the new pension scheme.

Another goal of this scenario is to evaluate the potential impact of reintroducing the old pay-as-you-go pension system. It is not a highly unlikely event, since many voters are not satisfied with the new pension reform, and perceive it as unfair. The results indicate that if the old pension system was intact and was used instead of the current scheme, by the year 2060 expenditures on education, health care, and pension would increase by 8.7%. Roughly a half of this amount (4.2%) would be attributed to health care expenditures. The rest would be charged to the pension costs. Since education expenses would decline only by 0.1%, it would not be possible to cover the increased cost of pensions and health care by the decrease in education expenditures. This fiscal gap would need to be financed by a higher GDP growth achieved through productivity increase. It would require an annual real GDP growth of 3.24% for the

growing expenses to remain a constant fraction of the GDP. The annual real GDP growth was considerably lower in the previous ten years (2.85% during 1993-2003). This suggests that the current policies are not sustainable in the long run, and therefore, expenditures on health care or pension should be cut. The annual real GDP growth of 1.72% in the decade following the pension reform (2003-2013) was considerably lower than the rate necessary to sustain the old system, which proves that it was wise for the sake of fiscal balance to change the pension scheme.

11 years passed from that moment, and we can evaluate what happened. Firstly, we can see that consumption and production have not changed much since 2003. The previously predicted values for health care expenditures in 2015 turned out to be correct, while the predicted expenditures on education were off by only 1.5%. This justifies the assumption that NTA profiles will not change dramatically. At the moment, conditions are very favorable, because the current government public expenditures on EHP are 25.4%, and will reach 33% in the year 2060. Pension expenses are 7.5% in 2015, and they were 14.8% in 2003 and would be 16.5% under old pension system. As we see savings attributed to the new pension scheme are 9% of GDP. Now pension expenditures are artificially low, due to overcompensation of balancing mechanism in the year 2009. Even if financial crisis did not happen savings from new pension system would attribute to 5% of GDP. Fiscal system is very stable at the moment and if no policies change in EHP will be introduced and consumption profiles will remain the same it will require less than 1% of annual real GDP growth to maintain fiscal balance. Unfortunately, it is highly unlikely that consumption profiles will not change at all. While education public consumption pattern has a real chance to remain stable, we doubt that pension and health care consumption patterns will continue to be stable in the aging society. Since the change in retirement consumption profile was evaluated in the first scenario only thing left was to evaluate health care cost increase.

Under the last scenario, we assumed that health care consumption per capita would increase for every age group due to technology improvement and additionally it will gradually increase for people 50+ due to increasing in long-term health care cost. Under this scenario, EHP expenditures will reach 37.7% of GDP. If SCB underestimated life expectancy, as usually the case is life expectancy forecasts in the last 50 year, EHP would reach 40.6% of GDP and health care expenditures will reach 22%. It is twice the share GDP that health care costs at the moment. To continue current public coverage of health care expenses, it will require annual real GDP growth of 2.88%. At the moment, this increase does not seem reachable. For the last 22 years, annual real GDP growth was only 2.39% and for the previous 12 years it is even lower – 2 % growth annually. If current life expectancy and health care expenditures per capita trend will

continue inference is straightforward. We will face fiscal gap due to increased health care spending, and health care reform will be inevitable.

Table 8. GDP development and surplus/deficit under different scenarios.

Scenario	Real annual GDP growth, in %		
	Expected growth*	Necessary growth	Difference
Pension reform	2	3.24	-1.24
Status quo (2060, EHP - 25% of GDP)	2	3.42	-1.42
Status quo (2060, EHP - 33% of GDP)	**2**	**0.1**	**1.9**
Health care reform (2060, EHP - 25% of GDP)	2	4.6	-2.6
Health care reform (2060, EHP - 33% of GDP)	**2**	**2.19**	**-0.19**
	GDP in absolute amount (normalized, GDP for the year 2015 is 100)		
	Expected growth*	Necessary growth	Difference
Pension reform	243.79	419.91	176.13
Status quo (2060, EHP - 25% of GDP)	243.79	454.15	210.37
Status quo (2060, EHP - 33% of GDP)	**243.79**	**104.60**	**-139.18**
Health care reform (2060, EHP - 25% of GDP)	243.79	756.70	512.92
Health care reform (2060, EHP - 33% of GDP)	**243.79**	**265.08**	**21.30**
*Expected growth based on 2003-2015 growth			

