Public Expenditure Projections for Health and Long-Term Care for China Until 2030

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Health Working Papers

OECD Health Working Paper No. 84

PUBLIC EXPENDITURE PROJECTIONS FOR HEALTH AND LONG-TERM CARE FOR CHINA UNTIL 2030

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ACKNOWLEDGEMENTS

ABSTRACT

In recent years, China has seen an unprecedented expansion of health insurance for its population in its quest to achieve universal health coverage. By 2011, 95% of the Chinese population was insured up from less than 50% in 2005 through public or employer-based insurance schemes. As part of this move, the structure of health care financing has shifted significantly, such that public sources in 2013 funded well over half of all health spending, compared with just over a third in the early 2000s. In that context, it is important to determine the main drivers of future growth in health spending in the medium term, to assess the possible impact on public budgets. Using a component-based health expenditure model developed at the OECD, future projections of public spending on health care and long-term care are made for OECD and key emerging economies, including China. The uniform cross-country framework allows for consistent international comparisons under different cost-pressure and cost-containment scenarios.

Results of the projection exercise show that China's public health and long-term care expenditure as a share of GDP is projected to increase from the 3.0% of GDP in 2012 to 4.7% or 5.2% by 2030, according to the different scenarios. This represents a larger increase in percentage terms – up 55% and 72% under the two scenarios - than the average of OECD countries – 29% and 40% - and other key emerging economies – 46% and 63% - reflecting in part the rapidly ageing population in China. That said, technology and relative prices remain the most important drivers of public health and long-term care spending growth across all countries. These projection results point to important policy challenges for China as it looks to balance cost control while further improving the depth and quality of health care coverage.

RÉSUMÉ

Ces dernières années, la Chine a connu une expansion sans précédent de la population couverte par l'assurance maladie dans sa quête pour une assurance maladie universelle. Dès 2011, 95% de la population chinoise était assurée contre moins de 50 % en 2005 par le biais de l'assurance maladie publique. Dans cette même mouvance, la structure du financement des soins de santé s'est déplacée de manière significative, au point que plus de la moitié des dépenses de santé est financée publiquement en 2013, contre un peu plus d'un tiers au début des années 2000. Dans ce contexte, il est important de déterminer les principaux moteurs de la croissance future des dépenses de santé à moyen terme, afin d'évaluer l'impact possible sur les budgets publics. En utilisant un modèle *component-based* des dépenses de santé développé à l'OCDE, des projections de la dépense publique en soins de santé et de longue durée, ont été réalisées pour les pays de l'OCDE et quelques pays émergents, incluant la Chine. L'utilisation d'une méthodologie unique pour l'ensemble des pays permet des comparaisons internationales cohérentes, avec différents scénarios de tension sur les coûts et de maitrise des coûts.

Ces projections, selon différents scénarios, prévoient en Chine une augmentation de la part des dépenses publiques en soins de santé et de long terme dans le PIB de 3.0% en 2012 à 4.7% ou 5.2% dès 2030. Cela correspond à une augmentation de de 55% à 72% -selon le scénario- bien plus importante que celle observée dans les pays de l'OCDE – 29% à 40% en moyenne- et d'autres économies émergentes clés– 46% et 63%. Cet écart reflète en partie le vieillissement rapide de la population chinoise. Cela étant dit, la technologie et les prix relatifs restent les moteurs les plus importants dans l'augmentation des dépenses de santé publique et de soins de longue durée à travers tous les pays. Ces résultats de projection mettent en évidence les défis politiques importants pour la Chine, alors qu'elle cherche à équilibrer le contrôle des coûts tout en continuant à améliorer la profondeur et la qualité de l'assurance maladie.

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Executive summary

1.   Health care spending in both OECD countries and key emerging economies has rapidly increased over past decades, notwithstanding the slowdown in the growth rates observed in many OECD countries following the 2008 economic and financial crisis. At the same time, three-quarters of health spending on average across OECD countries is financed from public sources, either government revenues, social health insurance, or a combination of the two. While the public share of health spending is much lower in middle- and low-income countries (typically less than 50%), the expansion of coverage and the move towards universal health coverage are changing the balance between public and private sources of funding. There is therefore a strong policy requirement for all such countries to examine future scenarios of health spending growth and the impact on public budgets.

2.   China presents a case in point with an unprecedented expansion of insurance coverage to its 1.3 billion population in recent years. As a result, the government share of health spending has risen from around 36% in the early 2000s to 56% in 2013. With such an increase in public spending on health, it is of paramount importance to examine the various demographic and non-demographic factors that will determine public spending on health in the next fifteen years. This report therefore proposes a set of public expenditure projections for both health and long-term care for China and other emerging economies until 2030 using a component-based projection model developed by the OECD Economics Department. The model treats the two components, namely health care and long-term care expenditure separately, and within each projects the separate effects of demographic and non-demographic drivers. Projections based on both a cost-containment and a cost-pressure scenario are provided, together with sensitivity analysis of some of the key assumptions.

Figure 1. Projected public expenditure on health care to 2030
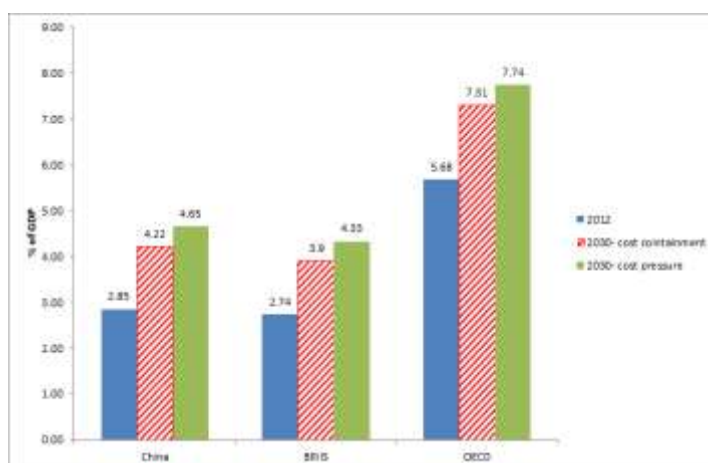
Note: BRIIS refers to the average of Brazil, Russia, India, Indonesia and South Africa.
Source: OECD calculations.

Figure 2. Projected public expenditure on long-term care to 2030
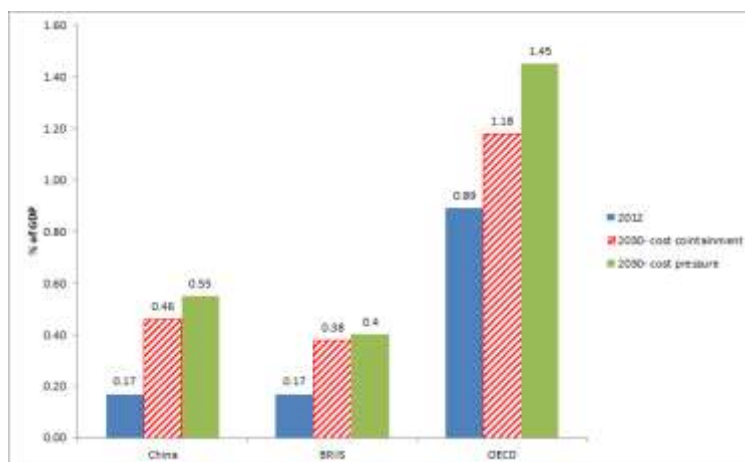
Note: BRIIS refers to the average of Brazil, Russia, India, Indonesia and South Africa.
Source: OECD calculations.

3.   The results of the exercise show that both health and long-term care expenditures are projected to put sizeable pressure on public finances over the coming years. China's public health and long-term care expenditure as a share of GDP is projected to rise by more than 70% under the cost pressure scenario, increasing from 3% in 2012 to 5.2% if GDP by 2030 (Figures 1 and 2). Under the cost containment scenario, China is still projected to see an increase in the share of GDP by more than a half to 4.7% of GDP. The difference between the results under the cost pressure and the cost containment scenarios is driven in part by technology development, and higher price growth in the health sector relative to the economy as a whole in China. For the other key emerging economies, Brazil, Russia, India, Indonesia and South Africa (referred to as BRIIS countries), health and long-term care spending is projected to increase by a little over 60% on average (equating to 1.8 percentage points of GDP) and by just under half (1.3 percentage points of GDP) in the cost-pressure and the cost-containment scenarios respectively over the same period, while for OECD countries the health and long-term care spending will increase in the order of just under 40% (2.6 percentage points of GDP) and 29% (1.9 percentage points), albeit from a much higher starting point.

4.   In summary, the projection results are driven by a combination of demographic, income and technology effects.

- The demographic effect for China is expected to be of higher importance than for the OECD average and in other BRIICS countries, reflecting China's rapidly ageing population. However, its overall effect remains relatively modest because the OECD model assumes a healthy ageing hypothesis. In particular, demographics are expected to increase the public health spending share of GDP in China by 1.2 percentage points by 2030. Most of this increase is related to health care spending (0.9 percentage points) as compared with long-term care spending (0.3 percentage points).

- Income is, everything else being equal, expected to slightly decrease the health expenditure to GDP ratio in China. This is because the effect of technologies, relative prices and other factors are separately modelled and real income elasticity is assumed to be below one. However, income is still expected to increase health and long-term care spending in absolute terms.

- Technology and relative prices are major cost drivers. They are expected to increase the public health spending share of GDP by 1.6 and 2 percentage points in China by 2030 in the cost containment and the cost pressure scenarios respectively.

1. INTRODUCTION

5.   Concerns about health expenditure growth and its long-term sustainability have stimulated the development of health expenditure forecasting models in many countries, both developed and emerging economies. Whether it is because of concerns surrounding the fiscal sustainability of public expenditures, rising health prices, the productivity of the health sector, financial pressures on patients and families or extending coverage, policy makers are seeking to understand how health expenditure might evolve and to set a course for policy.

