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Scenarios for Health Expenditure in Poland

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Abstract

The report is a result of the Ageing, Health Status and Determinants of Health Expenditure (AHEAD) project within the EC 6th Framework programme. The objective of the research was to present the model of future health care system revenues and expenditures in Poland and to discuss projection assumptions and results. The projections are based on methodology adopted in the International Labour Organization (ILO) Social Budget model. The projection examines impact of demographic changes and changes in health status on future (up to 2050) health expenditures. Next to it, future changes in the labour market participation and their impact on the health care system revenues are examined. Impact of demography on the health care system financial balanced is examined in four different scenarios: baseline scenario, death-related costs scenario, different longevity scenario and diversified employment rates scenario. Results indicate dynamic and systematic increase of the health expenditures in the next 30 years. Afterwards the dynamics of this process is foreseen to slow down. Despite the increase of the revenues of the health care system, the system will face deficit in the close future. This holds for each scenario, however the size of the deficit differs depending on longevity and labour market participation assumptions. Results lead to a discussion on possible reforms of the health care system.

Introduction

The question of ageing-related changes in health care system expenditure in Poland was raised in the context of EU policy debate rather than in response to the internal (locally raised) discussions on the volume and structure of public health care expenditures. Due to low level of public health care funding and dynamic institutional changes in the sector, national policy making process is focused on the sources of health care system funding, the size of funding and the efficiency of funding allocation. Issues related to the level and individual determinants of expenditures are not within the scope of main policy debate. Consequently, projecting scenarios of future health expenditure development and its determinants is an innovative project in Poland. Most likely, the same is true for other New Member States which have recently gone through transition.

The objective of this Report is to present the model of future health care system revenues and expenditures in Poland, and to discuss assumptions for the projection and projection results.

Expenditure analysis is based on International Labour Organization (ILO) social budget model, part of which is health budget model. The model takes into account the revenue side of health care system as well, which is consistent with the above-mentioned discussion on health care system funding and its sustainability. Moreover, until recently, data and information sources applicable for long-term comparative projections in the New Member States were limited. It is only from 2005 that such an analysis – comparable with the EU-15 – will be feasible, based on EU-SILC survey panel data.

The first part of the Report is dedicated to social, and especially health-related, expenditure models and projections applied in Poland. Following, detailed description of data and information used in the current projection is presented. Baseline projections of main demographic and macro-economic variables and indicators used in the model are shown, and the assumptions for the development of these indicators and their inter-relations are discussed. Three scenarios are presented: the baseline scenario, death-related costs scenario, and the scenario with different longevity improvements. Projection results cover both the revenue and the expenditure side of health care system. Finally, conclusions are made and policy recommendations are formulated, based on projection results.

Chapter 1.

Applied model of health revenues and expenditures

Over the last 16 years, several social expenditure projections have been applied in Poland in the process of economic and social reforms. These projections varied with respect to their purpose (policy or research-related), time frame (short- or long-term), or the scope of modeling (social or health budget and expenditures). Application of these models was either coordinated by country institutions, including ministries and research institutes, or by international institutions involved in reform. However, until recently, there has been no projection exercise focused on health expenditures and public health care system budget. Hereby, several models and projections that were developed and used for policy purposes are briefly presented.

The first one – the ILO social budget model - was developed in the mid-1990's. It covered the entire social budget. It was applied not only in Poland, but also in other Eastern European countries, i.e. Hungary and Slovakia. The purpose behind ILO social budget model introduction was to monitor long-term social revenues and expenditures, with focus on social budget balance. The model covered pension scheme and short-term benefits revenue and expenditure projections (including social assistance, family benefits and unemployment benefits). Originally, it was planned that the model should also include health care budget, but despite the fact that some of the data had been collected, the task was never completed, and health care budget was never presented. Social budget model design was coordinated by the Ministry of Labor, together with Gdansk Institute for Market Economics. To our knowledge, the model is still used by the Ministry, with the input from economic and labor market projections from the Ministry of Labor and Social Policy. Some sections of pension model and estimations were also used for the European Commission (DG Economic and Financial Affairs - DG ECFIN) Ageing Working Group (AWG) Project to estimate the impact of ageing on the pension system. Generally speaking, the most sophisticated social expenditure models concentrate on pensions. Long-term (50 years) pension expenditure projections were made by the government (Office of the

Government Plenipotentiary for Social Security Reform), with the World Bank assistance, during the work on three pillar pension reform in Poland (Chłoń et al., 1999). Currently, long-term pension expenditure projection is also a task bestowed upon social insurance institution, ZUS.

Until 2004, health care expenditures on aggregate level had not been subject to analysis and projections in Poland. It was then that CASE-Center for Social and Economic Research launched AHEAD Project[1] and the first modeling attempts were initiated. Interestingly, the 1999 (introduction of health insurance) and 2003 (centralization of regional Sickness Funds and establishment of one insurance institution – National Health Fund) health care sector reforms were not supported or justified by revenue and expenditure projections. Only short-term revenue and expenditure projections were made by the National Health Fund and the Ministry of Finance during the work on the state budget. In November 2004, the Ministry of Health appointed a group of experts to collect the data and information on health care system expenditures in Poland, and to prepare a Green Book of Health Care Financing (MZ 2004). At that time, the work on health care budget model carried out within AHEAD Project was intensified, and preliminary results of health care budget were presented in the Green Book. This task was performed by the experts from CASE and the Institute of Public Health, Collegium Medicum of Jagiellonian University, under AHEAD Project. Side by side with long-term projections, short term projections based on econometric model, made by the University of Warsaw, Economics Department, were presented in the Green Book, as well. Short-term projections covered a 3-year period and demonstrated estimated levels of aggregate public and private health expenditures and public revenues of the health care system (MZ 2004).

In 2005 Poland, as an EU member, was included in the European Commission project, coordinated by the DG ECFIN and targeted towards the estimation of ageing-related costs in EU-25 member states. Based on country data on medical service single expenditure and long-term care costs, experts from DG ECFIN prepared a 50-year projection of health and long-term care expenditures. In comparison to health budget model used in AHEAD projections, DG ECFIN estimations cover only the expenditure side, whereas health budget focuses on balance between revenues and expenditures (European Commission 2006). Both models take into account the impact of demographic changes, as well as changes in mortality and costs related to premature deaths. Furthermore, both models refer to a number of economic and labor market variables needed to estimate revenues and expenditures side of projections.

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[1] The Ageing, Health Status and Determinants of Health Expenditure (AHEAD) project has been started in 2004 by an ENEPRI consortium led by Centre for European Policy Studies (CESPS). Information about the project is available at http://www.enepri.org/Ahead.

Chapter 2.

Application of the ILO health budget model

Projections of health care system financing and financial balance were made based on the actuarial model prepared by the Social Security Department (SECSOC) of the International Labour Organization (ILO). The baseline model of social budget was restricted to health care budget and further adjusted for country situation, health care system performance and country legal regulations.

The model has one significant advantage, compared to other models that have been applied in health care financing projections in Poland: namely, it covers not only health care system expenditures, but also revenues. In effect, it is useful not only for international comparisons of health care system expenditures – as was the case with the Ageing Working Group projection – but also for country-based policy makers who are interested in health care system long-term financial sustainability. Moreover, the model focuses on insurance revenues and expenditures, which aptly reflects the structure of the Polish health care system, which since 1999 has been a health insurance system, with only a minor role for government revenues and expenditures.

Demographic development data and information include population size, fertility and life expectancy. Labour market factors include the size of labour market active and employed population which contributes to health care system revenues and is entitled to utilize medical services. Economic factors are applied for the projection of future increase in health care system expenditures, while governance factors can be applied to check system sensibility and to project future reforms. Health care system financial projections should also include information on population health. In the model adjusted for Poland, information on the size of population close to death and costs borne by this population is used. In order to assure projections' best fit, variables used on both the revenue and the expenditure side should be as accurate as possible. When accurate data is not available, appropriate estimations can be used.

Chapter 3.

Sources of data for the ILO health budget model

The model is built on a number of data, covering four main areas:
- demographic development,
- labour market changes,
- economic changes,
- aggregate health care system expenditures and expenditures by single cohorts.

ILO model data includes cross-sectional and time series data, as well as results of projections prepared by international and government institutions. Data for the model was collected from various national institutions, mainly public, governmental organizations, and represents official statistics. The same rule was applied to demographic, labour market and economic projections – whenever possible, official projections prepared by governmental organizations were used. However, in some cases we needed to rely on expert knowledge regarding future development of specific indicators such as, for example, the 'wage growth'. Assumptions regarding the development of specific indicators were based on past trends, taking into account the experience of EU-15 countries and in line with convergence plan Poland has adopted.

3.1. Sources of demographic data

There are several available data sources covering demography at the base year and demographic projections. These include: demographic data from the Central Statistical Office of Poland (GUS) and GUS population projections, population projections by EUROSTAT (Cruijsen et al. 2004), also used within the AWG project, and population projections by the United Nations (2002 version). Data for the base year (2003) is taken from national statistics provided by the Central Statistical Office,

while demographic projection is based on assumptions prepared by the United Nations (UN). Consequently, GUS projections are not applied in the model, since they only cover the 2003-2030 period, while the model is designed to cover the period up to 2050. Since the UN population projections are the best fit for the ILO social budget model, as their structure is the same as the one the demographic part of the model is built upon, UN projections were applied in the model. UN population projections cover the period of 2003-2050.

3.2. Sources of labour market and economic data

Analogically, GUS statistical information represents the main source of data on labour market and economic development. With respect to the base year, publicly available and regularly published GUS data is used, covering labour market participation rates and employment rates by 5-year cohorts and sex, unemployment rate and shares of employed by employment status. Listed labour market indicators are calculated based on Labour Force Survey (LFS) results, and published on a quarterly basis.

The data on key macro-economic variables (GDP, CPI) is taken from GUS and government statistics published together with the national budget information (execution and plans).

Projections concerning future development of those variables are made by government experts and were published in government documents such as, in particular:

• National Development Plan (Ministry of Economy 2005);

• Convergence Program (Ministry of Finance 2006).

Macro-economic projection assumptions and results were discussed among CASE experts and government experts involved in AWG activities. Long-term macro-economic and employment projections correspond to Lisbon Strategy objectives.

3.3. Sources of data on health care system

The original ILO health care model was based on the information regarding the levels of medical services utilization. In Poland, however, detailed administrative data on utilization by sex and age cohorts is not available, while there is detailed information on the cost of services by single ages, provided by the National Health

Fund, so that data is used for modeling purposes. The data also includes information on insurance inpatient and outpatient care expenditures for survivors and non-survivors. The original model is adjusted for this change. Besides the data on expenditure levels by age, sex and type of medical service, aggregate information from National Health Accounts on overall public health care system expenditures level is used (Annex 3).

Chapter 4.

Projecting the development of variables

Projection base year is 2003. This is the last year for which all the necessary data was available at the time when the work on the model was initiated. This is also the last year for which the National Health Accounts data is published by the GUS.

Following the structure of the model, variables used in the analysis and projections cover four areas, namely: demography, labour market, economic performance, and governance.

4.1. Demographic projection

Demographic part of the model is based on the United Nations demographic projection for Poland and future developments of main variables (including Total Fertility Rate – TFR, and Life Expectancy – LE) typical of Eastern European region. Base year (2003) data reflects Polish demographic situation as presented by GUS. For the base year, the actual population size by single ages is introduced. Further, size of the population changes depending on the assumptions concerning fertility level and longevity.

4.1.1. Total Fertility Rate

For the base year (2003), TFR is taken from the actual GUS data and is equivalent to 1.22. In 2003, GUS prepared a projection on future development of population size, which assumes further decline of the population, accompanied by TFR decrease until 2010 (to the 1.1 level), and then slow increase in TFR, but still much below population reproduction level (GUS 2004). Changes in fertility level are mostly driven by changes on the labour market and higher labour market participation of women. Yet, one

important factor which affects the overall fertility level is increasing age of women having children. According to GUS, the average age of women having children will increase in the next 30 years from 28 to more than 30 (GUS 2004). However, this projection covers only the period of 2003-2030, while our projections are targeted towards the year 2050. Therefore, a medium variant of UN population projection is used in the model. The UN population projection was prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat[2] and revised in 2004. In UN projections Poland is classified as a low fertility country, which means that in recent years fertility level was below replacement level (2.1 children per one woman). UN projection is built on the assumption that fertility level in every country will eventually converge to the level of 1.85 per one woman[3]. However, some countries (Poland being one of them) will not reach that level even in the target year 2050. In Poland, fertility is assumed to stay below the level of 1.85 children per woman during the whole projection period. Over the first 5-10 years of projection period, fertility level and fertility pattern follow recently observed trends, but later on fertility level is expected to increase in a linear fashion at the level of 0.07 children per woman per quinquennium. This assumption holds for the medium fertility scenario, used in our model. The medium scenario implies further decline of population size, though to a lower extent that it is at the moment. Next to the medium scenario, additional scenarios are prepared for each country, including Poland: high fertility scenario, low fertility scenario and constant fertility scenario (Table 1).

Table 1. Total Fertility Rate in Poland, 2000-2050

Period	Medium variant	High variant	Low variant	Constant fertility variant
2000-2005	1.26	1.26	1.26	1.26
2045-2050	1.76[4]	2.26	1.26	1.26

Source: UN (2006) World Population Prospects: the 2004 Revision Population Database

In the high fertility scenario, TFR is projected to be 0.5 percentage points higher than in the medium scenario. This implies reaching the reproduction level at the end of projection period. In contrast, in the low fertility scenario fertility is projected 0.5 percentage points lower than in the medium scenario. In the case of Poland this means that, in the long run, fertility level will be the same as in 2000-2005 period, and in the medium term fertility level will be very low: it is projected to be less than 1 child per woman in fertile age.

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[2] Population estimations and the development of main variables are presented at http://esa.un.org/unpp/p2k0data.asp
[3] UN demographic projection methodology and assumptions are described at http://esa.un.org/unpp/index.asp?panel=4
[4] According to UN population projections published in 2007 (*World Population Prospects: The 2006 Revision* and *World Urbanization Prospects*, *http://esa.un.org/unpp/p2k0data.asp*), TFR for the years 2045-2050 equals 1.6. Presented model is based on previous projection, which was effective when the model was being prepared.

