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Old age takes its toll: long-run projections of health-related public expenditure in Luxembourg*


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We simulate long-term trends in Luxembourg's public expenditure on healthcare and on long-term care. This requires combining official population projections with micro-simulations of individuals' health status that account for their demographic, socio-economic characteristics and their childhood circumstances. In particular, we simulate different scenarios for health-related public expenditure through 2070 to evaluate the separate contributions of population ageing, costs of producing health-related services, and the distribution of health status across age cohorts. Results suggest that increases in per capita expenditure on healthcare will mostly be driven by production costs, while increases in expenditure on long-term care will mostly reflect population ageing.

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1. Introduction

Luxembourg provides wide access to high quality public healthcare but its system is among the most costly in Europe (OECD, 2017; European Commission, 2020). Demographic change represents a major challenge, as it might endanger the sustainability of the social protection system. In particular, the share of age-related expenditure in GDP is expected to double by 2070, placing Luxembourg well above other countries in the European Union (AWG, 2021).

Policies to meet this challenge need to affect individual decisions including age at retirement, savings rate, and health-related behaviour (e.g. physical activity, smoking and drinking habits). To evaluate these policies, Giordana and Pi Alperin (2022) developed a simulation tool for Luxembourg that allows individual economic decisions and health-related behaviour to affect long-term public expenditure on healthcare and long-term care. Their tool adapts a standard theoretical framework (Deaton, 1991) to the specificities of the healthcare system in Luxembourg. Model equations are estimated by combining micro data on individuals from the Survey of Health, Ageing and Retirement in Europe (SHARE) with aggregate data from several branches of the Luxembourg Social Security system.

The resulting empirical model links health-related public expenditure to individuals' health status and health-related behaviour as well as their demographic, socio-economic characteristics and childhood circumstances. Dynamic simulations are designed to match long-term demographic projections published by the European Commission and corresponding macroeconomic projections published by the Central Bank of Luxembourg.

Comparing results across three scenarios helps to decompose the projected increase in health-related public expenditure into the contributions of unit costs, population growth, ageing and changes in health status.

2. Scenarios and simulation results

The *benchmark scenario* assumes that the unit cost of healthcare provision increases at the same rate as real GDP *per capita*. This assumption may be particularly plausible for the health sector, given its high level of labour intensity in production. We assume that real GDP will grow at 1.2% in the long run (0.73% growth per capita), following projections for Luxembourg by Garcia Sanchez et al. (2021). In the benchmark scenario, each individual's health status determines the probability of survival into the following period.

Our second scenario (*morbidity compression*) only differs from the benchmark by breaking the link between individual health status and survival probability. Instead, survival becomes a function of age and gender only. This implies that some individuals may live longer in relatively poor health.

Our third scenario (*constant unit cost*) deviates from the benchmark in assuming that production costs for healthcare and long-term care do not increase with per capita GDP, but remain constant in real terms. This 'optimistic' scenario evaluates whether technical progress and better management in the health sector could limit the impact of population ageing on health-related public expenditure.

In all simulations, population growth and age structure match the baseline scenario of the EUROPOP2019 projections. All scenarios assume constant *prevalence*[3] for the diseases and limitations considered, meaning that over the whole simulation horizon these affect the same share of the population as observed in the 2015 SHARE survey.[4]

[3] Prevalence is the share of population affected by a given disease at a given time or over a given period.
[4] The simulations do not account for the substantial rise in 2020 expenditure due to the Covid-19 pandemic or for the associated economic recession. For 2020 we assume costs remained at 2019 levels.

2.1 Public expenditure on healthcare

Table 1 reports projected public expenditure on healthcare from 2020 to 2070 under the different scenarios. Euro amounts are reported at constant prices (base year 2020).

In the *benchmark*, public expenditure on healthcare increases 119.1% between 2020 and 2070, and per capita expenditure increases 74.2%. This corresponds to an annual growth rate of 1.58%, well above the real GDP growth rate of 1.2%. Therefore, public expenditure on healthcare would rise from 5.8% of GDP to 7%. This increase is driven by the increase in the unit cost of producing healthcare services and by changes in the health status of the population. The other two scenarios help to disentangle these factors.

In the *morbidity compression* scenario, public expenditure on healthcare increases 120.6% between 2020 and 2070 (1.59% annual growth). However, it remains below the benchmark in all simulated periods. This is because the assumption that survival probability is unrelated to health status combines with the constant prevalence assumption to compress morbidity and concentrate poor health among the oldest individuals, who represent the smallest population group. Since the benchmark scenario links survival probability to individual health status, it distributes unhealthy individuals more evenly across ages. Therefore, comparing these two scenarios provides an estimate of the financial savings associated with the morbidity compression hypothesis (Fries, 1980). Public expenditure on healthcare is only 0.06% of GDP lower than in the benchmark, suggesting this assumption has only a limited impact.