6.   China has made enormous strides towards achieving effective universal health coverage in recent years (Liang *et al.* 2013; Marten *et al.* 2014). Since the early 2000's, China has gone through several phases of health reform. One of the major changes in the health system has concerned three insurance schemes: The New Rural Cooperative Medical Scheme (NCMS) in 2003 was re-established; Urban Resident Basic Medical Insurance (URBMI) was introduced in 2007, and finally the Urban Employee Basic Medical Insurance (UEBMI) was strengthened (Yu, 2015). In 2009, the Chinese central government announced another health system reform plan to provide safe, efficient and affordable basic health care for all Chinese residents by 2020. The reform laid out plans to expand health insurance coverage, establishing an essential medicine program, implementing public health programs and primary care, and lastly reforming public hospitals.

7.   By 2011, 95% of the Chinese population was insured, compared to less than 50% in 2005, and has been put forward as a successful model for other countries on the same road, a significant increase in the use of healthcare, and the reduction of inequality in access to healthcare between the poorest and the wealthiest (Yu, 2015). A key factor in being able to achieve universal health coverage has been the significant economic growth in China in recent decades, which has given the government the capacity to heavily subsidise the health insurance premiums for the 1.3 billion population. As such, the structure of health financing has shifted significantly with government spending accounting for 56% of health spending in 2013 compared with around 36% in the early 2000s (Figure 3). Consequently, the out-of-pocket burden on households has dropped from 60% to less than 34% over the same period.

8.   The rapid expansion in coverage has resulted in per capita annual health spending growth of almost 11% in China between 2000 and 2012, with government spending on health growing at more than 14% on average each year. While public spending on health as a share of GDP has almost doubled from 1.6% to 3.0% between the early 2000s and 2013, the share of overall government spending remains relatively low at around 8%[1]. By comparison, across OECD countries, public health spending as a share of GDP is twice that of China at around 6.5% and 15% of total government spending is on health care.

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[1] Overall government expenditures include the general budget account, government-managed funds, State-administered state-owned enterprises funds and social security funds.

Figure 3. Expenditure on health by type of financing, China, 2000-2013
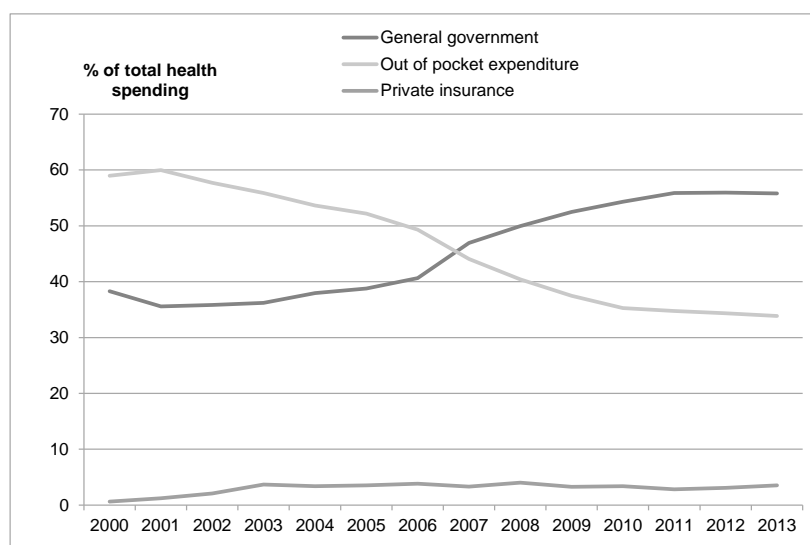
Source: WHO Global Health Expenditures Database (2015)

9.   In this context, China now faces some of the common challenges of balancing cost control and improving depth and quality of coverage. This report aims to discuss the results of a health and long-term care expenditure projection exercise for China over the medium term, using a model developed at the OECD. The projection framework is a tool that can be adapted to specific cases. It allows for sensitivity analysis and parameters can be changed as better estimates become available. The results presented in this paper provide baseline health and long-term care expenditure trends and scenarios for China out to 2030, as well as average projections for OECD countries and other key emerging economies – Brazil, the Russian Federation, India, Indonesia and South Africa - over the same timeframe.

10.   The structure of the report is as follows. Following a brief discussion of the different families of health expenditure forecasting models, section 2 continues with an overview of the main characteristics of the OECD health expenditure projection model used in this exercise. Section 3 describes the health and long-term care expenditure data sources and detailed methods used to project spending to 2030. Section 4 compares the results for China against the results for OECD countries and other BRIIS countries. The summary and conclusions are provided in section 5.

2. HEALTH EXPENDITURE FORECASTING MODELS

2.1. Macro-level, component-based and microsimulation models

11.   Forecasting models typically project health care expenditure at the level of individuals, groups of individuals or the community as a whole (Hollembeck, 1995). At the same time, models can focus on specific sections of health expenditure, such as public expenditure, social security, private insurance, or households' out-of-pocket payments. By considering both the level of aggregation of the units analysed and the level of detail of health expenditure to be projected, it is useful to identify three broad categories of health expenditure forecasting models: macro-level models, component-based models and micro-models (Astolfi *et al*, 2012).

12.   Macro-level models focus on forecasting total health expenditure and include analyses of time-series and cross-sections of aggregate indicators. This class of model also includes computable general equilibrium models which allow for the measurement of broader consequences to the economy resulting from spending growth and for feedback or reaction from consumers and producers. Examples of this category of model include the Australian Government Productivity Commission model (Productivity Commission, 2005) and the US Centers for Medicare and Medicaid Services Dynamic Computable General Equilibrium Model (Borger *et al*, 2008; Friedman, 2010).

13.   Component-based-models include a large variety of forecasting models that analyse expenditure by financing agents, by providers, by type of goods and services consumed, by groups of the population or by some combination of these groups. An important sub-class of component-based models is represented by cohort-based models where individuals are grouped into cells according to several key attributes. Age is the principal criterion used to stratify the population of interest, while further refinements are obtained by sub-dividing the cohorts according to other commonly-used attributes, such as gender, health status, and proximity to death. Such models are often referred to as actuarial models or cell-based models, where the term 'cell' identifies the subcategories into which each cohort is divided. Examples of this family of model include the European Union/Ageing Working Group model (European Commission, 2011; European Commission, 2012), the New Zealand Ministry of Health and Treasury model (Bryant *et al*, 2004) and the Dutch Bureau for Economic Policy Analysis model (Besseling *et al*, 2011).

14.   The units of analysis of the microsimulation models are individuals. These individuals can be aggregated into policy-relevant groups and analysed using relevant indicators such as inequality and poverty indices. Microsimulation models reproduce the characteristics and behaviour of a large sample of individuals representing the whole population of interest. Major life-course events (e.g. exposure to risk factors) can be represented in the lives of the simulated individuals and, in the case of dynamic models, certain characteristics and behaviours can evolve over the life course. Micro models simulate entire populations and offer the flexibility to test a range of "what if" policy scenarios related to prevention, treatment and the organisation and financing of care, and to examine forecast results by different characteristics included in the model, such as by diseases, age-groups, providers or treatments. The Canadian Population Health Model (Wolfson, 1994; Statistics Canada, 2011) and the Long-term Demand for Welfare Services developed by the Swedish Ministry of Health and Social Affairs (Klevmarken, 2011; Brouwers *et al*, 2011) are examples of this family of models.

15.   Component-based models are the dominant class and are typically more data demanding than macro-level models but less demanding than microsimulation models, and this partially explains their popularity. Basic versions of component-based models typically break down health expenditure into major spending categories and age classes and employ actuarial projections as the main driver of future health spending. The development of more sophisticated versions of these models requires additional information, such as health spending broken down by gender and disease categories, by descendent and survivor status or by end-of-life costs.

16.   The implementation and maintenance of component-based models tends to be relatively simple and inexpensive, and they are typically integrated into a broader framework that projects other spending, such as social security expenditure (e.g. including pensions). In these models, the impact of policy changes can be assessed by simply modifying the policy parameters that were included.

2.2. The OECD health care and long-term care expenditure projection model

17.   An example of a component-based model is given by the OECD health expenditure forecasting model (de la Maisonneuve *et al*, 2013). The projections rely on a uniform cross-country framework of current[2] public health expenditure, allowing for consistent international comparisons. Per-capita expenditure profiles by age and sex are estimated in the base year for two components[3]: health care (HC); and long-term care (LTC). The per-capita expenditure for each component is projected according to specific assumptions, and then multiplied by the group-specific population in the projection year. The baseline data required also comprises population, number of deaths and number of dependants, disaggregated where possible by age group and gender. Projections also make use of separate demographic, GDP growth and labour force participation forecasts.

18.   For both health care and long-term care, the model is limited to projecting public expenditures. This reflects the model being designed to address policy concerns around the fiscal sustainability of health systems, in a policy context where health expenditures are typically financed predominantly from public sources (OECD, 2015). The EU Ageing Reports, with which the OECD model shares certain characteristics and data, also has the same public spending focus (European Commission, 2012; European Commission, 2015).

19.   In 2013, public health expenditure accounted for 73% of total health expenditure across OECD countries, while it represented less than half of total spending in BRIICS countries (Figure 4). While most middle- and low-income countries' health expenditures are predominantly financed through private sources - typically with high levels of out-of-pocket spending - move towards universal health coverage inevitably lead to significant increases in public funding - as is the case with China. Therefore, the focus on public financing and its future sustainability is deemed appropriate.

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[2]   Note that gross capital formation is excluded.

[3]   The two components are estimated separately as the factors that drive spending are different.