4.1.2. Life Expectancy at Birth

Following on GUS data on longevity, LE for male was accepted at the level of 70.4 in the model, and for female at 78.9 for the base year (GUS 2004). Again, it was impossible to rely on GUS life expectancy projection data due to the different projection periods (2003-2030 for GUS projections).

Original ILO model provides three scenarios of life expectancy development: fast, medium and a slow one, and this source of projection was used. For the baseline scenario, medium development of LE was chosen. In the second and the third scenario, the impact of fast and slow development of LE was analyzed.

4.1.3. Migration

Another factor often included in demographic projections is migration level. The assumption on migration size is especially important for the short-term projections, given its strong impact on the labour market. GUS projection also assumes migrations from urban to rural areas (GUS 2004) and between regions (voivodships). Hereby, as projection of health care system revenues and expenditures is at the macro (national) level, internal migrations do not influence projection output. On the other hand, external (cross-country) migrations are very difficult to predict due to lack of adequate and detailed data. For the moment, Poland is facing a widespread emigration to the EU-15 countries. However, impact of the emigration process on the long-term projection may not be that strong. In the long run emigration will be balanced by immigrants from Asia and Africa that would come to Poland. Since the scale of these processes is difficult to predict in the long run, migration factor is not included in projections.

Table 2 (below) presents the values of demographic variables for the base year and their projected development. Despite life expectancy increase, population is shrinking due to low TFR levels. Even though TFR is slowly increasing during the whole projection period, even when reaching the top value it stays much below population reproduction level.

Overall, female life expectancy increases by 5 years, while male longevity increases by 6.9 years. In consequence, the gap between sexes is shrinking (from 8.4 to 6.5 years.) Faster improvement in male health status is a result (compensation) of its previous deterioration and high mortality in the communist period (Okólski 2004). In the next 50 years that trend among male population is expected to reverse.

Demographic projection indicates that Poland, analogically to other European countries, will enter the phase of population ageing in the next decade, with increase

Table 2. Development of main demographic variables for Poland, 2003-2050

	2003 (base year)	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
TFR	1.22	1.26	1.35	1.43	1.51	1.58	1.64	1.69	1.73	1.75	1.76
LE – males	70.5	70.9	71.9	72.8	73.6	74.4	75.2	75.9	76.4	76.9	77.4
LE – females	78.9	79.2	80.0	80.7	81.2	81.7	82.2	82.7	83.1	83.5	83.9

Source: Own calculations and the ILO model

(in number) of elderly cohorts and decrease of younger cohorts (Graph 1 and Graph 2.) This process will be accelerated after the year 2010 (Graph 3).

Graph 1. Poland: Population histogram – 2003
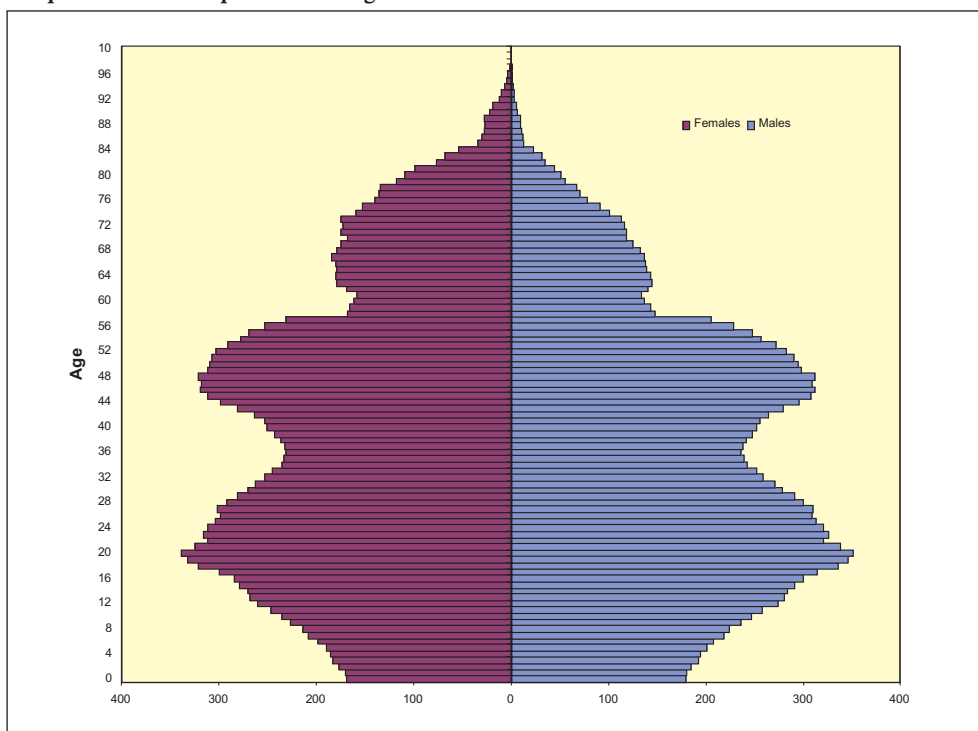
Source: Own calculations

Baby-boom generation, which in the base year is at the age of 17-21, will enter the elderly (pensioners) cohort in the target year of 2050. We can also observe that the number of newborn babies is decreasing with each year, which is reflected in the number of children and youngsters in the next decades.

The total population number will stop to grow in 2015, approximately, and from 2015 onwards it is foreseen to decrease. By 2050, total population decrease is

**Graph 2. Poland: Population histogram – 2050**
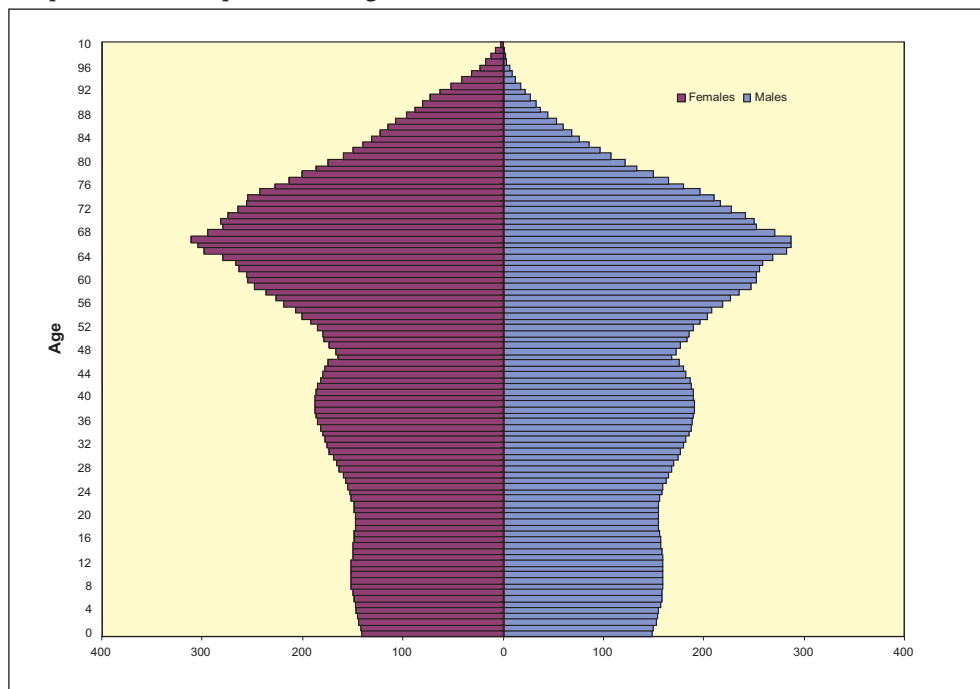
Source: Own calculations

equivalent to 13.2% of base year population. The share of the elderly (65+) will by 2050 increase from about 13% to nearly 30%, and the share of active age population (15-64) is expected to decrease from 70% to 56% (Graph 3).

According to population estimation based on UN fertility and longevity assumptions (UN 2006), the Polish population in the first years does not shrink as fast as EUROSTAT and GUS projections forecast (European Commission 2006, GUS 2004). However, the ageing effect keeps for more than one cohort, and a drop in population size is even stronger after 2025. At the end of projection period, there is greater convergence between EUROSTAT and model projections (Graph 4).

4.2. Labour market and economic projection

Three economic and labour market indicators are crucial for future development of revenues and expenditures of the public health care system: GDP changes, employment/unemployment level, and productivity of workers in the future. Assumptions on the development of those indicators were discussed with experts from

Graph 3. Projected population size, 2003-2050
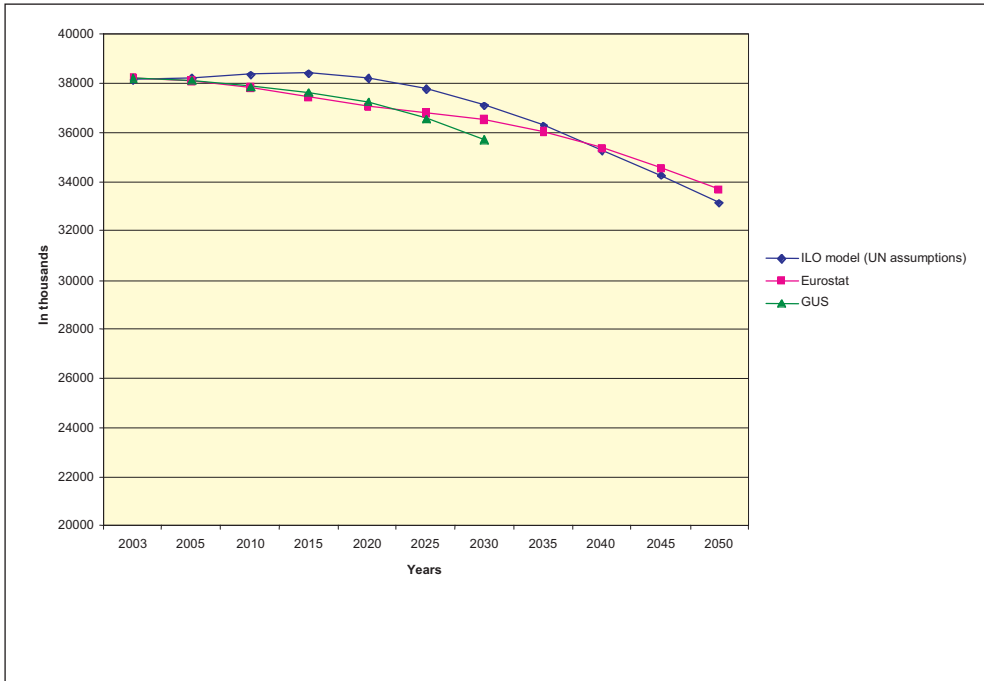
Source: own calculations

Graph 4. Projected age structure of the Polish population, 2003-2050
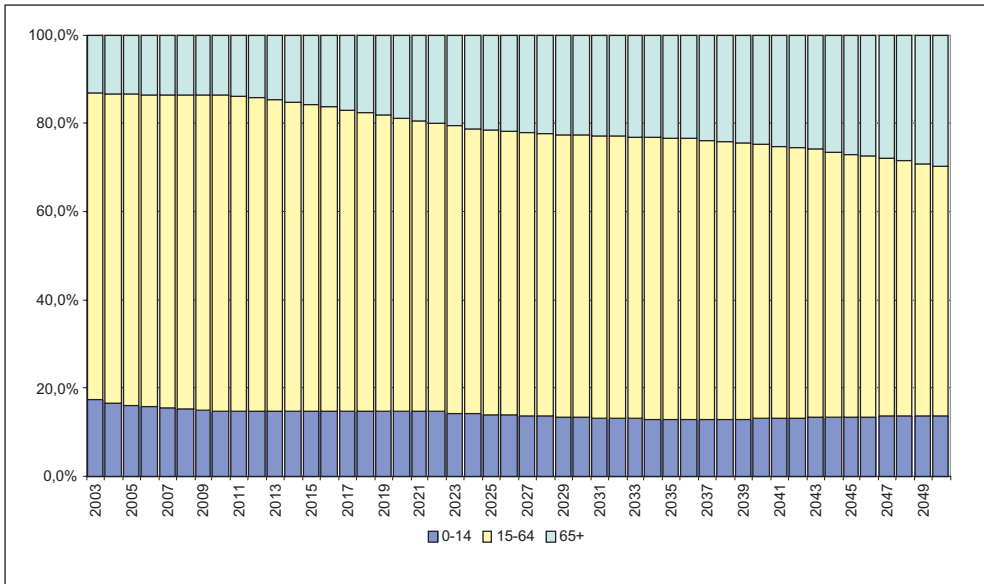
Source: Own calculations

the Ministry of Labour and Social Policy, and with CASE experts. Assumptions are also based on government policy documents in which short-term developments of main economic indicators are analyzed, and long-term objectives for labour and economic policy are set forth. These include: the National Development Plan (MGiP 2004), the national budgets (Ministry of Finance 2006), the convergence strategy (Ministry of Finance 2006), and the labour market strategy (MGiP 2005).

4.2.1. GDP

GDP development assumptions are based on the relation between employment rate and productivity. It is foreseen that during projection period GDP will develop in two stages. In the next decade, annual GDP growth in real terms will reach app. 5%. The following factors will contribute to GDP growth during that time: high investments rate, increasing employment and high labour productivity. These economic changes result from European enlargements and expansion to the European market. It is expected, however, that this growing trend is going to reverse after 2015, and GDP growth rate is projected to decrease. Decreasing GDP growth trend is caused predominantly by labour market changes and decreasing number of the employed which does not go hand in hand with corresponding increase in productivity – at least the increase is not strong enough to maintain dynamic economic growth (Table 5). In consequence, in the year 2050 annual real GDP growth is forecasted to reach the level of 1%.

Similar short-term assumptions are presented in a short-term projection included in the 2007-2009 national budget prepared by the Ministry of Finance (Ministry of Finance 2006), in the National Development Plan (MGiP 2004), and in the National Employment Strategy adopted by the government in 2005 (MGiP 2005.) According to these projections, annual average real GDP growth in 2007-2009 will reach the level of 4.9%.