Table 1: Public expenditure on healthcare between 2020 and 2070

		Projections						Change
Scenario		**2020(*)**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020-2070**
Benchmark	Expenditure[a]	3395.2	4234.4	5121.5	6014.9	6771.1	7437.8	119.1%
	% of GDP	5.8	5.7	6.0	6.4	6.5	7.0	1.2 ppts
	per capita[b]	5.4	6.1	6.9	7.8	8.6	9.4	74.2%
Morbidity compression	Expenditure[a]	3344.4	4176.0	5085.9	5959.2	6688.9	7376.4	120.6%
	% of GDP	5.7	5.6	6.0	6.4	6.4	6.9	1.2 ppts
	per capita[b]	5.3	6.0	6.9	7.7	8.5	9.4	75.4%
Constant unit cost	Expenditure[a]	3395.2	3934.8	4422.5	4826.6	5049.0	5153.7	51.8%
	% of GDP	5.8	5.3	5.2	5.2	4.9	4.8	-0.9 ppts
	per capita[b]	5.4	5.7	6.0	6.3	6.4	6.5	20.7%

(a) Million euros at 2020 prices (b) Thousand euros per capita at 2020 prices(*) Excluding Covid-19 pandemic effects. *Source: Giordana and Pi Alperin (2022).*

In the *constant unit cost* scenario, public expenditure on healthcare only increases 51.8% between 2020 and 2070. This only reflects population growth and ageing, because the unit cost of producing healthcare services is kept at its 2019 level. *Per capita* expenditure increases 21%, reflecting the constant prevalence assumption, which raises the share of individuals who suffer several chronic conditions simultaneously, as would be expected in an ageing population. Finally, the GDP share of public expenditure on healthcare actually declines, since expenditure grows 0.84% per year in this scenario, while GDP grows 1.2% per year.

Comparing scenarios at the 2070 horizon, population ageing explains an increase of 1,100 euros per capita (constant unit cost scenario) and rising costs of healthcare provision explain an increase of 2,900 euros per capita (difference between benchmark and constant unit cost scenarios). The morbidity compression assumption does not have a substantial effect, adding only 78 euros per capita.

2.2 Public expenditure on long-term care

Giordana and Pi Alperin (2022) identify potential beneficiaries of long-term care with an algorithm that mimics current procedures in public administration. This distinguishes recipients of benefits in-kind, benefits in-cash or both. It also distinguishes beneficiaries living in nursing homes from those receiving aid at home.

Table 2 reports public expenditure on long-term care under the three scenarios. In the *benchmark*, public expenditure increases 568.5% between 2020 and 2070 (3.87% annual growth) and the number of beneficiaries increases 265%. While per capita expenditure rises 431.5%, expenditure per beneficiary increases only 83%, indicating substantial population ageing. As a share of GDP, public expenditure on long-term care rises from 0.7 to 2.5 percentage points, which will require a substantial adjustment of public finances. Expenditure rises rapidly until 2050, when it reaches 2.0% of GDP, after which it grows only slightly faster than GDP.

In the *morbidity compression* scenario, public expenditure on long-term care increases 352% from 2020 to 2070 (3.06% annual growth), less than in the benchmark. Its share in GDP rises to 2.4% in 2070, 0.1 percentage points below its level in the benchmark. These aggregate results may seem counterintuitive. Since the morbidity compression scenario concentrates poor health among the elderly, we would expect this group to suffer more limitations in daily life activities, leading to higher expenditure on long-term care. However, only expenditure per beneficiary is higher than in the benchmark scenario. A disaggregated analysis indicates that the change in the age distribution of beneficiaries explains these results (Giordana and Pi Alperin, 2022).