Figure 4. Expenditure on health by type of financing by country, 2013 (or nearest year)
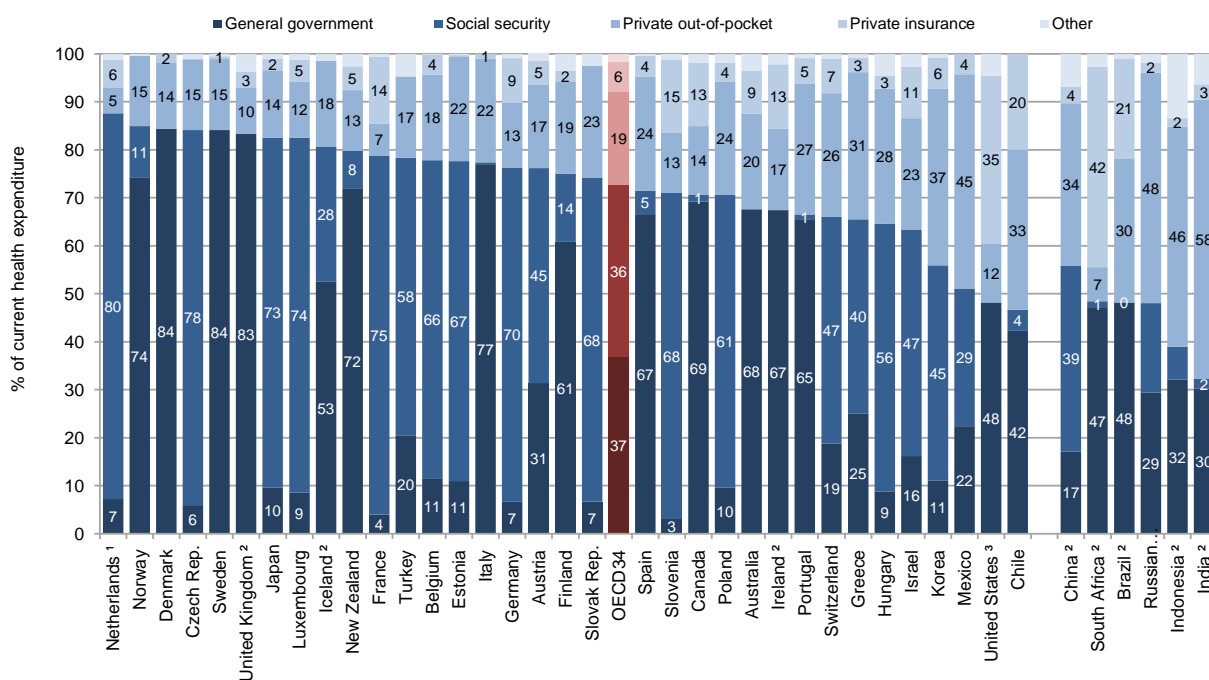
1. The Netherlands report compulsory cost-sharing in health care insurance and in Exceptional Medical Expenses Act under social security rather than under private out-of-pocket, resulting in an underestimation of the out-of-pocket share.

2. Data refer to total health expenditure (= current health expenditure plus capital formation).

3. Social security reported together with general government.

Source: OECD Health Statistics 2015, WHO Global Health Expenditure Database.

3. DATA AND METHODS

3.1 The System of Health Accounts and other data sources

20.   The principle source of data for public spending on health care (HC) and long-term care (LTC) is the data collected under the Joint OECD/Eurostat/WHO Health Accounts Questionnaire. The expenditure data collected is based on the System of Health Accounts (OECD, Eurostat, WHO, 2011), an accounting framework which tracks health and long-term care spending according to internationally harmonised definitions and boundaries, and is closely aligned to concepts and rules of the System of National Accounts. Current health spending (that is, spending on health care goods and services, excluding investment) is disaggregated according to three dimensions: financing, function and provider. For the purposes of the projection exercise, current public expenditures (comprising general government and social health insurance) are extracted and disaggregated into two functions (components) - namely health care (HC) and long-term care (LTC). The source of OECD countries' health spending data is the OECD Health Statistics database, while data for China and the BRIIS countries are extracted from the WHO Global Health Expenditure Database[4].

21.   The public health expenditure by age groups have been provided by the European Commission for the European countries and by the Swiss Federal Statistical Office, Health Canada, the Australian Institute for Health and Welfare and the China National Health Development Research Center for Switzerland, Canada, Australia and China, respectively.

22.   The population projections are sourced from Eurostat for European OECD countries, while for non-European countries projections are from the United Nations Population Database. GDP projections, published in the OECD Economic Outlook (2012), are based on a standard aggregate Cobb-Douglas production function with constant returns to scale (Johansson et al. 2013). The productivity data and labour participation rates come from the OECD Economic Outlook (2012) and Johansson (2013).

3.2 Health care projection framework

23.   The determinants of the growth in public spending on health care (HC) are categorised into the two broad components: demographic and non-demographic. Demographic factors relate broadly to the age and sex structure of the population and the evolution of its health status. A rising share of older age groups in the population will put upward pressure on costs because health costs rise with age. For the analysis, the average cost per individual in older age groups should fall over time for two reasons: longevity gains are assumed to translate into additional years of good health ("healthy ageing"); and major health costs come at the end of life. That said, discussions over the compression of morbidity as a result of longer life expectancy remain inconclusive (Lafortune et al., 2007).

24.   The starting point of the demographic component is the cost curves as a function of age. From these general cost curves, the next step of the analysis is to estimate cost curves separately for survivors and non-survivors. This is to reflect the death-related costs hypothesis, namely that proximity to death is a key driver of health spending. The survivors' costs are then adjusted to reflect a healthy ageing hypothesis, whereby age-related increases in health expenditure are postponed according to expected gains in life expectancy.

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[4] http://apps.who.int/nha/database

25.   The main observed non-demographic driver is income. On the one hand, rising incomes increase expectations on the quality and scope of care. At the same time, health care is often an individual necessity. While there is a broad consensus that increases in income leads to more spending on health, the exact relationship between health expenditure and incomes (the income elasticity) remains a hotly disputed issue. Earlier studies using national-level data typically found income elasticity greater than one, implying that health care is a luxury good. However, such studies were often found to omit important variables (e.g. technological progress proxies) and have other mis-specification issues that lead to an upward bias. Recent studies that address these issues have typically found elasticity lower than one. Considering the varying degrees of development in economy and the availability and accessibility to public healthcare services, income elasticity may vary between high, middle and low-income countries. A cross country study supported such notion that income elasticity is highest in middle-income countries followed by high-income and low-income countries (Farag, et al., 2012). However, since such studies focusing on middle- and low- income countries are scarce and inconclusive, the OECD study assumes an income elasticity of 0.8, justified by taking the middle point from recent econometric estimates (see Annex 2).

26.   Demographic and income effects combined can only help explain a certain part of past growth in health care expenditures, leaving an observed but unexplained residual growth. The third modelled factor reflects this residual. Studies have shown that technological progress, relative prices in the health sector and institutional characteristics and health policies are the most likely factors explaining this residual. The OECD model uses auxiliary regression results to explain this residual growth component in terms of these factors. It finds that the residual expenditure has increased health care expenditure by around 1.7% per year in OECD countries between 2000 and 2009, with technology and health relative prices explaining 0.8%, and other factors such as changes in policies and institutions explaining 0.9%[5].

27.   Demographic factors, income effects and a residual growth factor are all modelled separately, represented in a simplified projection equation as follows:

$$\Delta \log\left(\frac{HC}{Y}\right) = \Delta \log(demo) + (\varepsilon - 1) \cdot \Delta \log\left(\frac{Y}{N}\right) + \Delta \log(Res)$$

     where *demo* reflects the three combined demographic factors – that is , death-related costs, pure age effects and a healthy ageing effect; ε is the income elasticity of health care (HC) expenditures; and *Res* is the residual growth factor. Note that *HC/Y* is health care expenditure as a share of GDP and *N* is the total population.

28.   Projected values for each of these drivers (demographic, income and residual) are adjusted to allow for a gradual convergence of HC spending toward the OECD average HC expenditure to GDP ratio. The convergence factor that is applied reflects the likelihood that countries with relatively low (high) health spending to GDP ratios in the baseline as compared with the OECD average will increase (decrease) the projected growth rate of health spending relative to GDP.

29.   The analytical framework to project public health care expenditures is applied according to two scenarios over 2012-2030. In the "cost pressure scenario" no policy action is undertaken to curb pressures on expenditure whereas the "cost-containment scenario" assumes some policy action to rein in these

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[5] As part of the OECD model, a set of auxiliary regressions were run to try and explain the residual factor, that is the part of health care expenditure growth unrelated to demographics and income. These regressions included proxy variables for technology (research and development efforts and number of patents) and relative prices (a health price deflator as a ratio of the GDP deflator). This 1.7% growth rate was then used as the starting value for residual expenditure growth estimates. For further details, see de la Maisonneuve and Oliveira Martins (2013).

pressures on expenditures. Even though the nature of such policies is not made explicit, they can be thought of as actions to limit the pressures arising from excessive growth of relative health prices, e.g.*,* by monitoring more closely the adoption of new technologies or modifying incentives via changes in the governance of health institutions. All these scenarios assume "healthy ageing" and an income elasticity of 0.8.

3.3 Long-term care projection framework

30.   A striking difference between spending on health care and LTC is that the cost of LTC per beneficiary is roughly independent of age. Moreover, while potentially the entire population may benefit from health care, only dependent persons will benefit from LTC. Therefore, the age-specific cost curve for LTC is expressed per dependant.

31.   The determinants of government spending on LTC are categorised into the two broad components: demographic and non-demographic. The demographic driver is modelled by changes in the number of dependent people in the population. Those changes depend on the age of the population and the evolution of life expectancy. The non-demographic drivers are income and the demand for public-financed LTC services. As with the health ageing hypothesis, the long-term care model assumes stability with regard to disability levels, by shifting the years of disability in line with the gains in life expectancy.