4.2.2. Employment Rate

Future employment developments are contingent upon the changes in two types of factors that determine the level of employment:

- demographic changes, especially in the size of labour market active age population (population aged 15-64),
- assumptions on the level of investments and changes in the level of entrepreneurial activity, development of knowledge-based economy and future level of exports.

Future employment level assumptions draw on the National Employment Strategy (MGiP 2005). drafted by the Ministry of Economy and Labour[5]. Despite unfavorable

demographic trend expected after 2010, the forecasts prepared by the Ministry of Labour and Social Policy (MGiP) shows employment rate increase to the level of 58-62% (depending on the scenario) by 2013. In the model, the most pessimistic scenario is followed. Given very low level of employment rate observed in recent years (about 52%), a slower increase of employment rate is presented in the projection – up to the level of 58% in 2013. Employment rate increase in both short- and long-term could be fostered by an extension in the length of professional activity of women, up to age of 65 (which is currently discussed in the Ministry of Labour and Social Policy).

In the following decades, the ageing process will not contribute to employment level increase. Poland, however, is going to implement Lisbon Strategy with the objective of employment level at 70%. Pursuant to the National Employment Strategy, Poland will reach such level of employment in 2030. Later on, in the last two decades included in the projection, slower increase of employment rate is foreseen, up to the level of 74%. Increase in employment will be possible thanks to the factors other than demography (*inter alia*, the impact of restrictions to early retirement introduced in the funded pension scheme.) Such employment level is necessary to keep the economy growing, even if productivity growth is high.

Another important feature of Polish labour market which was taken into account in the model and which exerts big impact on the revenue side of health care system is the structure of employment, with high share of the self-employed in agriculture (over 20%). For the base year, structure of employment introduced in the model follows GUS statistics (GUS 2004), with domination of private sector employees (37.3%), followed by public sector employees (26.5%.) Convergence rule and internal migration trends guide us to assume that in the next years the share of the self-employed in agriculture is going to decrease. According to GUS data (GUS 2004), the number of individuals employed in agriculture was, on average, decreasing by 3% annually in the period of 1995-2002 (Table 3). This trend is expected to continue, but with a milder slope. Therefore, it is assumed in the model that the share of employed in agriculture will further decrease by 2% annually. In effect, the share of self-employed in agriculture in the year 2050 will decrease by more than a half.

Table 3. Employment in agriculture in Poland, 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Employment in agriculture (thousands)	3498	3331	3298	3104	2914	2657	2715	2711	2652
Percentage of change versus previous year		-4.78	-0.99	-5.88	-6.11	-8.84	2.21	-0.16	-2.18

Source: GUS (2004)

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[5] Currently Ministry of Labour and Social Policy.

It is projected that the decreasing share of employed in agriculture will be accompanied by increasing share of employment in private formal sector and the self-employed outside agriculture. Employment increase in those groups will progress gradually and equally between the two said groups of employed. The share of employment in public sector is kept constant during the whole projection period.

4.2.3. Unemployment Rate

The level of unemployment rate depends on economic and institutional factors, with special emphasis on the development of business-friendly regulations and the incentive to stay employed, built in the funded pension scheme. It is assumed that unemployment rate decrease will be rather slow.

According to the National Employment Strategy, in the optimistic and middle scenario unemployment rate should go down to the level of 8-10% in 2013. In view of that fact, however, that unemployment in Poland is structural in nature and strongly related to age, presented projection follows pessimistic scenario in the short term, assuming that unemployment rate will reach the level of 12% by 2013. In the following decades, unemployment rate will further decrease to the average European level of 7% (European Commission 2006).

4.2.4. Labour Productivity

Assumptions on labour productivity play the key role in future development of GDP and employment levels. Negative impact of demographic changes on the economy and GDP growth can only be offset with labour productivity increase. In spite of rapid growth of labour productivity in Poland in the last 10-15 years (Table 4), productivity level in Poland is still over 30% lower than in the EU-15.

Table 4. Labour productivity in Poland as compared to the EU-15 level

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	average 1996-2006
EU-15	100	100	100	100	100	100	100	100	100	100	100	100.00
Poland	54.3	55.6	56.1	59.9	62.4	53.9	55.0	63.4	65.9	66.8	67.0	60.02

Source: Eurostat, http://epp.eurostat.ec.europa.eu/

Thus, it is assumed that productivity level in Poland will increase further to reach the average level of productivity in the EU-15, with small fluctuations related to economic situation. Although high labour productivity growth in the next decades will by lower than GDP growth. Only in the last years of projection period will labour productivity dynamics be slightly higher than GDP growth dynamics.

Overall, the impact of ageing on productivity level in the long run is unclear. On the one hand, older employees are perceived as less flexible in their approach to new technologies and tasks, which may hamper productivity level. On the other hand, changes in work organization designed to better exploit the potential and expertise of older workers may have positive impact on labour productivity (Carone et al. 2005).

All in all, we arrive at the following scenarios for the development of main economic and labour market indicators:

Table 5. Development of main economic and labour market indicators

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
GDP growth (%)	5.3	5.1	4.8	4.2	3.7	3.2	2.6	2.1	1.5	1.0
Employment rate (%)	51.2	55.3	59.4	62.9	66.5	70.0	71.0	72.0	73.0	74.0
Labour productivity growth (%)	3.0	3.3	4.4	4.2	3.4	2.7	3.1	3.2	3.0	2.7

Source: Own estimations

4.3. Policy assumptions

To observe the impact of ageing on health care system performance, the *status quo* of currently binding legal regulations is assumed (non-policy changes) (Kohman, Weale 2006.) This implies that current financial regulations are in place for the whole projection period, especially on the revenue side. Health insurance contribution rate is expected to grow to the level of 9% in 2007, and remains at that level afterwards. Similarly, the level of contributions paid by local self-government authorities for the unemployed was kept stable. It is calculated either in relation to unemployment benefit (for those eligible for the benefit), or as 40% of nursing benefit (for those not eligible for unemployment benefit).

Apart from an increase in contribution rate for the employed, another important political issue currently discussed by decision-makers which may be modified in the future is the concept that farmers should contribute at the same level as the employees. At present, farmers are covered under the Agricultural Social Insurance Fund, and they do not contribute pursuant to the same legal regulations as employees. In our model, insurance contribution per one self-employed in agriculture was estimated based on Agricultural Social Insurance Fund total expenditure on health care and the number of self-employed in agriculture. The amount of contribution per one farmer is kept stable for the whole projection period.

The final governance-related issue that should be discussed is the level of spending from the general budget. According to legal regulations, general budget financing

covers emergency services, medical university hospitals, public health activities, highly specialized procedures, education and training. The level of spending is difficult to project in the long run since it depends on political decision taken for each budgetary year. Consequently, it is assumed that the level of government spending as a share of insurance expenditure calculated in the National Health Accounts (16.3%) will not change in the coming years.

4.4. Other assumptions

4.4.1. Income elasticity

Public health expenditures, including government and insurance expenditures, are estimated on the basis of the National Health Accounts for 2003 (GUS 2006). Increase in the level of expenditure is driven by GDP per capita growth, which constitutes the most important non-demographic driver in health expenditures. It is assumed in the model that health expenditure income elasticity is equivalent to unity. As a result, average health expenditure growth equals annual increase of GDP per capita. A similar pattern of increase in GDP and health expenditures is regarded as the closest approximation possible, given that the model does not include other factors that affect health expenditure increase, such as technological advancements or Baumol effect[6]. Unfortunately, the research on income elasticity of health expenditure growth has not been conducted in Poland to date, and the identification of such research in other countries from the region was unsuccessful, except for one estimation by OECD experts suggesting that health expenditure income elasticity in Poland in the period of 1992-2002 equals 0.96 (European Commission 2006). However, as authors admit, the period for which the data is available is very short, which can adversely affect the soundness of the analysis.

4.4.2. Health insurance contributors

Another employment-related factor of big importance for the revenue side of projections is the number of contributors to health insurance system. According to National Health Fund estimations, contribution collection rate for the employed for the base year is at the level of 83%. In the model, it is assumed that contribution collection

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[6] Baumol Effect is a phenomenon described by W.J.Baumol and W.G.Bowen in the 1960s, originally in performing art sector. In sectors which labour-intensive production (also health care sector) relatively low labour productivity growth over time is observed. So wages increase cause prices increase and production is relatively more expensive over time.

rate is going to improve to the level of 90% in 2050. The number of old age and disability pensioners who contribute to health insurance is estimated thanks to the comparison between the number of pensioners in 2003 and the number of contributors. Contribution collection rate among pensioners was estimated at 92%. Further improvement in collection rate in this group is foreseen, up to the level of 95% in 2050.

The average number of dependants covered by health insurance per one insured person was estimated as being equal to the average reported by the insurer (0.6). This indicator is projected to decrease during projection period (average 0.5 in 2025, and 0.4 in 2050).

4.4.3. Expenditures on pharmaceuticals and technology

According to OECD studies, public expenditure on pharmaceuticals increases faster than the expenditure on medical services utilization related to ageing (Martins 2006). Detailed analysis shows that in the period of 1990 – 2002 annual public expenditure on pharmaceuticals in developed countries was 30% higher than the increase in other expenditures (Orosz 2003). Therefore, the annual increase in public expenditure on pharmaceuticals is assumed to be 1.3 times bigger than other insurance health expenditures.

The model does not include specific indicators regarding technology development in health care and the impact of such development on overall expenditure level and health system budget.

Chapter 5.

Projection results

Projection was performed for three scenarios. All the scenarios are presented and discussed below:

I. Baseline scenario;

II. Death-related costs scenario, with different average expenditure for survivors and deceased;

III. Variations in health improvement and mortality trends (baseline scenario assumes middle longevity improvement, the other two scenarios – fast and slow longevity improvement.)

5.1. Baseline scenario

Insurance expenditure profile differs significantly for males and females. Discrepancies in medical services utilization pattern have been presented in earlier studies based on survey data (Golinowska, Sowa 2005), and can be accounted for by different needs for health care services. Graph 5 presents average expenditures per capita, by gender and 5-year age groups.

High level of expenditures at the earliest stage of life, gender notwithstanding, is related to intensive care for infants and big health needs of children in the first years of life (vaccinations, common hospitalization in case of any health problems). Later, as children grow, the level of expenditure decreases. For males, the level of expenditure is almost stable until 40 years of age, with even lower levels at the age of 20-35. This stage of life, on average, represents the best health status in the course of a lifetime. For females, rapid increase in health expenditures related to pregnancy and birth can be observed (20-40 years of age). Between 40 and 55 years of age, expenditures for both sexes increase with similar dynamics. Between the age of 55 and 75, health expenditures for males grow faster than for females, and then drop after the age of 75. Expenditures on females grow much slower and reach their peak

at later stages of life. These discrepancies can be attributed to differences in longevity and to the fact that the highest expenditures are incurred during the one or two years

Graph 5. Average per capita insurance expenditures as percent of GDP per capita, base year (2003)
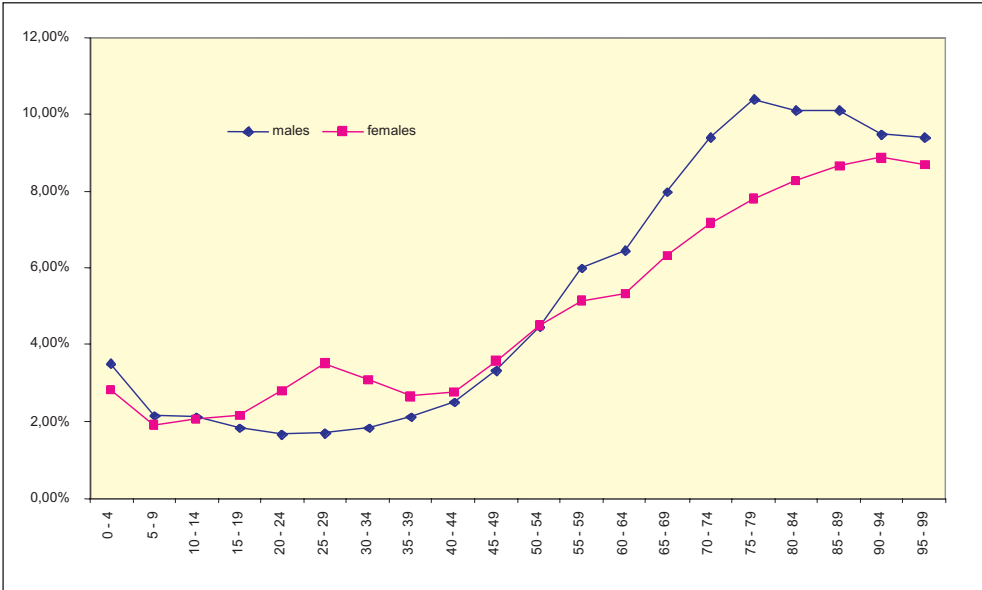
Source: Own calculations