Summarizing it is necessary to say that from the financial point of view pension reform of 2004 was necessary and unavoidable. The reason behind it is population aging. Otherwise, by the present time, Sweden would need substantial annual foreign borrowing to sustain same generous benefits to the elderly. In Table 8 we can see that old pay-as-you-go system would cause the additional deficit amounting to 176.13% of current GDP by the year 2060. In the year 2015, the national debt of Sweden was 34% of GDP, and this number has declining trend since 1995 when foreign debt accounted for 80% of GDP (Swedish National Debt Office, 2016). It would not be wise to accumulate external debt again. Therefore, rebalancing of the current budget is the wisest way to sustain fiscal balance. This budget adjustment will provide a surplus to the government amounting to 139.18% of GDP by the year 2060.

From Table 8, we can draw several inferences. First of all, we can say that the currently skewed structure of EHP expenditures is not sustainable under any scenario in the long run. It means that Swedish government is exploiting pension system rebalancing lag now. During next 1-5 years, the government will be forced to return to the previous structure of EHP expenditures. Namely change will be from the current EHP cost of the quarter of GDP to the previous number which is approximately one-third of GDP. Table 8 shows that it is highly unlikely that old pay-as-you-go system will be used again in the foreseeable future. It leaves us with two possible options. In the case of no technological change in the medical sector, the current system of public social expenditures is stable and can exist up to the year 2060 without any policy

adjustments. However, it is very plausible that health care costs will rise substantially due to the population aging and medical technologies development. It will lead to the fiscal gap which will not be covered if annual GDP growth rate will not rise substantially in the nearest future. If this the case we can expect health care reform in Sweden, which will be similar to pension reform of 2004. It should shift part of the public health care expenditures to the private costs. Will Sweden remain welfare state in this scenario? Yes, but slightly less generous for the elderly population and the reason behind it is the population aging. Otherwise, Sweden will need to make substantial foreign borrowing, increasing foreign debt from 34% to 55.3% of GDP.

6. Conclusion

The population structure has been favorable for economic growth in the most developed and developing countries starting from the 1950s. The proportion of working-age population has been increasing, and many states have used this demographic dividend in their favor. Public programs have increased both in absolute amount and in per capita values. However, this situation will not last longer. For some countries, such as Sweden, the era of demographic dividend is over. We are now facing the population aging phenomenon.

This study evaluates the possible fiscal impact of population aging in Sweden under different macroeconomic policy scenarios. All results are subject to the correctness of the input variables. We show that fiscal outcomes are most sensitive to changes in mortality rate, closely followed by changes in net migration. The fiscal balance is least sensitive to changes in fertility levels.

Despite the fact that big proportion of population perceives the pension reform of 1994 as unfair (Kruse & Bengtsson, 2010), our results show that this reform was unavoidable. To sustain the old pay-as-you-go system, the government would need to borrow funds amounting to 176% of the GDP, to cover additional pension expenditures for the years 2015-2060. These results are similar to results for the UK obtained by Young (2002), where they show that PAYG system is not sustainable in the long run. Introduction of the new pension scheme allowed Sweden to have a balanced budget and led to a decrease in the national debt during the last decade.

After evaluating the impact of population aging, it becomes apparent that the current pension reform is likely to stay for a long time. This puts additional emphasis on the status quo scenario, because it seems there will not be any significant EHP policy changes in the foreseeable future. We show that at the moment the Swedish government is exploiting flaws in the new pension system to some extent. The new pension system decreased the share of public expenditures on pension in the GDP from 15% to 10%. Further, by introducing implementation

lag in the balancing mechanism, the government enjoys an additional 2% reduction of public pension cost due to 2009 crisis. Therefore, the total saving on pension compared to the year 2003 is more than 7% of the GDP, which led to current state of EHP accounting only for a quarter of the total expenditures. Our analysis shows that this situation is not sustainable in the long run, because it will require foreign borrowing in amount of more than twice the GDP by the year 2060. The only alternative for the government is to rebalance the state budget in the near future, so that EHP expenditures constitute again roughly a third of the GDP, as they did during the last decades. After this adjustment, the fiscal system will become stable in the long run. Saving on the pension cost will partly cover the increase in the medical care cost due to population aging. The rest will be covered by the annual GDP growth of 0.1%. This is in line with the results obtained by Kruse and Bengtsson (2010) that pension system is balanced, and extends them to the educational and health care systems, which also seem to be balanced under no policies change scenario. 0.1% GDP growth is consistent with 0.3% labor productivity growth necessary for covering the consumption deficit for the whole Swedish economy, according to Bengtsson and Scott (2011). It is due to the fact that labor productivity is a good proxy for the real GDP growth in the Solow model, and EHP expenditures account for the third of the GDP.