32.   Income is assumed to have a direct effect via increases in living standards (GDP per capita) and an indirect effect via cost-disease (relative productivity or Baumol effect) (Baumol, 1967) (discussed further in Annex 1). Given the importance of informal care provided by family and friends, the demand for public spending on LTC is assumed to depend on changes in the availability of informal carers which, in turn, depend on changes in formal labour force participation.

33.   Four factors are used to project long-term care expenditure following the projection equation below:

$$\Delta \log \left(\frac{LTC}{Y} \right) = \Delta \log \ (demo) + (\varepsilon - 1) \cdot \Delta \log \ \left(\frac{Y}{N} \right) + \gamma \Delta \log \ (Baumol) + \ \delta \ \Delta \log \ (Participation)$$

where *Demo* stands for demographic effects which in the case of LTC stand for the number of dependent people; *Baumol* stands for the cost-disease effect captured by the labour productivity differential between the LTC sector and the rest of the economy; *Participation* is a proxy for the increase of public formal care; and ε is the income elasticity of LTC expenditures.

34.   Projected values for each driver are adjusted to allow for gradual convergence of LTC spending to the OECD average LTC expenditure to GDP ratio. A convergence factor that reflects the likelihood that countries with relatively low (high) LTC spending to GDP ratios in the baseline as compared with the OECD average will increase (decrease) the projected growth rate of LTC spending relative to GDP is applied.

35.   As for health care, a cost-pressure scenario and a cost-containment scenario were computed. Both scenarios are based on a unitary income elasticity assumption and the "healthy ageing" hypothesis. However, in the cost-pressure scenario, for OECD countries, a full Baumol effect is assumed, meaning that LTC unit labour costs increase fully in line with aggregate labour productivity; for BRIIS countries and China, excess labour supply especially in the non-tradable sector suggests weaker wage pressures than in the OECD countries, and therefore the cost-pressure scenario only incorporates half of the Baumol effect.

36.   The detailed step of the analysis for both the health care and long-term care expenditure projected are covered in Annex 1.

3.4 Assumptions

37.   The results of the model should be interpreted in the light of the following assumptions:

- Health care expenditure profiles by age class and sex are estimated for all countries in this study on the basis of a regression analysis. This means that also for countries – including China - for which observed health care expenditure profiles by age class and gender are available, estimated figures are used.

- Health care and long-term care expenditure projections are based on expenditure profiles estimated for the entire population in each country. This means that any changes in coverage in terms of the proportion of the population, the basket of services and financial aspects are not addressed directly through the model. This may be considered a limitation in the current model for other emerging economies where universal health coverage has not yet been achieved and where an expansion of coverage might be expected.

- China has undergone substantial structural changes in recent decades, including a significant urbanisation of the population. The current version of the model does not capture differences in health needs, benefits and spending between rural and urban populations.

- For BRIICS countries, the share of LTC spending over total spending is assumed to be 5.75%; that is half of the average share observed in OECD countries. This reflects the low capacity of LTC services financed by government in those countries.

- Dependency ratios by age class are assumed to be constant across countries.

- A common residual is applied to all countries in order not to extrapolate country-specific idiosyncrasies over time.

- For health care and long-term care spending, a convergence factor towards the OECD average for the projected value of each driver is applied.

38.   Thus the results shown in this report should be seen as illustrative of future trends of health care and long-term care spending projected used a comparable model. For BRIICS countries, estimates of health and long-term care spending growth may be conservative as they use a common residual and a "convergence towards the OECD mean" assumption.

4. RESULTS

4.1 Public expenditure on health and long-term care

39.   China's public spending on health care is projected to reach between 4.2% and 4.6% of GDP in 2030, up from 2.8% in 2012. Public spending on LTC is projected to reach between 0.5% and 0.6% of GDP in 2030, up from 0.2% in 2012. The overall public health expenditures (that is, combining health care and LTC spending) are projected to reach between 4.7% and 5.2% of GDP in 2030, up from 3% in 2012.

4.2 Drivers of health care spending

40.   On average, the demographic effect accounts for a modest increase in expenditure under the assumption that longevity gains would progressively postpone health expenditure from one age class to the next, rather than raise it ("dynamic equilibrium" or "healthy ageing" hypothesis), although the changing demographic trends in China are such that the impact is greater than that for the OECD and BRIIS averages (see Table 3). Indeed, a projected doubling of the population over 65 years old in China means that the demographic effect pushes up spending by almost 1 percentage point from 2.8 % to 3.8 % of GDP in 2030. In OECD countries, the demographic effect is less than half of that, pushing up spending from 5.7 % of GDP on average to 6.1 % in 2030, while in BRIIS countries it increases spending from 2.7 % of GDP to 3.1% in 2030.

41.   With real income elasticity assumed to be less than unity, the underlying increase in income would imply *ceteris paribus* a decline in the health expenditure to GDP ratio. As the GDP projections embody a degree of convergence towards living standards of high-income countries, this downward income effect on spending ratios is more important for rapidly catching-up low-income countries. Indeed, on average for OECD countries the decline in expenditure ratios due to income growth will amount to -0.4 percentage points in 2030 while for China it will be – 1.1 percentage points. For BRIIS countries the decline in expenditure ratios will be, on average, -0.7 percentage points.

42.   Under the "cost pressure scenario" (Table 1), it is assumed that, on top of the demographic and income effects, health expenditure will grow by a residual 2% per year over the whole projection period. Under this scenario, the average OECD public expenditure on health to GDP ratio is projected to increase by more than 2 percentage points, reaching close to 8% in 2030 from a starting value of 5.7 % in 2012. Starting from a much lower ratio of public health expenditure to GDP at 2.9 %, China will experience an increase of 1.8 percentage points, to reach 4.6 % in 2030. The most important part of these increases is due to the residual component. The BRIIS will experience an average increase of 1.6 percentage points, to reach 4.3 %.

Table 1. Breakdown of the projections of public health care expenditure to 2030 for each driver. Cost pressure scenario

	Health care expenditure as a % of GDP	Demographic effect	Income effect	Residual	Health care expenditure as a % of GDP	
	2012	Increase in % points of GDP 2013-2030			2030	Growth rate 2030/2012
China	*2.9*	*0.9*	*-1.1*	*2.0*	*4.6*	62.8
BRIIS[1]	2.7	0.4	-0.7	2.0	4.3	58.2
OECD[1]	5.7	0.4	-0.4	2.0	7.7	36.1

1. Unweighted average of values for individual countries.

43.   While the cost-pressure projections may be useful as a benchmark, they may not appear realistic. It is unlikely that public health-care expenditures to GDP would continue to grow at such rates, without limit.

44.   Accordingly, a long-run convergence condition is considered in the cost-containment scenario (Table 2). Specifically, the growth contribution of the spending residual, whose past growth was partly attributable to technology and relative price effects, is assumed to converge to zero in 2060, implicitly representing the assumption that policies are more effective than in the past in controlling the expenditure growth driven by non-demographic non-income related factors.

45.   Under this cost-containment scenario, the health care expenditure to GDP ratio for China would increase by 1.4 percentage points, to reach 4.2 % by 2030. The increase in OECD countries averages 1.6 percentage points, to reach 7.3 % of GDP by 2030, while the increase in BRIIS countries averages 1.2 percentage points, to reach 3.9% of GDP by 2030.

Table 2. Breakdown of the projections of public health care expenditure to 2030 for each driver. Cost containment scenario

	Health care expenditure as a % of GDP	Demographic effect	Income effect	Residual	Health care expenditure as a % of GDP	
	2012	Increase in % points of GDP 2013-2030			2030	Growth rate 2030/2012
China	*2.9*	*0.9*	*-1.1*	*1.6*	*4.2*	48.0
BRIIS[1]	2.7	0.4	-0.7	1.6	3.9	42.5
OECD[1]	5.7	0.4	-0.4	1.6	7.3	28.7

1. Unweighted average of values for individual countries.

4.3 Drivers for long-term care spending

46.   Demographic drivers account for the largest share of future expenditure increases in China. With an assumed elasticity of unity, the income effect is not creating additional pressures in terms of expenditure shares to GDP. On the contrary, demographic changes are projected to exert a relatively minor influence on future public LTC expenditures in OECD countries. Indeed, as the LTC cost is independent of age, the pure age effect has only a moderate impact on spending. Moreover, this effect is mitigated by the 'healthy ageing' assumption.

47.   In the cost-pressure scenario, starting from 0.2 % of GDP , the ratio of public LTC expenditure to GDP in China is projected to increase by 0.4 percentage points to reach 0.5 % of GDP in 2030 (Table 3).

For OECD countries, the increase in LTC spending is projected to be, on average, 0.6 percentage points, to reach 1.4% of GDP in 2030, while for BRIIS countries, the increase is projected to be, on average, half times that experienced by OECD countries but starting from a much lower level (0.2 %), to reach 0.4 % of GDP in 2030.

Table 3. Breakdown of the projections of public long-term care expenditure to 2030 for each driver. Cost pressure scenario

	Long-term care expenditure as a % of GDP	Demographic effect	Cost disease effect	Participation rate of people aged 50-64	Long-term care expenditure as a % of GDP	
	2012	Increase in % points of GDP 2013-2030			2030	Growth rate 2030/2012
China	*0.2*	*0.3*	*0.2*	*-0.1*	*0.6*	215.8
BRIIS[1]	0.2	0.2	0.1	0.0	0.4	139.5
OECD[1]	0.9	0.1	0.3	0.1	1.5	62.9

1. Unweighted average of values for individual countries.

48.   In the cost-containment scenario (Table 4), the public LTC expenditure to GDP ratio for China increases by 0.3 percentage point from 0.2 % to 0.5 % of GDP. BRIIS countries will experience, on average, a lower increase as compared to OECD countries (0.2 versus 0.3 percentage points) to reach 0.4 % of GDP in 2030.