Graph 6. Projected total expenditures by single ages, 2003, 2025, 2050 (PLN per capita)
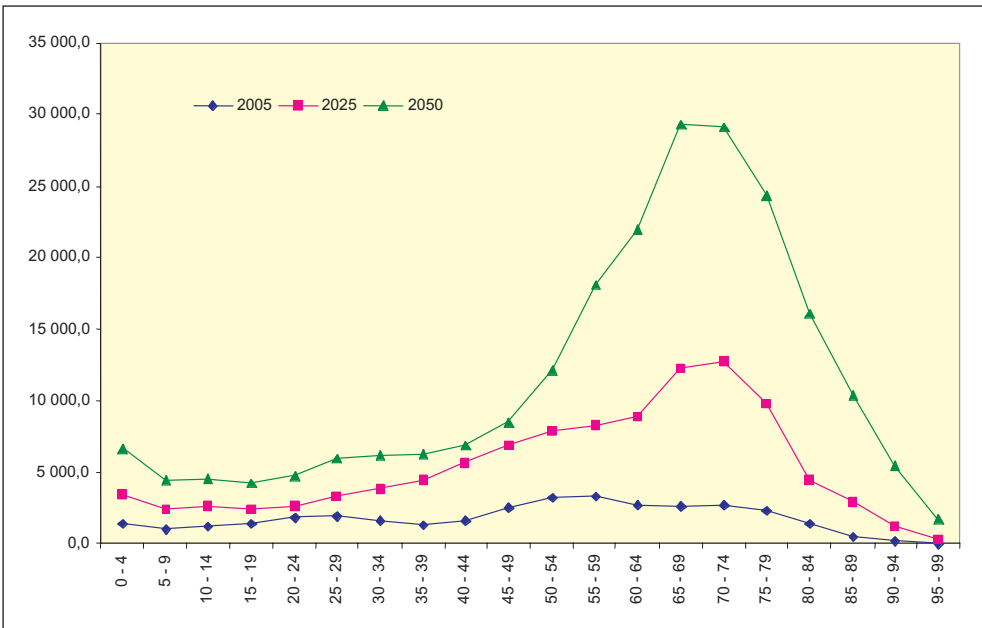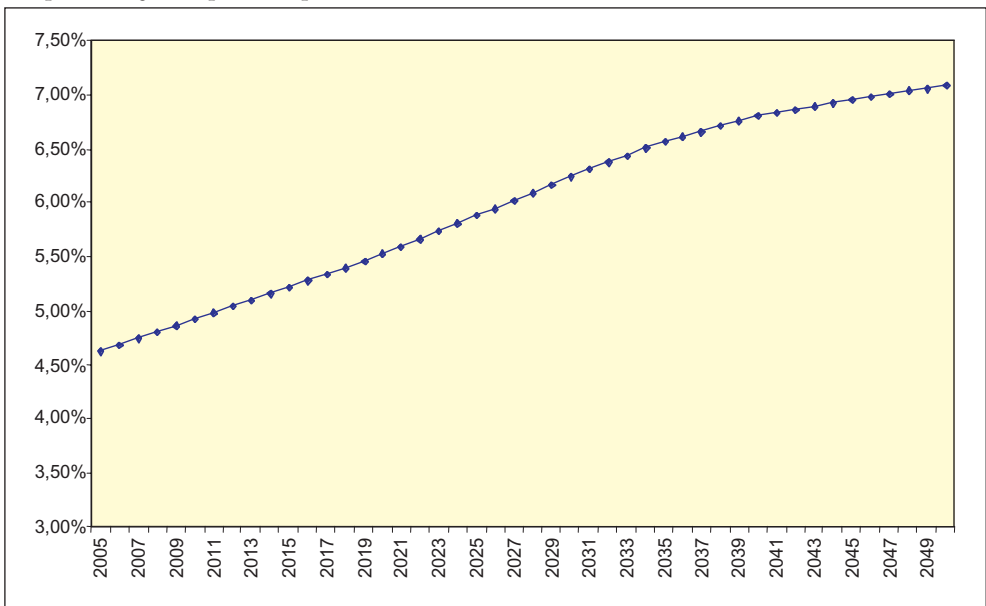

Source: Own calculations

directly preceding death. Females live longer, so they tend to generate higher level of expenditures at a later stage in life than men.

Presented pattern of total health expenditures changes in the course of projection period. The changes are presented in Graph 6.

One can distinguish between two types of factors affecting the level of expenditures. First, expenditure increase is related to income changes, which brings the total expenditure level upwards. This goes back to the assumption of equal growth of expenditure by single ages in line with GDP per capita. Simultaneously, the pattern of total insurance expenditure changes to a great extent with age, which shifts the expenditure upwards for the cohort of 55/60 to 85 years of age. The increase in projected total expenditure level for older cohort is caused by growing numbers of the elderly. We can observe that in the year 2025 expenditures for middle age cohort grow (35–50 years of age), while in 2050 - due to a decrease in the size of population at this age - expenditures for this cohort even slightly decrease (Graph 6). In the model, there is no assumption of health status improvement of elderly cohorts (except for LE improvement assumption) that would shift the expenditure curve to the right, with higher expenditures incurred later on in life cycle.

When we look at the macro level, total public health expenditures increase sharply due to the ageing process and increase of expenditures commensurate with the national income (Graph 7). The steepest increase can be observed over the first 30

**Graph 7. Projected public expenditure on health care in Poland as a share of GDP**

Source: Own calculations

years of projection period; later on the increase in expenditures slows down. Overall, public health expenditures are expected to increase by 57% (in GDP share category).

Insurance expenditures constitute the main part of public health expenditures. They are, in fact, the expenditures on medical services driven by health needs of the population and strongly related to changes in the population structure. They account for 86% of total public health expenditures. The remaining 14% stand for central and local government expenditures. These expenditures are not directly related to changes in population size or health status.

Insurance expenditures increase constantly during the whole projection period (Graph 8), from 4% to over 6% of GDP. Already in the base year (2003) health insurance system in Poland is under-funded – expenditures slightly exceed insurance revenues (0.3% of GDP). The deficit is shrinking with the increase in contribution rate and decrease in unemployment in the first years of projection period, but starting from 2007/2008, health insurance deficit begins to increase again (see also Graph 9).

**Graph 8. Projected insurance revenues and expenditures in Poland as a share of GDP**
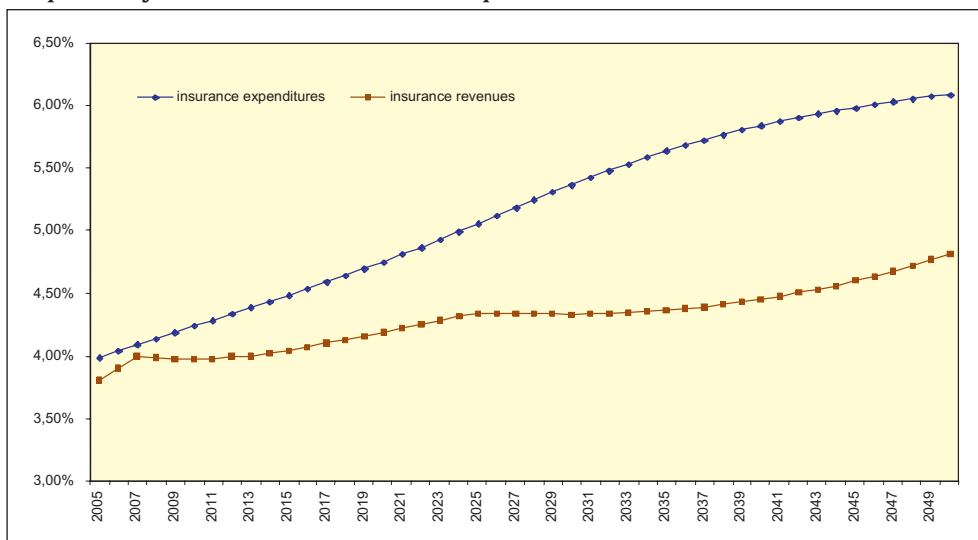
Source: Own calculations

The amount of total insurance revenues - measured in relation to GDP during projection period - changes depending on population and employment changes, as well as growth in wages (which reflects productivity changes), with an assumption of policy stability and unchanged (after 2007) contribution rate.

Overall, despite some small fluctuations, projected deficit in health insurance system goes up during the whole projection period by 1% of GDP (Graph 9, Table 6). The highest deficit can be observed in years 2040-2045, and afterwards it slowly decreases (Graph 9). The decrease can be attributed to population shrinking accompanied by high increase in productivity and continued GDP growth (1% annually).

Graph 9. Projected deficit in insurance health care system in Poland as a share of GDP
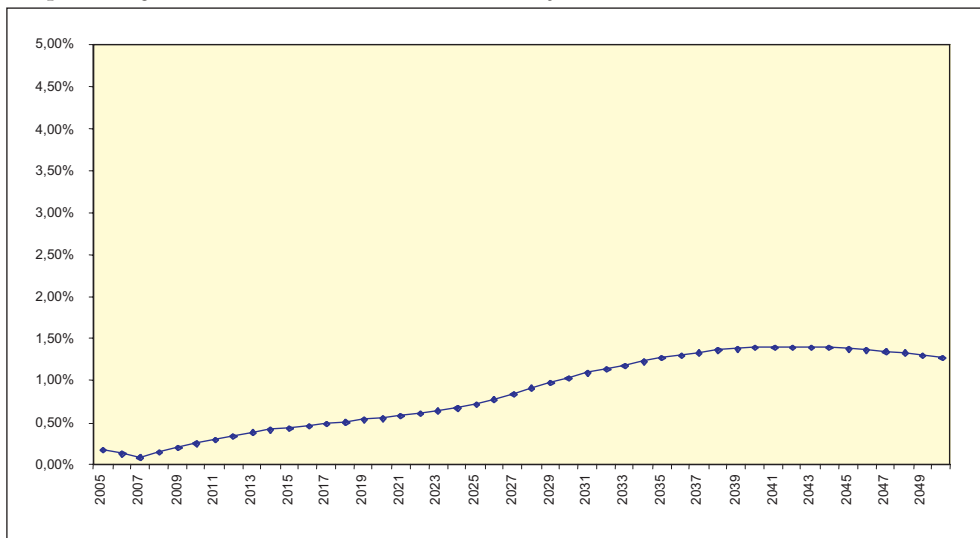
Source: Own calculations

Graph 10. Health insurance contribution rate real and needed to cover expenditures
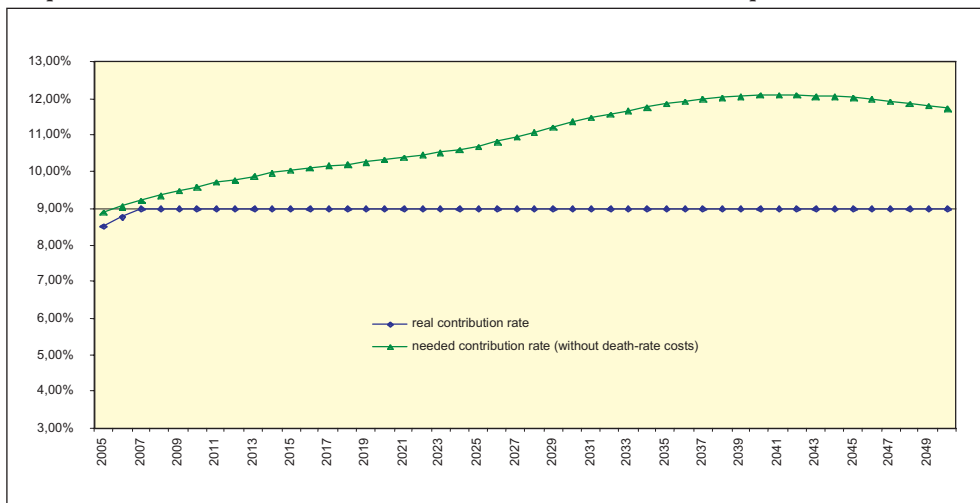
Source: Own calculations

Table 6. Summary of results – baseline scenario

	2003	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Total public expenditure as % of GDP	4.51	4.63	4.93	5.22	5.53	5.88	6.24	6.56	6.80	6.96	7.08
Insurance expenditure as % of GDP	3.88	3.98	4.24	4.49	4.75	5.06	5.37	5.64	5.85	5.98	6.09
Insurance revenues as % of GDP	3.58	3.80	3.97	4.04	4.19	4.34	4.33	4.37	4.45	4.60	4.81
Insurance deficit (%)	0.29	0.18	0.26	0.44	0.56	0.72	1.04	1.28	1.39	1.39	1.28
Contribution rate needed (%)	8.64	8.90	9.60	10.03	10.32	10.67	11.36	11.86	12.08	12.01	11.73

Source: Own estimations

5.2. Death-related costs scenario

In this scenario, expenditures incurred in the last year of patient's life are separated from the other years. In fact, such a separation could constrain rapid increase in total expenditures on health care, i.e. expected increase would be smaller than in the baseline scenario. This is a results of a fact that expenditures in the last year of life of younger population are significantly higher than for the elderly (due to more common utilization of intensive and costly treatment for younger population, types of diseases related to age and moving the costs of care of elderly outside the health care system – to a long term care and home care) (Brockmann 2002).

Assuming increasing life expectancy and decreasing mortality rates, the moment of death and higher health expenditures is moved towards older age. The average expenditures by age change over the years so, that in every age cohort the share of persons generating higher costs (costs related to death) decreases (Ahn et al. 2005, Batljan 2004, Seshamani and Gray 2004).

In that approach the concept of "healthy ageing" is applicable (Felder et al. 2000).

In 2003, the average public per capita expenditure on health care in Poland equals PLN 963 (4.5% of GDP per capita). However, there are substantial discrepancies in health care expenditures between the survivors and the deceased. Graph 11 presents average insurance expenditures on an individual in the last year of life, while Graph 12 presents expenditures per survivor (by gender and 5- year cohorts.) Expenditures are presented as a share of GDP per capita.

Expenditure level and structure vary to a great extent, depending on individual's status (survivor of deceased) and age. Below the age of 65, expenditures for deceased

men are much lower than expenditures for deceased women. This can be attributed to high rates of fatal accidents among men aged 20-50, and relatively low cost of related hospital treatment. In subsequent years of life the level of expenditure is nearly equal for both sexes, while after the age of 70 expenditures for deceased men are slightly higher than those for deceased women. The gap in older age, however, does not exceed 5 percentage points.