Table 2: Public expenditure on long-term care between 2020 and 2070

		Projections						Change
Scenario		**2020(*)**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020-2070**
Benchmark	Expenditure[a]	400.5	835.3	1528.9	1907.9	2336.4	2677.2	568.5%
	% of GDP	0.7	1.1	1.8	2.0	2.3	2.5	1.8
	per capita[b]	0.6	1.2	2.1	2.5	3.0	3.4	431.5%
	per beneficiary[c]	41.7	47.1	62.3	66.9	69.8	76.2	83.0%
	Beneficiaries	9612	17717	24555	28502	33495	35114	265.3%
Morbidity compression	Expenditure[a]	559.4	846.7	1471.9	1881.6	2181.0	2527.5	351.8%
	% of GDP	1.0	1.1	1.7	2.0	2.1	2.4	1.4
	per capita[b]	0.9	1.2	2.0	2.4	2.8	3.2	259.2%
	per beneficiary[c]	55.6	49.6	62.5	69.9	71.5	76.9	38.2%
	Beneficiaries	10053	17067	23560	26921	30495	32861	226.9%
Constant unit cost	Expenditure[a]	400.5	776.2	1320.3	1531.0	1742.2	1855.1	363.2%
	% of GDP	0.7	1.0	1.5	1.6	1.7	1.7	1.1
	per capita[b]	0.6	1.1	1.8	2.0	2.2	2.4	268.3%
	per beneficiary[c]	41.7	43.8	53.8	53.7	52.0	52.8	26.8%
	Beneficiaries	9612	17717	24555	28502	33495	35114	265.3%

(a) Million euros at 2020 prices. (b) Thousand euros per capita at 2020 prices. (c) Thousand euros per beneficiary at 2020 prices. (*) Excluding Covid-19 pandemic effects. *Source: Giordana and Pi Alperin (2022).*

In the *constant unit cost* scenario, public expenditure on long-term care increases only 363% between 2020 and 2070 (3.11% annual growth). Expenditure per beneficiary only increases 27%, but expenditure *per capita* increases 268%. This indicates that population ageing, and the associated deterioration in health, has a limited effect on expenditure per beneficiary but an important effect on the number of beneficiaries. Finally, the GDP share of public expenditure on long-term care rises to 1.5% in 2040, after which expenditure grows only slightly faster than GDP.

Comparing 2020 to 2070, population ageing in the constant unit cost scenario raises per capita expenditure by 1,800 euros and per beneficiary expenditure by 11,100 euros. The difference with the benchmark indicates that higher unit costs explain only 1,000 euros of the increase in per capita expenditure and 23,400 euros of the increase in per beneficiary expenditure. The difference with the morbidity compression scenario indicates that the latter would reduce per capita expenditure by 200 euros but increase per beneficiary expenditure by 700 euros.

3. Conclusion

These projections are in line with the analysis by the European Commission, which warns that Luxembourg will face the sharpest increase in ageing-related spending among EU countries (European Commission, 2020). Although Luxembourg's Social Security system is currently in a comfortable financial situation, the projected increase in spending endangers its sustainability. While the increase in expenditure is mainly driven by pensions, enhancing the efficiency of healthcare and long-term care could contribute to limit the impact on public finances.

The standard caveats apply. Over the next fifty years, supply and demand for healthcare and long-term care services could change substantially. For instance, medical innovations could provide cheaper and more effective substitutes for current treatments, as well as new (potentially) expensive treatments, income growth and changes in the income distribution could affect the demand for healthcare, new diseases (e.g., Covid-19) may alter the age-related path of individuals' health status and, of course, demographic projections are also subject to uncertainty.

Subject to these caveats, the model in Giordana and Pi Alperin (2022) can still provide simulations for ex-ante evaluation of health-related policies. In particular, the model could focus on specific conditions associated with ageing, such as dementia, which affects more than 28% of long-term care beneficiaries above 80 in Luxembourg. Other potential applications could focus on technological innovations, prevention policies and behavioural/lifestyle changes among younger generations. ■

References

AWG. (2021). The 2021 Ageing Report: Economic and budgetary projections for the EU Member States (2019-2070). *European Economy*, Institutional Paper 148, Brussels, pp.398.

Deaton, A. (1991). Saving and Liquidity Constraints. *Econometrica*, 59(5), pp. 1221-1248.

European Commission, (2020). Country report Luxembourg 2020. 2020 European Semester: Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011.

Fries, J. (1980). Aging, Natural Death, and the Compression of Morbidity. *The New England journal of medicine*, 303, pp. 130-135.

Garcia Sanchez, P., Marchiori, L., Moura, A. and Pierrard, O. (2021). Impact de la crise Covid-19 sur l'économie luxembourgeoise – Analyses avec les modèles d'équilibre général LU-EAGLE et LOLA. *BCL Bulletin* 2021-2, pp. 36-51, Central Bank of Luxembourg.

Giordana, G.A. and Pi Alperin, M.N. (2022). Old age takes its toll: long-run projections of health-related public expenditure in Luxembourg. *Central Bank of Luxembourg Working Papers* 158.

OECD/European Observatory on Health Systems and Policies, (2017). *Luxembourg: Country health profile 2017, State of Health in the EU*. Organization for Economic Cooperation and Development Publishing, Paris; European Observatory on Health Systems and Policies, Brussels.

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