Table 4. Breakdown of the projections of public long-term care expenditure to 2030 for each driver. Cost containment scenario

	Long-term care expenditure as a % of GDP	Demographic effect	Cost disease effect	Participation rate of people aged 50-64	Long-term care expenditure as a % of GDP	
	2012	Increase in % points of GDP 2013-2030			2030	Growth rate 2030/2012
China	*0.2*	*0.3*	*0.1*	*-0.1*	*0.5*	164.1
BRIIS[1]	0.2	0.2	0.0	0.0	0.4	115.5
OECD[1]	0.9	0.1	0.0	0.1	1.2	33.0

1. Unweighted average of values for individual countries.

4.4 Sensitivity analyses and comparison with previous results

49.   In the sensitivity analysis of public health care expenditure (HC), a number of parameters were changed in the context of the cost-containment scenario: the income elasticity, and factors underlying health status at old age.

50.   As noted above, there is considerable uncertainty concerning the income elasticity of health spending. The sensitivity analysis is carried out taking plus and minus two standard deviations from the value estimated in the benchmark regressions, corresponding to income elasticities of 0.6 and 1.0 respectively. When the income elasticity is set to 1.0, the public health expenditure deviation from the base case for China will be 1.1 percentage points of GDP, to reach 5.3% in 2030. The health expenditure deviation will be 0.4 percentage points of GDP on average for OECD countries (Table 5), to reach 7.7% in

2030. It is higher for BRIIS countries at an average of 0.7 percentage points of GDP, to reach 4.6% in 2030. In both groups of countries, those with the largest projected GDP per capita growth are obviously the most affected by changes in the income elasticity. When the income elasticity is set to 0.6, health expenditure deviates from the base case by -0.9 percentage points of GDP in China, to reach 3.3% in 2030. Under this scenario, this deviation is - 0.3 percentage points of GDP on average in OECD countries, to reach 7.0 %. The deviation is more than double in BRIIS countries - -0.6 percentage points of GDP – and the share of public health care spending on GDP is projected to decrease to 3.3% in 2030.

Table 5. Sensitivity analysis on public health care expenditure projections performed on the cost containment scenario

		Income elasticity = 0.6	Income elasticity = 1	Compression of morbidity	Expansion of morbidity
	Health care expenditure as a % of GDP - 2030	*Percentage point deviations from cost-containment scenario in 2030*			
China	*4.2*	*-0.9*	*1.1*	*-0.4*	*0.5*
BRIIS[1]	3.9	-0.6	0.7	-0.4	0.5
OECD[1]	7.3	-0.3	0.4	-0.3	0.4

1. Unweighted average of values for individual countries.

51.   Sensitivity to alternative health status was also explored. In an "expansion of morbidity" scenario, people will live longer but more disabled/ill-health lives. Thus longevity gains do not translate into additional years in good health. In a "compression of morbidity" scenario, people will live longer, healthier lives. Thus longevity gains are doubled into additional years in good health. Under these scenarios, by 2030 health care expenditure in China ranges from 3.8 to 4.7% of GDP, while – on average - in OECD countries it ranges from 7.0 to 7.7% of GDP and in BRIIS countries from 3.5 to 4.4%.

52.   For public LTC spending, projections were performed assuming an income elasticity of 2.0 for the cost-containment scenario for OECD countries, while for BRIIS countries and China the sensitivity analysis assumed an income elasticity of 1.5. In China, public long-term care spending projections will increase by 0.3 percentage points if compared to the cost-containment scenario baseline. This matches the average for OECD countries (Table 6) with LTC expenditure reaching 1.5% of GDP in 2030. For BRIIS countries, the average share of LTC in GDP would reach 0.7% of GDP, also an increase of 0.3 percentage points as compared to the baseline scenario.

Table 6. Sensitivity analysis on public long-term care expenditure projections performed on the cost containment scenario

		Income elasticity = 2 (=1.5 for BRIIS and China)	Life expectancy plus 2 standard deviations	Life expectancy minus 2 standard deviations
	Long-term care expenditure as a % of GDP - 2030	*Percentage point deviations from cost-containment scenario in 2030*		
China	*0.5*	*0.3*	*0.1*	*-0.1*
BRIIS[1]	0.4	0.3	0.1	0.0
OECD[1]	1.2	0.3	0.1	-0.1

1. Unweighted average of values for individual countries.

53. A sensitivity analysis has also been carried out for the evolution of the number of dependants. One of the drivers of the dependency ratio, life expectancy, has been changed relative to baseline. Taking life expectancy plus (minus) two standard deviations (SD) would induce an average deviation from the baseline case for OECD countries of 0.1 (-0.1) percentage points in the LTC expenditure to GDP ratio, which would then reach, on average, 1.3% (1.1%) of GDP in 2030. The expenditure for BRIIS countries will deviate from base case by 0.1 percentage points if we take like expectancy plus two SD, while remains stable under the other scenario. In China, the deviation from the baseline will be plus (life expectancy plus 2 SD scenario) or minus (life expectancy minus 2 SD scenario) 0.1 percentage points. Due to the very limited impact of health expenditure, alternative assumptions in this area have only a slight impact.

54. The results presented here are higher than previous results for China from the original OECD model results (de la Maisonneuve *et al* 2014). Differences predominantly reflect the updated and age-disaggregated health expenditure data for China, and also slightly updated health accounts data for other countries. Note that for HC spending, the underlying methodology and key assumptions from the previous modelling have not been changed.

55. For public health care expenditure to GDP ratios in 2030 for China, the new cost pressure scenario estimate of 4.6% compares with the earlier result of 3.7%; and the new cost containment scenario estimate of 4.2% compares with 3.2%. For public long-term care spending, the new cost pressure scenario of 0.5% compares with the earlier result of 0.5%; and the new cost containment scenario estimate of 0.5% compares with 0.4%.

56. The results presented here are also higher than those reported by the International Monetary Fund (Soto *et al*. 2012). The IMF results show that public health spending in China is projected to rise by less than 1 percentage point of GDP until 2030, under the assumption of an excess cost growth[6] of 1.0 percent, similar to the average growth observed in advanced economies over the last three decades.

57. Official medium term projections forecast *total* spending on health care to reach around 6.2% of GDP by 2020, of which 4 % will be from government sources[7]. Our findings, under the assumption of an increase of the share of public health care spending to total health care spending over time, are consistent with those official results.

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[6] While the determinants (income levels, demographic composition, technology and other factors) are the same in both models, the OECD model has one growth estimation method for all countries, the IMF model applies two growth estimate models – one for advanced economies and the other for emerging economies. Excess cost growth in the IMF model is defined as the growth in public health spending in excess of GDP growth after controlling for the effect of ageing. This includes a slowdown in this factor as countries with low spending ratios converge toward the advanced economy mean.

[7] Huazhong University of Science and Technology, (2014) "China health spending report", Ministry of Health (2012) "Healthy China 2020" http://www.moh.gov.cn/wsb/pzcjd/201208/55651.shtml

5. DISCUSSION

58.   Between the early 2000s and 2012, public health and long-term care spending almost doubled from 1.6% to 3.0% of GDP, as China experience a huge expansion of health care insurance as part of its move towards universal health coverage. Taking that as a base, total public health and long-term care expenditure in China is projected to increase by a further 1.6 and 2.2 percentage points of GDP between 2012 and 2030 in the cost-containment and the cost-pressure scenarios respectively (Table 7).

Table 7. Projection scenarios for public health and long-term care expenditure. China, BRIIS countries and OECD countries

	Public health care and LTC expenditure as a % of GDP				
	2012	*2030- cost cointainment*	*2030- cost pressure*	Growth rate 2030-2012 - cost containment	Growth rate 2030-2012 - cost pressure
China	*3.0*	*4.7*	*5.2*	*55.0*	*72.2*
BRIIS[1]	2.9	4.3	4.7	46.4	62.5
OECD[1]	6.6	8.5	9.2	29.2	39.9

1. Unweighted average of values for individual countries.

59.   On average across OECD countries, the overall public health care and LTC expenditure to GDP ratio is projected to increase from 6.6% in the starting period to 9.2% of GDP in 2030 in the cost pressure scenario. In the cost-containment scenario the ratio would still increase by almost 2 percentage points, to reach 8.5% (Figure 5). For the BRIIS, starting from a much lower but more comparable level to China, public health and LTC expenditure will increase from 2.9% in the starting period to about 4.7% and to 4.3% in 2030 under the cost-pressure and the cost-containment scenarios respectively.