Graph 11. Average insurance expenditures per deceased as a share of GDP, base year (2003)
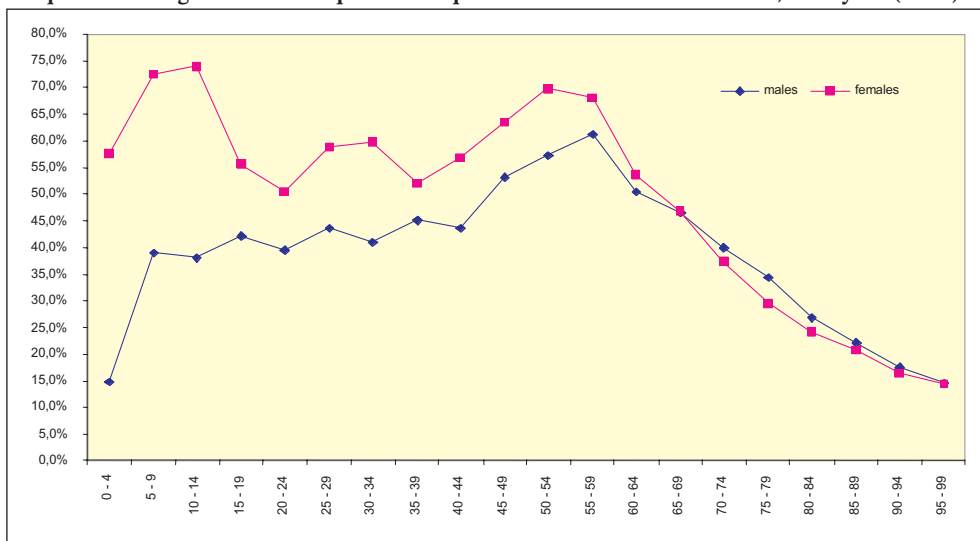
Source: Own calculations

Graph 12. Average insurance expenditures per survivor as a share of GDP, base year (2003)
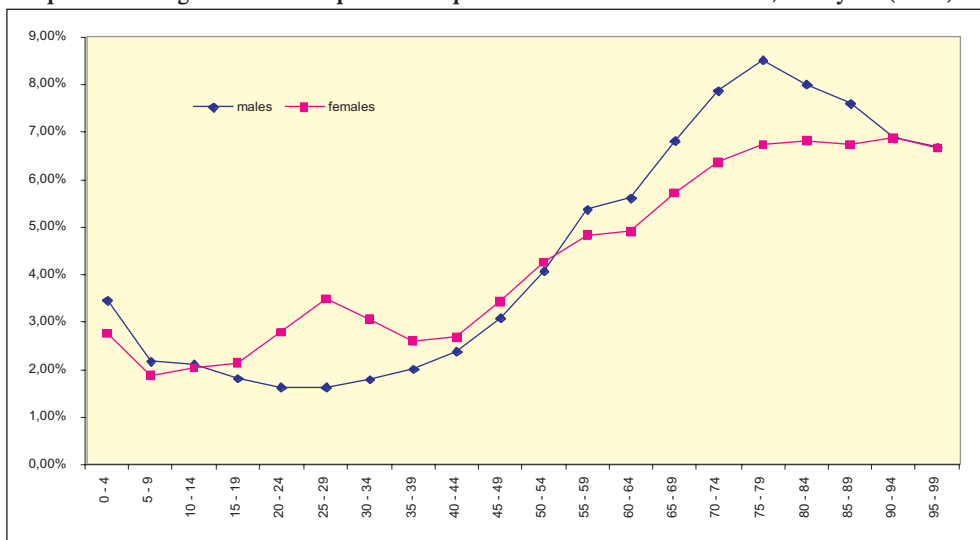
Source: Own calculations

Steep increase in average expenditure per deceased is observed at the age of 45–60 (Graph 11). This trend is conspicuous for both sexes and can be explained by the fact that middle age is characterized by deterioration in health status. Oftentimes, the diseases that occur at this stage of life are civilization diseases (circular system diseases and cancer), which are difficult to cure and require expensive medical treatment based on advanced modern technology.

At the outset of older age (after 60), average expenditure in the last year of life decreases radically. Between the age of 60 and 90, expenditure decrease is equivalent to 37 percentage points for women and 33 percentage points for men (in the GDP per capita category). Such reduction in expenditures is related chiefly to a less intensive utilization of expensive treatment at that age. Another important factor is the fact that treatment is shifted out of hospitals and there is growing need for palliative care or home care at later stages of life.

Structure of expenditures for survivors is reversed in comparison to the age structure of expenditures for deceased (Graph 12). After the period of high expenditures related to neonatal care and extensive care in the first years of life, the level of expenditures is relatively low. Up to 19 years of age, and at the age of 40-54, the levels of expenditures for females and males are similar. At the age of 20-39, while expenditures for men are rather stable (fluctuations of 0.2 percentage point), expenditures for women grow due to more intensive care related to pregnancy and childbirth. Men at this age exhibit the lowest health needs in their life cycle, and the lowest level of expenditures. The situation changes after 40 years of age, when health needs begin to increase. Average expenditures grow faster for men than for women. This tendency continues up to age of 75-79, when expenditures for both sexes reach their peak (6.74% of GDP per capita for female and 8.51% for male). After the age of 80, one can observe a slow decrease in the level of expenditures.

When we compare an average level of expenditures per survivor to an average level of expenditures per person with indifferent status, we see that up to the age of 45 health expenditures are almost identical (Graph 13 and Graph 14). This observation holds for men and women alike. Differences appear at older ages and are related to increasing mortality for every cohort. In consequence, due to high mortality levels, even though expenditures per single deceased decrease in a single year, the overall share of total expenditures for deceased men and women is increasing.

In the first five years of life, death-related costs per person are higher than in subsequent years. This is explained by higher probability of mortality than in the next years of life. Later in the life cycle, up to 30 years of age, the share of expenditures related to death is low. In the age 30 – 35 it slowly starts to increase. After the age of 55 for men and 65 for women, expenditures on health care in the last year of life

exceed 10% of total expenditures, and this share keeps increasing. Above-mentioned changes in the level of expenditure are shown in Graph 15 and Graph 16.

Graph 13. Insurance expenditures per survivor and per person in general as a share of GDP per capita - males, base year (2003)
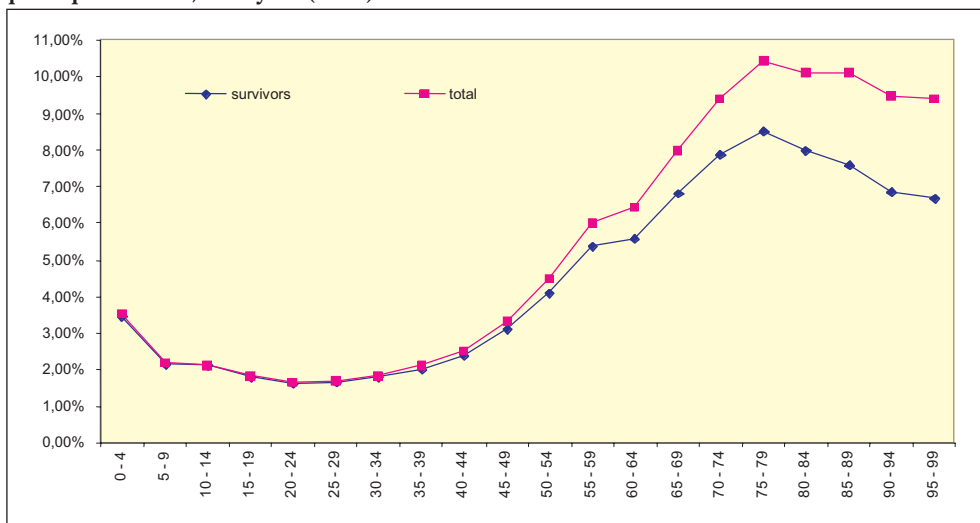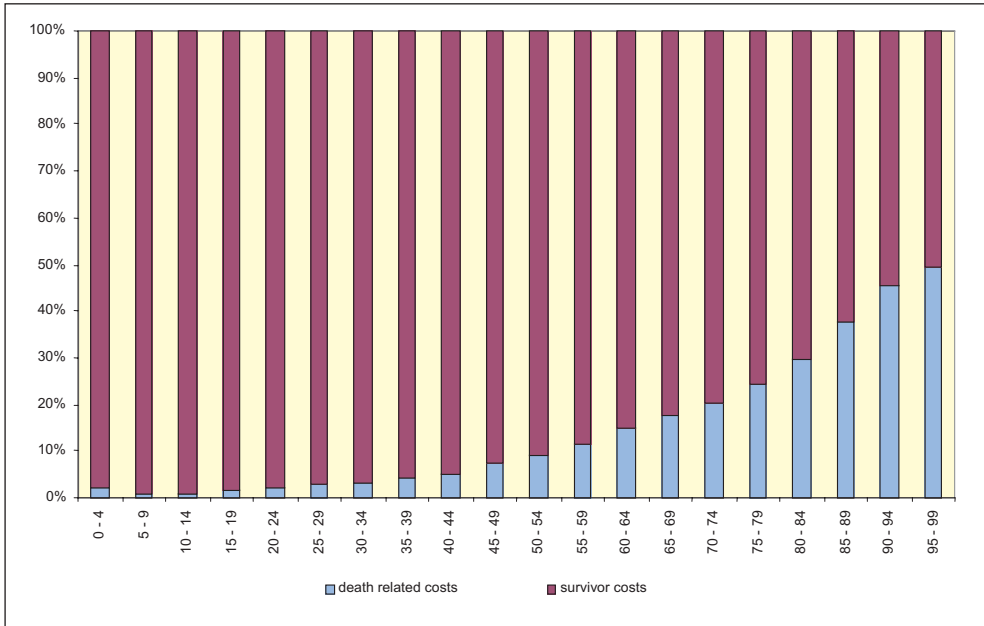

Source: Own calculations

Graph 14. Insurance expenditures per survivor and per person in general as percent of GDP per capita - females, base year (2003)
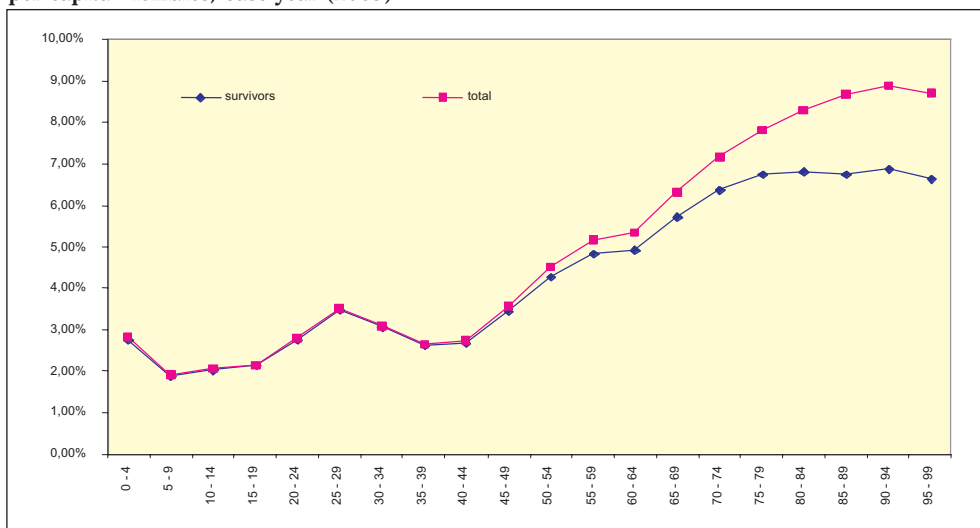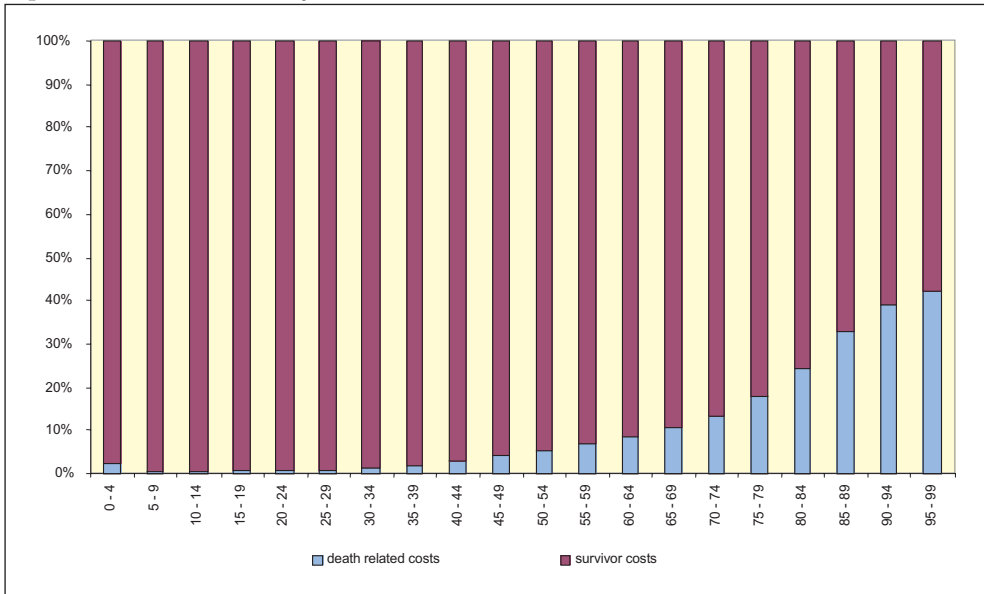

Source: Own calculations

Graph 15. Share of total expenditures in the last year of person's life in total health care expenditures - males, base year (2003)

Source: Own calculations

Graph 16. Share of total expenditures in the last year of person's life in total health care expenditures - females, base year (2003)

Source: Own calculations

In the oldest cohorts, the rate of increase of the share of death–related costs is slower, but it is still increasing. In case of individuals over 95, the share of expenditures in the last year of life is close to 50% for male, and slightly above 40% for female.

The value of indicator representing the relation between average expenditures per person in the last year of life and per survivor, according to age and sex (*k indicator*[7]), is presented in Graph 17.

For male, the highest value of k-indicator is observed between the ages of 20 and 30. This can be explained by the relatively good health status of men at this age, resulting in low expenditures on medical services for survivors on the one hand, and high average expenditure per deceased on the other hand. High expenditure per deceased is related to a substantial number of fatal accidents among young men and the cost of ineffective treatment observed in such cases.

For female at this age (20-30), the value of k-indicator decreases predominantly due to high expenditures on survivors related to increasing health needs in the child-bearing period.