Our last research question was to evaluate the impact of population aging under the scenario of medical progress. The exponential growth in the per capita medical cost for the elderly is clearly visible in the historical data. Ultimately, this will lead to an even higher per capita expenditure on health care, especially for the older population. This assumption is consistent with Lee and Edwards (2002), Faruqee and Mühleisen (2003), Nuta (2014) and many others. Most of the studies predict an increase in per capita medical expenditures both due to the technological improvement and the rising cost of the long term care due to population aging. In this scenario, our findings are similar to those of the status quo scenario. The Swedish government will be forced to rearrange the budget in the nearest future. EHP costs will constitute a third of the GDP again in the near future. Otherwise, situation will become unsustainable, and it will require more than 500% of the GDP of foreign borrowing by the year 2060. Health care cost increase becomes manageable after the budget adjustment to the previous EHP structure. It will either require 20% of the GDP of foreign borrowing by the year 2060, or will trigger the health care reform if the government will be reluctant to increase the national debt. This health care reform will change the current expenditure funding composition. Taking into account the success of the current pension reform for the fiscal stability, it is likely that an analogous health care reform will be introduced in Sweden in the medium term of 5 to 15 years in the future. We expect some self-balancing mechanism for health care expenses to be implemented, which will potentially raise the maximum amount of medical expenditures financed privately.

7. References

Appleby, J. 2013, Spending on health and social care over the next 50 years', Why think long term?, pp. 10-78.

Bengtsson, T., & Scott, K. 2011, 'Population Aging and the Future of the Welfare State: The Example of Sweden', Population and Development Review, pp. 158-170.

Bengtsson, T., & Scott, K. 2010, 'The Ageing Population', Population Ageing - A Threat to the Welfare State? The Case of Sweden, pp. 7-23.

Faruqee, H., & Mühleisen, M. 2003, 'Population aging in Japan: demographic shock and fiscal sustainability', Japan & The World Economy, 15, pp. 185-210.

Felix, A., & Watkins, K. 2013, 'The Impact of an Aging U.S. Population on State Tax Revenues', Economic Review (01612387), pp. 5-37.

Gist, J. 2011, 'Chapter 25: Fiscal Implications of Population Aging', Handbook Of Aging And The Social Sciences, pp. 353-366.

IMF 2009, 'The IMF on the Fiscal Impact of Population Aging', Population and Development Review, 2, pp. 437-442.

Kluge, F. 2013, 'The Fiscal Impact of Population Aging in Germany', Public Finance Review, 41, 1, pp. 37-63.

Kruse, A., & Bengtsson, T. 2010, 'A Stable Pension System: The Eighth Wonder', Population Ageing - A Threat to the Welfare State? The Case of Sweden, pp. 47-80.

Kudrna, G., Tran, C., & Woodland, A. 2015, 'The dynamic fiscal effects of demographic shift: The case of Australia', Economic Modelling, 50, pp. 105-122.

Lee, R., & Donehower, G. 2011, 'Private transfers in comparative perspective', Population Aging And The Generational Economy: A Global Perspective, pp.185-208.

Lee, R., & Edwards, R. 2002, 'The fiscal effects of population aging in the U.S.: assessing the uncertainties', NBER/Tax Policy & The Economy (MIT Press), 16, 1, pp. 141-180.

Lee, R., & Mason, A. 2011, 'Population Aging And The Generational Economy: A Global Perspective', n.p.: Cheltenham : Edward Elgar, cop. 2011.

Lee, S., & Ogawa, N. 2011, 'Labor income over the lifecycle', Population Aging And The Generational Economy: A Global Perspective, pp.161-184.