Figure 5. Projected public health and long-term care expenditure to 2030 under the cost containment and cost pressure scenarios. China, BRIIS countries and OECD countries.
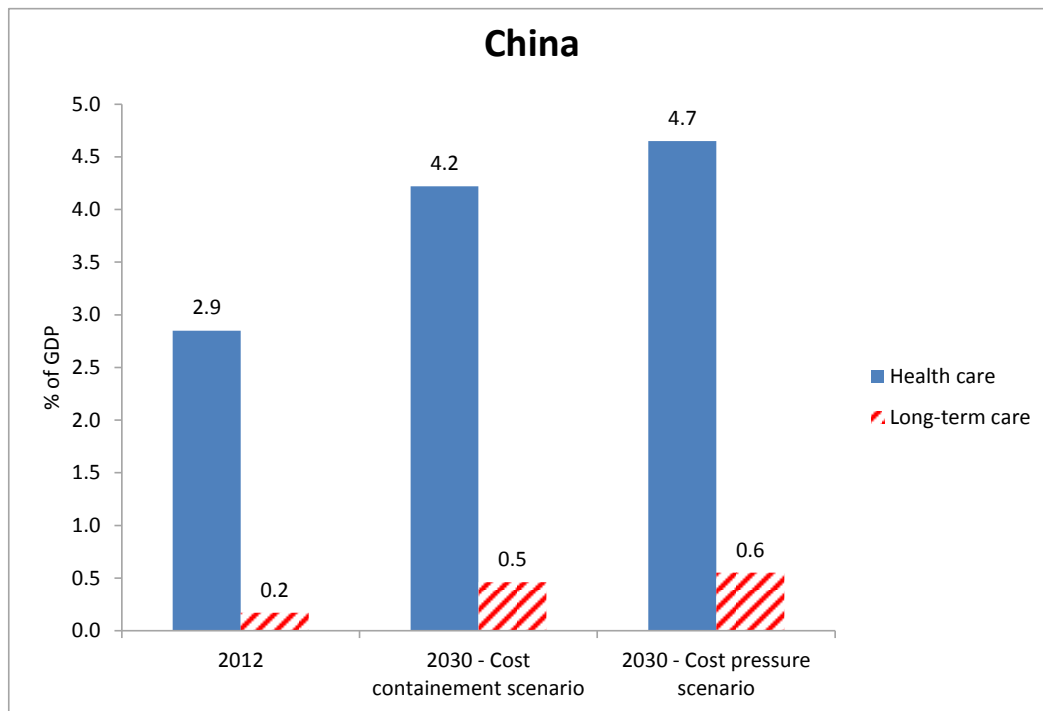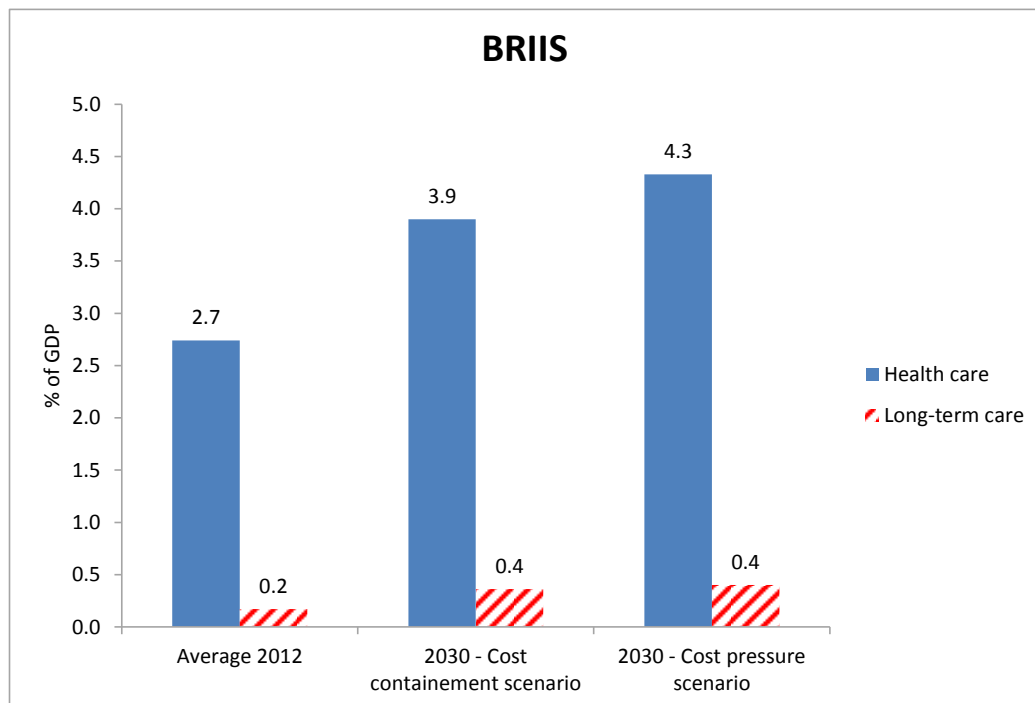
Source: OECD calculations.

Source: OECD calculations.
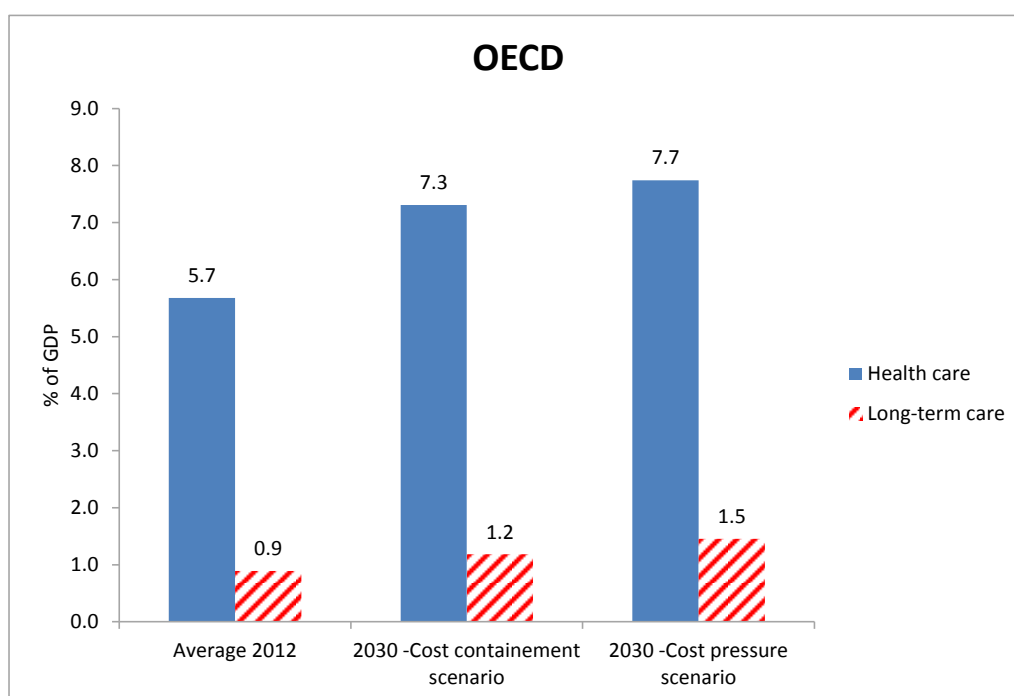
OECD

Source: OECD calculations.

60.   It should be noted that the OECD model is limited to projecting public expenditures. But in many emerging economies, private sector spending on health and long-term care can be substantial. At the same time, many of these countries, including China, have witnessed a shift from private to public spending in recent years in the context of moves towards universal health coverage. Whilst the general theoretical principles on which the OECD model is based would remain unchanged – particularly that ageing, income and technologies are major drivers of health spending growth – there may well be important differences in the extent to which these drivers affect private as opposed to public spending. Future work by the OECD plans to address this by modelling both public and private health expenditures. It also plans to address how different paths towards universal health coverage impact future trends in health care and long-term care spending, in particular in BRIICS countries.

61.   The suitability of some of the model assumption to China, particularly on income elasticity and the drivers of long-term care also warrants further discussion. Health care expenditures depend – among other factors – on the size and structure of the population and its health status. It is a popular notion that an ageing population is a major driver of health care costs as the increase in life expectancy is assumed to be associated with a decline of the health status of the population. However, the hypothesis that people living longer also age healthily moderates this notion. Although ageing plays a minor role among factors that drive the growth in the OECD projection model (de la Maisonneuve *et al* 2013), the ageing effect is more pronounced in China where the ageing of the population is taking place faster than the other OECD and BRIIS countries.

62.   Income has been identified as one of the most important factors that explains differences across countries in the level and growth of health spending. The "income elasticity" of health spending varies a lot in empirical results and whether health care is a luxury good or a necessity is still an unsettled issue. Using the base assumption of an income elasticity of 0.8 for health care and 1.0 for LTC in the OECD model, results for China show a decrease of one percentage point of health spending as a percentage of GDP by 2030.

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63.   Regarding LTC, higher spending could arise from increased dependency due to, in particular, dementia. With ageing populations, strong increases in the prevalence of dementia may be expected, though prevention and treatment may also improve in the future.

64.   Finally, the use of component-based models can provide some guidance about future health spending but are inherently limited in their capacity to build in policy levers that could change the future course of health spending. Despite these limitations, these projection results point to important policy challenges, in particular, the fiscal sustainability of health and long-term care public spending in the context of China achieving its goal of universal health coverage.

ACRONYMS

BRIIS: Brazil, the Russian Federation, India, Indonesia and South Africa

DRC = death-related costs

GDP = Gross Domestic Product

GHE = Government Health Expenditure

HC = Health Care

HE = Health Expenditure

LTC = Long-term Care

N = Population

Res = Residual

Y = Income

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ANNEX 1 STEPS OF THE ANALYSIS

Health care (HC)

Demographic drivers

65.   The starting point of the demographic component is the cost curves as a function of age. Average per capita HC expenditure profiles by age group for 24 countries provide empirical cost curve estimates for the year 2012.

66.   Depending on data availability, expenditure profiles in these 24 countries are for 16 or 20 age groups[8]. All HC expenditures are also disaggregated by gender. For the remaining 16 countries, cost curves are derived. Table A1.1 lists countries according to the data that are available:

Table A1.1. Availability of disaggregated health expenditure data by country

Health expenditure data available for 20 age groups and gender	Health expenditure data available for 16 age groups and gender	No age or gender-specific health expenditure data available
Austria, Belgium, Denmark, Finland, Greece, Ireland, Luxembourg, Netherlands, Norway, Poland, Portugal, Sweden, Switzerland	Australia, Canada, China, Czech Republic, France, Germany, Hungary, Italy, Slovak Republic, Spain, United Kingdom	Brazil, Chile, Estonia, Iceland, India, Indonesia, Israel, Japan, Korea, Mexico, New Zealand, Russia, Slovenia South Africa, Turkey, United States

67.   From these general cost curves, the next step of the analysis is to estimate cost curves separately for survivors and non-survivors. This is to reflect the death-related costs (DRC) hypothesis, namely that proximity to death is a key driver of health spending. Under this assumption, it is not ageing *per se* that pushes up average health expenditures, but the fact that mortality rates are higher for older people. Both non-survivor and survivor cost curves are further disaggregated by gender.