The differences pertaining to k-indicator development between men and women tend to disappear after age 40. After 80, indicator value is lower than 4, and at the last stage of life it is relatively close to 1 (1.7 for male over 95, and 1.8 for female). The tendency shows that the gap between expenditures on survivors and the deceased is

Graph 17. Value of k-indicator (average expenditures per deceased/average expenditures per survivor) for 5-year cohorts
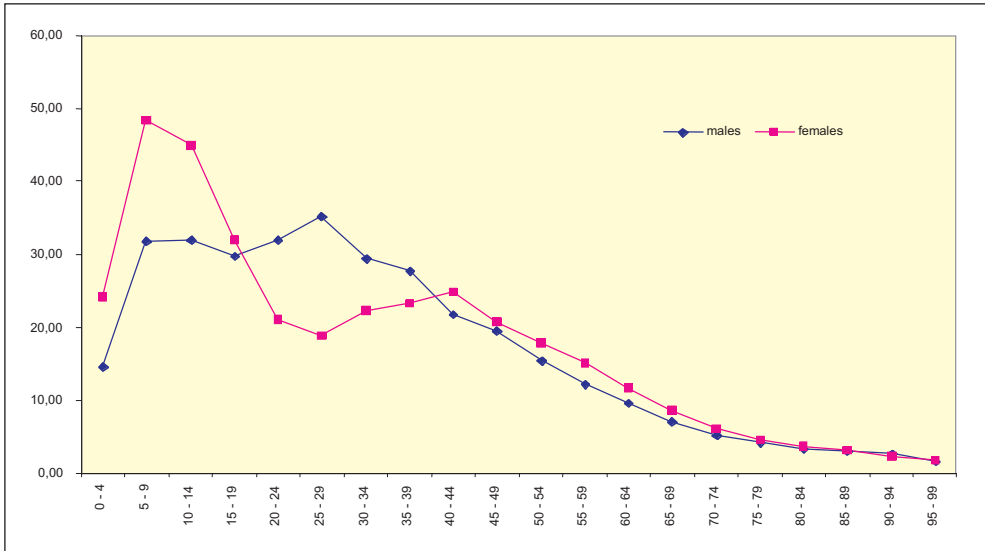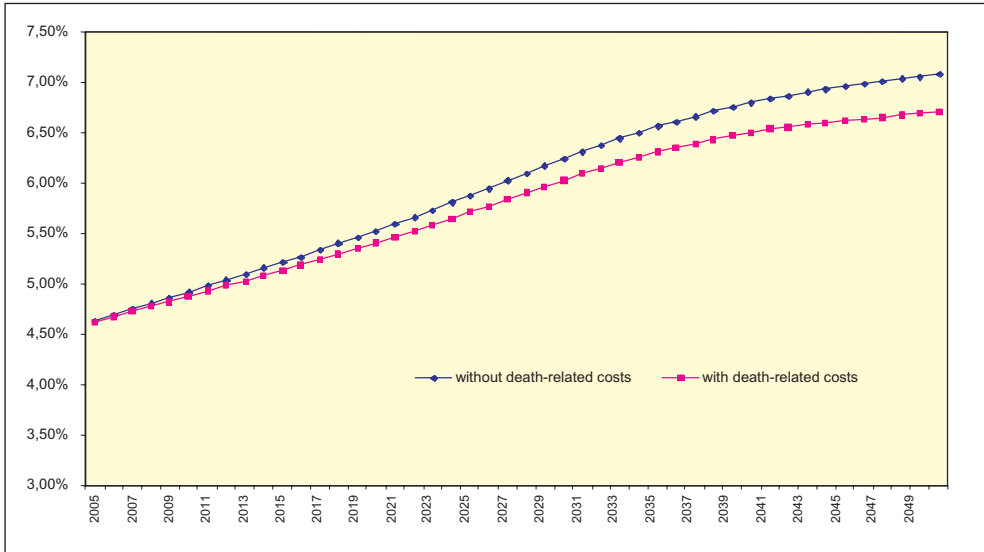

Source: Own calculations

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[7] Detailed description of *k-indicator* estimation is presented in Annex 2.

getting smaller with age. It may be related to lower level of hospital care utilization at this age, lower utilization of expensive medical treatment, as well as the predominance of nursery, palliative and home care.

Graph 18. Projected public expenditures on health care in Poland as a share of GDP: baseline and death-related costs scenarios
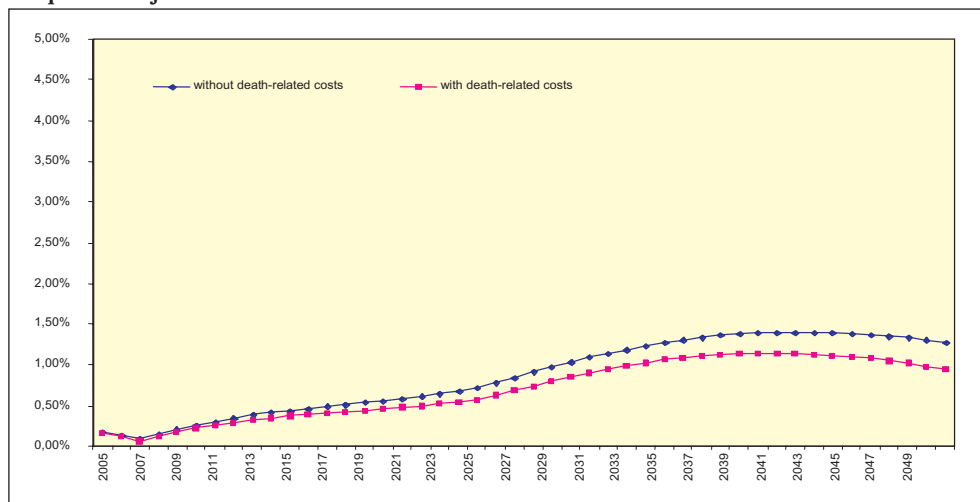

Source: Own calculations

Graph 19. Projected insurance system revenues and expenditures in Poland as a share of GDP: death-related costs scenario
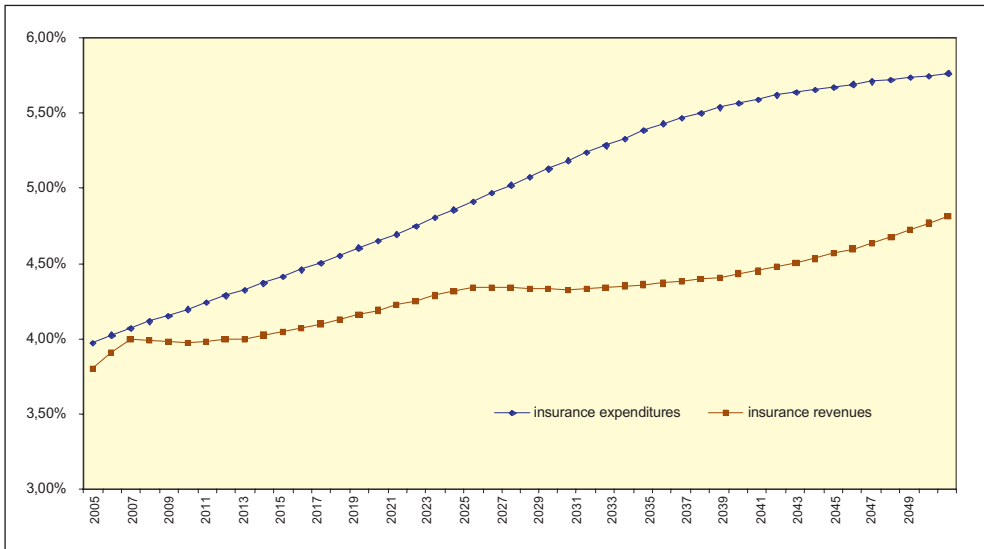
Source: Own calculations

When death-related costs are taken into account, projected public health expenditures grow more slowly than in the case when costs are calculated for the population irrespective of individual status (survivor or deceased.) The discrepancy accounts for up to 1% of GDP (Graph 18). Insurance expenditures in the second scenario are lower as well, with similar difference in the level of expenditure in relation to GDP.

Graph 20. Projected insurance deficit as a share of GDP: baseline and death-related costs scenarios
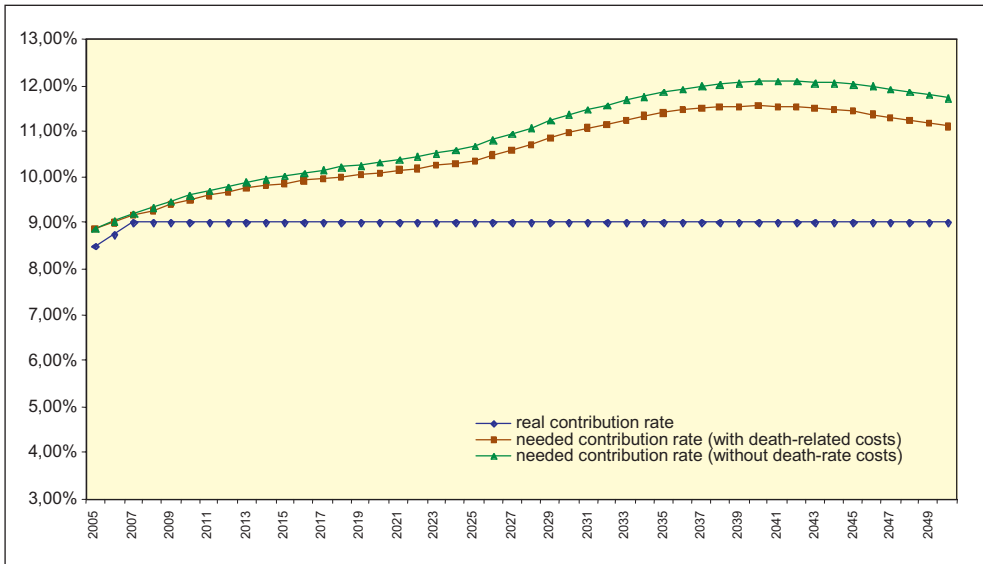

Source: Own calculations

Table 7. Comparison of contribution rate needed (in %) in a baseline scenario and death-related costs scenario

	2003	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Baseline scenario	8.64	8.90	9.60	10.03	10.32	10.67	11.36	11.86	12.08	12.01	11.73
Death related costs scenario	8.64	8.87	9.51	9.87	10.01	10.37	10.97	11.39	11.55	11.42	11.09

Source: Own estimations

As a result, the gap between health insurance revenues and expenditures is smaller than in the baseline scenario (Graph 19). The deficit amounts to 1.1% of GDP in the years 2040-2045, and after 2045 it slightly decreases to the level just below 1% of GDP (Graph 20). Lower expenditures are reflected in the calculation of the contribution rate required for expenditures and revenues to meet. Contribution rate in death-related costs scenario increases stepwise, but more slowly than in the baseline scenario, reaching 11.5% of insurable earnings in 2040, and slowly decreasing to the level of 11%, approximately (Graph 21, Table 7).

Graph 21. Health insurance contribution rate needed to cover expenditures: baseline and death-related costs scenarios

Source: Own calculations

5.3. Fast and slow longevity increase scenarios

The third scenario included in the projection allows for a differentiation in the scale of life expectancy improvement in subsequent decades on the basis of different longevity trends. It is assumed in the baseline scenario that life expectancy will develop with medium dynamics, as was the case in the last decade. It is possible, however, that longevity increase will not be medium. Therefore, two alternative situations of fast and slow life expectancy improvement are tested. The differences in life expectancy improvement do not imply that ageing will be healthier. In fact, with changes in longevity we assume that the health status for each single age-group remains unchanged (OECD 2006). Consequently, the share of life years of each cohort assumed to be spent in good and in bad health is the same as today, and as longevity improves, the time spent in poor health status for each cohort expands analogically, as these years do not translate into years of better health status. This approach is close to the expansion of morbidity hypothesis[8]. Hereby, scenarios of healthy ageing

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[8] "The hypothesis that increases in longevity translate into a higher share of life lived in relatively bad health" (OECD 2006, page 9).

(dynamic equilibrium)[9] or compression[10] of morbidity are not tested, the scale of longevity improvement being the only issue in question.

In fast longevity improvement scenario, it is assumed that in the year 2050 life expectancy of males will be equivalent to 78.7 (compared to 77.4 in the middle longevity improvement scenario), and for females it will reach 85.2 years of age (compared to 83.9 in the middle longevity scenario). What that means is that, compared to the base year, male longevity improves by 8.2 years, and female longevity improves by 6.3 years.

In the slower longevity improvement scenario it is assumed that in the year 2050 life expectancy of males will be equivalent to 75.8 years (compared to 77.4 in the middle longevity improvement scenario), and for females it will reach 82.3 (compared to 83.9 in the middle longevity scenario.) This means, compared to the base year, that male longevity will improve only by 5.3 years, and female longevity will improve by 3.4 years.

Slower longevity improvement has a cost-constraining effect, whereas faster increase in longevity translates into growth in public health expenditures, although it does not entail cost explosion. All in all, the differences in public health expenditures and health insurance expenditures between middle longevity growth and slow/fast longevity improvement account for GDP changes at the level of 0.2 percentage points, approximately, in the year 2050 (Table 8), and even less in the mid-term (year 2025).

Table 8. Different longevity scenarios – Summary of results

	LE –slow growth			LE – middle growth (baseline scenario)			LE – fast growth		
	2005	**2025**	**2050**	**2005**	**2025**	**2050**	**2005**	**2025**	**2050**
Public expenditure (%GDP)	4.63	5.84	6.92	4.63	5.88	7.08	4.63	5.92	7.25
Insurance expenditure (%GDP)	3.98	5.02	5.95	3.98	5.06	6.09	3.98	5.09	6.24
Insurance revenues (%GDP)	3.80	4.32	4.74	3.80	4.34	4.81	3.80	4.36	4.89
Insurance deficit (%GDP)	0.18	0.71	1.21	0.18	0.72	1.28	0.18	0.73	1.35
Contribution rate needed (%)	8.90	10.65	11.62	8.90	10.67	11.73	8.90	10.70	11.84

Source: Own estimations

The differences in health insurance revenues in 2050 are even smaller than the differences in the level of expenditures, when three longevity scenarios are analyzed. Differences in insurance revenues amount to 0.07-0.08% GDP. This implies that, while longevity changes have impact on the level of expenditures, the level of revenues is more affected by changes in employment and productivity.

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[9] "The hypothesis that the number of life years lived in bad health remains constant in the wake of increased longevity (or increased life expectancy translates into additional years of life in good health" (OECD 2006, p. 9).

[10] "The hypothesis that increases in longevity translate into a lower share of life lived in relatively bad health" (OECD 2006, p. 9).