Mason, A., Ogawa, N., Chawla, A. & Matsukura, R. 2011, 'Asset-based flows from a generational perspective', Population Aging And The Generational Economy: A Global Perspective, pp.209-236.

Miller, T. 2011, 'The rise of the intergenerational state: aging and development', Population Aging And The Generational Economy: A Global Perspective, pp.161-184.

Miller, T., & Castanheira, H. 2010, 'The fiscal impact of population aging in Brazil', paper presented at Brazil Country Study on Aging Authors', Workshop, Brasilia and Washington, DC, 6–7 April 2010.

Miller, T., Mason, C., & Holz M. 2009, 'The fiscal impact of demographic change in ten Latin American countries: projecting public expenditures in health, education, and pensions', Demographic Change and Social Workshop, World Bank, Washington, DC, 14–15 July 2009.

Narayana, M. 2012, 'Impact of population ageing on India's public finance', Asian Population Studies, 8, 3, pp. 301-326.

Narayana, M. 2014, 'Impact of population ageing on sustainability of India's current fiscal policies: A Generational Accounting approach', The Journal Of The Economics Of Ageing, 3, pp. 71-83.

National Transfer Accounts Project 2016a, 'NTA methodology'. Available Online: http://www.ntaccounts.org/web/nta/show/Methodology/1.%20Overview [Accessed 26 February 2016].

National Transfer Accounts Project 2016b, 'Country Summaries'. Available Online: http://www.ntaccounts.org/doc/repository/public%20Sweden%20profile%202003.xlsx [Accessed 26 February 2016].

Nuta, A. 2014, 'Some comments about the impact of population ageing on fiscal indicators', Journal Of Public Administration, Finance & Law, 6, pp. 188-208.

Park, S 2012, 'Quantifying Impact Of Aging Population On Fiscal Space', Washington, DC : International Monetary Fund, ePublications.

Ridler, N 1984, 'Population aging: its fiscal impact in selected OECD countries', Canadian Studies In Population, 1, pp. 47-60.

Statistics Sweden 2013, 'Expenditure for social protection in relation to GDP decreases'. Available Online: http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/National-Accounts/National-Accounts/Social-protection-expenditure-and-receipts-in-Sweden-and-Europe-ESSPROS/Aktuell-Pong/58116/Behallare-for-Press/Social-protection-expenditure-and-receipts-in-Sweden-and-Europe/ [Accessed 26 February 2016].

Statistics Sweden 2015a, 'Households account for 15 percent of health and medical care costs'. Available Online: http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/National-Accounts/National-Accounts/System-of-Health-Accounts-SHA/Aktuell-pong/231546/Behallare-for-Press/387404/ [Accessed 26 February 2016].

Statistics Sweden 2015b, 'The future population of Sweden 2015-2060'. Available Online: http://www.scb.se/Statistik/_Publikationer/BE0401_2015I60_BR_BE51BR1502.pdf [Accessed 26 February 2016].

Statistics Sweden 2016a, 'Educational attainment of the population'. Available Online: http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Education-and-research/Education-of-the-population/Educational-attainment-of-the-population/Aktuell-Pong/9575/37671/ [Accessed 26 February 2016].

Statistics Sweden 2016b, 'Population forecast 2015-2060'. Available Online: http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START__BE__BE0401__BE0401A/BefolkprognRev2015/?rxid=c1a0bdbe-58e1-44c0-9eca-fab6bc1214b4 [Accessed 26 February 2016].

Swedish National Debt Office 2016, 'Debt as share of GDP'. Available Online: https://www.riksgalden.se/en/aboutsndo/Central-government-debt-and-finances/Statistics-new/Share_of_GDP/ [Accessed 26 February 2016].

Swedish Pensions Agency 2016, 'Swedish Pensions Agency budget proposal for the years 2017-2019'. Available Online: https://secure.pensionsmyndigheten.se/download/18.5123d181152fabb158c20633/1456933485763/Pensionsmyndighetens+budgetunderlag+2017-2019,+v.1.0.pdf [Accessed 26 February 2016].

Tung, A. 2011, 'Consumption over the lifecycle: an international comparison', Population Aging And The Generational Economy : A Global Perspective, pp.136-160.

Young, G. 2002, 'The implications of an ageing population for the UK economy', Bank of England Working Paper No. 159, pp. 310-353.