68.   To estimate baseline non-survivor cost curves (death-related costs) for 24 countries - including China – for which disaggregated health care expenditure data are available, the general hypothesis is that the cost of death can be proxied by using per capita HC expenditures for the oldest age group, multiplied by an age-specific adjustment factor. More specifically:

*   The cost of death is calculated by first using average HC expenditure per capita for the oldest age group as a proxy. Expenditures on people aged 95 years or older are used when data are available (in 13 countries), otherwise for people aged 75 years or older (in 11 countries, including China).

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[8]   Age groups are identified on the basis of five year intervals. Countries reporting on the basis of 16 age groups identify the highest age group as 75+, while countries reporting on the basis of 20 age groups identify highest groups as 75-79, 80-84, 85-89, 90-94 and 95+.

- An adjustment factor is then applied, capturing the tendency for costs of death to be higher at younger ages. This adjustment factor is set to 4 for deaths between 0 and 59 years, decreasing in a linear fashion to unity for age groups from 60 to 95+ years. This adjustment factor is consistent with other estimates of death-related costs.

69.   This produces baseline non-survivor cost curves per capita, disaggregated by 20 age groups and gender for each of the 24 countries.

70.   To estimate baseline non-survivor cost curves for 16 countries without data on health expenditure disaggregated by age and gender, cost of death is proxied as a multiple of average health expenditures. This multiple reflects the ratio of the cost of death to average HC costs for countries where these data are available. More specifically:

- When age-specific HC data are not available, the cost of death is calculated as a multiple of average health expenditure. This is assumed to be a multiple of 3 times.

- An adjustment factor is then applied, capturing a tendency for the costs of death to be higher at younger ages.

- The share of HC expenditure in health expenditures (i.e. as compared with LTC expenditure) is based on health accounts data regularly collected at the OECD. For the BRIIS countries, the share of LTC spending over total health spending is assumed, in the absence of data, to be 5.75%. This represents half of the average share of LTC spending overt total spending observed in OECD reporting countries from 2000-2012. It reflects the lower government capacity for long-term care services in the BRIICS countries, as compared with high-income countries[9].

- The split of health expenditure between men and women equals the average male to female health expenditure ratio from 24 countries. This equals 0.94 for men and 1.06 for women as compared to the total.

71.   To estimate baseline survivor cost curves for all countries, the model uses the same survivor cost curve functions (one for men and another for women) for all countries. This allows the projections to be less sensitive to initial conditions and data idiosyncrasies. Country-specific curves are then derived from these shared cost curve functions by calibrating them to each country's total health expenditure. More specifically, an average survivor cost curve is estimated as a non-linear function of age (separately for men and women) based on data from a panel of 24 countries – including China - and 20 age groups:

$$\text{MALE: } \frac{hc_{age\,group}}{N_{age\,group}} = 1586.8 - 143.7 * age + 9.1 * age^2 - 0.26 * age^3 +$$
$$0.004 * age^4 - 0.00002 * age^5$$

$$\text{FEMALE: } \frac{hc_{age\,group}}{N_{age\,group}} = 1448.2 - 164.6 * age + 13.2 * age^2 - 0.39 *$$
$$age^3 + 0.005 * age^4 - 0.00002 * age^5$$

where *age* is the mid-point of each age group (e.g. for the age group 5-9, *age* equals 7).

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[9]   Indeed, Feng et al (2012) noted that government-financed long-term care services remain fragmented, with private sector care homes meeting increased demands instead.

72.   This produces a cross-country average survivor cost curve per case, separately for men and women, with costs for 20 age groups.

For each country, average survivor cost curves (male and female) are multiplied by the population in each of 20 age groups. This gives a non-calibrated estimate of total country-specific HC expenditure for survivors, by gender and age group. Expenditure estimates for each country are then calibrated, so that estimated government health expenditure per capita equals actual government HC expenditure per capita in the base year (as per the OECD health expenditure database).

73.   These analytical steps produce the requisite data for the baseline year for each of the 40 countries analysed. The demographic impact on health expenditures over time is then calculated by combining these data with the demographic projections in each country. A 'pure demographic' effect is calculated first, reflecting the impact of an ageing population with the implicit assumption of unchanged health status at any given age. The pure demographic effect is disaggregated into death-related costs (non-survivors) and survivor-related costs. The survivors' costs are then adjusted downwards to reflect a healthy ageing hypothesis, whereby age-related increases in health expenditure are postponed according to expected gains in life expectancy.

74.   The pure demographic impact is modelled by applying baseline cost curves for survivors and non-survivors to projected changes to the demographic structure over time. More specifically, the baseline cost curves for survivors and non-survivors do not change over time. That is, there is no change in the relative health expenditures across different age groups. The pure demographic impact is therefore captured by projected changes to the population structure (population ageing) over time.

75.   This produces projected survivor and non-survivor cost curves per capita, that reflect a pure demographic effect.

76.   The pure demographic impact is then adjusted to reflect the healthy ageing hypothesis. This assumes that all the gains in life expectancy are converted to healthy life years. This is reflected by allowing survivor cost curves to shift right according to longevity gains, progressively postponing age-related increases in expenditure. More specifically, an individual aged x years is assumed to have an equivalent health status – and therefore health expenditure – in the year 2030 of someone aged x years minus the projected gains in life expectancy by 2030. For example, in China a 70 year old woman is projected to have the health status of a 67.1 year old by 2030. This hypothesis is applied to all individuals aged 30 years or older.

77.   This produces projected survivor cost curves per capita adjusted for the healthy ageing hypothesis.

Non-demographic drivers

78.   Non-demographic drivers are split into an income effect and a residual growth effect, then separately analysed. The estimation procedure for each is conceptually straightforward, applying coefficients from econometric results to future projections.

79.   The income elasticity used reflects a 'pure' income effect, that is independent of technology and other residual effects. More specifically, income elasticity is assumed to be 0.8 for all countries (though this is varied as part of the sensitivity analysis). As discussed earlier, this estimate reflects the middle point across recent econometric estimates. For each country, this income elasticity coefficient to GDP is applied to input forecasts of real GDP growth for OECD and BRIICS countries from the OECD Economic Outlook.

80.   A residual growth factor is first calculated using a simple accounting analysis. It is then estimated from a regression on health spending per capita, after controlling for income and demographic effects. More specifically, the residual growth factor for health spending is estimated to be 1.7% per year, reflecting technology and relative price effects, and the effect of changes in policy and institutions. This value is applied to all countries in order not to extrapolate country-specific idiosyncrasies over a long period.

Allowing for convergence over time

81.   Projected values for each of these drivers (demographic, income and residual) are adjusted to allow for a gradual convergence of HC spending toward the OECD average HC expenditure to GDP ratio. This assumption is based on an analysis of a common set of OECD countries that shows that over the 30 year period between 1980 and 2010, there was indeed a strong convergence of public health expenditures as a share of GDP towards the average (Figure A1.1).

Figure A1.1. Public expenditure on health (share of GDP) as % of OECD average
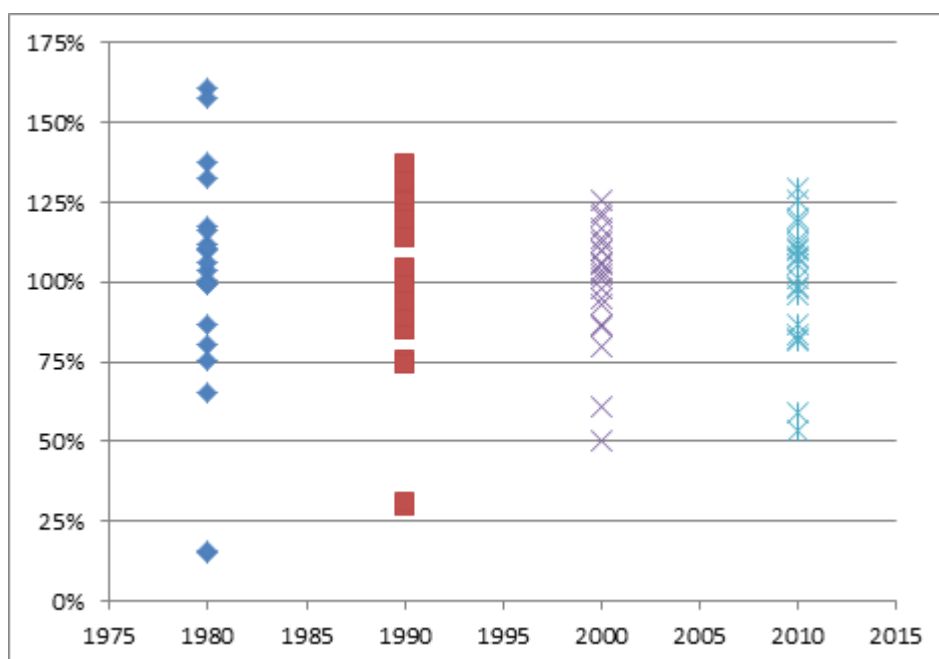
82.   The convergence factor that is applied reflects the likelihood that countries with relatively low (high) health spending to GDP ratios in the baseline as compared with the OECD average will increase (decrease) the projected growth rate of health spending relative to GDP. The convergence factor uses the following general formula:

$$\left(\frac{HC}{Y}\right)_{i,t} = \left[1 + \left(\frac{(HC/Y)_{OECD,0}}{(HC/Y)_{i,0}}\right) \cdot gHC_i\right] / \left(\frac{HC}{Y}_{i,0}\right)$$

where gHC_i is the growth rate of health spending for country i (from period 0 to t), $HC/Y_{i,0}$ is the HC expenditure ratio for country i in the base period, and $HC/Y_{OECD,0}$ is the HC expenditure ratio for the OECD average in the base period.