5.4. Higher and lower employment rate scenarios

Scenario 4 assumes negative and positive changes in employment rate projection, as compared to the baseline scenario. The optimistic scenario assumes that by the year 2013 employment rate will change in line with the National Employment Strategy (MGiP 2005), and after that period it will be by 2 percentage points higher than in the baseline scenario. The pessimistic scenario assumes that in the period of 2005-2013 employment rate will be lower than in the baseline scenario - by the year 2013 it will be by 2 percentage points lower, and after that period the difference between the baseline scenario and the pessimistic scenario will be held constant at the 2 percentage points level.

Table 9. Different employment rate scenarios – Summary of results

	Optimistc version of employment rate development			Baseline scenario			Pessimistic version of employment rate development		
	2005	**2025**	**2050**	**2005**	**2025**	**2050**	**2005**	**2025**	**2050**
Public revenues (%PKB)	4.45	5.24	5.88	4.45	5.16	5.80	4.45	5.08	5.73
Public expenditures (%GDP)	4.63	5.88	7.08	4.63	5.88	7.08	4.63	5.88	7.08
Insurance revenues (%GDP)	3.80	4.42	4.89	3.80	4.34	4.81	3.80	4.26	4.74
Insurance expenditures (%GDP)	3.98	5.06	6.09	3.98	5.06	6.09	3.98	5.06	6.09
Deficit (%GDP)	0.18	0.64	1.20	0.18	0.72	1.28	0.18	0.80	1.35
Contribution rate needed	8.90	10.46	11.54	8.90	10.67	11.73	8.90	10.89	11.94

Source: Own estimations

As might be expected, health insurance revenues are higher in the optimistic scenario, and lower when pessimistic development of employment rate is projected. The differences in both cases - in comparison to baseline scenario – are equivalent to less than 0.1 percentage point (+0.8 in optimistic scenario and -0.7 in pessimistic one). The level of expenditures does not change when Scenario 4 is applied, thus, the same differences are observed in the size of the deficit. Differences expressed as share of GDP may not be very impressive, but in nominal terms they amount to almost PLN 3 billion.

Chapter 6.

Conclusions

Presented results refer to three main elements: the level of public health care expenditures during projection period, the level of public revenues, and the size of financial deficit in public health care system.

The impact of the main factors (age and income) on final results is different in each scenario under analysis: (1) baseline scenario, (2) death-related costs scenario, (3) different longevity scenario, and (4) different employment rate scenario.

Table 10. Average yearly increases of expenditures and revenues (%)

		2003-2010	2011-2020	2021-2030	2031-2040	2041-2050
EXPENDITURES						
Baseline scenario		6.36	5.92	4.92	3.44	1.90
Scenario 2 (death-related costs)		6.22	5.79	4.79	3.35	1.78
Scenario 3	Slow increase of LE	6.35	5.88	4.86	3.37	1.84
	Fast increase of LE	6.37	5.96	4.99	3.52	1.97
Scenario 4	Optimistic employment rate	6.36	5.92	4.92	3.44	1.90
	Pessimistic employment rate	6.36	5.92	4.92	3.44	1.90
REVENUES						
Baseline scenario		6.56	5.36	4.14	2.96	2.22
Scenario 2 (death-related costs)		6.56	5.36	4.14	2.96	2.22
Scenario 3	Slow increase of LE	6.55	5.33	4.09	2.91	2.17
	Fast increase of LE	6.57	5.39	4.18	3.01	2.27
Scenario 4	Optimistic employment rate	6.77	5.38	4.13	2.95	2.20
	Pessimistic employment rate	6.45	5.27	4.14	2.97	2.23
DEFICIT						
Baseline scenario		9.81	13.11	10.24	5.62	0.62
Scenario 2 (death-related costs)		10.05	12.56	10.37	5.56	0.60
Scenario 3	Slow increase of LE	9.76	13.02	10.13	5.45	0.45
	Fast increase of LE	9.85	13.21	10.40	5.75	0.75
Scenario 4	Optimistic employment rate	14.71	14.71	11.04	5.85	0.57
	Pessimistic employment rate	11.19	13.10	9.60	5.42	0.65

Source: Own estimations

All value increases in Table 10 were calculated in nominal terms (and were not related to GDP).

In the baseline scenario, there is a systematic increase in health care system expenditures in the next 30 years. Afterwards expenditure growth pace will slow down, in proportion to slower GDP dynamics. The average increase in health care sector revenues is lower until 2040, but in the final ten years of the projection period it will exceed average expenditure growth. That will lead to a very slow increase of deficit in this period (average 0.62% in 2041-2050). In general, the average dynamics of deficit increase is lower after 2011.

Projection results are different when additional elements are taken into account, such as the assumption of death-related costs, different scenarios of longevity improvement and employment rate development.

With regard to different longevity dynamics, typical (trivial) tendency in shaping the aggregate function of health care expenditures is indicated (Christiansen et al. 2006). We observe that the bigger the longevity improvement, the higher the expenditures, in comparison to the baseline scenario. Greater longevity improvement leads to an increase on the revenue side of projections as well. Such increase, however, cannot compensate for the growth in expenditures to the same extent as in the baseline scenario. In consequence, health care system deficit growth is the highest in the case of fast longevity increase scenario.

At the same time, when we take death-related costs into account, the level of expenditures decreases in comparison to the baseline scenario (with no changes on the revenue side) and, finally, to the level of deficit.

**Table 11. Summary of projection results, different scenarios**

Scenario		Expenditures			Revenues			Deficit		
		2003	2025	2050	2003	2025	2050	2003	2025	2050
Baseline (% of GDP)		**4.51**	**5.88**	**7.08**	**4.22**	**5.16**	**5.80**	**0.29**	**0.72**	**1.28**
*% of change**		*0*	*30*	*57*	*0*	*22*	*37*	*0*	*148*	*341*
Death-ralated costs scenario (% of GDP)		**4.51**	**5.71**	**6.70**	**4.22**	**5.16**	**5.80**	**0.29**	**0.55**	**0.90**
*% of change**		*0*	*27*	*49*	*0*	*22*	*37*	*0*	*90*	*210*
Scenario of different longevity increases (% of GDP)	**slow**	**4.51**	**5.84**	**6.92**	**4.22**	**5.13**	**5.71**	**0.29**	**0.71**	**1.21**
	*% of change**	*0*	*29*	*53*	*0*	*22*	*35*	*0*	*145*	*317*
	fast	**4.51**	**5.92**	**7.25**	**4.22**	**5.19**	**5.91**	**0.29**	**0.73**	**1.35**
	*% of change**	*0*	*31*	*61*	*0*	*23*	*40*	*0*	*152*	*366*
Scenario of different employment rate assumptions (% of GDP)	**optimistic**	**4.51**	**5.88**	**7.08**	**4.22**	**5.24**	**5.88**	**0.29**	**0.64**	**1.20**
	*% of change**	*0*	*30*	*57*	*0*	*24*	*39*	*0*	*121*	*313*
	pessimistic	**4.51**	**5.88**	**7.08**	**4.22**	**5.08**	**5.73**	**0.29**	**0.80**	**1.35**
	*% of change**	*0*	*30*	*57*	*0*	*20*	*36*	*0*	*175*	*365*

*in comparison to the base year
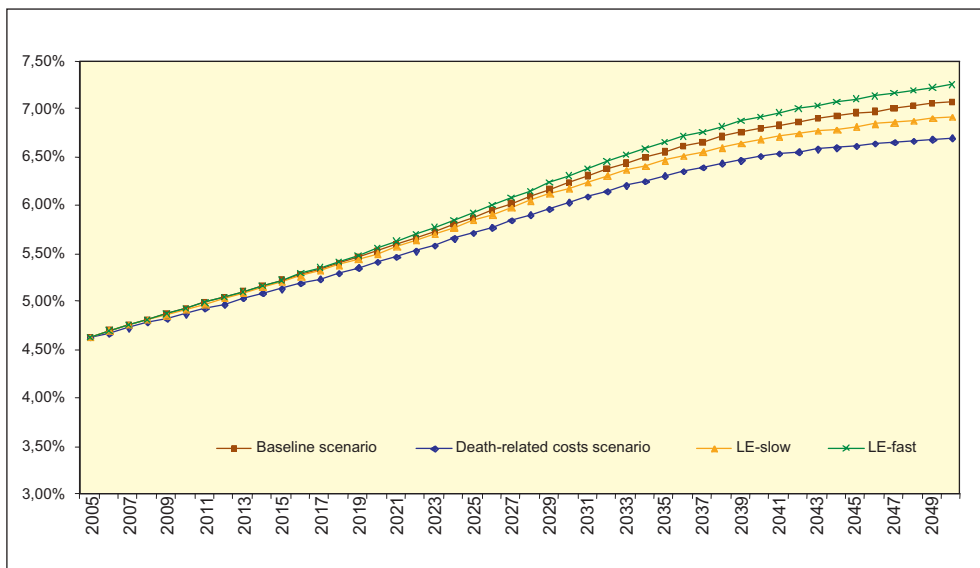Source: Own calculations

In Scenario 4 (employment rate changes), expenditures do not change, while the revenues change due to differences in the number of employed and insured.

Graph 22. Projected public revenues on health care in Poland as a share of GDP, different scenarios
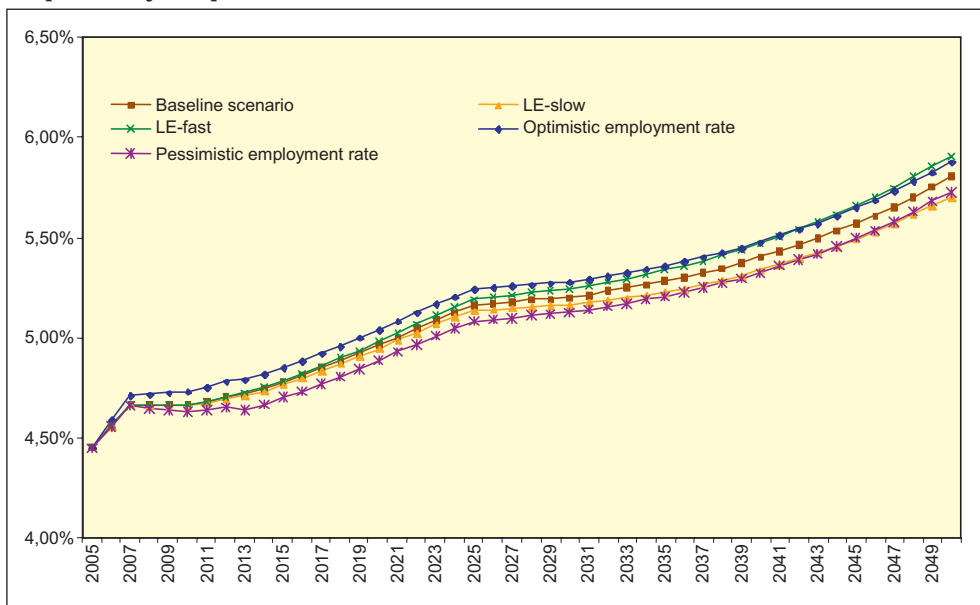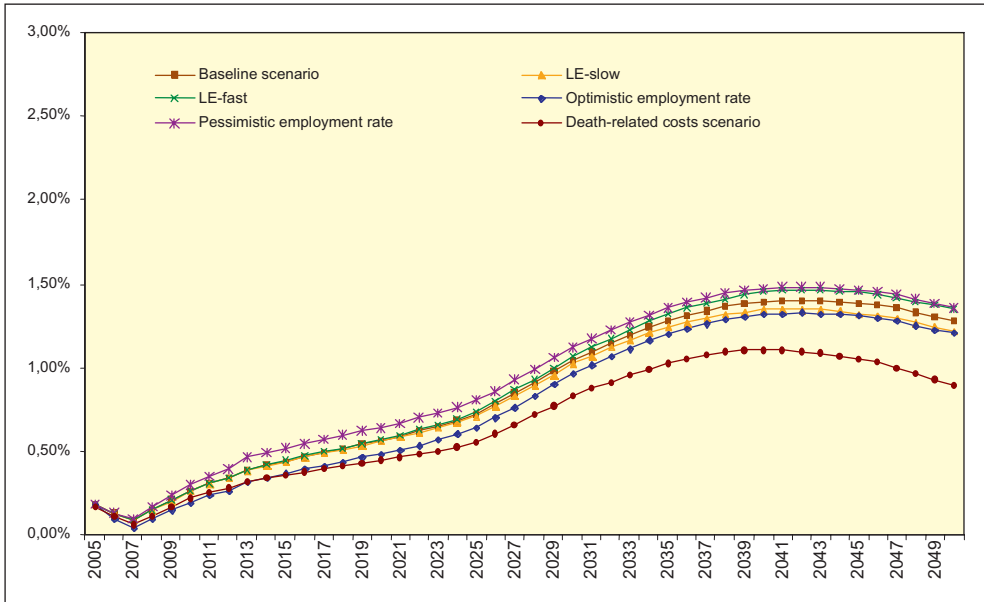

Source: Own calculations

Graph 23. Projected public expenditures on health care in Poland as a share of GDP, different scenarios

Source: Own calculations

Graph 24. Projected public deficit in health care in Poland as a share of GDP, different scenarios

Source: Own calculations

Chapter 7.

Discussion of the model and the results

The model applied in the study belongs to a group of models which concentrate on external factors that affect the growth in health expenditures Thanks to such model structure, one can identify the impact of demographic, economic and labour market factors. Moreover, the model allows for the analysis of expenditure side as well as the revenue side of finances in the health care sector.

Research objective was to identify the impact exerted on health expenditures by demography and the ageing process in Polish society. Consequently, the analysis focused on estimations of per capita health expenditures according to cohort and gender. The level of health expenditures strongly depends on projected population size and its age structure.

Some difficulties in the application of the model arise when economic and labour market factors are taken into account. It is necessary to project future development of economic and labour market variables, since historical data or simple extrapolation of past trends are not sufficient. In the case of a transition country (such as Poland), which faces economic restructuring and significant changes in the economic system, projection of future economic developments and changes on the labour market over the next half of a century is a risky task. However, long term projection (covering the next 45 years) is a necessity, given that in the impact of demographic changes cannot be observed over a shorter time period. Population projection is more credible than economic and labour market projections. At the same time, however, the results of possible mis-estimation multiply, as demographic development affects economic and labour market performance.