8. Appendices

Appendix 1

Overview of assumptions about migration, fertility, and mortality 2015-2060. Thousands, children per woman, year

Year	Immigration	Emmigration	Net migration thousands	TFR	Life expectancy Women	Life expectancy Men
2015	156	53	104	1,89	84,1	80,5
2016	172	54	117	1,90	84,2	80,7
2017	171	56	115	1,91	84,3	80,9
2018	141	58	83	1,92	84,4	81,0
2019	128	60	68	1,93	84,5	81,2
2020	126	61	65	1,94	84,6	81,4
2021	125	63	62	1,94	84,8	81,5
2022	124	64	60	1,95	84,9	81,7
2023	123	65	58	1,94	85,0	81,9
2024	122	67	56	1,94	85,1	82,0
2025	121	68	53	1,94	85,2	82,2
2026	119	69	50	1,93	85,3	82,3
2027	117	70	47	1,93	85,4	82,5
2028	116	71	45	1,92	85,6	82,7
2029	115	72	43	1,91	85,7	82,8
2030	114	73	41	1,91	85,8	82,9
2031	113	74	39	1,91	85,9	83,1
2032	112	75	38	1,90	86,0	83,2
2033	112	75	36	1,90	86,1	83,4
2034	111	76	35	1,90	86,3	83,5
2035	110	77	33	1,90	86,4	83,6
2036	110	78	32	1,90	86,5	83,8
2037	109	79	31	1,90	86,6	83,9
2038	109	79	30	1,89	86,7	84,0
2039	109	80	29	1,89	86,8	84,2
2040	108	81	28	1,89	87,0	84,3
2041	108	81	27	1,89	87,1	84,4
2042	108	82	26	1,89	87,2	84,6
2043	108	82	25	1,89	87,3	84,7
2044	108	83	25	1,89	87,4	84,8
2045	108	83	24	1,89	87,5	84,9
2046	108	84	24	1,89	87,6	85,1
2047	108	84	23	1,89	87,7	85,2
2048	107	85	23	1,89	87,8	85,3
2049	107	85	23	1,89	88,0	85,4
2050	107	85	22	1,89	88,1	85,6
2051	108	85	22	1,89	88,2	85,7
2052	108	86	22	1,89	88,3	85,8
2053	108	86	22	1,89	88,4	85,9
2054	108	86	22	1,89	88,5	86,0
2055	108	86	21	1,89	88,6	86,1
2056	108	86	21	1,89	88,7	86,3
2057	108	87	21	1,89	88,8	86,4
2058	108	87	21	1,89	88,9	86,5
2059	108	87	21	1,89	89,0	86,6
2060	109	87	21	1,89	89,1	86,7

Source: Statistics Sweden, 2015b

Appendix 2

Total fertility rate 2014 and forecast 2015-2060. Children per woman

Year	Low fertility	Base line	High fertility
2014		1,88	
2015	1,64	1,89	2,20
2020	1,54	1,94	2,35
2030	1,55	1,91	2,30
2040	1,63	1,89	2,20
2050	1,64	1,89	2,18
2060	1,65	1,89	2,17

Mortality 2014 and forecast 2015-2060. Life expectancy in years

	Low mortality		Base line		High mortality	
Year	Women	Men	Women	Men	Women	Men
2014			84,1	80,3		
2015	84,1	80,5	84,1	80,5	84,1	80,5
2020	84,9	81,6	84,6	81,4	84,1	80,5
2030	86,7	83,9	85,8	82,9	84,1	80,5
2040	88,7	86,2	87,0	84,3	84,1	80,5
2050	90,7	88,3	88,1	85,6	84,1	80,5
2060	92,2	90,1	89,1	86,7	84,1	80,5

Migration 2014 and forecast 2015-2060. Thousands

	Low migration			Base Line			High migration		
Year	In	Out	Net	In	Out	Net	In	Out	Net
2014				127	51	76			
2015	62	52	10	156	53	104	163	53	10
2020	55	51	4	126	61	65	148	63	85
2030	52	49	3	114	73	41	147	77	70
2040	49	47	2	108	81	28	152	88	64
2050	49	45	4	107	85	22	159	97	62
2060	50	43	7	109	87	21	165	104	62

Source: Statistics Sweden, 2015b