83.   This section applies the analytical framework to project public health care expenditures according to two scenarios over 2012-2030. The section looks first at the demographic and income effects on

expenditures and, subsequently, two scenarios regarding the evolution of drivers other than income and demographics (i.e., the residual growth) are analysed. In the "cost pressure scenario" no policy action is undertaken to curb pressures on expenditure whereas the "cost-containment scenario" assumes some policy action to rein in these pressures on expenditures. Even though the nature of such policies is not made explicit, they can be thought of as actions to limit the pressures arising from excessive growth of quality-adjusted relative health prices, e.g., by monitoring more closely the adoption of new technologies or modifying incentives via changes in the governance of health institutions. All these scenarios assume healthy ageing and an income elasticity of 0.8.

84.   Demographic effects on public health care expenditures can be decomposed into health care costs for survivors, the adjustment for "healthy ageing" and death-related costs. The pure ageing effect can be quite large in some countries, but tends to be compensated by better health status. Whereas on a per capita basis death-related costs account for the largest part of lifetime expenditures, for the population as a whole they account for only a small fraction of the increase in expenditures as a share of GDP since they concern only the non-survivors.

Long-term care

Demographic drivers

85.   The starting point of the demographic component is the number of dependants per country per age group. Twenty age groups (5 years) are used. The age-specific dependency ratios have been estimated by the European commission for 22 European countries (European Commission, 2012). Dependency ratios are assumed to be broadly uniform across countries and an average dependency ratio by age group was calculated and used in the projections, including for China.

86.   LTC expenditure per dependant person is estimated by dividing LTC expenditures – an input to the model - by the number of dependants by country.

87.   The demographic impact on LTC expenditures over time is then calculated by combining these data with demographic projections in each country. A pure demographic effect is calculated first, reflecting the impact of an ageing population with the implicit assumption of unchanged dependency ratio and LTC expenditure per dependant at any given age. These results are then adjusted downwards to reflect a healthy ageing hypothesis, whereby age-related increases in LTC expenditure are postponed according to expected gains in life expectancy and health expenditure.

88.   The pure demographic impact is modelled by applying baseline LTC expenditure per dependant to projected changes to the demographic structure over time. More specifically: the baseline LTC expenditure per dependant as well as the dependency ratio does not change over time. The pure demographic impact is therefore captured by projected changes to the population structure (population ageing) over time only.

89.   The healthy ageing hypothesis is then reflected by allowing the dependency ratio to change according to longevity gains and health expenditure. More specifically, the dependency ratio evolution has been investigated by means of panel regression techniques as a function of life expectancy at birth and health expenditure in 20 countries for which data are available. The equation was estimated for the population aged 52 and above as the dependency ratio for people below 52 is small and roughly constant over time.

Non-demographic drivers

90.   One of the main non-demographic drivers of public LTC expenditure is the relative share of informal and formal care. Since there is evidence that informal elderly care is associated with lower female labour force participation, informal carers have been proxied by the labour force participation of women aged 50-64 to project the future evolution of LTC spending (Colombo et al, 2011).

91.   Participation is projected using a "cohort" approach. The "cohort approach" (Burniaux *et al.*, 2004) consists in calculating cohort-specific entry and exit rates into or out of the labour force by tracking the participation rates of a given cohort over time. In each OECD country, entry and exit rates into and out of the labour force are calculated by comparing participation rates of a given cohort across two subsequent 5-year periods (*e.g.* the participation rate of a cohort aged 40-44 in 2012 is compared with its participation rate when aged 35-39 in 2007).

92.   As participation rates by age and gender are not readily available for BRIIS countries and China, informal carers have been proxied by the overall participation rates in these countries (including China). An estimated participation rate elasticity of 0.7 is used.

93.   Another important non-demographic driver of public LTC expenditure is a "cost disease" or Baumol effect. Baumol's model of unbalanced growth states that productivity in the health sector is low relative to other sectors because health services are highly customised and labour-intensive. This is even more the case in the long-term care sector. Hence, prices for health services will tend to rise relative to other prices because wages in low-productivity sectors must keep up with wages in high-productivity sectors. In this model, productivity growth in the total economy has been used as a proxy for the Baumol effect on public LTC expenditures.

94.   Finally, income is also likely to play a role in LTC expenditure. In many OECD countries, the coverage of long-term care costs is still very much in development, and even more so in emerging and debvloping countries. Thus, as real incomes rise, demand may be directed at higher quality services, thereby increasing expenditures. It is difficult however to distinguish the income from the cost-disease effect, proxied by aggregate productivity, since they are too highly correlated. Given the multicollinearity between productivity and income, the two effects were estimated separately and an income elasticity of 1 was conservatively assumed.

Allowing for convergence over time

95.   Projected values for each driver are adjusted to allow for gradual convergence of LTC spending to the OECD average LTC expenditure to GDP ratio.

96.   A convergence factor is then applied. This reflects the likelihood that countries with relatively low (high) LTC spending to GDP ratios in the baseline as compared with the OECD average will increase (decrease) the projected growth rate of LTC spending relative to GDP. The convergence factor uses the following general formula (similar to the one used for health care):

$$\left(\frac{LTC}{Y}\right)_{i,t} = \left[1 + \left(\frac{(LTC/Y)_{OECD,0}}{(LTC/Y)_{i,0}}\right) \cdot gLTC_i\right] / \left(\frac{LTC}{Y}_{i,0}\right)$$

where $gLTC_i$ is the growth rate of LTC spending for country i (from period *0* to *t*), $LTC/Y_{i,0}$ is the LTC expenditure ratio for country i in the base period, and $LTC/Y_{OECD,0}$ is the LTC expenditure ratio for the OECD average in the base period.

97.   As for health care, a cost-pressure scenario and a cost-containment scenario were computed. Both scenarios are based on a unitary income elasticity assumption and the "healthy ageing" hypothesis. However, in the cost-pressure scenario, for OECD countries, a full Baumol effect is assumed, meaning that LTC unit labour costs increase fully in line with aggregate labour productivity; for BRIIS countries and China, excess labour supply especially in the non-tradeable sector suggests weaker wage pressures than in the OECD countries, and therefore the cost-pressure scenario only incorporates half of the Baumol effect.

98.   In the cost-containment scenario, the elasticity of LTC spending to productivity increases is set at half the value of the cost-pressure scenario (0.5 for OECD countries, and 0.25 for BRIIS countries and China), possibly reflecting policy action aimed at mitigating relative wage increases of LTC providers. For example, action to curb expenditure could be aimed at facilitating access to LTC provision by low-skilled migrants or at providing incentives to balance institutional and home-based LTC.

ANNEX 2 RECENT LITERATURE DISCUSSIONS ON INCOME ELASTICITY

(This annex summarises the discussion on recent studies on income elasticity included in De la Maisonneuve et al, 2013)

99.   This OECD projection model on health care expenditure assumes an income elasticity of 0.8. The model also applies two different elasticities under the sensitivity analysis, namely 1.0 and 0.6. For healthcare, the baseline model thus assumes that an increase in income, ceteris paribus, would lead to a decline in the health expenditure to GDP ratio.

100.   There is a considerate amount of debate in the literature as to whether healthcare is a luxury good or a necessity since the article by Newhouse in 1997. This remains inconclusive up to now; however, a general consensus based on a number of recent empirical studies suggests that an income elasticity of healthcare is above zero but less than one, implying that healthcare is considered no more than a necessity.

101.   The following summarises some of the on-going discussions from recent studies.

102.   The behaviour of individuals with insurance or generous coverage might be different from that of individuals without or less generous insurance. Those with insurance might have little incentive to limit health expenditure (Getzen, 2000). The pattern of use of care by sector – private or public is different and such differentiation should be taken into consideration. For example, using pooled OLS estimation, income elasticity was found to be below or close to one for per capita private health expenditures while it exceeded one for per capita public or total health expenditures.

103.   It is argued that omitted variables and unfitted specifications might increase the chance of introducing bias in the model. Such potential bias includes technology or insurance coverage. Others such as Di Matteo and Di Matteo (1998) argue that health care is labour intensive and its cost may increase as a function of average income, so that measured income elasticity is blurred by the price effect and the income coefficient is likely to be biased downward.

104.   Nonetheless, several authors come to conclude that income elasticity is less than one.

105.   Acemoglu et al., (2009) used instrument variables, local area income with the variation of oil prices weighted by oil reserves, to come up with an income elasticity of 0.7. Freeman (2003), using disposable personal income at the US state level between 1986-1998, found that health care expenditures and incomes at state level are non-stationary and co-integrated and estimated income elasticity of health care between 0.817 to 0.844. Moscone and Tosetti (2010) studied the relationship between health and expenditure controlling for cross-section income and unobserved heterogeneity. The study found the relationship is non-stationary and co-integrated, too. Dreger and Reimers (2005) used panel co-integration techniques and used life expectancy and infant mortality to proxy medical technology and not too far from one.

106.   Baltagi and Moscone (2010) used a panel of 20 OECD countries and studied the non-stationary and co-integration properties of health expenditure and income. Their findings show lower elasticity than other studies. Narayan et al., (2011) studied OECD countries using real health expenditure and a specific health-care price index and found a panel unit root and co-integrated when a time trend is included in the

model. The authors found that GDP has a positive and statistically significant effect on health but obtained mixed results for the income elasticity by country. For the panel as a whole the income elasticity is close to one. Based on real expenditure deflated by the health deflator, GDP and health spending are found to be non-stationary and co-integrated with and without a trend. For the panel as a whole the elasticity of health with respect to GDP was less than one.

Table A2.1. Selected recent income elasticity estimates of health care expenditures

Papers	Elasticity
Acemoglu et al . (2009)	≈0.7
Baltagi and Moscone (2010)	<1
Bech et al . (2011)	≈1
Dreger and Reimers (2005)	≈1
Dormont et al. (2011)	>1
Freeman (2003) (US States level)	≈0.8
Holly et al. (2011)	0.75 to 0.95
Moscone and Tosetti (2010) (US States level)	<1
Narayan et. al (2011)	
HE deflated by GDP	≈1
HE deflated by Health price	<1

Source: de la Maisonneuve et al. (2013)

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