Another issue for discussion is the assumption of inter-relations between variables. One of the most important assumptions built in the model is the premise that income elasticity of health expenditures is equal to a unity over the whole projection period. According to income elasticity estimations, its level is slightly higher than one, but the research is incomprehensive due to lack of necessary data and short-time series of

historical data on revenues and expenditures. Therefore, the assumption of income elasticity equal unity is rather intuitive, based on the observation of historic changes of this relation in Western Europe and the USA at the times when economic development of these regions was similar to Poland's present situation. The assumption of neutral income elasticity is rather conservative. With dynamic economic development, income elasticity will be higher than one (health will become a luxury item!), which will lead to projected increase in health expenditure deficit.

Basic version of the model does not include changes in population health status. Average life expectancy is the only variable that reflects health status of the population. Nevertheless, its changes only have impact on demographic projection and do not directly influence per capita health expenditures. The only scenario which takes into consideration some changes in population health status is the death-related costs scenario. In each age cohort, assumed mortality rates directly impact health expenditures per capita. It is related to changes in the number of deaths in each age cohort and does not describe changes in the health status that affect mortality.

It is assumed that health care system organization and other factors that impact expenditures (i.e. medical technologies) are unchanged during the whole projection period. Quantification of those variables and their introduction to the model still remains a challenge to health care system and policy analysts.

When discussing the model and projection results one must be aware of model limitations, as well as the uncertainly of future development of projected variables. The greatest advantage of the model is the simulation which provides answers to the questions on what could happen if the variables should develop in a projected way, while other variables – those not included in the model – remain unchanged (*ceteris paribus* assumption.) Projection outcome for Poland is somewhat disturbing and should be perceived as a warning signal. It shows that external factors will continue to generate disequilibrium between health care system revenues and expenditures. Health care system reforms will be faced with a challenge to increase efficiency in order to compensate for the deficit generated by external factors.

Chapter 8.

Policy recommendations

Presented scenarios of future health care system revenues and expenditures provide a useful frame for potential choices made by policy makers. On the one hand, we forecast possible development of factors responsible for future revenues in the health care system: GDP and employment accompanied by projected growth of labour productivity level, leading to the convergence of Polish economy to the average EU-15 level. On the other hand, we arrive with a picture of possible shapes of future health care system expenditures determined by demographic changes and health status. Factors that are taken into account include: structure of the population by age (especially the increasing share of elderly population), longevity improvement, and increasing costs during the latest stage of life and those related to death.

The juxtaposition of revenue and expenditure side of the health care sector provides information on the active/adverse balance of the national health care budget. In each of the scenarios assumed and calculated, the projection implies deficit in the health care sector. This means that the needs of the sector, which to a large extent are determined by the demographic structure of the population and increasing longevity, combined with the assumption regarding medical service utilization pattern and utilization level tendencies (including utilization of new technologies and medicines), generate higher health care sector expenditures than the revenues which can be assured with current insurance contribution rate and assumed trends in future GDP and employment development.

In recent years, one could observe lack of financial balance in health care sector in Poland. In consequence of that fact, medical service providers have been falling into debt in their attempts to provide services and fulfill the constitutional obligation to take care of each patient in need, irrespective of financial resources available. The projection implies that in the future, in the face of increasing longevity, this financial imbalance may grow. This should represent a strong incentive for public sector (and especially the health care system) financial reform.

Several policy paths could be discussed in order to reduce the deficit. One of them would be to constrain the basket of medical services available under public health

insurance and increase the cost- effectiveness of health insurance system; yet another would be to increase the amount of insurance contribution in order to meet the demand for medical services. The latter was tested in projections. The estimations indicate that in order to cover health insurance deficit, further increase of contribution rate, after the year 2008, would be required. To balance increasing expenditures, contribution rate should increase by another 3-4%, in line with expenditures, and in 2050 it should reach not less than 11.7% of individual insurable earnings. The mere increase in insurance contribution rate, (or any other form of health care tax), however, and the adjustments to the revenue and expenditure side, although tested in the projection, do not represent a solution in the face of relatively high non-wage labour costs in Poland and low employment rate[11].

Yet, among other social contribution rates, health insurance contribution is relatively low, and the pension contribution is dominant. Thus, there is room for reform in the social welfare contribution rate system. On the other hand, though, it would be extremely difficult to reduce pension expenditures due to political implications (pensioners constitute a substantial part of the electorate voting for the political parties that win the elections), and the ongoing pension system reform that introduces a funded pension system for future generations. In a transition period – from the PAYG to the funded pension scheme – the so-called "transition costs" are relatively high and put a strain on public finances.

A question is raised, whether it would be possible to adjust the expenditure side to revenue side of the health care system. Various proposals and programs targeted towards cost reduction and management improvements in the sector are limited by low funding of the health care system. Expenditures geared towards improvements in system efficiency and management (information, analytical, institutional, human resources, technological, and other improvements) compete with current expenditures on payments for medical services, routine renovations, better equipment and increasing salaries of medical staff, especially nurses and young doctors who often emigrate in search of higher income.

Projection of health care revenues and expenditures provides arguments for the preparation of comprehensive health care system reform in Poland. Such restructuring effort should include changes to the revenue and expenditure side of the health care system. On one hand, it is necessary to increase health insurance contribution rate (without increasing total social insurance contribution rate, if possible.) On the other hand, it is necessary to implement reforms targeted towards

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[11] The so-called 'tax wedge', resulting from high taxation put on labour, is referred to as one of the reasons for high unemployment in Poland (Golinowska, Neneman 2006.)

improvements in system efficiency and rationing of medical services. A proposal for a complex health care system reform in Poland was prepared by CASE Doradcy (CASE-Doradcy 2005.) Policy makers, however, are neither ready or able to undertake long-term reforms, as they focus on urgent problem issues that emerge (strikes of medical personnel, requests from patients with regard to resources for the hospitals they use, countermeasures against increasing emigration of medical personnel, unrest caused by management failures in some health care units.) Finally, one more important policy issue is the lack of awareness that solving the problems the health care system may face in the future is an important tool for current improvements in health care system management.

Annex 1.

Projection methodology – baseline scenario

Health insurance expenditures

Health insurance expenditure estimation is based on the data on individual per capita insurance expenditures by gender and age cohort. All estimations are made for 5-year age groups and based on National Health Fund data. The data does not include pharmaceutical expenditures. Therefore, additional assumption is made that the structure of pharmaceutical expenditures is identical with the structure of other health expenditures. Primary health care services in Poland are financed via capitation system, thus for this type of care identical individual expenditures are assumed, with no differentiation by gender or age.

The National Health Fund data covers the year 2004[12], while the base year for projections is the year 2003. Thus, it is assumed that the structure of expenditures by gender and age did not change during one year. As the next step, individual expenditures in 2003 are estimated based on the structure of expenditures in 2004. Individual expenditures in each category sum up to the amount of expenditures listed in the National Health Accounts from 2003.

Individual expenditures for each age cohort are estimated based on the assumption of annual growth equal to GDP growth per citizen (pharmaceutical expenditures are assumed to grow 30% faster than other expenditures):

$$AE_{a,p,n} = AE_{a,p,n-1} \cdot (1 + r_n)$$

where:

$a \in \{1,..,20\}$, 5-age cohort

$p \in \{m, f\}$, sex: m – male, f – female

n – the following year of projection,

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[12] This was the first year when individual expenditure data by gender and single ages was collected.

rn – GDP growth per capita in the year *n* (for pharmaceuticals 1,3 * other expenditures growth rate)

Total hospital and outpatient care expenditures (including pharmaceuticals) are calculated through the multiplication of annual individual expenditures by projected population structure:

$$TE_n = \sum_{a=1}^{20} AE_{a,m,n} \cdot N_{a,m,n} + \sum_{a=1}^{20} AE_{a,f,n} \cdot N_{a,f,n}$$

where $N_{a,m,n}$, $N_{a,f,n}$ is the population number in age cohort *a*, year *n* and sex (*m* – male, *f* – female).

Resulting expenditures are aggregated with the remaining insurance expenditures, which represent mainly administrative cost. Since most of administrative costs are wages, they are multiplied on annual basis by assumed wage growth.

Government expenditures on health care

It is extremely difficult to prepare a projection of government expenditures on health, since the expenditures are decided upon each year during parliamentary debate, and then incorporated into the annual budget. It is assumed that government expenditures on health constitute a share of health insurance expenditures that is stable in time. This share is set at the base year and equals 16.3%.

Health insurance revenues

The revenue side of projections is based mainly on the assumptions pertaining to labour market future development. Projected employed population is divided in each year according to employment structure. These include: public sector employees, private sector employees, self-employed outside agriculture, and self-employed in agriculture. Separately, the unemployed, the disabled, pensioners and voluntarily insured are taken into account in projections.

Revenues from insurance are estimated separately for each group, assuming the *status quo* of insurance legal regulations.

Annex 2.

Methodology for death-related costs estimation

Five main stages were performed in the process of calculation of total expenditures with death-related costs taken into account:

1. Estimation based on National Health Fund data on average expenditures per capita (per deceased and survivor, broken down according to gender and 5-year age cohorts) for medical services for which appropriate data is available:

$$\overline{AE}^{l}_{a,p,2004} = \frac{\overline{\overline{TE}}^{l}_{a,p,2004}}{N^{l}_{a,p,2004}}$$

where:

$l \in \{s, d\}$, status of an individual: s – survivor, d – deceased,

$a \in \{1,..,20\}$, 5-year age cohort,

$p \in \{m, f\}$, sex: m – male, f – female,

$\overline{AE}^{l}_{a,p,2004}$ – average per capita expenditures for an individual a person of l status, age cohort a and sex p in the year 2004,

$\overline{\overline{TE}}^{l}_{a,p,2004}$ – total expenditures for l status, age cohort a and sex p (according to National Health Fund data in the year 2004),

$N^{l}_{a,p,2004}$ – number of individuals with l status (deceased in the given year or survivors) in age cohort a and sex p in the year 2004 (according to the demographic projection used in the ILO model.)

2. Estimation of *k-indicator*, broken down according to gender and age:

$$k_{a,p} = \frac{\overline{AE}^{d}_{a,p,2004}}{\overline{AE}^{s}_{a,p,2004}}$$

K-indicator describes the ratio between average expenditures for given medical services per deceased in the base year, and average expenditures per survivor. The value of the indicator is constant during projection period, and specified according to the sex and age cohort.

3. Estimation based on the National Health Fund data, pertaining to annual insurance expenditures for given medical services. As the National Health Fund data includes the data with an undefined status of a person (without information on sex and/or age), it was necessary to divide these expenditures using the k-indicator between groups, in order to receive expenditures coherent with National Health Data. These estimations, covering year 2004, are further applied to the 2003 National Health Data assuming constancy of the k-indicator and unchanged proportions of expenditures between genders and age cohorts. Average expenditures per capita for a person with *s* (survivor) and *d* (deceased) status were calculated as:

$$AE^{s}_{a,p,2003} = \frac{AE_{a,p,2003}}{(1-\alpha) + k \cdot \alpha}$$

$$AE^{d}_{a,p,2003} = k_{a,p} \cdot AE^{s}_{a,p,2003}$$

where:

      a – probability of death depending on sex and age cohort in a given year,

      $AE_{a,p,2003}$ – average per capita expenditures depending on sex and age, calculated based on National Health Data expenditures, applying sex and age structure from National Health Fund data

4. Calculation of average per capita expenditures depending on sex, age and status for the year n and assuming growth of expenditures in line with GDP per capita.

$$AE^{s}_{a,p,n} = AE^{s}_{a,p,n-1} \cdot (1 + r_n)$$

$$AE^{d}_{a,p,n} = AE^{d}_{a,p,n-1} \cdot (1 + r_n)$$

where:

n – following year of projection

r_n – GDP per capita growth rate in year n

5. Calculation of total expenditures in year n:

$$TE_n^s = \sum_{a=1}^{20} AE_{a,m,n}^s \cdot N_{a,m,n}^s + \sum_{a=1}^{20} AE_{a,f,n}^s \cdot N_{a,f,n}^s$$

$$TE_n^d = \sum_{a=1}^{20} AE_{a,m,n}^d \cdot N_{a,m,n}^d + \sum_{a=1}^{20} AE_{a,f,n}^d \cdot N_{a,f,n}^d$$

$$TE_n = TE_n^s + TE_n^d$$

where:

TE_n^s, TE_n^d – total expenditures in year n for survivors (*s*) and deceased (*d*)

TE_n – total expenditures in year *n*

Due to lack of adequate data on pharmaceutical expenditures, additional indicator defining the ratio between average pharmaceutical expenditures per deceased and average pharmaceutical expenditures per survivor is used. It is assumed that the value of this indicator equals the value of the indicator for other types of medical services. As a result, total expenditures are summed up with expenditures on pharmaceuticals, divided by sex, age cohort and status.

In view of the capitation system in primary care services financing, National Health Fund expenditures on primary care are divided proportionally between the insured, and added to total expenditures.

Annex 3.

National Health Account data for Poland (2003)

Current health care by provider and sources of financing	Government		Private Sector					Rest of the world	Sub-Total
	General Government (excl. Social Security)	Social Security Funds	Private social insurance schemes	Other private insurance schemes	Private out-of pocket payments	Non-Profit institutions (other than social insurance)	Corporations		
	in million zloty (current prices)								
Hospitals	638.5	13 962.8							14 601.3
Nursing and residential care facilities	477.2	2 068.4							2 545.6
Providers of ambulatory health care	121.5	7 201.7							7 323.2
Retail sale and other providers of medical goods	82.5	6 721.6							6 804.1
Provision and administration of public health	1 572.9	59.1							1 632.0
General health administration and insurance	316.2	398.4							714.6
Government health administration									0.0
Social Security Funds									0.0
Other social insurance									0.0
Other industries (remaining sectors of the economy)	34.6	1 224.8							1 259.4
Occupational health care services			15.3	438.9					454.2
Private households as providers of home care			461.9	1 629.5					2 091.4
All other secondary producers of health care	34.6	1 224.8							1 259.4
Rest of the world									0.0
Unclassified									0.0
Total current expenditure on health care	**3 243.4**	**31 636.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**34 880.2**
Gross Capital Formation	*1 906.9*	*9.9*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*1 916,8*

Source: Central Statistical Office (GUS) 2006

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